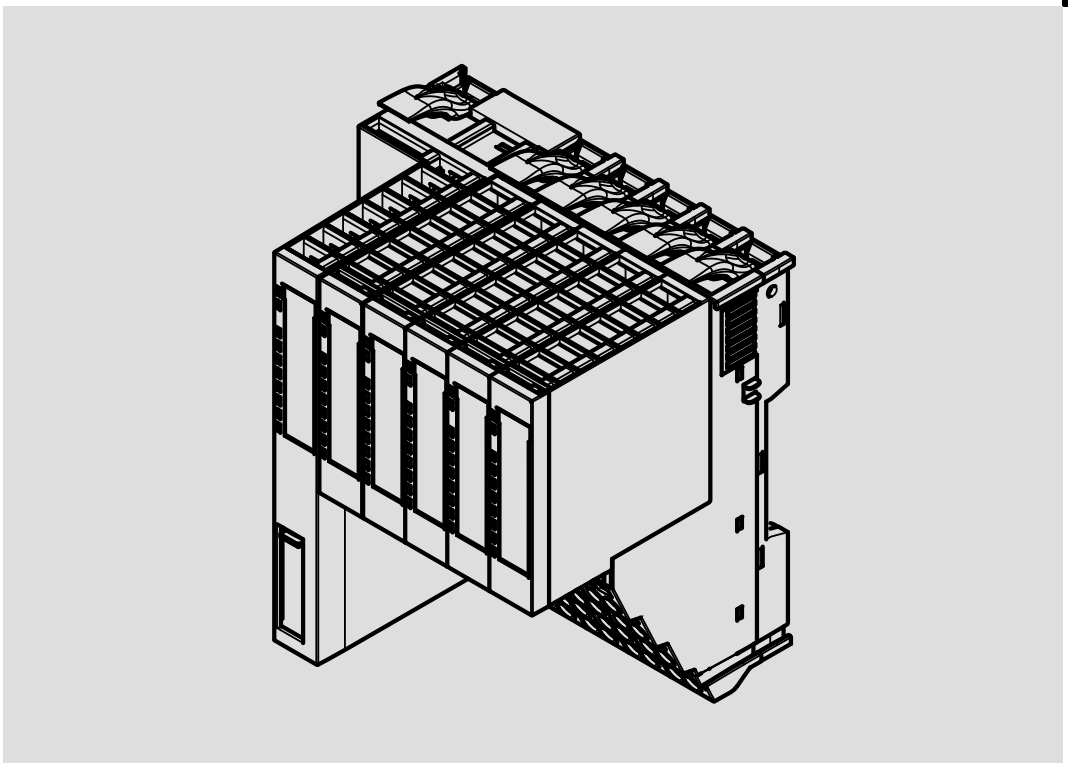
EDSIO1000
13525977

L-force *Controls*

System Manual

I/O System 1000



EPM-Sxxx

Modular I/O system

Lenze

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1 About this documentation

Contents

This documentation informs you about the intended use of the components of the I/O system 1000.

Target group

This documentation is intended for all persons who design, install, set up, and adjust the I/O system 1000.

Tip!

Information and tools concerning the Lenze products can be found in the download area at

www.lenze.com

Validity

The information given in this documentation applies to the components of the I/O system 1000 according to the following module labelling:

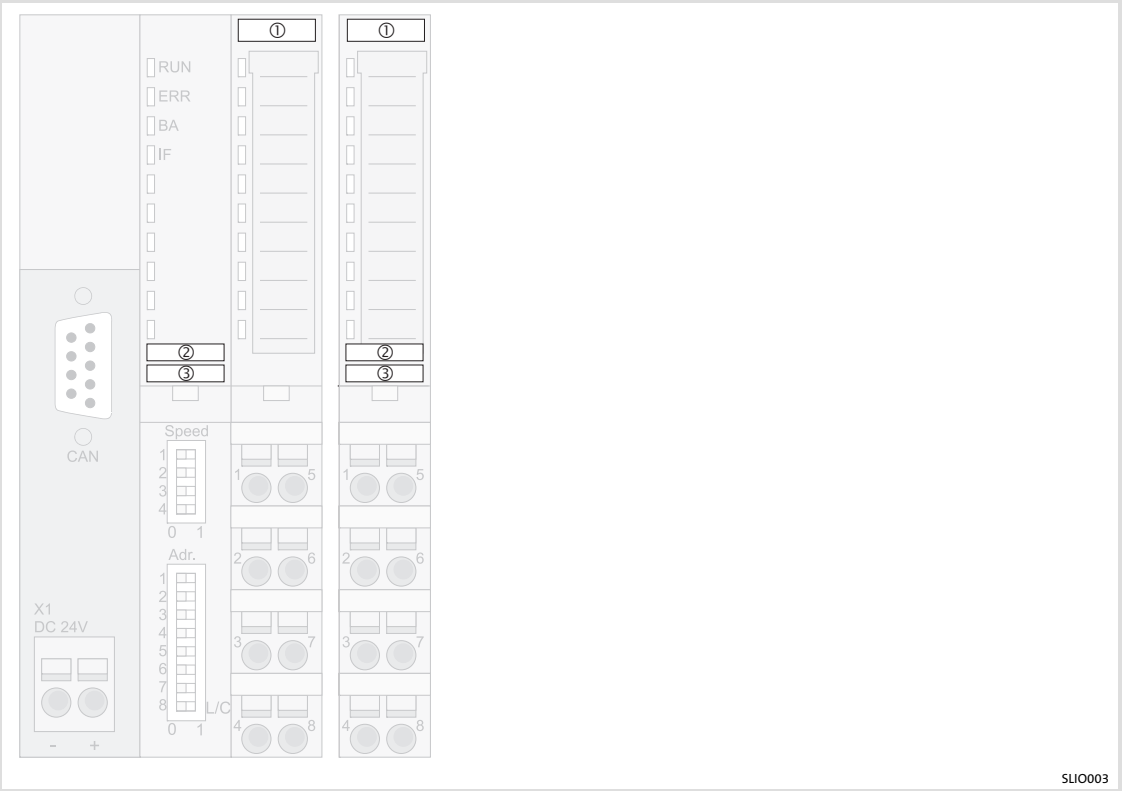


Fig. 1-1 Labelling of the modules

① Module designation according to the following table (e.g. AI 2, 12 bits, DC 0 ...10 V)
② Type designation according to the following table (e.g. EPM-S400)
③ Hardware version/software version according to the following table (e.g. 1A.10)

Module function	Module designation	Type designation	From hardware version	From software version
	①	②	③	
Bus coupler module				
CANopen	CANopen	EPM-S110	1D	30
PROFIBUS	PROFIBUS-DP	EPM-S120	1D	30
EtherCAT	EtherCAT	EPM-S130	1D	30
PROFINET	PROFINET	EPM-S140	1D	10
DeviceNet	DeviceNet	EPM-S150	1D	10
Modbus TCP	Modbus TCP	EPM-S160	1D	10
I/O compound module				
Digital I/O				
2 digital inputs	DI 2, DC 24 V	EPM-S200	1B	-
4 digital inputs	DI 4, DC 24 V	EPM-S201	1B	-
8 digital inputs	DI 8, DC 24 V	EPM-S202	1B	-
4 digital inputs three-wire conductor	DI 4, DC 24 V	EPM-S203	1B	-
2 digital inputs NPN	DI 2, NPN, DC 24 V	EPM-S204	1B	-
4 digital inputs NPN	DI 4, NPN, DC 24 V	EPM-S205	1B	-
8 digital inputs NPN	DI 8, NPN, DC 24 V	EPM-S206	1B	-
2 digital inputs, time stamp	DI 2, 2 µs, DC 24 V	EPM-S207	1B	10
2 digital outputs 0.5 A	DO 2, DC 24 V, 0.5 A	EPM-S300	1B	-
4 digital outputs 0.5 A	DO 4, DC 24 V, 0.5 A	EPM-S301	1B	-
8 digital outputs 0.5 A	DO 8, DC 24 V, 0.5 A	EPM-S302	1B	-
2 digital outputs 0.5 A NPN	DO 2, NPN, DC 24 V, 0.5 A	EPM-S303	1B	-
4 digital outputs 0.5 A NPN	DO 4, NPN, DC 24 V, 0.5 A	EPM-S304	1B	-
8 digital outputs 0.5 A NPN	DO 8, NPN, DC 24 V, 0.5 A	EPM-S305	1B	-
2 digital outputs 2 A	DO 2, DC 24 V, 2 A	EPM-S306	1B	-
4 digital outputs 2 A	DO 4, DC 24 V, 2 A	EPM-S309	1B	-
2 digital outputs, time stamp	DO 2, 1 µs, DC 24 V, 0.5 A	EPM-S310	1B	10
2 relay outputs	Relay 2, AC 230 V, 3 A	EPM-S308	1B	-
Analog I/O				
2 analog inputs, 12 bits, 0 ... 10 V	AI 2, 12 bits, DC 0...10 V	EPM-S400	1B	10
4 analog inputs, 12 bits, 0 ... 10 V	AI 4, 12 bits, DC 0...10 V	EPM-S401	1B	10
2 analog inputs, 12 bits, 0/4 ... 20 mA	AI 2, 12 bits, DC 0/4...20 mA	EPM-S402	1B	10
4 analog inputs, 12 bits, 0/4 ... 20 mA	AI 4, 12 bits, DC 0/4...20 mA	EPM-S403	1B	10
2 analog inputs, 16 bits, -10 ... +10 V	AI 2, 16 bits, DC -10...+10 V	EPM-S406	1B	10
2 analog inputs, 16 bits, 0/4 ... 20 mA	AI 2, 16 bits, DC 0/4...20 mA	EPM-S408	1B	10
2 analog outputs, 12 bits, 0 ... 10 V	AO 2, 12 bits, DC 0...10 V	EPM-S500	1B	10
4 analog outputs, 12 bits, 0 ... 10 V	AO 4, 12 bits, DC 0...10 V	EPM-S501	1B	10
2 analog outputs, 12 bits, 0/4 ... 20 mA	AO 2, 12 bits, DC 0/4...20 mA	EPM-S502	1B	10
4 analog outputs, 12 bits, 0/4 ... 20 mA	AO 4, 12 bits, DC 0/4...20 mA	EPM-S503	1B	10
Temperature measurement				
4(2) analog inputs resistor	AI 4, 16 bits, resistor	EPM-S404	1B	10
2 analog inputs thermocouple	AI 2, 16 bits, thermo	EPM-S405	1B	10

Module function	Module designation	Type designation	From hardware version	From software version
	①	②	③	
Meters				
1 counter 32 bits, 24 V DC (reading, setting, comparing, time stamp)	Counter 1, DC 24 V	EPM-S600	1B	10
2 counters, 32 bits, 24 V DC (reading, setting)	Counter 2, DC 24 V	EPM-S601	1B	10
1 counter, 32 bits, 5 V DC (reading, setting, time stamp)	Counter 1, DC 5 V	EPM-S602	1B	10
2 counters, 32 bits, 24 V DC (reading)	Counter 2, DC 24 V	EPM-S603	1B	10
Encoder evaluation				
SSI interface	SSI	EPM-S604	1B	10
Technology modules				
2 digital outputs PWM (output of pulse width modulated signals)	PWM	EPM-S620	1B	10
RS232 interface	RS232	EPM-S640	1B	10
RS422/RS485 interface	RS422/RS485	EPM-S650	1B	10
Power supply modules				
I/O supply	Power, DC 24 V	EPM-S701	1B	-
I/O supply and electronic supply	Power, DC 24 V/24 V	EPM-S702	1B	-
Potential distributor module				
8 terminals DC 24 V	Supply DC 24 V	EPM-S910	1A	-
8 terminals DC 0 V	Supply DC 0 V	EPM-S911	1A	-
4/4 terminals DC 24 V/0 V	Supply DC 24 V/0 V	EPM-S912	1A	-

1.1 Document history

Material number	Version			Description
13525977	8.0	01/2017	TD29	General revision and error recovery
13409968	7.1	01/2015	TD29	Technical data for EPM-S310 amended
13409968	7.0	06/2012	TD29	Description of the I/O compound modules EPM-S406, EPM-S408 and EPM-S650 supplemented; error correction
13392311	6.1	02/2012	TD29	General revision and error recovery
13376655	6.0	04/2011	TD29	Descriptions added: Bus coupler EPM-S140, EPM-S150, EPM-S160 I/O compound module EPM-S640 Power distributor module EPM-S910, EPM-S911, EPM-S912
13358613	5.0	11/2010	TD29	Descriptions of I/O compound modules EPM-S207, EPM-S310, EPM-S620 and bus coupler EPM-S130 supplemented; troubleshooting
13339410	4.0	05/2010	TD29	Troubleshooting
13321837	3.0	04/2010	TD29	Descriptions of the I/O compound modules EPM-S306, EPM-S308, EPM-S309, EPM-S600, EPM-S601, EPM-S602, EPM-S603, EPM-S604 supplemented; technical data for all modules revised
13313389	2.1	08/2009	TD29	Technical data for EPM-S120 amended
13313389	2.0	08/2009	TD29	First edition
13297999	1.0	06/2009	TD29	Validation

1.2 Conventions used

This documentation uses the following conventions to distinguish between different types of information:

Spelling of numbers		
Decimal separator	Point	In general, the decimal point is used. For instance: 1234.56
Warnings		
UL warnings		Given in English and French
UR warnings		
Text		
Program name	» «	PC software For example: »Engineer«, »Global Drive Control« (GDC)
Icons		
Page reference	🕮	Reference to another page with additional information For instance: 🕮 16 = see page 16
Documentation reference		Reference to another documentation with additional information For example: EDKxxx = see documentation EDKxxx

1.3 Notes used

The following pictographs and signal words are used in this documentation to indicate dangers and important information:

Safety instructions

Structure of safety instructions:

Danger!
(characterises the type and severity of danger)
Note
(describes the danger and gives information about how to prevent dangerous situations)

Pictograph and signal word	Meaning
Danger!	**Danger of personal injury through dangerous electrical voltage.** Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
Danger!	**Danger of personal injury through a general source of danger.** Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
Stop!	**Danger of property damage.** Reference to a possible danger that may result in property damage if the corresponding measures are not taken.

Application notes

Pictograph and signal word	Meaning
 **Note!**	Important note to ensure troublefree operation
 **Tip!**	Useful tip for simple handling
	Reference to another documentation

1.4 Terminology used

Term	Meaning
I/O compound module	EPM-S2xx, EPM-S3xx, EPM-S4xx, EPM-S5xx, EPM-S6xx; module of the I/O system 1000 (DI, DO, AI, AO, counter, etc.)
Bus coupler, bus coupler module	EPM-S1xx; for connection of the I/O system 1000 to a fieldbus system (CANopen, PROFIBUS, etc.). With an integrated DC power supply unit (main supply) for supply of the bus coupler module and the connected I/O compound modules via backplane bus.
Power supply module	EPM-S7xx; additional DC power supply unit that is used in extensive systems if the main supply of the bus coupler is not sufficient to supply the I/O level and/or the electronics.
Power distributor module	EPM-S9xx; power distributor for the supply of external consumers via the I/O system 1000 (24 V and/or 0 V)
Backplane bus	The control signals on the process level are transferred by the I/O compound modules via the internal backplane bus.
Ohmic load	In the technical data, the load capacity at a constant ohmic load is often characterised by specifying a maximum output current at signal ”1”.
Lamp load	When the lamp load is specified, the fact is taken into account that an incandescent lamp has the n-fold starting current compared to the rated current. Only when the glow wire is heated, the resistance strongly increases. In the data sheets, the lamp load is characterised by specification of a power in watts which is considerably lower than the product of the rated voltage and the permissible output current. The high starting current of an incandescent lamp is also the reason for the fact that the maximum switching frequency is lower by a factor of approximately ten than it would be at a constant ohmic load. Therefore only incandescent lamps which, in total, do not feature a higher rated power than specified in the specification of the lamp load must be connected to a digital output. This does not concern LED lamps; they are treated as an ohmic load.
Inductive load	In the case of an inductive load, the impedance of the consumer (relay coil, contactor) depends on the operating frequency of the digital output. In this case, as well, the permissible switching frequency is strongly reduced compared to that for a constant ohmic load, in order to ensure reliable switching of the relay. The cause of this is the discharge of inductance by the interrupting current via the suppressor circuit. If the switching frequency is too high, the interrupting current can no longer decay sufficiently, so that for instance the relay at the output cannot be disconnected anymore. Without a suppressor circuit, an overvoltage at the power transistors of the digital output may occur, causing damage or destruction of the module.
AI/AO	Analog input/output
DI/DO	Digital input/output

Term	Meaning
µs ticker	Some I/O compound modules are provided with an integrated µs-ticker for the logging of states. The µs-ticker works with a resolution of 1 µs, counts from 0 ... 65535 µs after power-on and then starts with 0 again.
Time stamp	By means of the time stamp function, initial states, together with a time value (see µs-ticker) and a consecutive number, can be transferred to the FIFO memory as a time stamp entry.
PWM	Pulse width modulation
SSI interface	For direct connection of the I/O system to an SSI encoder (EPM-S604)
Basic error limit	Accuracy of analog I/Os at 25 °C relating to the upper limit of effective range (according to EN61131); example: measuring range = 0 ... 10 V or -10 V ... +10 V; basic error limit = ±0.2 % → 10 V * 0.2/100 = 20 mV; this means that at 25 °C a maximum measuring error of ±20 mV can occur.
Operational error limit	Accuracy of analog I/Os across the entire admissible temperature range for the module relating to the upper limit of effective range (according to EN61131).
Basic conversion time	Time required by an A/D converter to record the measured value.
PLC	Programmable Logic Controller
»Global Drive Control« (GDC)	Lenze Engineering tools supporting you during the whole life cycle of a machine - from planning to maintenance.
»Engineer«	
»PLC Designer«	

2 Safety instructions

2.1 General safety information

Scope

The following general safety instructions apply to all Lenze drive and automation components.

The product-specific safety and application notes given in this documentation must be observed!

For your own safety

Danger!

Disregarding the following basic safety measures may lead to severe personal injury and damage to material assets!

- Lenze drive and automation components ...
  - ... must only be used for the intended purpose.
  - ... must never be operated if damaged.
  - ... must never be subjected to technical modifications.
  - ... must never be operated unless completely assembled.
  - ... must never be operated without the covers/guards.
  - ... can - depending on their degree of protection - have live, movable or rotating parts during or after operation. Surfaces can be hot.
- All specifications of the corresponding enclosed documentation must be observed.

  This is vital for safe and trouble-free operation and for achieving the specified product features.

  The procedural notes and circuit details provided in this document are proposals which the user must check for suitability for his application. The manufacturer does not accept any liability for the suitability of the specified procedures and circuit proposals.
- Only qualified skilled personnel are permitted to work with or on Lenze drive and automation components.

  According to IEC 60364 or CENELEC HD 384, these are persons ...

  ... who are familiar with the installation, assembly, commissioning and operation of the product,

  ... possess the appropriate qualifications for their work,

  ... and are acquainted with and can apply all the accident prevent regulations, directives and laws applicable at the place of use.

Transport, storage

- Transport and storage in a dry, low-vibration environment without aggressive atmosphere; preferably in the packaging provided by the manufacturer.
  – Protect against dust and impacts.
  – Observe climatic conditions according to the technical data.
- Use load carrying equipment for transport! (📖 264)

Mechanical installation

- Install the product according to the regulations of the corresponding documentation. In particular observe the section ”Operating conditions” in the chapter ”Technical data”.
- Provide for careful handling and avoid mechanical overload. During handling neither bend components, nor change the insulation distances.
- The product contains electrostatic sensitive devices which can easily be damaged by short circuit or static discharge (ESD). Thus, electronic components and contacts must not be touched unless ESD measures are taken beforehand.

Electrical installation

- Carry out the electrical installation according to the relevant regulations (e. g. cable cross-sections, fusing, connection to the PE conductor). Additional notes are included in the documentation.
- When working on live products, observe the applicable national regulations for the prevention of accidents (e.g. BGV 3).
- The Instructions contain notes concerning wiring according to EMC regulations (shielding, earthing, filters and cable routing). The compliance with limit values required by the EMC legislation is the responsibility of the manufacturer of the machine or system.

  Warning: The inverters are automation components which can be used in industrial environment according to EN 61000-6-4. These products may cause radio interference in residential areas. If this happens, the operator may need to take appropriate action.
- For compliance with the limit values for radio interference emission at the site of installation, the components - if specified in the technical data - have to be mounted in housings (e. g. control cabinets). The housings have to enable an EMC-compliant installation. In particular observe that for example control cabinet doors preferably have a circumferential metallic connection to the housing. Reduce openings or cutouts through the housing to a minimum.
- Only plug in or remove pluggable terminals in the deenergised state!

Commissioning

- If required, you have to equip the system with additional monitoring and protective devices in accordance with the respective valid safety regulations (e. g. law on technical equipment, regulations for the prevention of accidents).

Operation

- Keep all protective covers and doors closed during operation.

Safety functions

- Without a higher-level safety system, the described product must neither be used for the protection of machines nor persons.

Maintenance and servicing

- The components are maintenance-free if the required operating conditions are observed.
- If the cooling air is polluted, the cooling surfaces may be contaminated or the air vents may be blocked. Under these operating conditions, the cooling surfaces and air vents must be cleaned at regular intervals. Never use sharp objects for this purpose!
- After the system has been disconnected from the supply voltage, live components and power connections must not be touched immediately because capacitors may be charged. Please observe the corresponding notes on the device.

Disposal

- Recycle or dispose of the product according to the applicable regulations.

3 Product description

3.1 Device features

The I/O system 1000 can be used to implement complex automation applications. It includes a bus coupler module and several I/O compound modules which use an internal backplane bus to communicate with each other within the station and exchange process data, parameter data, and diagnostic information.

- Modular system
- Mounting on standard DIN rail (35 mm)
- The two-piece structure (separation of electronics and process integration) enables a quick exchange of modules in the event of service
- Supply voltage of electronics and process level is separated.
- Wiring level via spring terminal
- Shield connection to standard busbar
- Individual labelling by insertable labels (item designation)
- Creation of electrical isolations by power supply modules

3.2 Application as directed

The I/O system 1000 is applied as directed if it is only used for implementing automation tasks in common industrial and commercial areas. Any other use is not permissible.

A **use contrary to the intended purposes** is also the case if it bears severe risks or dangers which can cause death, injuries, or damage to material assets if an extremely high level of safety measures is not provided.

The I/O system 1000 may especially **not** be used ...

- in private areas
- in potentially explosive atmospheres
- in areas with harmful gases, oils, acids, radiation, etc.
- in applications where vibration and impact loads occur which exceed the requirements of the EN 60068-2-6 / EN 60068-2-27
- to execute safety functions, as for example
  – in the air-traffic control / in flight control systems
  – for monitoring/controlling nuclear reactions
  – for monitoring/controlling mass transportation
  – for monitoring/controlling medical systems
  – for monitoring/controlling weapons systems

  In order to ensure the protection of persons and material assets, higher-level safety systems must be used!

3.3 System overview

3.3.1 System design

An I/O system 1000 consists of the following modules:

- An EPM-S1xx bus coupler module
  - Connection of the aystem to a fieldbus system (CANopen, PROFIBUS, etc.)
  - Integrated DC power supply unit for the supply of the bus coupler module and the connected I/O compound modules via the backplane bus.
- Up to 64 EPM-S2xx ... EPM-S6xx I/O compound modules (DI, DO, AI, AO, counter, etc.)

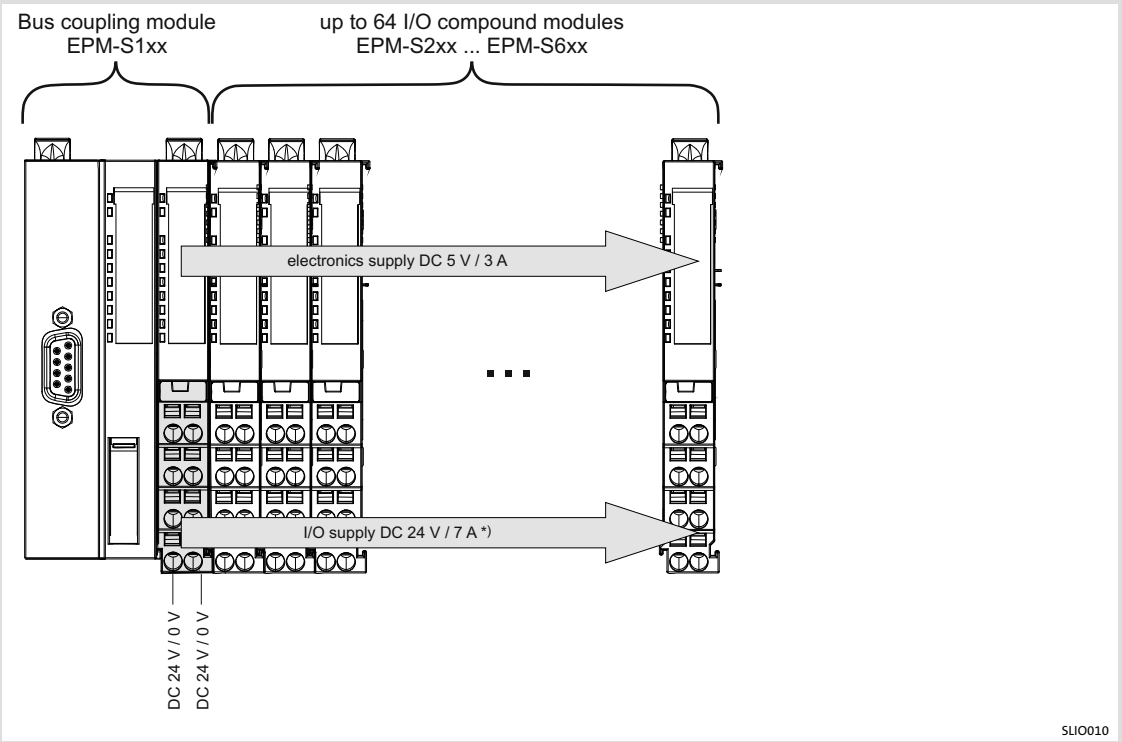


Fig. 3-1 Standard design

*) If no UL conformity is required, the maximum permissible load for the I/O supply is 10 A.

Electronic supply:5 V voltage for the supply of the bus coupler module electronics and the I/O-compound modules connected.

I/O supply: 24 V voltage for the power supply of the I/O-compound modules.

If, in the case of great station designs, the power of the main bus coupler supply does not suffice to supply the I/O level and/or the electronics, power supply modules can be used. Each supply provides an individual separate potential area.

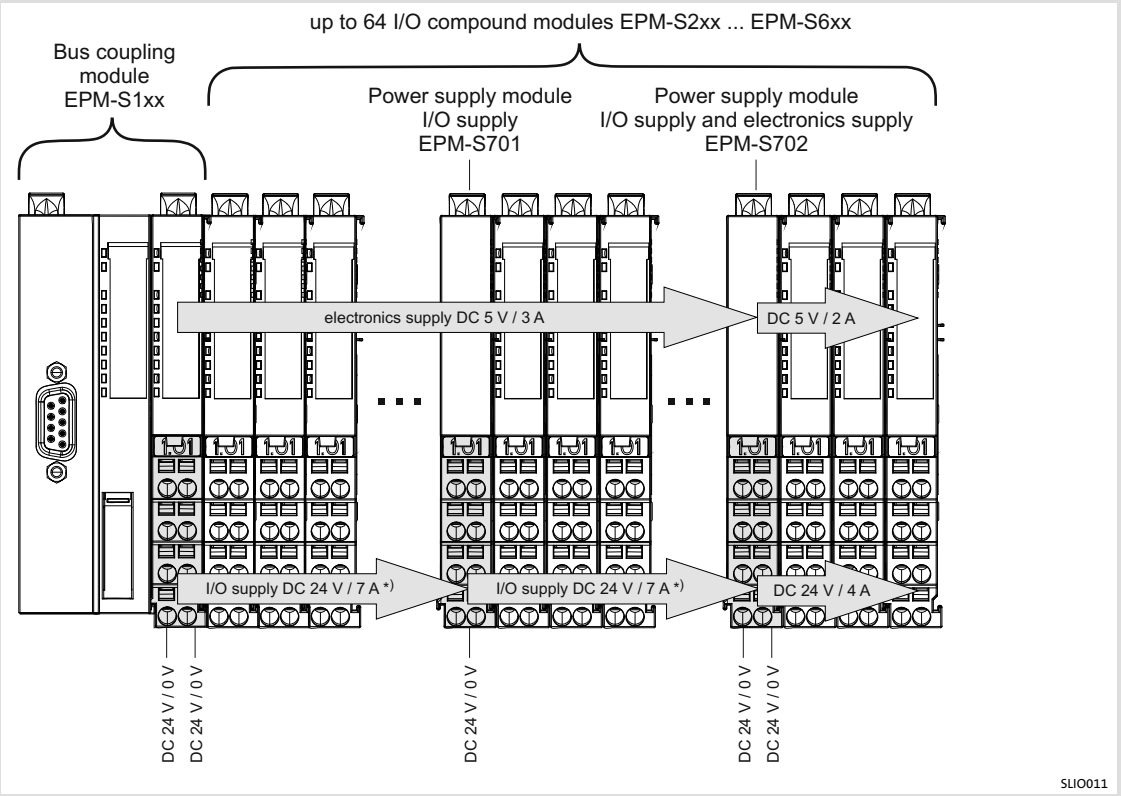


Fig. 3-2 Grouping through power supply modules

*) If no UL conformity is required, the maximum permissible load for the I/O supply is 10 A.

For the supply of external consumers via the I/O system 1000 you can use power distributor modules (EPM-S9xx) which provide the 24 V and/or 0 V voltage of the I/O supply via their terminals.

3.4 Module design

3.4.1 Bus coupler modules

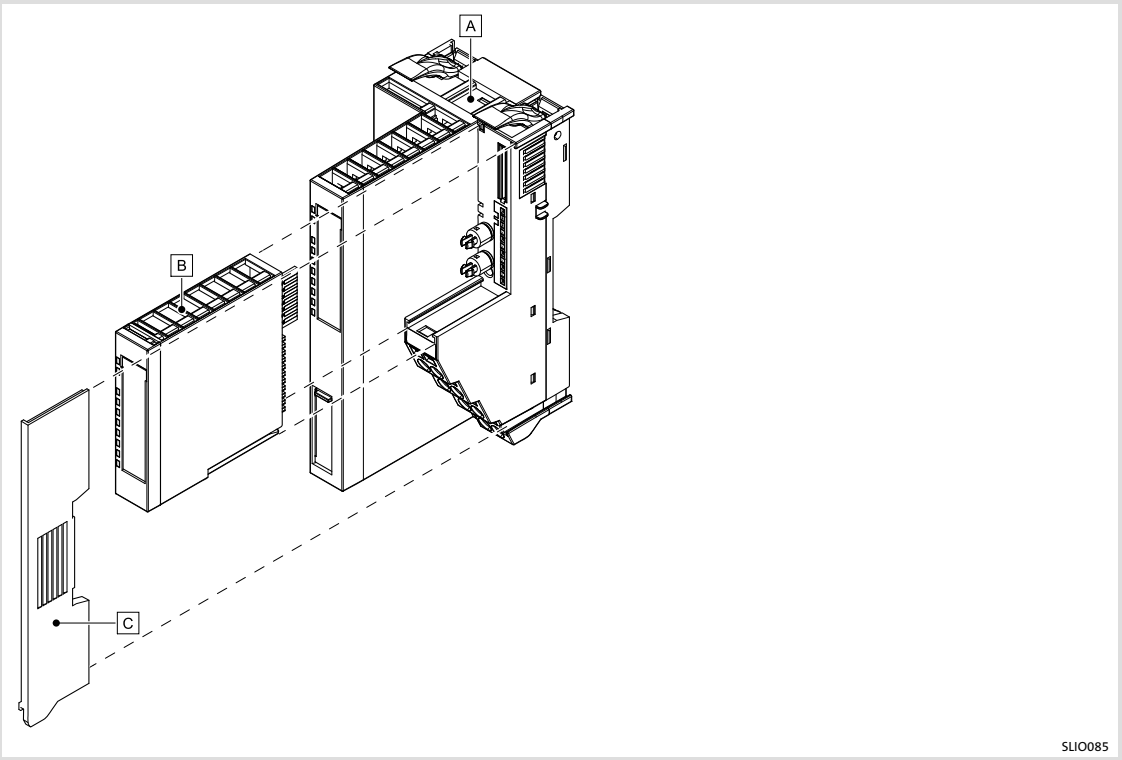


Fig. 3-3 Components of an EPM-S1xx bus coupler module

- A Bus coupler with firmly attached base module (inseparable)
- B Electronic module (main supply with fuse; spare part order designation: EPM-S700)
- C Contact cover for the last module of an I/O system

3.4.2 I/O compound modules

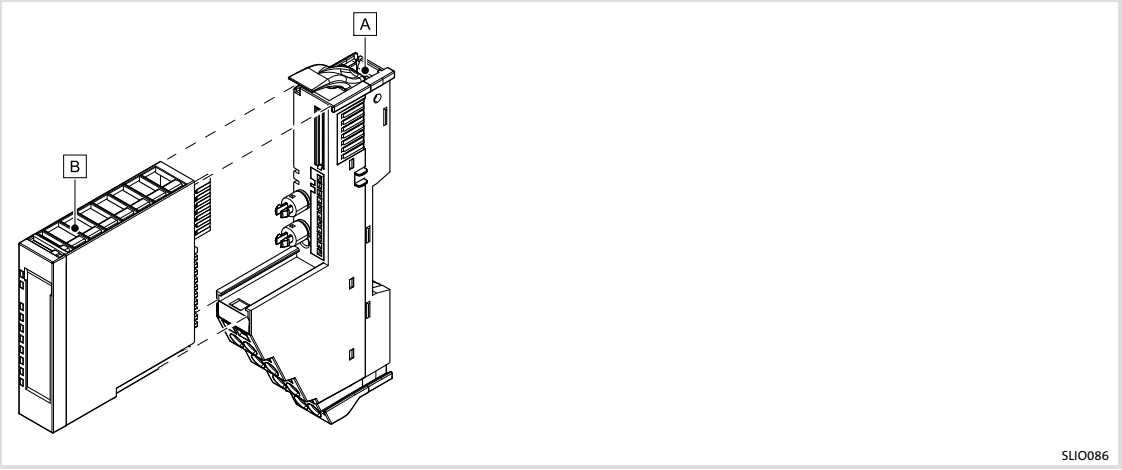


Fig. 3-4 Components of an EPM-S2xx ... EPM-S6xx I/O compound module

- A Base module
- B Electronic module

3.4.3 Supply modules

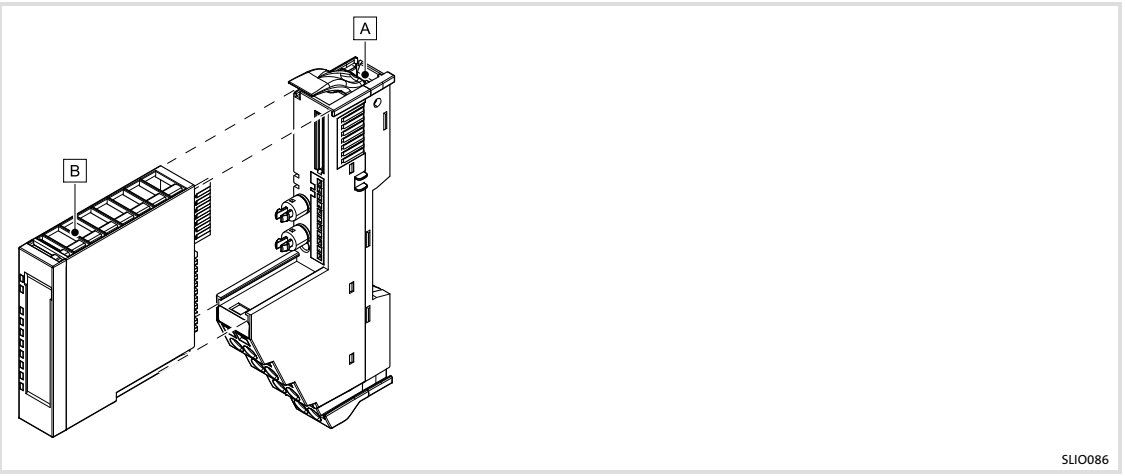


Fig. 3-5 Components of an EPM-S7xx power supply module

A Base module
B Electronic module

3.4.4 Power distributor module

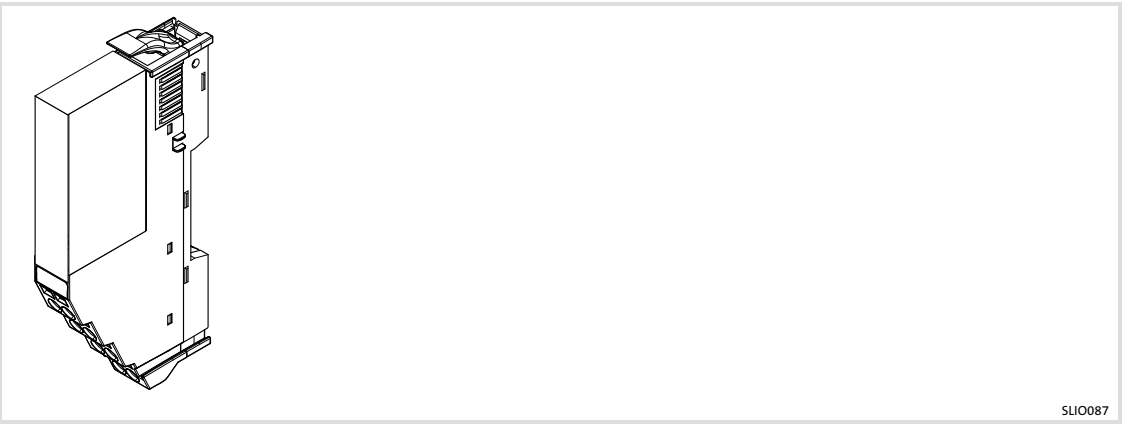


Fig. 3-6 EPM-S9xx Power distributor module

3.4.5 Accessories

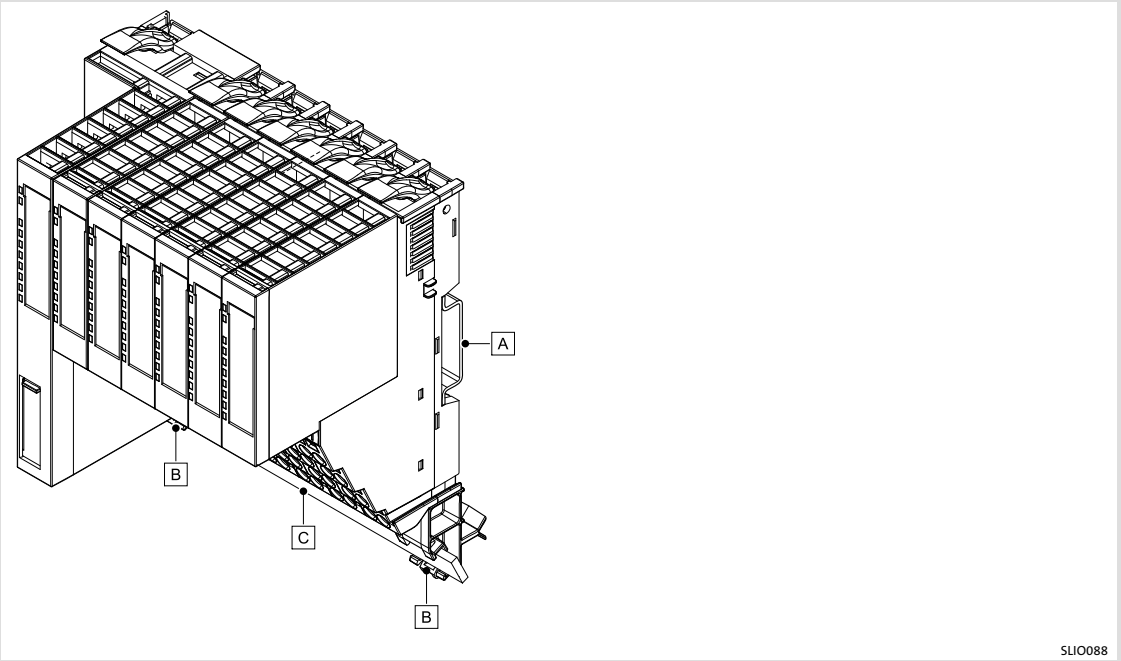


Fig. 3-7 I/O system 1000 accessories

- A 35 mm DIN rail (available in specialist shops)
- B EPM-S900 busbar support
- C 10 x 3 mm busbar for shield connection via shield terminals (available in specialist shops)

3.4.6 Function elements

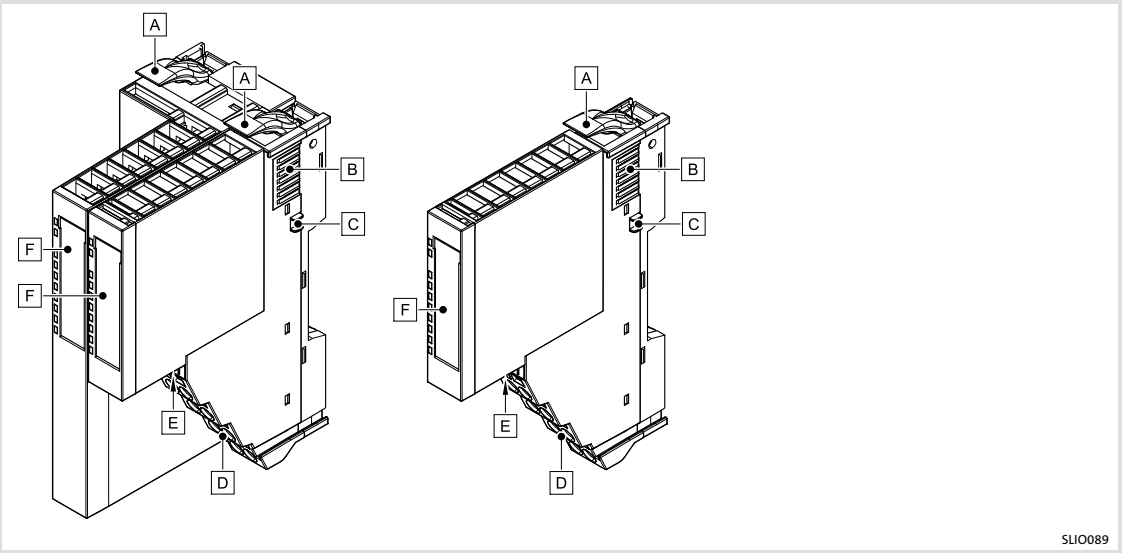


Fig. 3-8 Standard function elements (on the left bus coupler module, on the rechts I/O compound module)

- A Base module ↔DIN rail locking lever
- B Contacts - backplane bus
- C Contacts, I/O supply
- D Terminals
- E Electronic module ↔base module locking button
- F Status displays (LEDs) with labelling strips

Note!

The description of the module-specific function elements can be found in the following module descriptions.

3.5 Bus coupler modules

3.5.1 CANopen - EPM-S110

The bus coupler module represents the interface between the process level (I/O level) and the higher-level fieldbus. The control signals on the process level are transmitted by the I/O compound modules via the internal backplane bus.

Features

- Up to 64 I/O compound modules can be connected to a CANopen bus coupler module
- Integrated power supply unit for the internal voltage supply and the voltage supply of the connected I/O compound modules
  – Power supply unit is fed via an external DC voltage source
- Connected to the CAN bus via a 9-pole Sub-D plug
- Setting of the CAN address and baud ratevia coding switch
- LEDs for status display

Overview

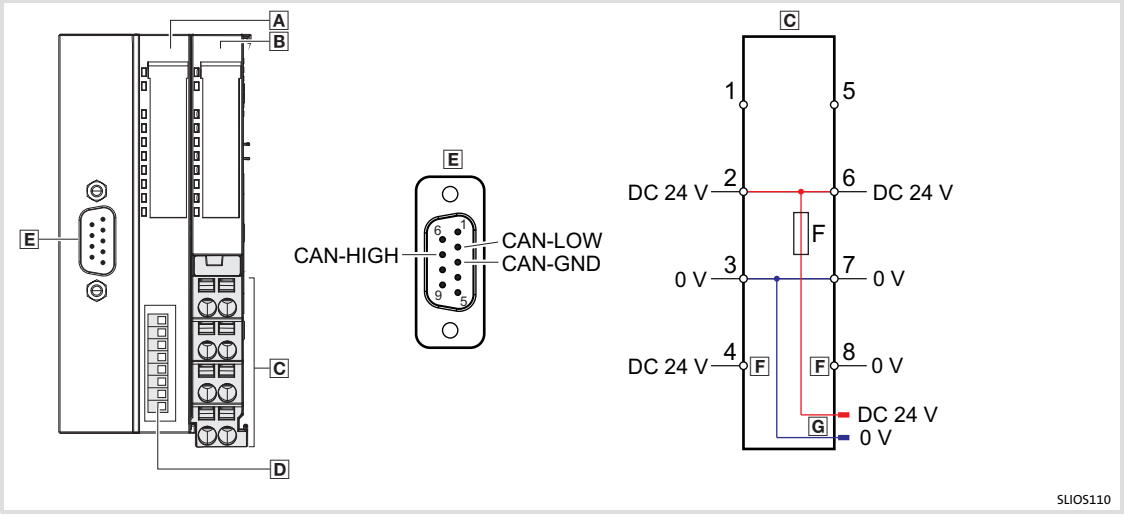


Fig. 3-9 Elements and circuit diagram of voltage supply

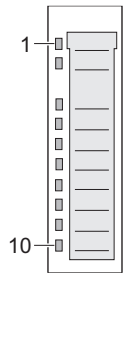
- A Displays for station and fieldbus status
- B Displays for electronics and I/O supply status
- C Terminals for the voltage supply
- D Coding switch for setting the CAN address and baud rate
- E Sub-D plug for connection to the fieldbus
- F Electronic supply
- G I/O supply

Note!

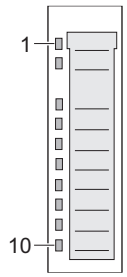
The 24V terminal is an integral part of the bus coupler module and cannot be separated from it.

Status displays

Fieldbus status LEDs A

View	Pos.	Designation	Colour	Explanation
	1	PWR	Green	On: Bus coupler is supplied with voltage
	2	SF	Red	On: Station error, station structure does not comply with configuration.
	3	BA	Green	On: Operating mode ”Operational” (ready for data exchange) Blinking: Operating mode ”Pre-operational” (waiting for parameters)
	4	IF	Red	On: Internal error is pending
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

Module status LEDs A

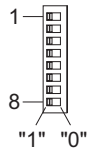
View	Pos.	Designation	Colour	Explanation
	1	PWR IO	Green	On: I/O supply okay
	2	PF IO	Red	On: Fuse for I/O supply is defective
	3	PWR	Green	On: Electronic supply okay
	4	PF	Red	On: Fuse for electronic supply defective
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

Control elements

The CAN node address and the baud rate are set via the coding switch.

Setting the baud rate:

Coding switch - CAN address and baud rate (addr.) 🄳

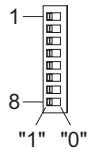
View	Pos.	Valency	Baud rate [kbps]	Example	
				Switching status	Baud rate
 SLIO004	1	not assigned	-	-	
	2	1	0 = 1000 1 = 500 2 = 250 3 = 125 4 = 100 5 = 50 6 = 20 7 = 10 8 = 800	1	1 + 2 = 3 → baud rate 125 kbps
	3	2		1	
	4	4		0	
	5	8		0	
	6	16		0	
	7	32		0	
	8	64		0	

1. Switch off the voltage supply for the I/O system.
2. Set all switches at the coding switch to ”0”.
3. Switch on the voltage supply for the I/O system.
   The LEDs SF, IF and CAN-RUN are blinking with a frequency of 1 Hz.
4. Set the desired baud rate with the coding switch. You have 10 seconds to do this.
   The IF LED goes off after 10 seconds, and the set baud rate is saved.

   You have a further 10 seconds time to set the node address.

Setting the node address:

Coding switch - CAN address and baud rate (addr.) 🄳

View	Pos.	Valency	Example	
			Switching status	Node address
 SLIO004	1	not assigned	-	
	2	1	1	1 + 2 + 16 = 19 →address 19
	3	2	1	
	4	4	0	
	5	8	0	
	6	16	1	
	7	32	0	
	8	64	0	

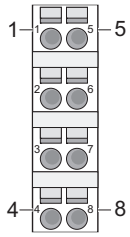
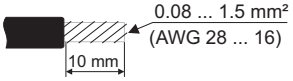
5. Set the node address for the module with the coding switch.
   – Device addresses permitted are 1 ... 127.
   – Each node address must be assigned only once.

Note!

The node address can be changed any time by means of the coding switch. The setting is accepted once the supply voltage is switched on.

Terminals

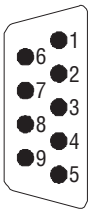
Module terminals, spring terminals C

View	Designation	Explanation	Terminal data
 SLIO002	1	Not assigned	
	2	I/O supply +24 V DC	
	3	I/O supply 0 V	
	4	Electronic supply +24 V DC	
	5	Not assigned	
	6	I/O supply +24 V DC	
	7	I/O supply 0 V	
	8	Electronic supply 0 V	

Note!

- ► Terminals 2 and 6 as well as 3 and 7 are bridged internally. Please note that the **max. permissible bridge current is 5 A**.
- ► Both the I/O supply and the electronic supply are protected against overload internally by a fuse. When the fuses have been tripped, the main supply of the bus coupler (EPM-S700) must be replaced (📖 776).

System bus (CAN) / CANopen (”CAN”), 9-pole Sub-D plug F

View	Pin	Assignment	Explanation
 epm-t023	1	-	Not assigned
	2	CAN-LOW	Data line
	3	CAN-GND	Data ground
	4	-	Not assigned
	5	-	Not assigned
	6	-	Not assigned
	7	CAN-HIGH	Data line
	8	-	Not assigned
	9	-	Not assigned

Stop!

Housing breakage in the case of a too high tightening torque of the securing screws

If the connector securing screws are tightened too firmly, the housing may break.

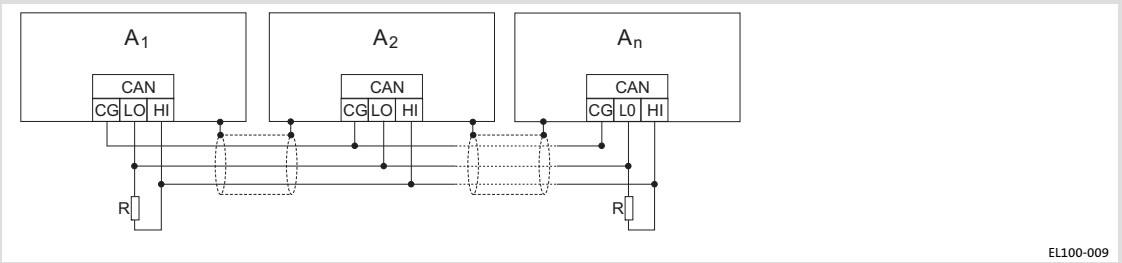
Possible consequences:

- ► The plug connection is no longer secured against tension.
- ► Enclosure IP20 of the module which is warranted can no longer be guaranteed.

Protective measures:

- ► Tighten securing screws without using force (max. 40 Nm).

Wiring



A1	Node 1
A2	Node 2
An	Node n
CG	CAN-GND
LO	CAN-LOW
HI	CAN-HIGH
R	120 Ω-bus terminating resistor

We recommend the use of CAN cables in accordance with ISO 11898-2:

CAN cable in accordance with ISO 11898-2	
Cable type	Paired with shielding
Impedance	120 Ω (95 ... 140 Ω)
Cable resistance/cross-section	
Cable length ≤ 300 m	≤ 70 mΩ/m / 0.25 ... 0.34 mm² (AWG22)
Cable length 301 ... 1000 m	≤ 40 mΩ/m / 0.5 mm² (AWG20)
Signal propagation delay	≤ 5 ns/m

More information on the system bus (CAN) / CANopen can be found in the chapter ”CANopen communication” (📖 275).

Accessories

- CAN bus plug ”Node” - EPM-T950
  - SUB-D, 90°
  - Screw terminals
- CAN bus plug ”Termination” - EPM-T951
  - SUB-D, 90°
  - Screw terminals
  - Integrated terminating resistor
- CAN bus plug ”Even” - EPM-T952
  - SUB-D, 180°
  - Screw terminals
  - Switched terminating resistor
- CAN bus plug ”Switch” - EWZ0046
  - SUB-D, 90°
  - Spring-type terminals
  - Switched terminating resistor

Technical data

EPM-S110: Rated data	
Electrical data	
Supply voltage	
Nominal value	DC 24 V
Permissible range	DC 20.4 ... 28.8 V
Current consumption	
Nominal value	0.95 A
In idle state	0.09 A
Starting current	3.9 A
I^2t	0.14 A^2s
Current output, max.	
At the backplane bus	3 A
Load supply	7 A (if no UL conformity is required: max. 10 A)
Polarity reversal protection	Yes
Power loss	3 W
Status, alarm, diagnostics	
Status display	Yes
Alarms	Yes, parameterisable
Process alarm	No
Diagnostic alarm	Yes, parameterisable
Diagnostic function	Yes, parameterisable
Diagnostic information can be read out	Possible
Supply voltage display	Green LED
Group error display	Red LED
Channel error display	None
System limits	
Mounting racks, max.	1
Modules per mounting rack	64
Number, max.	
I/O compound modules	64 (depends on current consumption)
Inputs/outputs	128 bytes /128 bytes (128 bytes = 16 PDOs of 8 bytes each)
Digital inputs/outputs	512
Analog inputs/outputs	36
Meters	4
SSI	8
Digital inputs, time stamp	4
Digital outputs, time stamp	4
Digital outputs, PWM	4

EPM-S110: Rated data	
communication	
Fieldbus	CANopen
Physics	CAN
Connection	9-pole Sub-D plug
Topology	Linear bus with bus termination at both ends
Electrical isolation	Yes
Station	
Number, max.	127
Address	1 ... 127
Transmission speed	
Min.	10 kbps
Max.	1 Mbps
Address range	
Inputs, max.	128 bytes
Outputs, max.	128 bytes
Number of TxPDOs/RxPDO, max.	
for controller-based automation	16/16
for drive-based automation	10/10

Calculation example for determining the maximum number of modules

Note!

If the CANopen bus coupler is used in conjunction with Lenze drives as part of Drive-based Automation (i.e. as a ”terminal extension” to the drive), the PDO configuration of the factory adjustment is used (see examples below):

► PDO1 only purely digital I/O compound modules

► PDO2 only purely analog I/O compound modules

► as of PDO3 counter, rapid I/Os with time stamp function etc.

With Controller-based Automation however all 16 PDOs are available in any distribution.

Example 1: Maximum configuration with digital inputs/outputs

In the default setting, 9 Rx-/Tx-PDOs are provided for digital inputs/outputs (DI/DO).

9 x 8 bytes = 72 bytes = 576 bits

Since only 64 I/O compound modules are permissible, max. 64 x 8 bits (DI8/DO8) = 512 channels can be used.

Example 2: Maximum configuration with analog inputs/outputs

In the default setting, 9 Rx-/Tx-PDOs are provided for analog inputs/outputs (AI/AO).

9 x 8 bytes = 72 bytes = 576 bits

Since 2 bytes are always occupied by an analog channel, max. 72 : 2 = 36 AI/AO channels can be used.

3.5.2 PROFIBUS - EPM-S120

The bus coupler module represents the interface between the process level (I/O level) and the higher-level fieldbus. The control signals on the process level are transmitted by the I/O compound modules via the internal backplane bus.

Features

- PROFIBUS-DP slave; supports PROFIBUS-DP-V1
- Up to 64 I/O compound modules can be connected to a PROFIBUS bus coupler module
- Integrated power supply unit for the internal voltage supply and the voltage supply of the connected I/O compound modules
  – Power supply unit is fed via an external DC voltage source
- Connection to the PROFIBUS via 9-pin Sub-D socket
- Coding switch for setting the PROFIBUS address
- LEDs for status display

Overview

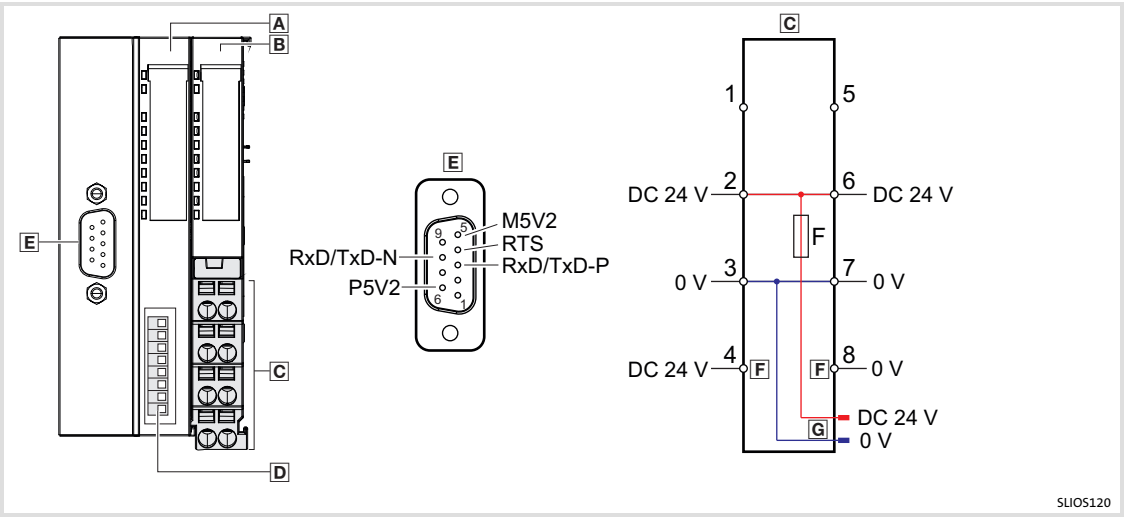
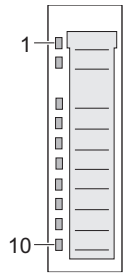


Fig. 3-10 Elements and circuit diagram of voltage supply

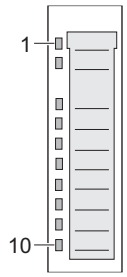
- A Displays for station and fieldbus status
- B Displays for electronics and I/O supply status
- C Terminals for the voltage supply
- D Coding switch for setting the PROFIBUS address
- E Sub-D socket for connection to the fieldbus
- F Electronic supply
- G I/O supply

Status displays

Fieldbus status LEDs [A]

View	Pos.	Designation	Colour	Explanation
	1	PWR	Green	On: Bus coupler is supplied with voltage
	2	SF	Red	On: Station error, station structure does not comply with configuration.
	3	DE	Green	On: ”Data Exchange” state Blinking: Bus coupler waiting for parameters
	4	IF	Red	On: Internal error is pending
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

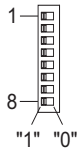
Module status LEDs [A]

View	Pos.	Designation	Colour	Explanation
	1	PWR IO	Green	On: I/O supply okay
	2	PF IO	Red	On: Fuse for I/O supply is defective
	3	PWR	Green	On: Electronic supply okay
	4	PF	Red	On: Fuse for electronic supply defective
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

Control elements

Via coding switch [D] the PROFIBUS node address is set. The setting is permanently stored in EEPROM.

Coding switch - PROFIBUS address (addr.) [D]

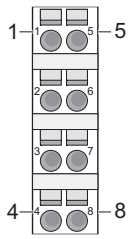
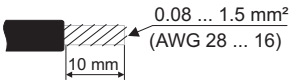
View	Pos.	Valency	Example	
			Switching status	Node address
	1	Not assigned	-	
	2	1	1	19_{dec} □ℳ❒address: 19
	3	2	1	
	4	4	0	
	5	8	0	
	6	16	1	
	7	32	0	
	8	64	0	

How to proceed:

1. Switch off the voltage supply for the I/O system.
2. Set the node address with the coding switch [D].
   – Permitted addresses: 1 ... 125
   – Each node address within a fieldbus system must be non-ambiguous.
3. Switch on the voltage supply for the I/O system.

Terminals

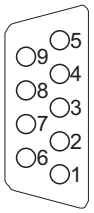
Module terminals, spring terminals C

View	Designation	Explanation	Terminal data
 SLIO002	1	Not assigned	
	2	I/O supply +24 V DC	
	3	I/O supply 0 V	
	4	Electronic supply +24 V DC	
	5	Not assigned	
	6	I/O supply +24 V DC	
	7	I/O supply 0 V	
	8	Electronic supply 0 V	

Note!

- ► Terminals 2 and 6 as well as 3 and 7 are bridged internally. Please note that the **max. permissible bridge current is 5 A**.
- ► Both the I/O supply and the electronic supply are protected against overload internally by a fuse. When the fuses have been tripped, the main supply of the bus coupler (EPM-S700) must be replaced (🕮 776).

Profibus, 9-pole Sub-D socket F

View	Pin	Assignment	Explanation
 EPM-T223	1	-	Not assigned
	2	-	Not assigned
	3	RxD/TxD-P	Data line B (received / transmitted data plus)
	4	RTS	Request To Send (received / transmitted data, no differential signal)
	5	M5V2	Data ground (ground at 5 V)
	6	P5V2	DC 5 V / 30 mA (bus termination)
	7	-	Not assigned
	8	RxD/TxD-N	Data line A (received / transmitted data minus)
	9	-	Not assigned

Stop!

Housing breakage in the case of a too high tightening torque of the securing screws

If the connector securing screws are tightened too firmly, the housing may break.

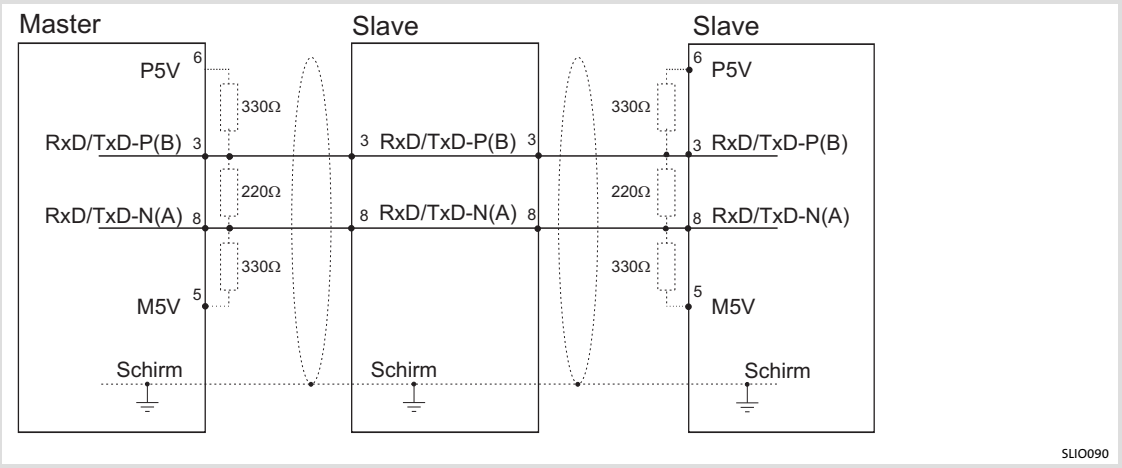
Possible consequences:

- ► The plug connection is no longer secured against tension.
- ► Enclosure IP20 of the module which is warranted can no longer be guaranteed.

Protective measures:

- ► Tighten securing screws without using force (max. 40 Nm).

Wiring



Note!

The PROFIBUS cable must be terminated with its surge impedance.

More information on the PROFIBUS can be found in the chapter ”PROFIBUS communication” (📖 410).

Technical data

EPM-S120: Rated data	
Electrical data	
Supply voltage	
Nominal value	DC 24 V
Permissible range	DC 20.4 ... 28.8 V
Current consumption	
Nominal value	0.95 A
In idle state	0.09 A
Starting current	3.9 A
I^2t	0.14 A^2s
Current output, max.	
At the backplane bus	3 A
Load supply	7 A (if no UL conformity is required: max. 10 A)
Polarity reversal protection	Yes
Power loss	3 W
Status, alarm, diagnostics	
Status display	Yes
Alarms	Yes, parameterisable
Process alarm	Yes, parameterisable
Diagnostic alarm	Yes, parameterisable
Diagnostic function	Yes, parameterisable
Diagnostic information can be read out	Possible
Supply voltage display	Green LED
Group error display	Red LED
Channel error display	None
System limits	
Mounting racks, max.	1
Modules per mounting rack	64

EPM-S120: Rated data	
communication	
Fieldbus	PROFIBUS-DP in accordance with EN 50170
Physics	RS485 insulated
Connection	9-pole Sub-D socket
Topology	Linear bus with bus termination at both ends
Electrical isolation	Yes
Station	
Number, max.	125
Address	1 ... 125
Transmission speed	9.6 kbps ... 12 Mbps
Process data for PROFIBUS-DP-V0	
Input data, max.	244 bytes
Output data, max.	244 bytes
Process data for PROFIBUS-DP-V1	
Input data, max.	240 bytes
Output data, max.	240 bytes
Parameter data, max. length *	224 bytes
the amount required by an I/O module with ...	
digital inputs or outputs (EPM-S200 ... EPM-S305)	0 bytes
2 analog inputs (EPM-S400/-S402)	6 bytes
4 analog inputs (EPM-S401/-S403)	8 bytes
2 analog outputs (EPM-S500/-S502)	8 bytes
4 analog outputs (EPM-S501/-S503)	10 bytes
4 analog inputs res. (EPM-S404)	34 bytes
2 analog inputs TE (EPM-S405)	22 bytes
1 counter 32 bits, 24 V DC (EPM-S600)	21 bytes
2 counters 32 bits, 24 V DC (EPM-S601)	42 bytes
1 counter 32 bits, 5 V DC (EPM-S602)	22 bytes
2 counters 32 bits, 24 V DC (EPM-S603)	8 bytes
SSI (EPM-S604)	33 bytes
2 dig. inputs, time stamp (EPM-S207)	6 bytes
2 dig. outputs, time stamp (EPM-S310)	2 bytes
2 dig. outputs, PWM (EPM-S620)	8 bytes
RS232 interface (EPM-S640)	8/20/60 bytes (parameterisable)

* Calculation example: 5 x EPM-S400 and 5 x EPM-S501 → (5 x 6 bytes) + (5 x 10 bytes) = 80 bytes; i.e. a reserve of 144 bytes

3.5.3 EtherCAT - EPM-S130

Note!

In conjunction with the EPM-S130 bus coupler module (EtherCAT), only I/O compound modules EPM-Sxxx from hardware version 1B on are supported.

The bus coupler module represents the interface between the process level (I/O level) and the higher-level fieldbus. The control signals on the process level are transmitted by the I/O compound modules via the internal backplane bus.

Features

- EtherCAT bus coupler module for up to 64 peripheral modules
- Ethernet-based fieldbus system with high real-time capability
- Online project planning using Mater system
- Extensive diagnostic functions
- Integrated power supply unit for the internal voltage supply and the voltage supply of the connected I/O compound modules
  - Power supply unit supplied via an external DC voltage source
- Connected to fieldbus via RJ45 socket 100BaseTX, 10BaseT
- LEDs for status display
- ”Distributed Clock” and ”Station Alias” are not supported

Overview

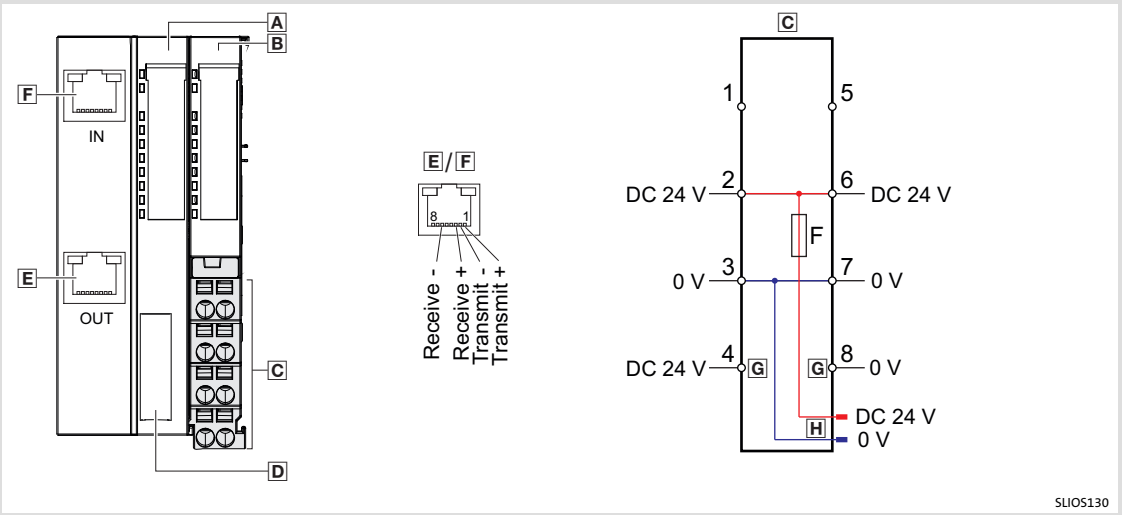


Fig. 3-11 Elements and circuit diagram of voltage supply

- A Displays for station and fieldbus status
- B Displays for electronics and I/O supply status
- C Terminals for the voltage supply
- D Bus interface
- E RJ45 socket OUT
- F RJ45 socket IN
- G Electronic supply
- H I/O supply

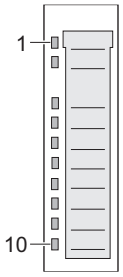
Note!

EtherCAT uses the Ethernet as its transmission medium. Only EtherCAT components may be used in an EtherCAT network. To produce topologies deviating from the line topology, you will need the corresponding EtherCAT components which support such deviations. Hubs cannot be used.

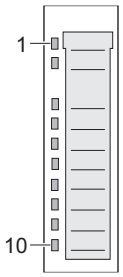
An EtherCAT network always consists of a master and any number of EtherCAT slaves (bus couplers). Each EtherCAT slave has an ”IN” and ”OUT” RJ45 socket. The EtherCAT cable from the master should be plugged into the socket marked as ”IN”. The socket marked as ”OUT” should be connected to the following node. The ”OUT” socket on the last node is free.

Status displays

Fieldbus status LEDs [A]

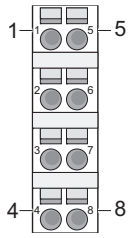
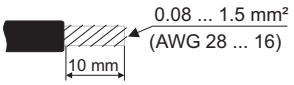
View	Pos.	Designation	Colour	Explanation
	1	PWR	Green	On: bus coupler is supplied with voltage
	2	SF	Red	Flashes at 0.5 Hz: EtherCAT timeout (watchdog) Flashes at 1 Hz: status change due to error Flashes at 2 Hz: configuration error
	3	RUN	Green	On: bus coupler in operational status Flashes at 1 Hz: bus coupler in pre-operational status Flashes at 2 Hz: bus coupler in safe operational status Off: bus coupler in initialisation status
	4	L/A1	Green	Off: no communication with preceding EtherCAT node On: preceding EtherCAT node is connected
	5	IF1	Red	On: internal error in communication with preceding EtherCAT node
	6	L/A2	Green	Off: no communication with following EtherCAT node On: following EtherCAT node is connected
	7	IF2	Red	On: internal error in communication with following EtherCAT node
	8	-	-	Not assigned
	9			
	10			

Module status LEDs [A]

View	Pos.	Designation	Colour	Explanation
	1	PWR IO	Green	On: I/O supply okay
	2	PF IO	Red	On: Fuse for I/O supply is defective
	3	PWR	Green	On: Electronic supply okay
	4	PF	Red	On: Fuse for electronic supply defective
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

Terminals

Module terminals, spring terminals C

View	Designation	Explanation	Terminal data
 SLIO002	1	Not assigned	
	2	I/O supply +24 V DC	
	3	I/O supply 0 V	
	4	Electronic supply +24 V DC	
	5	Not assigned	
	6	I/O supply +24 V DC	
	7	I/O supply 0 V	
	8	Electronic supply 0 V	

Note!

- Terminals 2 and 6 as well as 3 and 7 are bridged internally. Please note that the **max. permissible bridge current is 5 A**.
- Both the I/O supply and the electronic supply are protected against overload internally by a fuse. When the fuses have been tripped, the main supply of the bus coupler (EPM-S700) must be replaced (📖 776).

EtherCAT, RJ45 socket E, F

View	Pin	Assignment	Explanation
 SLIO065	1	Transmit +	Transmitted data plus
	2	Transmit -	Transmitted data minus
	3	Receive +	Received data plus
	4	-	Not assigned
	5	-	Not assigned
	6	Receive -	Received data minus
	7	-	Not assigned
	8	-	Not assigned
	9	-	Not assigned

Technical data

EPM-S130: rated data	
Electrical data	
Supply voltage	
Nominal value	DC 24 V
Permissible range	DC 20.4 ... 28.8 V
Current consumption	
Nominal value	0.95 A
In idle state	0.095 A
Starting current	3.9 A
I^2t	0.14 A^2s
Current output, max.	
At the backplane bus	3 A
Load supply	7 A (if no UL conformity is required: max. 10 A)
Polarity reversal protection	No
Power loss	3 W

EPM-S130: rated data	
Status, alarm, diagnostics	
Status display	Yes
Alarms	Yes, parameterisable
Process alarm	Yes, parameterisable
Diagnostic alarm	Yes, parameterisable
Diagnostic function	Yes, parameterisable
Diagnostic information can be read out	Possible
Supply voltage display	Green LED
Group error display	Red SF-LED
Channel error display	None
System limits	
Mounting racks, max.	1
Modules per mounting rack	64
communication	
Fieldbus	EtherCAT
Physics	Ethernet 100 Mbits
Connection	RJ45
Topology	Line topology with branches and spur lines
Electrical isolation	No
Station	
Number, max.	65535
Address	None
Transmission speed	100 Mbps
Address range	
Inputs, max.	4 kB
Outputs, max.	4 kB
Process data	
Input data, max.	1024 bytes
Output data, max.	1024 bytes

3.5.4 PROFINET - EPM-S140

The bus coupler module represents the interface between the process level (I/O level) and the higher-level fieldbus. The control signals on the process level are transmitted by the I/O compound modules via the internal backplane bus.

Features

- PROFINET I/O-Device according to IEC 61158
- Up to 64 I/O compound modules can be connected to a PROFINET bus coupler module
- Integrated power supply unit for the internal voltage supply and the voltage supply of the connected I/O compound modules
  – Power supply unit supplied via an external DC voltage source
- Integrated 2-port switch
  – Ethernet connection via 2 RJ45 sockets (P1, P2)
  – Auto negotiation (negotiating the transmission parameters)
  – Auto crossover (transmit and receive path are automatically crossed if required)
- Setting of the PROFINET address via coding switch
- LEDs for status display

Overview

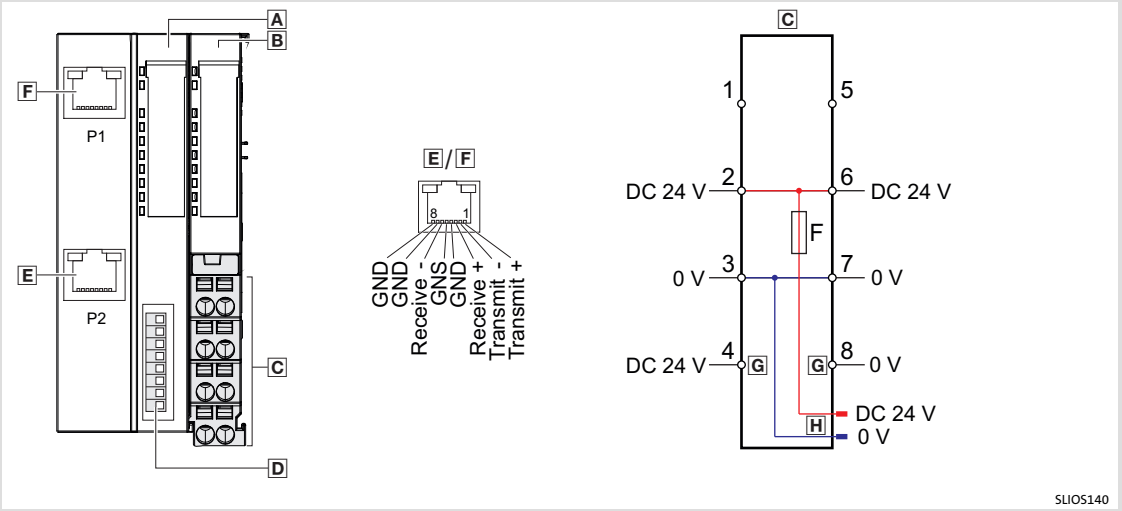
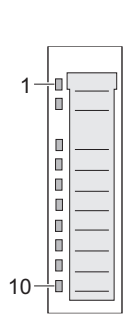


Fig. 3-12 Elements and circuit diagram of voltage supply

- A Displays for station and fieldbus status
- B Displays for electronics and I/O supply status
- C Terminals for the voltage supply
- D Coding switch for setting the PROFINET address
- E RJ45 socket for connection to the fieldbus (P1)
- F RJ45 socket for connection to the fieldbus (P2)
- G Electronic supply
- H I/O supply

Status displays

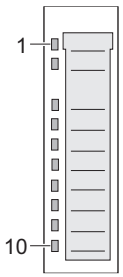
Fieldbus status LEDs A

View	Pos.	Designation	Colour	Explanation
	1	PWR	Green	On: bus coupler is supplied with voltage
	2	SF	Red	On: System error; error at PROFINET or at backplane bus
	3	BS	Green	Bus error; error in PROFINET communication
	4	MT	Yellow	Maintenance: PROFINET maintenance request
	5	LINK1	Green	Physical connection to PROFINET (P1)
	6	ACT1	Green	Communication via PROFINET (P1)
	7	LINK2	Green	Physical connection to PROFINET (P2)
	8	ACT2	Green	Communication via PROFINET (P2)
	9	-	-	Not assigned
	10			

PWR	SF	BS	MT	LINK1	ACT1	LINK2	ACT2	Status
Green	Red	Green	Yellow	Green	Green	Green	Green	
On	-	-	-	-	-	-	-	The PROFINET bus coupler is supplied with voltage.
On	Off	0.5 Hz	-	[On]	-	[On]	-	It is not possible to establish a connection with the PROFINET I/O controller. A connection to the switch, however, exists (no AR is active) LNK1 or LNK2 is on.
On	Off	On	-	Off	Off	Off	Off	There is no physical connection to the Ethernet. LNK1 and LNK2 are off.
On	-	Off	-	[On]	Pulse	[On]	Pulse	A connection to a PROFINET I/O controller has been established (at least one AR is active) LNK1 or LNK2 is on.
On	On	-	-	-	-	-	-	• A diagnostic message not yet acknowledged is available. • Error at the backplane bus (e.g. module defective, bus disturbed). • Error at firmware update (only visible for a short time, afterwards restart).
On	2 Hz	On	-	On	-	On	-	IP address error • No valid IP address has been assigned. • The assigned IP address already exists in the system.
On	-	1 Hz	1 Hz	-	-	-	-	A firmware update is currently being executed. Here, BS and MT are blinking alternately.
On	-	-	-	2 Hz	-	2 Hz	-	Identification via DCP. Depending on the connection, LINK1 or LINK2 is blinking for 3 seconds with 2 Hz.
On	On	-	On	-	-	-	-	Maintenance request (Maintenance demanded/requested) • After the coupler has been parameterised, no sync frame has been received. • Jitter is outside the limits (renewed synchronisation). • Switch has rejected 10 frames (network overloaded). • Error at the system SLIO bus (version error).

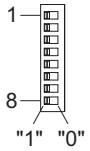
"-": Not relevant; "x Hz": Blinking with x Hz; "[an]": Option; "Puls": Pulsating

Module status LEDs Ⓐ

View	Pos.	Designation	Colour	Explanation
 SLIO001	1	PWR IO	Green	On: I/O supply okay
	2	PF IO	Red	On: Fuse for I/O supply is defective
	3	PWR	Green	On: Electronic supply okay
	4	PF	Red	On: Fuse for electronic supply defective
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

Control elements

Coding switch PROFINET address Ⓓ

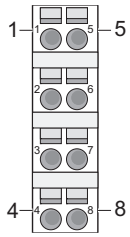
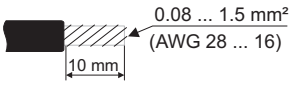
View	Pos.	Valency	Example	
			Switching status	Node address
 SLIO004	1	-	-	No function
	2	1	1	Profinet name: ”EPM-S140-xxx” with xxx = decimal value of position 2 ... 8; for example: 19_{dec} → xxx = 19
	3	2	1	
	4	4	0	
	5	8	0	
	6	16	1	
	7	32	0	
	8	64	0	

Important switch positions

Pos.	Status	Behaviour at restart
2 ... 8	0	Profinet-compliant (IEC 61158-6-10, IEC 61784-2) ● IP address./subnet mask comes from flash memory. ● Profinet name comes from flash memory.
2 ... 8	[1 ... 127]	● IP address./subnet mask comes from flash memory. ● Profinet name: EPM-S140-xxx (with xxx = decimal value of position 2...8): Profinet name with I/O controller cannot be changed.

Terminals

Module terminals, spring terminals C

View	Designation	Explanation	Terminal data
 SLIO002	1	Not assigned	
	2	I/O supply +24 V DC	
	3	I/O supply 0 V	
	4	Electronic supply +24 V DC	
	5	Not assigned	
	6	I/O supply +24 V DC	
	7	I/O supply 0 V	
	8	Electronic supply 0 V	

Note!

- Terminals 2 and 6 as well as 3 and 7 are bridged internally. Please note that the **max. permissible bridge current is 5 A**.
- Both the I/O supply and the electronic supply are protected against overload internally by a fuse. When the fuses have been tripped, the main supply of the bus coupler (EPM-S700) must be replaced (📖 776).

PROFINET, RJ45 socket D

View	Pin	Assignment	Explanation
 SLIO065	1	Transmit +	Transmitted data plus
	2	Transmit -	Transmitted data minus
	3	Receive +	Received data plus
	4	GND	Ground
	5	GND	Ground
	6	Receive -	Received data minus
	7	GND	Ground
	8	GND	Ground

Technical data

Rated data EPM-S140	
Electrical data	
Supply voltage	
Nominal value	DC 24 V
Permissible range	DC 20.4 ... 28.8 V
Current consumption	
Nominal value	0.95 A
In idle state	0.095 A
Starting current	3.9 A
I^2t	0.14 A^2s
Current output, max.	
At the backplane bus	3 A
Load supply	7 A (if no UL conformity is required: max. 10 A)
Polarity reversal protection	Yes
Power loss	3 W

Rated data EPM-S140	
Status, alarm, diagnostics	
Status display	Yes
Alarms	Yes, parameterisable
Process alarm	Yes, parameterisable
Diagnostic alarm	Yes, parameterisable
Diagnostic function	Yes, parameterisable
Diagnostic information can be read out	Possible
Supply voltage display	Green LED
Maintenance display	Yellow LED
Group error display	Red LED
Channel error display	None
System limits	
Mounting racks, max.	
Modules per mounting rack	64
communication	
Fieldbus	PROFINET-IO
Physics	Ethernet 100 Mbits
Connection	2 x RJ45
Electrical isolation	Yes
Transmission speed	100 Mbps
Address range	
Inputs, max.	512 bytes
Outputs, max.	512 bytes

3.5.5 DeviceNet - EPM-S150

The bus coupler module represents the interface between the process level (I/O level) and the higher-level fieldbus. The control signals on the process level are transmitted by the I/O compound modules via the internal backplane bus.

Features

- DeviceNet coupler
- Up to 64 I/O compound modules can be connected to a DeviceNet bus coupler module
- Group 2 only Device uses Predefined Connection Set
- Poll only Device
  - No operating mode BIT STROBE
  - NO operating mode CHANGE OF STATE
  - Profile Generic Device
- Support of all baud rates: 125, 250 und 500 kbps
- Max. 255 bytes input/output data
- Integrated power supply unit for the internal voltage supply and the voltage supply of the connected I/O compound modules
  - Power supply unit supplied via an external DC voltage source
- Connection to the DeviceNet via ”Open Style Connector”
- Setting of the DeviceNet address and the baud rate via coding switch
- LEDs for status display

Overview

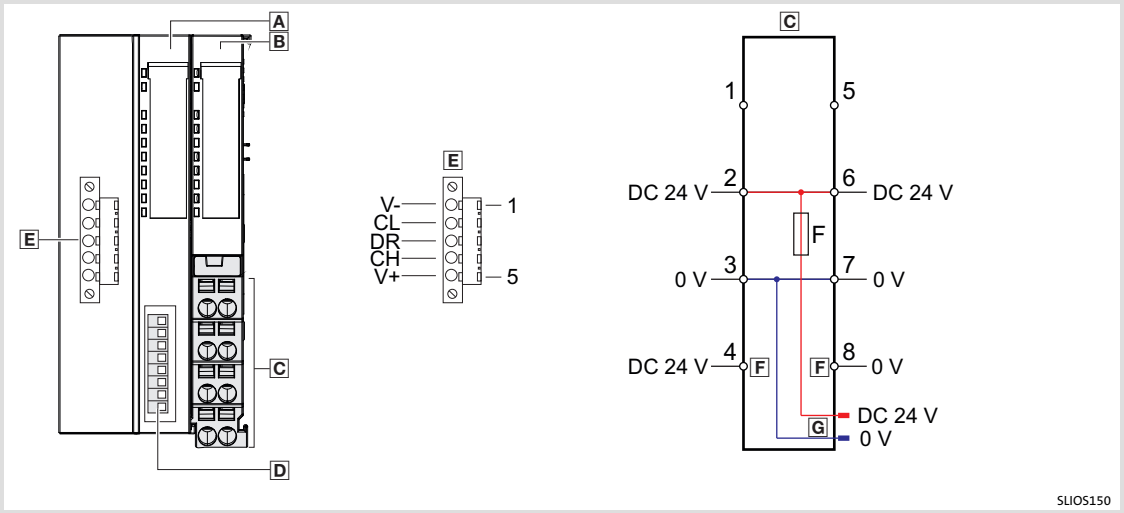
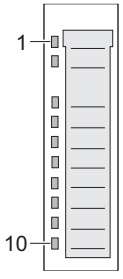


Fig. 3-13 Elements and circuit diagram of voltage supply

- A Displays for station and fieldbus status
- B Displays for electronics and I/O supply status
- C Terminals for the voltage supply
- D Coding switch for setting the DeviceNet address
- E Fieldbus connection
- F Electronic supply
- G I/O supply

Status displays

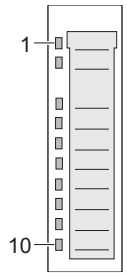
Fieldbus status LEDs A

View	Pos.	Designation	Colour	Explanation
	1	PW	Green	On: Bus coupler is supplied with voltage
	2	SF	Red	On: Error at DeviceNet or at backplane bus
	3	RD	Green	On: Backplane bus okay
	4	BA	Yellow	On: DeviceNet okay
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

SF	RD	BA	State
Red	Green	Yellow	
On	Off	Off	Invalid switch position at the address switch
Off	On	Off	Baud rate has been accepted successfully
1 Hz	1 Hz	1 Hz	Firmware update is running
On	On	On	Firmware update completed successfully
2 Hz	On	On	Firmware update completed with errors ● EDS file defective ● Transmission error ● Flash error
-	-	Off	Fieldbus is offline ● No DC 24V at the fieldbus plug ● No further node at the fieldbus
-	-	1 Hz	Fieldbus is ready ● No connection established
-	-	On	Fieldbus connected
On	-	Off	Fieldbus error ● Fieldbus address already exists ● Communication error at the fieldbus
On	-	1 Hz	Inactivity monitoring - Connection has been terminated due to inactivity
-	1 Hz	-	System SLIO Bus ready, outputs inactive
-	On	-	System SLIO bus active
On	2 Hz	-	Access error to system SLIO bus
2 Hz	2 Hz	-	Configuration error of system SLIO bus ● The numbers of plugged and projected modules are different. ● The module type of at least one plugged module differs from the parameterised module type.
1 Hz	2 Hz	2 Hz	Device error / internal error Please contact the Lenze service!

”-”: Not relevant; ”x Hz”: Blinking with x Hz

Module status LEDs A

View	Pos.	Designation	Colour	Explanation
	1	PWR IO	Green	On: I/O supply okay
	2	PF IO	Red	On: Fuse for I/O supply is defective
	3	PWR	Green	On: Electronic supply okay
	4	PF	Red	On: Fuse for electronic supply defective
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

Control elements

The coding switch serves for the following settings:

- Baud rate
- DeviceNet address
- Update mode for firmware update

Note!

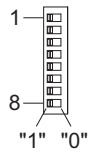
Changes at the coding switch get only effective after PowerON or automatic reset. Changes during operation will not be recognised!

Setting the baud rate:

Every station on the DeviceNet communicates with the same transfer rate. Proceed as follows to define the baud rate:

1. Switch off the voltage supply.
2. Set the switch 1 to ”1” (= baud rate).
3. Set the baud rate via switches 2 ... 4 according to the following table.

Baud rate D

View	Pos.	Description	Example	
			Switching status	Result
 SLIO004	1	Configuration	1	1: Setting of baud rate/update mode
	2	Baud rate 125 kbps	0	Baud rate: 250 kbps
	3	Baud rate 250 kbps	1	
	4	Baud rate 500 kbps	0	
	5	Not assigned	-	
	6	Not assigned	-	
	7	Update mode	0	
	8	Not assigned	-	

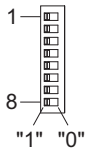
4. Switch on the voltage supply.
   The set baud rate is stored in the EEPROM.

Setting the DeviceNet address:

All stations on the bus must be uniquely identified by means of a DeviceNet address which is between 0 and 63. Proceed as follows to define the baud rate:

1. Switch off the voltage supply.
2. Set the switch 1 to ”0” (address).
3. Set the address via switches 2 ... 4 according to the following table.

DeviceNet address D

View	Pos.	Valency	Example	
			Switching status	Result
	1	Configuration	0	0: Address setting
	2	1	1	1 + 2 + 16 = 19 □ℳ❒ address: 19
	3	2	1	
	4	4	0	
	5	8	0	
	6	16	1	
	7	32	0	
SLIO004	8	Not assigned	-	

4. Switch on the voltage supply.
   The set node address is saved in the EEPROM. In case of a wrong or already available address the SF-LED (red) is lit after PowerON.

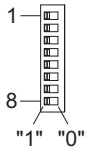
Setting the update mode:

Set the update mode to transmit a firmware to the bus coupler.

How to proceed:

1. Switch off the voltage supply.
2. Set the switch 1 to ”1” (= baud rate/update mode).
3. Set the update mode via switches 2 ... 4 according to the following table.

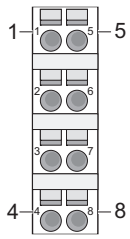
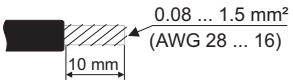
Baud rate D

View	Pos.	Description	Example	
			Switching status	Result
	1	Configuration	1	1: Setting of baud rate/update mode
	2	Baud rate 125 kbps	0	Update mode active
	3	Baud rate 250 kbps	0	
	4	Baud rate 500 kbps	0	
	5	Not assigned	-	
	6	Not assigned	-	
	7	Update mode	1	
SLIO004	8	Not assigned	-	

4. Switch on the voltage supply.
   The firmware is copied to the bus coupler.

Terminals

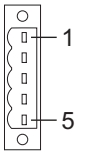
Module terminals, spring terminals C

View	Designation	Explanation	Terminal data
 SLIO002	1	Not assigned	
	2	I/O supply +24 V DC	
	3	I/O supply 0 V	
	4	Electronic supply +24 V DC	
	5	Not assigned	
	6	I/O supply +24 V DC	
	7	I/O supply 0 V	
	8	Electronic supply 0 V	

Note!

- ► Terminals 2 and 6 as well as 3 and 7 are bridged internally. Please note that the **max. permissible bridge current is 5 A**.
- ► Both the I/O supply and the electronic supply are protected against overload internally by a fuse. When the fuses have been tripped, the main supply of the bus coupler (EPM-S700) must be replaced (📖 776).

DeviceNet, 5-pole socket E

View	Pin	Assignment	Explanation
 SLIO066	1	V-	GND, voltage supply
	2	CL	CAN Low
	3	DR	DRAIN / shield
	4	CH	CAN High
	9	V+	DC 24 V, voltage supply

Stop!

Housing breakage in the case of a too high tightening torque of the securing screws

If the connector securing screws are tightened too firmly, the housing may break.

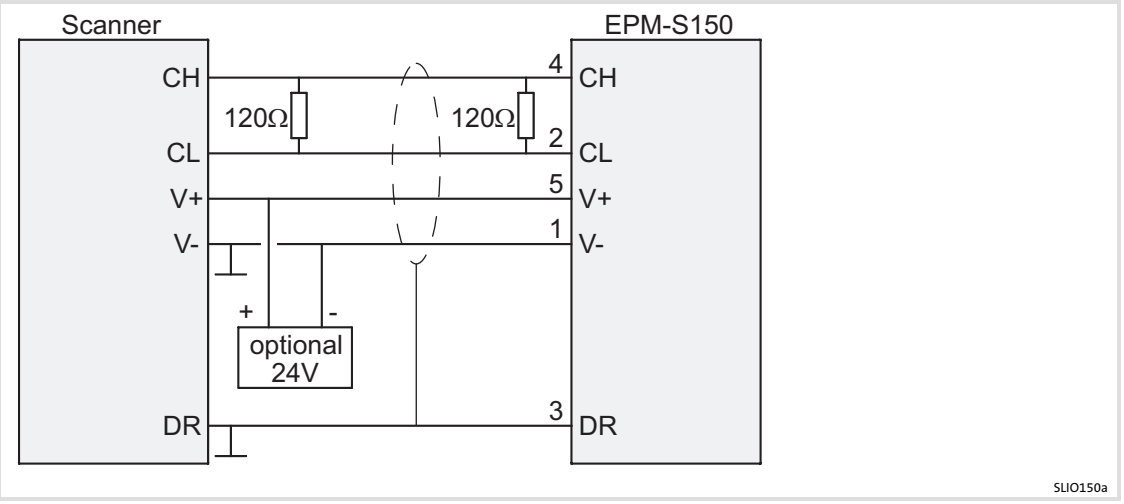
Possible consequences:

- ► The plug connection is no longer secured against tension.
- ► Enclosure IP20 of the module which is warranted can no longer be guaranteed.

Protective measures:

- ► Tighten securing screws without using force (max. 40 Nm).

Wiring



More information on the DeviceNet can be found in the chapter "DeviceNet communication" (📖 610).

Technical data

EPM-S150: Rated data	
Electrical data	
Supply voltage	
Nominal value	DC 24 V
Permissible range	DC 20.4 ... 28.8 V
Current consumption	
Nominal value	0.95 A
In idle state	0.09 A
Starting current	3.9 A
I^2t	0.14 A^2s
Current output, max.	
At the backplane bus	3 A
Load supply	7 A (if no UL conformity is required: max. 10 A)
Polarity reversal protection	Yes
Power loss	3 W
Status, alarm, diagnostics	
Status display	Yes
Alarms	None
Process alarm	None
Diagnostic alarm	None
Diagnostic function	None
Diagnostic information can be read out	Possible
Supply voltage display	Green LED
Group error display	Red SF-LED
Channel error display	None

EPM-S150: Rated data	
System limits	
Mounting racks, max.	1
Modules per mounting rack	64
communication	
Fieldbus	DeviceNet
Physics	CAN
Connection	5-pole open-style connector
Topology	Line with bus termination at both ends
Electrical isolation	Yes
Station	
Number, max.	64
Address	0 ... 63
Transmission speed	125 ... 500 kbps
Process data	
Address range input data, max.	256 bytes
Address range output data, max.	256 bytes

3.5.6 Modbus TCP- EPM-S160

The bus coupler module represents the interface between the process level (I/O level) and the higher-level fieldbus. The control signals on the process level are transmitted by the I/O compound modules via the internal backplane bus.

Features

- Ethernet slave with Modbus TCP protocol
- Up to 64 I/O compound modules connectable to a bus coupler module
- Integrated power supply unit for the internal voltage supply and the voltage supply of the connected I/O compound modules
  – Power supply unit supplied via an external DC voltage source
- I/O access of up to 8 stations
- Online parameter setting via integrated web server
- RJ45 socket 100BaseTX, 10BaseTX
- Automatic polarity and speed detection (auto negotiation)
- Automatic detection of parallel or crossed cables (auto crossover)
- LEDs for status display

Overview

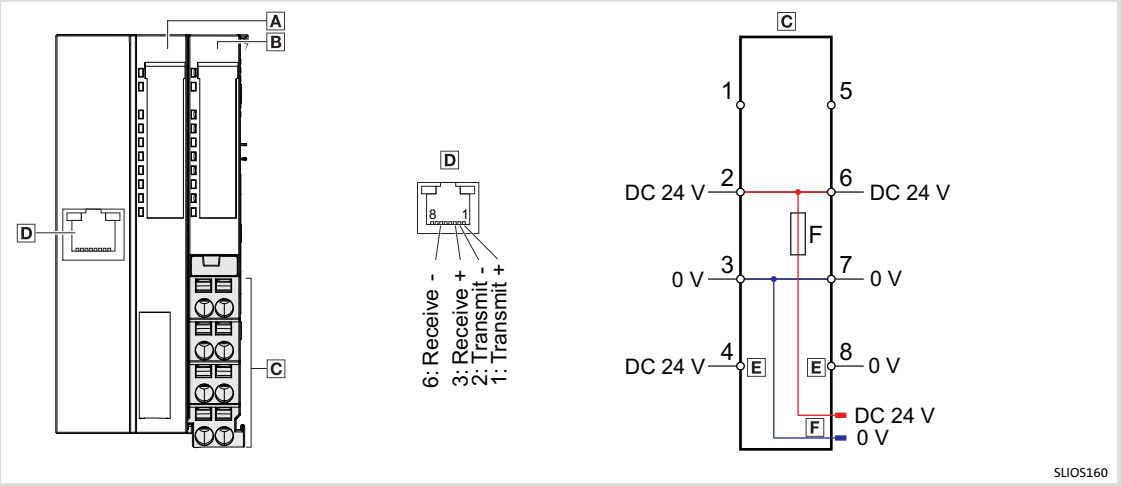
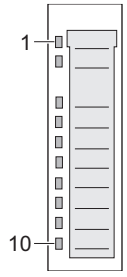


Fig. 3-14 Elements and circuit diagram of voltage supply

- A Displays for station and fieldbus status
- B Displays for electronics and I/O supply status
- C Terminals for the voltage supply
- D Fieldbus connection
- E Electronic supply
- F I/O supply

Status displays

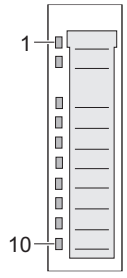
Fieldbus status LEDs A

View	Pos.	Designation	Colour	Explanation
	1	PWR	Green	On: Bus coupler is supplied with voltage
	2	SF	Red	On: System error; error at Ethernet or at backplane bus
	3	RUN	Green	Bus coupler status
	4	MT	Yellow	Bus coupler is localised
	5	L/A	Green	On: Ethernet is connected physically Blinking: Bus activity
	6	SPD	Green	On: Speed 100 Mbps Off: Speed 10 Mbps
	7	-	-	Not assigned
	8			
	9			
	10			

PWR	SF	RUN	MT	L/A	SPD	State
Green	Red	Green	Yellow	Green	Green	
On	-	-	-	-	-	Bus coupler is supplied with voltage.
On	Off	On	-	On	-	Bus coupler is communicating via Ethernet; no errors are pending.
On	-	-	-	Off	Off	There is no physical connection to the Ethernet.
On	On	Off	-	-	-	Error of Ethernet communication ● IP address error ● Error in DHCP setting ● Defective module connected
On	B2	Off	-	-	-	Backplane bus error; module is not supported
On	B3	Off	-	-	-	Backplane bus error; parameterisation error
On	-	-	B1	-	-	Bus coupler is localised; identification. Blinking lasts for 10 s.

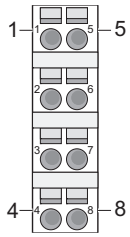
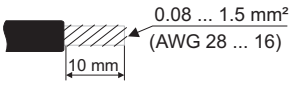
"-":not relevant
"B1": Blinking code with a period of 1 s "off-off-on-on"
"B2": Blinking code with a period of 1 s "on-on-on-on-off"
"B3": Blinking code with a period of 1 s "off-off-off-off-on"

Module status LEDs A

View	Pos.	Designation	Colour	Explanation
	1	PWR IO	Green	On: I/O supply okay
	2	PF IO	Red	On: Fuse for I/O supply is defective
	3	PWR	Green	On: Electronic supply okay
	4	PF	Red	On: Fuse for electronic supply defective
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

Terminals

Module terminals, spring terminals C

View	Designation	Explanation	Terminal data
 SLIO002	1	Not assigned	
	2	I/O supply +24 V DC	
	3	I/O supply 0 V	
	4	Electronic supply +24 V DC	
	5	Not assigned	
	6	I/O supply +24 V DC	
	7	I/O supply 0 V	
	8	Electronic supply 0 V	

Note!

- Terminals 2 and 6 as well as 3 and 7 are bridged internally. Please note that the **max. permissible bridge current is 5 A**.
- Both the I/O supply and the electronic supply are protected against overload internally by a fuse. When the fuses have been tripped, the main supply of the bus coupler (EPM-S700) must be replaced (📖 776).

Modbus TCP, 5-pole socket D

View	Pin	Assignment	Explanation
 SLIO065	1	Transmit +	Transmitted data plus
	2	Transmit -	Transmitted data minus
	3	Receive +	Received data plus
	4	-	Not assigned
	5	-	Not assigned
	6	Receive -	Received data minus
	7	-	Not assigned
	8		

Technical data

EPM-S160: Rated data	
Electrical data	
Supply voltage	
Nominal value	DC 24 V
Permissible range	DC 20.4 ... 28.8 V
Current consumption	
Nominal value	0.95 A
In idle state	0.095 A
Starting current	3.9 A
I^2t	0.14 A^2s
Current output, max.	
At the backplane bus	3 A
Load supply	7 A (if no UL conformity is required: max. 10 A)
Polarity reversal protection	Yes
Power loss	3 W

EPM-S160: Rated data	
Status, alarm, diagnostics	
Status display	Yes
Alarms	Yes, parameterisable
Process alarm	Yes, parameterisable
Diagnostic alarm	Yes, parameterisable
Diagnostic function	Yes, parameterisable
Diagnostic information can be read out	Possible
Supply voltage display	Green LED
Maintenance display	Yellow LED
Group error display	Red LED
Channel error display	None
System limits	
Mounting racks, max.	
Modules per mounting rack	64
communication	
Fieldbus	Modbus / TCP/IP
Physics	Ethernet 10/100 Mbps
Connection	RJ45
Electrical isolation	Yes
Transmission speed	10 ... 100 Mbps
Address range	
Inputs, max.	1 kB
Outputs, max.	1 kB

3.6 I/O compound modules - digital I/O

3.6.1 Two digital inputs - EPM-S200 and EPM-S204 (NPN)

This module detects up to two binary control signals from the process level and transmits them to the higher-level bus system.

Features

- 2 digital inputs (EPM-S204: N-switching)
- Suitable for switches and proximity switches
- LEDs display the switching states of the digital inputs

Overview

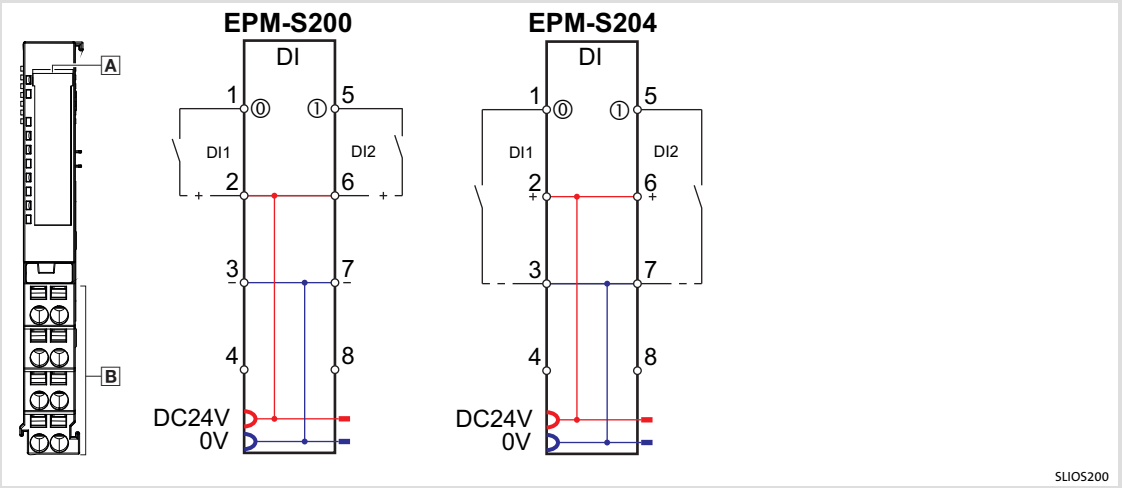
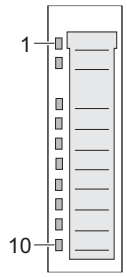


Fig. 3-15 Elements and circuit diagram

A	Displays for module status
B	Terminals
1 ... 8	Connection number
⓪ ... ⑦	Bit number in bit presentation

Status displays

Module status LEDs A

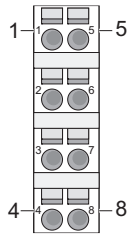
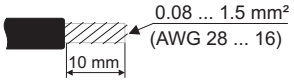
View	Pos.	Designation	Colour	Explanation
 SLIO001	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	DI1	Green	On: Digital input triggered
	4	DI2		
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
 SLIO002	1	Digital input DI1	
	2	24 V DC	
	3	GND	
	4	Not assigned	
	5	Digital input DI2	
	6	24 V DC	
	7	GND	
	8	Not assigned	

Technical data

EPM-S200 / EPM-S204 (NPN): Rated data	
Module identifier	EPM-S200: 1_{dec}; EPM-S204: 2_{dec}
Current consumption/power loss	
Current consumption from backplane bus	EPM-S200: 55 mA; EPM-S204: 60 mA
Power loss	0.5 W
Digital inputs	
Number of inputs	2
Cable length	
shielded	1000 m
unshielded	600 m
Input voltage	
Nominal value	DC 24 (DC 20.4 ... 28.8 V)
for signal ”0”	EPM-S200: DC 0 ... 5 V; EPM-S204: DC 15 ... 28.8 V
for signal ”1”	EPM-S200: DC 15 ... 28.8 V; EPM-S204: DC 0 ... 5 V
Input current	
for signal ”1”	3 mA
2-wire BERO	
Connection possible	Yes
Max. permissible closed-circuit current	0.5 mA
Input delay	
from ”0” to ”1”	3 ms
from ”1” to ”0”	3 ms
Number of inputs which can be used simultaneously	
horizontal structure	2
vertical structure	2
Input characteristic	EPM-S200: IEC 61131, type 1; EPM-S204: none
Input data size	8 bits (with EPM-S110: 2 bits)
Status, alarm, diagnostics	
Status display	Green LEDs per channel
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	No
Diagnostic information can be read out	None
Module status	Green LED
Module error display	Red LED
Channel error display	None
Electrical isolation	
Between the channels and the backplane bus	Yes
Insulation checked with	DC 500 V

3.6.2 Four digital inputs - EPM-S201 and EPM-S205 (NPN)

This module detects up to four binary control signals from the process level and transmits them to the higher-level bus system.

Features

- 4 digital inputs (EPM-S205: N-switching)
- Suitable for switches and proximity switches
- LEDs display the switching states of the digital inputs

Overview

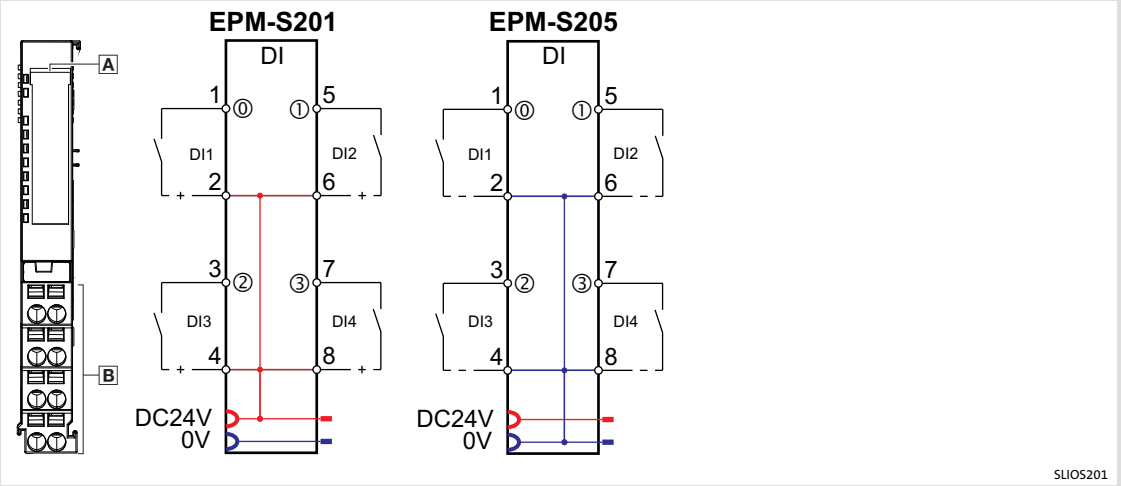
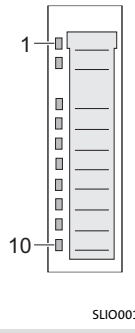


Fig. 3-16 Elements and circuit diagram

A	Displays for module status
B	Terminals
1 ... 8	Connection number
⓪ ... ⑦	Bit number in bit presentation

Status displays

Module status LEDs A

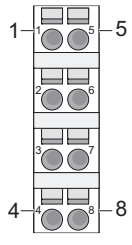
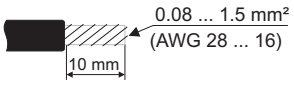
View	Pos.	Designation	Colour	Explanation
	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	DI1	Green	On: Digital input triggered
	4	DI2		
	5	DI3		
	6	DI4		
	7	-	-	Not assigned
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
	1	Digital input DI1	
	2	24 V DC	
	3	Digital input DI3	
	4	24 V DC	
	5	Digital input DI2	
	6	24 V DC	
	7	Digital input DI4	
	8	24 V DC	

Technical data

EPM-S201 / EPM-S205 (NPN): rated data	
Module identifier	EPM-S201: 3_{dec}; EPM-S205: 4_{dec}
Current consumption/power loss	
Current consumption from backplane bus	EPM-S201: 55 mA; EPM-S205: 65 mA;
Power loss	0.6 W
Digital inputs	
Number of inputs	4
Cable length	
shielded	1000 m
unshielded	600 m
Input voltage	
Nominal value	DC 24 (DC 20.4 ... 28.8 V)
for signal ”0”	EPM-S201: DC 0 ... 5 V; EPM-S205: DC 15 ... 28.8 V
for signal ”1”	EPM-S201: DC 15 ... 28.8 V; EPM-S205: DC 0 ... 5 V
Input current	
for signal ”1”	3 mA
2-wire BERO	
Connection possible	Yes
Max. permissible closed-circuit current	0.5 mA
Input delay	
from ”0” to ”1”	3 ms
from ”1” to ”0”	3 ms
Number of inputs which can be used simultaneously	
horizontal structure	4
vertical structure	4
Input characteristic	EPM-S201: IEC 61131, type 1; EPM-S205: none
Input data size	8 bits (with EPM-S110: 4 bits)
Status, alarm, diagnostics	
Status display	Green LEDs per channel
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	No
Diagnostic information can be read out	None
Module status	Green LED
Module error display	Red LED
Channel error display	None
Electrical isolation	
Between the channels and the backplane bus	Yes
Insulation checked with	DC 500 V

3.6.3 Eight digital inputs - EPM-S202 and EPM-S206 (NPN)

This module detects up to eight binary control signals from the process level and transmits them to the higher-level bus system.

Features

- 8 digital inputs (EPM-S206: N-switching)
- Suitable for switches and proximity switches
- LEDs display the switching states of the digital inputs

Overview

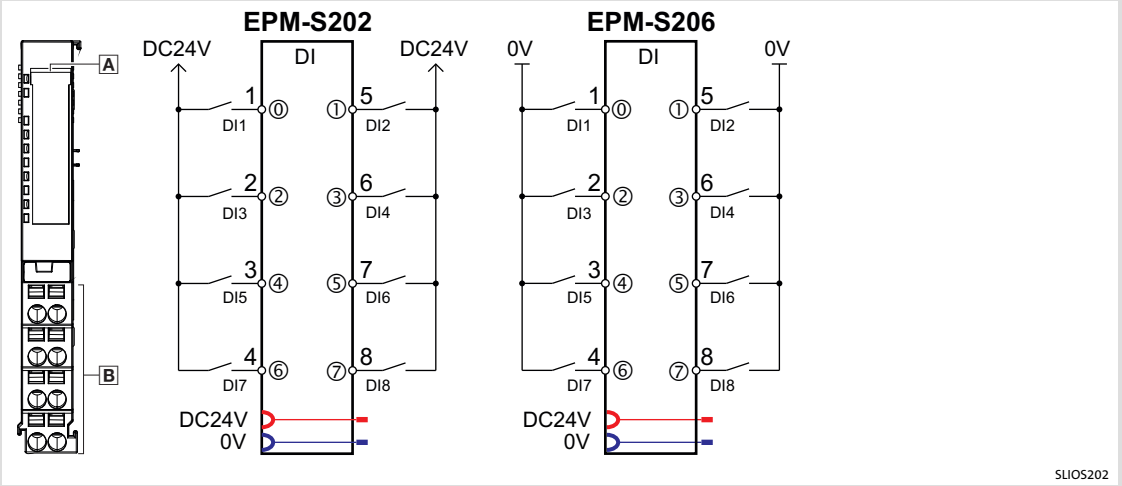
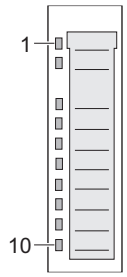


Fig. 3-17 Elements and circuit diagram

A	Displays for module status
B	Terminals
1 ... 8	Connection number
⓪ ... ⑦	Bit number in bit presentation

Status displays

Module status LEDs A

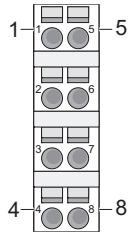
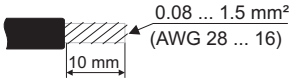
View	Pos.	Designation	Colour	Explanation
 SLIO001	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	DI1	Green	On: Digital input triggered
	4	DI2		
	5	DI3		
	6	DI4		
	7	DI5		
	8	DI6		
	9	DI7		
	10	DI8		

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
 SLIO002	1	Digital input DI1	
	2	Digital input DI3	
	3	Digital input DI5	
	4	Digital input DI7	
	5	Digital input DI2	
	6	Digital input DI4	
	7	Digital input DI6	
	8	Digital input DI8	

Technical data

EPM-S202 / EPM-S206 (NPN): rated data	
Module identifier	EPM-S202: 5_{dec}; EPM-S206: 7_{dec}
Current consumption/power loss	
Current consumption from backplane bus	EPM-S202: 60 mA; EPM-S206: 65 mA;
Power loss	0.9 W
Digital inputs	
Number of inputs	8
Cable length	
shielded	1000 m
unshielded	600 m
Input voltage	
Nominal value	DC 24 (DC 20.4 ... 28.8 V)
for signal ”0”	EPM-S202: DC 0 ... 5 V; EPM-S206: DC 15 ... 28.8 V
for signal ”1”	EPM-S202: DC 15 ... 28.8 V; EPM-S206: DC 0 ... 5 V
Input current	
for signal ”1”	3 mA
2-wire BERO	
Connection possible	Yes
Max. permissible closed-circuit current	0.5 mA
Input delay	
from ”0” to ”1”	3 ms
from ”1” to ”0”	3 ms
Number of inputs which can be used simultaneously	
horizontal structure	8
vertical structure	8
Input characteristic	EPM-S202: IEC 61131, type 1; EPM-S206: none
Input data size	8 bits
Status, alarm, diagnostics	
Status display	Green LEDs per channel
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	No
Diagnostic information can be read out	None
Module status	Green LED
Module error display	Red LED
Channel error display	None
Electrical isolation	
Between channels and the backplane bus	Yes
Insulation checked with	DC 500 V

3.6.4 Four digital inputs (three-wire conductor connection) - EPM-S203

This module detects up to four binary control signals from the process level and transmits them to the higher-level bus system.

Features

- 4 digital inputs in three-wire conductor technique
- Suitable for switches and proximity switches
- LEDs display the switching states of the digital inputs

Overview

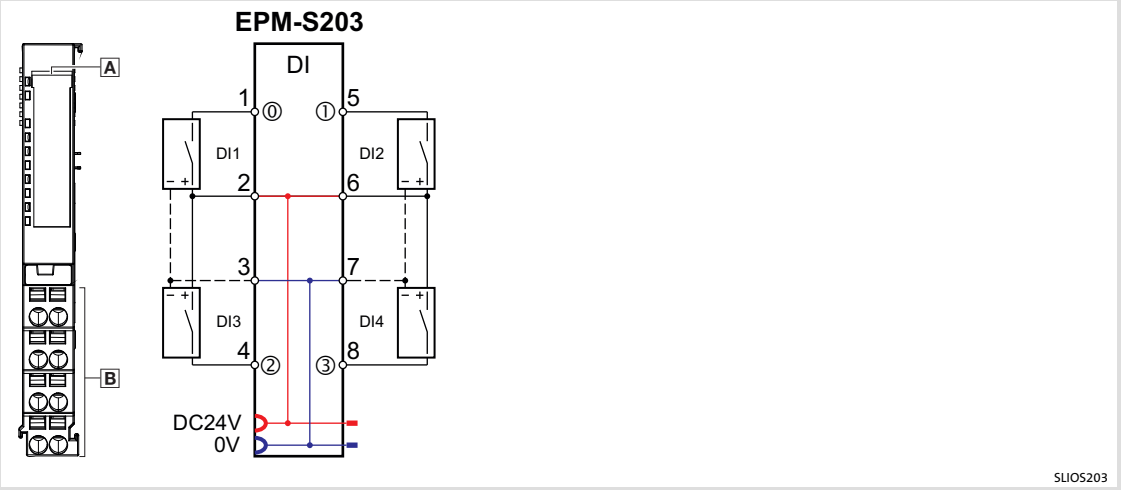
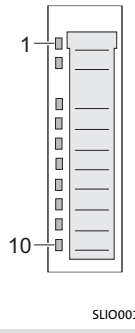


Fig. 3-18 Elements and circuit diagram

A	Displays for module status
B	Terminals
1 ... 8	Connection number
⓪ ... ⑦	Bit number in bit presentation

Status displays

Module status LEDs A

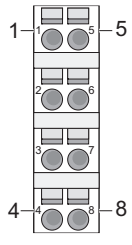
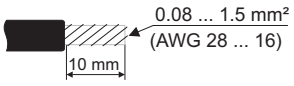
View	Pos.	Designation	Colour	Explanation
	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	DI1	Green	On: Digital input triggered
	4	DI2		
	5	DI3		
	6	DI4		
	7	-	-	Not assigned
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
	1	Digital input DI1	
	2	24 V DC	
	3	GND	
	4	Digital input DI3	
	5	Digital input DI2	
	6	24 V DC	
	7	GND	
	8	Digital input DI4	

Technical data

EPM-S203: Rated data	
Module identifier	8_{dec}
Current consumption/power loss	
Current consumption from backplane bus	55 mA
Power loss	0.6 W
Digital inputs	
Number of inputs	4
Cable length	
shielded	1000 m
unshielded	600 m
Input voltage	
Nominal value	DC 24 (DC 20.4 ... 28.8 V)
for signal ”0”	DC 0 ... 5 V
for signal ”1”	DC 15 ... 28.8 V
Input current	
for signal ”1”	3 mA
2-wire BERO	
Connection possible	Yes
Max. permissible closed-circuit current	0.5 mA
Input delay	
from ”0” to ”1”	3 ms
from ”1” to ”0”	3 ms
Number of inputs which can be used simultaneously	
horizontal structure	4
vertical structure	4
Input characteristic	IEC 61131
Input data size	8 bits (with EPM-S110: 4 bits)
Status, alarm, diagnostics	
Status display	Green LEDs per channel
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	No
Diagnostic information can be read out	None
Module status	Green LED
Module error display	Red LED
Channel error display	None
Electrical isolation	
Between channels and the backplane bus	Yes
Insulation checked with	DC 500 V

3.6.5 2 digital inputs with time stamp function - EPM-S207

This module detects up to two binary control signals from the process level and transmits them to the higher-level bus system.

If the time stamp function is parameterised, in the case of a specified edge (rising or falling), the current time of the system-internal µs-ticker is stored as a time stamp entry in the process image along with the status of the inputs and a consecutive number.

Depending on the configuration, up to 15 time successive stamp entries can be recorded in the process image.

Features

- 2 digital inputs
- up to 15 time stamp entries can be recorded
- Suitable for switches and proximity switches
- LEDs display the switching states of the digital inputs (even when electronic supply is switched off)

Overview

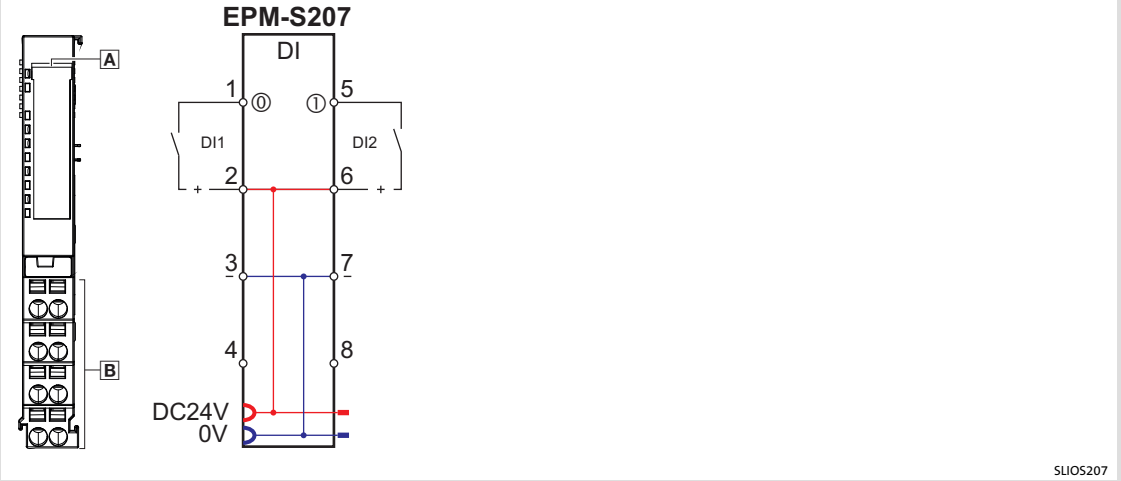
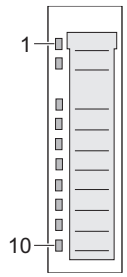


Fig. 3-19 Elements and circuit diagram

A	Displays for module status
B	Terminals
1 ... 8	Connection number
⓪ ... ⑦	Bit number in bit presentation

Status displays

Module status LEDs A

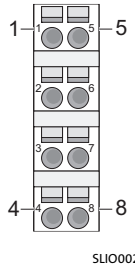
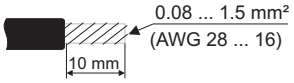
View	Pos.	Designation	Colour	Explanation
	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	DI1	Green	On: Digital input triggered
	4	DI2		
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
	1	Digital input DI1	
	2	24 V DC	
	3	GND	
	4	Not assigned	
	5	Digital input DI2	
	6	24 V DC	
	7	GND	
	8	Not assigned	

Technical data

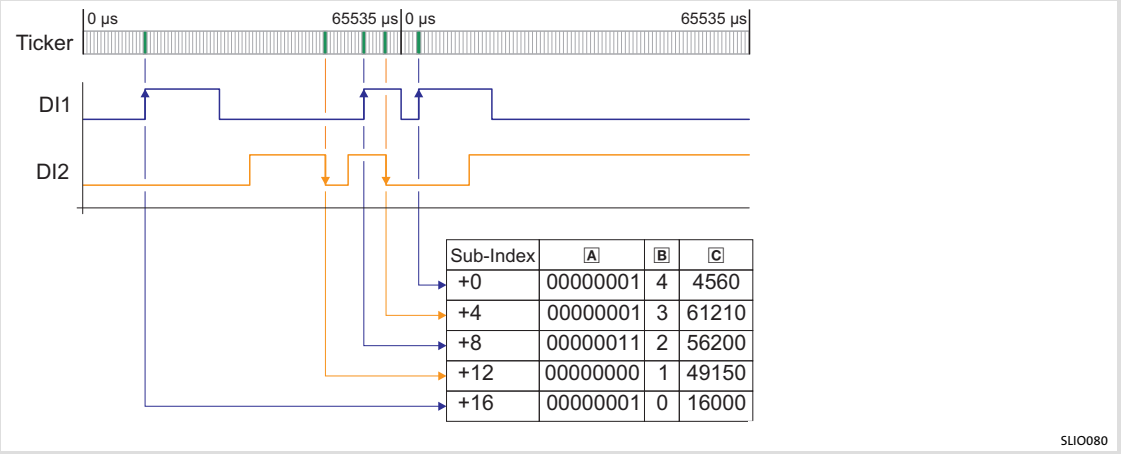
EPM-S207: rated data	
Module identifier	3841_{dec}
Current consumption/power loss	
Current consumption from backplane bus	85 mA
Power loss	0.9 W
Digital inputs	
Number of inputs	2
Cable length	
shielded	1000 m
unshielded	600 m
Load voltage	
Nominal value	DC 24 V
Current consumption from load voltage L+	10 mA (without load)
Input voltage	
Nominal value	DC 20.4 ... 28.8 V
for signal ”0”	DC 0 ... 5 V
for signal ”1”	DC 15 ... 28.8 V
Input current	
for signal ”1”	3 mA
2-wire BERO	
Connection possible	Yes
Max. permissible closed-circuit current	0.5 mA
Input delay	
from ”0” to ”1”	Parameterisable
from ”1” to ”0”	Parameterisable
Number of inputs which can be used simultaneously	
horizontal structure	2
vertical structure	2
Input characteristic	IEC 61131, type 1
Input data size	60 bytes
Status, alarm, diagnostics	
Status display	Green LEDs per channel
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	No
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	None
Electrical isolation	
zwischen Kanälen in Gruppen zu	2
Between the channels and the backplane bus	Yes
Insulation checked with	DC 500 V

Functional principle taking the example of the system bus CAN

Long cycle times or fieldbus cycle times which fluctuate depending on bus load inevitably result in unacceptable inaccuracy when precise switching times are needed. The time stamp function can be used to calculate switching times for outputs accurate to 1 µs.

An I/O compound module with time stamp function is fitted with an internal ticker. The tickers within a station are all synchronised via the backplane bus to ensure the same time base.

- The ticker has a resolution of 1 µs. After power-on, it counts from 0 ... 65535 µs and then goes back to 0.
- If using I/O compound modules with the time stamp function, when the signal undergoes a edge change, the ticker value is saved to the process image along with the channel status.
- Up to 15 DI switching orders (sub-index entries) can be transmitted with the time stamp function.



Sub-Index	A	B	C
+0	00000001	4	4560
+4	00000001	3	61210
+8	00000011	2	56200
+12	00000000	1	49150
+16	00000001	0	16000

Fig. 3-20 Saving the time stamp entries

DI1 Digital input 1
The time stamp entry for the edge evaluation is generated with a rising edge.

DI2 Digital input 2
The time stamp entry for the edge evaluation is generated with a falling edge.

A Channel status

B Running number (RN)
A consecutive number from 0 ... 63 which always starts afresh. The ”running number” serves to determine the chronological sequence of the entries. It must be incremented with each time stamp entry. During the first run, the ”running number” must start with 1.

C Ticker value

Example of the operating principle of the time stamp function

Note!

The time stamp modules EPM-S207 and EPM-S310 can only be operated usefully on bus coupler modules in which a µs ticker is integrated.

The example shows in which order the time stamp entries are stored and processed.

A module is projected here which has 20 bytes assigned for 5 time stamp entries in the output area. The outputs are supposed to adopt the following states at the indicated ticker times:

Running number (RN)	Ticker value [µs]	State DO 0 (bit 7)	State DO 1 (bit 6)	Release DO 0 (bit 5)	Release DO 1 (bit 4)
0x01	6000	0	0	1	1
0x02	12506	1	0	1	1
0x03	34518	1	1	1	1
0x04	49526	0	0	1	1
0x05	54529	0	1	1	1
0x06	3500	1	1	1	1
0x07	12443	1	0	1	1
0x08	20185	0	0	1	1
0x09	30140	1	0	1	1
0x0A	37330	0	0	1	1
0x0B	40000	0	0	0	0

The values of the table result in the following time diagram:

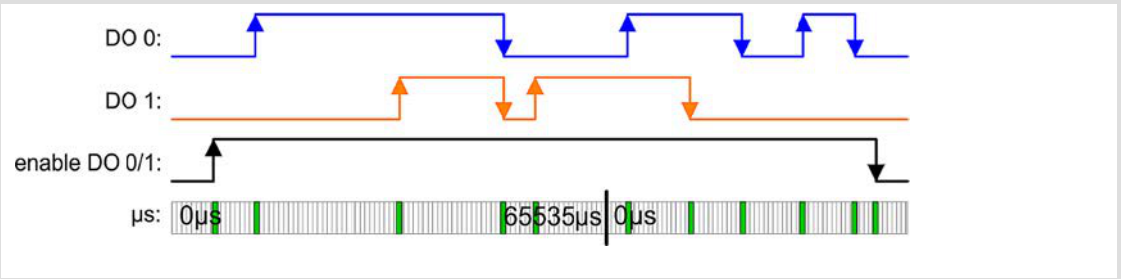


Fig. 3-21 Time diagram: example of time stamp function

Writing the time stamp entries 1 ... 5

After writing the first 5 time stamp entries (RN = 0x01 ... 0x05) in the process output data, they are directly transferred to the FIFO memory of the module.

The respective status bytes are listed below the input data.

FIFO	Output data	Running number (RN)	Ticker value [µs]	Input data
1	0b00110000	0x01	6000	RN_LAST: 0x45 RN_NEXT: 0xC1 STS_FIFO: 0x00 NUM_ETS: 0x05
2	0b10110000	0x02	12506	
3	0b11110000	0x03	34518	
4	0b00110000	0x04	49526	
5	0b01110000	0x05	54529	
6	0b00000000	0x00	0	
...	0b00000000	0x00	0	
31	0b00000000	0x00	0	

The values of the table result in the following time diagram:

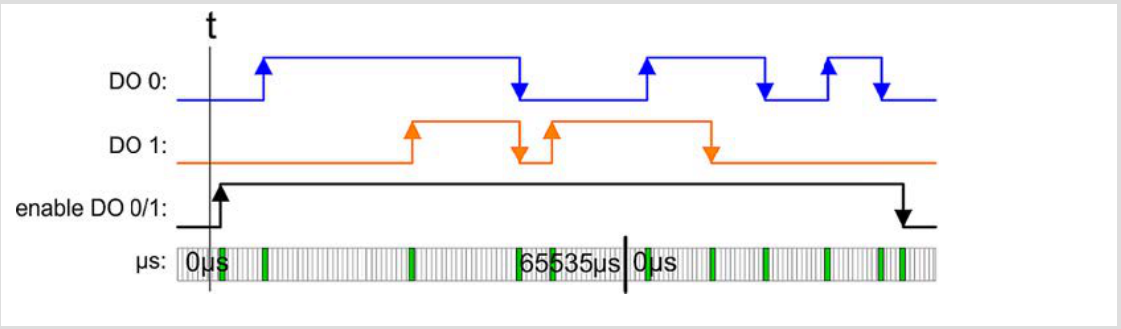


Fig. 3-22 Time diagram: writing the time stamp entries 1 ... 5

Executing the time stamp function for the first entry

In order to be able to trigger the outputs accordingly, they must previously be enabled. In this example you enable the two outputs with the first "running number" (RN). The first time stamp entry (RN = 0x01) is executed and deleted from the FIFO memory.

FIFO	Output data	Running number (RN)	Ticker value [µs]	Input data
1	0b10110000	0x02	12506	RN_LAST: 0x45 RN_NEXT: 0xC2 STS_FIFO: 0x00/0x02 NUM_ETS: 0x04
2	0b11110000	0x03	34518	
3	0b00110000	0x04	49526	
4	0b01110000	0x05	54529	
5	0b00000000	0x00	0	
...	0b00000000	0x00	0	
31	0b00000000	0x00	0	

The values of the table result in the following time diagram:

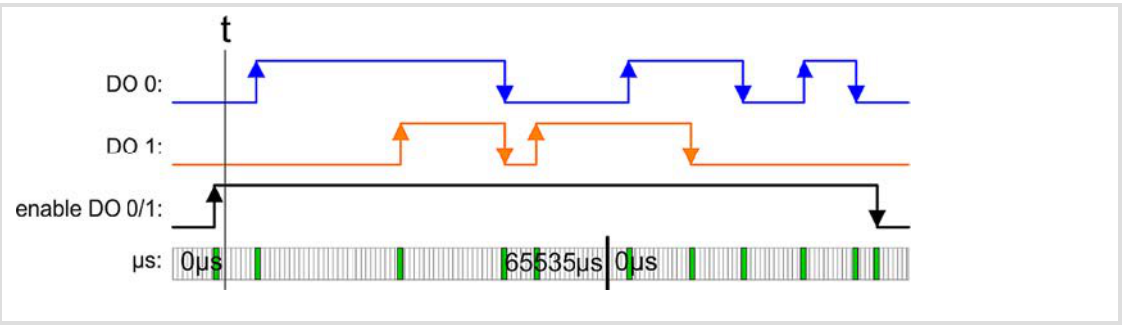


Fig. 3-23 Time diagram: executing the time stamp function for the first entry

Executing the time stamp function for the entries 2 ... 4

The states of the time stamp entries 2 ... 4 (RN = 0x02 ... 0x04) are output consecutively and deleted from the FIFO memory.

FIFO	Output data	Running number (RN)	Ticker value [µs]	Input data
1	0b01110000	0x05	54529	RN_LAST: 0x45 RN_NEXT: 0xC5 STS_FIFO: 0x00/0x02 NUM_ETS: 0x01
2	0b00000000	0x05	0	
...	0b00000000	0x00	0	
31	0b00000000	0x00	0	

The values of the table result in the following time diagram:

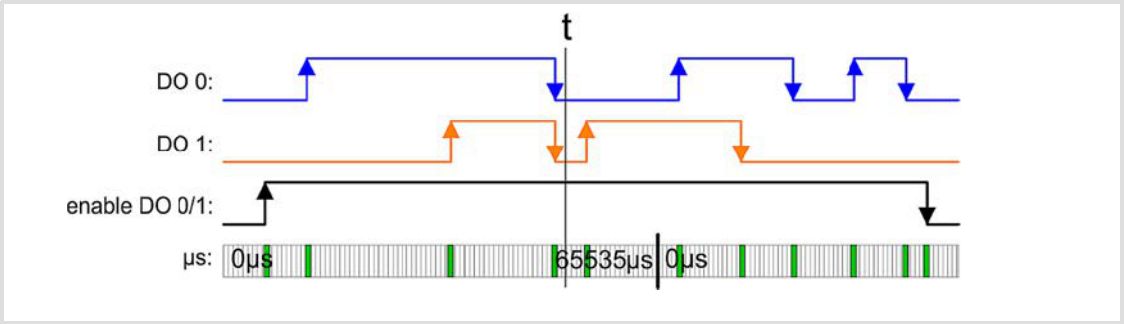


Fig. 3-24 Time diagram: executing the time stamp function for the entries 2 ... 4

Writing the time stamp entries 6 ... 10

After writing the time stamp entries 6 ... 10 (RN = 0x06 ... 0x0A) in the process output data, they are directly transferred to the FIFO memory of the module.

FIFO	Output data	Running number (RN)	Ticker value [µs]	Input data
1	0b01110000	0x05	54529	RN_LAST: 0x4A RN_NEXT: 0xC5 STS_FIFO: 0x00/0x02 NUM_ETS: 0x06
2	0b11110000	0x06	3500	
3	0b10110000	0x07	12443	
4	0b00110000	0x08	20185	
5	0b10110000	0x09	30140	
6	0b00110000	0x0A	37330	
7	0b00000000	0x00	0	
...	0b00000000	0x00	0	
31	0b00000000	0x00	0	

The values of the table result in the following time diagram:

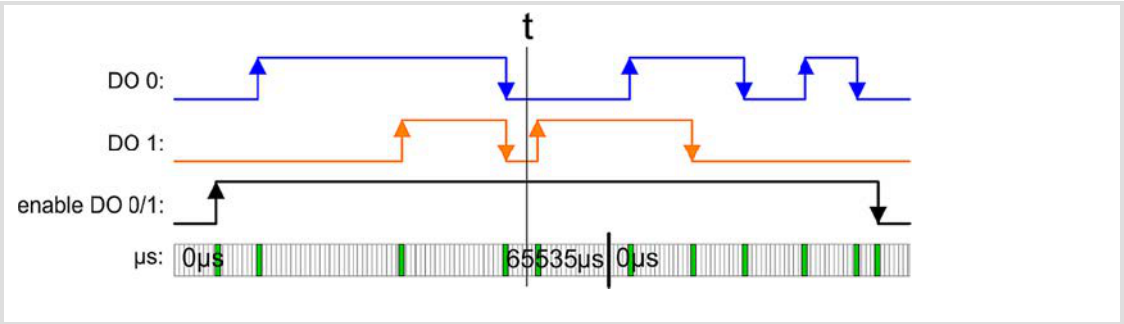


Fig. 3-25 Time diagram: writing the time stamp entries 6 ... 10

Executing the time stamp entries 6 ... 8

The states of the time stamp entries 6 ... 8 (RN = 0x06 ... 0x08) are output consecutively and deleted from the FIFO memory.

FIFO	Output data	Running number (RN)	Ticker value [µs]	Input data
1	0b10110000	0x09	30140	RN_LAST: 0x4A RN_NEXT: 0xC5 STS_FIFO: 0x00/0x02 NUM_ETS: 0x02
2	0b00110000	0x0A	37330	
3	0b00000000	0x00	0	
...	0b00000000	0x00	0	
31	0b00000000	0x00	0	

The values of the table result in the following time diagram:

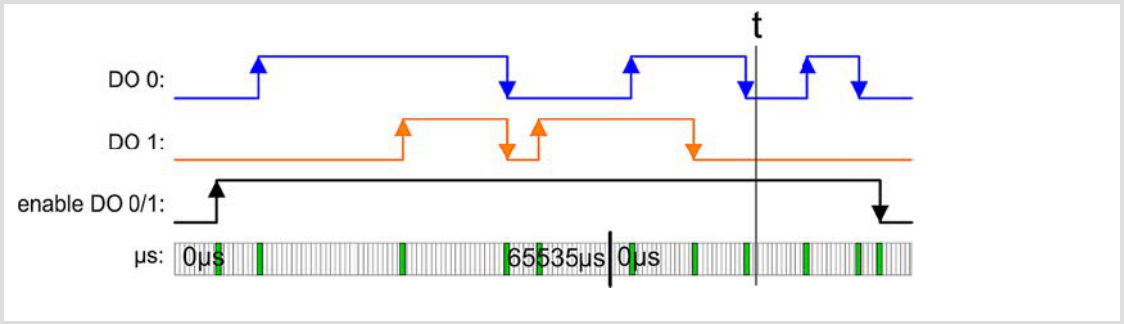


Fig. 3-26 Time diagram: writing the time stamp entries 6 ... 10

Writing the last time stamp entry

As less than five time stamp entries are written, bit 6 of the ”running number” (RN) must always be set at the last time stamp entry: RN = 0x0B becomes 0x4B.

FIFO	Output data	Running number (RN)	Ticker value [µs]	Input data
1	0b10110000	0x09	30140	RN_LAST: 0x4B RN_NEXT: 0xC9 STS_FIFO: 0x80/0x82 NUM_ETS: 0x03
2	0b00110000	0x0A	37330	
3	0b00000000	0x0B	40000	
4	0b00000000	0x00	0	
...	0b00000000	0x00	0	
31	0b00000000	0x00	0	

The values of the table result in the following time diagram:

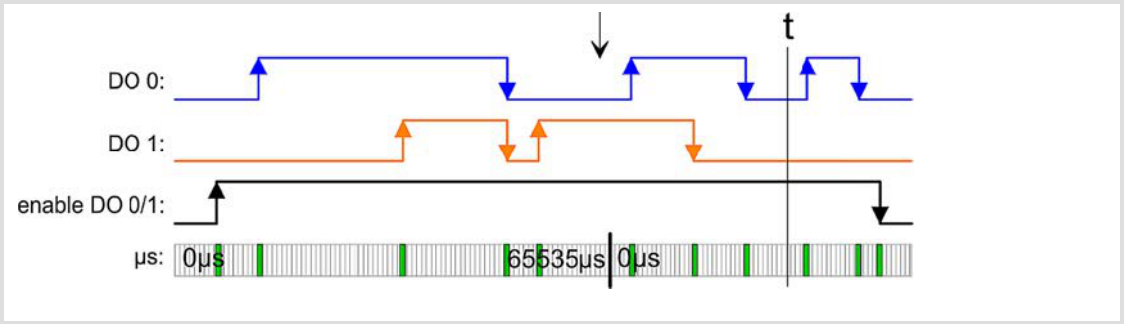


Fig. 3-27 Time diagram: writing the last time stamp entry

Executing the time stamp function for the last entries

The states of the last time stamp entries (RN = 0x09 ... 0x4B) are output consecutively and deleted from the FIFO memory.

FIFO	Output data	Running number (RN)	Ticker value [µs]	Input data
1	0b00000000	0x00	0	RN_LAST: 0x4B RN_NEXT: 0xCC STS_FIFO: 0x80/0x82 NUM_ETS: 0x00
2	0b00000000	0x00	0	
...	0b00000000	0x00	0	
31	0b00000000	0x00	0	

The values of the table result in the following time diagram:

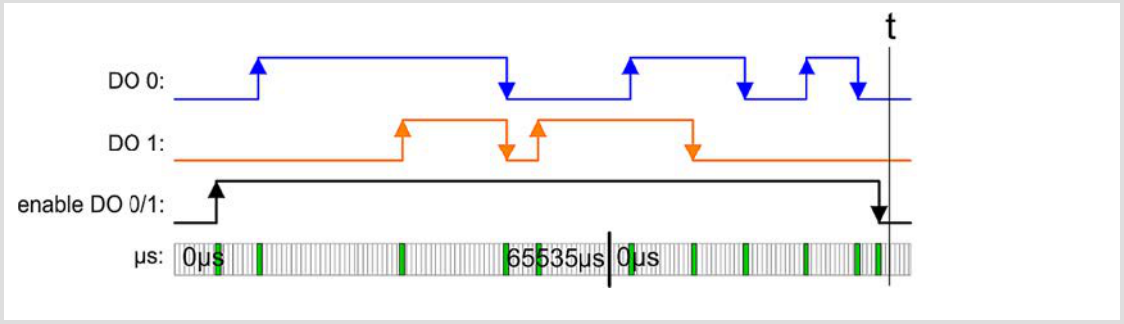


Fig. 3-28 Time diagram: executing the time stamp function for the last entries

3.6.6 Two digital outputs 0.5 A - EPM-S300 and EPM-S303 (NPN)

This module detects up to two binary control signals from the higher-level bus system and transmits them to the process level.

Features

- 2 digital outputs (EPM-S303 N-switching)
- LEDs display the switching states of the digital outputs

Overview

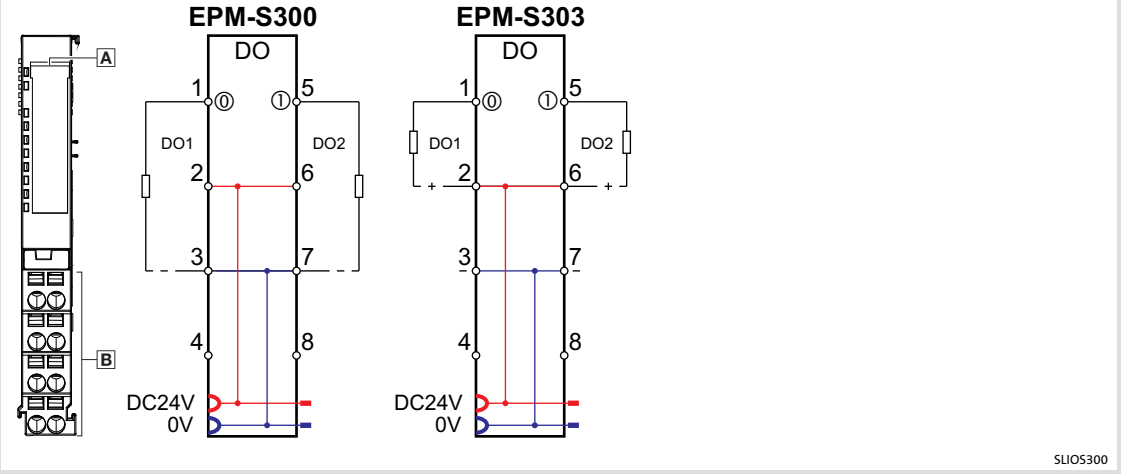
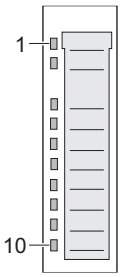


Fig. 3-29 Elements and circuit diagram

A	Displays for module status
B	Terminals
1 ... 8	Connection number
⓪ ... ⑦	Bit number in bit presentation

Status displays

Module status LEDs A

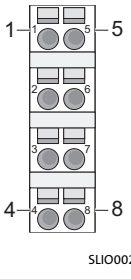
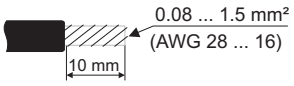
View	Pos.	Designation	Colour	Explanation
	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error and error at overload, short circuit, overtemperature (see table below)
	3	DO1	Green	On: Digital output triggered
	4	DO2		
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
	1	Digital output DO1	
	2	24 V DC	
	3	GND	
	4	Not assigned	
	5	Digital output DO2	
	6	24 V DC	
	7	GND	
	8	Not assigned	

Technical data

EPM-S300 / EPM-S303 (NPN): rated data	
Module identifier	EPM-S300: 257_{dec}; EPM-S303: 259_{dec}
Current consumption/power loss	
Current consumption from backplane bus	EPM-S300: 55 mA; EPM-S303: 60 mA
Power loss	0.4 W
Digital outputs	
Number of outputs	2
Cable length	
shielded	1000 m
unshielded	600 m
Load voltage	
Nominal value	DC 24 (DC 20.4 ... 28.8 V)
Current consumption from load voltage L+	EPM-S300: 5 mA (without load); EPM-S303: 2.5 mA (without load)
Total current	
for each group, horizontal structure, 40°C	1 A
for each group, horizontal structure, 60°C	1 A
for each group, vertical structure	1 A
Output voltage	
for ”1” signal, max. current	Only for EPM-S303: M (+250 mV)
for ”1” signal, min. current	Only for EPM-S303: M (+0 V)
Output current	
for ”1” signal, nominal value	0.5 A
Output delay	
from ”0” to ”1”	30 µs
from ”1” to ”0”	EPM-S300: 175 µs; EPM-S303: 100 µs
Lamp load	10 W
Parallel switching of outputs	
for redundant control	Not possible
for power increase	Not possible
Control of a digital input	Possible
Switching frequencies	
for ohmic loads	Max. 1000 Hz
for inductive loads	Max. 0.5 Hz
for lamp loads	Max. 10 Hz
Limitation (internal) of the inductive breaking voltage	EPM-S300: L+ (-52 V); EPM-S303: +45 V
Short circuit protection of the output	Electronically
Operating threshold of the protection system	EPM-S300: 1 A; EPM-S303: 1.7 A
Output data size	8 bits (with EPM-S110: 2 bits)

EPM-S300 / EPM-S303 (NPN): rated data	
Status, alarm, diagnostics	
Status display	Green LEDs per channel
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	No
Diagnostic information can be read out	None
Module status	Green LED
Module error display	Red LED
Channel error display	None
Electrical isolation	
Between the channels and the backplane bus	Yes
Insulation checked with	DC 500 V

3.6.7 Four digital outputs 0.5 A - EPM-S301 and EPM-S304 (NPN)

This module detects up to four binary control signals from the higher-level bus system and transmits them to the process level.

Features

- 4 digital outputs (EPM-S304 N-switching)
- LEDs display the switching states of the digital outputs

Overview

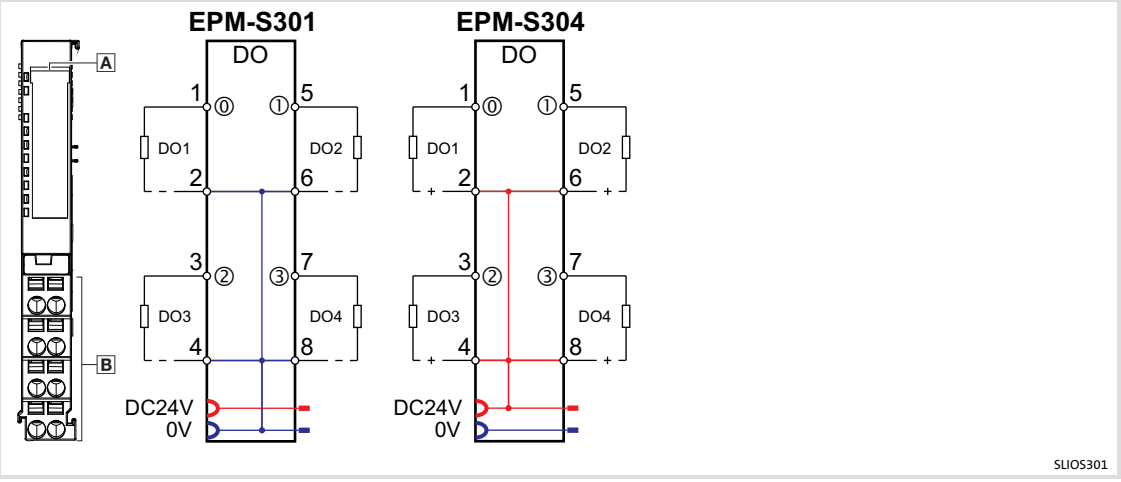
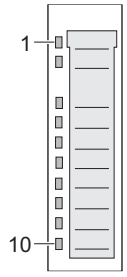


Fig. 3-30 Elements and circuit diagram

A	Displays for module status
B	Terminals
1 ... 8	Connection number
⓪ ... ⑦	Bit number in bit presentation

Status displays

Module status LEDs A

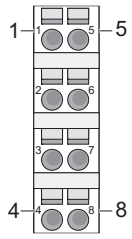
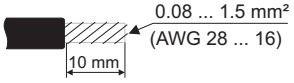
View	Pos.	Designation	Colour	Explanation
	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error and error at overload, short circuit, overtemperature (see table below)
	3	DO1	Green	On: Digital output triggered
	4	DO2		
	5	DO3		
	6	DO4		
	7	-	-	Not assigned
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
	1	Digital output DO1	
	2	EPM-S301: GND EPM-S304: 24 V DC	
	3	Digital output DO3	
	4	EPM-S301: GND EPM-S304: 24 V DC	
	5	Digital output DO2	
	6	EPM-S301: GND EPM-S304: 24 V DC	
	7	Digital output DO4	
	8	EPM-S301: GND EPM-S304: 24 V DC	

Technical data

EPM-S301 / EPM-S304 (NPN): rated data	
Module identifier	EPM-S301: 260_{dec}; EPM-S304: 261_{dec}
Current consumption/power loss	
Current consumption from backplane bus	EPM-S301: 55 mA; EPM-S304: 65 mA
Power loss	0.5 W
Digital outputs	
Number of outputs	4
Cable length	
shielded	1000 m
unshielded	600 m
Load voltage	
Nominal value	DC 24 (DC 20.4 ... 28.8 V)
Current consumption from load voltage L+	EPM-S301: 10 mA (without load); EPM-S304: 5 mA (without load)
Total current	
for each group, horizontal structure, 40°C	2 A
for each group, horizontal structure, 60°C	2 A
for each group, vertical structure	2 A
Output voltage	
for ”1” signal, max. current	Only for EPM-S304: M (+250 mV)
for ”1” signal, min. current	Only for EPM-S304: M (+0 V)
Output current	
for ”1” signal, nominal value	0.5 A
Output delay	
from ”0” to ”1”	30 µs
from ”1” to ”0”	EPM-S301: 175 µs; EPM-S304: 100 µs
Lamp load	10 W
Parallel switching of outputs	
for redundant control	Not possible
for power increase	Not possible
Control of a digital input	Possible
Switching frequencies	
for ohmic loads	Max. 1000 Hz
for inductive loads	Max. 0.5 Hz
for lamp loads	Max. 10 Hz
Limitation (internal) of the inductive breaking voltage	EPM-S301: L+ (-52 V); EPM-S304: +45 V
Short circuit protection of the output	Electronically
Operating threshold of the protection system	EPM-S301: 1 A; EPM-S304: 1.7 A
Output data size	8 bits (with EPM-S110: 4 bits)

EPM-S301 / EPM-S304 (NPN): rated data	
Status, alarm, diagnostics	
Status display	Green LEDs per channel
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	No
Diagnostic information can be read out	None
Module status	Green LED
Module error display	Red SF-LED
Channel error display	None
Electrical isolation	
Between the channels and the backplane bus	Yes
Insulation checked with	DC 500 V

3.6.8 Eight digital outputs 0.5 A - EPM-S302 and EPM-S305 (NPN)

This module detects up to eight binary control signals from the higher-level bus system and transmits them to the process level.

Features

- 8 digital outputs (EPM-S305 N-switching)
- LEDs show the switching states of the digital outputs

Overview

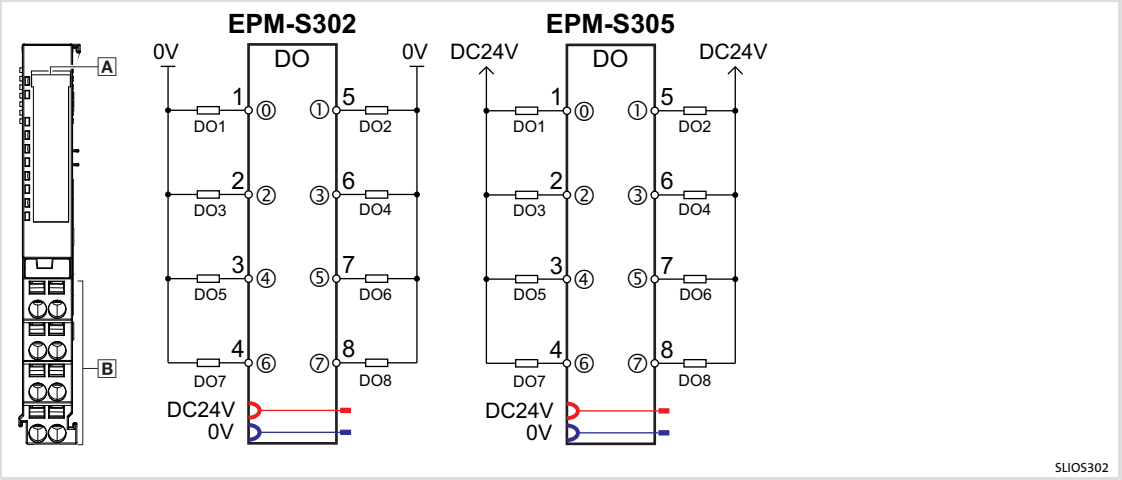
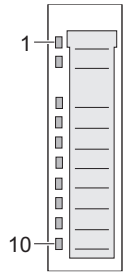


Fig. 3-31 Elements and circuit diagram

A	Displays for module status
B	Terminals
1 ... 8	Connection number
⓪ ... ⑦	Bit number in bit presentation

Status displays

Module status LEDs A

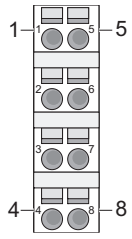
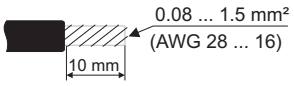
View	Pos.	Designation	Colour	Explanation
 SLIO001	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error and error at overload, short circuit, overtemperature (see table below)
	3	DO1	Green	On: Digital output triggered
	4	DO2		
	5	DO3		
	6	DO4		
	7	DO5		
	8	DO6		
	9	DO7		
	10	DO8		

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
 SLIO002	1	Digital output DO1	
	2	Digital output DO3	
	3	Digital output DO5	
	4	Digital output DO7	
	5	Digital output DO2	
	6	Digital output DO4	
	7	Digital output DO6	
	8	Digital output DO8	

Technical data

EPM-S302 / EPM-S305 (NPN): rated data	
Module identifier	EPM-S302: 262_{dec}; EPM-S305: 263_{dec}
Current consumption/power loss	
Current consumption from backplane bus	EPM-S302: 65 mA; EPM-S305: 70 mA
Power loss	EPM-S302: 0.7 W; EPM-S305: 0.6 W
Digital outputs	
Number of outputs	8
Cable length	
shielded	1000 m
unshielded	600 m
Load voltage	
Nominal value	DC 24 (DC 20.4 ... 28.8 V)
Current consumption from load voltage L+	EPM-S302: 15 mA (without load); EPM-S305: 10 mA (without load)
Total current	
for each group, horizontal structure, 40°C	EPM-S302: 4 A; EPM-S305: 2.5 A
for each group, horizontal structure, 60°C	EPM-S302: 4 A; EPM-S305: 2.5 A
for each group, vertical structure	EPM-S302: 4 A; EPM-S305: 2.5 A
Output voltage	
for ”1” signal, max. current	Only for EPM-S305: M (+250 mV)
for ”1” signal, min. current	Only for EPM-S305: M (+0 V)
Output current	
for ”1” signal, nominal value	0.5 A
Output delay	
from ”0” to ”1”	30 µs
from ”1” to ”0”	EPM-S302: 175 µs; EPM-S305: 100 µs
Lamp load	10 W
Parallel switching of outputs	
for redundant control	Not possible
for power increase	Not possible
Control of a digital input	Possible
Switching frequencies	
for ohmic loads	Max. 1000 Hz
for inductive loads	Max. 0.5 Hz
for lamp loads	Max. 10 Hz
Limitation (internal) of the inductive breaking voltage	EPM-S302: L+ (-52 V); EPM-S305: +45 V
Short circuit protection of the output	Electronically
Operating threshold of the protection system	EPM-S302: 1 A; EPM-S305: 1.7 A
Output data size	8 bits

EPM-S302 / EPM-S305 (NPN): rated data	
Status, alarm, diagnostics	
Status display	Green LEDs per channel
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	No
Diagnostic information can be read out	None
Module status	Green LED
Module error display	Red LED
Channel error display	None
Electrical isolation	
Between the channels and the backplane bus	Yes
Insulation checked with	DC 500 V

3.6.9 Two digital outputs 2 A - EPM-S306

This module detects up to two binary control signals from the higher-level bus system and transmits them to the process level.

Features

- 2 digital outputs which each can be loaded with 2 A
- LEDs show the switching states of the digital outputs
- Overload protection (outputs switch off at overload)

Overview

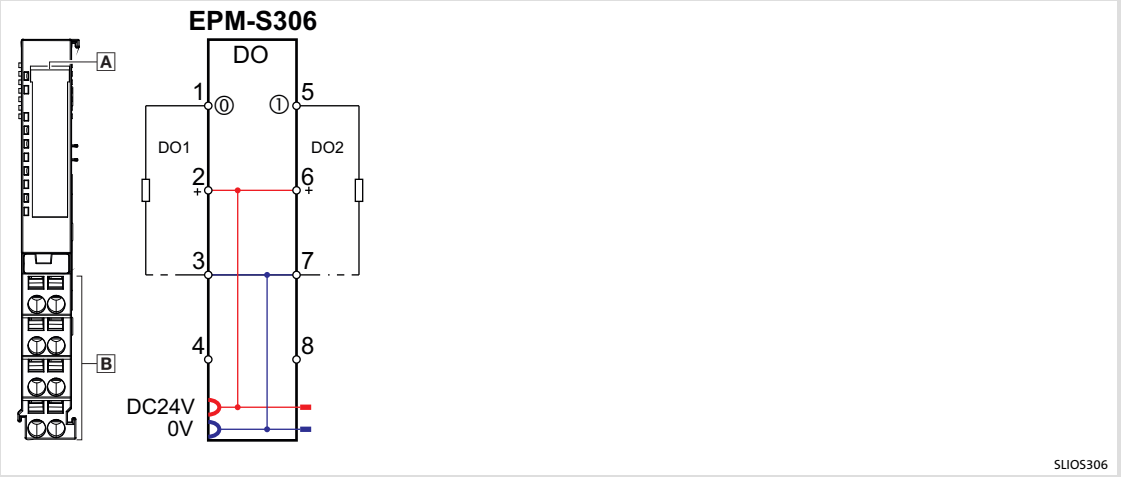
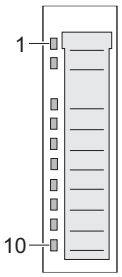


Fig. 3-32 Elements and circuit diagram

A	Displays for module status
B	Terminals
1 ... 8	Connection number
⓪ ... ⑦	Bit number in bit presentation

Status displays

Module status LEDs A

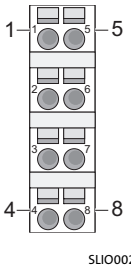
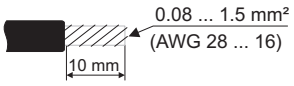
View	Pos.	Designation	Colour	Explanation
	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error and error at overload, short circuit, overtemperature (see table below)
	3	DO1	Green	On: Digital output triggered
	4	DO2		
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
	1	Digital output DO1	
	2	24 V DC	
	3	GND	
	4	Not assigned	
	5	Digital output DO2	
	6	24 V DC	
	7	GND	
	8	Not assigned	

Technical data

EPM-S306: rated data	
Module identifier	258_{dec}
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Power loss	0.55 W
Digital outputs	
Number of outputs	2
Cable length	
shielded	1000 m
unshielded	600 m
Load voltage	
Nominal value	DC 24 (DC 20.4 ... 28.8 V)
Current consumption from load voltage L+	10 mA (without load)
Total current	
for each group, horizontal structure, 40°C	4 A
for each group, horizontal structure, 60°C	4 A
for each group, vertical structure	4 A
Output current	
for ”1” signal, nominal value	2 A
Output delay	
from ”0” to ”1”	100 µs
from ”1” to ”0”	250 µs
Lamp load	10 W
Parallel switching of outputs	
for redundant control	Not possible
for power increase	Not possible
Control of a digital input	Possible
Switching frequencies	
for ohmic loads	Max. 1000 Hz
for inductive loads	Max. 0.5 Hz
for lamp loads	Max. 10 Hz
Limitation (internal) of the inductive breaking voltage	L+ (-52 V)
Short circuit protection of the output	Electronically
Operating threshold of the protection system	2.7 A
Output data size	8 bits (with EPM-S110: 2 bits)

EPM-S306: rated data	
Status, alarm, diagnostics	
Status display	Green LEDs per channel
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	No
Diagnostic information can be read out	None
Module status	Green LED
Module error display	Red LED
Channel error display	None
Electrical isolation	
Between the channels and the backplane bus	Yes
Insulation checked with	DC 500 V

3.6.10 Four digital outputs 2 A - EPM-S309

This module detects up to four binary control signals from the higher-level bus system and transmits them to the process level.

Features

- 4 digital outputs, each can be loaded with 2 A (permanent total current max. 4 A)
- LEDs show the switching states of the digital outputs
- Overload protection (outputs switch off at overload)

Overview

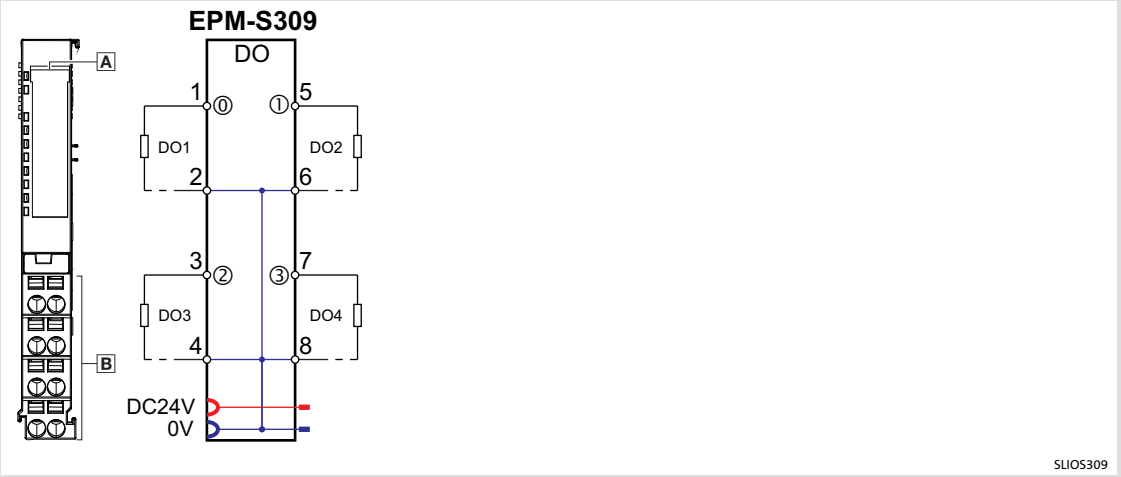
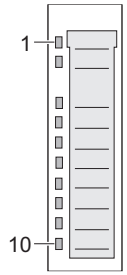


Fig. 3-33 Elements and circuit diagram

A	Displays for module status
B	Terminals
1 ... 8	Connection number
⓪ ... ⑦	Bit number in bit presentation

Status displays

Module status LEDs A

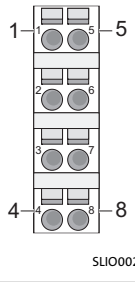
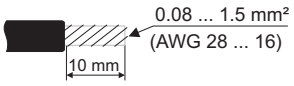
View	Pos.	Designation	Colour	Explanation
	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error and error at overload, short circuit, overtemperature (see table below)
	3	DO1	Green	On: Digital output triggered
	4	DO2		
	5	DO3		
	6	DO4		
	7	-	-	Not assigned
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
	1	Digital output DO1	
	2	GND	
	3	Digital output DO3	
	4	GND	
	5	Digital output DO2	
	6	GND	
	7	Digital output DO4	
	8	GND	

Technical data

EPM-S309: rated data	
Module identifier	264_{dec}
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Power loss	0.8 W
Digital outputs	
Number of outputs	4
Cable length	
shielded	1000 m
unshielded	600 m
Load voltage	
Nominal value	DC 24 (DC 20.4 ... 28.8 V)
Current consumption from load voltage L+	20 mA (without load)
Total current	
for each group, horizontal structure, 40°C	4 A
for each group, horizontal structure, 60°C	4 A
for each group, vertical structure	4 A
Output current	
for ”1” signal, nominal value	2 A
Output delay	
from ”0” to ”1”	100 µs
from ”1” to ”0”	250 µs
Lamp load	10 W
Parallel switching of outputs	
for redundant control	Not possible
for power increase	Not possible
Control of a digital input	Not possible
Switching frequencies	
for ohmic loads	Max. 1000 Hz
for inductive loads	Max. 0.5 Hz
for lamp loads	Max. 10 Hz
Limitation (internal) of the inductive breaking voltage	L+ (-52 V)
Short circuit protection of the output	Electronically
Operating threshold of the protection system	2.7 A
Output data size	8 bits (with EPM-S110: 4 bits)

EPM-S309: rated data	
Status, alarm, diagnostics	
Status display	Green LEDs per channel
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	No
Diagnostic information can be read out	None
Module status	Green LED
Module error display	Red SF-LED
Channel error display	None
Electrical isolation	
Between the channels and the backplane bus	Yes
Insulation checked with	DC 500 V

3.6.11 2 digital outputs with time stamp function - EPM-S310

This module detects up to two binary control signals from the higher-level bus system and transmits them to the process level with time control using the time stamp function.

If the time stamp function has been parameterised, 15 initial states can be transferred to the FIFO memory as time stamp entry together with a time value of the µs ticker and a consecutive number. The FIFO memory offers space for max. 31 time stamp entries.

Features

- Two digital outputs
- FIFO memory for up to 15 time stamp entries
- Activation via process image
- LEDs show the switching states of the digital outputs

Overview

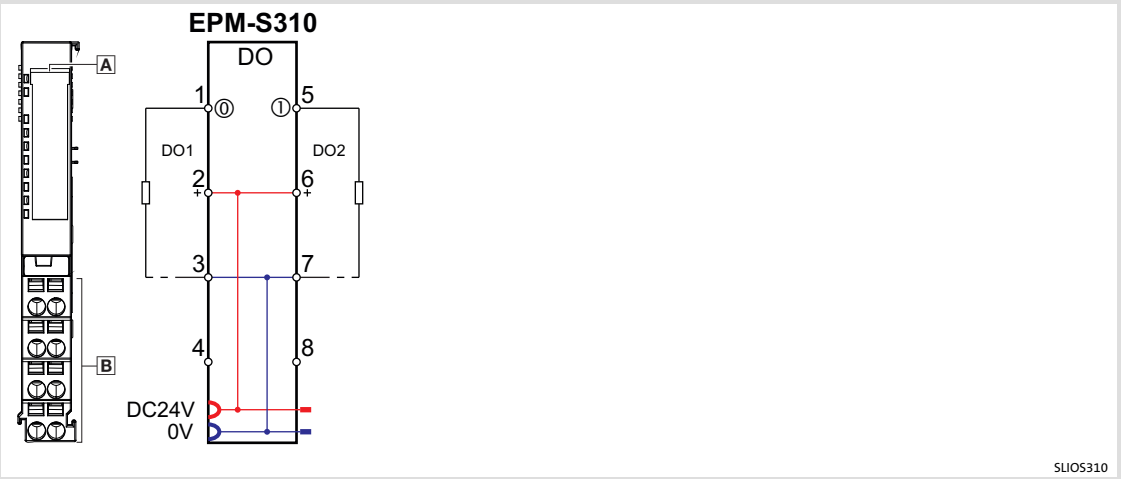
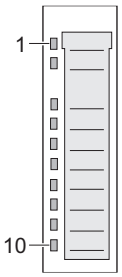


Fig. 3-34 Elements and circuit diagram

A	Displays for module status
B	Terminals
1 ... 8	Connection number
⓪ ... ⑦	Bit number in bit presentation

Status displays

Module status LEDs A

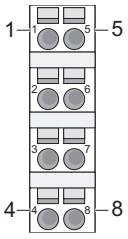
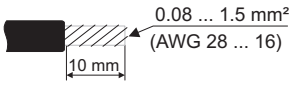
View	Pos.	Designation	Colour	Explanation
 SLIO001	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error and error at overload, short circuit, overtemperature (see table below)
	3	DO1	Green	On: Digital output triggered
	4	DO2		
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
 SLIO002	1	Digital output DO1	
	2	24 V DC	
	3	GND	
	4	Not assigned	
	5	Digital output DO2	
	6	24 V DC	
	7	GND	
	8	Not assigned	

Technical data

EPM-S310: rated data	
Module identifier	3905_{dec}
Current consumption/power loss	
Current consumption from backplane bus	85 mA
Power loss	0.95 W
Digital outputs	
Number of outputs	2
Cable length	
shielded	1000 m
unshielded	600 m
Load voltage	
Nominal value	DC 24 (DC 20.4 ... 28.8 V)
Current consumption from load voltage L+	15 mA (without load)
Total current	
for each group, horizontal structure, 40°C	1 A
for each group, horizontal structure, 60°C	1 A
for each group, vertical structure	1 A
Output current	
for ”1” signal, nominal value	0.5 A
Output delay	
from ”0” to ”1”	Max. 100 ns
from ”1” to ”0”	Max. 100 ns
Lamp load	10 W
Parallel switching of outputs	
for redundant control	Not possible
for power increase	Not possible
Control of a digital input	Possible
Switching frequencies	
for ohmic loads	Max. 40 kHz
for inductive loads	Max. 40 kHz
for lamp loads	Max. 40 kHz
Limitation (internal) of the inductive breaking voltage	L+ (-52 V)
Short circuit protection of the output	Electronically; only highside
Operating threshold of the protection system	2.5 A
Output data size	60 bits

EPM-S310: rated data	
Status, alarm, diagnostics	
Status display	Green LEDs per channel
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	No
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	None
Electrical isolation	
Between the channels in groups of	2
Between the channels and the backplane bus	Yes
Insulation checked with	DC 500 V

Functional principle taking the example of the system bus CAN

Long cycle times or fieldbus cycle times which fluctuate depending on bus load inevitably result in unacceptable inaccuracy when precise switching times are needed. The time stamp function can be used to calculate switching times for outputs accurate to 1 µs.

An I/O compound module with time stamp function is fitted with an internal ticker. The tickers within a station are all synchronised via the backplane bus to ensure the same time base.

- The ticker has a resolution of 1 µs. After power-on, it counts from 0 ... 65535 µs and then goes back to 0.
- If using I/O compound modules with the time stamp function, when the signal undergoes a edge change, the ticker value is saved to the process image along with the channel status.
- Up to 15 DO switching orders can be received with the time stamp function which allows an output to be activated several times within a cycle.

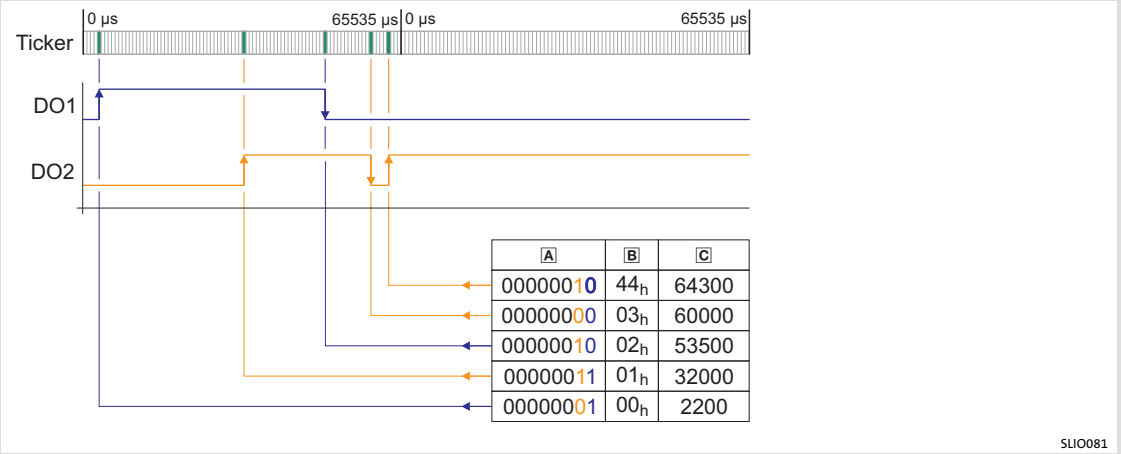


Fig. 3-35 Output of time stamp entries

DO1 Digital output 1
The output signal is switched according to the time stamp entry.

DO2 Digital output 2
The output signal is switched according to the time stamp entry.

A Status of digital outputs

B Running number (RN)
A consecutive number from 0 ... 63 which always starts afresh. The ”running number” serves to determine the chronological sequence of the entries. It must be incremented with each time stamp entry. During the first run, the ”running number” must start with 1.

C Ticker value

Example of the operating principle of the time stamp function

Note!

The time stamp modules EPM-S207 and EPM-S310 can only be operated usefully on bus coupler modules in which a µs ticker is integrated.

The example shows in which order the time stamp entries are stored and processed.

A module is projected here which has 20 bytes assigned for 5 time stamp entries in the output area. The outputs are supposed to adopt the following states at the indicated ticker times:

Running number (RN)	Ticker value [µs]	State DO 0 (bit 7)	State DO 1 (bit 6)	Release DO 0 (bit 5)	Release DO 1 (bit 4)
0x01	6000	0	0	1	1
0x02	12506	1	0	1	1
0x03	34518	1	1	1	1
0x04	49526	0	0	1	1
0x05	54529	0	1	1	1
0x06	3500	1	1	1	1
0x07	12443	1	0	1	1
0x08	20185	0	0	1	1
0x09	30140	1	0	1	1
0x0A	37330	0	0	1	1
0x0B	40000	0	0	0	0

The values of the table result in the following time diagram:

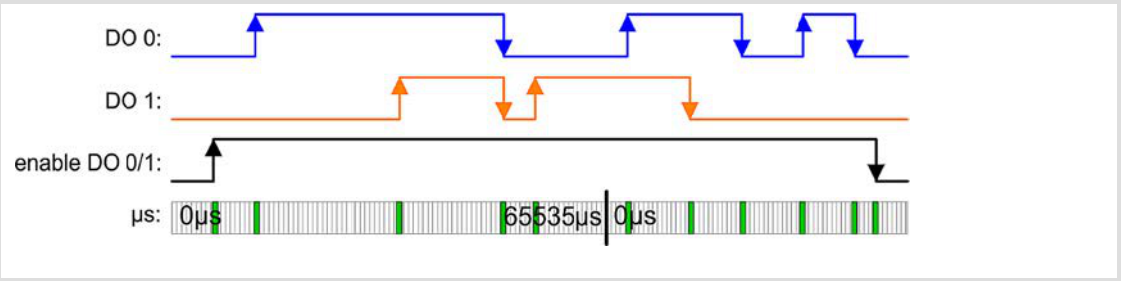


Fig. 3-36 Time diagram: example of time stamp function

Writing the time stamp entries 1 ... 5

After writing the first 5 time stamp entries (RN = 0x01 ... 0x05) in the process output data, they are directly transferred to the FIFO memory of the module.

The respective status bytes are listed below the input data.

FIFO	Output data	Running number (RN)	Ticker value [µs]	Input data
1	0b00110000	0x01	6000	RN_LAST: 0x45 RN_NEXT: 0xC1 STS_FIFO: 0x00 NUM_ETS: 0x05
2	0b10110000	0x02	12506	
3	0b11110000	0x03	34518	
4	0b00110000	0x04	49526	
5	0b01110000	0x05	54529	
6	0b00000000	0x00	0	
...	0b00000000	0x00	0	
31	0b00000000	0x00	0	

The values of the table result in the following time diagram:

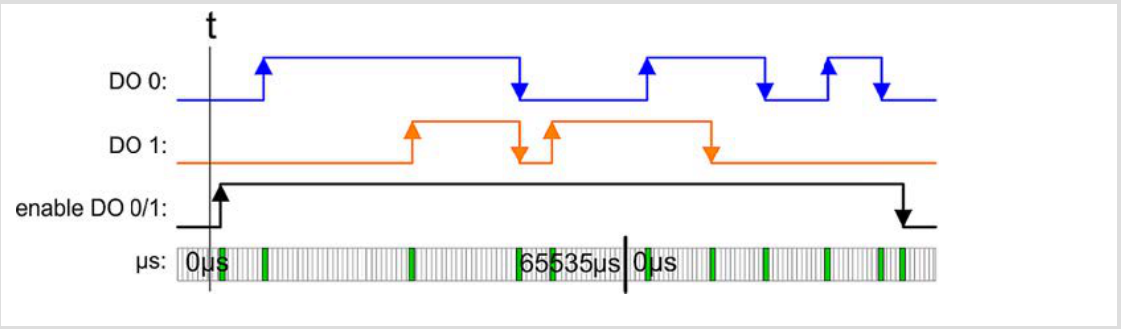


Fig. 3-37 Time diagram: writing the time stamp entries 1 ... 5

Executing the time stamp function for the first entry

In order to be able to trigger the outputs accordingly, they must previously be enabled. In this example you enable the two outputs with the first "running number" (RN). The first time stamp entry (RN = 0x01) is executed and deleted from the FIFO memory.

FIFO	Output data	Running number (RN)	Ticker value [µs]	Input data
1	0b10110000	0x02	12506	RN_LAST: 0x45 RN_NEXT: 0xC2 STS_FIFO: 0x00/0x02 NUM_ETS: 0x04
2	0b11110000	0x03	34518	
3	0b00110000	0x04	49526	
4	0b01110000	0x05	54529	
5	0b00000000	0x00	0	
...	0b00000000	0x00	0	
31	0b00000000	0x00	0	

The values of the table result in the following time diagram:

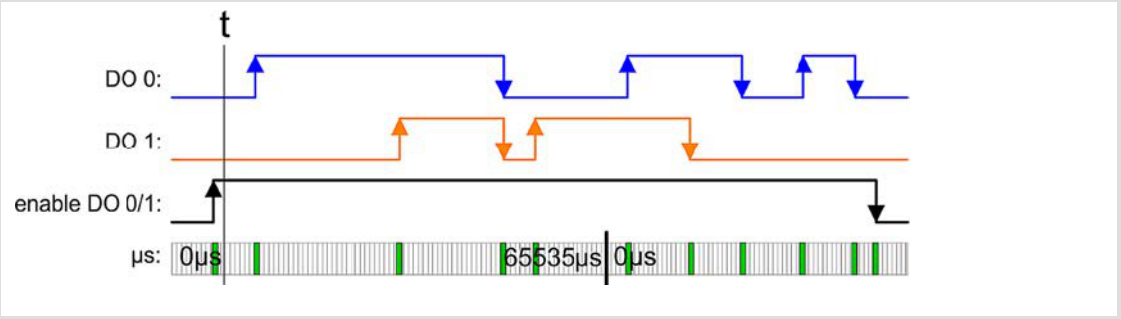


Fig. 3-38 Time diagram: executing the time stamp function for the first entry

Executing the time stamp function for the entries 2 ... 4

The states of the time stamp entries 2 ... 4 (RN = 0x02 ... 0x04) are output consecutively and deleted from the FIFO memory.

FIFO	Output data	Running number (RN)	Ticker value [µs]	Input data
1	0b01110000	0x05	54529	RN_LAST: 0x45 RN_NEXT: 0xC5 STS_FIFO: 0x00/0x02 NUM_ETS: 0x01
2	0b00000000	0x05	0	
...	0b00000000	0x00	0	
31	0b00000000	0x00	0	

The values of the table result in the following time diagram:

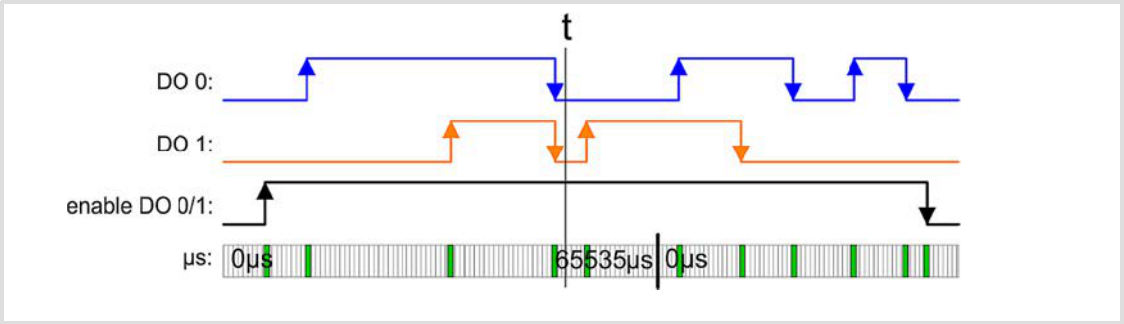


Fig. 3-39 Time diagram: executing the time stamp function for the entries 2 ... 4

Writing the time stamp entries 6 ... 10

After writing the time stamp entries 6 ... 10 (RN = 0x06 ... 0x0A) in the process output data, they are directly transferred to the FIFO memory of the module.

FIFO	Output data	Running number (RN)	Ticker value [µs]	Input data
1	0b01110000	0x05	54529	RN_LAST: 0x4A RN_NEXT: 0xC5 STS_FIFO: 0x00/0x02 NUM_ETS: 0x06
2	0b11110000	0x06	3500	
3	0b10110000	0x07	12443	
4	0b00110000	0x08	20185	
5	0b10110000	0x09	30140	
6	0b00110000	0x0A	37330	
7	0b00000000	0x00	0	
...	0b00000000	0x00	0	
31	0b00000000	0x00	0	

The values of the table result in the following time diagram:

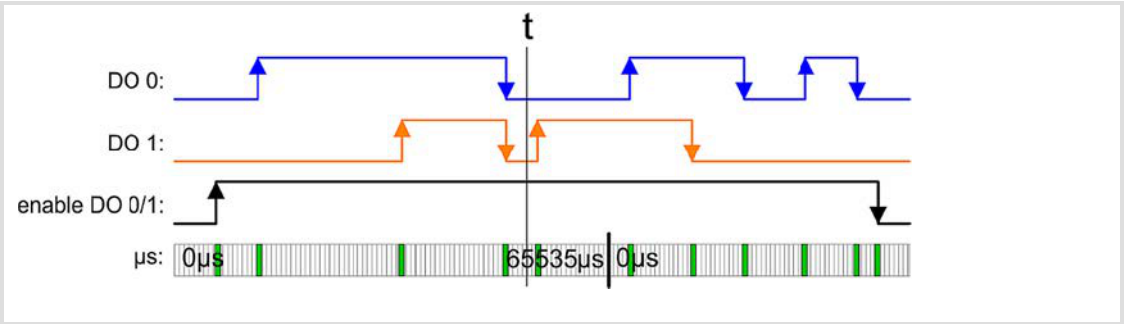


Fig. 3-40 Time diagram: writing the time stamp entries 6 ... 10

Executing the time stamp entries 6 ... 8

The states of the time stamp entries 6 ... 8 (RN = 0x06 ... 0x08) are output consecutively and deleted from the FIFO memory.

FIFO	Output data	Running number (RN)	Ticker value [µs]	Input data
1	0b10110000	0x09	30140	RN_LAST: 0x4A RN_NEXT: 0xC5 STS_FIFO: 0x00/0x02 NUM_ETS: 0x02
2	0b00110000	0x0A	37330	
3	0b00000000	0x00	0	
...	0b00000000	0x00	0	
31	0b00000000	0x00	0	

The values of the table result in the following time diagram:

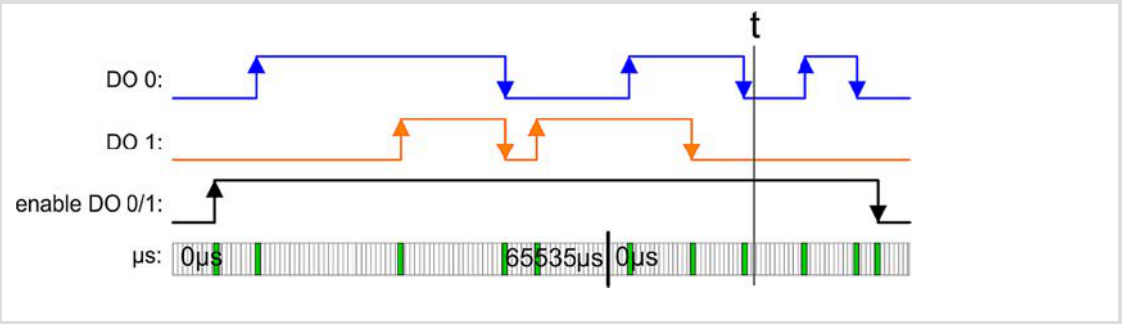


Fig. 3-41 Time diagram: writing the time stamp entries 6 ... 10

Writing the last time stamp entry

As less than five time stamp entries are written, bit 6 of the ”running number” (RN) must always be set at the last time stamp entry: RN = 0x0B becomes 0x4B.

FIFO	Output data	Running number (RN)	Ticker value [µs]	Input data
1	0b10110000	0x09	30140	RN_LAST: 0x4B RN_NEXT: 0xC9 STS_FIFO: 0x80/0x82 NUM_ETS: 0x03
2	0b00110000	0x0A	37330	
3	0b00000000	0x0B	40000	
4	0b00000000	0x00	0	
...	0b00000000	0x00	0	
31	0b00000000	0x00	0	

The values of the table result in the following time diagram:

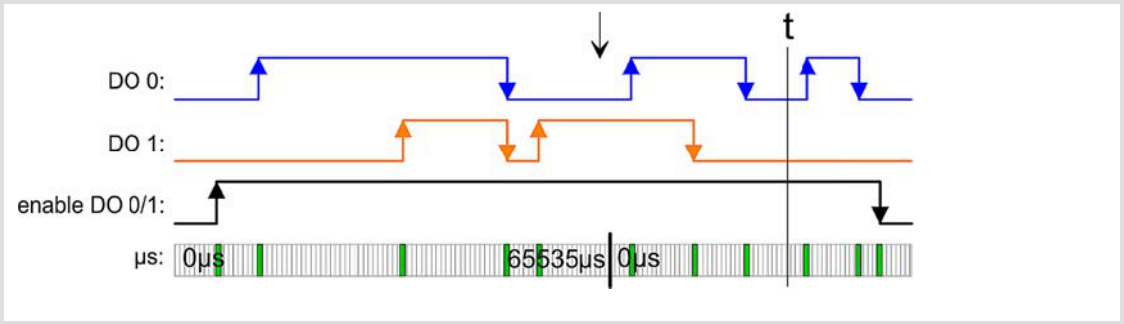


Fig. 3-42 Time diagram: writing the last time stamp entry

Executing the time stamp function for the last entries

The states of the last time stamp entries (RN = 0x09 ... 0x4B) are output consecutively and deleted from the FIFO memory.

FIFO	Output data	Running number (RN)	Ticker value [µs]	Input data
1	0b00000000	0x00	0	RN_LAST: 0x4B RN_NEXT: 0xCC STS_FIFO: 0x80/0x82 NUM_ETS: 0x00
2	0b00000000	0x00	0	
...	0b00000000	0x00	0	
31	0b00000000	0x00	0	

The values of the table result in the following time diagram:

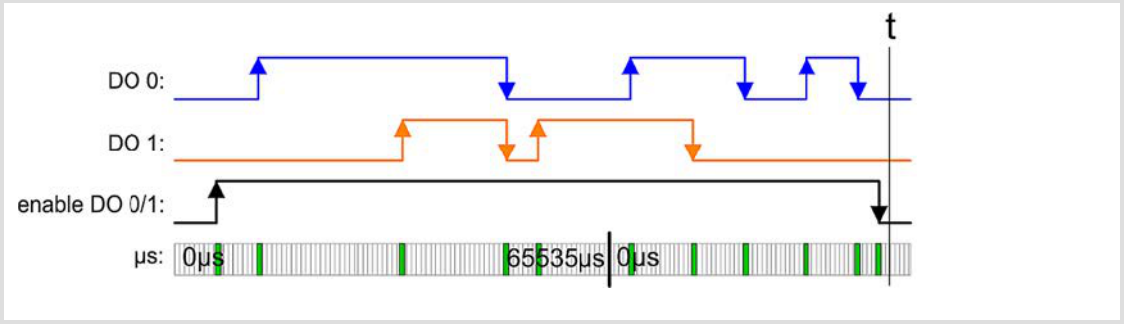


Fig. 3-43 Time diagram: executing the time stamp function for the last entries

3.6.12 Two relay outputs - EPM-S308

This module detects up to two binary control signals from the higher-level bus system and transmits them to the process level via relay outputs (switches).

Features

- 2 relay outputs (switches), potential-free
- LEDs show the switching states of the outputs

Overview

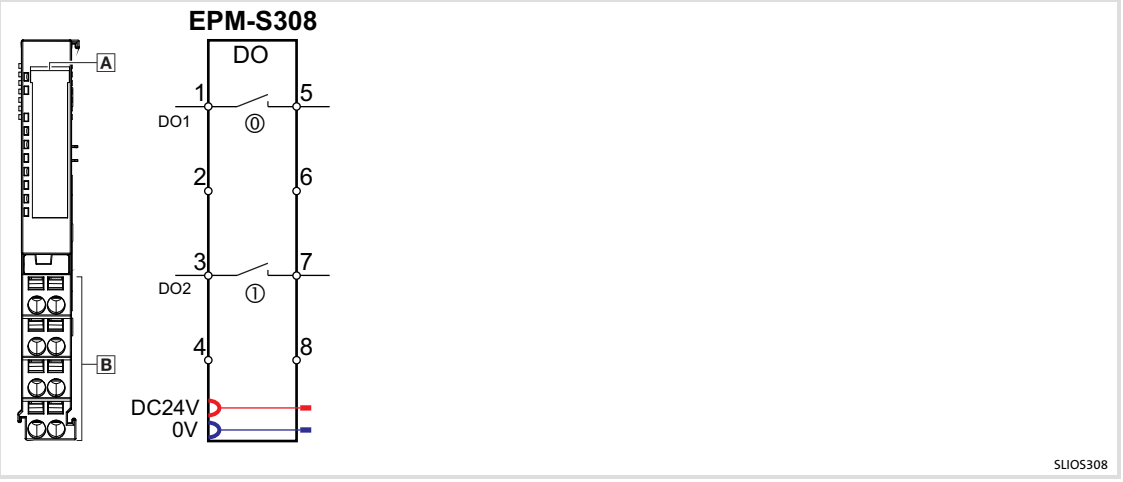
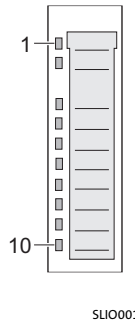


Fig. 3-44 Elements and circuit diagram

A	Displays for module status
B	Terminals
1 ... 8	Connection number
⓪ ... ⑦	Bit number in bit presentation

Status displays

Module status LEDs A

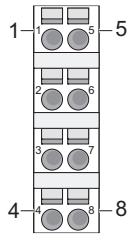
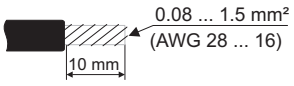
View	Pos.	Designation	Colour	Explanation
	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	DO1	Green	On: Relay output triggered
	4	DO2		
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

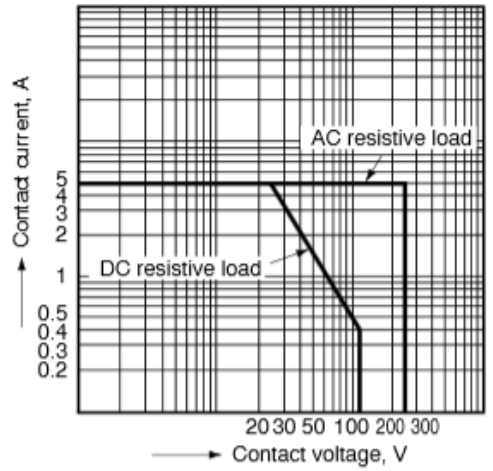
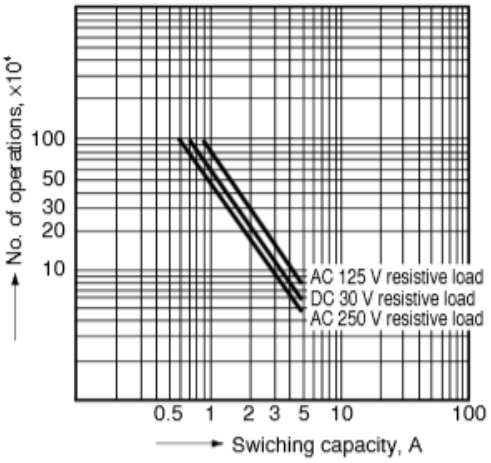
Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
	1	Relay output DO1	
	2	Not assigned	
	3	Relay output DO2	
	4	Not assigned	
	5	Relay output DO1	
	6	Not assigned	
	7	Relay output DO2	
	8	Not assigned	

Technical data

EPM-S308: rated data	
Module identifier	265_{dec}
Current consumption/power loss	
Current consumption from backplane bus	130 mA
Power loss	0.7 W

EPM-S308: rated data	
Relay outputs	
Number of outputs	2
Load voltage	
Nominal value	DC 30 V / AC 230 V
Total current	
for each group, horizontal structure, 40°C	3 A
for each group, horizontal structure, 60°C	3 A
for each group, vertical structure	3 A
Output current	
for ”1” signal, nominal value	3 A
Maximum switching capacity	
Service life	
Parallel switching of outputs	
for redundant control	Not possible
for power increase	Not possible
Control of a digital input	Not possible
Switching frequencies	
for ohmic loads	Max. 100 Hz
Output data size	8 bits (with EPM-S110: 2 bits)

EPM-S308: rated data	
Status, alarm, diagnostics	
Status display	Green LEDs per channel
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	No
Diagnostic information can be read out	None
Module status	Green LED
Module error display	Red LED
Channel error display	None
Electrical isolation	
between the channels	Yes
Between the channels and the backplane bus	Yes
Insulation checked with	DC 500 V

3.7 I/O compound modules - analog I/O

3.7.1 Representation of analog values

Analog values can only be processed in a binary form. For this, the analog module converts each process signal into a digital form and passes it on as a word.

Resolution	Analog value															
	HIGH byte (byte 0)								LOW byte (byte 1)							
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Valency	Sign bit	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
12 bits + sign bit	Sign bit	Measured value												0	0	0
15 bits + sign bit	Sign bit	Measured value														

Resolution: In the case of a resolution of 12 bits plus sign bit, the lower-order digits that are not used (3 bits) are written to with ”0”.

Sign bit: Bit 15 = ”0” →positive value; bit 15 = ”1” →negative value.

Response in the event of an error: If a measured value exceeds the overrange or falls below the lower range, the following value is output:

Measured value > overrange →32767 ($7FFF_h$)
Measured value < lower range →-32768 (8000_h)

If a parameterisation error occurs, the measured value 32767 ($7FFF_h$) is output.

3.7.2 2 analog inputs 0 ... 10 V (12 bits) - EPM-S400

This module detects up to two analog control signals from the process level and transmits them to the higher-level bus system.

Features

- 2 analog inputs
- Voltage range 0 ... 10 V
- 12-bit resolution
- Signal function is parameterisable
- An LED indicates if an input signal is outside the permissible measuring range

Stop!

Overvoltage at the inputs

The electronics of the electronic module are not protected against too high input signals.

Possible consequences:

- The module is destroyed

Protective measures:

- Make sure that the signals and encoders connected match the measuring range parameterised.

Overview

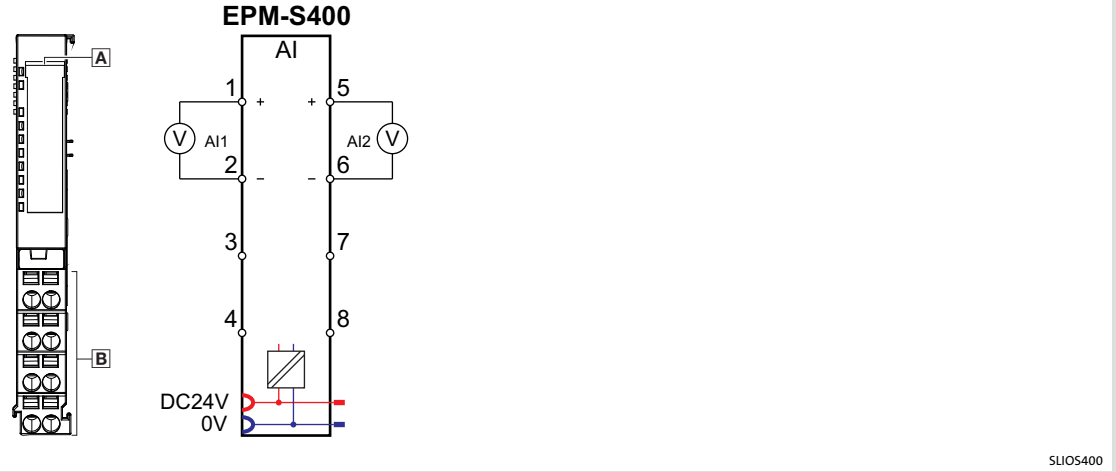
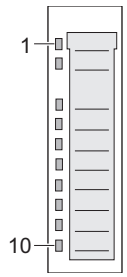


Fig. 3-45 Elements and circuit diagram

A Displays for module status
B Terminals
1 ... 8 Connection number

Status displays

Module status LEDs A

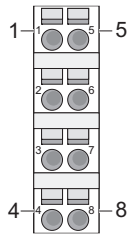
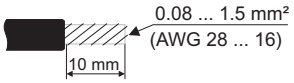
View	Pos.	Designation	Colour	Explanation
 SLIO001	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	AI1	Red	On: Channel 1, signal outside the measuring range, error in parameter setting
	4	AI2	Red	On: Channel 2, signal outside the measuring range, error in parameter setting
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
 SLIO002	1	Analog input AI1 (+)	
	2	Analog input AI1 (GND)	
	3	Not assigned	
	4	Not assigned	
	5	Analog input AI2 (+)	
	6	Analog input AI2 (GND)	
	7	Not assigned	
	8	Not assigned	

Note!

- ► Use parameter setting to deactivate unused inputs.
- ► The module does not provide any auxiliary supply for sensors.

Technical data

EPM-S400: Rated data	
Module identifier	1025_{dec}
Current consumption/power loss	
Current consumption from backplane bus	70 mA
Power loss	0.7 W
Analog inputs	
Number of inputs	2
Cable length	
shielded	200 m
Load voltage	
Nominal value	DC 24 V
Current consumption from load voltage L+	15 mA (without load)
Voltage inputs	
Input voltage ranges	0 V ... +10 V
Destruction limit (input voltage)	30 V
Min. input resistance	100 kΩ
Operational error limit	+/- 0.3 %
Basic error limit	+/- 0.2 %
Measuring principle	Gradual approximation
Resolution	12 bits
Basic conversion time	2 ms all channels
Interference voltage suppression for a frequency of	> 50 d**B** bei 50 Hz (UCM < 2 V)
Temperature error (relating to input range)	± 0.005 %/K
Linearity distortion (relating to input range)	± 0.02 %
Repeat accuracy (in steady-state vibration at 25°C, relating to the input range)	± 0.05 %
Input data size	4 bytes
Status, alarm, diagnostics	
Status display	Yes
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	Yes
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	Red LEDs per channel

EPM-S400: Rated data	
Electrical isolation	
Between the channels and the backplane bus	Yes
Between the channels and the voltage supply	Yes
Max. potential difference between inputs (U_{cm})	DC 2 V
Max. potential difference between the analog channel (e.g. input) and the I/O supply	DC 75 V / AC 60 V
Insulation checked with	DC 500 V

3.7.3 4 analog inputs 0 ... 10 V (12 bits) - EPM-S401

This module detects up to four analog control signals from the process level and transmits them to the higher-level bus system.

Features

- 4 analog inputs
- Voltage range 0 ... 10 V
- 12-bit resolution
- Signal function is parameterisable
- An LED indicates if an input signal is outside the permissible measuring range

Stop!

Overvoltage at the inputs

The electronics of the electronic module are not protected against too high input signals.

Possible consequences:

- The module is destroyed

Protective measures:

- Make sure that the signals and encoders connected match the measuring range parameterised.

Overview

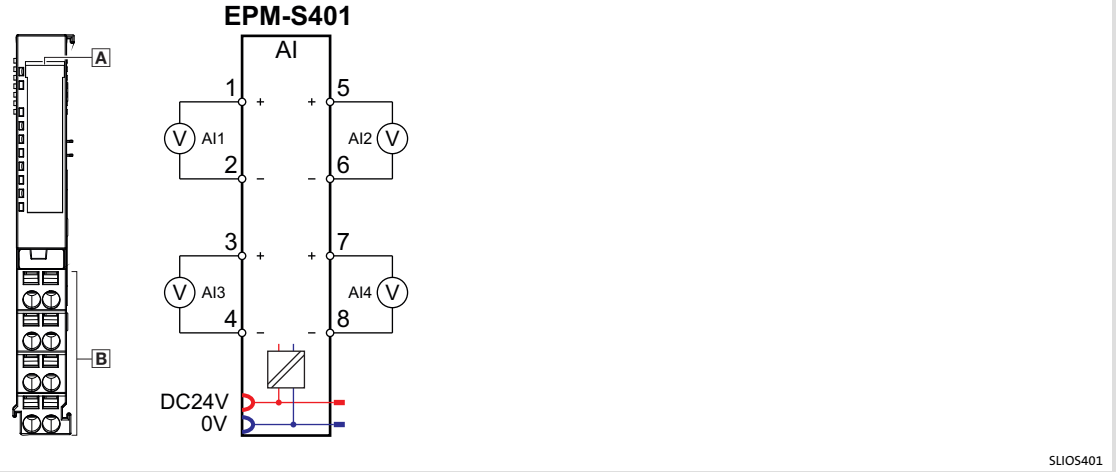
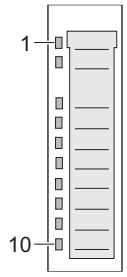


Fig. 3-46 Elements and circuit diagram

A Displays for module status
B Terminals
1 ... 8 Connection number

Status displays

Module status LEDs A

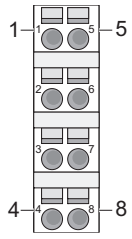
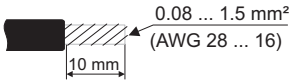
View	Pos.	Designation	Colour	Explanation
 SLIO001	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	AI1	Red	On: Channel 1, signal outside the measuring range, error in parameter setting
	4	AI2	Red	On: Channel 2, signal outside the measuring range, error in parameter setting
	5	AI3	Red	On: Channel 3, signal outside the measuring range, error in parameter setting
	6	AI4	Red	On: Channel 4, signal outside the measuring range, error in parameter setting
	7	-	-	Not assigned
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
 SLIO002	1	Analog input AI1 (+)	
	2	Analog input AI1 (GND)	
	3	Analog input AI3 (+)	
	4	Analog input AI3 (GND)	
	5	Analog input AI2 (+)	
	6	Analog input AI2 (GND)	
	7	Analog input AI4 (+)	
	8	Analog input AI4 (GND)	

Note!

- ► Use parameter setting to deactivate unused inputs.
- ► The module does not provide any auxiliary supply for sensors.

Technical data

EPM-S401: Rated data	
Module identifier	1028_{dec}
Current consumption/power loss	
Current consumption from backplane bus	70 mA
Power loss	0.7 W
Analog inputs	
Number of inputs	4
Cable length	
shielded	200 m
Load voltage	
Nominal value	DC 24 V
Current consumption from load voltage L+	15 mA (without load)
Voltage inputs	
Input voltage ranges	0 V ... +10 V
Destruction limit (input voltage)	30 V
Min. input resistance	100 kΩ
Operational error limit	+/- 0.3 %
Basic error limit	+/- 0.2 %
Measuring principle	Gradual approximation
Resolution	12 bits
Basic conversion time	4 ms all channels
Interference voltage suppression for a frequency of	> 50 dB bei 50 Hz (UCM < 2 V)
Temperature error (relating to input range)	±0.005 %/K
Linearity distortion (relating to input range)	±0.02 %
Repeat accuracy (in steady-state vibration at 25°C, relating to the input range)	±0.05 %
Input data size	8 bytes
Status, alarm, diagnostics	
Status display	Yes
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	Yes
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	Red LEDs per channel

EPM-S401: Rated data	
Electrical isolation	
Between the channels and the backplane bus	Yes
Between the channels and the voltage supply	Yes
Max. potential difference between inputs (U_{cm})	DC 2 V
Max. potential difference between the analog channel (e.g. input) and the I/O supply	DC 75 V / AC 60 V
Insulation checked with	DC 500 V

3.7.4 2 analog inputs 0/4 ... 20 mA (12 bits) - EPM-S402

This module detects up to four analog control signals from the process level and transmits them to the higher-level bus system.

Features

- 2 analog inputs
- Current range 0/4 ... 20 mA
- 12-bit resolution
- Signal function is parameterisable
- An LED indicates if an input signal is outside the permissible measuring range

Stop!

Overvoltage at the inputs

The electronics of the electronic module are not protected against too high input signals.

Possible consequences:

- The module is destroyed

Protective measures:

- Make sure that the signals and encoders connected match the measuring range parameterised.

Overview

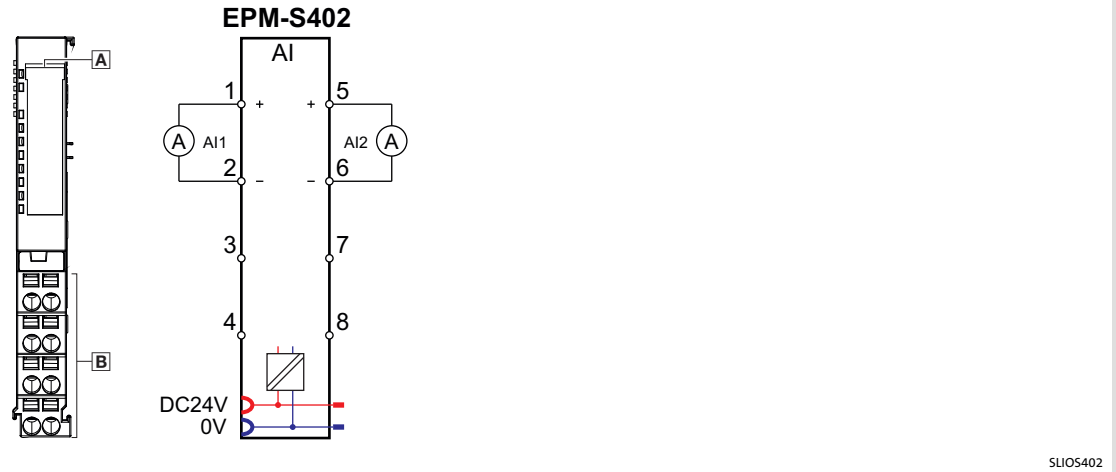
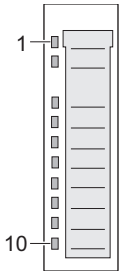


Fig. 3-47 Elements and circuit diagram

A Displays for module status
B Terminals
1 ... 8 Connection number

Status displays

Module status LEDs A

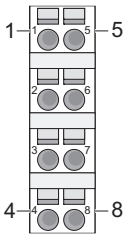
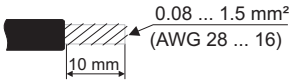
View	Pos.	Designation	Colour	Explanation
 SLIO001	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	AI1	Red	On: Channel 1, signal outside the measuring range, error in parameter setting
	4	AI2	Red	On: Channel 2, signal outside the measuring range, error in parameter setting
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
 SLIO002	1	Analog input AI1 (+)	
	2	Analog input AI1 (GND)	
	3	Not assigned	
	4		
	5	Analog input AI2 (+)	
	6	Analog input AI2 (GND)	
	7	Not assigned	
	8		

Note!

- ► Use parameter setting to deactivate unused inputs.
- ► The module does not provide any auxiliary supply for sensors.

Technical data

EPM-S402: Rated data	
Module identifier	1026_{dec}
Current consumption/power loss	
Current consumption from backplane bus	70 mA
Power loss	0.7 W
Analog inputs	
Number of inputs	2
Cable length	
shielded	200 m
Load voltage	
Nominal value	DC 24 V
Current consumption from load voltage L+	15 mA (without load)
Current inputs	
Input current ranges	0 mA ... +20 mA +4 mA ... +20 mA
Destruction limit (input current)	40 mA
Max. input resistance	110 Ω
Operational error limit	+/- 0.3 % ... +/- 0.5 %
Basic error limit	+/- 0.2 % ... +/- 0.3 %
Measuring principle	Gradual approximation
Resolution	12 bits
Basic conversion time	2 ms all channels
Interference voltage suppression for a frequency of	> 50 dB bei 50 Hz (UCM < 2 V)
Temperature error (relating to input range)	±0.005 %/K
Linearity distortion (relating to input range)	±0.02 %
Repeat accuracy (in steady-state vibration at 25°C, relating to the input range)	±0.05 %
Input data size	4 bytes
Status, alarm, diagnostics	
Status display	Yes
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	Yes
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	Red LEDs per channel

EPM-S402: Rated data	
Electrical isolation	
Between the channels and the backplane bus	Yes
Between the channels and the voltage supply	Yes
Max. potential difference between inputs (U_{cm})	DC 2 V
Max. potential difference between the analog channel (e.g. input) and the I/O supply	DC 75 V / AC 60 V
Insulation checked with	DC 500 V

3.7.5 4 analog inputs 0/4 ... 20 mA (12 bits) - EPM-S403

This module detects up to four analog control signals from the process level and transmits them to the higher-level bus system.

Features

- 4 analog inputs
- Current range 0/4 ... 20 mA
- 12-bit resolution
- Signal function is parameterisable
- An LED indicates if an input signal is outside the permissible measuring range

Stop!

Overvoltage at the inputs

The electronics of the electronic module are not protected against too high input signals.

Possible consequences:

- The module is destroyed

Protective measures:

- Make sure that the signals and encoders connected match the measuring range parameterised.

Overview

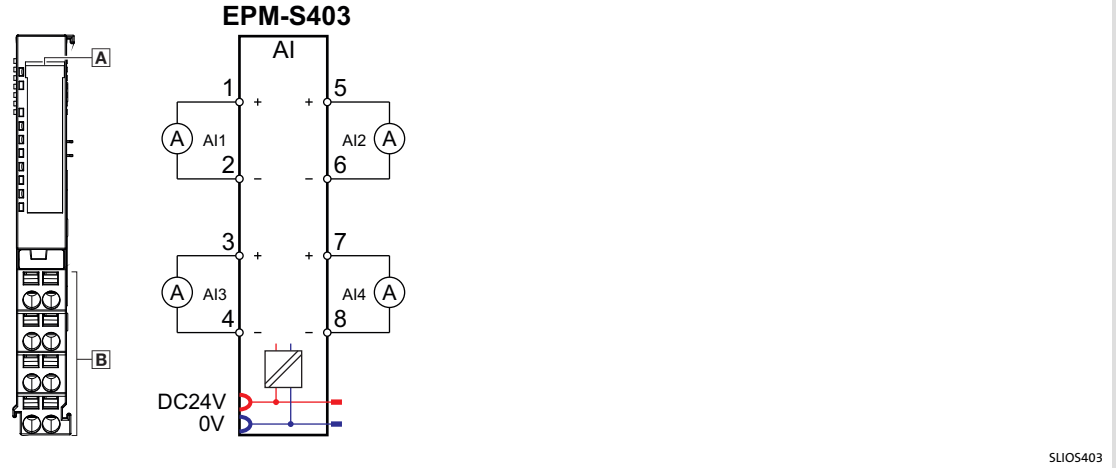
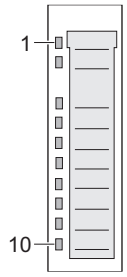


Fig. 3-48 Elements and circuit diagram

A Displays for module status
B Terminals
1 ... 8 Connection number

Status displays

Module status LEDs A

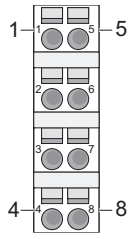
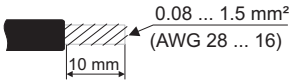
View	Pos.	Designation	Colour	Explanation
 SLIO001	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	AI1	Red	On: Channel 1, signal outside the measuring range, error in parameter setting
	4	AI2	Red	On: Channel 2, signal outside the measuring range, error in parameter setting
	5	AI3	Red	On: Channel 3, signal outside the measuring range, error in parameter setting
	6	AI4	Red	On: Channel 4, signal outside the measuring range, error in parameter setting
	7	-	-	Not assigned
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
 SLIO002	1	Analog input AI1 (+)	
	2	Analog input AI1 (GND)	
	3	Analog input AI3 (+)	
	4	Analog input AI3 (GND)	
	5	Analog input AI2 (+)	
	6	Analog input AI2 (GND)	
	7	Analog input AI4 (+)	
	8	Analog input AI4 (GND)	

Note!

- ► Use parameter setting to deactivate unused inputs.
- ► The module does not provide any auxiliary supply for sensors.

Technical data

EPM-S403: Rated data	
Module identifier	1029_{dec}
Current consumption/power loss	
Current consumption from backplane bus	70 mA
Power loss	0.7 W
Analog inputs	
Number of inputs	4
Cable length	
shielded	200 m
Load voltage	
Nominal value	DC 24 V
Current consumption from load voltage L+	15 mA (without load)
Current inputs	
Input current ranges	0 mA ... +20 mA +4 mA ... +20 mA
Destruction limit (input current)	40 mA
Max. input resistance	110 Ω
Operational error limit	+/- 0.3 % ... +/- 0.5 %
Basic error limit	+/- 0.2 % ... +/- 0.3 %
Measuring principle	Gradual approximation
Resolution	12 bits
Basic conversion time	4 ms all channels
Interference voltage suppression for a frequency of	> 50 dB bei 50 Hz (UCM < 2 V)
Temperature error (relating to input range)	±0.005 %/K
Linearity distortion (relating to input range)	±0.02 %
Repeat accuracy (in steady-state vibration at 25°C, relating to the input range)	±0.05 %
Input data size	8 bytes
Status, alarm, diagnostics	
Status display	Yes
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	Yes
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	Red LEDs per channel

EPM-S403: Rated data	
Electrical isolation	
Between the channels and the backplane bus	Yes
Between the channels and the voltage supply	Yes
Max. potential difference between inputs (U_{cm})	DC 2 V
Max. potential difference between the analog channel (e.g. input) and the I/O supply	DC 75 V / AC 60 V
Insulation checked with	DC 500 V

3.7.6 2 analog inputs -10 ... +10 V (16 bits) - EPM-S406

This module detects up to two analog control signals from the process level and transmits them to the higher-level bus system.

Note!
The UL approval for this module is in preparation.

Features

- 2 analog inputs
- Voltage range -10 ... +10 V
- 16-bit resolution
- Signal function is parameterisable
- An LED indicates if an input signal is outside the permissible measuring range

Stop!

Overvoltage at the inputs

The electronics of the electronic module are not protected against too high input signals.

Possible consequences:

- The module is destroyed

Protective measures:

- Make sure that the signals and encoders connected match the measuring range parameterised.

Overview

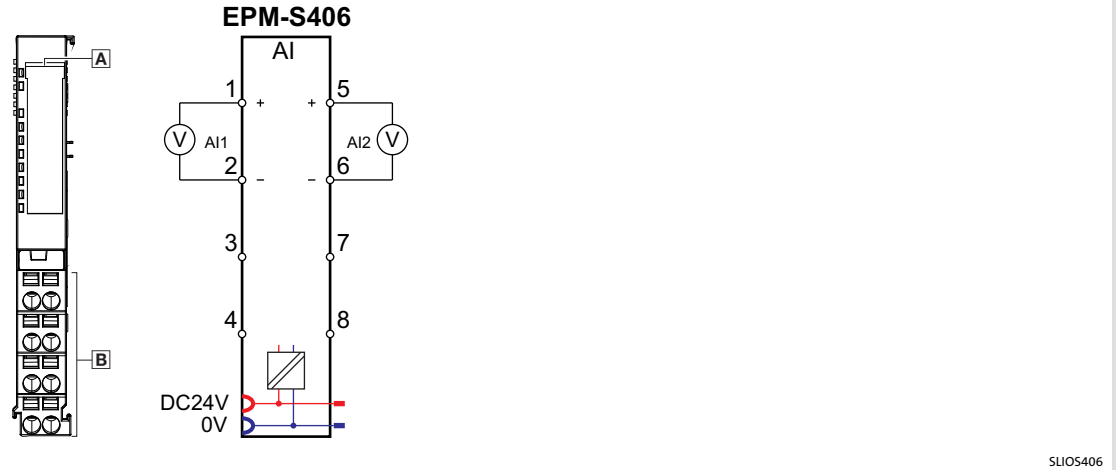
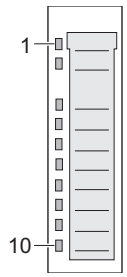


Fig. 3-49 Elements and circuit diagram

A	Displays for module status
B	Terminals
1 ... 8	Connection number

Status displays

Module status LEDs A

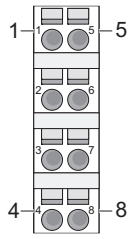
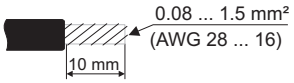
View	Pos.	Designation	Colour	Explanation
 SLIO001	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	AI1	Red	On: Channel 1, signal outside the measuring range, error in parameter setting
	4	AI2	Red	On: Channel 2, signal outside the measuring range, error in parameter setting
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
 SLIO002	1	Analog input AI1 (+)	
	2	Analog input AI1 (GND)	
	3	Not assigned	
	4	Not assigned	
	5	Analog input AI2 (+)	
	6	Analog input AI2 (GND)	
	7	Not assigned	
	8	Not assigned	

Note!

- ► Use parameter setting to deactivate unused inputs.
- ► The module does not provide any auxiliary supply for sensors.

Technical data

EPM-S406: Rated data	
Module identifier	1036_{dec}
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Power loss	0.8 W
Analog inputs	
Number of inputs	2
Cable length	
shielded	200 m
Load voltage	
Nominal value	DC 24 V
Current consumption from load voltage L+	20 mA (without load)
Voltage inputs	
Input voltage ranges	-10 V ... +10 V
Min. input resistance	200 kΩ
Operational error limit	+/- 0.2 %
Basic error limit	+/- 0.1 %
Measuring principle	Gradual approximation
Resolution	16 bits
Basic conversion time	240 µs all channels
Interference voltage suppression for a frequency of	> 80 dB at 50 Hz (UCM < 9 V)
Input data size	4 bytes
Status, alarm, diagnostics	
Status display	Yes
Alarms	Yes, parameterisable
Process alarm	Yes, parameterisable
Diagnostic alarm	Yes, parameterisable
Diagnostic function	Yes
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	Red LEDs per channel
Electrical isolation	
Between the channels and the backplane bus	Yes
Between the channels and the voltage supply	Yes
Max. potential difference between inputs (U_{cm})	DC 9 V
Max. potential difference between the analog channel (e.g. input) and the I/O supply	DC 75 V / AC 60 V
Insulation checked with	DC 500 V

3.7.7 2 analog inputs 0/4 ... 20 mA (16 bits) - EPM-S408

This module detects up to four analog control signals from the process level and transmits them to the higher-level bus system.

Note!

The UL approval for this module is in preparation.

Features

- 2 analog inputs
- Current range 0/4 ... 20 mA
- 16-bit resolution
- Signal function is parameterisable
- An LED indicates if an input signal is outside the permissible measuring range

Stop!

Overvoltage at the inputs

The electronics of the electronic module are not protected against too high input signals.

Possible consequences:

- The module is destroyed

Protective measures:

- Make sure that the signals and encoders connected match the measuring range parameterised.

Overview

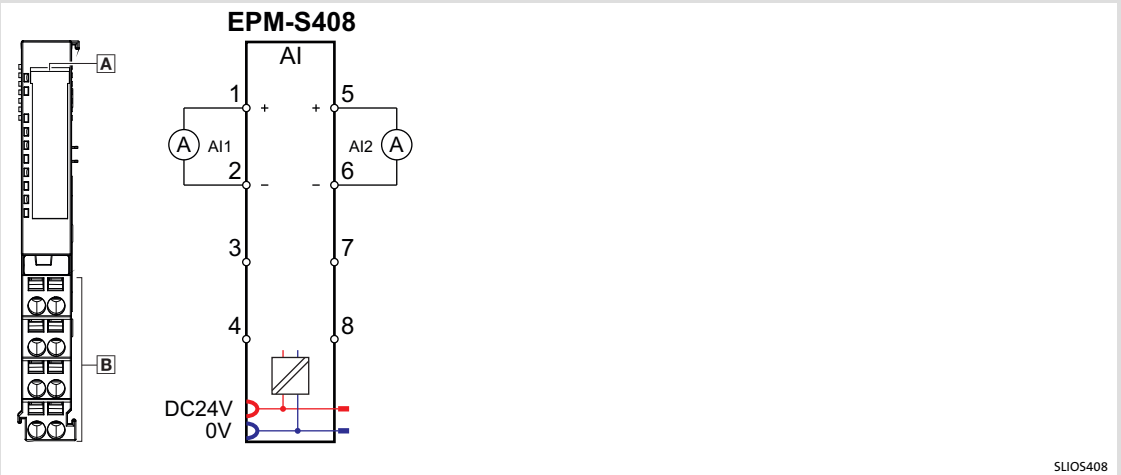
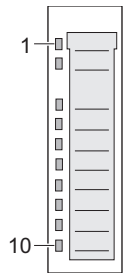


Fig. 3-50 Elements and circuit diagram

A Displays for module status
B Terminals
1 ... 8 Connection number

Status displays

Module status LEDs A

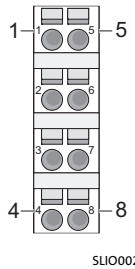
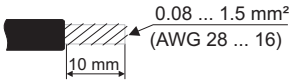
View	Pos.	Designation	Colour	Explanation
	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	AI1	Red	On: Channel 1, signal outside the measuring range, error in parameter setting
	4	AI2	Red	On: Channel 2, signal outside the measuring range, error in parameter setting
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
	1	Analog input AI1 (+)	
	2	Analog input AI1 (GND)	
	3	Not assigned	
	4		
	5	Analog input AI2 (+)	
	6	Analog input AI2 (GND)	
	7	Not assigned	
	8		

Note!

- ► Use parameter setting to deactivate unused inputs.
- ► The module does not provide any auxiliary supply for sensors.

Technical data

EPM-S408: Rated data	
Module identifier	1035_{dec}
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Power loss	0.7 W
Analog inputs	
Number of inputs	2
Cable length	
shielded	200 m
Load voltage	
Nominal value	DC 24 V
Current consumption from load voltage L+	15 mA (without load)
Current inputs	
Input current ranges	0 mA ... +20 mA +4 mA ... +20 mA
Max. input resistance	60 Ω
Operational error limit	+/- 0.2 %
Basic error limit	+/- 0.1 %
Measuring principle	Gradual approximation
Resolution	16 bits
Basic conversion time	240 µs all channels
Interference voltage suppression for a frequency of	> 80 dB (UCM < 4 V)
Input data size	4 bytes
Status, alarm, diagnostics	
Status display	Yes
Alarms	Yes, parameterisable
Process alarm	Yes, parameterisable
Diagnostic alarm	Yes, parameterisable
Diagnostic function	Yes
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	Red LEDs per channel
Electrical isolation	
Between the channels and the backplane bus	Yes
Between the channels and the voltage supply	Yes
Max. potential difference between inputs (U_{cm})	DC 4 V
Max. potential difference between the analog channel (e.g. input) and the I/O supply	DC 75 V / AC 60 V
Insulation checked with	DC 500 V

3.7.8 2 analog outputs 0 ... 10 V (12 bits) - EPM-S500

This module detects up to two analog control signals from the higher-level bus system and transmits them to the process level.

Features

- 2 analog outputs
- Voltage output 0 ... +10 V
- 12-bit resolution
- Signal function parameterisable
- 24 V DC supply voltage
- A reference potential for all outputs
- Short circuit protection
- An LED indicates if an output signal is outside the permissible measuring range

Overview

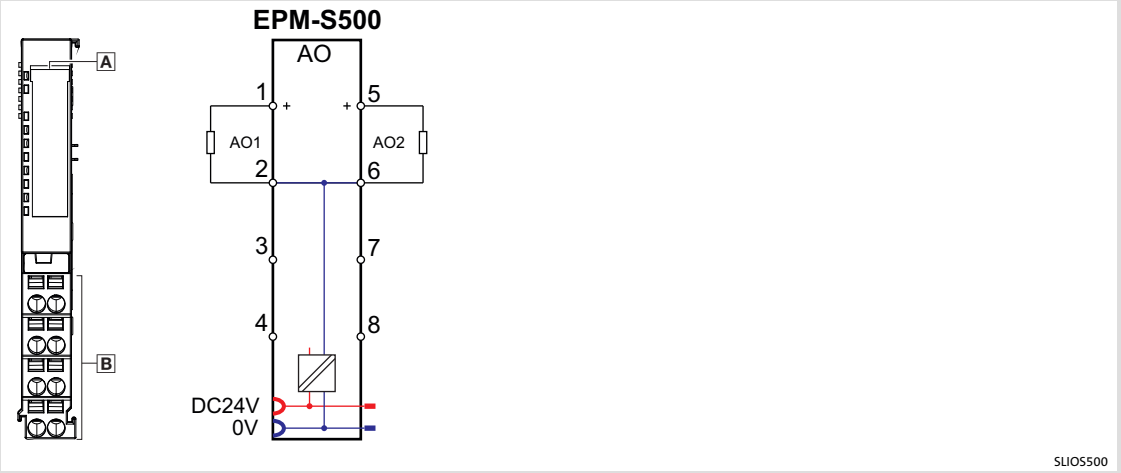
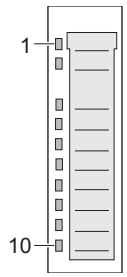


Fig. 3-51 Elements and circuit diagram

A	Displays for module status
B	Terminals
1 ... 8	Connection number

Status displays

Module status LEDs A

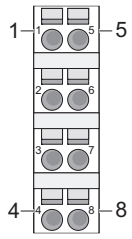
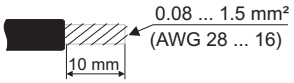
View	Pos.	Designation	Colour	Explanation
 SLIO001	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	AO1	Red	On: Channel 1, overload, short circuit, error in parameter setting
	4	AO2	Red	On: Channel 2, overload, short-circuit, error in parameter setting
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
 SLIO002	1	Analog output AO1 (+)	
	2	Analog output AO1 (GND)	
	3	Not assigned	
	4		
	5	Analog output AO2 (+)	
	6	Analog output AO2 (GND)	
	7	Not assigned	
	8		

Note!

- ► When connecting the actuators, make sure that the polarity is correct.
- ► Outputs that are not used are not connected.
- ► The module does not provide any auxiliary supply for actuators.

Technical data

EPM-S500: Rated data	
Module identifier	1281_{dec}
Current consumption/power loss	
Current consumption from backplane bus	80 mA
Power loss	1.2 W
Analog outputs	
Number of outputs	2
Cable length	
shielded	200 m
Load voltage	
Nominal value	DC 24 V
Current consumption from load voltage L+	35 mA (without load)
Voltage outputs	
Output voltage ranges	0 V ... +10 V
Min. load impedance	5 kΩ
Max. capacitive load	1 µF
Operational error limit	+/- 0.3 %
Basic error limit	+/- 0.2 %
Short circuit protection	Yes
Wire-break protection	No
Voltage at the outputs	15 V
Current	30 mA
Interference suppression (cross-talk between the outputs)	> 40 dB
Resolution	12 bits
Basic conversion time	2 ms all channels
Substitute values can be applied	Yes
Temperature error (relating to the output range)	±0.01 %/K
Linearity distortion (relating to the output range)	±0.1 %
Output ripple; bandwidth 0 to 50 kHz (relating to the output range)	±0.05 %
Repeat accuracy (in steady-state vibration at 25°C, relating to the output range)	±0.05 %
Dwell time	
for ohmic loads	1.5 ms
for capacitive loads	2 ms
Output data size	4 bytes

EPM-S500: Rated data	
Status, alarm, diagnostics	
Status display	Yes
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	Yes
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	Red LEDs per channel
Electrical isolation	
Between the channels and the backplane bus	Yes
Between the channels and the voltage supply	Yes
Max. potential difference between the analog channel (e.g. input) and the I/O supply	DC 75 V / AC 60 V
Insulation checked with	DC 500 V

3.7.9 4 analog outputs 0 ... 10 V (12 bits) - EPM-S501

This module detects up to four analog control signals from the higher-level bus system and transmits them to the process level.

Features

- 4 analog outputs
- Voltage output 0 ... +10 V
- 12-bit resolution
- Signal function parameterisable
- 24 V DC supply voltage
- A reference potential for all outputs
- Short circuit protection
- An LED indicates if an output signal is outside the permissible measuring range

Overview

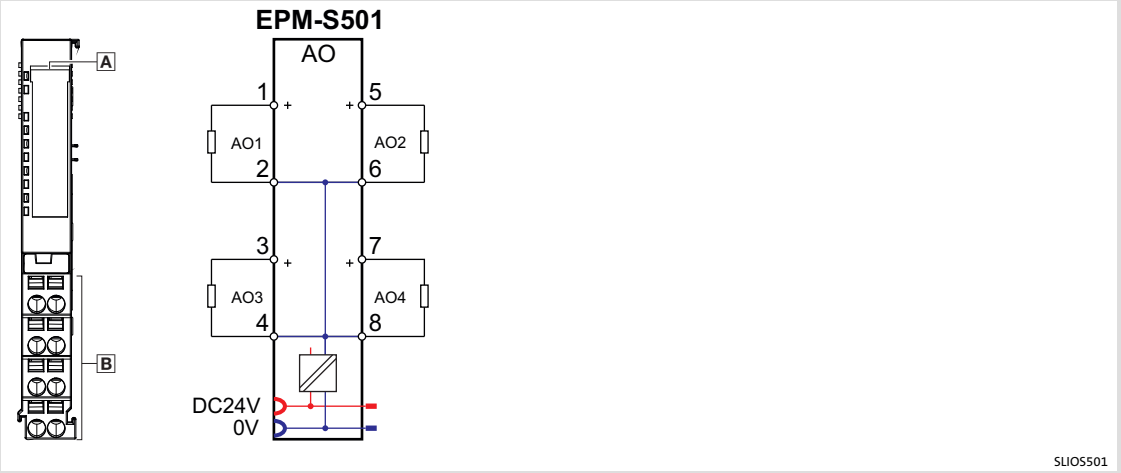
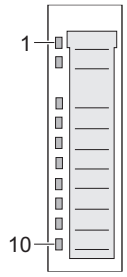


Fig. 3-52 Elements and circuit diagram

A	Displays for module status
B	Terminals
1 ... 8	Connection number

Status displays

Module status LEDs A

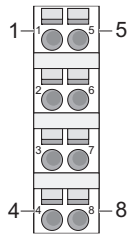
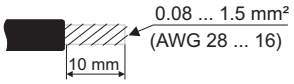
View	Pos.	Designation	Colour	Explanation
 SLIO001	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	AO1	Red	Channel 1, overload, short-circuit, error in parameter setting
	4	AO2	Red	Channel 2, overload, short-circuit, error in parameter setting
	5	AO3	Red	Channel 3, overload, short-circuit, error in parameter setting
	6	AO4	Red	Channel 4, overload, short-circuit, error in parameter setting
	7	-	-	Not assigned
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
 SLIO002	1	Analog output AO1 (+)	
	2	Analog output AO1 (GND)	
	3	Analog output AO3 (+)	
	4	Analog output AO3 (GND)	
	5	Analog output AO2 (+)	
	6	Analog output AO2 (GND)	
	7	Analog output AO4 (+)	
	8	Analog output AO4 (GND)	

Note!

- ► When connecting the actuators, make sure that the polarity is correct.
- ► Outputs that are not used are not connected.
- ► The module does not provide any auxiliary supply for actuators.

Technical data

EPM-S501: Rated data	
Module identifier	1283_{dec}
Current consumption/power loss	
Current consumption from backplane bus	80 mA
Power loss	1.2 W
Analog outputs	
Number of outputs	4
Cable length	
shielded	200 m
Load voltage	
Nominal value	DC 24 V
Current consumption from load voltage L+	35 mA (without load)
Voltage outputs	
Output voltage ranges	0 V ... +10 V
Min. load impedance	5 kΩ
Max. capacitive load	1 µF
Operational error limit	+/- 0.3 %
Basic error limit	+/- 0.2 %
Short circuit protection	Yes
Wire-break protection	No
Voltage at the outputs	15 V
Current	30 mA
Interference suppression (cross-talk between the outputs)	> 40 dB
Resolution	12 bits
Basic conversion time	2 ms all channels
Substitute values can be applied	Yes
Temperature error (relating to the output range)	±0.01 %/K
Linearity distortion (relating to the output range)	±0.1 %
Output ripple; bandwidth 0 to 50 kHz (relating to the output range)	±0.05 %
Repeat accuracy (in steady-state vibration at 25°C, relating to the output range)	±0.05 %
Dwell time	
for ohmic loads	1.5 ms
for capacitive loads	2 ms
Output data size	8 bytes

EPM-S501: Rated data	
Status, alarm, diagnostics	
Status display	Yes
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	Yes
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	Red LEDs per channel
Electrical isolation	
Between the channels and the backplane bus	Yes
Between the channels and the voltage supply	Yes
Max. potential difference between the analog channel (e.g. input) and the I/O supply	DC 75 V / AC 60 V
Insulation checked with	DC 500 V

3.7.10 2 analog outputs 0/4 ... 20 mA (12 bits) - EPM-S502

This module detects up to two analog control signals from the higher-level bus system and transmits them to the process level.

Features

- 2 analog outputs
- Current output 0/4 ... 20 mA
- 12-bit resolution
- Signal function parameterisable
- 24 V DC supply voltage
- A reference potential for all outputs
- Wire-break protection
- An LED indicates if an output signal is outside the permissible measuring range

Overview

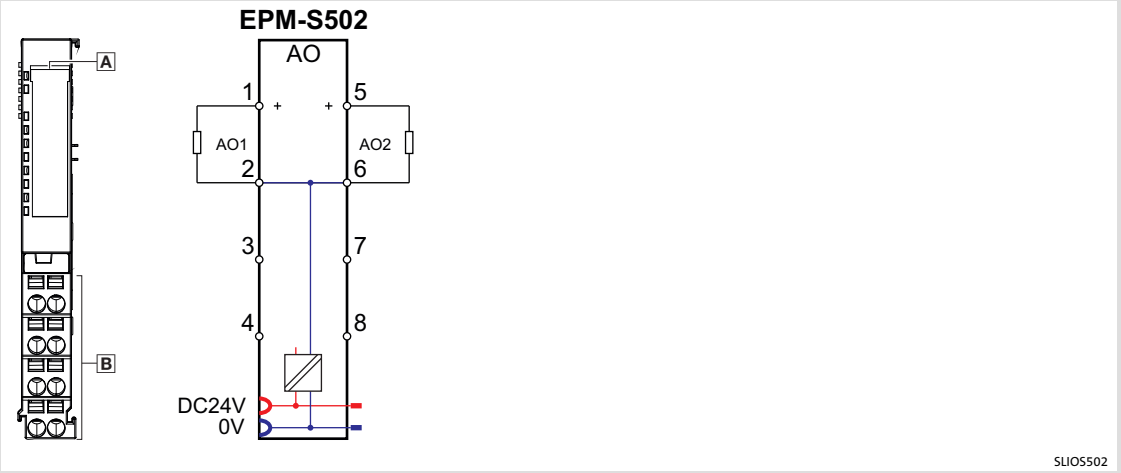
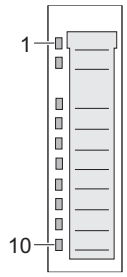


Fig. 3-53 Elements and circuit diagram

A Displays for module status
B Terminals
1 ... 8 Connection number

Status displays

Module status LEDs A

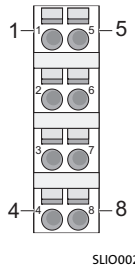
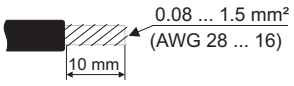
View	Pos.	Designation	Colour	Explanation
	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	AO1	Red	On: Channel 1, open circuit, parameterisation error
	4	AO2	Red	On: Channel 2, open circuit, parameterisation error
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
	1	Analog output AO1 (+)	
	2	Analog output AO1 (GND)	
	3	Not assigned	
	4		
	5	Analog output AO2 (+)	
	6	Analog output AO2 (GND)	
	7	Not assigned	
	8		

Note!

- ► When connecting the actuators, make sure that the polarity is correct.
- ► Outputs that are not used are not connected.
- ► The module does not provide any auxiliary supply for actuators.

Technical data

EPM-S502: Rated data	
Module identifier	1282_{dec}
Current consumption/power loss	
Current consumption from backplane bus	80 mA
Power loss	0.8 W
Analog outputs	
Number of outputs	2
Cable length	
shielded	200 m
Load voltage	
Nominal value	DC 24 V
Current consumption from load voltage L+	15 mA (without load)
Current outputs	
Output current ranges	0 mA ... +20 mA +4 mA ... +20 mA
Max. load impedance	350 Ω
Max. inductive load	10 mH
Operational error limit	+/- 0.4 % ... +/- 0.5 %
Basic error limit	+/- 0.2 % ... +/- 0.3 %
Short circuit protection	No
Wire-break protection	Yes
Voltage at the outputs	12 V
Interference suppression (cross-talk between the outputs)	> 40 dB
Resolution	12 bits
Basic conversion time	2 ms all channels
Substitute values can be applied	Yes
Temperature error (relating to the output range)	±0.01 %/K
Linearity distortion (relating to the output range)	±0.1 %
Output ripple; bandwidth 0 to 50 kHz (relating to the output range)	±0.05 %
Repeat accuracy (in steady-state vibration at 25°C, relating to the output range)	±0.05 %
Dwell time	
for ohmic loads	0.25 ms
for inductive load	1.5 ms
Output data size	4 bytes

EPM-S502: Rated data	
Status, alarm, diagnostics	
Status display	Yes
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	Yes
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	Red LEDs per channel
Electrical isolation	
Between the channels and the backplane bus	Yes
Between the channels and the voltage supply	Yes
Max. potential difference between the analog channel (e.g. input) and the I/O supply	DC 75 V / AC 60 V
Insulation checked with	DC 500 V

3.7.11 4 analog outputs 0/4 ... 20 mA (12 bits) - EPM-S503

This module detects up to four analog control signals from the higher-level bus system and transmits them to the process level.

Features

- 4 analog outputs
- Current output 0/4 ... 20 mA
- 12-bit resolution
- Signal function parameterisable
- 24 V DC supply voltage
- A reference potential for all outputs
- Wire-break protection
- An LED indicates if an output signal is outside the permissible measuring range

Overview

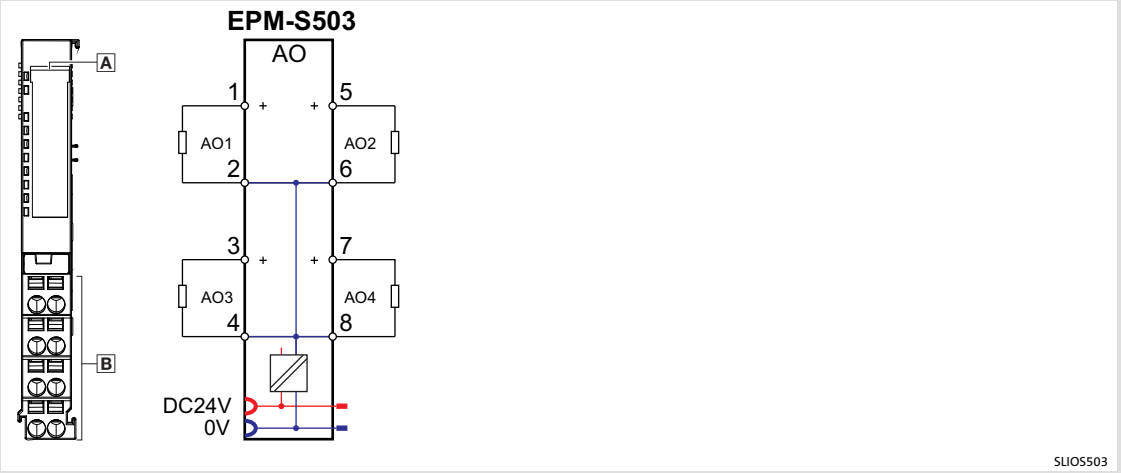
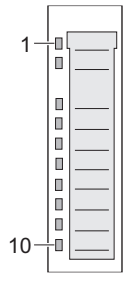


Fig. 3-54 Elements and circuit diagram

A Displays for module status
B Terminals
1 ... 8 Connection number

Status displays

Module status LEDs A

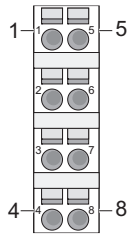
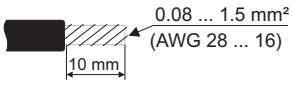
View	Pos.	Designation	Colour	Explanation
	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	AO1	Red	On: Channel 1, open circuit, parameterisation error
	4	AO2	Red	On: Channel 2, open circuit, parameterisation error
	5	AO3	Red	On: Channel 3, open circuit, parameterisation error
	6	AO4	Red	On: Channel 4, open circuit, parameterisation error
	7	-	-	Not assigned
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
	1	Analog output AO1 (+)	
	2	Analog output AO1 (GND)	
	3	Analog output AO3 (+)	
	4	Analog output AO3 (GND)	
	5	Analog output AO2 (+)	
	6	Analog output AO2 (GND)	
	7	Analog output AO4 (+)	
	8	Analog output AO4 (GND)	

Note!

- ► When connecting the actuators, make sure that the polarity is correct.
- ► Outputs that are not used are not connected.
- ► The module does not provide any auxiliary supply for actuators.

Technical data

EPM-S503: Rated data	
Module identifier	1284_{dec}
Current consumption/power loss	
Current consumption from backplane bus	80 mA
Power loss	0.8 W
Analog outputs	
Number of outputs	4
Cable length	
shielded	200 m
Load voltage	
Nominal value	DC 24 V
Current consumption from load voltage L+	15 mA (without load)
Current outputs	
Output current ranges	0 mA ... +20 mA +4 mA ... +20 mA
Max. load impedance	350 Ω
Max. inductive load	10 mH
Operational error limit	+/- 0.4 % ... +/- 0.5 %
Basic error limit	+/- 0.2 % ... +/- 0.3 %
Short circuit protection	No
Wire-break protection	Yes
Voltage at the outputs	12 V
Interference suppression (cross-talk between the outputs)	> 40 dB
Resolution	12 bits
Basic conversion time	2 ms all channels
Substitute values can be applied	Yes
Temperature error (relating to the output range)	±0.01 %/K
Linearity distortion (relating to the output range)	±0.1 %
Output ripple; bandwidth 0 to 50 kHz (relating to the output range)	±0.05 %
Repeat accuracy (in steady-state vibration at 25°C, relating to the output range)	±0.05 %
Dwell time	
for ohmic loads	0.25 ms
for inductive load	1.5 ms
Output data size	8 bytes

EPM-S503: Rated data	
Status, alarm, diagnostics	
Status display	Yes
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	Yes
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	Red LEDs per channel
Electrical isolation	
Between the channels and the backplane bus	Yes
Between the channels and the voltage supply	Yes
Max. potential difference between the analog channel (e.g. input) and the I/O supply	DC 75 V / AC 60 V
Insulation checked with	DC 500 V

3.8 I/O compound modules - temperature measurement

3.8.1 Representation of analog values

Analog values can only be processed in a binary form. For this, the analog module converts each process signal into a digital form and passes it on as a word.

Resolution	Analog value															
	HIGH byte (byte 0)								LOW byte (byte 1)							
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Valency	Sign bit	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
12 bits + sign bit	Sign bit	Measured value												0	0	0
15 bits + sign bit	Sign bit	Measured value														

Resolution: In the case of a resolution of 12 bits plus sign bit, the lower-order digits that are not used (3 bits) are written to with ”0”.

Sign bit: Bit 15 = ”0” →positive value; bit 15 = ”1” →negative value.

Response in the event of an error: If a measured value exceeds the overrange or falls below the lower range, the following value is output:

Measured value > overrange →32767 ($7FFF_h$)
Measured value < lower range →-32768 (8000_h)

If a parameterisation error occurs, the measured value 32767 ($7FFF_h$) is output.

3.8.2 Four (two) analog inputs for resistance tests - EPM-S404

This module detects up to four analog control signals from the process level and transmits them to the higher-level bus system.

Features

- 4 analog inputs (for 2-wire technology) or 2 analog inputs (for 3- and 4-wire technology)
- For resistance-type sensors 0 ... 3000 and resistance temperature sensors Pt100, Pt1000, Ni100 or Ni1000
- 16-bit resolution
- Signal function is parameterisable
- An LED indicates if an input voltage is outside the permitted measuring range

Stop!

Overvoltage at the inputs

The electronics of the electronic module are not protected against too high input signals.

Possible consequences:

- The module is destroyed

Protective measures:

- Make sure that the signals and encoders connected match the measuring range parameterised.

Overview

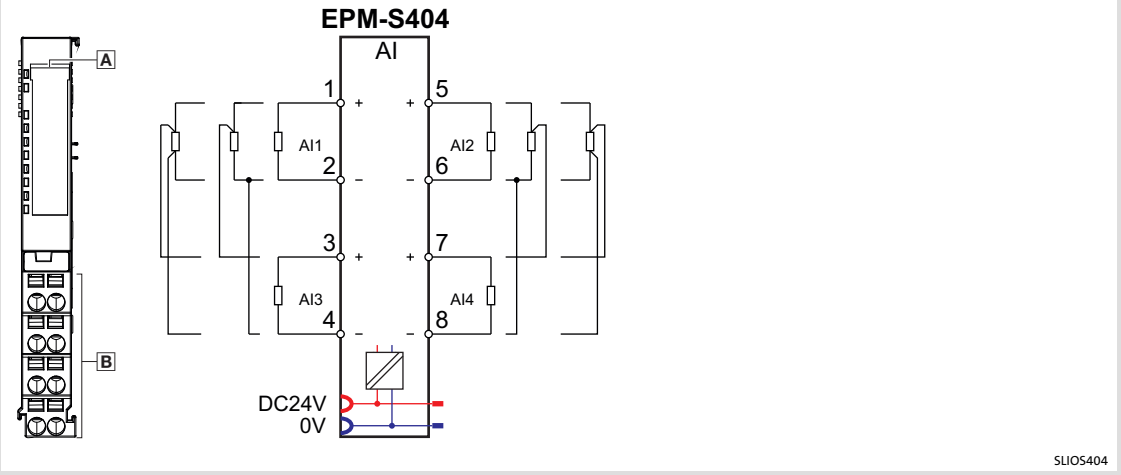
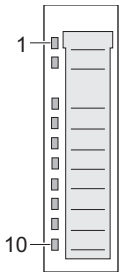


Fig. 3-55 Elements and circuit diagram

A Displays for module status
B Terminals
1 ... 8 Connection number

Status displays

Module status LEDs A

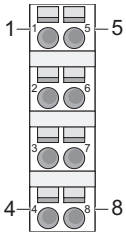
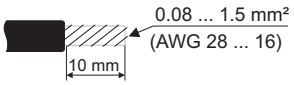
View	Pos.	Designation	Colour	Explanation
	1	RUN	Green	On: Module is ready for operation (see following table)
	2	MF	Red	On: Module error (see table below)
	3	AI1	Red	On: Channel 1, signal outside the measuring range, parameterisation error, open circuit
	4	AI2	Red	On: Channel 2, signal outside the measuring range, parameterisation error, open circuit
	5	AI3	Red	On: Channel 3, signal outside the measuring range, parameterisation error, open circuit
	6	AI4	Red	On: Channel 4, signal outside the measuring range, parameterisation error, open circuit
	7	-	-	Not assigned
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
	1	Analog input AI1 (+)	
	2	Analog input AI1 (GND)	
	3	Analog input AI3 (+)	
	4	Analog input AI3 (GND)	
	5	Analog input AI2 (+)	
	6	Analog input AI2 (GND)	
	7	Analog input AI4 (+)	
	8	Analog input AI4 (GND)	

Note!

- ► Use parameter setting to deactivate unused inputs.
- ► If thermal detectors are connected in a 3-wire or 4-wire setup, channels 3 and/or 4 must be deactivated.
- ► The module does not provide any auxiliary supply for sensors.

2-wire, 3-wire, 4-wire measurement

From the above terminal assignment you can see how to connect your sensors for 2-wire, 3-wire or 4-wire measurement.

- All channels are suitable for 2-wire measurement.
- A 3-wire measurement is only possible on channels 1 and 2.
  - Please note that in the event of 3-wire measurement you always have to deactivate the corresponding channel by parameterisation. The corresponding channel of channel 1 is channel 3 and the one of channel 2 is channel 4.
  - Deactivate any unused channels by parameterisation.
- A 4-wire measurement is only possible on channels 1 and 2.
  - The measuring current for channel 1 is output at pins 1 and 2. The measurement for channel 1 takes place at pins 3 and 4. The analog value for channel 1 is represented in the input word 0.
  - The measuring current for channel 2 is output at pins 5 and 6. The measurement for channel 2 takes place at pins 7 and 8. The analog value for channel 2 is represented in the input word 1.
  - Please note that in the event of 4-wire measurement you always have to deactivate the corresponding channel by parameterisation. The corresponding channel of channel 1 is channel 3 and the one of channel 2 is channel 4.
- Use parameter setting to deactivate unused inputs.

Technical data

EPM-S404: Rated data	
Module identifier	1030_{dec}
Current consumption/power loss	
Current consumption from backplane bus	75 mA
Power loss	1 W
Analog inputs	
Number of inputs	4
Cable length	
shielded	200 m
Load voltage	
Nominal value	DC 24 V
Current consumption from load voltage L+	30 mA (without load)
Resistor inputs	
Resistance ranges	0 ... 60 Ω 0 ... 600 Ω 0 ... 3000 Ω
Operational error limit	±0.4 %
Basic error limit	±0.2 %
Resistance thermometer inputs	
Resistance thermometer ranges	Pt100 Pt1000 Ni100 Ni1000
Operational error limit	±0.4 %
Basic error limit	±0.2 %
Measuring principle	Sigma-delta
Resolution	16 bits
Basic conversion time	4.2 ... 324.1 ms (50 Hz) per channel 3.8 ... 270.5 ms (60 Hz) per channel
Interference voltage suppression for a frequency of	> 80 dB at 50 Hz (UCM < 60 V)
Destruction limit (input voltage)	9 V
Temperature error (relating to input range)	±0.005 %/K
Linearity distortion (relating to input range)	±0.005 %
Repeat accuracy (in steady-state vibration at 25°C, relating to the input range)	±0.05 %
Input data size	8 bytes

EPM-S404: Rated data	
Status, alarm, diagnostics	
Status display	Yes
Alarms	Yes, parameterisable
Process alarm	Yes, parameterisable
Diagnostic alarm	Yes, parameterisable
Diagnostic function	Yes
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	Red LEDs per channel
Electrical isolation	
Between the channels and the backplane bus	Yes
Between the channels and the voltage supply	Yes
Max. potential difference between inputs (U_{cm})	DC 6 V
Max. potential difference between the analog channel (e.g. input) and the I/O supply	DC 75 V / AC 60 V
Insulation checked with	DC 500 V

3.8.3 Two analog inputs for thermocouple measurement - EPM-S405

This module detects up to two analog control signals from the process level and transmits them to the higher-level bus system.

Features

- 2 analog inputs
- For thermocouple type B, C, E, J, K, L, N, R, S or T
- 16-bit resolution
- Internal temperature compensation
- Signal function is parameterisable
- An LED indicates if an input voltage is outside the permitted measuring range



Stop!

Overvoltage at the inputs

The electronics of the electronic module are not protected against too high input signals.

Possible consequences:

- The module is destroyed

Protective measures:

- Make sure that the signals and encoders connected match the measuring range parameterised.

Mounting instructions

Variations in temperature within the module may affect the measuring accuracy. Therefore please observe the following recommendations:

- Do **not** place the module...
  - directly next to the bus coupler module
  - directly next to a power supply module
  - in a position as the last module within an I/O system
- If possible, the ambient temperature should be constant. After a change in the ambient temperature, the module requires approx. 30 minutes until obtaining its ensured measuring accuracy.

Overview

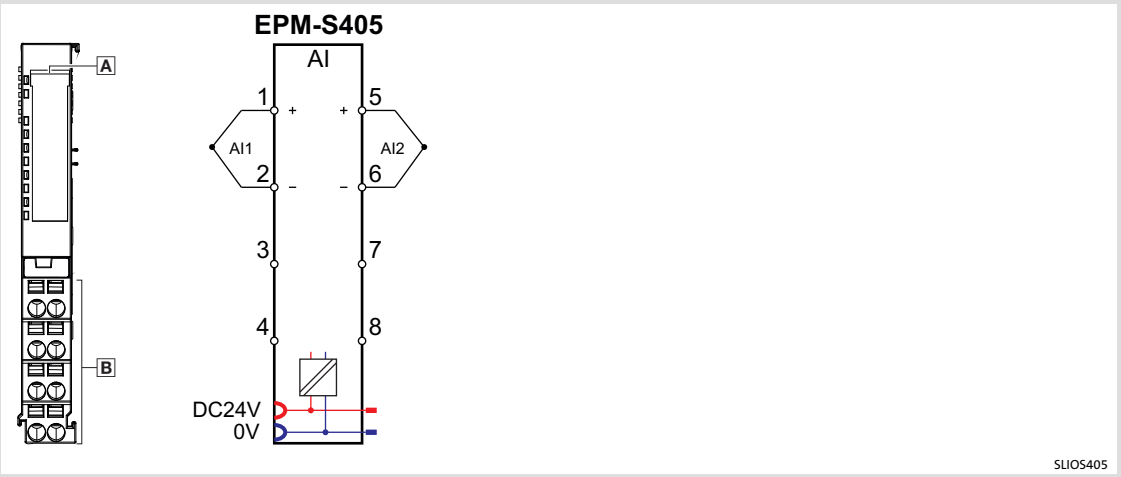
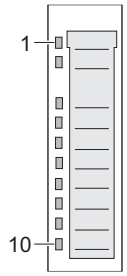


Fig. 3-56 Elements and circuit diagram

A Displays for module status
B Terminals
1 ... 8 Connection number

Status displays

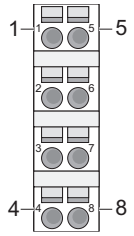
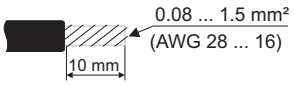
Module status LEDs A

View	Pos.	Designation	Colour	Explanation
	1	RUN	Green	On: Module is ready for operation (see following table)
	2	MF	Red	On: Module error (see table below)
	3	AI1	Red	On: Channel 1, signal outside the measuring range, parameterisation error, open circuit
	4	AI2	Red	On: Channel 2, signal outside the measuring range, parameterisation error, open circuit
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B			
View	Designation	Explanation	Terminal data
	1	Analog input AI1 (+)	
	2	Analog input AI1 (GND)	
	3	Not assigned	
	4		
	5	Analog input AI2 (+)	
	6	Analog input AI2 (GND)	
	7	Not assigned	
	8		

Note!

- ► Use parameter setting to deactivate unused inputs.
- ► The module does not provide any auxiliary supply for sensors.

Technical data

EPM-S405: Rated data	
Module identifier	1027_{dec}
Current consumption/power loss	
Current consumption from backplane bus	75 mA
Power loss	1 W
Analog inputs	
Number of inputs	2
Cable length	
shielded	200 m
Load voltage	
Nominal value	DC 24 V
Current consumption from load voltage L+	30 mA (without load)
Voltage inputs	
Input voltage ranges	-80 mV ... +80 mV
Destruction limit (input voltage)	30 V
Operational error limit	With interference frequency suppression: ±0.1 % Without interference frequency suppression: ±0.3 %
Basic error limit	With interference frequency suppression: ±0.05 % Without interference frequency suppression: ±0.25 %
Thermocouple inputs	
Thermocouple ranges	Types B, C, E, J, K, L, N, R, S, T
Operational error limit	With interference frequency suppression: Types E, L, T, J, K, N: ±1.5 K Types B, C, R, S: ±4.0 K Without interference frequency suppression: Types E, L, T, J, K, N: ±2.5 K Types B, C, R, S: ±8.0 K
Basic error limit	With interference frequency suppression: Types E, L, T, J, K, N: ±1.0 K Types B, C, R, S: ±3.0 K Without interference frequency suppression: Types E, L, T, J, K, N: ±2.0 K Types B, C, R, S: ±7.0 K
Measuring principle	Sigma-delta
Resolution	16 bits
Basic conversion time	4.2 ... 324.1 ms (50 Hz) per channel 3.8 ... 270.5 ms (60 Hz) per channel
Interference voltage suppression for a frequency of	> 90 dB bei 50 Hz (UCM < 10 V)
Temperature error (relating to input range)	±0.001 %/K
Linearity distortion (relating to input range)	±0.005 %
Repeat accuracy (in steady-state vibration at 25°C, relating to the input range)	±0.05 %
Temperature error of the internal compensation	±0.2 %
Temperature compensation	
parameterisable	Yes
external	Yes
internal	Yes
Input data size	4 bytes

EPM-S405: Rated data	
Status, alarm, diagnostics	
Status display	Yes
Alarms	Yes
Process alarm	Yes, parameterisable
Diagnostic alarm	Yes, parameterisable
Diagnostic function	Yes
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	Red LEDs per channel
Electrical isolation	
Between the channels and the backplane bus	Yes
Between the channels and the voltage supply	Yes
Max. potential difference between inputs (U_{cm})	DC 140 V / AC 60 V
Max. potential difference between the analog channel (e.g. input) and the I/O supply	DC 75 V / AC 60 V
Insulation checked with	DC 500 V

3.9 I/O compound modules - counter

3.9.1 One counter 32 bits, 24 V DC - EPM-S600

This module measures the pulses of one connected encoder and processes them according to the mode selected.

Features

- 1 counter 32 bits (AB), invertible, DC 24 V
- Counting frequency max. 400 kHz
- Latch value, comparison value, set value, input filter
- Hardware gate, digital output
- Alarm and diagnostic function

Overview

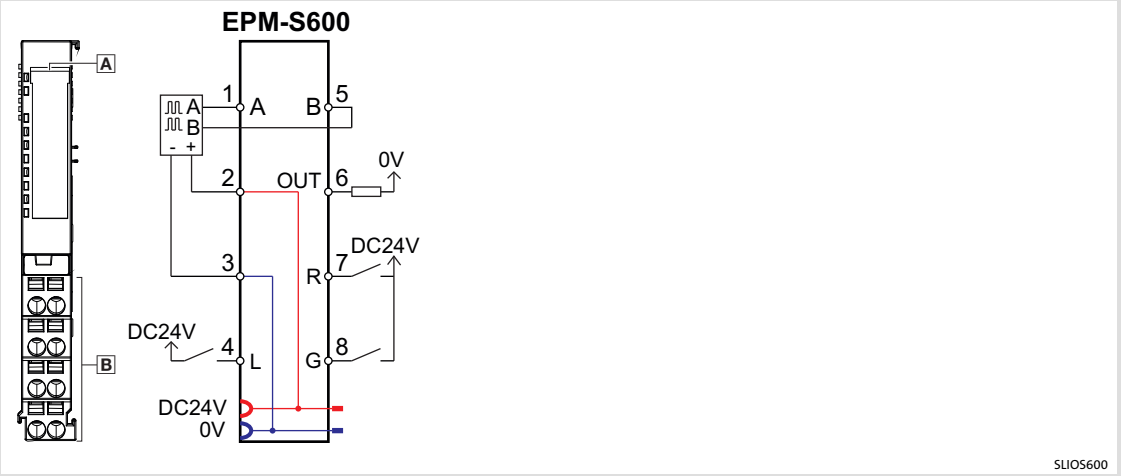
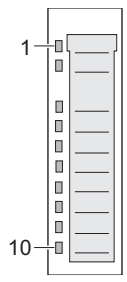


Fig. 3-57 Elements and circuit diagram

A Displays for module status
B Terminals
1 ... 8 Connection number

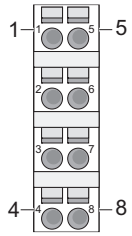
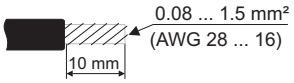
Status displays

Module status LEDs A

View	Pos.	Designation	Colour	Explanation
	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	A	Green	On: Digital input 1 "A"/"pulse" triggered
	4	B		On: Digital input 5 "B"/"direction" triggered
	5	Latch		On: Digital input 4 "Latch" triggered
	6	Gate		On: Digital input 8 "Hardware gate" triggered
	7	Reset		On: Digital input 7 "Reset" triggered
	8	OUT		On: Digital output "OUT" triggered
	9	-		Not assigned
	10			

Messages of the status LEDs RUN and MF		
RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B			
View	Designation	Explanation	Terminal data
 SLIO002	1	Digital input ”A”/”pulse” Pulse input for counting signal or track A of an encoder for single, double, or quadruple evaluation	
	2	DC 24 V for encoder supply	
	3	GND	
	4	Digital input ”Latch” With a positive edge or a level-triggered signal at ”Latch”, the current counter content is stored as latch value in the input area.	
	5	Digital input ”B”/”direction” Direction signal or track B of an encoder (can be inverted via parameterisation)	
	6	Digital output ”OUT” (parameterisable)	
	7	Digital input ”Reset” With a positive edge at this input the counter is reset.	
	8	Digital input ”Hardware gate” With a HIGH level at this input the hardware gate is opened and the counting process is started (parameterisable).	

Technical data

EPM-S600: rated data	
Module identifier	2241_{dec}
Current consumption/power loss	
Current consumption from backplane bus	75 mA
Power loss	1 W
Digital inputs	
Number of inputs	5
Cable length	
shielded	100 m
Load voltage	
Nominal value	DC 20.4 ... 28.8 V
Current consumption from load voltage L+	20 mA (without load)
Input voltage	
Nominal value	DC 20.4 ... 28.8 V
for signal ”0”	DC 0 ... 5 V
for signal ”1”	DC 15 ... 28.8 V
Input current	
for signal ”1”	3 mA
2-wire BERO	
Connection possible	Yes
Max. permissible closed-circuit current	0.5 mA
Input delay	
from ”0” to ”1”	0.8 µs
from ”1” to ”0”	0.8 µs
Number of inputs which can be used simultaneously	
horizontal structure	5
vertical structure	5
Input characteristic	IEC 61131, type 1
Input data size	12 bytes

EPM-S600: rated data	
Digital outputs	
Number of outputs	1
Cable length	
shielded	100 m
unshielded	100 m
Load voltage	
Nominal value	DC 20.4 ... 28.8 V
Output delay	
from ”0” to ”1”	30 µs
from ”1” to ”0”	30 µs
Lamp load	10 W
Parallel switching of outputs	
for redundant control	Not possible
for power increase	Not possible
Control of a digital input	Possible
Switching frequencies	
for ohmic loads, max.	10 kHz
for inductive loads, max.	0.5 Hz
for lamp loads, max.	10 kHz
Limitation (internal) of the inductive breaking voltage	L+ (-52 V)
Short circuit protection	
Type	Electronically
Operating threshold	1 A
Output data size	10 bytes
Meters	
Number of counters	1
Counter width	32 bits
Frequency	
Input frequency, max	500 kHz
Counting frequency, max	400 kHz
Operating mode	
Incremental encoder	Possible
Pulse/direction	Possible
Pulse	Not possible
Frequency measurement	Not possible
Period duration measurement	Not possible
Connection	
Gate connection	Possible
Latch connection	Possible
Reset connection	Possible
Counter output	Possible

EPM-S600: rated data	
Status, alarm, diagnostics	
Status display	Yes
Alarms	Yes, parameterisable
Process alarm	Yes, parameterisable
Diagnostic alarm	Yes, parameterisable
Diagnostic function	Yes, parameterisable
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	None
Electrical isolation	
Between the channels and the backplane bus	Yes
Insulation checked with	DC 500 V

Parameterisable functions

Counting functions	Description
Counting continuously	The counter counts from the loading value to the counting limit, then skips to the opposite counting limit and continues to count from there.
Counting once	The counter counts once/periodically from the loading value in the specified counting range.
Counting periodically	

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Main counting direction	The main counting direction can be parameterised: **None:** The whole counting range is available. **Forwards:** Limitation of the counting range upwards. The counter counts from the parameterised loading value in the positive direction to the parameterised final value -1 and then skips to the loading value again with the encoder pulse that is following. **Backwards:** Limitation of the counting range downwards. The counter counts from the parameterised loading value in the negative direction to the parameterised final value +1 and then skips to the loading value again with the encoder pulse that is following.
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter a differentiation between the internal gate (I-gate), hardware gate (HW gate), and software gate (SW gate) is made. ● The I-gate is the AND logic operation of the software gate (SW gate) and the hardware gate (HW gate). ● The SW gate is controlled via your user program (status word in the output area). ● The HW gate is controlled via the digital gate input. The following response can be parameterised: **Cancelling gate function:**After closing the gate and opening it again, the counting process continues from the loading value again. **Interrupting gate function:**After closing the gate and opening it again, the counting process continues with the last current counter content.
Latch function	If a positive edge occurs at the latch input, the current count value is stored in the latch register. The latch register is accessed via the input area. After a STOP-RUN transition, latch is always 0.
Comparator	You can specify a comparison value which, depending on the count value, activates the digital output or triggers a process alarm.
Hysteresis	By specification of a hysteresis you can for instance prevent the output from being permanently switched if the value of an encoder signal fluctuates around the comparison value.
Process alarm	The activation of a process alarm can be parameterised. A process alarm can be triggered in the case of the following events: ● Hardware gate open ● Hardware gate closed ● Counting limit - overflow ● Counting limit - underflow ● Comparison value reached ● Final value reached ● Latch value reached
Diagnostic alarm	If the diagnostic alarm is enabled in the parameter setting, it occurs as soon as another process alarm is triggered for the same event during process alarm processing.
Diagnostic function	Diagnostic functions are provided in the modules.
Diagnostic information	The diagnostic information describes the diagnostic contents which can be read out from a module. The diagnostic formation is not automatically sent by the module but must actively be read out by SDO access.

Counting continuously

Limits	Counting range
Lower counting limit	-2 147 483 648 (-2^{31})
Upper counting limit	+2 147 483 647 ($2^{31}-1$)

Function:

- For starting the counting process the internal gate has to be opened.
  - The counter counts from the loading value in the counting range.
  - If the counter reaches the upper counting limit when counting forwards, and if a further count pulse in positive direction occurs, the counter skips to the lower counting limit and continues to count from there.
  - If the counter reaches the lower counting limit when counting backwards, and if a further negative count pulse occurs, the counter skips to the upper counting limit and continues to count from there.
  - If maximum values are exceeded or minimum values are not reached, the status bits *STS_OFLW* or *STS_UFLW* are set. These bits remain set until they are reset with *RES_SET* in the control word. If enabled, additionally a process alarm is triggered.
- For stopping the counting process the internal gate has to be closed.

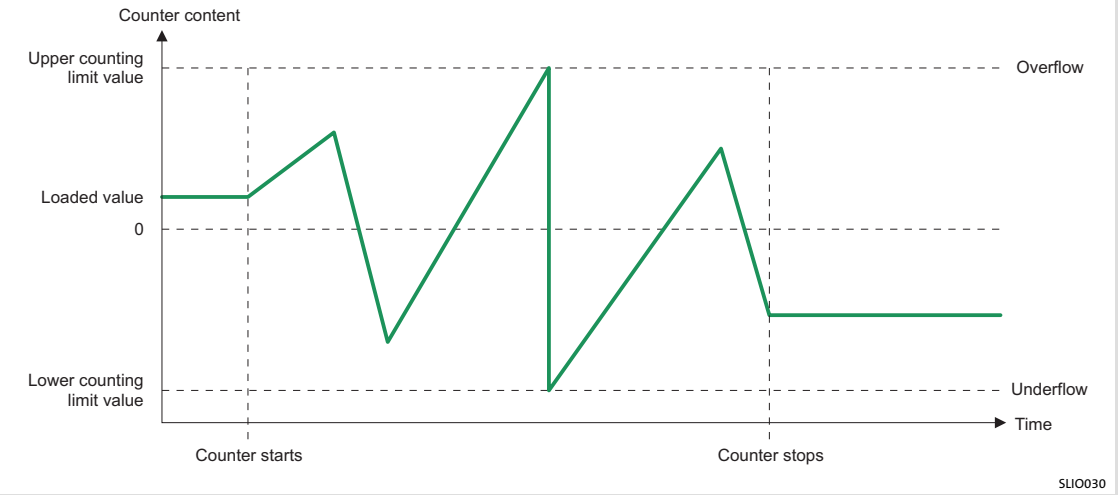


Fig. 3-58 Example of ”Counting continuously”

Counting once

A) No main counting direction:

Limits	Counting range
Lower counting limit	-2 147 483 648 (-2^{31})
Upper counting limit	+2 147 483 647 ($2^{31}-1$)

Function:

- ► For starting the counting process the internal gate has to be opened.
  - – The counter counts forwards once from the loading value or backwards in the preset counting range.
  - – If the counting limits are not reached or exceeded, the counter skips to the other counting limit, respectively, the internal gate is closed automatically and the status bits *STS_OFLW* or *STS_UFLW* are set. If enabled, a process alarm is effected.
- ► For stopping the counting process the internal gate has to be closed.
- ► For starting the counting process again, the internal gate has to be opened.
  - – If the gate control is interrupted, the counting process continues at the current counter content.
  - – If the gate control is cancelled, the counter starts from the loading value.

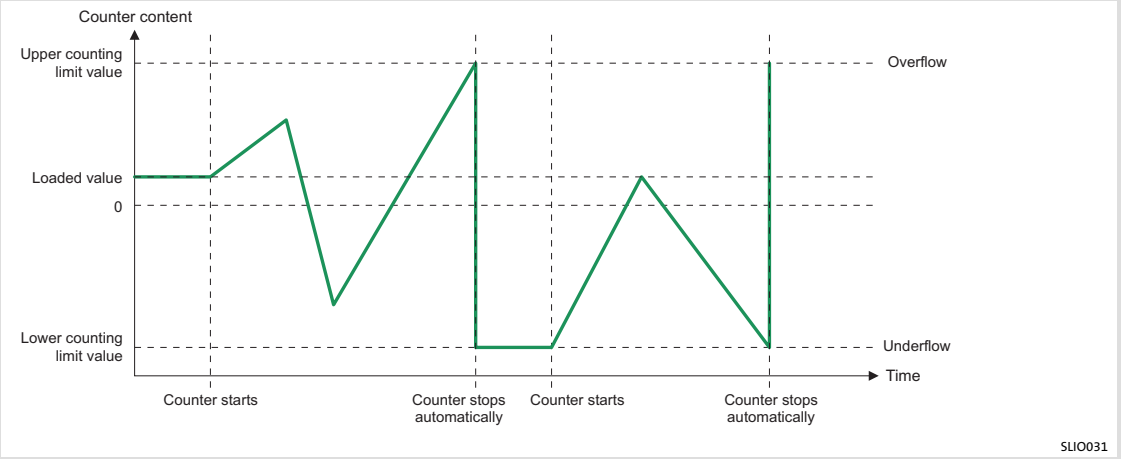


Fig. 3-59 Example of ”Counting once”, no main counting direction and with interrupting gate control

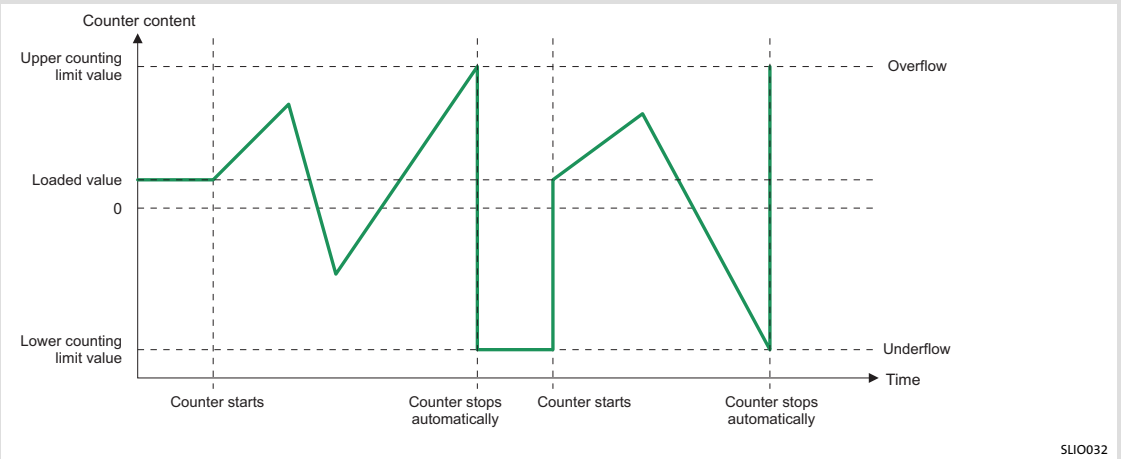


Fig. 3-60 Example of ”Counting once”, no main counting direction and with cancelling gate control

B) Main counting direction forwards:

Limits	Counting range
Final value	-2 147 483 646 ($-2^{31}+1$) to +2 147 483 646 ($2^{31}-1$)
Lower counting limit	-2 147 483 648 (-2^{31})

Function:

- For starting the counting process the internal gate has to be opened.
  - The counter counts forwards from the loading value.
  - If the counter reaches the final value -1 in the positive direction, it skips to the loading value at the next count pulse and the internal gate is closed automatically.
- For starting the counting process again, the internal gate has to be opened.
  - The counter counts from the loading value.
  - You can also count above the lower counting limit.

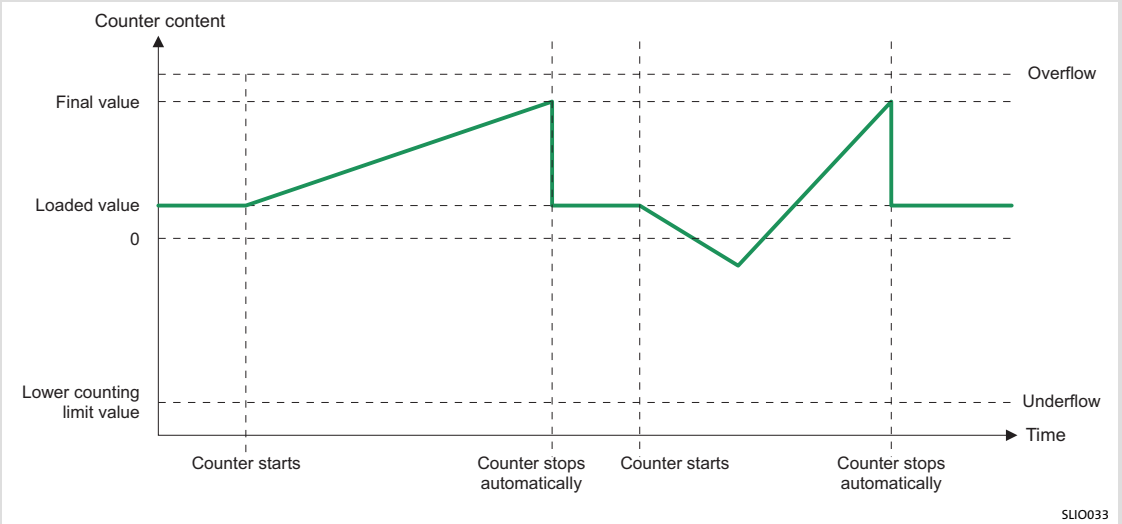


Fig. 3-61 Example of "Counting once" with main counting direction forwards

C) Main counting direction backwards:

Limits	Counting range
Final value	-2 147 483 646 ($-2^{31}+1$) to +2 147 483 646 ($2^{31}-1$)
Upper counting limit	+2 147 483 646 ($2^{31}-1$)

Function:

- For starting the counting process the internal gate has to be opened.
  - The counter counts backwards from the loading value.
  - If the counter reaches the final value +1 in the negative direction, it skips to the loading value at the next count pulse and the internal gate is closed automatically.
- For starting the counting process again, the internal gate has to be opened again.
  - The counter starts from the loading value.
  - You can also count above the upper counting limit.

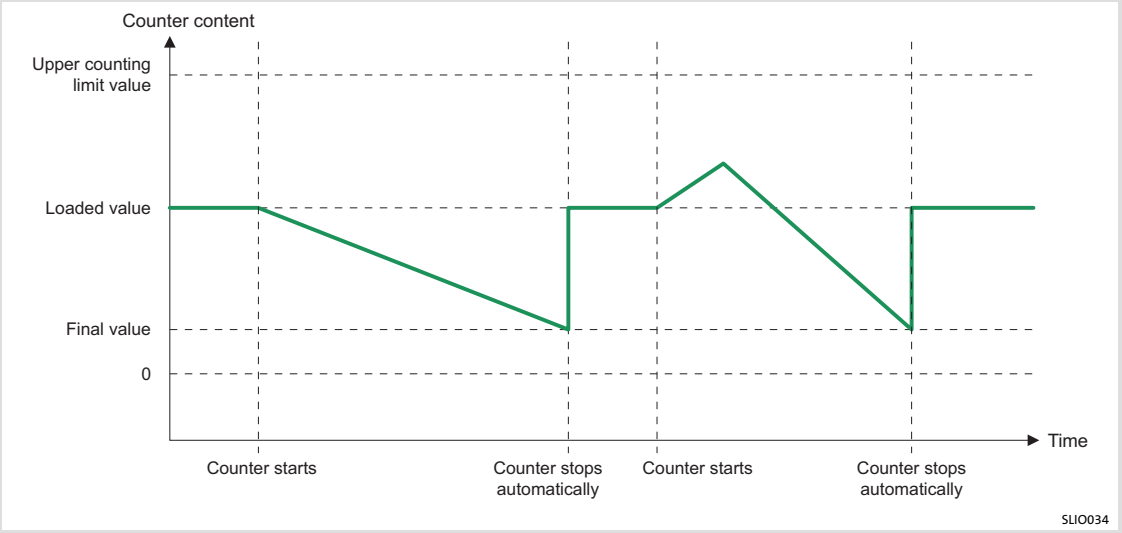


Fig. 3-62 Example of ”Counting once” with main counting direction backwards

Counting periodically

A) No main counting direction:

Limits	Counting range
Lower counting limit	-2 147 483 648 (-2^{31})
Upper counting limit	+2 147 483 647 ($2^{31}-1$)

Function:

- For starting the counting process the internal gate has to be opened.
  - The counter counts forwards from the loading value or backwards in the counting range.
  - If there is an overflow or underflow at the respective counting limit, the counter skips to the loading value and continues to count from there.
- For stopping the counting process the internal gate has to be closed.

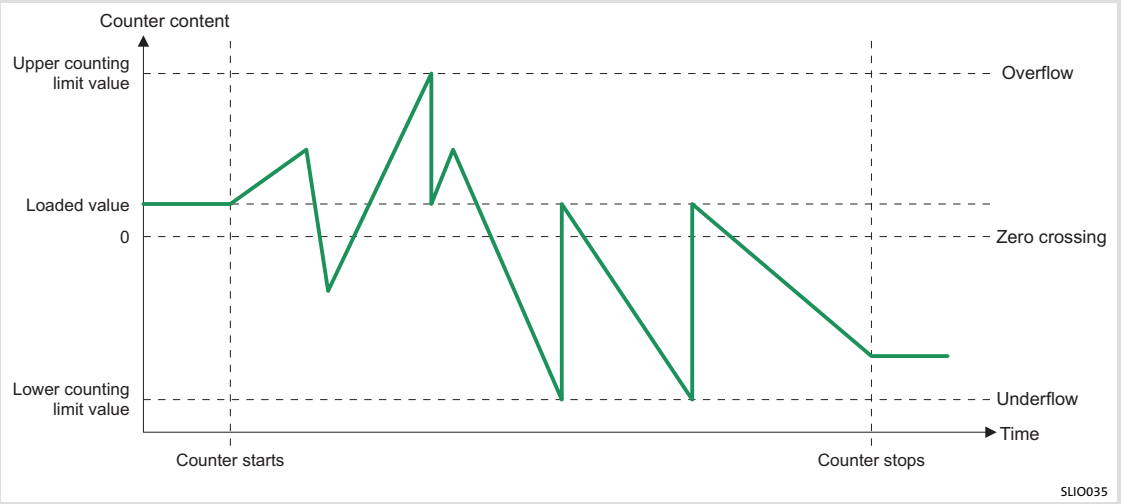


Fig. 3-63 Example of ”Counting periodically” and no main counting direction

B) Main counting direction forwards:

Limits	Counting range
Final value	-2 147 483 646 ($-2^{31}+1$) to +2 147 483 646 ($2^{31}-1$)
Lower counting limit	-2 147 483 648 (-2^{31})

Function:

- For starting the counting process the internal gate has to be opened.
  - The counter counts forwards from the loading value.
  - If the counter reaches the final value -1 in the positive direction, it skips to the loading value at the next positive count pulse and continues to count from there.
  - You can also count above the lower counting limit.
- For stopping the counting process the internal gate has to be closed.

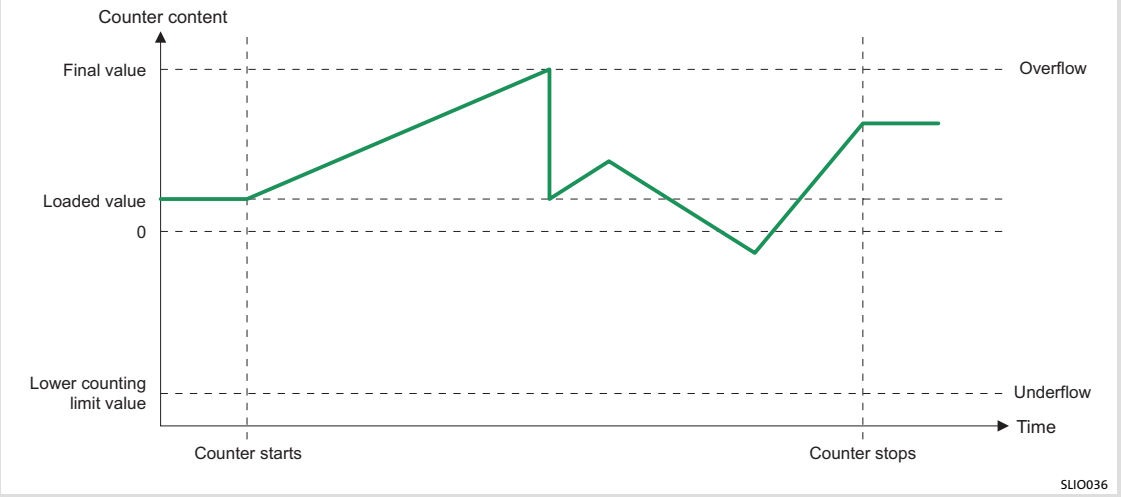


Fig. 3-64 Example of "Counting periodically" and main counting direction forwards

C) Main counting direction backwards:

Limits	Counting range
Final value	-2 147 483 646 ($-2^{31}+1$) to +2 147 483 646 ($2^{31}-1$)
Upper counting limit	+2 147 483 646 ($2^{31}-1$)

Function:

- For starting the counting process the internal gate has to be opened.
  - The counter counts backwards from the loading value.
  - If the counter reaches the final value +1 in the negative direction, it skips to the loading value at the next negative count pulse and continues to count from there.
  - You can also count above the upper counting limit.
- For stopping the counting process the internal gate has to be closed.

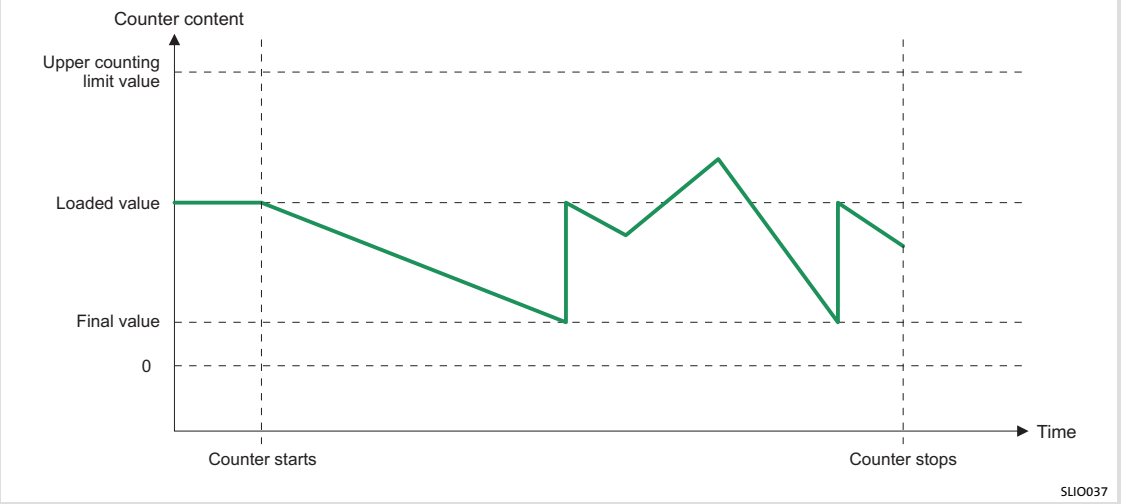


Fig. 3-65 Example of ”Counting periodically” and main counting direction backwards

Gate function

The counter is controlled via the ”internal gate” (I-gate) which is the AND logic operation of the software gate (SW gate) and the hardware gate (HW gate).

- The SW gate is opened and closed via the user program (control word).
  - With an edge change 0-1 at control word bit *SW_GATE_SET*, the SW gate opens (counter starts).
  - With an edge change 0-1 at control word bit *SW_GATE_RESET*, the SW gate closes (counter stops).
- The HW gate is opened and closed via the digital gate input.

  In the parameter setting the HW gate can be deactivated, so that it is only possible to activate the counter via the SW gate.

The following states have an impact on the I-gate:

SW gate	HW gate	Has an impact on the I-gate
0	Edge change 0-1	0
1	Edge change 0-1	1
Edge change 0-1	1	1
Edge change 0-1	0	0
Edge change 0-1	deactivated	1

Via the parameter setting you define whether the gate is to cancel or interrupt the counting process.

- In the case of a cancelling gate function, the counting process starts after a restart from the loading value.
- In the case of an interrupting gate function, the counting process is continued at the current count value after a restart.

Action and response of the gate control:

Function	SW gate	HW gate	Counter response
Gate control via SW gate, cancelling	Edge change 0-1	deactivated	Restart with loading value
Gate control via SW gate, interrupting	Edge change 0-1	Deactivated	Continuation
Gate control via SW/HW gate, cancelling	Edge change 0-1	1	Continuation
	1	Edge change 0-1	Restart with loading value
Gate control via SW/HW gate, interrupting	Edge change 0-1	1	Continuation
	1	Edge change 0-1	Continuation

In particular in the case of the gate control via SW/HW gate in the ”Counting once” operating mode: If the internal gate has been closed automatically, it can only be opened when the following conditions are met:

SW gate	HW gate	Response of I-gate
1	Edge change 0-1	1
Edge change 0-1 (after edge change 0-1 at HW gate)	1	1

Comparator

The comparison value is specified via the output area. If a comparison condition is met, bit *STS_DO* is set in the status word.

Note!

Please note that bit *STS_DO* can only be triggered if bit *STS_CTRL_DO* is set in the status word.

By parameterisation you can define the response of the counter output:

- Output never switches
- Output switches if count value ≥ comparison value

  As long as the count value is greater than or equals the comparison value, the output remains set
- Output switches if count value ≤ comparison value

  As long as the count value is smaller than or equals the comparison value, the output remains set.
- Output switches at comparison value

Pulse at comparison value: If the counter reaches the comparison value, the output is set for the parameterised pulse duration. If the pulse duration is = 0, the output is set until the comparison condition is no longer met. If you have set a main counting direction, the output is only switched from the main counting direction when the comparison value is reached.

Pulse duration: The pulse duration indicates for how long the output is to be set. It can be preselected in steps of 2.048 ms between 0 and 522.24 ms. The pulse duration starts with the setting of the respective digital output. The inaccuracy of the pulse duration is smaller than 2.048 ms. The pulse duration is not re-triggered if the comparison value has been exited and reached again during one pulse output.

Note!

Together with bit *STS_DO*, bit *STS_CMP* is set in the status word. In contrast to bit *STS_DO*, however, it remains set until it is reset with *RES_SET* in the control word.

Hysteresis

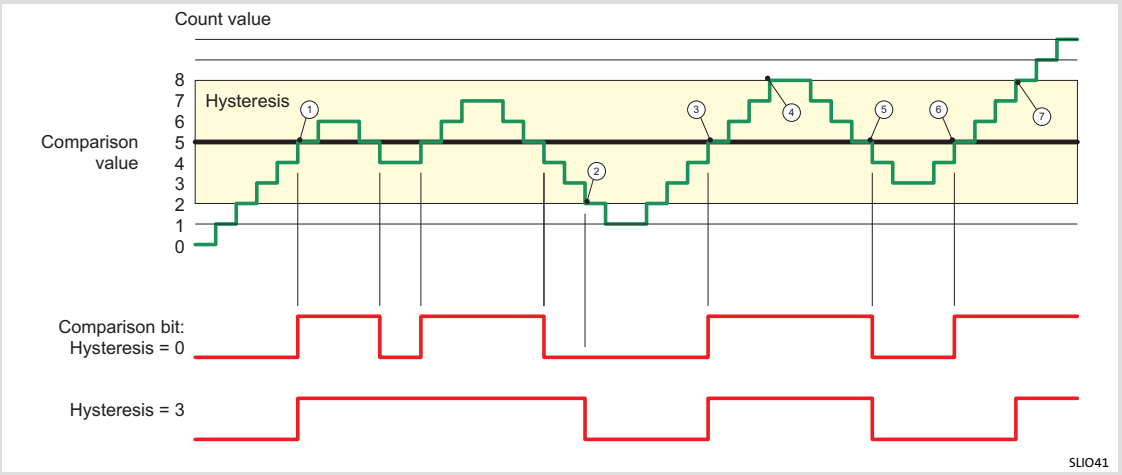
The hysteresis for instance serves to avoid frequent switching operations of the output and triggering of the alarm when the count value is within the range of the comparison value. For the hysteresis you can select a range between 0 and 255. With the settings 0 and 1 the hysteresis is switched off. The hysteresis has an effect on the zero crossing, overflow/underflow, and on the comparison value.

An active hysteresis remains active after the change. The new hysteresis range becomes active at the next hysteresis event.

In the following illustrations the response of the output at hysteresis 0 and hysteresis 3 for the corresponding conditions is represented:

A) Function mode in the case of count value ≥ comparison value

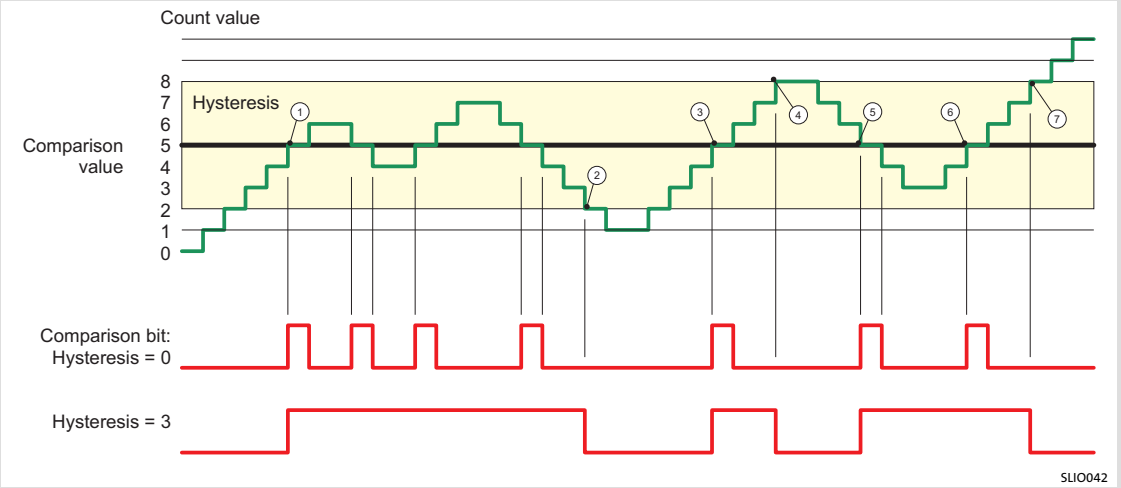
When the comparison condition is met, hysteresis becomes active. When hysteresis is active, the comparison result remains unchanged until the count value exits the hysteresis range set. After the hysteresis range is exited, hysteresis is only activated again when the comparison conditions are met.



① Count value ≥ comparison value →Output is set and hysteresis is activated
② Exiting of the hysteresis range →Output is reset
③ Count value ≥ comparison value →Output is set and hysteresis is activated
④ Exiting of the hysteresis range, output remains set, since count value ≥ comparison value
⑤ Count value < comparison value and hysteresis active → Output is reset
⑥ Count value ≥ comparison value →Output is not set since hysteresis is activated
⑦ Exiting of the hysteresis range, output is set, since count value ≥ comparison value

B) Function mode in the case of comparison value with zero pulse duration

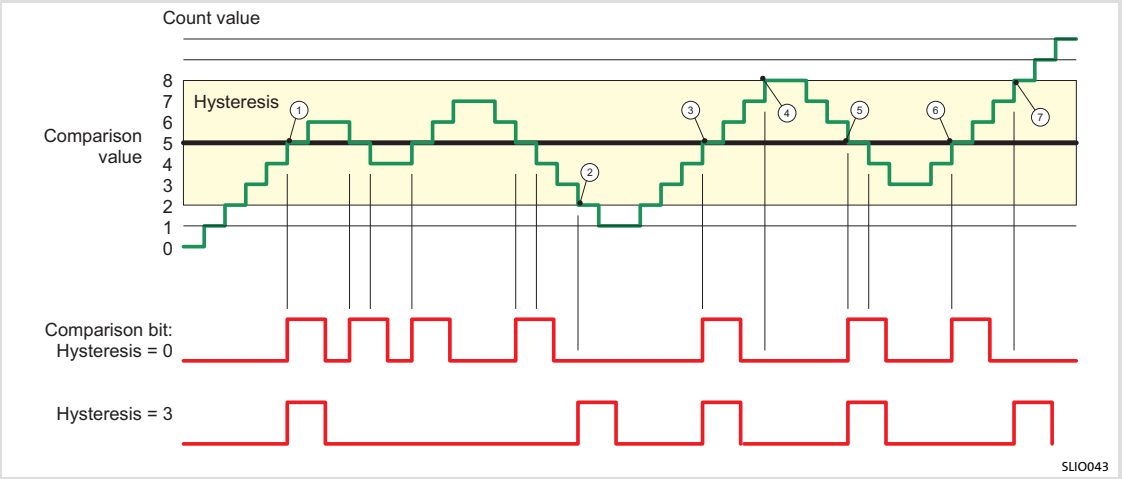
When the comparison condition is met, hysteresis becomes active. When hysteresis is active, the comparison result remains unchanged until the count value exits the hysteresis range set. After the hysteresis range is exited, hysteresis is only activated again when the comparison conditions are met.



① Count value = comparison value →Output is set and hysteresis is activated
② Exiting of the hysteresis range →Output is reset and count value < comparison value
③ Count value = comparison value →Output is set and hysteresis is activated
④ Output is reset due to exiting of the hysteresis range and count value > comparison value
⑤ Count value = comparison value →Output is set and hysteresis is activated
⑥ Count value = comparison value and hysteresis active → Output remains set
⑦ Exiting of the hysteresis range and count value > comparison value → Output is reset

C) Function mode for comparison value with non-zero pulse duration

When the comparison condition is met, hysteresis becomes active and a pulse of the parameterised duration is released. As long as the count value is within the hysteresis range, no further pulse is released. With activation of the hysteresis, the counting direction is stored within the module. If the count value exits the hysteresis range in opposition to the counting direction stored, a pulse of the parameterised duration is released. When the hysteresis range is exited without a change in direction, no pulse is released.



① Count value = comparison value →Pulse of the parameterised period is output, hysteresis is activated, and the counting direction is stored

② Exiting of the hysteresis range against the counting direction stored → Pulse of the parameterised pulse duration is output and hysteresis is deactivated

③ Count value = comparison value →Pulse of the parameterised pulse duration is output, hysteresis is activated, and the counting direction is stored

④ Hysteresis range is exited without change of the counting direction → Hysteresis is deactivated

⑤ Count value = comparison value →Pulse of the parameterised pulse duration is output, hysteresis is activated, and the counting direction is stored

⑥ Count value = comparison value and hysteresis active → No pulse

⑦ Exiting of the hysteresis range against the counting direction stored → Pulse of the parameterised pulse duration is output and hysteresis is deactivated

3.9.2 Two counters 32 bits, 24 V DC - EPM-S601

This module measures the pulses of up to two connected encoders and processes them according to the mode selected.

Features

- 2 counters 32 bits (AB), invertible, DC 24 V
- Counting frequency max. 400 kHz
- Comparison value, set value, input filter
- Alarm and diagnostic function

Overview

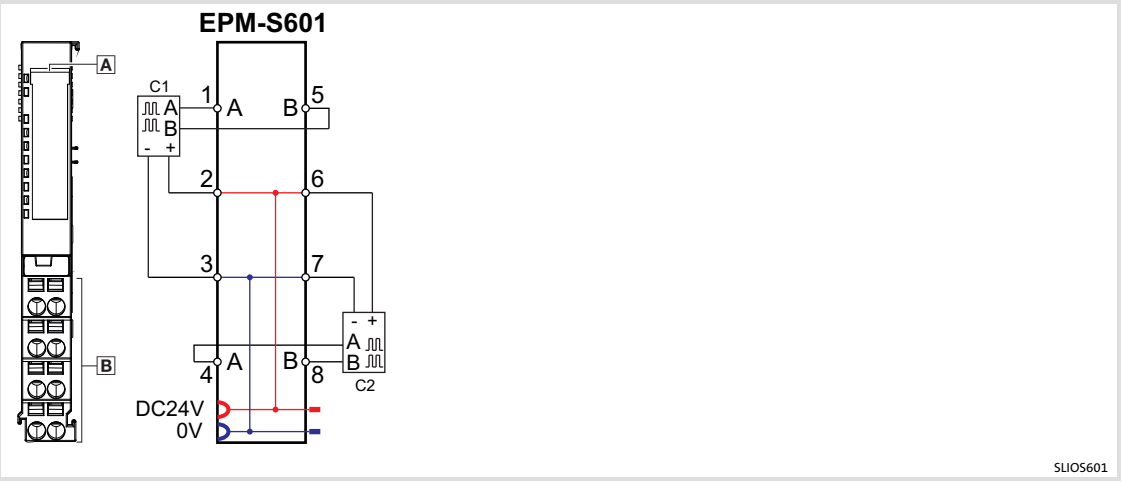
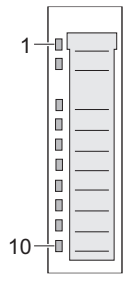


Fig. 3-66 Elements and circuit diagram

A Displays for module status
B Terminals
1 ... 8 Connection number

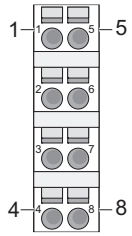
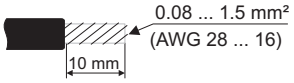
Status displays

Module status LEDs A

View	Pos.	Designation	Colour	Explanation
 SLIO001	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	A1	Green	On: Digital input 1, counter 1, "A1"/"pulse" triggered
	4	B1		On: Digital input 5, counter 1, "B1"/"direction" triggered
	5	A2		On: Digital input 4, counter 2, "A2"/"pulse" triggered
	6	B2		On: Digital input 8, counter 2, "B2"/"direction" triggered
	7	-	-	Not assigned
	8			
	9			
	10			

Messages of the status LEDs RUN and MF		
RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B			
View	Designation	Explanation	Terminal data
 SLIO002	1	Digital input, counter 1, ”A”/”pulse” Pulse input for counting signal or track A of an encoder for single, double, or quadruple evaluation	
	2	DC 24 V for encoder supply	
	3	GND	
	4	Digital input, counter 2, ”A”/”pulse” Pulse input for counting signal or track A of an encoder for single, double, or quadruple evaluation	
	5	Digital input, counter 1, ”B”/”direction” Direction signal or track B of an encoder (can be inverted via parameterisation)	
	6	DC 24 V for encoder	
	7	GND	
	8	Digital input, counter 2, ”B”/”direction” Direction signal or track B of an encoder (can be inverted via parameterisation)	

Technical data

EPM-S601: rated data	
Module identifier	2243_{dec}
Current consumption/power loss	
Current consumption from backplane bus	75 mA
Power loss	0.9 W

EPM-S601: rated data	
Digital inputs	
Number of inputs	4
Cable length	
shielded	100 m
Load voltage	
Nominal value	DC 20.4 ... 28.8 V
Current consumption from load voltage L+	15 mA (without load)
Input voltage	
Nominal value	DC 20.4 ... 28.8 V
for signal ”0”	DC 0 ... 5 V
for signal ”1”	DC 15 ... 28.8 V
Input current	
for signal ”1”	3 mA
2-wire BERO	
Connection possible	Yes
Max. permissible closed-circuit current	0.5 mA
Input delay	
from ”0” to ”1”	0.8 µs
from ”1” to ”0”	0.8 µs
Number of inputs which can be used simultaneously	
horizontal structure	4
vertical structure	4
Input characteristic	IEC 61131, type 1
Input data size	12 bytes
Digital outputs	
Output data size	12 bytes
Meters	
Number of counters	2
Counter width	32 bits
Frequency	
Input frequency, max	500 kHz
Counting frequency, max	400 kHz
Operating mode	
Incremental encoder	Possible
Pulse/direction	Possible
Pulse	Not possible
Frequency measurement	Not possible
Period duration measurement	Not possible
Connection	
Gate connection	Not possible
Latch connection	Not possible
Reset connection	Not possible
Counter output	Not possible

EPM-S601: rated data	
Status, alarm, diagnostics	
Status display	Yes
Alarms	Yes, parameterisable
Process alarm	Yes, parameterisable
Diagnostic alarm	Yes, parameterisable
Diagnostic function	Yes, parameterisable
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	None
Electrical isolation	
Between the channels and the backplane bus	Yes
Insulation checked with	DC 500 V

Parameterisable functions

Counting functions	Description
Counting continuously	The counter counts from the loading value to the counting limit, then skips to the opposite counting limit and continues to count from there.
Counting once	The counter counts once/periodically from the loading value in the specified counting range.
Counting periodically	

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Main counting direction	The main counting direction can be parameterised: **None:** The whole counting range is available. **Forwards:** Limitation of the counting range upwards. The counter counts from the parameterised loading value in the positive direction to the parameterised final value -1 and then skips to the loading value again with the encoder pulse that is following. **Backwards:** Limitation of the counting range downwards. The counter counts from the parameterised loading value in the negative direction to the parameterised final value +1 and then skips to the loading value again with the encoder pulse that is following.
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter the internal gate (I-gate) is conform to the software gate (SW gate) which you control via your user program (status word in the output area). The following response can be parameterised: **Cancelling gate function:**After closing the gate and opening it again, the counting process continues from the loading value again. **Interrupting gate function:**After closing the gate and opening it again, the counting process continues with the last current counter content.
Comparator	You can specify a comparison value which, depending on the count value, activates the digital output or triggers a process alarm.
Hysteresis	By specification of a hysteresis you can for instance prevent the output from being permanently switched if the value of an encoder signal fluctuates around the comparison value.
Process alarm	The activation of a process alarm can be parameterised. A process alarm can be triggered in the case of the following events: ● Hardware gate open ● Hardware gate closed ● Counting limit - overflow ● Counting limit - underflow ● Comparison value reached ● Final value reached ● Latch value reached
Diagnostic alarm	If the diagnostic alarm is enabled in the parameter setting, it occurs as soon as another process alarm is triggered for the same event during process alarm processing.
Diagnostic function	Diagnostic functions are provided in the modules.
Diagnostic information	The diagnostic information describes the diagnostic contents which can be read out from a module. The diagnostic formation is not automatically sent by the module but must actively be read out by SDO access.

Counting continuously

Limits	Counting range
Lower counting limit	-2 147 483 648 (-2^{31})
Upper counting limit	+2 147 483 647 ($2^{31}-1$)

Function:

- For starting the counting process the internal gate has to be opened.
  - The counter counts from the loading value in the counting range.
  - If the counter reaches the upper counting limit when counting forwards, and if a further count pulse in positive direction occurs, the counter skips to the lower counting limit and continues to count from there.
  - If the counter reaches the lower counting limit when counting backwards, and if a further negative count pulse occurs, the counter skips to the upper counting limit and continues to count from there.
  - If maximum values are exceeded or minimum values are not reached, the status bits *STS_OFLW* or *STS_UFLW* are set. These bits remain set until they are reset with *RES_SET* in the control word. If enabled, additionally a process alarm is triggered.
- For stopping the counting process the internal gate has to be closed.

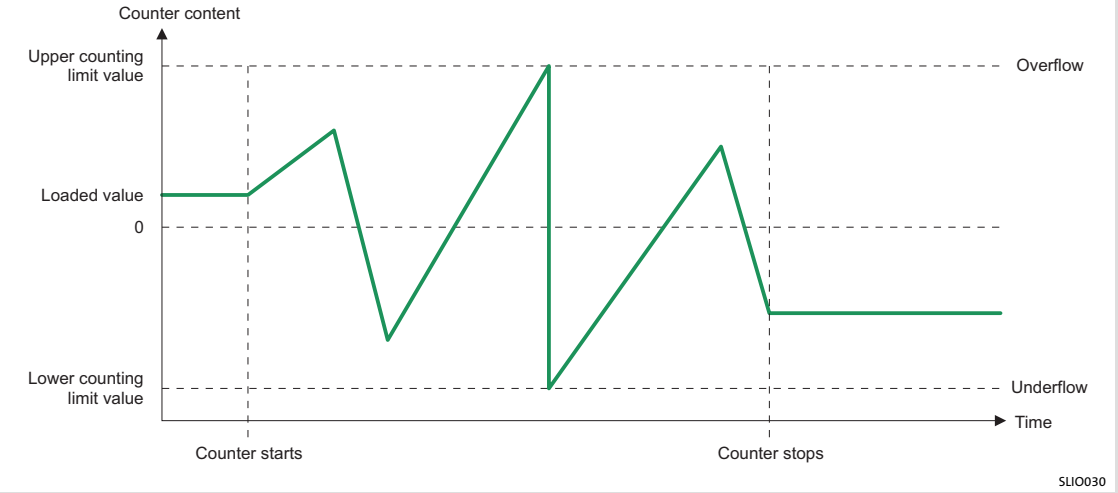


Fig. 3-67 Example of ”Counting continuously”

Counting once

A) No main counting direction:

Limits	Counting range
Lower counting limit	-2 147 483 648 (-2^{31})
Upper counting limit	+2 147 483 647 ($2^{31}-1$)

Function:

- For starting the counting process the internal gate has to be opened.
  - The counter counts forwards once from the loading value or backwards in the preset counting range.
  - If the counting limits are not reached or exceeded, the counter skips to the other counting limit, respectively, the internal gate is closed automatically and the status bits *STS_OFLW* or *STS_UFLW* are set. If enabled, a process alarm is effected.
- For stopping the counting process the internal gate has to be closed.
- For starting the counting process again, the internal gate has to be opened.
  - If the gate control is interrupted, the counting process continues at the current counter content.
  - If the gate control is cancelled, the counter starts from the loading value.

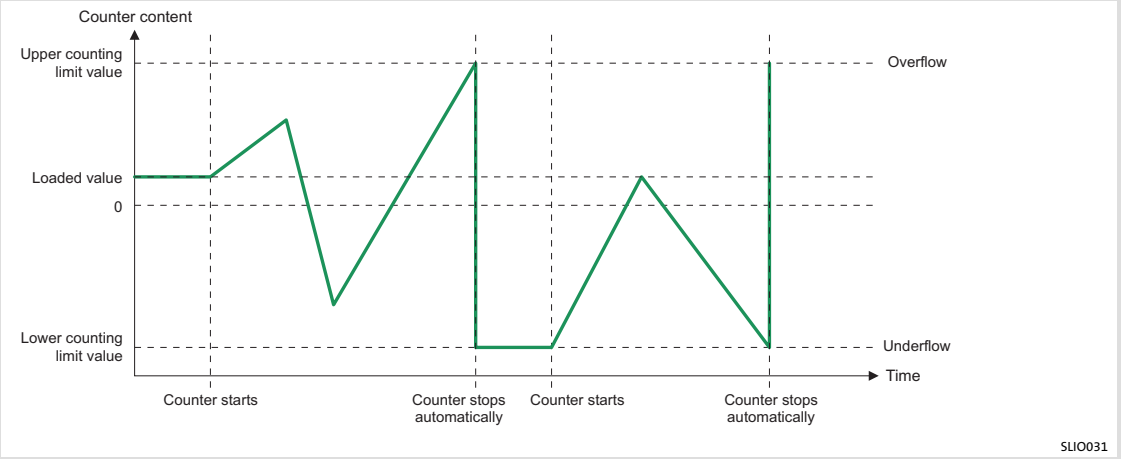


Fig. 3-68 Example of ”Counting once”, no main counting direction and with interrupting gate control

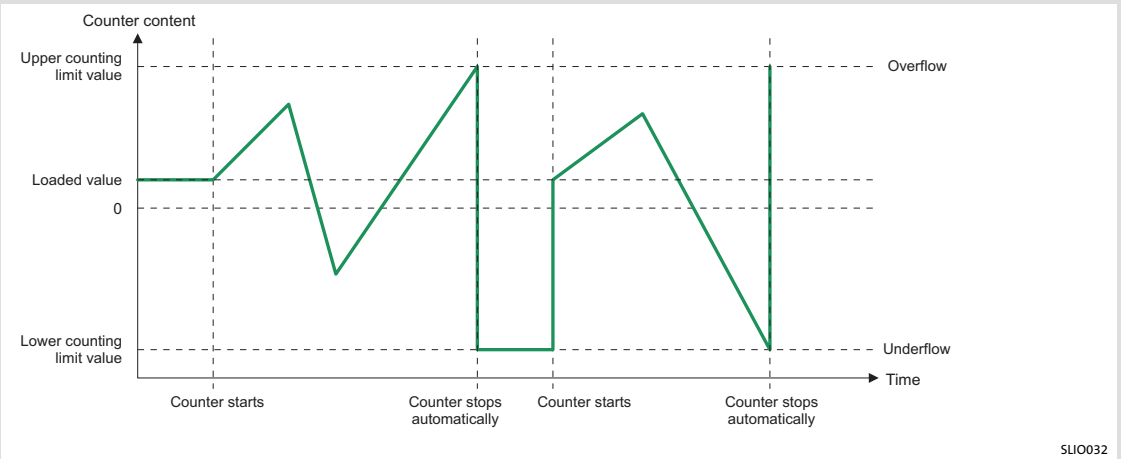


Fig. 3-69 Example of ”Counting once”, no main counting direction and with cancelling gate control

B) Main counting direction forwards:

Limits	Counting range
Final value	-2 147 483 646 ($-2^{31}+1$) to +2 147 483 646 ($2^{31}-1$)
Lower counting limit	-2 147 483 648 (-2^{31})

Function:

- For starting the counting process the internal gate has to be opened.
  - The counter counts forwards from the loading value.
  - If the counter reaches the final value -1 in the positive direction, it skips to the loading value at the next count pulse and the internal gate is closed automatically.
- For starting the counting process again, the internal gate has to be opened.
  - The counter counts from the loading value.
  - You can also count above the lower counting limit.

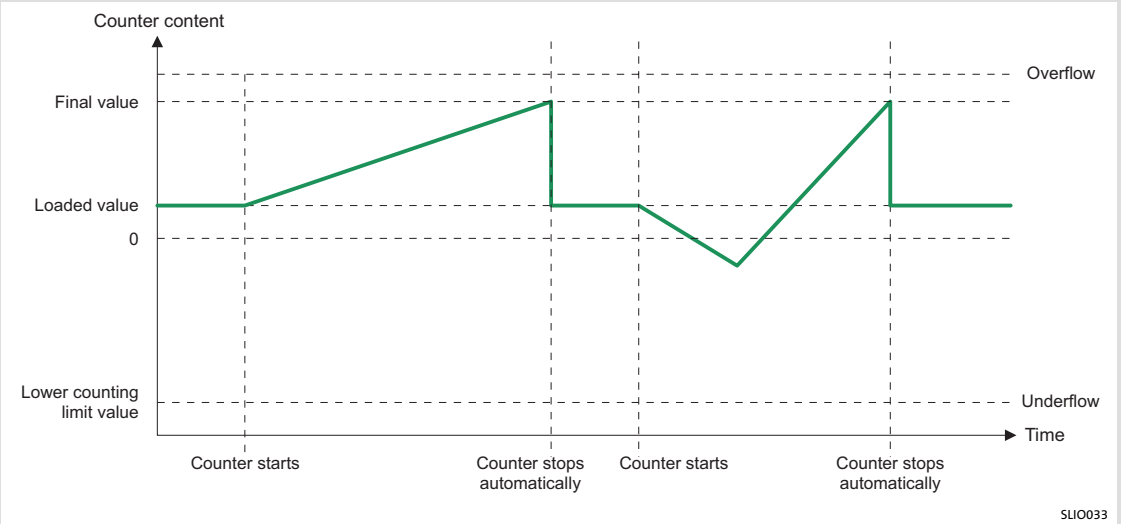


Fig. 3-70 Example of "Counting once" with main counting direction forwards

C) Main counting direction backwards:

Limits	Counting range
Final value	-2 147 483 646 ($-2^{31}+1$) to +2 147 483 646 ($2^{31}-1$)
Upper counting limit	+2 147 483 646 ($2^{31}-1$)

Function:

- For starting the counting process the internal gate has to be opened.
  - The counter counts backwards from the loading value.
  - If the counter reaches the final value +1 in the negative direction, it skips to the loading value at the next count pulse and the internal gate is closed automatically.
- For starting the counting process again, the internal gate has to be opened again.
  - The counter starts from the loading value.
  - You can also count above the upper counting limit.

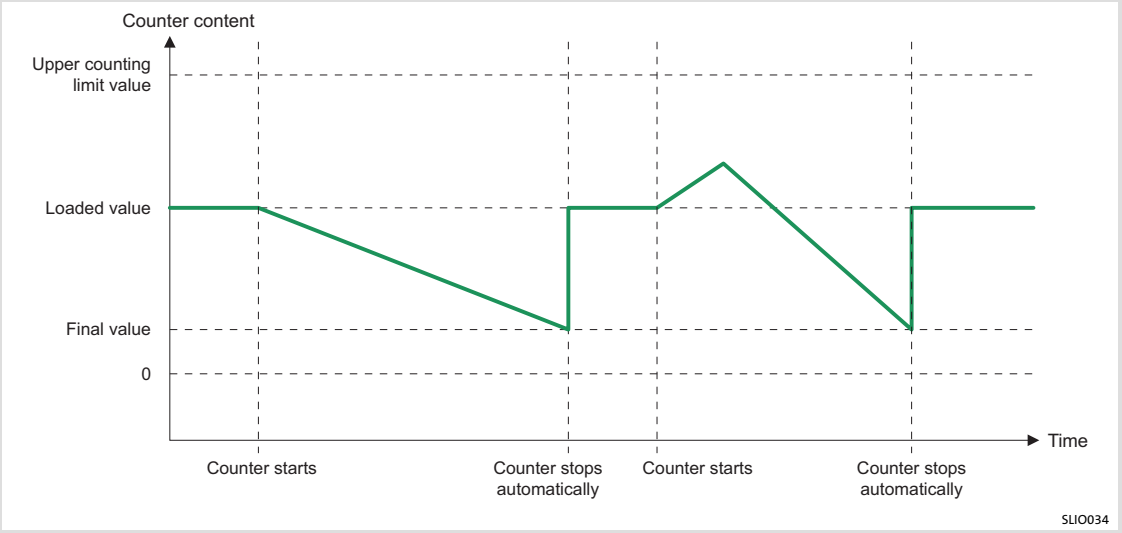


Fig. 3-71 Example of ”Counting once” with main counting direction backwards

Counting periodically

A) No main counting direction:

Limits	Counting range
Lower counting limit	-2 147 483 648 (-2^{31})
Upper counting limit	+2 147 483 647 ($2^{31}-1$)

Function:

- For starting the counting process the internal gate has to be opened.
  - The counter counts forwards from the loading value or backwards in the counting range.
  - If there is an overflow or underflow at the respective counting limit, the counter skips to the loading value and continues to count from there.
- For stopping the counting process the internal gate has to be closed.

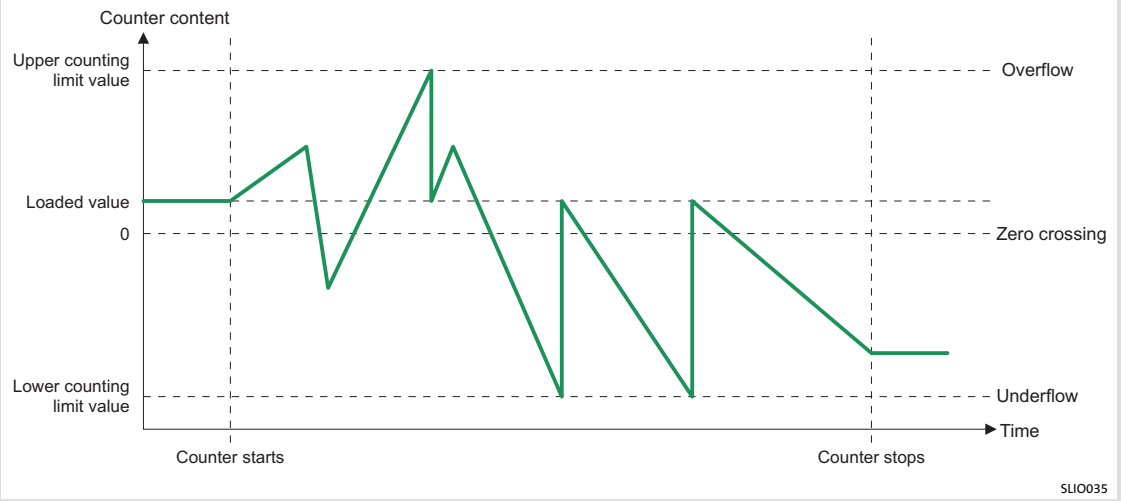


Fig. 3-72 Example of ”Counting periodically” and no main counting direction

B) Main counting direction forwards:

Limits	Counting range
Final value	-2 147 483 646 ($-2^{31}+1$) to +2 147 483 646 ($2^{31}-1$)
Lower counting limit	-2 147 483 648 (-2^{31})

Function:

- For starting the counting process the internal gate has to be opened.
  - The counter counts forwards from the loading value.
  - If the counter reaches the final value -1 in the positive direction, it skips to the loading value at the next positive count pulse and continues to count from there.
  - You can also count above the lower counting limit.
- For stopping the counting process the internal gate has to be closed.

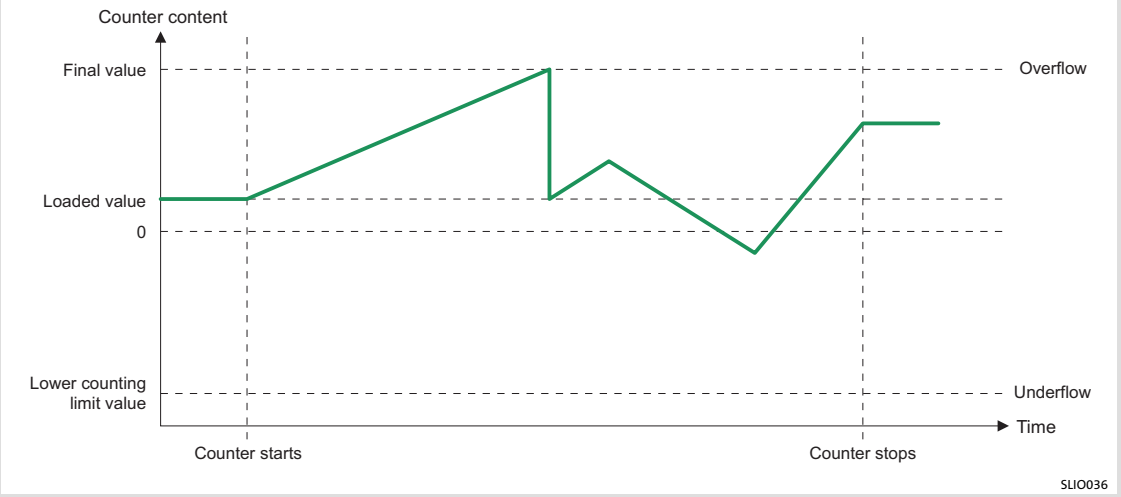


Fig. 3-73 Example of "Counting periodically" and main counting direction forwards

C) Main counting direction backwards:

Limits	Counting range
Final value	-2 147 483 646 (-2^{31}+1) to +2 147 483 646 (2^{31}-1)
Upper counting limit	+2 147 483 646 (2^{31}-1)

Function:

- For starting the counting process the internal gate has to be opened.
  - The counter counts backwards from the loading value.
  - If the counter reaches the final value +1 in the negative direction, it skips to the loading value at the next negative count pulse and continues to count from there.
  - You can also count above the upper counting limit.
- For stopping the counting process the internal gate has to be closed.

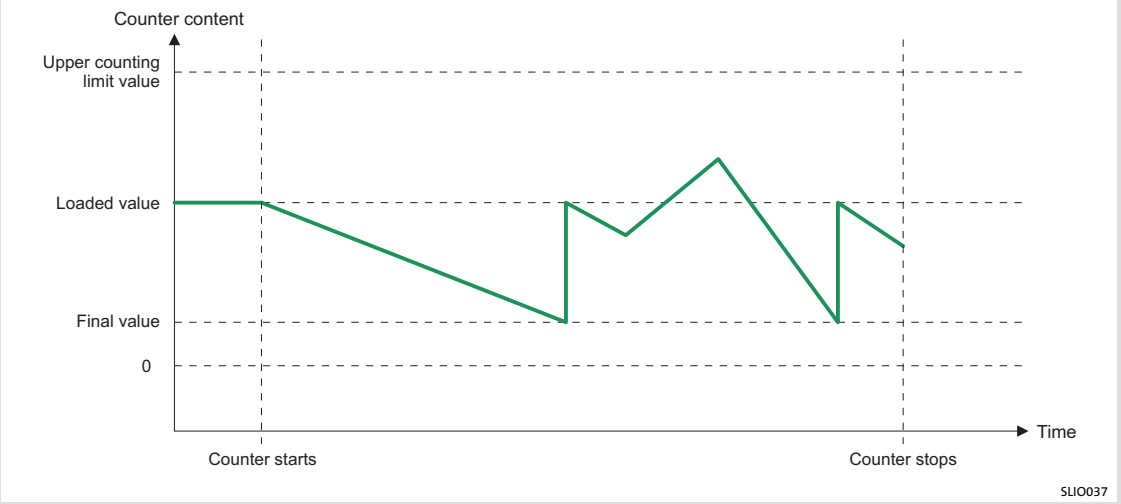


Fig. 3-74 Example of ”Counting periodically” and main counting direction backwards

Gate function

The counter is controlled via the ”internal gate” (I-gate). For this counter, the I-gate is conform to the software gate (SW gate).

The SW gate is opened and closed via the user program (control word).

- With an edge change 0-1 at the control word bit *SW_GATE_SET*, the SW gate opens (counter starts).
- With an edge change 0-1 at the control word bit *SW_GATE_RESET*, the SW gate closes (counter stops).

The following states have an impact on the I-gate:

SW gate	Response of I-gate
0	0
1	1
Edge change 0-1	1

Via the parameter setting you define whether the gate is to cancel or interrupt the counting process.

- In the case of a cancelling gate function, the counting process starts after a restart from the loading value.
- In the case of an interrupting gate function, the counting process is continued at the current count value after a restart.

Characteristic for the gate control via SW/HW gate in the ”Counting once” operating mode: If the I-gate was closed automatically, it can only be opened by means of an edge change 0-1 at *SW_GATE_SET*.

Comparator

The comparison value is specified via the output area. The comparison bit can be found in the status word under *STS_COMP*.

Note!

Please note that bit *STS_COMP* can only be triggered if bit *STS_CTRL_COMP* is set in the status word.

Via the parameter setting you can define the response of the comparison bit:

- Comparison bit never switches
- Comparison bit is set if count value ≥ comparison value

  As long as the count value is greater than or equals the comparison value, the comparison bit remains set
- Comparison bit is set if count value ≤ comparison value

  As long as the count value is smaller than or equals the comparison value, the comparison bit remains set.
- Comparison bit is set if count value = comparison value

  If the count value = comparison value, the comparison bit is set. The bit remains set until the comparison condition is no longer met. If you have set a main counting direction, the comparison bit is only set when the comparison value from the main counting direction is reached.

Note!

Together with bit *STS_COMP*, bit *STS_CMP* is set in the status word. In contrast to bit *STS_COMP*, however, it remains set until it is reset with *RES_SET* in the control word.

Hysteresis

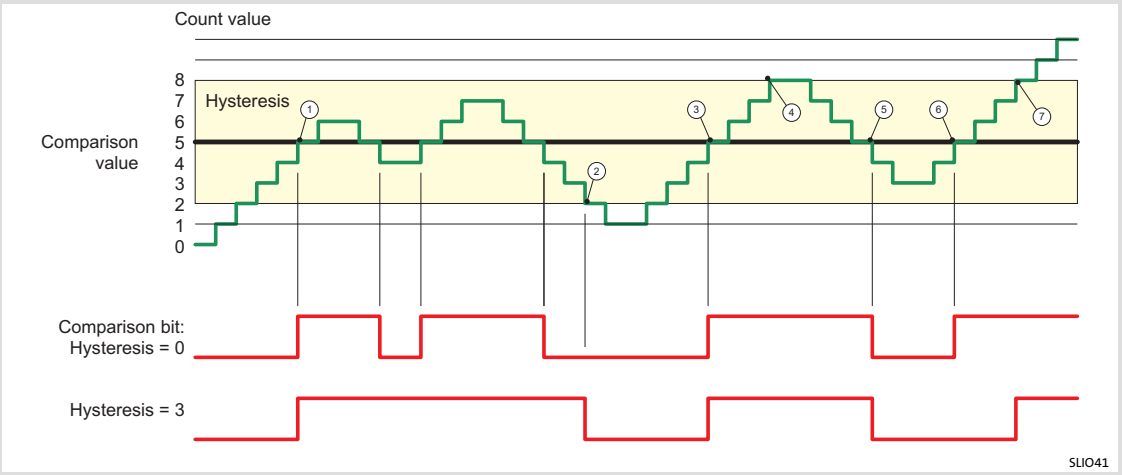
The hysteresis for instance serves to avoid frequent switching operations of the output and triggering of the alarm when the count value is within the range of the comparison value. For the hysteresis you can select a range between 0 and 255. With the settings 0 and 1 the hysteresis is switched off. The hysteresis has an effect on the zero crossing, overflow/underflow, and on the comparison value.

An active hysteresis remains active after the change. The new hysteresis range becomes active at the next hysteresis event.

In the following illustrations the response of the output at hysteresis 0 and hysteresis 3 for the corresponding conditions is represented:

A) Function mode in the case of count value ≥ comparison value

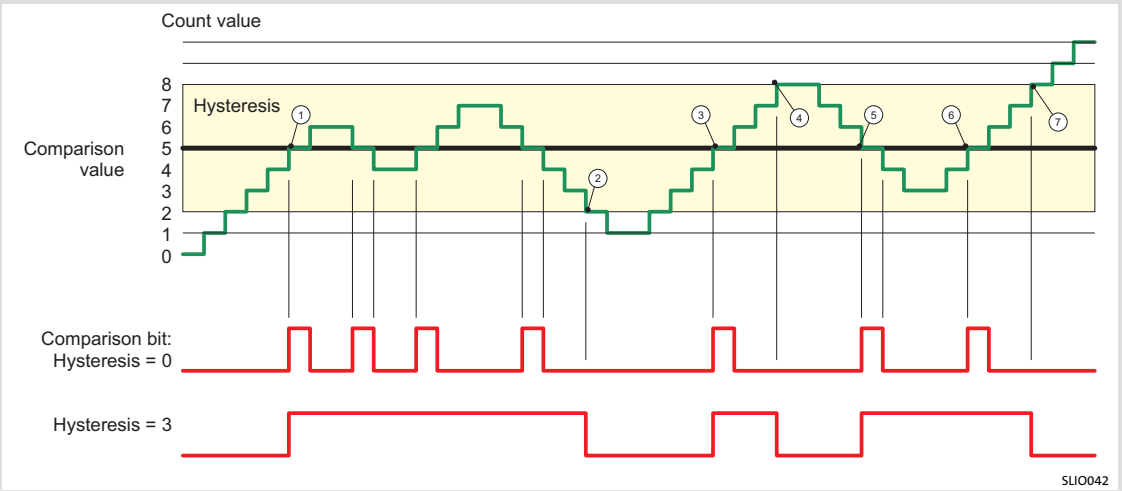
When the comparison condition is met, hysteresis becomes active. When hysteresis is active, the comparison result remains unchanged until the count value exits the hysteresis range set. After the hysteresis range is exited, hysteresis is only activated again when the comparison conditions are met.



① Count value ≥ comparison value →Comparison bit is set and hysteresis is activated
② Exiting of the hysteresis range →Comparison bit is reset
③ Count value ≥ comparison value →Comparison bit is set and hysteresis is activated
④ Exiting of the hysteresis range, comparison bit remains set, since count value ≥ comparison value
⑤ Count value < comparison value and hysteresis active → Comparison bit is reset
⑥ Count value ≥ comparison value →Comparison bit is not set since hysteresis is activated
⑦ Exiting of the hysteresis range, comparison bit is set, since count value ≥ comparison value

B) Function mode for count value = comparison value

When the comparison condition is met, hysteresis becomes active. When hysteresis is active, the comparison result remains unchanged until the count value exits the hysteresis range set. After the hysteresis range is exited, hysteresis is only activated again when the comparison conditions are met.



① Count value = comparison value →Comparison bit is set and hysteresis is activated
② Exiting of the hysteresis range →Comparison bit is reset and count value < comparison value
③ Count value = comparison value →Comparison bit is set and hysteresis is activated
④ Comparison bit is reset due to exiting of the hysteresis range and count value > comparison value
⑤ Count value = comparison value →Comparison bit is set and hysteresis is activated
⑥ Count value = comparison value and hysteresis active → Comparison bit remains set
⑦ Exiting of the hysteresis range and count value > comparison value → Comparison bit is reset

3.9.3 One counter 32 bits, 5 V DC - EPM-S602

This module measures the pulses of one connected encoder and processes them according to the mode selected.

Features

- 1 counter 32 bits (AB), invertible, DC 5 V (differential signal)
- Counting frequency max. 2 MHz
- Comparison value, set value, input filter
- Alarm and diagnostic function

Overview

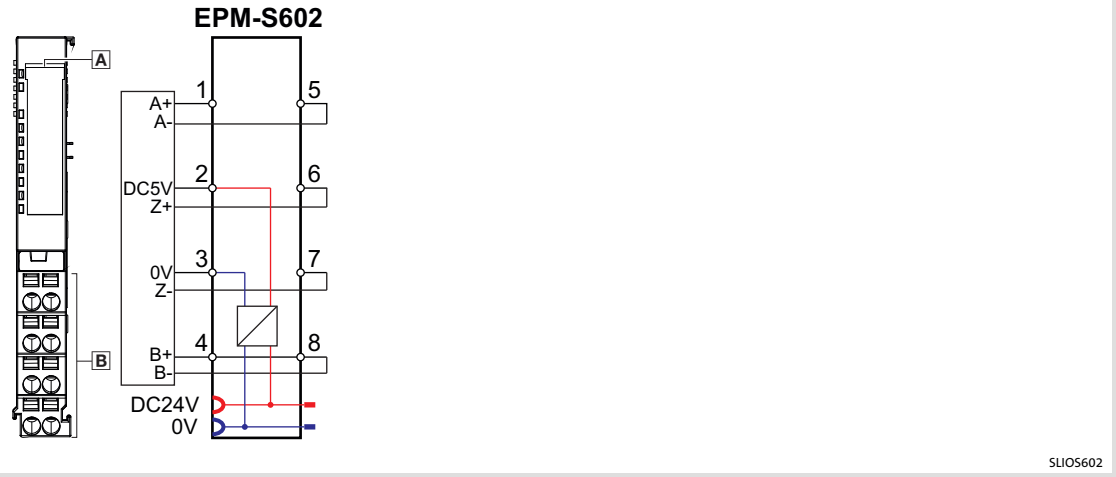
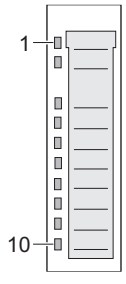


Fig. 3-75 Elements and circuit diagram

A Displays for module status
B Terminals
1 ... 8 Connection number

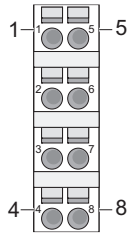
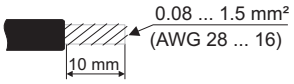
Status displays

Module status LEDs A

View	Pos.	Designation	Colour	Explanation
	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	A	Green	On: Digital input 1 and 5, "A"/"pulse" triggered
	4	B		On: Digital input 4 and 8, "B"/"direction" triggered
	5	Reset		On: Digital input 6 and 7, "Reset" triggered
	6	-	-	Not assigned
	7			
	8			
	9			
	10			

Messages of the status LEDs RUN and MF		
RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B			
View	Name	Explanation	Terminal data
 SLIO002	1	Digital input ”A+”/”pulse” Differential input for counting signal or track A of an encoder for single, double, or quadruple evaluation	
	2	DC 5 V for encoder supply Load capacity: max. 500 mA	
	3	GND	
	4	Digital input ”B+”/”direction” Differential input for direction signal or track B of an encoder (can be inverted via parameterisation)	
	5	Digital input ”A-”/”pulse” See 1	
	6	Differential input for reset ”Z+”	
	7	Differential input for reset ”Z-”	
	8	Digital input ”B-”/”direction” See 4	

Technical data

EPM-S602: rated data	
Module identifier	2242_{dec}
Current consumption/power loss	
Current consumption from backplane bus	70 mA
Power loss	0.85 W

EPM-S602: rated data	
Digital inputs	
Number of inputs	0
Cable length	
shielded	100 m
Load voltage	
Nominal value	DC 20.4 ... 28.8 V
Current consumption from load voltage L+	20 mA (without load)
Input voltage	
for signal ”0”	Differential signal RS422
for signal ”1”	Differential signal RS422
Input resistance	120 Ω
Input delay	
from ”0” to ”1”	0.8 µs
from ”1” to ”0”	0.8 µs
Input data size	8 bytes
Digital outputs	
Output data size	10 bytes
Counter	
Number of counters	1
Counter width	32 bits
Frequency	
Input frequency, max	500 kHz
Counting frequency, max	2 MHz
Operating mode	
Incremental encoder	Possible
Pulse/direction	Possible
Pulse	Not possible
Frequency measurement	Not possible
Period duration measurement	Not possible
Connection	
Gate connection	Not possible
Latch connection	Not possible
Reset connection	Possible
Counter output	Not possible
Status, alarm, diagnostics	
Status display	Yes
Alarms	Yes, parameterisable
Process alarm	Yes, parameterisable
Diagnostic alarm	Yes, parameterisable
Diagnostic function	Yes, parameterisable
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	None

EPM-S602: rated data	
Electrical isolation	
Between the channels and the backplane bus	Yes
Insulation checked with	DC 500 V

Parameterisable functions

Counting functions	Description
Counting continuously	The counter counts from the loading value to the counting limit, then skips to the opposite counting limit and continues to count from there.
Counting once	The counter counts once/periodically from the loading value in the specified counting range.
Counting periodically	

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Main counting direction	The main counting direction can be parameterised: **None:** The whole counting range is available. **Forwards:** Limitation of the counting range upwards. The counter counts from the parameterised loading value in the positive direction to the parameterised final value -1 and then skips to the loading value again with the encoder pulse that is following. **Backwards:** Limitation of the counting range downwards. The counter counts from the parameterised loading value in the negative direction to the parameterised final value +1 and then skips to the loading value again with the encoder pulse that is following.
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter the internal gate (I-gate) is conform to the software gate (SW gate) which you control via your user program (status word in the output area). The following response can be parameterised: **Cancelling gate function:**After closing the gate and opening it again, the counting process continues from the loading value again. **Interrupting gate function:**After closing the gate and opening it again, the counting process continues with the last current counter content.
Comparator	You can specify a comparison value which, depending on the count value, activates the digital output or triggers a process alarm.
Hysteresis	By specification of a hysteresis you can for instance prevent the output from being permanently switched if the value of an encoder signal fluctuates around the comparison value.
Process alarm	The activation of a process alarm can be parameterised. A process alarm can be triggered in the case of the following events: ● Hardware gate open ● Hardware gate closed ● Counting limit - overflow ● Counting limit - underflow ● Comparison value reached ● Final value reached ● Latch value reached
Diagnostic alarm	If the diagnostic alarm is enabled in the parameter setting, it occurs as soon as another process alarm is triggered for the same event during process alarm processing.
Diagnostic function	Diagnostic functions are provided in the modules.
Diagnostic information	The diagnostic information describes the diagnostic contents which can be read out from a module. The diagnostic formation is not automatically sent by the module but must actively be read out by SDO access.

Counting continuously

Limits	Counting range
Lower counting limit	-2 147 483 648 (-2^{31})
Upper counting limit	+2 147 483 647 ($2^{31}-1$)

Function:

- For starting the counting process the internal gate has to be opened.
  - The counter counts from the loading value in the counting range.
  - If the counter reaches the upper counting limit when counting forwards, and if a further count pulse in positive direction occurs, the counter skips to the lower counting limit and continues to count from there.
  - If the counter reaches the lower counting limit when counting backwards, and if a further negative count pulse occurs, the counter skips to the upper counting limit and continues to count from there.
  - If maximum values are exceeded or minimum values are not reached, the status bits *STS_OFLW* or *STS_UFLW* are set. These bits remain set until they are reset with *RES_SET* in the control word. If enabled, additionally a process alarm is triggered.
- For stopping the counting process the internal gate has to be closed.

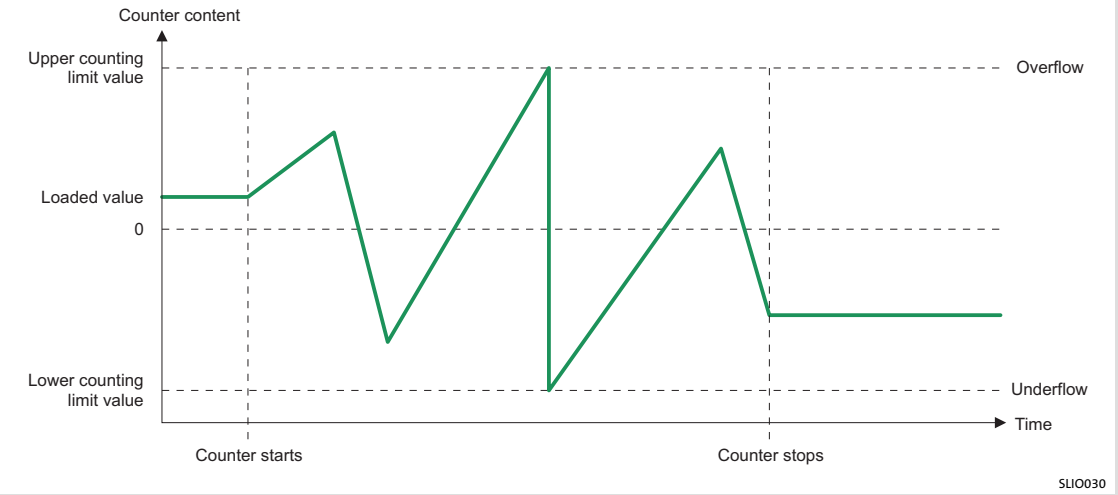


Fig. 3-76 Example of ”Counting continuously”

Counting once

A) No main counting direction:

Limits	Counting range
Lower counting limit	-2 147 483 648 (-2^{31})
Upper counting limit	+2 147 483 647 ($2^{31}-1$)

Function:

- For starting the counting process the internal gate has to be opened.
  - The counter counts forwards once from the loading value or backwards in the preset counting range.
  - If the counting limits are not reached or exceeded, the counter skips to the other counting limit, respectively, the internal gate is closed automatically and the status bits *STS_OFLW* or *STS_UFLW* are set. If enabled, a process alarm is effected.
- For stopping the counting process the internal gate has to be closed.
- For starting the counting process again, the internal gate has to be opened.
  - If the gate control is interrupted, the counting process continues at the current counter content.
  - If the gate control is cancelled, the counter starts from the loading value.

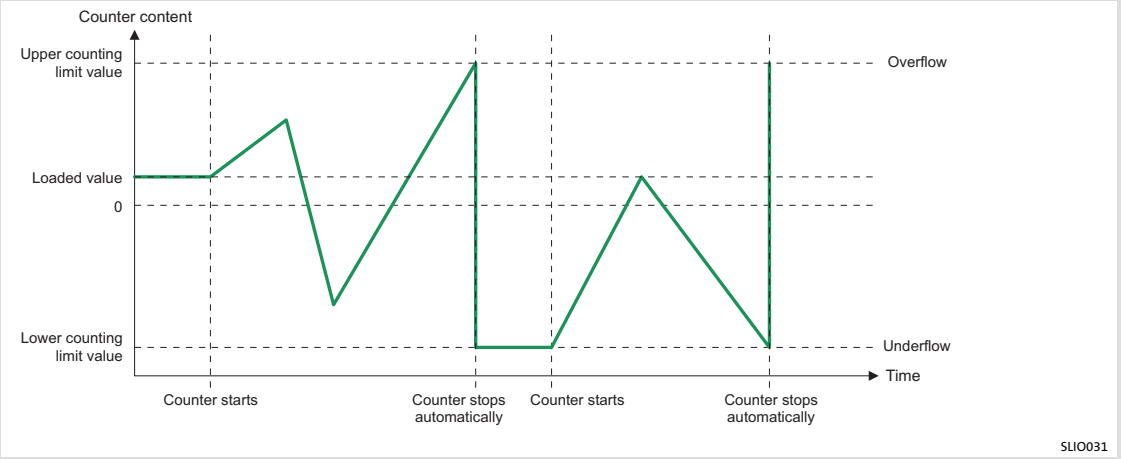


Fig. 3-77 Example of ”Counting once”, no main counting direction and with interrupting gate control

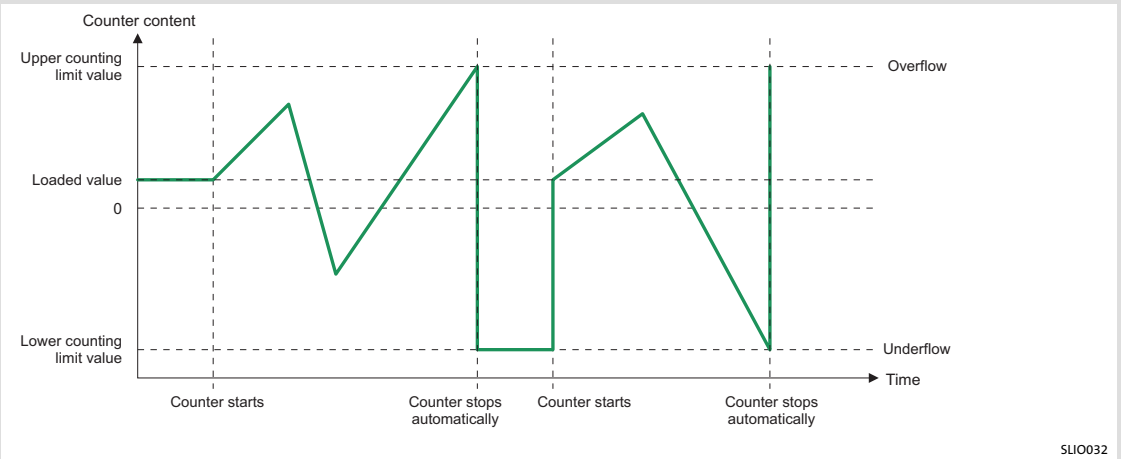


Fig. 3-78 Example of ”Counting once”, no main counting direction and with cancelling gate control

B) Main counting direction forwards:

Limits	Counting range
Final value	-2 147 483 646 ($-2^{31}+1$) to +2 147 483 646 ($2^{31}-1$)
Lower counting limit	-2 147 483 648 (-2^{31})

Function:

- For starting the counting process the internal gate has to be opened.
  - The counter counts forwards from the loading value.
  - If the counter reaches the final value -1 in the positive direction, it skips to the loading value at the next count pulse and the internal gate is closed automatically.
- For starting the counting process again, the internal gate has to be opened.
  - The counter counts from the loading value.
  - You can also count above the lower counting limit.

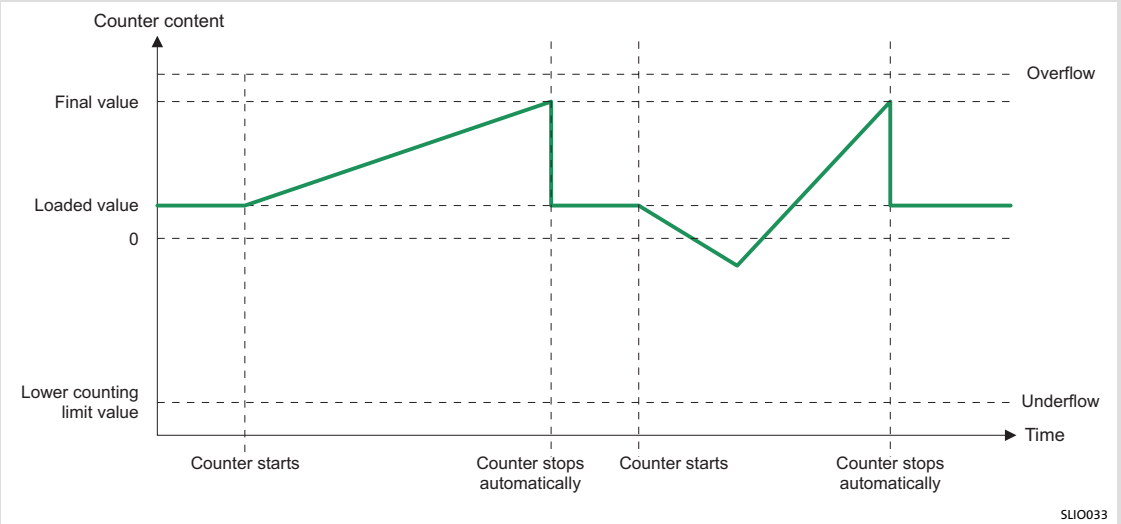


Fig. 3-79 Example of "Counting once" with main counting direction forwards

C) Main counting direction backwards:

Limits	Counting range
Final value	-2 147 483 646 ($-2^{31}+1$) to +2 147 483 646 ($2^{31}-1$)
Upper counting limit	+2 147 483 646 ($2^{31}-1$)

Function:

- For starting the counting process the internal gate has to be opened.
  - The counter counts backwards from the loading value.
  - If the counter reaches the final value +1 in the negative direction, it skips to the loading value at the next count pulse and the internal gate is closed automatically.
- For starting the counting process again, the internal gate has to be opened again.
  - The counter starts from the loading value.
  - You can also count above the upper counting limit.

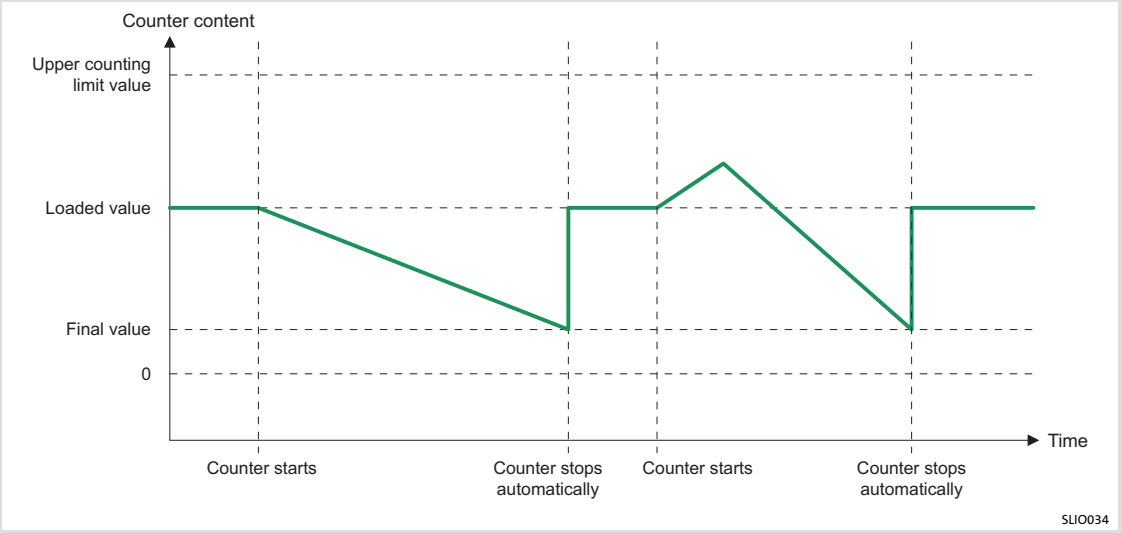


Fig. 3-80 Example of ”Counting once” with main counting direction backwards

Counting periodically

A) No main counting direction:

Limits	Counting range
Lower counting limit	-2 147 483 648 (-2^{31})
Upper counting limit	+2 147 483 647 ($2^{31}-1$)

Function:

- For starting the counting process the internal gate has to be opened.
  - The counter counts forwards from the loading value or backwards in the counting range.
  - If there is an overflow or underflow at the respective counting limit, the counter skips to the loading value and continues to count from there.
- For stopping the counting process the internal gate has to be closed.

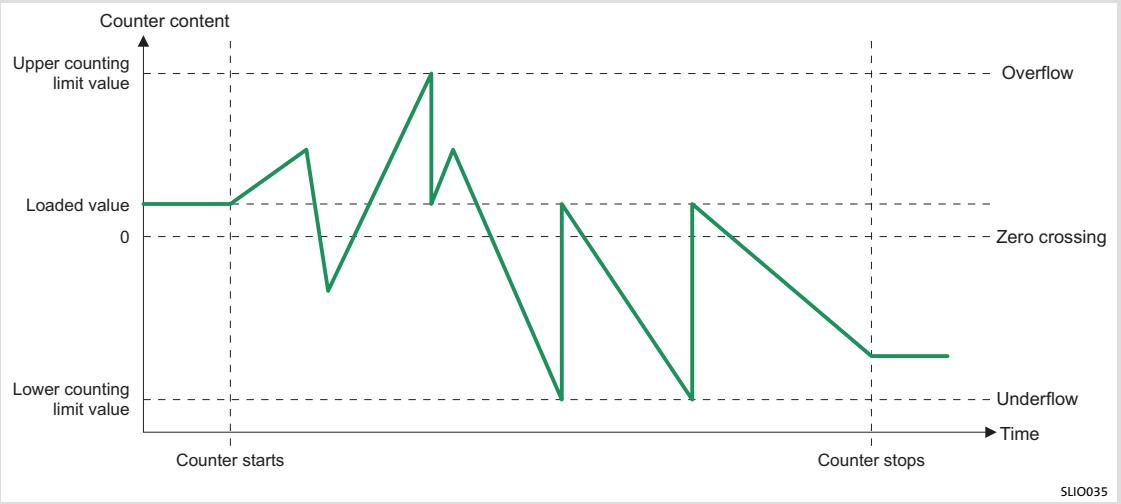


Fig. 3-81 Example of ”Counting periodically” and no main counting direction

B) Main counting direction forwards:

Limits	Counting range
Final value	-2 147 483 646 ($-2^{31}+1$) to +2 147 483 646 ($2^{31}-1$)
Lower counting limit	-2 147 483 648 (-2^{31})

Function:

- For starting the counting process the internal gate has to be opened.
  - The counter counts forwards from the loading value.
  - If the counter reaches the final value -1 in the positive direction, it skips to the loading value at the next positive count pulse and continues to count from there.
  - You can also count above the lower counting limit.
- For stopping the counting process the internal gate has to be closed.

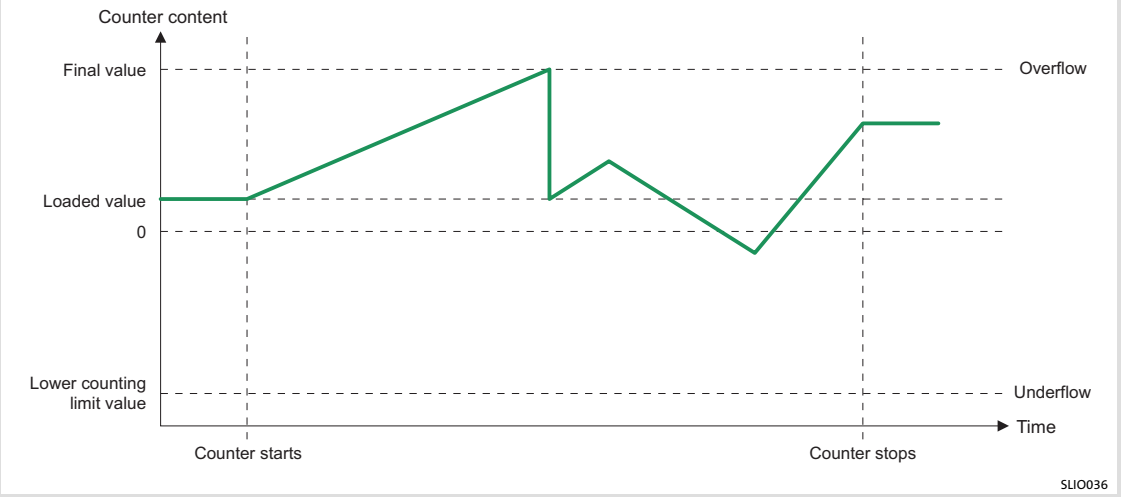


Fig. 3-82 Example of "Counting periodically" and main counting direction forwards

C) Main counting direction backwards:

Limits	Counting range
Final value	-2 147 483 646 ($-2^{31}+1$) to +2 147 483 646 ($2^{31}-1$)
Upper counting limit	+2 147 483 646 ($2^{31}-1$)

Function:

- For starting the counting process the internal gate has to be opened.
  - The counter counts backwards from the loading value.
  - If the counter reaches the final value +1 in the negative direction, it skips to the loading value at the next negative count pulse and continues to count from there.
  - You can also count above the upper counting limit.
- For stopping the counting process the internal gate has to be closed.

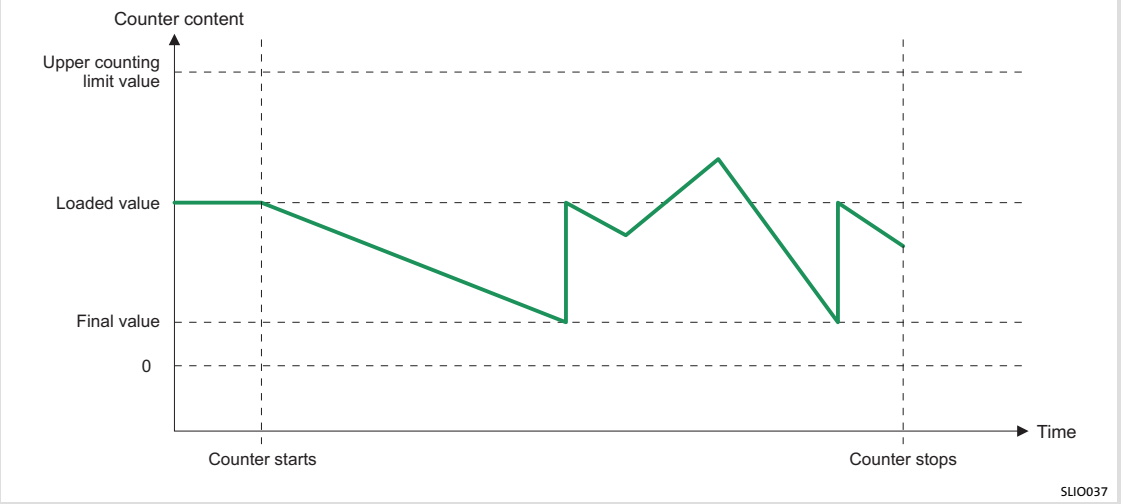


Fig. 3-83 Example of ”Counting periodically” and main counting direction backwards

Gate function

The counter is controlled via the ”internal gate” (I-gate). For this counter, the I-gate is conform to the software gate (SW gate).

The SW gate is opened and closed via the user program (control word).

- With an edge change 0-1 at the control word bit *SW_GATE_SET*, the SW gate opens (counter starts).
- With an edge change 0-1 at the control word bit *SW_GATE_RESET*, the SW gate closes (counter stops).

The following states have an impact on the I-gate:

SW gate	Response of I-gate
0	0
1	1
Edge change 0-1	1

Via the parameter setting you define whether the gate is to cancel or interrupt the counting process.

- In the case of a cancelling gate function, the counting process starts after a restart from the loading value.
- In the case of an interrupting gate function, the counting process is continued at the current count value after a restart.

Characteristic for the gate control via SW/HW gate in the ”Counting once” operating mode: If the I-gate was closed automatically, it can only be opened by means of an edge change 0-1 at *SW_GATE_SET*.

Comparator

The comparison value is specified via the output area. The comparison bit can be found in the status word under *STS_COMP*.

Note!

Please note that bit *STS_COMP* can only be triggered if bit *STS_CTRL_COMP* is set in the status word.

Via the parameter setting you can define the response of the comparison bit:

- Comparison bit never switches
- Comparison bit is set if count value ≥ comparison value

  As long as the count value is greater than or equals the comparison value, the comparison bit remains set
- Comparison bit is set if count value ≤ comparison value

  As long as the count value is smaller than or equals the comparison value, the comparison bit remains set.
- Comparison bit is set if count value = comparison value

  If the count value = comparison value, the comparison bit is set. The bit remains set until the comparison condition is no longer met. If you have set a main counting direction, the comparison bit is only set when the comparison value from the main counting direction is reached.

Note!

Together with bit *STS_COMP*, bit *STS_CMP* is set in the status word. In contrast to bit *STS_COMP*, however, it remains set until it is reset with *RES_SET* in the control word.

Hysteresis

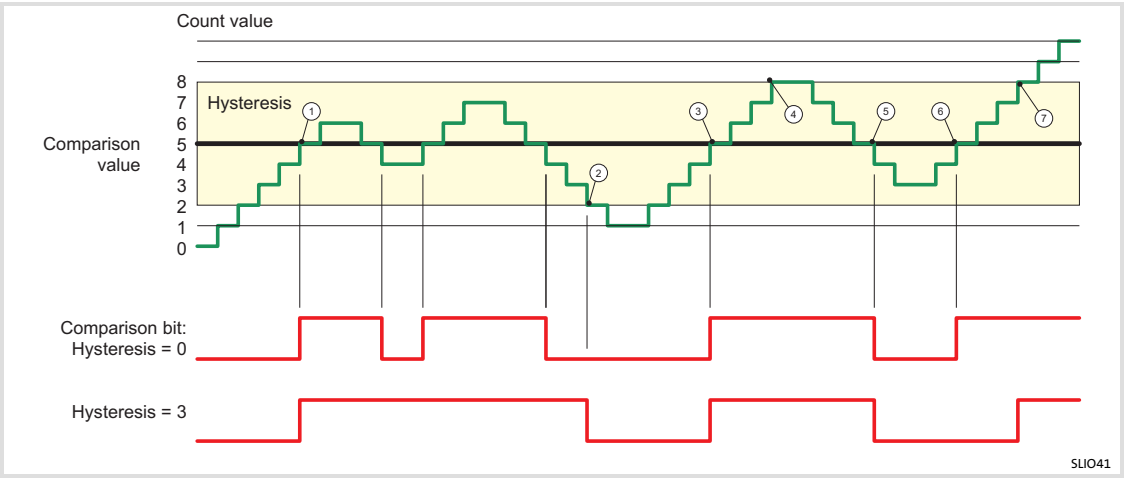
The hysteresis for instance serves to avoid frequent switching operations of the output and triggering of the alarm when the count value is within the range of the comparison value. For the hysteresis you can select a range between 0 and 255. With the settings 0 and 1 the hysteresis is switched off. The hysteresis has an effect on the zero crossing, overflow/underflow, and on the comparison value.

An active hysteresis remains active after the change. The new hysteresis range becomes active at the next hysteresis event.

In the following illustrations the response of the output at hysteresis 0 and hysteresis 3 for the corresponding conditions is represented:

A) Function mode in the case of count value ≥ comparison value

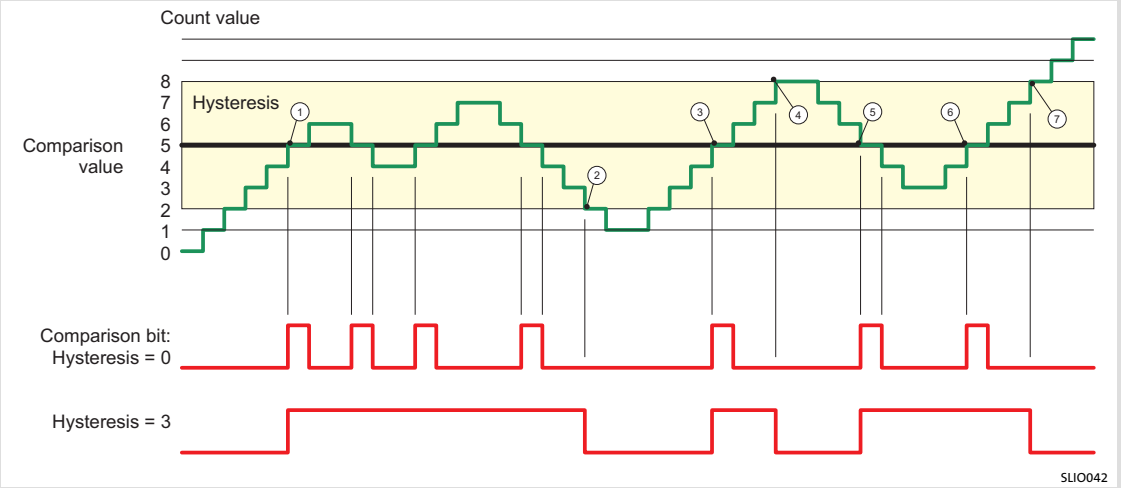
When the comparison condition is met, hysteresis becomes active. When hysteresis is active, the comparison result remains unchanged until the count value exits the hysteresis range set. After the hysteresis range is exited, hysteresis is only activated again when the comparison conditions are met.



① Count value ≥ comparison value →Comparison bit is set and hysteresis is activated
② Exiting of the hysteresis range →Comparison bit is reset
③ Count value ≥ comparison value →Comparison bit is set and hysteresis is activated
④ Exiting of the hysteresis range, comparison bit remains set, since count value ≥ comparison value
⑤ Count value < comparison value and hysteresis active → Comparison bit is reset
⑥ Count value ≥ comparison value →Comparison bit is not set since hysteresis is activated
⑦ Exiting of the hysteresis range, comparison bit is set, since count value ≥ comparison value

B) Function mode for count value = comparison value

When the comparison condition is met, hysteresis becomes active. When hysteresis is active, the comparison result remains unchanged until the count value exits the hysteresis range set. After the hysteresis range is exited, hysteresis is only activated again when the comparison conditions are met.



① Count value = comparison value →Comparison bit is set and hysteresis is activated
② Exiting of the hysteresis range →Comparison bit is reset and count value < comparison value
③ Count value = comparison value →Comparison bit is set and hysteresis is activated
④ Comparison bit is reset due to exiting of the hysteresis range and count value > comparison value
⑤ Count value = comparison value →Comparison bit is set and hysteresis is activated
⑥ Count value = comparison value and hysteresis active → Comparison bit remains set
⑦ Exiting of the hysteresis range and count value > comparison value → Comparison bit is reset

3.9.4 Two counters 32 bits, 24 V DC - EPM-S603

This module measures the pulses of up to two connected encoders and processes them according to the mode selected.

Features

- 2 counters 32 bits, DC 24 V
- Counting frequency max. 400 kHz
- Input filter
- Diagnostic function

Overview

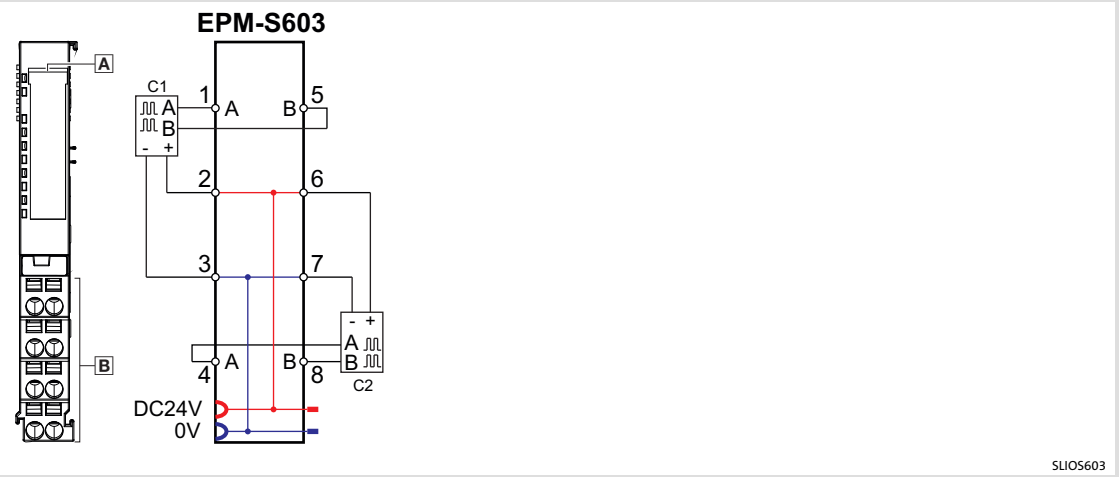
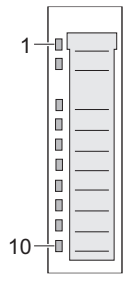


Fig. 3-84 Elements and circuit diagram

A Displays for module status
B Terminals
1 ... 8 Connection number

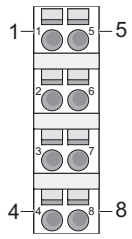
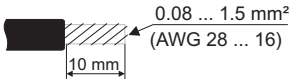
Status displays

Module status LEDs A

View	Pos.	Designation	Colour	Explanation
	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	A1	Green	On: Digital input 1, counter 1, "A1"/"pulse" triggered
	4	B1		On: Digital input 5, counter 1, "B1"/"direction" triggered
	5	A2		On: Digital input 4, counter 2, "A2"/"pulse" triggered
	6	B2		On: Digital input 8, counter 2, "B2"/"direction" triggered
	7	-	-	Not assigned
	8			
	9			
	10			

Messages of the status LEDs RUN and MF		
RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)
BLINKING (2 Hz)	BLINKING (2 Hz)	Module reports parameterisation error Bus communication is OK

Terminals

Module terminals, spring terminals B			
View	Designation	Explanation	Terminal data
 SLIO002	1	Digital input, counter 1, ”A”/”pulse” Pulse input for counting signal or track A of an encoder for single, double, or quadruple evaluation	
	2	DC 24 V for encoder supply	
	3	GND	
	4	Digital input, counter 2, ”A”/”pulse” Pulse input for counting signal or track A of an encoder for single, double, or quadruple evaluation	
	5	Digital input, counter 1, ”B”/”direction” Direction signal or track B of an encoder (can be inverted via parameterisation)	
	6	DC 24 V for encoder	
	7	GND	
	8	Digital input, counter 2, ”B”/”direction” Direction signal or track B of an encoder (can be inverted via parameterisation)	

Technical data

EPM-S603: rated data	
Module identifier	2244_{dec}
Current consumption/power loss	
Current consumption from backplane bus	75 mA
Power loss	0.9 W

EPM-S603: rated data	
Digital inputs	
Number of inputs	4
Cable length	
shielded	100 m
Load voltage	
Nominal value	DC 20.4 ... 28.8 V
Current consumption from load voltage L+	15 mA (without load)
Input voltage	
Nominal value	DC 20.4 ... 28.8 V
for signal ”0”	DC 0 ... 5 V
for signal ”1”	DC 15 ... 28.8 V
Input current	
for signal ”1”	3 mA
2-wire BERO	
Connection possible	Yes
Max. permissible closed-circuit current	0.5 mA
Input delay	
from ”0” to ”1”	0.8 µs
from ”1” to ”0”	0.8 µs
Number of inputs which can be used simultaneously	
horizontal structure	4
vertical structure	4
Input characteristic	IEC 61131, type 1
Input data size	12 bytes
Digital outputs	
Output data size	4 bytes
Meters	
Number of counters	2
Counter width	32 bits
Frequency	
Input frequency, max	500 kHz
Counting frequency, max	400 kHz
Operating mode	
Incremental encoder	Possible
Pulse / direction	Possible
Pulse	Not possible
Frequency measurement	Not possible
Period duration measurement	Not possible
Connection	
Gate connection	Not possible
Latch connection	Not possible
Reset connection	Not possible
Counter output	Not possible

EPM-S603: rated data	
Status, alarm, diagnostics	
Status display	Yes
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	No
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	None
Electrical isolation	
Between the channels and the backplane bus	Yes
Insulation checked with	DC 500 V

Parameterisable functions

Counting functions	Description
Counting continuously	The counter counts from 0 to the counting limit, then skips to the opposite counting limit and continues to count from there.

Signal evaluation	Description
Single rotary transducer	Connection to input ”A/pulse” and ”B/direction”
Double rotary transducer	
Quadruple rotary transducer	
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter the internal gate (I-gate) is conform to the software gate (SW gate) which you control via your user program (status word in the output area).

Counting continuously

Limits	Counting range
Lower counting limit	-2 147 483 648 (-2^{31})
Upper counting limit	+2 147 483 647 ($2^{31}-1$)

Function:

- For starting the counting process the internal gate has to be opened.
  - The counter always counts from 0.
  - If the counter reaches the upper counting limit when counting forwards, and if a further count pulse in positive direction occurs, the counter skips to the lower counting limit and continues to count from there.
  - If the counter reaches the lower counting limit when counting backwards, and if a further negative count pulse occurs, the counter skips to the upper counting limit and continues to count from there.
  - If values are exceeded or not reached, the status bits *STS_OFLW* or *STS_UFLW* are set. These bits remain set until they are reset with *RES_SET* in the control word.
- For stopping the counting process the internal gate has to be closed.

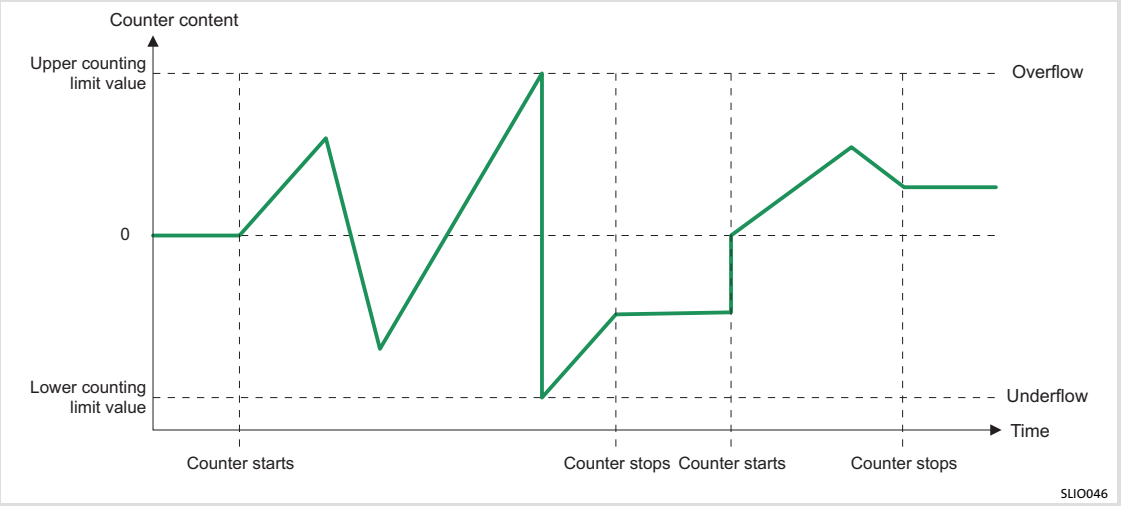


Fig. 3-85 Example of ”Counting continuously”

Gate function

The counter is controlled via the ”internal gate” (I-gate). For this counter, the I-gate is conform to the software gate (SW gate).

The SW gate is opened and closed via the user program (control word).

- With an edge change 0-1 at the control word bit *SW_GATE_SET*, the SW gate opens (counter starts from count value).
- With an edge change 0-1 at the control word bit *SW_GATE_RESET*, the SW gate closes (counter stops).

The following states have an impact on the I-gate:

SW gate	Response of I-gate
0	0
1	1
Edge change 0-1	1

3.9.5 Control and status word

EPM-S600 status word		
Bit	**Designation**	**Function**
0	STS_SYNC	Reset was active
1	STS_CTRL_DO	Is set if the digital output is enabled
2	STS_SW-GATE	Software gate status (set if SW gate active)
3	STS_RST	Status of reset input
4	STS_STRT	Hardware gate status (set if HW gate active)
5	STS_GATE	Status of internal gate (set if internal gate active)
6	STS_DO	Status of digital counter output (DO)
7	STS_C_DN	Status set for counter direction backwards
8	STS_C_UP	Status set for counter direction forwards
9	STS_CMP*	Comparator status is set if the comparison condition is met. If the comparison is deactivated (counter mode byte 1 = 000_b), the bit has no function.
10	STS_END*	Status set if final value was reached
11	STS_OFLW*	Status set in the case of overflow
12	STS_UFLW*	Status set in the case of underflow
13	STS_ZP*	Status set in the case of zero crossing
14	STS_LTCH	Status of latch input
15	-	Reserved

* The bits are set until reset with RES_SET (bit 6 control word)

EPM-S600 control word		
Bit	**Name**	**Function**
0	CTRL_SYNC_SET	Activation/deactivation of the counting signal: 0 (FALSE): The input for the couting signal is deactivated and the current counter content is reset to 0. 1 (TRUE): The input for the counting signal is activated.
1	CTRL_DO_SET	Enables the digital output
2	SW_GATE_SET	Sets the software gate
3	-	Reserved
4	-	Reserved
5	COUNTERVAL_SET	Sets the counter temporarily to the value in the set value
6	RES_SET	Resets bits STS_CMP, STS_END, STS_OFLW, STS_UFLW and STS_ZP with a rising edge
7	-	Reserved
8	CTRL_SYNC_RESET	Activation/deactivation of the zero track evaluation: 0 (FALSE): The zero track evaluation is activated. 1 (TRUE): The zero track evaluation is stopped. The counter keeps counting irrespective of the zero pulse. Bit 0 (CTRL_SYNC_SET) must be set to TRUE for this purpose.
9	CTRL_DO_RESET	Inhibits the digital output
10	SW_GATE_RESET	Resets the software gate
11	-	Reserved
12		
13		
14		
15		

EPM-S601 status word		
Bit	**Designation**	**Function**
0	-	Reserved
1	STS_CTRL_COMP	Is set if the comparison bit is enabled
2	STS_SW-GATE	Software gate status (set if SW gate active)
3	-	Reserved
4	-	Reserved
5	STS_GATE	Status of internal gate (set if internal gate active)
6	STS_COMP	Status of comparison bit
7	STS_C_DN	Status set for counter direction backwards
8	STS_C_UP	Status set for counter direction forwards
9	STS_CMP*	Comparator status is set if the comparison condition is met. If the comparison is deactivated (counter mode byte 1 = 000_b), the bit has no function.
10	STS_END*	Status set if final value was reached
11	STS_OFLW*	Status set in the case of overflow
12	STS_UFLW*	Status set in the case of underflow
13	STS_ZP*	Status set in the case of zero crossing
14	-	Reserved
15	-	Reserved

* The bits are set until reset with RES_SET (bit 6 control word)

EPM-S601 control word		
Bit	**Designation**	**Function**
0	-	Reserved
1	CTRL_COMP_SET	Enables the comparison bit
2	SW_GATE_SET	Sets the software gate
3	-	Reserved
4	-	Reserved
5	COUNTERVAL_SET	Sets the counter temporarily to the value in the set value
6	RES_SET	Resets bits STS_CMP, STS_END, STS_OFLW, STS_UFLW and STS_ZP with a rising edge
7	-	Reserved
8	-	Reserved
9	CTRL_COMP_RESET	Inhibits comparison bit
10	SW_GATE_RESET	Resets the software gate
11	-	Reserved
12		
13		
14		
15		

EPM-S602 status word		
Bit	**Designation**	**Function**
0	STS_SYNC	Reset was active
1	STS_CTRL_COMP	Is set if the comparison bit is enabled
2	STS_SW-GATE	Software gate status (set if SW gate active)
3	STS_RST	Status of reset input
4	-	Reserved
5	STS_GATE	Status of internal gate (set if internal gate active)
6	STS_COMP	Status of comparison bit
7	STS_C_DN	Status set for counter direction backwards
8	STS_C_UP	Status set for counter direction forwards
9	STS_CMP*	Comparator status is set if the comparison condition is met. If the comparison is deactivated (counter mode byte 1 = 000_b), the bit has no function.
10	STS_END*	Status set if final value was reached
11	STS_OFLW*	Status set in the case of overflow
12	STS_UFLW*	Status set in the case of underflow
13	STS_ZP*	Status set in the case of zero crossing
14	-	Reserved
15	-	Reserved

* The bits are set until reset with RES_SET (bit 6 control word)

EPM-S602 control word		
Bit	**Name**	**Function**
0	CTRL_SYNC_SET	Activation/deactivation of the counting signal: TRUE=>FALSE edge: The input for the counting signal is deactivated and the current counter content is reset to 0. FALSE=>TRUE edge: The input for the counting signal is activated.
1	CTRL_COMP_SET	Enables the comparison bit
2	SW_GATE_SET	Sets the software gate
3	-	Reserved
4	-	Reserved
5	COUNTERVAL_SET	Sets the counter temporarily to the value in the set value
6	RES_SET	Resets bits STS_CMP, STS_END, STS_OFLW, STS_UFLW and STS_ZP with a rising edge
7	-	Reserved
8	CTRL_SYNC_RESET	Activation/deactivation of the zero track evaluation: TRUE=>FALSE edge: The zero track evaluation is activated. FALSE=>TRUE edge: The zero track evaluation is stopped. The counter keeps counting irrespective of the zero pulse. Bit 0 (CTRL_SYNC_SET) must be set to TRUE for this purpose.
9	CTRL_COMP_RESET	Inhibits the comparison bit
10	SW_GATE_RESET	Resets the software gate
11	-	Reserved
12		
13		
14		
15		

EPM-S603 status word		
Bit	**Designation**	**Function**
0	-	Reserved
1	-	Reserved
2	STS_SW-GATE	Software gate status (set if SW gate active)
3	-	Reserved
4	-	Reserved
5	STS_GATE	Status of internal gate (set if internal gate active)
6	-	Reserved
7	STS_C_DN	Status set for counter direction backwards
8	STS_C_UP	Status set for counter direction forwards
9	-	Reserved
10	-	Reserved
11	STS_OFLW*	Status set in the case of overflow
12	STS_UFLW*	Status set in the case of underflow
13	STS_ZP*	Status set in the case of zero crossing
14	-	Reserved
15	-	Reserved

* The bits are set until reset with RES_SET (bit 6 control word)

EPM-S603 control word		
Bit	**Designation**	**Function**
0	-	Reserved
1	-	Reserved
2	SW_GATE_SET	Sets the software gate
3	-	Reserved
4	-	Reserved
5	-	Reserved
6	RES_SET	Resets bits STS_CMP, STS_END, STS_OFLW, STS_UFLW and STS_ZP with a rising edge
7	-	Reserved
8	-	Reserved
9	-	Reserved
10	SW_GATE_RESET	Resets the software gate
11	-	Reserved
12		
13		
14		
15		

3.10 I/O compound modules - encoder evaluation

3.10.1 SSI - EPM-S604

The module is an SSI interface for direct connection to an SSI encoder.

During the parameterisation you can adapt the module to the corresponding SSI encoder.

Features

- 1xSSI for absolute value encoders with 8 ... 32 bits
- Connection via differential signal (RS422)
- Clock output for master operating mode
- Clock input for monitoring operation
- Integrated converter for Gray/Dual
- Cyclic encoder value measurement
- Scaling of the encoder value, i. e. subsequent bits are removed

Overview

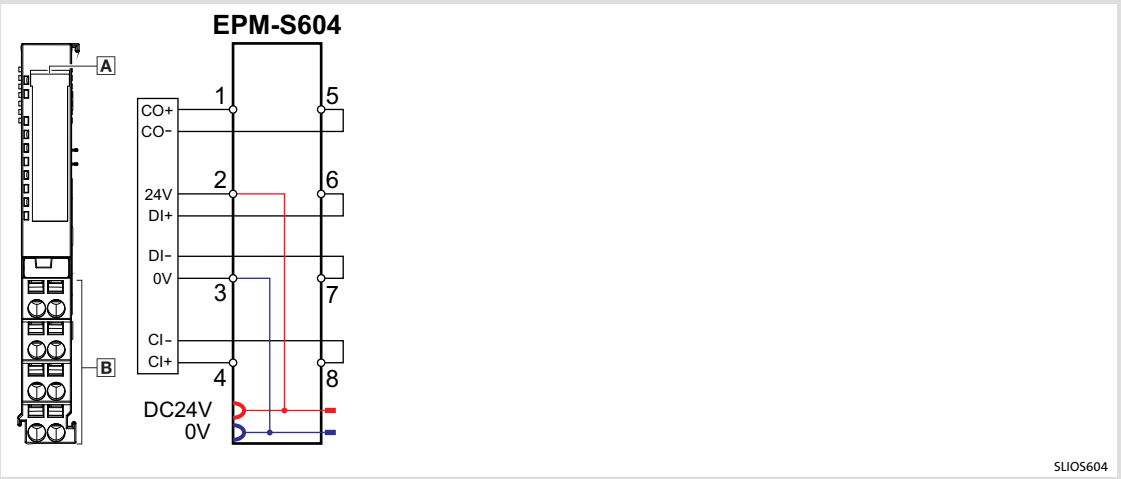
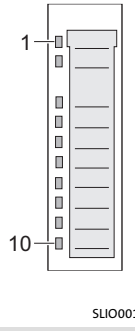


Fig. 3-86 Elements and circuit diagram

A Displays for module status
B Terminals
1 ... 8 Connection number

Status displays

Module status LEDs A

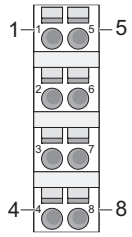
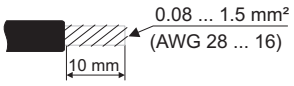
View	Pos.	Designation	Colour	Explanation
	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	CO	Green	Clock OUT activity
	4	DI		Data IN activity
	5	CI		Clock IN activity
	6	-	-	Not assigned
	7			
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
	1	Digital output ”Clock OUT+” Differential output for Clock OUT	
	2	DC 24 V for encoder	
	3	GND	
	4	Digital input ”Clock IN+” Differential input for Clock IN	
	5	Digital output ”Clock OUT-” Differential output for Clock OUT	
	6	Digital input ”Data IN+” Differential input for Data IN	
	7	Digital input ”Data IN-” Differential input for Data IN	
	8	Digital input ”Clock IN-” Differential input for Clock IN	

Technical data

EPM-S604: rated data	
Module identifier	2497_{dec}
Current consumption/power loss	
Current consumption from backplane bus	70 mA
Power loss	1 W
SSI	
Number of terminals for SSI encoders	1
Physics	RS422
Encoder	
Supply voltage	DC 24 V
Bit length	8 ... 32 bits
Cycle	125 kHz ... 2 MHz
Operating modes	Master mode, monitoring operation
Coding	Binary, gray
Scaling	Yes, parameterisable
Output data size	6 bytes
Status, alarm, diagnostics	
Status display	Yes
Alarms	Yes, parameterisable
Process alarm	No
Diagnostic alarm	Yes, parameterisable
Diagnostic function	Yes, parameterisable
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	None
Electrical isolation	
Between the channels and the backplane bus	Yes
Insulation checked with	DC 500 V

Operating modes

In the **"Master mode"**the module is directly connected to an SSI encoder and also supplies it. For reading out the encoder, the module provides a cycle to the encoder and presents the received data current in the process image.

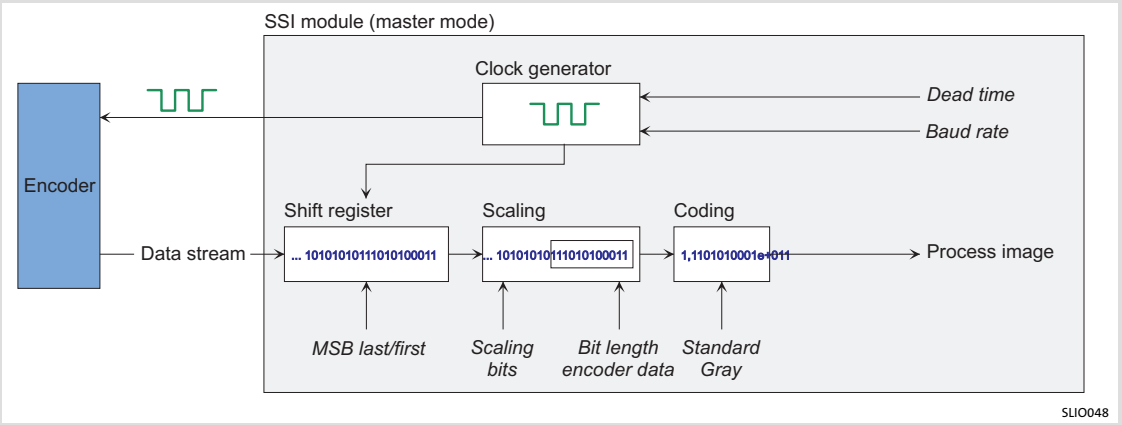


Fig. 3-87 "Master mode" block diagram

In **"Monitoring operation"**the monitoring module is operated on an SSI encoder passively to the master module. During this operating mode the SSI encoder has to be supplied via the master module. During operation, the module monitors the signals of the SSI telegram and provides the data flow in the process image. In this case again, the module has to be adapted to the corresponding encoder via parameterisation. The "Baud rate" parameter is irrelevant.

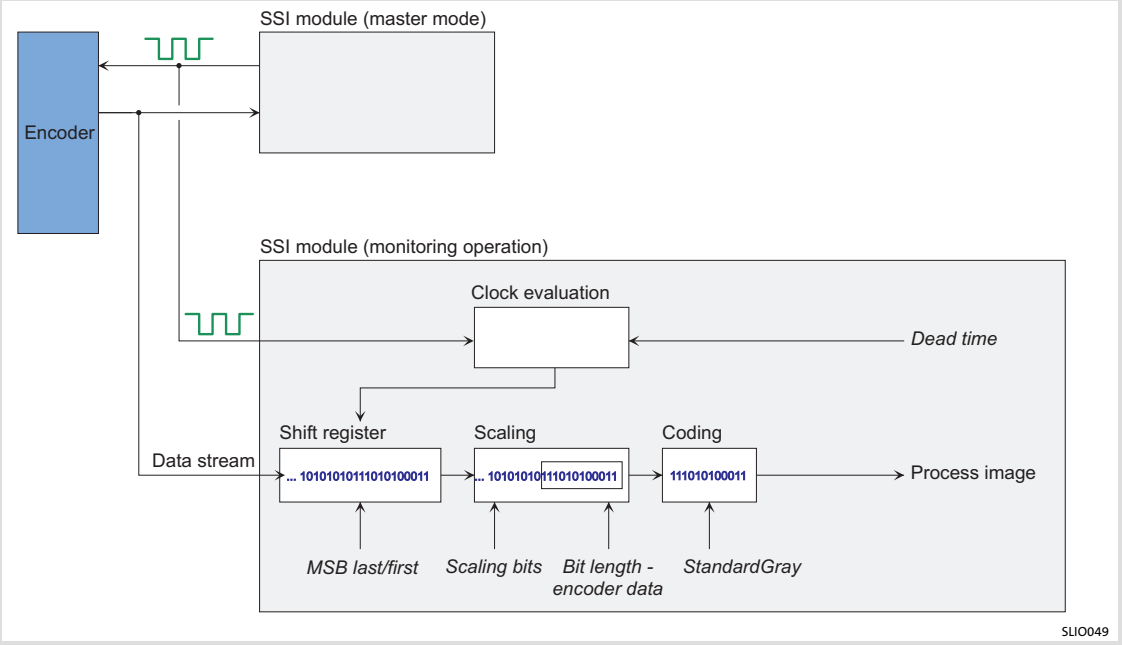


Fig. 3-88 "Monitoring operation" block diagram

3.11 I/O compound modules - pulse width modulation (PWM)

3.11.1 2 digital outputs with PWM functionality - EPM-S620

This module has two output channels with PWM functionality (**P**ulse**W**idth**M**odulation).

By specifying time parameters, you can forward a pulse train to the desired output with the mark-to-space ratio you want.

Features

- 2 PWM outputs, can be switched between ”push/pull” and ”highside”
  - Push/pull mode should be used if you need defined high/low levels for a rapid change. This is used with a low load especially if ”highside” mode cannot move the output to low fast enough during a low status. With push/pull, the output is switched to ground with low active and to voltage with high active.
  - In highside mode, the output switched to low remains in a state of uncertainty between ground and voltage. The load has to ”pull” itself to ground. In highside mode, the switch is only made to high level active.
- Variable period and scanning ratio
- LEDs show the switching states of the digital outputs

Overview

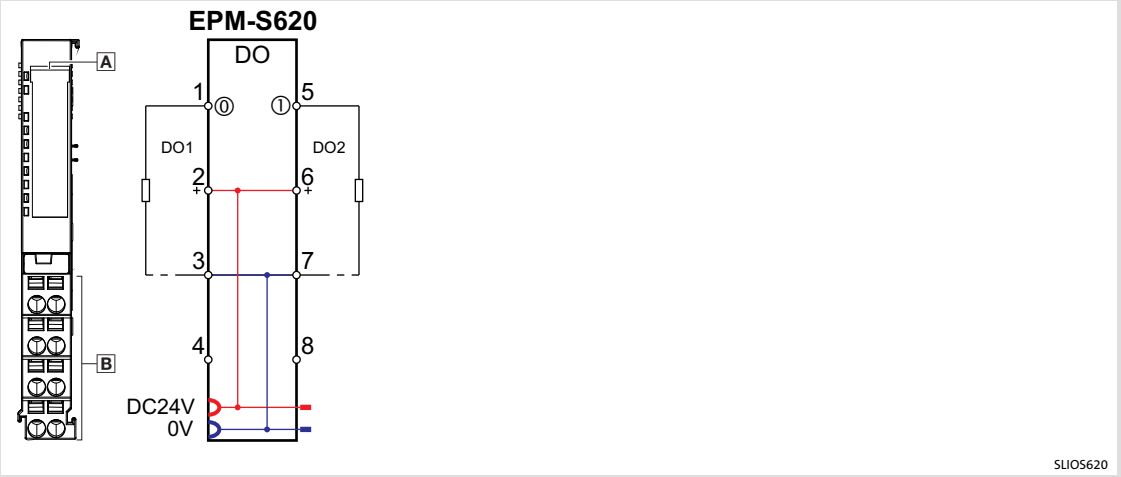
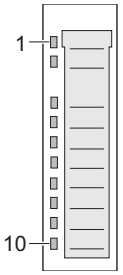


Fig. 3-89 Elements and circuit diagram

A	Displays for module status
B	Terminals
1 ... 8	Connection number
⓪ ... ⑦	Bit number in bit presentation

Status displays

Module status LEDs A

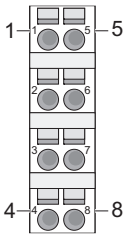
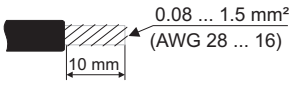
View	Pos.	Designation	Colour	Explanation
	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error and error at overload, short circuit, overtemperature (see table below)
	3	DO1	Green	On: Digital output triggered
	4	DO2		
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
	1	Digital output DO1	
	2	24 V DC	
	3	GND	
	4	Not assigned	
	5	Digital output DO2	
	6	24 V DC	
	7	GND	
	8	Not assigned	

Technical data

EPM-S620: Rated data	
Module identifier	2305_{dec}
Current consumption/power loss	
Current consumption from backplane bus	85 mA
Power loss	0.95 W
Digital outputs	
Number of outputs	2
Cable length	
shielded	1000 m
unshielded	600 m

EPM-S620: Rated data	
Load voltage	
Nominal value	DC 24 (DC 20.4 ... 28.8 V)
Current consumption from load voltage L+	15 mA (without load)
Total current	
for each group, horizontal structure, 40°C	1 A
for each group, horizontal structure, 60°C	1 A
for each group, vertical structure	1 A
Output current	
for ”1” signal, nominal value	0.5 A
Output delay	
from ”0” to ”1”	Max. 100 ns
from ”1” to ”0”	Max. 100 ns
Lamp load	10 W
Parallel switching of outputs	
for redundant control	Not possible
for power increase	Not possible
Control of a digital input	Possible
Switching frequencies	
for ohmic loads	max. 40 kHz
for inductive loads	max. 40 kHz
for lamp loads	max. 40 kHz
Limitation (internal) of the inductive breaking voltage	L+ (-52 V)
Short circuit protection of the output	Electronically; only highside
Operating threshold of the protection system	2.5 A
Input data size	4 bytes
Output data size	12 bytes
Status, alarm, diagnostics	
Status display	Green LEDs per channel
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	No
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	None
Electrical isolation	
Between the channels and the backplane bus	Yes
Insulation checked with	DC 500 V

Functional principle

Both electronic module outputs are supported by the PWM function (pulse width modulation). Specifying the time parameters produces a pulse train with the desired pulse/pause ratio.

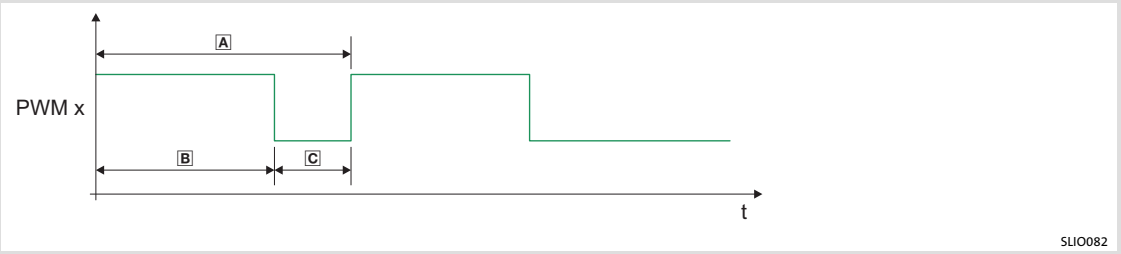


Fig. 3-90 Pulse/pause ratio for output signal

PWM x	Signal level of digital output, PWM 1 or PWM 2
A	Period
B	Pulse duration
C	Break duration

The pulse pause is obtained by setting parameters for period and pulse duration. The settings determine the pulse/pause ratio.

3.11.2 Control and status word

EPM-S620 status word		
Bit	**Designation**	**Function**
0	–	Reserved
1	Status of PWM	0: PWM output stopped 1: PWM output active
2	Output status	0: push/pull output 1: highside output
3 ... 15	–	Reserved

EPM-S620 control word		
Bit	**Designation**	**Function**
0 ... 1	–	Reserved
2	PWM response	• 0: push/pull output Push/pull mode should be used if you need defined high/low levels for a rapid change. This is used with a low load especially if ”highside” mode cannot move the output to low fast enough during a low status. With push/pull, the output is switched to ground with low active and to voltage with high active. • 1: highside output In highside mode, the output switched to low remains in a state of uncertainty between ground and voltage. The load has to ”pull” itself to ground. In highside mode, the switch is only made to high level active.
3 ... 7	Output status	Reserved
8	Start PWM output	0-1 edge: PWM output starts
9	Stop PWM output	0-1 edge: PWM output stops
10 ... 15	–	Reserved

3.12 I/O compound modules - communication

3.12.1 RS232 interface - EPM-S640

Note!

This module can only be actuated on a bus coupler module with HW version 1D or higher.

This module features an RS232 interface for access to field devices with an RS232 interface. For access to devices with an RS232 interface, the protocol of the field device must be implemented in the control in each case.

The following function blocks are provided for this purpose:

IPC / control	Programming via	Bus system	Function block
Lenze Industrial PC ● EL 1800-9800 ● CS 5800-9800 ● CPC 2800	PLC Designer V2	● CAN ● EtherCAT ● PROFIBUS	Data reception: L_IO1000_EPMS640_RS232Write Data transmission: L_IO1000_EPMS640_RS232Read
L-force Controller 3200 C	PLC Designer V3		

Further information on the subject ...

► "Serial process interfacing with I/O compound modules", see appendix.
► "Parameterisation", see in the corresponding chapter for the fieldbuses.
► "Handling blocks", see documentation for the PLC Designer.

Features

► Serial RS232 interface (isolated towards the backplane bus)
► Logic states as voltage level
► Transmission speed 150 bps ... 115.2 kbps
► Data transfer up to a distance of 15 m
► Hardware handshake (RTS/CTS)
► Protocols
  – ASCII
  – STX/ETX
  – 3964(R)
► Up to 250 frames (1024 bytes of receive or transmit buffer)
► Character delay time can be parameterised in ms grid
► Parameter setting via 17 bytes of parameter data
► Modem Signals Management DTR-DSR-DCD

Overview

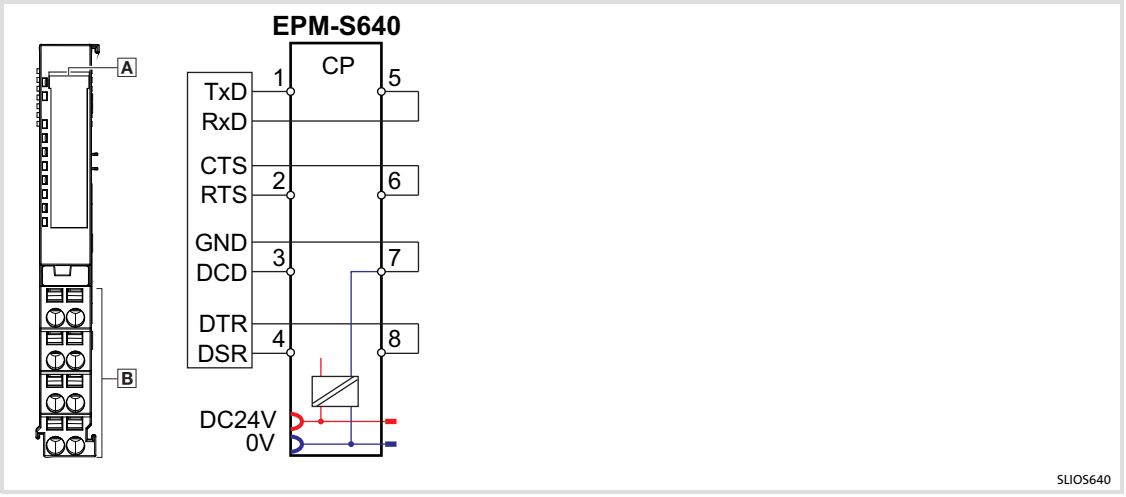
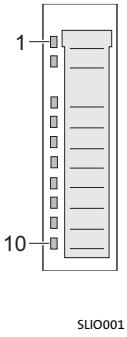


Fig. 3-91 Elements and circuit diagram

A Displays for module status
B Terminals
1...8 Connection number

Status displays

Module status LEDs A

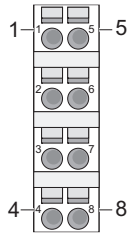
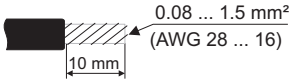
View	Pos.	Designation	Colour	Explanation
	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	TxD	Green	On: Transmit data
	4	RxD		On: Receive data
	5	IF	Red	Blinking: Line interruption, overflow, parity error, or character frame error
	6	-	-	Not assigned
	7			
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

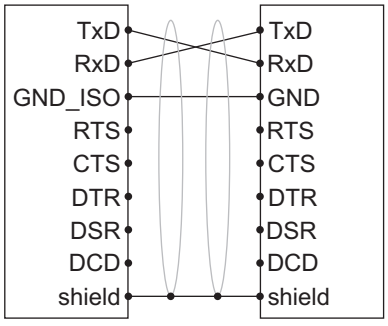
Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
 SLIO002	1	TxD output (transmit data); transmitted data	
	2	RTS output (request to send) RTS = ”1”: module ready to transmit RTS = ”0”: module is not transmitting	
	3	DCD input (Data Carrier Detect); data can be received	
	4	DSR input (Data Set Ready); modem signalises ready for operation	
	5	RxD input (receive data); received data	
	6	CTS input (clear to send); module is allowed to send data	
	7	GND_ISO (Signal Ground); zero reference point signal (isolated)	
	8	DTR output (Data Terminal Ready); module ready for operation	

Note!

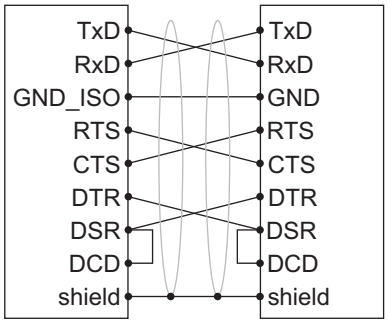
RI (Ring indicator) - modem ring is not used!

Wiring



SLIO640a

Fig. 3-92 Without hardware handshake



SLIO640b

Fig. 3-93 With hardware handshake

Technical data

Rated data EPM-S640	
Module identifier	3585_{dec}
Current consumption/power loss	
Current consumption from backplane bus	100 mA
Current consumption from load voltage L+	10 mA (without load)
Power loss	1 W
Status, alarm, diagnostics	
Status display	Yes
Alarms	Yes, parameterisable
Process alarm	No
Diagnostic alarm	Yes, parameterisable
Diagnostic function	Yes, parameterisable
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	Red LED
Communication	
Interface	RS232
Electrical isolation	To the backplane bus
PtP communication	Yes
Transmission speed	150 bps ... 115.2 kbps
Cable length, max.	15 m
Input data for bus coupler module	
EPM-S110	8 bytes
EPM-S120	8/20/60 bytes (selectable)
EPM-S140	20/60 bytes (selectable)
EPM-S130, EPM-S150, EPM-S160	60 bytes
Output data for bus coupler module	
EPM-S110	8 bytes
EPM-S120	8/20/60 bytes (selectable)
EPM-S140	20/60 bytes (selectable)
EPM-S130, EPM-S150, EPM-S160	60 bytes

Rated data EPM-S640	
Point-to-point protocols	
ASCII	
Telegram length, max.	1024 bytes
Character delay time	0 ... 65535 in ms steps (0 = 3-fold character time)
Flow control	None, hardware, XON/XOFF
Number of frames to be buffered, max.	250
Recognition of the end of a frame	after the character delay time has elapsed
STX/ETX	
Telegram length, max.	1024 bytes
Character delay time TMO	0 ... 65535 in ms steps (0 = 3-fold character time)
Flow control	None, hardware, XON/XOFF
Number of frames to be buffered, max.	250
Recognition of the end of a frame	by parameterised final character
Number of initial characters	0 ... 2 (characters can be parameterised)
Number of final characters	0 ... 2 (characters can be parameterised)
3964, 3964R	
Telegram length, max.	1024 bytes
Block check times	Only 3964R
Priority	LOW/HIGH
Character delay time	0 ... 255 in 20 ms steps (0 = 3-fold character time)
Character delay time acknowledgement time	0 ... 255 in 20 ms steps (0 = 3-fold character time)
Number of establishment tests	0 ... 255
Number of transmission tests	1 ... 255

3.12.2 RS422/RS485 interface - EPM-S650

This module can be used to communicate with field devices via an RS422 or RS485 interface. For access to devices with an RS422/RS485 interface, the protocol of the field device must be implemented in the control system in each case.

The following function blocks are provided for this purpose:

IPC / control	Programming via	Bus system	Function block
Lenze Industrial PC ● EL 1800-9800 ● CS 5800-9800 ● CPC 2800	PLC Designer V2	● CAN ● EtherCAT ● PROFIBUS	Data reception: L_IO1000_EPMS640_RS232Write Data transmission: L_IO1000_EPMS640_RS232Read
L-force Controller 3200 C	PLC Designer V3		

Further information on the subject ...

► "Serial process interfacing with I/O compound modules", see appendix.

► "Parameterisation", see in the corresponding chapter for the fieldbuses.

► "Handling blocks", see documentation for the PLC Designer.

Features

► Serial RS422/RS485 interface (isolated from the backplane bus)

► Transmission speed 150 bps ... 115.2 kbps

► Protocols
  – ASCII
  – STX/ETX
  – 3964(R)

► Up to 250 frames (1024 bytes of receive or transmit buffer)

► Character delay time can be parameterised in ms grid

► Parameter setting via 19 bytes of parameter data

Note!

More information can be found in the "Communication" chapter.

Overview

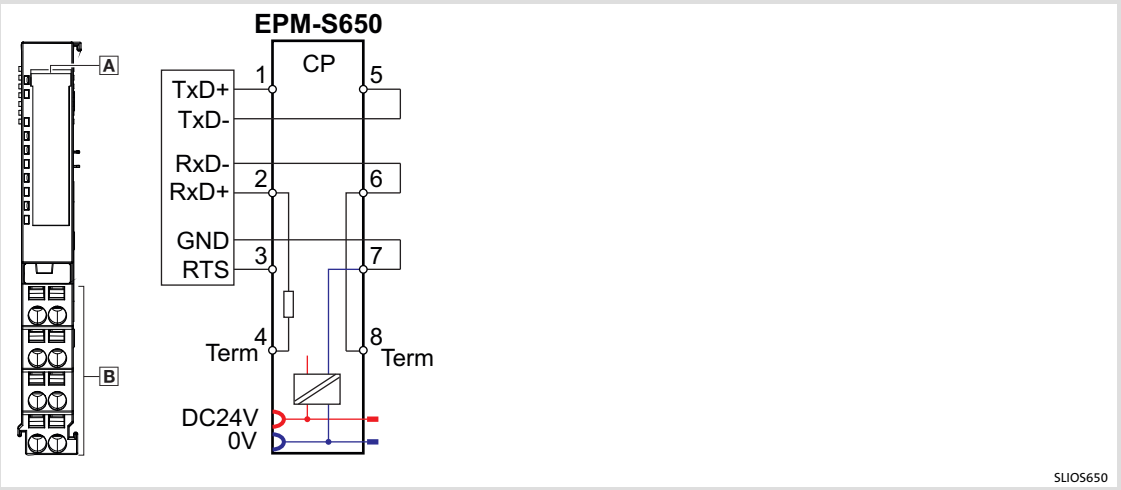
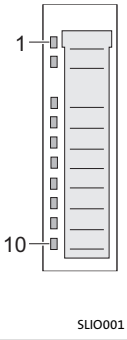


Fig. 3-94 Elements and circuit diagram

A Displays for module status
B Terminals
1...8 Connection number

Status displays

Module status LEDs A

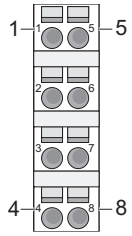
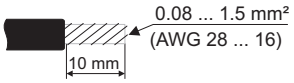
View	Pos.	Designation	Colour	Explanation
	1	RUN	Green	On: Module is ready for operation
	2	MF	Red	On: Module error (see table below)
	3	TxD	Green	On: Transmit data
	4	RxD		On: Receive data
	5	IF	Red	Blinking: Line interruption, overflow, parity error, or character frame error
	6	-	-	Not assigned
	7			
	8			
	9			
	10			

Messages of the status LEDs RUN and MF

RUN	MF	Meaning
On	Off	Module status OK Bus communication is OK
On	On	Module reports error Bus communication is OK
Off	On	Module reports error Bus communication not possible
Off	Off	Error in the bus supply voltage
Blinking	Blinking	Configuration error (📖 274)

Terminals

Module terminals, spring terminals B

View	Designation	Explanation	Terminal data
 SLIO002	1	TxD-P (B) output (transmit data); transmitted data RS422	
	2	RxD-P (B) input; received data RS422 TxD/RxD-P (B) output/input; transmitted/received data RS485	
	3	RTS output (request to send) RS485 RTS = ”1”: module ready to transmit RTS = ”0”: module is not transmitting	
	4	TERM; terminating resistor A bridge between the two TERM connections activates a terminating resistor of 120 Ωbetween terminal 2 and 6 on the receiver side.	
	5	TxD-N (A) output (transmit data); transmitted data RS422	
	6	RxD-N (A) input; received data RS422 TxD/RxD-N (A) output/input; transmitted/received data RS485	
	7	GND_ISO Signal Ground; Signal zero reference point (isolated)	
	8	TERM; terminating resistor	

Wiring

- Logic states as a voltage difference between 2 twisted cores
- Serial bus connection
  - Full duplex (RS422 four-wire operation)
  - Half duplex (RS485 two-wire operation)
- Cable length: 250 m for 115.2 kbps ... 1200 m for 19.2 kbps
- Data transfer rate: Max. 115.2 kbps

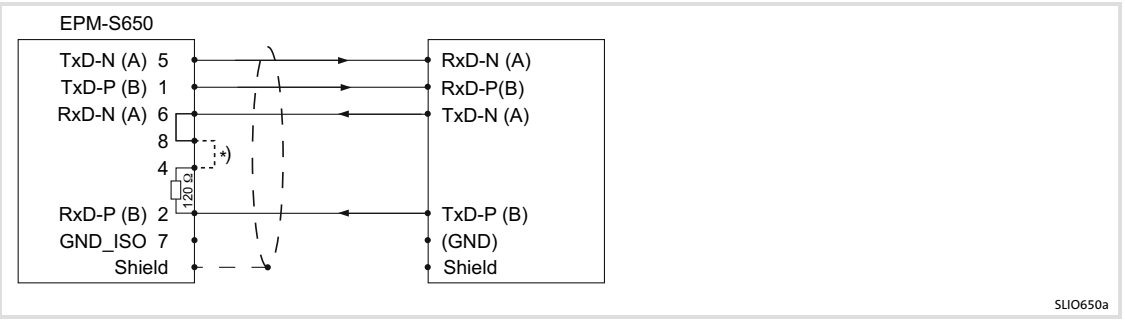


Fig. 3-95 RS422 wiring

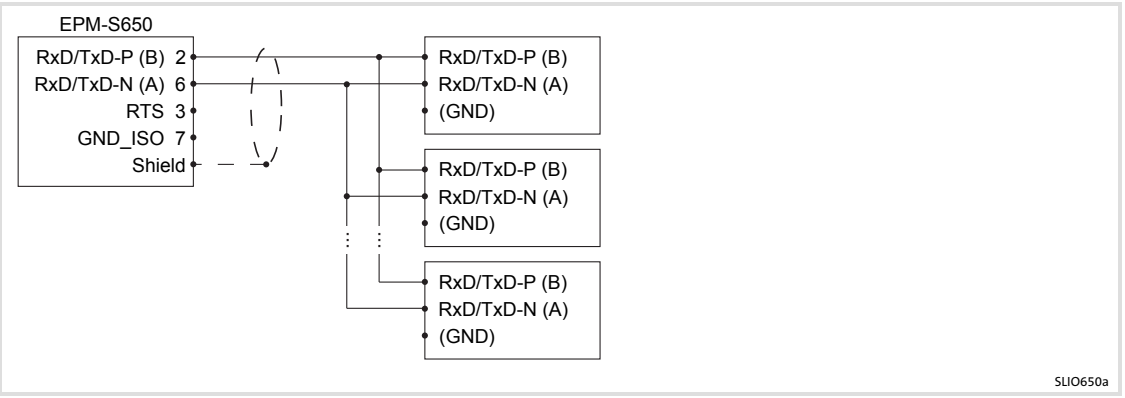


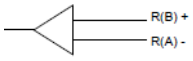
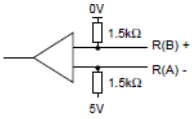
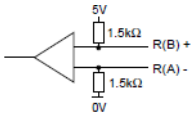
Fig. 3-96 RS485 wiring

*) A bridge between pin 8 and 4 in the EPM-S650 activates a 120 Ω terminating resistor between RxD-P (pin 2) and RxD-N (pin 6).

Parameterisable idle level:

For a connection with minimum reflections and the open circuit detection in RS422/485 operation, the cables can be pre-assigned via parameters with a defined idle level.

The receiver is connected as follows:

Parameter	Description	Receiver connection
None	No pre-assignment of the receive path. This setting is only advisable for special drivers that are provided with a bus capability.	
Signal R(A) 5 V (open circuit detection) Signal R(B) 0 V	If this pre-assignment is set, open circuit detection is possible in full duplex operation (RS422).	
Signal R(A) 0 V Signal R(B) 5 V	This pre-assignment corresponds to the idle state (no transmitter active) in half duplex operation under RS485. Open circuit detection is not possible.	

Technical data

EPM-S650: Rated data	
Module identifier	2625_{dec}
Current consumption/power loss	
Current consumption from backplane bus	100 mA
Current consumption from load voltage L+	10 mA (without load)
Power loss	1 W
Status, alarm, diagnostics	
Status display	Yes
Alarms	Yes, parameterisable
Process alarm	No
Diagnostic alarm	Yes, parameterisable
Diagnostic function	Yes, parameterisable
Diagnostic information can be read out	Possible
Module status	Green LED
Module error display	Red LED
Channel error display	Red LED
Communication	
Interface	RS422 and RS485
Electrical isolation	To the backplane bus
PtP communication	Yes
20 mA / TTY	No
Transmission speed	150 bps ... 115.2 kbps
Cable length, max.	1200 m

EPM-S650: Rated data	
Point-to-point protocols	
ASCII	
Telegram length, max.	1024 bytes
Character delay time	0 ... 65535 in ms steps (0 = 3-fold character time)
Flow control	None, hardware, XON/XOFF
Number of frames to be buffered, max.	250
Recognition of the end of a frame	after the character delay time has elapsed
STX/ETX	
Telegram length, max.	1024 bytes
Character delay time TMO	0 ... 65535 in ms steps (0 = 3-fold character time)
Flow control	None, hardware, XON/XOFF
Number of frames to be buffered, max.	250
Recognition of the end of a frame	by parameterised final character
Number of initial characters	0 ... 2 (characters can be parameterised)
Number of final characters	0 ... 2 (characters can be parameterised)
3964, 3964R	
Telegram length, max.	1024 bytes
Block check times	Only 3964R
Priority	LOW/HIGH
Character delay time	0 ... 255 in 20 ms steps (0 = 3-fold character time)
Character delay time acknowledgement time	0 ... 255 in 20 ms steps (0 = 3-fold character time)
Number of establishment tests	0 ... 255
Number of transmission attempts	1 ... 255

3.13 Power supply modules

3.13.1 I/O supply - EPM-S701

If the bus coupler main supply does not have sufficient power to feed the I/O level, this module can be used.

Features

- Incoming supply for I/O supply
- Cable protection by monitored internal fuse

Overview

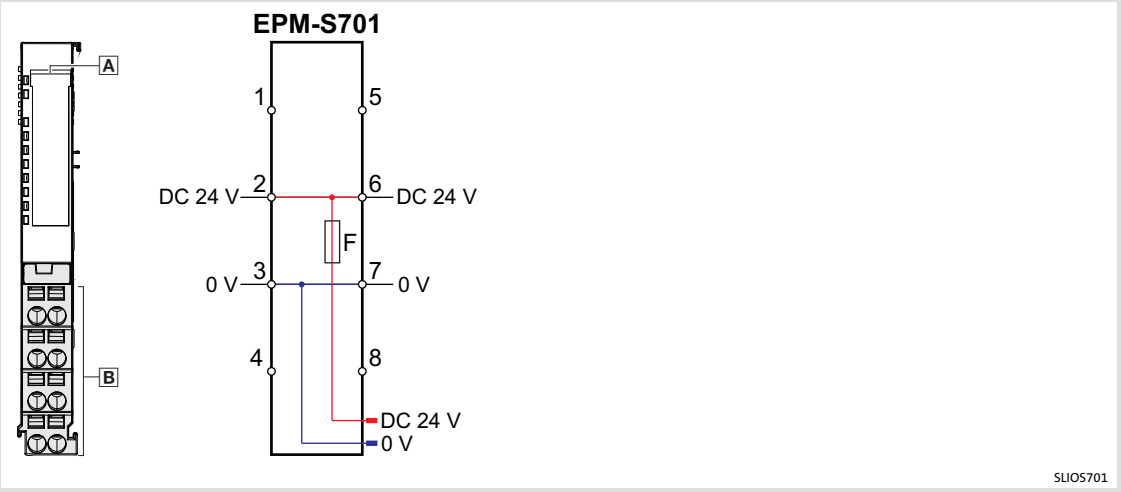
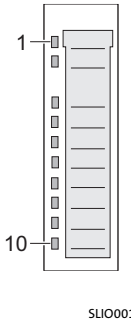


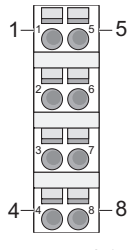
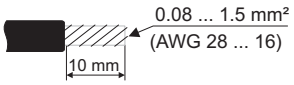
Fig. 3-97 Elements and circuit diagram

A	Displays for module status
B	Terminals
1 ... 8	Connection number

Status displays

Module status LEDs A				
View	Pos.	Designation	Colour	Explanation
	1		Green	On: 24 V for I/O supply has been applied
	2		Red	On: Fuse for I/O supply is defective
	3	-	-	Not assigned
	4			
	5			
	6			
	7			
	8			
	9			
	10			

Terminals

Module terminals, spring terminals ©			
View	Designation	Explanation	Terminal data
	1	Not assigned	
	2	I/O supply +24 V DC	
	3	I/O supply 0 V	
	4	Not assigned	
	5	Not assigned	
	6	I/O supply +24 V DC	
	7	I/O supply 0 V	
	8	Not assigned	

Note!

- ► Terminals 2 and 6 as well as 3 and 7 are bridged internally. Please note that the **max. permissible bridge current is 5 A**.
- ► Both the I/O supply and the electronic supply are protected against overload internally by a fuse. When the fuses have been tripped, the main supply of the bus coupler (EPM-S700) must be replaced (📖 776).

Technical data

EPM-S701: Rated data	
Module identifier	-
Electrical data	
Input (supply)	
Rated voltage	DC 24 V
Voltage range	DC 20.4 ... 28.8 V
Output	
I/O supply	DC 24 V, max. 7 A (if UL conformity is required, max. 10 A)
Status, alarm, diagnostics	
Status display	Yes
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	No
Diagnostic information can be read out	No
Module status display	Green LED
Module error display	Red LED

3.13.2 I/O supply and electronic supply - EPM-S702

If the bus coupler main supply does not have sufficient power to feed the I/O level and/or the electronic components, this module can be used.

Features

- Incoming supply for I/O and electronic supply
- Cable protection by monitored internal fuses

Overview

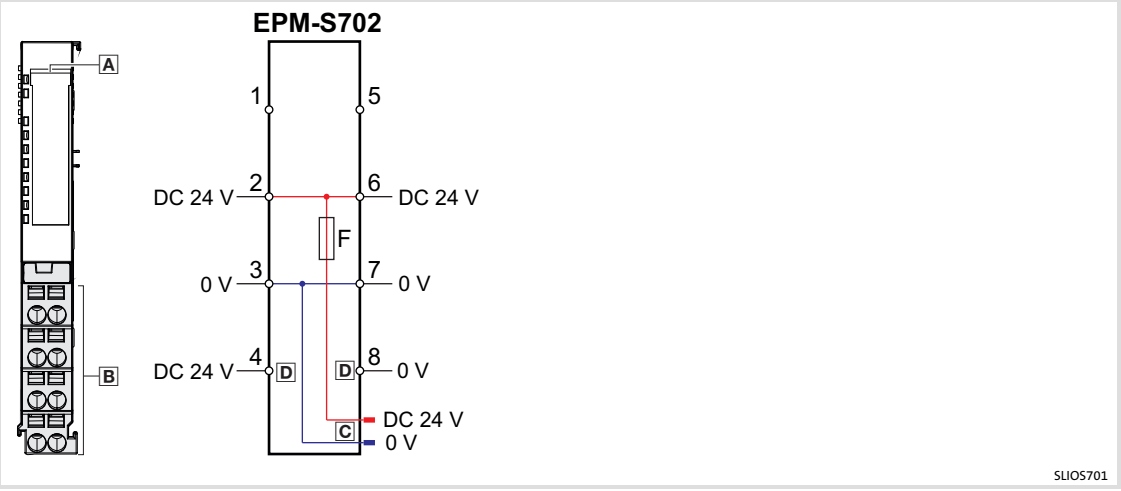
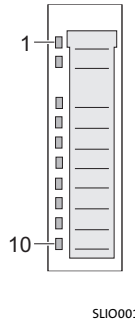


Fig. 3-98 Elements and circuit diagram

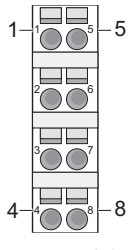
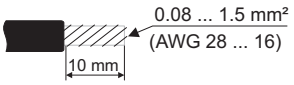
A	Displays for module status
B	Terminals
C	Power supply of the I/O level
D	Electronic supply
1...8	Connection number

Status displays

Module status LEDs A

View	Pos.	Designation	Colour	Explanation
	1		Green	On: 24 V for I/O supply has been applied
	2		Red	On: Fuse for I/O supply is defective
	3		Green	On: 24 V for electronic supply is applied
	4		Red	On: Fuse for electronic supply defective
	5	-	-	Not assigned
	6			
	7			
	8			
	9			
	10			

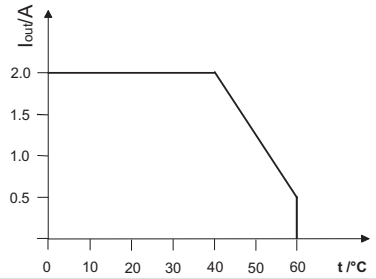
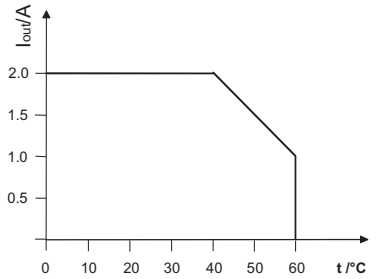
Terminals

Module terminals, spring terminals ©			
View	Designation	Explanation	Terminal data
 SLIO002	1	Not assigned	
	2	I/O supply +24 V DC	
	3	I/O supply 0 V	
	4	Electronic supply +24 V DC	
	5	Not assigned	
	6	I/O supply +24 V DC	
	7	I/O supply 0 V	
	8	Electronic supply 0 V	

Note!

- Terminals 2 and 6 as well as 3 and 7 are bridged internally. Please note that the **max. permissible bridge current is 5 A**.
- Both the I/O supply and the electronic supply are protected against overload internally by a fuse. When the fuses have been tripped, the main supply of the bus coupler (EPM-S700) must be replaced (📖 776).

Technical data

EPM-S702: Rated data	
Module identifier	-
Electrical data	
Input (supply)	
Rated voltage	DC 24 V
Voltage range	DC 20.4 ... 28.8 V
Output	
I/O supply	DC 24 V, max. 4 A
Electronic supply	DC 5 V, max. 2 A
Derating of electronic supply	
Convection	
Air circulation 0.5 m/s	
Power loss	1.4 W
Efficiency	89 %
Overvoltage protection	Up to 36 V
Polarity reversal protection	Yes
Status, alarm, diagnostics	
Status display	Yes
Alarms	No
Process alarm	No
Diagnostic alarm	No
Diagnostic function	No
Diagnostic information can be read out	None
Module status display	Green LED
Module error display	Red LED

3.14 Terminal modules

3.14.1 8 terminals 24 V - EPM-S910

The terminals of this module provide the 24 Volts of the I/O supply. The backplane bus is looped through.

Features

- 8 terminals 24 V (I/O supply)

Overview

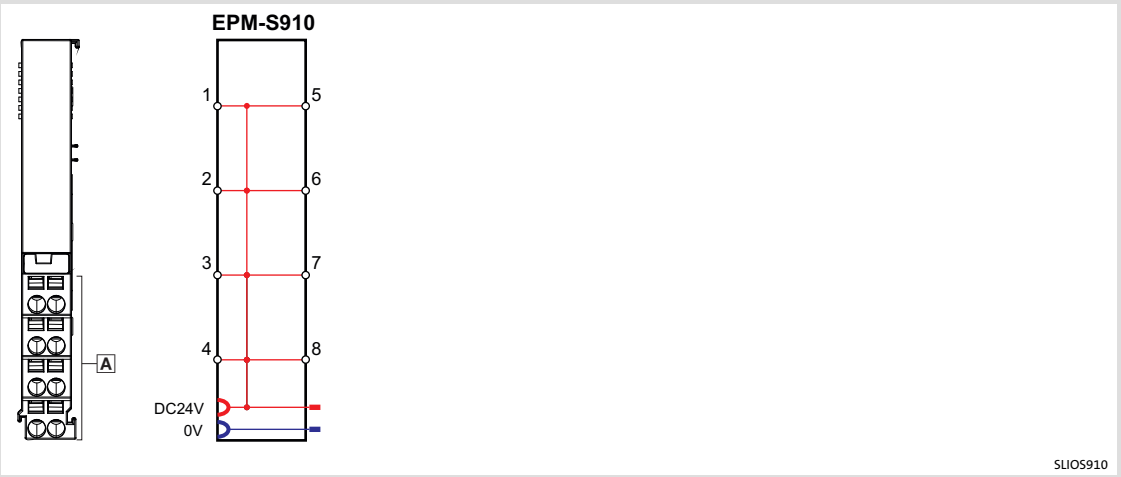
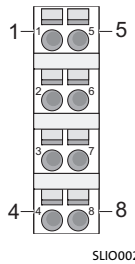
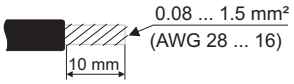


Fig. 3-99 Elements and circuit diagram

A Terminals
1...8 Connection number

Terminals

Module terminals, spring terminals A			
View	Designation	Explanation	Terminal data
	1	I/O supply +24 V DC	
	2		
	3		
	4		
	5		
	6		
	7		
	8		

Technical data

EPM-S910: Rated data	
Module identifier	-
Terminal parameters	
Terminal voltage, max.	DC 30 V
Terminal current, max.	10 A

3.14.2 8 terminals 0 V - EPM-S911

The terminals of this module provide the GND of the I/O supply. The backplane bus is looped through.

Features

- 8 terminals mass GND (I/O supply)

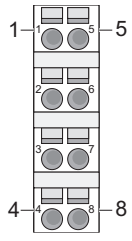
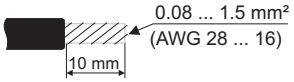
Overview



Fig. 3-100 Elements and circuit diagram

A Terminals
1...8 Connection number

Terminals

Module terminals, spring terminals A			
View	Designation	Explanation	Terminal data
	1	I/O supply 0 V	
	2		
	3		
	4		
	5		
	6		
	7		
	8		

Technical data

EPM-S911: Rated data	
Module identifier	-
Terminal parameters	
Terminal voltage, max.	0 V
Terminal current, max.	10 A

3.14.3 4/4 terminals 24 V/0 V - EPM-S912

The terminals of this module provide the 24 Volts and the GND of the I/O supply. The backplane bus is looped through.

Features

- 4 terminals 24 V (I/O supply)
- 4 terminals mass GND (I/O supply)

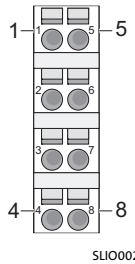
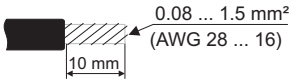
Overview



Fig. 3-101 Elements and circuit diagram

A Terminals
1...8 Connection number

Terminals

Module terminals, spring terminals A			
View	Designation	Explanation	Terminal data
	1	I/O supply +24 V DC	
	2		
	3		
	4		
	5	I/O supply 0 V	
	6		
	7		
	8		

Technical data

EPM-S912: Rated data	
Module identifier	-
Terminal parameters	
Terminal voltage, max.	DC 30 V
Terminal current, max.	10 A

4 Technical data

Note!

The technical data of the I/O system modules can be found in the individual module descriptions which are provided in the ”Product description” chapter.

General data

Conformity and approval		
Conformity		
CE	2006/95/EG	Low-Voltage Directive
Approval		
UL	UL 508	File No. E343358
Other		
RoHS	-	Products lead-free in accordance with EC Directive 2002/95/EC

Protection of persons and device protection		
Degree of protection		IP20
Electrical isolation		
To the fieldbus		Electrically isolated
To the process level		Electrically isolated
Insulation resistance	IEC 61131-2	
Insulation voltage against reference earth of the inputs/outputs		AC / DC 50V, for test voltage AC 500V
Protective measures		Against short circuit

EMC			
Noise emission	EN 61000-6-4	Class A (industrial premises)	
Noise immunity Zone B	EN 61000-6-2	Industrial premises	
		EN 61000-4-2	ESD; severity: 3, i.e. 8 kV in the case of air discharge, 4 kV in the case of contact discharge
		EN 61000-4-3	RF interference (housing) 80 MHz ... 1000 MHz, 10 V/m 80 % AM (1 kHz)
		EN 61000-4-4	Burst, severity: 3
		EN 61000-4-5	Surge, severity 3 *
		EN 61000-4-6	RF conducted 150 kHz ... 80 MHz, 10 V/m 80 % AM (1 kHz)

* Due to the high-energy single current pulses, a surge requires a suitable external connection with lightning protection elements like for instance lightning conductors and overvoltage arresters.

Operating conditions

Ambient conditions		
Climatic		
Storage	EN 60068-2-14	-25 ... +70 °C
Operation		
Horizontal installation	EN 61131-2	0 ... +60 °C
Vertical installation	EN 61131-2	0 ... +60 °C
Air humidity	EN 60068-2-30	RH1 (without condensation, relative humidity 10 ... 95 %)
Pollution	EN 61131-2	Degree of pollution: 2
Mechanical		
Vibration	EN 60068-2-6	1 G
Shock	EN 60068-2-27	15 G

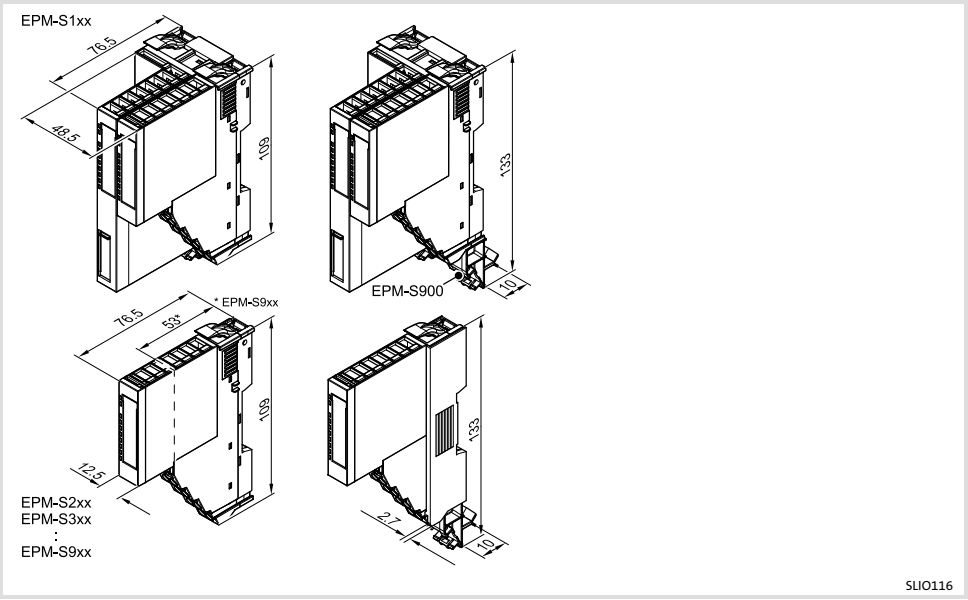
Mounting conditions		
Mounting place		In the control cabinet
Mounting position		Horizontal and vertical

5 Mechanical installation

5.1 Important notes

- The mounting location must always ensure the operating conditions mentioned in the technical data. Take additional measures if necessary.
- Always ensure permanent mechanical connections.
- The fixing rail and the mounting plate in the control cabinet must be electrically conductive and free of lacquer.
- Plug and unplug the modules only if the supply voltage has been switched off to prevent the modules of the I/O system from being damaged by short circuit.
- Always arrange the modules from the left to the right and start with the bus coupler.
- The modules must always be plugged directly next to each other. Free slots are not permissible since this would interrupt the backplane bus.
- Always use the contact cover - which is included in the scope of supply of the bus coupler module - to protect the last module's contacts to the sides. Otherwise, the modules of the I/O system may become damaged by short circuit or static discharge.

5.2 Dimensions



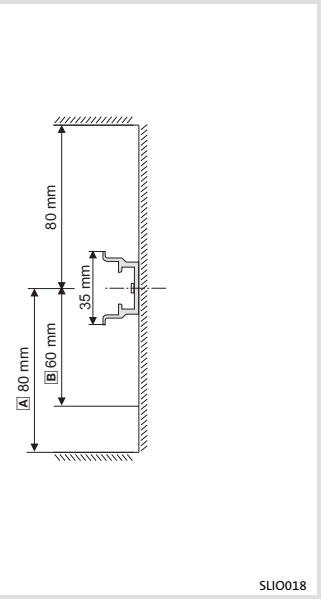


Fig. 5-1 Dimensions and mounting clearances

A Mounting clearance without shield bus

B Mounting clearance with shield bus

All dimensions in millimetres.

5.3 Mounting

5.3.1 Standard mounting

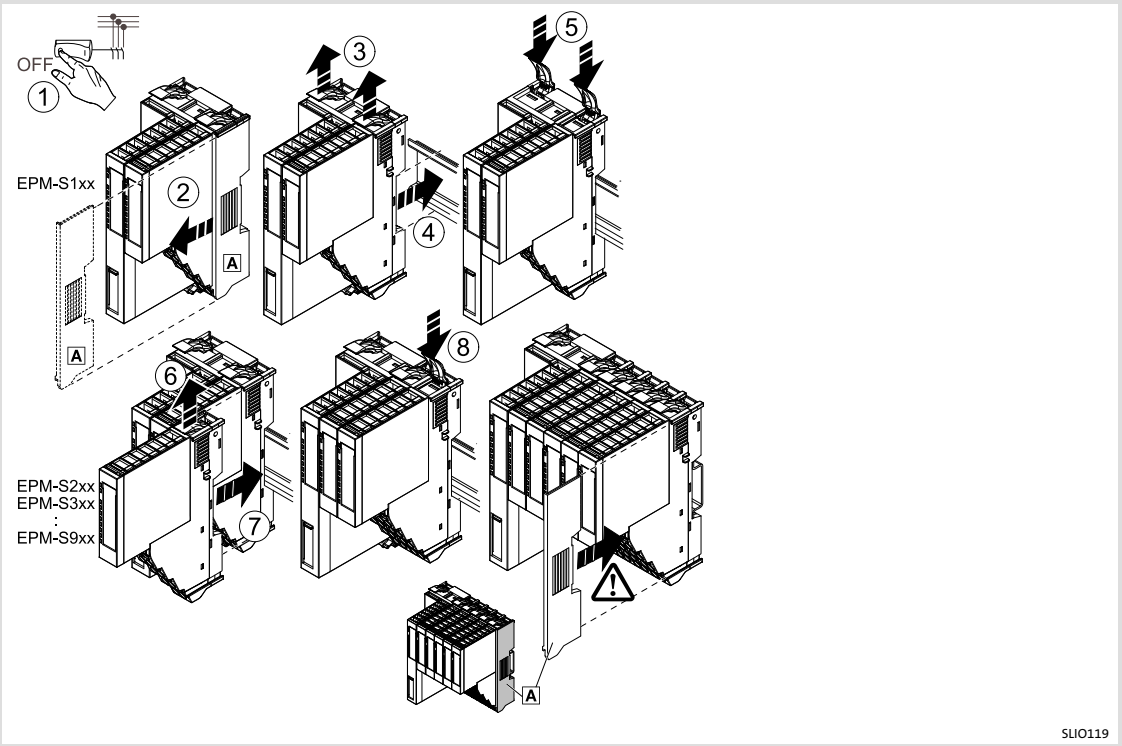


Fig. 5-2 Mounting modules

EPM-S1xx	Bus coupler module
EPM-S2xx ... EPM-S6xx	I/O compound module
EPM-S7xx	Power supply module
EPM-S9xx	Power distributor module module
A	Contact cover (included in the scope of supply of the bus coupler module)

5.3.2 Block mounting

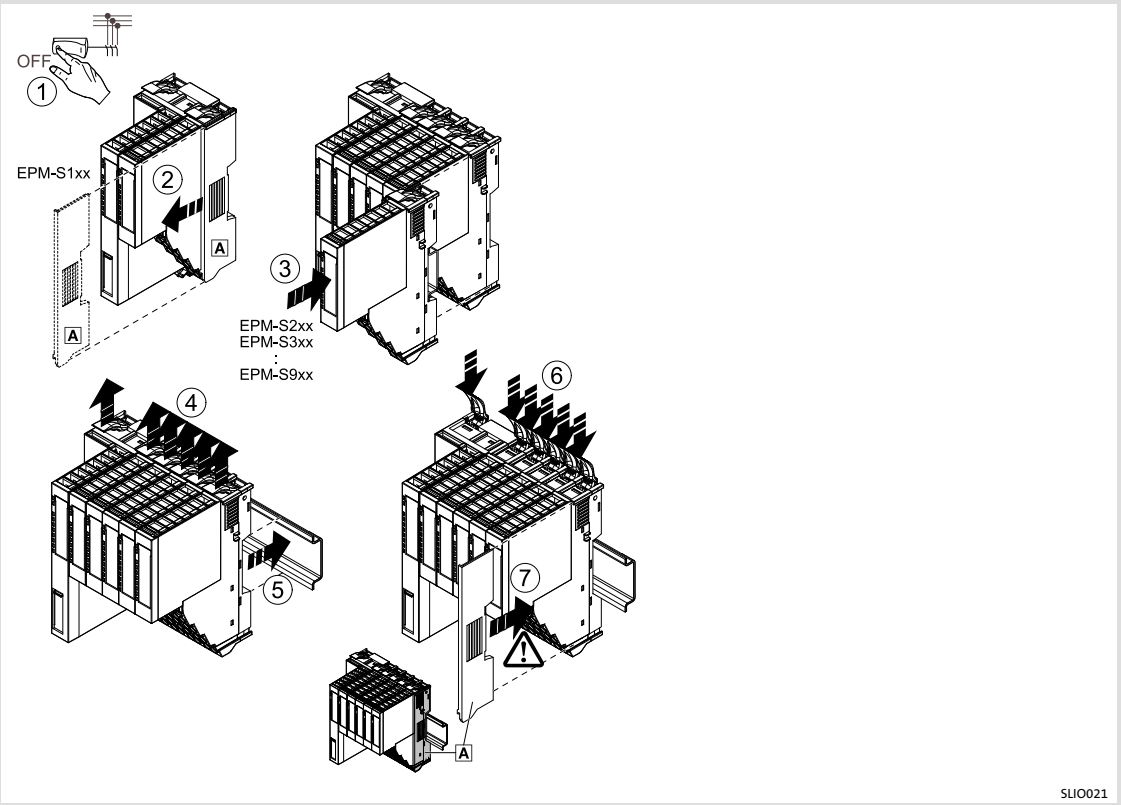


Fig. 5-3 Mounting modules in blocks

EPM-S1xx	Bus coupler module
EPM-S2xx ... EPM-S6xx	I/O compound module
EPM-S7xx	Power supply module
EPM-S9xx	Power distributor module module
A	Contact cover (included in the scope of supply of the bus coupler module)

5.3.3 Mounting the busbar for the shield connection

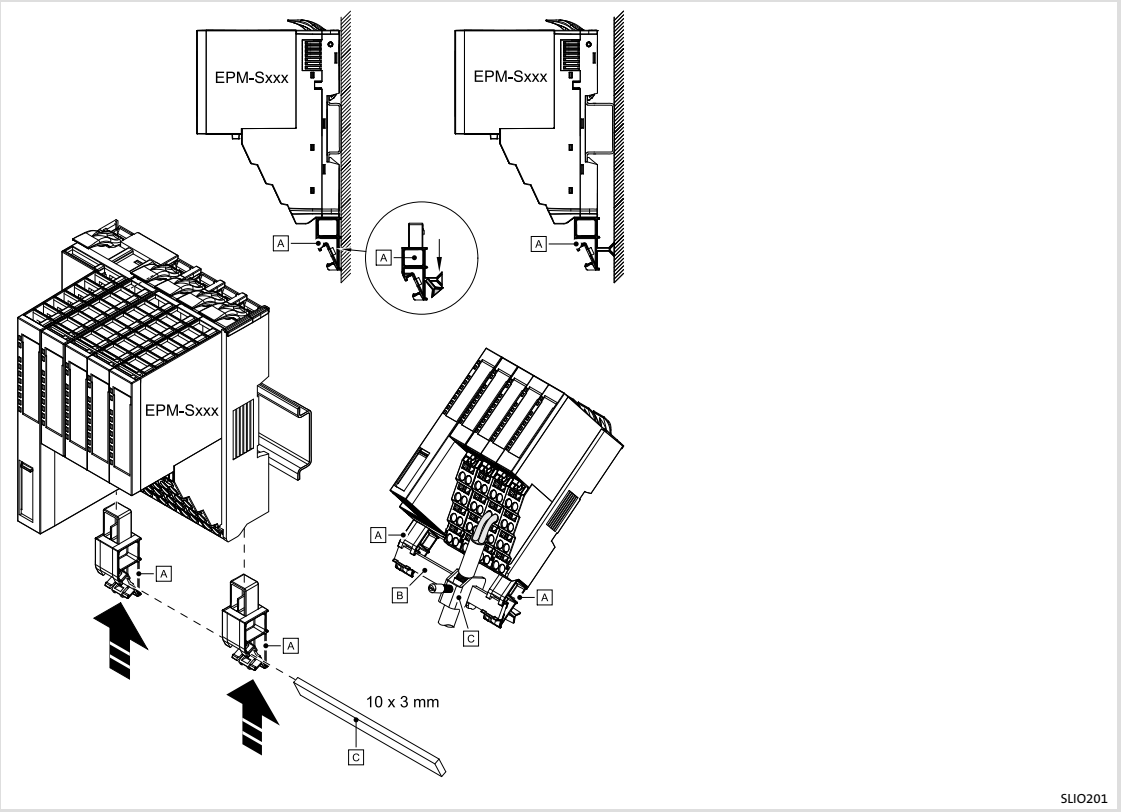


Fig. 5-4 Mounting the busbar for the shield connection

EPM-Sxxx	Bus coupler module, I/O compound module, power supply module
A	Busbar support for EPM-S900 shield connection (accessories)
B	Busbar 10 x 3 mm (available in selected stores)
C	Shield connection terminal (available in selected stores)

Insert the EPM-S900 A busbar support into the base module as shown in the illustration. Mount more supports for assistance in case of longer busbars.

5.4 Dismounting

5.4.1 Dismounting the bus coupler module, the I/O compound module, and the power supply module

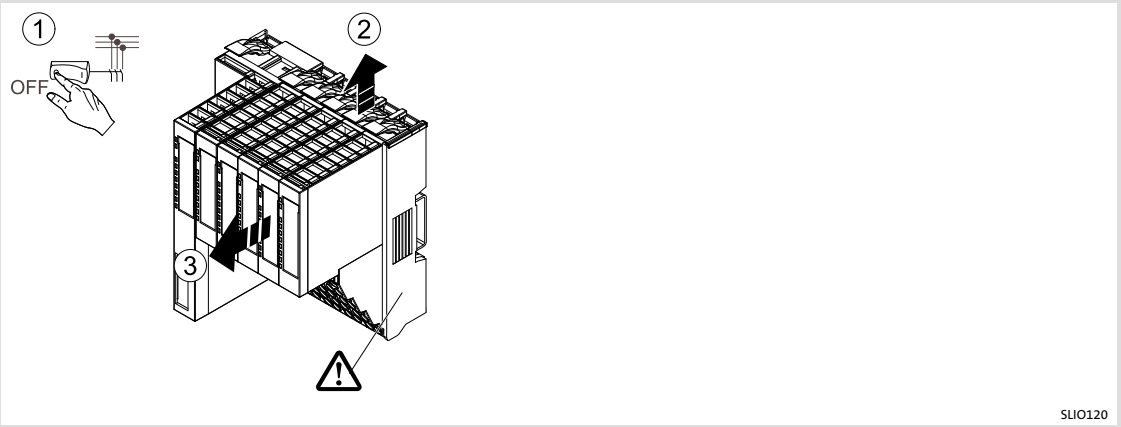


Fig. 5-5 Dismounting modules

5.4.2 Removing the bus coupler module

Note!

Before removing the bus coupler module EPM-Sxxx, the adjacent electronic module A must be pulled from its base module B.

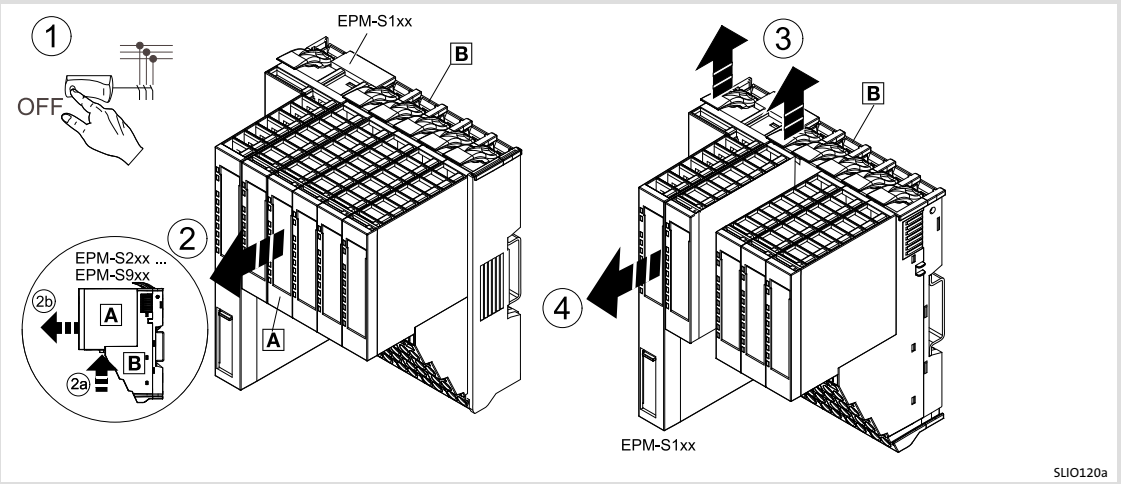


Fig. 5-6 Disassembly of bus coupler modules

6 Electrical installation

6.1 EMC-compliant wiring

General notes	● The electromagnetic compatibility of the system depends on the type of installation and care taken. Especially consider the following: – Assembly – Shielding – Earthing ● For installations differing from the one described, the evaluation of the conformity with the EMC Directive requires a check of the system regarding the EMC limit values. This for instance applies to: – Use of unshielded cables ● **The compliance with the EMC Directive is in the responsibility of the user.** – If you observe the following measures, you can assume that no EMC problems will occur during operation and that compliance with the EMC Directive and the EMC law is achieved. – If devices which do not comply with the CE requirement concerning noise immunity (EN 6100042) are operated close to the system, these devices may be electromagnetically affected by the system.
Assembly	● Provide electrical contact between the DIN rail and the earthed mounting plate: – Mounting plates with electrically conductive surfaces (zinc-coated or stainless steel) allow permanent contact. – Painted plates are not suitable for an EMC-compliant installation. ● If you use several mounting plates: – Connect as much surface of the mounting plates as possible (e.g. with copper strips). ● When laying the cables, pay attention to the separation of signal cables and mains cables. ● Lay the cables as close as possible to the reference potential. Freely suspended cables act like aerials.
Shielding	● Only use cables with braided shield if possible. ● The overlap rate of the shield should be higher than 80%. ● For data cables for serial connection, always use metal or metallised connectors. Connect the shield of the data cable to the connector shell.
Earthing	● Earth all metallically conductive components using suitable cables connected to a central earthing point (PE bar). ● Keep to the minimum cross-sections defined in the safety instructions: – For EMC not the cable cross-section is important, but the surface of the cable and the contact with a cross-section as large as possible, i.e. large surface.

6.2 Supply voltage connection

Note!

The supply inputs of the bus coupler modules (main supply) and the power supply modules are provided with internal fuses which protect them against overvoltages.

The fuse is located in the main supply of the bus coupler module and in the electronic module of the power supply module. If this fuse has tripped, the main supply or the electronic module, respectively, needs to be replaced (📖 776).

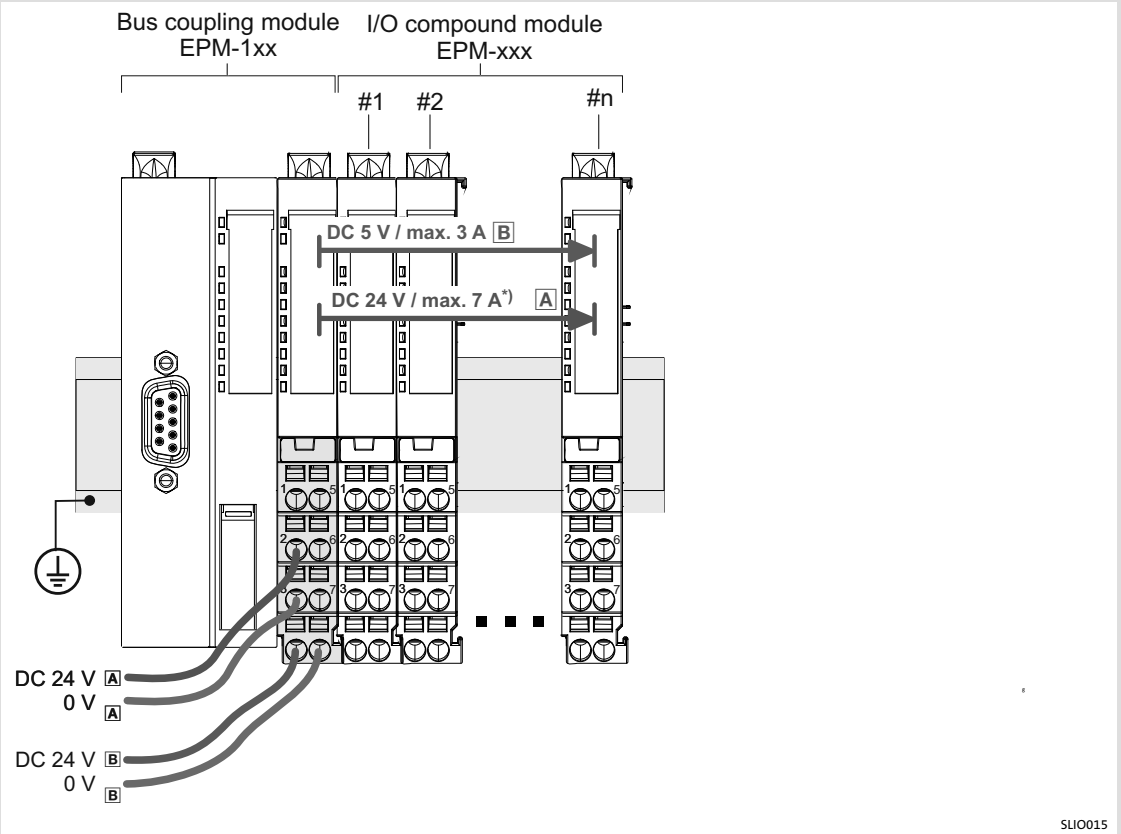


Fig. 6-1 Supply via bus coupler module (main supply)

*) If no UL conformity is required, the maximum permissible load for the I/O supply is 10 A.

A I/O supply
The I/O supply must be secured externally using a fuse that corresponds to the maximum current: fast fuse, or circuit breaker with a Z characteristic

B Electronic supply
We recommend securing the electronic supply externally according to the maximum current: fast fuse, or circuit breaker with a Z characteristic

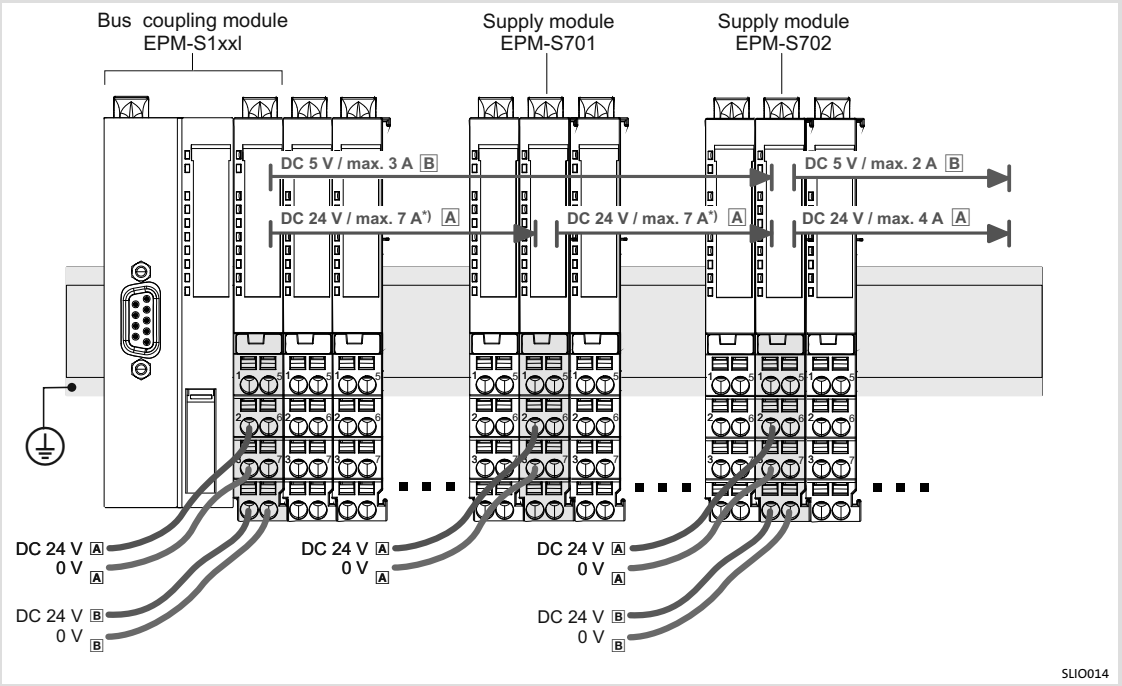


Fig. 6-2 Supply via Bus coupler module (main supply) and power supply modules

*) If no UL conformity is required, the maximum permissible load for the I/O supply is 10 A.

A I/O supply
The I/O supply must be secured externally using a fuse that corresponds to the maximum current: fast fuse, or circuit breaker with a Z characteristic

B Electronic supply
We recommend securing the electronic supply externally according to the maximum current: fast fuse, or circuit breaker with a Z characteristic

6.3 Wiring of the control connections

Note!

Information on wiring the connections of I/O compound modules can be found in the individual descriptions of the modules that are provided in the "Product description" chapter.

6.4 Connecting the shield

Information on mounting the busbar for the shield connection can be found in the "Mechanical installation" chapter (📖 268).

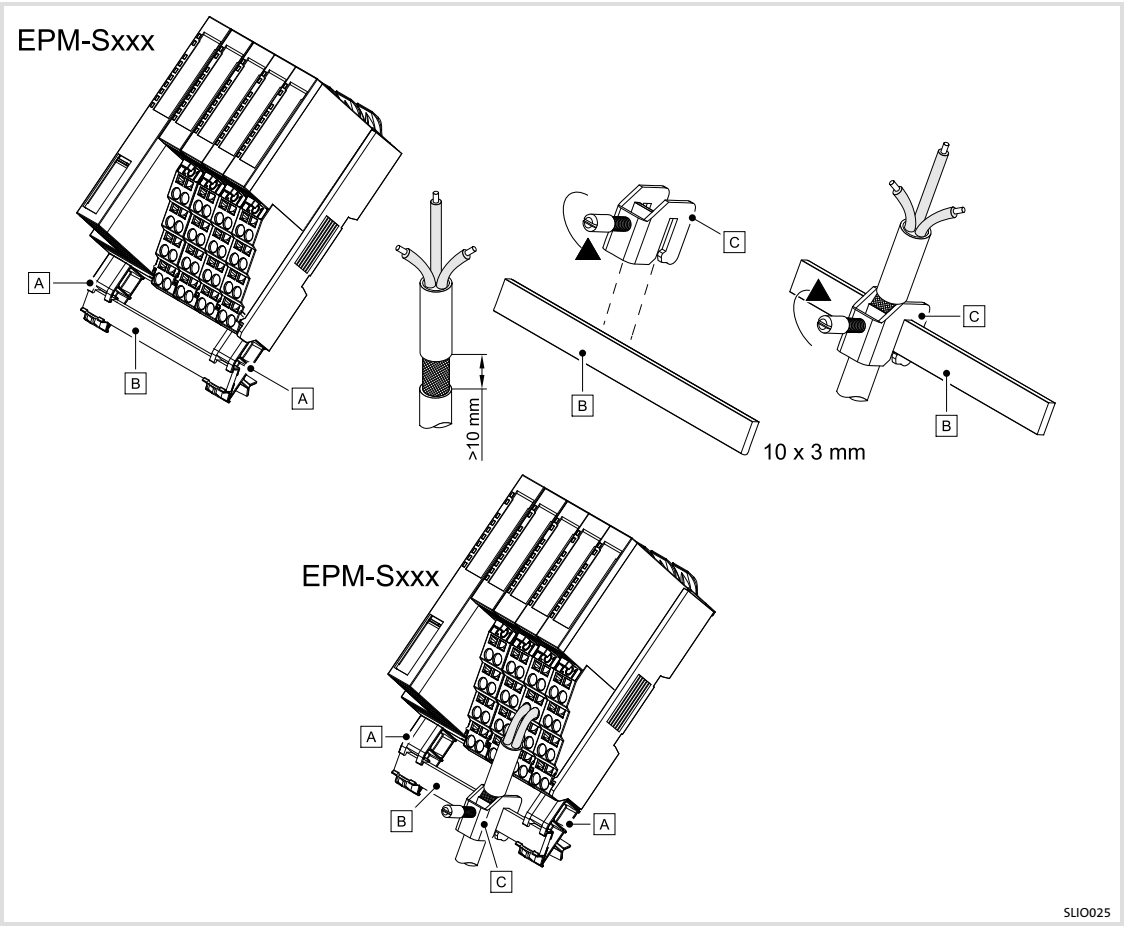


Fig. 6-3 Attaching the cable shield to the shield bus

EPM-Sxxx	Bus coupler module, I/O compound module, power supply module
A	Busbar support for EPM-S900 shield connection (accessories)
B	Busbar 10 x 3 mm (available in selected stores)
C	Shield connection terminal (available in selected stores)

7 Troubleshooting and fault elimination

7.1 Troubleshooting via RUN- and MF-LED

On the front, each module is equipped with the RUN and MF LEDs. You can use these LEDs to determine errors in your system or defective modules.

Response	Cause	Remedy
After switch-on, the RUN-LED stays off on each module, and the MF-LED is lit sporadically.	The maximum current for the electronic supply is exceeded.	Place an EPM-S702 power supply module in the position in which the total current for the electronic supply exceeds the maximum current
After switch-on, the MF-LED is blinking on one module or on several modules. The RUN-LED remains switched off.	In this position a module is plugged in, which does not comply with the module currently configured.	Coordinate the configuration and the hardware setup.
After switch-on, all RUN-LEDs up to the defective module are blinking. At all following modules, the MF LED is lit and the RUN-LED is off.	The module on the right to the blinking modules is defective.	Replace the defective module.

Note!

Further fault messages of the I/O system modules can be found in the individual module descriptions which are provided in the ”Product description” chapter.

8 CANopen communication

8.1 About CANopen

The I/O system supports the communication module CANopen.

The CANopen protocol is a standardised layer-7 protocol for the CAN bus. This layer is based on the CAN Application Layer (CAL) which was developed as a universal protocol.

However, as the practice shows, applications with CAL were too complex for the users. CANopen provides a uniform and simple structure for connecting the CAN devices of the various manufacturers.

8.1.1 Structure of the CAN data telegram

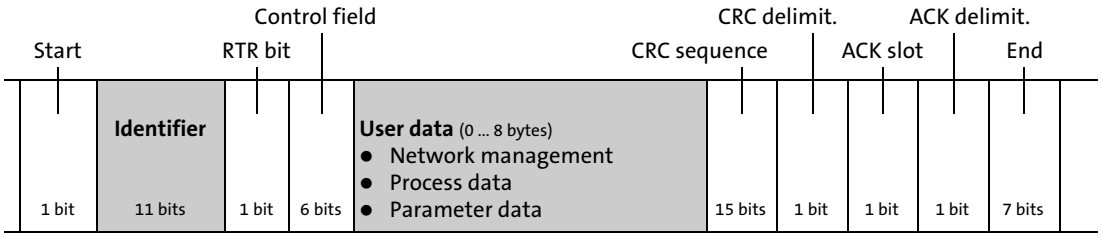


Fig. 8-1 Basic structure of the CAN telegram

Note!

Only the identifier and the user data are relevant to the user. All other data of the CAN telegram are automatically processed by the system.

8.1.2 Identifier

The principle of CAN communication is based on a message-oriented data exchange between a transmitter and many receivers. Therefore, all nodes can transmit and receive more or less at the same time.

The so-called *identifier* in the CAN telegram, also called *COB-ID* (*Communication Object Identifier*)), controls which node is to receive a transmitted message. In addition to the addressing, the identifier contains information on the priority of the message and the type of user data.

The identifier consists of a 'basic identifier' and the node address of the device to be approached:

Identifier = Basic identifier + node address

- ► This node address is set with the coding switch at the module(📖 32).
- ► Network management and sync telegram only require the basic identifier.
- ► The identifiers can also be set individually(📖 281).

8.1.3 Saving settings

The settings are permanently stored via $I1010_h$ (communication protocol DS301/DS401).

8.2 Network management (NMT)

Via the network management, the master can change a communication status for the whole CAN network.

Communication phases

Status	Explanation
"Initialisation"	Initialisation starts when the I/O system is switched on. In this phase, the I/O system does not take part in the bus data transfer. Furthermore it is in each NMT status possible to restart the entire initialisation or parts of it by transferring different telegrams (see "Status transitions"). All parameters already set are overwritten with their standard values. After initialisation has been completed, the I/O system is automatically set to the status "Pre-operational".
"Pre-Operational" (before ready for operation)	The I/O system can receive parameter data. The process data are ignored.
"Operational" (Ready for operation)	The I/O system can receive parameter and process data.
"Stopped"	Parameter and process data cannot be received. Network management telegrams can be received. The module outputs switch to the configured status (see chapter "Monitoring").

Telegram structure

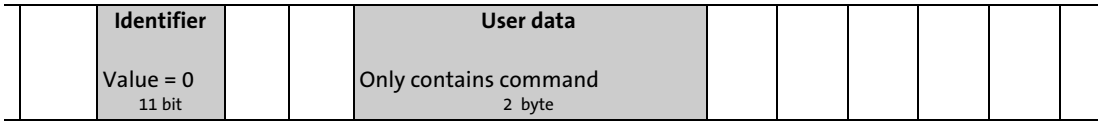


Fig. 8-2 Telegram for changing the communication phase

The telegram used for network management contains an identifier and the command which is part of the user data and consists of command byte and node address.

Telegrams with the identifier 0 and two bytes user data are used to change between the communication phases.

Only the network master (e.g. controller) can change a communication status for the whole network.

Note!

Only a change to "Operational" status enables communication via the process data!

Example:

If all nodes connected to the bus are to be switched from the "Pre-Operational" communication status to the "Operational" communication status via the CAN master, the identifier and the user data must have the following values in the transmission telegram:

► Identifier: 0x00 (broadcast telegram)

► User data: 0x0100

State transitions

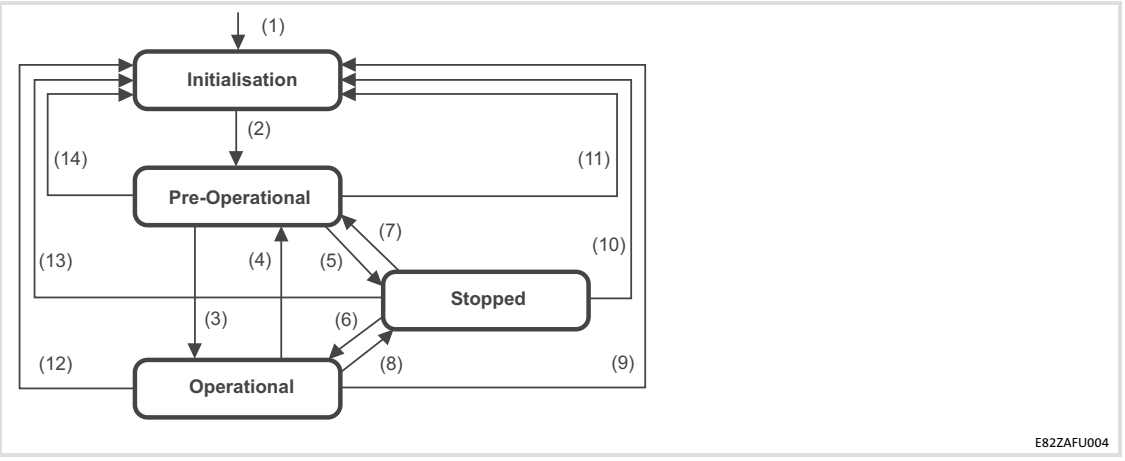


Fig. 8-3 Network management status transitions

State transition	Command (hex)	Network state after the change	Impact on process / parameter data after the state change
(1)	-	Initialisation	If the mains is switched on, initialisation is automatically started. During the initialisation phase, the I/O system is not involved in the data transfer. After the initialisation is complete, a boot-up message with its own identifier is sent to the master and the node changes automatically to the Pre-Operational state.
(2)	-	Pre-operational	In this phase, the master decides in which way the I/O system partakes in the communication.
From here, the change-over of the states is carried out by the master for the entire network. A target address contained in the command gives details about the recipient(s).			
(3), (6)	01 xx	Operational	Network management telegrams, sync, emergency, process data (PDO) and parameter data (SDO) are active. Optional: When the status is changed, event and time-controlled process data (PDO) will be sent once.
(4), (7)	80 xx	Pre-operational	Network management telegrams, sync, emergency and parameter data (SDO) are active (like “Enter pre-operational state“)
(5), (8)	02 xx	Stopped	Network management telegrams can only be received.
(9)	81 xx	Initialisation	The parameters saved last via $I1010_h$ are loaded for all indices. If no values have been saved yet, the Lenze setting is loaded.
(10)			
(11)			
(12)	82 xx		The parameters saved last via I_{1010h} are loaded for all communication parameters (index 0-1FFFh). If no values have been saved yet, the Lenze setting will be loaded.
(13)			
(14)			

xx = 00_h	With this assignment, all controllers connected are addressed by the telegram. All controllers can change their status at the same time.
xx = node ID	If a node address is indicated, the status will only be changed for the controller addressed.

8.3 Transmitting process data

Process data are used for control-specific purposes, such as setpoint and actual values, for example.

- ► Process data or the input / output data of the I/O system are transmitted as so-called PDOs (*Process Data Objects*)).

8.3.1 Process data telegram

Structure of the process data telegram:

11 bits	8 bytes of user data							
Identifier	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8

Identifier

Information on the identifier can be found in the ”Structure of the CAN data telegram” chapter.

Note!

In the Lenze setting, the identifiers are defined according to CANopen (assignment in accordance with DS301). Via $I2101_h$ the identifier calculation according to the system bus (assignment according to the Lenze system bus) can be specified.

User data

The eight bytes of user data transmit the input signals (sent user data) and the output signals (received user data) of the modules.

Note!

Lenze controllers expect a PDO length of eight bytes even though not all of them may have assigned I/O values. The PDO length can be set via $I2100_h$:

0: PDO length of eight bytes (Lenze setting)

1: PDO length according to process image

8.3.2 Identifier of the process data objects (PDO)

The identifiers of process data objects PDO1 ... PDO10 consist of the so-called basic identifiers and the set node address:

Identifier = Basic identifier + node address

Basic identifiers of the process data objects

			Basic identifier	
			dec	hex
PDOs	Process data object 1			
		PDO1-Rx	512	200
		PDO1-Tx	384	180
	Process data object 2			
		PDO2-Rx	768	300
		PDO2-Tx	640	280
	Process data object 3			
		PDO3-Rx	1024	400
		PDO3-Tx	896	380
	Process data object 4			
		PDO4-Rx	1280	500
		PDO4-Tx	1152	480
	Process data object 5			
		PDO5-Rx	1920	780
		PDO5-Tx	1664	680
	Process data object 6			
		PDO6-Rx	576	240
		PDO6-Tx	448	1C0
	Process data object 7			
		PDO7-Rx	832	340
		PDO7-Tx	704	2C0
	Process data object 8			
		PDO8-Rx	1088	440
		PDO8-Tx	960	3C0
	Process data object 9			
		PDO9-Rx	1344	540
		PDO9-Tx	1216	4C0
	Process data object 10			
		PDO10-Rx	1984	7C0
		PDO10-Tx	1728	6C0

8.3.3 Assigning individual identifiers

For larger networks with many nodes, it may be useful to set individual identifiers for process data objects PDO1 ... PDO10, that are independent of the set node address.

Process data objects for input data

Individual identifiers for input data can be set via the indices $I1400_h$, subindex 1 ... $I1409_h$, subindex 1.

Process data objects for output data

Individual identifiers for output data can be set via the indices $I1800_h$, subindex 1 ... $I1809_h$, subindex 1.

Note!

- ► Set the value which makes the required identifier (x = corresponding process data object) in index $I140x_h$, subindex 1 or $I180x_h$, subindex 1.
- ► Make a reset node so that the changes are accepted.

8.3.4 Process data transmission mode

Transmission mode for process input data

The transmission mode is configured via the index $I1400_h$, subindex 2 (PDO1-Rx) ... $I1409_h$, subindex 2 (PDO10-Rx):

- ► Sync-controlled reception
- ► n-sync-controlled reception
  - – First, a certain number (n) of sync telegrams must be transmitted ($I140x_h$, subindex 2 = 1 ... 240). Then the PDO telegram must be received from the master. Finally, the process input data are accepted.
- ► Event-controlled reception (Lenze setting)

Transmission mode for process output data

The transmission mode is configured via the index $I1800_h$, subindex 2 (PDO1-Tx) ... $I1809_h$, subindex 2 (PDO10-Tx):

- ► Sync-controlled transmission
- ► n-sync-controlled transmission
  - – First, a certain number (n) of sync telegrams must be transmitted ($I180x_h$, subindex 2 = 2 ... 240). Then, the PDO telegram is transmitted to the master.
- ► Event-controlled transmission (Lenze setting)

Note!

After changing to the CAN state ”Operational”, the current process image is transmitted from the I/O system.

Sync telegram for cyclic process data

A special telegram, the Sync telegram, is required for synchronisation when cyclic process data are transmitted.

The sync telegram must be generated by **another** node. It initiates the transmission for the cyclic process data of the I/O system and at the same time triggers data acceptance of cyclic process data received in the I/O system.

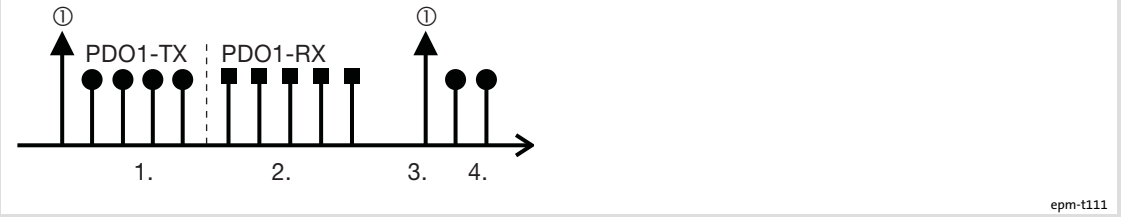


Fig. 8-4 Synchronisation of cyclical process data with the help of a sync telegram (asynchronous data not considered)

① Sync telegram

Transmission sequence

1. After receiving a sync telegram, the I/O system transmits the cyclic process output data (PDO1-Tx) if ”sync-controlled transmission” is active.
2. Once the transmission is completed, the I/O system receives the cyclic process input data (PDO1-Rx).
3. The data is accepted by the I/O system with the next sync telegram if ”sync-controlled reception” is active.
4. All other telegrams (e.g. for parameter or event-controlled process data) are accepted asynchronously by the I/O system after transmission.

8.3.5 PDO mapping

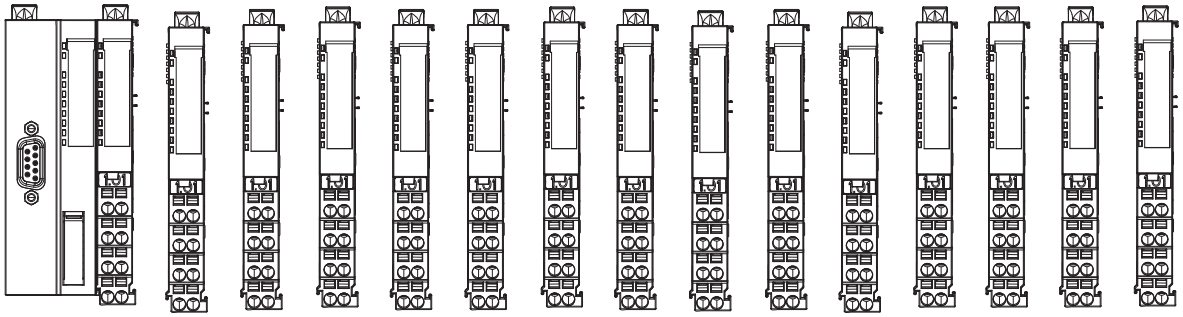
The PDO mapping differs depending on the motion control to be configured:

Drive-based automation (decentralised, with intelligent controllers)	Controller-based automation (with a central control)
• Direct data exchange between the IO system and the controller without a master control. Configuration with L-force Engineer	• Direct data exchange between the IO system and the control (IPC). Configuration via L-force PLC Designer
• Static PDO mapping (default setting)	• Free mapping by means of a bus configurator (e.g. PLC Designer)
• Up to 10 RPDOs and TPDOs can be used	• Up to 16 RPDOs and TPDOs can be used

The following representation describes the static PDO mapping (Drive-based automation) by means of an example station structure:

Installation

Module



	Bus coupler EPM-S1xx	2 x DI	8 x DI	4 × DI	2 × DI	8 × DI	8 × DI	8 × DI	8 × DI	2 × DI	8 × DI	2 x AI	4 x AI	8xDO	2 x DO
No.	**M0**	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**	**M11**	**M12**	**M13**	**M14**

n x DI I/O compound module with n digital inputs
n x DO I/O compound module with n digital outputs
n x AI I/O compound module with n analog inputs
n x AO I/O compound module with n analog outputs

Process image			Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
PDO1	Permanent for the first DI or DO	RPDO1	M13	M14	–	–	–	–	–	–
		TPDO1	M1	M2	M3M4	M5	M6	M7	M8	M9
PDO2	Permanent for the first AI or AO	RPDO2	–	–	–	–	–	–	–	–
		TPDO2	M11	M11	M11	M11	M12	M12	M12	M12
PDO3	DI/DO, DI/DO TimeStamp, DO PWM, AI/AO, counter, SSI, RS232, RS422/RS485	RPDO3	–	–	–	–	–	–	–	–
		TPDO3	M12	M12	M12	M12	–	–	–	–
PDO4	DI/DO, DI/DO TimeStamp, DO PWM, AI/AO, counter, SSI, RS232, RS422/RS485	RPDO4	–	–	–	–	–	–	–	–
		TPDO4	M10	–	–	–	–	–	–	–
...	...	...								
PDO10	DI/DO, DI/DO TimeStamp, DO PWM, AI/AO, counter, SSI, RS232, RS422/RS485	RPDO10	–	–	–	–	–	–	–	–
		TPDO10	–	–	–	–	–	–	–	–

The following rules for assigning the PDO apply in accordance with the CANopen communication profile DS401:

- RPDO1 is reserved for the first I/O compound modules with digital inputs.
- TPDO1 is reserved for the first I/O compound modules with digital outputs.
- RPDO2 is reserved for the first I/O compound modules with analog inputs.
- TPDO2 is reserved for the first I/O compound modules with analog outputs.
- As of PDO3: a PDO can only be occupied by electronic modules of one module class. Free bytes are reserved for modules of the same module class.

  Sorting sequence for module classes:
  - Digital inputs and outputs (EPM-S200 to EPM-S206, EPM-S300 to EPM-S309)
  - Analog inputs and outputs (EPM-S400 to EPM-S503)
  - Counter (EPM-S600 to EPM-S603)
  - SSI encoder (EPM-S604)
  - Digital outputs with pulse width modulation (EPM-S620)
  - Interfaces RS232 and RS422/RS485 (EPM-S640/EPM-S650)
  - Digital outputs with time stamp functionality (EPM-S310)
  - Digital inputs with time stamp functionality (EPM-S207)

Note!

In order to ensure data consistency, the data in the PDO are mapped as follows:

- Digital I/O:

  With digital values, an I/O compound module is always mapped in one byte. If a byte in a PDO does not have enough free bits, the I/O compound module is mapped in the next byte.
- Analog I/O:

  In the case of analog values the data lengths of which exceed one byte, the data consistency is extended. Since one channel assigns two bytes, each channel of an I/O compound module is mapped in two successive PDOs.

8.3.6 PDO mapping for I/O compound modules with a serial interface

Mapping for I/O compound modules with a serial interface (EPM-S640, EPM-S650) starts at PDO 3.

Default mapping

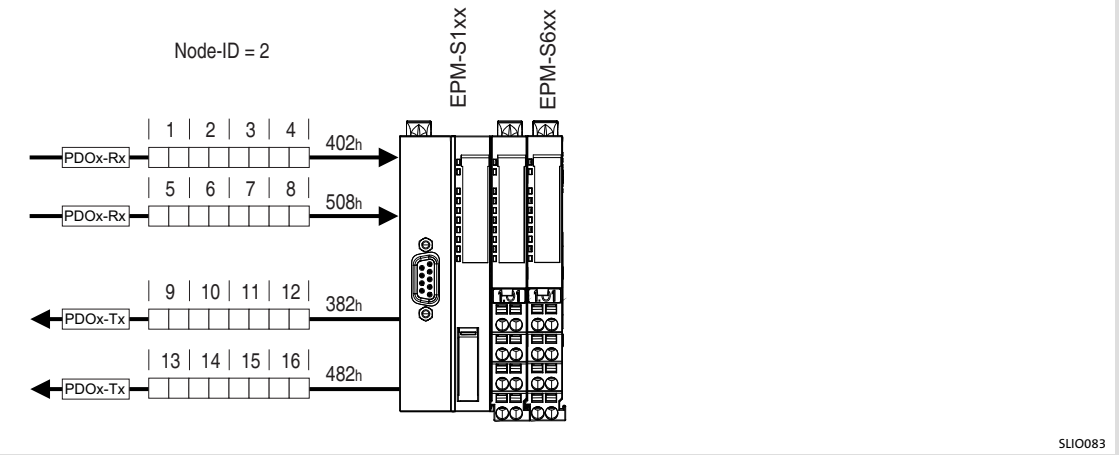


Fig. 8-5 Mapping contents

Word	EPM-S640, EPM-S650
1	Rx byte 0 ... 1
2	Rx byte 2 ... 3
3	Rx byte 4 ... 5
4	Rx byte 6 ... 7
5	–
6	–
7	–
8	–
9	Tx byte 0 ... 1
10	Tx byte 2 ... 3
11	Tx byte 4 ... 5
12	Tx byte 6 ... 7
13	–
14	–
15	–
16	–

8.3.7 PDO mapping for I/O compound modules with time stamp function

Mapping for I/O compound modules with a time stamp function begins at PDO 3.

Default mapping

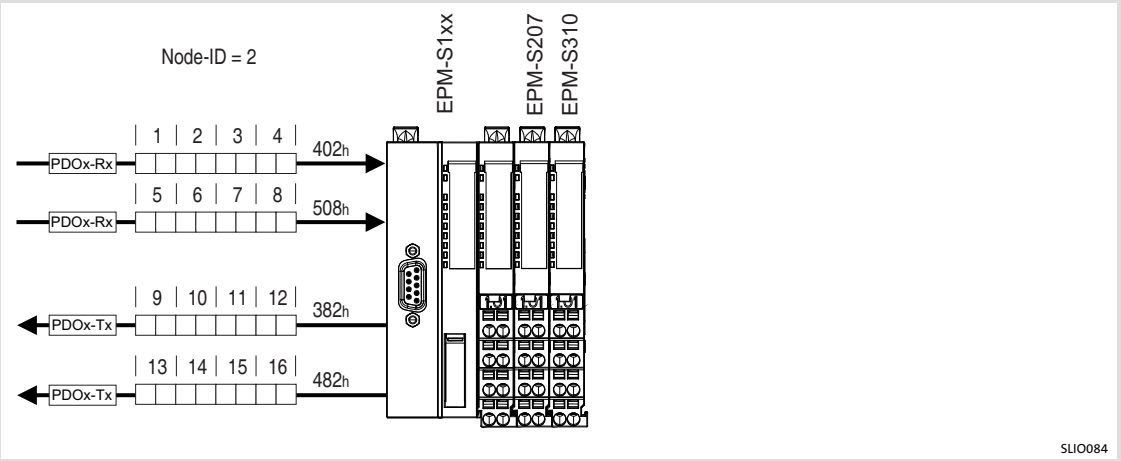


Fig. 8-6 Mapping contents

Word	EPM-S207	EPM-S310
1	–	Ticker value DO1
2	–	Running number Channel status DO1
3	–	Ticker value DO2
4	–	Running number Channel status DO2
5	–	–
6	–	–
7	–	–
8	–	–
9	Ticker value DI1	Status of FIFO memory
10	Running number Channel status DI1	
11	Ticker value DI2	–
12	Running number Channel status DI2	–
13	–	–
14	–	–
15	–	–
16	–	–

Ticker value EPM-S207 and EPM-S310		
Bit	**Designation**	**Function**
0 ... 15	Ticker value	After mains connection, a timer (µs ticker) is started, which after 65535 µs starts with 0 again.

Running number, channel status EPM-S207		
Bit	**Name**	**Function**
0 ... 7	Running number (RN)	Counter which counts from 0 ... 63 and then goes back to 0. During the first run, the running number must start with 1.
8	Channel status DI1	0: FALSE 1: TRUE
9	Channel status DI2	0: FALSE 1: TRUE
10 ... 15	–	Reserved (fix 0)

Running number, channel status EPM-S310		
Bit	**Name**	**Function**
0 ... 7	Running number (RN)	Counter which counts from 0 ... 63 and then goes back to 0. During the first run, the running number must start with 1.
8 ... 11	–	Reserved (fix 0)
12	Enable DO1	0: inhibit 1: enable
13	Enable DO2	
14	Channel status DO1	0: FALSE 1: TRUE
15	Channel status DO2	0: FALSE 1: TRUE

Status of FIFO memory for EPM-S310		
Bit	**Designation**	**Function**
0 ... 5	RN-LAST	Running number of the time stamp entry last detected as valid by the module and written into the FIFIO memory.
6		1 (fix); is used for identification in the process image
7		0 (fix); is used for identification in the process image
8 ... 13	RN_NEXT	Running number of the time stamp entry to be processed next in the FIFO memory.
14		1 (fix); is used for identification in the process image
15		1 (fix); is used for identification in the process image
16 ... 23	STS_FIFO	Status information of FIFO memory ● 00_h or 80_h: Everything is OK; you will receive this message directly after the acceptance into the FIFO memory of the module. ● 01_h or 81_h: No follow-up entry available; the running number does not correspond to the expected running number. Check the running number in the output area. ● 02_h or 82_h: No new entries available in the FIFO memory. ● 03h or 83h: FIFO memory full. No new entries possible. A full memory will not accept any more time stamp entries. Perform a status query to establish the FIFO memory's status before transferring more time stamp entries. **Note:** If less than possible time stamp entries are written, bit 6 must be set in the running number (RN) of the last time stamp entry. This is required in order to not write the follow-up entries as "invalid" since the module ignores all time stamp entries after an entry with a set RN bit 6. If a time stamp entry with a running number and a set bit 6 is in the FIFO memory, STS_FIFO with 80_h is returned in an OR-ed manner.
24 ... 31	–	Current number of time stamp entries in FIFO memory.

8.3.8 PDO mapping for I/O compound modules with PWM function

Mapping for I/O compound modules with a PWM function begins at PDO 3.

Default mapping

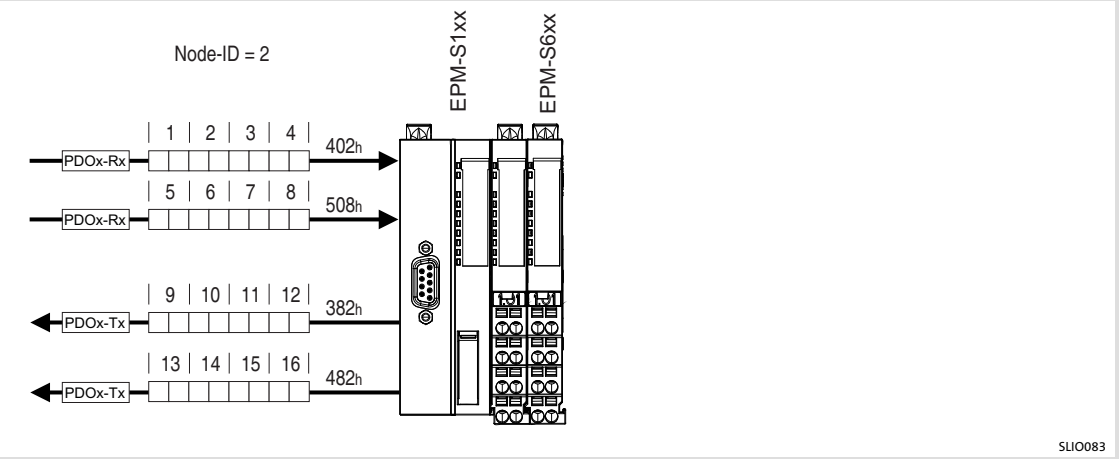


Fig. 8-7 Mapping contents

Word	EPM-S620
1	Pulse duration DO1
2	
3	Pulse duration DO2
4	
5	Control word DO1
6	Control word DO2
7	–
8	–
9	Status word DO1
10	Status word DO2
11	–
12	–
13	–
14	–
15	–
16	–

Information on the structure of the control word and the status word 📖 242.

8.3.9 PDO mapping for counters and encoder evaluation

The mapping for counters starts at PDO 3, since the first two PDOs are reserved for digital and analog modules.

The following table describes the indices for the PDO mapping for counters.

Index	Name	Possible settings				Important	
		Lenze	Selection				
I5400$_h$ ↲	Counter Value		00000000$_h$	{1$_h$}	FFFFFFFF$_h$	Count value	📖 290
1	DWord 1					EPM-S600/-S602: Subindex is increased by 1 for each counter EPM-S601/-S603: Subindex is increased by 2 for each counter	
2	DWord 2						
...	...						
64	DWord 64						
I5401$_h$ ↲	Latch value		00000000$_h$	{1}	FFFFFFFF$_h$	Latch value	📖 290
1	DWord 1					EPM-S600: Subindex is increased by 1 for each counter EPM-S601/-S602/-S603: without function	
2	DWord 2						
...	...						
64	DWord 64						
I5402$_h$ ↲	Status word		0000$_h$	{1}	FFFF$_h$	Status word	📖 290
1	DWord 1					EPM-S600/-S602: Subindex is increased by 1 for each counter EPM-S601/-S603: Subindex is increased by 2 for each counter	
2	DWord 2						
...	...						
64	DWord 64						
I5403$_h$ ↲	Counter ticker value		0000$_h$	{1}	FFFF$_h$	Ticker value	📖 290
1	DWord 1					EPM-S600/-S602: Subindex is increased by 1 for each counter EPM-S601/-S603: without function	
2	DWord 2						
...	...						
64	DWord 64						
I5600$_h$ ↲	Counter Compare Value		00000000$_h$	{1}	FFFFFFFF$_h$	Comparison value	📖 290
1	DWord 1					EPM-S600/-S602: Subindex is increased by 1 for each counter EPM-S601: Subindex is increased by 2 for each counter EPM-S603: without function	
2	DWord 2						
...	...						
64	DWord 64						
I5601$_h$ ↲	Counter Set Value		00000000$_h$	{1}	FFFFFFFF$_h$	Set value	📖 290
1	DWord 1					EPM-S600/-S602: Subindex is increased by 1 for each counter EPM-S601/-S603: without function	
2	DWord 2						
...	...						
64	DWord 64						
I5602$_h$ ↲	Counter Control Word		0000$_h$	{1}	FFFF$_h$	Control word	
1	DWord 1					EPM-S600/-S602: Subindex is increased by 1 for each counter EPM-S601/-S603: Subindex is increased by 2 for each counter	📖 290
2	DWord 2						
...	...						
64	DWord 64						

Default mapping

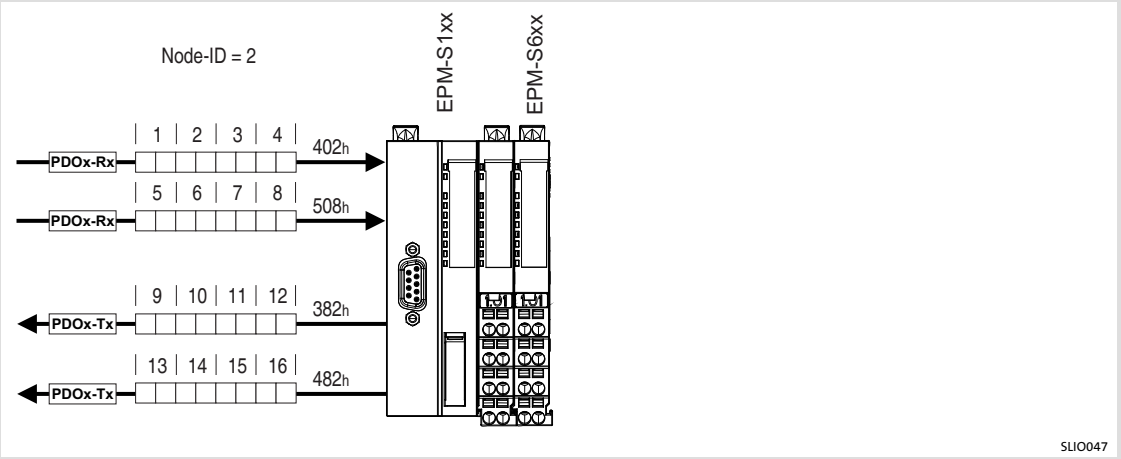


Fig. 8-8 Mapping contents

Word	EPM-S600	EPM-S601	EPM-S602	EPM-S603	EPM-S604
1	Comparison value	Comparison value C1	Comparison value	Control word C1	-
2				Control word C2	
3	Set value	Comparison value C2	Set value	-	
4					
5	Control word	Control word C1	Control word		
6	-	Control word C2	-		
7		-			
8					
9	Count value	Count value C1	Count value	Count value C1	Encoder value
10					
11	Latch value	Count value C2	Status word	Count value C2	Ticker value
12			Ticker value		
13	Status word	Status word C1	-	Status word C1	-
14	Ticker value	Status word C2		Status word C2	
15	-	-		-	
16					

Comparison value: Here you can select a value which, by comparison with the current counter content, can impact the counter output or trigger a process alarm. The response of the output or the process alarm can be parameterised.

Set value: With an edge change 0-1 of *COUNTERVAL_SET* in the control word, the set value is accepted in the counter.

Count value: Current counter content

Latch value: If there is a positive edge at the latch input, the count value is stored here.

Ticker value: After mains connection a timer (µs ticker) is started, which after 65535 µs starts with 0 again. With every change of the count value the time value of the timer is stored as 16-bit µs value together with the count value in the input area.

Information on the structure of the control word and the status word 📖 229.

8.3.10 Data transfer between I/O system and controller

In the Lenze setting of the I/O system 1000, the basic identifiers of the PDOs are set according to CANopen.

For communicating with Lenze controllers the basic identifiers for the process data object 1 must be adapted.

1. Set RPDO1 via index 1400_h, subindex 1 to 770.
2. Set TPDO1 via index 1800_h, subindex 1 to 769.
   The input data are accepted on sync telegram transmission.

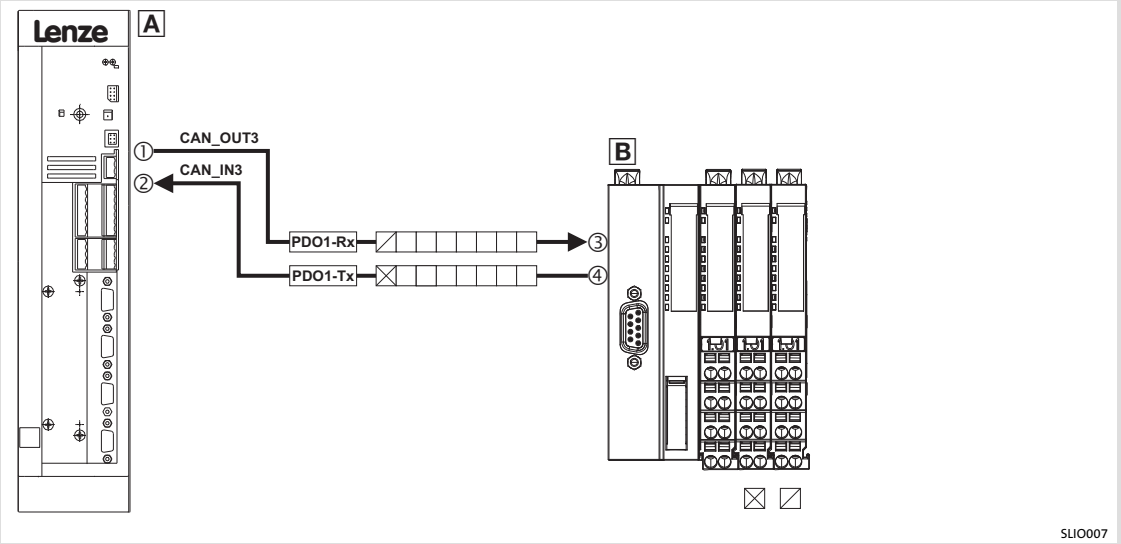


Fig. 8-9 Data transfer between I/O system and controller

PDO-Rx The I/O system receives the status information from the controller
PDO-Tx The I/O system transmits the status information to the controller
A Controller with node address 1 (C0350 = 1)
① 768_d (basic identifier) + 1 (node address) = 769_d (identifier)
② 769_d (basic identifier) + 1 (node address) = 770_d (identifier)
B CAN bus coupler module with node address 2
③ 767_d (basic identifier) + 2 (node address) = 769_d (identifier)
④ 768_d (basic identifier) + 2 (node address) = 770_d (identifier)

8.3.11 Indices for setting the process data transfer

Process data objects for input data

COB-IDs can be changed as follows:

The COB-ID is set via a 32 bit value.

Bit 0 ... 11	Bit 12 ... 29	Bit 30	Bit 31
COB-ID	Reserved	RTR allowed	PDO not valid: 1 PDO valid: 0

Example: Changing the COB-ID from 201 to 202

1. Enter the COB-ID value and bit 31 = 1.
   0xC0000202
2. Bit 31 = 0
   0x40000202
   The PDO is activated with a new identifier. The changes will be accepted in the Pre-Operational or Operational status.

Index	Name	Possible settings				Important	
		Lenze	Selection				
I1400$_h$ ↵							281
1	COB-ID used by RxPDO 1	513 + NID	385	{1}	2047	Definition of specific identifiers for process data object 1 (NID= Node ID / node address)	
2	Transmission type	255	0	{1}	255	Defining the transmission mode	
			0 ... 240	Process data update on every sync telegram transmission		The input data are accepted on sync telegram transmission.	
			241 ... 254	Reserved			
			255	Process data update on every occurrence of an event		Every received value is accepted	
...	...						
I1409$_h$ ↵							281
1	COB-ID used by RxPDO 10	1984 + NID	385	{1}	2047	Definition of specific identifiers for process data object 10 (NID= Node ID / node address)	
2	Transmission type	255	0	{1}	255	Defining the transmission mode	
			0 ... 240	Process data update on every sync telegram transmission		The input data are accepted on sync telegram transmission.	
			241 ... 254	Reserved			
			255	Process data update on every occurrence of an event		Every received value is accepted	

Process data objects for output data

COB-IDs can be changed as follows:

The COB-ID is set via a 32 bit value.

Bit 0 ... 11	Bit 12 ... 29	Bit 30	Bit 31
COB-ID	Reserved	RTR allowed	PDO not valid: 1 PDO valid: 0

Example: A COB-ID value of 182 is to be set

1. Enter the COB-ID value and bit 31 = 1.
   0x80000182
2. Bit 31 = 0
   0x00000182
   The PDO is activated with a new identifier. The changes will be accepted in the Pre-Operational or Operational status.

Index	Name	Possible settings				Important	
		Lenze	Selection				
$I1800_h$ ↵							📖 281
1	COB-ID used by TxPDO 1	384+ NID	385	{1}	2047	Definition of specific identifiers for process data object 1 (NID= Node ID / node address)	
2	Transmission type	255	0	{1}	255	Defining the transmission mode	
			0	Function deactivated		The output data are accepted on sync telegram transmission.	
			1 ... 240	Process data transfer after sync no. 1 ... Process data transfer after sync no. 240		The output data are accepted after transmission of the set number (1 ... 240) of sync telegrams.	
			254	Time-controlled process data transfer		Only if a cycle time is set in $I180x_h$, subindex 5	
			255	Event-controlled process data transfer			
			255	Event-controlled process data transfer with cyclic overlay		Only if a cycle time is set in $I180x_h$, subindex 5	
3	Inhibit time	0	0	{1 ms}	65535	Blocking time	
5	Event time	100	0	{1 ms}	65535	Cycle time	
...	...						

Index	Name	Possible settings				Important	
		Lenze	Selection				
I1809$_h$ ↵							281
1	COB-ID used by TxPDO 10	1728 + NID	385	{1}	2047	Definition of specific identifiers for process data object 10 (NID= Node ID / node address)	
2	Transmission type	255	0	{1}	255	Defining the transmission mode	
			0	Function deactivated		The output data are accepted on sync telegram transmission.	
			1 ... 240	Process data transfer after sync no. 1 ... Process data transfer after sync no. 240		The output data are accepted after transmission of the set number (1 ... 240) of sync telegrams.	
			254	Time-controlled process data transfer		Only if a cycle time is set in I180x$_h$, subindex 5	
			255	Event-controlled process data transfer			
			255	Event-controlled process data transfer with cyclic overlay		Only if a cycle time is set in I180x$_h$, subindex 5	
3	Inhibit time	0	0	{1 ms}	65535	Blocking time	
5	Event time	0	0	{1 ms}	65535	Cycle time	

8.4 Transmitting parameter data

Parameter data are the so-called indices.

Parameters are usually set only once during commissioning.

Parameter data are transmitted as so-called SDOs (*Service Data Objects*) via the system bus and acknowledged by the receiver, i.e. the transmitter gets a feedback if the transmission was successful.

8.4.1 Telegram structure

Structure of the telegram for parameter data:

11 bits	8 bytes of user data							
Identifier	Instruction code	Index		Subindex	Data 1	Data 2	Data 3	Data 4
		Low byte	High byte					

► The subchapters below explain the individual telegram components in detail.

► The chapter 8.4.2 contains an example of how to write a parameter. (📖 298)

► The chapter 8.4.3 contains an example of how to read a parameter. (📖 299)

Identifier

Identifier	Instruction code	Index		Subindex	Data 1	Data 2	Data 3	Data 4
		Low byte	High byte					

One parameter channel is available for parameter data transmission, which is addressed via the identifier.

	Identifier =	Basic identifier		+ node address of the device
		dec	hex	
SDO	Parameter channel 1			
	Output (transmit)	1408	580	+ value set with coding switch
	Input (receive)	1536	600	

Instruction code

Identifier	Instruction code	Index		Subindex	Data 1	Data 2	Data 3	Data 4
		Low byte	High byte					

The instruction code contains the command to be executed and information about the parameter data length. It is structured as follows:

	Bit 7 (MSB)	Bit6	Bit 5	Bit4	Bit3	Bit2	Bit 1	Bit 0
Command	**Command Specifier (cs)**				**Length**		**E**	**s**
Write Request	0	0	1	0	00 = 4 bytes 01 = 3 bytes 10 = 2 bytes 11 = 1 byte		1	1
Write Response	0	1	1	0			0	0
Read Request	0	1	0	0			0	0
Read Response	0	1	0	0			1	1
Error Response	1	0	0	0	0	0	0	0

Instruction code for parameters with 4 bytes of data length:

Command	4 bytes of data		Information
	hex	dec	
Write Request	23	35	Transmitting parameters to a node
Write Response	60	96	Node response to the Write Request (acknowledgement)
Read Request	40	64	Request to read a parameter from a node
Read Response	43	67	Response to the read request with the actual value
Error Response	80	128	Node reports a communication error

Instruction “Error Response”

If an error occurs, the addressed node generates an “Error Response”.

In data 4, this telegram always contains the value “6”, in data 3 it contains an error code:

Command code Error Response	Data 3	Data 4	Error message
80_h	3	6	Access denied
	5		Wrong subindex
	6		Wrong index

Parameter addressing (Index/subindex)

Identifier	Instruction code	Index		Subindex	Data 1	Data 2	Data 3	Data 4
		Low byte	High byte					

The index of the telegram is used to address the index to be read or written:

- The index value must be entered in flush-left Intel format and divided into Low byte and High byte (see example).
- For subindices, the number of the associated subindex must be entered into the telegram’s subindex.
- For indices without subindex, the subindex always has the value “0’.

Example

The subindex 1 of index $I2400_h$ (monitoring time for PDO1) is to be addressed:

11 bits	8 bytes of user data							
Identifier	Instruction code	Index		Subindex	Data 1	Data 2	Data 3	Data 4
		Low byte	High byte					
		00_h	24_h	1				

Parameter data (data 1 ... data 4)

Identifier	Instruction code	Index		Subindex	Data 1	Data 2	Data 3	Data 4
		Low byte	High byte					

Up to 4 bytes (data 1 ... data 4) are available for parameter data.

Data are entered in left-justified Intel format with data 1 as LSB and data 4 as MSB (see example).

Example

The value ”1 s” is to be transmitted for the index 2400_h (monitoring time).

$Data_{1...4} = 1 \times 1000 = 1000 = 00\ 00\ 03\ E8_h$

11 bits	8 bytes of user data							
Identifier	Instruction code	Index		Subindex	Data 1	Data 2	Data 3	Data 4
		Low byte	High byte					
					$E8_h$	03_h	00_h	00_h
					(LSB)			(MSB)

8.4.2 Writing a parameter (example)

Task

An I/O system 1000 has been assigned node address 2. The function of the first channel (voltage signal 0 ... +10 V, 0 ... 27648dec) is to be output at the first analog I/O compound module (EPM-S500, 2 analog outputs 0 ... 10 V).

Telegram to the I/O system

	Formula	Information
Identifier	= Basic identifier + node address = 1536 + 2 =1538 = **602_h**	• Basic identifier for parameter channel 1 (output) = 1536 • Node address of the I/O system = 2
Instruction code	= **23_h**	• Write Request command (transmitting parameters to the I/O system)
Index	= **$I3100_h$**	• First channel of the analog module
Subindex	= **1**	• First analog module
Data 1 **Data 2 ... 4**	= $0F_h$ = 00_h	• 0 ... 10 V, 0 ... 07648_{dec} • No function

11 bits	Eight bytes of user data							
Identifier	Instruction code	Index		Subindex	Data 1	Data 2	Data 3	Data 4
		LOW byte	HIGH byte					
602_h	23_h	00_h	31_h	$0F_h$	00_h	00_h	00_h	00_h
					(LSB)			(MSB)

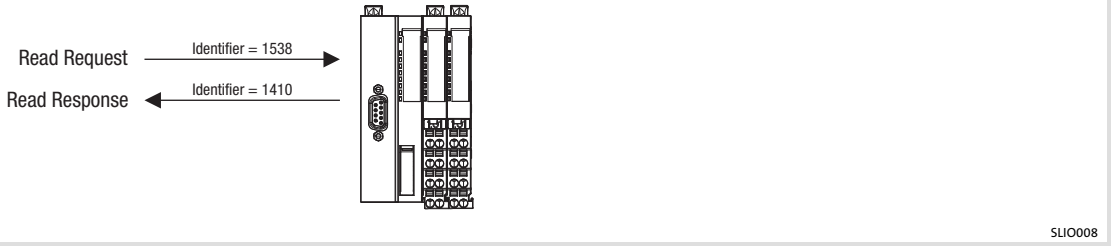


Fig. 8-10 Writing a parameter

Telegram from the I/O system (acknowledgement when being executed faultlessly)

	Formula	Information
Identifier	= Basic identifier + node address = 1408 + 2 = **1410**	• Basic identifier for parameter channel 1 (input) = 1408 • Node address of the I/O system = 2
Instruction code	= **60_h**	• Command “Write Response ’ (acknowledgement from the I/O system)
Index	= Index of the read request	
Subindex	= Subindex of the read request	
Data 1 ... 4	= **0**	• Acknowledgement only

11 bits	Eight bytes of user data							
Identifier	**Instruction code**	**Index**		**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
		LOW byte	**HIGH byte**					
1410	60_h	01_h	30_h	0	0	0	0	3

8.4.3 Reading a parameter (example)

Task

An I/O system 1000 has been assigned node address 2. The function of the first channel is to be read at the first analog I/O compound module (EPM-S500, 2 analog outputs 0 ... 10 V).

Telegram to the I/O system

	Formula	Information
Identifier	= Basic identifier + node address = 1536 + 2 =1538 = **602_h**	• Basic identifier for parameter channel 1 (output) = 1536 • Node address of the I/O system = 2
Instruction code	= **40_h**	• Read Request command (request for reading a parameter of the I/O system)
Index	= **$I3100_h$**	• First channel of the analog module
Subindex	= **1**	• First analog module
Data 1 **Data 2** **Data 3** **Data 4** **Data 1 ... 4**	= 00_h = 00_h = 00_h = 00_h = **$00\ 00\ 00\ 00_h$**	• Read request only

11 bits	Eight bytes of user data							
Identifier	**Instruction code**	**Index**		**Subindex**	**Data 1**	**Data 2**	**Data 3**	**Data 4**
		LOW byte	**HIGH byte**					
602_h	40_h	00_h	31_h	1	$0F_h$	00_h	00_h	00_h
					(LSB)			(MSB)

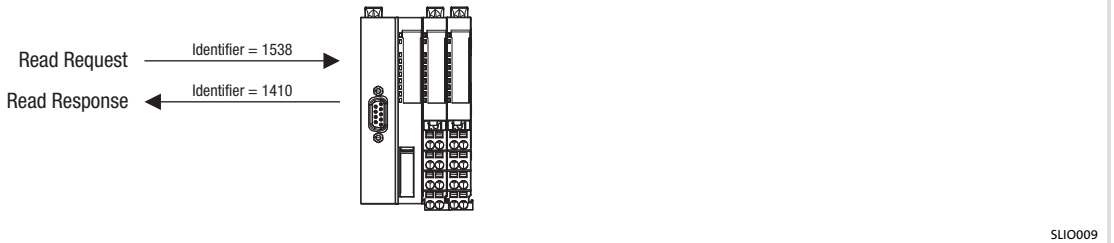


Fig. 8-11 Reading a parameter

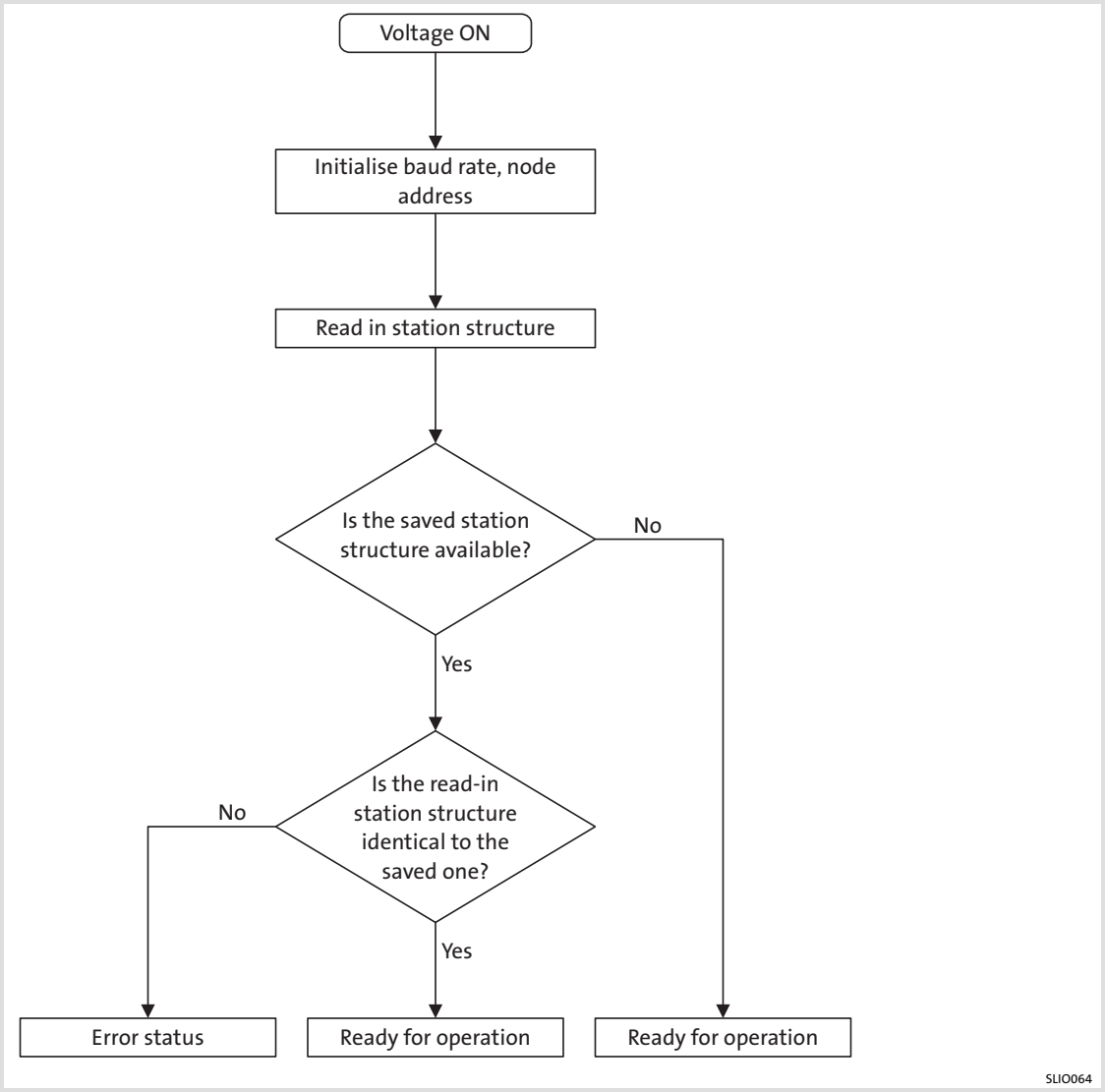
Telegram from the I/O system (value of the requested parameter)

	Formula	Information
Identifier	= Basic identifier + node address = 1408 + 2 = **1410**	• Basic identifier for parameter channel 1 (input) = 1408 • Node address of the I/O system = 2
Instruction code	= **43_h**	• Read Response command (response to the read request with the current value)
Index	= Index of the read request	
Subindex	= Subindex of the read request	
Data 1 **Data 2** **Data 3** **Data 4** **Data 1 ... 4**	= 00_h = 00_h = 05_h = $3B_h$ = **$00\ 00\ 05\ 3B_h$**	• Assumption: The first channel of the first analog module outputs a voltage signal 0 ... +10 V with a resolution of 0 ... 07648_{dec}.

11 bits	Eight bytes of user data							
Identifier	Instruction code	Index		Subindex	Data 1	Data 2	Data 3	Data 4
		LOW byte	HIGH byte					
1410	43_h	00_h	31_h	0	00_h	00_h	05_h	3Bh

8.5 Response of the station after switch-on

The sequence diagram shows the test routine of the I/O system after every switch-on of the supply voltage.



8.6 Baud rate and node address (node ID) setting

Baud rate

For establishing a communication, all devices must use the same baud rate for the data transfer.

► Use the coding switch to set the baud rate at the CANopen bus coupler module (📖 32).

Node address

Each node of the network must be assigned to a node address, also called *node ID* within a range of 1 ... 127 for clear identification.

► A node address in a network may be used only once.

► Use the coding switch to set the node address of the I/O system at the CANopen bus coupler module (📖 32).

► The set node address can be read in index $I100B_h$.

8.7 General function of the parameter setting

8.7.1 Parameterising digital I/Os

The parameter data of the digital I/O define if the control signals are to be transmitted with original or inverted polarity.

For parameter data, 1 byte is available which is assigned via SDO.

- Digital inputs are parameterised via index I6002h.
- Digital outputs are parameterised via index $I6202_h$.

The subindex depends on the slot.

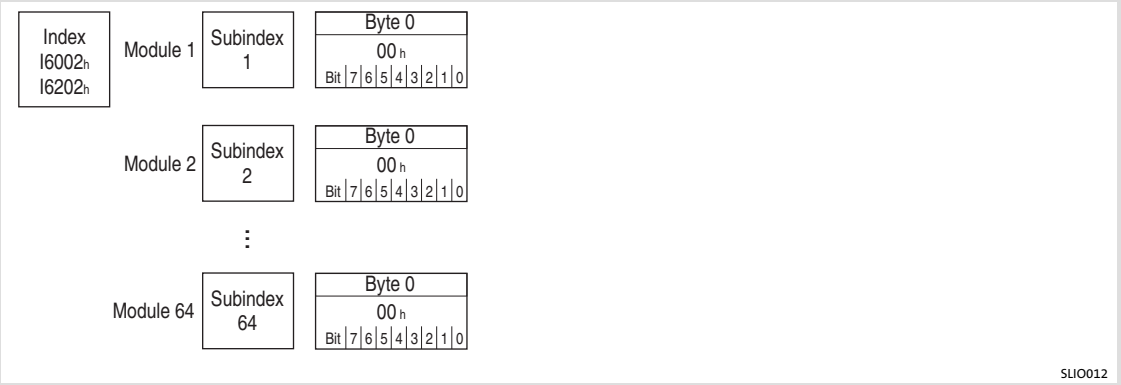


Fig. 8-12 Display of the digital I/O parameter data

Byte	Assignment				Lenze setting
0	Polarity of the transmitted signals	Bit0	0	Signal is transmitted in original form	00_h
			1	Signal is transmitted in inverse form	
		Bit 1...7		Reserve	

Note!

Store changed parameters in the EEPROM via index $I1010_h$. The settings are maintained after the supply voltage is switched off.

8.7.2 Parameterising analog I/Os, counter, SSI, time stamp and PWM

The parameter data of each parameterisable I/O compound module (e.g. analog I/O, counter, SSI, digital I/O time stamp or PWM) are values in the index range 0x3100 ... 0x3129.

The parameter data of the 1st parameterisable I/O compound module are in subindex 1 of this range, the parameter data of the 2nd parameterisable I/O compound module in subindex 2, etc.

Index range for	#1 (analog I/O)	#2 (analog I/O)	#3 (counter)	...
Signal functions	0x3100/1 : 0x3129/1	0x3100/2 : 0x3129/2	0x3100/3 : 0x3129/3	...

8.8 Setting the parameters of analog I/O

8.8.1 2 analog inputs 0 ... 10 V (12 bits) - EPM-S400

Parameter data

Index/sub index	Name	Description/value	Lenze
0x3100/x	Function channel 1	16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
0x3101/x	Function channel 2		20_h
0x3102/x	Reserved	0	
...	...	...	
0x311D/x	Reserved	0	

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

8.8.2 4 analog inputs 0 ... 10 V (12 bits) - EPM-S401

Parameter data

Index/sub index	Name	Description/value	Lenze
0x3100/x	Function channel 1	16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
0x3101/x	Function channel 2		20_h
0x3102/x	Function channel 3		20_h
0x3103/x	Function channel 4		20_h
0x3104/x	Reserved	0	
...	...	...	
0x311D/x	Reserved	0	

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

8.8.3 2 analog inputs 0/4 ... 20 mA (12 bits) - EPM-S402

Parameter data

Index/sub index	Name	Description/value	Lenze
0x3100/x	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	31_h
0x3101/x	Function channel 2		31_h
0x3102/x	Reserved	0	
...	...	...	
0x311D/x	Reserved	0	

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

8.8.4 4 analog inputs 0/4 ... 20 mA (12 bits) - EPM-S403

Parameter data

Index/sub index	Name	Description/value	Lenze
0x3100/x	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	31_h
0x3101/x	Function channel 2		31_h
0x3102/x	Function channel 3		31_h
0x3103/x	Function channel 4		31_h
0x3104/x	Reserved	0	
...	...	...	
0x311D/x	Reserved	0	

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

8.8.5 2 analog inputs -10 ... +10 V (16 bits) - EPM-S406

Parameter data

Index/sub index	Name	Description/value	Lenze
0x3100/x	Diagnostics	Bits 0 ... 5: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
0x3101/x	Reserved	0	
0x3102/x	Limit value monitoring	Bit 0: Channel 1 (0 = inhibited; 1 = enabled) Bit 1: Channel 2 (0 = inhibited; 1 = enabled) Bits 7 ... 2: Reserved	00_h
0x3103/x	Interference frequency suppression	Bit 1, 0: Channel 1 00: Deactivated 01: 60 Hz 10: 50 Hz Bit 3, 2: Channel 2 00: Deactivated 01: 60 Hz 10: 50 Hz Bits 7 ... 4: Reserved	00_h
0x3104/x	Function channel 1	12 (12_h): -10 ... 10 V / -27648 ... 27648_{dec} 34 (22_h): -10 ... 10 V / -16384 ... 16384_{dec} 16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
0x3105/x	Reserved	0	
0x3106/x 0x3107/x	Upper limit value channel 1	Value from the rated range; if this value is exceeded and the limit value monitoring function is enabled, a process alarm is triggered. $7FFF_h$: Limit value alarm deactivated	$7FFF_h$
0x3108/x 0x3109/x	Lower limit value channel 1	Value from the rated range; if the actual value falls below this value and the limit value monitoring function is enabled, a process alarm is triggered. 8000_h: Limit value alarm deactivated	8000_h
0x310A/x	Function channel 2	12 (12_h): -10 ... 10 V / -27648 ... 27648_{dec} 34 (22_h): -10 ... 10 V / -16384 ... 16384_{dec} 16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
0x310B/x	Reserved	0	
0x310C/x 0x310D/x	Upper limit value channel 2	Value from the rated range; if this value is exceeded and the limit value monitoring function is enabled, a process alarm is triggered. $7FFF_h$: Limit value alarm deactivated	$7FFF_h$
0x310E/x 0x310F/x	Lower limit value channel 2	Value from the rated range; if the actual value falls below this value and the limit value monitoring function is enabled, a process alarm is triggered. 8000_h: Limit value alarm deactivated	8000_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
-10 ... +10 V (12_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	0	0000		
	-5	-13824	CA00		
	-10	**-27648**	9400		
	-11.76	-32512	8100	Underflow	
-10 ... +10 V (22_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	0	0000		
	-5	-8192	E000		
	-10	**-16384**	C000		
	-12.5	-20480	B000	Underflow	
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	0	0000		
	-1.76	-4864	ED00	Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	-2	-3277	F333	Underflow	

8.8.6 2 analog inputs 0/4 ... 20 mA (16 bits) - EPM-S408

Parameter data

Index/sub index	Name	Description/value	Lenze
0x3100/x	Diagnostics	Bits 0 ... 5: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
0x3101/x	Reserved	0	
0x3102/x	Limit value monitoring	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 (0 = deactivated; 1 = activated) Bits 7 ... 2: Reserved	00_h
0x3103/x	Interference frequency suppression	Bit 1, 0: Channel 1 00: Deactivated 01: 60 Hz 10: 50 Hz Bit 3, 2: Channel 2 00: Deactivated 01: 60 Hz 10: 50 Hz Bits 7 ... 4: Reserved	00_h
0x3104/x	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	41_h
0x3105/x	Reserved	0	
0x3106/x 0x3107/x	Upper limit value channel 1	Value from the rated range; if this value is exceeded and the limit value monitoring function is active, a process alarm is triggered. $7FFF_h$: Limit value alarm deactivated	$7FFF_h$
0x3108/x 0x3109/x	Lower limit value channel 1	Value from the rated range; if the actual value falls below this value and the limit value monitoring function is active, a process alarm is triggered. 8000_h: Limit value alarm deactivated	8000_h
0x310A/x	Function channel 2	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	41_h
0x310B/x	Reserved	0	
0x310C/x 0x310D/x	Upper limit value channel 2	Value from the rated range; if this value is exceeded and the limit value monitoring function is active, a process alarm is triggered. $7FFF_h$: Limit value alarm deactivated	$7FFF_h$
0x310E/x 0x310F/x	Lower limit value channel 2	Value from the rated range; if the actual value falls below this value and the limit value monitoring function is active, a process alarm is triggered. 8000_h: Limit value alarm deactivated	8000_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

8.8.7 2 analog outputs 0 ... 10 V (12 bits) - EPM-S500

Parameter data

Index/sub index	Name	Description/value	Lenze
0x3100/x	Reserved	0	
0x3101/x	Short-circuit detection	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 Bits 2 ... 7: Reserved	00_h
0x3102/x	Function channel 1	16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
0x3103/x	Function channel 2		20_h
0x3104/x	Reserved		
...	...	...	
0x311D/x	Reserved	0	

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Output area (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	

8.8.8 4 analog outputs 0 ... 10 V (12 bits) - EPM-S501

Parameter data

Index/sub index	Name	Description/value	Lenze
0x3100/x	Reserved	0	
0x3101/x	Short-circuit detection	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 Bit 2: Channel 3 Bit 3: Channel 4 Bits 4 ... 7: Reserved	00_h
0x3102/x	Function channel 1	16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
0x3103/x	Function channel 2		20_h
0x3104/x	Function channel 3		20_h
0x3105/x	Function channel 4		20_h
0x3106/x	Reserved	0	
...	...	...	
0x311D/x	Reserved	0	

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Output area (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	

8.8.9 2 analog outputs 0/4 ... 20 mA (12 bits) - EPM-S502

Parameter data

Index/sub index	Name	Description/value	Lenze
0x3100/x	Reserved	0	
0x3101/x	Wire-breakage detection	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 Bits 2 ... 7: Reserved	00_h
0x3102/x	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	31_h
0x3103/x	Function channel 2		31_h
0x3104/x	Reserved		
...	...	...	
0x311D/x	Reserved	0	

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

8.8.10 4 analog outputs 0/4 ... 20 mA (12 bits) - EPM-S503

Parameter data

Index/sub index	Name	Description/value	Lenze
0x3100/x	Reserved	0	
0x3101/x	Wire-breakage detection	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 Bit 2: Channel 3 Bit 3: Channel 4 Bits 4 ... 7: Reserved	00_h
0x3102/x	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	31_h
0x3103/x	Function channel 2		31_h
0x3104/x	Function channel 3		31_h
0x3105/x	Function channel 4		31_h
0x3106/x	Reserved	0	
...	...	...	
0x311D/x	Reserved	0	

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

8.8.11 Error behaviour

Index	Name	Possible settings				Important	
		Lenze	Selection				
I6443$_h$ ↵	Error mode analog output		0	{1}	255	Configures analog output monitoring	📖 371
			0	All analog outputs retain the last value output			
			255	Response from I6444$_h$		In I6444$_h$ the response can be configured individually for each analog output	
1	Channel 1	0					
2	Channel 2	0					
...	...	...					
36	Channel 36	0					
I6444$_h$ ↵	Error value analog output		-32768	{1}	32767	Configures the individual analog output responses	📖 371
1	Channel 1	0				The analog outputs provide the set value	
2	Channel 2	0					
...	...	...					
36	Channel 36	0					

8.9 Parameterising the temperature measurement

8.9.1 Four (two) analog inputs for resistance tests - EPM-S404

Note!

- ► Use parameter setting to deactivate unused inputs.
- ► If thermal detectors are connected in a 3-wire or 4-wire setup, channels 3 and/or 4 must be deactivated.
- ► The module does not provide any auxiliary supply for sensors.

Parameter data

Index/sub index	Name	Description/value	Lenze
0x3100/x	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 0 ... 5: Reserved Bit 6: diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
0x3101/x	Wire-breakage detection	Bit 0: Channel 1 (0 = inhibited; 1 = enabled) : Bit 3: Channel 4 Bits 4 ... 7: Reserved	00_h
0x3102/x	Limit value monitoring	Bit 0: Channel 1 (0 = inhibited; 1 = enabled) : Bit 3: Channel 4 Bit 4 ... 7: Reserved	00_h
0x3103/x	Reserved		
0x3104/x	Temperature system	Bit 0, 1: 00_b = °C; 01_b= °F; 10_b = K Bits 2 ... 7: Reserved	00_h
0x3105/x	Interference frequency suppression	Bit 0, 1: 01_b = 60 Hz; 10_b = 50 Hz Bits 2 ... 7: Reserved	02_h

Index/sub index	Name	Description/value	Lenze
Channel 1			
0x3106/x	Function channel 1	Thermal detector: 80 (50_h): PT100 2-wire conductor -200°C ... +850°C / -2000 ... $+8500_{dec}$ 81 (51_h): PT1000 2-wire conductor -200°C ... +850°C / -2000 ... $+8500_{dec}$ 82 (52_h): Ni100 2-wire conductor -60°C ... +250°C / -600 ... $+2500_{dec}$ 83 (53_h): Ni1000 2-wire conductor -60°C ... +250°C / -600 ... $+2500_{dec}$ 88 (58_h): PT100 3-wire conductor -200°C ... +850°C / -2000 ... $+8500_{dec}$ 89 (59_h): PT1000 3-wire conductor -200°C ... +850°C / -2000 ... $+8500_{dec}$ 90 ($5A_h$): Ni100 3-wire conductor -60°C ... +250°C / -600 ... $+2500_{dec}$ 91 ($5B_h$): Ni1000 3-wire conductor -60°C ... +250°C / -600 ... $+2500_{dec}$ 96 (60_h): PT100 4-wire conductor -200°C ... +850°C / -2000 ... $+8500_{dec}$ 97 (61_h): PT1000 4-wire conductor -200°C ... +850°C / -2000 ... $+8500_{dec}$ 98 (62_h): Ni100 4-wire conductor -60°C ... +250°C / -600 ... $+2500_{dec}$ 99 (63_h): Ni1000 4-wire conductor -60°C ... +250°C / -600 ... $+2500_{dec}$ Resistor: 112 (70_h): R 60-Ω2-wire conductor 0.00 ... +60.00 / 0 ... $+32767_{dec}$ 113 (71_h): R 600-Ω2-wire conductor 0.00 ... +600.00 / 0 ... $+32767_{dec}$ 114 (72_h): R 3000-Ω2-wire conductor 0.00 ... +3000.00 / 0 ... $+32767_{dec}$ 115 (73_h): R 6000-Ω2-wire conductor 0.00 ... +6000.00 / 0 ... $+32767_{dec}$ 128 (80_h): R 60-Ω4-wire conductor 0.00 ... +60.00 / 0 ... $+32767_{dec}$ 129 (81_h): R 600-Ω4-wire conductor 0.00 ... +600.00 / 0 ... $+32767_{dec}$ 130 (82_h): R 3000-Ω4-wire conductor 0.00 ... +3000.00 / 0 ... $+32767_{dec}$ 144 (90_h): R 60-Ω2-wire conductor 0.00 ... +60.00 / 0 ... $+6000_{dec}$ 145 (91_h): R 600-Ω2-wire conductor 0.00 ... +600.00 / 0 ... $+6000_{dec}$ 146 (92_h): R 3000-Ω2-wire conductor 0.00 ... +3000.00 / 0 ... $+30000_{dec}$ 160 ($A0_h$): R 60-Ω2-wire conductor 0.00 ... +60.00 / 0 ... $+6000_{dec}$ 161 ($A1_h$): R 600-Ω2-wire conductor 0.00 ... +600.00 / 0 ... $+6000_{dec}$ 162 ($A2_h$): R 3000-Ω2-wire conductor 0.00 ... +3000.00 / 0 ... $+30000_{dec}$ 255 (FF_h): channel deactivated	50_h

Index/sub index	Name	Description/value	Lenze
0x3107/x	Conversion time channel 1	You can set the transformer speed as a function of the interference frequency suppression (see 0x3105/x) for each channel. 0 (00_h): At 50 Hz: 324.1 ms/channel 16 bits; at 60 Hz: 270.5 ms/channel 16 bits 1 (01_h): At 50 Hz: 164.2 ms/channel 16 bits; at 60 Hz: 137.2 ms/channel 16 bits 2 (02_h): At 50 Hz: 84.2 ms/channel 16 bits; at 60 Hz: 70.5 ms/channel 16 bits 3 (03_h): at 50 Hz: 44.1 ms/channel 16 bits; at 60 Hz: 37.2 ms/channel 16 bits 4 (04_h): At 50 Hz: 24.2 ms/channel 16 bits; at 60 Hz: 20.5 ms/channel 16 bits 5 (05_h): At 50 Hz: 14.2 ms/channel 16 bits; at 60 Hz: 12.2 ms/channel 16 bits 6 (06_h): At 50 Hz: 9.2 ms/channel 16 bits; at 60 Hz: 8.0 ms/channel 16 bits 7 (07_h): At 50 Hz: 6.6 ms/channel 15 bits; at 60 Hz: 5.9 ms/channel 15 bits 8 (08_h): At 50 Hz: 4.2 ms/channel 13 bits; at 60 Hz: 3.8 ms/channel 13 bits	00_h
0x3108/x	Upper limit value (HIGH byte) channel 1	You can define an upper or lower limit value for each channel. For this you can only specify values from the nominal range, otherwise you'll receive a parameterisation error. By specification of 7FFFh for the upper or 8000h for the lower limit value, the corresponding limit value is deactivated. If your measured value is outside a limit value and you have activated the limit value monitoring, a process alarm is triggered.	$7F_h$
0x3109/x	Upper limit value channel 1 (LOW byte)		FF_h
0x310A/x	Lower limit value (HIGH byte) channel 1		80_h
0x310B/x	Lower limit value channel 1 (LOW byte)		00_h
Channel 2			
0x310C/x	Function channel 2	See channel 1	50_h
0x310D/x	Conversion time channel 2	See channel 1	00_h
0x310E/x	Upper limit value channel 2 (HIGH byte)	See channel 1	$7F_h$
0x310F/x	Upper limit value (LOW byte) channel 2		FF_h
0x3110/x	Lower limit value channel 2 (HIGH byte)		80_h
0x3111/x	Lower limit value (LOW byte) channel 2		00_h
Channel 3 (for two-wire conductor connections only)			
0x3112/x	Function channel 3	See channel 1	50_h
0x3113/x	Conversion time channel 3	See channel 1	00_h
0x3114/x	Upper limit value channel 3 (HIGH byte)	See channel 1	$7F_h$
0x3115/x	Upper limit value channel 3 (LOW byte)		FF_h
0x3116/x	Lower limit value channel 3 (HIGH byte)		80_h
0x3117/x	Lower limit value channel 3 (LOW byte)		00_h

Index/sub index	Name	Description/value	Lenze
Channel 4 (for two-wire conductor connections only)			
0x3118/x	Function channel 4	See channel 1	50_h
0x3119/x	Conversion time channel 4	See channel 1	00_h
0x311A/x	Upper limit value channel 4 (HIGH byte)	See channel 1	$7F_h$
0x311B/x	Upper limit value channel 4 (LOW byte)		FF_h
0x311C/x	Lower limit value channel 4 (HIGH byte)		80_h
0x311D/x	Lower limit value channel 4 (LOW byte)		00_h

Measuring range

Measuring range (Fct. no.)	Measured value	Signal range	Range
2-wire: PT100 (50_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
2-wire: PT1000 (51_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
2-wire: NI100 (52_h)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
2-wire: NI1000 (53_h)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
3-wire: PT100 (58_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
3-wire: PT1000 (59_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
3-wire: NI100 ($5A_h$)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
3-wire: NI1000 ($5B_h$)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
4-wire: PT100 (60_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
4-wire: PT1000 (61_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow

Measuring range (Fct. no.)	Measured value	Signal range	Range
4-wire: NI100 (62_h)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	$-600 \ldots +2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
4-wire: NI1000 (63_h)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	$-600 \ldots +2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
2-wire: 0 ... 60 Ω (70_h)	-	-	Overflow
	0 ... 60 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
2-wire: 0 ... 600 Ω (71_h)	-	-	Overflow
	0 ... 600 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
2-wire: 0 ... 3000 Ω (72_h)	-	-	Overflow
	0 ... 3000 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
3-wire: 0 ... 60 Ω (78_h)	-	-	Overflow
	0 ... 60 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
3-wire: 0 ... 600 Ω (79_h)	-	-	Overflow
	0 ... 600 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
3-wire: 0 ... 3000 Ω ($7A_h$)	-	-	Overflow
	0 ... 3000 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
4-wire: 0 ... 60 Ω (80_h)	-	-	Overflow
	0 ... 60 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
4-wire: 0 ... 600 Ω (81_h)	-	-	Overflow
	0 ... 600 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
4-wire: 0 ... 3000 Ω (82_h)	-	-	Overflow
	0 ... 3000 Ω	0 ... 32767	Nominal range
	-	-	Underflow
2-wire: 0 ... 60 Ω (90_h)	-	-	Overflow
	0 ... 60 Ω	$0 \ldots 6000_{dec}$	Nominal range
	-	-	Underflow
2-wire: 0 ... 600 Ω (91_h)	-	-	Overflow
	0 ... 600 Ω	$0 \ldots 6000_{dec}$	Nominal range
	-	-	Underflow
2-wire: 0 ... 3000 Ω (92_h)	-	-	Overflow
	0 ... 3000 Ω	$0 \ldots 30000_{dec}$	Nominal range
	-	-	Underflow
3-wire: 0 ... 60 Ω (98_h)	-	-	Overflow
	0 ... 60 Ω	$0 \ldots 6000_{dec}$	Nominal range
	-	-	Underflow

Measuring range (Fct. no.)	Measured value	Signal range	Range
3-wire: 0 ... 600 Ω (99_h)	-	-	Overflow
	0 ... 600 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 3000 Ω ($9A_h$)	-	-	Overflow
	0 ... 3000 Ω	0 ... 30000_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 60 Ω ($A0_h$)	-	-	Overflow
	0 ... 60 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 600 Ω ($A1_h$)	-	-	Overflow
	0 ... 600 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 3000 Ω ($A2_h$)	-	-	Overflow
	0 ... 3000 Ω	0 ... 30000_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 60 Ω ($D0_h$)	70.55 Ω	32511_{dec}	Overflow
	0 ... 60 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 600 Ω ($D1_h$)	705.5 Ω	32511_{dec}	Overflow
	0 ... 600 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 3000 Ω ($D2_h$)	3528 Ω	32511_{dec}	Overflow
	0 ... 3000 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 60 Ω ($D8_h$)	70.55 Ω	32511_{dec}	Overflow
	0 ... 60 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 600 Ω ($D9_h$)	705.5 Ω	32511_{dec}	Overflow
	0 ... 600 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 3000 Ω (DA_h)	3528 Ω	32511_{dec}	Overflow
	0 ... 3000 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 60 Ω ($E0_h$)	70.55 Ω	32511_{dec}	Overflow
	0 ... 60 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 600 Ω ($E1_h$)	705.5 Ω	32511_{dec}	Overflow
	0 ... 600 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 3000 Ω ($E2_h$)	3528 Ω	32511_{dec}	Overflow
	0 ... 3000 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow

8.9.2 Two analog inputs for thermocouple measurement - EPM-S405

Parameter data

Index/sub index	Name	Description/value	Lenze
0x3100/x	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 0 ... 5: Reserved Bit 6: diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
0x3101/x	Wire-breakage detection	Bit 0: Channel 1 (0 = inhibited; 1 = enabled) Bit 1: Channel 2 Bits 2 ... 7: Reserved	00_h
0x3102/x	Limit value monitoring	Bit 0: Channel 1 (0 = inhibited; 1 = enabled) Bit 1: Channel 2 Bits 2 ... 7: Reserved	00_h
0x3103/x	Reserved	0	
0x3104/x	Temperature system	Bit 0, 1: 00_b = °C; 10_b = °F; 11_b = K Bits 2 ... 7: Reserved	00_h
0x3105/x	Interference frequency suppression	Bit 0, 1: 01_b = 60 Hz; 10_b = 50 Hz Bits 2 ... 7: Reserved	02_h
Channel 1			
0x3106/x	Function channel 1	External temperature compensation: 176 (60_h): type J, -210.0 ... +1200.0 °C / -2100 ... +12000_{dec} 177 (61_h): type K, -270.0 ... +1372.0 °C / -2700 ... +13720_{dec} 178 (62_h): type N -270.0 ... +1300.0 °C / -2700 ... +13000_{dec} 179 (63_h): type R, -50.0 ... +1769.0 °C / -500 ... +17690_{dec} 180 (64_h): type S, -50.0 ... +1769.0 °C / -500 ... +17690_{dec} 181 (65_h): type T, -270.0 ... +400.0 °C / -2700 ... +4000_{dec} 182 (66_h): type B, 0.0 ... +1820.0 °C / 0 ... +18200_{dec} 183 (67_h): type C, 0.0 ... +2315.0 °C / 0 ... +23150_{dec} 184 (68_h): type E, -270.0 ... +1000.0 °C / -2700 ... +10000_{dec} 185 (69_h): type L, -200.0 ... +900.0 °C / -2000 ... +9000_{dec} Internal temperature compensation: 192 ($C0_h$): type J, -210.0 ... +1200.0 °C / -2100 ... +12000_{dec} 193 ($C1_h$): type K, -270.0 ... +1372.0 °C / -2700 ... +13720_{dec} 194 ($C2_h$): type N -270.0 ... +1300.0 °C / -2700 ... +13000_{dec} 195 ($C3_h$): type R, -50.0 ... +1769.0 °C / -500 ... +17690_{dec} 196 ($C4_h$): type S, -50.0 ... +1769.0 °C / -500 ... +17690_{dec} 197 ($C5_h$): type T, -270.0 ... +400.0 °C / -2700 ... +4000_{dec} 198 ($C6_h$): type B, 0.0 ... +1820.0 °C / 0 ... +18200_{dec} 199 ($C7_h$): type C, 0.0 ... +2315.0 °C / 0 ... +23150_{dec} 200 ($C8_h$): type E, -270.0 ... +1000.0 °C / -2700 ... +10000_{dec} 201 ($C9_h$): type L, -200.0 ... +900.0 °C / -2000 ... +9000_{dec} 255 (FF_h): channel deactivated	$C1_h$

Index/sub index	Name	Description/value	Lenze
0x3107/x	Conversion time channel 1	You can set the transformer speed as a function of the interference frequency suppression (see 0x3105/x) for each channel. 0 (00_h): At 50 Hz: 324.1 ms/channel 16 bits; at 60 Hz: 270.5 ms/channel 16 bits 1 (01_h): at 50 Hz: 164.2 ms/channel 16 bits; at 60 Hz: 137.2 ms/channel 16 bits 2 (02_h): At 50 Hz: 84.2 ms/channel 16 bits; at 60 Hz: 70.5 ms/channel 16 bits 3 (03_h): at 50 Hz: 44.1 ms/channel 16 bits; at 60 Hz: 37.2 ms/channel 16 bits 4 (04_h): At 50 Hz: 24.2 ms/channel 16 bits; at 60 Hz: 20.5 ms/channel 16 bits 5 (05_h): at 50 Hz: 14.2 ms/channel 16 bits; at 60 Hz: 12.2 ms/channel 16 bits 6 (06_h): at 50 Hz: 9.2 ms/channel 16 bits; at 60 Hz: 8.0 ms/channel 16 bits 7 (07_h): at 50 Hz: 6.6 ms/channel 15 bits; at 60 Hz: 5.9 ms/channel 15 bits 8 (08_h): at 50 Hz: 4.2 ms/channel 13 bits; at 60 Hz: 3.8 ms/channel 13 bits	02_h
0x3108/x	Upper limit value (HIGH byte) channel 1	You can define an upper or lower limit value for each channel. For this you can only specify values from the nominal range, otherwise you'll receive a parameterisation error. By specification of 7FFFh for the upper or 8000h for the lower limit value, the corresponding limit value is deactivated. If your measured value is outside a limit value and you have activated the limit value monitoring, a process alarm is triggered.	$7F_h$
0x3109/x	Upper limit value channel 1 (LOW byte)		FF_h
0x310A/x	Lower limit value (HIGH byte) channel 1		80_h
0x310B/x	Lower limit value channel 1 (LOW byte)		00_h
Channel 2			
0x310C/x	Function channel 2	See channel 1	$C1_h$
0x310D/x	Conversion time channel 2	See channel 1	02_h
0x310E/x	Upper limit value channel 2 (HIGH byte)		$7F_h$
0x310F/x	Upper limit value (LOW byte) channel 2		FF_h
0x3110/x	Lower limit value channel 2 (HIGH byte)		80_h
0x3111/x	Lower limit value (LOW byte) channel 2		00_h
0x3112/x	Reserved	0	
...	...	...	
0x311D/x	Reserved	0	

Measuring range

Measuring range (Fct. no.)	Measured value [°C]	[°F]	[K]	Range
Type J: -210 ... +1200 °C -346 ... 2192 °F 63.2 ... 1473.2 K ($B0_h$: ext. comp. 0 °C) ($C0_h$: int. comp. 0 °C)	+14500	26420	17232	Overflow
	-2100 ... +12000	-3460 ... +21920	632 ... 14732	Nominal range
	-	-	-	Underflow

Measuring range (Fct. no.)	Measured value [°C]	[°F]	[K]	Range
Type K: -210 ... +1372 °C -454 ... 2501.6 °F 0 ... 1645.2 K ($B1_h$: ext. comp. 0 °C) ($C1_h$: int. comp. 0 °C)	+16220	29516	18952	Overflow
	-2700 ... +13720	-4540 ... 25016	0 ... 16452	Nominal range
	-	-	-	Underflow
Type N: -270 ... +1300 °C -454 ... 2372 °F 0 ... 1573.2 K ($B2_h$: ext. comp. 0 °C) ($C2_h$: int. comp. 0 °C)	+15500	28220	18232	Overflow
	-2700 ... +13000	-4540 ... 23720	0 ... 15732	Nominal range
	-	-	-	Underflow
Type R: -50 ... +1769 °C -58 ... 3216.2 °F 223.2 ... 2042.2 K ($B3_h$: ext. comp. 0 °C) ($C3_h$: int. comp. 0 °C)	+20190	32766	22922	Overflow
	-500 ... +17690	-580 ... 32162	2232 ... 20422	Nominal range
	-1700	-2740	1032	Underflow
Type S: -50 ... +1769 °C -58 ... 3216.2 °F 223.2 ... 2042.2 K ($B4_h$: ext. comp. 0 °C) ($C4_h$: int. comp. 0 °C)	+20190	32766	22922	Overflow
	-500 ... +17690	-580 ... 32162	2232 ... 20422	Nominal range
	-1700	-2740	1032	Underflow
Type T: -270 ... +440 °C -454 ... 752 °F 3.2 ... 673.2 K ($B2_h$: ext. comp. 0 °C) ($C2_h$: int. comp. 0 °C)	+5400	10040	8132	Overflow
	-2700 ... +4000	-4540 ... 7520	32 ... 6732	Nominal range
	-	-	-	Underflow
Type B: 0 ... +1820 °C 32 ... 2786.5 °F 273.2 ... 2093.2 K ($B6_h$: ext. comp. 0 °C) ($C6_h$: int. comp. 0 °C)	+20700	32766	23432	Overflow
	0 ... +18200	320 ... 27865	2732 ... 20932	Nominal range
	-1200	-1840	1532	Underflow
Type C: 0 ... +2315 °C 32 ... 2786.5 °F 273.2 ... 2093.2 K ($B7_h$: ext. comp. 0 °C) ($C7_h$: int. comp. 0 °C)	+25000	32766	23432	Overflow
	0 ... +23150	320 ... 27865	2732 ... 20932	Nominal range
	-1200	-1840	1532	Underflow
Type E: -270 ... +1000 °C -454 ... 1832 °F 0 ... 1273.2 K ($B8_h$: ext. comp. 0 °C) ($C8_h$: int. comp. 0 °C)	+12000	21920	14732	Overflow
	-2700 ... +10000	-4540 ... 18320	0 ... 12732	Nominal range
	-	-	-	Underflow
Type L: -200 ... +900 °C -328 ... 1652 °F 73.2 ... 1173.2 K ($B9_h$: ext. comp. 0 °C) ($C9_h$: int. comp. 0 °C)	+11500	21020	14232	Overflow
	-2000 ... +9000	-3280 ... 16520	732 ... 11732	Nominal range
	-	-	-	Underflow

8.9.3 Error behaviour

Index	Name	Possible settings				Important	
		Lenze	Selection				
I6443$_h$ ↵	Error mode analog output		0	{1}	255	Configures analog output monitoring	📖 371
			0	All analog outputs retain the last value output			
			255	Response from I6444$_h$		In I6444$_h$ the response can be configured individually for each analog output	
1	Channel 1	0					
2	Channel 2	0					
...	...	...					
36	Channel 36	0					
I6444$_h$ ↵	Error value analog output		-32768	{1}	32767	Configures the individual analog output responses The analog outputs provide the set value	📖 371
1	Channel 1	0					
2	Channel 2	0					
...	...	...					
36	Channel 36	0					

8.10 Parameterising the counter

8.10.1 Commissioning examples

The indexes for the signal setting in the following examples refer to the EPM-S600. In the case of different counters the function selection can be placed on a different index (📖 Parameter data of the counter).

Example 1: Counting upwards

Step	Setting	Comment
1	Set signal evaluation: Index 0x310A/x, bit 2 ... 0 = 100_b (direction)	A signal evaluation has to be specified, otherwise the counting process is not started.
2	Accept parameter setting: 0x31FF = 255_{dec}	No storage into the EEPROM of the bus coupler.
3	Enable of the software gates via control word 📖 290: Bit 2 (*SW_GATE_SET*) = HIGH	Transfer control word to the counter via PDO.

Example 2: Accept set value

Step	Setting	Comment
1	Set signal evaluation: Index 0x310A/x, bit 2 ... 0 = 100_b (direction)	A signal evaluation has to be specified, otherwise the counting process is not started.
2	Accept parameter setting: 0x31FF = 255_{dec}	No storage into the EEPROM of the bus coupler.
3	Transfer set value to the counter via PDO: e.g. 2147483583_{dec}→Tx-PDO= □□□□|7F|FF|FF|BF	
4	Activation of the set value via control word 📖 290: Bit 5 (*COUNTERval_SET*) = HIGH	Transfer control word via PDO to the counter.

Example 3: Set comparison bit

If the count value is 255 (= comparison value), the digital output is set.

Step	Setting	Comment
1	Set signal evaluation: Index 0x310A/x, bit 2 ... 0 = 100_b (direction)	A signal evaluation has to be specified, otherwise the counting process is not started.
2	Set comparator: Index 0x3109/x, bit 2 ... 0 = 010_b (count value ≤ comparison value)	
3	Accept parameter setting: 0x31FF = 255_{dec}	No storage into the EEPROM of the bus coupler.
4	Transfer comparison value to the counter via PDO: e.g. 255_{dec}→Tx-PDO= FF|00|00|00|00	
5	Enable digital output via control word 📖 290: Bit 1 (*CTRL_DO_SET*) = HIGH	Transfer control word to the counter via PDO.



Further information ...
Default mapping 📖 291
Control and status words 📖 229

8.10.2 Rotary transducer signal evaluation

Depending on which edge of a channel is evaluated, the following pulse trains and the associated pulse multiplication can be realised.

Pulse trains	Description	
Channel A		
Channel B		
Single evaluation		There is a response to the falling edges of channel A. The number of pulses has not increased.
Double evaluation		There is a response to the rising and the falling edges of channel A. The number of pulses has doubled and is symmetrical.
Four-fold evaluation		The rising and the falling edges of channels A and B are evaluated. The number of pulses is quadrupled and is symmetrical.

8.10.3 One counter 32 bits, 24 V DC - EPM-S600

The following functions can be parameterised:

Counting functions	Description
Counting continuously	The counter counts from the loading value to the counting limit, then skips to the opposite counting limit and continues to count from there.
Counting once	The counter counts once/periodically from the loading value in the specified counting range.
Counting periodically	

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Main counting direction	The main counting direction can be parameterised: **None:** The whole counting range is available. **Forwards:** Limitation of the counting range upwards. The counter counts from the parameterised loading value in the positive direction to the parameterised final value -1 and then skips to the loading value again with the encoder pulse that is following. **Backwards:** Limitation of the counting range downwards. The counter counts from the parameterised loading value in the negative direction to the parameterised final value +1 and then skips to the loading value again with the encoder pulse that is following.
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter a differentiation between the internal gate (I-gate), hardware gate (HW gate), and software gate (SW gate) is made. ● The I-gate is the AND logic operation of the software gate (SW gate) and the hardware gate (HW gate). ● The SW gate is controlled via your user program (status word in the output area). ● The HW gate is controlled via the digital gate input. The following response can be parameterised: **Cancelling gate function:**After closing the gate and opening it again, the counting process continues from the loading value again. **Interrupting gate function:**After closing the gate and opening it again, the counting process continues with the last current counter content.
Latch function	If a positive edge occurs at the latch input, the current count value is stored in the latch register. The latch register is accessed via the input area. After a STOP-RUN transition, latch is always 0.
Comparator	You can specify a comparison value which, depending on the count value, activates the digital output or triggers a process alarm.
Hysteresis	By specification of a hysteresis you can for instance prevent the output from being permanently switched if the value of an encoder signal fluctuates around the comparison value.
Process alarm	The activation of a process alarm can be parameterised. A process alarm can be triggered in the case of the following events: ● Hardware gate open ● Hardware gate closed ● Counting limit - overflow ● Counting limit - underflow ● Comparison value reached ● Final value reached ● Latch value reached
Diagnostic alarm	If the diagnostic alarm is enabled in the parameter setting, it occurs as soon as another process alarm is triggered for the same event during process alarm processing.
Diagnostic function	Diagnostic functions are provided in the modules.
Diagnostic information	The diagnostic information describes the diagnostic contents which can be read out from a module. The diagnostic formation is not automatically sent by the module but must actively be read out by SDO access.



Further information can be found in the chapter ”Product description”.

Parameter data

Index/sub index	Name	Description/value	Lenze
0x3100/x	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 5 ... 0: Reserved Bit 6: diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
0x3101/x	Input frequency track A	Filters for instance serve to filter signal peaks in the case of an unclean input signal. 0 (00_h): 500 kHz 1 (01_h): 300 kHz 2 (02_h): 100 kHz 3 (03_h): 60 kHz 4 (04_h): 30 kHz 6 (06_h): 10 kHz 7 (07_h): 5 kHz 8 (08_h): 2 kHz 9 (09_h): 1 kHz Other values are not permissible!	02_h
0x3102/x	Input frequency track B		02_h
0x3103/x	Input frequency latch		02_h
0x3104/x	Input frequency gate		02_h
0x3105/x	Input frequency reset		00_h
0x3106/x	Reserved		
0x3107/x	Alarm response	Setting activates process alarm Bit 0: Proc. alarm HW gate open Bit 1: Proc. alarm HW gate closed Bit 2: Proc. alarm overflow Bit 3: Proc. alarm underflow Bit 4: Proc. alarm comparison value Bit 5: Proc. alarm final value Bit 6: Proc. alarm latch value Bit 7: Reserved	80_h
0x3108/x	Counter function	Bits 5 ... 0: 000000_b = counting continuously 000001_b = counting once, main counting direction forwards 000010_b = counting once, main counting direction backwards 000100_b = counting once, no main counting direction 001000_b = counting periodically, main counting direction forwards 010000_b = counting periodically, main counting direction backwards 100000_b = counting periodically, no main counting direction Bits 7 ... 6: Reserved	40_h
0x3109/x	Comparator	Bit 2 ... 0: output switches (... if condition is met) 000_b = never 001_b = count value ≥ comparison value 010_b = count value ≤ comparison value 100_b = count value = comparison value Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 6 ... 4: Reset 000_b = deactivated 001_b = HIGH level 011_b = rising edge 101_b = rising edge, once Bit 7: Reserved	00_h

Index/sub index	Name	Description/value	Lenze
0x310A/x	Signal evaluation	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (to A/pulse) 010_b = double rotary transducer (to A/pulse) 011_b = four-fold rotary transducer (to A/pulse and B/direction) 100_b = direction (pulse to A/pulse and direction to B/direction) Bit 6 ... 3: hardware gate (HW gate) 000_b = deactivated (counter starts by setting SW gate) 001_b = activated (HIGH level at gate activates the HW gate. Counter starts if HW and SW gate are set.) Bit 7: Gate function (internal gate) 0= abort (counting process starts again from loading value) 1 = interrupt (counting process is continued with counter content)	00_h
0x310B/x ... 0x310E/x	Final value	Upper limit of the counting range; counting method: 0x310B: byte 3 (high byte) 0x310C: byte 2 0x310D: byte 1 0x310E: byte 0 (low byte)	00_h
0x310F/x ... 0x3112/x	Start value	Lower limit of the counting range; counting method: 0x310B: byte 3 (high byte) 0x3110: byte 2 0x3111: byte 1 0x3112: byte 0 (low byte)	00_h
0x3113/x	Hysteresis	The hysteresis for instance serves to avoid frequent switching operations of the output and/or triggering of the alarm when the count value is within the range of the comparison value. For the hysteresis you can select a range between 0 and 255. With the settings 0 and 1 the hysteresis is switched off. The hysteresis has an effect on the zero crossing, comparison, overflow/underflow.	00_h
0x3114/x	Pulse	The pulse duration indicates for how long the output is to be set if the parameterised comparison criterion is reached or exceeded. The pulse duration can be specified in steps of 2.048 ms between 0 and 522.24 ms. If the pulse duration is = 0, the output is set until the comparison condition is no longer met.	00_h
0x3115/x ... 0x3129/x	Reserved		

8.10.4 Two counters 32 bits, 24 V DC - EPM-S601

The following functions can be parameterised:

Counting functions	Description
Counting continuously	The counter counts from the loading value to the counting limit, then skips to the opposite counting limit and continues to count from there.
Counting once	The counter counts once/periodically from the loading value in the specified counting range.
Counting periodically	

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Main counting direction	The main counting direction can be parameterised: **None:** The whole counting range is available. **Forwards:** Limitation of the counting range upwards. The counter counts from the parameterised loading value in the positive direction to the parameterised final value -1 and then skips to the loading value again with the encoder pulse that is following. **Backwards:** Limitation of the counting range downwards. The counter counts from the parameterised loading value in the negative direction to the parameterised final value +1 and then skips to the loading value again with the encoder pulse that is following.
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter the internal gate (I-gate) is conform to the software gate (SW gate) which you control via your user program (status word in the output area). The following response can be parameterised: **Cancelling gate function:**After closing the gate and opening it again, the counting process continues from the loading value again. **Interrupting gate function:**After closing the gate and opening it again, the counting process continues with the last current counter content.
Comparator	You can specify a comparison value which, depending on the count value, activates the digital output or triggers a process alarm.
Hysteresis	By specification of a hysteresis you can for instance prevent the output from being permanently switched if the value of an encoder signal fluctuates around the comparison value.
Process alarm	The activation of a process alarm can be parameterised. A process alarm can be triggered in the case of the following events: ● Hardware gate open ● Hardware gate closed ● Counting limit - overflow ● Counting limit - underflow ● Comparison value reached ● Final value reached ● Latch value reached
Diagnostic alarm	If the diagnostic alarm is enabled in the parameter setting, it occurs as soon as another process alarm is triggered for the same event during process alarm processing.
Diagnostic function	Diagnostic functions are provided in the modules.
Diagnostic information	The diagnostic information describes the diagnostic contents which can be read out from a module. The diagnostic formation is not automatically sent by the module but must actively be read out by SDO access.

Further information can be found in the chapter ”Product description”.

Parameter data

Index/sub index	Name	Description/value	Lenze
0x3100/x	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
0x3101/x	Input frequency counter 1, track A	Filters for instance serve to filter signal peaks in the case of an unclean input signal. 0 (00_h): 500 kHz 1 (01_h): 300 kHz 2 (02_h): 100 kHz 3 (03_h): 60 kHz 4 (04_h): 30 kHz 6 (06_h): 10 kHz 7 (07_h): 5 kHz 8 (08_h): 2 kHz 9 (09_h): 1 kHz Other values are not permissible!	02_h
0x3102/x	Input frequency counter 1, track B		02_h
0x3103/x	Input frequency counter 2, track A		02_h
0x3104/x	Input frequency counter 2, track B		02_h
0x3105/x	Alarm response counter 1	Setting activates process alarm Bits 1 ... 0: reserved Bit 2: Proc. alarm overflow Bit 3: Proc. alarm underflow Bit 4: Proc. alarm comparison value Bit 5: Proc. alarm final value Bits 7 ... 6: Reserved	00_h
0x3106/x	Counter function counter 1	Bits 5 ... 0: 000000_b = counting continuously 000001_b = once: forwards 000010_b = once: backwards 000100_b = once: no main counting direction 001000_b = periodically: forwards 010000_b = periodically: backwards 100000_b = periodically: no main counting direction Bits 7 ... 6: Reserved	00_h
0x3107/x	Comparator counter 1	Bits 2 ... 0: Comparison bit is set (... if condition is met) 000_b = never 001_b = count value ≥ comparison value 010_b = count value ≤ comparison value 100_b = count value = comparison value Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 7 ... 4: Reserved	00_h
0x3108/x	Signal evaluation counter 1	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (to A/pulse) 010_b = double rotary transducer (to A/pulse) 011_b = four-fold rotary transducer (to A/pulse and B/direction) 100_b = direction (pulse to A/pulse and direction to B/direction) Bits 6 ... 3: Reserved Bit 7: Gate function (internal gate) 0= abort (counting process starts again from loading value) 1 = interrupt (counting process is continued with counter content)	00_h

Index/sub index	Name	Description/value	Lenze
0x3109/x ... 0x310C/x	Set value counter 1	By specifying a set value, the counter can be loaded with the set value. With an edge 0-1 to COUNTERVAL_SET in the control word, the set value is adopted by the counter. Counting method: 0x3109: byte 3 (high byte) 0x310A: byte 2 0x310B: byte 1 0x310C: byte 0 (low byte)	00_h
0x310D/x ... 0x3110/x	Final value counter 1	Upper limit of the counting range Counting method: 0x310D: byte 3 (high byte) 0x310E: byte 2 0x310F: byte 1 0x3110: byte 0 (low byte)	00_h
0x3111/x ... 0x3114/x	Loading value counter 1	Lower limit of the counting range Counting method: 0x3111: byte 3 (high byte) 0x3112: byte 2 0x3113: byte 1 0x3114: byte 0 (low byte)	00_h
0x3115/x	Hysteresis counter 1	The hysteresis for instance serves to avoid frequent switching operations of the output and/or triggering of the alarm when the count value is within the range of the comparison value. For the hysteresis you can select a range between 0 and 255. With the settings 0 and 1 the hysteresis is switched off. The hysteresis has an effect on the zero crossing, comparison, overflow/underflow.	00_h
0x3116/x	Reserved		
0x3117/x	Alarm response counter 2	See counter 1	00_h
0x3118/x	Counter function counter 2	See counter 1	00_h
0x3119/x	Comparator counter 2	See counter 1	00_h
0x311A/x	Signal evaluation counter 2	See counter 1	00_h
0x311B/x ... 0x311E/x	Set value counter 2	See counter 1	00_h
0x311F/x ... 0x3122/x	Final value counter 2	See counter 1	00_h
0x3123/x ... 0x3126/x	Loading value counter 2	See counter 1	00_h
0x3127/x	Hysteresis counter 2	See counter 1	00_h
0x3128/x 0x3129/x	Reserved		

8.10.5 One counter 32 bits, 5 V DC - EPM-S602

The following functions can be parameterised:

Counting functions	Description
Counting continuously	The counter counts from the loading value to the counting limit, then skips to the opposite counting limit and continues to count from there.
Counting once	The counter counts once/periodically from the loading value in the specified counting range.
Counting periodically	

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Main counting direction	The main counting direction can be parameterised: **None:** The whole counting range is available. **Forwards:** Limitation of the counting range upwards. The counter counts from the parameterised loading value in the positive direction to the parameterised final value -1 and then skips to the loading value again with the encoder pulse that is following. **Backwards:** Limitation of the counting range downwards. The counter counts from the parameterised loading value in the negative direction to the parameterised final value +1 and then skips to the loading value again with the encoder pulse that is following.
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter the internal gate (I-gate) is conform to the software gate (SW gate) which you control via your user program (status word in the output area). The following response can be parameterised: **Cancelling gate function:**After closing the gate and opening it again, the counting process continues from the loading value again. **Interrupting gate function:**After closing the gate and opening it again, the counting process continues with the last current counter content.
Comparator	You can specify a comparison value which, depending on the count value, activates the digital output or triggers a process alarm.
Hysteresis	By specification of a hysteresis you can for instance prevent the output from being permanently switched if the value of an encoder signal fluctuates around the comparison value.
Process alarm	The activation of a process alarm can be parameterised. A process alarm can be triggered in the case of the following events: ● Hardware gate open ● Hardware gate closed ● Counting limit - overflow ● Counting limit - underflow ● Comparison value reached ● Final value reached ● Latch value reached
Diagnostic alarm	If the diagnostic alarm is enabled in the parameter setting, it occurs as soon as another process alarm is triggered for the same event during process alarm processing.
Diagnostic function	Diagnostic functions are provided in the modules.
Diagnostic information	The diagnostic information describes the diagnostic contents which can be read out from a module. The diagnostic formation is not automatically sent by the module but must actively be read out by SDO access.



Further information can be found in the chapter ”Product description”.

Parameter data

Index/sub index	Name	Description/value	Lenze
0x3100/x	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
0x3101/x	Input frequency track A	Filters for instance serve to filter signal peaks in the case of an unclean input signal. 0 (00_h): 500 kHz 1 (01_h): 300 kHz 2 (02_h): 100 kHz 3 (03_h): 60 kHz 4 (04_h): 30 kHz 6 (06_h): 10 kHz 7 (07_h): 5 kHz 8 (08_h): 2 kHz 9 (09_h): 1 kHz Other values are not permissible!	02_h
0x3102/x	Input frequency track B		02_h
0x3103/x	Input frequency reset		02_h
0x3104/x	Reserved		
0x3105/x	Alarm response	Setting activates process alarm Bits 1 ... 0: reserved Bit 2: Proc. alarm overflow Bit 3: Proc. alarm underflow Bit 4: Proc. alarm comparison value Bit 5: Proc. alarm final value Bits 7 ... 6: Reserved	00_h
0x3106/x	Counter function	Bits 5 ... 0: 000000_b = counting continuously 000001_b = once: forwards 000010_b = once: backwards 000100_b = once: no main counting direction 001000_b = periodically: forwards 010000_b = periodically: backwards 100000_b = periodically: no main counting direction Bits 7 ... 6: Reserved	00_h
0x3107/x	Comparator	Bits 2 ... 0: Comparison bit is set (... if condition is met) 000_b = never 001_b = count value ≥ comparison value 010_b = count value ≤ comparison value 100_b = count value = comparison value Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 6 ... 4: Reset 000_b = deactivated 001_b = HIGH level 011_b = rising edge 101_b = rising edge, once Bit 7: Reserved	00_h

Index/sub index	Name	Description/value	Lenze
0x3108/x	Signal evaluation	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (to A/pulse) 010_b = double rotary transducer (to A/pulse) 011_b = four-fold rotary transducer (to A/pulse and B/direction) 100_b = direction (pulse to A/pulse and direction to B/direction) Bits 6 ... 3: Reserved Bit 7: Gate function (internal gate) 0= abort (counting process starts again from loading value) 1 = interrupt (counting process is continued with counter content)	00_h
0x3109/x ... 0x310C/x	Final value	Upper limit of the counting range; counting method: 0x3109: byte 3 (high byte) 0x310A: byte 2 0x310B: byte 1 0x310C: byte 0 (low byte)	00_h
0x310D/x ... 0x3110/x	Start value	Lower limit of the counting range; counting method: 0x310D: byte 3 (high byte) 0x310E: byte 2 0x311F: byte 1 0x3110: byte 0 (low byte)	00_h
0x3111/x	Hysteresis		00_h
0x3112/x ... 0x3129/x	Reserved		00_h

8.10.6 Two counters 32 bits, 24 V DC - EPM-S603

The following functions can be parameterised:

Counting functions	Description
Counting continuously	The counter counts from 0 to the counting limit, then skips to the opposite counting limit and continues to count from there.

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter the internal gate (I-gate) is conform to the software gate (SW gate) which you control via your user program (status word in the output area).



Further information can be found in the chapter ”Product description”.

Parameter data

Index/sub index	Name	Description/value	Lenze
0x3100/x	Input frequency counter 1, track A	Filters for instance serve to filter signal peaks in the case of an unclean input signal. 0 (00_h): 500 kHz 1 (01_h): 300 kHz 2 (02_h): 100 kHz 3 (03_h): 60 kHz 4 (04_h): 30 kHz 6 (06_h): 10 kHz 7 (07_h): 5 kHz 8 (08_h): 2 kHz 9 (09_h): 1 kHz Other values are not permissible!	02_h
0x3101/x	Input frequency counter 1, track B		02_h
0x3102/x	Input frequency counter 2, track A		02_h
0x3103/x	Input frequency counter 2, track B		02_h
0x3104/x	Counting direction counter 1, track B	Bits 2 ... 0: Reserved Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 7 ... 4: Reserved	00_h
0x3105/x	Signal evaluation counter 1	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (to A/pulse) 010_b = double rotary transducer (to A/pulse) 011_b = four-fold rotary transducer (to A/pulse and B/direction) 100_b = direction (pulse to A/pulse and direction to B/direction) Bits 7 ... 3: Reserved	00_h
0x3106/x	Counting direction counter 2, track B	Bits 2 ... 0: Reserved Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 7 ... 4: Reserved	00_h
0x3107/x	Signal evaluation counter 2	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (to A/pulse) 010_b = double rotary transducer (to A/pulse) 011_b = four-fold rotary transducer (to A/pulse and B/direction) 100_b = direction (pulse to A/pulse and direction to B/direction) Bits 7 ... 3: Reserved	00_h
0x3108/x 0x3129/x	Reserved		

8.11 Parameterising the encoder evaluation

8.11.1 SSI - EPM-S604



Further information can be found in the chapter ”Product description”.

Parameter data

Index/sub index	Name	Description/value	Lenze
0x3100/x	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 5 ... 0: reserved Bit 6: diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
0x3101/x	Dead time HIGH byte	The dead time, also called tbs (time between sends), defines the waiting time between two encoder values to be observed by the module so that the encoder is able to process its value. This data can be found in the data sheet for your encoder. HIGH LOW 00_h 30_h: 1 µs 00_h 60_h: 2 µs 00_h $C0_h$: 4 µs 01_h 80_h: 8 µs 03_h 00_h: 16 µs 06_h 00_h: 32 µs 09_h 00_h: 48 µs $0C_h$ 00_h: 64 µs	0Ch
0x3102/x	Dead time LOW byte		00_h
0x3103/x	Baud rate HIGH byte	In the ”Monitoring operation” mode, the baud rate is irrelevant. Enter the baud rate here. This corresponds to the clock frequency via which the connected encoder communicates. More information on this can be found in the data sheet for your encoder. HIGH LOW 00_h 18_h: 2 MHz 00_h 20_h: 1.5 MHz 00_h 30_h: 1 MHz 00_h 60_h: 500 kHz 00_h $C0_h$: 250 kHz 01_h 80_h: 125 kHz	01_h
0x3104/x	Baud rate LOW byte		80_h
0x3105/x	Reserved		
0x3106/x	Scaling	Depending on the encoder, further bits are transmitted in addition to the encoder value. Scaling serves to determine how many bits postpositioned to the encoder value will be removed by shifting the encoder value to the right. The encoder value is scaled by the module only after a gray-binary conversion. More information can be found in the data sheet for your encoder. Value range: 00_h ... $0F_h$ = 0 bits ... 15 bits	00_h

Index/sub index	Name	Description/value	Lenze
0x3107/x	Bit length of encoder data	Enter the bit length of the encoder data here. Depending on the encoder, the encoder data consist of the current encoder value with subsequent bits. The total length has to be specified here. More information on this can be found in the data sheet for your encoder. 7 (07_h) = ”8 bits” 8 (08_h) = ”9 bits” 9 (09_h) = ”10 bits” 10 ($0A_h$) = ”11 bits” 11 ($0B_h$) = ”12 bits” 12 ($0C_h$) = ”13 bits” 13 ($0D_h$) = ”14 bits” 14 $0E_h$) = ”15 bits” 15 ($0F_h$) = ”16 bits” 16 (10_h) = ”17 bits” 17 (11_h) = ”18 bits” 18 (12_h) = ”19 bits” 19 (13_h) = ”20 bits” 20 (14_h) = ”21 bits” 21 (15_h) = ”22 bits” 22 (16_h) = ”23 bits” 23 (17_h) = ”24 bits” 24 (18_h) = ”25 bits” 25 (19_h) = ”26 bits” 26 ($1A_h$) = ”27 bits” 27 ($1B_h$) = ”28 bits” 28 ($1C_h$) = ”29 bits” 29 ($1D_h$) = ”30 bits” 30 ($1E_h$) = ”31 bits” 31 ($1F_h$) = ”32 bits”	18_h

Index/sub index	Name	Description/value	Lenze
0x3108/x		Bit 1 ... 0: ready for operation During ”Monitoring operation” the module serves to monitor the data exchange between an SSI master and an SSI encoder. It receives the cycle by the master and the data flow by the SSI encoder. In the ”Master mode” operating mode the module provides a cycle to the encoder and receives data by the encoder. 01_b = monitoring operation 10_b = master mode Bit 2: shifting direction Specify the orientation of the encoder data here. More information can be found in the data sheet for your encoder. Usually, the SSI encoder uses ”MSB first”. 0 = LSB first (LSB is transmitted first) 1 = MSB first (MSB is transmitted first) Bit 3: edge clock signal Here you can specify the edge type of the clock signal, in the case of which the encoder supplies data. Information on this can be found in the data sheet for your encoder. Usually the SSI encoders respond to rising edges. 0 = falling edge 1 = rising edge Bit 4: coding In the ”Binary code” setting, the provided encoder value remains unchanged. In the ”Gray code” setting, the gray-coded value provided by the encoder is converted into a binary value. Only after this conversion, the received encoder value is scaled, if required. The Gray code is another form of representation of the binary code. It is based on the fact that two adjacent Gray numbers differ from each other in exactly one bit. If the Gray code is used, transmission errors can be easily detected, since adjacent characters must only differ from each other in one digit. Information on this can be found in the data sheet for your encoder. 0 = standard code 1 = Gray code Bits 7 ... 5: reserved	$1E_h$
0x3109/x ... 0x310B/x	Reserved		
0x310C/x	SSI function	By enabling the SSI function the module starts with the cycle output and the evaluation of the encoder data. In the ”monitor operation” mode, the module starts with the encoder evaluation. 0 (00_h) = inhibited 1 (01_h) = enabled	00_h
0x310D/x ... 0x3129/x	Reserved		

8.12 Time stamp parameterising

8.12.1 2 digital inputs with time stamp function - EPM-S207

Parameter data

Index/sub index	Name	Description/value	Lenze
0x3100/x	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	14_h or $3C_h$ (fix)
0x3101/x	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	00_h (fix)
0x3102/x	Input delay DI1	00_h = 1 µs 02_h = 3 µs 04_h = 10 µs 07_h = 86 µs 09_h = 342 µs $0C_h$ = 273 µs Other values are not permissible.	02_h
0x3103/x	Input delay DI2		02_h
0x3104/x	Edge 0-1 at DIx	Time stamp entry on rising edge Bit 0: DI1 (0: inhibit, 1 = enable) Bit 1: DI2 (0: inhibit, 1 = enable) Bits 7 ... 2: Reserved	00_h
0x3105/x	Edge 1-0 at DIx	Time stamp entry on falling edge Bit 0: DI1 (0: inhibit, 1 = enable) Bit 1: DI2 (0: inhibit, 1 = enable) Bits 7 ... 2: Reserved	00_h
0x3106/x ... 0x3129/x	Reserved		

8.12.2 2 digital outputs with time stamp function - EPM-S310

Parameter data

Index/sub index	Name	Description/value	Lenze
0x3100/x	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	14_h or $3C_h$ (fix)
0x3101/x	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	00_h (fix)
0x3102/x ... 0x3129/x	Reserved		

8.13 Parameterising technology modules

8.13.1 2 digital outputs with PWM functionality - EPM-S620

Parameter data

Index/sub index	Name	Description/value	Lenze
0x3100/x	PWM 1: Period byte 3	Set parameters here for the total time for pulse duration and pulse pause. The time should be selected as a factor for the 20.83 ns basis. Values below 25 µs are ignored. If the pulse duration is higher or equal to the period, the DO output is set permanently. Value range: 1200 ... 8388607 (25 µs ... approx. 175 ms)	$1F40_h$
0x3101/x	PWM 1: Period byte 2		
0x3102/x	PWM 1: Period byte 1		
0x3103/x	PWM 1: Period byte 0		
0x3104/x	PWM 2: Period byte 3		$1F40_h$
0x3105/x	PWM 2: Period byte 2		
0x3106/x	PWM 2: Period byte 1		
0x3107/x	PWM 2: Period byte 0		
0x3108/x ... 0x3129/x	Reserved		
0x5620/x	PWM pulse duration	Selection of pulse duration Permissible values. 48 ... 8388607 (corresponds to 1 ... 175000 µs	

Note!

The pulse/pause ratio is determined by specifying the period (0x3100 ... 0x3107) and pulse duration (0x5620).

8.13.2 RS232 interface - EPM-S640

Parameter data

Parameter data - ASCII protocol			
Index/ Subindex	**Name**	**Description/value**	**Lenze**
0x3100/x	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
0x3101/x	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
0x3102/x	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
0x3103/x	Baud rate	00_h: 9600 Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
0x3104/x	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 01_h: ASCII	01_h
Option 1, character frame			
0x3105/x	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
		Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
		Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
		Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2 ... 3, ZNA			
0x3106/x	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
0x3107/x	ZNA (LOW byte)		00_h

Parameter data - ASCII protocol			
Index/ Subindex	**Name**	**Description/value**	**Lenze**
Option 4 ... 5, ZVZ			
0x3108/x	Character delay time (HIGH byte)	Character delay time (ZVZ) The character delay time defines the maximum permissible time interval between two characters received within a telegram. If ZVZ = 0, the module calculates the ZVZ by means of the baud rate (approx. double character time). 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
0x3109/x	Character delay time (LOW byte)		FA_h
Option 6, number of receive buffers			
0x310A/x	Number of receive buffers	Defines the number of receive buffers. As long as only one receive buffer is used and is assigned, no more data can be received. If up to 250 receive buffers are connected, the received data can be redirected to a still free receive buffer. 1 ... 255 (01_h ... FF_h)	01_h
Option 7 ... 12, reserved			
0x310B/x ... 0x3110/x	Reserved		00_h

Parameter data STX/ETX protocol			
Index/ Subindex	**Name**	**Description/value**	**Lenze**
0x3100/x	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
0x3101/x	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
0x3102/x	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
0x3103/x	Baud rate	00_h: 9600 Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
0x3104/x	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 02_h: STX/ETX	02_h
Option 1, character frame			
0x3105/x	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
		Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
		Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
		Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2 ... 3, ZNA			
0x3106/x	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
0x3107/x	ZNA (LOW byte)		00_h

Parameter data STX/ETX protocol			
Index/ Subindex	**Name**	**Description/value**	**Lenze**
Option 4 ... 5, TMO			
0x3108/x	TMO (HIGH byte)	TMO serves to define the maximally permissible interval between two frames. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
0x3109/x	TMO (LOW byte)		FA_h
Option 6, number of start identifiers			
0x310A/x	No. of start identifiers	00_h: 1 start identifier (2. start identifier is ignored) 01_h: 2 start identifiers	01_h
Option 7, start identifier 1			
0x310B/x	Start identifier 1	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 8, start identifier 2			
0x310C/x	Start identifier 2	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 9, number of end identifiers			
0x310D/x	No. of end identifier	00_h: 1 end identifier (2nd end identifier is ignored) 01_h: 2 end identifiers	00_h
Option 10, end identifier 1			
0x310E/x	End identifier 1	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 11, end identifier 2			
0x310F/x	End identifier 2	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 12, reserved			
0x3110/x	Reserved		00_h

Parameter data 3964(R) protocol			
Index/ Subindex	**Name**	**Description/value**	**Lenze**
0x3100/x	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
0x3101/x	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
0x3102/x	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
0x3103/x	Baud rate	00_h: 9600 Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
0x3104/x	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 03_h: 3964 04_h: 3964R	03_h
Option 1, character frame			
0x3105/x	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
		Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
		Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
		Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2, ZNA (x 20 ms)			
0x3106/x	ZNA	Time after request (ZNA) Waiting time observed until the next transmit request is processed. The ZNA is indicated as a factor in steps of 20 ms. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h

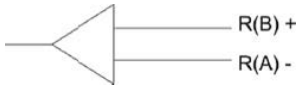
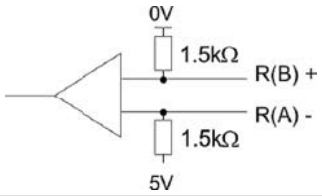
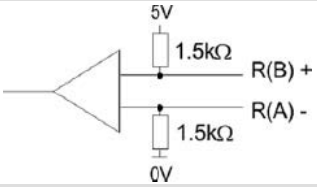
Parameter data 3964(R) protocol			
Index/ Subindex	**Name**	**Description/value**	**Lenze**
Option 3, ZVZ (x 20 ms)			
0x3107/x	Character delay time	Character delay time (ZVZ) The ZVZ defines the maximum permissible time interval between two characters received within a telegram. The ZVZ is indicated as a factor in steps of 20 ms. If ZVZ = 0, the module calculates the ZVZ by means of the baud rate (approx. double character time). 0 ... 255 [ms] (00_h ... FF_h)	00_h
Option 4, QVZ (x 20 ms)			
0x3108/x	Acknowledgement time	Acknowledgement time (QVZ) The QVZ defines the max. permissible time interval until the partner is acknowledged while establishing/terminating a connection. The QVZ is indicated as a factor in steps of 20 ms. 1 ... 255 [ms] (01_h ... FF_h)	00_h
Option 5, BWZ (x 20 ms)			
0x3109/x	Block wait time	Block wait time (BWZ) The BWZ is the maximum time period between the confirmation of a request frame (DLE) and STX of the response frame. The BWZ is indicated as a factor in steps of 20 ms. 1 ... 255 [ms] (01_h ... FF_h)	FA_h
Option 6, STX repetitions			
0x310A/x	STX repetitions	Maximum number of times the module attempts to establish a connection. 1 ... 255 [ms] (01_h ... FF_h)	01_h
Option 7, DBL			
0x310B/x	DBL	When exceeding the block wait time (BWZ) you can specify the maximum number of repetitions for the request frame using the DBL parameter. If these attempts fail, transmission is cancelled. 1 ... 255 [ms] (01_h ... FF_h)	00_h
Option 8, priority			
0x310C/x	Priority	A communication partner has high priority if its sending attempt has precedence over the partner's transmit request. In the event of low priority, it must take second place behind the partner's transmit request. With 3964(R) the priorities of both partners must be different. The following settings are possible: 00_h: LOW 01_h: HIGH	00_h
Option 9 ... 12, reserved			
0x310D/x ... 0x3110/x	Reserved		00_h

8.13.3 RS422/RS485 interface - EPM-S650

Parameter data

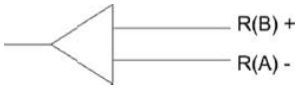
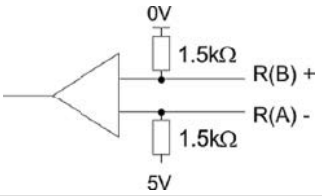
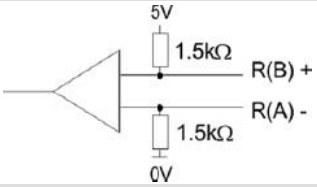
Parameter data - ASCII protocol			
Index/ Subindex	**Name**	**Description/value**	**Lenze**
0x3100/x	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
0x3101/x	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
0x3102/x	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
0x3103/x	Baud rate	00_h: 9600 Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
0x3104/x	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 01_h: ASCII	01_h
Option 1, character frame			
0x3105/x	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
		Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
		Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
		Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2 ... 3, ZNA			
0x3106/x	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
0x3107/x	ZNA (LOW byte)		00_h

Parameter data - ASCII protocol			
Index/ Subindex	**Name**	**Description/value**	**Lenze**
Option 4 ... 5, ZVZ			
0x3108/x	Character delay time (HIGH byte)	Character delay time (ZVZ) The character delay time defines the maximum permissible time interval between two characters received within a telegram. If ZVZ = 0, the module calculates the ZVZ by means of the baud rate (approx. double character time). 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
0x3109/x	Character delay time (LOW byte)		FA_h
Option 6, number of receive buffers			
0x310A/x	Number of receive buffers	Defines the number of receive buffers. As long as only one receive buffer is used and is assigned, no more data can be received. If up to 250 receive buffers are connected, the received data can be redirected to a still free receive buffer. 1 ... 255 (01_h ... FF_h)	01_h
Option 7 ... 12, reserved			
0x310B/x ... 0x3110/x	Reserved		00_h
Option 13, operating mode			
0x3111/x	Operating mode	The operating mode serves to determine if the interface is operated in half duplex mode (RS485) or full duplex mode (RS422). ● 0x00: Half duplex - two-wire operation (RS485) Half duplex operation means that at a point of time data are either sent or received. The data are transmitted between the communication partners in both directions in turns. If the parameterisation is half duplex under RS485, a software data flow control is not possible. ● 0x01: Full duplex - four-wire operation (RS422) The data are exchanged simultaneously between the communication partners; transmission and reception can take place at the same time. Each communication partner must simultaneously actuate a receive path.	01_h
Option 14, cable assignment			
0x3112/x	Cable assignment	For a connection with minimum reflections and the open circuit detection in RS422/485 operation, the cables can be pre-assigned via parameters with a defined idle level (see following table "Cable assignment parameters")	00_h

Cable assignment parameter		
Values	**Description**	
00_h	No pre-assignment of the receive path. This setting is only advisable for special drivers that are provided with a bus capability.	
01_h	Signal R(A) 5 V (open-circuit detection), signal R(B) 0 V Open-circuit detection is possible in full duplex operation under RS422.	
02_h	Signal R(A) 0 V, signal R(B) 5 V This pre-assignment corresponds to the idle state (no transmitter active) in half duplex operation under RS485. Open-circuit detection is not possible here.	

Parameter data STX/ETX protocol			
Index/ Subindex	**Name**	**Description/value**	**Lenze**
0x3100/x	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
0x3101/x	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
0x3102/x	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
0x3103/x	Baud rate	00_h: 9600 Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
0x3104/x	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 02_h: STX/ETX	02_h
Option 1, character frame			
0x3105/x	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
		Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
		Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
		Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2 ... 3, ZNA			
0x3106/x	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
0x3107/x	ZNA (LOW byte)		00_h

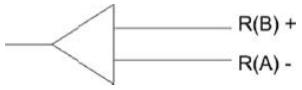
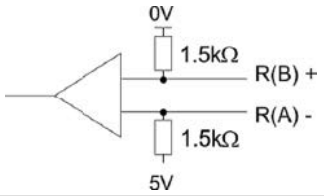
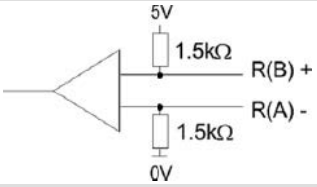
Parameter data STX/ETX protocol			
Index/ Subindex	**Name**	**Description/value**	**Lenze**
Option 4 ... 5, TMO			
0x3108/x	TMO (HIGH byte)	TMO serves to define the maximally permissible interval between two frames. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
0x3109/x	TMO (LOW byte)		FA_h
Option 6, number of start identifiers			
0x310A/x	No. of start identifiers	00_h: 1 start identifier (2. start identifier is ignored) 01_h: 2 start identifiers	01_h
Option 7, start identifier 1			
0x310B/x	Start identifier 1	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 8, start identifier 2			
0x310C/x	Start identifier 2	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 9, number of end identifiers			
0x310D/x	No. of end identifier	00_h: 1 end identifier (2nd end identifier is ignored) 01_h: 2 end identifiers	00_h
Option 10, end identifier 1			
0x310E/x	End identifier 1	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 11, end identifier 2			
0x310F/x	End identifier 2	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 12, reserved			
0x3110/x	Reserved		00_h
Option 13, operating mode			
0x3111/x	Operating mode	The operating mode serves to determine if the interface is operated in half duplex mode (RS485) or full duplex mode (RS422). ● 0x00: Half duplex - two-wire operation (RS485) Half duplex operation means that at a point of time data are either sent or received. The data are transmitted between the communication partners in both directions in turns. If the parameterisation is half duplex under RS485, a software data flow control is not possible. ● 0x01: Full duplex - four-wire operation (RS422) The data are exchanged simultaneously between the communication partners; transmission and reception can take place at the same time. Each communication partner must simultaneously actuate a receive path.	01_h
Option 14, cable assignment			
0x3112/x	Cable assignment	For a connection with minimum reflections and the open circuit detection in RS422/485 operation, the cables can be pre-assigned via parameters with a defined idle level (see following table ”Cable assignment parameters”)	00_h

Cable assignment parameter		
Values	**Description**	
00_h	No pre-assignment of the receive path. This setting is only advisable for special drivers that are provided with a bus capability.	
01_h	Signal R(A) 5 V (open-circuit detection), signal R(B) 0 V Open-circuit detection is possible in full duplex operation under RS422.	
02_h	Signal R(A) 0 V, signal R(B) 5 V This pre-assignment corresponds to the idle state (no transmitter active) in half duplex operation under RS485. Open-circuit detection is not possible here.	

Parameter data 3964(R) protocol			
Index/ Subindex	**Name**	**Description/value**	**Lenze**
0x3100/x	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
0x3101/x	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
0x3102/x	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
0x3103/x	Baud rate	00_h: 9600 Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
0x3104/x	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 03_h: 3964 04_h: 3964R	03_h
Option 1, character frame			
0x3105/x	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
		Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
		Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
		Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2, ZNA (x 20 ms)			
0x3106/x	ZNA	Time after request (ZNA) Waiting time observed until the next transmit request is processed. The ZNA is indicated as a factor in steps of 20 ms. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h

Parameter data 3964(R) protocol			
Index/ Subindex	**Name**	**Description/value**	**Lenze**
Option 3, ZVZ (x 20 ms)			
0x3107/x	Character delay time	Character delay time (ZVZ) The ZVZ defines the maximum permissible time interval between two characters received within a telegram. The ZVZ is indicated as a factor in steps of 20 ms. If ZVZ = 0, the module calculates the ZVZ by means of the baud rate (approx. double character time). 0 ... 255 [ms] (00_h ... FF_h)	00_h
Option 4, QVZ (x 20 ms)			
0x3108/x	Acknowledgement time	Acknowledgement time (QVZ) The QVZ defines the max. permissible time interval until the partner is acknowledged while establishing/terminating a connection. The QVZ is indicated as a factor in steps of 20 ms. 1 ... 255 [ms] (01_h ... FF_h)	00_h
Option 5, BWZ (x 20 ms)			
0x3109/x	Block wait time	Block wait time (BWZ) The BWZ is the maximum time period between the confirmation of a request frame (DLE) and STX of the response frame. The BWZ is indicated as a factor in steps of 20 ms. 1 ... 255 [ms] (01_h ... FF_h)	FA_h
Option 6, STX repetitions			
0x310A/x	STX repetitions	Maximum number of times the module attempts to establish a connection. 1 ... 255 [ms] (01_h ... FF_h)	01_h
Option 7, DBL			
0x310B/x	DBL	When exceeding the block wait time (BWZ) you can specify the maximum number of repetitions for the request frame using the DBL parameter. If these attempts fail, transmission is cancelled. 1 ... 255 [ms] (01_h ... FF_h)	00_h
Option 8, priority			
0x310C/x	Priority	A communication partner has high priority if its sending attempt has precedence over the partner's transmit request. In the event of low priority, it must take second place behind the partner's transmit request. With 3964(R) the priorities of both partners must be different. The following settings are possible: 00_h: LOW 01_h: HIGH	00_h
Option 9 ... 12, reserved			
0x310D/x ... 0x3110/x	Reserved		00_h
Option 13, operating mode			

Parameter data 3964(R) protocol			
Index/ Subindex	**Name**	**Description/value**	**Lenze**
0x3111/x	Operating mode	The operating mode serves to determine if the interface is operated in half duplex mode (RS485) or full duplex mode (RS422). ● 0x00: Half duplex - two-wire operation (RS485) Half duplex operation means that at a point of time data are either sent or received. The data are transmitted between the communication partners in both directions in turns. If the parameterisation is half duplex under RS485, a software data flow control is not possible. ● 0x01: Full duplex - four-wire operation (RS422) The data are exchanged simultaneously between the communication partners; transmission and reception can take place at the same time. Each communication partner must simultaneously actuate a receive path.	01_h
Option 14, cable assignment			
0x3112/x	Cable assignment	For a connection with minimum reflections and the open circuit detection in RS422/485 operation, the cables can be pre-assigned via parameters with a defined idle level (see following table "Cable assignment parameters")	00_h

Cable assignment parameter		
Values	**Description**	
00_h	No pre-assignment of the receive path. This setting is only advisable for special drivers that are provided with a bus capability.	
01_h	Signal R(A) 5 V (open-circuit detection), signal R(B) 0 V Open-circuit detection is possible in full duplex operation under RS422.	
02_h	Signal R(A) 0 V, signal R(B) 5 V This pre-assignment corresponds to the idle state (no transmitter active) in half duplex operation under RS485. Open-circuit detection is not possible here.	

8.14 ”Store” function

All parameter changes and the structure of the station are permanently stored via index $I1010_{hex}$ (Store parameter).

Note!

If the real structure of the station does not correspond with its stored structure anymore after a restart, the bus coupler module reports an error.

- ► The (red) SF LED is permanently ON.
- ► The (green) PWR LED is permanently ON.
- ► The (green) CAN-RUN LED is blinking.

The stored structure of the station is deleted via index $I1011_{hex}$ (Restore parameter).

Index	Name	Possible settings		Important	
		Lenze	Selection		
$I1010_h$ ↵	Save All Parameters	0		Saving the parameter settings and the station structure in the EEPPROM of the bus coupler. Function in accordance with CANopen (DS301/DS401 communication protocol).	📖 363
0			Number of subindexes assigned	Read only Number of the subindexes used by the index 1010_h	
1	Save		0 = no function 1702257011_d = save parameters	The numerical value is ASCII-coded and complies with: $65\ 76\ 61\ 73_h$ = ”E” ”V” ”A” ”S”	

8.15 Loading the default setting

All parameter changes are reset to the default setting via index $I1011_{hex}$.

The default setting is accepted by switching the supply off and on again. Changes that you may have carried out before will be deleted from the EEPROM of the I/O system.

Index	Name	Possible settings		Important	
		Lenze	Selection		
$I1011_h$ ↵	Restore All Parameters	0		Resetting the parameter setting in the EEPPROM of the bus coupler to the Lenze setting. Function in accordance with CANopen (DS301/DS401 communication protocol).	📖 363
0			Number of subindexes assigned	Read only Number of the subindexes used by the index 1011_h	
1	Load		0 = no function 1684107116_d = load Lenze setting	The numerical value is ASCII-coded and complies with: 64 61 6F $6C_h$ = ”D” ”A” ”O” ”L” After executing ”Load”, acceptance is effected by ● Voltage off/on, or ● Transmission of a reset node telegram (00 82 xx, mit xx = node address)	

8.16 Node Guarding

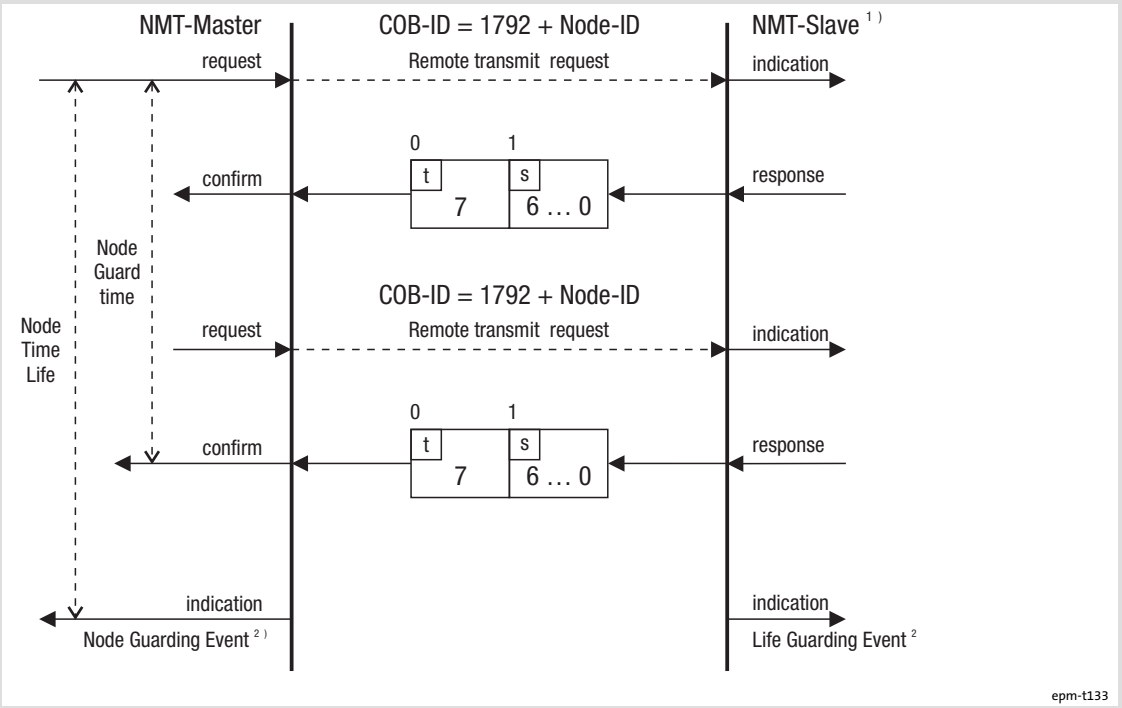


Fig. 8-13 Node Guarding Protocol

1) I/O system
s Status of the I/O system
t Toggle bit

Description

The Node Guarding Protocol monitors the connection between master and slave.

Via index I100C$_h$, Guard time, a time [ms] can be set and in index I100D$_h$, Life Time Factor, a factor can be set. If both indexes are multiplied by each other, you get a monitoring time in which the master must send a Node Guarding telegram to the slave. If one of the two indexes is set to zero, the monitoring time is also zero and hence deactivated. The slave sends a telegram with its current status to the master.

With event-controlled process data transmission, Node Guarding ensures cyclical node monitoring.

- The master starts the Node Guarding by sending the Node Guarding telegram.
- If the slave (I/O system) does not receive a telegram within the monitoring time, a Node Guarding event will be triggered. The I/O system switches to the status set in I1029$_h$. The outputs switch to defined states (📖 380).
- A change to the Operational status triggers a reset.

Status telegram

11 bits	1 byte of user data	
Identifier	Device status (bits 0 ... 6)	Toggle bit
1792_d (700_h)		

Identifier:

	Formula	Information
Identifier	= Basic identifier + node address = 1792_d + xx	The basic identifier for Node Guarding is firmly adjusted to 1792_d (700_h) xx = Node address of the I/O system

Device status (bit 0 ... 6) of the slave (I/O system):

Command (hex)	Device status
04	Stopped
05	Operational
7F	Pre-Operational

Indices for setting

Index	Name	Possible settings				Important	
		Lenze	Selection				
I100C$_h$ *	Guard time	0	0	{1 ms}	65535	Node Guarding Monitoring time 0 = monitoring not active	📖 365
I100D$_h$ *	Life time factor	0	0	{1}	255	Node Guarding Response time computation factor 0 = monitoring not active The response time is computed as: Monitoring period x factor	📖 365
I100E$_h$	Node Guarding identifier					Display only Identifier = Basic identifier + node address (basic identifier cannot be modified)	📖 365

Note!

The Lenze PLC's 9300 servo PLC and Drive PLC in connection with the function library LenzeCanDSxDrv.lib support the "Node Guarding" function.

8.17 Heartbeat

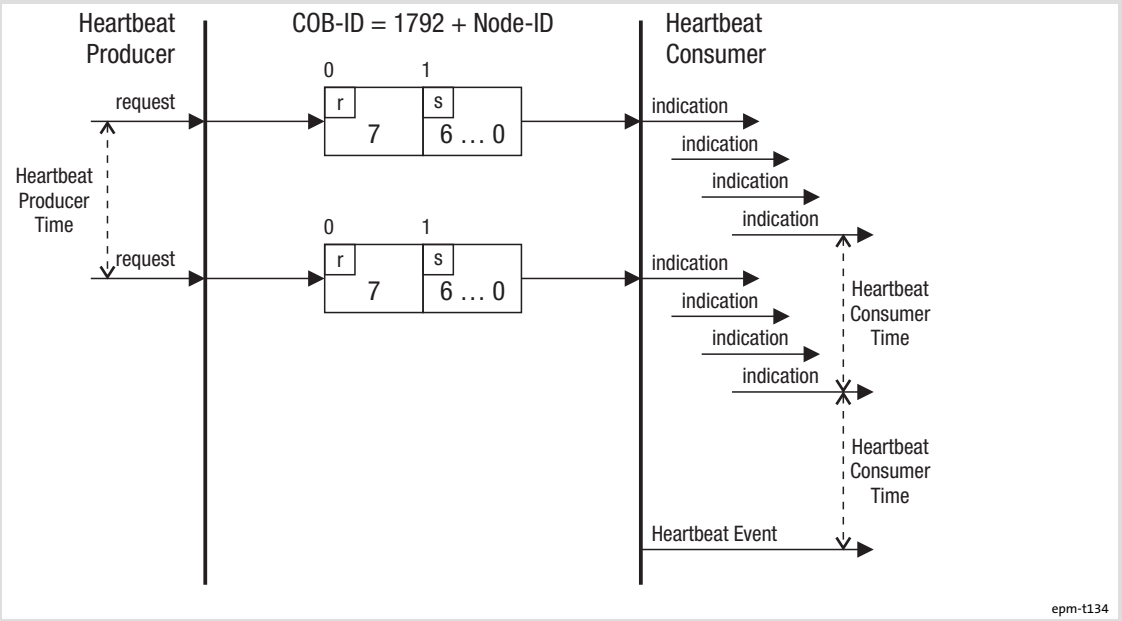


Fig. 8-14 Heartbeat Protocol

r Reserved
s State of the Heartbeat Producer

Heartbeat Producer

The I/O system transmits a status telegram to the fieldbus and can thus be monitored by other nodes.

Settings are made in index $I1017_h$.

- Producer heartbeat is automatically started if a time > 0 is entered in the index 1017_h and the I/O system changes to the status ”Operational”.
- After the cycle time has elapsed, the status telegram is transferred from the I/O system to the fieldbus.
- A change into the Operational status triggers a reset.

Status telegram

11 bits	1 byte of user data	
Identifier	**Device status (bits 0 ... 6)**	**Bit 7**
1792_d (700_h)		Reserved

Identifier:

	Formula	Information
Identifier	= Basic identifier + node address = 1792_d + xx	The basic identifiers for heartbeat is firmly adjusted to 1792_d (700_h) xx = Node address of the I/O system

Device status (bit 1 ... 6) of the heartbeat producer:

Command (hex)	Status
00	Boot-up
05	Operational
04	Stopped
7F	Pre-Operational

Note!

The Lenze 9300 servo PLC and Drive PLC in connection with the function library LenzeCanDSxDrv.lib support the ”heartbeat” function.

8.18 Monitoring

8.18.1 Time monitoring for PDO1-Rx ... PDO10-Rx

A time monitoring can be configured for the inputs of the process data objects PDO1-Rx ... PDO10-Rx via index $I2400_h$.

If no PDO is received within the time set in $I2400_h$, the outputs will switch to their defined error status (see following sections).

Index	Name	Possible settings				Important	
		Lenze	Selection				
$I2400_h$ ↵	Timer value		0	{1 ms}	65535	Monitoring time for process data input objects	📖 369
1	Lenze PDO control 1	0					
2	Lenze PDO control 2	0					
3	Lenze PDO control 3	0					
4	Lenze PDO control 4	0					
5	Lenze PDO control 5	0					
6	Lenze PDO control 6	0					
7	Lenze PDO control 7	0					
8	Lenze PDO control 8	0					
9	Lenze PDO control 9	0					
10	Lenze PDO control 10	0					

8.18.2 Digital output monitoring

Via the index $I6206_h$ you can configure the reactions of the digital outputs which are to take place when no telegrams, Node Guarding Events or Heartbeat, have been received in the adjusted monitoring time.

Index	Name	Possible settings			Important	
		Lenze	Selection			
$I6206_h$ ↵	Error mode - digital output		0 {1} 255		Configures digital output monitoring	📖 370
			0	All digital outputs retain the last status output.		
			255	Response from $I6207_h$	In $I6207_h$, the response can be configured individually for each digital output	
1	Byte 1	0				
2	Byte 2	0				
...	...	...				
80	Byte 80	0				

Individual response setting

Via index $I6207_h$ the response can be configured individually for each digital output.

Index	Name	Possible settings			Important	
		Lenze	Selection			
$I6207_h$ ↵	Error value - digital output	0	0 {1} 255		Configures the individual digital output responses	📖 370
			8 bits of information			
			Bit value 0	Output switches to LOW		
			Bit value 1	Output retains last status output		
1	Byte 1	0				
2	Byte 2	0				
...	...	...				
64	Byte 80	0				

8.18.3 Monitoring of the analog outputs

Via the index $I6443_h$ you can configure the reactions of the analog outputs which are to take place when no telegrams, Node Guarding Events or Heartbeat, have been received in the adjusted monitoring time.

- ► Monitoring is started on receipt of the next PDO telegram after the settings.
- ► If a telegram is not transmitted within the adjusted time, the module switches to the ”Pre-Operational” state. No further process data are transmitted.
- ► A change into the ”Operational” state triggers a reset.

Index	Name	Possible settings					Important	
		Lenze	Selection					
$I6443_h$ ↲	Error mode analog output		0	{1}	255		Configures analog output monitoring	📖 371
			0	All analog outputs retain the last value output				
			255	Response from $I6444_h$			In $I6444_h$ the response can be configured individually for each analog output	
1	Channel 1	0						
2	Channel 2	0						
...	...	...						
36	Channel 36	0						

Individual response setting

Via index $I6444_h$ the response can be configured individually for each analog output.

Index	Name	Possible settings				Important	
		Lenze	Selection				
$I6444_h$ ↲	Error value analog output		-32768	{1}	32767	Configures the individual analog output responses The analog outputs provide the set value	📖 371
1	Channel 1	0					
2	Channel 2	0					
...	...	...					
36	Channel 36	0					

8.19 Diagnostics

Note!

The diagnostic function is only supported by I/O compound modules from HW version 1B and by bus coupler modules from HW version 1A.

If a module in the system complies with an earlier HW version, the diagnostic function is deactivated for all modules.

The following indexes can be used for purposes of diagnostics. They show operating states. Settings cannot be made.

Index	Information displayed	Description
$I1014_h$	Emergency telegram	📖 372
$I1027_h$	Reading out the module IDs	📖 379
$I6000_h$	Status of digital inputs	📖 380
$I6200_h$	Status of digital outputs	📖 380
$I6401_h$	Status of analog inputs	📖 380
$I6411_h$	Status of analog outputs	📖 380
$I5400_h$ ... $I5403_h$	Counter status	📖 381
$I1003_h$	Current errors	

8.19.1 Emergency telegram

By means of the emergency telegram, the I/O system communicates internal device errors to other system bus nodes with high priority. 8 bytes of user data are available.

Index	Name	Possible settings		Important	
		Lenze	Selection		
$I1003_h$				Display only Fault memory	
1	Actual errors				
$I1014_h$	COB ID emergency			Emergency telegram Identifier 80h + node address is displayed after boot-up.	📖 372

Emergency telegram structure

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
LOW byte	HIGH byte	Error register $I1001_h$	Error information				
Error code	Error code	The error code 81_h (= device error) is displayed in index $I1001_h$ (error register).	1	2	3	4	5

Error codes

Error code	Meaning	Error information				
		1	2	3	4	5
0x0000	Reset Emergency	0x00	0x00	0x00	0x00	0x00
0x8100	Heartbeat consumer	Node ID	LOW byte timer value	HIGH byte timer value	0x00	0x00
0x8130	Node guarding error	LOW byte guard time	HIGH byte guard time	LifeTime	0x00	0x00
0x8157	Module removed from slot [n]; no communication	0x05	0x[n]	0x00	0x00	0x00
0x8210	PDO not executed due to length error	PDO number	Wrong length	PDO length	0x00	0x00
0x8220	PDO length exceeded	PDO number	0x1000	PDO number	0x00	0x00
0x1000	Module configuration was changed	0x01	0x00	0x00	0x00	0x00
0x1000	Error during initialisation of the backplane modules	0x02	Module number	LOW byte Error register	HIGH byte Error register	0x00
0x1000	Diagnostic alarm	0x40 + module number	Diagnostic byte 1	Diagnostic byte 2	Diagnostic byte 3	Diagnostic byte 4
0x0000	Process alarm	0x80 + module number	Diagnostic byte 1	Diagnostic byte 2	Diagnostic byte 3	Diagnostic byte 4
0x1000	Backplane bus: Initialisation error	E0	Module number	LOW byte Error bitfield	HIGH byte Error bitfield	0x00
0x1000	Backplane bus: Initialisation error pre-operational → operational	E0	0x00	0x00	0x00	0x00
0x1000	Backplane bus: Bus error	E1	0x00	0x00	0x00	0x00
0x1001	Lenze PDO control, monitoring time exceeded	FF	0x10	PDO number	Monitoring time that has been set in [ms]	
0x2000	Description of the process data width not permissible for modules with a time stamp functionality or a serial interface (index 3100/x, 3101/x)	E2	0x00	0x00	0x00	0x00

Example: error information ”46 0D 15 00 00”

The error information ”46 0D 15 00 00” is contained in the emergency telegram in the bytes 3 ... 7.

Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Error information				
1	2 (Diagnostic byte 1)	3 (Diagnostic byte 2)	4 (Diagnostic byte 3)	5 (Diagnostic byte 4)
0x46 (0x40 + slot no. 6)	0x0D	0x15	0x00	0x00

► Byte 4: 0x0D = 0b00001101

Meaning: module fault, external error, channel error available.

Byte 4 (diagnostic byte 1)								Bit information
0	0	0	0	1	1	0	1	
								Bit 0: Module fault
								Bit 1: Internal error
								Bit 2: External error
								Bit 3: Channel error
								Bit 4: No external supply voltage
								Bit 5: Reserved
								Bit 6: Reserved
								Bit 7: Parameterisation error

► Byte 5: 0x15 = 0b00010101

Meaning: Module class ”analog module”, channel information (channel error) available.

Byte 5 (diagnostic byte 2)								Bit information
0	0	0	0	0	1	0	1	
								Bit 0 ... 3: Module class 0b0101 = Analog module 0b1000 = Function module 0b1100 = Communication module
								Bit 4: Channel information available
								Bit 5: Reserved
								Bit 6: Reserved
								Bit 7: Reserved

The module-specific bit information of the ”diagnostic bytes 1 ... 4” (process/diagnostic alarms) are described in the following sections.

Process alarm

EPM-S404 - process alarm	
Diagnostic byte	**Bit 7 ... 0**
1	Bit 0: Limit value exceeded channel 1 Bit 1: Limit value exceeded channel 2 Bit 7 ... 2: 0 (fixed)
2	Bit 0: Limit value not reached, channel 1 Bit 1: Limit value not reached, channel 2 Bit 7 ... 2: 0 (fixed)
3/4	Ticker value at the time of the alarm

EPM-S405 - process alarm	
Diagnostic byte	**Bit 7 ... 0**
1	Bit 0: Limit exceedance channel 1 Bit 1: Limit exceedance channel 2 Bit 2: Limit exceedance channel 3 Bit 3: Limit exceedance channel 4 Bit 7 ... 4: 0 (fix)
2	Bit 0: Limit value underflow channel 1 Bit 1: Limit value underflow channel 2 Bit 2: Limit value underflow channel 3 Bit 3: Limit value underflow channel 4 Bit 7 ... 4: 0 (fix)
3/4	Ticker value at the time of the alarm

EPM-S406, EPM-S408 - process alarm	
Diagnostic byte	**Bit 7 ... 0**
1	Bit 0: Limit value exceeded channel 1 Bit 1: Limit value exceeded channel 2 Bit 7 ... 2: 0 (fixed)
2	Bit 0: Limit value not reached, channel 1 Bit 1: Limit value not reached, channel 2 Bit 7 ... 2: 0 (fixed)
3/4	µs-ticker value at the time of the alarm The I/O compound module features an integrated 32-bit timer (µs-ticker) which is started at switch-on and starts at 0 again after 23^2 - 1 µs. These two bytes represent the lower 2 bytes of the µs-ticker (0 ... 2^{16} - 1)

EPM-S600 - process alarm	
Diagnostic byte	**Bit 7 ... 0**
1	Bit 0: Hardware gate open Bit 1: Hardware gate closed Bit 2: Overflow/underflow/final value Bit 3: Comparison value reached Bit 4: Latch value Bit 7 ... 5: 0 (fixed)
2	State of the inputs at the time of the alarm Bit 0: A/pulse Bit 1: B/direction Bit 2: Latch Bit 3: Hardware gate Bit 4: Reset Bit 7 ... 5: 0 (fixed)
3/4	Ticker value at the time of the alarm

EPM-S601, EPM-S602 - process alarm	
Diagnostic byte	**Bit 7 ... 0**
1	Bit 0: 0 Bit 1: 0 Bit 2: Counter 1, overflow/underflow/final value Bit 3: Counter 1, comparison value reached Bit 4: 0 Bit 5: 0 Bit 6: Counter 2, overflow/underflow/final value Bit 7: Counter 2, comparison value reached
2	State of the inputs at the time of the alarm Bit 0: Counter 1, A/pulse Bit 1: Counter 1, B/direction Bit 2: Counter 2, A/pulse Bit 3: Counter 2, B/direction Bit 7 ... 4: 0 (fix)
3/4	16 bit µs value at the time of the alarm

Diagnostic alarm

EPM-S600 - diagnostic alarm	
Diagnostic byte	**Bit 7 ... 0**
1	Bit 0: Set if module fault Bit 1: 0 (fixed) Bit 2: Set in the case of an external error Bit 3: Set in the case of a channel error Bit 6 ... 4: 0 (fixed) Bit 7: Parameterisation error
2	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
3	0 (fixed)
4	Bit 5 ... 0: 0 (fixed) Bit 6: Process alarm lost Bit 7: 0 (fixed)

EPM-S601 - diagnostic alarm	
Diagnostic byte	**Bit 7 ... 0**
1	Bit 0: Set if module fault Bit 1: 0 (fixed) Bit 2: Set in the case of an external error Bit 3: Set in the case of a channel error Bit 6 ... 4: 0 (fixed) Bit 7: Parameterisation error
2	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
3	0 (fixed)
4	Bit 5 ... 0: 0 (fixed) Bit 6: Process alarm lost Bit 7: 0 (fixed)

EPM-S603 - diagnostic alarm	
Diagnostic byte	**Bit 7 ... 0**
1	0 (fixed)
2	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
3	0 (fixed)
4	0 (fixed)

EPM-S604 - diagnostic alarm	
Diagnostic byte	**Bit 7 ... 0**
1	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of missing external supply voltage Bit 6 ... 5: 0 (fixed) Bit 7: Parameterisation error
2	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
3	0 (fixed)
4	Bit 5 ... 0: 0 (fixed) Bit 6: Process alarm lost Bit 7: 0 (fixed)

EPM-S640 - diagnostic alarm	
Diagnostic byte	**Bit 7 ... 0**
1	Bit 0: set in the case of module fault Bit 1: set in the case of internal error Bit 2: set in the case of external error (cable break only for RS422) Bit 3: 0 (fixed) Bit 4: set in the case of missing external supply voltage Bit 5, 6: 0 (fixed) Bit 7: set in the case of parameterisation error
2	Bits 3 ... 0: module class, 1100_b: communication module Bit 4: set if channel information available Bits 7 ... 5: 0 (fixed)
3	Bits 3 ... 0: 0 (fixed) Bit 4: set in the case of internal communication error Bits 7 ... 5: 0 (fixed)
4	Bits 6 ... 0: channel type, 60_h: communication processor Bit 7: 0 (fixed)

EPM-S650 - diagnostic alarm	
Diagnostic byte	**Bit 7 ... 0**
1	Bit 0: set in the case of module fault Bit 1: set in the case of internal error Bit 2: set in the case of external error (cable break only for RS422) Bit 3: 0 (fixed) Bit 4: set in the case of missing external supply voltage Bit 5, 6: 0 (fixed) Bit 7: set in the case of parameterisation error
2	Bits 3 ... 0: module class, 1100_b: communication module Bit 4: set if channel information available Bits 7 ... 5: 0 (fixed)
3	Bits 3 ... 0: 0 (fixed) Bit 4: set in the case of internal communication error Bits 7 ... 5: 0 (fixed)
4	Bits 6 ... 0: channel type, 60_h: communication processor Bit 7: 0 (fixed)

8.19.2 Reading out the module identifiers

The number of I/O compound modules connected and the module types used can be read out via index $I1027_h$. Each module type can be identified unambiguously via a hex value.

Index	Subindex	Read out...	Module type	Module identifier	
$I1027_h$	0	... the number of plugged modules (0 ... 64)	–	23_{dec}	017_h
	1 ... 64	... the module type in slots 1 ... 64	EPM-S200	1_{dec}	001_h
			EPM-S201	3_{dec}	003_h
			EPM-S202	5_{dec}	005_h
			EPM-S203	8_{dec}	008_h
			EPM-S204	2_{dec}	002_h
			EPM-S205	4_{dec}	004_h
			EPM-S206	7_{dec}	007_h
			EPM-S207	3841_{dec}	$F01_h$
			EPM-S300	257_{dec}	101_h
			EPM-S301	260_{dec}	104_h
			EPM-S302	262_{dec}	106_h
			EPM-S303	259_{dec}	103_h
			EPM-S304	261_{dec}	105_h
			EPM-S305	263_{dec}	107_h
			EPM-S306	258_{dec}	102_h
			EPM-S308	265_{dec}	109_h
			EPM-S309	264_{dec}	108_h
			EPM-S310	3905_{dec}	$F41_h$
			EPM-S400	1025_{dec}	401_h
			EPM-S401	1028_{dec}	404_h
			EPM-S402	1026_{dec}	402_h
			EPM-S403	1029_{dec}	405_h
			EPM-S404	1030_{dec}	406_h
			EPM-S405	1027_{dec}	403_h
			EPM-S406	1036_{dec}	$40C_h$
			EPM-S408	1035_{dec}	$40B_h$
			EPM-S500	1281_{dec}	501_h
			EPM-S501	1283_{dec}	503_h
			EPM-S502	1282_{dec}	502_h
			EPM-S503	1284_{dec}	504_h
			EPM-S600	2241_{dec}	$8C1_h$
			EPM-S601	2243_{dec}	$8C3_h$
			EPM-S602	2242_{dec}	$8C2_h$
			EPM-S603	2244_{dec}	$8C4_h$
			EPM-S604	2497_{dec}	$9C1_h$
			EPM-S620	2305_{dec}	901_h
			EPM-S640	3585_{dec}	$E01_h$
			EPM-S650	2625_{dec}	$A41_h$

8.19.3 Status of the digital inputs

Via the index $I6000_h$ the status of the digital inputs can be displayed.

Index	Name	Possible settings				Important	
		Lenze	Selection				
$I6000_h$	Digital input		0	{1}	255	Read only Digital input status	📖 380
1	Byte 1						
2	Byte 2						
...	...						
80	Byte 80						

8.19.4 Status of the digital outputs

Via the index $I6200_h$ the status of the digital outputs can be displayed:

Index	Name	Possible settings				Important	
		Lenze	Selection				
$I6200_h$*	Digital output		0	{1}	255	• Digital output status • The outputs can be set manually (forcing): – Depends on CAN status and $I2360_h$	📖 380
1	Byte 1						
2	Byte 2						
...	...						
80	Byte 80						

8.19.5 Status of the analog inputs

Via the index $I6401_h$ the status of the analog inputs can be displayed.

Index	Name	Possible settings				Important	
		Lenze	Selection				
$I6401_h$	Analog input		-32768	{1}	32767	Display only Analog input status	📖 380
1	Channel 1						
2	Channel 2						
...	...						
36	Channel 36						

8.19.6 Status of the analog outputs

Via the index $I6411_h$ the status of the analog outputs can be displayed:

Index	Name	Possible settings				Important	
		Lenze	Selection				
$I6411_h$*	Analog output		-32768	{1}	32767	• Analog output status • The outputs can be set manually (forcing): – Depends on CAN status and $I2360_h$	📖 380
1	Channel 1						
2	Channel 2						
...	...						
36	Channel 36						

8.19.7 Status of the counters

Via the following indexes you can have the status of the counters displayed:

Index	Name	Possible settings				Important	
		Lenze	Selection				
I5400$_h$ ↵	Counter Value		00000000$_h$	{1$_h$}	FFFFFFFF$_h$	Count value	📖 290
1	DWord 1					EPM-S600/-S602: Subindex is increased by 1 for each counter EPM-S601/-S603: Subindex is increased by 2 for each counter	
2	DWord 2						
...	...						
64	DWord 64						
I5401$_h$ ↵	Latch value		00000000$_h$	{1}	FFFFFFFF$_h$	Latch value	📖 290
1	DWord 1					EPM-S600: Subindex is increased by 1 for each counter EPM-S601/-S602/-S603: without function	
2	DWord 2						
...	...						
64	DWord 64						
I5402$_h$ ↵	Status word		0000$_h$	{1}	FFFF$_h$	Status word	📖 290
1	DWord 1					EPM-S600/-S602: Subindex is increased by 1 for each counter EPM-S601/-S603: Subindex is increased by 2 for each counter	
2	DWord 2						
...	...						
64	DWord 64						
I5403$_h$ ↵	Counter ticker value		0000$_h$	{1}	FFFF$_h$	Ticker value	📖 290
1	DWord 1					EPM-S600/-S602: Subindex is increased by 1 for each counter EPM-S601/-S603: without function	
2	DWord 2						
...	...						
64	DWord 64						

8.19.8 Status of digital inputs with time stamp function

Index I5430$_h$ can be used to display the status of the digital inputs with time stamp function.

Index	Name	Possible settings				Important	
		Lenze	Selection				
I5430$_h$	DI time stamp state		0000$_h$	{1}	FFFFh	Read only Status of time stamp 15 entries per module	📖 285
1	DWORD 1					Bit 0: channel status DI1 (0: FALSE; 1: TRUE) Bit 1: channel status DI2 (0: FALSE; 1: TRUE) Bits 2 ... 7: reserved Bits 8 ... 15: counter which counts from 0 ... 127 and then goes back to 0. Bits 16 ... 32: ticker value	
2	DWORD 2						
...	...						
80	DWORD 64						

8.19.9 Status of digital outputs with time stamp function

The following index can be used to display the status of the digital outputs with time stamp function.

Index	Name	Possible settings				Important	
		Lenze	Selection				
I5440$_h$	DO time stamp state		0000$_h$	{1}	FFFFh	Read only Status of FIFO memory 1 entry per module Bits 0 ... 5: running number of time stamp entry last written to the FIFO memory. Bits 6 ... 7: reserved Bits 8 ... 13: running number of time stamp entry to be processed next. Bits 14 ... 15: reserved Bits 16 ... 23: ● 00h or 80h: everything ok ● 01h or 81h: no following entry ● 02h or 82h: no new entries ● 03h or 83h: FIFO memory full. No new entries possible. A full memory will not accept any more time stamp entries. Perform a status query to establish the FIFO memory's status before transferring more time stamp entries. Bits 24 ... 31:number of time stamp entries in FIFO memory.	📖 285
1	DWORD 1						
2	DWORD 2						
...	...						
80	DWORD 64						

You can specify values using the following index.

Index	Name	Possible settings				Important	
		Lenze	Selection				
I5640$_h$	DO time stamp control		0000$_h$	{1}	FFFFh	15 entries per module Bits 0 ... 5: reserved Bit 6: channel status D01 (0: FALSE; 1: TRUE) Bit 7: channel status D02 (0: FALSE; 1: TRUE) Bits 8 ... 15: counter which counts from 0 ... 127 and then goes back to 0. Bits 16 ... 32: ticker value	📖 285
1	DWORD 1						
2	DWORD 2						
...	...						
80	DWORD 64						

8.19.10 Status of digital outputs with PWM function

You can use the following indexes to display the status of the digital outputs with PWM function.

Index	Name	Possible settings				Important	
		Lenze	Selection				
I5420$_h$	PWM state		0000$_h$	{1}	FFFFh	Read only Status of PWM	📖 289
1	WORD 1					2 entries per module Bit 0: reserved Bit 1: PWM status (0: PWM output stopped; 1: PWM output active) Bit 2: output status (0: push/pull output; 1: highside output) Bits 3 ... 15: reserved	
2	WORD 2						
...	...						
80	WORD 64						
I5620$_h$	PWM pulse duration		0000$_h$	{1}	FFFFh	Status of PWM 2 entries per module Specification of pulse duration in [µs].	📖 289
1	DWORD 1						
2	DWORD 2						
...	...						
80	DWORD 64						
I5621$_h$	PMW control		0000$_h$	{1}	FFFFh	Control word PWM 2 entries per module Bits 0 ... 1: reserved Bit 2: ● 0: push/pull output The output signal is switched to HIGH level active and LOW level active. ● 1: highside output The output signal is only switched to HIGH level active. Bits 3 ... 7: reserved Bit 8: 0-1 edge: PWM output starts Bit 9: 1-0 edge: PWM output stops Bits 10 ... 15: reserved	📖 380
1	WORD 1						
2	WORD 2						
...	...						
80	WORD 64						

8.20 Index table

- The indices are numbered in ascending order for reference purposes.
- How to read the index table:

Column	Abbreviation		Meaning
Index	$Ixxxx_h$		Index $Ixxxx_h$
	1		Subindex 1 of $Ixxxx_h$
	2		Subindex 2 of $Ixxxx_h$
	$Ixxxx_h$ ↵		After entry, the index parameter value is stored in the EEPROM
	$Ixxxx_h$*		Index parameter value is stored in the EEPROM with $I2003_h$ = 1
Name			Index name
Lenze			Lenze setting, setting on delivery
Selection	1	{%} 99	Min. value (unit) max. value
Important	–		Brief, important explanations
	📖 Page x		Reference to detailed explanations

Index	Name	Possible settings				Important	
		Lenze	Selection				
$I1000_h$	Device type					Display only Type	
$I1001_h$	Error register					Display only	📖 372
			Bit 0	Generic	An unspecified error has occurred (flag set on each error message)		
			Bit 1	Reserved			
			Bit2	Reserved			
			Bit3	Reserved			
			Bit4	Comm.	Communication error (Overrun CAN)		
			Bit 5	Reserved			
			Bit6	Reserved			
			Bit 7	ManSpec.	Manufacturer-specific error	Shown in detail in $I1003_h$	
$I1003_h$						Display only Fault memory	
1	Actual errors						
$I1004_h$	Number of supported PDOs					Display only	
1	Number of synchronous PDOs supported						
2	Number of synchronous PDOs supported						
$I1005_h$*	Sync COB-ID	128	128	{1}	2047		

Index	Name	Possible settings				Important	
		Lenze	Selection				
I1006$_h$ *	Sync interval (µs)	0	0	{1 µs}	4294967295	● The I/O system acts as sync consumer: – Set bit 30 = 0 under I1005$_h$ – After the time set under I1006$_h$, I/O system switches to the communication status set under I1029$_h$ – A reset will be carried out with the next sync telegram – With I1006$_h$ = 0, the monitoring is deactivated	
I1007$_h$	Synchronous window length	0	0	{1 µs}	4294967295	Die Lange des Zeitfensters fur synchrone PDOs in µs.	
I1008$_h$	DIS: Device name					Display only Device name	
I1009$_h$	DIS: Hardware version					Display only Hardware version	
I100A$_h$	DIS: Software version					Display only Software version	
I100B$_h$	Node ID		1	{1}	127	Read only CANopen node address	
I100C$_h$ *	Guard time	0	0	{1 ms}	65535	Node Guarding Monitoring time 0 = monitoring not active	🕮 365
I100D$_h$ *	Life time factor	0	0	{1}	255	Node Guarding Response time computation factor 0 = monitoring not active The response time is computed as: Monitoring period x factor	🕮 365
I100E$_h$	Node Guarding identifier					Display only Identifier = Basic identifier + node address (basic identifier cannot be modified)	🕮 365
I1010$_h$ ↵	Save All Parameters	0				Saving the parameter settings and the station structure in the EEPPROM of the bus coupler. Function in accordance with CANopen (DS301/DS401 communication protocol).	🕮 363
0			Number of subindexes assigned			Read only Number of the subindexes used by the index 1010$_h$	
1	Save		0 = no function 1702257011$_d$ = save parameters			The numerical value is ASCII-coded and complies with: 65 76 61 73$_h$ = ”E” ”V” ”A” ”S”	

Index	Name	Possible settings		Important	
		Lenze	Selection		
I1011$_h$ ↵	Restore All Parameters	0		Resetting the parameter setting in the EEPPROM of the bus coupler to the Lenze setting. Function in accordance with CANopen (DS301/DS401 communication protocol).	📖 363
0			Number of subindexes assigned	Read only Number of the subindexes used by the index 1011$_h$	
1	Load		0 = no function 1684107116$_d$ = load Lenze setting	The numerical value is ASCII-coded and complies with: 64 61 6F 6C$_h$ = ”D” ”A” ”O” ”L” After executing ”Load”, acceptance is effected by ● Voltage off/on, or ● Transmission of a reset node telegram (00 82 xx, mit xx = node address)	
I1014$_h$	COB ID emergency			Emergency telegram Identifier 80h + node address is displayed after boot-up.	📖 372
I1017$_h$ ↵	Heartbeat producer time	0	0 {1 ms} 65535 0 Function is not active	I/O system can be monitored by other nodes. Within this time the device status of I/O system is transmitted to the fieldbus.	📖 367
I1018$_h$				Display only Device identification	
1	Vendor ID				
2	Product code				
3	Revision number				
I1027$_h$	Type of			Read only	📖 379
0				Number of plugged-in modules	📖 379
1	Module no. 1			Module list Subindexes 1 ... 64 Module identifiers of the plugged-in modules	📖 379
2	Module no. 2				
...	...				
64	Module no. 64				
I1029$_h$ *	Error behaviour		0 Pre-Operational 1 No state changed 2 Stopped 3 Reset	Error behaviour	
1	Communication error	0		I/O system switches to the status set if the communication with the master fails or ”node guarding”, ”heartbeat”, or the output monitoring have been activated.	
2	Manufacturer-specific error	0		No function	
I1200$_h$	Server SDO parameter 1			Read only Current identifiers for SDO communication	
1	SDO1-Rx		1536 (basic identifier) + node address		
2	SDO1-Tx		1408 (basic identifier) + node address		
I1201$_h$	Server SDO parameter 2			Current identifiers for SDO communication SDO channel deactivated: bit 31 = 1 SDO channel activated: bit 31 = 0 + identifier from the SDO area	
1	SDO2-Rx	0	COB-ID client -> server (Rx)		
2	SDO2-Tx	0	COB-ID server -> client (Tx)		

Index	Name	Possible settings				Important	
		Lenze	Selection				
I1400$_h$ ↵							281
1	COB-ID used by RxPDO 1	513 + NID	385	{1}	2047	Definition of specific identifiers for process data object 1 (NID= Node ID / node address)	
2	Transmission type	255	0	{1}	255	Defining the transmission mode	
			0 ... 240	Process data update on every sync telegram transmission		The input data are accepted on sync telegram transmission.	
			241 ... 254	Reserved			
			255	Process data update on every occurrence of an event		Every received value is accepted	
I1401$_h$ ↵							281
1	COB-ID used by RxPDO 2	768 + NID	385	{1}	2047	Definition of specific identifiers for process data object 2 (NID= Node ID / node address)	
2	Transmission type	255	0	{1}	255	Defining the transmission mode	
			0 ... 240	Process data update on every sync telegram transmission		The input data are accepted on sync telegram transmission.	
			241 ... 254	Reserved			
			255	Process data update on every occurrence of an event		Every received value is accepted	
I1402$_h$ ↵							281
1	COB-ID used by RxPDO 3	1024 + NID	385	{1}	2047	Definition of specific identifiers for process data object 3 (NID= Node ID / node address)	
2	Transmission type	255	0	{1}	255	Defining the transmission mode	
			0 ... 240	Process data update on every sync telegram transmission		The input data are accepted on sync telegram transmission.	
			241 ... 254	Reserved			
			255	Process data update on every occurrence of an event		Every received value is accepted	
I1403$_h$ ↵							281
1	COB-ID used by RxPDO 4	1280 + NID	385	{1}	2047	Definition of specific identifiers for process data object 4 (NID= Node ID / node address)	
2	Transmission type	255	0	{1}	255	Defining the transmission mode	
			0 ... 240	Process data update on every sync telegram transmission		The input data are accepted on sync telegram transmission.	
			241 ... 254	Reserved			
			255	Process data update on every occurrence of an event		Every received value is accepted	

Index	Name	Possible settings			Important	
		Lenze	Selection			
I1404$_h$ ↵						📖 281
1	COB-ID used by RxPDO 5	1920 + NID	385	{1} 2047	Definition of specific identifiers for process data object 5 (NID= Node ID / node address)	
2	Transmission type	255	0	{1} 255	Defining the transmission mode	
			0 ... 240	Process data update on every sync telegram transmission	The input data are accepted on sync telegram transmission.	
			241 ... 254	Reserved		
			255	Process data update on every occurrence of an event	Every received value is accepted	
I1405$_h$ ↵						📖 281
1	COB-ID used by RxPDO 6	576 + NID	385	{1} 2047	Definition of specific identifiers for process data object 6 (NID= Node ID / node address)	
2	Transmission type	255	0	{1} 255	Defining the transmission mode	
			0 ... 240	Process data update on every sync telegram transmission	The input data are accepted on sync telegram transmission.	
			241 ... 254	Reserved		
			255	Process data update on every occurrence of an event	Every received value is accepted	
I1406$_h$ ↵						📖 281
1	COB-ID used by RxPDO 7	832 + NID	385	{1} 2047	Definition of specific identifiers for process data object 7 (NID= Node ID / node address)	
2	Transmission type	255	0	{1} 255	Defining the transmission mode	
			0 ... 240	Process data update on every sync telegram transmission	The input data are accepted on sync telegram transmission.	
			241 ... 254	Reserved		
			255	Process data update on every occurrence of an event	Every received value is accepted	
I1407$_h$ ↵						📖 281
1	COB-ID used by RxPDO 8	1088 + NID	385	{1} 2047	Definition of specific identifiers for process data object 8 (NID= Node ID / node address)	
2	Transmission type	255	0	{1} 255	Defining the transmission mode	
			0 ... 240	Process data update on every sync telegram transmission	The input data are accepted on sync telegram transmission.	
			241 ... 254	Reserved		
			255	Process data update on every occurrence of an event	Every received value is accepted	

Index	Name	Possible settings					Important	
		Lenze	Selection					
I1408$_h$ ↵								281
1	COB-ID used by RxPDO 9	1344 + NID	385	{1}	2047		Definition of specific identifiers for process data object 9 (NID= Node ID / node address)	
2	Transmission type	255	0	{1}	255		Defining the transmission mode	
			0 ... 240	Process data update on every sync telegram transmission			The input data are accepted on sync telegram transmission.	
			241 ... 254	Reserved				
			255	Process data update on every occurrence of an event			Every received value is accepted	
I1409$_h$ ↵								281
1	COB-ID used by RxPDO 10	1984 + NID	385	{1}	2047		Definition of specific identifiers for process data object 10 (NID= Node ID / node address)	
2	Transmission type	255	0	{1}	255		Defining the transmission mode	
			0 ... 240	Process data update on every sync telegram transmission			The input data are accepted on sync telegram transmission.	
			241 ... 254	Reserved				
			255	Process data update on every occurrence of an event			Every received value is accepted	
I1600$_h$ ↵							Mapping parameters for receive PDOs	
0	Number of mapped RxPDO1		0	{1}	255		8 bit value	
1	1st mapped object		00000000$_h$	{1}	FFFFFFFF$_h$		32 bit value	
2	2nd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$		32 bit value	
3	3rd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$		32 bit value	
4	4th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$		32 bit value	
5	5th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$		32 bit value	
6	6th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$		32 bit value	
7	7th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$		32 bit value	
8	8th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$		32 bit value	

Index	Name	Possible settings				Important
		Lenze	Selection			
I1601$_h$ ↵						Mapping parameters for receive PDOs
0	Number of mapped RxPDO2		0	{1}	255	8 bit value
1	1st mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
2	2nd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
3	3rd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
4	4th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
5	5th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
6	6th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
7	7th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
8	8th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
I1602$_h$ ↵						Mapping parameters for receive PDOs
0	Number of mapped RxPDO3		0	{1}	255	8 bit value
1	1st mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
2	2nd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
3	3rd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
4	4th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
5	5th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
6	6th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
7	7th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
8	8th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value

Index	Name	Possible settings				Important
		Lenze	Selection			
I1603$_h$ ↵						Mapping parameters for receive PDOs
0	Number of mapped RxPDO4		0	{1}	255	8 bit value
1	1st mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
2	2nd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
3	3rd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
4	4th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
5	5th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
6	6th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
7	7th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
8	8th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
I1604$_h$ ↵						Mapping parameters for receive PDOs
0	Number of mapped RxPDO5		0	{1}	255	8 bit value
1	1st mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
2	2nd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
3	3rd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
4	4th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
5	5th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
6	6th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
7	7th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
8	8th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value

Index	Name	Possible settings				Important
		Lenze	Selection			
I1605$_h$ ↵						Mapping parameters for receive PDOs
0	Number of mapped RxPDO6		0	{1}	255	8 bit value
1	1st mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
2	2nd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
3	3rd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
4	4th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
5	5th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
6	6th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
7	7th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
8	8th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
I1606$_h$ ↵						Mapping parameters for receive PDOs
0	Number of mapped RxPDO7		0	{1}	255	8 bit value
1	1st mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
2	2nd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
3	3rd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
4	4th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
5	5th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
6	6th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
7	7th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
8	8th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value

Index	Name	Possible settings				Important
		Lenze	Selection			
I1607$_h$ ↵						Mapping parameters for receive PDOs
0	Number of mapped RxPDO8		0	{1}	255	8 bit value
1	1st mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
2	2nd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
3	3rd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
4	4th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
5	5th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
6	6th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
7	7th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
8	8th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
I1608$_h$ ↵						Mapping parameters for receive PDOs
0	Number of mapped RxPDO9		0	{1}	255	8 bit value
1	1st mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
2	2nd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
3	3rd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
4	4th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
5	5th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
6	6th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
7	7th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
8	8th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value

Index	Name	Possible settings				Important	
		Lenze	Selection				
I1609$_h$ ↵						Mapping parameters for receive PDOs	
0	Number of mapped RxPDO10		0	{1}	255	8 bit value	
1	1st mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
2	2nd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
3	3rd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
4	4th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
5	5th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
6	6th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
7	7th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
8	8th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
I1800$_h$ ↵							📖 281
1	COB-ID used by TxPDO 1	384+ NID	385	{1}	2047	Definition of specific identifiers for process data object 1 (NID= Node ID / node address)	
2	Transmission type	255	0	{1}	255	Defining the transmission mode	
			0	Function deactivated		The output data are accepted on sync telegram transmission.	
			1 ... 240	Process data transfer after sync no. 1 ... Process data transfer after sync no. 240		The output data are accepted after transmission of the set number (1 ... 240) of sync telegrams.	
			254	Time-controlled process data transfer		Only if a cycle time is set in I180x$_h$, subindex 5	
			255	Event-controlled process data transfer			
			255	Event-controlled process data transfer with cyclic overlay		Only if a cycle time is set in I180x$_h$, subindex 5	
3	Inhibit time	0	0	{1 ms}	65535	Blocking time	
5	Event time	100	0	{1 ms}	65535	Cycle time	

Index	Name	Possible settings				Important	
		Lenze	Selection				
I1801$_h$ ↵							281
1	COB-ID used by TxPDO 2	640 + NID	385	{1}	2047	Definition of specific identifiers for process data object 2 (NID= Node ID / node address)	
2	Transmission type	255	0	{1}	255	Defining the transmission mode	
			0	Function deactivated		The output data are accepted on sync telegram transmission.	
			1 ... 240	Process data transfer after sync no. 1 ... Process data transfer after sync no. 240		The output data are accepted after transmission of the set number (1 ... 240) of sync telegrams.	
			254	Time-controlled process data transfer		Only if a cycle time is set in I180x$_h$, subindex 5	
			255	Event-controlled process data transfer			
			255	Event-controlled process data transfer with cyclic overlay		Only if a cycle time is set in I180x$_h$, subindex 5	
3	Inhibit time	0	0	{1 ms}	65535	Blocking time	
5	Event time	0	0	{1 ms}	65535	Cycle time	
I1802h ↵							281
1	COB-ID used by TxPDO 3	896 + NID	385	{1}	2047	Definition of specific identifiers for process data object 3 (NID= Node ID / node address)	
2	Transmission type	255	0	{1}	255	Defining the transmission mode	
			0	Function deactivated		The output data are accepted on sync telegram transmission.	
			1 ... 240	Process data transfer after sync no. 1 ... Process data transfer after sync no. 240		The output data are accepted after transmission of the set number (1 ... 240) of sync telegrams.	
			254	Time-controlled process data transfer		Only if a cycle time is set in I180x$_h$, subindex 5	
			255	Event-controlled process data transfer			
			255	Event-controlled process data transfer with cyclic overlay		Only if a cycle time is set in I180x$_h$, subindex 5	
3	Inhibit time	0	0	{1 ms}	65535	Blocking time	
5	Event time	0	0	{1 ms}	65535	Cycle time	

Index	Name	Possible settings				Important	
		Lenze	Selection				
I1803$_h$ ↵							📖 281
1	COB-ID used by TxPDO 4	1152 + NID	385	{1}	2047	Definition of specific identifiers for process data object 4 (NID= Node ID / node address)	
2	Transmission type	255	0	{1}	255	Defining the transmission mode	
			0	Function deactivated		The output data are accepted on sync telegram transmission.	
			1 ... 240	Process data transfer after sync no. 1 ... Process data transfer after sync no. 240		The output data are accepted after transmission of the set number (1 ... 240) of sync telegrams.	
			254	Time-controlled process data transfer		Only if a cycle time is set in I180x$_h$, subindex 5	
			255	Event-controlled process data transfer			
			255	Event-controlled process data transfer with cyclic overlay		Only if a cycle time is set in I180x$_h$, subindex 5	
3	Inhibit time	0	0	{1 ms}	65535	Blocking time	
5	Event time	0	0	{1 ms}	65535	Cycle time	
I1804$_h$ ↵							📖 281
1	COB-ID used by TxPDO 5	1664 + NID	385	{1}	2047	Definition of specific identifiers for process data object 5 (NID= Node ID / node address)	
2	Transmission type	255	0	{1}	255	Defining the transmission mode	
			0	Function deactivated		The output data are accepted on sync telegram transmission.	
			1 ... 240	Process data transfer after sync no. 1 ... Process data transfer after sync no. 240		The output data are accepted after transmission of the set number (1 ... 240) of sync telegrams.	
			254	Time-controlled process data transfer		Only if a cycle time is set in I180x$_h$, subindex 5	
			255	Event-controlled process data transfer			
			255	Event-controlled process data transfer with cyclic overlay		Only if a cycle time is set in I180x$_h$, subindex 5	
3	Inhibit time	0	0	{1 ms}	65535	Blocking time	
5	Event time	0	0	{1 ms}	65535	Cycle time	

Index	Name	Possible settings				Important	
		Lenze	Selection				
I1805$_h$ ↵							281
1	COB-ID used by TxPDO 6	448 + NID	385	{1}	2047	Definition of specific identifiers for process data object 6 (NID= Node ID / node address)	
2	Transmission type	255	0	{1}	255	Defining the transmission mode	
			0	Function deactivated		The output data are accepted on sync telegram transmission.	
			1 ... 240	Process data transfer after sync no. 1 ... Process data transfer after sync no. 240		The output data are accepted after transmission of the set number (1 ... 240) of sync telegrams.	
			254	Time-controlled process data transfer		Only if a cycle time is set in I180x$_h$, subindex 5	
			255	Event-controlled process data transfer			
			255	Event-controlled process data transfer with cyclic overlay		Only if a cycle time is set in I180x$_h$, subindex 5	
3	Inhibit time	0	0	{1 ms}	65535	Blocking time	
5	Event time	0	0	{1 ms}	65535	Cycle time	
I1806$_h$ ↵							281
1	COB-ID used by TxPDO 7	704 + NID	385	{1}	2047	Definition of specific identifiers for process data object 7 (NID= Node ID / node address)	
2	Transmission type	255	0	{1}	255	Defining the transmission mode	
			0	Function deactivated		The output data are accepted on sync telegram transmission.	
			1 ... 240	Process data transfer after sync no. 1 ... Process data transfer after sync no. 240		The output data are accepted after transmission of the set number (1 ... 240) of sync telegrams.	
			254	Time-controlled process data transfer		Only if a cycle time is set in I180x$_h$, subindex 5	
			255	Event-controlled process data transfer			
			255	Event-controlled process data transfer with cyclic overlay		Only if a cycle time is set in I180x$_h$, subindex 5	
3	Inhibit time	0	0	{1 ms}	65535	Blocking time	
5	Event time	0	0	{1 ms}	65535	Cycle time	

Index	Name	Possible settings				Important	
		Lenze	Selection				
I1807$_h$ ↵							📖 281
1	COB-ID used by TxPDO 8	960 + NID	385	{1}	2047	Definition of specific identifiers for process data object 8 (NID= Node ID / node address)	
2	Transmission type	255	0	{1}	255	Defining the transmission mode	
			0	Function deactivated		The output data are accepted on sync telegram transmission.	
			1 ... 240	Process data transfer after sync no. 1 ... Process data transfer after sync no. 240		The output data are accepted after transmission of the set number (1 ... 240) of sync telegrams.	
			254	Time-controlled process data transfer		Only if a cycle time is set in I180x$_h$, subindex 5	
			255	Event-controlled process data transfer			
			255	Event-controlled process data transfer with cyclic overlay		Only if a cycle time is set in I180x$_h$, subindex 5	
3	Inhibit time	0	0	{1 ms}	65535	Blocking time	
5	Event time	0	0	{1 ms}	65535	Cycle time	
I1808$_h$ ↵							📖 281
1	COB-ID used by TxPDO 9	1216 + NID	385	{1}	2047	Definition of specific identifiers for process data object 9 (NID= Node ID / node address)	
2	Transmission type	255	0	{1}	255	Defining the transmission mode	
			0	Function deactivated		The output data are accepted on sync telegram transmission.	
			1 ... 240	Process data transfer after sync no. 1 ... Process data transfer after sync no. 240		The output data are accepted after transmission of the set number (1 ... 240) of sync telegrams.	
			254	Time-controlled process data transfer		Only if a cycle time is set in I180x$_h$, subindex 5	
			255	Event-controlled process data transfer			
			255	Event-controlled process data transfer with cyclic overlay		Only if a cycle time is set in I180x$_h$, subindex 5	
3	Inhibit time	0	0	{1 ms}	65535	Blocking time	
5	Event time	0	0	{1 ms}	65535	Cycle time	

Index	Name	Possible settings				Important	
		Lenze	Selection				
I1809$_h$ ↵							281
1	COB-ID used by TxPDO 10	1728 + NID	385	{1}	2047	Definition of specific identifiers for process data object 10 (NID= Node ID / node address)	
2	Transmission type	255	0	{1}	255	Defining the transmission mode	
			0	Function deactivated		The output data are accepted on sync telegram transmission.	
			1 ... 240	Process data transfer after sync no. 1 ... Process data transfer after sync no. 240		The output data are accepted after transmission of the set number (1 ... 240) of sync telegrams.	
			254	Time-controlled process data transfer		Only if a cycle time is set in I180x$_h$, subindex 5	
			255	Event-controlled process data transfer			
			255	Event-controlled process data transfer with cyclic overlay		Only if a cycle time is set in I180x$_h$, subindex 5	
3	Inhibit time	0	0	{1 ms}	65535	Blocking time	
5	Event time	0	0	{1 ms}	65535	Cycle time	
I1A00$_h$ ↵						Mapping parameters for transmit PDOs	
0	Number of mapped TxPDO1		0	{1}	255	8 bit value	
1	1st mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
2	2nd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
3	3rd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
4	4th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
5	5th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
6	6th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
7	7th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
8	8th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	

Index	Name	Possible settings				Important
		Lenze	Selection			
$I1A01_h$ ↵						Mapping parameters for transmit PDOs
0	Number of mapped TxPDO2		0	{1}	255	8 bit value
1	1st mapped object		00000000_h	{1}	$FFFFFFFF_h$	32 bit value
2	2nd mapped object		00000000_h	{1}	$FFFFFFFF_h$	32 bit value
3	3rd mapped object		00000000_h	{1}	$FFFFFFFF_h$	32 bit value
4	4th mapped object		00000000_h	{1}	$FFFFFFFF_h$	32 bit value
5	5th mapped object		00000000_h	{1}	$FFFFFFFF_h$	32 bit value
6	6th mapped object		00000000_h	{1}	$FFFFFFFF_h$	32 bit value
7	7th mapped object		00000000_h	{1}	$FFFFFFFF_h$	32 bit value
8	8th mapped object		00000000_h	{1}	$FFFFFFFF_h$	32 bit value
$I1A02_h$ ↵						Mapping parameters for transmit PDOs
0	Number of mapped TxPDO3		0	{1}	255	8 bit value
1	1st mapped object		00000000_h	{1}	$FFFFFFFF_h$	32 bit value
2	2nd mapped object		00000000_h	{1}	$FFFFFFFF_h$	32 bit value
3	3rd mapped object		00000000_h	{1}	$FFFFFFFF_h$	32 bit value
4	4th mapped object		00000000_h	{1}	$FFFFFFFF_h$	32 bit value
5	5th mapped object		00000000_h	{1}	$FFFFFFFF_h$	32 bit value
6	6th mapped object		00000000_h	{1}	$FFFFFFFF_h$	32 bit value
7	7th mapped object		00000000_h	{1}	$FFFFFFFF_h$	32 bit value
8	8th mapped object		00000000_h	{1}	$FFFFFFFF_h$	32 bit value

Index	Name	Possible settings				Important
		Lenze	Selection			
I1A03$_h$ ↵						Mapping parameters for transmit PDOs
0	Number of mapped TxPDO4		0	{1}	255	8 bit value
1	1st mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
2	2nd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
3	3rd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
4	4th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
5	5th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
6	6th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
7	7th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
8	8th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
I1A04$_h$ ↵						Mapping parameters for transmit PDOs
0	Number of mapped TxPDO5		0	{1}	255	8 bit value
1	1st mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
2	2nd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
3	3rd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
4	4th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
5	5th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
6	6th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
7	7th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
8	8th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value

Index	Name	Possible settings				Important
		Lenze	Selection			
I1A05$_h$ ↵						Mapping parameters for transmit PDOs
0	Number of mapped TxPDO6		0	{1}	255	8 bit value
1	1st mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
2	2nd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
3	3rd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
4	4th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
5	5th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
6	6th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
7	7th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
8	8th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
I1A06$_h$ ↵						Mapping parameters for transmit PDOs
0	Number of mapped TxPDO7		0	{1}	255	8 bit value
1	1st mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
2	2nd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
3	3rd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
4	4th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
5	5th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
6	6th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
7	7th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
8	8th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value

Index	Name	Possible settings				Important
		Lenze	Selection			
I1A07$_h$ ↵						Mapping parameters for transmit PDOs
0	Number of mapped TxPDO8		0	{1}	255	8 bit value
1	1st mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
2	2nd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
3	3rd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
4	4th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
5	5th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
6	6th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
7	7th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
8	8th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
I1A08$_h$ ↵						Mapping parameters for transmit PDOs
0	Number of mapped TxPDO9		0	{1}	255	8 bit value
1	1st mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
2	2nd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
3	3rd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
4	4th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
5	5th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
6	6th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
7	7th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value
8	8th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value

Index	Name	Possible settings				Important	
		Lenze	Selection				
I1A09$_h$ ↵						Mapping parameters for transmit PDOs	
0	Number of mapped TxPDO10		0	{1}	255	8 bit value	
1	1st mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
2	2nd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
3	3rd mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
4	4th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
5	5th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
6	6th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
7	7th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
8	8th mapped object		00000000$_h$	{1}	FFFFFFFF$_h$	32 bit value	
I2100$_h$	PDO length	0	0	{1}	255	Setting of the user data width Note: Lenze controllers expect a PDO length of eight bytes even though not all of them may have assigned I/O values.	
			0	PDO length 8 bytes			
			1	PDO length according to process image			
I2101$_h$	Identifierbelegung		0	CANopen (Belegung nach DS301)			
			1	Belegung nach Lenze-Systembus			
I2359$_h$	Bus State		0	Operational		Aktueller Busstatus	
			1	Pre-Operational			
I2361$_h$	Mode		0	CANopen			
			1	Lenze Systembus			
I2400$_h$ ↵	Timer value		0	{1 ms}	65535	Monitoring time for process data input objects	📖 369
1	Lenze PDO control 1	0					
2	Lenze PDO control 2	0					
3	Lenze PDO control 3	0					
4	Lenze PDO control 4	0					
5	Lenze PDO control 5	0					
6	Lenze PDO control 6	0					
7	Lenze PDO control 7	0					
8	Lenze PDO control 8	0					
9	Lenze PDO control 9	0					
10	Lenze PDO control 10	0					

Index	Name	Possible settings				Important	
		Lenze	Selection				
I3100$_h$ ... I311D$_h$	Parameter data byte		0	{1$_h$}	255	Contents are written by the parameterisable module	303 318 328 343 346 347
1	Module 1						
2	Module 2						
...	...						
64	Module 64						
I31FE$_h$ ↵	Accept module parameter (single)	0	0	{1}	255	Index for accepting parameter settings one module at a time. Used e.g. in the PLC Designer	
1	DWord 1		255	Accept module parameters		Each subindex corresponds to a parameterisable module (sequence according to the slot, from left to right). The value changes are only accepted after writing the corresponding subindex with 255	
2	DWord 2						
...	...						
64	DWord 64						
I31FF$_h$	Accept module parameter	0	0	{1}	255	After describing the index with 255, the parameter changes are transferred by all modules	
			0				
			255	Accept module parameters			
I5400$_h$ ↵	Counter Value		00000000$_h$	{1$_h$}	FFFFFFFF$_h$	Count value	290
1	DWord 1					EPM-S600/-S602: Subindex is increased by 1 for each counter EPM-S601/-S603: Subindex is increased by 2 for each counter	
2	DWord 2						
...	...						
64	DWord 64						
I5401$_h$ ↵	Latch value		00000000$_h$	{1}	FFFFFFFF$_h$	Latch value	290
1	DWord 1					EPM-S600: Subindex is increased by 1 for each counter EPM-S601/-S602/-S603: without function	
2	DWord 2						
...	...						
64	DWord 64						
I5402$_h$ ↵	Status word		0000$_h$	{1}	FFFF$_h$	Status word	290
1	DWord 1					EPM-S600/-S602: Subindex is increased by 1 for each counter EPM-S601/-S603: Subindex is increased by 2 for each counter	
2	DWord 2						
...	...						
64	DWord 64						
I5403$_h$ ↵	Counter ticker value		0000$_h$	{1}	FFFF$_h$	Ticker value	290
1	DWord 1					EPM-S600/-S602: Subindex is increased by 1 for each counter EPM-S601/-S603: without function	
2	DWord 2						
...	...						
64	DWord 64						
I5420$_h$	PWM state		0000$_h$	{1}	FFFFh	Read only Status of PWM	289
1	WORD 1					2 entries per module Bit 0: reserved Bit 1: PWM status (0: PWM output stopped; 1: PWM output active) Bit 2: output status (0: push/pull output; 1: highside output) Bits 3 ... 15: reserved	
2	WORD 2						
...	...						
80	WORD 64						

Index	Name	Possible settings				Important	
		Lenze	Selection				
I5430$_h$	DI time stamp state		0000$_h$	{1}	FFFFh	Read only Status of time stamp 15 entries per module	📖 285
1	DWORD 1					Bit 0: channel status DI1 (0: FALSE; 1: TRUE) Bit 1: channel status DI2 (0: FALSE; 1: TRUE) Bits 2 ... 7: reserved Bits 8 ... 15: counter which counts from 0 ... 127 and then goes back to 0. Bits 16 ... 32: ticker value	
2	DWORD 2						
...	...						
80	DWORD 64						
I5440$_h$	DO time stamp state		0000$_h$	{1}	FFFFh	Read only Status of FIFO memory 1 entry per module Bits 0 ... 5: running number of time stamp entry last written to the FIFO memory.	📖 285
1	DWORD 1					Bits 6 ... 7: reserved Bits 8 ... 13: running number of time stamp entry to be processed next. Bits 14 ... 15: reserved Bits 16 ... 23: ● 00h or 80h: everything ok ● 01h or 81h: no following entry ● 02h or 82h: no new entries ● 03h or 83h: FIFO memory full. No new entries possible. A full memory will not accept any more time stamp entries. Perform a status query to establish the FIFO memory's status before transferring more time stamp entries. Bits 24 ... 31:number of time stamp entries in FIFO memory.	
2	DWORD 2						
...	...						
80	DWORD 64						
I5600$_h$ ↲	Counter Compare Value		00000000$_h$	{1}	FFFFFFFF$_h$	Comparison value	📖 290
1	DWord 1					EPM-S600/-S602: Subindex is increased by 1 for each counter EPM-S601: Subindex is increased by 2 for each counter EPM-S603: without function	
2	DWord 2						
...	...						
64	DWord 64						
I5601$_h$ ↲	Counter Set Value		00000000$_h$	{1}	FFFFFFFF$_h$	Set value	📖 290
1	DWord 1					EPM-S600/-S602: Subindex is increased by 1 for each counter EPM-S601/-S603: without function	
2	DWord 2						
...	...						
64	DWord 64						
I5602$_h$ ↲	Counter Control Word		0000$_h$	{1}	FFFF$_h$	Control word	
1	DWord 1					EPM-S600/-S602: Subindex is increased by 1 for each counter EPM-S601/-S603: Subindex is increased by 2 for each counter	📖 290
2	DWord 2						
...	...						
64	DWord 64						

Index	Name	Possible settings				Important	
		Lenze	Selection				
I5620$_h$	PWM pulse duration		0000$_h$	{1}	FFFFh	Status of PWM 2 entries per module Specification of pulse duration in [µs].	📖 289
1	DWORD 1						
2	DWORD 2						
...	...						
80	DWORD 64						
I5621$_h$	PMW control		0000$_h$	{1}	FFFFh	Control word PWM 2 entries per module Bits 0 ... 1: reserved Bit 2: ● 0: push/pull output The output signal is switched to HIGH level active and LOW level active. ● 1: highside output The output signal is only switched to HIGH level active. Bits 3 ... 7: reserved Bit 8: 0-1 edge: PWM output starts Bit 9: 1-0 edge: PWM output stops Bits 10 ... 15: reserved	📖 380
1	WORD 1						
2	WORD 2						
...	...						
80	WORD 64						
I5640$_h$	DO time stamp control		0000$_h$	{1}	FFFFh	15 entries per module Bits 0 ... 5: reserved Bit 6: channel status D01 (0: FALSE; 1: TRUE) Bit 7: channel status D02 (0: FALSE; 1: TRUE) Bits 8 ... 15: counter which counts from 0 ... 127 and then goes back to 0. Bits 16 ... 32: ticker value	📖 285
1	DWORD 1						
2	DWORD 2						
...	...						
80	DWORD 64						
I6000$_h$	Digital input		0	{1}	255	Read only Digital input status	📖 380
1	Byte 1						
2	Byte 2						
...	...						
80	Byte 80						
I6002$_h$ ↵	Change polarity - digital input		0	{1}	255	Inverts digital input signals	📖 303
1	Byte 1	0					
2	Byte 2	0					
...	...	...					
80	Byte 80	0					
I6200$_h$ *	Digital output		0	{1}	255	● Digital output status ● The outputs can be set manually (forcing): – Depends on CAN status and I2360$_h$	📖 380
1	Byte 1						
2	Byte 2						
...	...						
80	Byte 80						

Index	Name	Possible settings				Important	
		Lenze	Selection				
I6202$_h$ ↲	Change polarity - digital output		0	{1}	255	Inverts digital output signals	📖 303
1	Byte 1	0					
2	Byte 2	0					
...	...	...					
80	Byte 80	0					
I6206$_h$ ↲	Error mode - digital output		0	{1}	255	Configures digital output monitoring	📖 370
			0	All digital outputs retain the last status output.			
			255	Response from I6207$_h$		In I6207$_h$, the response can be configured individually for each digital output	
1	Byte 1	0					
2	Byte 2	0					
...	...	...					
80	Byte 80	0					
I6207$_h$ ↲	Error value - digital output	0	0	{1}	255	Configures the individual digital output responses	📖 370
			8 bits of information				
			Bit value 0	Output switches to LOW			
			Bit value 1	Output retains last status output			
1	Byte 1	0					
2	Byte 2	0					
...	...	...					
64	Byte 80	0					
I6401$_h$	Analog input		-32768	{1}	32767	Display only Analog input status	📖 380
1	Channel 1						
2	Channel 2						
...	...						
36	Channel 36						
I6411$_h$ *	Analog output		-32768	{1}	32767	• Analog output status • The outputs can be set manually (forcing): – Depends on CAN status and I2360$_h$	📖 380
1	Channel 1						
2	Channel 2						
...	...						
36	Channel 36						
I6421$_h$ ↲	Trigger selection		0	{1}	255	Enables interrupt for analog inputs/outputs	
1	Channel 1	0					
2	Channel 2	0					
...	...	...					
36	Channel 36	0					

Index	Name	Possible settings					Important	
		Lenze	Selection					
$I6423_h$ ↲	Global interrupt enable		0	{1}	255		Global activation/deactivation of the event-controlled process data transfer of the analog input signals. The setting in $I6423_h$ has a higher priority than the settings in the TxPDOs. ● Lenze setting: – System bus (CAN): $I6423_h$ = 255 – CANopen: $I6423_h$ = 0	
			0	Event-controlled process data transfer deactivated				
			255	Event-controlled process data transfer activated				
$I6424_h$ ↲	Upper limit analog input		00000000_h	{1}	$FFFFFFFF_h$			
1	Channel 1	0						
2	Channel 2	0						
...	...	...						
36	Channel 36	0						
$I6425_h$ ↲	Lower limit analog input		00000000_h	{1}	$FFFFFFFF_h$			
1	Channel 1	0						
2	Channel 2	0						
...	...	...						
36	Channel 36	0						
$I6426_h$ ↲	Delta limit analog input		00000000_h	{1}	$FFFFFFFF_h$			
1	Channel 1	0						
2	Channel 2	0						
...	...	...						
36	Channel 36	0						
$I6443_h$ ↲	Error mode analog output		0	{1}	255		Configures analog output monitoring	📖 371
			0	All analog outputs retain the last value output				
			255	Response from $I6444_h$			In $I6444_h$ the response can be configured individually for each analog output	
1	Channel 1	0						
2	Channel 2	0						
...	...	...						
36	Channel 36	0						
$I6444_h$ ↲	Error value analog output		-32768	{1}	32767		Configures the individual analog output responses The analog outputs provide the set value	📖 371
1	Channel 1	0						
2	Channel 2	0						
...	...	...						
36	Channel 36	0						

9 PROFIBUS communication

9.1 Via Profibus-DP

PROFIBUS is an integrated, open, digital communication system with a wide application range mainly in manufacturing and process automation. PROFIBUS is suitable for fast, time-critical and complex communication tasks.

PROFIBUS-DP can be used for manufacturing automation. It provides for an easy, fast, cyclic and deterministic process data exchange between a master and the assigned slaves. Power section DP-V0 is provided with these basic functions. Power section DP-V1 was enhanced by an acyclic data exchange between master and slave.

Power section DP-V0

Profibus-DP-V0 (Decentralised Peripherals) provides the basic functions of DP.

Power section DP-V1

The power section DP-V1 contains supplements for DP-V0 with the focus on process automation: Simultaneously to the cyclic process data transfer, an acyclic data link to the slaves is built up in order to parameterise the slaves.

Note!

Power section DP-V1 can only be used if it is supported by the master and the slaves.

9.2 System configuration

9.2.1 Types

PROFIBUS differentiates between active nodes (master) and passive nodes (slave).

Class 1 master (DPM 1)

A class 1 master (DPM 1) is a central control which exchanges data with the slaves in a fixed cycle. Typical DPM 1 are, for example, PLC or PC. Via an active bus access, measured data is read cyclically from the input modules of the slaves and setpoints are written to the output modules of the slaves.

Class 2 master (DPM 2)

Class 2 masters (DPM 2) are used for engineering, configuration or operation. During commissioning, maintenance and diagnostics, for example, DPM 2 can be used to configure the connected slaves, evaluate measured values and parameters and query the status of the slaves. The data is transmitted acyclically. DPM 2 do not have to be permanently connected to the bus. DPM 2 are provided with active bus access.

Slave

Slaves are peripherals (PROFIBUS bus couplers) making process information (input data and output data) available. Slaves only respond to direct requests by the master.

9.2.2 Mono-master system

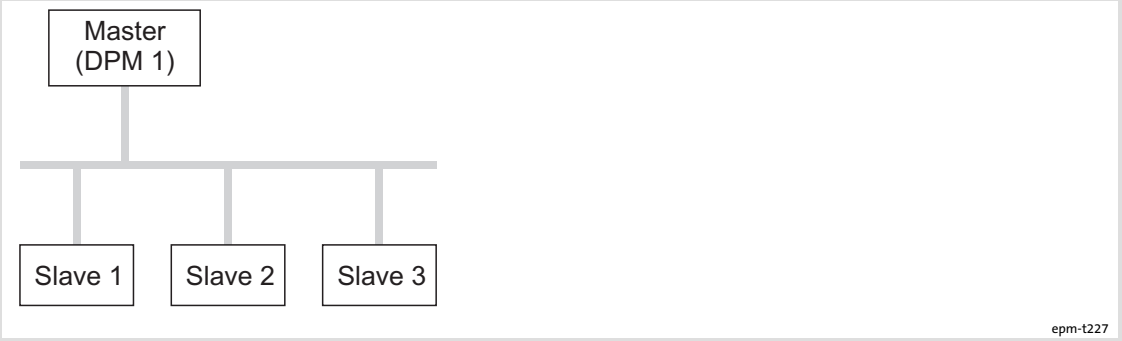


Fig. 9-1 PROFIBUS-DP mono-master system

In the case of mono-master systems, only one master on the bus is active during operation. The slaves are coupled to the master via the transmission medium in a decentralised manner. This system configuration achieves the shortest bus cycle time.

9.2.3 Multi-master system

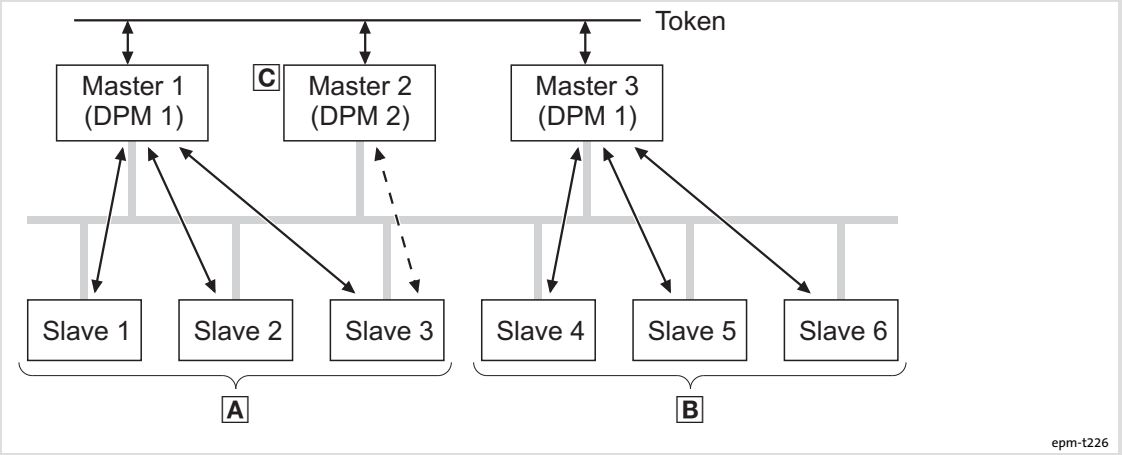


Fig. 9-2 PROFIBUS-DP multi-master system

- A Subsystem consisting of master 1 and slaves 1 ... 3 with cyclic data transfer.
- B Subsystem consisting of master 3 and slaves 4 ... 6 with cyclic data transfer.
- C For configuration and diagnostics, master 2 can communicate with slave 1 ... 6. The data transfer is acyclic.

In multi-master operation, several masters are connected to one bus. They either form independent subsystems consisting of one class 1 master (DPM 1) each and the corresponding slaves, or additional class 2 masters (DPM 2) for configuration and diagnostics. The input and output images of the slaves can be read by all masters. Only the respective class 1 master (DPM 1) can write the outputs.

9.3 Communication

9.3.1 Bus access

The transmission protocol offers two bus access procedures.

Master ↔ Master

The master communication is also referred to as token passing procedure. The token passing procedure makes sure that the bus access authorisation is assigned. The bus access authorisation is given by means of a ”token”. The token is a special telegram transmitted via the bus.

If a master has a token, it can communicate with all of the other bus nodes. The token hold time is defined during system configuration. Once the token hold time has elapsed, the token is passed on to the next master which is then in possession of the bus access authorisation and can communicate with all of the other nodes.

The data transfer between the master and the slaves assigned to it is automatically controlled by the master and takes place in a fixed and recurring sequence. The slaves are assigned to a master during configuration. In addition, it can be defined which slaves participate in the cyclic process data transfer.

Master ↔ Slave

Before master and slave can communicate, the configuration and the parameter setting are checked for errors after startup.

The following are checked: type, format information, length information and the number of inputs and outputs.

If the parameters are valid, the slave changes over to the DataExchange (DE) state. The master can now transmit output data to the slave and receive the current input data from the slave.

While the process data transfer is in progress, the master can transmit new parameter data to the slave.

9.3.2 Cyclic data transfer

The data communication with PROFIBUS-DP-V0 includes cyclic diagnostics as well as cyclic process data and parameter data transfer.

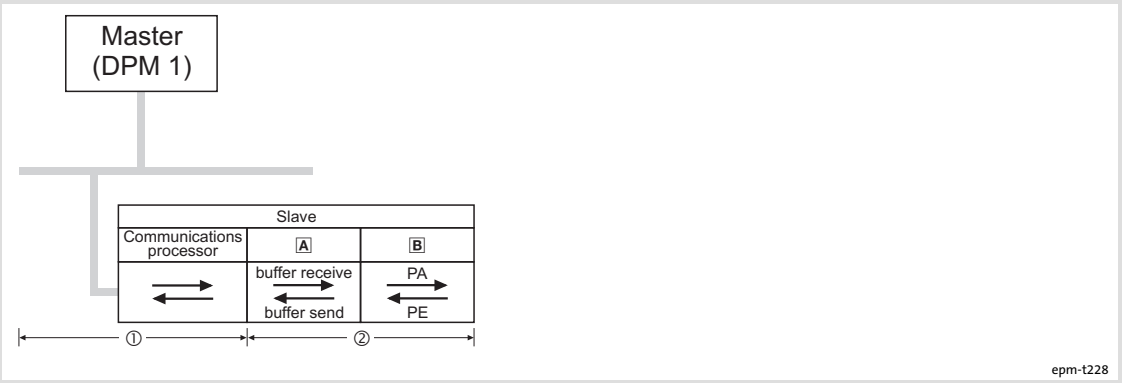


Fig. 9-3 DP cycle and cycle of backplane bus

- A Backplane bus with transmit and receive buffer
- B Input / output modules
  PO: process image of outputs
  PI: process image of inputs
- ① PROFIBUS cycle
- ② Backplane bus cycle

Backplane bus cycle

During a backplane bus cycle

- ► the input data (PI) on the inputs is collected and transmitted to the transmit buffer (buffer send),
- ► the output data (PO) of the receive buffer (buffer receive) is written to the outputs.

PROFIBUS cycle

During a PROFIBUS cycle, the master successively addresses all its assigned slaves with a DataExchange. During a DataExchange, the memory areas assigned to the PROFIBUS are transmitted.

- ► The data of the PROFIBUS input area is transmitted to the receive buffer (buffer receive).
- ► The data of the transmit buffer (buffer send) is transmitted to the PROFIBUS output area.

9.3.3 Acyclic data transfer

The PROFIBUS-DP-V1 service can be used as an optional extension to enable an acyclic parameter data transfer. PROFIBUS-DP-V0 and PROFIBUS-DP-V1 may be operated simultaneously in one network.

The integration of the acyclic service in a fixed bus cycle depends on the correct configuration of DPM 1:

- If configured, a time slot is reserved.
- If not configured, the acyclic service is added when a DP-V1 slave is accessed acyclically with a DPM 2.
- The acyclic service always has lower priority.

Parameter data transfer between DPM 1 and slaves

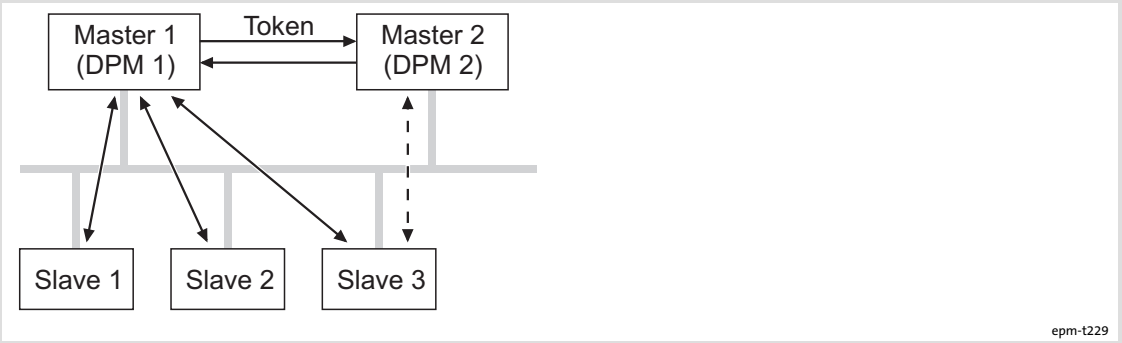


Fig. 9-4 Acyclic data transfer

⟷ Cyclic process data transfer between DPM 1 and slave 1 ... 3
◄ – –► Acyclic parameter data transfer between DPM 1 and slave 3

1. DPM 1 has the send authorisation (token) and communicates in a fixed sequence with slave 1, then with slave 2 etc. up to the last slave of the current list via the MS0 channel by means of request and response.
2. DPM 1 transfers the token to DPM 2.
3. During the remaining cycle time (time slot), DPM 2 establishes an acyclical connection to one of the slaves in order to transmit parameter data via the MS2 channel.
4. At the end of the running cycle time, DPM 2 returns the token to DPM 1.
   – Depending on the remaining cycle time, several time slots may be required for the acyclical data record transfer.
5. Once all of the data records have been transferred, DPM 2 establishes the connection within one time slot.

Note!

DPM 1 can perform the acyclical parameter data exchange via the MS1 channel.

Services for the acyclic parameter data transfer

Data transfer between DPM 1 and slaves

The connection is established by DPM 1 via the MS1 channel. The connection to the slave can only be established by the master that has parameterised and configured the slave.

Service	Description
Read	The master reads a data block from the slave.
Write	The master writes a data block to the slave.
Alarm	The slave transmits an alarm message to the master. The master acknowledges receipt. To prevent alarm messages from being overwritten, the slave can only transmit a new alarm message if it has received the acknowledgement.
Alarm_Acknowledge	The master transmits an acknowledgement to the slave, confirming that it has received an alarm message.
Status	The slave transmits a status message to the master. The master does not acknowledge receipt.

Data transfer between DPM 2 and slaves

The connection is established by DPM 2 via the MS1 channel using the ”Initiate” service. One slave can maintain several active connections at the same time. The number of connections is limited depending on the resources available in the slave.

Service	Description
Initiate / Abort	Establishing or terminating a connection for the acyclic data transfer between DPM 2 and a slave.
Read	The master reads a data block from the slave.
Write	The master writes a data block to the slave.
Data_Transport	The master writes user-specific data (defined in profiles) to the slave and, if required, it reads data from the slave in the same cycle.

Note!

For further information on the services and communication with DP-V0 and DP-V1, refer to standard IEC 61158.

9.3.4 Communication medium

- The communication medium is an RS485 interface.
- The bus can be configured as line or tree topology.
- The bus structure under RS485 enables the reactionless connection and disconnection of stations as well as the gradual commissioning of the system. Subsequent enhancements do not affect the stations already in operation. It is automatically detected whether a node has failed or just been connected to the mains.
- The PROFIBUS bus coupler is provided with a 9-pole Sub-D socket for connecting them to the bus.

9.4 Project planning

The I/O system is configured via the master. The following work steps must be carried out:

- Import the GSE file (device description) of the I/O system into the project planning tool.
  - PROFIBUS bus coupler: LENZ0C3A.gse
  - The description or linkage of the GSE file can be found in the project planning tool.
- Address nodes
  - Every node at the PROFIBUS is identified by an address.
  - Each address may only be assigned once in a bus system.
  - Addresses between 1 ... 125 can be assigned.
  - At the PROFIBUS bus coupler (slave), the address with the front DIP switch is set(📖 39).
  - At the master, the address is set during the configuration.
- Set the baud rate
  - The baud rate is set in the configuration tool.
  - The baud rate must correspond to the length of the bus cable.
- Parameterise slaves

Note!

The diagnostic function is only supported by I/O compound modules from HW version 1B and by bus coupler modules from HW version 1A.

If a module in the system complies with an earlier HW version, the diagnostic function is deactivated for all modules.

9.5 Setting the parameters of analog I/O

9.5.1 2 analog inputs 0 ... 10 V (12 bits) - EPM-S400

Parameter data

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
128	0	Function channel 1	16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
129	0	Function channel 2		20_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	

Diagnostic data

Since this module does not support an alarm, the diagnostic data serve to provide information on this module. In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

The following errors are registered in the diagnostic data:

- Configuration/parameterisation errors
- Measuring range exceeded
- Measuring range not reached

By the use of the SFB 52 you can access the diagnostic data of the module anytime. Data set 1 has the following structure:

Byte	Bit 7 ... 0
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of a missing external supply voltage Bit 6: 0 (fixed) Bit 7: Parameterisation error
1	Bits 3 ... 0: Module class, 0101_b: Analog module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 71_h: Analog input Bit 7: 0 (fix)
5	Number of diagnostic bits output by the module per channel (here 02_h)
6	Number of channels of a module (here 02_h:)
7	Bit 0: Channel error, channel 1 Bit 1: Channel error, channel 2 Bit 7 ... 2: 0 (fixed)
8	Channel-specific errors: channel 1: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
9	Channel-specific errors: channel 2: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
10 ... 15	0 (fixed)

9.5.2 4 analog inputs 0 ... 10 V (12 bits) - EPM-S401

Parameter data

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
128	0	Function channel 1	16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
129	0	Function channel 2		20_h
130	0	Function channel 3		20_h
131	0	Function channel 4		20_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	

Diagnostic data

Since this module does not support an alarm, the diagnostic data serve to provide information on this module. In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

The following errors are registered in the diagnostic data:

- Configuration/parameterisation errors
- Measuring range exceeded
- Measuring range not reached

By the use of the SFB 52 you can access the diagnostic data of the module anytime. Data set 1 has the following structure:

Byte	Bit 7 ... 0
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of a missing external supply voltage Bit 6: 0 (fixed) Bit 7: Parameterisation error
1	Bits 3 ... 0: Module class, 0101_b: Analog module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 71_h: Analog input Bit 7: 0 (fix)
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 04_h:)
7	Bit 0: Channel error channel 1 Bit 1: Channel error channel 2 Bit 2: Channel error channel 3 Bit 3: Channel error channel 4 Bit 7 ... 4: 0 (fixed)
8	Channel-specific errors: channel 1: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
9	Channel-specific errors: channel 2: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
10	Channel-specific errors: channel 3: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
11	Channel-specific errors: channel 4: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
12 ... 15	0 (fixed)

9.5.3 2 analog inputs 0/4 ... 20 mA (12 bits) - EPM-S402

Parameter data

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
128	0	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	31_h
129	0	Function channel 2		31_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

Diagnostic data

Since this module does not support an alarm, the diagnostic data serve to provide information on this module. In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

The following errors are registered in the diagnostic data:

- Configuration/parameterisation errors
- Measuring range exceeded
- Measuring range not reached

By the use of the SFB 52 you can access the diagnostic data of the module anytime. Data set 1 has the following structure:

Byte	Bit 7 ... 0
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of a missing external supply voltage Bit 6: 0 (fixed) Bit 7: Parameterisation error
1	Bits 3 ... 0: Module class, 0101_b: Analog module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 71_h: Analog input Bit 7: 0 (fix)
5	Number of diagnostic bits output by the module per channel (here 02_h)
6	Number of channels of a module (here 02_h:)
7	Bit 0: Channel error, channel 1 Bit 1: Channel error, channel 2 Bit 7 ... 2: 0 (fixed)
8	Channel-specific errors: channel 1: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
9	Channel-specific errors: channel 2: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
10 ... 15	0 (fixed)

9.5.4 4 analog inputs 0/4 ... 20 mA (12 bits) - EPM-S403

Parameter data

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
128	0	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	31_h
129	0	Function channel 2		31_h
130	0	Function channel 3		31_h
131	0	Function channel 4		31_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

Diagnostic data

Since this module does not support an alarm, the diagnostic data serve to provide information on this module. In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

The following errors are registered in the diagnostic data:

- Configuration/parameterisation errors
- Measuring range exceeded
- Measuring range not reached

By the use of the SFB 52 you can access the diagnostic data of the module anytime. Data set 1 has the following structure:

Byte	Bit 7 ... 0
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of a missing external supply voltage Bit 6: 0 (fixed) Bit 7: Parameterisation error
1	Bits 3 ... 0: Module class, 0101_b: Analog module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 71_h: Analog input Bit 7: 0 (fix)
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 04_h:)
7	Bit 0: Channel error channel 1 Bit 1: Channel error channel 2 Bit 2: Channel error channel 3 Bit 3: Channel error channel 4 Bit 7 ... 4: 0 (fixed)
8	Channel-specific errors: channel 1: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
9	Channel-specific errors: channel 2: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
10	Channel-specific errors: channel 3: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
11	Channel-specific errors: channel 4: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
12 ... 15	0 (fixed)

9.5.5 2 analog inputs -10 ... +10 V (16 bits) - EPM-S406

Parameter data

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
0	1	Reserved	0	
	2	Limit value monitoring	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 (0 = deactivated; 1 = activated) Bits 7 ... 2: Reserved	00_h
1	0	Interference frequency suppression	Bit 1, 0: Channel 1 00: Deactivated 01: 60 Hz 10: 50 Hz Bit 3, 2: Channel 2 00: Deactivated 01: 60 Hz 10: 50 Hz Bits 7 ... 4: Reserved	00_h
128	0	Function channel 1	12 (12_h): -10 ... 10 V / -27648 ... 27648_{dec} 34 (22_h): -10 ... 10 V / -16384 ... 16384_{dec} 16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
	1	Reserved	0	
	2	Upper limit value channel 1	Value from the rated range; if this value is exceeded and the limit value monitoring function is active, a process alarm is triggered. $7FFF_h$: Limit value alarm deactivated	$7FFF_h$
	3	Lower limit value channel 1	Value from the rated range; if the actual value falls below this value and the limit value monitoring function is active, a process alarm is triggered. 8000_h: Limit value alarm deactivated	8000_h
129	0	Function channel 2	12 (12_h): -10 ... 10 V / -27648 ... 27648_{dec} 34 (22_h): -10 ... 10 V / -16384 ... 16384_{dec} 16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
	1	Reserved	0	
	2	Upper limit value channel 2	Value from the rated range; if this value is exceeded and the limit value monitoring function is active, a process alarm is triggered. $7FFF_h$: Limit value alarm deactivated	$7FFF_h$
	3	Lower limit value channel 2	Value from the rated range; if the actual value falls below this value and the limit value monitoring function is active, a process alarm is triggered. 8000_h: Limit value alarm deactivated	8000_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
-10 ... +10 V (12_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	0	0000		
	-5	-13824	CA00		
	-10	**-27648**	9400		
	-11.76	-32512	8100	Underflow	
-10 ... +10 V (22_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	0	0000		
	-5	-8192	E000		
	-10	**-16384**	C000		
	-12.5	-20480	B000	Underflow	
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	0	0000		
	-1.76	-4864	ED00	Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	-2	-3277	F333	Underflow	

Diagnostic data

Since this module does not support an alarm, the diagnostic data serve to provide information on this module. In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

The following errors are registered in the diagnostic data:

- Configuration/parameterisation errors
- Measuring range exceeded
- Measuring range not reached

By the use of the SFB 52 you can access the diagnostic data of the module anytime. Data set 1 has the following structure:

Byte	Bit 7 ... 0
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of a missing external supply voltage Bit 6: 0 (fixed) Bit 7: Parameterisation error
1	Bits 3 ... 0: Module class, 0101_b: Analog module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 71_h: Analog input Bit 7: 0 (fix)
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 04_h:)
7	Bit 0: Channel error channel 1 Bit 1: Channel error channel 2 Bit 2: Channel error channel 3 Bit 3: Channel error channel 4 Bit 7 ... 4: 0 (fixed)
8	Channel-specific errors: channel 1: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
9	Channel-specific errors: channel 2: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
10	Channel-specific errors: channel 3: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
11	Channel-specific errors: channel 4: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
12 ... 15	0 (fixed)

9.5.6 2 analog inputs 0/4 ... 20 mA (16 bits) - EPM-S408

Parameter data

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
0		Diagnostics	Bits 0 ... 5: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
		Reserved	0	
		Limit value monitoring	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 (0 = deactivated; 1 = activated) Bits 7 ... 2: Reserved	00_h
1		Interference frequency suppression	Bit 1, 0: Channel 1 00: Deactivated 01: 60 Hz 10: 50 Hz Bit 3, 2: Channel 2 00: Deactivated 01: 60 Hz 10: 50 Hz Bits 7 ... 4: Reserved	00_h
128		Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	41_h
		Reserved	0	
		Upper limit value channel 1	Value from the rated range; if this value is exceeded and the limit value monitoring function is active, a process alarm is triggered. $7FFF_h$: Limit value alarm deactivated	$7FFF_h$
		Lower limit value channel 1	Value from the rated range; if the actual value falls below this value and the limit value monitoring function is active, a process alarm is triggered. 8000_h: Limit value alarm deactivated	8000_h
129		Function channel 2	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	41_h
		Reserved	0	
		Upper limit value channel 2	Value from the rated range; if this value is exceeded and the limit value monitoring function is active, a process alarm is triggered. $7FFF_h$: Limit value alarm deactivated	$7FFF_h$
		Lower limit value channel 2	Value from the rated range; if the actual value falls below this value and the limit value monitoring function is active, a process alarm is triggered. 8000_h: Limit value alarm deactivated	8000_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

Diagnostic data

Since this module does not support an alarm, the diagnostic data serve to provide information on this module. In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

The following errors are registered in the diagnostic data:

- Configuration/parameterisation errors
- Measuring range exceeded
- Measuring range not reached

By the use of the SFB 52 you can access the diagnostic data of the module anytime. Data set 1 has the following structure:

Byte	Bit 7 ... 0
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of a missing external supply voltage Bit 6: 0 (fixed) Bit 7: Parameterisation error
1	Bits 3 ... 0: Module class, 0101_b: Analog module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 71_h: Analog input Bit 7: 0 (fix)
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 04_h:)
7	Bit 0: Channel error channel 1 Bit 1: Channel error channel 2 Bit 2: Channel error channel 3 Bit 3: Channel error channel 4 Bit 7 ... 4: 0 (fixed)
8	Channel-specific errors: channel 1: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
9	Channel-specific errors: channel 2: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
10	Channel-specific errors: channel 3: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
11	Channel-specific errors: channel 4: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
12 ... 15	0 (fixed)

9.5.7 2 analog outputs 0 ... 10 V (12 bits) - EPM-S500

Parameter data

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
0	1	Short-circuit detection	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 Bits 2 ... 7: Reserved	00_h
128	0	Function channel 1	16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
129	0	Function channel 2		20_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Output area (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	

Diagnostic data

Since this module does not support an alarm, the diagnostic data serve to provide information on this module. In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

The following errors are registered in the diagnostic data:

- Configuration/parameterisation errors
- Short circuit/overload (if parameterised)

Using SFB 52 you can access the diagnostic data of the module anytime. Data set 1 has the following structure:

Byte	Bit 7 ... 0
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of a missing external supply voltage Bit 6: 0 (fixed) Bit 7: Parameterisation error
1	Bits 3 ... 0: Module class, 0101_b: Analog module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 73_h: analog output Bit 7: 0 (fixed)
5	Number of diagnostic bits output by the module per channel (here 02_h)
6	Number of channels of a module (here 02_h:)
7	Bit 0: Channel error, channel 1 Bit 1: Channel error, channel 2 Bit 7 ... 2: 0 (fixed)
8	Channel-specific errors: channel 1: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Short circuit after M Bit 7 ... 4: 0 (fixed)
9	Channel-specific errors: channel 2: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Short circuit after M Bit 7 ... 4: 0 (fixed)
10 ... 15	0 (fixed)

9.5.8 4 analog outputs 0 ... 10 V (12 bits) - EPM-S501

Parameter data

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
0	1	Short-circuit detection	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 Bit 2: Channel 3 Bit 3: Channel 4 Bits 4 ... 7: Reserved	00_h
128	0	Function channel 1	16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
129	0	Function channel 2		20_h
130	0	Function channel 3		20_h
131	0	Function channel 4		20_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Output area (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	

Diagnostic data

Since this module does not support an alarm, the diagnostic data serve to provide information on this module. In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

The following errors are registered in the diagnostic data:

- Configuration/parameterisation errors
- Short circuit/overload (if parameterised)

Using SFB 52 you can access the diagnostic data of the module anytime. Data set 1 has the following structure:

Byte	Bit 7 ... 0
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of a missing external supply voltage Bit 6: 0 (fixed) Bit 7: Parameterisation error
1	Bits 3 ... 0: Module class, 0101_b: Analog module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 73_h: analog output Bit 7: 0 (fixed)
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 04_h:)
7	Bit 0: Channel error channel 1 Bit 1: Channel error channel 2 Bit 2: Channel error channel 3 Bit 3: Channel error channel 4 Bit 7 ... 4: 0 (fixed)
8	Channel-specific errors: channel 1: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Short circuit after M Bit 7 ... 4: 0 (fixed)
9	Channel-specific errors: channel 2: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Short circuit after M Bit 7 ... 4: 0 (fixed)
10	Channel-specific errors: channel 3: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Short circuit after M Bit 7 ... 4: 0 (fixed)
11	Channel-specific errors: channel 4: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Short circuit after M Bit 7 ... 4: 0 (fixed)
12 ... 15	0 (fixed)

9.5.9 2 analog outputs 0/4 ... 20 mA (12 bits) - EPM-S502

Parameter data

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
0	1	Wire-breakage detection	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 Bits 2 ... 7: Reserved	00_h
128	0	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	31_h
129	0	Function channel 2		31_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

Diagnostic data

Since this module does not support an alarm, the diagnostic data serve to provide information on this module. In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

The following errors are registered in the diagnostic data:

- Configuration/parameterisation errors
- Open circuit (if parameterised)

By the use of the SFB 52 you can access the diagnostic data of the module anytime. Data set 1 has the following structure:

Byte	Bit 7 ... 0
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of a missing external supply voltage Bit 6: 0 (fixed) Bit 7: Parameterisation error
1	Bits 3 ... 0: Module class, 0101_b: Analog module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 73_h: analog output Bit 7: 0 (fixed)
5	Number of diagnostic bits output by the module per channel (here 02_h)
6	Number of channels of a module (here 02_h:)
7	Bit 0: Channel error, channel 1 Bit 1: Channel error, channel 2 Bit 7 ... 2: 0 (fixed)
8	Channel-specific errors: channel 1: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Open circuit Bit 7 ... 4: 0 (fixed)
9	Channel-specific errors: channel 2: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Open circuit Bit 7 ... 4: 0 (fixed)
10 ... 15	0 (fixed)

9.5.10 4 analog outputs 0/4 ... 20 mA (12 bits) - EPM-S503

Parameter data

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
0	1	Wire-breakage detection	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 Bit 2: Channel 3 Bit 3: Channel 4 Bits 4 ... 7: Reserved	00_h
128	0	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	31_h
129	0	Function channel 2		31_h
130	0	Function channel 3		31_h
131	0	Function channel 4		31_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

Diagnostic data

Since this module does not support an alarm, the diagnostic data serve to provide information on this module. In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

The following errors are registered in the diagnostic data:

- Configuration/parameterisation errors
- Open circuit (if parameterised)

By the use of the SFB 52 you can access the diagnostic data of the module anytime. Data set 1 has the following structure:

Byte	Bit 7 ... 0
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of a missing external supply voltage Bit 6: 0 (fixed) Bit 7: Parameterisation error
1	Bits 3 ... 0: Module class, 0101_b: Analog module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 73_h: analog output Bit 7: 0 (fixed)
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 04_h:)
7	Bit 0: Channel error channel 1 Bit 1: Channel error channel 2 Bit 2: Channel error channel 3 Bit 3: Channel error channel 4 Bit 7 ... 4: 0 (fixed)
8	Channel-specific errors: channel 1: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Open circuit Bit 7 ... 4: 0 (fixed)
9	Channel-specific errors: channel 2: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Open circuit Bit 7 ... 4: 0 (fixed)
10	Channel-specific errors: channel 3: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Open circuit Bit 7 ... 4: 0 (fixed)
11	Channel-specific errors: channel 4: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Open circuit Bit 7 ... 4: 0 (fixed)
12 ... 15	0 (fixed)

9.6 Parameterising the temperature measurement

9.6.1 Four (two) analog inputs for resistance tests - EPM-S404

Note!

- ► Use parameter setting to deactivate unused inputs.
- ► If thermal detectors are connected in a 3-wire or 4-wire setup, channels 3 and/or 4 must be deactivated.
- ► The module does not provide any auxiliary supply for sensors.

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
0	0	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 0 ... 5: Reserved Bit 6: diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
	1	Wire-breakage detection	Bit 0: Channel 1 (0 = inhibited; 1 = enabled) : Bit 3: Channel 4 Bits 4 ... 7: Reserved	00_h
	2	Limit value monitoring	Bit 0: Channel 1 (0 = inhibited; 1 = enabled) : Bit 3: Channel 4 Bits 4 ... 7: Reserved	00_h
	3	Reserved		
1	0	Temperature system	Bit 0, 1: 00_b = °C; 01_b= °F; 10_b = K Bits 2 ... 7: Reserved	00_h
	1	Interference frequency suppression	Bit 0, 1: 01_b = 60 Hz; 10_b = 50 Hz Bits 2 ... 7: Reserved	02_h
Channel 1				
128	0	Function channel 1	80 (50_h) ... 162 ($A2_h$): see "measuring range" 255 (FF_h): channel deactivated	50_h
	1	Conversion time channel 1	You can set the transformer speed as a function of the interference frequency suppression (see 0x3105/x) for each channel. 0 (00_h): At 50 Hz: 324.1 ms/channel 16 bits; at 60 Hz: 270.5 ms/channel 16 bits 1 (01_h): At 50 Hz: 164.2 ms/channel 16 bits; at 60 Hz: 137.2 ms/channel 16 bits 2 (02_h): At 50 Hz: 84.2 ms/channel 16 bits; at 60 Hz: 70.5 ms/channel 16 bits 3 (03_h): at 50 Hz: 44.1 ms/channel 16 bits; at 60 Hz: 37.2 ms/channel 16 bits 4 (04_h): At 50 Hz: 24.2 ms/channel 16 bits; at 60 Hz: 20.5 ms/channel 16 bits 5 (05_h): At 50 Hz: 14.2 ms/channel 16 bits; at 60 Hz: 12.2 ms/channel 16 bits 6 (06_h): At 50 Hz: 9.2 ms/channel 16 bits; at 60 Hz: 8.0 ms/channel 16 bits 7 (07_h): At 50 Hz: 6.6 ms/channel 15 bits; at 60 Hz: 5.9 ms/channel 15 bits 8 (08_h): At 50 Hz: 4.2 ms/channel 13 bits; at 60 Hz: 3.8 ms/channel 13 bits	00_h

Data set		Name	Description/value	Lenze
No.	Byte			
	2, 3	Upper limit value channel 1	You can define an upper or lower limit value for each channel. For this you can only specify values from the nominal range, otherwise you'll receive a parameterisation error. By specification of $7FFF_h$ for the upper or 8000_h for the lower limit value, the corresponding limit value is deactivated. As soon as the measured value is outside a limit value and limit value monitoring is activated, a process alarm is triggered.	$7FFF_h$
	4,5	Lower limit value channel 1		8000_h
Channel 2				
129	0	Function channel 2	See channel 1	50_h
	1	Conversion time channel 2	See channel 1	00_h
	2, 3	Upper limit value channel 2	See channel 1	$7FFF_h$
	4, 5	Lower limit value channel 2 (HIGH byte)		8000_h
Channel 3 (for two-wire conductor connections only)				
130	0	Function channel 3	See channel 1	50_h
	1	Conversion time channel 3	See channel 1	00_h
	2, 3	Upper limit value channel 3	See channel 1	$7FFF_h$
	4, 5	Lower limit value channel 3		8000_h
Channel 4 (for two-wire conductor connections only)				
131	0	Function channel 4	See channel 1	50_h
	1	Conversion time channel 4	See channel 1	00_h
	2, 3	Upper limit value channel 4	See channel 1	$7FFF_h$
	4, 5	Lower limit value channel 4		8000_h

Measuring range

Measuring range (Fct. no.)	Measured value	Signal range	Range
2-wire: PT100 (50_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
2-wire: PT1000 (51_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
2-wire: NI100 (52_h)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
2-wire: NI1000 (53_h)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
3-wire: PT100 (58_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow

Measuring range (Fct. no.)	Measured value	Signal range	Range
3-wire: PT1000 (59_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
3-wire: NI100 ($5A_h$)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
3-wire: NI1000 ($5B_h$)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
4-wire: PT100 (60_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
4-wire: PT1000 (61_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
4-wire: NI100 (62_h)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
4-wire: NI1000 (63_h)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
2-wire: 0 ... 60 Ω (70_h)	-	-	Overflow
	0 ... 60 Ω	0 ... 32767_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 600 Ω (71_h)	-	-	Overflow
	0 ... 600 Ω	0 ... 32767_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 3000 Ω (72_h)	-	-	Overflow
	0 ... 3000 Ω	0 ... 32767_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 60 Ω (78_h)	-	-	Overflow
	0 ... 60 Ω	0 ... 32767_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 600 Ω (79_h)	-	-	Overflow
	0 ... 600 Ω	0 ... 32767_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 3000 Ω ($7A_h$)	-	-	Overflow
	0 ... 3000 Ω	0 ... 32767_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 60 Ω (80_h)	-	-	Overflow
	0 ... 60 Ω	0 ... 32767_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 600 Ω (81_h)	-	-	Overflow
	0 ... 600 Ω	0 ... 32767_{dec}	Nominal range
	-	-	Underflow

Measuring range (Fct. no.)	Measured value	Signal range	Range
4-wire: 0 ... 3000 Ω (82_h)	-	-	Overflow
	0 ... 3000 Ω	0 ... 32767	Nominal range
	-	-	Underflow
2-wire: 0 ... 60 Ω (90_h)	-	-	Overflow
	0 ... 60 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 600 Ω (91_h)	-	-	Overflow
	0 ... 600 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 3000 Ω (92_h)	-	-	Overflow
	0 ... 3000 Ω	0 ... 30000_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 60 Ω (98_h)	-	-	Overflow
	0 ... 60 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 600 Ω (99_h)	-	-	Overflow
	0 ... 600 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 3000 Ω ($9A_h$)	-	-	Overflow
	0 ... 3000 Ω	0 ... 30000_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 60 Ω ($A0_h$)	-	-	Overflow
	0 ... 60 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 600 Ω ($A1_h$)	-	-	Overflow
	0 ... 600 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 3000 Ω ($A2_h$)	-	-	Overflow
	0 ... 3000 Ω	0 ... 30000_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 60 Ω ($D0_h$)	70.55 Ω	32511_{dec}	Overflow
	0 ... 60 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 600 Ω ($D1_h$)	705.5 Ω	32511_{dec}	Overflow
	0 ... 600 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 3000 Ω ($D2_h$)	3528 Ω	32511_{dec}	Overflow
	0 ... 3000 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 60 Ω ($D8_h$)	70.55 Ω	32511_{dec}	Overflow
	0 ... 60 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 600 Ω ($D9_h$)	705.5 Ω	32511_{dec}	Overflow
	0 ... 600 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow

Measuring range (Fct. no.)	Measured value	Signal range	Range
3-wire: 0 ... 3000 Ω (DA_h)	3528 Ω	32511_{dec}	Overflow
	0 ... 3000 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 60 Ω ($E0_h$)	70.55 Ω	32511_{dec}	Overflow
	0 ... 60 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 600 Ω ($E1_h$)	705.5 Ω	32511_{dec}	Overflow
	0 ... 600 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 3000 Ω ($E2_h$)	3528 Ω	32511_{dec}	Overflow
	0 ... 3000 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow

Diagnostics and alarm

Trigger	Process alarm	Diagnostic alarm	Parameterisable
Configuration/parameterisation error	-	X	-
Open circuit detected	-	X	X
Measuring range exceeded	-	X	-
Measuring range not reached	-	X	-
Limit value exceeded	X	-	X
Limit value not reached	X	-	X
Process alarm lost	-	X	-

Process alarm

A process alarm causes a call of the OB 40. Within the OB 40 you have the possibility of determining the logic basic address of the module that has triggered the process alarm via the local word 6. Further information on the triggering event can be found in the ”Local double word 8”.

Local double word 8 of OB 40:

Local byte	Bit 7 ... 0
1	Bit 0: Limit value exceeded channel 1 Bit 1: Limit value exceeded channel 2 Bit 2: Limit value exceeded channel 3 Bit 3: Limit value exceeded channel 4 Bit 7 ... 4: 0 (fixed)
2	Bit 0: Limit value not reached channel 1 Bit 1: Limit value not reached channel 2 Bit 2: Limit value not reached, channel 3 Bit 3: Limit value not reached, channel 4 Bit 7 ... 4: 0 (fixed)
3/4	Ticker value at the time of the alarm After mains connection, a timer (µs ticker) is started which after 65535 µs starts with 0 again.

Diagnostic alarm

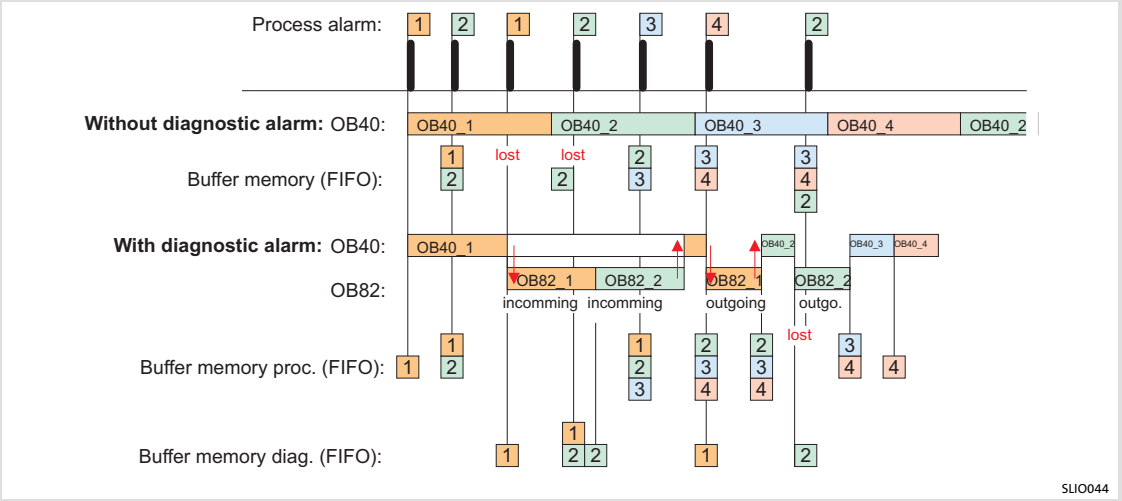
You have the possibility of globally activating a diagnostic alarm for the module via parameterisation (data set 00h). A diagnostic alarm occurs if a further process alarm is triggered for the same event during a process alarm processing in the OB 40.

By activation of a diagnostic alarm the current process alarm processing in the OB 40 is interrupted and branched to the diagnostic alarm processing$_{incoming}$ in OB 82. If further events occur on other channels during the diagnostic alarm processing, which can trigger a process or diagnostic alarm, they are buffered. At the end of the diagnostic alarm processing, first all buffered diagnostic alarms are processed in order of their occurrence, and afterwards all process alarms.

If further process alarms occur on a channel for which a diagnostic alarm$_{incoming}$ is currently processed or buffered, they are lost. If a process alarm for which a diagnostic alarm$_{incoming}$ has been triggered is processed, the diagnostic alarm processing is called again as diagnostic alarm$_{outgoing}$.

All events of a channel between the diagnostic alarm$_{incoming}$ and diagnostic alarm$_{outgoing}$ are not buffered and are lost. During this time (first diagnostic alarm$_{incoming}$ to the last diagnostic alarm$_{outgoing}$) the MF-LED of the module is lit. Additionally an entry in the diagnostic buffer of the CPU is made for every diagnostic alarm$_{incoming/outgoing}$.

Example:



Diagnostic alarm processing:

Using SFB 52 you can read out the diagnostic bytes. If the diagnostic alarm is deactivated, you can access the last diagnostic event in each case.

If you have activated the diagnostic function in your hardware configuration, OB 82 is called automatically. Here you can react on the diagnostics accordingly. With the SFB 52 you can additionally read out data set 1 which contains further information.

After exiting OB 82, the data ca no longer be clearly assigned to the last diagnostic alarm.

Data set 1 is structured as follows:

Data set 1, diagnostics$_{incoming}$	
Byte	**Bit 7 ... 0**
0	Bit 0: Set if module fault Bit 1: 0 (fixed) Bit 2: Set in the case of an external error Bit 3: Set in the case of a channel error Bit 6 ... 4: 0 (fixed) Bit 7: Parameterisation error
1	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	Bit 5 ... 0: 0 (fixed) Bit 6: Process alarm lost Bit 7: 0 (fixed)
4	Bit 6 ... 0: Channel type, 76h: counter module Bit 7: Further channel types available, 0: no, 1: yes
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 01_h)
7	Bit 0: Error in channel group 0 (counter) Bit 7 ... 1: 0 (fixed)
8	Diagnostic alarm due to process alarm lost to ... Bit 0: Hardware gate open Bit 1: Hardware gate closed Bit 2: Overflow/underflow/final value Bit 3: Comparison value reached Bit 4: Latch value Bit 7 ... 5: 0 (fixed)
9 ... 15	0 (fixed)

Data set 1, diagnostics$_{outgoing}$
After the error recovery a diagnostic message$_{outgoing\ is\ effected}$

9.6.2 Two analog inputs for thermocouple measurement - EPM-S405

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
0	0	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 0 ... 5: Reserved Bit 6: diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
	1	Wire-breakage detection	Bit 0: Channel 1 (0 = inhibited; 1 = enabled) Bit 1: Channel 2 Bits 2 ... 7: Reserved	00_h
	2	Limit value monitoring	Bit 0: Channel 1 (0 = inhibited; 1 = enabled) Bit 1: Channel 2 Bits 2 ... 7: Reserved	00_h
	3	Reserved	0	
1	0	Temperature system	Bit 0, 1: 00_b = °C; 10_b = °F; 11_b = K Bits 2 ... 7: Reserved	00_h
	1	Interference frequency suppression	Bit 0, 1: 01_b = 60 Hz; 10_b = 50 Hz Bits 2 ... 7: Reserved	02_h
Channel 1				
128	0	Function channel 1	176 (60_h) ... 201 ($C9_h$): see "measuring range" External temperature compensation: 176 (60_h) ... 185 (69_h) Internal temperature compensation: 192 ($C0_h$): ... 201 ($C9_h$) 255 (FF_h): channel deactivated	$C1_h$
	1	Conversion time channel 1	You can set the transformer speed as a function of the interference frequency suppression (see 0x3105/x) for each channel. 0 (00_h): At 50 Hz: 324.1 ms/channel 16 bits; at 60 Hz: 270.5 ms/channel 16 bits 1 (01_h): at 50 Hz: 164.2 ms/channel 16 bits; at 60 Hz: 137.2 ms/channel 16 bits 2 (02_h): At 50 Hz: 84.2 ms/channel 16 bits; at 60 Hz: 70.5 ms/channel 16 bits 3 (03_h): at 50 Hz: 44.1 ms/channel 16 bits; at 60 Hz: 37.2 ms/channel 16 bits 4 (04_h): At 50 Hz: 24.2 ms/channel 16 bits; at 60 Hz: 20.5 ms/channel 16 bits 5 (05_h): at 50 Hz: 14.2 ms/channel 16 bits; at 60 Hz: 12.2 ms/channel 16 bits 6 (06_h): at 50 Hz: 9.2 ms/channel 16 bits; at 60 Hz: 8.0 ms/channel 16 bits 7 (07_h): at 50 Hz: 6.6 ms/channel 15 bits; at 60 Hz: 5.9 ms/channel 15 bits 8 (08_h): at 50 Hz: 4.2 ms/channel 13 bits; at 60 Hz: 3.8 ms/channel 13 bits	02_h
	2, 3	Upper limit value channel 1	You can define an upper or lower limit value for each channel. For this you can only specify values from the nominal range, otherwise you'll receive a parameterisation error. By specification of $7FFF_h$ for the upper or 8000_h for the lower limit value, the corresponding limit value is deactivated. If the measured value is outside a limit value and the limit value monitoring is activated, a process alarm is triggered.	$7FFF_h$
	4, 5	Lower limit value channel 1		8000_h

Data set		Name	Description/value	Lenze
No.	Byte			
Channel 2				
129	0	Function channel 2	See channel 1	$C1_h$
	1	Conversion time channel 2	See channel 1	02_h
	2, 3	Upper limit value channel 2	See channel 1	$7FFF_h$
	3, 4	Lower limit value channel 2		8000_h

Measuring range

Measuring range	Measured value			Range
(Fct. no.)	[°C]	[°F]	[K]	
Type J: -210 ... +1200 °C -346 ... 2192 °F 63.2 ... 1473.2 K ($B0_h$: ext. comp. 0 °C) ($C0_h$: int. comp. 0 °C)	+14500	26420	17232	Overflow
	-2100 ... +12000	-3460 ... +21920	632 ... 14732	Nominal range
	-	-	-	Underflow
Type K: -210 ... +1372 °C -454 ... 2501.6 °F 0 ... 1645.2 K ($B1_h$: ext. comp. 0 °C) ($C1_h$: int. comp. 0 °C)	+16220	29516	18952	Overflow
	-2700 ... +13720	-4540 ... 25016	0 ... 16452	Nominal range
	-	-	-	Underflow
Type N: -270 ... +1300 °C -454 ... 2372 °F 0 ... 1573.2 K ($B2_h$: ext. comp. 0 °C) ($C2_h$: int. comp. 0 °C)	+15500	28220	18232	Overflow
	-2700 ... +13000	-4540 ... 23720	0 ... 15732	Nominal range
	-	-	-	Underflow
Type R: -50 ... +1769 °C -58 ... 3216.2 °F 223.2 ... 2042.2 K ($B3_h$: ext. comp. 0 °C) ($C3_h$: int. comp. 0 °C)	+20190	32766	22922	Overflow
	-500 ... +17690	-580 ... 32162	2232 ... 20422	Nominal range
	-1700	-2740	1032	Underflow
Type S: -50 ... +1769 °C -58 ... 3216.2 °F 223.2 ... 2042.2 K ($B4_h$: ext. comp. 0 °C) ($C4_h$: int. comp. 0 °C)	+20190	32766	22922	Overflow
	-500 ... +17690	-580 ... 32162	2232 ... 20422	Nominal range
	-1700	-2740	1032	Underflow
Type T: -270 ... +440 °C -454 ... 752 °F 3.2 ... 673.2 K ($B2_h$: ext. comp. 0 °C) ($C2_h$: int. comp. 0 °C)	+5400	10040	8132	Overflow
	-2700 ... +4000	-4540 ... 7520	32 ... 6732	Nominal range
	-	-	-	Underflow
Type B: 0 ... +1820 °C 32 ... 2786.5 °F 273.2 ... 2093.2 K ($B6_h$: ext. comp. 0 °C) ($C6_h$: int. comp. 0 °C)	+20700	32766	23432	Overflow
	0 ... +18200	320 ... 27865	2732 ... 20932	Nominal range
	-1200	-1840	1532	Underflow

Measuring range (Fct. no.)	Measured value [°C]	[°F]	[K]	Range
Type C: 0 ... +2315 °C 32 ... 2786.5 °F 273.2 ... 2093.2 K ($B7_h$: ext. comp. 0 °C) ($C7_h$: int. comp. 0 °C)	+25000	32766	23432	Overflow
	0 ... +23150	320 ... 27865	2732 ... 20932	Nominal range
	-1200	-1840	1532	Underflow
Type E: -270 ... +1000 °C -454 ... 1832 °F 0 ... 1273.2 K ($B8_h$: ext. comp. 0 °C) ($C8_h$: int. comp. 0 °C)	+12000	21920	14732	Overflow
	-2700 ... +10000	-4540 ... 18320	0 ... 12732	Nominal range
	-	-	-	Underflow
Type L: -200 ... +900 °C -328 ... 1652 °F 73.2 ... 1173.2 K ($B9_h$: ext. comp. 0 °C) ($C9_h$: int. comp. 0 °C)	+11500	21020	14232	Overflow
	-2000 ... +9000	-3280 ... 16520	732 ... 11732	Nominal range
	-	-	-	Underflow

Diagnostics and alarm

Trigger	Process alarm	Diagnostic alarm	Parameterisable
Configuration/parameterisation error	-	X	-
Open circuit detected	-	X	X
Measuring range exceeded	-	X	-
Measuring range not reached	-	X	-
Limit value exceeded	X	-	X
Limit value not reached	X	-	X
Process alarm lost	-	X	-

Process alarm

A process alarm causes a call of the OB 40. Within the OB 40 you have the possibility of determining the logic basic address of the module that has triggered the process alarm via the local word 6. Further information on the triggering event can be found in the ”Local double word 8”.

Local double word 8 of OB 40:

Local byte	Bit 7 ... 0
1	Bit 0: Limit value exceeded channel 1 Bit 1: Limit value exceeded channel 2 Bit 7 ... 2: 0 (fixed)
2	Bit 0: Limit value not reached, channel 1 Bit 1: Limit value not reached, channel 2 Bit 7 ... 2: 0 (fixed)
3/4	Ticker value at the time of the alarm After mains connection, a timer (µs ticker) is started which after 65535 µs starts with 0 again.

Diagnostic alarm

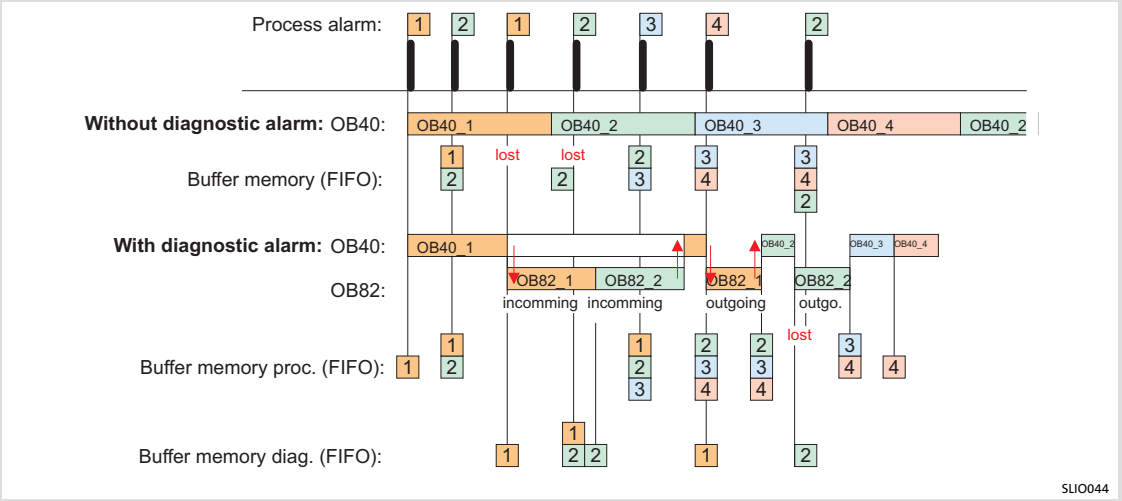
You have the possibility of globally activating a diagnostic alarm for the module via parameterisation (data set 00h). A diagnostic alarm occurs if a further process alarm is triggered for the same event during a process alarm processing in the OB 40.

By activation of a diagnostic alarm the current process alarm processing in the OB 40 is interrupted and branched to the diagnostic alarm processing$_{incoming}$ in OB 82. If further events occur on other channels during the diagnostic alarm processing, which can trigger a process or diagnostic alarm, they are buffered. At the end of the diagnostic alarm processing, first all buffered diagnostic alarms are processed in order of their occurrence, and afterwards all process alarms.

If further process alarms occur on a channel for which a diagnostic alarm$_{incoming}$ is currently processed or buffered, they are lost. If a process alarm for which a diagnostic alarm$_{incoming}$ has been triggered is processed, the diagnostic alarm processing is called again as diagnostic alarm$_{outgoing}$.

All events of a channel between the diagnostic alarm$_{incoming}$ and diagnostic alarm$_{outgoing}$ are not buffered and are lost. During this time (first diagnostic alarm$_{incoming}$ to the last diagnostic alarm$_{outgoing}$) the MF-LED of the module is lit. Additionally an entry in the diagnostic buffer of the CPU is made for every diagnostic alarm$_{incoming/outgoing}$.

Example:



Diagnostic alarm processing:

Using SFB 52 you can read out the diagnostic bytes. If the diagnostic alarm is deactivated, you can access the last diagnostic event in each case.

If you have activated the diagnostic function in your hardware configuration, OB 82 is called automatically. Here you can react on the diagnostics accordingly. With the SFB 52 you can additionally read out data set 1 which contains further information.

After exiting OB 82, the data ca no longer be clearly assigned to the last diagnostic alarm.

Data set 1 is structured as follows:

Data set 1, diagnostics$_{incoming}$	
Byte	**Bit 7 ... 0**
0	Bit 0: Set if module fault Bit 1: 0 (fixed) Bit 2: Set in the case of an external error Bit 3: Set in the case of a channel error Bit 6 ... 4: 0 (fixed) Bit 7: Parameterisation error
1	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	Bit 5 ... 0: 0 (fixed) Bit 6: Process alarm lost Bit 7: 0 (fixed)
4	Bit 6 ... 0: Channel type, 76h: counter module Bit 7: Further channel types available, 0: no, 1: yes
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 01_h)
7	Bit 0: Error in channel group 0 (counter) Bit 7 ... 1: 0 (fixed)
8	Diagnostic alarm due to process alarm lost to ... Bit 0: Hardware gate open Bit 1: Hardware gate closed Bit 2: Overflow/underflow/final value Bit 3: Comparison value reached Bit 4: Latch value Bit 7 ... 5: 0 (fixed)
9 ... 15	0 (fixed)

Data set 1, diagnostics$_{outgoing}$
After the error recovery a diagnostic message$_{outgoing\ is\ effected}$

9.7 Parameterising the counter

9.7.1 Rotary transducer signal evaluation

Depending on which edge of a channel is evaluated, the following pulse trains and the associated pulse multiplication can be realised.

Pulse trains	Description	
Channel A		
Channel B		
Single evaluation		There is a response to the falling edges of channel A. The number of pulses has not increased.
Double evaluation		There is a response to the rising and the falling edges of channel A. The number of pulses has doubled and is symmetrical.
Four-fold evaluation		The rising and the falling edges of channels A and B are evaluated. The number of pulses is quadrupled and is symmetrical.

9.7.2 One counter 32 bits, 24 V DC - EPM-S600

By integration of the GSE file VI010C19.gse you can specify all counter parameters via a hardware configuration.

The following functions can be parameterised:

Counting functions	Description
Counting continuously	The counter counts from the loading value to the counting limit, then skips to the opposite counting limit and continues to count from there.
Counting once	The counter counts once/periodically from the loading value in the specified counting range.
Counting periodically	

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Main counting direction	The main counting direction can be parameterised: **None:** The whole counting range is available. **Forwards:** Limitation of the counting range upwards. The counter counts from the parameterised loading value in the positive direction to the parameterised final value -1 and then skips to the loading value again with the encoder pulse that is following. **Backwards:** Limitation of the counting range downwards. The counter counts from the parameterised loading value in the negative direction to the parameterised final value +1 and then skips to the loading value again with the encoder pulse that is following.
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter a differentiation between the internal gate (I-gate), hardware gate (HW gate), and software gate (SW gate) is made. ● The I-gate is the AND logic operation of the software gate (SW gate) and the hardware gate (HW gate). ● The SW gate is controlled via your user program (status word in the output area). ● The HW gate is controlled via the digital gate input. The following response can be parameterised: **Cancelling gate function:**After closing the gate and opening it again, the counting process continues from the loading value again. **Interrupting gate function:**After closing the gate and opening it again, the counting process continues with the last current counter content.
Latch function	If a positive edge occurs at the latch input, the current count value is stored in the latch register. The latch register is accessed via the input area. After a STOP-RUN transition, latch is always 0.
Comparator	You can specify a comparison value which, depending on the count value, activates the digital output or triggers a process alarm.
Hysteresis	By specification of a hysteresis you can for instance prevent the output from being permanently switched if the value of an encoder signal fluctuates around the comparison value.
Process alarm	The activation of a process alarm can be parameterised. A process alarm can be triggered in the case of the following events: ● Hardware gate open ● Hardware gate closed ● Counting limit - overflow ● Counting limit - underflow ● Comparison value reached ● Final value reached ● Latch value reached
Diagnostic alarm	If the diagnostic alarm is enabled in the parameter setting, it occurs as soon as another process alarm is triggered for the same event during process alarm processing.
Diagnostic function	Diagnostic functions are provided in the modules.
Diagnostic information	The diagnostic information describes the diagnostic contents which can be read out from a module. The diagnostic formation is not automatically sent by the module but must actively be read out by SDO access.

Read data: 12 bytes

Input area		
Addr.	**Access**	**Assignment**
+0	Double word	Count value
+4	Double word	Latch value
+8	Word	Status word (see the following table)
+10	Word	Ticker value

Count value: Current counter content

Latch value: If there is a positive edge at the latch input, the count value is stored here.

Ticker value: After mains connection a timer (µs ticker) is started, which after 65535 µs starts with 0 again. With every change of the count value the time value of the timer is stored as 16-bit µs value together with the count value in the input area.

EPM-S600 status word		
Bit	**Designation**	**Function**
0	STS_SYNC	Reset was active
1	STS_CTRL_DO	Is set if the digital output is enabled
2	STS_SW-GATE	Software gate status (set if SW gate active)
3	STS_RST	Status of reset input
4	STS_STRT	Hardware gate status (set if HW gate active)
5	STS_GATE	Status of internal gate (set if internal gate active)
6	STS_DO	Status of digital counter output (DO)
7	STS_C_DN	Status set for counter direction backwards
8	STS_C_UP	Status set for counter direction forwards
9	STS_CMP*	Comparator status is set if the comparison condition is met. If the comparison is deactivated (counter mode byte 1 = 000_b), the bit has no function.
10	STS_END*	Status set if final value was reached
11	STS_OFLW*	Status set in the case of overflow
12	STS_UFLW*	Status set in the case of underflow
13	STS_ZP*	Status set in the case of zero crossing
14	STS_LTCH	Status of latch input
15	-	Reserved

* The bits are set until reset with RES_SET (bit 6 control word)

Write data: 10 bytes

Output area		
Addr.	**Access**	**Assignment**
+0	Double word	Comparison value
+4	Double word	Set value
+8	Word	Control word (see the following table)

Comparison value: Here you can select a value which, by comparison with the current counter content, can impact the counter output or trigger a process alarm. The response of the output or the process alarm can be parameterised.

Set value: With an edge change 0-1 of *COUNTERVAL_SET* in the control word, the set value is accepted in the counter.

EPM-S600 control word		
Bit	**Name**	**Function**
0	CTRL_SYNC_SET	Activation/deactivation of the counting signal: 0 (FALSE): The input for the couting signal is deactivated and the current counter content is reset to 0. 1 (TRUE): The input for the counting signal is activated.
1	CTRL_DO_SET	Enables the digital output
2	SW_GATE_SET	Sets the software gate
3	-	Reserved
4	-	Reserved
5	COUNTERVAL_SET	Sets the counter temporarily to the value in the set value
6	RES_SET	Resets bits STS_CMP, STS_END, STS_OFLW, STS_UFLW and STS_ZP with a rising edge
7	-	Reserved
8	CTRL_SYNC_RESET	Activation/deactivation of the zero track evaluation: 0 (FALSE): The zero track evaluation is activated. 1 (TRUE): The zero track evaluation is stopped. The counter keeps counting irrespective of the zero pulse. Bit 0 (CTRL_SYNC_SET) must be set to TRUE for this purpose.
9	CTRL_DO_RESET	Inhibits the digital output
10	SW_GATE_RESET	Resets the software gate
11	-	Reserved
12		
13		
14		
15		

Parameter data

Data set		Name	Description/value	Lenze
No.	Byte			
00_h	0	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 5 ... 0: Reserved Bit 6: diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
01_h	0	Input frequency track A	Filters for instance serve to filter signal peaks in the case of an unclean input signal. 0 (00_h): 500 kHz 1 (01_h): 300 kHz 2 (02_h): 100 kHz 3 (03_h): 60 kHz 4 (04_h): 30 kHz 6 (06_h): 10 kHz 7 (07_h): 5 kHz 8 (08_h): 2 kHz 9 (09_h): 1 kHz Other values are not permissible!	02_h
	1	Input frequency track B		02_h
	2	Input frequency latch		02_h
	3	Input frequency gate		02_h
	4	Input frequency reset		00_h
	5	Reserved		
80_h	0	Alarm response	Setting activates process alarm Bit 0: Proc. alarm HW gate open Bit 1: Proc. alarm HW gate closed Bit 2: Proc. alarm overflow Bit 3: Proc. alarm underflow Bit 4: Proc. alarm comparison value Bit 5: Proc. alarm final value Bit 6: Proc. alarm latch value Bit 7: Reserved	80_h
	1	Counter function	Bits 5 ... 0: 000000_b = counting continuously 000001_b = counting once, main counting direction forwards 000010_b = counting once, main counting direction backwards 000100_b = counting once, no main counting direction 001000_b = counting periodically, main counting direction forwards 010000_b = counting periodically, main counting direction backwards 100000_b = counting periodically, no main counting direction Bits 7 ... 6: Reserved	40_h
	2	Comparator	Bit 2 ... 0: output switches (... if condition is met) 000_b = never 001_b = count value ≥ comparison value 010_b = count value ≤ comparison value 100_b = count value = comparison value Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 6 ... 4: Reset 000_b = deactivated 001_b = HIGH level 011_b = rising edge 101_b = rising edge, once Bit 7: Reserved	00_h

Data set		Name	Description/value	Lenze
No.	Byte			
	3	Signal evaluation	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (connection to input "A/pulse") 010_b = double rotary transducer (connection to input "A/pulse") 011_b = four-fold rotary transducer (connection to input "A/pulse" and "B/direction") 100_b = direction (pulse to "A/pulse" and direction to "B/direction") Bit 6 ... 3: Hardware gate (HW gate) 000_b = deactivated (counter starts by setting SW gate) 001_b = activated (HIGH level at gate activates the HW gate. Counter starts if HW and SW gate are set.) Bit 7: Gate function (internal gate) 0= abort (counting process starts again from loading value) 1 = interrupt (counting process is continued with counter content)	00_h
81_h	0	Final value	Upper limit of the counting range	00_h
	1	Start value	Lower limit of the counting range	00_h
	2	Hysteresis	The hysteresis for instance serves to avoid frequent switching operations of the output and/or triggering of the alarm when the count value is within the range of the comparison value. For the hysteresis you can select a range between 0 and 255. With the settings 0 and 1 the hysteresis is switched off. The hysteresis has an effect on the zero crossing, comparison, overflow/underflow.	00_h
	3	Pulse	The pulse duration indicates for how long the output is to be set if the parameterised comparison criterion is reached or exceeded. The pulse duration can be specified in steps of 2.048 ms between 0 and 522.24 ms. If the pulse duration is = 0, the output is set until the comparison condition is no longer met.	00_h

Process alarm

A process alarm causes a call of the OB 40. Within the OB 40 you have the possibility of determining the logic basic address of the module that has triggered the process alarm via the local word 6. Further information on the triggering event can be found in the ”Local double word 8”.

Local double word 8 of OB 40:

Local byte	Bit 7 ... 0
1	Bit 0: Hardware gate open Bit 1: Hardware gate closed Bit 2: Overflow/underflow/final value Bit 3: Comparison value reached Bit 4: Latch value Bit 7 ... 5: 0 (fixed)
2	State of the inputs at the time of the alarm Bit 0: A/pulse Bit 1: B/direction Bit 2: Latch Bit 3: Hardware gate Bit 4: Reset Bit 7 ... 5: 0 (fixed)
3/4	Ticker value at the time of the alarm

Gate counter open/closed: Bit 0 is set if the HW gate is activated while the SW gate is active. Bit 1 is set if the HW gate is deactivated while the SW gate is active.

Ticker value: After mains connection a timer (µs ticker) is started, which after 65535 µs starts with 0 again. With every change of the count value the time value of the timer is stored as 16-bit µs value together with the count value in the input area.

Diagnostic alarm

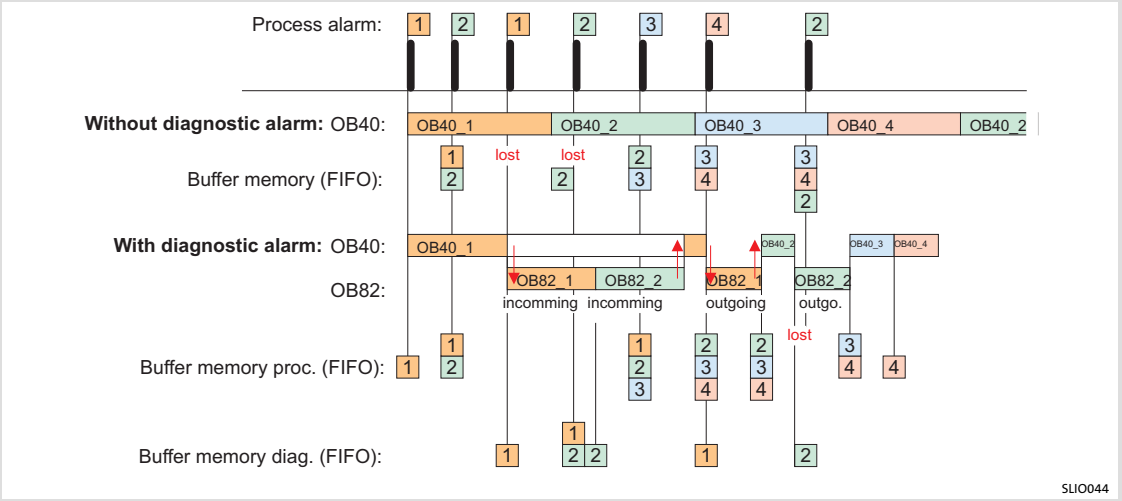
You have the possibility of globally activating a diagnostic alarm for the module via parameterisation (data set 00h). A diagnostic alarm occurs if a further process alarm is triggered for the same event during a process alarm processing in the OB 40.

By activation of a diagnostic alarm the current process alarm processing in the OB 40 is interrupted and branched to the diagnostic alarm processing$_{incoming}$ in OB 82. If further events occur on other channels during the diagnostic alarm processing, which can trigger a process or diagnostic alarm, they are buffered. At the end of the diagnostic alarm processing, first all buffered diagnostic alarms are processed in order of their occurrence, and afterwards all process alarms.

If further process alarms occur on a channel for which a diagnostic alarm$_{incoming}$ is currently processed or buffered, they are lost. If a process alarm for which a diagnostic alarm$_{incoming}$ has been triggered is processed, the diagnostic alarm processing is called again as diagnostic alarm$_{outgoing}$.

All events of a channel between the diagnostic alarm$_{incoming}$ and diagnostic alarm$_{outgoing}$ are not buffered and are lost. During this time (first diagnostic alarm$_{incoming}$ to the last diagnostic alarm$_{outgoing}$) the MF-LED of the module is lit. Additionally an entry in the diagnostic buffer of the CPU is made for every diagnostic alarm$_{incoming/outgoing}$.

Example:



Diagnostic alarm processing:

Using SFB 52 you can read out the diagnostic bytes. If the diagnostic alarm is deactivated, you can access the last diagnostic event in each case.

If you have activated the diagnostic function in your hardware configuration, OB 82 is called automatically. Here you can react on the diagnostics accordingly. With the SFB 52 you can additionally read out data set 1 which contains further information.

After exiting OB 82, the data ca no longer be clearly assigned to the last diagnostic alarm.

Data set 1 is structured as follows:

Data set 1, diagnostics$_{incoming}$	
Byte	**Bit 7 ... 0**
0	Bit 0: Set if module fault Bit 1: 0 (fixed) Bit 2: Set in the case of an external error Bit 3: Set in the case of a channel error Bit 6 ... 4: 0 (fixed) Bit 7: Parameterisation error
1	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	Bit 5 ... 0: 0 (fixed) Bit 6: Process alarm lost Bit 7: 0 (fixed)
4	Bit 6 ... 0: Channel type, 76h: counter module Bit 7: Further channel types available, 0: no, 1: yes
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 01_h)
7	Bit 0: Error in channel group 0 (counter) Bit 7 ... 1: 0 (fixed)
8	Diagnostic alarm due to process alarm lost to ... Bit 0: Hardware gate open Bit 1: Hardware gate closed Bit 2: Overflow/underflow/final value Bit 3: Comparison value reached Bit 4: Latch value Bit 7 ... 5: 0 (fixed)
9 ... 15	0 (fixed)

Data set 1, diagnostics$_{outgoing}$
After the error recovery a diagnostic message$_{outgoing\ is\ effected}$

9.7.3 Two counters 32 bits, 24 V DC - EPM-S601

By integration of the GSE file VI010C19.gse you can specify all counter parameters via a hardware configuration.

The following functions can be parameterised:

Counting functions	Description
Counting continuously	The counter counts from the loading value to the counting limit, then skips to the opposite counting limit and continues to count from there.
Counting once	The counter counts once/periodically from the loading value in the specified counting range.
Counting periodically	

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Main counting direction	The main counting direction can be parameterised: **None:** The whole counting range is available. **Forwards:** Limitation of the counting range upwards. The counter counts from the parameterised loading value in the positive direction to the parameterised final value -1 and then skips to the loading value again with the encoder pulse that is following. **Backwards:** Limitation of the counting range downwards. The counter counts from the parameterised loading value in the negative direction to the parameterised final value +1 and then skips to the loading value again with the encoder pulse that is following.
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter the internal gate (I-gate) is conform to the software gate (SW gate) which you control via your user program (status word in the output area). The following response can be parameterised: **Cancelling gate function:**After closing the gate and opening it again, the counting process continues from the loading value again. **Interrupting gate function:**After closing the gate and opening it again, the counting process continues with the last current counter content.
Comparator	You can specify a comparison value which, depending on the count value, activates the digital output or triggers a process alarm.
Hysteresis	By specification of a hysteresis you can for instance prevent the output from being permanently switched if the value of an encoder signal fluctuates around the comparison value.
Process alarm	The activation of a process alarm can be parameterised. A process alarm can be triggered in the case of the following events: ● Hardware gate open ● Hardware gate closed ● Counting limit - overflow ● Counting limit - underflow ● Comparison value reached ● Final value reached ● Latch value reached
Diagnostic alarm	If the diagnostic alarm is enabled in the parameter setting, it occurs as soon as another process alarm is triggered for the same event during process alarm processing.
Diagnostic function	Diagnostic functions are provided in the modules.
Diagnostic information	The diagnostic information describes the diagnostic contents which can be read out from a module. The diagnostic formation is not automatically sent by the module but must actively be read out by SDO access.

Read data: 12 bytes

Input area in the process image		
Addr.	**Access**	**Assignment**
+0	Double word	Counter 1: count value
+4	Double word	Counter 2: count value
+8	Word	Counter 1: status word (see following table)
+10	Word	Counter 2: status word (see following table)

Count value: Current counter content

EPM-S601 status word		
Bit	**Designation**	**Function**
0	-	Reserved
1	STS_CTRL_COMP	Is set if the comparison bit is enabled
2	STS_SW-GATE	Software gate status (set if SW gate active)
3	-	Reserved
4	-	Reserved
5	STS_GATE	Status of internal gate (set if internal gate active)
6	STS_COMP	Status of comparison bit
7	STS_C_DN	Status set for counter direction backwards
8	STS_C_UP	Status set for counter direction forwards
9	STS_CMP*	Comparator status is set if the comparison condition is met. If the comparison is deactivated (counter mode byte 1 = 000_b), the bit has no function.
10	STS_END*	Status set if final value was reached
11	STS_OFLW*	Status set in the case of overflow
12	STS_UFLW*	Status set in the case of underflow
13	STS_ZP*	Status set in the case of zero crossing
14	-	Reserved
15	-	Reserved

* The bits are set until reset with RES_SET (bit 6 control word)

Write data: 12 bytes

Output area in the process image		
Addr.	**Access**	**Assignment**
+0	Double word	Counter 1: Comparison value
+4	Double word	Counter 2: Comparison value
+8	Word	Counter 1: Control word (see following table)
+10	Word	Counter 2: Control word (see following table)

Comparison value: With the comparison value you can specify a value which, by comparison with the current counter content, can impact the counter output or trigger a process alarm. The response of the comparison bit *STS_COMP* in the counter status or the process alarm is to be specified via data set 80_h for counter 1 and 82_h for counter 2.

EPM-S601 control word		
Bit	**Designation**	**Function**
0	-	Reserved
1	CTRL_COMP_SET	Enables the comparison bit
2	SW_GATE_SET	Sets the software gate
3	-	Reserved
4	-	Reserved
5	COUNTERVAL_SET	Sets the counter temporarily to the value in the set value
6	RES_SET	Resets bits STS_CMP, STS_END, STS_OFLW, STS_UFLW and STS_ZP with a rising edge
7	-	Reserved
8	-	Reserved
9	CTRL_COMP_RESET	Inhibits comparison bit
10	SW_GATE_RESET	Resets the software gate
11	-	Reserved
12		
13		
14		
15		

Parameter data

Data set		Name	Description/value	Lenze
No.	Byte			
00_h	0	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
01_h	0	Input frequency counter 1, track A	Filters for instance serve to filter signal peaks in the case of an unclean input signal. 0 (00_h): 500 kHz 1 (01_h): 300 kHz 2 (02_h): 100 kHz 3 (03_h): 60 kHz 4 (04_h): 30 kHz 6 (06_h): 10 kHz 7 (07_h): 5 kHz	02_h
	1	Input frequency counter 1, track B		02_h
	2	Input frequency counter 2, track A		02_h

Data set		Name	Description/value	Lenze
No.	Byte			
	3	Input frequency counter 2, track B	8 (08_h): 2 kHz 9 (09_h): 1 kHz Other values are not permissible!	02_h
80_h	0	Alarm response counter 1	Setting activates process alarm Bits 1 ... 0: reserved Bit 2: Proc. alarm overflow Bit 3: Proc. alarm underflow Bit 4: Proc. alarm comparison value Bit 5: Proc. alarm final value Bits 7 ... 6: Reserved	00_h
	1	Counter function counter 1	Bits 5 ... 0: 000000_b = counting continuously 000001_b = once: forwards 000010_b = once: backwards 000100_b = once: no main counting direction 001000_b = periodically: forwards 010000_b = periodically: backwards 100000_b = periodically: no main counting direction Bits 7 ... 6: Reserved	00_h
	2	Comparator counter 1	Bits 2 ... 0: Comparison bit is set (... if condition is met) 000_b = never 001_b = count value ≥ comparison value 010_b = count value ≤ comparison value 100_b = count value = comparison value Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 7 ... 4: Reserved	00_h
	3	Signal evaluation counter 1	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (connection to input ”A/pulse”) 010_b = double rotary transducer (connection to input ”A/pulse”) 011_b = four-fold rotary transducer (connection to input ”A/pulse” and ”B/direction”) 100_b = direction (pulse to ”A/pulse” and direction to ”B/direction”) Bits 6 ... 3: Reserved Bit 7: Gate function (internal gate) 0= abort (counting process starts again from loading value) 1 = interrupt (counting process is continued with counter content)	00_h
81_h	0...3	Set value counter 1	By specifying a set value, the counter can be loaded with the set value. With an edge 0-1 to COUNTERVAL_SET in the control word, the set value is adopted by the counter.	00_h
	4...7	Final value counter 1	Upper limit of the counting range	00_h
	8...11	Loading value counter 1	Lower limit of the counting range	00_h
	12	Hysteresis counter 1	The hysteresis for instance serves to avoid frequent switching operations of the output and/or triggering of the alarm when the count value is within the range of the comparison value. For the hysteresis you can select a range between 0 and 255. With the settings 0 and 1 the hysteresis is switched off. The hysteresis has an effect on the zero crossing, comparison, overflow/underflow.	00_h
	13	Reserved		

Data set		Name	Description/value	Lenze
No.	Byte			
82_h	0	Alarm response counter 2	See counter 1	00_h
	1	Counter function counter 2	See counter 1	00_h
	2	Comparator counter 2	See counter 1	00_h
	3	Signal evaluation counter 2	See counter 1	00_h
83_h	0...3	Set value counter 2	See counter 1	00_h
	4...7	Final value counter 2	See counter 1	00_h
	8...11	Loading value counter 2	See counter 1	00_h
	12	Hysteresis counter 2	See counter 1	00_h

Process alarm

A process alarm causes a call of the OB 40. Within the OB 40 you have the possibility of determining the logic basic address of the module that has triggered the process alarm via the local word 6. Further information on the triggering event can be found in the ”Local double word 8”.

Local double word 8 of OB 40:

Local byte	Bit 7 ... 0
1	Bit 0: 0 Bit 1: 0 Bit 2: Counter 1, overflow/underflow/final value Bit 3: Counter 1, comparison value reached Bit 4: 0 Bit 5: 0 Bit 6: Counter 2, overflow/underflow/final value Bit 7: Counter 2, comparison value reached
2	State of the inputs at the time of the alarm Bit 0: Counter 1, A/pulse Bit 1: Counter 1, B/direction Bit 2: Counter 2, A/pulse Bit 3: Counter 2, B/direction Bit 7 ... 4: 0 (fix)
3/4	16 bit µs value at the time of the alarm

Ticker value: After mains connection a timer (µs ticker) is started, which after 65535 µs starts with 0 again. With every change of the count value the time value of the timer is stored as 16-bit µs value together with the count value in the input area.

Diagnostic alarm

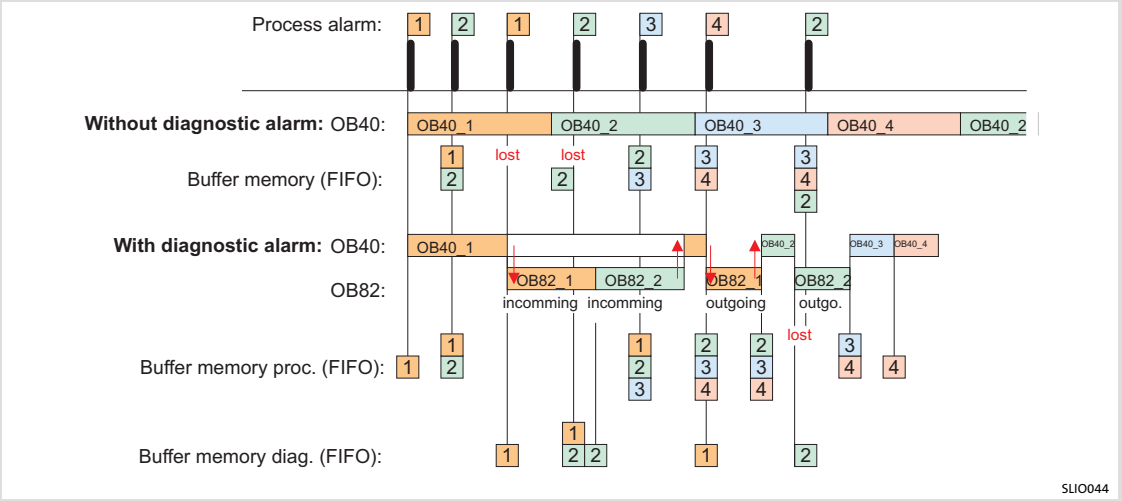
You have the possibility of globally activating a diagnostic alarm for the module via parameterisation (data set 00h). A diagnostic alarm occurs if a further process alarm is triggered for the same event during a process alarm processing in the OB 40.

By activation of a diagnostic alarm the current process alarm processing in the OB 40 is interrupted and branched to the diagnostic alarm processing$_{incoming}$ in OB 82. If further events occur on other channels during the diagnostic alarm processing, which can trigger a process or diagnostic alarm, they are buffered. At the end of the diagnostic alarm processing, first all buffered diagnostic alarms are processed in order of their occurrence, and afterwards all process alarms.

If further process alarms occur on a channel for which a diagnostic alarm$_{incoming}$ is currently processed or buffered, they are lost. If a process alarm for which a diagnostic alarm$_{incoming}$ has been triggered is processed, the diagnostic alarm processing is called again as diagnostic alarm$_{outgoing}$.

All events of a channel between the diagnostic alarm$_{incoming}$ and diagnostic alarm$_{outgoing}$ are not buffered and are lost. During this time (first diagnostic alarm$_{incoming}$ to the last diagnostic alarm$_{outgoing}$) the MF-LED of the module is lit. Additionally an entry in the diagnostic buffer of the CPU is made for every diagnostic alarm$_{incoming/outgoing}$.

Example:



Diagnostic alarm processing:

Using the SFB 52 you can read out the diagnostic bytes. If the diagnostic alarm is deactivated, you can access the last diagnostic event in each case.

If you have activated the diagnostic function in your hardware configuration, OB 82 is called automatically. Here you can react on the diagnostics accordingly. With the SFB 52 you can additionally read out data set 1 which contains further information.

After exiting OB 82, the data can no longer be clearly assigned to the last diagnostic alarm.

Data set 1 is structured as follows:

Data set 1, diagnostics$_{incoming}$	
Byte	**Bit 7 ... 0**
0	Bit 0: Set if module fault Bit 1: 0 (fixed) Bit 2: Set in the case of an external error Bit 3: Set in the case of a channel error Bit 6 ... 4: 0 (fixed) Bit 7: Parameterisation error
1	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	Bit 5 ... 0: 0 (fixed) Bit 6: Process alarm lost Bit 7: 0 (fixed)
4	Bits 6 ... 0: channel type, 76h: counter module Bit 7: further channel types available, 0: no, 1: yes
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 02_h)
7	Bit 0: Error in channel group 0 (counter 1) Bit 1: Error in channel group 1 (counter 2) Bit 7 ... 2: 0 (fix)
8	Channel group 0: diagnostic alarm due to lost process alarm to ... Bits 1 ... 0: 0 (fixed) Bit 2: overflow/underflow/final value Bit 3: comparison value reached Bits 7 ... 4: 0 (fixed)
9	Channel group 1: diagnostic alarm due to lost process alarm to ... Bits 1 ... 0: 0 (fixed) Bit 2: overflow/underflow/final value Bit 3: comparison value reached Bits 7 ... 4: 0 (fixed)
10 ... 15	0 (fixed)

Data set 1, diagnostics$_{outgoing}$
After the error recovery a diagnostic message$_{outgoing\ is\ effected}$

9.7.4 One counter 32 bits, 5 V DC - EPM-S602

By integration of the GSE file VI010C19.gse you can specify all counter parameters via a hardware configuration.

The following functions can be parameterised:

Counting functions	Description
Counting continuously	The counter counts from the loading value to the counting limit, then skips to the opposite counting limit and continues to count from there.
Counting once	The counter counts once/periodically from the loading value in the specified counting range.
Counting periodically	

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Main counting direction	The main counting direction can be parameterised: **None:** The whole counting range is available. **Forwards:** Limitation of the counting range upwards. The counter counts from the parameterised loading value in the positive direction to the parameterised final value -1 and then skips to the loading value again with the encoder pulse that is following. **Backwards:** Limitation of the counting range downwards. The counter counts from the parameterised loading value in the negative direction to the parameterised final value +1 and then skips to the loading value again with the encoder pulse that is following.
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter the internal gate (I-gate) is conform to the software gate (SW gate) which you control via your user program (status word in the output area). The following response can be parameterised: **Cancelling gate function:**After closing the gate and opening it again, the counting process continues from the loading value again. **Interrupting gate function:**After closing the gate and opening it again, the counting process continues with the last current counter content.
Comparator	You can specify a comparison value which, depending on the count value, activates the digital output or triggers a process alarm.
Hysteresis	By specification of a hysteresis you can for instance prevent the output from being permanently switched if the value of an encoder signal fluctuates around the comparison value.
Process alarm	The activation of a process alarm can be parameterised. A process alarm can be triggered in the case of the following events: ● Hardware gate open ● Hardware gate closed ● Counting limit - overflow ● Counting limit - underflow ● Comparison value reached ● Final value reached ● Latch value reached
Diagnostic alarm	If the diagnostic alarm is enabled in the parameter setting, it occurs as soon as another process alarm is triggered for the same event during process alarm processing.
Diagnostic function	Diagnostic functions are provided in the modules.
Diagnostic information	The diagnostic information describes the diagnostic contents which can be read out from a module. The diagnostic formation is not automatically sent by the module but must actively be read out by SDO access.

Read data: 8 bytes

Input area		
Addr.	**Access**	**Assignment**
+0	Double word	Count value
+4	Word	Status word (see the following table)
+6	Word	Ticker value

Count value: Current counter content

Ticker value: After mains connection a timer (µs ticker) is started, which after 65535 µs starts with 0 again. With every change of the count value the time value of the timer is stored as 16-bit µs value together with the count value in the input area.

EPM-S602 status word		
Bit	**Designation**	**Function**
0	STS_SYNC	Reset was active
1	STS_CTRL_COMP	Is set if the comparison bit is enabled
2	STS_SW-GATE	Software gate status (set if SW gate active)
3	STS_RST	Status of reset input
4	-	Reserved
5	STS_GATE	Status of internal gate (set if internal gate active)
6	STS_COMP	Status of comparison bit
7	STS_C_DN	Status set for counter direction backwards
8	STS_C_UP	Status set for counter direction forwards
9	STS_CMP*	Comparator status is set if the comparison condition is met. If the comparison is deactivated (counter mode byte 1 = 000_b), the bit has no function.
10	STS_END*	Status set if final value was reached
11	STS_OFLW*	Status set in the case of overflow
12	STS_UFLW*	Status set in the case of underflow
13	STS_ZP*	Status set in the case of zero crossing
14	-	Reserved
15	-	Reserved

* The bits are set until reset with RES_SET (bit 6 control word)

Write data: 10 bytes

Output area		
Addr.	**Access**	**Assignment**
+0	Double word	Comparison value
+4	Double word	Set value
+8	Word	Control word (see the following table)

Comparison value: Here you can select a value which, by comparison with the current counter content, can impact the counter output or trigger a process alarm. The response of the output or the process alarm can be parameterised.

Set value: With an edge change 0-1 of *COUNTERVAL_SET* in the control word, the set value is accepted in the counter.

EPM-S602 control word		
Bit	**Name**	**Function**
0	CTRL_SYNC_SET	Activation/deactivation of the counting signal: TRUE=>FALSE edge: The input for the counting signal is deactivated and the current counter content is reset to 0. FALSE=>TRUE edge: The input for the counting signal is activated.
1	CTRL_COMP_SET	Enables the comparison bit
2	SW_GATE_SET	Sets the software gate
3	-	Reserved
4	-	Reserved
5	COUNTERVAL_SET	Sets the counter temporarily to the value in the set value
6	RES_SET	Resets bits STS_CMP, STS_END, STS_OFLW, STS_UFLW and STS_ZP with a rising edge
7	-	Reserved
8	CTRL_SYNC_RESET	Activation/deactivation of the zero track evaluation: TRUE=>FALSE edge: The zero track evaluation is activated. FALSE=>TRUE edge: The zero track evaluation is stopped. The counter keeps counting irrespective of the zero pulse. Bit 0 (CTRL_SYNC_SET) must be set to TRUE for this purpose.
9	CTRL_COMP_RESET	Inhibits the comparison bit
10	SW_GATE_RESET	Resets the software gate
11	-	Reserved
12		
13		
14		
15		

Parameter data

Data set		Name	Description/value	Lenze
No.	Byte			
00_h	0	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
01_h	0	Input frequency track A	Filters for instance serve to filter signal peaks in the case of an unclean input signal. 0 (00_h): 500 kHz 1 (01_h): 300 kHz 2 (02_h): 100 kHz 3 (03_h): 60 kHz 4 (04_h): 30 kHz 6 (06_h): 10 kHz 7 (07_h): 5 kHz 8 (08_h): 2 kHz 9 (09_h): 1 kHz Other values are not permissible!	02_h
	1	Input frequency track B		02_h
	2	Input frequency reset		02_h
	3	Reserved		
80_h	0	Alarm response	Setting activates process alarm Bits 1 ... 0: reserved Bit 2: Proc. alarm overflow Bit 3: Proc. alarm underflow Bit 4: Proc. alarm comparison value Bit 5: Proc. alarm final value Bits 7 ... 6: Reserved	00_h
	1	Counter function	Bits 5 ... 0: 000000_b = counting continuously 000001_b = once: forwards 000010_b = once: backwards 000100_b = once: no main counting direction 001000_b = periodically: forwards 010000_b = periodically: backwards 100000_b = periodically: no main counting direction Bits 7 ... 6: Reserved	00_h
	2	Comparator	Bits 2 ... 0: Comparison bit is set (... if condition is met) 000_b = never 001_b = count value ≥ comparison value 010_b = count value ≤ comparison value 100_b = count value = comparison value Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 6 ... 4: Reset 000_b = deactivated 001_b = HIGH level 011_b = rising edge 101_b = rising edge, once Bit 7: Reserved	00_h

Data set		Name	Description/value	Lenze
No.	Byte			
	3	Signal evaluation	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (connection to input "A/pulse") 010_b = double rotary transducer (connection to input "A/pulse") 011_b = four-fold rotary transducer (connection to input "A/pulse" and "B/direction") 100_b = direction (pulse to "A/pulse" and direction to "B/direction") Bits 6 ... 3: Reserved Bit 7: Gate function (internal gate) 0= abort (counting process starts again from loading value) 1 = interrupt (counting process is continued with counter content)	00_h
81_h	4...7	Final value	Upper limit of the counting range	00_h
	8...11	Start value	Lower limit of the counting range; counting method:	00_h
	12	Hysteresis		00_h

Process alarm

A process alarm causes a call of the OB 40. Within the OB 40 you have the possibility of determining the logic basic address of the module that has triggered the process alarm via the local word 6. Further information on the triggering event can be found in the "Local double word 8".

Local double word 8 of OB 40:

Local byte	Bit 7 ... 0
1	Bit 0: 0 Bit 1: 0 Bit 2: Counter 1, overflow/underflow/final value Bit 3: Counter 1, comparison value reached Bit 4: 0 Bit 5: 0 Bit 6: Counter 2, overflow/underflow/final value Bit 7: Counter 2, comparison value reached
2	State of the inputs at the time of the alarm Bit 0: Counter 1, A/pulse Bit 1: Counter 1, B/direction Bit 2: Counter 2, A/pulse Bit 3: Counter 2, B/direction Bit 7 ... 4: 0 (fix)
3/4	16 bit µs value at the time of the alarm

Ticker value: After mains connection a timer (µs ticker) is started, which after 65535 µs starts with 0 again. With every change of the count value the time value of the timer is stored as 16-bit µs value together with the count value in the input area.

Diagnostic alarm

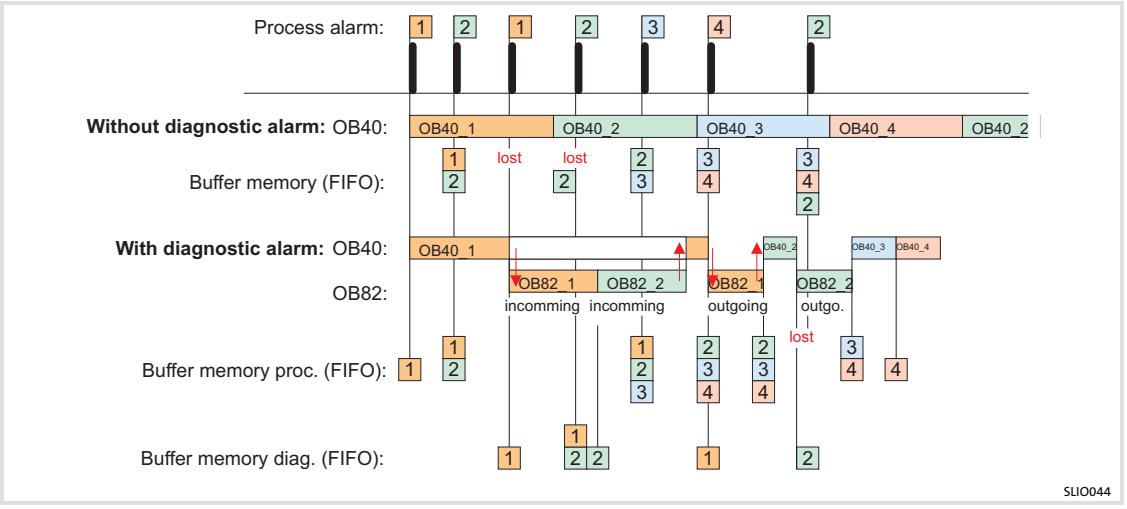
You have the possibility of globally activating a diagnostic alarm for the module via parameterisation (data set 00h). A diagnostic alarm occurs if a further process alarm is triggered for the same event during a process alarm processing in the OB 40.

By activation of a diagnostic alarm the current process alarm processing in the OB 40 is interrupted and branched to the diagnostic alarm processing$_{incoming}$ in OB 82. If further events occur on other channels during the diagnostic alarm processing, which can trigger a process or diagnostic alarm, they are buffered. At the end of the diagnostic alarm processing, first all buffered diagnostic alarms are processed in order of their occurrence, and afterwards all process alarms.

If further process alarms occur on a channel for which a diagnostic alarm$_{incoming}$ is currently processed or buffered, they are lost. If a process alarm for which a diagnostic alarm$_{incoming}$ has been triggered is processed, the diagnostic alarm processing is called again as diagnostic alarm$_{outgoing}$.

All events of a channel between the diagnostic alarm$_{incoming}$ and diagnostic alarm$_{outgoing}$ are not buffered and are lost. During this time (first diagnostic alarm$_{incoming}$ to the last diagnostic alarm$_{outgoing}$) the MF-LED of the module is lit. Additionally an entry in the diagnostic buffer of the CPU is made for every diagnostic alarm$_{incoming/outgoing}$.

Example:



Diagnostic alarm processing:

Using the SFB 52 you can read out the diagnostic bytes. If the diagnostic alarm is deactivated, you can access the last diagnostic event in each case.

If you have activated the diagnostic function in your hardware configuration, OB 82 is called automatically. Here you can react on the diagnostics accordingly. With the SFB 52 you can additionally read out data set 1 which contains further information.

After exiting OB 82, the data can no longer be clearly assigned to the last diagnostic alarm.

Data set 1 is structured as follows:

Data set 1, diagnostics$_{incoming}$	
Byte	**Bit 7 ... 0**
0	Bit 0: Set if module fault Bit 1: 0 (fixed) Bit 2: Set in the case of an external error Bit 3: Set in the case of a channel error Bit 6 ... 4: 0 (fixed) Bit 7: Parameterisation error
1	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	Bit 5 ... 0: 0 (fixed) Bit 6: Process alarm lost Bit 7: 0 (fixed)
4	Bits 6 ... 0: channel type, 76h: counter module Bit 7: further channel types available, 0: no, 1: yes
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 02_h)
7	Bit 0: Error in channel group 0 (counter 1) Bit 1: Error in channel group 1 (counter 2) Bit 7 ... 2: 0 (fix)
8	Channel group 0: diagnostic alarm due to lost process alarm to ... Bits 1 ... 0: 0 (fixed) Bit 2: overflow/underflow/final value Bit 3: comparison value reached Bits 7 ... 4: 0 (fixed)
9	Channel group 1: diagnostic alarm due to lost process alarm to ... Bits 1 ... 0: 0 (fixed) Bit 2: overflow/underflow/final value Bit 3: comparison value reached Bits 7 ... 4: 0 (fixed)
10 ... 15	0 (fixed)

Data set 1, diagnostics$_{outgoing}$
After the error recovery a diagnostic message$_{outgoing\ is\ effected}$

9.7.5 Two counters 32 bits, 24 V DC - EPM-S603

By integration of the GSE file VI010C19.gse you can specify all counter parameters via a hardware configuration.

The following functions can be parameterised:

Counting functions	Description
Counting continuously	The counter counts from 0 to the counting limit, then skips to the opposite counting limit and continues to count from there.

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter the internal gate (I-gate) is conform to the software gate (SW gate) which you control via your user program (status word in the output area).

Read data: 12 bytes

Input area in the process image		
Addr.	**Access**	**Assignment**
+0	Double word	Counter 1: count value
+4	Double word	Counter 2: count value
+8	Word	Counter 1: status word (see following table)
+10	Word	Counter 2: status word (see following table)

EPM-S603 status word		
Bit	**Designation**	**Function**
0	-	Reserved
1	-	Reserved
2	STS_SW-GATE	Software gate status (set if SW gate active)
3	-	Reserved
4	-	Reserved
5	STS_GATE	Status of internal gate (set if internal gate active)
6	-	Reserved
7	STS_C_DN	Status set for counter direction backwards
8	STS_C_UP	Status set for counter direction forwards
9	-	Reserved
10	-	Reserved
11	STS_OFLW*	Status set in the case of overflow
12	STS_UFLW*	Status set in the case of underflow
13	STS_ZP*	Status set in the case of zero crossing
14	-	Reserved
15	-	Reserved

* The bits are set until reset with RES_SET (bit 6 control word)

Write data: 4 bytes

Output area in the process image		
Addr.	**Access**	**Assignment**
+0	Word	Counter 1: Control word (see following table)
+2	Word	Counter 2: Control word (see following table)

EPM-S603 control word		
Bit	**Designation**	**Function**
0	-	Reserved
1	-	Reserved
2	SW_GATE_SET	Sets the software gate
3	-	Reserved
4	-	Reserved
5	-	Reserved
6	RES_SET	Resets bits STS_CMP, STS_END, STS_OFLW, STS_UFLW and STS_ZP with a rising edge
7	-	Reserved
8	-	Reserved
9	-	Reserved
10	SW_GATE_RESET	Resets the software gate
11	-	Reserved
12		
13		
14		
15		

Parameter data

Data set		Name	Description/value	Lenze
No.	Byte			
01_h	0	Input frequency counter 1, track A	Filters for instance serve to filter signal peaks in the case of an unclean input signal. 0 (00_h): 500 kHz 1 (01_h): 300 kHz 2 (02_h): 100 kHz 3 (03_h): 60 kHz 4 (04_h): 30 kHz 6 (06_h): 10 kHz 7 (07_h): 5 kHz 8 (08_h): 2 kHz 9 (09_h): 1 kHz Other values are not permissible!	02_h
	1	Input frequency counter 1, track B		02_h
	2	Input frequency counter 2, track A		02_h
	3	Input frequency counter 2, track B		02_h
80_h	0	Counting direction counter 1, track B	Bits 2 ... 0: Reserved Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 7 ... 4: Reserved	00_h
	1	Signal evaluation counter 1	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (connection to input ”A/pulse”) 010_b = double rotary transducer (connection to input ”A/pulse”) 011_b = four-fold rotary transducer (connection to input ”A/pulse” and ”B/direction”) 100_b = direction (pulse to ”A/pulse” and direction to ”B/direction”) Bits 7 ... 3: Reserved	00_h
82_h	0	Counting direction counter 2, track B	Bits 2 ... 0: Reserved Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 7 ... 4: Reserved	00_h
	1	Signal evaluation counter 2	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (connection to input ”A/pulse”) 010_b = double rotary transducer (connection to input ”A/pulse”) 011_b = four-fold rotary transducer (connection to input ”A/pulse” and ”B/direction”) 100_b = direction (pulse to ”A/pulse” and direction to ”B/direction”) Bits 7 ... 3: Reserved	00_h

Diagnostic data

Using the SFB 52 you can access the diagnostic data of the module anytime. Since this module does not support a process alarm, the diagnostic data serve to provide information on this module.

Data set 1 is structured as follows:

Byte	Bit 7 ... 0
0	0 (fixed)
1	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 76h: counter module Bit 7: Further channel types available, 0: no, 1: yes
5	Number of diagnostic bits output by the module per channel (here 00_h)
6	Number of channels of a module (here 02_h)
7 ... 15	0 (fixed)

9.8 Parameterising the encoder evaluation

9.8.1 SSI - EPM-S604

By integration of the GSE file VI010C19.gse you can specify all counter parameters via a hardware configuration.

The following functions can be parameterised:

Functions	Description
SSI encoder parameters	According to encoder data sheet
Operating mode	Master mode or monitoring operation
Alarm response	With definition of the comparison and limit values

Read data: 6 bytes

Input area		
Addr.	**Access**	**Assignment**
+0	Double word	Encoder value
+4	Word	Ticker value

Encoder value: Current encoder value

Ticker value: After mains connection a timer (µs ticker) is started, which after 65535 µs starts with 0 again. With every change of the encoder value the time value of the timer is stored as 16-bit µs value together with the encoder value in the input area.

Parameter data

Data set		Name	Description/value	Lenze
No.	Byte			
00_h	0	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 5 ... 0: reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
80_h	0	Dead time	The dead time, also called tbs (time between sends), defines the waiting time between two encoder values to be observed by the module so that the encoder is able to process its value. This data can be found in the data sheet for your encoder. HIGH LOW 00_h 30_h: 1 µs 00_h 60_h: 2 µs 00_h $C0_h$: 4 µs 01_h 80_h: 8 µs 03_h 00_h: 16 µs 06_h 00_h: 32 µs 09_h 00_h: 48 µs $0C_h$ 00_h: 64 µs	$0C00_h$

Data set		Name	Description/value	Lenze
No.	Byte			
	1	Baud rate	In the ”Monitoring operation” mode, the baud rate is irrelevant. Enter the baud rate here. This corresponds to the clock frequency via which the connected encoder communicates. More information on this can be found in the data sheet for your encoder. HIGH LOW 00_h 18_h: 2 MHz 00_h 20_h: 1.5 MHz 00_h 30_h: 1 MHz 00_h 60_h: 500 kHz 00_h $C0_h$: 250 kHz 01_h 80_h: 125 kHz	0180_h
	2	Reserved		
	3	Scaling	Depending on the encoder, further bits are transmitted in addition to the encoder value. Scaling serves to determine how many bits postpositioned to the encoder value will be removed by shifting the encoder value to the right. The encoder value is scaled by the module only after a gray-binary conversion. More information can be found in the data sheet for your encoder. Value range: 00_h ... $0F_h$ = 0 bits ... 15 bits	00_h
	4	Bit length of encoder data	Enter the bit length of the encoder data here. Depending on the encoder, the encoder data consist of the current encoder value with subsequent bits. The total length has to be specified here. More information on this can be found in the data sheet for your encoder. 7 (07_h) = ”8 bits” 8 (08_h) = ”9 bits” ... 24 (18_h) = ”25 bits” ... 31 ($1F_h$) = ”32 bits”	18_h

Data set		Name	Description/value	Lenze
No.	Byte			
	5		Bit 1 ... 0: Ready for operation During ”Monitoring operation” the module serves to monitor the data exchange between an SSI master and an SSI encoder. It receives the cycle by the master and the data flow by the SSI encoder. In the ”Master mode” operating mode the module provides a cycle to the encoder and receives data by the encoder. 01_b = monitoring operation 10_b = master mode Bit 2: Shifting direction Specify the orientation of the encoder data here. More information can be found in the data sheet for your encoder. Usually, the SSI encoder uses ”MSB first”. 0 = LSB first (LSB is transmitted first) 1 = MSB first (MSB is transmitted first) Bit 3: edge clock signal Here you can specify the edge type of the clock signal, in the case of which the encoder supplies data. Information on this can be found in the data sheet for your encoder. Usually the SSI encoders respond to rising edges. 0 = falling edge 1 = rising edge Bit 4: Coding In the ”Binary code” setting, the provided encoder value remains unchanged. In the ”Gray code” setting, the gray-coded value provided by the encoder is converted into a binary value. Only after this conversion, the received encoder value is scaled, if required. The Gray code is another form of representation of the binary code. It is based on the fact that two adjacent Gray numbers differ from each other in exactly one bit. If the Gray code is used, transmission errors can be easily detected, since adjacent characters must only differ from each other in one digit. Information on this can be found in the data sheet for your encoder. 0 = standard code 1 = Gray code Bits 7 ... 5: reserved	$1E_h$
	6	Reserved		
	7	SSI function	By enabling the SSI function the module starts with the cycle output and the evaluation of the encoder data. In the ”monitor operation” mode, the module starts with the encoder evaluation. 0 (00_h) = inhibited 1 (01_h) = enabled	00_h

Diagnostic alarm

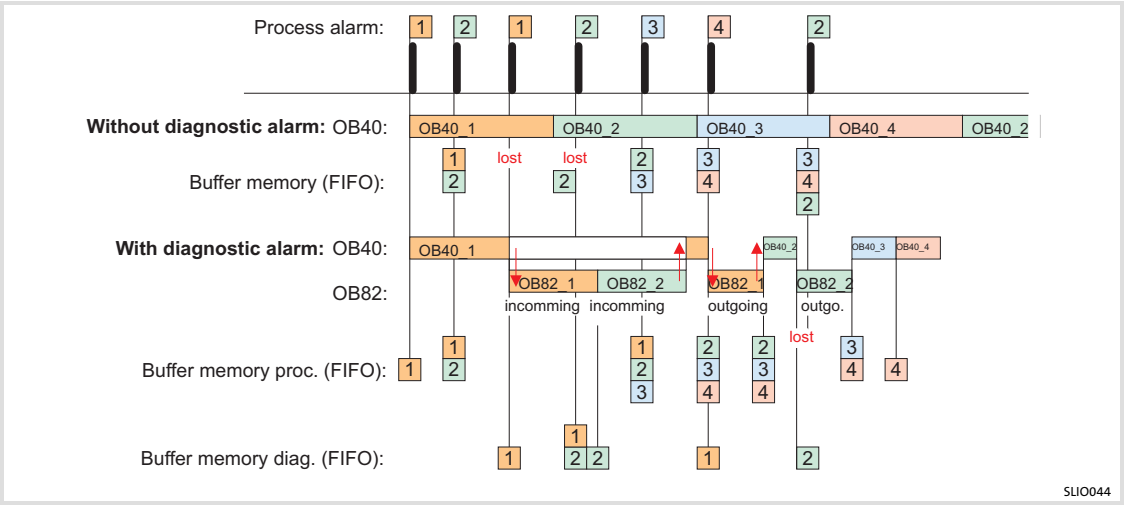
You have the possibility of globally activating a diagnostic alarm for the module via parameterisation (data set 00h). A diagnostic alarm occurs if a further process alarm is triggered for the same event during a process alarm processing in the OB 40.

By activation of a diagnostic alarm the current process alarm processing in the OB 40 is interrupted and branched to the diagnostic alarm processing$_{incoming}$ in OB 82. If further events occur on other channels during the diagnostic alarm processing, which can trigger a process or diagnostic alarm, they are buffered. At the end of the diagnostic alarm processing, first all buffered diagnostic alarms are processed in order of their occurrence, and afterwards all process alarms.

If further process alarms occur on a channel for which a diagnostic alarm$_{incoming}$ is currently processed or buffered, they are lost. If a process alarm for which a diagnostic alarm$_{incoming}$ has been triggered is processed, the diagnostic alarm processing is called again as diagnostic alarm$_{outgoing}$.

All events of a channel between the diagnostic alarm$_{incoming}$ and diagnostic alarm$_{outgoing}$ are not buffered and are lost. During this time (first diagnostic alarm$_{incoming}$ to the last diagnostic alarm$_{outgoing}$) the MF-LED of the module is lit. Additionally an entry in the diagnostic buffer of the CPU is made for every diagnostic alarm$_{incoming/outgoing}$.

Example:



Diagnostic alarm processing:

Using SFB 52 you can read out the diagnostic bytes. If the diagnostic alarm is deactivated, you can access the last diagnostic event in each case.

If you have activated the diagnostic function in your hardware configuration, OB 82 is called automatically. Here you can react on the diagnostics accordingly. With the SFB 52 you can additionally read out data set 1 which contains further information.

After exiting OB 82, the data ca no longer be clearly assigned to the last diagnostic alarm.

Data set 1 is structured as follows:

Data set 1, diagnostics$_{incoming}$	
Byte	**Bit 7 ... 0**
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of missing external supply voltage Bit 6 ... 5: 0 (fixed) Bit 7: Parameterisation error
1	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	Bit 5 ... 0: 0 (fixed) Bit 6: Process alarm lost Bit 7: 0 (fixed)
4	Bit 6 ... 0: Channel type, 76h: counter module Bit 7: 0 (fixed)
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 01_h)
7	Bit 0: Error in channel group 0
8 ... 15	0 (fixed)

Data set 1, diagnostics$_{outgoing}$
After the error recovery a diagnostic message$_{outgoing\ is\ effected}$

9.9 Time stamp parameterising

9.9.1 2 digital inputs with time stamp function - EPM-S207

By integration of the GSE file VI010C19.gse you can specify all counter parameters via a hardware configuration.

The following functions can be parameterised:

Functions	Description
Input delay	For example, signal peaks can be filtered in the event of an unclean input signal.
Edge selection	Specification of signal edge for input signal to produce a time stamp entry.

Read data: 6 bytes

Input area		
Addr.	**Access**	**Assignment**
+0	Byte	Status of inputs (PAE)
+1	Byte	Running number (RN)
+2	Word	Ticker value

Status of inputs:the status of the inputs after the edge change is saved here. Parameters can be set for the following variants by incorporating the GSD file LE010C3A.gsd:

20 bytes, 5 time stamp entries:

Addr.	+0	+1	+2	+3
+0	PAE	RN	16-bit µs value	
+4	PAE	RN-1	16-bit µs value	
+8	PAE	RN-2	16-bit µs value	
+12	PAE	RN-3	16-bit µs value	
+16	PAE	RN-4	16-bit µs value	

60 bytes, 15 time stamp entries:

Addr.	+0	+1	+2	+3
+0	PAE	RN	16-bit µs value	
+4	PAE	RN-1	16-bit µs value	
+8	PAE	RN-2	16-bit µs value	
+12	PAE	RN-3	16-bit µs value	
...	...	...	...	
+56	PAE	RN-14	16-bit µs value	

Running number (RN): The ”running number” is a consecutive number between 0 ... 63, which always starts afresh from 0. You use the ”running number” to determine the time sequence of entries. It should be incremented with every time stamp entry. During the first run, the ”running number” must start with 1.

Ticker value: After mains connection, a timer (µs ticker) is started, which after 65535 µs starts with 0 again. With every change in the encoder value the time value of the timer is stored as a 16-bit µs value together with the encoder value in the input area.

Parameter data

Data set		Name	Description/value	Lenze
No.	Byte			
02_h	0	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	14_h or $3C_h$ (fix)
	1	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	00_h (fix)
01_h	0	Input delay DI 1	00_h = 1 µs 02_h = 3 µs 04_h = 10 µs 07_h = 86 µs 09_h = 342 µs $0C_h$ = 273 µs Other values are not permissible.	02_h
	1	Input delay DI 2		02_h
80_h	0	Edge 0-1 an DI x	Time stamp entry on rising edge Bit 0: DI 1 (0: inhibit, 1 = enable) Bit 1: DI 2 (0: inhibit, 1 = enable) Bits 7 ... 2: Reserved	00_h
	1	Edge 1-0 at DI x	Time stamp entry on falling edge Bit 0: DI 1 (0: inhibit, 1 = enable) Bit 1: DI 2 (0: inhibit, 1 = enable) Bits 7 ... 2: Reserved	00_h

Diagnostic data

Using SFB 52, you can read out the diagnostic bytes which provide information about the module. With SFB 52 you can also read out data set 1 which contains further information.

Data set 1 is structured as follows:

Data set 1, diagnostics	
Byte	**Bit 7 ... 0**
0	0 (fixed)
1	Bits 3 ... 0: module class, 1111_b: digital module Bit 4: channel information available Bits 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bits 6 ... 0: channel type, 70_h: digital module Bit 7: more channel types available (0: yes; 1: no)
5	Number of diagnostic bits output by the module per channel (here 00_h)
6	Number of channels of a module (here 02_h)
7 ... 15	0 (fixed)

9.9.2 2 digital outputs with time stamp function - EPM-S310

By integration of the GSE file VI010C19.gse you can specify all counter parameters via a hardware configuration.

The module has an FIFO (first-in-first-out) memory for 15 time stamp entries. Depending on parameter setting, you can use the output area to transfer up to 15 time stamp entries to the FIFO memory. The input process image provides information on the status of the FIFO memory and the status of processing.

Read data: 4 bytes

Input area		
Addr.	**Access**	**Assignment**
+0	Byte	Bits 5 ... 0: running number (RN = **R**unning **N**umber) of the last FIFO entry Bit 6: 1 (fixed) Bit 7: 0 (fixed)
+1	Byte	Bits 5 ... 0: running number of the next FIFO entry Bit 6: 1 (fixed) Bit 7: 1 (fixed)
+2	Byte	Status
+3	Byte	Number of time stamp entries in FIFO memory.

Running number: here you will find the running number of the time stamp entry last/next written to the FIFO.

Status: The status informs you of the status of the FIFO memory:

Code 00_h/80_h: everything OK

Code 01_h/81_h: no following time stamp entry

Code 02_h/82_h: no new time stamp entries.

Code 03_h/83_h: FIFO memory is full. No new time stamp entries can be accepted.

If bit 6 of the last processed running number (RN) was set, the code is returned at 80_h OR-ed.

Note!

Note that no more time stamp entries can be accepted once the FIFO memory is full. You should always establish the status of the FIFO memory before the transfer to ensure that your entries are accepted.

Write data: 20 bytes/60 bytes

Depending on project planning, the output area can be used to write up to 15 time stamp entries. 4 bytes in the process image are intended for each time stamp entry:

Output area		
Addr.	**Access**	**Assignment**
+0	Byte	Bits 3 ... 0: 0 (fixed) Bit 4: Release of DO 1 (0: inhibit, 1: enable) Bit 5: Release of DO 0 (0: inhibit, 1: enable) Bit 6: State DO 1 Bit 7: State DO 0
+1	Byte	Running number (RN)
+2	Word	Ticker value

Status of outputs:the status of the outputs for the time required is stated here. You can project plan the following variants by incorporating the GSD file LE010C3A.gsd.gsd:

20 bytes, 5 time stamp entries:

Addr.	+0	+1	+2	+3
+0	PAA	RN	16-bit µs value	
+4	PAA	RN-1	16-bit µs value	
+8	PAA	RN-2	16-bit µs value	
+12	PAA	RN-3	16-bit µs value	
+16	PAA	RN-4	16-bit µs value	

60 bytes, 15 time stamp entries:

Addr.	+0	+1	+2	+3
+0	PAA	RN	16-bit µs value	
+4	PAA	RN-1	16-bit µs value	
+8	PAA	RN-2	16-bit µs value	
+12	PAA	RN-3	16-bit µs value	
...	...	...	...	
+56	PAA	RN-14	16-bit µs value	

Running number (RN): The ”running number” is a consecutive number between 0 ... 63, which always starts afresh from 0. You use the ”running number” to determine the time sequence of entries. It should be incremented with every time stamp entry. During the first run, the ”running number” must start with 1.



Note!

If using SFC 15 to write consistent user data, up to 15 time stamp entries can be written. If less than 15 time stamp entries are written, bit 6 must also be set for the last RN. This has to be done to ensure that the following entries don’t have to be written in an ”invalid” way. The module ignores all time stamp entries after an entry with a set bit 6.

Ticker value: Specify a time here in µs at which the status of the outputs is to be accepted (value range: 0 ... 65535).

Parameter data

Data set		Name	Description/value	Lenze
No.	Byte			
02_h	0	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	14_h or $3C_h$ (fix)
	1	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	00_h (fix)

Diagnostic data

Using SFB 52, you can read out the diagnostic bytes which provide information about the module. With SFB 52 you can also read out data set 1 which contains further information.

Data set 1 is structured as follows:

Data set 1, diagnostics	
Byte	**Bit 7 ... 0**
0	0 (fixed)
1	Bits 3 ... 0: module class, 1111_b: digital module Bit 4: channel information available Bits 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bits 6 ... 0: channel type, 70_h: digital module Bit 7: more channel types available (0: yes; 1: no)
5	Number of diagnostic bits output by the module per channel (here 00_h)
6	Number of channels of a module (here 02_h)
7 ... 15	0 (fixed)

9.10 Parameterising technology modules

9.10.1 2 digital outputs with PWM functionality - EPM-S620

The following functions can be parameterised:

By integration of the GSE file VI010C19.gse you can specify all counter parameters via a hardware configuration.

Read data: 4 bytes

Input area			
Addr.	**Name**	**Byte**	**Function**
+0	PWMSTS_I	2	PWM 1: status
+2	PWMSTS_II	2	PWM 2: status

Status PVMx		
Bit	**Name**	**Function**
0	-	Reserved
1	STS_PVM	Status PWM 0: PWM output stopped 1: PWM output active
2	STS_OUTBV	Output status 0: push/pull output 1: highside output
3 ... 15	-	Reserved

Write data: 12 bytes

Output area			
Addr.	**Name**	**Byte**	**Function**
+0	PWMPD_I	4	PWM 1: pulse duration
+4	PWMSTS_II	4	PWM 2: pulse duration
+8	PWMCTRL_I	2	PWM 1: control word
+10	PWMSTS_II	2	PWM 2: control word

PWMPD_I, PWMPD_II pulse duration: Determine the scanning ratio for the parameterised period here by stating the duration of the HIGH level for the corresponding PWM channel. The pulse duration should be chosen as a factor for the 20.83 ns basis.

Value range: 48 ... 8388607 (1µs ... approx. 175ms)

PWMPD_I, PWMPD_II control word:here you can specify the PWM output response for the corresponding channel and start or stop PWM output.

Control word PWMPDx		
Bit	**Name**	**Function**
0	-	Reserved
1	CTRL_OUTBV	PWM output response 0: push/pull output Push/pull mode should be used if you need defined high/low levels for a rapid change. This is used with a low load especially if "highside" mode cannot move the output to low fast enough during a low status. With push/pull, the output is switched to ground with low active and to voltage with high active. 1: highside output In highside mode, the output switched to low remains in a state of uncertainty between ground and voltage. The load has to "pull" itself to ground. In highside mode, the switch is only made to high level active.
3 ... 7	-	Reserved
8	CTRL_STRT	Edge 0-1 starts PWM output on channel x
9	CTRL_STP	Edge 0-1 stops PWM output on channel x
10 ... 15	-	Reserved

Parameter data

Data set		Name	Description/value	Lenze
No.	Byte			
80_h	0	PWM 1: period	Set parameters here for the total time for pulse duration and pulse pause. The time should be selected as a factor for the 20.83 ns basis. Values below 25 µs are ignored. If the pulse duration is higher or equal to the period, the DO output is set permanently. Value range: 1200 ... 8388607 (25 µs ... approx. 175 ms)	$1F40_h$
81_h	0	PWM 2: Period		$1F40_h$

Diagnostic data

Since this module does not support alarms, the diagnostic data provides information about this module.

Diagnostic data set - data set 01h			
Name	**Byte**	**Function**	**Default**
ERR_A	1	Reserved	00_h
MODTYP	1	Module information Byte 0: Bit 3 ... 0: module class (1111b: digital module) Bit 4: channel information available Bits 7 ... 4: 0 reserved	15_h
ERR_C	1	Reserved	00_h
ERR_D	1	Reserved	00_h
CHTYP	1	Channel type Byte 0: Bits 6 ... 0: channel type (72h: digital output) Bit 7: reserved	72_h
NUMBIT	1	Number of diagnostic bits per channel Byte 0: here 00_h	00_h
NUMCH	1	Number of channels in module Byte 0: here 02_h	02_h
CHERR	1	Reserved	00_h
CH0ERR ... CH7ERR	6	Reserved	00_h
DIAG_US	4	Value of µs ticker when diagnostics occur Bytes 0 ...3	0

9.10.2 RS232 interface - EPM-S640

Information on the transmission principles can be found in the appendix (📖 777).

Parameter data

Parameter data - ASCII protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
00_h	0	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
02_h	0	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
	1	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
80_h	0	Baud rate	00_h: 9600Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
	1	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 01_h: ASCII	01_h
Option 1, character frame				
80_h	2	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
			Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
			Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
			Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b

Parameter data - ASCII protocol				
Data set		Name	Description/value	Lenze
No.	Byte			
Option 2/3, ZNA				
80_h	3	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
	4	ZNA (LOW byte)		00_h
Option 4/5, ZVZ				
80_h	5	Character delay time	Character delay time (ZVZ) The character delay time defines the maximum permissible time interval between two characters received within a telegram. If ZVZ = 0, the module calculates the ZVZ by means of the baud rate (approx. double character time). 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
80_h	6			FA_h
Option 6, number of receive buffers				
80_h	7	Number of receive buffers	Defines the number of receive buffers. As long as only one receive buffer is used and is assigned, no more data can be received. If up to 250 receive buffers are connected, the received data can be redirected to a still free receive buffer. 1 ... 255 (01_h ... FF_h)	01_h
Option 7 ... 12, reserved				
80_h	8 ... 13	Reserved		00_h

Parameter data STX/ETX protocol				
Data set		Name	Description/value	Lenze
No.	Byte			
00_h	0	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
02_h	0	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
	1	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
80_h	0	Baud rate	00_h: 9600Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h

Parameter data STX/ETX protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
	1	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 01_h: ASCII	01_h
Option 1, character frame				
80_h	2	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
			Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
			Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
			Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2/3, ZNA				
80_h	3	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
	4	ZNA (LOW byte)		00_h

Parameter data STX/ETX protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
Option 4/5, TMO				
80_h	5	TMO (HIGH byte)	TMO serves to define the maximally permissible interval between two frames. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
	6	TMO (LOW byte)		FA_h
Option 6, number of start identifiers				
80_h	7	Number of start identifiers	00_h: 1 start identifier (2nd start identifier is ignored) 01_h: 2 start identifiers	01_h
Option 7, start identifier 1				
80_h	8	Start identifier 1	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 8, start identifier 2				
80_h	9	Start identifier 2	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 9, number of end identifiers				
80_h	10	No. of end identifier	00_h: 1 end identifier (2. end identifier (0x310D/x) is ignored) 01_h: 2 end identifiers	00_h
Option 10, end identifier 1				
80_h	11	End identifier 1	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 11, end identifier 2				
80_h	12	End identifier 2	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 12, reserved				
80_h	13	Reserved		00_h

Parameter data 3964(R) protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
00_h	0	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
02_h	0	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
	1	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	

Parameter data 3964(R) protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
80_h	0	Baud rate	00_h: 9600Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
	1	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 01_h: ASCII	01_h
Option 1, character frame				
80_h	2	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
			Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
			Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
			Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2, ZNA (x 20 ms)				
80_h	3	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. The ZNA is indicated as a factor in steps of 20ms. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h

Parameter data 3964(R) protocol				
Data set		Name	Description/value	Lenze
No.	Byte			
Option 3, ZVZ (x 20 ms)				
80_h	4	Character delay time	Character delay time (ZVZ) The character delay time defines the maximum permissible time interval between two characters received within a telegram. The ZVS is indicated as a factor in steps of 20ms. If ZVZ = 0, the module calculates the ZVZ by means of the baud rate (approx. double character time). 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
Option 4, QVZ (x 20 ms)				
80_h	5	Acknowledgement time	Acknowledgement time (QVZ) The QVZ defines the max. permissible time interval until the partner is acknowledged while establishing/terminating a connection. The QVZ is indicated as a factor in steps of 20 ms. 1 ... 255 [ms] (01_h ... FF_h)	00_h
Option 5, BWZ (x 20 ms)				
80_h	6	Block wait time	Block wait time (BWZ) The BWZ is the maximum time period between the confirmation of a request frame (DLE) and STX of the response frame. The BWZ is indicated as a factor in steps of 20 ms. 1 ... 255 [ms] (01_h ... FF_h)	FA_h
Option 6, STX (x 20 ms)				
80_h	7	STX repetitions	Maximum number of times the module attempts to establish a connection. 1 ... 255 [ms] (01_h ... FF_h)	01_h
Option 7, DBL (x 20 ms)				
80_h	8	DBL	When exceeding the block wait time (BWZ) you can specify the maximum number of repetitions for the request frame using the DBL parameter. If these attempts fail, transmission is cancelled. 1 ... 255 [ms] (01_h ... FF_h)	00_h
Option 8, priority (x 20 ms)				
80_h	9	Priority	A communication partner has high priority if its sending attempt has precedence over the partner's transmit request. In the event of low priority, it must take second place behind the partner's transmit request. With 3964(R) the priorities of both partners must be different. The following settings are possible: 00_h: LOW 01_h: HIGH	00_h
Option 9 ... 12, reserved				
80_h	10 ... 13	Reserved		00_h

Diagnostic data

Since this module does not support alarms, the diagnostic data provides information about this module.

In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

Diagnostic data - data set 01h			
Name	**Byte**	**Function**	**Default**
ERR_A	1	ERR_A-diagnostics Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error (cable break) Bit 3: Reserved Bit 4: Set in the case of a missing external supply voltage Bit 5, 6: Reserved Bit 7: Set in the case of parameterisation error	00_h
MODTYP	1	Module information Byte 0: Bit 3 ... 0: Module class (0111b: Gateway module) Bit 4: channel information available Bits 7 ... 4: 0 reserved	17_h
ERR_C	1	ERR_A-diagnostics Bit 7 ... 0: Reserved	00_h
ERR_D	1	ERR_D diagnostics Bit 3 ... 0: Reserved Bit 4: Set in the case of internal communication error Bit 7 ... 5: Reserved	00_h
CHTYP	1	Channel type Bit 7 ... 0: Reserved	00_h
NUMBIT	1	Number of diagnostic bits of the module per channel (here 08_h)	08_h
NUMCH	1	Number of channels in module Bit 7 ... 0: Reserved	00_h
CHERR	1	Bit 7 ... 0: Reserved	00_h
CH0ERR ... CH7ERR	8	Bit 7 ... 0: Reserved	00_h
DIAG_US	4	Value of µs ticker when diagnostics occur Bytes 0 ...3	00_h

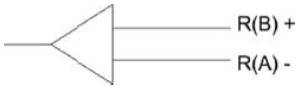
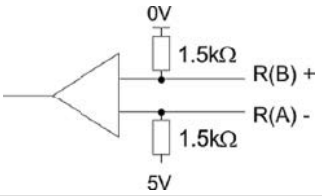
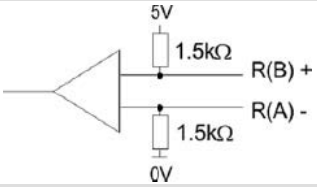
9.10.3 RS422/RS485 interface - EPM-S650

Information on the transmission principles can be found in the appendix (📖 777).

Parameter data

Parameter data - ASCII protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
00_h	0	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
02_h	0	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
	1	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
80_h	0	Baud rate	00_h: 9600Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
	1	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 01_h: ASCII	01_h
Option 1, character frame				
80_h	2	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
			Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
			Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
			Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b

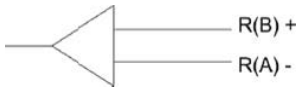
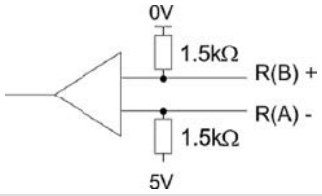
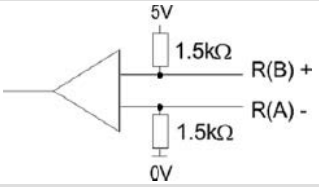
Parameter data - ASCII protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
Option 2/3, ZNA				
80_h	3	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
	4	ZNA (LOW byte)		00_h
Option 4/5, ZVZ				
80_h	5	Character delay time	Character delay time (ZVZ) The character delay time defines the maximum permissible time interval between two characters received within a telegram. If ZVZ = 0, the module calculates the ZVZ by means of the baud rate (approx. double character time). 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
80_h	6			FA_h
Option 6, number of receive buffers				
80_h	7	Number of receive buffers	Defines the number of receive buffers. As long as only one receive buffer is used and is assigned, no more data can be received. If up to 250 receive buffers are connected, the received data can be redirected to a still free receive buffer. 1 ... 255 (01_h ... FF_h)	01_h
Option 7 ... 12, reserved				
80_h	8 ... 13	Reserved		00_h
Option 13, operating mode				
80_h	14	Operating mode	The operating mode serves to determine if the interface is operated in half duplex mode (RS485) or full duplex mode (RS422). ● 0x00: Half duplex - two-wire operation (RS485) Half duplex operation means that at a point of time data are either sent or received. The data are transmitted between the communication partners in both directions in turns. If the parameterisation is half duplex under RS485, a software data flow control is not possible. ● 0x01: Full duplex - four-wire operation (RS422) The data are exchanged simultaneously between the communication partners; transmission and reception can take place at the same time. Each communication partner must simultaneously actuate a receive path.	01_h
Option 14, cable assignment				
80_h	15	Cable assignment	For a connection with minimum reflections and the open circuit detection in RS422/485 operation, the cables can be pre-assigned via parameters with a defined idle level (see following table "Cable assignment parameters")	00_h

Cable assignment parameter		
Values	**Description**	
00_h	No pre-assignment of the receive path. This setting is only advisable for special drivers that are provided with a bus capability.	
01_h	Signal R(A) 5 V (open-circuit detection), signal R(B) 0 V Open-circuit detection is possible in full duplex operation under RS422.	
02_h	Signal R(A) 0 V, signal R(B) 5 V This pre-assignment corresponds to the idle state (no transmitter active) in half duplex operation under RS485. Open-circuit detection is not possible here.	

Parameter data STX/ETX protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
00_h	0	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
02_h	0	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
	1	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
80_h	0	Baud rate	00_h: 9600Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
	1	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 01_h: ASCII	01_h
Option 1, character frame				
80_h	2	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
			Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
			Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
			Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2/3, ZNA				
80_h	3	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
	4	ZNA (LOW byte)		00_h

Parameter data STX/ETX protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
Option 4/5, TMO				
80_h	5	TMO (HIGH byte)	TMO serves to define the maximally permissible interval between two frames. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
	6	TMO (LOW byte)		FA_h
Option 6, number of start identifiers				
80_h	7	Number of start identifiers	00_h: 1 start identifier (2nd start identifier is ignored) 01_h: 2 start identifiers	01_h
Option 7, start identifier 1				
80_h	8	Start identifier 1	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 8, start identifier 2				
80_h	9	Start identifier 2	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 9, number of end identifiers				
80_h	10	No. of end identifier	00_h: 1 end identifier (2. end identifier (0x310D/x) is ignored) 01_h: 2 end identifiers	00_h
Option 10, end identifier 1				
80_h	11	End identifier 1	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 11, end identifier 2				
80_h	12	End identifier 2	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 12, reserved				
80_h	13	Reserved		00_h
Option 13, operating mode				
80_h	14	Operating mode	The operating mode serves to determine if the interface is operated in half duplex mode (RS485) or full duplex mode (RS422). ● 0x00: Half duplex - two-wire operation (RS485) Half duplex operation means that at a point of time data are either sent or received. The data are transmitted between the communication partners in both directions in turns. If the parameterisation is half duplex under RS485, a software data flow control is not possible. ● 0x01: Full duplex - four-wire operation (RS422) The data are exchanged simultaneously between the communication partners; transmission and reception can take place at the same time. Each communication partner must simultaneously actuate a receive path.	01_h

Parameter data STX/ETX protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
Option 14, cable assignment				
80_h	15	Cable assignment	For a connection with minimum reflections and the open circuit detection in RS422/485 operation, the cables can be pre-assigned via parameters with a defined idle level (see following table "Cable assignment parameters")	00_h

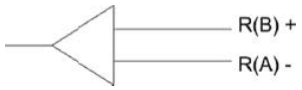
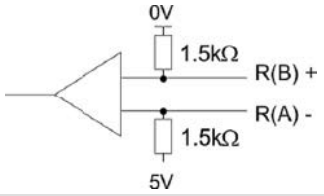
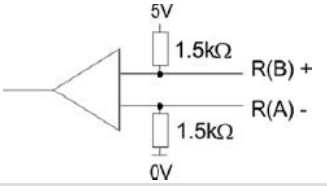
Cable assignment parameter		
Values	**Description**	
00_h	No pre-assignment of the receive path. This setting is only advisable for special drivers that are provided with a bus capability.	
01_h	Signal R(A) 5 V (open-circuit detection), signal R(B) 0 V Open-circuit detection is possible in full duplex operation under RS422.	
02_h	Signal R(A) 0 V, signal R(B) 5 V This pre-assignment corresponds to the idle state (no transmitter active) in half duplex operation under RS485. Open-circuit detection is not possible here.	

Parameter data 3964(R) protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
00_h	0	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
02_h	0	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
	1	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	

Parameter data 3964(R) protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
80_h	0	Baud rate	00_h: 9600Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
	1	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 01_h: ASCII	01_h
Option 1, character frame				
80_h	2	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
			Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
			Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
			Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2, ZNA (x 20 ms)				
80_h	3	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. The ZNA is indicated as a factor in steps of 20ms. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h

Parameter data 3964(R) protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
Option 3, ZVZ (x 20 ms)				
80_h	4	Character delay time	Character delay time (ZVZ) The character delay time defines the maximum permissible time interval between two characters received within a telegram. The ZVS is indicated as a factor in steps of 20ms. If ZVZ = 0, the module calculates the ZVZ by means of the baud rate (approx. double character time). 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
Option 4, QVZ (x 20 ms)				
80_h	5	Acknowledgement time	Acknowledgement time (QVZ) The QVZ defines the max. permissible time interval until the partner is acknowledged while establishing/terminating a connection. The QVZ is indicated as a factor in steps of 20 ms. 1 ... 255 [ms] (01_h ... FF_h)	00_h
Option 5, BWZ (x 20 ms)				
80_h	6	Block wait time	Block wait time (BWZ) The BWZ is the maximum time period between the confirmation of a request frame (DLE) and STX of the response frame. The BWZ is indicated as a factor in steps of 20 ms. 1 ... 255 [ms] (01_h ... FF_h)	FA_h
Option 6, STX (x 20 ms)				
80_h	7	STX repetitions	Maximum number of times the module attempts to establish a connection. 1 ... 255 [ms] (01_h ... FF_h)	01_h
Option 7, DBL (x 20 ms)				
80_h	8	DBL	When exceeding the block wait time (BWZ) you can specify the maximum number of repetitions for the request frame using the DBL parameter. If these attempts fail, transmission is cancelled. 1 ... 255 [ms] (01_h ... FF_h)	00_h
Option 8, priority (x 20 ms)				
80_h	9	Priority	A communication partner has high priority if its sending attempt has precedence over the partner's transmit request. In the event of low priority, it must take second place behind the partner's transmit request. With 3964(R) the priorities of both partners must be different. The following settings are possible: 00_h: LOW 01_h: HIGH	00_h
Option 9 ... 12, reserved				
80_h	10 ... 13	Reserved		00_h

Parameter data 3964(R) protocol				
Data set		Name	Description/value	Lenze
No.	Byte			
Option 13, operating mode				
80_h	14	Operating mode	The operating mode serves to determine if the interface is operated in half duplex mode (RS485) or full duplex mode (RS422). ● 0x00: Half duplex - two-wire operation (RS485) Half duplex operation means that at a point of time data are either sent or received. The data are transmitted between the communication partners in both directions in turns. If the parameterisation is half duplex under RS485, a software data flow control is not possible. ● 0x01: Full duplex - four-wire operation (RS422) The data are exchanged simultaneously between the communication partners; transmission and reception can take place at the same time. Each communication partner must simultaneously actuate a receive path.	01_h
Option 14, cable assignment				
80_h	15	Cable assignment	For a connection with minimum reflections and the open circuit detection in RS422/485 operation, the cables can be pre-assigned via parameters with a defined idle level (see following table ”Cable assignment parameters”)	00_h

Cable assignment parameter		
Values	Description	
00_h	No pre-assignment of the receive path. This setting is only advisable for special drivers that are provided with a bus capability.	
01_h	Signal R(A) 5 V (open-circuit detection), signal R(B) 0 V Open-circuit detection is possible in full duplex operation under RS422.	
02_h	Signal R(A) 0 V, signal R(B) 5 V This pre-assignment corresponds to the idle state (no transmitter active) in half duplex operation under RS485. Open-circuit detection is not possible here.	

Diagnostic data

In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

Diagnostic data - data set 01h			
Name	**Byte**	**Function**	**Default**
ERR_A	1	ERR_A-diagnostics Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error (cable break) Bit 3: Reserved Bit 4: Set in the case of a missing external supply voltage Bit 5, 6: Reserved Bit 7: Set in the case of parameterisation error	00_h
MODTYP	1	Module information Byte 0: Bit 3 ... 0: Module class (0111b: Gateway module) Bit 4: channel information available Bits 7 ... 4: 0 reserved	17_h
ERR_C	1	ERR_A-diagnostics Bit 7 ... 0: Reserved	00_h
ERR_D	1	ERR_D diagnostics Bit 3 ... 0: Reserved Bit 4: Set in the case of internal communication error Bit 7 ... 5: Reserved	00_h
CHTYP	1	Channel type Bit 7 ... 0: Reserved	00_h
NUMBIT	1	Number of diagnostic bits of the module per channel (here 08_h)	08_h
NUMCH	1	Number of channels in module Bit 7 ... 0: Reserved	00_h
CHERR	1	Bit 0: set in the event of an error of channel group 1 Bits 7 ... 1 0 (fixed)	00_h
CH0ERR	8	Channel-specific error: channel x: Bits 3 ... 0: 0 (fixed) Bit 4 : set in the case of open circuit (only possible for RS422) Bits 7 ... 5: 0 (fixed)	00_h
CH1ERR ... CH7ERR	8	Bit 7 ... 0: Reserved	00_h
DIAG_US	4	Value of µs ticker when diagnostics occur Bytes 0 ...3	00_h

9.11 Diagnostics

The comprehensive diagnostic functions of PROFIBUS-DP allow for fast fault localisation. The diagnostic data are transferred by the bus and summarised by the master. There you can access the diagnostic data e.g. with your projecting tool. The diagnostic messages created by the PROFIBUS slave have a maximum length of 122 bytes, depending on the parameterisation. As soon as the slave sends a diagnostic message to the master, 6 bytes of slave standard diagnostic data are put in front of the max. 122 bytes of diagnostic data.

Structure of diagnostic data	
Byte	**Function**
0 ... 5	Standard diagnostic data Are only put in front in the event of transfer to the master via PROFIBUS.
x ... x + 8	Identifier-related diagnostics (can be inhibited/enabled by parameterisation)
x ... x + 19	Module status (can be inhibited/enabled by parameterisation)
max. 21 × (x ... x + 2)	Channel-related diagnostics (can be inhibited/enabled by parameterisation)
x ... x + 20	Alarm (can be inhibited/enabled by parameterisation)

9.11.1 Slave standard diagnostic data

When transferring a diagnostic message to the master, the standard diagnostic data is put in front of the diagnostic bytes.

Standard diagnostic data	
Byte	**Function**
0	Bit 0: 0 (fix) Bit 1: Slave is not ready for data exchange Bit 2: Configuration data do not match Bit 3: Slave has external diagnostic data Bit 4: Slave does not support requested function Bit 5: 0 (fix) Bit 6: Wrong parameterisation Bit 7: 0 (fix)
1	Bit 0: Slave must be re-parameterised Bit 1: Statistic diagnostics Bit 2: 1 (fix) Bit 3: Response monitoring active Bit 4: ”FREEZE” command received Bit 5: ”SYNC” command received Bit 6: Reserved Bit 7: 0 (fix)
2	Bit 6 ... 0: Reserved Bit 7: Diagnostic data overflow
3	Master address after parameterisation 0xFF: Slave is without parameterisation
4	ID number of high byte
5	ID number of low byte

You can find more detailed information on the structure of standard diagnostic data in the publications of standards of the PROFIBUS user organisation.

9.11.2 Identifier-related diagnostics

The identifier-related diagnostics serve to provide you with the information at which PROFIBUS slot (module) an error has occurred. You will receive more detailed information on the error with the module status and the channel-related diagnostics. The identifier-related diagnostics can be activated by parameterisation.

Diagnostic data	
Byte	**Function**
x	Bit 5 ... 0: 0b001001 (fix): Length of the identifier-related diagnostics Bit 7 ... 6: 0b01 (fix): Code for the identifier-related diagnostics
x + 1	The bits of the modules per PROFIBUS slot are set if: ● the module is removed; ● a non-projected module is plugged; ● a module cannot be accessed; ● a module signals a diagnostic alarm. Bit 0: Input of module in PROFIBUS slot 1 ... Bit 7: Input of module in PROFIBUS slot 8
x + 2	Bit 0: Input of module in PROFIBUS slot 9 ... Bit 7: Input of module in PROFIBUS slot 16
x + 3	Bit 0: Input of module in PROFIBUS slot 17 ... Bit 7: Input of module in PROFIBUS slot 24
x + 4	Bit 0: Input of module in PROFIBUS slot 25 ... Bit 7: Input of module in PROFIBUS slot 32
x + 5	Bit 0: Input of module in PROFIBUS slot 33 ... Bit 7: Input of module in PROFIBUS slot 40
x + 6	Bit 0: Input of module in PROFIBUS slot 41 ... Bit 7: Input of module in PROFIBUS slot 48
x + 7	Bit 0: Input of module in PROFIBUS slot 49 ... Bit 7: Input of module in PROFIBUS slot 56
x + 8	Bit 0: Input of module in PROFIBUS slot 57 ... Bit 7: Input of module in PROFIBUS slot 64

9.11.3 Module status

The module status serves to give you more detailed information on the error which has occurred in a module. The module status can be activated by parameterisation.

Diagnostic data	
Byte	**Function**
x	Bit 5 ... 0: 0b001001 (fix): Length of the module status Bit 7 ... 6: 0b01 (fix): Code for the module status
x + 1	0x82 (fix): Status type of the module status
x + 2	0x00 (fix)
x + 3	0x00 (fix)
x + 4	The following errors are specified for PROFIBUS slot 1 ... 64: ● 0b00: Module has valid data ● 0b01: Module error - invalid data (module defective) ● 0b10: Wrong module - invalid data ● 0b11: No module plugged - invalid data Bit 1, 0: Module status module in PROFIBUS slot 1 Bit 3, 2: Module status module in PROFIBUS slot 2 Bit 5, 4: Module status module in PROFIBUS slot 3 Bit 7, 6: Module status module in PROFIBUS slot 4
x + 5	Bit 1, 0: Module status module in PROFIBUS slot 5 Bit 3, 2: Module status module in PROFIBUS slot 6 Bit 5, 4: Module status module in PROFIBUS slot 7 Bit 7, 6: Module status module in PROFIBUS slot 8
x + 6	Bit 1, 0: Module status module in PROFIBUS slot 9 Bit 3, 2: Module status module in PROFIBUS slot 10 Bit 5, 4: Module status module in PROFIBUS slot 11 Bit 7, 6: Module status module in PROFIBUS slot 12
x + 7	Bit 1, 0: Module status module in PROFIBUS slot 13 Bit 3, 2: Module status module in PROFIBUS slot 14 Bit 5, 4: Module status module in PROFIBUS slot 15 Bit 7, 6: Module status module in PROFIBUS slot 16
x + 8	Bit 1, 0: Module status module in PROFIBUS slot 17 Bit 3, 2: Module status module in PROFIBUS slot 18 Bit 5, 4: Module status module in PROFIBUS slot 19 Bit 7, 6: Module status module in PROFIBUS slot 20
x + 9	Bit 1, 0: Module status module in PROFIBUS slot 21 Bit 3, 2: Module status module in PROFIBUS slot 22 Bit 5, 4: Module status module in PROFIBUS slot 23 Bit 7, 6: Module status module in PROFIBUS slot 24
x + 10	Bit 1, 0: Module status module in PROFIBUS slot 25 Bit 3, 2: Module status module in PROFIBUS slot 26 Bit 5, 4: Module status module in PROFIBUS slot 27 Bit 7, 6: Module status module in PROFIBUS slot 28
x + 11	Bit 1, 0: Module status module in PROFIBUS slot 29 Bit 3, 2: Module status module in PROFIBUS slot 30 Bit 5, 4: Module status module in PROFIBUS slot 31 Bit 7, 6: Module status module in PROFIBUS slot 32
x + 12	Bit 1, 0: Module status module in PROFIBUS slot 33 Bit 3, 2: Module status module in PROFIBUS slot 34 Bit 5, 4: Module status module in PROFIBUS slot 35 Bit 7, 6: Module status module in PROFIBUS slot 36
x + 13	Bit 1, 0: Module status module in PROFIBUS slot 37 Bit 3, 2: Module status module in PROFIBUS slot 38 Bit 5, 4: Module status module in PROFIBUS slot 39 Bit 7, 6: Module status module in PROFIBUS slot 40

Diagnostic data	
Byte	**Function**
x + 14	Bit 1, 0: Module status module in PROFIBUS slot 41 Bit 3, 2: Module status module in PROFIBUS slot 42 Bit 5, 4: Module status module in PROFIBUS slot 43 Bit 7, 6: Module status module in PROFIBUS slot 44
x + 15	Bit 1, 0: Module status module in PROFIBUS slot 45 Bit 3, 2: Module status module in PROFIBUS slot 46 Bit 5, 4: Module status module in PROFIBUS slot 47 Bit 7, 6: Module status module in PROFIBUS slot 48
x + 16	Bit 1, 0: Module status module in PROFIBUS slot 49 Bit 3, 2: Module status module in PROFIBUS slot 50 Bit 5, 4: Module status module in PROFIBUS slot 51 Bit 7, 6: Module status module in PROFIBUS slot 52
x + 17	Bit 1, 0: Module status module in PROFIBUS slot 53 Bit 3, 2: Module status module in PROFIBUS slot 54 Bit 5, 4: Module status module in PROFIBUS slot 55 Bit 7, 6: Module status module in PROFIBUS slot 56
x + 18	Bit 1, 0: Module status module in PROFIBUS slot 57 Bit 3, 2: Module status module in PROFIBUS slot 58 Bit 5, 4: Module status module in PROFIBUS slot 59 Bit 7, 6: Module status module in PROFIBUS slot 60
x + 19	Bit 1, 0: Module status module in PROFIBUS slot 61 Bit 3, 2: Module status module in PROFIBUS slot 62 Bit 5, 4: Module status module in PROFIBUS slot 63 Bit 7, 6: Module status module in PROFIBUS slot 64

9.11.4 Channel-related diagnostics

The channel-related diagnostics serve to provide you with detailed information on channel errors within a module. The diagnostic alamr of each module must be enabled by parameterisation in order to use the channel-related diagnostics. The channel-related diagnostics can be activated by parameterisation.

Note!

The maximum number of channel-related diagnostic messages is limited by the max. overall length of 122 bytes. By deactivating other diagnostic areas, you can release these areas for further channel-related diagnostic messages. 3 bytes each are used per channel.

Diagnostic data for a channel	
Byte	**Function**
x	Bit 5 ... 0: 0b001001 (fix): ● 0b000000 ... 0b111111: ID number of the module which provides the channel-related diagnostics ● PROFIBUS slot 1 has the ID number ”0” ... ● PROFIBUS slot 64 has the ID number ”63” Bit 7 ... 6: 0b01 (fix): ● 0b10 (fix): Code for the channel-related diagnostics
x + 1	Bits 5 ... 0: ● 0b000000 .... 0b111111: Number of the channel or channel group which provides the diagnostics Bit 7, 6: Module type ● 0b01: Input module ● 0b10: Output module ● 0b11: Input/output module
x + 2	Bit 4 ... 0: Error type according to PROFIBUS standard ● 0b00001: Short circuit ● 0b00010: Undervoltage (supply voltage) ● 0b00011: Overvoltage (supply voltage) ● 0b00100: Output module is overloaded ● 0b00101: Output module overtemperature ● 0b00110: Cable break of sensor or actuator ● 0b00111: Upper limit value exceeded ● 0b01000: Lower limit value exceeded ● 0b01001: Error (load voltage at output, encoder supply, hardware error of the module) Bit 4 ... 0: Manufacturer-specific error type ● 0b10000: Parameterisation error ● 0b10001: Module-specific error ● 0b10010: Fuse defective ● 0b10100: Grounding error ● 0b10101: Reference channel error ● 0b10110: Process alarm lost ● 0b11001: Safety-oriented switch-off ● 0b11010: External error ● 0b11010: Unclear error (not specifiable) Bit 7 ... 5: Channel type ● 0b001: Bit ● 0b010: 2 bits ● 0b011: 4 bits ● 0b100: Byte ● 0b101: Word ● 0b110: 2 words

9.11.5 Alarms

The alarm part of the slave diagnostic message provides information on the alarm type and the cause which has tripped an alarm. The alarm part consists of a maximum of 24 bytes. Per slave diagnostic message, a maximum of 1 alarm can be reported. If activated in the parameterisation, the alarm part is always added to the diagnostic message as the last part.

Structure of the alarm part, depending on the alarm type	
Byte	**Function**
x ... x + 3	**Alarm status** Contains information on the alarm type.
x + 4 ... x + 20	**Diagnostic alarm** The 20 bytes correspond to data set 1 of the CPU diagnostics.
x + 4 ... x + 7	**Process alarm** The 4 bytes are module-specific and described with the respective module.

Alarm status

If there is a diagnostic result for channel/channel group 0 of a module, there may also be a module error in addition to a channel error. In this case an entry is made even if you have not enabled the diagnostics for channel/channel group 0 of the module.

Structure of the alarm status – byte x ... x + 3	
Byte	**Function**
x	Bits 5 ... 0: ● 0b010100: Length of the alarm part incl. byte x Bit 7 ... 6: ● 0b00 (fix): Code for device-related diagnostics
x + 1	Bit 6 ... 0: Alarm type ● 0b0000001: Diagnostic alarm ● 0b0000010: Process alarm Bit 7: Code for alarm
x + 2	Bit 7 ... 0: ● 0b00000000 ... 0b00111111: ID number of the module which provides the alarm ● PROFIBUS slot 1 has the ID number ”0” ... ● PROFIBUS slot 64 has the ID number ”63”
x + 3	Bit 1, 0: Alarm type ● 0b00: Process alarm ● 0b01: Diagnostic alarm coming ● 0b10: Diagnostic alarm going ● 0b11: reserved Bit 2: ● 0 (fixed) Bit 7 ... 3: Alarm sequence number 0 ... 31 ● 0b00000 ... 0b11111

Diagnostic alarm

Structure of the diagnostic alarm – byte x + 4 ... x + 20	
Byte	**Function**
x + 4	● Bit 0: Module fault, i.e. an error has been detected ● Bit 1: Internal error in the module ● Bit 2: External error (module no longer addressable) ● Bit 3: Channell error in the module ● Bit 4: External supply voltage missing ● Bit 5, 6: reserved ● Bit 7: Parameterisation error
x + 5	Bit 3 ... 0: Module class ● 0b1111: Digital module ● 0b0101: Analog module ● 0b1000: FM ● 0b0111: ETS, CP Bit 4: Channel information available Bit 7 ... 5: ● 0 (fixed)
x + 6	see module description
x + 7	Bit 5 ... 0: Reserved ● Bit 6: Process alarm lost ● Bit 7: reserved
x + 8	Channel type ● 0x70: Module with digital inputs ● 0x71: Module with analog inputs ● 0x72: Module with digital outputs ● 0x73: Module with analog outputs ● 0x74: Module with analog inputs and outputs ● 0x76: Counter
x + 9	Number of diagnostic bits per channel
x + 10	Number of channels per module
x + 11	Position (channel) of the diagnostic event
x + 12	Diagnostic result for channel/channel group 0 Assignment see module description
...	...
x + 19	Diagnostic result for channel/channel group 7 Assignment see module description
x + 20	µs ticker (4 bytes) Value of µs ticker when diagnostic alarm occurs

Process alarm

You can find more detailed information on the diagnostic data of a process alarm (bytes x + 4 to x + 7) in the corresponding module description.

10 EtherCAT communication

Note!

In conjunction with the EPM-S130 bus coupler module (EtherCAT), only I/O compound modules EPM-Sxxx from hardware version 1B on are supported.

10.1 About EtherCAT

EtherCAT (**Ether**net for **C**ontroller and **A**utomation **T**echnology) is an Ethernet-based fieldbus system which complies with the application profile for the field of industrial real-time systems. In contrast to the classic Ethernet communication, the I/O data in full duplex operation are exchanged with 100 MBit/s. By this, the telegrams are delayed in the µs-range.

The EtherCAT protocol optimised for process data is transported directly in the Ethernet telegram, which, in turn, can consist of several subtelegrams, each operating a memory area of the process image.

As each EtherCAT gateway is provided with a clear address (MAC address), the data-related order is irrespective of the physical order of the EtherCAT gateway in the network.

10.1.1 EtherCAT frame

EtherCAT frames have the following structure:

Ethernet header			Ethernet data				FCS
48 bits	48 bits	16 bits	11 bits	1 bit	4 bits	48 ... 1498 bytes	32 bits
Destination	Source	EtherType	Header			Datagrams	
			Length	Reserved	Type		

Ethernet header

The Ethernet header contains the following information:

- Target address of the EtherCAT frame (destination)
- Source address of the EtherCAT frame (source)
- Type of the EtherCAT frame (EtherType)

Ethernet data

The Ethernet data contain the following information:

- Length of the datagrams within the EtherCAT frame (length)
- One reserved bit
- Type of the datagrams within the Ether-CAT frame (type)
- Datagrams

FCS

- Checksum of the EtherCAT frame

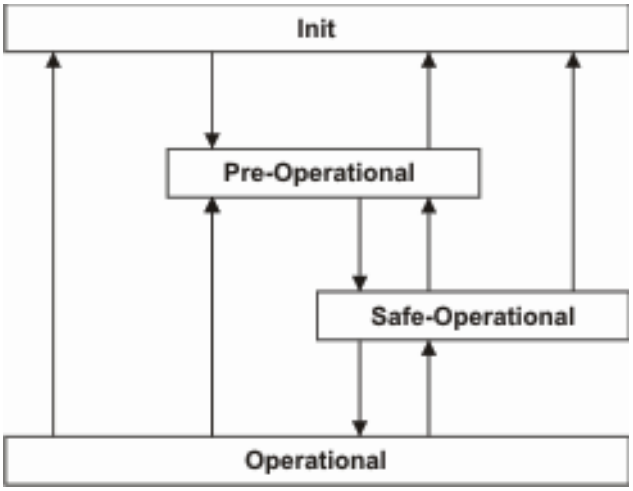
10.1.2 EtherCAT datagrams

EtherCAT datagrams have the following structure:

Header	Data	WKC
10 bits	Max. 1486 bytes	2 bytes WKC = Working Counter

10.1.3 EtherCAT state machine

Each fieldbus node is led through a state machine by the master. The state changes of the bus are shown in the following illustration.



Status	Description
Init	● No communication on the ”Application layer” ● The master has access to the ”DL information register”.
Pre-operational	● Mailbox communication on the ”Application layer” ● No process data communication
Safe-operational	● Mailbox communication on the ”Application layer” ● Process data communication (Only the inputs are evaluated; the outputs are in the ”Safe” status.)
Operational	● Inputs and outputs are evaluated.

10.2 Transmitting process data

EtherCAT transfers parameter data and process data between master and slaves, which, depending on their time-critical behaviour, are divided into corresponding communication channels.

The process data are transferred via the process data channel using so-called ”datagrams”.

- The process data serve to control the I/O channels.
- The transmission of process data is time-critical.
- Process data is cyclically transferred between the host system and the I/O system (permanent exchange of current input data and output data).
- The master can directly access the process data. In the PLC, for instance, the data are directly stored in the I/O area.
- Process data are not saved in the I/O system.
- Process data are input data and output data, for instance, of the I/O system.

Note!

With regard to their direction, process data telegrams between the master and the EtherCAT bus coupler modules that are part of the bus are differentiated into:

- process data telegrams from EtherCAT bus coupler module (Tx data)
- process data telegrams to EtherCAT bus coupler module (Rx data)

Note!

The process data size of the I/O area is described by XML device description files.

Import the following two files via an EtherCAT configurator for this purpose:

EtherCAT bus coupler module: Lenze_IOSystem1000_EPM_S130.xml

I/O compound module: Lenze_IOSystem1000_EPM_S130_Modules.xml

10.2.1 PDO mapping

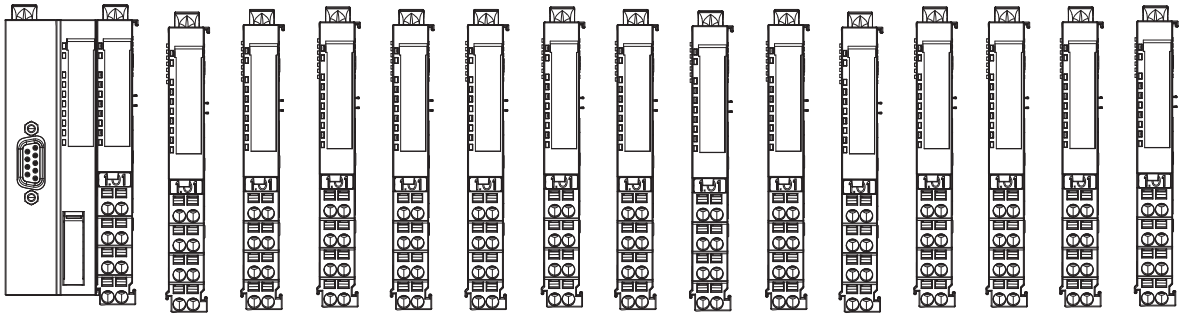
The PDO mapping differs depending on the motion control to be configured:

Drive-based automation (decentralised, with intelligent controllers)	Controller-based automation (with a central control)
• Direct data exchange between the IO system and the controller without a master control. Configuration with L-force Engineer	• Direct data exchange between the IO system and the control (IPC). Configuration via L-force PLC Designer
• Static PDO mapping (default setting)	• Free mapping by means of a bus configurator (e.g. PLC Designer)
• Up to 10 RPDOs and TPDOs can be used	• Up to 16 RPDOs and TPDOs can be used

The following representation describes the static PDO mapping (Drive-based automation) by means of an example station structure:

Installation

Module



	Bus coupler EPM-S1xx	2 x DI	8 x DI	4 × DI	2 × DI	8 × DI	8 × DI	8 × DI	8 × DI	2 × DI	8 × DI	2 x AI	4 x AI	8xDO	2 x DO
No.	**M0**	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**	**M11**	**M12**	**M13**	**M14**

n x DI I/O compound module with n digital inputs
n x DO I/O compound module with n digital outputs
n x AI I/O compound module with n analog inputs
n x AO I/O compound module with n analog outputs

Process image			Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
PDO1	Permanent for the first DI or DO	RPDO1	M13	M14	–	–	–	–	–	–
		TPDO1	M1	M2	M3M4	M5	M6	M7	M8	M9
PDO2	Permanent for the first AI or AO	RPDO2	–	–	–	–	–	–	–	–
		TPDO2	M11	M11	M11	M11	M12	M12	M12	M12
PDO3	DI/DO, DI/DO TimeStamp, DO PWM, AI/AO, counter, SSI, RS232, RS422/RS485	RPDO3	–	–	–	–	–	–	–	–
		TPDO3	M12	M12	M12	M12	–	–	–	–
PDO4	DI/DO, DI/DO TimeStamp, DO PWM, AI/AO, counter, SSI, RS232, RS422/RS485	RPDO4	–	–	–	–	–	–	–	–
		TPDO4	M10	–	–	–	–	–	–	–
...	...	...								
PDO10	DI/DO, DI/DO TimeStamp, DO PWM, AI/AO, counter, SSI, RS232, RS422/RS485	RPDO10	–	–	–	–	–	–	–	–
		TPDO10	–	–	–	–	–	–	–	–

The following rules for assigning the PDO apply in accordance with the CANopen communication profile DS401:

- RPDO1 is reserved for the first I/O compound modules with digital inputs.
- TPDO1 is reserved for the first I/O compound modules with digital outputs.
- RPDO2 is reserved for the first I/O compound modules with analog inputs.
- TPDO2 is reserved for the first I/O compound modules with analog outputs.
- As of PDO3: a PDO can only be occupied by electronic modules of one module class. Free bytes are reserved for modules of the same module class.

  Sorting sequence for module classes:
  - Digital inputs and outputs (EPM-S200 to EPM-S206, EPM-S300 to EPM-S309)
  - Analog inputs and outputs (EPM-S400 to EPM-S503)
  - Counter (EPM-S600 to EPM-S603)
  - SSI encoder (EPM-S604)
  - Digital outputs with pulse width modulation (EPM-S620)
  - Interfaces RS232 and RS422/RS485 (EPM-S640/EPM-S650)
  - Digital outputs with time stamp functionality (EPM-S310)
  - Digital inputs with time stamp functionality (EPM-S207)

Note!

In order to ensure data consistency, the data in the PDO are mapped as follows:

- Digital I/O:

  With digital values, an I/O compound module is always mapped in one byte. If a byte in a PDO does not have enough free bits, the I/O compound module is mapped in the next byte.
- Analog I/O:

  In the case of analog values the data lengths of which exceed one byte, the data consistency is extended. Since one channel assigns two bytes, each channel of an I/O compound module is mapped in two successive PDOs.

10.2.2 PDO mapping for I/O compound modules with a serial interface

Mapping for I/O compound modules with a serial interface (EPM-S640, EPM-S650) starts at PDO 3.

Default mapping

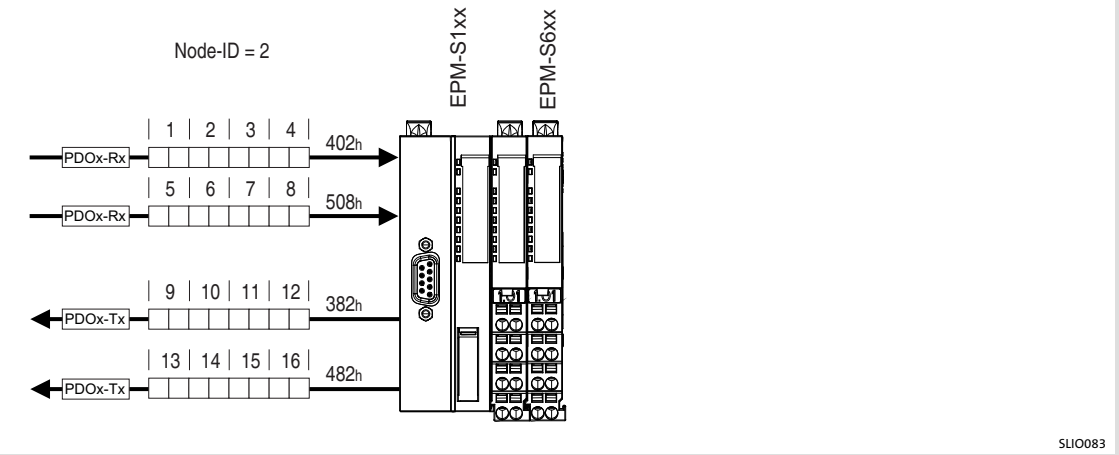


Fig. 10-1 Mapping contents

Word	EPM-S640, EPM-S650
1	Rx byte 0 ... 1
2	Rx byte 2 ... 3
3	Rx byte 4 ... 5
4	Rx byte 6 ... 7
5	–
6	–
7	–
8	–
9	Tx byte 0 ... 1
10	Tx byte 2 ... 3
11	Tx byte 4 ... 5
12	Tx byte 6 ... 7
13	–
14	–
15	–
16	–

10.2.3 PDO mapping for I/O compound modules with time stamp function

Mapping for I/O compound modules with a time stamp function begins at PDO 3.

Default mapping

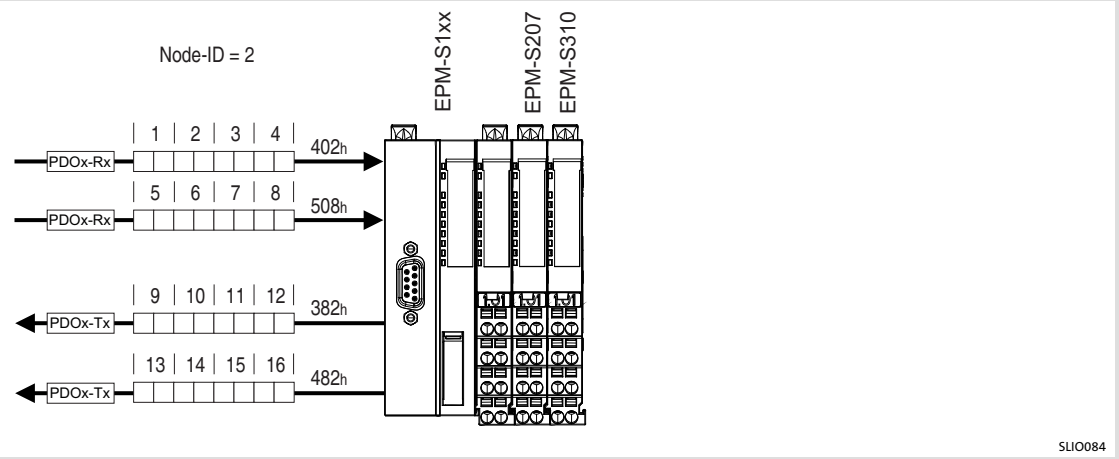


Fig. 10-2 Mapping contents

Word	EPM-S207	EPM-S310
1	–	Ticker value DO1
2	–	Running number Channel status DO1
3	–	Ticker value DO2
4	–	Running number Channel status DO2
5	–	–
6	–	–
7	–	–
8	–	–
9	Ticker value DI1	Status of FIFO memory
10	Running number Channel status DI1	
11	Ticker value DI2	–
12	Running number Channel status DI2	–
13	–	–
14	–	–
15	–	–
16	–	–

Ticker value EPM-S207 and EPM-S310		
Bit	**Designation**	**Function**
0 ... 15	Ticker value	After mains connection, a timer (µs ticker) is started, which after 65535 µs starts with 0 again.

Running number, channel status EPM-S207		
Bit	**Name**	**Function**
0 ... 7	Running number (RN)	Counter which counts from 0 ... 63 and then goes back to 0. During the first run, the running number must start with 1.
8	Channel status DI1	0: FALSE 1: TRUE
9	Channel status DI2	0: FALSE 1: TRUE
10 ... 15	–	Reserved (fix 0)

Running number, channel status EPM-S310		
Bit	**Name**	**Function**
0 ... 7	Running number (RN)	Counter which counts from 0 ... 63 and then goes back to 0. During the first run, the running number must start with 1.
8 ... 11	–	Reserved (fix 0)
12	Enable DO1	0: inhibit 1: enable
13	Enable DO2	
14	Channel status DO1	0: FALSE 1: TRUE
15	Channel status DO2	0: FALSE 1: TRUE

Status of FIFO memory for EPM-S310		
Bit	**Designation**	**Function**
0 ... 5	RN-LAST	Running number of the time stamp entry last detected as valid by the module and written into the FIFIO memory.
6		1 (fix); is used for identification in the process image
7		0 (fix); is used for identification in the process image
8 ... 13	RN_NEXT	Running number of the time stamp entry to be processed next in the FIFO memory.
14		1 (fix); is used for identification in the process image
15		1 (fix); is used for identification in the process image
16 ... 23	STS_FIFO	Status information of FIFO memory ● 00_h or 80_h: Everything is OK; you will receive this message directly after the acceptance into the FIFO memory of the module. ● 01_h or 81_h: No follow-up entry available; the running number does not correspond to the expected running number. Check the running number in the output area. ● 02_h or 82_h: No new entries available in the FIFO memory. ● 03h or 83h: FIFO memory full. No new entries possible. A full memory will not accept any more time stamp entries. Perform a status query to establish the FIFO memory's status before transferring more time stamp entries. **Note:** If less than possible time stamp entries are written, bit 6 must be set in the running number (RN) of the last time stamp entry. This is required in order to not write the follow-up entries as "invalid" since the module ignores all time stamp entries after an entry with a set RN bit 6. If a time stamp entry with a running number and a set bit 6 is in the FIFO memory, STS_FIFO with 80_h is returned in an OR-ed manner.
24 ... 31	–	Current number of time stamp entries in FIFO memory.

10.2.4 PDO mapping for I/O compound modules with PWM function

Mapping for I/O compound modules with a PWM function begins at PDO 3.

Default mapping

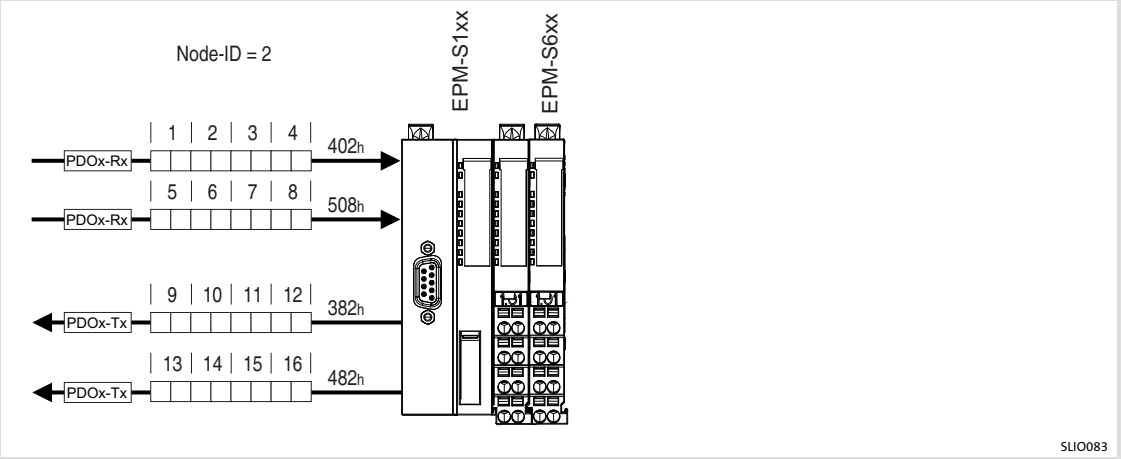


Fig. 10-3 Mapping contents

Word	EPM-S620
1	Pulse duration DO1
2	
3	Pulse duration DO2
4	
5	Control word DO1
6	Control word DO2
7	–
8	–
9	Status word DO1
10	Status word DO2
11	–
12	–
13	–
14	–
15	–
16	–

Information on the structure of the control word and the status word 📖 242.

10.2.5 PDO mapping for counters and encoder evaluation

The mapping for counters starts at PDO 3, since the first two PDOs are reserved for digital and analog modules.

The following table describes the indices for the PDO mapping for counters.

Index	Name	Possible settings				Important	
		Lenze	Selection				
I5400$_h$ ↲	Counter Value		00000000$_h$	{1$_h$}	FFFFFFFF$_h$	Count value	📖 529
1	DWord 1					EPM-S600/-S602: Subindex is increased by 1 for each counter EPM-S601/-S603: Subindex is increased by 2 for each counter	
2	DWord 2						
...	...						
64	DWord 64						
I5401$_h$ ↲	Latch value		00000000$_h$	{1}	FFFFFFFF$_h$	Latch value	📖 529
1	DWord 1					EPM-S600: Subindex is increased by 1 for each counter EPM-S601/-S602/-S603: without function	
2	DWord 2						
...	...						
64	DWord 64						
I5402$_h$ ↲	Status word		0000$_h$	{1}	FFFF$_h$	Status word	📖 529
1	DWord 1					EPM-S600/-S602: Subindex is increased by 1 for each counter EPM-S601/-S603: Subindex is increased by 2 for each counter	
2	DWord 2						
...	...						
64	DWord 64						
I5403$_h$ ↲	Counter ticker value		0000$_h$	{1}	FFFF$_h$	Ticker value	📖 529
1	DWord 1					EPM-S600/-S602: Subindex is increased by 1 for each counter EPM-S601/-S603: without function	
2	DWord 2						
...	...						
64	DWord 64						
I5600$_h$ ↲	Counter Compare Value		00000000$_h$	{1}	FFFFFFFF$_h$	Comparison value	📖 529
1	DWord 1					EPM-S600/-S602: Subindex is increased by 1 for each counter EPM-S601: Subindex is increased by 2 for each counter EPM-S603: without function	
2	DWord 2						
...	...						
64	DWord 64						
I5601$_h$ ↲	Counter Set Value		00000000$_h$	{1}	FFFFFFFF$_h$	Set value	📖 529
1	DWord 1					EPM-S600/-S602: Subindex is increased by 1 for each counter EPM-S601/-S603: without function	
2	DWord 2						
...	...						
64	DWord 64						
I5602$_h$ ↲	Counter Control Word		0000$_h$	{1}	FFFF$_h$	Control word	
1	DWord 1					EPM-S600/-S602: Subindex is increased by 1 for each counter EPM-S601/-S603: Subindex is increased by 2 for each counter	📖 529
2	DWord 2						
...	...						
64	DWord 64						

Default mapping

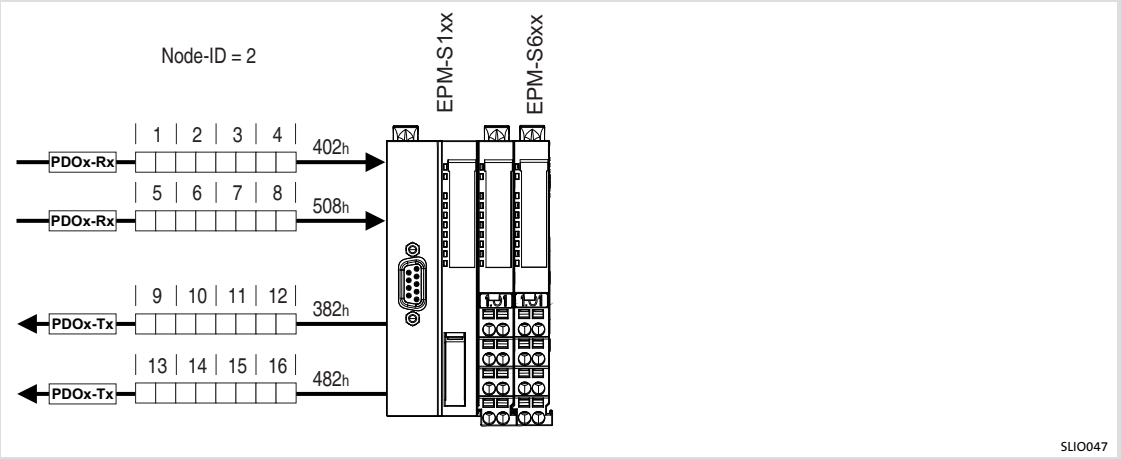


Fig. 10-4 Mapping contents

Word	EPM-S600	EPM-S601	EPM-S602	EPM-S603	EPM-S604
1	Comparison value	Comparison value C1	Comparison value	Control word C1	-
2				Control word C2	
3	Set value	Comparison value C2	Set value	-	
4					
5	Control word	Control word C1	Control word		
6	-	Control word C2	-		
7		-			
8					
9	Count value	Count value C1	Count value	Count value C1	Encoder value
10					
11	Latch value	Count value C2	Status word	Count value C2	Ticker value
12			Ticker value		
13	Status word	Status word C1	-	Status word C1	-
14	Ticker value	Status word C2		Status word C2	
15	-	-		-	
16					

Comparison value: Here you can select a value which, by comparison with the current counter content, can impact the counter output or trigger a process alarm. The response of the output or the process alarm can be parameterised.

Set value: With an edge change 0-1 of *COUNTERVAL_SET* in the control word, the set value is accepted in the counter.

Count value: Current counter content

Latch value: If there is a positive edge at the latch input, the count value is stored here.

Ticker value: After mains connection a timer (µs ticker) is started, which after 65535 µs starts with 0 again. With every change of the count value the time value of the timer is stored as 16-bit µs value together with the count value in the input area.

Information on the structure of the control word and the status word 📖 229.

10.2.6 Access to the I/O area

SDO access can be used for read-only access to the object directory's input and output data.

Input data

When accessing the input area of an I/O compound module, addressing takes place via index 0x6000 + EtherCAT slot no. Subindexes give you access to the corresponding input data. The relevant module description contains the subindex assignment.

Index	Subindex	Name	Type	Attr.	Default	Meaning
0x6000 ... 0x603F	0x00	Input data	Unsigned8	ro		Number of input data subindexes for the corresponding EtherCAT slot no.
	0x01 0x02 ...			ro ro		Input data (see module description)

Output data

During read-only access to the output area of an I/O compound module, addressing takes place via index 0x7000 + EtherCAT slot no. Subindexes give you read-only access to the corresponding output data. The relevant module description contains the subindex assignment.

Index	Subindex	Name	Type	Attr.	Default	Meaning
0x7000 ... 0x703F	0x00	Output data	Unsigned8	ro		Number of output data subindexes for the corresponding EtherCAT slot no.
	0x01 0x02 ...			ro ro		Output data (see module description)

10.3 Transmitting parameter data

Note!

Parameter data can be transferred from the EtherCAT master to the EtherCAT bus coupler module EPM-S130 (slave). Once the EtherCAT master has been started, the data is transferred to the bus coupler module where the settings are accepted after the change from ”Pre-operational” operating mode to ”Operational”.

EtherCAT transfers parameter data and process data between the master and the bus coupler modules, which, depending on their time-critical behaviour, are divided into corresponding communication channels.

Parameter data (SDOs, service data objects) are transmitted via the SDO channel.

- Access to all indexes with CoE (CAN over EtherCAT) is enabled via the SDO channel.
- The transfer of parameter data is not normally time-critical.
- Parameter data corresponds to the indexes of the index list for the EtherCAT bus coupler module

Establishment of connection between the master and slave

Basically a master can always request parameter tasks from a slave if the slave is at least in the ”Pre-operational” state.

Acyclic data transmission

Parameters ...

- are values which are stored under an index in the Lenze I/O system.
- for instance are used if the system is set once or if material is changed within a machine.
- are transmitted with a low priority.

10.4 General function of the parameter setting

Parameterise I/O compound modules using SDO transfer.

Addressing takes place via index 0x3100 + EtherCAT slot no. Subindexes give you access to the corresponding parameters. The relevant module description contains the subindex assignment.

Index	Subindex	Name	Type	Attr.	Meaning
0x3100 ... 0x313F	0x00	Parameter	Unsigned8	ro	Number of input data subindexes for the corresponding EtherCAT slot no.
	0x01 0x02 ...	Param1 Param2		ro/rw ro/rw	Parameter data (see module description)

If the module is parameterisable, the following applies:

Index 0x3100: access to EtherCAT slot no. 1

Index 0x3101: access to EtherCAT slot no. 2

...

Index 0x313F: access to EtherCAT slot no. 64

The following example shows access to the parameters of the module in slot 4 via index 0x3103.

Phy. slot	1	2	3	4
Module	DI	DI	DO	AI
Index	0x3100*	03101*	0x3102*	0x3103
EtherCAT slot no.	1	-	2	3

* This entry is not executed because the module is not parameterisable.

10.5 Setting the parameters of analog I/O

10.5.1 2 analog inputs 0 ... 10 V (12 bits) - EPM-S400

Parameter data

Subindex	Name	Description/value	Lenze
01	Function channel 1	16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
02	Function channel 2		20_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	

10.5.2 4 analog inputs 0 ... 10 V (12 bits) - EPM-S401

Parameter data

Subindex	Name	Description/value	Lenze
01	Function channel 1	16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
02	Function channel 2		20_h
03	Function channel 3		20_h
04	Function channel 4		20_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	

10.5.3 2 analog inputs 0/4 ... 20 mA (12 bits) - EPM-S402

Parameter data

Subindex	Name	Description/value	Lenze
01	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	31_h
02	Function channel 2		31_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

10.5.4 4 analog inputs 0/4 ... 20 mA (12 bits) - EPM-S403

Parameter data

Subindex	Name	Description/value	Lenze
01	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	31_h
02	Function channel 2		31_h
03	Function channel 3		31_h
04	Function channel 4		31_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

10.5.5 2 analog inputs -10 ... +10 V (16 bits) - EPM-S406

Parameter data

Subindex	Name	Description/value	Lenze
01	Diagnostics	Bits 0 ... 5: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
02	Reserved	0	
03	Limit value monitoring	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 (0 = deactivated; 1 = activated) Bits 7 ... 2: Reserved	00_h
04	Interference frequency suppression	Bit 1, 0: Channel 1 00: Deactivated 01: 60 Hz 10: 50 Hz Bit 3, 2: Channel 2 00: Deactivated 01: 60 Hz 10: 50 Hz Bits 7 ... 4: Reserved	00_h
05	Function channel 1	12 (12_h): -10 ... 10 V / -27648 ... 27648_{dec} 34 (22_h): -10 ... 10 V / -16384 ... 16384_{dec} 16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
06	Reserved	0	
07	Upper limit value channel 1	Value from the rated range; if this value is exceeded and the limit value monitoring function is active, a process alarm is triggered. $7FFF_h$: Limit value alarm deactivated	$7FFF_h$
08	Lower limit value channel 1	Value from the rated range; if the actual value falls below this value and the limit value monitoring function is active, a process alarm is triggered. 8000_h: Limit value alarm deactivated	8000_h
09	Function channel 2	12 (12_h): -10 ... 10 V / -27648 ... 27648_{dec} 34 (22_h): -10 ... 10 V / -16384 ... 16384_{dec} 16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
0A	Reserved	0	
0B	Upper limit value channel 2	Value from the rated range; if this value is exceeded and the limit value monitoring function is active, a process alarm is triggered. $7FFF_h$: Limit value alarm deactivated	$7FFF_h$
0C	Lower limit value channel 2	Value from the rated range; if the actual value falls below this value and the limit value monitoring function is active, a process alarm is triggered. 8000_h: Limit value alarm deactivated	8000_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
-10 ... +10 V (12_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	0	0000		
	-5	-13824	CA00		
	-10	**-27648**	9400		
	-11.76	-32512	8100	Underflow	
-10 ... +10 V (22_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	0	0000		
	-5	-8192	E000		
	-10	**-16384**	C000		
	-12.5	-20480	B000	Underflow	
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	0	0000		
	-1.76	-4864	ED00	Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	-2	-3277	F333	Underflow	

10.5.6 2 analog inputs 0/4 ... 20 mA (16 bits) - EPM-S408

Parameter data

Subindex	Name	Description/value	Lenze
01	Diagnostics	Bits 0 ... 5: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
02	Reserved	0	
03	Limit value monitoring	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 (0 = deactivated; 1 = activated) Bits 7 ... 2: Reserved	00_h
04	Interference frequency suppression	Bit 1, 0: Channel 1 00: Deactivated 01: 60 Hz 10: 50 Hz Bit 3, 2: Channel 2 00: Deactivated 01: 60 Hz 10: 50 Hz Bits 7 ... 4: Reserved	00_h
05	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	41_h
06	Reserved	0	
07	Upper limit value channel 1	Value from the rated range; if this value is exceeded and the limit value monitoring function is active, a process alarm is triggered. $7FFF_h$: Limit value alarm deactivated	$7FFF_h$
08	Lower limit value channel 1	Value from the rated range; if the actual value falls below this value and the limit value monitoring function is active, a process alarm is triggered. 8000_h: Limit value alarm deactivated	8000_h
09	Function channel 2	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	41_h
0A	Reserved	0	
0B	Upper limit value channel 2	Value from the rated range; if this value is exceeded and the limit value monitoring function is active, a process alarm is triggered. $7FFF_h$: Limit value alarm deactivated	$7FFF_h$
0C	Lower limit value channel 2	Value from the rated range; if the actual value falls below this value and the limit value monitoring function is active, a process alarm is triggered. 8000_h: Limit value alarm deactivated	8000_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

10.5.7 2 analog outputs 0 ... 10 V (12 bits) - EPM-S500

Parameter data

Subindex	Name	Description/value	Lenze
01	Reserved	0	
02	Short-circuit detection	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 Bits 2 ... 7: Reserved	00_h
03	Function channel 1	16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
04	Function channel 2		20_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Output area (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	

10.5.8 4 analog outputs 0 ... 10 V (12 bits) - EPM-S501

Parameter data

Subindex	Name	Description/value	Lenze
01	Reserved	0	
02	Short-circuit detection	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 Bit 2: Channel 3 Bit 3: Channel 4 Bits 4 ... 7: Reserved	00_h
03	Function channel 1	16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
04	Function channel 2		20_h
05	Function channel 3		20_h
06	Function channel 4		20_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Output area (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	

10.5.9 2 analog outputs 0/4 ... 20 mA (12 bits) - EPM-S502

Parameter data

Subindex	Name	Description/value	Lenze
01	Reserved	0	
02	Wire-breakage detection	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 Bits 2 ... 7: Reserved	00_h
03	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	31_h
04	Function channel 2		31_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

10.5.10 4 analog outputs 0/4 ... 20 mA (12 bits) - EPM-S503

Parameter data

Subindex	Name	Description/value	Lenze
01	Reserved	0	
02	Wire-breakage detection	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 Bit 2: Channel 3 Bit 3: Channel 4 Bits 4 ... 7: Reserved	00_h
03	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	31_h
04	Function channel 2		31_h
05	Function channel 3		31_h
06	Function channel 4		31_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

10.6 Parameterising the temperature measurement

10.6.1 Four (two) analog inputs for resistance tests - EPM-S404

Note!

- ► Use parameter setting to deactivate unused inputs.
- ► If thermal detectors are connected in a 3-wire or 4-wire setup, channels 3 and/or 4 must be deactivated.
- ► The module does not provide any auxiliary supply for sensors.

Parameter data

Subindex	Name	Description/value	Lenze
01	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 0 ... 5: Reserved Bit 6: diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
02	Wire-breakage detection	Bit 0: Channel 1 (0 = inhibited; 1 = enabled) : Bit 3: Channel 4 Bits 4 ... 7: Reserved	00_h
03	Limit value monitoring	Bit 0: Channel 1 (0 = inhibited; 1 = enabled) : Bit 3: Channel 4 Bits 4 ... 7: Reserved	00_h
04	Reserved		
05	Temperature system	Bit 0, 1: 00_b = °C; 01_b= °F; 10_b = K Bits 2 ... 7: Reserved	00_h
06	Interference frequency suppression	Bit 0, 1: 01_b = 60 Hz; 10_b = 50 Hz Bits 2 ... 7: Reserved	02_h

Subindex	Name	Description/value	Lenze
Channel 1			
07	Function channel 1	Thermal detector: 80 (50_h): PT100 2-wire conductor -200°C ... +850°C / -2000 ... $+8500_{dec}$ 81 (51_h): PT1000 2-wire conductor -200°C ... +850°C / -2000 ... $+8500_{dec}$ 82 (52_h): Ni100 2-wire conductor -60°C ... +250°C / -600 ... $+2500_{dec}$ 83 (53_h): Ni1000 2-wire conductor -60°C ... +250°C / -600 ... $+2500_{dec}$ 88 (58_h): PT100 3-wire conductor -200°C ... +850°C / -2000 ... $+8500_{dec}$ 89 (59_h): PT1000 3-wire conductor -200°C ... +850°C / -2000 ... $+8500_{dec}$ 90 ($5A_h$): Ni100 3-wire conductor -60°C ... +250°C / -600 ... $+2500_{dec}$ 91 ($5B_h$): Ni1000 3-wire conductor -60°C ... +250°C / -600 ... $+2500_{dec}$ 96 (60_h): PT100 4-wire conductor -200°C ... +850°C / -2000 ... $+8500_{dec}$ 97 (61_h): PT1000 4-wire conductor -200°C ... +850°C / -2000 ... $+8500_{dec}$ 98 (62_h): Ni100 4-wire conductor -60°C ... +250°C / -600 ... $+2500_{dec}$ 99 (63_h): Ni1000 4-wire conductor -60°C ... +250°C / -600 ... $+2500_{dec}$ Resistor: 112 (70_h): R 60-Ω2-wire conductor 0.00 ... +60.00 / 0 ... $+32767_{dec}$ 113 (71_h): R 600-Ω2-wire conductor 0.00 ... +600.00 / 0 ... $+32767_{dec}$ 114 (72_h): R 3000-Ω2-wire conductor 0.00 ... +3000.00 / 0 ... $+32767_{dec}$ 115 (73_h): R 6000-Ω2-wire conductor 0.00 ... +6000.00 / 0 ... $+32767_{dec}$ 128 (80_h): R 60-Ω4-wire conductor 0.00 ... +60.00 / 0 ... $+32767_{dec}$ 129 (81_h): R 600-Ω4-wire conductor 0.00 ... +600.00 / 0 ... $+32767_{dec}$ 130 (82_h): R 3000-Ω4-wire conductor 0.00 ... +3000.00 / 0 ... $+32767_{dec}$ 144 (90_h): R 60-Ω2-wire conductor 0.00 ... +60.00 / 0 ... $+6000_{dec}$ 145 (91_h): R 600-Ω2-wire conductor 0.00 ... +600.00 / 0 ... $+6000_{dec}$ 146 (92_h): R 3000-Ω2-wire conductor 0.00 ... +3000.00 / 0 ... $+30000_{dec}$ 160 ($A0_h$): R 60-Ω2-wire conductor 0.00 ... +60.00 / 0 ... $+6000_{dec}$ 161 ($A1_h$): R 600-Ω2-wire conductor 0.00 ... +600.00 / 0 ... $+6000_{dec}$ 162 ($A2_h$): R 3000-Ω2-wire conductor 0.00 ... +3000.00 / 0 ... $+30000_{dec}$ 255 (FF_h): channel deactivated	50_h

Subindex	Name	Description/value	Lenze
08	Conversion time channel 1	You can set the transformer speed as a function of the interference frequency suppression (see 0x3105/x) for each channel. 0 (00_h): At 50 Hz: 324.1 ms/channel 16 bits; at 60 Hz: 270.5 ms/channel 16 bits 1 (01_h): At 50 Hz: 164.2 ms/channel 16 bits; at 60 Hz: 137.2 ms/channel 16 bits 2 (02_h): At 50 Hz: 84.2 ms/channel 16 bits; at 60 Hz: 70.5 ms/channel 16 bits 3 (03_h): at 50 Hz: 44.1 ms/channel 16 bits; at 60 Hz: 37.2 ms/channel 16 bits 4 (04_h): At 50 Hz: 24.2 ms/channel 16 bits; at 60 Hz: 20.5 ms/channel 16 bits 5 (05_h): At 50 Hz: 14.2 ms/channel 16 bits; at 60 Hz: 12.2 ms/channel 16 bits 6 (06_h): At 50 Hz: 9.2 ms/channel 16 bits; at 60 Hz: 8.0 ms/channel 16 bits 7 (07_h): At 50 Hz: 6.6 ms/channel 15 bits; at 60 Hz: 5.9 ms/channel 15 bits 8 (08_h): At 50 Hz: 4.2 ms/channel 13 bits; at 60 Hz: 3.8 ms/channel 13 bits	00_h
09	Upper limit value channel 1	You can define an upper or lower limit value for each channel. For this you can only specify values from the nominal range, otherwise you'll receive a parameterisation error. By specification of 7FFFh for the upper or 8000h for the lower limit value, the corresponding limit value is deactivated. If your measured value is outside a limit value and you have activated the limit value monitoring, a process alarm is triggered.	$7FFF_h$
0A	Lower limit value channel 1		8000_h
Channel 2			
0B	Function channel 2	See channel 1	50_h
0C	Conversion time channel 2	See channel 1	00_h
0D	Upper limit value channel 2	See channel 1	$7FFF_h$
0E	Lower limit value channel 2		8000_h
Channel 3 (for two-wire conductor connections only)			
0F	Function channel 3	See channel 1	50_h
10	Conversion time channel 3	See channel 1	00_h
11	Upper limit value channel 3	See channel 1	$7FFF_h$
12	Lower limit value channel 3		8000_h
Channel 4 (for two-wire conductor connections only)			
13	Function channel 4	See channel 1	50_h
14	Conversion time channel 4	See channel 1	00_h
15	Upper limit value channel 4	See channel 1	$7FFF_h$
16	Lower limit value channel 4		8000_h

Measuring range

Measuring range (Fct. no.)	Measured value	Signal range	Range
2-wire: PT100 (50_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
2-wire: PT1000 (51_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
2-wire: NI100 (52_h)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
2-wire: NI1000 (53_h)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
3-wire: PT100 (58_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
3-wire: PT1000 (59_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
3-wire: NI100 ($5A_h$)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
3-wire: NI1000 ($5B_h$)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
4-wire: PT100 (60_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
4-wire: PT1000 (61_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
4-wire: NI100 (62_h)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
4-wire: NI1000 (63_h)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
2-wire: 0 ... 60 Ω (70_h)	-	-	Overflow
	0 ... 60 Ω	0 ... 32767_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 600 Ω (71_h)	-	-	Overflow
	0 ... 600 Ω	0 ... 32767_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 3000 Ω (72_h)	-	-	Overflow
	0 ... 3000 Ω	0 ... 32767_{dec}	Nominal range
	-	-	Underflow

Measuring range (Fct. no.)	Measured value	Signal range	Range
3-wire: 0 ... 60 Ω (78_h)	-	-	Overflow
	0 ... 60 Ω	0 ... 32767_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 600 Ω (79_h)	-	-	Overflow
	0 ... 600 Ω	0 ... 32767_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 3000 Ω ($7A_h$)	-	-	Overflow
	0 ... 3000 Ω	0 ... 32767_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 60 Ω (80_h)	-	-	Overflow
	0 ... 60 Ω	0 ... 32767_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 600 Ω (81_h)	-	-	Overflow
	0 ... 600 Ω	0 ... 32767_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 3000 Ω (82_h)	-	-	Overflow
	0 ... 3000 Ω	0 ... 32767	Nominal range
	-	-	Underflow
2-wire: 0 ... 60 Ω (90_h)	-	-	Overflow
	0 ... 60 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 600 Ω (91_h)	-	-	Overflow
	0 ... 600 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 3000 Ω (92_h)	-	-	Overflow
	0 ... 3000 Ω	0 ... 30000_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 60 Ω (98_h)	-	-	Overflow
	0 ... 60 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 600 Ω (99_h)	-	-	Overflow
	0 ... 600 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 3000 Ω ($9A_h$)	-	-	Overflow
	0 ... 3000 Ω	0 ... 30000_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 60 Ω ($A0_h$)	-	-	Overflow
	0 ... 60 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 600 Ω ($A1_h$)	-	-	Overflow
	0 ... 600 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 3000 Ω ($A2_h$)	-	-	Overflow
	0 ... 3000 Ω	0 ... 30000_{dec}	Nominal range
	-	-	Underflow

Measuring range (Fct. no.)	Measured value	Signal range	Range
2-wire: 0 ... 60 Ω ($D0_h$)	70.55 Ω	32511_{dec}	Overflow
	0 ... 60 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 600 Ω ($D1_h$)	705.5 Ω	32511_{dec}	Overflow
	0 ... 600 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 3000 Ω ($D2_h$)	3528 Ω	32511_{dec}	Overflow
	0 ... 3000 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 60 Ω ($D8_h$)	70.55 Ω	32511_{dec}	Overflow
	0 ... 60 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 600 Ω ($D9_h$)	705.5 Ω	32511_{dec}	Overflow
	0 ... 600 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 3000 Ω (DA_h)	3528 Ω	32511_{dec}	Overflow
	0 ... 3000 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 60 Ω ($E0_h$)	70.55 Ω	32511_{dec}	Overflow
	0 ... 60 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 600 Ω ($E1_h$)	705.5 Ω	32511_{dec}	Overflow
	0 ... 600 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 3000 Ω ($E2_h$)	3528 Ω	32511_{dec}	Overflow
	0 ... 3000 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow

10.6.2 Two analog inputs for thermocouple measurement - EPM-S405

Parameter data

Subindex	Name	Description/value	Lenze
01	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 0 ... 5: Reserved Bit 6: diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
02	Wire-breakage detection	Bit 0: Channel 1 (0 = inhibited; 1 = enabled) Bit 1: Channel 2 Bits 2 ... 7: Reserved	00_h
03	Limit value monitoring	Bit 0: Channel 1 (0 = inhibited; 1 = enabled) Bit 1: Channel 2 Bits 2 ... 7: Reserved	00_h
04	Reserved	0	
05	Temperature system	Bit 0, 1: 00_b = °C; 10_b = °F; 11_b = K Bits 2 ... 7: Reserved	00_h
06	Interference frequency suppression	Bit 0, 1: 01_b = 60 Hz; 10_b = 50 Hz Bits 2 ... 7: Reserved	02_h
Channel 1			
07	Function channel 1	External temperature compensation: 176 (60_h): type J, -210.0 ... +1200.0 °C / -2100 ... +12000_{dec} 177 (61_h): type K, -270.0 ... +1372.0 °C / -2700 ... +13720_{dec} 178 (62_h): type N -270.0 ... +1300.0 °C / -2700 ... +13000_{dec} 179 (63_h): type R, -50.0 ... +1769.0 °C / -500 ... +17690_{dec} 180 (64_h): type S, -50.0 ... +1769.0 °C / -500 ... +17690_{dec} 181 (65_h): type T, -270.0 ... +400.0 °C / -2700 ... +4000_{dec} 182 (66_h): type B, 0.0 ... +1820.0 °C / 0 ... +18200_{dec} 183 (67_h): type C, 0.0 ... +2315.0 °C / 0 ... +23150_{dec} 184 (68_h): type E, -270.0 ... +1000.0 °C / -2700 ... +10000_{dec} 185 (69_h): type L, -200.0 ... +900.0 °C / -2000 ... +9000_{dec} Internal temperature compensation: 192 ($C0_h$): type J, -210.0 ... +1200.0 °C / -2100 ... +12000_{dec} 193 ($C1_h$): type K, -270.0 ... +1372.0 °C / -2700 ... +13720_{dec} 194 ($C2_h$): type N -270.0 ... +1300.0 °C / -2700 ... +13000_{dec} 195 ($C3_h$): type R, -50.0 ... +1769.0 °C / -500 ... +17690_{dec} 196 ($C4_h$): type S, -50.0 ... +1769.0 °C / -500 ... +17690_{dec} 197 ($C5_h$): type T, -270.0 ... +400.0 °C / -2700 ... +4000_{dec} 198 ($C6_h$): type B, 0.0 ... +1820.0 °C / 0 ... +18200_{dec} 199 ($C7_h$): type C, 0.0 ... +2315.0 °C / 0 ... +23150_{dec} 200 ($C8_h$): type E, -270.0 ... +1000.0 °C / -2700 ... +10000_{dec} 201 ($C9_h$): type L, -200.0 ... +900.0 °C / -2000 ... +9000_{dec} 255 (FF_h): channel deactivated	$C1_h$

Subindex	Name	Description/value	Lenze
08	Conversion time channel 1	You can set the transformer speed as a function of the interference frequency suppression (see 0x3105/x) for each channel. 0 (00_h): At 50 Hz: 324.1 ms/channel 16 bits; at 60 Hz: 270.5 ms/channel 16 bits 1 (01_h): at 50 Hz: 164.2 ms/channel 16 bits; at 60 Hz: 137.2 ms/channel 16 bits 2 (02_h): At 50 Hz: 84.2 ms/channel 16 bits; at 60 Hz: 70.5 ms/channel 16 bits 3 (03_h): at 50 Hz: 44.1 ms/channel 16 bits; at 60 Hz: 37.2 ms/channel 16 bits 4 (04_h): At 50 Hz: 24.2 ms/channel 16 bits; at 60 Hz: 20.5 ms/channel 16 bits 5 (05_h): at 50 Hz: 14.2 ms/channel 16 bits; at 60 Hz: 12.2 ms/channel 16 bits 6 (06_h): at 50 Hz: 9.2 ms/channel 16 bits; at 60 Hz: 8.0 ms/channel 16 bits 7 (07_h): at 50 Hz: 6.6 ms/channel 15 bits; at 60 Hz: 5.9 ms/channel 15 bits 8 (08_h): at 50 Hz: 4.2 ms/channel 13 bits; at 60 Hz: 3.8 ms/channel 13 bits	02_h
09	Upper limit value channel 1	You can define an upper or lower limit value for each channel. For this you can only specify values from the nominal range, otherwise you'll receive a parameterisation error. By specification of 7FFFh for the upper or 8000h for the lower limit value, the corresponding limit value is deactivated. If your measured value is outside a limit value and you have activated the limit value monitoring, a process alarm is triggered.	$7FFF_h$
0A	Lower limit value channel 1		8000_h
Channel 2			
0B	Function channel 2	See channel 1	$C1_h$
0C	Conversion time channel 2	See channel 1	02_h
0D	Upper limit value channel 2	See channel 1	$7FFF_h$
0E	Lower limit value channel 2		8000_h

Measuring range

Measuring range (Fct. no.)	Measured value [°C]	Measured value [°F]	Measured value [K]	Range
Type J: -210 ... +1200 °C -346 ... 2192 °F 63.2 ... 1473.2 K ($B0_h$: ext. comp. 0 °C) ($C0_h$: int. comp. 0 °C)	+14500	26420	17232	Overflow
	-2100 ... +12000	-3460 ... +21920	632 ... 14732	Nominal range
	-	-	-	Underflow
Type K: -210 ... +1372 °C -454 ... 2501.6 °F 0 ... 1645.2 K ($B1_h$: ext. comp. 0 °C) ($C1_h$: int. comp. 0 °C)	+16220	29516	18952	Overflow
	-2700 ... +13720	-4540 ... 25016	0 ... 16452	Nominal range
	-	-	-	Underflow
Type N: -270 ... +1300 °C -454 ... 2372 °F 0 ... 1573.2 K ($B2_h$: ext. comp. 0 °C) ($C2_h$: int. comp. 0 °C)	+15500	28220	18232	Overflow
	-2700 ... +13000	-4540 ... 23720	0 ... 15732	Nominal range
	-	-	-	Underflow

Measuring range (Fct. no.)	Measured value [°C]	[°F]	[K]	Range
Type R: -50 ... +1769 °C -58 ... 3216.2 °F 223.2 ... 2042.2 K ($B3_h$: ext. comp. 0 °C) ($C3_h$: int. comp. 0 °C)	+20190	32766	22922	Overflow
	-500 ... +17690	-580 ... 32162	2232 ... 20422	Nominal range
	-1700	-2740	1032	Underflow
Type S: -50 ... +1769 °C -58 ... 3216.2 °F 223.2 ... 2042.2 K ($B4_h$: ext. comp. 0 °C) ($C4_h$: int. comp. 0 °C)	+20190	32766	22922	Overflow
	-500 ... +17690	-580 ... 32162	2232 ... 20422	Nominal range
	-1700	-2740	1032	Underflow
Type T: -270 ... +440 °C -454 ... 752 °F 3.2 ... 673.2 K ($B2_h$: ext. comp. 0 °C) ($C2_h$: int. comp. 0 °C)	+5400	10040	8132	Overflow
	-2700 ... +4000	-4540 ... 7520	32 ... 6732	Nominal range
	-	-	-	Underflow
Type B: 0 ... +1820 °C 32 ... 2786.5 °F 273.2 ... 2093.2 K ($B6_h$: ext. comp. 0 °C) ($C6_h$: int. comp. 0 °C)	+20700	32766	23432	Overflow
	0 ... +18200	320 ... 27865	2732 ... 20932	Nominal range
	-1200	-1840	1532	Underflow
Type C: 0 ... +2315 °C 32 ... 2786.5 °F 273.2 ... 2093.2 K ($B7_h$: ext. comp. 0 °C) ($C7_h$: int. comp. 0 °C)	+25000	32766	23432	Overflow
	0 ... +23150	320 ... 27865	2732 ... 20932	Nominal range
	-1200	-1840	1532	Underflow
Type E: -270 ... +1000 °C -454 ... 1832 °F 0 ... 1273.2 K ($B8_h$: ext. comp. 0 °C) ($C8_h$: int. comp. 0 °C)	+12000	21920	14732	Overflow
	-2700 ... +10000	-4540 ... 18320	0 ... 12732	Nominal range
	-	-	-	Underflow
Type L: -200 ... +900 °C -328 ... 1652 °F 73.2 ... 1173.2 K ($B9_h$: ext. comp. 0 °C) ($C9_h$: int. comp. 0 °C)	+11500	21020	14232	Overflow
	-2000 ... +9000	-3280 ... 16520	732 ... 11732	Nominal range
	-	-	-	Underflow

10.7 Parameterising the counter

10.7.1 Rotary transducer signal evaluation

Depending on which edge of a channel is evaluated, the following pulse trains and the associated pulse multiplication can be realised.

Pulse trains	Description	
Channel A		
Channel B		
Single evaluation		There is a response to the falling edges of channel A. The number of pulses has not increased.
Double evaluation		There is a response to the rising and the falling edges of channel A. The number of pulses has doubled and is symmetrical.
Four-fold evaluation		The rising and the falling edges of channels A and B are evaluated. The number of pulses is quadrupled and is symmetrical.

10.7.2 One counter 32 bits, 24 V DC - EPM-S600

The following functions can be parameterised:

Counting functions	Description
Counting continuously	The counter counts from the loading value to the counting limit, then skips to the opposite counting limit and continues to count from there.
Counting once	The counter counts once/periodically from the loading value in the specified counting range.
Counting periodically	

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Main counting direction	The main counting direction can be parameterised: **None:** The whole counting range is available. **Forwards:** Limitation of the counting range upwards. The counter counts from the parameterised loading value in the positive direction to the parameterised final value -1 and then skips to the loading value again with the encoder pulse that is following. **Backwards:** Limitation of the counting range downwards. The counter counts from the parameterised loading value in the negative direction to the parameterised final value +1 and then skips to the loading value again with the encoder pulse that is following.
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter a differentiation between the internal gate (I-gate), hardware gate (HW gate), and software gate (SW gate) is made. ● The I-gate is the AND logic operation of the software gate (SW gate) and the hardware gate (HW gate). ● The SW gate is controlled via your user program (status word in the output area). ● The HW gate is controlled via the digital gate input. The following response can be parameterised: **Cancelling gate function:**After closing the gate and opening it again, the counting process continues from the loading value again. **Interrupting gate function:**After closing the gate and opening it again, the counting process continues with the last current counter content.
Latch function	If a positive edge occurs at the latch input, the current count value is stored in the latch register. The latch register is accessed via the input area. After a STOP-RUN transition, latch is always 0.
Comparator	You can specify a comparison value which, depending on the count value, activates the digital output or triggers a process alarm.
Hysteresis	By specification of a hysteresis you can for instance prevent the output from being permanently switched if the value of an encoder signal fluctuates around the comparison value.
Process alarm	The activation of a process alarm can be parameterised. A process alarm can be triggered in the case of the following events: ● Hardware gate open ● Hardware gate closed ● Counting limit - overflow ● Counting limit - underflow ● Comparison value reached ● Final value reached ● Latch value reached
Diagnostic alarm	If the diagnostic alarm is enabled in the parameter setting, it occurs as soon as another process alarm is triggered for the same event during process alarm processing.
Diagnostic function	Diagnostic functions are provided in the modules.
Diagnostic information	The diagnostic information describes the diagnostic contents which can be read out from a module. The diagnostic formation is not automatically sent by the module but must actively be read out by SDO access.



Further information can be found in the chapter ”Product description”.

Parameter data

Subindex	Name	Description/value	Lenze
01	Diagnostics *	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 5 ... 0: Reserved Bit 6: diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
02	Input frequency track A	Filters for instance serve to filter signal peaks in the case of an unclean input signal. 0 (00_h): 500 kHz 1 (01_h): 300 kHz 2 (02_h): 100 kHz 3 (03_h): 60 kHz 4 (04_h): 30 kHz 6 (06_h): 10 kHz 7 (07_h): 5 kHz 8 (08_h): 2 kHz 9 (09_h): 1 kHz Other values are not permissible!	02_h
03	Input frequency track B		02_h
04	Input frequency latch		02_h
05	Input frequency gate		02_h
06	Input frequency reset		00_h
07	Reserved		
08	Alarm response *	Setting activates process alarm Bit 0: Proc. alarm HW gate open Bit 1: Proc. alarm HW gate closed Bit 2: Proc. alarm overflow Bit 3: Proc. alarm underflow Bit 4: Proc. alarm comparison value Bit 5: Proc. alarm final value Bit 6: Proc. alarm latch value Bit 7: Reserved	80_h
09	Counter function *	Bits 5 ... 0: 000000_b = counting continuously 000001_b = counting once, main counting direction forwards 000010_b = counting once, main counting direction backwards 000100_b = counting once, no main counting direction 001000_b = counting periodically, main counting direction forwards 010000_b = counting periodically, main counting direction backwards 100000_b = counting periodically, no main counting direction Bits 7 ... 6: Reserved	40_h
0A	Comparator *	Bit 2 ... 0: output switches (... if condition is met) 000_b = never 001_b = count value ≥ comparison value 010_b = count value ≤ comparison value 100_b = count value = comparison value Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 6 ... 4: Reset 000_b = deactivated 001_b = HIGH level 011_b = rising edge 101_b = rising edge, once Bit 7: Reserved	00_h
0B	Signal evaluation *	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (connection to input "A/pulse") 010_b = double rotary transducer (connection to input	00_h

Subindex	Name	Description/value	Lenze
		”A/pulse”) 011_b = four-fold rotary transducer (connection to input ”A/pulse” and ”B/direction”) 100_b = direction (pulse to ”A/pulse” and direction to ”B/direction”) Bit 6 ... 3: hardware gate (HW gate) 000_b = deactivated (counter starts by setting SW gate) 001_b = activated (HIGH level at gate activates the HW gate. Counter starts if HW and SW gate are set.) Bit 7: Gate function (internal gate) 0= abort (counting process starts again from loading value) 1 = interrupt (counting process is continued with counter content)	
0C	Final value	Upper limit of the counting range	00_h
0D	Start value	Lower limit of the counting range	00_h
0E	Hysteresis	The hysteresis for instance serves to avoid frequent switching operations of the output and/or triggering of the alarm when the count value is within the range of the comparison value. For the hysteresis you can select a range between 0 and 255. With the settings 0 and 1 the hysteresis is switched off. The hysteresis has an effect on the zero crossing, comparison, overflow/underflow.	00_h
0F	Pulse	The pulse duration indicates for how long the output is to be set if the parameterised comparison criterion is reached or exceeded. The pulse duration can be specified in steps of 2.048 ms between 0 and 522.24 ms. If the pulse duration is = 0, the output is set until the comparison condition is no longer met.	00_h

* The values are adopted only after a state change from ”pre-operational” to ”operational”

10.7.3 Two counters 32 bits, 24 V DC - EPM-S601

The following functions can be parameterised:

Counting functions	Description
Counting continuously	The counter counts from the loading value to the counting limit, then skips to the opposite counting limit and continues to count from there.
Counting once	The counter counts once/periodically from the loading value in the specified counting range.
Counting periodically	

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Main counting direction	The main counting direction can be parameterised: **None:** The whole counting range is available. **Forwards:** Limitation of the counting range upwards. The counter counts from the parameterised loading value in the positive direction to the parameterised final value -1 and then skips to the loading value again with the encoder pulse that is following. **Backwards:** Limitation of the counting range downwards. The counter counts from the parameterised loading value in the negative direction to the parameterised final value +1 and then skips to the loading value again with the encoder pulse that is following.
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter the internal gate (I-gate) is conform to the software gate (SW gate) which you control via your user program (status word in the output area). The following response can be parameterised: **Cancelling gate function:**After closing the gate and opening it again, the counting process continues from the loading value again. **Interrupting gate function:**After closing the gate and opening it again, the counting process continues with the last current counter content.
Comparator	You can specify a comparison value which, depending on the count value, activates the digital output or triggers a process alarm.
Hysteresis	By specification of a hysteresis you can for instance prevent the output from being permanently switched if the value of an encoder signal fluctuates around the comparison value.
Process alarm	The activation of a process alarm can be parameterised. A process alarm can be triggered in the case of the following events: ● Hardware gate open ● Hardware gate closed ● Counting limit - overflow ● Counting limit - underflow ● Comparison value reached ● Final value reached ● Latch value reached
Diagnostic alarm	If the diagnostic alarm is enabled in the parameter setting, it occurs as soon as another process alarm is triggered for the same event during process alarm processing.
Diagnostic function	Diagnostic functions are provided in the modules.
Diagnostic information	The diagnostic information describes the diagnostic contents which can be read out from a module. The diagnostic formation is not automatically sent by the module but must actively be read out by SDO access.



Further information can be found in the chapter ”Product description”.

Parameter data

Subindex	Name	Description/value	Lenze
01	Diagnostics *	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
02	Input frequency counter 1, track A	Filters for instance serve to filter signal peaks in the case of an unclean input signal. 0 (00_h): 500 kHz 1 (01_h): 300 kHz 2 (02_h): 100 kHz 3 (03_h): 60 kHz 4 (04_h): 30 kHz 6 (06_h): 10 kHz 7 (07_h): 5 kHz 8 (08_h): 2 kHz 9 (09_h): 1 kHz Other values are not permissible!	02_h
03	Input frequency counter 1, track B		02_h
04	Input frequency counter 2, track A		02_h
05	Input frequency counter 2, track B		02_h
06	Alarm response counter 1 *	Setting activates process alarm Bits 1 ... 0: reserved Bit 2: Proc. alarm overflow Bit 3: Proc. alarm underflow Bit 4: Proc. alarm comparison value Bit 5: Proc. alarm final value Bits 7 ... 6: Reserved	00_h
07	Counter function counter 1 *	Bits 5 ... 0: 000000_b = counting continuously 000001_b = once: forwards 000010_b = once: backwards 000100_b = once: no main counting direction 001000_b = periodically: forwards 010000_b = periodically: backwards 100000_b = periodically: no main counting direction Bits 7 ... 6: Reserved	00_h
08	Comparator counter 1 *	Bits 2 ... 0: Comparison bit is set (... if condition is met) 000_b = never 001_b = count value ≥ comparison value 010_b = count value ≤ comparison value 100_b = count value = comparison value Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 7 ... 4: Reserved	00_h
09	Signal evaluation counter 1 *	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (connection to input ”A/pulse”) 010_b = double rotary transducer (connection to input ”A/pulse”) 011_b = four-fold rotary transducer (connection to input ”A/pulse” and ”B/direction”) 100_b = direction (pulse to ”A/pulse” and direction to ”B/direction”) Bits 6 ... 3: Reserved Bit 7: Gate function (internal gate) 0= abort (counting process starts again from loading value) 1 = interrupt (counting process is continued with counter content)	00_h

Subindex	Name	Description/value	Lenze
0A	Set value counter 1	By specifying a set value, the counter can be loaded with the set value. With an edge 0-1 to COUNTERVAL_SET in the control word, the set value is adopted by the counter.	00_h
0B	Final value counter 1	Upper limit of the counting range	00_h
0C	Loading value counter 1	Lower limit of the counting range	00_h
0D	Hysteresis counter 1	The hysteresis for instance serves to avoid frequent switching operations of the output and/or triggering of the alarm when the count value is within the range of the comparison value. For the hysteresis you can select a range between 0 and 255. With the settings 0 and 1 the hysteresis is switched off. The hysteresis has an effect on the zero crossing, comparison, overflow/underflow.	00_h
0E	Reserved		
0F	Alarm response counter 2 *	See counter 1	00_h
10	Counter function counter 2 *	See counter 1	00_h
11	Comparator counter 2 *	See counter 1	00_h
12	Signal evaluation counter 2 *	See counter 1	00_h
13	Set value counter 2	See counter 1	00_h
14	Final value counter 2	See counter 1	00_h
15	Loading value counter 2	See counter 1	00_h
16	Hysteresis counter 2	See counter 1	00_h

* The values are adopted only after a state change from ”pre-operational” to ”operational”

10.7.4 One counter 32 bits, 5 V DC - EPM-S602

The following functions can be parameterised:

Counting functions	Description
Counting continuously	The counter counts from the loading value to the counting limit, then skips to the opposite counting limit and continues to count from there.
Counting once	The counter counts once/periodically from the loading value in the specified counting range.
Counting periodically	

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Main counting direction	The main counting direction can be parameterised: **None:** The whole counting range is available. **Forwards:** Limitation of the counting range upwards. The counter counts from the parameterised loading value in the positive direction to the parameterised final value -1 and then skips to the loading value again with the encoder pulse that is following. **Backwards:** Limitation of the counting range downwards. The counter counts from the parameterised loading value in the negative direction to the parameterised final value +1 and then skips to the loading value again with the encoder pulse that is following.
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter the internal gate (I-gate) is conform to the software gate (SW gate) which you control via your user program (status word in the output area). The following response can be parameterised: **Cancelling gate function:**After closing the gate and opening it again, the counting process continues from the loading value again. **Interrupting gate function:**After closing the gate and opening it again, the counting process continues with the last current counter content.
Comparator	You can specify a comparison value which, depending on the count value, activates the digital output or triggers a process alarm.
Hysteresis	By specification of a hysteresis you can for instance prevent the output from being permanently switched if the value of an encoder signal fluctuates around the comparison value.
Process alarm	The activation of a process alarm can be parameterised. A process alarm can be triggered in the case of the following events: ● Hardware gate open ● Hardware gate closed ● Counting limit - overflow ● Counting limit - underflow ● Comparison value reached ● Final value reached ● Latch value reached
Diagnostic alarm	If the diagnostic alarm is enabled in the parameter setting, it occurs as soon as another process alarm is triggered for the same event during process alarm processing.
Diagnostic function	Diagnostic functions are provided in the modules.
Diagnostic information	The diagnostic information describes the diagnostic contents which can be read out from a module. The diagnostic formation is not automatically sent by the module but must actively be read out by SDO access.

Further information can be found in the chapter ”Product description”.

Parameter data

Subindex	Name	Description/value	Lenze
01	Diagnostics *	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
02	Input frequency track A	Filters for instance serve to filter signal peaks in the case of an unclean input signal. 0 (00_h): 500 kHz 1 (01_h): 300 kHz 2 (02_h): 100 kHz 3 (03_h): 60 kHz 4 (04_h): 30 kHz 6 (06_h): 10 kHz 7 (07_h): 5 kHz 8 (08_h): 2 kHz 9 (09_h): 1 kHz Other values are not permissible!	02_h
03	Input frequency track B		02_h
04	Input frequency reset		02_h
05	Reserved		
06	Alarm response *	Setting activates process alarm Bits 1 ... 0: reserved Bit 2: Proc. alarm overflow Bit 3: Proc. alarm underflow Bit 4: Proc. alarm comparison value Bit 5: Proc. alarm final value Bits 7 ... 6: Reserved	00_h
07	Counter function *	Bits 5 ... 0: 000000_b = counting continuously 000001_b = once: forwards 000010_b = once: backwards 000100_b = once: no main counting direction 001000_b = periodically: forwards 010000_b = periodically: backwards 100000_b = periodically: no main counting direction Bits 7 ... 6: Reserved	00_h
08	Comparator *	Bits 2 ... 0: Comparison bit is set (... if condition is met) 000_b = never 001_b = count value ≥ comparison value 010_b = count value ≤ comparison value 100_b = count value = comparison value Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 6 ... 4: Reset 000_b = deactivated 001_b = HIGH level 011_b = rising edge 101_b = rising edge, once Bit 7: Reserved	00_h

Subindex	Name	Description/value	Lenze
09	Signal evaluation *	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (connection to input ”A/pulse”) 010_b = double rotary transducer (connection to input ”A/pulse”) 011_b = four-fold rotary transducer (connection to input ”A/pulse” and ”B/direction”) 100_b = direction (pulse to ”A/pulse” and direction to ”B/direction”) Bits 6 ... 3: Reserved Bit 7: Gate function (internal gate) 0= abort (counting process starts again from loading value) 1 = interrupt (counting process is continued with counter content)	00_h
0A	Final value	Upper limit of the counting range	00_h
0B	Start value	Lower limit of the counting range	00_h
0C	Hysteresis		00_h

* The values are adopted only after a state change from ”pre-operational” to ”operational”

10.7.5 Two counters 32 bits, 24 V DC - EPM-S603

The following functions can be parameterised:

Counting functions	Description
Counting continuously	The counter counts from 0 to the counting limit, then skips to the opposite counting limit and continues to count from there.

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter the internal gate (I-gate) is conform to the software gate (SW gate) which you control via your user program (status word in the output area).



Further information can be found in the chapter ”Product description”.

Parameter data

Subindex	Name	Description/value	Lenze
01	Input frequency counter 1, track A	Filters for instance serve to filter signal peaks in the case of an unclean input signal. 0 (00_h): 500 kHz 1 (01_h): 300 kHz 2 (02_h): 100 kHz 3 (03_h): 60 kHz 4 (04_h): 30 kHz 6 (06_h): 10 kHz 7 (07_h): 5 kHz 8 (08_h): 2 kHz 9 (09_h): 1 kHz Other values are not permissible!	02_h
02	Input frequency counter 1, track B		02_h
03	Input frequency counter 2, track A		02_h
04	Input frequency counter 2, track B		02_h
05	Counting direction counter 1, track B *	Bits 2 ... 0: Reserved Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 7 ... 4: Reserved	00_h
06	Signal evaluation counter 1 *	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (connection to input ”A/pulse”) 010_b = double rotary transducer (connection to input ”A/pulse”) 011_b = four-fold rotary transducer (connection to input ”A/pulse” and ”B/direction”) 100_b = direction (pulse to ”A/pulse” and direction to ”B/direction”) Bits 7 ... 3: Reserved	00_h
07	Counting direction counter 2, track B *	Bits 2 ... 0: Reserved Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 7 ... 4: Reserved	00_h
08	Signal evaluation counter 2 *	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (connection to input ”A/pulse”) 010_b = double rotary transducer (connection to input ”A/pulse”) 011_b = four-fold rotary transducer (connection to input ”A/pulse” and ”B/direction”) 100_b = direction (pulse to ”A/pulse” and direction to ”B/direction”) Bits 7 ... 3: Reserved	00_h

* The values are adopted only after a state change from ”pre-operational” to ”operational”

10.8 Parameterising the encoder evaluation

10.8.1 SSI - EPM-S604



Further information can be found in the chapter ”Product description”.

Parameter data

Subindex	Name	Description/value	Lenze
01	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 5 ... 0: reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
02	Dead time	The dead time, also called tbs (time between sends), defines the waiting time between two encoder values to be observed by the module so that the encoder is able to process its value. This data can be found in the data sheet for your encoder. HIGH LOW 00_h 30_h: 1 µs 00_h 60_h: 2 µs 00_h $C0_h$: 4 µs 01_h 80_h: 8 µs 03_h 00_h: 16 µs 06_h 00_h: 32 µs 09_h 00_h: 48 µs $0C_h$ 00_h: 64 µs	$0C00_h$
03	Baud rate	In the ”Monitoring operation” mode, the baud rate is irrelevant. Enter the baud rate here. This corresponds to the clock frequency via which the connected encoder communicates. More information on this can be found in the data sheet for your encoder. HIGH LOW 00_h 18_h: 2 MHz 00_h 20_h: 1.5 MHz 00_h 30_h: 1 MHz 00_h 60_h: 500 kHz 00_h $C0_h$: 250 kHz 01_h 80_h: 125 kHz	0180_h
04	Reserved		
05	Scaling	Depending on the encoder, further bits are transmitted in addition to the encoder value. Scaling serves to determine how many bits postpositioned to the encoder value will be removed by shifting the encoder value to the right. The encoder value is scaled by the module only after a gray-binary conversion. More information can be found in the data sheet for your encoder. Value range: 00_h ... $0F_h$ = 0 bits ... 15 bits	00_h

Subindex	Name	Description/value	Lenze
06	Bit length of encoder data	Enter the bit length of the encoder data here. Depending on the encoder, the encoder data consist of the current encoder value with subsequent bits. The total length has to be specified here. More information on this can be found in the data sheet for your encoder. 7 (07_h) = ”8 bits” 8 (08_h) = ”9 bits” 9 (09_h) = ”10 bits” 10 ($0A_h$) = ”11 bits” 11 ($0B_h$) = ”12 bits” 12 ($0C_h$) = ”13 bits” 13 ($0D_h$) = ”14 bits” 14 $0E_h$) = ”15 bits” 15 ($0F_h$) = ”16 bits” 16 (10_h) = ”17 bits” 17 (11_h) = ”18 bits” 18 (12_h) = ”19 bits” 19 (13_h) = ”20 bits” 20 (14_h) = ”21 bits” 21 (15_h) = ”22 bits” 22 (16_h) = ”23 bits” 23 (17_h) = ”24 bits” 24 (18_h) = ”25 bits” 25 (19_h) = ”26 bits” 26 ($1A_h$) = ”27 bits” 27 ($1B_h$) = ”28 bits” 28 ($1C_h$) = ”29 bits” 29 ($1D_h$) = ”30 bits” 30 ($1E_h$) = ”31 bits” 31 ($1F_h$) = ”32 bits”	18_h

Subindex	Name	Description/value	Lenze
07		Bit 1 ... 0: Ready for operation During ”Monitoring operation” the module serves to monitor the data exchange between an SSI master and an SSI encoder. It receives the cycle by the master and the data flow by the SSI encoder. In the ”Master mode” operating mode the module provides a cycle to the encoder and receives data by the encoder. 01_b = monitoring operation 10_b = master mode Bit 2: Shifting direction Specify the orientation of the encoder data here. More information can be found in the data sheet for your encoder. Usually, the SSI encoder uses ”MSB first”. 0 = LSB first (LSB is transmitted first) 1 = MSB first (MSB is transmitted first) Bit 3: edge clock signal Here you can specify the edge type of the clock signal, in the case of which the encoder supplies data. Information on this can be found in the data sheet for your encoder. Usually the SSI encoders respond to rising edges. 0 = falling edge 1 = rising edge Bit 4: Coding In the ”Binary code” setting, the provided encoder value remains unchanged. In the ”Gray code” setting, the gray-coded value provided by the encoder is converted into a binary value. Only after this conversion, the received encoder value is scaled, if required. The Gray code is another form of representation of the binary code. It is based on the fact that two adjacent Gray numbers differ from each other in exactly one bit. If the Gray code is used, transmission errors can be easily detected, since adjacent characters must only differ from each other in one digit. Information on this can be found in the data sheet for your encoder. 0 = standard code 1 = Gray code Bits 7 ... 5: reserved	$1E_h$
08	Reserved		
09	SSI function	By enabling the SSI function the module starts with the cycle output and the evaluation of the encoder data. In the ”monitor operation” mode, the module starts with the encoder evaluation. 0 (00_h) = inhibited 1 (01_h) = enabled	00_h

10.9 Time stamp parameterising

10.9.1 2 digital inputs with time stamp function - EPM-S207

Parameter data

Subindex	Name	Description/value	Lenze
01	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	14_h or $3C_h$ (fix)
02	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	00_h (fix)
03	Input delay DI 0	00_h = 1 µs 02_h = 3 µs 04_h = 10 µs 07_h = 86 µs 09_h = 342 µs $0C_h$ = 273 µs Other values are not permissible.	02_h
04	Input delay DI 1		02_h
05	Edge 0-1 an DI x	Time stamp entry on rising edge Bit 0: DI 0 (0: inhibit, 1 = enable) Bit 1: DI 1 (0: inhibit, 1 = enable) Bits 7 ... 2: Reserved	00_h
06	Edge 1-0 at DI x	Time stamp entry on falling edge Bit 0: DI 0 (0: inhibit, 1 = enable) Bit 1: DI 1 (0: inhibit, 1 = enable) Bits 7 ... 2: Reserved	00_h

10.9.2 2 digital outputs with time stamp function - EPM-S310

Parameter data

Subindex	Name	Description/value	Lenze
01	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	14_h or $3C_h$ (fix)
02	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	00_h (fix)

10.10 Parameterising technology modules

10.10.1 2 digital outputs with PWM functionality - EPM-S620

Parameter data

Subindex	Name	Description/value	Lenze
01	PWM 0: period	Set parameters here for the total time for pulse duration and pulse pause. The time should be selected as a factor for the 20.83 ns basis.	$1F40_h$
02	PWM 1: period	Values below 25 µs are ignored. If the pulse duration is higher or equal to the period, the DO output is set permanently. Value range: 1200 ... 8388607 (25 µs ... approx. 175 ms)	$1F40_h$

10.10.2 RS232 interface - EPM-S640

Parameter data

Parameter data - ASCII protocol			
Subindex	**Name**	**Description/value**	**Lenze**
01	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
02	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
03	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
04	Baud rate	00_h: 9600 Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
05	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 01_h: ASCII	01_h
Option 1, character frame			
06	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
		Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
		Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
		Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2 ... 3, ZNA			
07	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
08	ZNA (LOW byte)		00_h

Parameter data - ASCII protocol			
Subindex	**Name**	**Description/value**	**Lenze**
Option 4 ... 5, ZVZ			
09	Character delay time (HIGH byte)	Character delay time (ZVZ) The character delay time defines the maximum permissible time interval between two characters received within a telegram. If ZVZ = 0, the module calculates the ZVZ by means of the baud rate (approx. double character time). 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
0A	Character delay time (LOW byte)		FA_h
Option 6, number of receive buffers			
0B	Number of receive buffers	Defines the number of receive buffers. As long as only one receive buffer is used and is assigned, no more data can be received. If up to 250 receive buffers are connected, the received data can be redirected to a still free receive buffer. 1 ... 255 (01_h ... FF_h)	01_h
Option 7 ... 12, reserved			
0C ... 11	Reserved		00_h

Parameter data STX/ETX protocol			
Subindex	**Name**	**Description/value**	**Lenze**
01	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
02	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
03	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
04	Baud rate	00_h: 9600 Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
05	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 02_h: STX/ETX	02_h
Option 1, character frame			
06	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
		Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
		Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
		Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2 ... 3, ZNA			
07	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
08	ZNA (LOW byte)		00_h

Parameter data STX/ETX protocol			
Subindex	**Name**	**Description/value**	**Lenze**
Option 4 ... 5, TMO			
09	TMO (HIGH byte)	TMO serves to define the maximally permissible interval between two frames. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
0A	TMO (LOW byte)		FA_h
Option 6, number of start identifiers			
0B	No. of start identifiers	00_h: 1 start identifier (2nd start identifier is ignored) 01_h: 2 start identifiers	01_h
Option 7, start identifier 1			
0C	Start identifier 1	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 8, start identifier 2			
0D	Start identifier 2	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 9, number of end identifiers			
0E	No. of end identifier	00_h: 1 end identifier (2nd end identifier is ignored) 01_h: 2 end identifiers	00_h
Option 10, end identifier 1			
0F	End identifier 1	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 11, end identifier 2			
10	End identifier 2	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 12, reserved			
11	Reserved		00_h

Parameter data 3964(R) protocol			
Subindex	**Name**	**Description/value**	**Lenze**
01	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
02	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
03	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
04	Baud rate	00_h: 9600 Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
05	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 03_h: 3964 04_h: 3964R	03_h
Option 1, character frame			
06	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
		Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
		Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
		Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2, ZNA (x 20 ms)			
07	ZNA	Time after request (ZNA) Waiting time observed until the next transmit request is processed. The ZNA is indicated as a factor in steps of 20 ms. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h

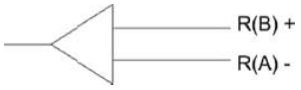
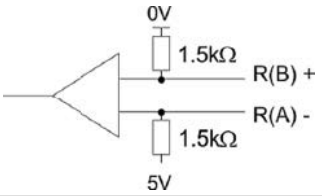
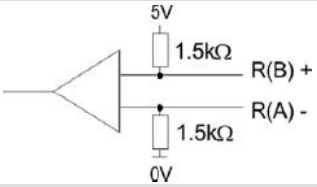
Parameter data 3964(R) protocol			
Subindex	**Name**	**Description/value**	**Lenze**
Option 3, ZVZ (x 20 ms)			
08	Character delay time	Character delay time (ZVZ) The ZVZ defines the maximum permissible time interval between two characters received within a telegram. The ZVZ is indicated as a factor in steps of 20 ms. If ZVZ = 0, the module calculates the ZVZ by means of the baud rate (approx. double character time). 0 ... 255 [ms] (00_h ... FF_h)	00_h
Option 4, QVZ (x 20 ms)			
09	Acknowledgement time	Acknowledgement time (QVZ) The QVZ defines the max. permissible time interval until the partner is acknowledged while establishing/terminating a connection. The QVZ is indicated as a factor in steps of 20 ms. 1 ... 255 [ms] (01_h ... FF_h)	00_h
Option 5, BWZ (x 20 ms)			
0A	Block wait time	Block wait time (BWZ) The BWZ is the maximum time period between the confirmation of a request frame (DLE) and STX of the response frame. The BWZ is indicated as a factor in steps of 20 ms. 1 ... 255 [ms] (01_h ... FF_h)	FA_h
Option 6, STX repetitions			
0B	STX repetitions	Maximum number of times the module attempts to establish a connection. 1 ... 255 [ms] (01_h ... FF_h)	01_h
Option 7, DBL			
0C	DBL	When exceeding the block wait time (BWZ) you can specify the maximum number of repetitions for the request frame using the DBL parameter. If these attempts fail, transmission is cancelled. 1 ... 255 [ms] (01_h ... FF_h)	00_h
Option 8, priority			
0D	Priority	A communication partner has high priority if its sending attempt has precedence over the partner's transmit request. In the event of low priority, it must take second place behind the partner's transmit request. With 3964(R) the priorities of both partners must be different. The following settings are possible: 00_h: LOW 01_h: HIGH	00_h
Option 9 ... 12, reserved			
0E ... 11	Reserved		00_h

10.10.3 RS422/RS485 interface - EPM-S650

Parameter data

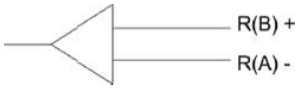
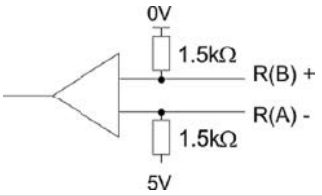
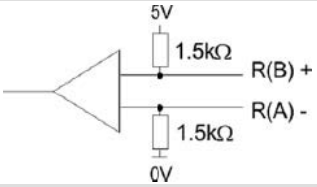
Parameter data - ASCII protocol			
Subindex	**Name**	**Description/value**	**Lenze**
01	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
02	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
03	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
04	Baud rate	00_h: 9600 Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
05	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 01_h: ASCII	01_h
Option 1, character frame			
06	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
		Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
		Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
		Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2 ... 3, ZNA			
07	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
08	ZNA (LOW byte)		00_h

Parameter data - ASCII protocol			
Subindex	**Name**	**Description/value**	**Lenze**
Option 4 ... 5, ZVZ			
09	Character delay time (HIGH byte)	Character delay time (ZVZ) The character delay time defines the maximum permissible time interval between two characters received within a telegram. If ZVZ = 0, the module calculates the ZVZ by means of the baud rate (approx. double character time). 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
0A	Character delay time (LOW byte)		FA_h
Option 6, number of receive buffers			
0B	Number of receive buffers	Defines the number of receive buffers. As long as only one receive buffer is used and is assigned, no more data can be received. If up to 250 receive buffers are connected, the received data can be redirected to a still free receive buffer. 1 ... 255 (01_h ... FF_h)	01_h
Option 7 ... 12, reserved			
0C ... 11	Reserved		00_h
Option 13, operating mode			
12	Operating mode	The operating mode serves to determine if the interface is operated in half duplex mode (RS485) or full duplex mode (RS422). ● 0x00: Half duplex - two-wire operation (RS485) Half duplex operation means that at a point of time data are either sent or received. The data are transmitted between the communication partners in both directions in turns. If the parameterisation is half duplex under RS485, a software data flow control is not possible. ● 0x01: Full duplex - four-wire operation (RS422) The data are exchanged simultaneously between the communication partners; transmission and reception can take place at the same time. Each communication partner must simultaneously actuate a receive path.	01_h
Option 14, cable assignment			
13	Cable assignment	For a connection with minimum reflections and the open circuit detection in RS422/485 operation, the cables can be pre-assigned via parameters with a defined idle level (see following table "Cable assignment parameters")	00_h

Cable assignment parameter		
Values	**Description**	
00_h	No pre-assignment of the receive path. This setting is only advisable for special drivers that are provided with a bus capability.	
01_h	Signal R(A) 5 V (open-circuit detection), signal R(B) 0 V Open-circuit detection is possible in full duplex operation under RS422.	
02_h	Signal R(A) 0 V, signal R(B) 5 V This pre-assignment corresponds to the idle state (no transmitter active) in half duplex operation under RS485. Open-circuit detection is not possible here.	

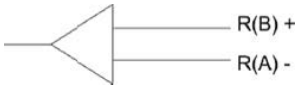
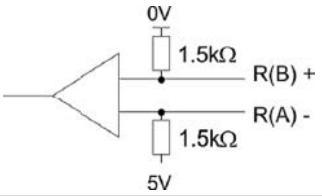
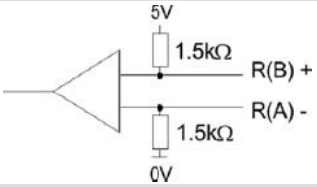
Parameter data STX/ETX protocol			
Subindex	**Name**	**Description/value**	**Lenze**
01	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
02	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
03	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
04	Baud rate	00_h: 9600 Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
05	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 02_h: STX/ETX	02_h
Option 1, character frame			
06	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
		Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
		Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
		Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2 ... 3, ZNA			
07	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
08	ZNA (LOW byte)		00_h

Parameter data STX/ETX protocol			
Subindex	**Name**	**Description/value**	**Lenze**
Option 4 ... 5, TMO			
09	TMO (HIGH byte)	TMO serves to define the maximally permissible interval between two frames. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
0A	TMO (LOW byte)		FA_h
Option 6, number of start identifiers			
0B	No. of start identifiers	00_h: 1 start identifier (2nd start identifier is ignored) 01_h: 2 start identifiers	01_h
Option 7, start identifier 1			
0C	Start identifier 1	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 8, start identifier 2			
0D	Start identifier 2	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 9, number of end identifiers			
0E	No. of end identifier	00_h: 1 end identifier (2nd end identifier is ignored) 01_h: 2 end identifiers	00_h
Option 10, end identifier 1			
0F	End identifier 1	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 11, end identifier 2			
10	End identifier 2	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 12, reserved			
11	Reserved		00_h
Option 13, operating mode			
12	Operating mode	The operating mode serves to determine if the interface is operated in half duplex mode (RS485) or full duplex mode (RS422). ● 0x00: Half duplex - two-wire operation (RS485) Half duplex operation means that at a point of time data are either sent or received. The data are transmitted between the communication partners in both directions in turns. If the parameterisation is half duplex under RS485, a software data flow control is not possible. ● 0x01: Full duplex - four-wire operation (RS422) The data are exchanged simultaneously between the communication partners; transmission and reception can take place at the same time. Each communication partner must simultaneously actuate a receive path.	01_h
Option 14, cable assignment			
13	Cable assignment	For a connection with minimum reflections and the open circuit detection in RS422/485 operation, the cables can be pre-assigned via parameters with a defined idle level (see following table "Cable assignment parameters")	00_h

Cable assignment parameter		
Values	**Description**	
00_h	No pre-assignment of the receive path. This setting is only advisable for special drivers that are provided with a bus capability.	
01_h	Signal R(A) 5 V (open-circuit detection), signal R(B) 0 V Open-circuit detection is possible in full duplex operation under RS422.	
02_h	Signal R(A) 0 V, signal R(B) 5 V This pre-assignment corresponds to the idle state (no transmitter active) in half duplex operation under RS485. Open-circuit detection is not possible here.	

Parameter data STX/ETX protocol			
Subindex	**Name**	**Description/value**	**Lenze**
01	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
02	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
03	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
04	Baud rate	00_h: 9600 Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
05	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 02_h: STX/ETX	02_h
Option 1, character frame			
06	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
		Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
		Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
		Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2 ... 3, ZNA			
07	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
08	ZNA (LOW byte)		00_h

Parameter data STX/ETX protocol			
Subindex	**Name**	**Description/value**	**Lenze**
Option 4 ... 5, TMO			
09	TMO (HIGH byte)	TMO serves to define the maximally permissible interval between two frames. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
0A	TMO (LOW byte)		FA_h
Option 6, number of start identifiers			
0B	No. of start identifiers	00_h: 1 start identifier (2nd start identifier is ignored) 01_h: 2 start identifiers	01_h
Option 7, start identifier 1			
0C	Start identifier 1	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 8, start identifier 2			
0D	Start identifier 2	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 9, number of end identifiers			
0E	No. of end identifier	00_h: 1 end identifier (2nd end identifier is ignored) 01_h: 2 end identifiers	00_h
Option 10, end identifier 1			
0F	End identifier 1	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 11, end identifier 2			
10	End identifier 2	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 12, reserved			
11	Reserved		00_h
Option 13, operating mode			
12	Operating mode	The operating mode serves to determine if the interface is operated in half duplex mode (RS485) or full duplex mode (RS422). ● 0x00: Half duplex - two-wire operation (RS485) Half duplex operation means that at a point of time data are either sent or received. The data are transmitted between the communication partners in both directions in turns. If the parameterisation is half duplex under RS485, a software data flow control is not possible. ● 0x01: Full duplex - four-wire operation (RS422) The data are exchanged simultaneously between the communication partners; transmission and reception can take place at the same time. Each communication partner must simultaneously actuate a receive path.	01_h
Option 14, cable assignment			
13	Cable assignment	For a connection with minimum reflections and the open circuit detection in RS422/485 operation, the cables can be pre-assigned via parameters with a defined idle level (see following table ”Cable assignment parameters”)	00_h

Cable assignment parameter		
Values	**Description**	
00_h	No pre-assignment of the receive path. This setting is only advisable for special drivers that are provided with a bus capability.	
01_h	Signal R(A) 5 V (open-circuit detection), signal R(B) 0 V Open-circuit detection is possible in full duplex operation under RS422.	
02_h	Signal R(A) 0 V, signal R(B) 5 V This pre-assignment corresponds to the idle state (no transmitter active) in half duplex operation under RS485. Open-circuit detection is not possible here.	

10.11 Monitoring

In case of error, the digital and analog outputs are switched to the state FALSE or 0 V.

Exception: digital outputs with time stamp functionality retain the last set value.

10.12 Diagnostics

10.12.1 Access to diagnostic data

I/O compound modules capable of alarms automatically transmit process alarm and/or diagnostic alarm data via the emergency telegram, provided that the alarm is activated by the parameter setting. You can however also request diagnostic data via SDO.

Alarm status

The alarm status contains a counter for the process alarm and a counter for the diagnostic alarm for alarm signalling. These counters are input data for the EtherCAT slave and are transferred along with the process data.

Index	Subindex	Name	Type	Attr.	Default	Meaning
0xF100	0x00	Interrupt status	Unsigned8	ro	2	
	0x01	Hardware interrupt counter	Unsigned32	ro	0x00000000	Counter for process alarm
	0x02	Diagnostic interrupt counter	Unsigned32	ro	0x00000000	Counter for diagnostic alarm

When auto-acknowledge is deactivated for the EtherCAT bus coupler module, the corresponding counter is set to 1 until you acknowledge it. To do this, write any value to subindex 0x06 using the index assigned.

When auto-acknowledge is activated for the EtherCAT bus coupler module, here you will find the number of process and/or diagnostic alarms which have been triggered since the last alarm reset. To reset the corresponding counter, write any value to subindex 0x06 using the index assigned.

The following index assignment applies:

- Writing to subindex 0x06 of index 0x5000: resets counter for process alarms
- Writing to subindex 0x06 of index 0x5002: resets counter for diagnostic alarms

Process alarm data

If the alarm status indicates a process alarm, you have access to the current process alarm data via index 0x5000.

Index	Subindex	Name	Type	Attr.	Default	Meaning
0x5000	0x00	Hardware interrupt data	Unsigned8	ro	0x00	Current process alarm data
	0x01	Slot number	Unsigned8	ro	0x00	EtherCAT slot no. of module on which the alarm has occurred
	0x02	Diagnostic byte 1	Unsigned8	ro	0x00	Process alarm data (see tables below)
	0x03	Diagnostic byte 2	Unsigned8	ro	0x00	
	0x04	Diagnostic byte 3	Unsigned8	ro	0x00	
	0x05	Diagnostic byte 4	Unsigned8	ro	0x00	
	0x06	Acknowledge	Unsigned8	rw	0x00	Writing any value resets the diagnostic alarm counter and if necessary acknowledges the alarm

EPM-S404 - process alarm	
Diagnostic byte	**Bit 7 ... 0**
1	Bit 0: Limit value exceeded channel 1 Bit 1: Limit value exceeded channel 2 Bit 7 ... 2: 0 (fixed)
2	Bit 0: Limit value not reached, channel 1 Bit 1: Limit value not reached, channel 2 Bit 7 ... 2: 0 (fixed)
3/4	Ticker value at the time of the alarm

EPM-S405 - process alarm	
Diagnostic byte	**Bit 7 ... 0**
1	Bit 0: Limit exceedance channel 1 Bit 1: Limit exceedance channel 2 Bit 2: Limit exceedance channel 3 Bit 3: Limit exceedance channel 4 Bit 7 ... 4: 0 (fix)
2	Bit 0: Limit value underflow channel 1 Bit 1: Limit value underflow channel 2 Bit 2: Limit value underflow channel 3 Bit 3: Limit value underflow channel 4 Bit 7 ... 4: 0 (fix)
3/4	Ticker value at the time of the alarm

EPM-S406, EPM-S408 - process alarm	
Diagnostic byte	**Bit 7 ... 0**
1	Bit 0: Limit value exceeded channel 1 Bit 1: Limit value exceeded channel 2 Bit 7 ... 2: 0 (fixed)
2	Bit 0: Limit value not reached, channel 1 Bit 1: Limit value not reached, channel 2 Bit 7 ... 2: 0 (fixed)
3/4	µs-ticker value at the time of the alarm The I/O compound module features an integrated 32-bit timer (µs-ticker) which is started at switch-on and starts at 0 again after 23^2 - 1 µs. These two bytes represent the lower 2 bytes of the µs-ticker (0 ... 2^{16} - 1)

EPM-S600 - process alarm	
Diagnostic byte	**Bit 7 ... 0**
1	Bit 0: Hardware gate open Bit 1: Hardware gate closed Bit 2: Overflow/underflow/final value Bit 3: Comparison value reached Bit 4: Latch value Bit 7 ... 5: 0 (fixed)
2	State of the inputs at the time of the alarm Bit 0: A/pulse Bit 1: B/direction Bit 2: Latch Bit 3: Hardware gate Bit 4: Reset Bit 7 ... 5: 0 (fixed)
3/4	Ticker value at the time of the alarm

EPM-S601, EPM-S602 - process alarm	
Diagnostic byte	**Bit 7 ... 0**
1	Bit 0: 0 Bit 1: 0 Bit 2: Counter 1, overflow/underflow/final value Bit 3: Counter 1, comparison value reached Bit 4: 0 Bit 5: 0 Bit 6: Counter 2, overflow/underflow/final value Bit 7: Counter 2, comparison value reached
2	State of the inputs at the time of the alarm Bit 0: Counter 1, A/pulse Bit 1: Counter 1, B/direction Bit 2: Counter 2, A/pulse Bit 3: Counter 2, B/direction Bit 7 ... 4: 0 (fix)
3/4	16 bit µs value at the time of the alarm

Diagnostic data (bytes 1 ... 4)

If the alarm status indicates a diagnostic alarm, index 0x5002 provides access to the current diagnostic alarm data.

Index	Subindex	Name	Type	Attr.	Default	Meaning
0x5002	0x00	Diagnostic data	Unsigned8	ro	6	Current diagnostic data
	0x01	Slot number	Unsigned8	ro	0x00	EtherCAT slot no. of module on which the alarm has occurred
	0x02	Diagnostic byte 1	Unsigned8	ro	0x00	Diagnostic data (see tables below)
	0x03	Diagnostic byte 2	Unsigned8	ro	0x00	
	0x04	Diagnostic byte 3	Unsigned8	ro	0x00	
	0x05	Diagnostic byte 4	Unsigned8	ro	0x00	
	0x06	Acknowledge	Unsigned8	rw	0x00	Writing any value resets the diagnostic alarm counter and if necessary acknowledges the alarm

EPM-S404, EMP-S405 - diagnostic alarm	
Diagnostic byte	**Bits 7 ... 0**
1	Bit 0: set if module fault Bit 1: set if internal error Bit 2: set if external error Bit 3: set if channel error available Bit 4: set if there is no external supply voltage Bit 6: 0 (fixed) Bit 7: set if parameterisation error
2	Bits 3 ... 0: module class, 0101_b: analog module Bit 4: set if channel information available Bits 7 ... 5: 0 (fixed)
3	0 (fixed)
4	Bits 3 ... 0: 0 (fixed) Bit 4: set if internal communication error Bit 5: reserved Bit 6: set if process alarm lost Bit 7: 0 (fixed)

EPM-S600 - diagnostic alarm	
Diagnostic byte	**Bit 7 ... 0**
1	Bit 0: Set if module fault Bit 1: 0 (fixed) Bit 2: Set in the case of an external error Bit 3: Set in the case of a channel error Bit 6 ... 4: 0 (fixed) Bit 7: Parameterisation error
2	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
3	0 (fixed)
4	Bit 5 ... 0: 0 (fixed) Bit 6: Process alarm lost Bit 7: 0 (fixed)

EPM-S601 - diagnostic alarm	
Diagnostic byte	**Bit 7 ... 0**
1	Bit 0: Set if module fault Bit 1: 0 (fixed) Bit 2: Set in the case of an external error Bit 3: Set in the case of a channel error Bit 6 ... 4: 0 (fixed) Bit 7: Parameterisation error
2	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
3	0 (fixed)
4	Bit 5 ... 0: 0 (fixed) Bit 6: Process alarm lost Bit 7: 0 (fixed)

EPM-S602 diagnostic alarm	
Diagnostic byte	**Bits 7 ... 0**
1	Bit 0: set if module fault Bit 1: set if internal error Bit 2: set if external error Bit 3: set if channel error exists Bit 4: set if there is no external voltage supply Bits 7 .... 5: 0 (fixed)
2	Bits 3 ... 0: module class, 1000_b: function module Bit 4: set if channel information available Bits 7 ... 5: 0 (fixed)
3	0 (fixed)
4	Bits 5 ... 0: 0 (fixed) Bit 6: set if process alarm lost Bit 7: 0 (fixed)

EPM-S603 - diagnostic alarm	
Diagnostic byte	**Bit 7 ... 0**
1	0 (fixed)
2	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
3	0 (fixed)
4	0 (fixed)

EPM-S604 - diagnostic alarm	
Diagnostic byte	**Bit 7 ... 0**
1	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of missing external supply voltage Bit 6 ... 5: 0 (fixed) Bit 7: Parameterisation error
2	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
3	0 (fixed)
4	Bit 5 ... 0: 0 (fixed) Bit 6: Process alarm lost Bit 7: 0 (fixed)

Diagnostic data (bytes 1 ... n)

This object gives you access to all a module's diagnostic data. You can either call up the current diagnostic data or a module's diagnostic data on any EtherCAT slot number.

Index	Subindex	Name	Type	Attr.	Default	Meaning
0x5005	0x00	Diagnostic data	Unsigned8	ro	18	
	0x01	Slot number	Unsigned8	rw	0	During read access, here you will find the EtherCAT slot no. of the module from which the following diagnostic data originates. By writing an EtherCAT slot no., you can query the diagnostic data of any module.
	0x02		Unsigned8	ro	0	Diagnostic alarm data (see module description)
	0x03		Unsigned8	ro	0	
	0x04		Unsigned8	ro	0	
	0x05		Unsigned8	ro	0	
	0x06		Unsigned8	ro	0	
	0x07		Unsigned8	ro	0	
	0x08		Unsigned8	ro	0	
	0x09		Unsigned8	ro	0	
	0x0A		Unsigned8	ro	0	
	0x0B		Unsigned8	ro	0	
	0x0C		Unsigned8	ro	0	
	0x0D		Unsigned8	ro	0	
	0x0E		Unsigned8	ro	0	
	0x0F		Unsigned8	ro	0	
	0x10		Unsigned8	ro	0	
	0x11		Unsigned8	ro	0	
	0x12		Unsigned32	ro	0	

EPM-S404, EMP-S405 - diagnostic alarm	
Diagnostic byte	**Bits 7 ... 0**
1	Bit 0: set if module fault Bit 1: set if internal error Bit 2: set if external error Bit 3: set if channel error available Bit 4: set if there is no external supply voltage Bit 6: 0 (fixed) Bit 7: set if parameterisation error
2	Bits 3 ... 0: module class, 0101_b: analog module Bit 4: set if channel information available Bits 7 ... 5: 0 (fixed)
3	0 (fixed)
4	Bits 3 ... 0: 0 (fixed) Bit 4: set if internal communication error Bit 5: reserved Bit 6: set if process alarm lost Bit 7: 0 (fixed)
5	Bits 6 ... 0: channel type, 71_h: analog input Bit 7: 0 (fixed)
6	Number of diagnostic bits output by the module per channel (here 08_h)
7	Number of channels of a module (here 04_h:)
8	Bit 0: channel error, channel group 0 Bit 1: channel error, group 1 Bits 7 ... 2: 0 (fixed)
9	Channel-specific error: channel 0: Bit 0: set if project planning/parameterising error Bits 3 ... 1: 0 (fixed) Bit 4: set if open circuit Bit 5: set if process alarm lost Bit 6: set if measuring range not reached Bit 7: set if measuring range exceeded
10	Channel-specific error: channel 1: Bit 0: set if project planning/parameterising error Bits 3 ... 1: 0 (fixed) Bit 4: set if open circuit Bit 5: set if process alarm lost Bit 6: set if measuring range not reached Bit 7: set if measuring range exceeded
11 ... 16	0 (fixed)

EPM-S600 - diagnostic alarm	
Diagnostic byte	**Bit 7 ... 0**
1	Bit 0: Set if module fault Bit 1: 0 (fixed) Bit 2: Set in the case of an external error Bit 3: Set in the case of a channel error Bit 6 ... 4: 0 (fixed) Bit 7: Parameterisation error
2	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
3	0 (fixed)
4	Bit 5 ... 0: 0 (fixed) Bit 6: Process alarm lost Bit 7: 0 (fixed)
5	Bits 6 ... 0: channel type, 76h: counter module Bit 7: further channel types available, 0: no, 1: yes
6	Number of diagnostic bits output by the module per channel (here 08_h)
7	Number of channels of a module (here 01_h)
8	Bit 0: error in channel group 0 (counter) Bits 7 ... 1: 0 (fixed)
9	Diagnostic alarm due to process alarm lost to ... Bit 0: hardware gate open Bit 1: hardware gate closed Bit 2: overflow/underflow/final value Bit 3: comparison value reached Bit 4: latch value Bits 7 ... 5: 0 (fixed)
10 ... 16	0 (fixed)

EPM-S601 - diagnostic alarm	
Diagnostic byte	**Bit 7 ... 0**
1	Bit 0: Set if module fault Bit 1: 0 (fixed) Bit 2: Set in the case of an external error Bit 3: Set in the case of a channel error Bit 6 ... 4: 0 (fixed) Bit 7: Parameterisation error
2	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
3	0 (fixed)
4	Bit 5 ... 0: 0 (fixed) Bit 6: Process alarm lost Bit 7: 0 (fixed)
5	Bit 6 ... 0: Channel type, 76_h: Counter module Bit 7: Further channel types available, 0: no, 1: yes
6	Number of diagnostic bits output by the module per channel (here 08_h)
7	Number of channels of a module (here 02_h)
8	Bit 0: Error in channel group 0 (counter 1) Bit 1: Error in channel group 1 (counter 2) Bit 7 ... 2: 0 (fix)
9	Channel group 0: diagnostic alarm due to lost process alarm to ... Bits 1 ... 0: 0 (fixed) Bit 2: overflow/underflow/final value Bit 3: comparison value reached Bits 7 ... 4: 0 (fixed)
10	Channel group 1: diagnostic alarm due to lost process alarm to ... Bits 1 ... 0: 0 (fixed) Bit 2: overflow/underflow/final value Bit 3: comparison value reached Bits 7 ... 4: 0 (fixed)
11 ... 16	0 (fixed)

EPM-S602 diagnostic alarm	
Diagnostic byte	**Bits 7 ... 0**
1	Bit 0: set if module fault Bit 1: set if internal error Bit 2: set if external error Bit 3: set if channel error exists Bit 4: set if there is no external voltage supply Bits 7 .... 5: 0 (fixed)
2	Bits 3 ... 0: module class, 1000_b: function module Bit 4: set if channel information available Bits 7 ... 5: 0 (fixed)
3	0 (fixed)
4	Bits 5 ... 0: 0 (fixed) Bit 6: set if process alarm lost Bit 7: 0 (fixed)
5	Bit 6 ... 0: Channel type, 76_h: Counter module Bit 7: Further channel types available, 0: no, 1: yes
6	Number of diagnostic bits output by the module per channel (here 08_h)
7	Number of channels of a module (here 02_h)
8	Bit 0: Error in channel group 0 (counter 1) Bit 1: Error in channel group 1 (counter 2) Bit 7 ... 2: 0 (fix)
9	Channel group 0: diagnostic alarm due to lost process alarm to ... Bits 1 ... 0: 0 (fixed) Bit 2: overflow/underflow/final value Bit 3: comparison value reached Bits 7 ... 4: 0 (fixed)
10	Channel group 1: diagnostic alarm due to lost process alarm to ... Bits 1 ... 0: 0 (fixed) Bit 2: overflow/underflow/final value Bit 3: comparison value reached Bits 7 ... 4: 0 (fixed)
11 ... 16	0 (fixed)

EPM-S603 - diagnostic alarm	
Diagnostic byte	**Bit 7 ... 0**
1	0 (fixed)
2	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
3	0 (fixed)
4	0 (fixed)
5	Bits 6 ... 0: channel type, 76h: counter module Bit 7: further channel types available, 0: no, 1: yes
6	Number of diagnostic bits output by the module per channel (here 00_h)
7	Number of channels of a module (here 02_h)
8 ... 16	0 (fixed)

EPM-S604 - diagnostic alarm	
Diagnostic byte	**Bit 7 ... 0**
1	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of missing external supply voltage Bit 6 ... 5: 0 (fixed) Bit 7: Parameterisation error
2	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
3	0 (fixed)
4	Bit 5 ... 0: 0 (fixed) Bit 6: Process alarm lost Bit 7: 0 (fixed)
5	Bits 6 ... 0: channel type, 76h: counter module Bits 7: 0 (fixed)
6	Number of diagnostic bits output by the module per channel (here 08_h)
7	Number of channels of a module (here 01_h)
8	Bit 0: error in channel group 0
9 ... 16	0 (fixed)

10.12.2 Standard objects

The following indexes can be used for diagnostic purposes. They show operating states. Settings cannot be made.

Index	Designation	Possible settings		IMPORTANT
		Lenze	Selection	
$0x1000_h$	Device type			Device type of the module Read only
$0x1003_h$	Last error			Current error, the fault memory is cleared by a reset or power cycle. Read only
0	Last error			
1	Error code			Bus status
2	Module number			Module slot
3	Error description			Error code
$0x1008_h$	Device name			Device name of the module Read only
$0x1009_h$	Hardware Version			Hardware version of the module Read only
$0x100A_h$	Software version			Software version of the module Read only
$0x100B_h$	System version			Delivery status, depending on FPGA versions of bus coupler and modules, at least system version 2 Read only
$0x1018_h$	Identity			General data of the EtherCAT bus coupler module Read only
0	Identity object			
1	Vendor ID			
2	Product code			
3	Revision number			
4	Serial number			
$0x1600_h$ ... 0x163F	Output mapping modules			
0	RxPDO Map			Number of outputs at this slot Entry only exists for slots with parameterisable modules
1	Output mapping			E.g.: 0x7000:01, 1 > the first output on slot 0 is 1 bit long
2	Output mapping			
...	...			

Index	Designation	Possible settings		IMPORTANT
		Lenze	Selection	
0x1A00$_h$ ... 0x1A3F	Input mapping modules			
0	TxPDO map			Number of inputs at this slot Entry only exists for slots with parameterisable modules
1	Input mapping			E.g.: 0x6000:01, 8 > the first output on slot 0 is 8 bits long
2	Input mapping			
...	...			
0x1AFF$_h$ ... 0x1A3F	Input mapping coupler			Due to the system design, the mapping in the project planning tool must not be changed otherwise errors may arise in the process image!
0	Status PDO			Mapping for coupler's alarm counter
1	Input mapping			Mapping for process alarm counter
2	Input mapping			
...	...			Mapping for the diagnostic alarm counter
0x1C00$_h$	Sync manager type			Use of the sync manager channels Read only
0	Sync manager type			
1	Subindex 01			Write mailbox from view of master
2	Subindex 02			Read mailbox from view of master
3	Subindex 03			Process input data from view of master
4	Subindex 04			Process output data from view of master
0x1C12$_h$	RxPDO assign			Mapping of the digital output modules Read only
0	RxPDO assign			
1	Subindex 001			Output module at slot 1
...	...			...
32	Subindex 032			Output module at slot 32
0x1C13$_h$	TxPDO assign			Mapping of the digital input modules Read only
0	TxPDO assign			
1	Subindex 001			Input module at slot 1
...	...			...
32	Subindex 032			Input module at slot 32

Index	Designation	Possible settings		IMPORTANT
		Lenze	Selection	
0x1C32$_h$	SM output parameter			Read only
0	SM output parameter			
1	Sync mode			
2	Cycle time			
3	Shift time			
4	Sync modes supported			
5	Minimum cycle time			
6	Maximum shift time			
0x1C33$_h$	SM input parameter			Read only
0	SM input parameter			
1	Sync mode			
2	Cycle time			
3	Shift time			
4	Sync modes supported			
5	Minimum cycle time			
6	Maximum shift time			
0x3000$_h$	Parameter EtherCAT coupler			
0	Coupler parameter			
1	Auto-acknowledge			States how the EtherCAT coupler is to respond to alarms. ● When auto-acknowledge = 0, you are responsible for acknowledgement. You are therefore informed of every alarm. If an alarm is not acknowledged, other alarms are inhibited. ● When auto-acknowledge = 1, each alarm is automatically acknowledged by the EtherCAT coupler. In this mode, diagnostic data is overwritten by new alarms. Auto-acknowledge = 1 by default. Auto-acknowledge should be activated for continuous use.

Index	Designation	Possible settings		IMPORTANT
		Lenze	Selection	
0x3100$_h$ ... 0x313F$_h$	Parameter EtherCAT coupler			This object provides access to the parameters of an I/O compound module. The EtherCAT slot is addressed via the index. Subindexes provide access to the corresponding parameter. The respective module description contains the subindex assignment. Again here, power and terminal modules are not detected by the EtherCAT coupler and are therefore not taken into account when listing and/or assigning slots.
0	Parameter			Number of parameters
1	Param			Module parameter data
2	Param			
...	...			
0x4000$_h$	Clear IO counter			Writing any value to the corresponding subindex clears the counter
0	Clear master counter			
1	Clear module counter			
0x4001$_h$				
0	Master counter			
1	Expected length error			
2	Timeout error			
3	Stop bit error			
4	FCS error			
5	Telegram length error			
6	Telegram type error			
7	Alarm retry error			
8	Bus idle time error			
9	Wrong node address			
A	Telegram valid			
B	Master load			
0x4002$_h$				
0	Module MDL counter			
1	Slot 1			
2	Slot 2			
...	...			
40	Slot 64			
0x4003$_h$				
0	Module NDL counter			
1	Slot 1			

Index	Designation	Possible settings		IMPORTANT	
		Lenze	Selection		
2	Slot 2				
...	...				
40	Slot 64				
0x4100$_h$					
0	System version			Version details of coupler components	
1	Master FPGA			FPGA version	
2	I/O bus			Backplane bus version	
3	Firmware package			Version package	
4	Mx file			Name and version of coupler's Mx file	
0x4101$_h$					
0	Module FPGA version			FPGA versions of modules	
1	Slot 1			EtherCAT slot	
2	Slot 1				
...	...				
64	Slot 64				
0x4102$_h$					
0	Module firmware version			Firmware versions of modules	
1	Slot 1			EtherCAT slot	
2	Slot 1				
...	...				
64	Slot 64				
0x4103$_h$					
0	Module serial number			Serial numbers of modules	
1	Slot 1			EtherCAT slot	
2	Slot 1				
...	...				
64	Slot 64				
0x5000$_h$				If object 0xF100 indicates that a process alarm has occurred, you can access the current process alarm data here. The corresponding module description contains the process alarm data assignment.	
0	Hardware interrupt data			Current process alarm data	
1	Slot number			EtherCAT slot no. of module on which the alarm has occurred	
2	Hardware interrupt data 00			Process alarm data	
3	Hardware interrupt data 01				
4	Hardware interrupt data 02				

Index	Designation	Possible settings		IMPORTANT	
		Lenze	Selection		
5	Hardware interrupt data 03				
6	Acknowledge			Writing any value resets the process alarm counter and if necessary acknowledges the alarm If auto-acknowledge is deactivated for the EtherCAT coupler, you can reset the hardware interrupt counter of object 0xF100 and acknowledge the process alarm by writing any value to subindex 0x06 of index 0x5000.	

10.12.3 Storage of the PDOs

Index	Description
0x6000	Input PDO (1. slot)
0x6001	Input PDO (2. slot)
...	...
0x601F	Input PDO (32. slot)
0x7000	Output PDO (1. slot)
0x7001	Output PDO (1. slot)
...	...
0x701F	Output PDO (32. slot)

10.12.4 Emergency telegram

Emgergency telegrams can only be sent by modules which support alarm functions such as ”process alarm” or ”diagnostic alarm”. These are EPM-S404, EPM-S405, EPM-S406, EPM-S408 and the counter modules EPM-S6xx.

Emergency messages are triggered in the context of device-internal mechanisms and are reported to the master via the mailbox service of EtherCAT.

If a state change of an EtherCAT gateway cannot be carried out, this fact is reported by the corresponding emergency message.

For a more detailed error description the EtherCAT master reads out the AL status code (AL = application layer). It is in the EtherCAT coupler in register ’0x0134’.

An emergency message has the following structure:

Byte							
0	1	2	3	4	5	6	7
Emergency Error		State	Slot	Type	Code		Reserved

Emergency Errror	Lenze = 0xFF00
State	1: Init
	2: Pre-Operational
	3: Save-Operational
	4: Operational
Slot	Slot of the module which has reported the error.
Type	1: Process alarm
	2: Diagnostic alarm
Code	Error code which is described with the corresponding module.

In the »PLC Designer« the emergency messages are displayed as raw data and entered into the logbook. Within this telegram, the reported error is entered as a 5-digit hex value from the information ”data:” on. The structure of the hex value corresponds to bytes 3 ... 7 in the above table.

Example of an error message

07174 2013-06-04 10:12:04 _02M6D601 (1008): CoE emergency request.
id=0x0, len=8, ErrCode=0x0, ErrReg=0x8, data: 0x5 0x2 0x0 0x15 0x0.

Error information ”data”:

- Slot: 5
- Type: diagnostic alarm
- Code: error message ’0x0015’ (Invalid mailbox configuration)

10.12.5 EtherCAT-specific error codes

Code	Description	Current State	Resulting State
0x0000	No error	Any	Current state
0x0001	Unspecified error	Any	Any + E
0x0002	No Memory	Any	Any + E
0x0011	Invalid requested state change	I → S, I → O, P → O, O → B, S → B, P → B	Current state + E
0x0012	Unknown requested state	Any	Current state + E
0x0013	Bootstrap not supported	I → B	I + E
0x0014	No valid firmware	I → P	I + E
0x0015	Invalid mailbox configuration	I → B	I + E
0x0016	Invalid mailbox configuration	I → P	I + E
0x0017	Invalid SyncManager configuration	P → S, S → O	Current state + E
0x0018	No valid inputs available	O, S → O	S + E
0x0019	No valid outputs	O, S → O	S + E
0x001A	Synchronization error	O, S → O	S + E
0x001B	SyncManager watchdog	O, S	S + E
0x001C	Invalid SyncManager Types	O, S, P → S	S + E
0x001D	Invalid Output Configuration	O, S, P → S	S + E
0x001E	Invalid Input Configuration	O, S, P → S	P + E
0x001F	Invalid Watchdog Configuration	O, S, P → S	P + E
0x0020	Coupler needs cold start	Any	Current state + E
0x0021	Coupler needs INIT	B, P, S, O	Current state + E
0x0022	Coupler needs PREOP	S, O	S + E, O + E
0x0023	Coupler needs SAFEOP	O	O + E
0x0024	Invalid Input Mapping	P → S	0x0019
0x0025	Invalid Output Mapping	P → S	P + E
0x0026	Inconsistent Settings	P → S	P + E
0x0027	Free-run not supported	P → S	P + E
0x0028	Synchronization not supported	P → S	P + E
0x0029	Free-run needs 3 Buffer Mode	P → S	P + E
0x002A	Background Watchdog	S, O	P + E
0x002B	No Valid Inputs and Outputs	O, S → O	S + E
0x002C	Fatal Sync Error	O	S + E
0x002D	No Sync Error	S → O	S + E
0x0030	Invalid DC SYNC Configuration	O, S → O, P → S	P + E, S + E
0x0031	Invalid DC Latch Configuration	O, S → O, P → S	P + E, S + E
0x0032	PLL Error	O, S → O	S + E
0x0033	DC Sync IO Error	O, S → O	S + E

Code	Description	Current State	Resulting State
0x0034	DC Sync Timeout Error	O, S → O	S + E
0x0035	DC Invalid Sync Cycle Time	P → S	P + E
0x0036	DC Sync0 Cycle Time	P → S	P + E
0x0037	DC Sync1 Cycle Time	P → S	P + E
0x0041	MBX_AOE	B, P, S, O	Current state + E
0x0042	MBX_EOE	B, P, S, O	Current state + E
0x0043	MBX_COE	B, P, S, O	Current state + E
0x0044	MBX_FOE	B, P, S, O	Current state + E
0x0045	MBX_SOE	B, P, S, O	Current state + E
0x004F	MBX_VOE	B, P, S, O	Current state + E
0x0050	EEPROM No Access	Any	Any + E
0x0051	EEPROM Error	Any	Any + E
0x0060	Coupler Restarted Locally	Any	I
< x8000	Reserved		

10.12.6 Manufacturer-specific error codes

Code	Description	Current State	Resulting State
0x8000	no module recognized or present	I	I + E
0x8001	Module at system bus needs update	P > S	P + E
0x8002	Init error	P > S	PO + E
0x8003	unexpected restart (Watchdog)	P > S	PO + E

I: Init
P: Pre-Operational
S: Safe-Operational
O: Operational
B: Bootstrap
E: Error

10.12.7 SDO error codes

Using the SDO service and the object index you can access all parameters of the EtherCATSlave.

If an SDO request receives a negative evaluation, the corresponding error code is output in the Abort SDO Transfer Protocol. The following table shows the possible error codes:

Code	Description
0x05030000	Toggle bit not alternated
0x05040000	SDO protocol timed out
0x05040001	Client/server command specifier not valid or unknown
0x05040002	Invalid block size (block mode only)
0x05040003	Invalid sequence number (block mode only)
0x05040004	CRC error (block mode only)
0x05040005	Out of memory
0x06010000	Unsupported access to an object
0x06010001	Attempt to read a write only object
0x06010002	Attempt to write a read only object
0x06020000	Object does not exist in the object dictionary
0x06040041	Object cannot be mapped to the PDO
0x06040042	The number and length of the objects to be mapped would exceed PDO length
0x06040043	General parameter incompatibility reason
0x06040047	General internal incompatibility in the device
0x06060000	Access failed due to an hardware error
0x06070010	Data type does not match, length of service parameter does not match
0x06070012	Data type does not match, length of service parameter too high
0x06070013	Data type does not match, length of service parameter too low
0x06090011	Sub-index does not exist
0x06090030	Value range of parameter exceeded (only for write access)
0x06090031	Value of parameter written too high
0x06090032	Value of parameter written too low
0x06090036	Maximum value is less than minimum value
0x08000000	General error
0x08000020	Data cannot be transferred or stored to the application
0x08000021	Data cannot be transferred or stored to the application because of local control
0x08000022	Data cannot be transferred or stored to the application because of the present device state
0x08000023	Object directory dynamic generation fails or no object directory is present (e.g. object directory is generated from file and generation fails because of an file error)

11 DeviceNet communication

11.1 About DeviceNet

DeviceNet is an open device net standard that satisfies the user profile for industrial real-time system applications. The DeviceNet protocol has an open specification that is the property of and administered by the independent vendor organization ”Open DeviceNet Vendor Association” ODVA. This is where standardised device profiles are created to provide compatibility and exchangeability on logical level for simple devices of the same type.

In contrast to the classical source–destination model, DeviceNet uses a modern producer/consumer model that requires data packets with identifier fields for the identification of the data. This approach caters for multiple priority levels, efficient transfers of I/O data and multiple consumers for the data.

A device that has data to send produces the data on the network together with an identifier. All devices requiring data listen for messages. When devices recognize a suitable identifier, they act and consume the respective data.

DeviceNet carries two types of messages:

- I/O messages

  Messages that are subject to critical timing constraints and contain data for control purposes that can be exchanged by means of single or multiple connections and that employ identifiers with a high priority.

- Explicit messages

  These are used to establish multi-purpose point-to-point communication paths between two devices, which are used for the configuration of network couplers and for diagnostic purposes. These functions usually employ identifiers of a low priority.

Messages that are longer than 8 bytes are subject to the fragmentation service. A set of rules for master/slave, peer-to-peer- and multi-master connections is also available.

Transmission medium

DeviceNet employs a screened five-core cable as data communication medium. DeviceNet uses voltage differences and for this reason it exhibits less sensitivity to interference than a voltage or current based interface.

Signals and power supply conductors are included in the same network cable. It is therefore possible to connect devices that obtain the operating voltage via the network as well as devices with an integrated power supply. Furthermore it is possible to connect redundant power supplies to the network that guarantees the power supply when required.

DeviceNet employs a master line/tap line topology with up to 64 network nodes. The maximum distance is either 500m at a rate of 125kbit/s, 250m at a rate of 250kbit/s or 100m at a rate of 500kbit/s.

The length of the tap lines can be up to 6m while the total length of all tap lines depends on the baud rate.

Network nodes can be removed from or inserted into the network without interruption of the network operation. New and failed stations are detected automatically.

Bus access method

DeviceNet operates according to the Carrier-Sense Multiple Access (CSMA) principle, i.e. every station on the network may access the bus when it is not occupied (random access).

The exchange of messages is message orientated and not station orientated.

Each message is provided with a unique and prioritising identifier. At any time only one station is able to occupy the bus with its messages.

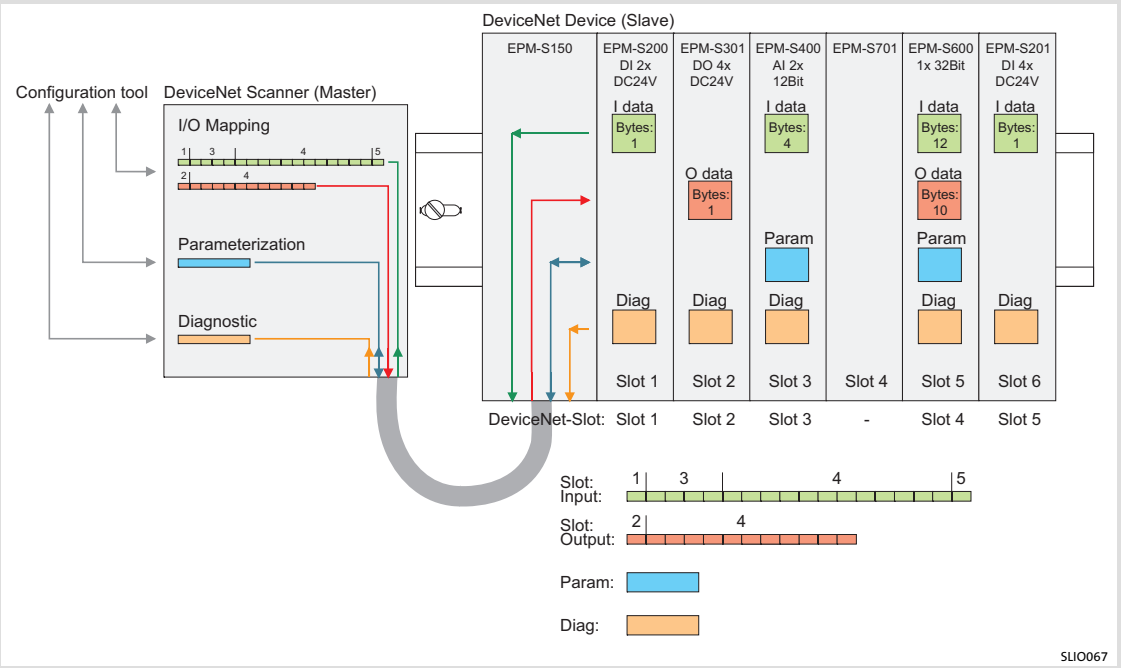
The DeviceNet bus access control is subject to non-destructive, bit-wise arbitration. In this case non-destructive means that the successful station participating in the arbitration does not need to re-send its message. The most important station is selected automatically when multiple stations access the bus simultaneously. If a station that is ready to send recognises that the bus is occupied, its send request is delayed until the current transfer has been completed.

Addressing

All stations on the bus must be uniquely identified by means of an ID address. Every DeviceNet device has addressing facilities.

11.2 Access to the I/O system 1000

The following figure shows the access to the areas ”I/O”, ”Parameters” and ”Diagnostics” under DeviceNet.



Note!

Please note that the supply and terminal modules do not have any type identification and thus cannot be recognised by the DeviceNet bus coupler.

In the following, slots within the DeviceNet are called DeviceNet slots. Counting always starts at 1.

EDS file (Electronic Data Sheet)

For the DeviceNet bus coupler module EPM-S150, the EDS file ”Lenze-EPM-S150_64_10.eds” is available in the download area of www.Lenze.de. Install this EDS file in your project planning tool. More information on how to install the EDS file can be found in the manual of your project planning tool.

11.2.1 Access to the I/O area

The DeviceNet bus coupler automatically detects the I/O compound modules plugged at the backplane bus and generates the number of the input and output bytes. (Supply and potential distributor modules are not considered.)

When the DeviceNet scanner is configured, the respective total length of the input or output data must be indicated. Information on I/O assignment of a module can be found in the ”Product description” chapter in the prevailing descriptions of the I/O compound modules.

The position (offset) of the input and output bytes within the input and output data results from the sequence of the modules (DeviceNet slot 1 ... 64). Use the basic address set for the bus coupler in the DeviceNet scanner to access the input or output data via the corresponding offset.

During operation, the DeviceNet bus coupler cyclically reads the input data of the peripheral modules and always provides the current state for the DeviceNet scanner. Output data, the DeviceNet bus coupler has directly received by the DeviceNet scanner will be directly forwarded to the modules as soon as they have been received via DeviceNet.

Configure DeviceNet scanner (master)

- ► Switch off the voltage supply of the DeviceNet bus coupler and set the baud rate and the DeviceNet address (📖 54).
- ► Start your configuration tool for the DeviceNet scanner.
- ► Set the ”POLL IO” connection type in the DeviceNet scanner.
- ► Enter the number of input and output data:
  Number of input data: Produced connection size
  Number of output data: Consumed connection size
- ► Enter a basic address for the input and output data (mapping).
- ► Activate the DeviceNet bus coupler EPM-S150 in the scan list.
- ► Start the DeviceNet scanner.

After the DeviceNet scanner has been configured, the input and output modules can be triggered under the configured addresses.

11.2.2 Access to parameter data

Your configuration tool also enables you to parameterise your I/O compound modules. For this purpose, the DeviceNet bus coupler must be located actively at the bus.

Your configuration tool serves to parameterise your modules in string form via the corresponding DeviceNet slot. you can also transfer the current parameters from the modules to the configuration tool, adapt and rewrite them.

Rules for parameter setting

- Each DeviceNet must be parameterised with a string.
- Within the string, each parameter consists of a type with attached value.
- The parameters must be separated by a space.
- Only parameters written in small letters are supported.

Depending on the type, you can indicate hexadecimal, decimal or binary values as parameters:

Type	Meaning	Value as	Example string
x	1 byte	Hexadecimal	xhh
2x	2 bytes	Hexadecimal	2xhhhh
4x	4 bytes	Hexadecimal	4xhhhhhhhh
+	1 byte	decimal positive	+ddd
2+	2 bytes	decimal positive	2+ddddd
4+	4 bytes	decimal positive	4+dddddddddd
-	1 byte	decimal negative	-ddd
2-	2 bytes	decimal negative	2-ddddd
4-	4 bytes	decimal negative	4-ddddddddd
b	1 byte	Binary	xbbbbbbbb

Example: The I/O compound module EPM-S405 has 18 bytes of parameter data. For parameterisation with the default values, the following string occurs:

x00 x00 x00 x00 x00 x02 xC1 x02 2x7FFF 2x8000 xC1 x02 2x7FFF 2x8000

Note!

If the parameter data does not match the hardware structure, the DeviceNet bus coupler changes to an error status and signalises it via its status LEDs (📖 54).

Modules that have not yet been parameterised will be automatically supplied with their default values as soon as a read access from the configuration tool is executed.

11.2.3 Access to diagnostic data

The DeviceNet bus coupler exclusively supports passive diagnostics, i.e. no alarm activation on the module side is required for diagnostics. You have to request the diagnostics by yourself.

For this purpose, go to your configuration tool and select the diagnostic data of the corresponding DeviceNet slot. All diagnostic data of the module will be displayed as byte sequence.

DeviceNet bus coupler

Class code: 100 (64_h)

No.	Name	Information	Format	Example
1	DeviceName	Device name	String	EPM-S150
2	HwVersion	HW output version	String	02
3	SwVersion	SW output version	String	V101
4	SerialNumber	Serial number	Unsigned16, String	00000205
5	FpgaVersion	FPGA version	Unsigned16, String	V208
6	MxFile	Mx file	String	MX000053.101
7	ProductVersion	Product version	String	01V01.00
8	OrderCode	Order no.	String	(8-digit Lenze material number)

I/O compound module

Class code:

Slot 1: 101 (65_h)

Slot 2: 102 (66_h)

...

Slot 64: 164 ($A4_h$)

No.	Name	Information	Format	Example
1	DeviceName	Device name	String	EPM-S403
2	HwVersion	HW output version	String	21
3	SwVersion	SW output version	String	V202
4	SerialNumber	Serial number	Unsigned32, String	00001143
5	FpgaVersion	FPGA version	Unsigned16, String	V208
6	MxFile	Mx file	String	MX000028.130
7	ProductVersion	Product version	String	01V31.001
8	OrderCode	Order no.	String	(8-digit Lenze material number)
20	Parameter	Parameter data	String	x00 x00 x31 x31 x31 x31
21	Diagnostics	Diagnostic data	String	x00 x15 x00 x00 x73 x08 x04 x00 x00 x00 x00 x00 x00 x00 x00 x00 4x000020EB

11.3 Setting the parameters of analog I/O

11.3.1 2 analog inputs 0 ... 10 V (12 bits) - EPM-S400

Parameter data

Pos. in string of digits	Name	Description/value	Lenze
1	Function channel 1	16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
2	Function channel 2		20_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	

11.3.2 4 analog inputs 0 ... 10 V (12 bits) - EPM-S401

Parameter data

Pos. in string of digits	Name	Description/value	Lenze
1	Function channel 1	16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
2	Function channel 2		20_h
3	Function channel 3		20_h
4	Function channel 4		20_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	

11.3.3 2 analog inputs 0/4 ... 20 mA (12 bits) - EPM-S402

Parameter data

Pos. in string of digits	Name	Description/value	Lenze
1	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	31_h
2	Function channel 2		31_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

11.3.4 4 analog inputs 0/4 ... 20 mA (12 bits) - EPM-S403

Parameter data

Pos. in string of digits	Name	Description/value	Lenze
1	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	31_h
2	Function channel 2		31_h
3	Function channel 3		31_h
4	Function channel 4		31_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

11.3.5 2 analog inputs -10 ... +10 V (16 bits) - EPM-S406

Parameter data

Pos. in string of digits	Name	Description/value	Lenze
1	Diagnostics	Bits 0 ... 5: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
2	Reserved	0	
3	Limit value monitoring	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 (0 = deactivated; 1 = activated) Bits 7 ... 2: Reserved	00_h
4	Interference frequency suppression	Bit 1, 0: Channel 1 00: Deactivated 01: 60 Hz 10: 50 Hz Bit 3, 2: Channel 2 00: Deactivated 01: 60 Hz 10: 50 Hz Bits 7 ... 4: Reserved	00_h
5	Function channel 1	12 (12_h): -10 ... 10 V / -27648 ... 27648_{dec} 34 (22_h): -10 ... 10 V / -16384 ... 16384_{dec} 16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
6	Reserved	0	
7	Upper limit value channel 1	Value from the rated range; if this value is exceeded and the limit value monitoring function is active, a process alarm is triggered. $7FFF_h$: Limit value alarm deactivated	$7FFF_h$
8	Lower limit value channel 1	Value from the rated range; if the actual value falls below this value and the limit value monitoring function is active, a process alarm is triggered. 8000_h: Limit value alarm deactivated	8000_h
9	Function channel 2	12 (12_h): -10 ... 10 V / -27648 ... 27648_{dec} 34 (22_h): -10 ... 10 V / -16384 ... 16384_{dec} 16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
10	Reserved	0	
11	Upper limit value channel 2	Value from the rated range; if this value is exceeded and the limit value monitoring function is active, a process alarm is triggered. $7FFF_h$: Limit value alarm deactivated	$7FFF_h$
12	Lower limit value channel 2	Value from the rated range; if the actual value falls below this value and the limit value monitoring function is active, a process alarm is triggered. 8000_h: Limit value alarm deactivated	8000_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
-10 ... +10 V (12_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	0	0000		
	-5	-13824	CA00		
	-10	**-27648**	9400		
	-11.76	-32512	8100	Underflow	
-10 ... +10 V (22_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	0	0000		
	-5	-8192	E000		
	-10	**-16384**	C000		
	-12.5	-20480	B000	Underflow	
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	0	0000		
	-1.76	-4864	ED00	Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	-2	-3277	F333	Underflow	

11.3.6 2 analog inputs 0/4 ... 20 mA (16 bits) - EPM-S408

Parameter data

Pos. in string of digits	Name	Description/value	Lenze
1	Diagnostics	Bits 0 ... 5: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
2	Reserved	0	
3	Limit value monitoring	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 (0 = deactivated; 1 = activated) Bits 7 ... 2: Reserved	00_h
4	Interference frequency suppression	Bit 1, 0: Channel 1 00: Deactivated 01: 60 Hz 10: 50 Hz Bit 3, 2: Channel 2 00: Deactivated 01: 60 Hz 10: 50 Hz Bits 7 ... 4: Reserved	00_h
5	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	41_h
6	Reserved	0	
7	Upper limit value channel 1	Value from the rated range; if this value is exceeded and the limit value monitoring function is active, a process alarm is triggered. $7FFF_h$: Limit value alarm deactivated	$7FFF_h$
8	Lower limit value channel 1	Value from the rated range; if the actual value falls below this value and the limit value monitoring function is active, a process alarm is triggered. 8000_h: Limit value alarm deactivated	8000_h
9	Function channel 2	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	41_h
10	Reserved	0	
11	Upper limit value channel 2	Value from the rated range; if this value is exceeded and the limit value monitoring function is active, a process alarm is triggered. $7FFF_h$: Limit value alarm deactivated	$7FFF_h$
12	Lower limit value channel 2	Value from the rated range; if the actual value falls below this value and the limit value monitoring function is active, a process alarm is triggered. 8000_h: Limit value alarm deactivated	8000_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

11.3.7 2 analog outputs 0 ... 10 V (12 bits) - EPM-S500

Parameter data

Pos. in string of digits	Name	Description/value	Lenze
1	Reserved	0	
2	Short-circuit detection	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 Bits 2 ... 7: Reserved	00_h
3	Function channel 1	16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
4	Function channel 2		20_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Output area (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	

11.3.8 4 analog outputs 0 ... 10 V (12 bits) - EPM-S501

Parameter data

Pos. in string of digits	Name	Description/value	Lenze
1	Reserved	0	
2	Short-circuit detection	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 Bit 2: Channel 3 Bit 3: Channel 4 Bits 4 ... 7: Reserved	00_h
3	Function channel 1	16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
4	Function channel 2		20_h
5	Function channel 3		20_h
6	Function channel 4		20_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Output area (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	

11.3.9 2 analog outputs 0/4 ... 20 mA (12 bits) - EPM-S502

Parameter data

Pos. in string of digits	Name	Description/value	Lenze
1	Reserved	0	
2	Wire-breakage detection	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 Bits 2 ... 7: Reserved	00_h
3	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	31_h
4	Function channel 2		31_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

11.3.10 4 analog outputs 0/4 ... 20 mA (12 bits) - EPM-S503

Parameter data

Pos. in string of digits	Name	Description/value	Lenze
1	Reserved	0	
2	Wire-breakage detection	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 Bit 2: Channel 3 Bit 3: Channel 4 Bits 4 ... 7: Reserved	00_h
3	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	31_h
4	Function channel 2		31_h
5	Function channel 3		31_h
6	Function channel 4		31_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

11.4 Parameterising the temperature measurement

11.4.1 Four (two) analog inputs for resistance tests - EPM-S404

Note!

- ► Use parameter setting to deactivate unused inputs.
- ► If thermal detectors are connected in a 3-wire or 4-wire setup, channels 3 and/or 4 must be deactivated.
- ► The module does not provide any auxiliary supply for sensors.

Parameter data

Pos. in string of digits	Name	Description/value	Lenze
1	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 0 ... 5: Reserved Bit 6: diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
2	Wire-breakage detection	Bit 0: Channel 1 (0 = inhibited; 1 = enabled) : Bit 3: Channel 4 Bits 4 ... 7: Reserved	00_h
3	Limit value monitoring	Bit 0: Channel 1 (0 = inhibited; 1 = enabled) : Bit 3: Channel 4 Bits 4 ... 7: Reserved	00_h
4	Reserved		
5	Temperature system	Bit 0, 1: 00_b = °C; 01_b= °F; 10_b = K Bits 2 ... 7: Reserved	00_h
6	Interference frequency suppression	Bit 0, 1: 01_b = 60 Hz; 10_b = 50 Hz Bits 2 ... 7: Reserved	02_h

Pos. in string of digits	Name	Description/value	Lenze
Channel 1			
7	Function channel 1	Thermal detector: 80 (50_h): PT100 2-wire conductor -200°C ... +850°C / -2000 ... $+8500_{dec}$ 81 (51_h): PT1000 2-wire conductor -200°C ... +850°C / -2000 ... $+8500_{dec}$ 82 (52_h): Ni100 2-wire conductor -60°C ... +250°C / -600 ... $+2500_{dec}$ 83 (53_h): Ni1000 2-wire conductor -60°C ... +250°C / -600 ... $+2500_{dec}$ 88 (58_h): PT100 3-wire conductor -200°C ... +850°C / -2000 ... $+8500_{dec}$ 89 (59_h): PT1000 3-wire conductor -200°C ... +850°C / -2000 ... $+8500_{dec}$ 90 ($5A_h$): Ni100 3-wire conductor -60°C ... +250°C / -600 ... $+2500_{dec}$ 91 ($5B_h$): Ni1000 3-wire conductor -60°C ... +250°C / -600 ... $+2500_{dec}$ 96 (60_h): PT100 4-wire conductor -200°C ... +850°C / -2000 ... $+8500_{dec}$ 97 (61_h): PT1000 4-wire conductor -200°C ... +850°C / -2000 ... $+8500_{dec}$ 98 (62_h): Ni100 4-wire conductor -60°C ... +250°C / -600 ... $+2500_{dec}$ 99 (63_h): Ni1000 4-wire conductor -60°C ... +250°C / -600 ... $+2500_{dec}$ Resistor: 112 (70_h): R 60-Ω2-wire conductor 0.00 ... +60.00 / 0 ... $+32767_{dec}$ 113 (71_h): R 600-Ω2-wire conductor 0.00 ... +600.00 / 0 ... $+32767_{dec}$ 114 (72_h): R 3000-Ω2-wire conductor 0.00 ... +3000.00 / 0 ... $+32767_{dec}$ 115 (73_h): R 6000-Ω2-wire conductor 0.00 ... +6000.00 / 0 ... $+32767_{dec}$ 128 (80_h): R 60-Ω4-wire conductor 0.00 ... +60.00 / 0 ... $+32767_{dec}$ 129 (81_h): R 600-Ω4-wire conductor 0.00 ... +600.00 / 0 ... $+32767_{dec}$ 130 (82_h): R 3000-Ω4-wire conductor 0.00 ... +3000.00 / 0 ... $+32767_{dec}$ 144 (90_h): R 60-Ω2-wire conductor 0.00 ... +60.00 / 0 ... $+6000_{dec}$ 145 (91_h): R 600-Ω2-wire conductor 0.00 ... +600.00 / 0 ... $+6000_{dec}$ 146 (92_h): R 3000-Ω2-wire conductor 0.00 ... +3000.00 / 0 ... $+30000_{dec}$ 160 ($A0_h$): R 60-Ω2-wire conductor 0.00 ... +60.00 / 0 ... $+6000_{dec}$ 161 ($A1_h$): R 600-Ω2-wire conductor 0.00 ... +600.00 / 0 ... $+6000_{dec}$ 162 ($A2_h$): R 3000-Ω2-wire conductor 0.00 ... +3000.00 / 0 ... $+30000_{dec}$ 255 (FF_h): channel deactivated	50_h

Pos. in string of digits	Name	Description/value	Lenze
8	Conversion time channel 1	You can set the transformer speed as a function of the interference frequency suppression (see 0x3105/x) for each channel. 0 (00_h): At 50 Hz: 324.1 ms/channel 16 bits; at 60 Hz: 270.5 ms/channel 16 bits 1 (01_h): At 50 Hz: 164.2 ms/channel 16 bits; at 60 Hz: 137.2 ms/channel 16 bits 2 (02_h): At 50 Hz: 84.2 ms/channel 16 bits; at 60 Hz: 70.5 ms/channel 16 bits 3 (03_h): at 50 Hz: 44.1 ms/channel 16 bits; at 60 Hz: 37.2 ms/channel 16 bits 4 (04_h): At 50 Hz: 24.2 ms/channel 16 bits; at 60 Hz: 20.5 ms/channel 16 bits 5 (05_h): At 50 Hz: 14.2 ms/channel 16 bits; at 60 Hz: 12.2 ms/channel 16 bits 6 (06_h): At 50 Hz: 9.2 ms/channel 16 bits; at 60 Hz: 8.0 ms/channel 16 bits 7 (07_h): At 50 Hz: 6.6 ms/channel 15 bits; at 60 Hz: 5.9 ms/channel 15 bits 8 (08_h): At 50 Hz: 4.2 ms/channel 13 bits; at 60 Hz: 3.8 ms/channel 13 bits	00_h
9	Upper limit value channel 1	You can define an upper or lower limit value for each channel. For this you can only specify values from the nominal range, otherwise you'll receive a parameterisation error. By specification of 7FFFh for the upper or 8000h for the lower limit value, the corresponding limit value is deactivated. If your measured value is outside a limit value and you have activated the limit value monitoring, a process alarm is triggered.	$7FFF_h$
10	Lower limit value channel 1		8000_h
Channel 2			
11	Function channel 2	See channel 1	50_h
12	Conversion time channel 2	See channel 1	00_h
13	Upper limit value channel 2	See channel 1	$7FFF_h$
14	Lower limit value channel 2		8000_h
Channel 3 (for two-wire conductor connections only)			
15	Function channel 3	See channel 1	50_h
16	Conversion time channel 3	See channel 1	00_h
17	Upper limit value channel 3	See channel 1	$7FFF_h$
18	Lower limit value channel 3		8000_h

Pos. in string of digits	Name	Description/value	Lenze
Channel 4 (for two-wire conductor connections only)			
19	Function channel 4	See channel 1	50_h
20	Conversion time channel 4	See channel 1	00_h
21	Upper limit value channel 4	See channel 1	$7FFF_h$
22	Lower limit value channel 4		8000_h

Measuring range

Measuring range (Fct. no.)	Measured value	Signal range	Range
2-wire: PT100 (50_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
2-wire: PT1000 (51_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
2-wire: NI100 (52_h)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
2-wire: NI1000 (53_h)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
3-wire: PT100 (58_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
3-wire: PT1000 (59_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
3-wire: NI100 ($5A_h$)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
3-wire: NI1000 ($5B_h$)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
4-wire: PT100 (60_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
4-wire: PT1000 (61_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
4-wire: NI100 (62_h)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow

Measuring range (Fct. no.)	Measured value	Signal range	Range
4-wire: NI1000 (63_h)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	$-600 \ldots +2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
2-wire: 0 ... 60 Ω (70_h)	-	-	Overflow
	0 ... 60 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
2-wire: 0 ... 600 Ω (71_h)	-	-	Overflow
	0 ... 600 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
2-wire: 0 ... 3000 Ω (72_h)	-	-	Overflow
	0 ... 3000 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
3-wire: 0 ... 60 Ω (78_h)	-	-	Overflow
	0 ... 60 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
3-wire: 0 ... 600 Ω (79_h)	-	-	Overflow
	0 ... 600 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
3-wire: 0 ... 3000 Ω ($7A_h$)	-	-	Overflow
	0 ... 3000 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
4-wire: 0 ... 60 Ω (80_h)	-	-	Overflow
	0 ... 60 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
4-wire: 0 ... 600 Ω (81_h)	-	-	Overflow
	0 ... 600 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
4-wire: 0 ... 3000 Ω (82_h)	-	-	Overflow
	0 ... 3000 Ω	0 ... 32767	Nominal range
	-	-	Underflow
2-wire: 0 ... 60 Ω (90_h)	-	-	Overflow
	0 ... 60 Ω	$0 \ldots 6000_{dec}$	Nominal range
	-	-	Underflow
2-wire: 0 ... 600 Ω (91_h)	-	-	Overflow
	0 ... 600 Ω	$0 \ldots 6000_{dec}$	Nominal range
	-	-	Underflow
2-wire: 0 ... 3000 Ω (92_h)	-	-	Overflow
	0 ... 3000 Ω	$0 \ldots 30000_{dec}$	Nominal range
	-	-	Underflow
3-wire: 0 ... 60 Ω (98_h)	-	-	Overflow
	0 ... 60 Ω	$0 \ldots 6000_{dec}$	Nominal range
	-	-	Underflow
3-wire: 0 ... 600 Ω (99_h)	-	-	Overflow
	0 ... 600 Ω	$0 \ldots 6000_{dec}$	Nominal range
	-	-	Underflow

Measuring range (Fct. no.)	Measured value	Signal range	Range
3-wire: 0 ... 3000 Ω ($9A_h$)	-	-	Overflow
	0 ... 3000 Ω	0 ... 30000_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 60 Ω ($A0_h$)	-	-	Overflow
	0 ... 60 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 600 Ω ($A1_h$)	-	-	Overflow
	0 ... 600 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 3000 Ω ($A2_h$)	-	-	Overflow
	0 ... 3000 Ω	0 ... 30000_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 60 Ω ($D0_h$)	70.55 Ω	32511_{dec}	Overflow
	0 ... 60 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 600 Ω ($D1_h$)	705.5 Ω	32511_{dec}	Overflow
	0 ... 600 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 3000 Ω ($D2_h$)	3528 Ω	32511_{dec}	Overflow
	0 ... 3000 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 60 Ω ($D8_h$)	70.55 Ω	32511_{dec}	Overflow
	0 ... 60 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 600 Ω ($D9_h$)	705.5 Ω	32511_{dec}	Overflow
	0 ... 600 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 3000 Ω (DA_h)	3528 Ω	32511_{dec}	Overflow
	0 ... 3000 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 60 Ω ($E0_h$)	70.55 Ω	32511_{dec}	Overflow
	0 ... 60 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 600 Ω ($E1_h$)	705.5 Ω	32511_{dec}	Overflow
	0 ... 600 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 3000 Ω ($E2_h$)	3528 Ω	32511_{dec}	Overflow
	0 ... 3000 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow

11.4.2 Two analog inputs for thermocouple measurement - EPM-S405

Parameter data

Pos. in string of digits	Name	Description/value	Lenze
01	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 0 ... 5: Reserved Bit 6: diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
02	Wire-breakage detection	Bit 0: Channel 1 (0 = inhibited; 1 = enabled) Bit 1: Channel 2 Bits 2 ... 7: Reserved	00_h
03	Limit value monitoring	Bit 0: Channel 1 (0 = inhibited; 1 = enabled) Bit 1: Channel 2 Bits 2 ... 7: Reserved	00_h
04	Reserved	0	
05	Temperature system	Bit 0, 1: 00_b = °C; 10_b = °F; 11_b = K Bits 2 ... 7: Reserved	00_h
06	Interference frequency suppression	Bit 0, 1: 01_b = 60 Hz; 10_b = 50 Hz Bits 2 ... 7: Reserved	02_h
Channel 1			
07	Function channel 1	External temperature compensation: 176 (60_h): type J, -210.0 ... +1200.0 °C / -2100 ... +12000_{dec} 177 (61_h): type K, -270.0 ... +1372.0 °C / -2700 ... +13720_{dec} 178 (62_h): type N -270.0 ... +1300.0 °C / -2700 ... +13000_{dec} 179 (63_h): type R, -50.0 ... +1769.0 °C / -500 ... +17690_{dec} 180 (64_h): type S, -50.0 ... +1769.0 °C / -500 ... +17690_{dec} 181 (65_h): type T, -270.0 ... +400.0 °C / -2700 ... +4000_{dec} 182 (66_h): type B, 0.0 ... +1820.0 °C / 0 ... +18200_{dec} 183 (67_h): type C, 0.0 ... +2315.0 °C / 0 ... +23150_{dec} 184 (68_h): type E, -270.0 ... +1000.0 °C / -2700 ... +10000_{dec} 185 (69_h): type L, -200.0 ... +900.0 °C / -2000 ... +9000_{dec} Internal temperature compensation: 192 ($C0_h$): type J, -210.0 ... +1200.0 °C / -2100 ... +12000_{dec} 193 ($C1_h$): type K, -270.0 ... +1372.0 °C / -2700 ... +13720_{dec} 194 ($C2_h$): type N -270.0 ... +1300.0 °C / -2700 ... +13000_{dec} 195 ($C3_h$): type R, -50.0 ... +1769.0 °C / -500 ... +17690_{dec} 196 ($C4_h$): type S, -50.0 ... +1769.0 °C / -500 ... +17690_{dec} 197 ($C5_h$): type T, -270.0 ... +400.0 °C / -2700 ... +4000_{dec} 198 ($C6_h$): type B, 0.0 ... +1820.0 °C / 0 ... +18200_{dec} 199 ($C7_h$): type C, 0.0 ... +2315.0 °C / 0 ... +23150_{dec} 200 ($C8_h$): type E, -270.0 ... +1000.0 °C / -2700 ... +10000_{dec} 201 ($C9_h$): type L, -200.0 ... +900.0 °C / -2000 ... +9000_{dec} 255 (FF_h): channel deactivated	$C1_h$

Pos. in string of digits	Name	Description/value	Lenze
08	Conversion time channel 1	You can set the transformer speed as a function of the interference frequency suppression (see 0x3105/x) for each channel. 0 (00_h): At 50 Hz: 324.1 ms/channel 16 bits; at 60 Hz: 270.5 ms/channel 16 bits 1 (01_h): at 50 Hz: 164.2 ms/channel 16 bits; at 60 Hz: 137.2 ms/channel 16 bits 2 (02_h): At 50 Hz: 84.2 ms/channel 16 bits; at 60 Hz: 70.5 ms/channel 16 bits 3 (03_h): at 50 Hz: 44.1 ms/channel 16 bits; at 60 Hz: 37.2 ms/channel 16 bits 4 (04_h): At 50 Hz: 24.2 ms/channel 16 bits; at 60 Hz: 20.5 ms/channel 16 bits 5 (05_h): at 50 Hz: 14.2 ms/channel 16 bits; at 60 Hz: 12.2 ms/channel 16 bits 6 (06_h): at 50 Hz: 9.2 ms/channel 16 bits; at 60 Hz: 8.0 ms/channel 16 bits 7 (07_h): at 50 Hz: 6.6 ms/channel 15 bits; at 60 Hz: 5.9 ms/channel 15 bits 8 (08_h): at 50 Hz: 4.2 ms/channel 13 bits; at 60 Hz: 3.8 ms/channel 13 bits	02_h
09	Upper limit value channel 1	You can define an upper or lower limit value for each channel. For this you can only specify values from the nominal range, otherwise you'll receive a parameterisation error. By specification of 7FFFh for the upper or 8000h for the lower limit value, the corresponding limit value is deactivated. If your measured value is outside a limit value and you have activated the limit value monitoring, a process alarm is triggered.	$7FFF_h$
0A	Lower limit value channel 1		8000_h
Channel 2			
0B	Function channel 2	See channel 1	$C1_h$
0C	Conversion time channel 2	See channel 1	02_h
0D	Upper limit value channel 2	See channel 1	$7FFF_h$
0E	Lower limit value channel 2		8000_h

Measuring range

Measuring range (Fct. no.)	Measured value [°C]	[°F]	[K]	Range
Type J: -210 ... +1200 °C -346 ... 2192 °F 63.2 ... 1473.2 K ($B0_h$: ext. comp. 0 °C) ($C0_h$: int. comp. 0 °C)	+14500	26420	17232	Overflow
	-2100 ... +12000	-3460 ... +21920	632 ... 14732	Nominal range
	-	-	-	Underflow
Type K: -210 ... +1372 °C -454 ... 2501.6 °F 0 ... 1645.2 K ($B1_h$: ext. comp. 0 °C) ($C1_h$: int. comp. 0 °C)	+16220	29516	18952	Overflow
	-2700 ... +13720	-4540 ... 25016	0 ... 16452	Nominal range
	-	-	-	Underflow

Measuring range (Fct. no.)	Measured value [°C]	[°F]	[K]	Range
Type N: -270 ... +1300 °C -454 ... 2372 °F 0 ... 1573.2 K ($B2_h$: ext. comp. 0 °C) ($C2_h$: int. comp. 0 °C)	+15500	28220	18232	Overflow
	-2700 ... +13000	-4540 ... 23720	0 ... 15732	Nominal range
	-	-	-	Underflow
Type R: -50 ... +1769 °C -58 ... 3216.2 °F 223.2 ... 2042.2 K ($B3_h$: ext. comp. 0 °C) ($C3_h$: int. comp. 0 °C)	+20190	32766	22922	Overflow
	-500 ... +17690	-580 ... 32162	2232 ... 20422	Nominal range
	-1700	-2740	1032	Underflow
Type S: -50 ... +1769 °C -58 ... 3216.2 °F 223.2 ... 2042.2 K ($B4_h$: ext. comp. 0 °C) ($C4_h$: int. comp. 0 °C)	+20190	32766	22922	Overflow
	-500 ... +17690	-580 ... 32162	2232 ... 20422	Nominal range
	-1700	-2740	1032	Underflow
Type T: -270 ... +440 °C -454 ... 752 °F 3.2 ... 673.2 K ($B2_h$: ext. comp. 0 °C) ($C2_h$: int. comp. 0 °C)	+5400	10040	8132	Overflow
	-2700 ... +4000	-4540 ... 7520	32 ... 6732	Nominal range
	-	-	-	Underflow
Type B: 0 ... +1820 °C 32 ... 2786.5 °F 273.2 ... 2093.2 K ($B6_h$: ext. comp. 0 °C) ($C6_h$: int. comp. 0 °C)	+20700	32766	23432	Overflow
	0 ... +18200	320 ... 27865	2732 ... 20932	Nominal range
	-1200	-1840	1532	Underflow
Type C: 0 ... +2315 °C 32 ... 2786.5 °F 273.2 ... 2093.2 K ($B7_h$: ext. comp. 0 °C) ($C7_h$: int. comp. 0 °C)	+25000	32766	23432	Overflow
	0 ... +23150	320 ... 27865	2732 ... 20932	Nominal range
	-1200	-1840	1532	Underflow
Type E: -270 ... +1000 °C -454 ... 1832 °F 0 ... 1273.2 K ($B8_h$: ext. comp. 0 °C) ($C8_h$: int. comp. 0 °C)	+12000	21920	14732	Overflow
	-2700 ... +10000	-4540 ... 18320	0 ... 12732	Nominal range
	-	-	-	Underflow
Type L: -200 ... +900 °C -328 ... 1652 °F 73.2 ... 1173.2 K ($B9_h$: ext. comp. 0 °C) ($C9_h$: int. comp. 0 °C)	+11500	21020	14232	Overflow
	-2000 ... +9000	-3280 ... 16520	732 ... 11732	Nominal range
	-	-	-	Underflow

11.5 Parameterising the counter

11.5.1 Rotary transducer signal evaluation

Depending on which edge of a channel is evaluated, the following pulse trains and the associated pulse multiplication can be realised.

Pulse trains	Description	
Channel A		
Channel B		
Single evaluation		There is a response to the falling edges of channel A. The number of pulses has not increased.
Double evaluation		There is a response to the rising and the falling edges of channel A. The number of pulses has doubled and is symmetrical.
Four-fold evaluation		The rising and the falling edges of channels A and B are evaluated. The number of pulses is quadrupled and is symmetrical.

11.5.2 One counter 32 bits, 24 V DC - EPM-S600

The following functions can be parameterised:

Counting functions	Description
Counting continuously	The counter counts from the loading value to the counting limit, then skips to the opposite counting limit and continues to count from there.
Counting once	The counter counts once/periodically from the loading value in the specified counting range.
Counting periodically	

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Main counting direction	The main counting direction can be parameterised: **None:** The whole counting range is available. **Forwards:** Limitation of the counting range upwards. The counter counts from the parameterised loading value in the positive direction to the parameterised final value -1 and then skips to the loading value again with the encoder pulse that is following. **Backwards:** Limitation of the counting range downwards. The counter counts from the parameterised loading value in the negative direction to the parameterised final value +1 and then skips to the loading value again with the encoder pulse that is following.
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter a differentiation between the internal gate (I-gate), hardware gate (HW gate), and software gate (SW gate) is made. ● The I-gate is the AND logic operation of the software gate (SW gate) and the hardware gate (HW gate). ● The SW gate is controlled via your user program (status word in the output area). ● The HW gate is controlled via the digital gate input. The following response can be parameterised: **Cancelling gate function:**After closing the gate and opening it again, the counting process continues from the loading value again. **Interrupting gate function:**After closing the gate and opening it again, the counting process continues with the last current counter content.
Latch function	If a positive edge occurs at the latch input, the current count value is stored in the latch register. The latch register is accessed via the input area. After a STOP-RUN transition, latch is always 0.
Comparator	You can specify a comparison value which, depending on the count value, activates the digital output or triggers a process alarm.
Hysteresis	By specification of a hysteresis you can for instance prevent the output from being permanently switched if the value of an encoder signal fluctuates around the comparison value.
Process alarm	The activation of a process alarm can be parameterised. A process alarm can be triggered in the case of the following events: ● Hardware gate open ● Hardware gate closed ● Counting limit - overflow ● Counting limit - underflow ● Comparison value reached ● Final value reached ● Latch value reached
Diagnostic alarm	If the diagnostic alarm is enabled in the parameter setting, it occurs as soon as another process alarm is triggered for the same event during process alarm processing.
Diagnostic function	Diagnostic functions are provided in the modules.
Diagnostic information	The diagnostic information describes the diagnostic contents which can be read out from a module. The diagnostic formation is not automatically sent by the module but must actively be read out by SDO access.

Further information can be found in the chapter ”Product description”.

Parameter data

Pos. in string of digits	Name	Description/value	Lenze
1	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 5 ... 0: Reserved Bit 6: diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
2	Input frequency track A	Filters for instance serve to filter signal peaks in the case of an unclean input signal. 0 (00_h): 500 kHz 1 (01_h): 300 kHz 2 (02_h): 100 kHz 3 (03_h): 60 kHz 4 (04_h): 30 kHz 6 (06_h): 10 kHz 7 (07_h): 5 kHz 8 (08_h): 2 kHz 9 (09_h): 1 kHz Other values are not permissible!	02_h
3	Input frequency track B		02_h
4	Input frequency latch		02_h
5	Input frequency gate		02_h
6	Input frequency reset		00_h
7	Reserved		
8	Alarm response	Setting activates process alarm Bit 0: Proc. alarm HW gate open Bit 1: Proc. alarm HW gate closed Bit 2: Proc. alarm overflow Bit 3: Proc. alarm underflow Bit 4: Proc. alarm comparison value Bit 5: Proc. alarm final value Bit 6: Proc. alarm latch value Bit 7: Reserved	80_h
9	Counter function	Bits 5 ... 0: 000000_b = counting continuously 000001_b = counting once, main counting direction forwards 000010_b = counting once, main counting direction backwards 000100_b = counting once, no main counting direction 001000_b = counting periodically, main counting direction forwards 010000_b = counting periodically, main counting direction backwards 100000_b = counting periodically, no main counting direction Bits 7 ... 6: Reserved	40_h
10	Comparator	Bit 2 ... 0: output switches (... if condition is met) 000_b = never 001_b = count value ≥ comparison value 010_b = count value ≤ comparison value 100_b = count value = comparison value Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 6 ... 4: Reset 000_b = deactivated 001_b = HIGH level 011_b = rising edge 101_b = rising edge, once Bit 7: Reserved	00_h

Pos. in string of digits	Name	Description/value	Lenze
11	Signal evaluation	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (connection to input ”A/pulse”) 010_b = double rotary transducer (connection to input ”A/pulse”) 011_b = four-fold rotary transducer (connection to input ”A/pulse” and ”B/direction”) 100_b = direction (pulse to ”A/pulse” and direction to ”B/direction”) Bit 6 ... 3: Hardware gate (HW gate) 000_b = deactivated (counter starts by setting SW gate) 001_b = activated (HIGH level at gate activates the HW gate. Counter starts if HW and SW gate are set.) Bit 7: Gate function (internal gate) 0= abort (counting process starts again from loading value) 1 = interrupt (counting process is continued with counter content)	00_h
12	Final value	Upper limit of the counting range	00_h
13	Start value	Lower limit of the counting range	00_h
14	Hysteresis	The hysteresis for instance serves to avoid frequent switching operations of the output and/or triggering of the alarm when the count value is within the range of the comparison value. For the hysteresis you can select a range between 0 and 255. With the settings 0 and 1 the hysteresis is switched off. The hysteresis has an effect on the zero crossing, comparison, overflow/underflow.	00_h
15	Pulse	The pulse duration indicates for how long the output is to be set if the parameterised comparison criterion is reached or exceeded. The pulse duration can be specified in steps of 2.048 ms between 0 and 522.24 ms. If the pulse duration is = 0, the output is set until the comparison condition is no longer met.	00_h

11.5.3 Two counters 32 bits, 24 V DC - EPM-S601

The following functions can be parameterised:

Counting functions	Description
Counting continuously	The counter counts from the loading value to the counting limit, then skips to the opposite counting limit and continues to count from there.
Counting once	The counter counts once/periodically from the loading value in the specified counting range.
Counting periodically	

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Main counting direction	The main counting direction can be parameterised: **None:** The whole counting range is available. **Forwards:** Limitation of the counting range upwards. The counter counts from the parameterised loading value in the positive direction to the parameterised final value -1 and then skips to the loading value again with the encoder pulse that is following. **Backwards:** Limitation of the counting range downwards. The counter counts from the parameterised loading value in the negative direction to the parameterised final value +1 and then skips to the loading value again with the encoder pulse that is following.
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter the internal gate (I-gate) is conform to the software gate (SW gate) which you control via your user program (status word in the output area). The following response can be parameterised: **Cancelling gate function:**After closing the gate and opening it again, the counting process continues from the loading value again. **Interrupting gate function:**After closing the gate and opening it again, the counting process continues with the last current counter content.
Comparator	You can specify a comparison value which, depending on the count value, activates the digital output or triggers a process alarm.
Hysteresis	By specification of a hysteresis you can for instance prevent the output from being permanently switched if the value of an encoder signal fluctuates around the comparison value.
Process alarm	The activation of a process alarm can be parameterised. A process alarm can be triggered in the case of the following events: ● Hardware gate open ● Hardware gate closed ● Counting limit - overflow ● Counting limit - underflow ● Comparison value reached ● Final value reached ● Latch value reached
Diagnostic alarm	If the diagnostic alarm is enabled in the parameter setting, it occurs as soon as another process alarm is triggered for the same event during process alarm processing.
Diagnostic function	Diagnostic functions are provided in the modules.
Diagnostic information	The diagnostic information describes the diagnostic contents which can be read out from a module. The diagnostic formation is not automatically sent by the module but must actively be read out by SDO access.

Further information can be found in the chapter ”Product description”.

Parameter data

Pos. in string of digits	Name	Description/value	Lenze
1	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
2	Input frequency counter 1, track A	Filters for instance serve to filter signal peaks in the case of an unclean input signal. 0 (00_h): 500 kHz 1 (01_h): 300 kHz 2 (02_h): 100 kHz 3 (03_h): 60 kHz 4 (04_h): 30 kHz 6 (06_h): 10 kHz 7 (07_h): 5 kHz 8 (08_h): 2 kHz 9 (09_h): 1 kHz Other values are not permissible!	02_h
3	Input frequency counter 1, track B		02_h
4	Input frequency counter 2, track A		02_h
5	Input frequency counter 2, track B		02_h
6	Alarm response counter 1	Setting activates process alarm Bits 1 ... 0: reserved Bit 2: Proc. alarm overflow Bit 3: Proc. alarm underflow Bit 4: Proc. alarm comparison value Bit 5: Proc. alarm final value Bits 7 ... 6: Reserved	00_h
7	Counter function counter 1	Bits 5 ... 0: 000000_b = counting continuously 000001_b = once: forwards 000010_b = once: backwards 000100_b = once: no main counting direction 001000_b = periodically: forwards 010000_b = periodically: backwards 100000_b = periodically: no main counting direction Bits 7 ... 6: Reserved	00_h
8	Comparator counter 1	Bits 2 ... 0: Comparison bit is set (... if condition is met) 000_b = never 001_b = count value ≥ comparison value 010_b = count value ≤ comparison value 100_b = count value = comparison value Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 7 ... 4: Reserved	00_h

Pos. in string of digits	Name	Description/value	Lenze
9	Signal evaluation counter 1	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (connection to input "A/pulse") 010_b = double rotary transducer (connection to input "A/pulse") 011_b = four-fold rotary transducer (connection to input "A/pulse" and "B/direction") 100_b = direction (pulse to "A/pulse" and direction to "B/direction") Bits 6 ... 3: Reserved Bit 7: Gate function (internal gate) 0= abort (counting process starts again from loading value) 1 = interrupt (counting process is continued with counter content)	00_h
10	Set value counter 1	By specifying a set value, the counter can be loaded with the set value. With an edge 0-1 to COUNTERVAL_SET in the control word, the set value is adopted by the counter.	00_h
11	Final value counter 1	Upper limit of the counting range	00_h
12	Loading value counter 1	Lower limit of the counting range	00_h
13	Hysteresis counter 1	The hysteresis for instance serves to avoid frequent switching operations of the output and/or triggering of the alarm when the count value is within the range of the comparison value. For the hysteresis you can select a range between 0 and 255. With the settings 0 and 1 the hysteresis is switched off. The hysteresis has an effect on the zero crossing, comparison, overflow/underflow.	00_h
14	Reserved		
15	Alarm response counter 2	See counter 1	00_h
16	Counter function counter 2	See counter 1	00_h
17	Comparator counter 2	See counter 1	00_h
18	Signal evaluation counter 2	See counter 1	00_h
19	Set value counter 2	See counter 1	00_h
20	Final value counter 2	See counter 1	00_h
21	Loading value counter 2	See counter 1	00_h
22	Hysteresis counter 2	See counter 1	00_h

11.5.4 One counter 32 bits, 5 V DC - EPM-S602

The following functions can be parameterised:

Counting functions	Description
Counting continuously	The counter counts from the loading value to the counting limit, then skips to the opposite counting limit and continues to count from there.
Counting once	The counter counts once/periodically from the loading value in the specified counting range.
Counting periodically	

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Main counting direction	The main counting direction can be parameterised: **None:** The whole counting range is available. **Forwards:** Limitation of the counting range upwards. The counter counts from the parameterised loading value in the positive direction to the parameterised final value -1 and then skips to the loading value again with the encoder pulse that is following. **Backwards:** Limitation of the counting range downwards. The counter counts from the parameterised loading value in the negative direction to the parameterised final value +1 and then skips to the loading value again with the encoder pulse that is following.
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter the internal gate (I-gate) is conform to the software gate (SW gate) which you control via your user program (status word in the output area). The following response can be parameterised: **Cancelling gate function:**After closing the gate and opening it again, the counting process continues from the loading value again. **Interrupting gate function:**After closing the gate and opening it again, the counting process continues with the last current counter content.
Comparator	You can specify a comparison value which, depending on the count value, activates the digital output or triggers a process alarm.
Hysteresis	By specification of a hysteresis you can for instance prevent the output from being permanently switched if the value of an encoder signal fluctuates around the comparison value.
Process alarm	The activation of a process alarm can be parameterised. A process alarm can be triggered in the case of the following events: ● Hardware gate open ● Hardware gate closed ● Counting limit - overflow ● Counting limit - underflow ● Comparison value reached ● Final value reached ● Latch value reached
Diagnostic alarm	If the diagnostic alarm is enabled in the parameter setting, it occurs as soon as another process alarm is triggered for the same event during process alarm processing.
Diagnostic function	Diagnostic functions are provided in the modules.
Diagnostic information	The diagnostic information describes the diagnostic contents which can be read out from a module. The diagnostic formation is not automatically sent by the module but must actively be read out by SDO access.



Further information can be found in the chapter ”Product description”.

Parameter data

Pos. in string of digits	Name	Description/value	Lenze
1	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
2	Input frequency track A	Filters for instance serve to filter signal peaks in the case of an unclean input signal. 0 (00_h): 500 kHz 1 (01_h): 300 kHz 2 (02_h): 100 kHz 3 (03_h): 60 kHz 4 (04_h): 30 kHz 6 (06_h): 10 kHz 7 (07_h): 5 kHz 8 (08_h): 2 kHz 9 (09_h): 1 kHz Other values are not permissible!	02_h
3	Input frequency track B		02_h
4	Input frequency reset		02_h
5	Reserved		
6	Alarm response	Setting activates process alarm Bits 1 ... 0: reserved Bit 2: Proc. alarm overflow Bit 3: Proc. alarm underflow Bit 4: Proc. alarm comparison value Bit 5: Proc. alarm final value Bits 7 ... 6: Reserved	00_h
7	Counter function	Bits 5 ... 0: 000000_b = counting continuously 000001_b = once: forwards 000010_b = once: backwards 000100_b = once: no main counting direction 001000_b = periodically: forwards 010000_b = periodically: backwards 100000_b = periodically: no main counting direction Bits 7 ... 6: Reserved	00_h
8	Comparator	Bits 2 ... 0: Comparison bit is set (... if condition is met) 000_b = never 001_b = count value ≥ comparison value 010_b = count value ≤ comparison value 100_b = count value = comparison value Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 6 ... 4: Reset 000_b = deactivated 001_b = HIGH level 011_b = rising edge 101_b = rising edge, once Bit 7: Reserved	00_h

Pos. in string of digits	Name	Description/value	Lenze
9	Signal evaluation	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (connection to input "A/pulse") 010_b = double rotary transducer (connection to input "A/pulse") 011_b = four-fold rotary transducer (connection to input "A/pulse" and "B/direction") 100_b = direction (pulse to "A/pulse" and direction to "B/direction") Bits 6 ... 3: Reserved Bit 7: Gate function (internal gate) 0= abort (counting process starts again from loading value) 1 = interrupt (counting process is continued with counter content)	00_h
10	Final value	Upper limit of the counting range	00_h
11	Start value	Lower limit of the counting range	00_h
12	Hysteresis		00_h

11.5.5 Two counters 32 bits, 24 V DC - EPM-S603

The following functions can be parameterised:

Counting functions	Description
Counting continuously	The counter counts from 0 to the counting limit, then skips to the opposite counting limit and continues to count from there.

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter the internal gate (I-gate) is conform to the software gate (SW gate) which you control via your user program (status word in the output area).



Further information can be found in the chapter ”Product description”.

Parameter data

Pos. in string of digits	Name	Description/value	Lenze
1	Input frequency counter 1, track A	Filters for instance serve to filter signal peaks in the case of an unclean input signal. 0 (00_h): 500 kHz 1 (01_h): 300 kHz 2 (02_h): 100 kHz 3 (03_h): 60 kHz 4 (04_h): 30 kHz 6 (06_h): 10 kHz 7 (07_h): 5 kHz 8 (08_h): 2 kHz 9 (09_h): 1 kHz Other values are not permissible!	02_h
2	Input frequency counter 1, track B		02_h
3	Input frequency counter 2, track A		02_h
4	Input frequency counter 2, track B		02_h
5	Counting direction counter 1, track B	Bits 2 ... 0: Reserved Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 7 ... 4: Reserved	00_h
6	Signal evaluation counter 1	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (connection to input ”A/pulse”) 010_b = double rotary transducer (connection to input ”A/pulse”) 011_b = four-fold rotary transducer (connection to input ”A/pulse” and ”B/direction”) 100_b = direction (pulse to ”A/pulse” and direction to ”B/direction”) Bits 7 ... 3: Reserved	00_h
7	Counting direction counter 2, track B	Bits 2 ... 0: Reserved Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 7 ... 4: Reserved	00_h
8	Signal evaluation counter 2	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (connection to input ”A/pulse”) 010_b = double rotary transducer (connection to input ”A/pulse”) 011_b = four-fold rotary transducer (connection to input ”A/pulse” and ”B/direction”) 100_b = direction (pulse to ”A/pulse” and direction to ”B/direction”) Bits 7 ... 3: Reserved	00_h

11.6 Parameterising the encoder evaluation

11.6.1 SSI - EPM-S604



Further information can be found in the chapter ”Product description”.

Parameter data

Pos. in string of digits	Name	Description/value	Lenze
1	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 5 ... 0: reserved Bit 6: diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
2	Dead time	The dead time, also called tbs (time between sends), defines the waiting time between two encoder values to be observed by the module so that the encoder is able to process its value. This data can be found in the data sheet for your encoder. HIGH LOW 00_h 30_h: 1 µs 00_h 60_h: 2 µs 00_h $C0_h$: 4 µs 01_h 80_h: 8 µs 03_h 00_h: 16 µs 06_h 00_h: 32 µs 09_h 00_h: 48 µs $0C_h$ 00_h: 64 µs	$0C00_h$
3	Baud rate	In the ”Monitoring operation” mode, the baud rate is irrelevant. Enter the baud rate here. This corresponds to the clock frequency via which the connected encoder communicates. More information on this can be found in the data sheet for your encoder. HIGH LOW 00_h 18_h: 2 MHz 00_h 20_h: 1.5 MHz 00_h 30_h: 1 MHz 00_h 60_h: 500 kHz 00_h $C0_h$: 250 kHz 01_h 80_h: 125 kHz	0180_h
4	Reserved		
5	Scaling	Depending on the encoder, further bits are transmitted in addition to the encoder value. Scaling serves to determine how many bits postpositioned to the encoder value will be removed by shifting the encoder value to the right. The encoder value is scaled by the module only after a gray-binary conversion. More information can be found in the data sheet for your encoder. Value range: 00_h ... $0F_h$ = 0 bits ... 15 bits	00_h

Pos. in string of digits	Name	Description/value	Lenze
6	Bit length of encoder data	Enter the bit length of the encoder data here. Depending on the encoder, the encoder data consist of the current encoder value with subsequent bits. The total length has to be specified here. More information on this can be found in the data sheet for your encoder. 7 (07_h) = ”8 bits” 8 (08_h) = ”9 bits” 9 (09_h) = ”10 bits” 10 ($0A_h$) = ”11 bits” 11 ($0B_h$) = ”12 bits” 12 ($0C_h$) = ”13 bits” 13 ($0D_h$) = ”14 bits” 14 $0E_h$) = ”15 bits” 15 ($0F_h$) = ”16 bits” 16 (10_h) = ”17 bits” 17 (11_h) = ”18 bits” 18 (12_h) = ”19 bits” 19 (13_h) = ”20 bits” 20 (14_h) = ”21 bits” 21 (15_h) = ”22 bits” 22 (16_h) = ”23 bits” 23 (17_h) = ”24 bits” 24 (18_h) = ”25 bits” 25 (19_h) = ”26 bits” 26 ($1A_h$) = ”27 bits” 27 ($1B_h$) = ”28 bits” 28 ($1C_h$) = ”29 bits” 29 ($1D_h$) = ”30 bits” 30 ($1E_h$) = ”31 bits” 31 ($1F_h$) = ”32 bits”	18_h

Pos. in string of digits	Name	Description/value	Lenze
7		Bit 1 ... 0: ready for operation During ”Monitoring operation” the module serves to monitor the data exchange between an SSI master and an SSI encoder. It receives the cycle by the master and the data flow by the SSI encoder. In the ”Master mode” operating mode the module provides a cycle to the encoder and receives data by the encoder. 01_b = monitoring operation 10_b = master mode Bit 2: shifting direction Specify the orientation of the encoder data here. More information can be found in the data sheet for your encoder. Usually, the SSI encoder uses ”MSB first”. 0 = LSB first (LSB is transmitted first) 1 = MSB first (MSB is transmitted first) Bit 3: edge clock signal Here you can specify the edge type of the clock signal, in the case of which the encoder supplies data. Information on this can be found in the data sheet for your encoder. Usually the SSI encoders respond to rising edges. 0 = falling edge 1 = rising edge Bit 4: coding In the ”Binary code” setting, the provided encoder value remains unchanged. In the ”Gray code” setting, the gray-coded value provided by the encoder is converted into a binary value. Only after this conversion, the received encoder value is scaled, if required. The Gray code is another form of representation of the binary code. It is based on the fact that two adjacent Gray numbers differ from each other in exactly one bit. If the Gray code is used, transmission errors can be easily detected, since adjacent characters must only differ from each other in one digit. Information on this can be found in the data sheet for your encoder. 0 = standard code 1 = Gray code Bits 7 ... 5: reserved	$1E_h$
8	Reserved		
9	SSI function	By enabling the SSI function the module starts with the cycle output and the evaluation of the encoder data. In the ”monitor operation” mode, the module starts with the encoder evaluation. 0 (00_h) = inhibited 1 (01_h) = enabled	00_h

11.7 Time stamp parameterising

11.7.1 2 digital inputs with time stamp function - EPM-S207

Parameter data

Pos. in string of digits	Name	Description/value	Lenze
1	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	14_h or $3C_h$ (fix)
2	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	00_h (fix)
3	Input delay DI1	00_h = 1 µs 02_h = 3 µs 04_h = 10 µs 07_h = 86 µs 09_h = 342 µs $0C_h$ = 273 µs Other values are not permissible.	02_h
4	Input delay DI2		02_h
5	Edge 0-1 an DI x	Time stamp entry on rising edge Bit 0: DI1 (0: inhibit, 1 = enable) Bit 1: DI2 (0: inhibit, 1 = enable) Bits 7 ... 2: Reserved	00_h
6	Edge 1-0 at DI x	Time stamp entry on falling edge Bit 0: DI1 (0: inhibit, 1 = enable) Bit 1: DI2 (0: inhibit, 1 = enable) Bits 7 ... 2: Reserved	00_h

11.7.2 2 digital outputs with time stamp function - EPM-S310

Parameter data

Pos. in string of digits	Name	Description/value	Lenze
1	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	14_h or $3C_h$ (fix)
2	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	00_h (fix)

11.8 Parameterising technology modules

11.8.1 2 digital outputs with PWM functionality - EPM-S620

Parameter data

Pos. in string of digits	Name	Description/value	Lenze
1	PWM 1: period	Set parameters here for the total time for pulse duration and pulse pause. The time should be selected as a factor for the 20.83 ns basis. Values below 25 µs are ignored. If the pulse duration is higher or equal to the period, the DO output is set permanently. Value range: 1200 ... 8388607 (25 µs ... approx. 175 ms)	$1F40_h$
2	PWM 2: Period		$1F40_h$

11.8.2 RS232 interface - EPM-S640

Parameter data

Parameter data - ASCII protocol			
Pos. in string of digits	**Name**	**Description/value**	**Lenze**
1	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
2	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
3	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
4	Baud rate	00_h: 9600 Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
5	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 01_h: ASCII	01_h
Option 1, character frame			
6	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
		Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
		Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
		Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2 ... 3, ZNA			
7	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
8	ZNA (LOW byte)		00_h

Parameter data - ASCII protocol			
Pos. in string of digits	**Name**	**Description/value**	**Lenze**
Option 4 ... 5, ZVZ			
9	Character delay time (HIGH byte)	Character delay time (ZVZ) The character delay time defines the maximum permissible time interval between two characters received within a telegram. If ZVZ = 0, the module calculates the ZVZ by means of the baud rate (approx. double character time). 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
10	Character delay time (LOW byte)		FA_h
Option 6, number of receive buffers			
11	Number of receive buffers	Defines the number of receive buffers. As long as only one receive buffer is used and is assigned, no more data can be received. If up to 250 receive buffers are connected, the received data can be redirected to a still free receive buffer. 1 ... 255 (01_h ... FF_h)	01_h
Option 7 ... 12, reserved			
12 ... 17	Reserved		00_h

Parameter data STX/ETX protocol			
Pos. in string of digits	**Name**	**Description/value**	**Lenze**
1	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
2	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
3	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
4	Baud rate	00_h: 9600 Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
5	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 02_h: STX/ETX	02_h
Option 1, character frame			
6	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
		Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
		Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
		Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2 ... 3, ZNA			
7	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
8	ZNA (LOW byte)		00_h

Parameter data STX/ETX protocol			
Pos. in string of digits	**Name**	**Description/value**	**Lenze**
Option 4 ... 5, TMO			
9	TMO (HIGH byte)	TMO serves to define the maximally permissible interval between two frames. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
10	TMO (LOW byte)		FA_h
Option 6, number of start identifiers			
11	No. of start identifiers	00_h: 1 start identifier (2nd start identifier is ignored) 01_h: 2 start identifiers	01_h
Option 7, start identifier 1			
12	Start identifier 1	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 8, start identifier 2			
13	Start identifier 2	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 9, number of end identifiers			
14	No. of end identifier	00_h: 1 end identifier (2nd end identifier is ignored) 01_h: 2 end identifiers	00_h
Option 10, end identifier 1			
15	End identifier 1	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 11, end identifier 2			
16	End identifier 2	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 12, reserved			
17	Reserved		00_h

Parameter data 3964(R) protocol			
Pos. in string of digits	**Name**	**Description/value**	**Lenze**
1	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
2	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
3	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
4	Baud rate	00_h: 9600 Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
5	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 03_h: 3964 04_h: 3964R	03_h
Option 1, character frame			
6	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
		Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
		Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
		Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2, ZNA (x 20 ms)			
7	ZNA	Time after request (ZNA) Waiting time observed until the next transmit request is processed. The ZNA is indicated as a factor in steps of 20 ms. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h

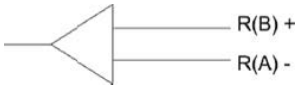
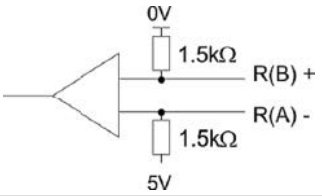
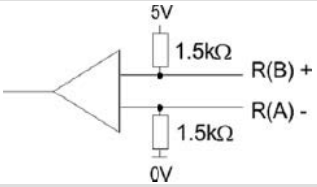
Parameter data 3964(R) protocol			
Pos. in string of digits	**Name**	**Description/value**	**Lenze**
Option 3, ZVZ (x 20 ms)			
8	Character delay time	Character delay time (ZVZ) The ZVZ defines the maximum permissible time interval between two characters received within a telegram. The ZVZ is indicated as a factor in steps of 20 ms. If ZVZ = 0, the module calculates the ZVZ by means of the baud rate (approx. double character time). 0 ... 255 [ms] (00_h ... FF_h)	00_h
Option 4, QVZ (x 20 ms)			
9	Acknowledgement time	Acknowledgement time (QVZ) The QVZ defines the max. permissible time interval until the partner is acknowledged while establishing/terminating a connection. The QVZ is indicated as a factor in steps of 20 ms. 1 ... 255 [ms] (01_h ... FF_h)	00_h
Option 5, BWZ (x 20 ms)			
10	Block wait time	Block wait time (BWZ) The BWZ is the maximum time period between the confirmation of a request frame (DLE) and STX of the response frame. The BWZ is indicated as a factor in steps of 20 ms. 1 ... 255 [ms] (01_h ... FF_h)	FA_h
Option 6, STX repetitions			
11	STX repetitions	Maximum number of times the module attempts to establish a connection. 1 ... 255 [ms] (01_h ... FF_h)	01_h
Option 7, DBL			
12	DBL	When exceeding the block wait time (BWZ) you can specify the maximum number of repetitions for the request frame using the DBL parameter. If these attempts fail, transmission is cancelled. 1 ... 255 [ms] (01_h ... FF_h)	00_h
Option 8, priority			
13	Priority	A communication partner has high priority if its sending attempt has precedence over the partner's transmit request. In the event of low priority, it must take second place behind the partner's transmit request. With 3964(R) the priorities of both partners must be different. The following settings are possible: 00_h: LOW 01_h: HIGH	00_h
Option 9 ... 12, reserved			
14 ... 17	Reserved		00_h

11.8.3 RS422/RS485 interface - EPM-S650

Parameter data

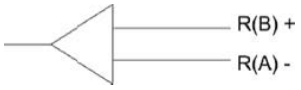
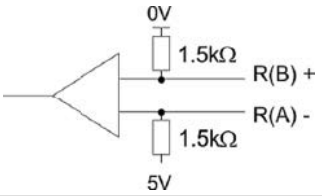
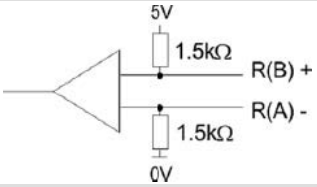
Parameter data - ASCII protocol			
Pos. in string of digits	**Name**	**Description/value**	**Lenze**
1	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
2	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
3	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
4	Baud rate	00_h: 9600 Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
5	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 01_h: ASCII	01_h
Option 1, character frame			
6	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
		Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
		Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
		Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2 ... 3, ZNA			
7	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
8	ZNA (LOW byte)		00_h

Parameter data - ASCII protocol			
Pos. in string of digits	**Name**	**Description/value**	**Lenze**
Option 4 ... 5, ZVZ			
9	Character delay time (HIGH byte)	Character delay time (ZVZ) The character delay time defines the maximum permissible time interval between two characters received within a telegram. If ZVZ = 0, the module calculates the ZVZ by means of the baud rate (approx. double character time). 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
10	Character delay time (LOW byte)		FA_h
Option 6, number of receive buffers			
11	Number of receive buffers	Defines the number of receive buffers. As long as only one receive buffer is used and is assigned, no more data can be received. If up to 250 receive buffers are connected, the received data can be redirected to a still free receive buffer. 1 ... 255 (01_h ... FF_h)	01_h
Option 7 ... 12, reserved			
12 ... 17	Reserved		00_h
Option 13, operating mode			
18	Operating mode	The operating mode serves to determine if the interface is operated in half duplex mode (RS485) or full duplex mode (RS422). ● 0x00: Half duplex - two-wire operation (RS485) Half duplex operation means that at a point of time data are either sent or received. The data are transmitted between the communication partners in both directions in turns. If the parameterisation is half duplex under RS485, a software data flow control is not possible. ● 0x01: Full duplex - four-wire operation (RS422) The data are exchanged simultaneously between the communication partners; transmission and reception can take place at the same time. Each communication partner must simultaneously actuate a receive path.	01_h
Option 14, cable assignment			
19	Cable assignment	For a connection with minimum reflections and the open circuit detection in RS422/485 operation, the cables can be pre-assigned via parameters with a defined idle level (see following table "Cable assignment parameters")	00_h

Cable assignment parameter		
Values	**Description**	
00_h	No pre-assignment of the receive path. This setting is only advisable for special drivers that are provided with a bus capability.	
01_h	Signal R(A) 5 V (open-circuit detection), signal R(B) 0 V Open-circuit detection is possible in full duplex operation under RS422.	
02_h	Signal R(A) 0 V, signal R(B) 5 V This pre-assignment corresponds to the idle state (no transmitter active) in half duplex operation under RS485. Open-circuit detection is not possible here.	

Parameter data STX/ETX protocol			
Pos. in string of digits	**Name**	**Description/value**	**Lenze**
1	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
2	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
3	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
4	Baud rate	00_h: 9600 Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
5	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 02_h: STX/ETX	02_h
Option 1, character frame			
6	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
		Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
		Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
		Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2 ... 3, ZNA			
7	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
8	ZNA (LOW byte)		00_h

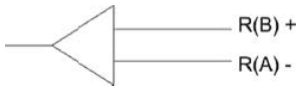
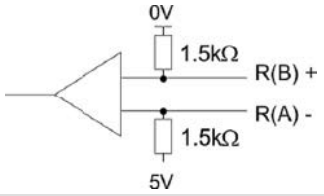
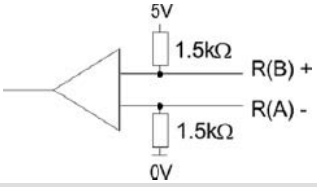
Parameter data STX/ETX protocol			
Pos. in string of digits	**Name**	**Description/value**	**Lenze**
Option 4 ... 5, TMO			
9	TMO (HIGH byte)	TMO serves to define the maximally permissible interval between two frames. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
10	TMO (LOW byte)		FA_h
Option 6, number of start identifiers			
11	No. of start identifiers	00_h: 1 start identifier (2nd start identifier is ignored) 01_h: 2 start identifiers	01_h
Option 7, start identifier 1			
12	Start identifier 1	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 8, start identifier 2			
13	Start identifier 2	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 9, number of end identifiers			
14	No. of end identifier	00_h: 1 end identifier (2nd end identifier is ignored) 01_h: 2 end identifiers	00_h
Option 10, end identifier 1			
15	End identifier 1	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 11, end identifier 2			
16	End identifier 2	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 12, reserved			
17	Reserved		00_h
Option 13, operating mode			
18	Operating mode	The operating mode serves to determine if the interface is operated in half duplex mode (RS485) or full duplex mode (RS422). ● 0x00: Half duplex - two-wire operation (RS485) Half duplex operation means that at a point of time data are either sent or received. The data are transmitted between the communication partners in both directions in turns. If the parameterisation is half duplex under RS485, a software data flow control is not possible. ● 0x01: Full duplex - four-wire operation (RS422) The data are exchanged simultaneously between the communication partners; transmission and reception can take place at the same time. Each communication partner must simultaneously actuate a receive path.	01_h
Option 14, cable assignment			
19	Cable assignment	For a connection with minimum reflections and the open circuit detection in RS422/485 operation, the cables can be pre-assigned via parameters with a defined idle level (see following table "Cable assignment parameters")	00_h

Cable assignment parameter		
Values	**Description**	
00_h	No pre-assignment of the receive path. This setting is only advisable for special drivers that are provided with a bus capability.	
01_h	Signal R(A) 5 V (open-circuit detection), signal R(B) 0 V Open-circuit detection is possible in full duplex operation under RS422.	
02_h	Signal R(A) 0 V, signal R(B) 5 V This pre-assignment corresponds to the idle state (no transmitter active) in half duplex operation under RS485. Open-circuit detection is not possible here.	

Parameter data 3964(R) protocol			
Pos. in string of digits	**Name**	**Description/value**	**Lenze**
1	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
2	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
3	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
4	Baud rate	00_h: 9600 Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
5	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 03_h: 3964 04_h: 3964R	03_h
Option 1, character frame			
6	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
		Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
		Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
		Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2, ZNA (x 20 ms)			
7	ZNA	Time after request (ZNA) Waiting time observed until the next transmit request is processed. The ZNA is indicated as a factor in steps of 20 ms. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h

Parameter data 3964(R) protocol			
Pos. in string of digits	**Name**	**Description/value**	**Lenze**
Option 3, ZVZ (x 20 ms)			
8	Character delay time	Character delay time (ZVZ) The ZVZ defines the maximum permissible time interval between two characters received within a telegram. The ZVZ is indicated as a factor in steps of 20 ms. If ZVZ = 0, the module calculates the ZVZ by means of the baud rate (approx. double character time). 0 ... 255 [ms] (00_h ... FF_h)	00_h
Option 4, QVZ (x 20 ms)			
9	Acknowledgement time	Acknowledgement time (QVZ) The QVZ defines the max. permissible time interval until the partner is acknowledged while establishing/terminating a connection. The QVZ is indicated as a factor in steps of 20 ms. 1 ... 255 [ms] (01_h ... FF_h)	00_h
Option 5, BWZ (x 20 ms)			
10	Block wait time	Block wait time (BWZ) The BWZ is the maximum time period between the confirmation of a request frame (DLE) and STX of the response frame. The BWZ is indicated as a factor in steps of 20 ms. 1 ... 255 [ms] (01_h ... FF_h)	FA_h
Option 6, STX repetitions			
11	STX repetitions	Maximum number of times the module attempts to establish a connection. 1 ... 255 [ms] (01_h ... FF_h)	01_h
Option 7, DBL			
12	DBL	When exceeding the block wait time (BWZ) you can specify the maximum number of repetitions for the request frame using the DBL parameter. If these attempts fail, transmission is cancelled. 1 ... 255 [ms] (01_h ... FF_h)	00_h
Option 8, priority			
13	Priority	A communication partner has high priority if its sending attempt has precedence over the partner's transmit request. In the event of low priority, it must take second place behind the partner's transmit request. With 3964(R) the priorities of both partners must be different. The following settings are possible: 00_h: LOW 01_h: HIGH	00_h
Option 9 ... 12, reserved			
14 ... 17	Reserved		00_h

Parameter data 3964(R) protocol			
Pos. in string of digits	**Name**	**Description/value**	**Lenze**
Option 13, operating mode			
18	Operating mode	The operating mode serves to determine if the interface is operated in half duplex mode (RS485) or full duplex mode (RS422). ● 0x00: Half duplex - two-wire operation (RS485) Half duplex operation means that at a point of time data are either sent or received. The data are transmitted between the communication partners in both directions in turns. If the parameterisation is half duplex under RS485, a software data flow control is not possible. ● 0x01: Full duplex - four-wire operation (RS422) The data are exchanged simultaneously between the communication partners; transmission and reception can take place at the same time. Each communication partner must simultaneously actuate a receive path.	01_h
Option 14, cable assignment			
19	Cable assignment	For a connection with minimum reflections and the open circuit detection in RS422/485 operation, the cables can be pre-assigned via parameters with a defined idle level (see following table ”Cable assignment parameters”)	00_h

Cable assignment parameter		
Values	**Description**	
00_h	No pre-assignment of the receive path. This setting is only advisable for special drivers that are provided with a bus capability.	
01_h	Signal R(A) 5 V (open-circuit detection), signal R(B) 0 V Open-circuit detection is possible in full duplex operation under RS422.	
02_h	Signal R(A) 0 V, signal R(B) 5 V This pre-assignment corresponds to the idle state (no transmitter active) in half duplex operation under RS485. Open-circuit detection is not possible here.	

12 PROFINET communication

12.1 About PROFINET

PROFINET is an open industrial Ethernet standard by PROFIBUS & PROFINET International (PI) for automation technology. PROFINET is standardised in IEC 61158.

PROFINET uses TCP/IP and IT standards and complements the PROFIBUS technology for applications where fast data communication in combination with industrial IT functions is required.

There are two PROFINET command classes which can be implemented in three performance steps:

- PROFINET IO
  - RT communication
  - IRT communication
- PROFINET CBA (is not supported by the EPM-S140 bus coupler)
  - TCP/IP communication

PROFINET IO

PROFINET IO describes an I/O data view on decentralised peripherals. PROFINET IO describes the entire data exchange between the I/O controller and the I/O device. In the configuration, PROFINET IO is based on PROFIBUS.

PROFINET IO always features the real time concept. PROFINET IO uses a Provider/Consumer model in contrast to the master/slave method under PROFIBUS. This supports the communication relations (AR = Application Relation) between the equal nodes at the Ethernet. Here, the provider transmits its data without a request of the communication partner. In addition to the user data exchange, functions for parameterisation and diagnostics are supported as well.

RT communication

RT stands for Real Time. RT communication is the basis for data exchange with PROFINET IO. Here, RT data is treated with higher priority.

IRT communication

IRT stands for Isochronous Real Time. With IRT communication, the bus cycle starts in a true-to-cycle mode, i.e. with a max. permissible deviation and is consistently synchronised. This ensures the time-controlled and cycle-synchronous transfer of data. Here, sync frames of a sync master in the network provide for synchronisation.

PROFINET performance features

PROFINET according to IEC 61158 has the following performance features:

- Full duplex transmission with 100Mbit/s via copper cables or optical fibre
- Switched Ethernet
- Auto negotiation (negotiating the transmission parameters)
- Auto crossover (transmit and receive path are automatically crossed if required)
- Wireless communication via Bluetooth or WLAN
- UDP/IP is used as higher-level protocol. UDP stands for User Datagram Protocol and comprises the unsecured connectionless broadcast communication in combination with IP.

PROFINET devices

As with PROFIBUS-DP, the following devices are classified according to their tasks with PROFINET IO as well:

- IO-Controller
- IO-Device
- IO-Supervisor

The IO-Controller is equivalent to the master under PROFIBUS. Here, it is the PLC with PROFINET connection in which the automation program is executed.

An IO-Device is a decentralised I/O field device which is connected via PROFINET. The IO-Device is equivalent to the slave under PROFIBUS.

An IO-Supervisor is an engineering station as for example a programming device, a PC or a control panel for commissioning and diagnostics.

Industrial Ethernet

Due to the openness of PROFINET standard, you can use standard Ethernet components. For industrial environments and due to the high baud rate of 100 Mbps, the PROFINET system should consist of industrial Ethernet components. All devices connected via switches are located in one network and can communicate directly with each other. A network is physically limited by a router. For communication via network limits, you must program your routers in such a way that they permit this communication.

Topology

Line: For the line structure, all nodes are connected in series. The line structure is achieved via switches which have already been implemented in the PROFINET devices. If a node fails, communication over the failed node is not possible.

Star: When nodes are connected to a switch with more than 2 PROFINET interfaces, a star-shaped network topology is automatically formed. If a single PROFINET device fails, this does not cause a complete network failure as in case of the other structures. The switch failure only causes a failure of the sub-network.

Ring: In order to increase the availability, you can connect both open ends of a line structure via a switch. When you parameterise the switch as redundancy manager, it will make the data be transmitted via an intact network connection in the case of power failure.

Tree: When several star-shaped structures are interconnected, a tree-shaped network topology is formed.

GSDML file

Lenze provides you with a GSDML file for your IO-Device. This file is either located on the enclosed data medium or in the download area of www.lenze.de.

Install the GSDML file in your project planning tool. More information on how to install the GSDML file can be found in the manual of your project planning tool. For configuration in your project planning tool, the GSDML file contains all system modules as XML data.

Addressing

In contrast to the PROFIBUS address, each device in PROFINET can be identified non-ambiguously via its PROFINET interface:

- IP address or MAC address
- Device name

Transmission medium

PROFINET is Ethernet-compatible according to the IEEE standards. The PROFINET IO field devices are exclusively connected via switches as network components. It is either carried out as a star-shaped structure via multiple port switches or line-shaped by means of switched implemented in the field device.

12.2 Access to the I/O system 1000

In the following, the access under PROFINET to the following ranges of the I/O system 1000 are displayed:

- I/O area
- Parameter data
- Diagnostic data

Note!

Please note that the supply and terminal modules do not have any type identification. They cannot be identified by the PROFINET coupler and are thus not considered in the listing or assignment of the slots.

In the following, slots within PROFINET are called PROFINET slots. Counting always starts at 0.

GSDML file

For configuring a Device-I/O interface connection in your own project planning tool, you get the performance features of the PROFINET components in the form of a GSDML file.

This file is either located on the enclosed data medium or in the download area of www.lenze.de. Install this GSDML file in your project planning tool.

More information on how to install the GSDML file can be found in the manual for your project planning tool. Structure and contents of the GSDML file are defined by the IEC 61158 standard.

Handling blocks

For accepting or changing data records during runtime, two corresponding handling blocks for reading/writing data records are required. For CPUs to be programmed with STEP7 by Siemens, the following handling blocks are available:

- SFB 52 Read data record
- SFB 53 Write data record
- SFB 54 Read diagnostic data

With ”slot” you address the module and via ”index” you address the data area related to a module.

Acyclic access to the I/O system

For an acyclic write and read access, PROFINET uses appropriate frames. Here, the PROFINET coupler or the module is addressed via slot (0 ... 64) and the corresponding data area within the module via index. Subslot is always 1.

Read access

Request frame (ReadRequest)							
0009_h +0	...	API +24	Slot +28	Subslot +30	Index +34	Length +36	... ... +64

Response with data (ReadResponse)							
0009_h +0	...	API +24	Slot +28	Subslot +30	Index +34	Length +36	... ... +64

Write access

Request frame (WriteRequest)								
8008_h +0	...	API +24	Slot +28	Subslot +30	Index +34	Length +36	... ... +63	Data +64 ...

Response with length (WriteResponse)							
0008_h +0	...	API +24	Slot +28	Subslot +30	Index +34	Length +36	... ... +64

12.2.1 Access to the I/O area

With PROFINET, the input/output area is automatically shown in the corresponding address range of the master system. The following index no. also provides access to the I/O areas:

- Index = 8028h: Reading of the input data (slot 1 ... 64)
- Index = 8029h: Reading of the output data (slot 1 ... 64)

12.2.2 Access to parameter data

The GSDML file serves to set parameter data for the corresponding modules via the hardware configuration. When the I/O device starts, the parameter data is given once to the modules via the I/O controller. After writing, the parameter data in the module is active.

Access to	Slot	Index
All parameters of the PROFINET coupler incl. header (4 bytes)	0	$007D_h$
All parameters of the PROFINET coupler	0	$007E_h$
All module parameters incl. header (4 bytes)	1 ... 64	$007D_h$
Data record DS 00_h of the module parameters	1 ... 64	$007E_h$
Data record DS 01_h of the module parameters	1 ... 64	$007F_h$
Data record DS 80_h ... 90_h of the module parameters	1 ... 64	0080_h ...0090_h

12.2.3 Access to diagnostic data

Alarm-capable I/O compound modules automatically send process alarm data or diagnostic data via the diagnostics frame if the alarm has been activated via parameterisation.

Another option is to request the diagnostic data. In this case, address the PROFINET bus coupler or the module via slot (0 ... 64) and the corresponding data area via the index.

Diagnostic data of PROFINET bus coupler

Slot = 0 / Subslot = 1 serves to access the PROFINET coupler. Depending on the index, you receive the following data:

Index = 0000_h: 4Byte: Byte 0: Diagnostic byte, byte 1 ... 3: 0 (fix)
Index = 0001_h: 20Byte: Byte 0: Diagnostic byte, byte 1 ... 19: 0 (fix)

Structure of diagnostic data of PROFINET bus coupler

Byte	Bit 7 ... 0	Lenze
0	Diagnostic byte Bit 0: Error at backplane bus Bit 1: Parameters have been rejected by the addressed module or coupler (error in data consistency) Bit 2: General bus coupler parameter error (data could not be saved) Bit 3: Version error at the backplane bus (at least one module at the backplane bus is not supported) Bit 5, 4: 0 (fix) Bit 6: Port error with activated port monitoring Bit 7: Configuration error backplane bus (actual configuration unequal to setpoint configuration)	00_h
2 ... 3 (19)	00_h (fix)	00_h

Diagnostic data of I/O compound module

Slot = 1 ... 64 / Subslot = 1 serves to access the corresponding I/O compound module. Depending on the index, you receive the following data:

- Index = 0000_h: Data record DS 00_h of the diagnostic data
- Index = 0001_h: Data record DS 01_h of the diagnostic data

Note!

Information on how to assign the ranges can be found in the descriptions of the corresponding I/O compound module.

Structure of diagnostic data of I/O compound module	
Byte	**Bit 7 ... 0**
0	Bit 0: Module fault, i.e. an error has been detected Bit 1: Internal error in the module Bit 2: External error - module cannot be addressed anymore Bit 3: Channel error in module Bit 4: External supply voltage is missing Bit 5, 6: Reserved Bit 7: Parameterisation error
1	Bit 3 ... 0: Module class 1111: Digital module 0101: Analog module 1000: Counter module, SSI module 0111: Time stamp module, gateway module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	see module description
3	Bit 5 ... 0: Reserved Bit 6: Process alarm lost Bit 7: Reserved
4	Channel type 70h: Module with digital inputs 71h: Module with analog inputs 72h: Module with digital outputs 73h: Module with analog outputs 74h: Module with analog inputs/outputs 76h: Counter
5	Number of diagnostic bits per channel
6	Number of channels per module
7	Position (channel) of the diagnostic event
8	Diagnostic event for channel/channel group 0 For assignment see module description
9	Diagnostic event for channel/channel group 1 For assignment see module description
...	
15	Diagnostic event for channel/channel group 7 For assignment see module description
16 ... 19	Value of the µs ticker when diagnostic data is generated (The I/O compound module features a timer that is started with mains ON and restarts with 0 after 232-1 µs.)

12.3 Project planning

Project planning is carried out as hardware configuration in your PROFINET configuring tool as for example the Siemens SIMATIC Manager. Here, you assign your I/O controller to the appropriate I/O device. A direct assignment is made via the PROFINET address that can be set at the I/O device via the address switch and the in I/O device properties.

By implementing the corresponding GSDML file, the PROFINET I/O bus coupler EPM-S140 is specified under:

PROFINET IO -> More field devices -> I/O > I/O system 1000

GSDML file

Lenze provides you with a GSDML file for the I/O device. This file is either located on the enclosed data medium or in the download area of www.lenze.de. Install the GSDML file in your configuring tool. More information on how to install the GSDML file can be found in the manual of your configuring tool.

For operating with your configuring tool, the GSDML file contains all I/O compound modules as XML files.

After installing the GSDML file, you can find the I/O system 1000 in the hardware catalogue of Siemens under:

PROFINET IO > More field devices > I/O > I/O system 1000

Commissioning

- ► Set up your PROFINET system.
- ► Start your configuring tool with a new project.
- ► Configure a master system and create a new
- ► PROFINET subnetwork.
- ► For configuring the bus coupler, select the ”EPM-S140” from the hardware catalogue and drag it to the PROFINET subnetwork.
- ► As soon as all switches of the address switch have the 0 status, the ”DeviceName” can be assigned freely via the properties of the PROFINET bus coupler. Otherwise assign a PROFINET name via the switch position of the address switch.
- ► If required, parameterise the I/O device.
- ► Transfer your project into the PLC.

Parameter data of PROFINET bus coupler

Parameter data of PROFINET bus coupler		
Byte	**Bit 7 ... 0**	**Lenze**
0	Bit 0: Process alarm 0 = inhibit 1 = enable Bit 1: Diagnostic alarm 0 = inhibit 1 = enable Bit 2: #Diagnostic alarm type 0 = manufacturer-specific data 1 = channel-specific data Bit 3 ... 6: Reserved Bit 7: Data format 0 = Data format Motorola 1 = Data format Intel	00_h
2 ... 6	00_h (fix)	00_h

Diagnostic alarm type Here you can determine the structure of the diagnostic alarm data that are sent via the diagnostic frame in the event of an error or be used to access standard PROFINET index numbers.

Manufacturer-specific data: You always obtain the data record DS 01h of the diagnostic data of a module.

Channel-specific data: You always obtain the data record DS 00h of the diagnostic data of a module.

Data format Motorola/Intel: This parameter refers to how a value is stored in the CPU address range.

In the Motorola format (default), the bytes are stored in descending order, i.e. the first byte contains the High byte and the second byte contains the Low byte.

In the Intel format, the bytes are stored in ascending order, i.e. the first byte contains the Low byte and the second byte contains the High byte.

12.4 I&M data

Identification and maintenance data (I&M) are information stored in a module which supports you in:

- Checking the system configuration
- Locating hardware changes in a system
- Eliminating errors in a system

Identification data (I data)are information on the module, as for instance order number and serial number, which are partly printed on the module housing. I data is manufacturer information on the module and can only be read.

Maintenance data (M data)are system-dependent information, as for instance mounting place and date of installation. M data is created during the project planning phase and written onto the module.

The I&M data serves to unambiguously identify modules online.

Via ”read data record” you can access certain identification data. Here, you address parts of the identification data via the corresponding index.

The data records have the following structure:

Contents	Length (byte)	Coding (hex.)
Head information		
- BlockType	2	I&M0: 0020_h I&M1: 0021_h I&M2: 0022_h I&M3: 0023_h
- BlockLength	2	I&M0: 0038_h I&M1: 0038_h I&M2: 0012_h I&M3: 0038_h
- BlockVersionHigh	1	01_h
- BlockVersionLow	4	00_h
Identification data (see the following table)	I&M0 / Index $AFF0_h$: 54_h I&M1 / Index $AFF1_h$: 54_h I&M2 / Index $AFF2_h$: 16_h I&M3 / Index $AFF3_h$: 54_h	

I&M data for PROFINET-IO

Identification data	Access	Lenze	Description
Identification data 0: (Index AFF0h)			
VendorIDHigh	Read (1 byte)	02h	Name of the manufacturer
VendorIDLow	Read (1 byte)	2Bh	
Order_ID	Read (20 bytes)		Order number
IM_SERIAL_NUMBER	Read (16 bytes)	-	Serial number
IM_HARDWARE_REVISION	Read (2 bytes)	1	HW output version
IM_SOFTWARE_REVISION ● SWRevisionPrefix ● IM_SWRevision_Functional_Enhancement ● IM_SWRevision_Bug_Fix ● IM_SWRevision_Internal_Change	Read (1 byte) (1 byte) (1 byte) (1 byte)	 V, R, P, U, T 00h ... FFh 00h ... FFh 00h ... FFh	Firmware version
IM_REVISION_COUNTER	Read (2 bytes)	0000h	for internal use
IM_PROFILE_ID	Read (2 bytes)	0000h	for internal use
IM_PROFILE_SPECIFIC_TYPE	Read (2 bytes)	0005h	for internal use
IM_VERSION ● IM_Version_Major ● IM_Version_Minor	Read (1 byte) (1 byte)	0101h	Version of the I&M data (e.g. 0101h = version 1.1)
IM_SUPPORTED	Read (2 bytes)	000Eh	I&M1 ... I&M3 are available
Maintenance data 1: (Index AFF1h)			
IM_TAG_FUNCTION	Read/write (32 bytes)	-	Selection of a clear identification throughout the system
IM_TAG_LOCATION	Read/write (22 bytes)	-	Selection of the mounting place
Maintenance data 2: (Index AFF2h)			
IM_DATE	Read/write (16 bytes)	YYYY-MMDD HH:MM	Selection of an date
Maintenance data 3: (Index AFF3h)			
IM_DESCRIPTOR	Read/write (54 bytes)	-	Selection of a comment

12.5 Index table

Within a module you can access the I/O data, parameter data and diagnostic data via index numbers. Under PROFINET the index numbers are summarised in the following areas:

0000_h ... $7FFF_h$: Manufacturer-specific index numbers
8000_h ... $F7FF_h$: Standard index numbers of PROFINET.

Information on this can be found in the PROFINET specification. There, the ”index” is also called ”data record”. In the following, all supported index numbers are listed.

Index	Description
Readable index numbers	
0000_h	Read DS 00_h diagnostic data
0001_h	Read DS 01_h diagnostic data
$007D_h$	Read all parameter data
$007E_h$	Read DS 00_h of the parameter data
$007F_h$ (only I/O compound modules)	Read DS 01_h of the parameter data
0080_h . 0090_h (only I/O compound modules)	Read DS 80_h . DS 90_h of the parameter data
8000_h / 8001_h / $800A_h$ / $800B_h$ / $800C_h$ / 8010_h / 8011_h / 8012_h / 8013_h / $801E_h$ / $802A_h$ / $802B_h$ / $802C_h$ / $802D_h$ / $802F_h$ / 8030_h / 8031_h / 8050_h / 8051_h / 8052_h / 8053_h / 8054_h / 8060_h / 8061_h / 8062_h / 8070_h / 8080_h / 8090_h	See PROFINET specification
8028_h (only I/O compound modules)	Read input data of a sub-slot
8029_h (only I/O compound modules)	Read output data of a sub-slot
$AFF0_h$	Read I&M 0 (serial no., name, SW/HW version)
$AFF1_h$ (only PROFINET bus coupler9)	Read I&M 1 (designation and mounting place)
$AFF2_h$ (only PROFINET bus coupler9)	Read I&M 2 (date of installation)
$AFF3_h$ (only PROFINET bus coupler9)	Read I&M 3 (comment)
$C000_h$ / $C001_h$ / $C00A_h$ / $C00B_h$ / $C00C_h$ / $C010_h$ / $C011_h$ / $C012_h$ / $C013_h$ / $E000_h$ / $E001_h$ / $E002_h$ / $E00A_h$ / $E00B_h$ / $E00C_h$ / $E010_h$ / $E011_h$ / $E012_h$ / $E013_h$ / $E030_h$ / $E040_h$ / $E050_h$ / $F000_h$ / $F001_h$ / $F00A_h$ / $F00B_h$ / $F00C_h$ / $F010_h$ / $F011_h$ / $F012_h$ / $F013_h$ / $F020_h$ / $F80C_h$ / $F820_h$ / $F821_h$ / $F830_h$ / $F831_h$ / $F840_h$ / 8041_h / $F842_h$	See PROFINET specification
Writable index numbers	
$007D_h$	Write all parameter data
$007E_h$	Write DS 00_h of the parameter data
$007F_h$ (only I/O compound modules)	Write DS 01_h of the parameter data
0080_h . 0090_h (only I/O compound modules)	Write DS 80_h . DS 90_h of the parameter data
$AFF1_h$ (only PROFINET bus coupler9)	Write I&M 1 (designation and mounting place)
$AFF2_h$ (only PROFINET bus coupler9)	Write I&M 2 (date of installation)
$AFF3_h$ (only PROFINET bus coupler9)	Write I&M 3 (comment)

12.6 Setting the parameters of analog I/O

12.6.1 2 analog inputs 0 ... 10 V (12 bits) - EPM-S400

Parameter data

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
128	0	Function channel 1	16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
129	0	Function channel 2		20_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	

Diagnostic data

Since this module does not support an alarm, the diagnostic data serve to provide information on this module. In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

The following errors are registered in the diagnostic data:

- Configuration/parameterisation errors
- Measuring range exceeded
- Measuring range not reached

By the use of the SFB 52 you can access the diagnostic data of the module anytime. Data set 1 has the following structure:

Byte	Bit 7 ... 0
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of a missing external supply voltage Bit 6: 0 (fixed) Bit 7: Parameterisation error
1	Bits 3 ... 0: Module class, 0101_b: Analog module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 71_h: Analog input Bit 7: 0 (fix)
5	Number of diagnostic bits output by the module per channel (here 02_h)
6	Number of channels of a module (here 02_h:)
7	Bit 0: Channel error, channel 1 Bit 1: Channel error, channel 2 Bit 7 ... 2: 0 (fixed)
8	Channel-specific errors: channel 1: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
9	Channel-specific errors: channel 2: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
10 ... 15	0 (fixed)

12.6.2 4 analog inputs 0 ... 10 V (12 bits) - EPM-S401

Parameter data

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
128	0	Function channel 1	16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
129	0	Function channel 2		20_h
130	0	Function channel 3		20_h
131	0	Function channel 4		20_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	

Diagnostic data

Since this module does not support an alarm, the diagnostic data serve to provide information on this module. In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

The following errors are registered in the diagnostic data:

- Configuration/parameterisation errors
- Measuring range exceeded
- Measuring range not reached

By the use of the SFB 52 you can access the diagnostic data of the module anytime. Data set 1 has the following structure:

Byte	Bit 7 ... 0
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of a missing external supply voltage Bit 6: 0 (fixed) Bit 7: Parameterisation error
1	Bits 3 ... 0: Module class, 0101_b: Analog module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 71_h: Analog input Bit 7: 0 (fix)
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 04_h:)
7	Bit 0: Channel error channel 1 Bit 1: Channel error channel 2 Bit 2: Channel error channel 3 Bit 3: Channel error channel 4 Bit 7 ... 4: 0 (fixed)
8	Channel-specific errors: channel 1: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
9	Channel-specific errors: channel 2: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
10	Channel-specific errors: channel 3: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
11	Channel-specific errors: channel 4: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
12 ... 15	0 (fixed)

12.6.3 2 analog inputs 0/4 ... 20 mA (12 bits) - EPM-S402

Parameter data

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
128	0	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	31_h
129	0	Function channel 2		31_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

Diagnostic data

Since this module does not support an alarm, the diagnostic data serve to provide information on this module. In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

The following errors are registered in the diagnostic data:

- Configuration/parameterisation errors
- Measuring range exceeded
- Measuring range not reached

By the use of the SFB 52 you can access the diagnostic data of the module anytime. Data set 1 has the following structure:

Byte	Bit 7 ... 0
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of a missing external supply voltage Bit 6: 0 (fixed) Bit 7: Parameterisation error
1	Bits 3 ... 0: Module class, 0101_b: Analog module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 71_h: Analog input Bit 7: 0 (fix)
5	Number of diagnostic bits output by the module per channel (here 02_h)
6	Number of channels of a module (here 02_h:)
7	Bit 0: Channel error, channel 1 Bit 1: Channel error, channel 2 Bit 7 ... 2: 0 (fixed)
8	Channel-specific errors: channel 1: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
9	Channel-specific errors: channel 2: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
10 ... 15	0 (fixed)

12.6.4 4 analog inputs 0/4 ... 20 mA (12 bits) - EPM-S403

Parameter data

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
128	0	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	31_h
129	0	Function channel 2		31_h
130	0	Function channel 3		31_h
131	0	Function channel 4		31_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

Diagnostic data

Since this module does not support an alarm, the diagnostic data serve to provide information on this module. In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

The following errors are registered in the diagnostic data:

- Configuration/parameterisation errors
- Measuring range exceeded
- Measuring range not reached

By the use of the SFB 52 you can access the diagnostic data of the module anytime. Data set 1 has the following structure:

Byte	Bit 7 ... 0
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of a missing external supply voltage Bit 6: 0 (fixed) Bit 7: Parameterisation error
1	Bits 3 ... 0: Module class, 0101_b: Analog module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 71_h: Analog input Bit 7: 0 (fix)
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 04_h:)
7	Bit 0: Channel error channel 1 Bit 1: Channel error channel 2 Bit 2: Channel error channel 3 Bit 3: Channel error channel 4 Bit 7 ... 4: 0 (fixed)
8	Channel-specific errors: channel 1: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
9	Channel-specific errors: channel 2: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
10	Channel-specific errors: channel 3: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
11	Channel-specific errors: channel 4: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
12 ... 15	0 (fixed)

12.6.5 2 analog inputs -10 ... +10 V (16 bits) - EPM-S406

Parameter data

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
0	1	Reserved	0	
	2	Limit value monitoring	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 (0 = deactivated; 1 = activated) Bits 7 ... 2: Reserved	00_h
1	0	Interference frequency suppression	Bit 1, 0: Channel 1 00: Deactivated 01: 60 Hz 10: 50 Hz Bit 3, 2: Channel 2 00: Deactivated 01: 60 Hz 10: 50 Hz Bits 7 ... 4: Reserved	00_h
128	0	Function channel 1	12 (12_h): -10 ... 10 V / -27648 ... 27648_{dec} 34 (22_h): -10 ... 10 V / -16384 ... 16384_{dec} 16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
	1	Reserved	0	
	2	Upper limit value channel 1	Value from the rated range; if this value is exceeded and the limit value monitoring function is active, a process alarm is triggered. $7FFF_h$: Limit value alarm deactivated	$7FFF_h$
	3	Lower limit value channel 1	Value from the rated range; if the actual value falls below this value and the limit value monitoring function is active, a process alarm is triggered. 8000_h: Limit value alarm deactivated	8000_h
129	0	Function channel 2	12 (12_h): -10 ... 10 V / -27648 ... 27648_{dec} 34 (22_h): -10 ... 10 V / -16384 ... 16384_{dec} 16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
	1	Reserved	0	
	2	Upper limit value channel 2	Value from the rated range; if this value is exceeded and the limit value monitoring function is active, a process alarm is triggered. $7FFF_h$: Limit value alarm deactivated	$7FFF_h$
	3	Lower limit value channel 2	Value from the rated range; if the actual value falls below this value and the limit value monitoring function is active, a process alarm is triggered. 8000_h: Limit value alarm deactivated	8000_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
-10 ... +10 V (12_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	0	0000		
	-5	-13824	CA00		
	-10	**-27648**	9400		
	-11.76	-32512	8100	Underflow	
-10 ... +10 V (22_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	0	0000		
	-5	-8192	E000		
	-10	**-16384**	C000		
	-12.5	-20480	B000	Underflow	
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	0	0000		
	-1.76	-4864	ED00	Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	-2	-3277	F333	Underflow	

Diagnostic data

Since this module does not support an alarm, the diagnostic data serve to provide information on this module. In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

The following errors are registered in the diagnostic data:

- Configuration/parameterisation errors
- Measuring range exceeded
- Measuring range not reached

By the use of the SFB 52 you can access the diagnostic data of the module anytime. Data set 1 has the following structure:

Byte	Bit 7 ... 0
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of a missing external supply voltage Bit 6: 0 (fixed) Bit 7: Parameterisation error
1	Bits 3 ... 0: Module class, 0101_b: Analog module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 71_h: Analog input Bit 7: 0 (fix)
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 04_h:)
7	Bit 0: Channel error channel 1 Bit 1: Channel error channel 2 Bit 2: Channel error channel 3 Bit 3: Channel error channel 4 Bit 7 ... 4: 0 (fixed)
8	Channel-specific errors: channel 1: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
9	Channel-specific errors: channel 2: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
10	Channel-specific errors: channel 3: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
11	Channel-specific errors: channel 4: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
12 ... 15	0 (fixed)

12.6.6 2 analog inputs 0/4 ... 20 mA (16 bits) - EPM-S408

Parameter data

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
0		Diagnostics	Bits 0 ... 5: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
		Reserved	0	
		Limit value monitoring	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 (0 = deactivated; 1 = activated) Bits 7 ... 2: Reserved	00_h
1		Interference frequency suppression	Bit 1, 0: Channel 1 00: Deactivated 01: 60 Hz 10: 50 Hz Bit 3, 2: Channel 2 00: Deactivated 01: 60 Hz 10: 50 Hz Bits 7 ... 4: Reserved	00_h
128		Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	41_h
		Reserved	0	
		Upper limit value channel 1	Value from the rated range; if this value is exceeded and the limit value monitoring function is active, a process alarm is triggered. $7FFF_h$: Limit value alarm deactivated	$7FFF_h$
		Lower limit value channel 1	Value from the rated range; if the actual value falls below this value and the limit value monitoring function is active, a process alarm is triggered. 8000_h: Limit value alarm deactivated	8000_h
129		Function channel 2	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	41_h
		Reserved	0	
		Upper limit value channel 2	Value from the rated range; if this value is exceeded and the limit value monitoring function is active, a process alarm is triggered. $7FFF_h$: Limit value alarm deactivated	$7FFF_h$
		Lower limit value channel 2	Value from the rated range; if the actual value falls below this value and the limit value monitoring function is active, a process alarm is triggered. 8000_h: Limit value alarm deactivated	8000_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

Diagnostic data

Since this module does not support an alarm, the diagnostic data serve to provide information on this module. In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

The following errors are registered in the diagnostic data:

- Configuration/parameterisation errors
- Measuring range exceeded
- Measuring range not reached

By the use of the SFB 52 you can access the diagnostic data of the module anytime. Data set 1 has the following structure:

Byte	Bit 7 ... 0
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of a missing external supply voltage Bit 6: 0 (fixed) Bit 7: Parameterisation error
1	Bits 3 ... 0: Module class, 0101_b: Analog module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 71_h: Analog input Bit 7: 0 (fix)
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 04_h:)
7	Bit 0: Channel error channel 1 Bit 1: Channel error channel 2 Bit 2: Channel error channel 3 Bit 3: Channel error channel 4 Bit 7 ... 4: 0 (fixed)
8	Channel-specific errors: channel 1: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
9	Channel-specific errors: channel 2: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
10	Channel-specific errors: channel 3: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
11	Channel-specific errors: channel 4: Bit 0: Configuration/parameterisation error Bit 5 ... 1: 0 (fixed) Bit 6: Measuring range not reached Bit 7: Measuring range exceeded
12 ... 15	0 (fixed)

12.6.7 2 analog outputs 0 ... 10 V (12 bits) - EPM-S500

Parameter data

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
0	1	Short-circuit detection	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 Bits 2 ... 7: Reserved	00_h
128	0	Function channel 1	16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
129	0	Function channel 2		20_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Output area (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	

Diagnostic data

Since this module does not support an alarm, the diagnostic data serve to provide information on this module. In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

The following errors are registered in the diagnostic data:

- Configuration/parameterisation errors
- Short circuit/overload (if parameterised)

Using SFB 52 you can access the diagnostic data of the module anytime. Data set 1 has the following structure:

Byte	Bit 7 ... 0
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of a missing external supply voltage Bit 6: 0 (fixed) Bit 7: Parameterisation error
1	Bits 3 ... 0: Module class, 0101_b: Analog module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 73_h: analog output Bit 7: 0 (fixed)
5	Number of diagnostic bits output by the module per channel (here 02_h)
6	Number of channels of a module (here 02_h:)
7	Bit 0: Channel error, channel 1 Bit 1: Channel error, channel 2 Bit 7 ... 2: 0 (fixed)
8	Channel-specific errors: channel 1: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Short circuit after M Bit 7 ... 4: 0 (fixed)
9	Channel-specific errors: channel 2: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Short circuit after M Bit 7 ... 4: 0 (fixed)
10 ... 15	0 (fixed)

12.6.8 4 analog outputs 0 ... 10 V (12 bits) - EPM-S501

Parameter data

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
0	1	Short-circuit detection	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 Bit 2: Channel 3 Bit 3: Channel 4 Bits 4 ... 7: Reserved	00_h
128	0	Function channel 1	16 (10_h): 0 ... 10 V / 0 ... 27648_{dec} 32 (20_h): 0 ... 10 V / 0 ... 16384_{dec} 255 (FF_h): channel deactivated	20_h
129	0	Function channel 2		20_h
130	0	Function channel 3		20_h
131	0	Function channel 4		20_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Output area (Fct. no.)	Voltage (U) [V]	Decimal (D)	Hex	Range	Conversion
0 ... 10 V (10_h)	11.76	32511	7EFF	Overflow	U = D * 10 / 27648 D = 27648 * U / 10
	10	**27648**	6C00	Nominal range	
	5	13824	3600		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	
0 ... 10 V (20_h)	12.5	20480	5000	Overflow	U = D * 10 / 16384 D = 16384 * U / 10
	10	**16384**	4000	Nominal range	
	5	8192	2000		
	0	**0**	0000		
	Not possible, is limited to 0 V			Underflow	

Diagnostic data

Since this module does not support an alarm, the diagnostic data serve to provide information on this module. In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

The following errors are registered in the diagnostic data:

- Configuration/parameterisation errors
- Short circuit/overload (if parameterised)

Using SFB 52 you can access the diagnostic data of the module anytime. Data set 1 has the following structure:

Byte	Bit 7 ... 0
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of a missing external supply voltage Bit 6: 0 (fixed) Bit 7: Parameterisation error
1	Bits 3 ... 0: Module class, 0101_b: Analog module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 73_h: analog output Bit 7: 0 (fixed)
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 04_h:)
7	Bit 0: Channel error channel 1 Bit 1: Channel error channel 2 Bit 2: Channel error channel 3 Bit 3: Channel error channel 4 Bit 7 ... 4: 0 (fixed)
8	Channel-specific errors: channel 1: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Short circuit after M Bit 7 ... 4: 0 (fixed)
9	Channel-specific errors: channel 2: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Short circuit after M Bit 7 ... 4: 0 (fixed)
10	Channel-specific errors: channel 3: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Short circuit after M Bit 7 ... 4: 0 (fixed)
11	Channel-specific errors: channel 4: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Short circuit after M Bit 7 ... 4: 0 (fixed)
12 ... 15	0 (fixed)

12.6.9 2 analog outputs 0/4 ... 20 mA (12 bits) - EPM-S502

Parameter data

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
0	1	Wire-breakage detection	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 Bits 2 ... 7: Reserved	00_h
128	0	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	31_h
129	0	Function channel 2		31_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

Diagnostic data

Since this module does not support an alarm, the diagnostic data serve to provide information on this module. In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

The following errors are registered in the diagnostic data:

- Configuration/parameterisation errors
- Open circuit (if parameterised)

By the use of the SFB 52 you can access the diagnostic data of the module anytime. Data set 1 has the following structure:

Byte	Bit 7 ... 0
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of a missing external supply voltage Bit 6: 0 (fixed) Bit 7: Parameterisation error
1	Bits 3 ... 0: Module class, 0101_b: Analog module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 73_h: analog output Bit 7: 0 (fixed)
5	Number of diagnostic bits output by the module per channel (here 02_h)
6	Number of channels of a module (here 02_h:)
7	Bit 0: Channel error, channel 1 Bit 1: Channel error, channel 2 Bit 7 ... 2: 0 (fixed)
8	Channel-specific errors: channel 1: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Open circuit Bit 7 ... 4: 0 (fixed)
9	Channel-specific errors: channel 2: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Open circuit Bit 7 ... 4: 0 (fixed)
10 ... 15	0 (fixed)

12.6.10 4 analog outputs 0/4 ... 20 mA (12 bits) - EPM-S503

Parameter data

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
0	1	Wire-breakage detection	Bit 0: Channel 1 (0 = deactivated; 1 = activated) Bit 1: Channel 2 Bit 2: Channel 3 Bit 3: Channel 4 Bits 4 ... 7: Reserved	00_h
128	0	Function channel 1	48 (30_h): 4 ... 20 mA / -4864 ... 32511 64 (40_h): 4 ... 20 mA / -3277 ... 20480 49 (31_h): 0 ... 20 mA / -4864 ... 32511 65 (41_h): 0 ... 20 mA / -3277 ... 20480 255 (FF_h): channel deactivated	31_h
129	0	Function channel 2		31_h
130	0	Function channel 3		31_h
131	0	Function channel 4		31_h

With the formulas listed in the following you can convert a digital value into an analog output value and vice versa.

Measuring range (Fct. no.)	Current (I) [mA]	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA (31_h)	23.52	32511	7EFF	Overflow	I = D * 20 / 27648 D = 27648 * I / 20
	20	**27648**	6C00	Nominal range	
	10	13824	3600		
	0	**0**	0000		
	-3.52	-4864	ED00	Underflow	
0 ... 20 mA (41_h)	25	20480	5000	Overflow	I = D * 20 / 16384 D = 16384 * I / 20
	20	**16384**	4000	Nominal range	
	10	8192	2000		
	0	**0**	0000		
	-4	-3277	F333	Underflow	
4 ... 20 mA (30_h)	22.81	32511	7EFF	Overflow	I = D * 16 / 27648 + 4 D = 27648 * (I-4) / 16
	20	**27648**	6C00	Nominal range	
	12	13824	3600		
	4	**0**	0000		
	1.19	-4864	ED00	Underflow	
4 ... 20 mA (40_h)	24	20480	5000	Overflow	I = D * 16 / 16384 + 4 D = 16384 * (I-4) / 16
	20	**16384**	4000	Nominal range	
	12	8192	2000		
	4	**0**	0000		
	0.8	-3277	F333	Underflow	

Diagnostic data

Since this module does not support an alarm, the diagnostic data serve to provide information on this module. In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

The following errors are registered in the diagnostic data:

- Configuration/parameterisation errors
- Open circuit (if parameterised)

By the use of the SFB 52 you can access the diagnostic data of the module anytime. Data set 1 has the following structure:

Byte	Bit 7 ... 0
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of a missing external supply voltage Bit 6: 0 (fixed) Bit 7: Parameterisation error
1	Bits 3 ... 0: Module class, 0101_b: Analog module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 73_h: analog output Bit 7: 0 (fixed)
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 04_h:)
7	Bit 0: Channel error channel 1 Bit 1: Channel error channel 2 Bit 2: Channel error channel 3 Bit 3: Channel error channel 4 Bit 7 ... 4: 0 (fixed)
8	Channel-specific errors: channel 1: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Open circuit Bit 7 ... 4: 0 (fixed)
9	Channel-specific errors: channel 2: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Open circuit Bit 7 ... 4: 0 (fixed)
10	Channel-specific errors: channel 3: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Open circuit Bit 7 ... 4: 0 (fixed)
11	Channel-specific errors: channel 4: Bit 0: Configuration/parameterisation error Bit 2 ... 1: 0 (fixed) Bit 3: Open circuit Bit 7 ... 4: 0 (fixed)
12 ... 15	0 (fixed)

12.7 Parameterising the temperature measurement

12.7.1 Four (two) analog inputs for resistance tests - EPM-S404

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
0	0	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 0 ... 5: Reserved Bit 6: diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
	1	Wire-breakage detection	Bit 0: Channel 1 (0 = inhibited; 1 = enabled) : Bit 3: Channel 4 Bits 4 ... 7: Reserved	00_h
	2	Limit value monitoring	Bit 0: Channel 1 (0 = inhibited; 1 = enabled) : Bit 3: Channel 4 Bits 4 ... 7: Reserved	00_h
	3	Reserved		
1	0	Temperature system	Bit 0, 1: 00_b = °C; 01_b= °F; 10_b = K Bits 2 ... 7: Reserved	00_h
	1	Interference frequency suppression	Bit 0, 1: 01_b = 60 Hz; 10_b = 50 Hz Bits 2 ... 7: Reserved	02_h
Channel 1				
128	0	Function channel 1	80 (50_h) ... 162 ($A2_h$): see "measuring range" 255 (FF_h): channel deactivated	50_h
	1	Conversion time channel 1	You can set the transformer speed as a function of the interference frequency suppression (see 0x3105/x) for each channel. 0 (00_h): At 50 Hz: 324.1 ms/channel 16 bits; at 60 Hz: 270.5 ms/channel 16 bits 1 (01_h): At 50 Hz: 164.2 ms/channel 16 bits; at 60 Hz: 137.2 ms/channel 16 bits 2 (02_h): At 50 Hz: 84.2 ms/channel 16 bits; at 60 Hz: 70.5 ms/channel 16 bits 3 (03_h): at 50 Hz: 44.1 ms/channel 16 bits; at 60 Hz: 37.2 ms/channel 16 bits 4 (04_h): At 50 Hz: 24.2 ms/channel 16 bits; at 60 Hz: 20.5 ms/channel 16 bits 5 (05_h): At 50 Hz: 14.2 ms/channel 16 bits; at 60 Hz: 12.2 ms/channel 16 bits 6 (06_h): At 50 Hz: 9.2 ms/channel 16 bits; at 60 Hz: 8.0 ms/channel 16 bits 7 (07_h): At 50 Hz: 6.6 ms/channel 15 bits; at 60 Hz: 5.9 ms/channel 15 bits 8 (08_h): At 50 Hz: 4.2 ms/channel 13 bits; at 60 Hz: 3.8 ms/channel 13 bits	00_h
	2, 3	Upper limit value channel 1	You can define an upper or lower limit value for each channel. For this you can only specify values from the nominal range, otherwise you'll receive a parameterisation error. By specification of $7FFF_h$ for the upper or 8000_h for the lower limit value, the corresponding limit value is deactivated. As soon as the measured value is outside a limit value and limit value monitoring is activated, a process alarm is triggered.	$7FFF_h$
	4,5	Lower limit value channel 1		8000_h
Channel 2				
129	0	Function channel 2	See channel 1	50_h

Data set		Name	Description/value	Lenze
No.	Byte			
	1	Conversion time channel 2	See channel 1	00_h
	2, 3	Upper limit value channel 2	See channel 1	$7FFF_h$
	4, 5	Lower limit value channel 2 (HIGH byte)		8000_h
Channel 3 (for two-wire conductor connections only)				
130	0	Function channel 3	See channel 1	50_h
	1	Conversion time channel 3	See channel 1	00_h
	2, 3	Upper limit value channel 3	See channel 1	$7FFF_h$
	4, 5	Lower limit value channel 3		8000_h
Channel 4 (for two-wire conductor connections only)				
131	0	Function channel 4	See channel 1	50_h
	1	Conversion time channel 4	See channel 1	00_h
	2, 3	Upper limit value channel 4	See channel 1	$7FFF_h$
	4, 5	Lower limit value channel 4		8000_h

Measuring range

Measuring range (Fct. no.)	Measured value	Signal range	Range
2-wire: PT100 (50_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
2-wire: PT1000 (51_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
2-wire: NI100 (52_h)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
2-wire: NI1000 (53_h)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
3-wire: PT100 (58_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
3-wire: PT1000 (59_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	-2000 ... $+8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
3-wire: NI100 ($5A_h$)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	-600 ... $+2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow

Measuring range (Fct. no.)	Measured value	Signal range	Range
3-wire: NI1000 ($5B_h$)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	$-600 \ldots +2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
4-wire: PT100 (60_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	$-2000 \ldots +8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
4-wire: PT1000 (61_h)	+1000 °C	$+10000_{dec}$	Overflow
	-200 ... +850 °C	$-2000 \ldots +8500_{dec}$	Nominal range
	-243 °C	-2430_{dec}	Underflow
4-wire: NI100 (62_h)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	$-600 \ldots +2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
4-wire: NI1000 (63_h)	+295 °C	$+2950_{dec}$	Overflow
	-60 ... +250 °C	$-600 \ldots +2500_{dec}$	Nominal range
	-105 °C	-1050_{dec}	Underflow
2-wire: 0 ... 60 Ω (70_h)	-	-	Overflow
	0 ... 60 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
2-wire: 0 ... 600 Ω (71_h)	-	-	Overflow
	0 ... 600 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
2-wire: 0 ... 3000 Ω (72_h)	-	-	Overflow
	0 ... 3000 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
3-wire: 0 ... 60 Ω (78_h)	-	-	Overflow
	0 ... 60 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
3-wire: 0 ... 600 Ω (79_h)	-	-	Overflow
	0 ... 600 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
3-wire: 0 ... 3000 Ω ($7A_h$)	-	-	Overflow
	0 ... 3000 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
4-wire: 0 ... 60 Ω (80_h)	-	-	Overflow
	0 ... 60 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
4-wire: 0 ... 600 Ω (81_h)	-	-	Overflow
	0 ... 600 Ω	$0 \ldots 32767_{dec}$	Nominal range
	-	-	Underflow
4-wire: 0 ... 3000 Ω (82_h)	-	-	Overflow
	0 ... 3000 Ω	0 ... 32767	Nominal range
	-	-	Underflow
2-wire: 0 ... 60 Ω (90_h)	-	-	Overflow
	0 ... 60 Ω	$0 \ldots 6000_{dec}$	Nominal range
	-	-	Underflow

Measuring range (Fct. no.)	Measured value	Signal range	Range
2-wire: 0 ... 600 Ω (91_h)	-	-	Overflow
	0 ... 600 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 3000 Ω (92_h)	-	-	Overflow
	0 ... 3000 Ω	0 ... 30000_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 60 Ω (98_h)	-	-	Overflow
	0 ... 60 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 600 Ω (99_h)	-	-	Overflow
	0 ... 600 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 3000 Ω ($9A_h$)	-	-	Overflow
	0 ... 3000 Ω	0 ... 30000_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 60 Ω ($A0_h$)	-	-	Overflow
	0 ... 60 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 600 Ω ($A1_h$)	-	-	Overflow
	0 ... 600 Ω	0 ... 6000_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 3000 Ω ($A2_h$)	-	-	Overflow
	0 ... 3000 Ω	0 ... 30000_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 60 Ω ($D0_h$)	70.55 Ω	32511_{dec}	Overflow
	0 ... 60 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 600 Ω ($D1_h$)	705.5 Ω	32511_{dec}	Overflow
	0 ... 600 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
2-wire: 0 ... 3000 Ω ($D2_h$)	3528 Ω	32511_{dec}	Overflow
	0 ... 3000 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 60 Ω ($D8_h$)	70.55 Ω	32511_{dec}	Overflow
	0 ... 60 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 600 Ω ($D9_h$)	705.5 Ω	32511_{dec}	Overflow
	0 ... 600 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
3-wire: 0 ... 3000 Ω (DA_h)	3528 Ω	32511_{dec}	Overflow
	0 ... 3000 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 60 Ω ($E0_h$)	70.55 Ω	32511_{dec}	Overflow
	0 ... 60 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow

Measuring range (Fct. no.)	Measured value	Signal range	Range
4-wire: 0 ... 600 Ω ($E1_h$)	705.5 Ω	32511_{dec}	Overflow
	0 ... 600 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow
4-wire: 0 ... 3000 Ω ($E2_h$)	3528 Ω	32511_{dec}	Overflow
	0 ... 3000 Ω	0 ... 27648_{dec}	Nominal range
	-	-	Underflow

Diagnostics and alarm

Trigger	Process alarm	Diagnostic alarm	Parameterisable
Configuration/parameterisation error	-	X	-
Open circuit detected	-	X	X
Measuring range exceeded	-	X	-
Measuring range not reached	-	X	-
Limit value exceeded	X	-	X
Limit value not reached	X	-	X
Process alarm lost	-	X	-

Process alarm

A process alarm causes a call of the OB 40. Within the OB 40 you have the possibility of determining the logic basic address of the module that has triggered the process alarm via the local word 6. Further information on the triggering event can be found in the ”Local double word 8”.

Local double word 8 of OB 40:

Local byte	Bit 7 ... 0
1	Bit 0: Limit value exceeded channel 1 Bit 1: Limit value exceeded channel 2 Bit 2: Limit value exceeded channel 3 Bit 3: Limit value exceeded channel 4 Bit 7 ... 4: 0 (fixed)
2	Bit 0: Limit value not reached channel 1 Bit 1: Limit value not reached channel 2 Bit 2: Limit value not reached, channel 3 Bit 3: Limit value not reached, channel 4 Bit 7 ... 4: 0 (fixed)
3/4	Ticker value at the time of the alarm After mains connection, a timer (µs ticker) is started which after 65535 µs starts with 0 again.

Diagnostic alarm

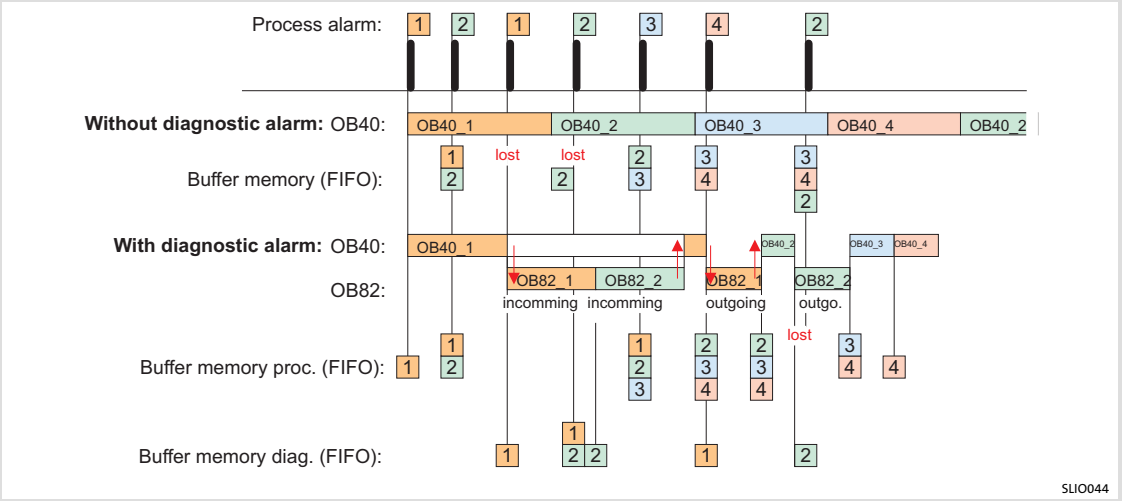
You have the possibility of globally activating a diagnostic alarm for the module via parameterisation (data set 00h). A diagnostic alarm occurs if a further process alarm is triggered for the same event during a process alarm processing in the OB 40.

By activation of a diagnostic alarm the current process alarm processing in the OB 40 is interrupted and branched to the diagnostic alarm processing$_{incoming}$ in OB 82. If further events occur on other channels during the diagnostic alarm processing, which can trigger a process or diagnostic alarm, they are buffered. At the end of the diagnostic alarm processing, first all buffered diagnostic alarms are processed in order of their occurrence, and afterwards all process alarms.

If further process alarms occur on a channel for which a diagnostic alarm$_{incoming}$ is currently processed or buffered, they are lost. If a process alarm for which a diagnostic alarm$_{incoming}$ has been triggered is processed, the diagnostic alarm processing is called again as diagnostic alarm$_{outgoing}$.

All events of a channel between the diagnostic alarm$_{incoming}$ and diagnostic alarm$_{outgoing}$ are not buffered and are lost. During this time (first diagnostic alarm$_{incoming}$ to the last diagnostic alarm$_{outgoing}$) the MF-LED of the module is lit. Additionally an entry in the diagnostic buffer of the CPU is made for every diagnostic alarm$_{incoming/outgoing}$.

Example:



Diagnostic alarm processing:

Using SFB 52 you can read out the diagnostic bytes. If the diagnostic alarm is deactivated, you can access the last diagnostic event in each case.

If you have activated the diagnostic function in your hardware configuration, OB 82 is called automatically. Here you can react on the diagnostics accordingly. With the SFB 52 you can additionally read out data set 1 which contains further information.

After exiting OB 82, the data ca no longer be clearly assigned to the last diagnostic alarm.

Data set 1 is structured as follows:

Data set 1, diagnostics$_{incoming}$	
Byte	**Bit 7 ... 0**
0	Bit 0: Set if module fault Bit 1: 0 (fixed) Bit 2: Set in the case of an external error Bit 3: Set in the case of a channel error Bit 6 ... 4: 0 (fixed) Bit 7: Parameterisation error
1	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	Bit 5 ... 0: 0 (fixed) Bit 6: Process alarm lost Bit 7: 0 (fixed)
4	Bit 6 ... 0: Channel type, 76h: counter module Bit 7: Further channel types available, 0: no, 1: yes
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 01_h)
7	Bit 0: Error in channel group 0 (counter) Bit 7 ... 1: 0 (fixed)
8	Diagnostic alarm due to process alarm lost to ... Bit 0: Hardware gate open Bit 1: Hardware gate closed Bit 2: Overflow/underflow/final value Bit 3: Comparison value reached Bit 4: Latch value Bit 7 ... 5: 0 (fixed)
9 ... 15	0 (fixed)

Data set 1, diagnostics$_{outgoing}$
After the error recovery a diagnostic message$_{outgoing\ is\ effected}$

12.7.2 Two analog inputs for thermocouple measurement - EPM-S405

During the execution time you can access the parameter data via the following data sets:

Data set		Name	Description/value	Lenze
No.	Byte			
0	0	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 0 ... 5: Reserved Bit 6: diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
	1	Wire-breakage detection	Bit 0: Channel 1 (0 = inhibited; 1 = enabled) Bit 1: Channel 2 Bits 2 ... 7: Reserved	00_h
	2	Limit value monitoring	Bit 0: Channel 1 (0 = inhibited; 1 = enabled) Bit 1: Channel 2 Bits 2 ... 7: Reserved	00_h
	3	Reserved	0	
1	0	Temperature system	Bit 0, 1: 00_b = °C; 10_b = °F; 11_b = K Bits 2 ... 7: Reserved	00_h
	1	Interference frequency suppression	Bit 0, 1: 01_b = 60 Hz; 10_b = 50 Hz Bits 2 ... 7: Reserved	02_h
Channel 1				
128	0	Function channel 1	176 (60_h) ... 201 ($C9_h$): see "measuring range" External temperature compensation: 176 (60_h) ... 185 (69_h) Internal temperature compensation: 192 ($C0_h$): ... 201 ($C9_h$) 255 (FF_h): channel deactivated	$C1_h$
	1	Conversion time channel 1	You can set the transformer speed as a function of the interference frequency suppression (see 0x3105/x) for each channel. 0 (00_h): At 50 Hz: 324.1 ms/channel 16 bits; at 60 Hz: 270.5 ms/channel 16 bits 1 (01_h): at 50 Hz: 164.2 ms/channel 16 bits; at 60 Hz: 137.2 ms/channel 16 bits 2 (02_h): At 50 Hz: 84.2 ms/channel 16 bits; at 60 Hz: 70.5 ms/channel 16 bits 3 (03_h): at 50 Hz: 44.1 ms/channel 16 bits; at 60 Hz: 37.2 ms/channel 16 bits 4 (04_h): At 50 Hz: 24.2 ms/channel 16 bits; at 60 Hz: 20.5 ms/channel 16 bits 5 (05_h): at 50 Hz: 14.2 ms/channel 16 bits; at 60 Hz: 12.2 ms/channel 16 bits 6 (06_h): at 50 Hz: 9.2 ms/channel 16 bits; at 60 Hz: 8.0 ms/channel 16 bits 7 (07_h): at 50 Hz: 6.6 ms/channel 15 bits; at 60 Hz: 5.9 ms/channel 15 bits 8 (08_h): at 50 Hz: 4.2 ms/channel 13 bits; at 60 Hz: 3.8 ms/channel 13 bits	02_h
	2, 3	Upper limit value channel 1	You can define an upper or lower limit value for each channel. For this you can only specify values from the nominal range, otherwise you'll receive a parameterisation error. By specification of $7FFF_h$ for the upper or 8000_h for the lower limit value, the corresponding limit value is deactivated. If the measured value is outside a limit value and the limit value monitoring is activated, a process alarm is triggered.	$7FFF_h$
	4, 5	Lower limit value channel 1		8000_h
Channel 2				
129	0	Function channel 2	See channel 1	$C1_h$

Data set		Name	Description/value	Lenze
No.	Byte			
	1	Conversion time channel 2	See channel 1	02_h
	2, 3	Upper limit value channel 2	See channel 1	$7FFF_h$
	3, 4	Lower limit value channel 2		8000_h

Measuring range

Measuring range	Measured value			Range
(Fct. no.)	[°C]	[°F]	[K]	
Type J: -210 ... +1200 °C -346 ... 2192 °F 63.2 ... 1473.2 K ($B0_h$: ext. comp. 0 °C) ($C0_h$: int. comp. 0 °C)	+14500	26420	17232	Overflow
	-2100 ... +12000	-3460 ... +21920	632 ... 14732	Nominal range
	-	-	-	Underflow
Type K: -210 ... +1372 °C -454 ... 2501.6 °F 0 ... 1645.2 K ($B1_h$: ext. comp. 0 °C) ($C1_h$: int. comp. 0 °C)	+16220	29516	18952	Overflow
	-2700 ... +13720	-4540 ... 25016	0 ... 16452	Nominal range
	-	-	-	Underflow
Type N: -270 ... +1300 °C -454 ... 2372 °F 0 ... 1573.2 K ($B2_h$: ext. comp. 0 °C) ($C2_h$: int. comp. 0 °C)	+15500	28220	18232	Overflow
	-2700 ... +13000	-4540 ... 23720	0 ... 15732	Nominal range
	-	-	-	Underflow
Type R: -50 ... +1769 °C -58 ... 3216.2 °F 223.2 ... 2042.2 K ($B3_h$: ext. comp. 0 °C) ($C3_h$: int. comp. 0 °C)	+20190	32766	22922	Overflow
	-500 ... +17690	-580 ... 32162	2232 ... 20422	Nominal range
	-1700	-2740	1032	Underflow
Type S: -50 ... +1769 °C -58 ... 3216.2 °F 223.2 ... 2042.2 K ($B4_h$: ext. comp. 0 °C) ($C4_h$: int. comp. 0 °C)	+20190	32766	22922	Overflow
	-500 ... +17690	-580 ... 32162	2232 ... 20422	Nominal range
	-1700	-2740	1032	Underflow
Type T: -270 ... +440 °C -454 ... 752 °F 3.2 ... 673.2 K ($B2_h$: ext. comp. 0 °C) ($C2_h$: int. comp. 0 °C)	+5400	10040	8132	Overflow
	-2700 ... +4000	-4540 ... 7520	32 ... 6732	Nominal range
	-	-	-	Underflow
Type B: 0 ... +1820 °C 32 ... 2786.5 °F 273.2 ... 2093.2 K ($B6_h$: ext. comp. 0 °C) ($C6_h$: int. comp. 0 °C)	+20700	32766	23432	Overflow
	0 ... +18200	320 ... 27865	2732 ... 20932	Nominal range
	-1200	-1840	1532	Underflow
Type C: 0 ... +2315 °C 32 ... 2786.5 °F 273.2 ... 2093.2 K ($B7_h$: ext. comp. 0 °C) ($C7_h$: int. comp. 0 °C)	+25000	32766	23432	Overflow
	0 ... +23150	320 ... 27865	2732 ... 20932	Nominal range
	-1200	-1840	1532	Underflow

Measuring range (Fct. no.)	Measured value [°C]	[°F]	[K]	Range
Type E: -270 ... +1000 °C -454 ... 1832 °F 0 ... 1273.2 K ($B8_h$: ext. comp. 0 °C) ($C8_h$: int. comp. 0 °C)	+12000	21920	14732	Overflow
	-2700 ... +10000	-4540 ... 18320	0 ... 12732	Nominal range
	-	-	-	Underflow
Type L: -200 ... +900 °C -328 ... 1652 °F 73.2 ... 1173.2 K ($B9_h$: ext. comp. 0 °C) ($C9_h$: int. comp. 0 °C)	+11500	21020	14232	Overflow
	-2000 ... +9000	-3280 ... 16520	732 ... 11732	Nominal range
	-	-	-	Underflow

Diagnostics and alarm

Trigger	Process alarm	Diagnostic alarm	Parameterisable
Configuration/parameterisation error	-	X	-
Open circuit detected	-	X	X
Measuring range exceeded	-	X	-
Measuring range not reached	-	X	-
Limit value exceeded	X	-	X
Limit value not reached	X	-	X
Process alarm lost	-	X	-

Process alarm

A process alarm causes a call of the OB 40. Within the OB 40 you have the possibility of determining the logic basic address of the module that has triggered the process alarm via the local word 6. Further information on the triggering event can be found in the ”Local double word 8”.

Local double word 8 of OB 40:

Local byte	Bit 7 ... 0
1	Bit 0: Limit value exceeded channel 1 Bit 1: Limit value exceeded channel 2 Bit 7 ... 2: 0 (fixed)
2	Bit 0: Limit value not reached, channel 1 Bit 1: Limit value not reached, channel 2 Bit 7 ... 2: 0 (fixed)
3/4	Ticker value at the time of the alarm After mains connection, a timer (µs ticker) is started which after 65535 µs starts with 0 again.

Diagnostic alarm

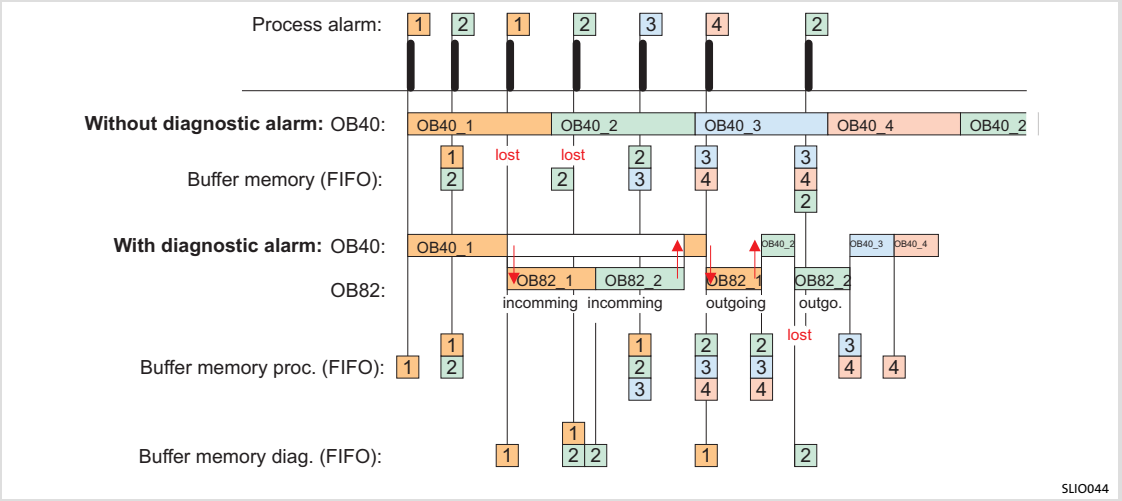
You have the possibility of globally activating a diagnostic alarm for the module via parameterisation (data set 00h). A diagnostic alarm occurs if a further process alarm is triggered for the same event during a process alarm processing in the OB 40.

By activation of a diagnostic alarm the current process alarm processing in the OB 40 is interrupted and branched to the diagnostic alarm processing$_{incoming}$ in OB 82. If further events occur on other channels during the diagnostic alarm processing, which can trigger a process or diagnostic alarm, they are buffered. At the end of the diagnostic alarm processing, first all buffered diagnostic alarms are processed in order of their occurrence, and afterwards all process alarms.

If further process alarms occur on a channel for which a diagnostic alarm$_{incoming}$ is currently processed or buffered, they are lost. If a process alarm for which a diagnostic alarm$_{incoming}$ has been triggered is processed, the diagnostic alarm processing is called again as diagnostic alarm$_{outgoing}$.

All events of a channel between the diagnostic alarm$_{incoming}$ and diagnostic alarm$_{outgoing}$ are not buffered and are lost. During this time (first diagnostic alarm$_{incoming}$ to the last diagnostic alarm$_{outgoing}$) the MF-LED of the module is lit. Additionally an entry in the diagnostic buffer of the CPU is made for every diagnostic alarm$_{incoming/outgoing}$.

Example:



Diagnostic alarm processing:

Using SFB 52 you can read out the diagnostic bytes. If the diagnostic alarm is deactivated, you can access the last diagnostic event in each case.

If you have activated the diagnostic function in your hardware configuration, OB 82 is called automatically. Here you can react on the diagnostics accordingly. With the SFB 52 you can additionally read out data set 1 which contains further information.

After exiting OB 82, the data ca no longer be clearly assigned to the last diagnostic alarm.

Data set 1 is structured as follows:

Data set 1, diagnostics$_{incoming}$	
Byte	**Bit 7 ... 0**
0	Bit 0: Set if module fault Bit 1: 0 (fixed) Bit 2: Set in the case of an external error Bit 3: Set in the case of a channel error Bit 6 ... 4: 0 (fixed) Bit 7: Parameterisation error
1	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	Bit 5 ... 0: 0 (fixed) Bit 6: Process alarm lost Bit 7: 0 (fixed)
4	Bit 6 ... 0: Channel type, 76h: counter module Bit 7: Further channel types available, 0: no, 1: yes
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 01_h)
7	Bit 0: Error in channel group 0 (counter) Bit 7 ... 1: 0 (fixed)
8	Diagnostic alarm due to process alarm lost to ... Bit 0: Hardware gate open Bit 1: Hardware gate closed Bit 2: Overflow/underflow/final value Bit 3: Comparison value reached Bit 4: Latch value Bit 7 ... 5: 0 (fixed)
9 ... 15	0 (fixed)

Data set 1, diagnostics$_{outgoing}$
After the error recovery a diagnostic message$_{outgoing\ is\ effected}$

12.8 Parameterising the counter

12.8.1 Rotary transducer signal evaluation

Depending on which edge of a channel is evaluated, the following pulse trains and the associated pulse multiplication can be realised.

Pulse trains	Description	
Channel A		
Channel B		
Single evaluation		There is a response to the falling edges of channel A. The number of pulses has not increased.
Double evaluation		There is a response to the rising and the falling edges of channel A. The number of pulses has doubled and is symmetrical.
Four-fold evaluation		The rising and the falling edges of channels A and B are evaluated. The number of pulses is quadrupled and is symmetrical.

12.8.2 One counter 32 bits, 24 V DC - EPM-S600

By integration of the GSE file VI010C19.gse you can specify all counter parameters via a hardware configuration.

The following functions can be parameterised:

Counting functions	Description
Counting continuously	The counter counts from the loading value to the counting limit, then skips to the opposite counting limit and continues to count from there.
Counting once	The counter counts once/periodically from the loading value in the specified counting range.
Counting periodically	

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Main counting direction	The main counting direction can be parameterised: **None:** The whole counting range is available. **Forwards:** Limitation of the counting range upwards. The counter counts from the parameterised loading value in the positive direction to the parameterised final value -1 and then skips to the loading value again with the encoder pulse that is following. **Backwards:** Limitation of the counting range downwards. The counter counts from the parameterised loading value in the negative direction to the parameterised final value +1 and then skips to the loading value again with the encoder pulse that is following.
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter a differentiation between the internal gate (I-gate), hardware gate (HW gate), and software gate (SW gate) is made. ● The I-gate is the AND logic operation of the software gate (SW gate) and the hardware gate (HW gate). ● The SW gate is controlled via your user program (status word in the output area). ● The HW gate is controlled via the digital gate input. The following response can be parameterised: **Cancelling gate function:**After closing the gate and opening it again, the counting process continues from the loading value again. **Interrupting gate function:**After closing the gate and opening it again, the counting process continues with the last current counter content.
Latch function	If a positive edge occurs at the latch input, the current count value is stored in the latch register. The latch register is accessed via the input area. After a STOP-RUN transition, latch is always 0.
Comparator	You can specify a comparison value which, depending on the count value, activates the digital output or triggers a process alarm.
Hysteresis	By specification of a hysteresis you can for instance prevent the output from being permanently switched if the value of an encoder signal fluctuates around the comparison value.
Process alarm	The activation of a process alarm can be parameterised. A process alarm can be triggered in the case of the following events: ● Hardware gate open ● Hardware gate closed ● Counting limit - overflow ● Counting limit - underflow ● Comparison value reached ● Final value reached ● Latch value reached
Diagnostic alarm	If the diagnostic alarm is enabled in the parameter setting, it occurs as soon as another process alarm is triggered for the same event during process alarm processing.
Diagnostic function	Diagnostic functions are provided in the modules.
Diagnostic information	The diagnostic information describes the diagnostic contents which can be read out from a module. The diagnostic formation is not automatically sent by the module but must actively be read out by SDO access.

Read data: 12 bytes

Input area		
Addr.	**Access**	**Assignment**
+0	Double word	Count value
+4	Double word	Latch value
+8	Word	Status word (see the following table)
+10	Word	Ticker value

Count value: Current counter content

Latch value: If there is a positive edge at the latch input, the count value is stored here.

Ticker value: After mains connection a timer (µs ticker) is started, which after 65535 µs starts with 0 again. With every change of the count value the time value of the timer is stored as 16-bit µs value together with the count value in the input area.

EPM-S600 status word		
Bit	**Designation**	**Function**
0	STS_SYNC	Reset was active
1	STS_CTRL_DO	Is set if the digital output is enabled
2	STS_SW-GATE	Software gate status (set if SW gate active)
3	STS_RST	Status of reset input
4	STS_STRT	Hardware gate status (set if HW gate active)
5	STS_GATE	Status of internal gate (set if internal gate active)
6	STS_DO	Status of digital counter output (DO)
7	STS_C_DN	Status set for counter direction backwards
8	STS_C_UP	Status set for counter direction forwards
9	STS_CMP*	Comparator status is set if the comparison condition is met. If the comparison is deactivated (counter mode byte 1 = 000_b), the bit has no function.
10	STS_END*	Status set if final value was reached
11	STS_OFLW*	Status set in the case of overflow
12	STS_UFLW*	Status set in the case of underflow
13	STS_ZP*	Status set in the case of zero crossing
14	STS_LTCH	Status of latch input
15	-	Reserved

* The bits are set until reset with RES_SET (bit 6 control word)

Write data: 10 bytes

Output area		
Addr.	**Access**	**Assignment**
+0	Double word	Comparison value
+4	Double word	Set value
+8	Word	Control word (see the following table)

Comparison value: Here you can select a value which, by comparison with the current counter content, can impact the counter output or trigger a process alarm. The response of the output or the process alarm can be parameterised.

Set value: With an edge change 0-1 of *COUNTERVAL_SET* in the control word, the set value is accepted in the counter.

EPM-S600 control word		
Bit	**Name**	**Function**
0	CTRL_SYNC_SET	Activation/deactivation of the counting signal: 0 (FALSE): The input for the couting signal is deactivated and the current counter content is reset to 0. 1 (TRUE): The input for the counting signal is activated.
1	CTRL_DO_SET	Enables the digital output
2	SW_GATE_SET	Sets the software gate
3	-	Reserved
4	-	Reserved
5	COUNTERVAL_SET	Sets the counter temporarily to the value in the set value
6	RES_SET	Resets bits STS_CMP, STS_END, STS_OFLW, STS_UFLW and STS_ZP with a rising edge
7	-	Reserved
8	CTRL_SYNC_RESET	Activation/deactivation of the zero track evaluation: 0 (FALSE): The zero track evaluation is activated. 1 (TRUE): The zero track evaluation is stopped. The counter keeps counting irrespective of the zero pulse. Bit 0 (CTRL_SYNC_SET) must be set to TRUE for this purpose.
9	CTRL_DO_RESET	Inhibits the digital output
10	SW_GATE_RESET	Resets the software gate
11	-	Reserved
12		
13		
14		
15		

Parameter data

Data set		Name	Description/value	Lenze
No.	Byte			
00_h	0	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 5 ... 0: Reserved Bit 6: diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved	00_h
01_h	0	Input frequency track A	Filters for instance serve to filter signal peaks in the case of an unclean input signal. 0 (00_h): 500 kHz 1 (01_h): 300 kHz 2 (02_h): 100 kHz 3 (03_h): 60 kHz 4 (04_h): 30 kHz 6 (06_h): 10 kHz 7 (07_h): 5 kHz 8 (08_h): 2 kHz 9 (09_h): 1 kHz Other values are not permissible!	02_h
	1	Input frequency track B		02_h
	2	Input frequency latch		02_h
	3	Input frequency gate		02_h
	4	Input frequency reset		00_h
	5	Reserved		

Data set		Name	Description/value	Lenze
No.	Byte			
80_h	0	Alarm response	Setting activates process alarm Bit 0: Proc. alarm HW gate open Bit 1: Proc. alarm HW gate closed Bit 2: Proc. alarm overflow Bit 3: Proc. alarm underflow Bit 4: Proc. alarm comparison value Bit 5: Proc. alarm final value Bit 6: Proc. alarm latch value Bit 7: Reserved	80_h
	1	Counter function	Bits 5 ... 0: 000000_b = counting continuously 000001_b = counting once, main counting direction forwards 000010_b = counting once, main counting direction backwards 000100_b = counting once, no main counting direction 001000_b = counting periodically, main counting direction forwards 010000_b = counting periodically, main counting direction backwards 100000_b = counting periodically, no main counting direction Bits 7 ... 6: Reserved	40_h
	2	Comparator	Bit 2 ... 0: output switches (... if condition is met) 000_b = never 001_b = count value ≥ comparison value 010_b = count value ≤ comparison value 100_b = count value = comparison value Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 6 ... 4: Reset 000_b = deactivated 001_b = HIGH level 011_b = rising edge 101_b = rising edge, once Bit 7: Reserved	00_h
	3	Signal evaluation	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (connection to input ”A/pulse”) 010_b = double rotary transducer (connection to input ”A/pulse”) 011_b = four-fold rotary transducer (connection to input ”A/pulse” and ”B/direction”) 100_b = direction (pulse to ”A/pulse” and direction to ”B/direction”) Bit 6 ... 3: Hardware gate (HW gate) 000_b = deactivated (counter starts by setting SW gate) 001_b = activated (HIGH level at gate activates the HW gate. Counter starts if HW and SW gate are set.) Bit 7: Gate function (internal gate) 0= abort (counting process starts again from loading value) 1 = interrupt (counting process is continued with counter content)	00_h
81_h	0	Final value	Upper limit of the counting range	00_h
	1	Start value	Lower limit of the counting range	00_h

Data set		Name	Description/value	Lenze
No.	Byte			
	2	Hysteresis	The hysteresis for instance serves to avoid frequent switching operations of the output and/or triggering of the alarm when the count value is within the range of the comparison value. For the hysteresis you can select a range between 0 and 255. With the settings 0 and 1 the hysteresis is switched off. The hysteresis has an effect on the zero crossing, comparison, overflow/underflow.	00_h
	3	Pulse	The pulse duration indicates for how long the output is to be set if the parameterised comparison criterion is reached or exceeded. The pulse duration can be specified in steps of 2.048 ms between 0 and 522.24 ms. If the pulse duration is = 0, the output is set until the comparison condition is no longer met.	00_h

Process alarm

A process alarm causes a call of the OB 40. Within the OB 40 you have the possibility of determining the logic basic address of the module that has triggered the process alarm via the local word 6. Further information on the triggering event can be found in the ”Local double word 8”.

Local double word 8 of OB 40:

Local byte	Bit 7 ... 0
1	Bit 0: Hardware gate open Bit 1: Hardware gate closed Bit 2: Overflow/underflow/final value Bit 3: Comparison value reached Bit 4: Latch value Bit 7 ... 5: 0 (fixed)
2	State of the inputs at the time of the alarm Bit 0: A/pulse Bit 1: B/direction Bit 2: Latch Bit 3: Hardware gate Bit 4: Reset Bit 7 ... 5: 0 (fixed)
3/4	Ticker value at the time of the alarm

Gate counter open/closed: Bit 0 is set if the HW gate is activated while the SW gate is active. Bit 1 is set if the HW gate is deactivated while the SW gate is active.

Ticker value: After mains connection a timer (µs ticker) is started, which after 65535 µs starts with 0 again. With every change of the count value the time value of the timer is stored as 16-bit µs value together with the count value in the input area.

Diagnostic alarm

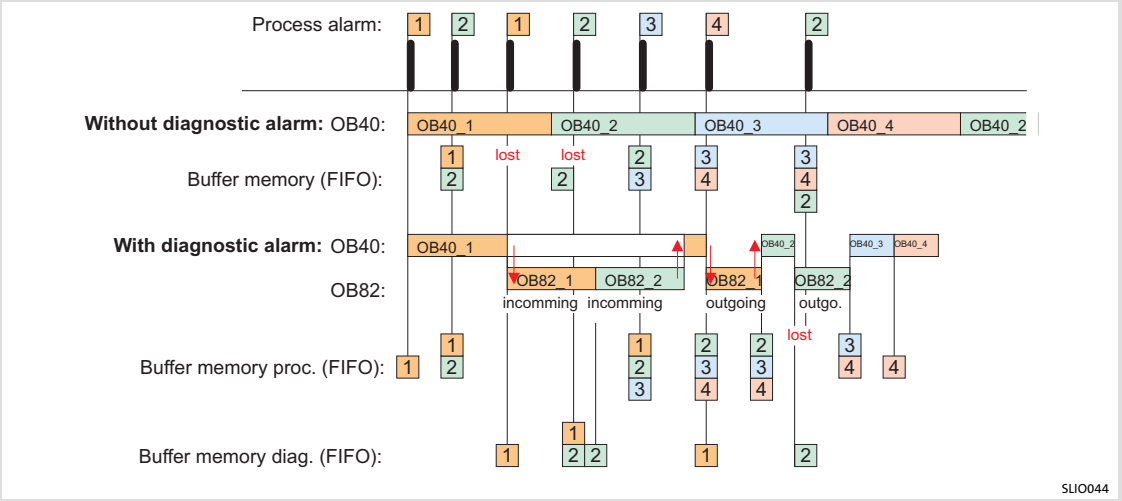
You have the possibility of globally activating a diagnostic alarm for the module via parameterisation (data set 00h). A diagnostic alarm occurs if a further process alarm is triggered for the same event during a process alarm processing in the OB 40.

By activation of a diagnostic alarm the current process alarm processing in the OB 40 is interrupted and branched to the diagnostic alarm processing$_{incoming}$ in OB 82. If further events occur on other channels during the diagnostic alarm processing, which can trigger a process or diagnostic alarm, they are buffered. At the end of the diagnostic alarm processing, first all buffered diagnostic alarms are processed in order of their occurrence, and afterwards all process alarms.

If further process alarms occur on a channel for which a diagnostic alarm$_{incoming}$ is currently processed or buffered, they are lost. If a process alarm for which a diagnostic alarm$_{incoming}$ has been triggered is processed, the diagnostic alarm processing is called again as diagnostic alarm$_{outgoing}$.

All events of a channel between the diagnostic alarm$_{incoming}$ and diagnostic alarm$_{outgoing}$ are not buffered and are lost. During this time (first diagnostic alarm$_{incoming}$ to the last diagnostic alarm$_{outgoing}$) the MF-LED of the module is lit. Additionally an entry in the diagnostic buffer of the CPU is made for every diagnostic alarm$_{incoming/outgoing}$.

Example:



Diagnostic alarm processing:

Using SFB 52 you can read out the diagnostic bytes. If the diagnostic alarm is deactivated, you can access the last diagnostic event in each case.

If you have activated the diagnostic function in your hardware configuration, OB 82 is called automatically. Here you can react on the diagnostics accordingly. With the SFB 52 you can additionally read out data set 1 which contains further information.

After exiting OB 82, the data ca no longer be clearly assigned to the last diagnostic alarm.

Data set 1 is structured as follows:

Data set 1, $diagnostics_{incoming}$	
Byte	**Bit 7 ... 0**
0	Bit 0: Set if module fault Bit 1: 0 (fixed) Bit 2: Set in the case of an external error Bit 3: Set in the case of a channel error Bit 6 ... 4: 0 (fixed) Bit 7: Parameterisation error
1	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	Bit 5 ... 0: 0 (fixed) Bit 6: Process alarm lost Bit 7: 0 (fixed)
4	Bit 6 ... 0: Channel type, 76h: counter module Bit 7: Further channel types available, 0: no, 1: yes
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 01_h)
7	Bit 0: Error in channel group 0 (counter) Bit 7 ... 1: 0 (fixed)
8	Diagnostic alarm due to process alarm lost to ... Bit 0: Hardware gate open Bit 1: Hardware gate closed Bit 2: Overflow/underflow/final value Bit 3: Comparison value reached Bit 4: Latch value Bit 7 ... 5: 0 (fixed)
9 ... 15	0 (fixed)

Data set 1, $diagnostics_{outgoing}$
After the error recovery a diagnostic $message_{outgoing\ is\ effected}$

12.8.3 Two counters 32 bits, 24 V DC - EPM-S601

By integration of the GSE file VI010C19.gse you can specify all counter parameters via a hardware configuration.

The following functions can be parameterised:

Counting functions	Description
Counting continuously	The counter counts from the loading value to the counting limit, then skips to the opposite counting limit and continues to count from there.
Counting once	The counter counts once/periodically from the loading value in the specified counting range.
Counting periodically	

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Main counting direction	The main counting direction can be parameterised: **None:** The whole counting range is available. **Forwards:** Limitation of the counting range upwards. The counter counts from the parameterised loading value in the positive direction to the parameterised final value -1 and then skips to the loading value again with the encoder pulse that is following. **Backwards:** Limitation of the counting range downwards. The counter counts from the parameterised loading value in the negative direction to the parameterised final value +1 and then skips to the loading value again with the encoder pulse that is following.
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter the internal gate (I-gate) is conform to the software gate (SW gate) which you control via your user program (status word in the output area). The following response can be parameterised: **Cancelling gate function:**After closing the gate and opening it again, the counting process continues from the loading value again. **Interrupting gate function:**After closing the gate and opening it again, the counting process continues with the last current counter content.
Comparator	You can specify a comparison value which, depending on the count value, activates the digital output or triggers a process alarm.
Hysteresis	By specification of a hysteresis you can for instance prevent the output from being permanently switched if the value of an encoder signal fluctuates around the comparison value.
Process alarm	The activation of a process alarm can be parameterised. A process alarm can be triggered in the case of the following events: ● Hardware gate open ● Hardware gate closed ● Counting limit - overflow ● Counting limit - underflow ● Comparison value reached ● Final value reached ● Latch value reached
Diagnostic alarm	If the diagnostic alarm is enabled in the parameter setting, it occurs as soon as another process alarm is triggered for the same event during process alarm processing.
Diagnostic function	Diagnostic functions are provided in the modules.
Diagnostic information	The diagnostic information describes the diagnostic contents which can be read out from a module. The diagnostic formation is not automatically sent by the module but must actively be read out by SDO access.

Read data: 12 bytes

Input area in the process image		
Addr.	**Access**	**Assignment**
+0	Double word	Counter 1: count value
+4	Double word	Counter 2: count value
+8	Word	Counter 1: status word (see following table)
+10	Word	Counter 2: status word (see following table)

Count value: Current counter content

EPM-S601 status word		
Bit	**Designation**	**Function**
0	-	Reserved
1	STS_CTRL_COMP	Is set if the comparison bit is enabled
2	STS_SW-GATE	Software gate status (set if SW gate active)
3	-	Reserved
4	-	Reserved
5	STS_GATE	Status of internal gate (set if internal gate active)
6	STS_COMP	Status of comparison bit
7	STS_C_DN	Status set for counter direction backwards
8	STS_C_UP	Status set for counter direction forwards
9	STS_CMP*	Comparator status is set if the comparison condition is met. If the comparison is deactivated (counter mode byte 1 = 000_b), the bit has no function.
10	STS_END*	Status set if final value was reached
11	STS_OFLW*	Status set in the case of overflow
12	STS_UFLW*	Status set in the case of underflow
13	STS_ZP*	Status set in the case of zero crossing
14	-	Reserved
15	-	Reserved

* The bits are set until reset with RES_SET (bit 6 control word)

Write data: 12 bytes

Output area in the process image		
Addr.	**Access**	**Assignment**
+0	Double word	Counter 1: Comparison value
+4	Double word	Counter 2: Comparison value
+8	Word	Counter 1: Control word (see following table)
+10	Word	Counter 2: Control word (see following table)

Comparison value: With the comparison value you can specify a value which, by comparison with the current counter content, can impact the counter output or trigger a process alarm. The response of the comparison bit *STS_COMP* in the counter status or the process alarm is to be specified via data set 80_h for counter 1 and 82_h for counter 2.

EPM-S601 control word		
Bit	**Designation**	**Function**
0	-	Reserved
1	CTRL_COMP_SET	Enables the comparison bit
2	SW_GATE_SET	Sets the software gate
3	-	Reserved
4	-	Reserved
5	COUNTERVAL_SET	Sets the counter temporarily to the value in the set value
6	RES_SET	Resets bits STS_CMP, STS_END, STS_OFLW, STS_UFLW and STS_ZP with a rising edge
7	-	Reserved
8	-	Reserved
9	CTRL_COMP_RESET	Inhibits comparison bit
10	SW_GATE_RESET	Resets the software gate
11	-	Reserved
12		
13		
14		
15		

Parameter data

Data set		Name	Description/value	Lenze
No.	Byte			
00_h	0	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
01_h	0	Input frequency counter 1, track A	Filters for instance serve to filter signal peaks in the case of an unclean input signal. 0 (00_h): 500 kHz 1 (01_h): 300 kHz 2 (02_h): 100 kHz 3 (03_h): 60 kHz 4 (04_h): 30 kHz 6 (06_h): 10 kHz 7 (07_h): 5 kHz 8 (08_h): 2 kHz 9 (09_h): 1 kHz Other values are not permissible!	02_h
	1	Input frequency counter 1, track B		02_h
	2	Input frequency counter 2, track A		02_h
	3	Input frequency counter 2, track B		02_h
80_h	0	Alarm response counter 1	Setting activates process alarm Bits 1 ... 0: reserved Bit 2: Proc. alarm overflow Bit 3: Proc. alarm underflow Bit 4: Proc. alarm comparison value Bit 5: Proc. alarm final value Bits 7 ... 6: Reserved	00_h

Data set		Name	Description/value	Lenze
No.	Byte			
	1	Counter function counter 1	Bits 5 ... 0: 000000_b = counting continuously 000001_b = once: forwards 000010_b = once: backwards 000100_b = once: no main counting direction 001000_b = periodically: forwards 010000_b = periodically: backwards 100000_b = periodically: no main counting direction Bits 7 ... 6: Reserved	00_h
	2	Comparator counter 1	Bits 2 ... 0: Comparison bit is set (... if condition is met) 000_b = never 001_b = count value ≥ comparison value 010_b = count value ≤ comparison value 100_b = count value = comparison value Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 7 ... 4: Reserved	00_h
	3	Signal evaluation counter 1	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (connection to input ”A/pulse”) 010_b = double rotary transducer (connection to input ”A/pulse”) 011_b = four-fold rotary transducer (connection to input ”A/pulse” and ”B/direction”) 100_b = direction (pulse to ”A/pulse” and direction to ”B/direction”) Bits 6 ... 3: Reserved Bit 7: Gate function (internal gate) 0= abort (counting process starts again from loading value) 1 = interrupt (counting process is continued with counter content)	00_h
81_h	0...3	Set value counter 1	By specifying a set value, the counter can be loaded with the set value. With an edge 0-1 to COUNTERVAL_SET in the control word, the set value is adopted by the counter.	00_h
	4...7	Final value counter 1	Upper limit of the counting range	00_h
	8...11	Loading value counter 1	Lower limit of the counting range	00_h
	12	Hysteresis counter 1	The hysteresis for instance serves to avoid frequent switching operations of the output and/or triggering of the alarm when the count value is within the range of the comparison value. For the hysteresis you can select a range between 0 and 255. With the settings 0 and 1 the hysteresis is switched off. The hysteresis has an effect on the zero crossing, comparison, overflow/underflow.	00_h
	13	Reserved		
82_h	0	Alarm response counter 2	See counter 1	00_h
	1	Counter function counter 2	See counter 1	00_h
	2	Comparator counter 2	See counter 1	00_h
	3	Signal evaluation counter 2	See counter 1	00_h
83_h	0...3	Set value counter 2	See counter 1	00_h

Data set		Name	Description/value	Lenze
No.	Byte			
	4...7	Final value counter 2	See counter 1	00_h
	8...11	Loading value counter 2	See counter 1	00_h
	12	Hysteresis counter 2	See counter 1	00_h

Process alarm

A process alarm causes a call of the OB 40. Within the OB 40 you have the possibility of determining the logic basic address of the module that has triggered the process alarm via the local word 6. Further information on the triggering event can be found in the ”Local double word 8”.

Local double word 8 of OB 40:

Local byte	Bit 7 ... 0
1	Bit 0: 0 Bit 1: 0 Bit 2: Counter 1, overflow/underflow/final value Bit 3: Counter 1, comparison value reached Bit 4: 0 Bit 5: 0 Bit 6: Counter 2, overflow/underflow/final value Bit 7: Counter 2, comparison value reached
2	State of the inputs at the time of the alarm Bit 0: Counter 1, A/pulse Bit 1: Counter 1, B/direction Bit 2: Counter 2, A/pulse Bit 3: Counter 2, B/direction Bit 7 ... 4: 0 (fix)
3/4	16 bit µs value at the time of the alarm

Ticker value: After mains connection a timer (µs ticker) is started, which after 65535 µs starts with 0 again. With every change of the count value the time value of the timer is stored as 16-bit µs value together with the count value in the input area.

Diagnostic alarm

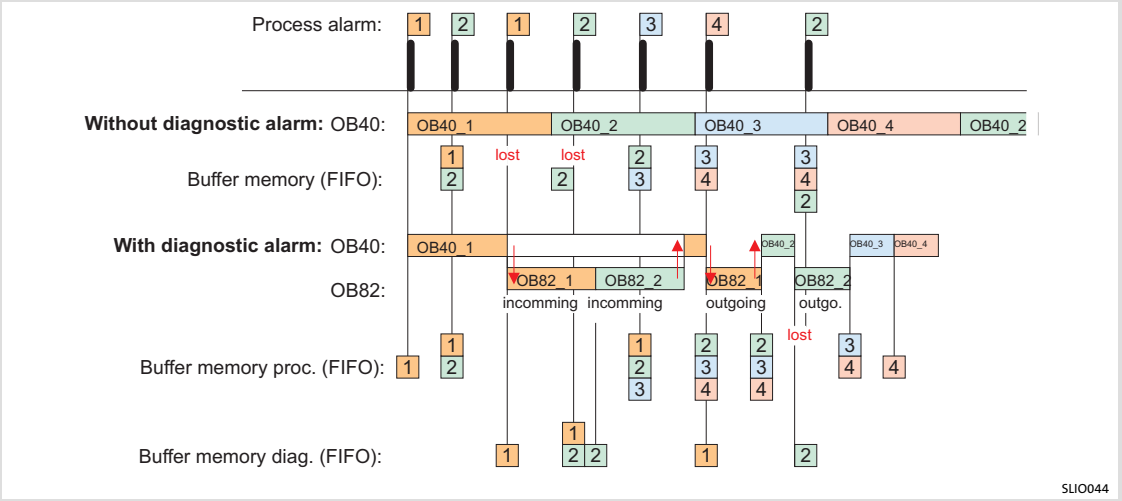
You have the possibility of globally activating a diagnostic alarm for the module via parameterisation (data set 00h). A diagnostic alarm occurs if a further process alarm is triggered for the same event during a process alarm processing in the OB 40.

By activation of a diagnostic alarm the current process alarm processing in the OB 40 is interrupted and branched to the diagnostic alarm processing$_{incoming}$ in OB 82. If further events occur on other channels during the diagnostic alarm processing, which can trigger a process or diagnostic alarm, they are buffered. At the end of the diagnostic alarm processing, first all buffered diagnostic alarms are processed in order of their occurrence, and afterwards all process alarms.

If further process alarms occur on a channel for which a diagnostic alarm$_{incoming}$ is currently processed or buffered, they are lost. If a process alarm for which a diagnostic alarm$_{incoming}$ has been triggered is processed, the diagnostic alarm processing is called again as diagnostic alarm$_{outgoing}$.

All events of a channel between the diagnostic alarm$_{incoming}$ and diagnostic alarm$_{outgoing}$ are not buffered and are lost. During this time (first diagnostic alarm$_{incoming}$ to the last diagnostic alarm$_{outgoing}$) the MF-LED of the module is lit. Additionally an entry in the diagnostic buffer of the CPU is made for every diagnostic alarm$_{incoming/outgoing}$.

Example:



Diagnostic alarm processing:

Using the SFB 52 you can read out the diagnostic bytes. If the diagnostic alarm is deactivated, you can access the last diagnostic event in each case.

If you have activated the diagnostic function in your hardware configuration, OB 82 is called automatically. Here you can react on the diagnostics accordingly. With the SFB 52 you can additionally read out data set 1 which contains further information.

After exiting OB 82, the data can no longer be clearly assigned to the last diagnostic alarm.

Data set 1 is structured as follows:

Data set 1, $diagnostics_{incoming}$	
Byte	**Bit 7 ... 0**
0	Bit 0: Set if module fault Bit 1: 0 (fixed) Bit 2: Set in the case of an external error Bit 3: Set in the case of a channel error Bit 6 ... 4: 0 (fixed) Bit 7: Parameterisation error
1	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	Bit 5 ... 0: 0 (fixed) Bit 6: Process alarm lost Bit 7: 0 (fixed)
4	Bits 6 ... 0: channel type, 76h: counter module Bit 7: further channel types available, 0: no, 1: yes
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 02_h)
7	Bit 0: Error in channel group 0 (counter 1) Bit 1: Error in channel group 1 (counter 2) Bit 7 ... 2: 0 (fix)
8	Channel group 0: diagnostic alarm due to lost process alarm to ... Bits 1 ... 0: 0 (fixed) Bit 2: overflow/underflow/final value Bit 3: comparison value reached Bits 7 ... 4: 0 (fixed)
9	Channel group 1: diagnostic alarm due to lost process alarm to ... Bits 1 ... 0: 0 (fixed) Bit 2: overflow/underflow/final value Bit 3: comparison value reached Bits 7 ... 4: 0 (fixed)
10 ... 15	0 (fixed)

Data set 1, $diagnostics_{outgoing}$
After the error recovery a diagnostic $message_{outgoing\ is\ effected}$

12.8.4 One counter 32 bits, 5 V DC - EPM-S602

By integration of the GSE file VI010C19.gse you can specify all counter parameters via a hardware configuration.

The following functions can be parameterised:

Counting functions	Description
Counting continuously	The counter counts from the loading value to the counting limit, then skips to the opposite counting limit and continues to count from there.
Counting once	The counter counts once/periodically from the loading value in the specified counting range.
Counting periodically	

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Main counting direction	The main counting direction can be parameterised: **None:** The whole counting range is available. **Forwards:** Limitation of the counting range upwards. The counter counts from the parameterised loading value in the positive direction to the parameterised final value -1 and then skips to the loading value again with the encoder pulse that is following. **Backwards:** Limitation of the counting range downwards. The counter counts from the parameterised loading value in the negative direction to the parameterised final value +1 and then skips to the loading value again with the encoder pulse that is following.
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter the internal gate (I-gate) is conform to the software gate (SW gate) which you control via your user program (status word in the output area). The following response can be parameterised: **Cancelling gate function:**After closing the gate and opening it again, the counting process continues from the loading value again. **Interrupting gate function:**After closing the gate and opening it again, the counting process continues with the last current counter content.
Comparator	You can specify a comparison value which, depending on the count value, activates the digital output or triggers a process alarm.
Hysteresis	By specification of a hysteresis you can for instance prevent the output from being permanently switched if the value of an encoder signal fluctuates around the comparison value.
Process alarm	The activation of a process alarm can be parameterised. A process alarm can be triggered in the case of the following events: ● Hardware gate open ● Hardware gate closed ● Counting limit - overflow ● Counting limit - underflow ● Comparison value reached ● Final value reached ● Latch value reached
Diagnostic alarm	If the diagnostic alarm is enabled in the parameter setting, it occurs as soon as another process alarm is triggered for the same event during process alarm processing.
Diagnostic function	Diagnostic functions are provided in the modules.
Diagnostic information	The diagnostic information describes the diagnostic contents which can be read out from a module. The diagnostic formation is not automatically sent by the module but must actively be read out by SDO access.

Read data: 8 bytes

Input area		
Addr.	**Access**	**Assignment**
+0	Double word	Count value
+4	Word	Status word (see the following table)
+6	Word	Ticker value

Count value: Current counter content

Ticker value: After mains connection a timer (µs ticker) is started, which after 65535 µs starts with 0 again. With every change of the count value the time value of the timer is stored as 16-bit µs value together with the count value in the input area.

EPM-S602 status word		
Bit	**Designation**	**Function**
0	STS_SYNC	Reset was active
1	STS_CTRL_COMP	Is set if the comparison bit is enabled
2	STS_SW-GATE	Software gate status (set if SW gate active)
3	STS_RST	Status of reset input
4	-	Reserved
5	STS_GATE	Status of internal gate (set if internal gate active)
6	STS_COMP	Status of comparison bit
7	STS_C_DN	Status set for counter direction backwards
8	STS_C_UP	Status set for counter direction forwards
9	STS_CMP*	Comparator status is set if the comparison condition is met. If the comparison is deactivated (counter mode byte 1 = 000_b), the bit has no function.
10	STS_END*	Status set if final value was reached
11	STS_OFLW*	Status set in the case of overflow
12	STS_UFLW*	Status set in the case of underflow
13	STS_ZP*	Status set in the case of zero crossing
14	-	Reserved
15	-	Reserved

* The bits are set until reset with RES_SET (bit 6 control word)

Write data: 10 bytes

Output area		
Addr.	**Access**	**Assignment**
+0	Double word	Comparison value
+4	Double word	Set value
+8	Word	Control word (see the following table)

Comparison value: Here you can select a value which, by comparison with the current counter content, can impact the counter output or trigger a process alarm. The response of the output or the process alarm can be parameterised.

Set value: With an edge change 0-1 of *COUNTERVAL_SET* in the control word, the set value is accepted in the counter.

EPM-S602 control word		
Bit	**Name**	**Function**
0	CTRL_SYNC_SET	Activation/deactivation of the counting signal: TRUE=>FALSE edge: The input for the counting signal is deactivated and the current counter content is reset to 0. FALSE=>TRUE edge: The input for the counting signal is activated.
1	CTRL_COMP_SET	Enables the comparison bit
2	SW_GATE_SET	Sets the software gate
3	-	Reserved
4	-	Reserved
5	COUNTERVAL_SET	Sets the counter temporarily to the value in the set value
6	RES_SET	Resets bits STS_CMP, STS_END, STS_OFLW, STS_UFLW and STS_ZP with a rising edge
7	-	Reserved
8	CTRL_SYNC_RESET	Activation/deactivation of the zero track evaluation: TRUE=>FALSE edge: The zero track evaluation is activated. FALSE=>TRUE edge: The zero track evaluation is stopped. The counter keeps counting irrespective of the zero pulse. Bit 0 (CTRL_SYNC_SET) must be set to TRUE for this purpose.
9	CTRL_COMP_RESET	Inhibits the comparison bit
10	SW_GATE_RESET	Resets the software gate
11	-	Reserved
12		
13		
14		
15		

Parameter data

Data set		Name	Description/value	Lenze
No.	Byte			
00_h	0	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
01_h	0	Input frequency track A	Filters for instance serve to filter signal peaks in the case of an unclean input signal. 0 (00_h): 500 kHz 1 (01_h): 300 kHz 2 (02_h): 100 kHz 3 (03_h): 60 kHz 4 (04_h): 30 kHz 6 (06_h): 10 kHz 7 (07_h): 5 kHz 8 (08_h): 2 kHz 9 (09_h): 1 kHz Other values are not permissible!	02_h
	1	Input frequency track B		02_h
	2	Input frequency reset		02_h
	3	Reserved		
80_h	0	Alarm response	Setting activates process alarm Bits 1 ... 0: reserved Bit 2: Proc. alarm overflow Bit 3: Proc. alarm underflow Bit 4: Proc. alarm comparison value Bit 5: Proc. alarm final value Bits 7 ... 6: Reserved	00_h

Data set		Name	Description/value	Lenze
No.	Byte			
	1	Counter function	Bits 5 ... 0: 000000_b = counting continuously 000001_b = once: forwards 000010_b = once: backwards 000100_b = once: no main counting direction 001000_b = periodically: forwards 010000_b = periodically: backwards 100000_b = periodically: no main counting direction Bits 7 ... 6: Reserved	00_h
	2	Comparator	Bits 2 ... 0: Comparison bit is set (... if condition is met) 000_b = never 001_b = count value ≥ comparison value 010_b = count value ≤ comparison value 100_b = count value = comparison value Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 6 ... 4: Reset 000_b = deactivated 001_b = HIGH level 011_b = rising edge 101_b = rising edge, once Bit 7: Reserved	00_h
	3	Signal evaluation	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (connection to input ”A/pulse”) 010_b = double rotary transducer (connection to input ”A/pulse”) 011_b = four-fold rotary transducer (connection to input ”A/pulse” and ”B/direction”) 100_b = direction (pulse to ”A/pulse” and direction to ”B/direction”) Bits 6 ... 3: Reserved Bit 7: Gate function (internal gate) 0= abort (counting process starts again from loading value) 1 = interrupt (counting process is continued with counter content)	00_h
81_h	4...7	Final value	Upper limit of the counting range	00_h
	8...11	Start value	Lower limit of the counting range; counting method:	00_h
	12	Hysteresis		00_h

Process alarm

A process alarm causes a call of the OB 40. Within the OB 40 you have the possibility of determining the logic basic address of the module that has triggered the process alarm via the local word 6. Further information on the triggering event can be found in the ”Local double word 8”.

Local double word 8 of OB 40:

Local byte	Bit 7 ... 0
1	Bit 0: 0 Bit 1: 0 Bit 2: Counter 1, overflow/underflow/final value Bit 3: Counter 1, comparison value reached Bit 4: 0 Bit 5: 0 Bit 6: Counter 2, overflow/underflow/final value Bit 7: Counter 2, comparison value reached
2	State of the inputs at the time of the alarm Bit 0: Counter 1, A/pulse Bit 1: Counter 1, B/direction Bit 2: Counter 2, A/pulse Bit 3: Counter 2, B/direction Bit 7 ... 4: 0 (fix)
3/4	16 bit µs value at the time of the alarm

Ticker value: After mains connection a timer (µs ticker) is started, which after 65535 µs starts with 0 again. With every change of the count value the time value of the timer is stored as 16-bit µs value together with the count value in the input area.

Diagnostic alarm

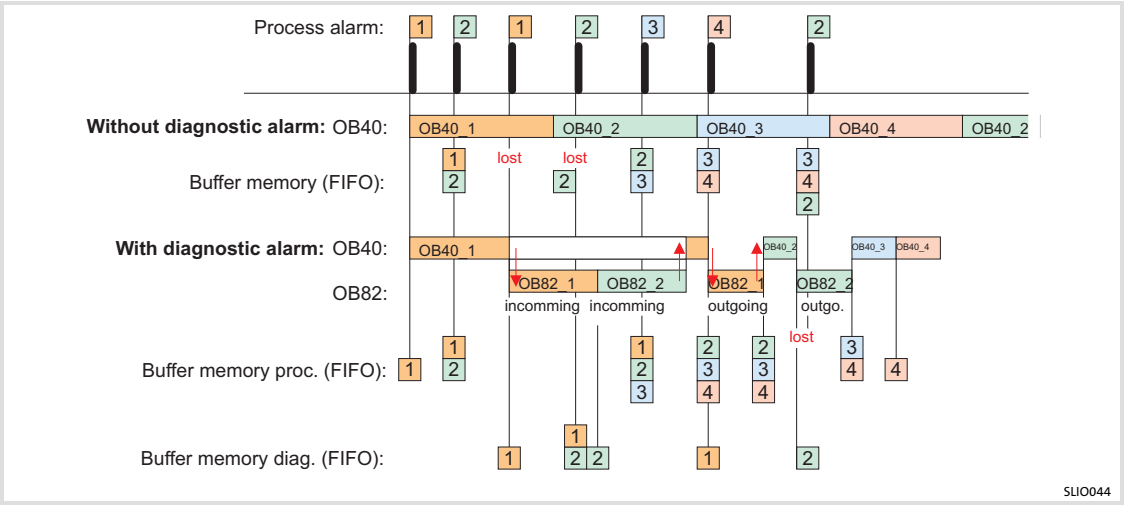
You have the possibility of globally activating a diagnostic alarm for the module via parameterisation (data set 00h). A diagnostic alarm occurs if a further process alarm is triggered for the same event during a process alarm processing in the OB 40.

By activation of a diagnostic alarm the current process alarm processing in the OB 40 is interrupted and branched to the diagnostic alarm processing$_{incoming}$ in OB 82. If further events occur on other channels during the diagnostic alarm processing, which can trigger a process or diagnostic alarm, they are buffered. At the end of the diagnostic alarm processing, first all buffered diagnostic alarms are processed in order of their occurrence, and afterwards all process alarms.

If further process alarms occur on a channel for which a diagnostic alarm$_{incoming}$ is currently processed or buffered, they are lost. If a process alarm for which a diagnostic alarm$_{incoming}$ has been triggered is processed, the diagnostic alarm processing is called again as diagnostic alarm$_{outgoing}$.

All events of a channel between the diagnostic alarm$_{incoming}$ and diagnostic alarm$_{outgoing}$ are not buffered and are lost. During this time (first diagnostic alarm$_{incoming}$ to the last diagnostic alarm$_{outgoing}$) the MF-LED of the module is lit. Additionally an entry in the diagnostic buffer of the CPU is made for every diagnostic alarm$_{incoming/outgoing}$.

Example:



Diagnostic alarm processing:

Using the SFB 52 you can read out the diagnostic bytes. If the diagnostic alarm is deactivated, you can access the last diagnostic event in each case.

If you have activated the diagnostic function in your hardware configuration, OB 82 is called automatically. Here you can react on the diagnostics accordingly. With the SFB 52 you can additionally read out data set 1 which contains further information.

After exiting OB 82, the data can no longer be clearly assigned to the last diagnostic alarm.

Data set 1 is structured as follows:

Data set 1, diagnostics$_{incoming}$	
Byte	**Bit 7 ... 0**
0	Bit 0: Set if module fault Bit 1: 0 (fixed) Bit 2: Set in the case of an external error Bit 3: Set in the case of a channel error Bit 6 ... 4: 0 (fixed) Bit 7: Parameterisation error
1	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	Bit 5 ... 0: 0 (fixed) Bit 6: Process alarm lost Bit 7: 0 (fixed)
4	Bit 6 ... 0: Channel type, 76h: counter module Bit 7: Further channel types available, 0: no, 1: yes
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 02_h)
7	Bit 0: Error in channel group 0 (counter 0) Bit 1: Error in channel group 1 (counter 1) Bit 7 ... 2: 0 (fixed)
8	Channel group 0: Diagnostic alarm ldue to lost process alarm to ... Bit 1 ... 0: 0 (fixed) Bit 2: Overflow/underflow/final value Bit 3: Comparison value reached Bit 7 ... 4: 0 (fixed)
9	Channel group 1: Diagnostic alarm ldue to lost process alarm to ... Bit 1 ... 0: 0 (fixed) Bit 2: Overflow/underflow/final value Bit 3: Comparison value reached Bit 7 ... 4: 0 (fixed)
10 ... 15	0 (fixed)

Data set 1, diagnostics$_{outgoing}$
After the error recovery a diagnostic message$_{outgoing\ is\ effected}$

12.8.5 Two counters 32 bits, 24 V DC - EPM-S603

By integration of the GSE file VI010C19.gse you can specify all counter parameters via a hardware configuration.

The following functions can be parameterised:

Counting functions	Description
Counting continuously	The counter counts from 0 to the counting limit, then skips to the opposite counting limit and continues to count from there.

Signal evaluation	Description
Rotary transducer, single	Connection to input ”A/pulse”
Rotary transducer, double	
Rotary transducer, fourfold	Connection to input ”A/pulse” and ”B/direction”
Direction	Pulse at input ”A/pulse” and direction at ”B/direction”

Additional functions	Description
Gate function	The gate function serves to start, stop, and interrupt a counting function. In the case of this counter the internal gate (I-gate) is conform to the software gate (SW gate) which you control via your user program (status word in the output area).

Read data: 12 bytes

Input area in the process image		
Addr.	**Access**	**Assignment**
+0	Double word	Counter 1: count value
+4	Double word	Counter 2: count value
+8	Word	Counter 1: status word (see following table)
+10	Word	Counter 2: status word (see following table)

EPM-S603 status word		
Bit	**Designation**	**Function**
0	-	Reserved
1	-	Reserved
2	STS_SW-GATE	Software gate status (set if SW gate active)
3	-	Reserved
4	-	Reserved
5	STS_GATE	Status of internal gate (set if internal gate active)
6	-	Reserved
7	STS_C_DN	Status set for counter direction backwards
8	STS_C_UP	Status set for counter direction forwards
9	-	Reserved
10	-	Reserved
11	STS_OFLW*	Status set in the case of overflow
12	STS_UFLW*	Status set in the case of underflow
13	STS_ZP*	Status set in the case of zero crossing
14	-	Reserved
15	-	Reserved

* The bits are set until reset with RES_SET (bit 6 control word)

Write data: 4 bytes

Output area in the process image		
Addr.	**Access**	**Assignment**
+0	Word	Counter 1: Control word (see following table)
+2	Word	Counter 2: Control word (see following table)

EPM-S603 control word		
Bit	**Designation**	**Function**
0	-	Reserved
1	-	Reserved
2	SW_GATE_SET	Sets the software gate
3	-	Reserved
4	-	Reserved
5	-	Reserved
6	RES_SET	Resets bits STS_CMP, STS_END, STS_OFLW, STS_UFLW and STS_ZP with a rising edge
7	-	Reserved
8	-	Reserved
9	-	Reserved
10	SW_GATE_RESET	Resets the software gate
11	-	Reserved
12		
13		
14		
15		

Parameter data

Data set		Name	Description/value	Lenze
No.	Byte			
01_h	0	Input frequency counter 1, track A	Filters for instance serve to filter signal peaks in the case of an unclean input signal. 0 (00_h): 500 kHz 1 (01_h): 300 kHz 2 (02_h): 100 kHz 3 (03_h): 60 kHz 4 (04_h): 30 kHz 6 (06_h): 10 kHz 7 (07_h): 5 kHz 8 (08_h): 2 kHz 9 (09_h): 1 kHz Other values are not permissible!	02_h
	1	Input frequency counter 1, track B		02_h
	2	Input frequency counter 2, track A		02_h
	3	Input frequency counter 2, track B		02_h
80_h	0	Counting direction counter 1, track B	Bits 2 ... 0: Reserved Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 7 ... 4: Reserved	00_h
	1	Signal evaluation counter 1	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (connection to input ”A/pulse”) 010_b = double rotary transducer (connection to input ”A/pulse”) 011_b = four-fold rotary transducer (connection to input ”A/pulse” and ”B/direction”) 100_b = direction (pulse to ”A/pulse” and direction to ”B/direction”) Bits 7 ... 3: Reserved	00_h
82_h	0	Counting direction counter 2, track B	Bits 2 ... 0: Reserved Bit 3: Invert counting direction track B 0 = no (do not invert) 1 = yes (invert) Bits 7 ... 4: Reserved	00_h
	1	Signal evaluation counter 2	Bits 2 ... 0: Signal evaluation 000_b = counter deactivated (the other parameter details for the counter are ignored) 001_b = single rotary transducer (connection to input ”A/pulse”) 010_b = double rotary transducer (connection to input ”A/pulse”) 011_b = four-fold rotary transducer (connection to input ”A/pulse” and ”B/direction”) 100_b = direction (pulse to ”A/pulse” and direction to ”B/direction”) Bits 7 ... 3: Reserved	00_h

Diagnostic data

Using the SFB 52 you can access the diagnostic data of the module anytime. Since this module does not support a process alarm, the diagnostic data serve to provide information on this module.

Data set 1 is structured as follows:

Byte	Bit 7 ... 0
0	0 (fixed)
1	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bit 6 ... 0: Channel type, 76h: counter module Bit 7: Further channel types available, 0: no, 1: yes
5	Number of diagnostic bits output by the module per channel (here 00_h)
6	Number of channels of a module (here 02_h)
7 ... 15	0 (fixed)

12.9 Parameterising the encoder evaluation

12.9.1 SSI - EPM-S604

By integration of the GSE file VI010C19.gse you can specify all counter parameters via a hardware configuration.

The following functions can be parameterised:

Functions	Description
SSI encoder parameters	According to encoder data sheet
Operating mode	Master mode or monitoring operation
Alarm response	With definition of the comparison and limit values

Read data: 6 bytes

Input area		
Addr.	**Access**	**Assignment**
+0	Double word	Encoder value
+4	Word	Ticker value

Encoder value: Current encoder value

Ticker value: After mains connection a timer (µs ticker) is started, which after 65535 µs starts with 0 again. With every change of the encoder value the time value of the timer is stored as 16-bit µs value together with the encoder value in the input area.

Parameter data

Data set		Name	Description/value	Lenze
No.	Byte			
00_h	0	Diagnostics	A diagnostic alarm occurs if the same event triggers a further process alarm during a process alarm processing. Bits 5 ... 0: reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
80_h	0	Dead time	The dead time, also called tbs (time between sends), defines the waiting time between two encoder values to be observed by the module so that the encoder is able to process its value. This data can be found in the data sheet for your encoder. HIGH LOW 00_h 30_h: 1 µs 00_h 60_h: 2 µs 00_h $C0_h$: 4 µs 01_h 80_h: 8 µs 03_h 00_h: 16 µs 06_h 00_h: 32 µs 09_h 00_h: 48 µs $0C_h$ 00_h: 64 µs	$0C00_h$

Data set		Name	Description/value	Lenze
No.	Byte			
	1	Baud rate	In the "Monitoring operation" mode, the baud rate is irrelevant. Enter the baud rate here. This corresponds to the clock frequency via which the connected encoder communicates. More information on this can be found in the data sheet for your encoder. HIGH LOW 00_h 18_h: 2 MHz 00_h 20_h: 1.5 MHz 00_h 30_h: 1 MHz 00_h 60_h: 500 kHz 00_h $C0_h$: 250 kHz 01_h 80_h: 125 kHz	0180_h
	2	Reserved		
	3	Scaling	Depending on the encoder, further bits are transmitted in addition to the encoder value. Scaling serves to determine how many bits postpositioned to the encoder value will be removed by shifting the encoder value to the right. The encoder value is scaled by the module only after a gray-binary conversion. More information can be found in the data sheet for your encoder. Value range: 00_h ... $0F_h$ = 0 bits ... 15 bits	00_h
	4	Bit length of encoder data	Enter the bit length of the encoder data here. Depending on the encoder, the encoder data consist of the current encoder value with subsequent bits. The total length has to be specified here. More information on this can be found in the data sheet for your encoder. 7 (07_h) = "8 bits" 8 (08_h) = "9 bits" ... 24 (18_h) = "25 bits" ... 31 ($1F_h$) = "32 bits"	18_h

Data set		Name	Description/value	Lenze
No.	Byte			
	5		Bit 1 ... 0: Ready for operation During ”Monitoring operation” the module serves to monitor the data exchange between an SSI master and an SSI encoder. It receives the cycle by the master and the data flow by the SSI encoder. In the ”Master mode” operating mode the module provides a cycle to the encoder and receives data by the encoder. 01_b = monitoring operation 10_b = master mode Bit 2: Shifting direction Specify the orientation of the encoder data here. More information can be found in the data sheet for your encoder. Usually, the SSI encoder uses ”MSB first”. 0 = LSB first (LSB is transmitted first) 1 = MSB first (MSB is transmitted first) Bit 3: edge clock signal Here you can specify the edge type of the clock signal, in the case of which the encoder supplies data. Information on this can be found in the data sheet for your encoder. Usually the SSI encoders respond to rising edges. 0 = falling edge 1 = rising edge Bit 4: Coding In the ”Binary code” setting, the provided encoder value remains unchanged. In the ”Gray code” setting, the gray-coded value provided by the encoder is converted into a binary value. Only after this conversion, the received encoder value is scaled, if required. The Gray code is another form of representation of the binary code. It is based on the fact that two adjacent Gray numbers differ from each other in exactly one bit. If the Gray code is used, transmission errors can be easily detected, since adjacent characters must only differ from each other in one digit. Information on this can be found in the data sheet for your encoder. 0 = standard code 1 = Gray code Bits 7 ... 5: reserved	$1E_h$
	6	Reserved		
	7	SSI function	By enabling the SSI function the module starts with the cycle output and the evaluation of the encoder data. In the ”monitor operation” mode, the module starts with the encoder evaluation. 0 (00_h) = inhibited 1 (01_h) = enabled	00_h

Diagnostic alarm

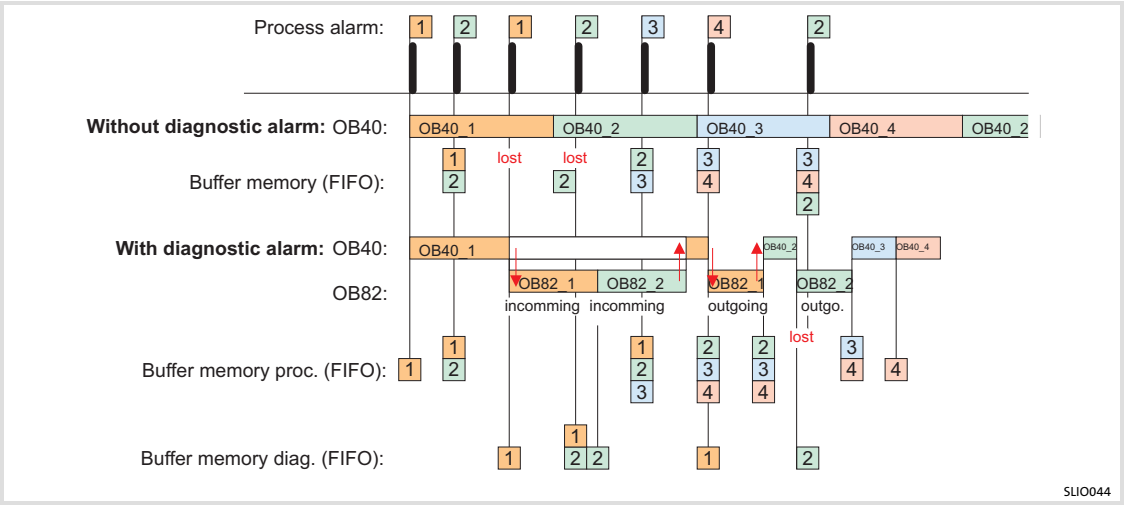
You have the possibility of globally activating a diagnostic alarm for the module via parameterisation (data set 00h). A diagnostic alarm occurs if a further process alarm is triggered for the same event during a process alarm processing in the OB 40.

By activation of a diagnostic alarm the current process alarm processing in the OB 40 is interrupted and branched to the diagnostic alarm processing$_{incoming}$ in OB 82. If further events occur on other channels during the diagnostic alarm processing, which can trigger a process or diagnostic alarm, they are buffered. At the end of the diagnostic alarm processing, first all buffered diagnostic alarms are processed in order of their occurrence, and afterwards all process alarms.

If further process alarms occur on a channel for which a diagnostic alarm$_{incoming}$ is currently processed or buffered, they are lost. If a process alarm for which a diagnostic alarm$_{incoming}$ has been triggered is processed, the diagnostic alarm processing is called again as diagnostic alarm$_{outgoing}$.

All events of a channel between the diagnostic alarm$_{incoming}$ and diagnostic alarm$_{outgoing}$ are not buffered and are lost. During this time (first diagnostic alarm$_{incoming}$ to the last diagnostic alarm$_{outgoing}$) the MF-LED of the module is lit. Additionally an entry in the diagnostic buffer of the CPU is made for every diagnostic alarm$_{incoming/outgoing}$.

Example:



Diagnostic alarm processing:

Using SFB 52 you can read out the diagnostic bytes. If the diagnostic alarm is deactivated, you can access the last diagnostic event in each case.

If you have activated the diagnostic function in your hardware configuration, OB 82 is called automatically. Here you can react on the diagnostics accordingly. With the SFB 52 you can additionally read out data set 1 which contains further information.

After exiting OB 82, the data ca no longer be clearly assigned to the last diagnostic alarm.

Data set 1 is structured as follows:

Data set 1, $diagnostics_{incoming}$	
Byte	**Bit 7 ... 0**
0	Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error Bit 3: Set if channel error available Bit 4: Set in the case of missing external supply voltage Bit 6 ... 5: 0 (fixed) Bit 7: Parameterisation error
1	Bit 3 ... 0: Module class, 1000_b: function module Bit 4: Channel information available Bit 7 ... 5: 0 (fixed)
2	0 (fixed)
3	Bit 5 ... 0: 0 (fixed) Bit 6: Process alarm lost Bit 7: 0 (fixed)
4	Bit 6 ... 0: Channel type, 76h: counter module Bit 7: 0 (fixed)
5	Number of diagnostic bits output by the module per channel (here 08_h)
6	Number of channels of a module (here 01_h)
7	Bit 0: Error in channel group 0
8 ... 15	0 (fixed)

Data set 1, $diagnostics_{outgoing}$
After the error recovery a diagnostic $message_{outgoing\ is\ effected}$

12.10 Time stamp parameterising

12.10.1 2 digital inputs with time stamp function - EPM-S207

By integration of the GSE file VI010C19.gse you can specify all counter parameters via a hardware configuration.

The following functions can be parameterised:

Functions	Description
Input delay	For example, signal peaks can be filtered in the event of an unclean input signal.
Edge selection	Specification of signal edge for input signal to produce a time stamp entry.

Read data: 6 bytes

Input area		
Addr.	**Access**	**Assignment**
+0	Byte	Status of inputs (PAE)
+1	Byte	Running number (RN)
+2	Word	Ticker value

Status of inputs:the status of the inputs after the edge change is saved here. Parameters can be set for the following variants by incorporating the GSD file LE010C3A.gsd:

20 bytes, 5 time stamp entries:

Addr.	+0	+1	+2	+3
+0	PAE	RN	16-bit µs value	
+4	PAE	RN-1	16-bit µs value	
+8	PAE	RN-2	16-bit µs value	
+12	PAE	RN-3	16-bit µs value	
+16	PAE	RN-4	16-bit µs value	

60 bytes, 15 time stamp entries:

Addr.	+0	+1	+2	+3
+0	PAE	RN	16-bit µs value	
+4	PAE	RN-1	16-bit µs value	
+8	PAE	RN-2	16-bit µs value	
+12	PAE	RN-3	16-bit µs value	
...	...	...	...	
+56	PAE	RN-14	16-bit µs value	

Running number (RN): The ”running number” is a consecutive number between 0 ... 63, which always starts afresh from 0. You use the ”running number” to determine the time sequence of entries. It should be incremented with every time stamp entry. During the first run, the ”running number” must start with 1.

Ticker value: After mains connection, a timer (µs ticker) is started, which after 65535 µs starts with 0 again. With every change in the encoder value the time value of the timer is stored as a 16-bit µs value together with the encoder value in the input area.

Parameter data

Data set		Name	Description/value	Lenze
No.	Byte			
02_h	0	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	14_h or $3C_h$ (fix)
	1	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	00_h (fix)
01_h	0	Input delay DI 1	00_h = 1 µs 02_h = 3 µs 04_h = 10 µs 07_h = 86 µs 09_h = 342 µs $0C_h$ = 273 µs Other values are not permissible.	02_h
	1	Input delay DI 2		02_h
80_h	0	Edge 0-1 an DI x	Time stamp entry on rising edge Bit 0: DI 1 (0: inhibit, 1 = enable) Bit 1: DI 2 (0: inhibit, 1 = enable) Bits 7 ... 2: Reserved	00_h
	1	Edge 1-0 at DI x	Time stamp entry on falling edge Bit 0: DI 1 (0: inhibit, 1 = enable) Bit 1: DI 2 (0: inhibit, 1 = enable) Bits 7 ... 2: Reserved	00_h

Diagnostic data

Using SFB 52, you can read out the diagnostic bytes which provide information about the module. With SFB 52 you can also read out data set 1 which contains further information.

Data set 1 is structured as follows:

Data set 1, diagnostics	
Byte	**Bit 7 ... 0**
0	0 (fixed)
1	Bits 3 ... 0: module class, 1111_b: digital module Bit 4: channel information available Bits 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bits 6 ... 0: channel type, 70_h: digital module Bit 7: more channel types available (0: yes; 1: no)
5	Number of diagnostic bits output by the module per channel (here 00_h)
6	Number of channels of a module (here 02_h)
7 ... 15	0 (fixed)

12.10.2 2 digital outputs with time stamp function - EPM-S310

By integration of the GSE file VI010C19.gse you can specify all counter parameters via a hardware configuration.

The module has an FIFO (first-in-first-out) memory for 15 time stamp entries. Depending on parameter setting, you can use the output area to transfer up to 15 time stamp entries to the FIFO memory. The input process image provides information on the status of the FIFO memory and the status of processing.

Read data: 4 bytes

Input area		
Addr.	**Access**	**Assignment**
+0	Byte	Bits 5 ... 0: running number (RN = **R**unning **N**umber) of the last FIFO entry Bit 6: 1 (fixed) Bit 7: 0 (fixed)
+1	Byte	Bits 5 ... 0: running number of the next FIFO entry Bit 6: 1 (fixed) Bit 7: 1 (fixed)
+2	Byte	Status
+3	Byte	Number of time stamp entries in FIFO memory.

Running number: here you will find the running number of the time stamp entry last/next written to the FIFO.

Status: The status informs you of the status of the FIFO memory:

Code 00_h/80_h: everything OK

Code 01_h/81_h: no following time stamp entry

Code 02_h/82_h: no new time stamp entries.

Code 03_h/83_h: FIFO memory is full. No new time stamp entries can be accepted.

If bit 6 of the last processed running number (RN) was set, the code is returned at 80_h OR-ed.

Note!

Note that no more time stamp entries can be accepted once the FIFO memory is full. You should always establish the status of the FIFO memory before the transfer to ensure that your entries are accepted.

Write data: 20 bytes/60 bytes

Depending on project planning, the output area can be used to write up to 15 time stamp entries. 4 bytes in the process image are intended for each time stamp entry:

Output area		
Addr.	**Access**	**Assignment**
+0	Byte	Bits 3 ... 0: 0 (fixed) Bit 4: Release of DO 1 (0: inhibit, 1: enable) Bit 5: Release of DO 0 (0: inhibit, 1: enable) Bit 6: State DO 1 Bit 7: State DO 0
+1	Byte	Running number (RN)
+2	Word	Ticker value

Status of outputs:the status of the outputs for the time required is stated here. You can project plan the following variants by incorporating the GSD file LE010C3A.gsd.gsd:

20 bytes, 5 time stamp entries:

Addr.	+0	+1	+2	+3
+0	PAA	RN	16-bit µs value	
+4	PAA	RN-1	16-bit µs value	
+8	PAA	RN-2	16-bit µs value	
+12	PAA	RN-3	16-bit µs value	
+16	PAA	RN-4	16-bit µs value	

60 bytes, 15 time stamp entries:

Addr.	+0	+1	+2	+3
+0	PAA	RN	16-bit µs value	
+4	PAA	RN-1	16-bit µs value	
+8	PAA	RN-2	16-bit µs value	
+12	PAA	RN-3	16-bit µs value	
...	...	...	...	
+56	PAA	RN-14	16-bit µs value	

Running number (RN): The ”running number” is a consecutive number between 0 ... 63, which always starts afresh from 0. You use the ”running number” to determine the time sequence of entries. It should be incremented with every time stamp entry. During the first run, the ”running number” must start with 1.



Note!

If using SFC 15 to write consistent user data, up to 15 time stamp entries can be written. If less than 15 time stamp entries are written, bit 6 must also be set for the last RN. This has to be done to ensure that the following entries don’t have to be written in an ”invalid” way. The module ignores all time stamp entries after an entry with a set bit 6.

Ticker value: Specify a time here in µs at which the status of the outputs is to be accepted (value range: 0 ... 65535).

Parameter data

Data set		Name	Description/value	Lenze
No.	Byte			
02_h	0	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	14_h or $3C_h$ (fix)
	1	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	00_h (fix)

Diagnostic data

Using SFB 52, you can read out the diagnostic bytes which provide information about the module. With SFB 52 you can also read out data set 1 which contains further information.

Data set 1 is structured as follows:

Data set 1, diagnostics	
Byte	**Bit 7 ... 0**
0	0 (fixed)
1	Bits 3 ... 0: module class, 1111_b: digital module Bit 4: channel information available Bits 7 ... 5: 0 (fixed)
2	0 (fixed)
3	0 (fixed)
4	Bits 6 ... 0: channel type, 70_h: digital module Bit 7: more channel types available (0: yes; 1: no)
5	Number of diagnostic bits output by the module per channel (here 00_h)
6	Number of channels of a module (here 02_h)
7 ... 15	0 (fixed)

12.11 Parameterising technology modules

12.11.1 2 digital outputs with PWM functionality - EPM-S620

The following functions can be parameterised:

By integration of the GSE file VI010C19.gse you can specify all counter parameters via a hardware configuration.

Read data: 4 bytes

Input area			
Addr.	**Name**	**Byte**	**Function**
+0	PWMSTS_I	2	PWM 1: status
+2	PWMSTS_II	2	PWM 2: status

Status PVMx		
Bit	**Name**	**Function**
0	-	Reserved
1	STS_PVM	Status PWM 0: PWM output stopped 1: PWM output active
2	STS_OUTBV	Output status 0: push/pull output 1: highside output
3 ... 15	-	Reserved

Write data: 12 bytes

Output area			
Addr.	**Name**	**Byte**	**Function**
+0	PWMPD_I	4	PWM 1: pulse duration
+4	PWMSTS_II	4	PWM 2: pulse duration
+8	PWMCTRL_I	2	PWM 1: control word
+10	PWMSTS_II	2	PWM 2: control word

PWMPD_I, PWMPD_II pulse duration: Determine the scanning ratio for the parameterised period here by stating the duration of the HIGH level for the corresponding PWM channel. The pulse duration should be chosen as a factor for the 20.83 ns basis.

Value range: 48 ... 8388607 (1µs ... approx. 175ms)

PWMPD_I, PWMPD_II control word:here you can specify the PWM output response for the corresponding channel and start or stop PWM output.

Control word PWMPDx		
Bit	**Name**	**Function**
0	-	Reserved
1	CTRL_OUTBV	PWM output response 0: push/pull output Push/pull mode should be used if you need defined high/low levels for a rapid change. This is used with a low load especially if "highside" mode cannot move the output to low fast enough during a low status. With push/pull, the output is switched to ground with low active and to voltage with high active. 1: highside output In highside mode, the output switched to low remains in a state of uncertainty between ground and voltage. The load has to "pull" itself to ground. In highside mode, the switch is only made to high level active.
3 ... 7	-	Reserved
8	CTRL_STRT	Edge 0-1 starts PWM output on channel x
9	CTRL_STP	Edge 0-1 stops PWM output on channel x
10 ... 15	-	Reserved

Parameter data

Data set		Name	Description/value	Lenze
No.	Byte			
80_h	0	PWM 1: period	Set parameters here for the total time for pulse duration and pulse pause. The time should be selected as a factor for the 20.83 ns basis. Values below 25 µs are ignored. If the pulse duration is higher or equal to the period, the DO output is set permanently. Value range: 1200 ... 8388607 (25 µs ... approx. 175 ms)	$1F40_h$
81_h	0	PWM 2: Period		$1F40_h$

Diagnostic data

Since this module does not support alarms, the diagnostic data provides information about this module.

Diagnostic data set - data set 01h			
Name	**Byte**	**Function**	**Default**
ERR_A	1	Reserved	00_h
MODTYP	1	Module information Byte 0: Bit 3 ... 0: module class (1111b: digital module) Bit 4: channel information available Bits 7 ... 4: 0 reserved	15_h
ERR_C	1	Reserved	00_h
ERR_D	1	Reserved	00_h
CHTYP	1	Channel type Byte 0: Bits 6 ... 0: channel type (72h: digital output) Bit 7: reserved	72_h
NUMBIT	1	Number of diagnostic bits per channel Byte 0: here 00_h	00_h
NUMCH	1	Number of channels in module Byte 0: here 02_h	02_h
CHERR	1	Reserved	00_h
CH0ERR ... CH7ERR	6	Reserved	00_h
DIAG_US	4	Value of µs ticker when diagnostics occur Bytes 0 ...3	0

12.11.2 RS232 interface - EPM-S640

Information on the transmission principles can be found in the appendix (📖 777).

Parameter data

Parameter data - ASCII protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
00_h	0	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
02_h	0	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
	1	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
80_h	0	Baud rate	00_h: 9600Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
	1	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 01_h: ASCII	01_h
Option 1, character frame				
80_h	2	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
			Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
			Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
			Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b

Parameter data - ASCII protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
Option 2/3, ZNA				
80_h	3	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
	4	ZNA (LOW byte)		00_h
Option 4/5, ZVZ				
80_h	5	Character delay time	Character delay time (ZVZ) The character delay time defines the maximum permissible time interval between two characters received within a telegram. If ZVZ = 0, the module calculates the ZVZ by means of the baud rate (approx. double character time). 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
80_h	6			FA_h
Option 6, number of receive buffers				
80_h	7	Number of receive buffers	Defines the number of receive buffers. As long as only one receive buffer is used and is assigned, no more data can be received. If up to 250 receive buffers are connected, the received data can be redirected to a still free receive buffer. 1 ... 255 (01_h ... FF_h)	01_h
Option 7 ... 12, reserved				
80_h	8 ... 13	Reserved		00_h

Parameter data STX/ETX protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
00_h	0	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhib.; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
02_h	0	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
	1	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
80_h	0	Baud rate	00_h: 9600Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
	1	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 01_h: ASCII	01_h
Option 1, character frame				
80_h	2	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
			Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
			Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
			Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2/3, ZNA				
80_h	3	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
	4	ZNA (LOW byte)		00_h

Parameter data STX/ETX protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
Option 4/5, TMO				
80_h	5	TMO (HIGH byte)	TMO serves to define the maximally permissible interval between two frames. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
	6	TMO (LOW byte)		FA_h
Option 6, number of start identifiers				
80_h	7	Number of start identifiers	00_h: 1 start identifier (2nd start identifier is ignored) 01_h: 2 start identifiers	01_h
Option 7, start identifier 1				
80_h	8	Start identifier 1	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 8, start identifier 2				
80_h	9	Start identifier 2	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 9, number of end identifiers				
80_h	10	No. of end identifier	00_h: 1 end identifier (2. end identifier (0x310D/x) is ignored) 01_h: 2 end identifiers	00_h
Option 10, end identifier 1				
80_h	11	End identifier 1	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 11, end identifier 2				
80_h	12	End identifier 2	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 12, reserved				
80_h	13	Reserved		00_h

Parameter data 3964(R) protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
00_h	0	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
02_h	0	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
	1	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
80_h	0	Baud rate	00_h: 9600Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
	1	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 01_h: ASCII	01_h
Option 1, character frame				
80_h	2	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
			Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
			Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
			Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2, ZNA (x 20 ms)				
80_h	3	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. The ZNA is indicated as a factor in steps of 20ms. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h

Parameter data 3964(R) protocol				
Data set		Name	Description/value	Lenze
No.	Byte			
Option 3, ZVZ (x 20 ms)				
80_h	4	Character delay time	Character delay time (ZVZ) The character delay time defines the maximum permissible time interval between two characters received within a telegram. The ZVS is indicated as a factor in steps of 20ms. If ZVZ = 0, the module calculates the ZVZ by means of the baud rate (approx. double character time). 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
Option 4, QVZ (x 20 ms)				
80_h	5	Acknowledgement time	Acknowledgement time (QVZ) The QVZ defines the max. permissible time interval until the partner is acknowledged while establishing/terminating a connection. The QVZ is indicated as a factor in steps of 20 ms. 1 ... 255 [ms] (01_h ... FF_h)	00_h
Option 5, BWZ (x 20 ms)				
80_h	6	Block wait time	Block wait time (BWZ) The BWZ is the maximum time period between the confirmation of a request frame (DLE) and STX of the response frame. The BWZ is indicated as a factor in steps of 20 ms. 1 ... 255 [ms] (01_h ... FF_h)	FA_h
Option 6, STX (x 20 ms)				
80_h	7	STX repetitions	Maximum number of times the module attempts to establish a connection. 1 ... 255 [ms] (01_h ... FF_h)	01_h
Option 7, DBL (x 20 ms)				
80_h	8	DBL	When exceeding the block wait time (BWZ) you can specify the maximum number of repetitions for the request frame using the DBL parameter. If these attempts fail, transmission is cancelled. 1 ... 255 [ms] (01_h ... FF_h)	00_h
Option 8, priority (x 20 ms)				
80_h	9	Priority	A communication partner has high priority if its sending attempt has precedence over the partner's transmit request. In the event of low priority, it must take second place behind the partner's transmit request. With 3964(R) the priorities of both partners must be different. The following settings are possible: 00_h: LOW 01_h: HIGH	00_h
Option 9 ... 12, reserved				
80_h	10 ... 13	Reserved		00_h

Diagnostic data

Since this module does not support alarms, the diagnostic data provides information about this module.

In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

Diagnostic data - data set 01h			
Name	**Byte**	**Function**	**Default**
ERR_A	1	ERR_A-diagnostics Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error (cable break) Bit 3: Reserved Bit 4: Set in the case of a missing external supply voltage Bit 5, 6: Reserved Bit 7: Set in the case of parameterisation error	00_h
MODTYP	1	Module information Byte 0: Bit 3 ... 0: Module class (0111b: Gateway module) Bit 4: channel information available Bits 7 ... 4: 0 reserved	17_h
ERR_C	1	ERR_A-diagnostics Bit 7 ... 0: Reserved	00_h
ERR_D	1	ERR_D diagnostics Bit 3 ... 0: Reserved Bit 4: Set in the case of internal communication error Bit 7 ... 5: Reserved	00_h
CHTYP	1	Channel type Bit 7 ... 0: Reserved	00_h
NUMBIT	1	Number of diagnostic bits of the module per channel (here 08_h)	08_h
NUMCH	1	Number of channels in module Bit 7 ... 0: Reserved	00_h
CHERR	1	Bit 7 ... 0: Reserved	00_h
CH0ERR ... CH7ERR	8	Bit 7 ... 0: Reserved	00_h
DIAG_US	4	Value of µs ticker when diagnostics occur Bytes 0 ...3	00_h

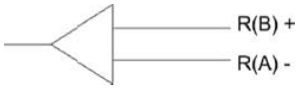
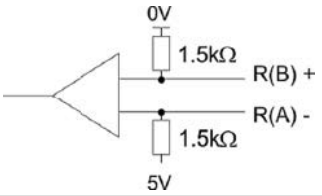
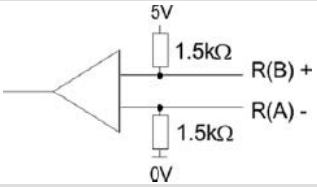
12.11.3 RS422/RS485 interface - EPM-S650

Information on the transmission principles can be found in the appendix (📖 777).

Parameter data

Parameter data - ASCII protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
00_h	0	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
02_h	0	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
	1	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
80_h	0	Baud rate	00_h: 9600Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
	1	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 01_h: ASCII	01_h
Option 1, character frame				
80_h	2	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
			Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
			Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
			Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b

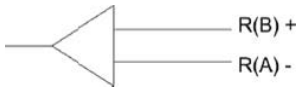
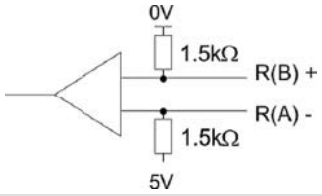
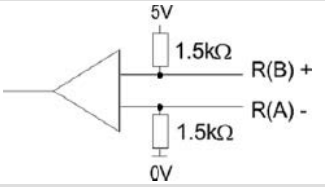
Parameter data - ASCII protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
Option 2/3, ZNA				
80_h	3	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
	4	ZNA (LOW byte)		00_h
Option 4/5, ZVZ				
80_h	5	Character delay time	Character delay time (ZVZ) The character delay time defines the maximum permissible time interval between two characters received within a telegram. If ZVZ = 0, the module calculates the ZVZ by means of the baud rate (approx. double character time). 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
80_h	6			FA_h
Option 6, number of receive buffers				
80_h	7	Number of receive buffers	Defines the number of receive buffers. As long as only one receive buffer is used and is assigned, no more data can be received. If up to 250 receive buffers are connected, the received data can be redirected to a still free receive buffer. 1 ... 255 (01_h ... FF_h)	01_h
Option 7 ... 12, reserved				
80_h	8 ... 13	Reserved		00_h
Option 13, operating mode				
80_h	14	Operating mode	The operating mode serves to determine if the interface is operated in half duplex mode (RS485) or full duplex mode (RS422). • 0x00: Half duplex - two-wire operation (RS485) Half duplex operation means that at a point of time data are either sent or received. The data are transmitted between the communication partners in both directions in turns. If the parameterisation is half duplex under RS485, a software data flow control is not possible. • 0x01: Full duplex - four-wire operation (RS422) The data are exchanged simultaneously between the communication partners; transmission and reception can take place at the same time. Each communication partner must simultaneously actuate a receive path.	01_h
Option 14, cable assignment				
80_h	15	Cable assignment	For a connection with minimum reflections and the open circuit detection in RS422/485 operation, the cables can be pre-assigned via parameters with a defined idle level (see following table "Cable assignment parameters")	00_h

Cable assignment parameter		
Values	**Description**	
00_h	No pre-assignment of the receive path. This setting is only advisable for special drivers that are provided with a bus capability.	
01_h	Signal R(A) 5 V (open-circuit detection), signal R(B) 0 V Open-circuit detection is possible in full duplex operation under RS422.	
02_h	Signal R(A) 0 V, signal R(B) 5 V This pre-assignment corresponds to the idle state (no transmitter active) in half duplex operation under RS485. Open-circuit detection is not possible here.	

Parameter data STX/ETX protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
00_h	0	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
02_h	0	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
	1	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
80_h	0	Baud rate	00_h: 9600Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
	1	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 01_h: ASCII	01_h
Option 1, character frame				
80_h	2	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
			Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
			Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
			Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2/3, ZNA				
80_h	3	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
	4	ZNA (LOW byte)		00_h

Parameter data STX/ETX protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
Option 4/5, TMO				
80_h	5	TMO (HIGH byte)	TMO serves to define the maximally permissible interval between two frames. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
	6	TMO (LOW byte)		FA_h
Option 6, number of start identifiers				
80_h	7	Number of start identifiers	00_h: 1 start identifier (2nd start identifier is ignored) 01_h: 2 start identifiers	01_h
Option 7, start identifier 1				
80_h	8	Start identifier 1	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 8, start identifier 2				
80_h	9	Start identifier 2	ASCII value of the initial character that is sent in advance of a frame and marks the start of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 9, number of end identifiers				
80_h	10	No. of end identifier	00_h: 1 end identifier (2. end identifier (0x310D/x) is ignored) 01_h: 2 end identifiers	00_h
Option 10, end identifier 1				
80_h	11	End identifier 1	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 11, end identifier 2				
80_h	12	End identifier 2	ASCII value of the end character that is sent after a frame and marks the end of a transmission. 0 ... 255 (00_h ... FF_h)	00_h
Option 12, reserved				
80_h	13	Reserved		00_h
Option 13, operating mode				
80_h	14	Operating mode	The operating mode serves to determine if the interface is operated in half duplex mode (RS485) or full duplex mode (RS422). ● 0x00: Half duplex - two-wire operation (RS485) Half duplex operation means that at a point of time data are either sent or received. The data are transmitted between the communication partners in both directions in turns. If the parameterisation is half duplex under RS485, a software data flow control is not possible. ● 0x01: Full duplex - four-wire operation (RS422) The data are exchanged simultaneously between the communication partners; transmission and reception can take place at the same time. Each communication partner must simultaneously actuate a receive path.	01_h

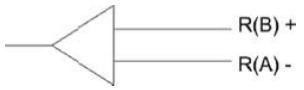
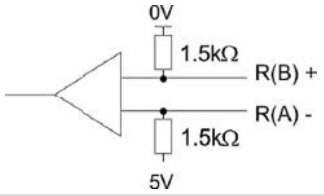
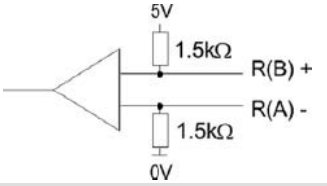
Parameter data STX/ETX protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
Option 14, cable assignment				
80_h	15	Cable assignment	For a connection with minimum reflections and the open circuit detection in RS422/485 operation, the cables can be pre-assigned via parameters with a defined idle level (see following table "Cable assignment parameters")	00_h

Cable assignment parameter		
Values	**Description**	
00_h	No pre-assignment of the receive path. This setting is only advisable for special drivers that are provided with a bus capability.	
01_h	Signal R(A) 5 V (open-circuit detection), signal R(B) 0 V Open-circuit detection is possible in full duplex operation under RS422.	
02_h	Signal R(A) 0 V, signal R(B) 5 V This pre-assignment corresponds to the idle state (no transmitter active) in half duplex operation under RS485. Open-circuit detection is not possible here.	

Parameter data 3964(R) protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
00_h	0	Diagnostics	Bits 5 ... 0: Reserved Bit 6: Diagnostic alarm (0 = inhibited; 1 = enabled) Bit 7: Reserved Other values are not permissible!	00_h
02_h	0	Length - process image input data	Length of input data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
	1	Length - process image output data	Length of output data (backplane bus communication); the values are specified by the system. Other values are not permissible.	
80_h	0	Baud rate	00_h: 9600Baud 01_h: 150 Baud 02_h: 300 Baud 03_h: 600 Baud 04_h: 1200 Baud 05_h: 1800 Baud 06_h: 2400 Baud 07_h: 4800 Baud 08_h: 7200 Baud 09_h: 9600 Baud $0A_h$: 14400 Baud $0B_h$: 19200 Baud $0C_h$: 38400 Baud $0D_h$: 57600 Baud $0E_h$: 115200 Baud $0F_h$: 76800 Baud 10_h: 109700 Baud	00_h
	1	Protocol	The protocol to be used. This setting influences the structure of the parameter data. 01_h: ASCII	01_h
Option 1, character frame				
80_h	2	Data format	Bit 1/0 number of data bits 00_b: 5 01_b: 6 10_b: 7 11_b: 8	11_b
			Bit 3/2 parity 00_b: none 01_b: odd 10_b: even 11_b: even	00_b
			Bit 5/4 number of stop bits 01_b: 1 10_b: 1.5 11_b: 2	01_b
			Bit 7/6 flow control 00_b: None 01_b: Hardware 10_b: XON/XOFF	00_b
Option 2, ZNA (x 20 ms)				
80_h	3	ZNA (HIGH byte)	Time after request (ZNA) Waiting time observed until the next transmit request is processed. The ZNA is indicated as a factor in steps of 20ms. 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h

Parameter data 3964(R) protocol				
Data set		**Name**	**Description/value**	**Lenze**
No.	Byte			
Option 3, ZVZ (x 20 ms)				
80_h	4	Character delay time	Character delay time (ZVZ) The character delay time defines the maximum permissible time interval between two characters received within a telegram. The ZVS is indicated as a factor in steps of 20ms. If ZVZ = 0, the module calculates the ZVZ by means of the baud rate (approx. double character time). 0 ... 65535 [ms] (0000_h .:. $FFFF_h$)	00_h
Option 4, QVZ (x 20 ms)				
80_h	5	Acknowledgement time	Acknowledgement time (QVZ) The QVZ defines the max. permissible time interval until the partner is acknowledged while establishing/terminating a connection. The QVZ is indicated as a factor in steps of 20 ms. 1 ... 255 [ms] (01_h ... FF_h)	00_h
Option 5, BWZ (x 20 ms)				
80_h	6	Block wait time	Block wait time (BWZ) The BWZ is the maximum time period between the confirmation of a request frame (DLE) and STX of the response frame. The BWZ is indicated as a factor in steps of 20 ms. 1 ... 255 [ms] (01_h ... FF_h)	FA_h
Option 6, STX (x 20 ms)				
80_h	7	STX repetitions	Maximum number of times the module attempts to establish a connection. 1 ... 255 [ms] (01_h ... FF_h)	01_h
Option 7, DBL (x 20 ms)				
80_h	8	DBL	When exceeding the block wait time (BWZ) you can specify the maximum number of repetitions for the request frame using the DBL parameter. If these attempts fail, transmission is cancelled. 1 ... 255 [ms] (01_h ... FF_h)	00_h
Option 8, priority (x 20 ms)				
80_h	9	Priority	A communication partner has high priority if its sending attempt has precedence over the partner's transmit request. In the event of low priority, it must take second place behind the partner's transmit request. With 3964(R) the priorities of both partners must be different. The following settings are possible: 00_h: LOW 01_h: HIGH	00_h
Option 9 ... 12, reserved				
80_h	10 ... 13	Reserved		00_h

Parameter data 3964(R) protocol				
Data set		Name	Description/value	Lenze
No.	Byte			
Option 13, operating mode				
80_h	14	Operating mode	The operating mode serves to determine if the interface is operated in half duplex mode (RS485) or full duplex mode (RS422). ● 0x00: Half duplex - two-wire operation (RS485) Half duplex operation means that at a point of time data are either sent or received. The data are transmitted between the communication partners in both directions in turns. If the parameterisation is half duplex under RS485, a software data flow control is not possible. ● 0x01: Full duplex - four-wire operation (RS422) The data are exchanged simultaneously between the communication partners; transmission and reception can take place at the same time. Each communication partner must simultaneously actuate a receive path.	01_h
Option 14, cable assignment				
80_h	15	Cable assignment	For a connection with minimum reflections and the open circuit detection in RS422/485 operation, the cables can be pre-assigned via parameters with a defined idle level (see following table ”Cable assignment parameters”)	00_h

Cable assignment parameter		
Values	Description	
00_h	No pre-assignment of the receive path. This setting is only advisable for special drivers that are provided with a bus capability.	
01_h	Signal R(A) 5 V (open-circuit detection), signal R(B) 0 V Open-circuit detection is possible in full duplex operation under RS422.	
02_h	Signal R(A) 0 V, signal R(B) 5 V This pre-assignment corresponds to the idle state (no transmitter active) in half duplex operation under RS485. Open-circuit detection is not possible here.	

Diagnostic data

In the event of an error the corresponding channel LED of the module is lit and the error is entered in the diagnostic data.

Diagnostic data - data set 01h			
Name	**Byte**	**Function**	**Default**
ERR_A	1	ERR_A-diagnostics Bit 0: Set in the case of module fault Bit 1: Set in the case of internal error Bit 2: Set in the case of external error (cable break) Bit 3: Reserved Bit 4: Set in the case of a missing external supply voltage Bit 5, 6: Reserved Bit 7: Set in the case of parameterisation error	00_h
MODTYP	1	Module information Byte 0: Bit 3 ... 0: Module class (0111b: Gateway module) Bit 4: channel information available Bits 7 ... 4: 0 reserved	17_h
ERR_C	1	ERR_A-diagnostics Bit 7 ... 0: Reserved	00_h
ERR_D	1	ERR_D diagnostics Bit 3 ... 0: Reserved Bit 4: Set in the case of internal communication error Bit 7 ... 5: Reserved	00_h
CHTYP	1	Channel type Bit 7 ... 0: Reserved	00_h
NUMBIT	1	Number of diagnostic bits of the module per channel (here 08_h)	08_h
NUMCH	1	Number of channels in module Bit 7 ... 0: Reserved	00_h
CHERR	1	Bit 0: set in the event of an error of channel group 1 Bits 7 ... 1 0 (fixed)	00_h
CH0ERR	8	Channel-specific error: channel x: Bits 3 ... 0: 0 (fixed) Bit 4 : set in the case of open circuit (only possible for RS422) Bits 7 ... 5: 0 (fixed)	00_h
CH1ERR ... CH7ERR	8	Bit 7 ... 0: Reserved	00_h
DIAG_US	4	Value of µs ticker when diagnostics occur Bytes 0 ...3	00_h

13 Maintenance

13.1 Regular checks

The system is maintenance-free. Nevertheless, visual inspections must be carried out at regular intervals which must not be too long, depending on the ambient conditions.

Please check the following:

- Does the environment of the system still meet the operating conditions specified in the Technical data?
- Is the heat dissipation impeded by dust or dirt?
- Are the mechanical and electrical connections still okay?

13.2 Cleaning



Stop!

Sensitive surfaces and components

The system can be damaged if it is not appropriately cleaned.

Possible consequences:

- Housings are scratched or get dull if you use alcohol-containing, solvent-containing or abrasive detergents.
- Electrical components may be damaged ...
  - by a short circuit due to humidity.
  - by static discharge.

Protective measures:

- Completely deenergise the system before cleaning.
- Clean the system as follows:
  - Use a clean, lint-free and soft cloth.
  - As cleaning agent only use water with a bit of standard liquid detergent.
  - Moisten the cloth with the detergent.
  - Make sure that no cleaning water enters the ventilation slots or the connections.

13.3 Repair

13.3.1 Replacing the electronic module/main supply

Note!

If an I/O compound module is defective, just replace its electronic module. Leave the base module and the wiring unchanged.

The input fuse of the power supply module is located in the electronic module. If this fuse has tripped, the electronic module needs to be replaced. The same applies to the main supply which is integrated in bus coupler modules.

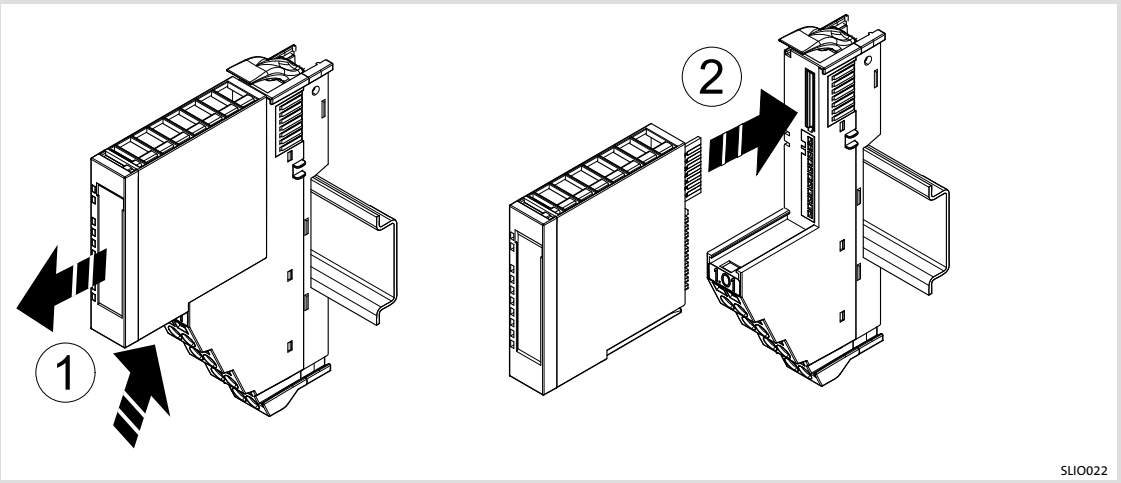


Fig. 13-1 Replacing the electronic module

How to proceed:

1. Press the locking button underneath the electronic module (or, in the case of bus coupler modules, the main supply, respectively) and remove the electronic module from the base module at the same time.
2. Slide a new electronic module of the same type on the base module until it locks into place.

14 Appendix

14.1 Serial process interfacing

With the EPM-S640 and EPM-S650 I/O compound modules a serial process interfacing to different target or source systems can be implemented.

EPM-S640: Serial process interfacing via RS232 interface

EPM-S650: Serial process interfacing via RS422 or RS485 interface

Serial transmission of a character

The point-to-point coupling between two communication partners is the simplest form of the exchange of information. The EPM-S640 I/O compound module provides the interface between a higher-level system (control) and a serially connected communication partner. In the case of serial data transmission, the individual bits of a byte of a piece of information to be transmitted are transferred successively in a defined sequence.

Character frame

The bidirectional data exchange makes a distinction between half duplex and full duplex operation. In half duplex operation, data are either sent or received at a certain time. A simultaneous data exchange can only be effected in full duplex operation.

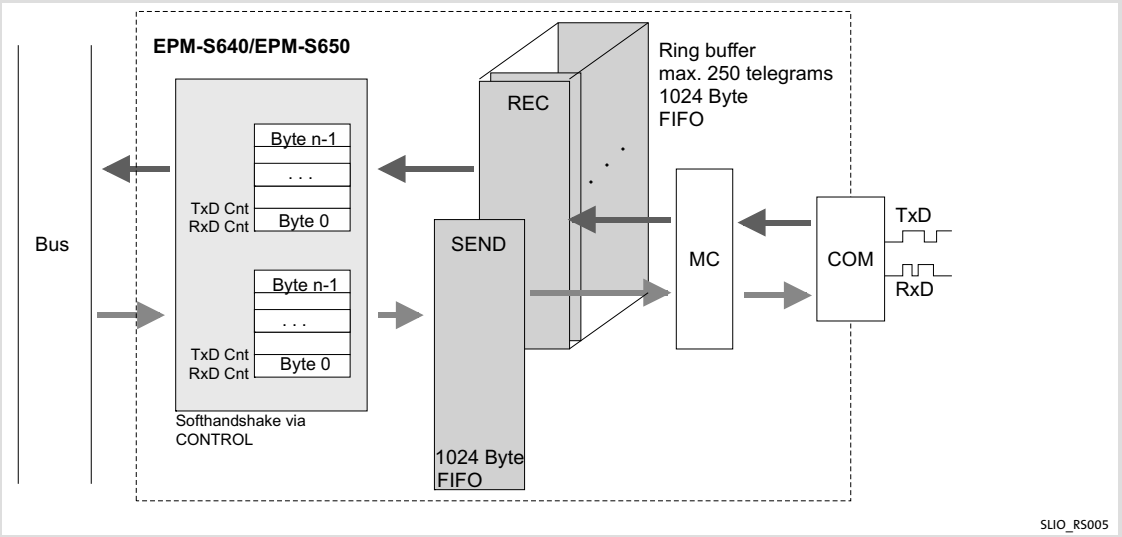
Each character to be transmitted is preceded by a synchronisation pulse as start bit. The end of the character transfer is set by the stop bit. In addition to the start and stop bit, further parameterisable agreements between the communication partners are required for a serial data transmission.

This character frame consists of the following elements:

- Transmission speed (baud rate)
- Character delay time and acknowledgement time
- Parity
- Number of data bits
- Number of stop bits

Communication

During the transmission, data which are written to the corresponding output area by a higher-level system via the backplane bus are written to the output buffer and are output via the interface from there. If the communication processor receives data via the interface, these data are stored in a ring buffer and are entered in the input area of the higher-level system via the backplane bus.



14.1.1 Protocols

The following protocols are supported:

- ASCII
- STX/ETX
- 3964(R)

Note!

Information on the parameterisation can be found in the corresponding chapters regarding the fieldbuses.

ASCII protocol: Data communication via ASCII is a simple form of data exchange and can be compared to a multicast/broadcast function.

The logical separation of the telegrams is effected via the character delay time. Within this time, the transmitter must have sent its telegram to the receiver. A telegram is only transferred to the higher-level system if it has been received completely. As long as the ”Time after request” has not elapsed, no new transmit request is accepted.

These two time specifications serve to establish a simple serial communication.

Since, apart from the use of the parity bit, no further backup measures are implemented for ASCII transmissions, the data transfer may be very efficient, however, it is not secured. With the parity the inversion of one bit within a character is secured. If several bits of a character are inverted, this error can no longer be detected.

STX/ETX protocol: STX/ETX is a simple protocol with headers and trailers. It is used for transmitting ASCII characters (20_h ... $7F_h$). This is done without block checks (BCC). If data are to be read in by the peripherals, STX (Start of Text) must be available as initial character, followed by the characters to be transmitted. An ETX (End of Text) must be inserted as the terminating character. The user data, i.e. all characters between STX and ETX, are transmitted to the control after the ETX terminating character has been received. When data are sent from the control to a peripheral device, the user data are transmitted to the EMP-S640 or EPM-S650 I/O compound module and are then transmitted to the communication partner with STX as initial character and ETX as final character.



Fig. 14-1 Telegram structure

Up to two initial characters and final characters can be freely defined. Here, a ”time delay after command” can be selected for the transmitter as well.

3964(R) protocol: 3964(R) manages the data transfer of a point-to-point coupling between the EPM-S640 or EPM-S650 I/O compound module and a communication partner.

During the data transfer, control characters are added to the user data. These enable the communication partner to check whether the data has arrived completely and correctly.

The following control characters are evaluated:

- STX (Start of Text)
- DLE (Data Link Escape)
- ETX (End of Text)
- BCC (Block Check Character; only for 3964R)
- NAK (Negative Acknowledge)



Note!

When a DLE is transmitted as information character, it is distinguished from the DLE control character by being sent twice while establishing/terminating a connection (DLE duplication). The receiver undoes the DLE duplication.

With 3964(R), the communication partner must be assigned with a lower priority. When both communication partners place a transmit request at the same time, the partner with lower priority will delay its transmit request.

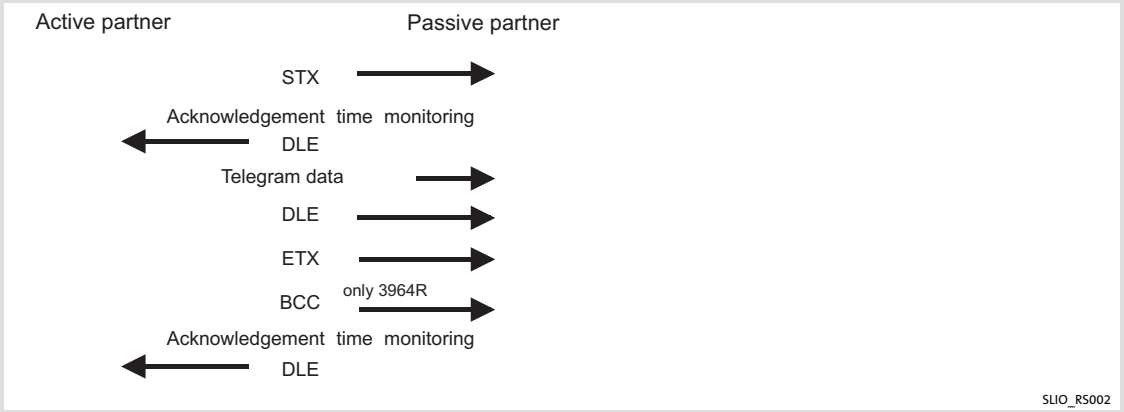


Fig. 14-2 Sequence

You can transfer a maximum of 250 bytes per frame.

Time-out times: Acknowledgement time is monitored between STX and DLE, as well as between BCC and DLE. Character delay time is monitored during the entire frame reception. After the acknowledgement time has elapsed after STX, STX is retransmitted and after 5 attempts a NAK is sent and the connection establishment is aborted. The same happens when after a STX a NAK or any character are received. After the acknowledgement time has elapsed after the frame (after BCC byte) or when a character unequal to DLE is received, the connection establishment and the frame will be repeated. Here, also 5 attempts are made, afterwards a NAK is sent and the transmission is aborted.

Passive operation: When the driver waits for the connection establishment and receives a character unequal to STS, a NAK is sent. When a NAK character is received, the driver does not send a respond. If the character delay time is exceeded while receiving a character, a NAK is sent and a renewed connection establishment is waited for. When the driver is not ready yet when the STX has received, a NAK is sent.

Block Check Character (BCC byte): For further backup, a block check character is added to the end of the frame of 3964R. The BCC byte is created by a XOR connection via the data of the entire frame including DLE/ETX. When a BCC byte is received that differs from the calculated one, a NAK is sent instead of the DLE.

Initialisation conflict: If two partners simultaneously attempt to establish a connection within the acknowledgement time, the partner with the lower priority sends the DLE and changes to receive mode.

Data Link Escape (DLE character): The DLE character in a frame is duplicated by the driver, i.e., DLE/DLE is sent. During the reception, duplicated DLEs are stored as a single DLE in the buffer. The frame always terminates with the combination DLE/ETX/BCC (only for 3964R).

Control codes:

- 02h = STX
- 03h = ETX
- 10h = DLE
- 15h = NAK

14.1.2 I/O area

Depending on the higher-level fieldbus system, the I/O compound module assigns the following number of bytes in the address range for the input and output, respectively.

- PROFIBUS: 8 bytes, 20 bytes or 60 bytes (selectable)
- PROFINET: 20 bytes or 60 bytes (selectable)
- CANopen: 8 bytes
- EtherCAT: 60 bytes
- DeviceNET: 60 bytes
- ModbusTCP: 60 bytes

14.1.3 Principle of backplane bus communication

Transmit data

During transmission, the higher-level system enters the data to be output in the output area and transfers them to the I/O compound module together with the control byte. At every telegram, the I/O compound module responds with an acknowledgement by copying bits 3 ... 0 of byte 0 of the output area to bits 7 ... 4 of byte 0 of the input area, or by returning a corresponding status message via this byte. Depending on the length of the data to be transmitted, the telegram is to be transferred to the I/O compound module in one or several fragments. In the case of the fragmented transmission, each fragment is acknowledged by the I/O compound module.

Transmission without fragmentation:

Higher-level system			EPM-S640/EPM-S650		Description
Byte	Function		Byte	Function	
0	Control byte				**Bits 3...0:** 8_h = idle state, no data available. A_h = start transmission without fragmentation. B_h = carry out a reset on the EPM-S6x0. **Bits 7...4:** Reserved for reception.
1	Telegram information byte				During the transmission process 00_h (fixed).
2	High byte length				User data length in bytes.
3	Low byte length				
4 ... n-1	User data bytes 0 ... n-5				User data; n = number of the bytes assigned in the address range (IO size).
		→			
		←	0	Acknowledgement / status	**Bits 3...0:** Reserved for reception. **Bits 7...4:** 8_h: acknowledgement, idle state A_h: acknowledgement, data without fragmentation received. C_h: status, reset was carried out on EPM-S6x0. D_h: status, the length specified is invalid. E_h: status, EPM-S6x0 communication error, partner is not responding.

Example of transmission without fragmentation: IO size = 60 bytes, length = 40 bytes

Higher-level system			EPM-S640/EPM-S650		Description
Byte	Value		Byte	Value	
0	$0A_h$				Command: start transmission without fragmentation.
1	00_h				Telegram information
2	00_h				User data length high byte
3	28_h				User data length low byte
4 ... 43	x				User data byte 0 ... 39
44 ... 59	-				Not used
		→			
		←	0	$A0_h$	Acknowledgement

Transmission with fragmentation:

In the case of the fragmented transmission, the number of user data and already part of the user data are transmitted with the 1. telegram (header). Then the fragment telegrams follow.

Procedure: Write 1. telegram →write fragment →write last fragment

Calculation of the number of fragments: number of fragments = (length + 3) / (IO_Size - 1)

Write 1. telegram (header)					
Higher-level system			**EPM-S640/EPM-S650**		**Description**
Byte	Function		Byte	Function	
0	Control byte				**Bits 3...0:** 8_h = idle state, no data available. 9_h = start transmission with fragmentation. A_h = transmission of last fragment. B_h = carry out a reset on the EPM-S640. **Bits 7...4:** Reserved for reception.
1	Telegram information byte				During the transmission process 00_h (fixed).
2	High byte length				User data length in bytes.
3	Low byte length				
4 ... n-1	User data bytes 0 ... n-5				User data; n = number of the bytes assigned in the address range (IO size)
		→			
		←	0	Acknowledgement / status	**Bits 3...0:** Reserved for reception. **Bits 7...4:** 8_h: acknowledgement, idle state 9_h: fragmented transmission started. A_h: acknowledgement, data without fragmentation received. C_h: status, reset was carried out on EPM-S6x0. D_h: status, the length specified is invalid. E_h: status, EPM-S6x0 communication error, partner is not responding.

Write fragment

Higher-level system			EPM-S640/EPM-S650		Description
Byte	Function		Byte	Function	
0	Control byte				**Bits 3...0:** 0_h ... 7_h = fragment number 8_h = idle state, no data available. B_h = carry out a reset on the EPM-S6x0. **Bits 7...4:** Reserved for reception.
1 ... n-1	User data				User data; n = number of the bytes assigned in the address range (IO size)
		→			
		←	0	Acknowledgement / status	**Bits 3...0:** Reserved for reception. **Bits 7...4:** 0_h ... 7_h = acknowledgement fragment number 8_h: acknowledgement, idle state 9_h: fragmented transmission started. C_h: status, reset was carried out on EPM-S6x0. D_h: status, the length specified is invalid. E_h: status, EPM-S6x0 communication error, partner is not responding.

Write last fragment

Higher-level system			EPM-S640/EPM-S650		Description
Byte	Function		Byte	Function	
0	Control byte				**Bits 3...0:** 8_h = idle state, no data available. A_h = transmission of last fragment. B_h = carry out a reset on the EPM-S6x0. **Bits 7...4:** Reserved for reception.
1 ... n-1	User data				User data; n = number of the bytes assigned in the address range (IO size)
		→			
		←	0	Acknowledgement / status	**Bits 3...0:** Reserved for reception. **Bits 7...4:** 8_h: acknowledgement, idle state A_h: acknowledgement, last fragment received. C_h: status, reset was carried out on EPM-S6x0. D_h: status, the length specified is invalid. E_h: status, EPM-S6x0 communication error, partner is not responding.

Example of transmission with fragmentation: IO size = 16 bytes, length = 50 bytes

Header

Higher-level system			EPM-S640/EPM-S650		Description
Byte	Value		Byte	Value	
0	09_h				Command: start transmission with fragmentation.
1	00_h				Telegram information
2	00_h				User data length high byte
3	32_h				User data length low byte
4 ... 15	x				User data byte 0 ... 11
		→			
		←	0	90_h	Status: fragmented transmission started.

1. fragment

Higher-level system			EPM-S640/EPM-S650		Description
Byte	Value		Byte	Value	
0	00_h				Fragment number
1 ... 15	x				User data byte 12 ... 26
		→			
		←	0	00_h	Acknowledgement 00_h

2. fragment

Higher-level system			EPM-S640/EPM-S650		Description
Byte	Value		Byte	Value	
0	01_h				Fragment number
1 ... 15	x				User data byte 27 ... 41
		→			
		←	0	10_h	Acknowledgement 01_h Note: At the first fragment, the serial number 01 is transferred. In the acknowledgement, this information is returned in a mirrored manner.

Last fragment

Higher-level system			EPM-S640/EPM-S650		Description
Byte	Value		Byte	Value	
0	$0A_h$				Fragment number
1 ... 8	x				User data byte 42 ... 49
11 ... 15	-				Not used
		→			
		←	0	$A0_h$	Acknowledgement of last fragment

Receive data

During reception, the data received are entered automatically in the input area of the higher-level system by the I/O compound module. Depending on the length of the data received, the telegram is transmitted to the higher-level system in one or several fragments.

Reception without fragmentation:

Higher-level system			EPM-S640/EPM-S650		Description
Byte	Function		Byte	Function	
			0	Information byte	**Bits 3...0:** 8_h = idle state, no data available. 9_h = data are transmitted in a fragmented manner. A_h = data are transmitted without fragmentation. **Bits 7...4:** Reserved for transmission
			1	Telegram information byte	00_h = the telegram does not contain any additional offset data. 04_h = the telegram contains additional offset data, which are placed behind the length as word. Via the offset data, the position of the user data in the input area is determined.
			2	High byte length	Length of the user data in bytes plus 2 bytes for RetVal.
			3	Low byte length	
			[4]	High byte offset	If the telegram information byte has the value 04_h, an offset is entered additionally. Otherwise there is no offset in the telegram.
			[5]	Low byte offset	
			6	RetVal high byte	0517_h = invalid length (length = 0 or length > 1024) $080A_h$ = a free receive buffer is not available. $080C_h$ = defective character received (character frame error or parity error).
			7	RetVal low byte	
			8 ... n-1	User data	User data received; n = number of the bytes assigned in the address range (IO size)
		←			
0	Acknowledgement	→	0		After having processed the data in your higher-level system, you have to acknowledge the reception to the I/O compound module. Only then you can provide these new received data. **Bits 3...0:** Reserved for transmission. **Bits 7...4:** 8_h: acknowledgement, idle state A_h: acknowledgement, input area free for new data. B_h: command, execute a reset on the I/O compound module.

Example of reception without fragmentation: IO size = 60 bytes, length = 40 bytes

Higher-level system			EPM-S640/EPM-S650		Description
Byte	Value		Byte	Value	
			0	$0A_h$	Information: Data are transferred without fragmentation.
			1	00_h	Information: The telegram does not contain any additional offset data.
			2	00_h	High byte length
			3	$2A_h$	Length of low byte + 2 bytes for RetVal
			6	00_h	RetVal high byte
			7	00_h	RetVal low byte
			6 ... 45	x	User data bytes 0 ... 9
			46 ... 59	-	Not used
		←			
0	$A0_h$	→	0		Acknowledgement, input area free for new data.

Received with fragmentation:

(Calculation of the number of frequencies: number of fragments = length + 7 / IO_Size - 1

Higher-level system			EPM-S640/EPM-S650		Description
Byte	Function		Byte	Function	
			0	Information byte	**Bits 3...0:** 8_h = idle state, no data available. 9_h = data are transmitted in a fragmented manner. A_h = data are transmitted without fragmentation. **Bits 7...4:** Reserved for transmission
			1	Telegram information byte	00_h = the telegram does not contain any additional offset data. 04_h = the telegram contains additional offset data, which are placed behind the length as word. Via the offset data, the position of the user data in the input area is determined.
			2	High byte length	Length of the user data in bytes plus 2 bytes for RetVal.
			3	Low byte length	
			[4]	High byte offset	If the telegram information byte has the value 04_h, an offset is entered additionally. Otherwise RetVal is entered here. Calculation of the offset for fragmented transmission: Data_offset = (fragment counter + 1) × (IO _ size - 1) - 7 + offset with Data_offset: Offset of the data in the input area Fragment counter: Absolute number of fragments IO_size: Number of bytes assigned in the address range Offset: Offset value in the telegram
			[5]	Low byte offset	
			6 ... n-1	User data	User data received; n = number of the bytes assigned in the address range (IO size)
		←			
0	Acknowledgement	→	0		After having processed the data in your higher-level system, you have to acknowledge the reception to the I/O compound module. Only then you can provide these new received data. **Bits 3...0:** Reserved for transmission. **Bits 7...4:** 8_h: acknowledgement, idle state A_h: acknowledgement, input area free for new data. B_h: command, execute a reset on the I/O compound module.

Example of reception with fragmentation: IO size = 16 bytes, length = 40 bytes

Header					
Higher-level system			EPM-S640/EPM-S650		Description
Byte	Value		Byte	Value	
			0	09_h	Information: Data are transferred with fragmentation.
			1	00_h	Information: The telegram does not contain any additional offset data.
			2	00_h	High byte length
			3	$2A_h$	Length of low byte + 2 bytes for RetVal
			6	00_h	RetVal high byte
			7	00_h	RetVal low byte
			6 ... 15	x	User data bytes 0 ... 9
		←			
0	90_h	→	0		Acknowledgement

1. fragment					
Higher-level system			EPM-S640/EPM-S650		Description
Byte	Value		Byte	Value	
			0	00_h	Fragment information
			1 ... 15	x	User data bytes 10 ... 24
		←			
0	00_h	→	0		Acknowledgement

Last fragment					
Higher-level system			EPM-S640/EPM-S650		Description
Byte	Value		Byte	Value	
			0	$0A_h$	Fragment information
			1 ... 15	x	User data bytes 25 ... 39
		←			
0	00_h	→	0		Acknowledgement, input area free for new data.

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Lenze Automation GmbH
Postfach 10 13 52, 31763 Hameln
Hans-Lenze-Str. 1, 31855 Aerzen
GERMANY
HR Hannover B 205381

+49 5154 82-0
+49 5154 82-2800
lenze@lenze.com
www.lenze.com

Service Lenze Service GmbH
Breslauer Straße 3, 32699 Extertal

GERMANY

008000 2446877 (24 h helpline)
+49 5154 82-1112
service@lenze.com

EDSIO1000 ■ 13525977 ■ EN ■ 8.0 ■ TD29

10 9 8 7 6 5 4 3 2 1

Manual



I/O system 1000

Bus coupler
Digital input / output modules
Analog input / output modules
Frequency measurement modul

Lenze

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1 Safety precautions

Please note!

With the energy measurement module EPM-S416 only AC voltages 230/400V and currents can be measured. Please note when using an energy measurement module the following safety instructions:



DANGER!

No use in EX-zone permitted!

This device is not certified for applications in explosive environments (EX-zone)!



DANGER!

Do not exchange phase and neutral connections!

Operation of the energy measuring module with phase (L1, L2 or L3) at *'N'* (pin 4) is not permitted!



DANGER!

Connection and module exchange only without power!

- Before you start to work on at the module for installation or maintenance, you have to disconnect it from the main power source, i.e. the power line is to be switched off (possibly remove fuses)!
- The electronic module may only be replaced on power off!
- Only properly qualified electrical staff is allowed to install, connect and/or modify electrical equipment!
- Please adhere to the national rules and regulations of the location and/or country where the units are installed (installation, safety precautions, EMC ...).



DANGER!

Provide overvoltage protection!

The module is designed for overvoltage category II. Provide a corresponding overvoltage protection in the supply lines (phases and neutral) so that a hazard to persons by touching on the low voltage side is excluded.



DANGER!

Provide touch protection!

Provide a touch protected wiring of the measurement including the measuring transformers and mark it with the according warnings!



DANGER!

Use only with terminal module 001-0AA40!

Please consider that the electronic module of the energy measurement modules may only be used at the terminal module 001-0AA40!



DANGER!

Line voltage max. 400V!

The line voltage at a voltage connector must not exceed 400V!



DANGER!

All phases of one supply grid!

Please note that the phases to be measured must be from the same supply grid!



CAUTION!

Do not exchange current and voltage connections!

Please note when connecting, that the current and voltage paths are not exchanged! The module will be destroyed by directly connecting one phase to a low-resistance current connector!



CAUTION!

Consider the maximum current for current transformers!

Depending on the energy measuring module used, the following maximum current limits for the current transformers must be considered:

- EPM-S416: max. 5A

Please also consider the data sheet of your current transformer!



CAUTION!

Note characteristics of current transformers!

- Please consider the data sheet of your current transformer!
- Some current transformer must not be operated in idle mode!
- Before commissioning your module must be connected to the secondary winding of the current transformer!



CAUTION!

Note characteristics of voltage transformers!

- Please note that the use of a voltage transformer is only supported by the energy measurement module EPM-S416!
- Please consider the data sheet and the safety instructions of your voltage transformer!

Interruption of the DC 24V power section supply!

When using energy measurement modules, the DC 24V power section supply of the further backplane bus is interrupted. By installing a power module after an energy measurement module, the DC 24V power section supply at the backplane bus can be continued.

Reset energy counters after installation!

As soon as the module is supplied by the DC 24V power section supply, the measurement is started and the counting of the energy counters is continued with the retentive stored counter values. The measurement is not interrupted by STOP or RESET of the CPU respectively the bus coupler. After installing the module the energy counters should be reset by CMD-Frame.

- As long as no Parameterss have been sent from the head station to the module after a power cycle, default values are transmitted by the module during a read access and not the Parameterss stored in the module.
- After transferring the Parameterss to the module the status bits are reset and the measurement is interrupted for a short time!
- Please note when at least one phase is de-activated, the Parameterss PF_MIN and VRMS_MIN are ignored and set to "0".
- On error in the parametrization the MF LED blinks and you receive an error message.

2 Bus Couplers

2.1 EPM-S131 - EtherCAT

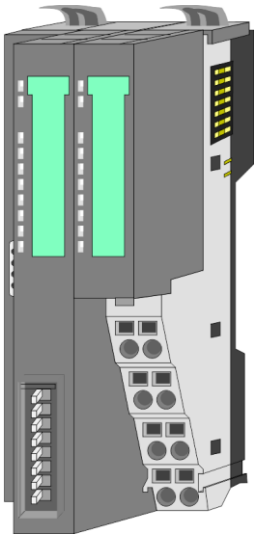
2.1.1 Hardware description

2.1.1.1 Properties

EPM-S131

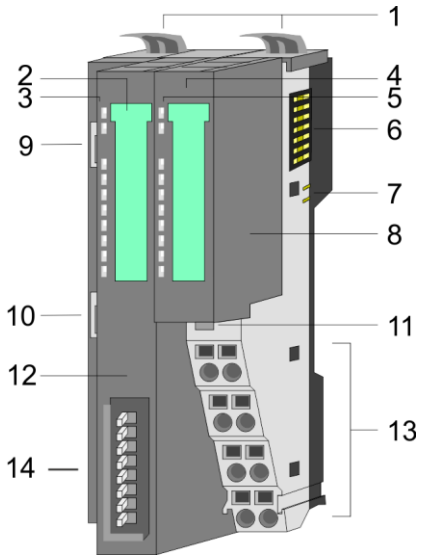
The EtherCAT coupler EPM-S131 serves for an easy connection of decentralized periphery to EtherCAT. EtherCAT offers real time Ethernet technology on I/O level.

- EtherCAT coupler for max. 64 peripheral modules
- Ethernet-based field bus system with high real-time capability
- Supports the application profile
  - CoE (CANopen over EtherCAT)
- Various diagnostics functions
- RJ45 jack 100BaseTX
- Operation Modes
  - FreeRun
  - SyncManager-Event
  - Distributed Clock
- Easy Maintenance
- Display of substitute values possible
- LEDs for status display



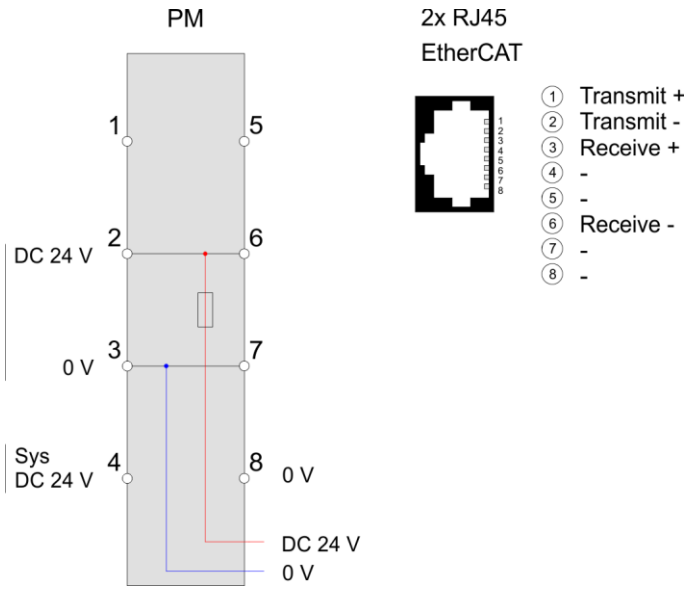
2.1.1.2 Structure

EPM-S131



1	Locking lever terminal module
2	Labeling strip bus interface
3	LED status indication bus interface
4	Labelling strip power module
5	LED status indication power module
6	Backplane bus
7	DC 24V power section supply
8	Power module
9	EtherCAT RJ45 bus interface "IN"
10	EtherCAT RJ45 bus interface “OUT"
11	Unlocking lever power module
12	Bus interface
13	Terminal power module
14	Address switch (future use)

2.1.1.2.1 Interfaces

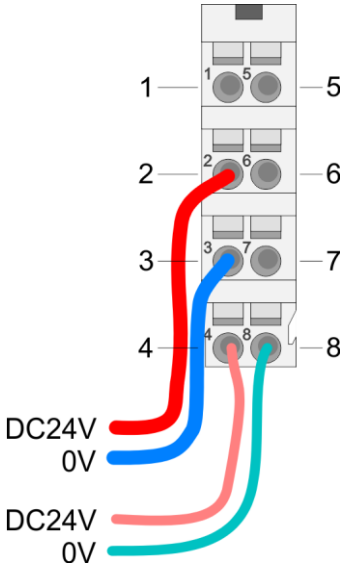


CAUTION!

Bus interface and power module of the bus coupler may not be separated!

Here you may only exchange the electronic module!

PM - Power module



For wires with a core cross-section of 0.08mm² up to 1.5mm².

Pos.	Function	Type	Description
1	---	---	not connected
2	DC 24V	I	DC 24V for power section supply
3	0V	I	GND for power section supply
4	Sys DC 24V	I	DC 24V for electronic section supply
5	---	---	not connected
6	DC 24V	I	DC 24V for power section supply
7	0V	I	GND for power section supply
8	Sys 0V	I	GND for electronic section supply

I: Input

Interface for EtherCAT communication

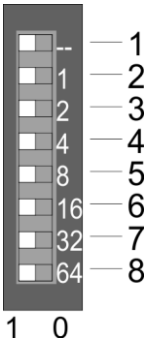
8pin RJ45 jacks:

- An EtherCAT network always consists of a master and an various number of EtherCAT salves (coupler).
- Each EtherCAT slave has an "IN" and "OUT" RJ45 jack. The arriving EtherCAT cable from the direction of the master is to be connected to the "IN" (Port 0) jack. The "OUT" (Port 1) jack is to be connected to the succeeding EtherCAT station. With the respective last EtherCAT station the "OUT" jack remains free.
- EtherCAT uses Ethernet as transfer medium. Standard CAT5 cables are used. Here distances of about 100m between 2 stations are possible.
- Only EtherCAT components may be used in an EtherCAT network. For topologies, which depart from the line structure, the corresponding EtherCAT components are necessary.
- Hubs may not be used.

2.1.1.2.2 Address switch (future use)

Evaluation address switch

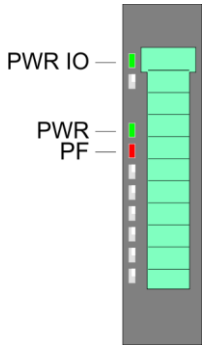
The address switch is not evaluated in conjunction with a Lenze controller.



Pos.	Value
1	not used
2	1
3	2
4	4
5	8
6	16
7	32
8	64

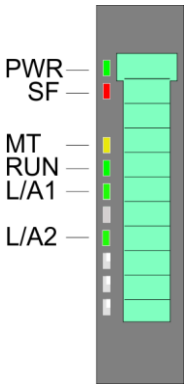
2.1.1.2.3 LEDs

LEDs power module



PWR IO green	PWR green	PF red	Description
■	X	□	Power section supply OK
■	■	□	Electronic section supply OK
X	X	■	Fuse electronic section supply defective
not relevant: X			

Status indication bus interface



LED		Description
PWR	■ green	Bus interface is power supplied
SF	■ red	• 1 flash per s: With state change due to an error e.g. a module is removed • 2 flashes per s: EtherCAT-Timeout (watchdog) e.g. EtherCAT master is missing • Blinking with 2.5Hz: Error in configuration • Blinks alternately with MT at firmware update
MT	■ yellow	Blinks alternately with SF at firmware update
RUN	□	Off: Bus coupler in state Init
	■ green	Bus coupler in state Operational
	■ green	• Blinking with 2.5Hz: Bus coupler in state Pre-Operational • SingleFlash: Bus coupler in state Safe-Operational
L/A1	□	Off: no communication to the preceding station
	■ green	Blinking with 10Hz: Preceding EtherCAT station is connected
L/A2	□	Off: no communication to the succeeding station
	■ green	Blinking with 10Hz: Succeeding EtherCAT station is connected

2.1.1.3 Address area

Input area

Max. number of possible data are 20byte.

Address	Bytes	Function
+0	4	Hardware interrupt counter: number of hardware interrupts
+4	4	Diagnostics interrupt counter: number of diagnostics interrupts
+8	8	Diagnostic module status
+16	1	*Newest Message* available
+17	1	Alignment
+18	1	Error Sync Manager Out
+19	1	Error Sync Manager In

Output area

No byte of the output area is used by the EtherCAT coupler.

2.1.1.4 Technical data

Order no.	EPM-S131
Type	EPM-S131 – EtherCAT-Slave
Module ID	-
Technical data power supply	
Power supply (rated value)	DC 24 V
Power supply (permitted range)	DC 20.4...28.8 V
Reverse polarity protection	✓
Current consumption (no-load operation)	95 mA
Current consumption (rated value)	0.95 A
Inrush current	3.9 A
I^2t	0.14 A^2s
Max. current drain at backplane bus	3 A
Max. current drain load supply	10 A
Power loss	3 W
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes, parameterizable
Diagnostics information read-out	possible
Supply voltage display	green LED
Service Indicator	yellow LED
Group error display	red SF LED
Channel error display	none
Hardware configuration	
Racks, max.	1

Order no.	EPM-S131
Modules per rack, max.	64
Number of digital modules, max.	64
Number of analog modules, max.	64
Communication	
Fieldbus	EtherCAT
Type of interface	Ethernet 100 MBit
Connector	2 x RJ45
Topology	Line
Electrically isolated	✓
Number of participants, max.	65535
Node addresses	-
Transmission speed, min.	100 Mbit/s
Transmission speed, max.	100 Mbit/s
Address range inputs, max.	1024 Byte
Address range outputs, max.	1024 Byte
Number of TxPDOs, max.	-
Number of RxPDOs, max.	-
Supported profile	-
Supported transfer cycle	-
Cyclic data size per node	-
Max. Number of nodes	-
Supported communication method	-
Supported command "Cyclic"	-
Supported command "Event driven"	-
Supported command "Message"	-
Datasizes	
Input bytes	20

Order no.	EPM-S131
Output bytes	-
Parameter bytes	3
Diagnostic bytes	-
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	48.5 mm x 109 mm x 76.5 mm
Net weight	160 g
Weight including accessories	160 g
Gross weight	175 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

2.1.2 Deployment

2.1.2.1 Basics EtherCAT

2.1.2.1.1 General

Ethernet is not real-time capable due to the type of cabling used and the rules for access rights. However, these networks do not offer real-time capability due to the kind of cabling that they use and the rules governing access rights. This effect was corrected with EtherCAT®.

EtherCAT®

- For EtherCAT® is valid: EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.
- EtherCAT means Ethernet for Controller and Automation Technology. It was originally developed by Beckhoff Automation GmbH and is now supported and further developed by the EtherCAT Technology Group (ETG). ETG is the word biggest international user and producer connection for industrial Ethernet
- EtherCAT is an open Ethernet based field bus system, which is standardized at the IEC.
- As open field bus system EtherCAT matches the user profile for the part of industrial real-time systems.
- In opposition to the normal Ethernet communication at EtherCAT the data exchange of I/O data takes place during the frame passes the coupler with 100Mbit/s in full-duplex. Since in this way a frame to send and receive direction reaches the data of many stations, EtherCAT has a rate of user data of over 90%.
- The EtherCAT protocol, which is optimized for process data, is directly transported with the Ethernet frame. This again can consist of several sub-frames, which serve for a storage area of the process image.

Transfer medium

EtherCAT uses Ethernet as transfer medium Standard CAT5 cables are used. Here distances of about 100m between 2 stations are possible.

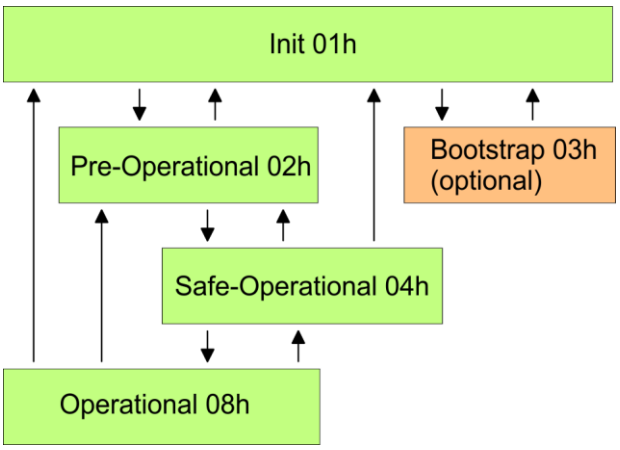
Only EtherCAT components may be used in an EtherCAT network. For topologies, which depart from the line structure, the corresponding EtherCAT components are necessary. Hubs may not be used.

Communication principle	At EtherCAT the master sends a telegram to the first station. The station takes its data from the current data stream, inserts its answer data and sends the frame to the succeeding station. Here the frame is handled with the same way. When the frame has reached the last station this recognizes that no further is connected and sends the frame back to the master. Here the telegram is sent through every station via the other pair of leads (full-duplex). Due to the plug sequence and the use of the full-duplex technology EtherCAT represents a logical ring.
EtherCAT State Machine	Via the EtherCAT State Machine the state of the EtherCAT members is controlled.
Object dictionary (SDOs)	In the object directory the parameter, diagnostics, interrupt or other data are listed, which may be written or read via EtherCAT. The object directory may be accessed by the SDO information service. Additionally the object directory may be found in the device master file.
Process data (PDOs)	The EtherCAT data link layer is optimized for the fast transfer of process data. Here it is specified how the process data of the device are assigned to the EtherCAT process data and how the application of the device is synchronized to the EtherCAT cycle. The mapping of the process data happens by PDO mapping and by Sync-Manager-PDO-Assign objects. These describe, which objects of the object directory are transferred as object data via EtherCAT. The cycle time to transfer the process data via EtherCAT and how this is synchronized for the transfer is specified with the Sync-Manager-Communication objects.
Emergencies	Via Emergencies diagnostics, process events and errors at state change of the State Machine may be transferred. Status messages, which show the current state of the device, should directly be transferred within the process data.
Distributed clocks (DC)	Due to the run time of an EtherCAT frame at the bus, the outputs of the EtherCAT slave stations are activated at different times and the inputs are read at different times. For an isochronous access to the process data EtherCAT provides the "distributed clock" functionality. In EtherCAT "**D**istributed **C**locks" means a logical combination of "clocks", which are located in the EtherCAT devices With this there is the possibility to locally provide a synchronized time in each bus device. With DC current output values are activated in equal time on the slave stations, and the input values read at precisely this time. This moment is called *Sync* signal. If an EtherCAT device supports the DC, it has its own clock. After PowerON this first locally works, based on an own pulse generator. By selecting an EtherCAT slave station, which has to provide the reference time, the distributed clocks can be synchronized. This *reference clock* so represents the system time.

2.1.2.1.2 EtherCAT State Machine

States

In each EtherCAT communication device a *state machine* is implemented. For each state there is defined which communication service is active via EtherCAT. The state machine of the slave station is controlled by the state machine of the EtherCAT master.



Init - 01h

After power-on the EtherCAT members are in state *Init*. There is neither mailbox nor process data communication possible. The EtherCAT master initializes the SyncManager channels 0 and 1 for the mailbox communication.

Pre-Operational (Pre-Op) - 02h

The EtherCAT master initializes the SyncManager channels for process data (starting with SyncManager channel 2), the FMMU channels and the PDO mapping respectively the SyncManager PDO assignment. Further in this state the settings for process data transfer and the module-specific parameters, which deviate from the default values are transferred. During the transition from *Init* to *Pre-Op* the EtherCAT slave checks whether the mailbox was correctly initialized. In the state *Pre-Op* mailbox communication and Ethernet over EtherCAT (EoE) are possible but the process data communication is blocked.

Safe-Operational (Safe-Op) - 04h

In *Safe-Op* the input data are cyclically updated but the outputs are de-activated. With the transition from *Pre-Op* to *Safe-Op* the EtherCAT slave checks if the SyncManager channels for process data communication are correct. Before it acknowledges the state change, the EtherCAT slave copies current input data to the corresponding DP RAM areas of the EtherCAT slave controller. In the state *Safe-Op* mailbox and process data communication is possible.

Operational (Op) - 08h

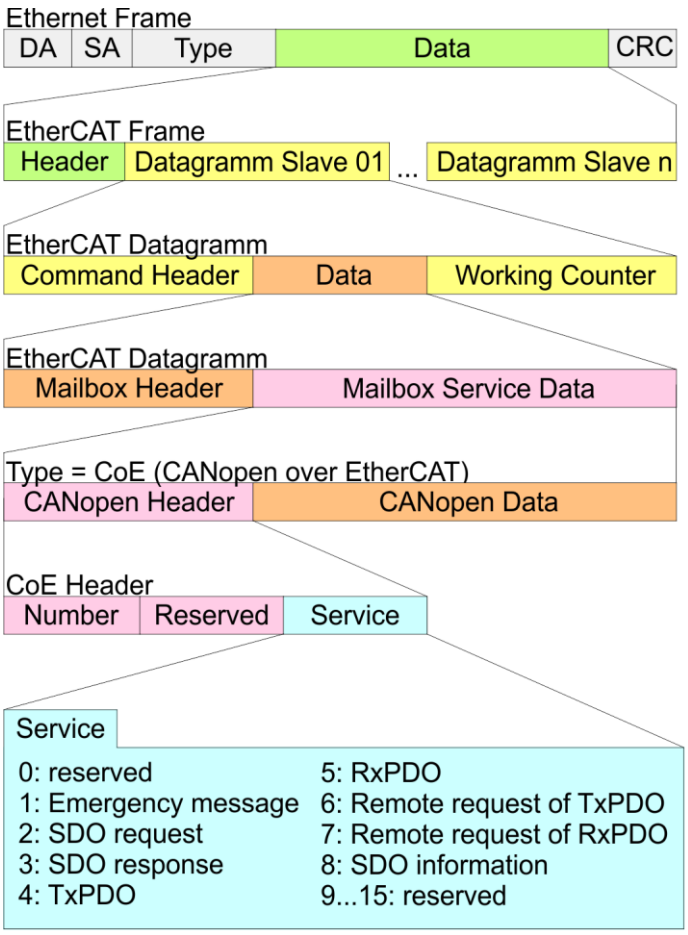
In the state *Op* the input data are cyclically updated and the EtherCAT master sends output data to the EtherCAT slave. The EtherCAT slave copies the output data of the master to its outputs and return input data to the EtherCAT master. In this state process data and mailbox communication is possible.

Bootstrap - option (Boot) - 03h

In state *Boot* the firmware of an EtherCAT slave may be updated via the EtherCAT master. This state may only be reached via Init. In the state *Boot* is mailbox communication via the protocol File-Access over EtherCAT (FoE) possible. Other mailbox and process data communications are de-activated.

2.1.2.1.3 CoE - CANopen over Ethernet

CoE means CANopen over EtherCAT. With CANopen you get a standard user interface, which makes a simplified system structure possible with most different devices. With CoE the device parameters may comfortably be accessed and data were may be read or written at the same time. Real-time data may be read by PDOs an the parametrization happens by SDOs. Further there are emergency objects available.



DA	Destination address
SA	Source address
CRC	Checksum

2.1.2.2 Synchronization modes

Overview

There are 3 modes of synchronization available to transfer the process data in EtherCAT:

- Synchron with SyncManager event (default)
- Free Run
- Synchron with distributed clocks (DC)

The configuration tools usually include the synchronization modes *Free Run* and *Synchron with SyncManager event* as the operating mode *'Free Run / SM-Synchron'*.

Synchron with SyncManager event

With this mode of synchronization, a SyncManager event (interrupt) is triggered when an EtherCAT frame is received. This interrupt then triggers the processing of the process data.



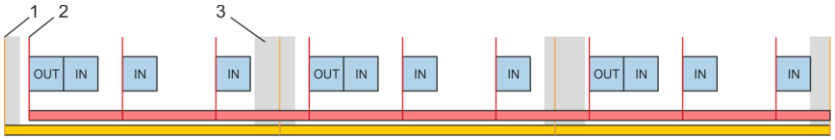
1 EtherCAT frame

2 Jitter, depends on the master implementation

Free Run

To use the *Free Run* synchronization mode, in your configuration tool, you must set the synchronization mode to *Free Run / SM-Synchron* and write 0 to the objects 0x1C32:01 and 0x1C33:01 in the *PreOp* state. The object can also be written by an Init command. More may be found in the manual of your configuration tool.

In the synchronization mode *Free Run*, the processing of the process data is controlled by an internal slave timer.



1 EtherCAT frame

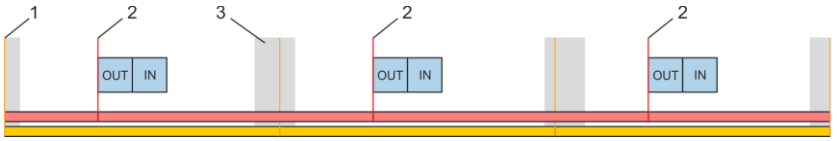
2 Local timer event (main loop), depending on the slave implementation

3 Jitter, depends on the master implementation

Synchron with distributed clocks (DC; Default)

To use the synchronization mode *Synchron with distributed clocks (DC)*, in your configuration tool you have to select the synchronization mode *Synchron with DC-Sync0 (Default Setting)*.

With this mode of synchronization, after receiving the EtherCAT frame, the process input or output data is read or written in sync with the *DC sync event*. The *DC sync event* is an interrupt which is triggered simultaneously on all DC capable slaves on the bus.



1	EtherCAT frame
2	DC sync event (DC Sync0)
3	Jitter, depends on the master implementation

In order to achieve isochronous mode, the synchronization mode *Synchronous with distributed clocks (DC)* does not perform any hardware retries on the backplane bus with process data telegrams. If errors are detected when reading or writing the process data on the backplane bus, the slave does not switch to *PreOp*. A module failure is detected by the NodeMonitoring.

2.1.2.3 Accessing the EPM-S131 / Modules

2.1.2.3.1 General

Calculation formula of the max. required cycle time in µs so that the coupler safely switches to the state *Operational (Op)*:

Max. required cycle time (in µs) = (1.83 * number of modules) + (0.33 * Σ of input and output bytes) + 60

2.1.2.3.2 Access to module information

Module information

Index:Sub	Name	Type	Offset	Access	Default	Description
0x4100:00	Module Information	U8	0	ro	8	Module Identity Information EPM-S131
0x4100:01	Module Name	VSTRG	16	ro	0	Module Name
0x4100:02	Module ID	U32	256	ro	0	Module ID
0x4100:03	Serial Number	VSTRG	288	ro	0	Serial number of the module
0x4100:04	Product Version	VSTRG	448	ro	0	Product version of the module
0x4100:05	Hardware Version	VSTRG	520	ro	0	Hardware version of the module
0x4100:06	Software Version	VSTRG	536	ro	0	Software version of the module
0x4100:07	FPGA Version	U16	632	ro	0	FPGA version
0x4100:08	Mx File	VSTRG	648	ro	0	Mx file of the coupler

↳ ‘Explanation of the elements’ *page 27*

When accessing the module information of EPM-S131 the corresponding module is addressed via the index (0x4100 + EtherCAT-Slot). Subindexes give you access to the corresponding module information.

2.1.2.3.3 Accessing diagnostics data

Hardware and diagnostic interrupt data of EPM-S131 modules with interrupt capability were automatically sent by an emergency telegram if the interrupt is activated by parameterization. There is also the possibility to request diagnostics data via SDO.

Alarm Status

The Alarm Status contains in each case a counter for hardware and diagnostic interrupts for interrupt signaling. These counter are input data of the EtherCAT coupler and were transferred together with the process data.

Diagnostic

Index:Sub	Name	Type	Offset	Access	Default	Description
0xF100:00	Diagnostic	U8	0	ro	3	
0xF100:01	Hardware interrupt counter	U32	16	ro	0x00000000	Counter for hardware interrupt
0xF100:02	Diagnostic interrupt counter	U32	48	ro	0x00000000	Counter for diagnostic interrupt
0xF100:03	Diagnostic Module Status	U64	80	ro	0x00000000	64 bit array, each bit represents a pending (but acknowledged) diagnostic alarm

‘Explanation of the elements’ *page 27*

- With de-activated *Auto-Acknowledge* of the EtherCAT coupler the corresponding counter is set for one cycle.
- With activated *Auto-Acknowledge* here you will find the number of hardware and diagnostics interrupts, which happened since the Start oft he EtherCAT Master.

Hardware interrupt data

Index:Sub	Name	Type	Offset	Access	Default	Description
0x5000:00	Hardware interrupt data	U8	0	ro	6	Current hardware interrupt data
0x5000:01	Slot number	U8	16	ro	0x00	EtherCAT-Slot of the module which reports an interrupt
0x5000:02	Hardware interrupt data 00	U8	24	ro	0x00	Hardware interrupt data (see module description)
0x5000:03	Hardware interrupt data 01	U8	32	ro	0x00	
0x5000:04	Hardware interrupt data 02	U8	40	ro	0x00	
0x5000:05	Hardware interrupt data 03	U8	48	ro	0x00	

Index:Sub	Name	Type	Offset	Access	Default	Description
0x5000:06	Acknowledge	U8	56	rw	0x00	Any value resets the hardware interrupt counter and acknowledges if necessary the interrupt.

‘Explanation of the elements’ *page 27*

- If the object 0xF100 indicates a hardware interrupt here the current hardware interrupt data may be accessed. The allocation of the hardware interrupt data may be found in the description of the corresponding module.
- With de-activated *Auto-Acknowledge* of the EtherCAT coupler the *hardware interrupt counter* of object 0xF100 is reset and the hardware interrupt is acknowledged. For this you have to write any value you like to subindex 0x06 of index 0x5000.

Diagnostic Interrupt Data (byte 1 ... 4)

Index:Sub	Name	Type	Offset	Access	Default	Description
0x5002:00	Diagnostic Interrupt Data	U8	0	ro	6	Current diagnostic interrupt data
0x5002:01	Slot number	U8	16	ro	0x00	EtherCAT-Slot of the module which reports an interrupt.
0x5002:02	Diagnostic data 00	U8	24	ro	0x00	Byte 1 ... 4 of the diagnostic data (see module description)
0x5002:03	Diagnostic data 01	U8	32	ro	0x00	
0x5002:04	Diagnostic data 02	U8	40	ro	0x00	
0x5002:05	Diagnostic data 03	U8	48	ro	0x00	
0x5002:06	Acknowledge	U8	56	rw	0x00	Any value resets the diagnostic interrupt counter and acknowledges if necessary the interrupt.

‘Explanation of the elements’ *page 27*

- If the object 0xF100 indicates a diagnostic interrupt here the first 4 bytes of the current diagnostics interrupt data may be accessed. The allocation of the diagnostics data may be found in the description of the corresponding module.
- With de-activated *Auto-Acknowledge* of the EtherCAT coupler the *diagnostic interrupt counter* of object 0xF100 is reset and the diagnostic interrupt is acknowledged. For this you have to write any value you like to subindex 0x06 of index 0x5002.

Diagnostic Data (byte 1 ... n)

Index:Sub	Name	Type	Offset	Access	Default	Description
0x5005:00	Diagnostic Data	U8	0	ro	19	

Index:Sub	Name	Type	Offset	Access	Default	Description
0x5005:01	Slot number	U8	16	rw	0	By reading this index here the EtherCAT-Slot of the module may be found, to which the following diagnostic data belong to. By writing of an EtherCAT-Slot to this index the diagnostic data of the corresponding module may be read.
0x5005:02	Module error	U8	24	ro	0	Diagnostics data of the module (see module description)
0x5005:03	Module type	U8	32	ro	0	
0x5005:04	Fix	U8	40	ro	0	
0x5005:05	Communication/Process interrupt	U8	48	ro	0	
0x5005:06	Channel type	U8	56	ro	0	
0x5005:07	Number of diagnostic bits	U8	64	ro	0	
0x5005:08	Number of channels	U8	72	ro	0	
0x5005:09	Channel error	U8	80	ro	0	
0x5005:0A	Channel-specific error channel 0	U8	88	ro	0	
0x5005:0B	Channel-specific error channel 1	U8	96	ro	0	
0x5005:0C	Channel-specific error channel 2	U8	104	ro	0	
0x5005:0D	Channel-specific error channel 3	U8	112	ro	0	
0x5005:0E	Channel-specific error channel 4	U8	120	ro	0	
0x5005:0F	Channel-specific error channel 5	U8	128	ro	0	
0x5005:10	Channel-specific error channel 6	U8	136	ro	0	

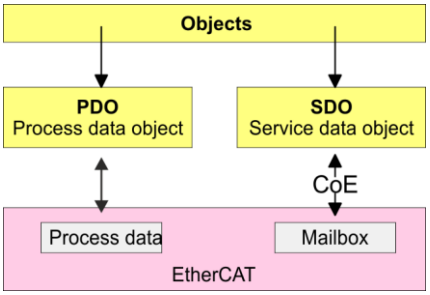
Index:Sub	Name	Type	Offset	Access	Default	Description
0x5005:11	Channel-specific error channel 7	U8	144	ro	0	
0x5005:13	-	U8	152	ro	0	
0x5005:14	µs-Ticker	U32	160	ro	0	

‘Explanation of the elements’ *page 27*

The whole diagnostic data of a module may be accessed with this object. Here you may either access current diagnostic data or the diagnostic data of a module on any EtherCAT-Slot.

2.1.2.4 Data transfer via PDO and SDO

Overview



PDO

PDO means **P**rocess **D**ata **O**bject. Process data may be transferred during run-time by means of PDOs. Here the Inputs respectively outputs are directly addressed within the frame. More concerning the process data transfer during run-time may be found in the manual of your EtherCAT master.

SDO

SDO means **S**ervice **D**ata **O**bject. Within a SDO message the parameter data of your system may be accessed. Here the parameters are addressed by according indexes and subindexes. An overview of the objects may be found in the object directory.

2.1.2.5 Object Dictionary

Object overview

Index	Object Dictionary Area
0x0000 ... 0x0FFF	Data Type Area
0x1000 ... 0x1FFF	Communication Area
0x2000 ... 0x5FFF	Manufacturer Specific Area
0x6000 ... 0x6FFF	Input Area
0x7000 ... 0x7FFF	Output Area
0x8000 ... 0x8FFF	Configuration Area
0x9000 ... 0x9FFF	Information Area
0xA000 ... 0xAFFF	Diagnosis Area
0xB000 ... 0xBFFF	Service Transfer Area
0xC000 ... 0xEFFF	Reserved Area
0xF000 ... 0xFFFF	Device Area



EtherCAT-Slot

Please consider the I/O-1000 power and clamp modules do not have any module ID. These may not be recognized by the Ether-CAT coupler and so are not listed respectively considered during slot allocation.

Further within EtherCAT the slots are designated as *'EtherCAT-Slot'*. The counting always begins with 0.

In the following example at the physical slot 2 a clamp module (CM) is connected. Since the clamp module does not have any module ID, this is not recognized by the EtherCAT coupler. So in EtherCAT the next module is mapped to EtherCAT-Slot 1 and so on.

Explanation of the elements

Index:Sub	-	Index and subindex
Ux	-	Data type UNSIGNEDx
VSTRG	-	Data type VISIBLE STRING
Access	-	Read, write access (ro: Read access only, rw: Read and write access)
Default	-	Default value
Offset	-	Please note the offset

Device Type

Index:Sub	Name	Type	Access	Default	Description
0x1000:00	Device type	U32	ro	0x00001389	0x00001389 means MDP

‘Explanation of the elements’ *page 27*

Error Register

Index:Sub	Name	Type	Access	Default	Description
0x1001:00	Error Register	U8	ro	0	Error Register • Bit 0: Generic error – A not more precisely specified error occurred (flag is set at every error message). • Bit 1: Current error • Bit 2: Voltage error • Bit 3: Temperature error • Bit 4: Communication error • Bit 5: Device profile specific error • Bit 6: reserved • Bit 7: Manufacturer specific error

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Device name

Index:Sub	Name	Type	Access	Default	Description
0x1008:00	Device name	VSTRG	ro	EPM-S131	Name of the coupler

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Hardware version

Index:Sub	Name	Type	Access	Default	Description
0x1009:00	Hardware version	VSTRG	ro		Hardware version of the coupler

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Software version

Index:Sub	Name	Type	Access	Default	Description
0x100A:00	Software version	VSTRG	ro		Software version of the coupler

Index:Sub	Name	Type	Access	Default	Description
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Identity object

Index:Sub	Name	Type	Offset	Access	Default	Description
0x1018:00	Identity object	U8	0	ro	4	Identity object
0x1018:01	Vendor ID	U32	16	ro	0x0000003B	Vendor ID assigned uniquely by ETG
0x1018:02	Product code	U32	48	ro	0x0000051E	Product Code assigned uniquely by vendor
0x1018:03	Revision number	U32	80	ro	3	Revision number assigned uniquely by vendor
0x1018:04	Serial number	U32	112	ro	0	Serial number assigned uniquely for this device by vendor
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Error Setting

Index:Sub	Name	Type	Offset	Access	Default	Description
0x10F1:00		U8	0	ro	0x0002	Error Setting
0x10F1:01		U32	16	rw	0x0001	• Local Error Reaction – 0 = PDO State slave changes the value of the PDO State Bit (either in the PDO Parameter or if it is part of the process data description there. Slave remains in state *Op*. – 1 = Disable SyncManager (outputs) from PDI side and go to ErrSafeOp
0x10F1:02		U16	48	rw	0x0004	• Sync Error Counter Limit – Limit set by the master when slave shall change its EtherCAT state to *Safe-Op* with AL Status Code 0x1A. The Slave shall reset an internal error counter when it is synchronized again and confirms the state transition from *Safe-Op* to *Op*.
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Diagnosis History

Index:Sub	Name	Type	Offset	Access	Default	Description
0x10F3:00	Diagnosis History	U8	0	ro	0xFF	Diagnosis History
0x10F3:01	Maximum Messages	U8	16	ro	0xFA	Maximum Messages
0x10F3:02	Newest Message	U8	24	ro	0	Newest Message • 0x10F3:02 Reading *Newest Message* and save at user program • Bit 0 set again: read again 0x10F3:02 and difference to previously read value is the number of new entries • 0x10F3:xx: Read entries accordingly
0x10F3:03	Newest Acknowledged Message	U8	32	rw	0	Newest Acknowledged Message
0x10F3:04	New Message Available	Bool	40	ro	0	New Message Available • Overwrite Mode: – 0: newest message was read – 1: newest message was not read • Acknowledge Mode: – 0: no unacknowledged message – 1: diagnosis messages are available which can be acknowledged
0x10F3:05	Flags	U16	48	rw	0	Flags
0x10F3:06	Diagnosis message	OCTET-STRING		ro	0	Diagnosis message
...		...		...	...	...
0x10F3:255	Diagnosis message	OCTET-STRING		ro	0	Diagnosis message

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In the *Diagnosis History*, both the diagnostic and process alarms, as information about status changes as well as EtherCAT-specific error messages are entered chronologically.



The "Input/Output Mapping " must not be changed, otherwise errors may occur in the process image!

Output mapping modules

Index:Sub	Name	Type	Offset	Access	Default	Description
0x1600 ...0x163F:00	RxPDO Map	U8	0	ro	Number of outputs at this slot	Entry only available at slots with output modules.
0x1600...0x163F:01	Output mapping	U32	16	ro		• Bit 7...0: length of the mapped objects in bits • Bit 15...8: subindex of the mapped object • Bit 31...16: index of the mapped object Example: 0x7000:01, 1 > at slot 0 the first output has a length of 1 bit.
0x1600...0x163F:02	Output mapping	U32		ro		
0x1600...0x163F: ...	...					

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Input mapping modules

Index:Sub	Name	Type	Offset	Access	Default	Description
0x1A00 ... 0x1A3F:00	TxPDO map	U8	0	Ro	Number of inputs at this slot	Entry only available at slots with input modules.
0x1A00... 0x1A3F:01	Input mapping	U32	16	Ro		• Bit 7...0: Length of the mapped objects in bits • Bit 15...8: Subindex of the mapped object • Bit 31...16: Index of the mapped object Example: 0x6000:01, 8 > at slot 0 the first input has a length of 8 bit.
0x1A00... 0x1A3F:02	Input mapping	U32		ro		
0x1A00... 0x1A3F: ...	...					

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Input Mapping coupler

Index:Sub	Name	Type	Offset	Access	Default	Description
0x1AFF:00	Status PDO Mapping	U8	0	ro	4	Mapping of Status PDO • Bit 7...0: Length of the mapped objects in bits • Bit 15...8: Subindex of the mapped object • Bit 31...16: Index of the mapped object
0x1AFF:01	Input Mapping 01	U32	16	ro	0xF1000120	Mapping of hardware interrupt counter
0x1AFF:02	Input Mapping 02	U32	48	ro	0xF1000220	Mapping of diagnostic interrupt counter

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Input Mapping coupler

Index:Sub	Name	Type	Offset	Access	Default	Description
0x1B00:00	Status PDO Mapping	U8	0	ro	2	Mapping of Status PDO • Bit 7...0: Length of the mapped objects in bits • Bit 15...8: Subindex of the mapped object • Bit 31...16: Index of the mapped object
0x1B00:01	Input Mapping 01	U32	16	ro	0xF1000340	Extended Diagnostic Data Diagnostic Module Status
0x1B00:02	Input Mapping 02	U32	48	ro	0x10F30401	*New Message* available

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The PDOs 0x1B00 and 0x1B01 are optional and can be activated or deactivated as required.

- Default:
  - PDO 0x1B00 is activated
  - PDO 0x1B01 is deactivated

Input Mapping coupler

Index:Sub	Name	Type	Offset	Access	Default	Description
0x1B01:00	Status PDO Mapping	U8	0	ro	2	Mapping of Status PDO • Bit 7...0: Length of the mapped objects in bits • Bit 15...8: Subindex of the mapped object • Bit 31...16: Index of the mapped object
0x1B01:01	Input Mapping 01	U32	16	ro	0x1C322001	Sync Error Status Sync Manager Out
0x1B01:02	Input Mapping 02	U32	48	ro	0x1C332001	Sync Error Status Sync Manager In

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The PDOs 0x1B00 and 0x1B01 are optional and can be activated or deactivated as required.

- Default:
  - PDO 0x1B00 is activated
  - PDO 0x1B01 is deactivated

SyncManager Type

Index:Sub	Name	Type	Offset	Access	Default	Description
0x1C00:00	SyncManager Type	U8	0	ro	4	Sync Manager Communication Type
0x1C00:01	SyncManager 1	U8	16	ro	1	1: Mailbox receive (master to slave)
0x1C00:02	SyncManager 2	U8	24	ro	2	2: Mailbox send (slave to master)
0x1C00:03	SyncManager 3	U8	32	ro	3	3: Process data output
0x1C00:04	SyncManager 4	U8	40	ro	4	4: Process data input

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The "RxPDO/TxPDO assign" must not be changed, otherwise errors may occur in the process image!

RxPDO Assign

Index:Sub	Name	Type	Offset	Access	Default	Description
0x1C12:00	RxPDO Assign	U8	0	ro	Number of modules with process output data	Sync Manager 2 PDO Assignment (0x16yy)
0x1C12:01	RxPDO Mapping 1	U16	16	ro		PDO Mapping object index of assigned PDO
0x1C12 ...	...	U16	...	ro		...
0x1C12:40	RxPDO Mapping 64	U16		ro		

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TxPDO Assign

Index:Sub	Name	Type	Offset	Access	Default	Description
0x1C13:00	TxPDO Assign	U8	0	ro	Number of input PDOs of coupler and modules	Sync Manager 3 PDO Assignment
0x1C13:01	TxPDO Mapping 1	U16	16	ro		PDO Mapping object index of assigned PDO (0x1Ayy)
0x1C13:02	TxPDO Mapping 2	U16		ro		
0x1C13: ...	...	U16	...	ro		...
0x1C13:40	TxPDO Mapping 64	U16		ro		

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The EtherCAT coupler also has process input data, which show the alarm status. So there is in the first place the assignment 0x1AFF for the input PDOs of the coupler.



"SM output/input parameter" must not be changed, otherwise errors may occur in the process image!

SM output parameter

Index:Sub	Name	Type	Offset	Access	Default	Description
0x1C32:00	SM output parameter	U8	0	ro	32	
0x1C32:01	Synchronization Type	U16	16	ro		• 0x00: Free Run (not synchronized) • 0x01: Synchronous - synchronized with Sync Manager Event • 0x02: DC Sync0 - synchronized with Sync0 Event • 0x03: DC Sync1 - synchronized with Sync1 Event
0x1C32:02	Cycle time	U32	32	ro		• Free Run: Time between two local timer events in ns • Free Run: Time between two local timer events in ns Synchronous SM2 Event: Minimum time between two SM2 events in ns • DC Sync0: Sync0 Cycle Time (Register 0x9A3-0x9A0) in ns
0x1C32:03	Shift time	U32	64	ro		• Time between related event and the associated action (outputs valid hardware) • Shift of output valid equal or greater than 0x1C32:09
0x1C32:04	Synchronization Types supported	U16	96	ro		
0x1C32:05	Minimum cycle time	U32	112	ro		• *Minimum cycle time* supported by the slave (maximum duration time of the local cycle) in ns • It might be necessary to start the Dynamic Cycle Time measurement SI04, Bit 14 and SI08, Bit 0 to get a valid value used in Synchronous or DC Mode
0x1C32:06	Calc and Copy Time	U32	144	ro		Time needed by the application controller to copy the process data from the Sync Manager to the local memory and perform calculations if necessary before the data is sent to the process.

Index:Sub	Name	Type	Offset	Access	Default	Description
0x1C32:07	Minimum Delay Time	U32	176	ro		Only important for DC Sync0/1 (Synchronization type = 0x02 or 0x03): Minimum Hardware delay time of the slave. Because of software synchronization there could be a distance between the minimum and the maximum delay time.
0x1C32:08	Get Cycle Time	U16	208	ro		• Bit 0: – 0: Measurement of local cycle time stopped – 1: Measurement of local cycle time started If written again, the measured values are reset Used in Synchronous or (DC Mode with variable Cycle Time) • Bit 1: – 0: Reserved – 1: Reset the error counters • Bit 15 … 2: Reserved
0x1C32:09	Delay Time	U32	224	ro		Only important for DC Sync0/1 (Synchronization type = 0x02 or 0x03): Hardware delay time of the slave. Time from receiving the trigger (Sync0 or Sync1 Event) to drive output values to the time until they become valid in the process (e.g. electrical signal available).
0x1C32:10	Sync0 Cycle Time	U32	256	ro		Only important for DC Sync0 (Synchronization type = 0x03) and subordinated local cycles: Time between two Sync0 signals if fixed *Sync0 Cycle Time* is needed by the application.
0x1C32:11	SM-Event Missed	U16	288	ro		• This error counter is incremented when the application expects a SM event but does not receive it in time and as consequence the data cannot be copied any more. • Used in DC mode.
0x1C32:12	Cycle Time Too Small	U16	304	ro		• This error counter is incremented when the cycle time is too small so that the local cycle cannot be completed and input data cannot be provided before the next SM event. • Used in Synchronous or DC Mode.
0x1C32:13	Shift Time Too Short	U16	320	ro		• This error counter is incremented when the time distance between the trigger (Sync0) and the Outputs Valid is too short because of a too short Shift Time or Sync1 Cycle Time. • Used in DC Mode.

Index:Sub	Name	Type	Offset	Access	Default	Description
0x1C32:14	RxPDO Toggle Failed	U16	336	ro		This error counter is incremented when the slave supports the RxPDO Toggle and does not receive new RxPDO data from the master (RxPDO Toggle set to TRUE).
0x1C32:15	Minimum Cycle Distance in ns	U32	352	ro		Used in conjunction with SI 16 to monitor the jitter between two SM events.
0x1C32:16	Maximum Cycle Distance in ns	U32	384	ro		Used in conjunction with SI 15 to monitor the jitter between two SM events.
0x1C32:17	Minimum SM SYNC Distance in ns	U32	416	ro		Used in conjunction with SI 18 to monitor the jitter between the SM event and SYNC0 event in DC-SYNC0 Mode
0x1C32:18	Maximum SM SYNC Distance in ns	U32	448	ro		Used in conjunction with SI 17 to monitor the jitter between the SM event and SYNC0 event in DC-SYNC0 Mode
0x1C32:32	Sync Error	BOOL	480	ro		Shall be supported if SM event Missed or Shift Time Too Short Counter is supported Mappable in TxPDO • 0: no Synchronization Error or Sync Error not supported • 1: Synchronization Error

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SM input parameter

Index:Sub	Name	Type	Offset	Access	Default	Description
0x1C33:00	SM input parameter	U8	0	ro	32	
0x1C33:01	Synchronization Type	U16	16	ro		• 0x00: Free Run (not synchronized) • 0x01: Synchronous with SM3 Event • 0x02: DC Sync0 – synchronized with Sync0 Event • 0x03: DC Sync1 – synchronized with Sync1 Event • 0x22: Synchronous with SM2 Event
0x1C33:02	Cycle time	U32	32	ro		• Free Run: Time between two local timer events in ns • Free Run: Time between two local timer events in ns Synchronous SM2 Event: Minimum time between two SM2 events in ns • DC Sync0: Sync0 Cycle Time (Register 0x9A3-0x9A0) in ns
0x1C33:03	Shift time	U32	64	ro		• Time between related event and the associated action (inputs latched from hardware) • Shift of Input Latch equal or greater than 0x1C33:09
0x1C33:04	Synchronization Types supported	U16	96	ro		
0x1C33:05	Minimum cycle time	U32	112	ro		• *Minimum cycle time* supported by the slave (maximum duration time of the local cycle) in ns • It might be necessary to start the Dynamic Cycle Time measurement SI04, Bit 14 and SI08, Bit 0 to get a valid value. • Used in Synchronous or DC Mode
0x1C33:06	Calc and Copy Time	U32	144	ro		Time in ns needed by the application controller to perform calculations on the input values if necessary and to copy the process data from the local memory to the Sync Manager before the data is available for EtherCAT.
0x1C33:07		U32	176	ro		Reserved

Index:Sub	Name	Type	Offset	Access	Default	Description
0x1C33:08	Get Cycle Time	U16	208	ro		• Bit 0: – 0: Measurement of local cycle time stopped – 1: Measurement of local cycle time started If written again, the measured values are reset Used in Synchronous or (DC Mode with variable Cycle Time) • Bit 1: – 0: Reserved – 1: Reset the error counters • Bit 15 … 2: Reserved
0x1C33:09	Delay Time	U32	224	ro		• Only important for DC Sync1 (Synchronization type = 3), if the Input Latch is started by the Sync1-event • Hardware delay time of the slave. • Used in DC mode
0x1C33:10	Sync0 Cycle Time	U32	256	ro		Only important for DC Sync0 (Synchronization type = 0x03) and subordinated local cycles: Time between two Sync0 signals if fixed Sync0 Cycle Time is needed by the application.
0x1C33:11	SM-Event Missed	U16	288	ro		• This error counter is incremented when the application expects a SM event but does not receive it in time and as consequence the data cannot be copied any more. • Used in DC mode.
0x1C33:12	Cycle Time Too Small	U16	304	ro		• This error counter is incremented when the cycle time is too small so that the local cycle cannot be completed and input data cannot be provided before the next SM event. • Used in Synchronous or DC Mode.
0x1C33:13	Shift Time Too Short	U16	320	ro		• This error counter is incremented when the time distance between the trigger (Sync0) and the outputs valid is too short because of a too short Shift Time or Sync1 Cycle Time. • Used in DC Mode.
0x1C33:14			336			Reserved
...			...			...
0x1C33:18			448			Reserved

Index:Sub	Name	Type	Offset	Access	Default	Description
0x1C33:32	Sync Error	BOOL	480	ro		Shall be supported if SM event Missed or Shift Time Too Short counter is supported Mappable in TxPDO • 0: no Synchronization Error or Sync Error not supported • 1: Synchronization Error

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Command

Index:Sub	Name	Type	Offset	Access	Default	Description
0x2000:00	Command	U8	0	ro	3	Command Object (complete access is not possible)
0x2000:01	Execute Command	U32	16	rw	0	Execute Command • 0x00000000: Clear all values in object 0x2000 • 0x00000001: Reset FMM data
0x2000:02	Parameter	U32	48	ro	0	Additional parameter for command execution
0x2000:03	Status	U32	80	ro	0	Return value of command execution: • 0: initial state • 1: command executed • 2: command not executed • 3: command unknown • 4: command not executable in this state
0x2359:00	Acceptance SSA	U8	0	rw	0	When writing the value 1, the Seccond Slave Address is taken over.

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Parameter EtherCAT coupler

Index:Sub	Name	Type	Offset	Access	Default	Description
0x3000:00	Coupler parameter	U8	0	ro	4	Parameter EtherCAT coupler
0x3000:01	Auto acknowledge	U8	16	rw	1	Auto acknowledge • 0x00: deactivated (default) • 0x01: activated
0x3000: 02	reserved	U8	24	rw	0	

Index:Sub	Name	Type	Offset	Access	Default	Description
0x3000:03	Default values	U8	32	rw	0	Default values • 0x00: deactivated (default) • 0x01: activated
0x3000:04	Operation Mode	U8	40	rw	0	Operating mode • 0x00: Normal mode (default)

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- Auto acknowledge
  - With this object the write access is only possible when the EtherCAT coupler is in *PreOp* state. In *Op* state write access is denied.
- Default values
  - Behavior when BASP (**B**efehls-**A**usgabe-**Sp**erre i.e. command output disable) is activated
  - With *Default values* = 0 and activated BASP all module outputs are switched off.
  - With *Default values* = 1 and activated BASP, the last states of the outputs are retained.

    Please note that this represents a potentially hazardous operating condition. This should only be used for test purposes respectively for troubleshooting.
- Operating mode
  - Operating mode of the EtherCAT coupler
  - In operating mode *Normal mode*, the EtherCAT coupler is backward compatible with the previous version and FSoE safety modules are not supported.

Parameter I/O-1000 Module

Index:Sub	Name	Type	Offset	Access	Default	Description
0x3100... 0x313F:00	Parameter	U8	0	ro	Number of parameters	Parameter of a I/O-1000 Module
0x3100... 0x313F:01	Param1	U8	16	rw		
0x3100... 0x313F:02	Param2	U8	32	rw		
0x3100... 0x313F: ...	...					

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With this object the parameters of a I/O-1000 module may be accessed. Here the addressing by index takes place. Via subindexes the corresponding parameters may be accessed. The allocation of the subindexes may be found in the description of the corresponding module. Also here it is valid that power and clamp modules are not recognized by the EtherCAT coupler and so are not listed and considered during slot allocation.

If the module has parameters it is valid

- Index 0x3100: Access to EtherCAT-Slot 0
- Index 0x3101: Access to EtherCAT-Slot 1
- ...
- Index 0x313F: Access to EtherCAT-Slot 64

In the following example, you have access to the parameters of the module at physical slot 4 via the following index.

Physical slot number	1	2	3	4
Module	DI	CM	DO	AI
Index (Operation mode: *Normal Mode*)	*0x3100**	-	*0x3101**	**0x3102**
EtherCAT-Slot	0	-	1	**2**

*) This entry is not listed, because the module has no parameters.

Clear EPM-S131 counter

Index:Sub	Name	Type	Offset	Access	Default	Description
0x4000:00	Clear EPM-S131 counter	U8	0	ro	2	Writing of a value you want to the corresponding subindex clears the counter.
0x4000:01	Clear master counter	U8	16	rw	0	• Master Counter – Object 0x4001
0x4000:02	Clear module counter	U8	24	rw	0	• MDL and NDL Counter – Object 0x4002 and 0x4003

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Master counter

Index:Sub	Name	Type	Offset	Access	Default	Description
0x4001:00	Master counter	U8	0	ro	14	Error counter of I/O-1000 Master
0x4001:01	Expected length error	U16	16	ro	0	
0x4001:02	TimeOut error	U16	32	ro	0	
0x4001:03	StopBit error	U16	48	ro	0	
0x4001:04	FCS error	U16	64	ro	0	
0x4001:05	Telegram length error	U16	80	ro	0	
0x4001:06	Telegram type error	U16	96	ro	0	
0x4001:07	Alarm retry error	U16	112	ro	0	
0x4001:08	Bus idle time error	U16	128	ro	0	
0x4001:09	Wrong node address	U16	144	ro	0	
0x4001:0A	Telegram valid	U16	160	ro	0	
0x4001:0B	Master load	U16	176	ro	0	
0x4001:0C	One Telegram Retry Counter	U16	192	ro	0	
0x4001:0D	Two Telegram Retry Counter	U16	208	ro	0	
0x4001:0E	Three or More Telegram Retry Counter	U16	224	ro	0	

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Module MDL counter

Index:Sub	Name	Type	Offset	Access	Default	Description
0x4002:00	Module MDL counter	U8	0	ro	64	Master Data Line Counter
0x4002:01	Slot 1	U16	16	ro	0	Slot 1
0x4002:02	Slot 2	U16	32	ro	0	Slot 2
0x4002: ...	...	U16	...	ro	0	...
0x4002:40	Slot 64	U16		ro	0	Slot 64

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Module NDL counter

Index:Sub	Name	Type	Offset	Access	Default	Description
0x4003:00	Module NDL counter	U8	0	ro	64	Node Data Line Counter
0x4003:01	Slot 1	U16	16	ro	0	Slot 1
0x4003:02	Slot 2	U16	32	ro	0	Slot 2
0x4003: ...	...	U16	...	ro	0	...
0x4003:40	Slot 64	U16		ro	0	Slot 64

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Module information

Index:Sub	Name	Type	Offset	Access	Default	Description
0x4100:00	Module Information	U8	0	ro	8	Module Identity Information
0x4100:01	Module Name	VSTRG	16	ro	0	Module Name
0x4100:02	Module ID	U32	256	ro	0	Module ID
0x4100:03	Serial Number	VSTRG	288	ro	0	Serial number of the module
0x4100:04	Product Version	VSTRG	448	ro	0	Product version of the module
0x4100:05	Hardware Version	VSTRG	520	ro	0	Hardware version of the module
0x4100:06	Software Version	VSTRG	536	ro	0	Software version of the module
0x4100:07	FPGA Version	U16	632	ro	0	FPGA version
0x4100:08	Mx File	VSTRG	648	ro	0	Mx file of the coupler

Index:Sub	Name	Type	Offset	Access	Default	Description
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When accessing the module information of EPM-S131 the corresponding module is addressed via the index (0x4100 + EtherCAT-Slot). Subindexes give you access to the corresponding module information.

Hardware interrupt data

Index:Sub	Name	Type	Offset	Access	Default	Description
0x5000:00	Hardware interrupt data	U8	0	ro	6	Current hardware interrupt data
0x5000:01	Slot number	U8	16	ro	0x00	EtherCAT-Slot of the module which reports an interrupt
0x5000:02	Hardware interrupt data 00	U8	24	ro	0x00	Hardware interrupt data (see module description)
0x5000:03	Hardware interrupt data 01	U8	32	ro	0x00	
0x5000:04	Hardware interrupt data 02	U8	40	ro	0x00	
0x5000:05	Hardware interrupt data 03	U8	48	ro	0x00	
0x5000:06	Acknowledge	U8	56	rw	0x00	Any value resets the hardware interrupt counter and acknowledges if necessary the interrupt.
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- If the object 0xF100 indicates a hardware interrupt here the current hardware interrupt data may be accessed. The allocation of the hardware interrupt data may be found in the description of the corresponding module.
- With de-activated *Auto-Acknowledge* of the EtherCAT coupler the *hardware interrupt counter* of object 0xF100 is reset and the hardware interrupt is acknowledged. For this you have to write any value you like to subindex 0x06 of index 0x5000.

Diagnostic Interrupt Data (byte 1 ... 4)

Index:Sub	Name	Type	Offset	Access	Default	Description
0x5002:00	Diagnostic Interrupt Data	U8	0	ro	6	Current diagnostic interrupt data
0x5002:01	Slot number	U8	16	ro	0x00	EtherCAT-Slot of the module which reports an interrupt.
0x5002:02	Diagnostic data 00	U8	24	ro	0x00	Byte 1 ... 4 of the diagnostic data (see module description)
0x5002:03	Diagnostic data 01	U8	32	ro	0x00	
0x5002:04	Diagnostic data 02	U8	40	ro	0x00	
0x5002:05	Diagnostic data 03	U8	48	ro	0x00	
0x5002:06	Acknowledge	U8	56	rw	0x00	Any value resets the diagnostic interrupt counter and acknowledges if necessary the interrupt.

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- If the object 0xF100 indicates a diagnostic interrupt here the first 4 bytes of the current diagnostics interrupt data may be accessed. The allocation of the diagnostics data may be found in the description of the corresponding module.
- With de-activated *Auto-Acknowledge* of the EtherCAT coupler the *diagnostic interrupt counter* of object 0xF100 is reset and the diagnostic interrupt is acknowledged. For this you have to write any value you like to subindex 0x06 of index 0x5002.

Diagnostic Data (byte 1 ... n)

Index:Sub	Name	Type	Offset	Access	Default	Description
0x5005:00	Diagnostic Data	U8	0	ro	19	
0x5005:01	Slot number	U8	16	rw	0	By reading this index here the EtherCAT-Slot of the module may be found, to which the following diagnostic data belong to. By writing of an EtherCAT-Slot to this index the diagnostic data of the corresponding module may be read.
0x5005:02	Module error	U8	24	ro	0	Diagnostics data of the module (see module description)
0x5005:03	Module type	U8	32	ro	0	
0x5005:04	Fix	U8	40	ro	0	
0x5005:05	Communication/Process interrupt	U8	48	ro	0	
0x5005:06	Channel type	U8	56	ro	0	

Index:Sub	Name	Type	Offset	Access	Default	Description
0x5005:07	Number of diagnostic bits	U8	64	ro	0	
0x5005:08	Number of channels	U8	72	ro	0	
0x5005:09	Channel error	U8	80	ro	0	
0x5005:0A	Channel-specific error channel 0	U8	88	ro	0	
0x5005:0B	Channel-specific error channel 1	U8	96	ro	0	
0x5005:0C	Channel-specific error channel 2	U8	104	ro	0	
0x5005:0D	Channel-specific error channel 3	U8	112	ro	0	
0x5005:0E	Channel-specific error channel 4	U8	120	ro	0	
0x5005:0F	Channel-specific error channel 5	U8	128	ro	0	
0x5005:10	Channel-specific error channel 6	U8	136	ro	0	
0x5005:11	Channel-specific error channel 7	U8	144	ro	0	
0x5005:13	-	U8	152	ro	0	
0x5005:14	µs-Ticker	U32	160	ro	0	

↯ ‘Explanation of the elements’ *page 27*

The whole diagnostic data of a module may be accessed with this object. Here you may either access current diagnostic data or the diagnostic data of a module on any EtherCAT-Slot.

Read input data

Index:Sub	Name	Type	Offset	Access	Default	Description
0x6000...0x603F:00	Input data	U8	0	ro	60	Number of subindexes of the input data for the corresponding EtherCAT-Slot.
0x6000...0x603F:01		U32	16	ro		Input data (see module description)
0x6000...0x603F:02		U32		ro		
0x6000...0x603F: ...	...	...		ro		

‘Explanation of the elements’ *page 27*

- With this object the input data of a I/O-1000 module may be read.
- Here the addressing of the EtherCAT-Slot via index (0x6000 + EtherCAT-Slot) takes place.
- The corresponding input data may be accessed via subindexes.
  - The allocation of the subindexes may be found in the description of the corresponding module.

Read output data

Index:Sub	Name	Type	Offset	Access	Default	Description
0x7000...0x703F:00	Output data	U8	0	ro	60	Number of subindexes of the output data for the corresponding EtherCAT-Slot.
0x7000...0x703F:01		U32	16	ro		Output data (see module description)
0x7000...0x703F:02		U32		ro		
0x7000...0x703F: ...	...	...		ro		

‘Explanation of the elements’ *page 27*

- With this object the output data of a I/O-1000 module may be read.
- Here the addressing via index (0x7000 + EtherCAT-Slot) takes place.
- The corresponding output data may be accessed via subindexes.
  - The allocation of the subindexes may be found in the description of the corresponding module.



Information concerning the write access to outputs may be found in the manual of your EtherCAT master.

Modular device profile

Index:Sub	Name	Type	Offset	Access	Default	Description
0xF000:00	Modular device profile	U8	0	ro	4	Contains information to interpret the objects in function areas of the modules
0xF000:01	Module index distance	U16	16	ro	1	Index distance between two modules
0xF000:02	Maximum number of modules	U16	32	ro	0x40 (64)	Maximum number of modules
0xF000:03	General configuration	U32	48	ro	0	
0xF000:04	General information	U32	80	ro	0	

‘Explanation of the elements’ *page 27*

Module Profile List

Index:Sub	Name	Type	Offset	Access	Default	Description
0xF010:00	Module Profile List	U8	0	ro	0x40 (64)	Module ID of the modules • Bit 15...0: Module profile information of the module • Bit 31…16: fix (0) Module profile specific information
0xF010:01	Subindex 001	U32	16	ro	0	
0xF010:02	Subindex 002	U32	48	ro	0	
0xF010: ...	...	U32	...	ro		
0xF010:40	Subindex 064	U32		ro	0	

‘Explanation of the elements’ *page 27*

Configured Module Ident List

Index:Sub	Name	Type	Offset	Access	Default	Description
0xF030:00	Configured Module Ident List	U8	0	rw	0x40 (64)	Module ID of the configured modules
0xF030:01	Subindex 001	U32	16	rw	0	
0xF030:02	Subindex 002	U32	48	rw	0	
0xF030: ...	...	U32	...	rw		
0xF030:40	Subindex 064	U32		rw	0	

‘Explanation of the elements’ *page 27*

Write access to the object 0xF030 is only possible with *CompleteAccess*. Single access is not allowed!

- When writing to a subindex the entered value is compared with the module ID of the same subindex of index 0xF050. So the configuration may be checked.
- Some configuration tools cannot automatically be write to this index, thus some configuration errors may not be detected.

Detected address list

Index:Sub	Name	Type	Offset	Access	Default	Description
0xF040:00	Detected address list	U8	0	ro	0x40 (64)	Addresses of the modules, which were recognized by the coupler.
0xF040:01	Subindex 001	U16	16	ro		
0xF040:02	Subindex 002	U16	32	ro		
0xF040: ...	...	U16		ro		
0xF040:40	Subindex 064	U16		ro		

‘Explanation of the elements’ *page 27*

Detected module list

Index:Sub	Name	Type	Offset	Access	Default	Description
0xF050:00	Detected module list	U8	0	ro	0x40 (64)	Module IDs of the modules, which were recognized by the coupler.
0xF050:01	Subindex 001	U32	16	ro		
0xF050:02	Subindex 002	U32	48	ro		
0xF050: ...	...	U32		ro		
0xF050:40	Subindex 064	U32		ro		

‘Explanation of the elements’ *page 27*

Diagnostic

Index:Sub	Name	Type	Offset	Access	Default	Description
0xF100:00	Diagnostic	U8	0	ro	3	
0xF100:01	Hardware interrupt counter	U32	16	ro	0x00000000	Counter for hardware interrupt
0xF100:02	Diagnostic interrupt counter	U32	48	ro	0x00000000	Counter for diagnostic interrupt
0xF100:03	Diagnostic Module Status	U64	80	ro	0x00000000	64 bit array, each bit represents a pending (but acknowledged) diagnostic alarm

↳ *'Explanation of the elements' page 27*

- With de-activated *Auto-Acknowledge* of the EtherCAT coupler the corresponding counter is set to 1 until you acknowledge this accordingly. For this you have to write any value you like to subindex 0x06 under the accordingly assigned index.
- With activated *Auto-Acknowledge* here you will find the number of hardware and diagnostics interrupts, which happened since the last interrupt reset. To reset the corresponding counter you have to write any value you like to the subindex 0x06 under the accordingly assigned index.

There are the following index assignments:

- Write to 0x06 of index 0x5000:
  - Reset of counter hardware interrupt
- Write to 0x06 of index 0x5002:
  - Reset of counter diagnostic interrupt

2.1.2.6 Error handling

2.1.2.6.1 Overview

In EtherCAT there are the following two types of error messages:

- Emergency error message
- Standard error message

2.1.2.6.2 Emergency error message

Emergency error messages are generated on errors during state changes respectively at hardware and diagnostic interrupts if the interrupt is activated by parameterization. Emergency error messages are released within device-internal mechanisms and sent to the master by means of the mailbox service.

Frame structure

Byte

0	1	2	3	4	5	6	7
EEC		ER	DATA				

EEC - **E**mergency **E**rror **C**odes following ETG specifications:
0xFFxx: Vendor-specific emergency message
0xA0xx: State Machine transition error, e.g. due to a configuration error (length, address, settings). More information concerning this may be found at ETG.

ER - Error register - State of the State Machine:
01: Init
02: Pre-Op
03: BootStrap
04: Safe-Op
08: Op

DATA - Error data with more information concerning the error

With a hardware interrupt or diagnostic interrupt respectively in DATA the *Manufacturer Specific Error Field* (MEF) may be found. The field has the following structure:

Byte

0	1	2	3	4	5	6	7
EEC		ER	SLOT	TYPE	DIAG		
			MEF				

SLOT - EtherCAT-Slot of the module where is the error from

TYPE - Interrupt type
01: Hardware interrupt
02: Diagnostics interrupt

DIAG - Error code, which is described at corresponding module.
The error code "DIAG" corresponds to the first 3 bytes of the diagnostic data described for the respective IO module (ERR_A, MODTYP, ERR_C).
Example:

Name	Byte	Funktion	Default
ERR_A	1	Diagnose	00_h
MODTYP	1	Modulinformation	15_h
ERR_C	1	reserviert	00_h

2.1.2.6.3 Standard error messages

Emergency error messages are released within device-internal mechanisms and sent to the EtherCAT master. The following standard error messages my occur:

AL Status Code

To get more information about the error the EtherCAT master reads the AL Status Code (AL = application layer). This is allocated in the EtherCAT coupler in register 0x0134.

EtherCAT specific error messages

Code	Description	Current State	Resulting State
0x0000	No error	Any	Current state
0x0001	Unspecified error	Any	Any + E
0x0002	No Memory	Any	Any + E
0x0011	Invalid requested state change	I > S, I > O, P > O, O > B, S > B, P > B	Current state + E

0x0012	Unknown requested state	Any	Current state + E
0x0013	Bootstrap not supported	I > B	I + E
0x0014	No valid firmware	I > P	I + E
0x0015	Invalid mailbox configuration	I > B	I + E
0x0016	Invalid mailbox configuration	I > P	I + E
0x0017	Invalid SyncManager configuration	P > S, S > O	Current state + E
0x0018	No valid inputs available	O, S > O	S + E
0x0019	No valid outputs	O, S > O	S + E
0x001A	Synchronization error	O, S > O	S + E
0x001B	SyncManager watchdog	O, S	S + E
0x001C	Invalid SyncManager Types	O, S, P > S	S + E
0x001D	Invalid Output Configuration	O, S, P > S	S + E
0x001E	Invalid Input Configuration	O, S, P > S	P + E
0x001F	Invalid Watchdog Configuration	O, S, P > S	P + E
0x0020	Coupler needs cold start	Any	Current state + E
0x0021	Coupler needs INIT	B, P, S, O	Current state + E
0x0022	Coupler needs PREOP	S, O	S + E, O + E
0x0023	Coupler needs SAFEOP	O	O + E
0x0024	Invalid Input Mapping	P > S	P + E
0x0025	Invalid Output Mapping	P > S	P + E
0x0026	Inconsistent Settings	P > S	P + E
0x0027	Free-run not supported	P > S	P + E
0x0028	Synchronization not supported	P > S	P + E
0x0029	Free-run needs 3 Buffer Mode	P > S	P + E
0x002A	Background Watchdog	S, O	P + E

0x002B	No Valid Inputs and Outputs	O, S > O	S + E
0x002C	Fatal Sync Error	O	S + E
0x002D	No Sync Error	S > O	S + E
0x0030	Invalid DC SYNC Configura-tion	O, S > O, P > S	P + E, S + E
0x0031	Invalid DC Latch Configuration	O, S > O, P > S	P + E, S + E
0x0032	PLL Error	O, S > O	S + E
0x0033	DC Sync IO Error	O, S > O	S + E
0x0034	DC Sync Timeout Error	O, S > O	S + E
0x0035	DC Invalid Sync Cycle Time	P > S	P + E
0x0036	DC Sync0 Cycle Time	P > S	P + E
0x0037	DC Sync1 Cycle Time	P > S	P + E
0x0041	MBX_AOE	B, P, S, O	Current state + E
0x0042	MBX_EOE	B, P, S, O	Current state + E
0x0043	MBX_COE	B, P, S, O	Current state + E
0x0044	MBX_FOE	B, P, S, O	Current state + E
0x0045	MBX_SOE	B, P, S, O	Current state + E
0x004F	MBX_VOE	B, P, S, O	Current state + E
0x0050	EEPROM No Access	Any	Any + E
0x0051	EEPROM Error	Any	Any + E
0x0060	Coupler Restarted Locally	Any	I
< x8000	Reserved		

SyncManager watchdog

0x001B

If there is no communication to the master possible e.g. line is interrupted, you will get the error message 0x001B after the SyncMaster watchdog time has been elapsed. The time is to be configured in the master.

- SyncManager watchdog is used for "frame monitoring"
  - If no more frames arrive to the slave in a certain time, it comes to the watchdog and the slave changes to SafeOp with the AlStatusCode 0x001B
- By default, the SyncManager watchdog is always active with a time of 100ms
- Changing in the parameters e.g. via the EtherCAT Manager is changed once and remains valid until new values are received. The values are not stored remanently
- Time from the SyncManager watchdog should always be greater than the set bus cycle time at the EtherCAT Master. Since the SyncManager watchdog is always triggered when a process data frame is received
- If parameterized, substitute values are displayed for the modules

2.1.2.6.4 SDO error code

If a SDO request is negative evaluated, an according SDO error code is released. In the following table the possible errors are listed.

Code	Description
0x05030000	Toggle bit not alternated
0x05040000	SDO protocol timed out
0x05040001	Client/server command specifier not valid or unknown
0x05040002	Invalid block size (block mode only)
0x05040003	Invalid sequence number (block mode only)
0x05040004	CRC error (block mode only)
0x05040005	Out of memory
0x06010000	Unsupported access to an object
0x06010001	Attempt to read a write only object
0x06010002	Attempt to write a read only object
0x06020000	Object does not exist in the object dictionary
0x06040041	Object cannot be mapped to the PDO
0x06040042	The number and length of the objects to be mapped would exceed PDO length
0x06040043	General parameter incompatibility reason

0x06040047	General internal incompatibility in the device
0x06060000	Access failed due to an hardware error
0x06070010	Data type does not match, length of service parameter does not match
0x06070012	Data type does not match, length of service parameter too high
0x06070013	Data type does not match, length of service parameter too low
0x06090011	Subindex does not exist
0x06090030	Value range of parameter exceeded (only for write access)
0x06090031	Value of parameter written too high
0x06090032	Value of parameter written too low
0x06090036	Maximum value is less than minimum value
0x08000000	General error
0x08000020	Data cannot be transferred or stored to the application
0x08000021	Data cannot be transferred or stored to the application because of local control
0x08000022	Data cannot be transferred or stored to the application because of the present device state
0x08000023	Object directory dynamic generation fails or no object directory is present (e.g. object directory is generated from file and generation fails because of an file error)

3 Digital input modules

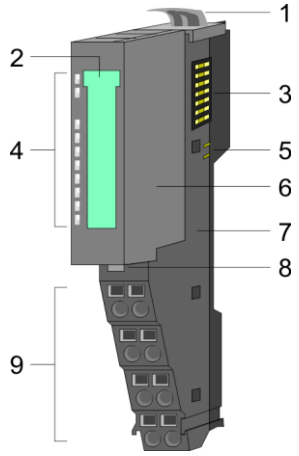
3.1 EPM-S208 - DI 4xDC 24V ETS

Properties

The electronic module collects the binary control signals from the process level and transmits them isolated to the central bus system. It has 4 channels and their status is monitored via LEDs. With configured ETS functionality (ETS = **e**dge **t**ime **s**tamp) and the corresponding (rising/falling) edge the current time value of the I/O-1000 µs timer is stored together with the state of the inputs in the process image. Depending on the configuration 5 (20byte) respectively 15 (60byte) ETS entries may be stored in the process image one after another.

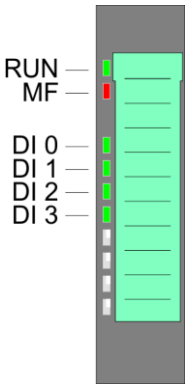
- 4 digital inputs, isolated to the backplane bus
- Configurable ETS functionality for 5 respectively 15 ETS entries (each 4byte)
- Diagnostics function
- Suited for switches and approximate switches
- Status indication of the channels via LEDs also with de-activated electronic power supply

Structure



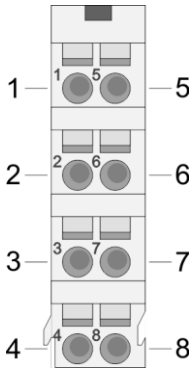
1	Locking lever terminal module
2	Labeling strip
3	Backplane bus
4	LED status indication
5	DC 24V power section supply
6	Electronic module
7	Terminal module
8	Locking lever electronic module
9	Terminal

Status indication

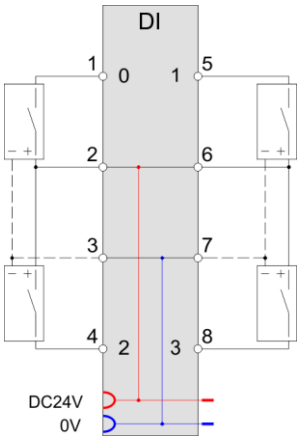


RUN green	MF red	DI x green	Description
■	□	X	Bus communication is OK Module status is OK
■	■	X	Bus communication is OK Module status reports an error
□	■	X	Bus communication is not possible Module status reports an error
□	□	X	Error at bus power supply
X	◪ 2Hz	X	Flashing: Error in configuration
■	□	■	Digital input has signal "1"
■	□	□	Digital input has signal "0"
not relevant: X			

Pin assignment



For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	DI 0	I	Digital input DI 0
2	DC 24V	O	DC 24V for sensor
3	0V	O	GND
4	DI 2	I	Digital input DI 2
5	DI 1	I	Digital input DI 1
6	DC 24V	O	DC 24V for sensor
7	0V	O	GND
8	DI 3	I	Digital input DI 3

I: Input, O: Output

In-/Output area

With configured ETS functionality (ETS=edge time stamp) and the corresponding edge the current time value of the I/O-1000 µs timer is stored together with the state of the inputs and a running number as ETS entry in the process image.

You may configure the following variants:

- EPM-S208 DI 4xDC24V (20): uses 20byte in the PII for 5 ETS entries
- EPM-S208 DI 4xDC24V (60): uses 60byte in the PII for 15 ETS entries

Output area

No byte of the output area is used by the module.

Input area 20byte respectively 60byte

Depending on the configured variant, the module serves for an area for 5 resp. 15 ETS entries. Each ETS entry uses 4byte in input area:

Input area

IX	-	IX = Index for access via CANopen. With s = Subindex the corresponding ETS entry is addressed.
SX	-	Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Structure of an ETS entry

Addr.	Name	Bytes	Function	IX	SX
+0	PII	1	State of the inputs	5430h/s	01h
+1	RN	1	Running number		02h
+2	ETS_US	2	µs ticker		03h

PII

Here the state of the inputs after an edge change is stored.

The input byte has the following bit assignment:

Bit 0: DI 0

Bit 1: DI 1

Bit 2: DI 2

Bit 3: DI 3

Bit 4 ... 7: 0 (fix)

RN

The **R**unning **N**umber (RN) is a continuous number 0 ... 127, which starts with 1. The RN corresponds to the chronological order of the edges.

ETS_US

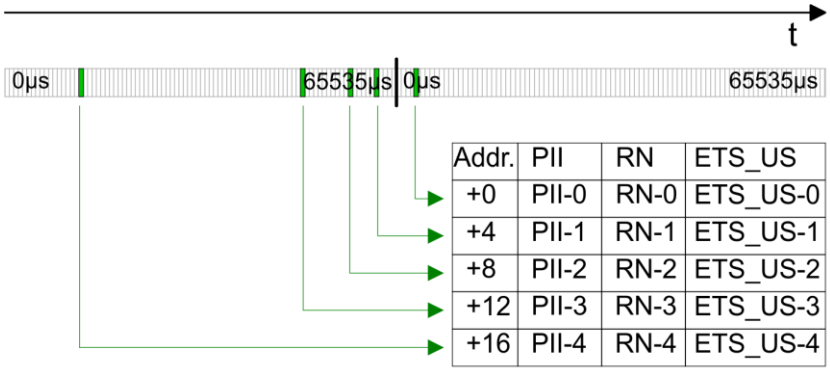
In the I/O-1000 module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

ETS_US always contains the low word of the µs ticker (0...65535µs).

ETS functionality

With the corresponding edge the value of the timer is stored as ETS entry in the process image as ETS_US together with the state of the inputs PII and the running number RN.

The following figure shows the sequence of how the ETS entries are stored in the input area.



Input area

The input range is used for status message.

IX	-	IX = Index for access via CANopen. With s = Subindex the corresponding ETS entry is addressed.
SX	-	Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Configured as EPM-S208 DI 4xDC 24V (20) 20byte - 5 ETS entries

Addr.	PII	IX=5430h	SX	Addr.	RN	IX=5430h	SX	Addr.	ETS-US	IX=5430h	SX
+0	PII-0	s=1	01h	+1	RN-0	s=1	02h	+2	ETS_US-0	s=1	03h
+4	PII-1	s=2	04h	+5	RN-1	s=2	05h	+6	ETS_US-1	s=2	06h
+8	PII-2	s=3	07h	+9	RN-2	s=3	08h	+10	ETS_US-2	s=3	09h
+12	PII-3	s=4	0Ah	+13	RN-3	s=4	0Bh	+14	ETS_US-3	s=4	0Ch
+16	PII-4	s=5	0Dh	+17	RN-4	s=5	0Eh	+18	ETS_US-4	s=5	0Fh

Configured as EPM-S208 DI 4xDC 24V (60) 60byte - 15 ETS entries

Addr.	PII	IX=5430h	SX	Addr.	RN	IX=5430h	SX	Addr.	ETS-US	IX=5430h	SX
+0	PII-0	s=1	01h	+1	RN-0	s=1	02h	+2	ETS_US-0	s=1	03h
+4	PII-1	s=2	04h	+5	RN-1	s=2	05h	+6	ETS_US-1	s=2	06h
+8	PII-2	s=3	07h	+9	RN-2	s=3	08h	+10	ETS_US-2	s=3	09h
+12	PII-3	s=4	0Ah	+13	RN-3	s=4	0Bh	+14	ETS_US-3	s=4	0Ch
+16	PII-4	s=5	0Dh	+17	RN-4	s=5	0Eh	+18	ETS_US-4	s=5	0Fh
+20	PII-5	s=6	10h	+21	RN-5	s=6	11h	+22	ETS_US-5	s=6	12h
+24	PII-6	s=7	13h	+25	RN-6	s=7	14h	+26	ETS_US-6	s=7	15h
+28	PII-7	s=8	16h	+29	RN-7	s=8	17h	+30	ETS_US-7	s=8	18h
+32	PII-8	s=9	19h	+33	RN-8	s=9	1Ah	+34	ETS_US-8	s=9	1Bh
+36	PII-9	s=10	1Ch	+37	RN-9	s=10	1Dh	+38	ETS_US-9	s=10	1Eh
+40	PII-10	s=11	1Fh	+41	RN-10	s=11	20h	+42	ETS_US-10	s=11	21h
+44	PII-11	s=12	22h	+45	RN-11	s=12	23h	+46	ETS_US-11	s=12	24h
+48	PII-12	s=13	25h	+49	RN-12	s=13	26h	+50	ETS_US-12	s=13	27h
+52	PII-13	s=14	28h	+53	RN-13	s=14	29h	+54	ETS_US-13	s=14	2Ah

3.1.1 Technical data

Order no.	EPM-S208
Type	EPM-S208 – digital input
Module ID	0F03 47C2
Current consumption/power loss	
Current consumption from backplane bus	100 mA
Power loss	0.95 W
Technical data digital inputs	
Number of inputs	4
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	15 mA
Rated value	DC 20.4...28.8 V
Input voltage for signal "0"	DC 0...5 V
Input voltage for signal "1"	DC 15...28.8 V
Input voltage hysteresis	-
Signal logic input	Sinking input
Frequency range	-
Input resistance	-
Input capacitance	-
Input current for signal "1"	3 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	0.5 mA
Input delay of "0" to "1"	Parametersizable 2µs - 3ms
Input delay of "1" to "0"	Parametersizable 2µs - 3ms
Number of simultaneously utilizable inputs horizontal configuration	4

Order no.	EPM-S208
Number of simultaneously utilizable inputs vertical configuration	4
Input characteristic curve	IEC 61131-2, type 1
Initial data size	60 Byte
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Safety	
Safety protocol	-
Safety requirements	-
Secure user address	-
Watchdog	-
Two channels	-
Test pulse outputs	-
Datasizes	

Order no.	EPM-S208
Input bytes	20 / 60
Output bytes	0
Parameters bytes	12
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	58 g
Weight including accessories	58 g
Gross weight	73 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

3.1.2 Parameter data

The following variants may be configured:

- EPM-S208 DI 4xDC24V (20):
  uses 20byte in the PII for 5 ETS entries
- EPM-S208 DI 4xDC24V (60):
  uses 60byte in the PII for 15 ETS entries

3.1.2.1 Parameters

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
PII_L	1	Length process image input data[1, 2]	14h resp. 3Ch (fix)	3100h	01h
PIQ_L	1	Length process image output data[2]	00h (fix)	3101h	02h
CH0D	1	Input delay DI 0	02h	3102h	03h
CH1D	1	Input delay DI 1	02h	3103h	04h
CH2D	1	Input delay DI 2	02h	3104h	05h
CH3D	1	Input delay DI 3	02h	3105h	06h
TSER	1	Raising edge 0-1 at DI x	00h	3106h	07h
TSEF	1	Falling edge 1-0 at DI x	00h	3107h	08h

PII_L

Byte	Bit 7 ... 0
0	The length of the process image of the input data is fix set to the configured variant (14h or 3Ch).

PIQ_L

Byte	Bit 7 ... 0
0	The length of the process image of the output data is fix set to 0 byte.

CHxD DI x

Byte	Description	Possible values	
0	Input delay DI x	00h: 1µs 02h: 3µs 04h: 10µs	07h: 86µs 09h: 342µs 0Ch: 2731µs
		Other values are not permissible!	

With the help of filters you may e.g. filter signal peaks at a blurred input signal.

Edge select

Here the ETS function for DI 0 ... DI 3 may be activated. With these 2 bytes you may define the type of edge of the input signal, to which the current µs timer value is stored in the process image together with the state of the inputs.

TSER edge 0-1 DI x

Byte	Bit 7 ... 0
0	Bit 0: ETS record at edge 0-1 (rising edge) DI 0 Bit 1: ETS record at edge 0-1 (rising edge) DI 1 Bit 2: ETS record at edge 0-1 (rising edge) DI 2 Bit 3: ETS record at edge 0-1 (rising edge) DI 3 (0: disable, 1: enable) Bit 7 ... 4: reserved

TSEF edge 1-0 DI x

Byte	Bit 7 ... 0
0	Bit 0: ETS record at edge 1-0 (falling edge) DI 0 Bit 1: ETS record at edge 1-0 (falling edge) DI 1 Bit 2: ETS record at edge 1-0 (falling edge) DI 2 Bit 3: ETS record at edge 1-0 (falling edge) DI 3 (0: disable, 1: enable) Bit 7 ... 4: reserved

3.1.2.2 Example of the principle of operation

In the following it is demonstrated by an example, in which order the ETS entries are stored.

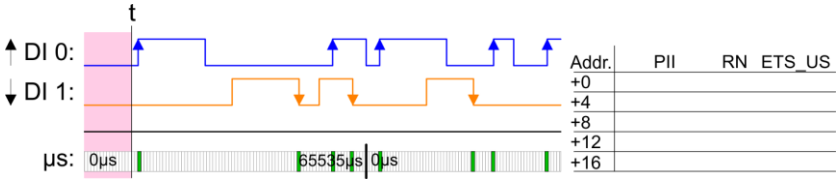
In this example a module is configured, which occupies 20byte for 5 ETS entries.

The following edges for the input channels are preset.

- DI 0: Edge 0-1: ↑
- DI 1: Edge 1-0: ↓
- DI 2 and DI 3 are 0 constant

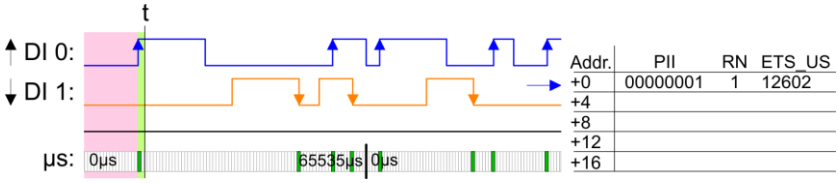
Process image is empty

New ETS entries are always registered starting from address +0. Thereby already existing ETS entries are shifted 4 byte each.



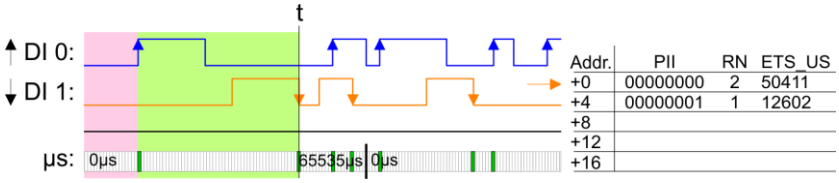
1. ETS entry

Released by an edge 0-1 from DI 0 the 1. ETS entry is registered starting from address +0.



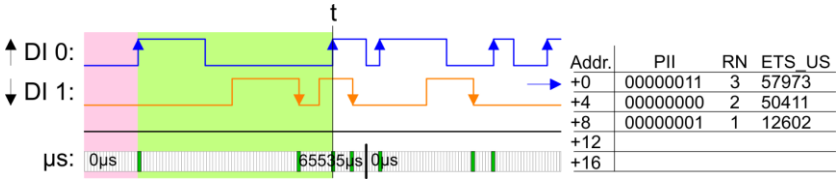
2. ETS entry

Released by an edge 1-0 from DI 1 the 2. ETS entry is registered starting from address +0 and the 1. ETS entry is shifted 4 byte.



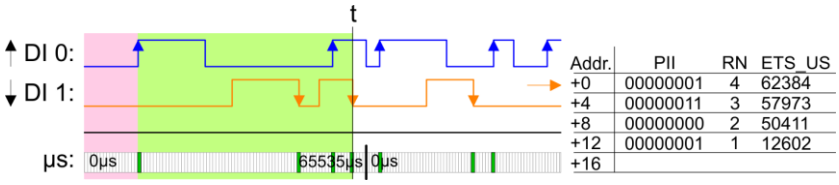
3. ETS entry

Released by an edge 0-1 from DI 0 the 3. ETS entry is registered starting from address +0 and already existing ETS entries are shifted 4 byte each.



4. ETS entry

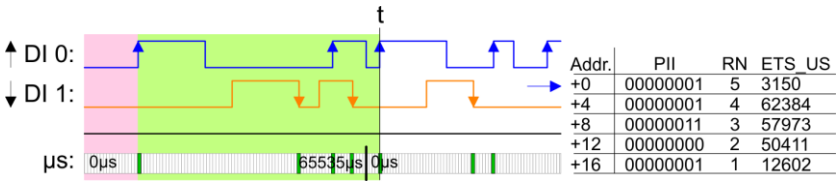
Released by an edge 1-0 from DI 1 the 4. ETS entry is registered starting from address +0 and already existing ETS entries are shifted 4 byte each.



Addr.	PII	RN	ETS_US
+0	00000001	4	62384
+4	00000011	3	57973
+8	00000000	2	50411
+12	00000001	1	12602
+16			

5. ETS entry

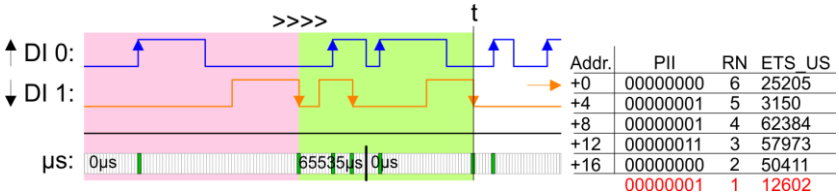
Released by an edge 0-1 from DI 0 the 5. ETS entry is registered starting from address +0 and already existing ETS entries are shifted 4 byte each. The maximum number of ETS entries is reached.



Addr.	PII	RN	ETS_US
+0	00000001	5	3150
+4	00000001	4	62384
+8	00000011	3	57973
+12	00000000	2	50411
+16	00000001	1	12602

6. ETS entry

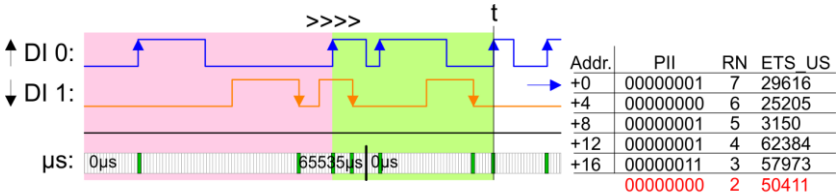
Released by an edge 1-0 from DI 1 the 6. ETS entry is registered starting from address +0 and already existing ETS entries are shifted 4 byte each. Thereby the 1. ETS entry is deleted and is not available any longer.



Addr.	PII	RN	ETS_US
+0	00000000	6	25205
+4	00000001	5	3150
+8	00000001	4	62384
+12	00000011	3	57973
+16	00000000	2	50411
	00000001	1	12602

7. ETS entry

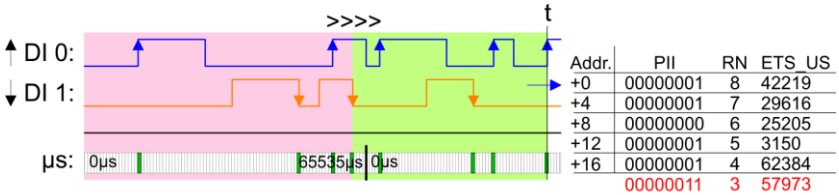
Released by an edge 0-1 from DI 0 the 7. ETS entry is registered starting from address +0 and already existing ETS entries are shifted 4 byte each. Thereby the 2. ETS entry is deleted and is not available any longer.



Addr.	PII	RN	ETS_US
+0	00000001	7	29616
+4	00000000	6	25205
+8	00000001	5	3150
+12	00000001	4	62384
+16	00000011	3	57973
	00000000	2	50411
	00000001	1	12602

8. ETS entry

Released by an edge 0-1 from DI 0 the 8. ETS entry is registered starting from address +0 and already existing ETS entries are shifted 4 byte each. Thereby the 3. ETS entry is deleted and is not available any longer.



Addr.	PII	RN	ETS_US
+0	00000001	8	42219
+4	00000001	7	29616
+8	00000000	6	25205
+12	00000001	5	3150
+16	00000001	4	62384
	00000011	3	57973
	00000000	2	50411
	00000001	1	12602

Please consider the ETS modules can only effectively be used together with head modules, which have an integrated µs ticker.

3.1.3 Diagnostic data

So the So this module does not support interrupt functions, the diagnostic data serve the information about this module.

IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX - Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
ERR_A	1	reserved	00h	2F01h	03h
MODTYP	1	Module information	1Fh		04h
ERR_C	1	reserved	00h		05h
ERR_D	1	reserved	00h		06h
CHTYP	1	Channel type	70h		07h
NUMBIT	1	Number of diagnostics bits per channel	00h		08h
NUMCH	1	Number channels of the module	04h		09h
CHERR	1	reserved	00h		0Ah ... 11h
CH0ERR… CH7ERR	8	reserved	00h		13h
DIAG_US	4	µs ticker (32bit)	00h		02h

MODTYP Module information

Byte	Bit 7 ... 0
0	Bit 3 ... 0: Module class 1111b Digital module Bit 4: Channel information present Bit 7 ... 5: reserved

CHTYP Channel type

Byte	Bit 7 ... 0
0	Bit 6 ... 0: Channel type 70h: Digital input Bit 7: 0 (fix)

NUMBIT Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostics bits of the module per channel (here 00h)

NUMCH channels

Byte	Bit 7 ... 0
0	Number of channels of the module (here 04h)

DIAG_US µs ticker

Byte	Bit 7 ... 0
0 ... 3	Value of the µs ticker at the moment of the diagnostic data generation

ERR_A/C/D CHERR, CHxERR reserved

Byte	Bit 7 ... 0
0	reserved

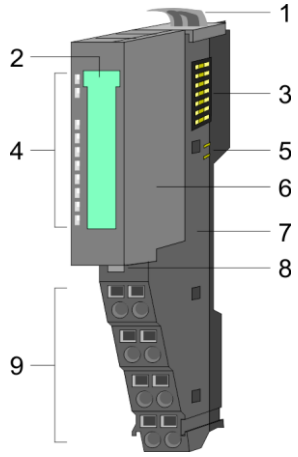
3.2 EPM-S209 - DI 8xDC 24V 0,5ms

Properties

The electronic module collects the binary control signals from the process level and transmits them isolated to the central bus system. It has 8 channels and their status is monitored via LEDs.

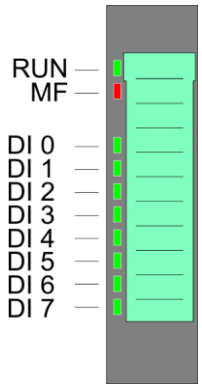
- 8 digital inputs, isolated to the backplane bus
- Suited for switches and approximate switches
- Status indication of the channels via LEDs also with de-activated electronic power supply

Structure



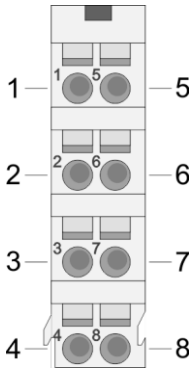
1	Locking lever terminal module
2	Labeling strip
3	Backplane bus
4	LED status indication
5	DC 24V power section supply
6	Electronic module
7	Terminal module
8	Locking lever electronic module
9	Terminal

Status indication

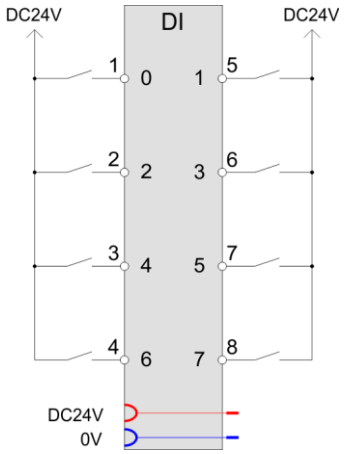


RUN green	MF red	DI x green	Description
■	□	X	Bus communication is OK Module status is OK
■	■	X	Bus communication is OK Module status reports an error
□	■	X	Bus communication is not possible Module status reports an error
□	□	X	Error at bus power supply
X	◪ 2Hz	X	Flashing: Error in configuration
■	□	■	Digital input has signal "1"
■	□	□	Digital input has signal "0"
not relevant: X			

Pin assignment



For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	DI 0	I	Digital input DI 0
2	DI 2	I	Digital input DI 2
3	DI 4	I	Digital input DI 4
4	DI 6	I	Digital input DI 6
5	DI 1	I	Digital input DI 1
6	DI 3	I	Digital input DI 3
7	DI 5	I	Digital input DI 5
8	DI 7	I	Digital input DI 7

I: Input

Input area

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	PII	1	State of the inputs	6000h	
			Bit 0: DI 0		01h
			Bit 1: DI 1		02h
			Bit 2: DI 2		03h
			Bit 3: DI 3		04h
			Bit 4: DI 4		05h
			Bit 5: DI 5		06h
			Bit 6: DI 6		07h
			Bit 7: DI 7		08h

Output area

No byte of the output area is used by the module.

3.2.1 Technical data

Order no.	EPM-S209
Type	EPM-S209 – digital input
Module ID	0013 9FC1
Current consumption/power loss	
Current consumption from backplane bus	35 mA
Power loss	0.9 W
Technical data digital inputs	
Number of inputs	8
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	-
Current consumption from load voltage L+ (without load)	-
Rated value	DC 20.4...28.8 V
Input voltage for signal "0"	DC 0...5 V
Input voltage for signal "1"	DC 15...28.8 V
Input voltage hysteresis	-
Signal logic input	Sinking input
Frequency range	-
Input resistance	-
Input capacitance	-
Input current for signal "1"	3 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	0.5 mA
Input delay of "0" to "1"	max. 500 µs
Input delay of "1" to "0"	max. 500 µs
Number of simultaneously utilizable inputs horizontal configuration	8

Order no.	EPM-S209
Number of simultaneously utilizable inputs vertical configuration	8
Input characteristic curve	IEC 61131-2, type 1
Initial data size	8 Bit
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	none
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Safety	
Safety protocol	-
Safety requirements	-
Secure user address	-
Watchdog	-
Two channels	-
Test pulse outputs	-
Datasizes	

Order no.	EPM-S209
Input bytes	1
Output bytes	0
Parameter bytes	0
Diagnostic bytes	0
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	57 g
Weight including accessories	57 g
Gross weight	71 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

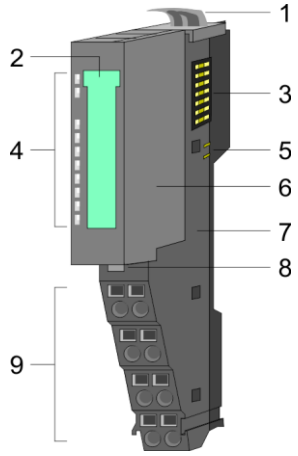
3.3 EPM-S210 - DI 8xDC 24V Diagnosis

Properties

The electronic module with diagnosis collects the binary control signals from the process level and transmits them isolated to the central bus system. It has 8 digital input channels (with parameterizable input delay) and their status is monitored via LEDs.

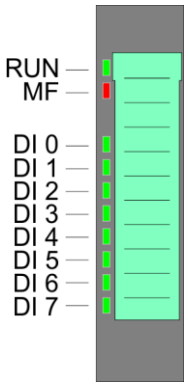
- 8 digital inputs, isolated to the backplane bus
- Suited for switches and approximate switches
- Monitoring wire break
- Parameterizable input delay
- Diagnostics function
- Status indication of the channels via LEDs also with de-activated electronic power supply

Structure



1	Locking lever terminal module
2	Labeling strip
3	Backplane bus
4	LED status indication
5	DC 24V power section supply
6	Electronic module
7	Terminal module
8	Locking lever electronic module
9	Terminal

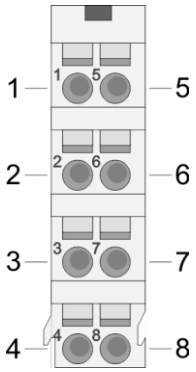
Status indication



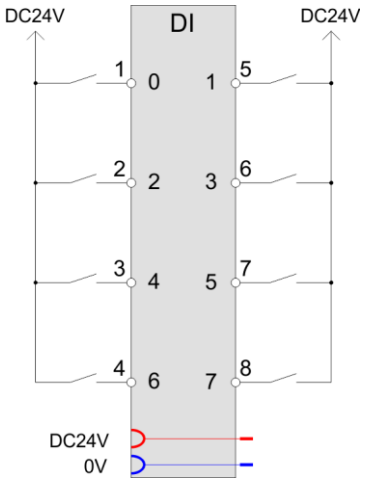
RUN green	MF red	DI x green	Description
■	□	X	Bus communication is OK Module status is OK
■	■	X	Bus communication is OK Module status reports an error
□	■	X	Bus communication is not possible Module status reports an error
□	□	X	Error at bus power supply
X	◪ 2Hz	X	Flashing: Error in configuration
■	□	■	Digital input has signal "1"
■	□	□	Digital input has signal "0"

not relevant: X

Pin assignment



For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	DI 0	I	Digital input DI 0
2	DI 2	I	Digital input DI 2
3	DI 4	I	Digital input DI 4
4	DI 6	I	Digital input DI 6
5	DI 1	I	Digital input DI 1
6	DI 3	I	Digital input DI 3
7	DI 5	I	Digital input DI 5
8	DI 7	I	Digital input DI 7

I: Input

To use wire break detection, there must be a minimum current of 0.5mA with signal state "0". This can be achieved by parallel connecting a resistor (22kΩ ... 47kΩ) on your switch.

Input area

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	PII	1	State of the inputs	6000h	
			Bit 0: DI 0		01h
			Bit 1: DI 1		02h
			Bit 2: DI 2		03h
			Bit 3: Di 3		04h
			Bit 4: DI 4		05h
			Bit 5: DI 5		06h
			Bit 6: DI 6		07h
			Bit 7: DI 7		08h

Output area

No byte of the output area is used by the module.

3.3.1 Technical data

Order no.	EPM-S210
Type	EPM-S210 – digital input
Module ID	0012 1F41
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Power loss	1.1 W
Technical data digital inputs	
Number of inputs	8
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	-
Current consumption from load voltage L+ (without load)	-
Rated value	DC 20.4...28.8 V
Input voltage for signal "0"	DC 0...5 V
Input voltage for signal "1"	DC 10,8...28,8 V
Input voltage hysteresis	-
Signal logic input	Sinking input
Frequency range	-
Input resistance	-
Input capacitance	-
Input current for signal "1"	3 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	1.5 mA
Input delay of "0" to "1"	parameterizable 100µs - 20ms
Input delay of "1" to "0"	parameterizable 100µs - 20ms
Number of simultaneously utilizable inputs horizontal configuration	8

Order no.	EPM-S210
Number of simultaneously utilizable inputs vertical configuration	8
Input characteristic curve	IEC 61131-2, type 3
Initial data size	8 Bit
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	yes
Process alarm	no
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
Safety	
Safety protocol	-
Safety requirements	-
Secure user address	-
Watchdog	-
Two channels	-
Test pulse outputs	-
Datasizes	

Order no.	EPM-S210
Input bytes	1
Output bytes	0
Parameter bytes	12
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	57 g
Weight including accessories	57 g
Gross weight	71 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

3.3.2 Parameter data

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
DIAG_EN	1	Diagnostic interrupt[1]	00h	3100h	01h
WIBRK_EN	1	Wire break recognition[1]	00h	3101h	02h
C0_OptionNo	1	Filter time DI 0, DI 1	11h	3102h	03h
C1_OptionNo	1	Filter time DI 2, DI 3	11h	3103h	04h
C2_OptionNo	1	Filter time DI 4, DI 5	11h	3104h	05h
C3_OptionNo	1	Filter time DI 6, DI 7	11h	3105h	06h

1) This record set may only be transferred at STOP state.

DIAG_EN Diagnostic interrupt

Byte	Bit 7 ... 0
0	• Diagnostic interrupt: – 00h: disable – 40h: enable

- Here you activate res. de-activate the diagnostic function.

WIBRK_EN Wire break recognition

Byte	Bit 7 ... 0
0	• Bit 0: Wire break recognition DI 0 (1: on) • Bit 1: Wire break recognition DI 1 (1: on) • ... • Bit 7: Wire break recognition DI 7 (1: on)

- Here you activate res. de-activate the Wire break recognition.

Cx_OptionNo Filter time

Byte	Function	Possible values
0	• Bit 3 ... 0: Filter time DI x • Bit 7 ... 4: Filter time DI x+1	1h: 100µs 2h: 400µs 3h: 800µs 4h: 1.6ms 5h: 3.2ms 6h: 10ms 7h: 20ms Other values are not permissible!

- Filter time allows you to preset a input delay for the corresponding channel x. With the help of filters you may e.g. filter signal peaks at a blurred input signal.

3.3.3 Diagnostic data

The following errors are listed in the diagnostics data:

- Error project engineering/parameterization
- Wire break (if parameterized)
- Internal communication error
- Internal diagnostics buffer overflow
- External power supply error

IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX - Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
ERR_A	1	Diagnostic	00h	2F01h	02h
MODTYP	1	Module information	1Fh		03h
ERR_C	1	reserved	00h		04h
ERR_D	1	Diagnostic	00h		05h
CHTYP	1	Channel type	70h		06h
NUMBIT	1	Number of diagnostics bits per channel	08h		07h
NUMCH	1	Number channels of the module	08h		08h
CHERR	1	Channel error	00h		09h
CH0ERR	1	Channel specific error DI 1	00h		0Ah
CH1ERR	1	Channel specific error DI 2	00h		0Bh
…		…			…
CH7ERR	1	Channel specific error DI 7	00h		11h
DIAG_US	4	µs ticker (32bit)	00h		13h

ERR_A Diagnostic

Byte	Bit 7 ... 0
0	• Bit 0: set at module failure • Bit 1: set at internal error • Bit 2: set at external error • Bit 3: set at channel error • Bit 4: set at external auxiliary supply missing • Bit 6, 5: reserved • Bit 7: set at error in parameterization

MODTYP Module information

Byte	Bit 7 ... 0
0	• Bit 3 ... 0: Module class – 1111b: Digital module • Bit 4: Channel information present • Bit 7 ... 5: reserved

ERR_C reserved

Byte	Bit 7 ... 0
0	reserved

ERR_D Diagnostic

Byte	Bit 7 ... 0
0	• Bit 2 ... 0: reserved • Bit 3: set at internal diagnostics buffer overflow • Bit 4: set at internal communication error • Bit 7 ... 5: reserved

CHTYP Channel type

Byte	Bit 7 ... 0
0	• Bit 6 ... 0: Channel type – 70h: Digital input • Bit 7: reserved

NUMBIT Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostics bits of the module per channel (here 08h)

NUMCH Channels

Byte	Bit 7 ... 0
0	Number of channels of the module (here 08h)

CHERR DI x

Byte	Bit 7 ... 0
0	• Bit 0: Channel error DI 0 • Bit 1: Channel error DI 1 • ... • Bit 7: Channel error DI 7

CHxERR

Byte	Bit 7 ... 0
0	Channel-specific error: DI x: • Bit 0: set at error in project engineering/parameterization • Bit 3 ... 1: reserved • Bit 4: set at wire break • Bit 7 ... 5: reserved

DIAG_US µs ticker

Byte	Bit 7 ... 0
0 ... 3	Value of the µs ticker at the moment of the diagnostic

µs ticker

In the I/O-1000 module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

4 Digital output modules

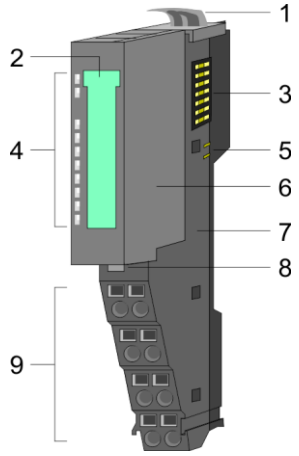
4.1 EPM-S311 - DO 4xDC 24V 0,5A ETS

Properties

The electronic module accepts binary control signals from the central bus system and transfers them time-controlled by means of ETS functionality to the process level via outputs. It has 4 channels and their status is monitored via LEDs. With configured ETS functionality (ETS = **e**dge **t**ime **s**tamp) depending on the configuration 5 (20byte) respectively 15 (60byte), you may transfer the states for the outputs together with a time value of the µs ticker as an ETS entry to the FIFO stack. The FIFO memory serves for space for max. 31 ETS entries.

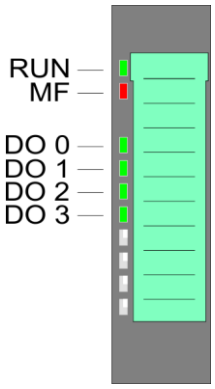
- 4 digital outputs, isolated to the backplane bus
- FIFO stack for 5 respectively 15 ETS entries (each 4byte)
- Diagnostics function
- Controlling by process image respectively handling blocks
- Status indication of the channels via LEDs

Structure



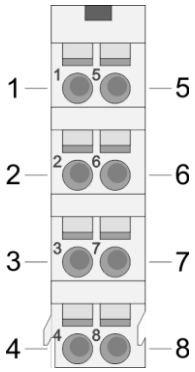
1	Locking lever terminal module
2	Labeling strip
3	Backplane bus
4	LED status indication
5	DC 24V power section supply
6	Electronic module
7	Terminal module
8	Locking lever electronic module
9	Terminal

Status indication

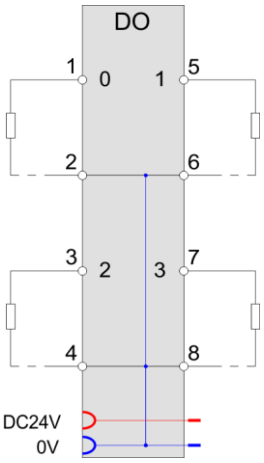


RUN green	MF red	DO x green	Description
■	□	X	Bus communication is OK Module status is OK
■	■	X	Bus communication is OK Module status reports an error with overload, short circuit or overheat
□	■	X	Bus communication is not possible Module status reports an error with overload, short circuit or overheat
□	□	X	Error at bus power supply
X	◪ 2Hz	X	Flashing: Error in configuration
■	□	■	Digital output has "1" signal
■	□	□	Digital output has "0" signal
not relevant: X			

Pin assignment



For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	DO 0	O	Digital output DO 0
2	0V	O	GND for actuator DO 0
3	DO 2	O	Digital output DO 2
4	0V	O	GND for actuator DO 2
5	DO 1	O	Digital output DO 1
6	0V	O	GND for actuator DO 1
7	DO 3	O	Digital output DO 3
8	0V	O	GND for actuator DO 3

O: Output

CAUTION!
Feeding in voltage at an output is not allowed and can destroy the module!

In-/Output area

With configured ETS functionality (ETS=**e**dge **t**ime **s**tamp) a time value (ETS_US) together with the state of the outputs (PIQ) and a running number (RN) may be stored as ETS entry in the process image.

You may configure the following variants:

- EPM-S311 DO 4xDC 24V (20): FIFO with 20byte for 5 ETS entries
- EPM-S311 DO 4xDC 24V (60): FIFO with 60byte for 15 ETS entries

Please consider, with a full FIFO stack no further ETS entries may be accepted.

To ensure that your ETS entries are kept, you should always check the state of the FIFO stack by STS_FIFO in the input area before.

Input area 4byte

IX - IX = Index for access via CANopen.

SX - Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	RN_LAST	1	Bit 5 ... 0: RN last FIFO entry Bit 6: 1 (fix) Bit 7: 0 (fix)	5440h	01h
+1	RN_NEXT	1	Bit 5 ... 0: RN next FIFO entry to be processed Bit 6: 1 (fix) Bit 7: 1 (fix)		02h
+2	STS_FIFO	1	State of the FIFO stack		03h
+3	NUM_ETS	1	Number of ETS entries in the FIFO stack		04h

RN_LAST

Bit 5 ... 0: Here the RN of the last ETS entry may be found, which was recognized as valid and written into the FIFO memory of the module.

Bit 6: 1 (fix) - serves for the identification in the process image

Bit 7: 0 (fix) - serves for the identification in the process image

RN_NEXT

Bit 5 ... 0: Here the RN of the ETS entry may be found, which will be executed next in the FIFO memory of the module.

Please consider Bit 6 and 7 of RN_NEXT are always set.

Bit 6: 1 (fix) - serves for the identification in the process image

Bit 7: 1 (fix) - serves for the identification in the process image

STS_FIFO

The State informs about the state of the FIFO stack:

STS_FIFO	Description
00h/80h	Everything is OK. You will get this message directly after the storage in the FIFO memory of the module.
01h/81h	There is no following ETS entry in the FIFO. The RN does not correspond to the expected RN. Please check your RN in the output area.
02h/82h	There are no new ETS entries in the FIFO.
03h/83h	FIFO stack is full. There is no more place for further ETS entries.

If there are less ETS entries written as possible, additionally bit 6 of the last RN must be set. This is necessary; otherwise you have to overwrite the following entries with a "not valid" entry. The module ignores entries after an entry with a set bit 6. If there is an ETS entry in the FIFO memory, whose bit 6 is set, STS_FIFO is always returned ored with 80h.

NUM_ETS

Here always the current number of the ETS entries in the FIFO memory of the module may be found.

Structure of an ETS entry

Depending on the configuration up to 15 ETS entries may be written via the output area. Each ETS entry uses 4byte in the process image:

Output area 20byte respectively 60byte

IX - Index for access via CANopen. With s = Subindex the corresponding ETS entry is addressed.

SX - Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	PIQ	1	Output byte	5640h/s	01h
+1	RN	1	Running number		02h
+2	ETS_US	2	µs ticker		03h

PIQ

Here the state of the outputs for the corresponding time may be defined and the output channels may be enabled respectively disabled. The output byte has the following bit allocation:

Bit 3 ... 0: 0 (fix)

Bit 4: State DO 3

Bit 5: State DO 2

Bit 6: State DO 1

Bit 7: State DO 0

RN

RN (**R**unning **N**umber) is a continuous number 0 ... 63, which has to start with 1. With the RN the chronological order of the ETS entries may be defined. With each ETS entry RN is to be incremented, otherwise the ETS entry may not be recognized by the module.



If there are less ETS entries written as possible, additionally bit 6 of the last RN must be set. This is necessary; otherwise you have to overwrite the following entries with a "not valid" entry. The module ignores entries after an entry with a set bit 6.

ETS_US

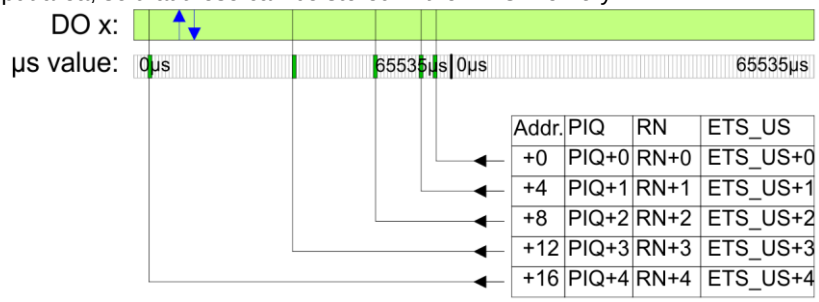
In the I/O-1000 module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting. After 2^{32}-1µs the timer starts with 0 again. For ETS_US of an ETS entry you have to define a time value from the low word of the µs ticker (0...65535µs).

Here please enter a time value in µs, to which the state of the outputs is to be taken.

Range of values: 0 ... 65535

ETS functionality

The following picture shows how the ETS entries are to be preset in the output area, so that these can be stored in the FIFO memory.



Output area 20byte respectively 60byte

IX - Index for access via CANopen. With s = Subindex the corresponding ETS entry is addressed.

SX - Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Configured as EPM-S311

DO 4xDC 24V (20)

20byte - 5 ETS entries

Adr.	PIQ	IX=5640h	SX	Adr.	RN	IX=5640h	SX	Adr.	ETS-US	IX=5640h	SX
+0	PIQ+0	s=1	01h	+1	RN+0	s=1	02h	+2	ETS_US+0	s=1	03h
+4	PIQ+1	s=2	04h	+5	RN+1	s=2	05h	+6	ETS_US+1	s=2	06h
+8	PIQ+2	s=3	07h	+9	RN+2	s=3	08h	+10	ETS_US+2	s=3	09h
+12	PIQ+3	s=4	0Ah	+13	RN+3	s=4	0Bh	+14	ETS_US+3	s=4	0Ch
+16	PIQ+4	s=5	0Dh	+17	RN+4	s=5	0Eh	+18	ETS_US+4	s=5	0Fh

Configured as EPM-S311 DO 4xDC 24V (60)
60byte - 15 ETS entries

Adr.	PIQ	IX=5640h	SX	Adr.	RN	IX=5640h	SX	Adr.	ETS-US	IX=5640h	SX
+0	PIQ+0	s=1	01h	+1	RN+0	s=1	02h	+2	ETS_US+0	s=1	03h
+4	PIQ+1	s=2	04h	+5	RN+1	s=2	05h	+6	ETS_US+1	s=2	06h
+8	PIQ+2	s=3	07h	+9	RN+2	s=3	08h	+10	ETS_US+2	s=3	09h
+12	PIQ+3	s=4	0Ah	+13	RN+3	s=4	0Bh	+14	ETS_US+3	s=4	0Ch
+16	PIQ+4	s=5	0Dh	+17	RN+4	s=5	0Eh	+18	ETS_US+4	s=5	0Fh
+20	PIQ+5	s=6	10h	+21	RN+5	s=6	11h	+22	ETS_US+5	s=6	12h
+24	PIQ+6	s=7	13h	+25	RN+6	s=7	14h	+26	ETS_US+6	s=7	15h
+28	PIQ+7	s=8	16h	+29	RN+7	s=8	17h	+30	ETS_US+7	s=8	18h
+32	PIQ+8	s=9	19h	+33	RN+8	s=9	1Ah	+34	ETS_US+8	s=9	1Bh
+36	PIQ+9	s=10	1Ch	+37	RN+9	s=10	1Dh	+38	ETS_US+9	s=10	1Eh
+40	PIQ+10	s=11	1Fh	+41	RN+10	s=11	20h	+42	ETS_US+10	s=11	21h
+44	PIQ+11	s=12	22h	+45	RN+11	s=12	23h	+46	ETS_US+11	s=12	24h
+48	PIQ+12	s=13	25h	+49	RN+12	s=13	26h	+50	ETS_US+12	s=13	27h
+52	PIQ+13	s=14	28h	+53	RN+13	s=14	29h	+54	ETS_US+13	s=14	2Ah
+56	PIQ+14	s=15	2Bh	+57	RN+14	s=15	2Ch	+58	ETS_US+14	s=15	2Dh

4.1.1 Technical data

Order no.	EPM-S311
Type	EPM-S311 – digital output
Module ID	0F43 57E2
Current consumption/power loss	
Current consumption from backplane bus	105 mA
Power loss	0.95 W
Technical data digital outputs	
Number of outputs	4
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 20.4...28.8 V
Current consumption from load voltage L+ (without load)	25 mA
Total current per group, horizontal configuration, 40°C	2 A
Total current per group, horizontal configuration, 60°C	2 A
Total current per group, vertical configuration	2 A
Output current at signal "1", rated value	0.5 A
Signal logic output	Sourcing output
Output delay of "0" to "1"	max. 100 ns
Output delay of "1" to "0"	max. 100 ns
Minimum load current	-
Lamp load	10 W
Parallel switching of outputs for redundant control of a load	not possible
Parallel switching of outputs for increased power	not possible
Actuation of digital input	✓
Switching frequency with resistive load	max. 40 kHz
Switching frequency with inductive load	max. 40 kHz
Switching frequency on lamp load	max. 40 kHz
Internal limitation of inductive shut-off voltage	L+ (-52 V)
Short-circuit protection of output	yes, electronic, and only highside
Trigger level	2.5 A

Order no.	EPM-S311
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	60 Byte
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	possible
Supply voltage display	green LED
Group error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
PWM data	
PWM channels	-
PWM time basis	-
Period length	-
Minimum pulse width	-
Type of output	-
Safety	
Safety protocol	-
Safety requirements	-
Secure user address	-
Watchdog	-
Two channels	-

Order no.	EPM-S311
Test pulse length	-
Circuit monitoring	-
Datasizes	
Input bytes	4
Output bytes	20 / 60
Parameter bytes	6
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	61 g
Weight including accessories	61 g
Gross weight	76 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

4.1.2 Parameter data

4.1.2.1 Parameters

The module has the following parameter data, which were fix set and may not be altered

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
PII_L	1	Length process image input data[1]	04h (fix)	3100h	01h
PIQ_L	1	Length process image output data[1, 2]	14h resp. 3Ch (fix)	3101h	02h

1) This record set may only be transferred at STOP state.

2) This parameter depends on the configured variant.

PII_L

Byte	Bit 7 ... 0
0	The length of the process image of the input data is fix set to 4byte.

PIQ_L

Byte	Bit 7 ... 0
0	The length of the process image of the output data is fix set to the configured variant (14h or 3Ch).

4.1.2.2 Example for the principle of operation

In the following it is demonstrated by an example, in which order the ETS entries are stored and processed.

With this example a module is configured, which uses 20byte for 5 ETS entries in the output area PIQ.

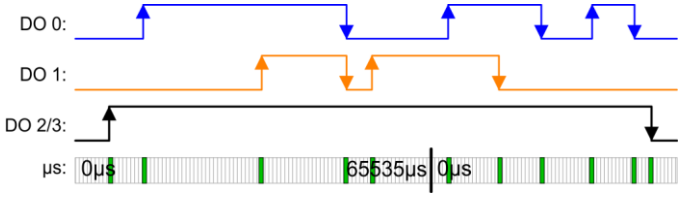
ETS values

With the following times of the µs ticker the following states of the outputs should be taken:

RN	ETS_US in µs	PIQ DO 0 (Bit 7)	PIQ DO 1 (Bit 6)	PIQ DO2 (Bit 5)	PIQ DO 3 (Bit 4)
01h	6000	0	0	1	1
02h	12506	1	0	1	1
03h	34518	1	1	1	1
04h	49526	0	0	1	1
05h	54529	0	1	1	1
06h	3500	1	1	1	1
07h	12443	1	0	1	1
08h	20185	0	0	1	1
09h	30140	1	0	1	1
0Ah	37330	0	0	1	1
0Bh	40000	0	0	0	0

Time diagram

From the table you get the following time diagram:



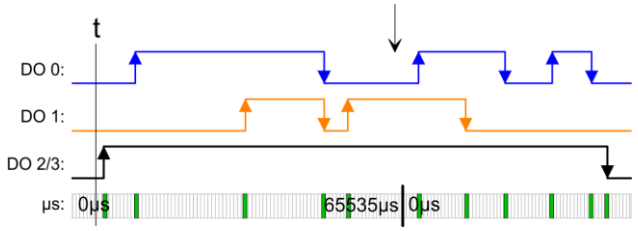
Writing 5 ETS entries

After writing the ETS entries into the process output image they are directly stored in the FIFO memory of the module.

The state of the outputs are shown in the diagram at the time "t".

In the PII you will find the status bytes.

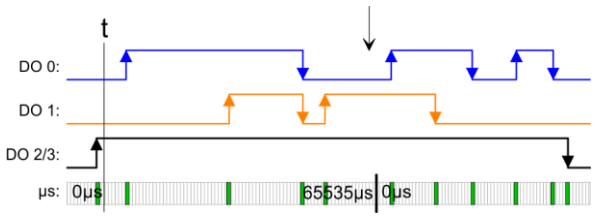
Adr.	PIQ	RN	ETS_US	→	FIFO	PIQ	RN	ETS_US	PII
+0	00110000	01h	6000		1	00110000	01h	6000	RN_LAST: 45h RN_NEXT: C1h STS_FIFO: 00h NUM_ETS: 05h
+4	10110000	02h	12506		2	10110000	02h	12506	
+8	11110000	03h	34518		3	11110000	03h	34518	
+12	00110000	04h	49526		4	00110000	04h	49526	
+16	01110000	05h	54529		5	01110000	05h	54529	
					6	00000000	00h	0	
					7	00000000	00h	0	
					8	00000000	00h	0	
					9	00000000	00h	0	
					...	00000000	00h	0	
					31	00000000	00h	0	



Executing ETS function for RN = 01h

The 1. ETS entry (RN = 01h) is executed and deleted in the FIFO.

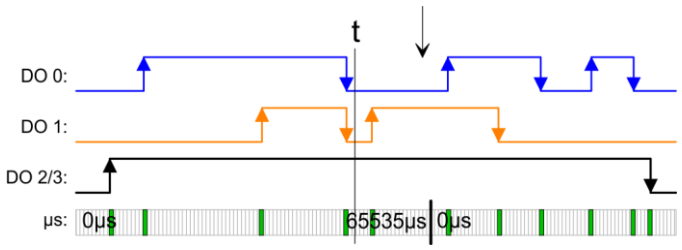
Adr.	PIQ	RN	ETS_US		FIFO	PIQ	RN	ETS_US	PII
+0	00110000	01h	6000	→	1	10110000	02h	12506	RN_LAST: 45h RN_NEXT: C2h STS_FIFO: 00h/02h NUM_ETS: 04h
+4	10110000	02h	12506		2	11110000	03h	34518	
+8	11110000	03h	34518		3	00110000	04h	49526	
+12	00110000	04h	49526		4	01110000	05h	54529	
+16	01110000	05h	54529		5	00000000	00h	0	
					6	00000000	00h	0	
					7	00000000	00h	0	
					8	00000000	00h	0	
					9	00000000	00h	0	
					...	00000000	00h	0	
					31	00000000	00h	0	



Executing ETS function for RN = 02h ... 04h

The states of RN = 02h ... RN 04h are successively issued and deleted in the FIFO.

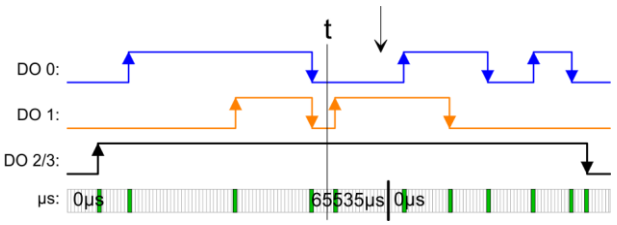
Adr.	PIQ	RN	ETS_US		FIFO	PIQ	RN	ETS_US	PII
+0	00110000	01h	6000	→	1	01110000	05h	54529	RN_LAST: 45h RN_NEXT: C5h STS_FIFO: 00h/02h NUM_ETS: 01h
+4	10110000	02h	12506		2	00000000	00h	0	
+8	11110000	03h	34518		3	00000000	00h	0	
+12	00110000	04h	49526		4	00000000	00h	0	
+16	01110000	05h	54529		5	00000000	00h	0	
					6	00000000	00h	0	
					7	00000000	00h	0	
					8	00000000	00h	0	
					9	00000000	00h	0	
					...	00000000	00h	0	
					31	00000000	00h	0	



Writing 5 ETS entries

After writing the next 5 ETS entries into the process output image they are directly stored in the FIFO memory of the module.

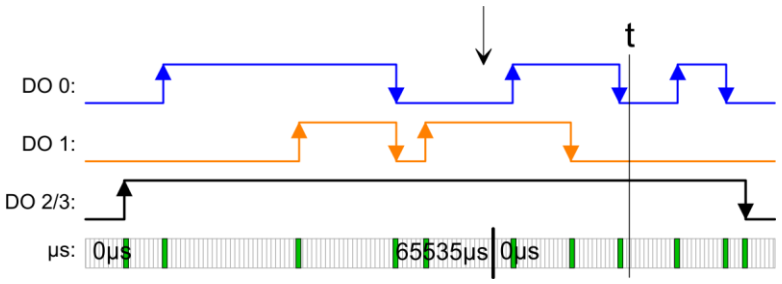
Adr.	PIQ	RN	ETS_US		FIFO	PIQ	RN	ETS_US	PII
+0	11110000	06h	3500	→	1	01110000	05h	54529	RN_LAST: 4Ah RN_NEXT: C5h STS_FIFO: 00h/02h NUM_ETS: 06h
+4	10110000	07h	12443		2	11110000	06h	3500	
+8	00110000	08h	20185		3	10110000	07h	12443	
+12	10110000	09h	30140		4	00110000	08h	20185	
+16	00110000	0Ah	37330		5	10110000	09h	30140	
					6	00110000	0Ah	37330	
					7	00000000	00h	0	
					8	00000000	00h	0	
					9	00000000	00h	0	
					...	00000000	00h	0	
					31	00000000	00h	0	



Executing ETS function for RN = 06h ... 08h

The states of RN = 06h ... RN 08h are successively issued and deleted in the FIFO.

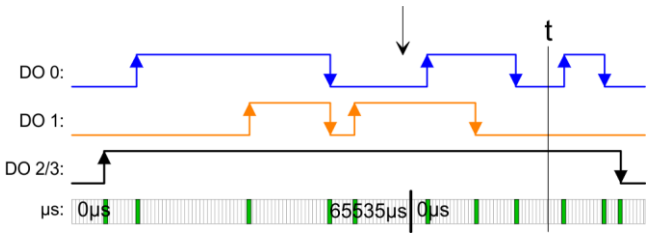
Adr.	PIQ	RN	ETS_US		FIFO	PIQ	RN	ETS_US	PII
+0	11110000	06h	3500	→	1	10110000	09h	30140	RN_LAST: 4Ah RN_NEXT: C5h STS_FIFO: 00h/02h NUM_ETS: 02h
+4	10110000	07h	12443		2	00110000	0Ah	37330	
+8	00110000	08h	20185		3	00000000	00h	0	
+12	10110000	09h	30140		4	00000000	00h	0	
+16	00110000	0Ah	37330		5	00000000	00h	0	
					6	00000000	00h	0	
					7	00000000	00h	0	
					8	00000000	00h	0	
					9	00000000	00h	0	
					...	00000000	00h	0	
					31	00000000	00h	0	



Writing last ETS entry

Since less than 5 ETS entries are written, bit 6 of RN of the last ETS entry must always be set. RN = 0Bh becomes 4Bh.

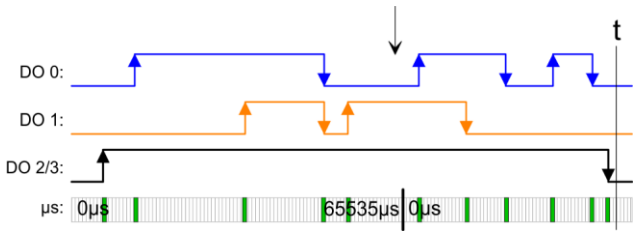
Adr.	PIQ	RN	ETS_US		FIFO	PIQ	RN	ETS_US	PII
+0	00000000	4Bh	40000	→	1	10110000	09h	30140	RN_LAST: 4Bh RN_NEXT: C9h STS_FIFO: 80h/82h NUM_ETS: 03h
+4	10110000	07h	12443		2	00110000	0Ah	37330	
+8	00110000	08h	20185		3	00000000	4Bh	40000	
+12	10110000	09h	30140		4	00000000	00h	0	
+16	00110000	0Ah	37330		5	00000000	00h	0	
					6	00000000	00h	0	
					7	00000000	00h	0	
					8	00000000	00h	0	
					9	00000000	00h	0	
					...	00000000	00h	0	
					31	00000000	00h	0	



Executing ETS function for RN = 09h ... 4Bh

The states of RN = 09h ... RN 4Bh are successively issued and deleted in the FIFO.

Adr.	PIQ	RN	ETS_US		FIFO	PIQ	RN	ETS_US	PII
+0	00000000	4Bh	40000	→	1	00000000	00h	0	RN_LAST: 4Bh RN_NEXT: CCh STS_FIFO: 80h/82h NUM_ETS: 00h
+4	10110000	07h	12443		2	00000000	00h	0	
+8	00110000	08h	20185		3	00000000	00h	0	
+12	10110000	09h	30140		4	00000000	00h	0	
+16	00110000	0Ah	37330		5	00000000	00h	0	
					6	00000000	00h	0	
					7	00000000	00h	0	
					8	00000000	00h	0	
					9	00000000	00h	0	
					...	00000000	00h	0	
					31	00000000	00h	0	



Please consider the ETS modules can only effectively be used together with head modules, which have an integrated µs ticker.

4.1.3 Diagnostic data

This module does not support interrupt functions, the diagnostic data serve the information about this module

IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX - Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
ERR_A	1	reserved	00h	2F01h	02h
MODTYP	1	Module information	1Fh		03h
ERR_C	1	reserved	00h		04h
ERR_D	1	reserved	00h		05h
CHTYP	1	Channel type	72h		06h
NUMBIT	1	Number of diagnostics bits per channel	00h		07h
NUMCH	1	Number channels of the module	04h		08h
CHERR	1	reserved	00h		09h
CH0ERR… CH7ERR	8	reserved	00h		0Ah ... 11h
DIAG_US	4	µs ticker (32bit)	00h		13h

MODTYP Module information

Byte	Bit 7 ... 0
0	Bit 3 ... 0: Module class 1111b Digital module Bit 4: Channel information present Bit 7 ... 5: reserved

CHTYP Channel type

Byte	Bit 7 ... 0
0	Bit 6 ... 0: Channel type 72h: Digital output Bit 7: 0 (fix)

NUMBIT Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostics bits of the module per channel (here 00h)

NUMCH Number of channels

Byte	Bit 7 ... 0
0	Number of channels of the module (here 04h)

DIAG_US µs ticker

Byte	Bit 7 ... 0
0 ... 3	Value of the µs ticker at the moment of the diagnostic data generation

ERR_A/C/D CHERR, CHxERR reserved

Byte	Bit 7 ... 0
0	reserved

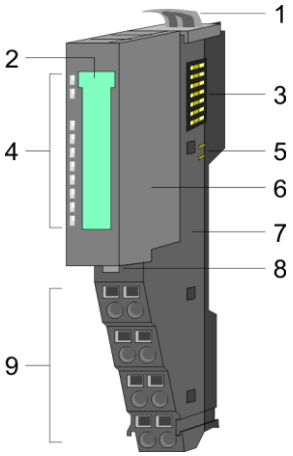
4.2 EPM-S312 - DO 8xDC 24V 0,5A Diagnostic

Properties

The electronic module with diagnosis accepts binary control signals from the central bus system and transfers them to the process level via outputs. It has 8 channels and their status is monitored via LEDs.

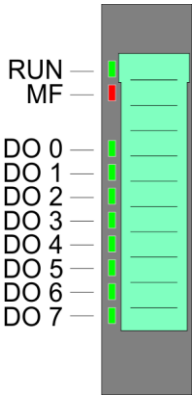
- 8 digital outputs, isolated to the backplane bus
- Monitoring wire-break and short-circuit
- Diagnostics function
- Status indication of the channels via LEDs

Structure



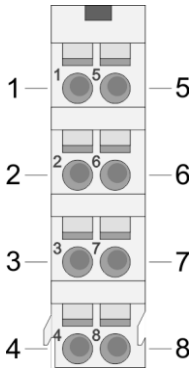
1	Locking lever terminal module
2	Labeling strip
3	Backplane bus
4	LED status indication
5	DC 24V power section supply
6	Electronic module
7	Terminal module
8	Locking lever electronic module
9	Terminal

Status indication

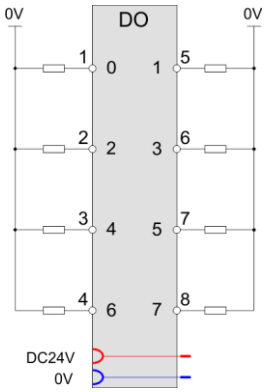


RUN green	MF red	DO x green	Description
■	□	X	Bus communication is OK Module status is OK
■	■	X	Bus communication is OK Module status reports an error with wire-break and short-circuit
□	■	X	Bus communication is not possible Module status reports an error with wire-break and short-circuit
□	□	X	Error at bus power supply
X	◪ 2Hz	X	Flashing: Error in configuration
■	□	■	Digital output has "1" signal
■	□	□	Digital output has "0" signal
not relevant: X			

Pin assignment



For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	DO 0	O	Digital output DO 0
2	DO 2	O	Digital output DO 2
3	DO 4	O	Digital output DO 4
4	DO 6	O	Digital output DO 6
5	DO 1	O	Digital output DO 1
6	DO 3	O	Digital output DO 3
7	DO 5	O	Digital output DO 5
8	DO 7	O	Digital output DO 7

O: Output

CAUTION!
Feeding in voltage at an output is not allowed and can destroy the module!

Input area

No byte of the input area is used by the module.

Output area

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	PIQ	1	State of the outputs	6200h	
			Bit 0: DO 0		01h
			Bit 1: DO 1		02h
			Bit 2: DO 2		03h
			Bit 3: DO 3		04h
			Bit 4: DO 4		05h
			Bit 5: DO 5		06h
			Bit 6: DO 6		07h
			Bit 7: DO 7		08h

4.2.1 Technical data

Order no.	EPM-S312
Type	EPM-S312 – digital output
Module ID	0113 2F48
Current consumption/power loss	
Current consumption from backplane bus	70 mA
Power loss	1 W
Technical data digital outputs	
Number of outputs	8
Cable length, shielded	1000 m
Cable length, unshielded	600 m
Rated load voltage	DC 20.4...28.8 V
Current consumption from load voltage L+ (without load)	11 mA
Total current per group, horizontal configuration, 40°C	4 A
Total current per group, horizontal configuration, 60°C	4 A
Total current per group, vertical configuration	4 A
Output current at signal "1", rated value	0.5 A
Signal logic output	Sourcing output
Output delay of "0" to "1"	max. 350 µs
Output delay of "1" to "0"	max. 350 µs
Minimum load current	-
Lamp load	10 W
Parallel switching of outputs for redundant control of a load	not possible
Parallel switching of outputs for increased power	not possible
Actuation of digital input	✓
Switching frequency with resistive load	max. 1000 Hz
Switching frequency with inductive load	max. 0.5 Hz
Switching frequency on lamp load	max. 10 Hz
Internal limitation of inductive shut-off voltage	L+ (-52 V)
Short-circuit protection of output	yes, electronic
Trigger level	1 A

Order no.	EPM-S312
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	8 Bit
Status information, alarms, diagnostics	
Status display	green LED per channel
Interrupts	yes, parameterizable
Process alarm	no
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	green LED
Group error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Insulation tested with	DC 500 V
PWM data	
PWM channels	-
PWM time basis	-
Period length	-
Minimum pulse width	-
Type of output	-
Safety	
Safety protocol	-
Safety requirements	-
Secure user address	-
Watchdog	-
Two channels	-

Order no.	EPM-S312
Test pulse length	-
Circuit monitoring	-
Datasizes	
Input bytes	0
Output bytes	1
Parameter bytes	7
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	57 g
Weight including accessories	57 g
Gross weight	71 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

4.2.2 Parameter data

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
DIAG_EN	1	Diagnostics[1]	00h	3100h	01h
WIBRK_EN	1	Wire-break recognition[1]	00h	3101h	02h
CH0D_EN	1	Short-circuit recognition[1]	00h	3102h	03h

1) This record set may only be transferred at STOP state.

DIAG_EN Diagnostic interrupt

Byte	Bit 7 ... 0
0	Diagnostic interrupt 00h: disable 40h: enable

- Here you activate res. de-activate the diagnostic function.

WIBRK_EN Wire-break recognition

Byte	Bit 7 ... 0
0	Bit 0: Wire-break recognition channel 0 (1: on) Bit 1: Wire-break recognition channel 1 (1: on) ... Bit 7: Wire-break recognition channel 7 (1: on)

- Here you activate res. de-activate the Wire-break recognition.

CH0D_EN Short-circuit recognition

Byte	Bit 7 ... 0
0	Bit 0: Short-circuit recognition channel 0 (1: on) Bit 1: Short-circuit recognition channel 1 (1: on) ... Bit 7: Short-circuit recognition channel 7 (1: on)

- Here you activate res. de-activate the Short-circuit recognition.

4.2.3 Diagnostic data

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Wire-break
- Short-circuit
- Error external auxiliary supply

IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX - Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
ERR_A	1	Diagnostic	00h	2F01h	02h
MODTYP	1	Module information	1Fh		03h
RES2	1	reserved	00h		04h
ERR_D	1	Diagnostic	00h		05h
CHTYP	1	Channel type	72h		06h
NUMBIT	1	Number diagnostic bits per channel	08h		07h
NUMCH	1	Number of channels of a module	08h		08h
CHERR	1	Channel error	00h		09h
CH0ERR	1	Channel-specific error channel 0	00h		0Ah
CH1ERR	1	Channel-specific error channel 1	00h		0Bh
...	...	...	...		...
CH7ERR	1	Channel-specific error channel 7	00h		11h
DIAG_US	4	µs ticker (32bit)	00h		13h

ERR_A Diagnostic

Byte	Bit 7 ... 0
0	Bit 0: set at module failure Bit 1: set at internal error Bit 2: set at external error Bit 3: set at channel error Bit 4: set at external auxiliary supply missing Bit 5, 6: reserved Bit 7: set at error in parameterization

MODTYP Module information

Byte	Bit 7 ... 0
0	Bit 3 ... 0: module class 1111b: Digital module Bit 4: set at channel information present Bit 7 ... 5: reserved

ERR_D Diagnostic

Byte	Bit 7 ... 0
0	Bit 3 ... 0: reserved Bit 4: set at internal communication error Bit 7 ... 5: reserved

CHTYP Channel type

Byte	Bit 7 ... 0
0	Bit 6 ... 0: channel type 72h: Digital output Bit 7: reserved

NUMBIT Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostic bits per channel (here 08h)

NUMCH Channels

Byte	Bit 7 ... 0
0	Number of channels of a module (here 08h)

CHERR Channel error

Byte	Bit 7 ... 0
0	Bit 0: set at error in channel 0 Bit 1: set at error in channel 1 ... Bit 7: set at error in channel 7

CH0ERR ... CH7ERR Channel specific

Byte	Bit 7 ... 0
0	Channel-specific error channel x: Bit 0: set at configuring- / parameter assignment error Bit 1: reserved Bit 2: short-circuit to +DC 24V Bit 3: short-circuit to M Bit 4: set at wire-break Bit 7 ... 5: reserved

DIAG_US µs ticker

Byte	Bit 7 ... 0
0...3	Value of the µs ticker at the moment of the diagnostic

µs ticker

In the I/O-1000 module there is a timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

5 Analog input modules

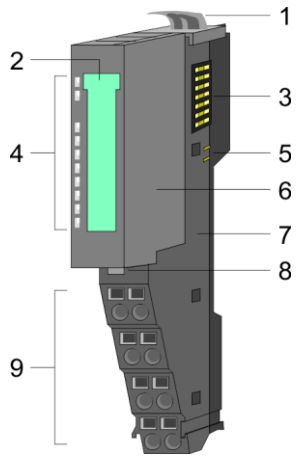
5.1 EPM-S409 - AI 2x12Bit 0(4)...20mA - ISO

Properties

The electronic module has 2 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. The sensor supplies are isolated from each other and via DC/DC converter from the DC 24V power supply.

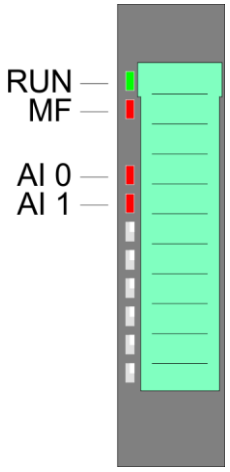
- 2 galvanically separated analog inputs
- Integrated sensor supply for each channel max. 35mA, (short circuit to 39mA)
- Suited for sensors with 0 ... 20mA; 4 ... 20mA
- Interrupt and diagnostics function
- 12bit resolution

Structure



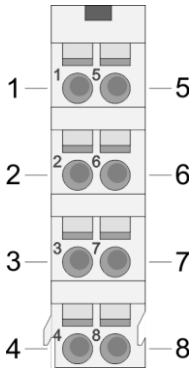
1	Locking lever terminal module
2	Labeling strip
3	Backplane bus
4	LED status indication
5	DC 24V power section supply
6	Electronic module
7	Terminal module
8	Locking lever electronic module
9	Terminal

Status indication

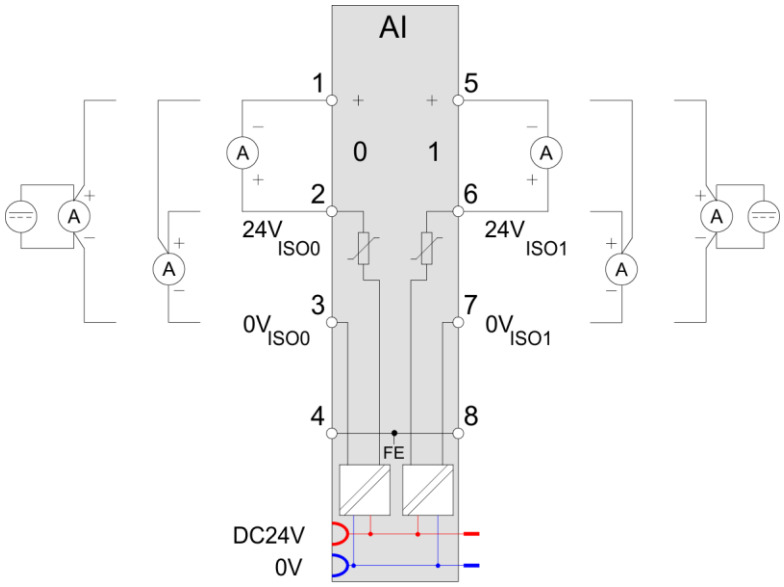


RUN green	MF red	AI x red	Description
		X	Bus communication is OK Module status is OK
		X	Bus communication is OK Module status reports an error
		X	Bus communication is not possible Module status reports an error
		X	Error at bus power supply
X	2Hz	X	Error in configuration
			Error channel x • Signal leaves measuring range • Error in parameterization • Overload/short circuit of the DC 24V_ISO
not relevant: X			

Pin assignment



For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	+AI 0	I	+ Channel 0
2	24V_ISO_0	O	DC 24V encoder supply Channel 0
3	0V_ISO_0	O	Ground channel 0
4	FE	---	Shield
5	AI 1	I	+ Channel 1
6	24V_ISO_1	O	DC 24V encoder supply Channel 1
7	0V_ISO_1	O	Ground Channel 1
8	FE	---	Shield

I: Input, O: Output

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h

Output area

No byte of the output area is used by the module.

5.1.1 Technical data

Order no.	EPM-S409
Type	EPM-S409 – analog input
Module ID	0411 1543
Current consumption/power loss	
Current consumption from backplane bus	50 mA
Power loss	0.7 W
Technical data analog inputs	
Number of inputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	20 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	-
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	-
Current inputs	✓
Max. input resistance (current range)	60 Ω
Input current ranges	+4 mA ... +20 mA 0 mA ... +20 mA
Operational limit of current ranges	+/-0.5%
Operational limit of current ranges with SFU	-
Basic error limit current ranges	+/-0.3%
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	max. 24V
Destruction limit current inputs (electrical current)	max. 40mA
Resistance inputs	-
Resistance ranges	-

Order no.	EPM-S409
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	12
Measurement principle	successive approximation
Basic conversion time	1.15 ms all channels
Noise suppression for frequency	>80dB (UCM<20V)
Status information, alarms, diagnostics	
Status display	yes

Order no.	EPM-S409
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	✓
Between channels of groups to	1
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	DC 75 V/ AC 50 V
Max. potential difference between inputs (Ucm)	DC 75 V/ AC 50 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	DC 75 V/ AC 50 V
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Technical data encoder supply	
Number of outputs	2
Output voltage (typ)	+24 V (-1.5 V)
Output voltage (rated value)	35 mA
Short-circuit protection	yes, electronic
Binding of potential	corresponding analog input
Datasizes	
Input bytes	4
Output bytes	0

Order no.	EPM-S409
Parameter bytes	20
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	65 g
Weight including accessories	65 g
Gross weight	79 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

5.1.2 Parameter data

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
DIAG_EN	1	Diagnostics[1]	00h	3100h	01h
SHORT_EN	1	Monitoring of sensor voltage[1]	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring[1]	00h	3102h	03h
RES	1	reserved	00h	3103h	04h
CH0FN	1	Function number channel 0	31h	3104h	05h
CH0FO	1	Function option channel 0	00h	3105h	06h
CH0UL	2	Upper limit value channel 0	7FFFh	3106h...3107h	07h
CH0LL	2	Lower limit value channel 0	8000h	3108h...3109h	08h
CH1FN	1	Function number channel 1	31h	310Ah	09h
CH1FO	1	Function option channel 1	00h	310Bh	0Ah
CH1UL	2	Upper limit value channel 1	7FFFh	310Ch...310Dh	0Bh
CH1LL	2	Lower limit value channel 1	8000h	310Eh...310Fh	0Ch

1) This record set may only be transferred at STOP state.

DIAG_EN Diagnostic interrupt

Byte	Bit 7 ... 0
0	• Diagnostic interrupt – 00h: disabled – 40h: enabled

- Here you can enable respectively disable the diagnostic interrupt.

SHORT_EN Monitoring sensor voltage

Byte	Bit 7 ... 0
0	• Bit 0: Monitoring of sensor voltage channel 0 (1: on) • Bit 1: Monitoring of sensor voltage channel 1 (1: on) • Bit 7 ... 2: reserved

LIMIT_EN Limit value monitoring

Byte	Bit 7 ... 0
0	• Bit 0: Limit value monitoring channel 0 (1: on) • Bit 1: Limit value monitoring channel 1 (1: on) • Bit 7 ... 2: reserved

CHxFN Function number channel x

In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module. With FFh the corresponding channel is disabled and disabled the respective sensor supply. The formulas listed here allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range (analog value) and vice versa.

0(4) ... 20mA

Meas. range (funct. no.)	Current (I)	Decimal (D)	Hex	Range	Formulas
0 ... 20mA Siemens S7 format (31h)	23.52mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I}{20}$ $I = D \cdot \frac{20}{27648}$
	20mA	27648	6C00h	nominal range	
	10mA	13824	3600h		
	0mA	0	0000h		
	-3.52mA	-4864	ED00h	underrange	
0 ... 20mA Siemens S5 format (41h)	25.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I}{20}$ $I = D \cdot \frac{20}{16384}$
	20mA	16384	4000h	nominal range	
	10mA	8192	2000h		
	0mA	0	0000h		
	-4,00mA	-3277	F333h	underrange	
4 ... 20mA Siemens S7 format (30h)	22.81mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I-4}{16}$ $I = D \cdot \frac{16}{27648} + 4$
	20mA	27648	6C00h	nominal range	
	12mA	13824	3600h		
	4mA	0	0000h		
	1.19mA	-4864	ED00h	underrange	
4 ... 20mA Siemens S5 format (40h)	24.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I-4}{16}$ $I = D \cdot \frac{16}{16384} + 4$
	20mA	16384	4000h	nominal range	
	12mA	8192	2000h		
	4mA	0	0000h		
	0.8mA	-3277	F333h	underrange	

0 ... 20mA / 4KM format

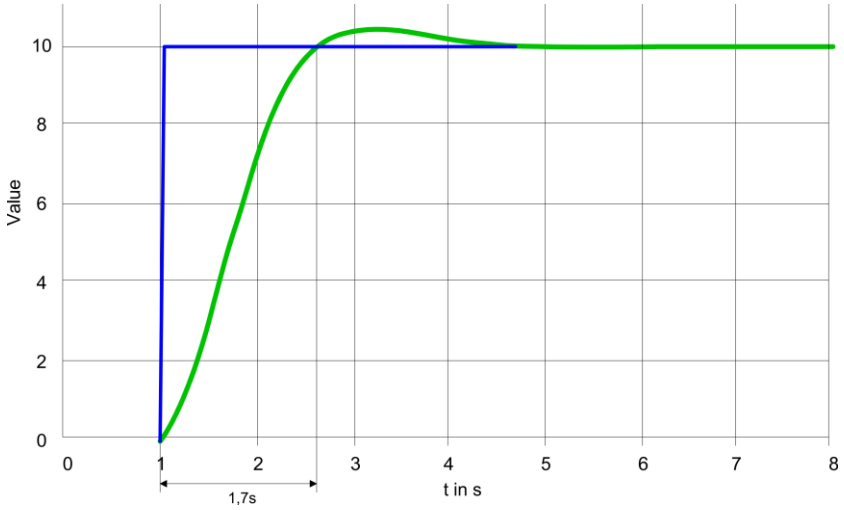
Meas. range (funct. no.)	Current (I)	Decimal (D)	Hex	Range	Formulas
0 ... 20mA 4KM format (3Fh)	20.457mA	4095	0FFFh	overrange	$D = 4000 \cdot \frac{I}{20}$ $I = D \cdot \frac{20}{4000}$
	20mA	4000	0FA0h	nominal range	
	10mA	2000	07D0h		
	0mA	0	0000h		
	---			underrange	

CHxFO Function option channel x

As function option for each channel a time constant x10ms may be preset for a low-pass filter. This is a second-order Butterworth filter. Here frequencies, which lie above the critical frequency, can be filtered. The setting for interference suppression (SFU) of 50Hz respectively 60Hz is 200ms respectively 170ms.

Range of values: 0 ... 250 (0 = deactivated)

The following diagram shows the transient behavior of the filter with a time constant of 500ms. Here the filter reaches the desired value after 1700ms for the first time.



CHxUL CHxLL Upper limit value Lower limit value channel x

For each channel an upper and a lower limit may be defined. Here only values of the nominal range may be preset, otherwise you receive a parameterization error. By presetting 7FFFh for the upper respectively 8000h for the lower limit value the corresponding limit is deactivated. As soon as the measuring value is beyond the limits and the limit value monitoring is activated, a hardware interrupt is initialized.

5.1.3 Diagnostics and interrupt

Event	Hardware interrupt	Diagnostics interrupt	parameterizable
Error in project engineering / parameterization	-	X	-
Measuring range overflow	-	X	-
Measuring range underflow	-	X	-
Limit overflow	X	-	X
Limit underflow	X	-	X
diagnostics buffer overflow	-	X	-
Hardware interrupt lost	-	X	-
Sensor voltage monitoring	-	X	-

Hardware interrupt

So you may react to asynchronous events, there is the possibility to activate a hardware interrupt. A hardware interrupt interrupts the linear program sequence and jumps depending on the master system to a corresponding Interrupt routine. Here you can react to the hardware interrupt accordingly.

With CANopen the hardware interrupt data a transferred via an emergency telegram.

SX - Subindex for access via EtherCAT with Index 5000h

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	SX
PRIT_OL	1	Upper limit overflow channel x	00h	02h
PRIT_UL	1	Lower limit underflow channel x	00h	03h
PRIT_US	2	µs-Ticker	00h	04h (high byte) 05h (low byte)

PRIT_OL upper limit overflow

Byte	Bit 7 ... 0
0	• Bit 0: Upper limit overflow channel 0 • Bit 1: Upper limit overflow channel 1 • Bit 7 ... 2: reserved

PRIT_UL Limit underflow

Byte	Bit 7 ... 0
0	• Bit 0: Lower limit underflow channel 0 • Bit 1: Lower limit underflow channel 1 • Bit 7 ... 2: reserved

PRIT_US µs-Ticker

Byte	Bit 7 ... 0
0...1	16bit µs value at the moment of the interrupt

µs ticker

In the I/O-1000 module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again. PRIT_US represents the lower 2 byte of the µs ticker value (0 ... 2^{16}-1).

Diagnostic data

Via the parametrization you may activate a diagnostic interrupt for the module. With a diagnostics interrupt the module serves for diagnostics data for diagnostic interruptincoming. As soon as the reason for releasing a diagnostic interrupt is no longer present, the diagnostic interruptgoing automatically takes place. All events of a channel between diagnostic interruptincoming and diagnostic interruptgoing are not stored and get lost. Within this time window (1. diagnostic interruptincoming until last diagnostic interruptgoing) the MF-LED of the module is on.

IX	-	Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
SX	-	Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
ERR_A	1	Diagnostic	00h	2F01h	02h
MODTYP	1	Module information	15h		03h
ERR_C	1	reserved	00h		04h
ERR_D	1	Diagnostic	00h		05h
CHTYP	1	Channel type	71h		06h
NUMBIT	1	Number diagnostic bits per channel	08h		07h
NUMCH	1	Number of channels of a module	02h		08h
CHERR	1	Channel error	00h		09h
CH0ERR	1	Channel-specific error channel 0	00h		0Ah
CH1ERR	1	Channel-specific error channel 1	00h		0Bh
CH2ERR… CH7ERR	6	reserved	00h		0Ch ... 11h
DIAG_US	4	µs ticker	00h		13h

ERR_A Diagnostic

Byte	Bit 7 ... 0
0	• Bit 0: set at module failure • Bit 1: set at internal error • Bit 2: set at external error • Bit 3: set at channel error • Bit 4: set at external auxiliary supply missing • Bit 6 ... 5: reserved • Bit 7: set at error in parametrization

MODTYP Module information

Byte	Bit 7 ... 0
0	• Bit 3 ... 0: module class – 0101b analog module • Bit 4: set at channel information present • Bit 7 ... 5: reserved

ERR_D Diagnostic

Byte	Bit 7 ... 0
0	• Bit 2 ... 0: reserved • Bit 3: set at internal diagnostics buffer overflow • Bit 4: set at internal communication error • Bit 5: reserved • Bit 6: set at hardware interrupt lost • Bit 7: reserved

CHTYP Channel type

Byte	Bit 7 ... 0
0	• Bit 6 ... 0: Channel type – 70h: Digital input – 71h: Analog input – 72h: Digital output – 73h: Analog output – 74h: Analog input/-output – 76h: Counter • Bit 7: reserved

NUMBIT Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostic bits per channel (here 08h)

NUMCH Channels

Byte	Bit 7 ... 0
0	Number of channels of a module (here 02h)

CHERR Channel error

Byte	Bit 7 ... 0
0	• Bit 0: set at error in channel group 0 • Bit 1: set at error in channel group 1 • Bit 7 ... 2: reserved

CH0ERR / CH1ERR Channel-specific

Byte	Bit 7 ... 0
0	Channel-specific error: Channel x: • Bit 0: set at project engineering/parameterization error • Bit 1: raw value above the permissible range • Bit 2: raw value below the acceptable range • Bit 3: reserved • Bit 4: error sensor supply voltage • Bit 5: set at hardware interrupt lost • Bit 6: set at measuring range underflow • Bit 7: set at measuring range overflow

CH2ERR ... CH7ERR reserved

Byte	Bit 7 ... 0
0	reserved

DIAG_US µs ticker

Byte	Bit 7 ... 0
0...3	Value of the µs ticker at the moment of the diagnostic

µs ticker

In the I/O-1000 module there is a timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

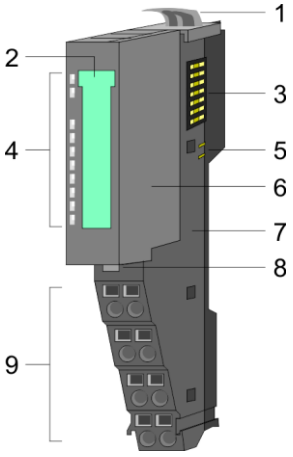
5.2 EPM-S410 - AI 2x12Bit 0(4)...20mA - Sensor

Properties

The electronic module has 2 inputs with parameterizable functions. The channels of the module are isolated to the backplane bus.

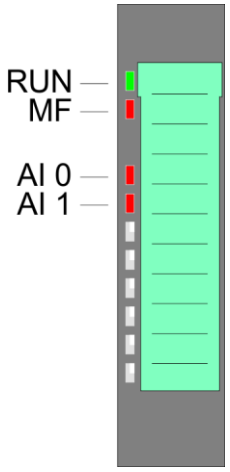
- 2 analog inputs
- Integrated sensor supply
- Suited for sensors with 0(4) ... 20mA with external supply
- Diagnostics function
- 12bit resolution

Structure



1	Locking lever terminal module
2	Labeling strip
3	Backplane bus
4	LED status indication
5	DC 24V power section supply
6	Electronic module
7	Terminal module
8	Locking lever electronic module
9	Terminal

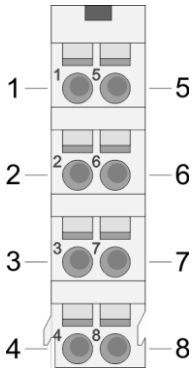
Status indication



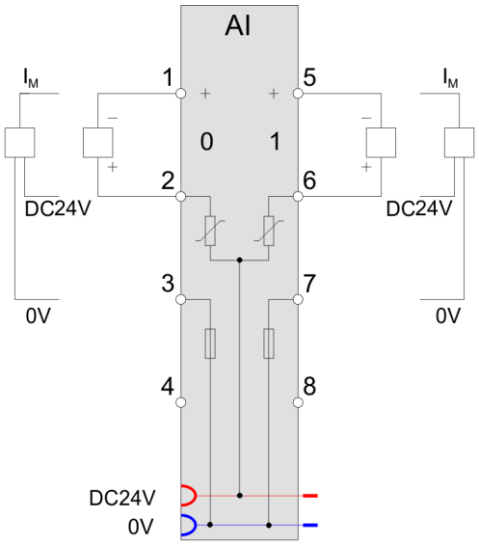
RUN green	MF red	AI x red	Description
		X	Bus communication is OK Module status is OK
		X	Bus communication is OK Module status reports an error
		X	Bus communication is not possible Module status reports an error
		X	Error at bus power supply
X	2Hz	X	Error in configuration
			Error channel x • Signal leaves measuring range • Error in parameterization
not relevant: X			

If the terminal module is not yet wired, when the module is power supplied the AI x LEDs get on due to the default parameterization 4 ... 20mA.

Pin assignment



For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	+AI 0	I	+ Channel 0
2	DC 24V	O	DC 24V for sensor Channel 0
3	0V	O	Ground for sensor (with 3 wire measurement)
4	---	---	not connected
5	+AI 0	I	+ Channel 0
6	DC 24V	O	DC 24V for sensor Channel 1
7	0V	O	Ground for sensor (with 3 wire measurement)
8	---	---	not connected

I: Input, O: Output

In-/Output area

IX	-	Index for access via CANopen with s = Subindex, depends on number and type of analog modules
SX	-	Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h

Output area

No byte of the output area is used by the module.

5.2.1 Technical data

Order no.	EPM-S410
Type	EPM-S410 – analog input
Module ID	0407 15C3
Current consumption/power loss	
Current consumption from backplane bus	50 mA
Power loss	0.7 W
Technical data analog inputs	
Number of inputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	15 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	-
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	-
Current inputs	✓
Max. input resistance (current range)	110 Ω
Input current ranges	0 mA ... +20 mA +4 mA ... +20 mA
Operational limit of current ranges	+/-0.5%
Operational limit of current ranges with SFU	-
Basic error limit current ranges	+/-0.3%
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	max. 24V
Destruction limit current inputs (electrical current)	max. 40mA
Resistance inputs	-
Resistance ranges	-

Order no.	EPM-S410
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	12
Measurement principle	successive approximation
Basic conversion time	2 ms all channels
Noise suppression for frequency	>50dB at 50Hz (UCM<2V)
Status information, alarms, diagnostics	
Status display	yes

Order no.	EPM-S410
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	-
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Technical data encoder supply	
Number of outputs	2
Output voltage (typ)	L+ (-250 mV)
Output voltage (rated value)	50 mA
Short-circuit protection	Multifuse 0.1 A
Binding of potential	Field voltage DC 24V
Datasizes	
Input bytes	4
Output bytes	0
Parameter bytes	6

Order no.	EPM-S410
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	58 g
Weight including accessories	58 g
Gross weight	72 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

5.2.2 Parameter data

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
CH0FN	1	Function number channel 0	30h	3100h	01h
CH1FN	1	Function number channel 1	30h	3101h	02h

CHxFN Function number channel x

In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module. With FFh the corresponding channel is deactivated. The formulas listed here allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range (analog value) and vice versa.

0(4) ... 20mA

Meas. range (funct. no.)	Current (I)	Decimal (D)	Hex	Range	Formulas
0 ... 20mA Siemens S7 format (31h)	23.52mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I}{20}$ $I = D \cdot \frac{20}{27648}$
	20mA	27648	6C00h	nominal range	
	10mA	13824	3600h		
	0mA	0	0000h		
	-3.52mA	-4864	ED00h	underrange	
0 ... 20mA Siemens S5 format (41h)	25.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I}{20}$ $I = D \cdot \frac{20}{16384}$
	20mA	16384	4000h	nominal range	
	10mA	8192	2000h		
	0mA	0	0000h		
	-4,00mA	-3277	F333h	underrange	
4 ... 20mA Siemens S7 format (30h)	22.81mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I-4}{16}$ $I = D \cdot \frac{16}{27648} + 4$
	20mA	27648	6C00h	nominal range	
	12mA	13824	3600h		
	4mA	0	0000h		
	1.19mA	-4864	ED00h	underrange	
4 ... 20mA Siemens S5 format (40h)	24.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I-4}{16}$ $I = D \cdot \frac{16}{16384} + 4$
	20mA	16384	4000h	nominal range	
	12mA	8192	2000h		
	4mA	0	0000h		
	0.8mA	-3277	F333h	underrange	

5.2.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow

IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX - Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
ERR_A	1	Diagnostic	00h	2F01h	02h
MODTYP	1	Module information	15h		03h
ERR_C	1	reserved	00h		04h
ERR_D	1	Diagnostic	00h		05h
CHTYP	1	Channel type	71h		06h
NUMBIT	1	Number diagnostic bits per channel	08h		07h
NUMCH	1	Number of channels of a module	02h		08h
CHERR	1	Channel error	00h		09h
CH0ERR	1	Channel-specific error channel 0	00h		0Ah
CH1ERR	1	Channel-specific error channel 1	00h		0Bh
CH2ERR… CH7ERR	6	reserved	00h		0Ch ... 11h
DIAG_US	4	µs ticker	00h		13h

ERR_A Diagnostic

Byte	Bit 7 ... 0
0	• Bit 0: set at module failure • Bit 1: set at internal error • Bit 2: set at external error • Bit 3: set at channel error • Bit 4: set at external auxiliary supply missing • Bit 6 ... 5: reserved • Bit 7: set at error in parametrization

MODTYP Module information

Byte	Bit 7 ... 0
0	• Bit 3 ... 0: module class – 0101b analog module • Bit 4: set at channel information present • Bit 7 ... 5: reserved

ERR_D Diagnostic

Byte	Bit 7 ... 0
0	• Bit 2 ... 0: reserved • Bit 3: set at internal diagnostics buffer overflow • Bit 4: set at internal communication error • Bit 7 ... 5: reserved

CHTYP Channel type

Byte	Bit 7 ... 0
0	• Bit 6 ... 0: Channel type – 70h: Digital input – 71h: Analog input – 72h: Digital output – 73h: Analog output – 74h: Analog input/-output – 76h: Counter • Bit 7: reserved

NUMBIT Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostic bits per channel (here 08h)

NUMCH Channels

Byte	Bit 7 ... 0
0	Number of channels of a module (here 02h)

CHERR Channel error

Byte	Bit 7 ... 0
0	• Bit 0: set at error in channel group 0 • Bit 1: set at error in channel group 1 • Bit 7 ... 2: reserved

CH0ERR / CH1ERR Channel-specific

Byte	Bit 7 ... 0
0	Channel-specific error channel x: • Bit 0: set at configuring/parameter assignment error • Bit 5 ... 1: reserved • Bit 6: set at measuring range underflow • Bit 7: set at measuring range overflow

CH2ERR ... CH7ERR reserved

Byte	Bit 7 ... 0
0	reserved

DIAG_US µs ticker

Byte	Bit 7 ... 0
0...3	Value of the µs ticker at the moment of the diagnostic

µs ticker

In the I/O-1000 module there is a timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

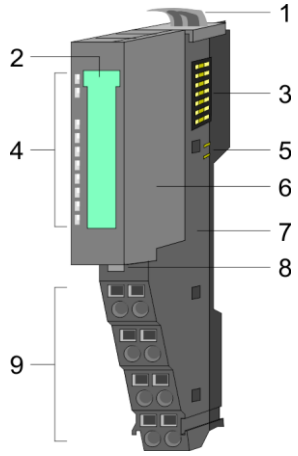
5.3 EPM-S411 - AI 1x16(24)Bit Strain gauge (DMS)

Properties

The electronic module has one channel and is suited to connect it to a strain gauge DMS sensor in load cells, force transducer and torque measuring shaft. The module has a configurable input filter and supports diagnostic interrupt.

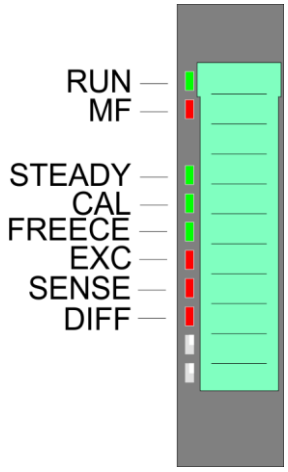
- 1-channel for connecting a full bridge
- Absolute accuracy (basic error ±0.1%)
- Manual calibration (zero and load adjustment)
- Configurable self-calibration (offset and gain error)
- Fast measurement by high signal bandwidth (ADC with 4 kHz limit frequency)
- Parametrizable IIR filter (300µs - 3.6s or dynamic)
- Parametrizable 50/60 Hz rejection
- Programmable power supply for the load cell(s) / full bridge(s)
- Parallel operation of load cells possible
- Diagnostic function
- 16bit resolution (24bit internal)

Structure



1	Locking lever terminal module
2	Labeling strip
3	Backplane bus
4	LED status indication
5	DC 24V power section supply
6	Electronic module
7	Terminal module
8	Locking lever electronic module
9	Terminal

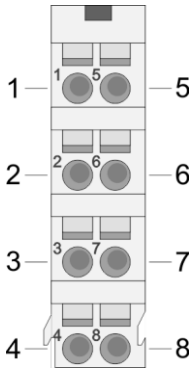
Status indication



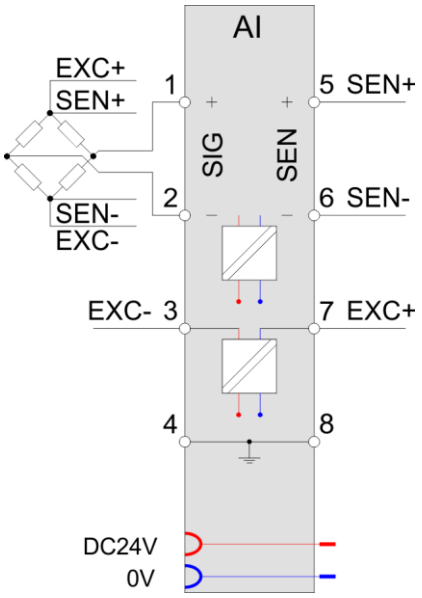
RUN green	MF red	Description
■	□	Bus communication is OK Module status is OK
■	■	Bus communication is OK Module status reports an error
□	■	Bus communication is not possible Module status reports an error
□	□	Error at bus power supply
X	◪ 2Hz	Error in configuration
not relevant: X		

STEADY green	CAL green	FREECE green	EXC red	SENSE red	DIFF red	Description
■	X	X	X	X	X	On in Steady State.
X	■	X	X	X	X	On at active self-calibration
X	X	■	X	X	X	On at activated Input-Freeze.
X	X	X	■	X	X	On at short circuit respectively over-load of the excitation voltage.
X	X	X	X	■	X	On at overrange of the excitation voltage
X	X	X	X	X	■	On at overrange of the differential voltage
not relevant: X						

Pin assignment



For wires with a core cross-section of 0.08mm² up to 1.5mm².

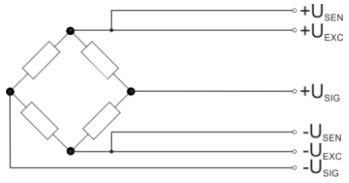


Pos.	Function	Type	Description
1	SIG+	I	+ Signal of the differential voltage U_{SIG} of the measuring bridge
2	SIG-	I	- Signal of the differential voltage U_{SIG} of the measuring bridge
3	EXC-	O	- Signal of the excitation voltage U_{EXC}
4	Shield	---	Connection for cable shield
5	SEN+	I	+ Sensor of the excitation voltage U_{SEN}
6	SEN-	I	- Sensor of the excitation voltage U_{SEN}
7	EXC+	O	+ Signal of the excitation voltage U_{EXC}
8	Shield	---	Connection for cable shield
O: Output, I: Input			

Please always use the excitation voltage U_{EXC} of the module! The connection of sensors with external power supply is not possible.

5.3.1 Connection variants

6 wire measurement

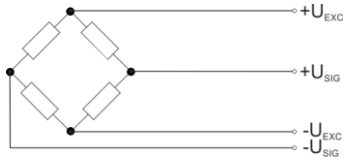


The following table shows the properties of the sensors, which can be used with the 6 wire measurement.

Sensor properties

Excitation voltage U_{EXC}	Bridge resistance R_B			
	120Ω	350Ω	700Ω	1000Ω
2.5V	X	X	X	X
5V	X	X	X	X
7.5V	X	X	X	X
10V	X	X	X	X
12V	X	X	X	X

4 wire measurement



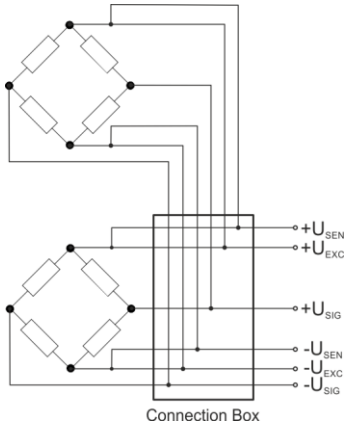
With the 4 wire measurement the U_{SEN} pins are not connected. With this operating mode there is an internal connection between U_{EXC} and U_{SEN}.

The following table shows the properties of the sensors, which can be used with the 4 wire measurement.

Sensor properties

Excitation voltage U_{EXC}	Bridge resistance R_B			
	120Ω	350Ω	700Ω	1000Ω
2.5V	X	X	X	X
5V	X	X	X	X
7.5V	X	X	X	X
10V	X	X	X	X
12V	X	X	X	X

Parallel connection



$$I_{EXC} = \frac{U_{EXC}}{\frac{R_B}{n}}$$

Normally large mechanical loads are divided to multiple strain gauge DMS load cells and these parallel connected via a connection box to the strain gauge DMS module. Please consider that the load cells are aligned together for this operating mode and approved by the manufacturer. And the current feed capacity of the transducer electronic should not be overloaded. The current feed capacity is derived from the number of parallel-connected load cells, excitation voltage U_{EXC} and the bridge resistance.

Depending on the excitation voltage U_{EXC}, I_{EXC} may not exceed a maximum current:

- 2.5V: maximum current 120mA
- 5V: maximum current 120mA
- 7.5V: maximum current 100mA
- 10V: maximum current 90mA
- 12V: maximum current 80mA

For the calculation of I_{EXC} the following formula is used:

I_{EXC}	Supply current
U_{EXC}	Excitation voltage
R_B	Bridge resistance
n	Number of parallel connections

The following tables show the properties of the sensors for e.g. 2 respectively 3 parallel connected load cells.

Example

2 parallel	Bridge resistance R_B			
Excitation voltage U_{EXC}	**60Ω**	**175Ω**	**350Ω**	**500Ω**
2.5V	X	X	X	X
5V	X	X	X	X
7.5V	not possible	X	X	X
10V	not possible	X	X	X
12V	not possible	X	X	X

3 parallel	Bridge resistance R_B			
Excitation voltage U_{EXC}	**40Ω**	**116.7Ω**	**233.3Ω**	**333.3Ω**
2.5V	X	X	X	X
5V	not possible	X	X	X
7.5V	not possible	X	X	X
10V	not possible	X	X	X
12V	not possible	not possible	X	X



To connect your sensors please always use shielded cables!
Please always use the excitation voltage U_{EXC} of the module!
The connection of sensors with external power supply is not possible.

5.3.2 In- / Output area

In-/Output area

IX - Index for access via CANopen with s = Subindex, depends on number and type of analog modules

SX - Subindex for access via EtherCAT with Index 6000h/7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	DMS_VAL	4	Measured value	5470h/s	01h
+3	DMS_STAT	1	Status	5471h/s	02h

DMS_VAL measured value (weight value)

	Byte 0								Byte 1							
Bit number	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Significance	SG	2^{30}	2^{29}	2^{28}	2^{27}	2^{26}	2^{25}	2^{24}	2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}
31Bit+SG	SG	**Measured value ...**														

	Byte 2								Byte 3							
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Significance	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
31Bit+SG	**... Mesured value**															

DMS_STAT Status

Addr.	Name	Bytes	Function
+3	DMS_STAT	1	• Status byte – Bit 0: 1 = Input Freeze active – Bit 1: 1 = Steady State active[1] – Bit 2: 1 = Self-calibration is running[1] – Bit 3: 1 = Tara was changed – Bit 4: 1 = Error in adjustment – Bit 5: 1 = Adjustment was changed – Bit 6: reserved – Bit 7: 1 = Zero balance respectively reference point set

1) These status bits are set by internal event of the module..

- Input Freeze

  - In the activated state no measurement values are passed to the digital filter.
  - As long as the command bit is set, this bit remains set.
- Steady State
  - As soon as a measured value is longer than the time SSW within the tolerance window SST, in the status word the Steady State bit is set.
  - As soon as this condition is not true, the last measured value is first used, the comparison timer restarted and the bit is reset.
  - The values SSW and SST can be specified by the parametrization.
- Self calibration
  - As long as the self calibration is active, this bit is set.
  - During the self calibration there are two reference values internally measured and based on this the internal offset & factor are calculated.
  - With the self calibration the internal offset and gain error may be compensated.
  - The calibration interval CI can be preset by the parametrization.
- Tara
  - When setting or clearing the tare value, this bit is set.
  - As long as the corresponding command bit is set, this bit remains set.
- Adjustment
  - When you save or delete the adjustment data, this bit is set.
  - As long as the corresponding command bit is set, this bit remains set.
- Zero balance respectively reference point
  - When setting the zero balance respectively reference point this bit is set.
  - As long as the corresponding command bit is set, this bit remains set.

Output area

Addr.	Name	Bytes	Function	IX	SX
+0	DMS_CMD	1	Command byte	5670h/s	01h

DMS_CMD

Addr.	Name	Bytes	Function
+0	DMS_CMD	1	• Command byte Each set bit in DMS_CMD is acknowledged by a bit in DMS_STAT. – Bit 0: Activate Input Freeze → DMS_STAT bit 0: active – Bit 1: Store adjustment → DMS_STAT bit 5: active – Bit 2: Delete adjustment → DMS_STAT bit 5: active – Bit 3: Set Tara → DMS_STAT bit 3: active – Bit 4: Delete Tara → DMS_STAT bit 3: active – Bit 5: reserved – Bit 6: Set zero point → DMS_STAT bit 7: active – Bit 7: Set reference point → DMS_STAT bit 7: active

- Input Freeze
  - In the activated state no measurement values are passed to the digital filter.
  - By a brief activation of Input Freeze pulses, e.g. caused by a filling procedure can be prevented, which would override the filter unnecessarily.
  - The status of Input Freeze can be determined at any time via bit 0 of DMS_STAT.
- Adjustment
  - Store adjustment: Used to store the adjustment data when loaded with the reference weight.
  - Delete adjustment: Used to delete the adjustment data.
  - With both commands bit 5 of DMS_STAT is set. In case of error bit 4 is set.
- Tara
  - Set Tara: The current value is taken as tara.
  - Delete Tara: Tara is reset to 0.
  - With both commands bit 3 of DMS_STAT is set.
- Zero balance respectively reference point
  - Both commands are used for user adjustment and on both commands bit 7 of DMS_STAT is set.
  - Set zero balance: Used to set the balance to 0 when operated without load.
  - Set reference point: Used to adjust the balance when it is loaded with a reference weight

5.3.3 Technical data

Order no.	EPM-S411
Type	EPM-S411 – analog input
Module ID	0841 1809
Current consumption/power loss	
Current consumption from backplane bus	55 mA
Power loss	1 W
Technical data strain gauge DMS inputs	
Number of inputs	1
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Reverse polarity protection of rated load voltage	✓
Current consumption from load voltage L+ (without load)	18 mA
Relative accuracy according to self-calibration	+/-0.01%
Operational limit Usense	+/-0.2%
Operational limit Usig	+/-0.2%
Basic error limit Usense	+/-0.1%
Basic error limit Usig	+/-0.1%
Destruction limit voltage	max. 12V
External bridge supply possible	-
Internal bridge supply possible	✓
Configurable bridge supply	2.5V / max. 120mA 5V / max. 120mA 7.5V / max. 100mA 10V / max. 90mA 12V / max. 80mA
Resolution in bit	24
Measurement principle	successive approximation
Basic conversion time	1ms cycle, 10ms...330ms depending on the filter

Order no.	EPM-S411
Input filter Hardware	Low pass 10kHz 3rd order
Input filter software	Dynamic IIR filter configurable IIR filter 0.1Hz...1000Hz configurable FIR filter 50Hz/60Hz
Initial data size	4 Byte
Data for selection of the strain gauge DMS sensor	
Bridge supply voltage EXC	0...12V
Bridge differential voltage SIG	+/-29mV
Rated output	0.5...4mV/V
4 wire connection possible	✓
6 wire connection possible	✓
Possible bridge configuration	symmetric full bridge
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	no
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	yes
Module error display	red LED
Channel error display	red LED
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	-
Max. potential difference between circuits	-

Order no.	EPM-S411
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	5
Output bytes	1
Parameter bytes	30
Diagnostic bytes	20
Housing	
Material	PC / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	64 g
Weight including accessories	64 g
Gross weight	78 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	in preparation

5.3.4 Functionality

5.3.4.1 Basis strain gauge DMS

Strain gauge DMS

Strain gauge DMS are fixed directly on a body or part of a sensor and serve for the following possibilities:

- Measurement of strains, compressions or torsions
- Measurement of forces and movements

There are the following strain gauge DMS types:

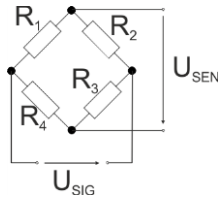
- electrical strain gauge DMS
  - An electrical strain gauge DMS consists of a carrier material (e.g. stretchable plastic film) with applied metal film. From this a grid of electrically conductive resistive material is created. During the measurement the behavior is used, that e.g. at the elongation of a metallic conductor resistance its length increases and its diameter decreases. Here the electrical resistance increases proportionally.
- optical strain gauge DMS
  - An optical strain gauge DMS consists of a fibre used as a sensor, with a laser-applied grid in the fibre. During the measurement the behavior is used, that with mechanical load the optical properties of the sensor are changed. Light is passed with a certain wavelength into the sensor. Depending on the deformation of the laser-applied grid of the sensor, a part of the light is reflected and evaluated with a suitable sensor (interrogator).

Characteristics of an strain gauge DMS

- Nominal load
  - Maximum permissible load for normal operation.
  - The nominal load is preset unit-free.
- Rated output
  - The rated output is a measure of the sensitivity of the resistance bridge in dependence of the used excitation voltage.
  - A typical value for a full bridge is 2mV/V, this means at nominal load with an excitation voltage of 12V the bridge differential voltage is ±24mV.
  - The common area is 0.5...4mV/V, depending on the bridge and sensor type.

5.3.4.2 Function

Measurement



To get a weight value a power supply is applied to the bridge circuit and a differential voltage (U_{SIG}) and excitation voltage (U_{SEN}) are measured. The principle of measurement is based on that the differential voltage U_{SIG} of the bridge changes with a deformation. Thus, a relative weight value is calculated by the difference of the both voltages U_{SIG} and U_{SEN}, which are measured at the same time. The resulting difference is converted to a weight value and stored as process data in the input area.

Weight value determination

With the exception of differential and excitation voltage the remaining values are to be preset by the parametrization. The resulting weight value Y is determined within the module via the following formulas:

$$Y_R = \frac{\frac{U_{SIG}}{U_{SEN}}}{RO}$$

Y_R	Relative value
U_{SIG}	Measured differential voltage of the measuring bridge
U_{SEN}	Measured excitation voltage
RO	Rated output

$$Y_A = Y_R \cdot NL \cdot SF$$

Y_A	Absolute value
Y_R	Relative value
NL	Nominal load
SF	Scale factor

$$Y = Y_A \cdot GN + TA$$

Y	Resulting weight value
Y_A	Absolute value
GN	Gain
TA	Tara

5.3.5 Parameter data

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Parameters

Name	Bytes	Function	Default	IX	SX
DIAG_EN	1	Diagnostic interrupt[1]	00h	3100h	01h
UEXC	1	Excitation voltage[1]	00h	3101h	02h
CAL	2	Calibration interval[1]	0000	3102h	03h
MEAS	1	Measurement method	23h	3104h	04h
FILT	1	Filter selection	00h	3105h	05h
DFCT	2	Dynamic filter change time	10h	3106h	06h
DFD	2	Dynamic filter delta	20h	3108h	07h
RO	2	Rated output	4E20h	310Ah	08h
ZB	2	Zero balance	0000h	310Ch	09h
GN	2	Gain	1000h	310Eh	0Ah
TA	2	Tara	0000h	3110h	0Bh
NL	2	Nominal load	0002h	3112h	0Ch
SF	2	Scale factor	03E8h	3114h	0Dh
SST	2	Steady state tolerance	0005h	3116h	0Eh
SSW	2	Steady state window	03E8h	3118h	0Fh
RL	4	Reference load	00000100h	311Ah	10h

1) This record set may only be transferred at STOP state.

DIAG_EN Diagnostic interrupt

Byte	Bit 7 ... 0
0	• Diagnostic interrupt – 00h: disable – 40h: enable

- Here you activate respectively de-activate the diagnostic function.

UEXC select power supply

Byte	Bit 7 ... 0
0	• Power supply – 00h: 2.5V – 01h: 5V – 02h: 7.5V – 03h: 10V – 04h: 12V

- Here you can specify the power supply for the excitation voltage U_{EXC}, which the module provides via the pins EXC+ und EXC-.



Please always use the excitation voltage U of the module$_{EXC}$! The connection of strain gauge DMS sensors with external power supply is not possible.

CAL Calibration interval

Byte	Bit 7 ... 0
0...1	• Interval for the calibration. – Calibration interval as 100ms value – 00h: de-activates the calibration

- By setting a calibration interval as 100ms value, the self-calibration is always performed after this time.
- With the self-calibration the internal offset and gain error may be compensated.
- There is always the entire signal path including all passive components checked.
- During self-calibration, the CAL LED is on an the measured value is frozen.
- 00h de-activates the calibration.

MEAS Measurement method

Byte	Bit 7 ... 0
0	• Measurement method – 23h: 6 wire measurement – 25h: 4 wire measurement – FFh: de-activated

- Here you can choose between 4 and 6 wire measurement respectively disable the measurement.

FILT Filter selection

Byte	Bit 7 ... 0
0	• Filter selection – 00h: Filter de-activated – 01h: Activate dynamic IIR filter – 02h: IIR1 – 03h: IIR2 – 04h: IIR3 – 05h: IIR4 – 06h: IIR5 – 07h: IIR6 – 08h: IIR7 – 09h: IIR8 – 0Ah: FIR 50Hz – 0Bh: FIR 60Hz

Filter functions

- FIR 50/60 Hz
  - Suppression of mains frequency interference
- Dynamic IIR filter
  - automatic selection
  - Filter selection dependent on the current weight change
- Static IIR filter
  - De-activation respectively fix setting of a filter level (IIR1...IIR8)

DFCT Dynamic Filter Change Time

Byte	Bit 7 ... 0
0...1	Sampling rate for filter change-over in ms

- Here you can specify the time for re-evaluation for the filter change-over in ms.

DFD Dynamic filter delta

Byte	Bit 7 ... 0
0...1	Limit value for filter change-over

- Here you can specify the limit value for the filter change-over.

RO Rated output

Byte	Bit 7 ... 0
0...1	Rated output in 0.0001mV/V

- Here you can specify the rated output in 0.0001mV/V. Information to the rated output can be found in the data sheet of you force transducer.

ZB Zero balance

Byte	Bit 7 ... 0
0...1	Zero balance in 0.0001mV/V

- Here you can specify the zero balance as 0.0001mV/V value. Information to the zero balance can be found in the data sheet of you force transducer.

GN Gain

Byte	Bit 7 ... 0
0...1	Gain for user scaling of the output value

- Here you can specify a factor as 2^{-12} value. The factor is multiplied with the output value.

TA Tara

Byte	Bit 7 ... 0
0...1	User offset for the output value

- Here you can specify an offset as 2^{-12} value. The offset is added to the determined output value.

NL Nominal load

Byte	Bit 7 ... 0
0...1	Nominal load of the force transducer

- Here you can specify the nominal load of the force transducer unit-free. Information to nominal load can be found in the data sheet of you force transducer.

SF Scale factor process data

Byte	Bit 7 ... 0
0...1	Scale factor for the nominal load

- Here you can specify the scale factor for the nominal load, such as to convert kg to g.
  - Example: Nominal load in kg and scale factor 1000 (03E8h) results display in g.

SST Steady state tolerance

Byte	Bit 7 ... 0
0...1	Tolerance for Steady State

- Here you can specify a tolerance window for the state Steady State. This is specified as a deviation of the scaled nominal load.
  - Example: With a rated load in kg and scaling factor of 1000 (03E8h) you must specify the value 0005h to set a tolerance window of 5g.

SSW Steady state window

Byte	Bit 7 ... 0
0...1	Time interval for Steady State in ms

- Here you can specify a time interval for the setting of the Steady State bit (DMS_STAT-Bit 1).
- If the measured value is within the tolerance window SST longer than the time interval SSW, then bit 1 of the status word DMS_STAT is set.

RL Reference load

Byte	Bit 7 ... 0
0...3	Reference load for the calibration

- Here you can specify the reference load for the calibration unit-free. The reference load must be at least 20% of the Nominal load NL.

5.3.6 Deployment of the filter functions

Overview

The module has the following filter functions, which can be activated via the parametrization:

- FIR 50/60 Hz
- Dynamic IIR filter
- Static IIR filter

FIR 50/60 Hz

In the parametrization via FILT you can specify the filter FIR 50 Hz respectively FIR 60 Hz. These filters acts a notch filter. Notch filter generate at the configured frequency and the multiple thereof zeros (notches) in the frequency response. They attenuate these frequencies here in the amplitude. When filters are used, these influence the conversion time of your module. The higher the filter frequency, the faster the conversion time. This can be used for the suppression of mains frequency interferences.

Dynamic IIR filter

- By activation of the dynamic IIR filter in the FILT parameter, dependent on the current weight change, it is automatically switched between 8 different filters. The aim here is to obtain a filter with the best possible damping, which must lead to stable measuring values. The Dynamic IIR filter acts as 1. order low-pass filter and has the following properties:
  - If there is a rapid change of the input value, it is switched-over to the next lower filter (e.g. IIR1→IIR2). In this way the load changes are less precise, but it is faster recognized.
  - If there is small change in the measured value, it is switched-over to the next higher filter (e.g. IIR2→IIR1), so you will get a higher precision.
  - With the IIR1 filter you get the lowest noise suppression and the most unstable measured value.
  - With the IIR8 filter you get the highest noise suppression and the most stable measured value.
  - The revaluation, which can lead to a modification of the filter levels, takes place in a fixed interval, which can be specified via parameter DFCT in ms.

Filter level	Limit frequency	Filter constant	Rise time 10-90% [s] (typ.)
02h: IIR1	1000	$a_0 = 0.5$	0.0003
03h: IIR2	500Hz	$a_0 = 0.25$	0.0008
04h: IIR3	125Hz	$a_0 = 62.5x10^{-3}$	0.0035
05h: IIR4	30Hz	$a_0 = 15.6x10^{-3}$	0.014
06h: IIR5	8Hz	$a_0 = 3.91x10^{-3}$	0.056
07h: IIR6	2Hz	$a_0 = 977x10^{-6}$	0.225
08h: IIR7	0.5Hz	$a_0 = 244x10^{-6}$	0.9
09h: IIR8	0.1Hz	$a_0 = 61.0x10^{-6}$	3.6



Prevent overriding the filter

By a brief activation of Input Freeze in the command byte DMS_CMD pulses, e.g. caused by a filling procedure can be prevented, which would override the filter unnecessarily. As soon as Input Freeze is activated, no measurement values are passed to the digital filter.

Static IIR filter

Via the FILT parameter you can de-activate the filter function or you can specify a fix filter level (IIR1...IIR8).

5.3.7 Calibration

Proceeding

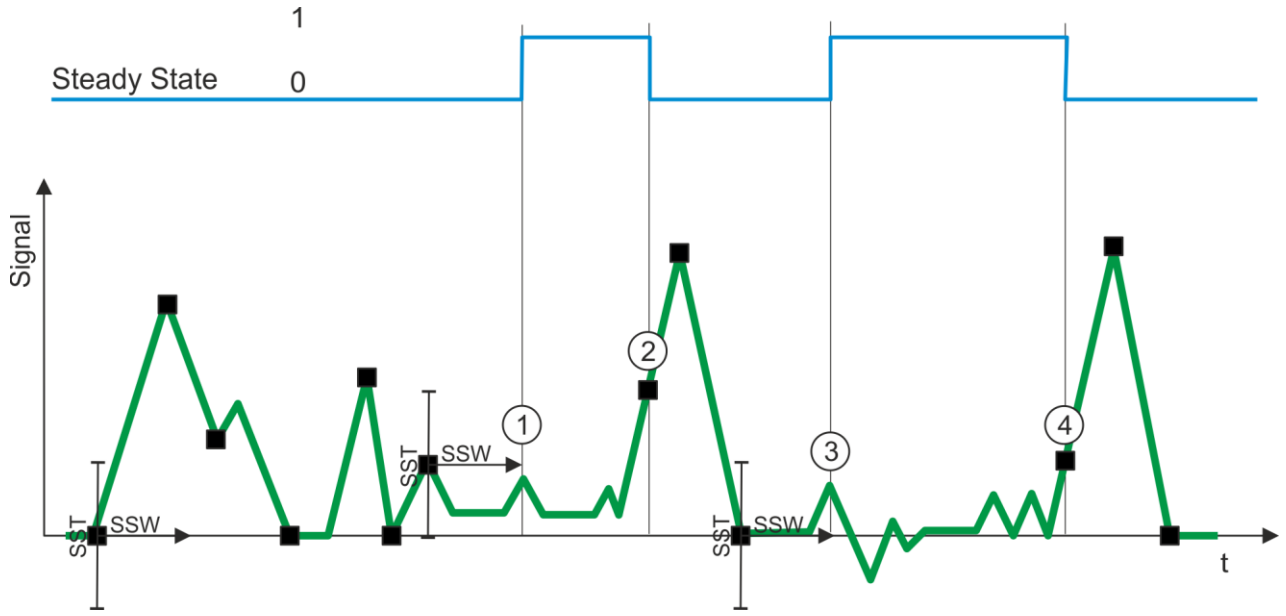
Please use for the calibration the IIR8 filter (FILT = 09h - slow). The following steps are necessary for the calibration:

1. Specify in the parametrization the Reference load RL. The Reference load must be at least 20% of the Nominal load.
2. Operate the balance without load.
3. As soon as a stable value is shown, set bit 6 (set zero point) in the command byte DMS_CMD.
4. Apply the balance with the reference load. As soon as a stable value is shown, set bit 7 (set reference point) in the command byte DMS_CMD.
5. Set bit 1 (store adjustment) in the command byte DMS_CMD.
   ⇨ As soon as the adjustment data were stored successfully, the module measures with these parameters.
6. Remove the reference weight again and wait until a stable value is shown.
7. Tare the balance by setting bit 3 (set tare) in the DMS_CMD command byte.
   ⇨ The calibration is complete.
   - The adjustment data remain even after a power loss condition and can be deleted (delete adjustment) via bit 2.
   - The adjustment data can be rewritten every 120 seconds.

5.3.8 Steady state detection

Functionality

- If the measured value is within the range of values SST longer than the the time interval SSW, then bit 1 (steady state active) of the status word DMS_STAT is set. The current measured value is used as the starting point for the range of values and the steady state timer is started. ↳ *Page 157*. If the measured value remains within SST over the period SSW, the steady-state bit is set.
- If the tolerance range SST is exceeded, the last measured value is used as starting point and the time is newly started.
- The values SSW and SST can be specified by the parametrization. ↳ *Chap.‘* Parameter data*‘ page 165*



■ Starting point of the SSW timer is newly started. Only when the measured signal is longer than the time SSW within the range of values SST, steady state is set.

[1] SSW timer has expired and the measured signal is within the range of values → Steady state bit is set.

[2] Measured signal exceeds the range of values → Steady state bit is reset.

[3] SSW timer has expired and the measured signal is within the range of values → Steady state bit is set.

[4] Measured signal exceeds the range of values → Steady state bit is reset.

5.3.9 Diagnostics

Diagnostic data

Via the parametrization you may activate a diagnostic interrupt for the module. With a diagnostics interrupt the module serves for diagnostics data for diagnostic interrupt$_{incoming}$. As soon as the reason for releasing a diagnostic interrupt is no longer present, the diagnostic interrupt$_{going}$ automatically takes place. All events of a channel between diagnostic interrupt$_{incoming}$ and diagnostic interrupt$_{going}$ are not stored and get lost. Within this time window (1. diagnostic interrupt$_{incoming}$ until last diagnostic interrupt$_{going}$) the MF-LED of the module is on.

The following events can cause a diagnostic interrupt:

- External auxiliary supply is missing
- Internal diagnostic puffer overflow
- Internal communication error
- Project engineering/parametrization error
- Measuring range underflow
- Measuring range overerflow

IX	-	Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.
SX	-	Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
ERR_A	1	Diagnostic	00h	2F01h	02h
MODTYP	1	Module information	15h		03h
ERR_C	1	reserved	00h		04h
ERR_D	1	Diagnostic	00h		05h
CHTYP	1	Channel type	71h		06h
NUMBIT	1	Number diagnostic bits per channel	08h		07h
NUMCH	1	Number of channels of a module	01h		08h
CHERR	1	Channel error	00h		09h
CHxERR	8	Channel-specific error channel x	00h		0Ah...11h
DIAG_US	4	µs ticker	00h		13h

ERR_A Diagnostic

Byte	Bit 7 ... 0
0	• Bit 0: set at module failure • Bit 1: reserved • Bit 2: set at external error • Bit 3: set at channel error • Bit 4: set at external auxiliary supply missing • Bit 6 ... 5: reserved • Bit 7: set at error in parameterization

MODTYP Module information

Byte	Bit 7 ... 0
0	• Bit 3 ... 0: module class – 0101b analog module • Bit 4: set at channel information present • Bit 7 ... 5: reserved

ERR_C reserved

Byte	Bit 7 ... 0
0	reserved

ERR_D Diagnostic

Byte	Bit 7 ... 0
0	• Bit 2 ... 0: reserved • Bit 3: set at internal diagnostics buffer overflow • Bit 4: set at internal communication error • Bit 7 ... 5: reserved

CHTYP Channel type

Byte	Bit 7 ... 0
0	• Bit 6 ... 0: Channel type – 70h: Digital input – 71h: Analog input – 72h: Digital output – 73h: Analog output – 74h: Analog input/-output – 76h: Counter • Bit 7: reserved

NUMBIT Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostic bits per channel (here 08h)

NUMCH Channels

Byte	Bit 7 ... 0
0	Number of channels of the module (here 01h)

CHERR Channel error

Byte	Bit 7 ... 0
0	• Bit 0: set at error in channel 0

CHxERR Channel-specific

Byte	Bit 7 ... 0
0	Channel-specific error channel 0 • Bit 0: set at project engineering respectively parametrization error • Bit 2...1: reserved • Bit 3: set at short circuit of excitation voltage U_{EXC} • Bit 5...4: reserved • Bit 6: set at measuring range underflow • Bit 7: set at measuring range overflow
1...7	reserved

DIAG_US µs ticker

Byte	Bit 7 ... 0
0...3	Value of the µs ticker at the moment of the diagnostic

µs ticker

In the I/O-1000 module there is a timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

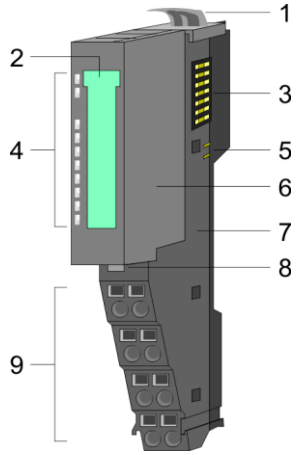
5.4 EPM-S412 - AI 4x16Bit 0...10V

Properties

The electronic module has 4 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

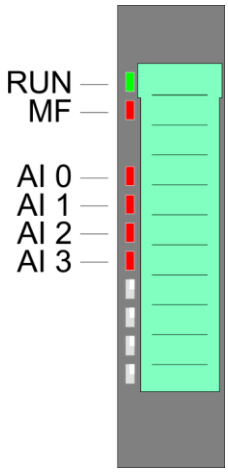
- 4 analog inputs
- Suited for sensors with 0 ... 10V
- Interrupt and diagnostics function
- Interference frequency suppression parameterizable (50/60Hz)
- 16bit resolution

Structure



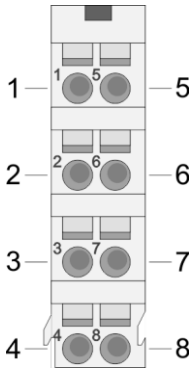
1	Locking lever terminal module
2	Labeling strip
3	Backplane bus
4	LED status indication
5	DC 24V power section supply
6	Electronic module
7	Terminal module
8	Locking lever electronic module
9	Terminal

Status indication

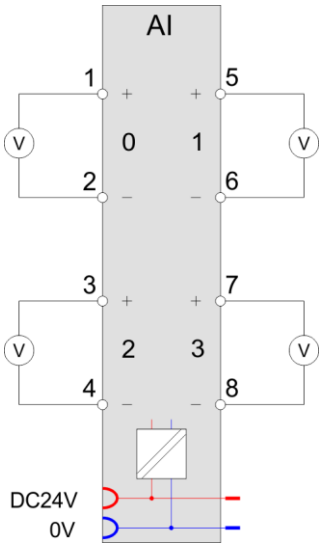


RUN ■ green	MF ■ red	AI x ■ red	Description
■	□	X	Bus communication is OK Module status is OK
■	■	X	Bus communication is OK Module status reports an error
□	■	X	Bus communication is not possible Module status reports an error
□	□	X	Error at bus power supply
X	◪ 2Hz	X	Error in configuration
■	□	■	Error channel x • Signal leaves measuring range • Error in parameterization
not relevant: X			

Pin assignment



For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	+AI 0	I	+ Channel 0
2	-AI 0	I	Ground Channel 0
3	+AI 2	I	+ Channel 2
4	-AI 2	I	Ground Channel 2
5	+AI 1	I	+ Channel 1
6	-AI 1	I	Ground Channel 1
7	+AI 3	I	+ Channel 3
8	-AI 3	I	Ground Channel 3

I: Input

In-/Output area

IX	-	Index for access via CANopen with s = Subindex, depends on number and type of analog modules
SX	-	Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h
+4	AI 2	2	Analog value channel 2	6401h/s+2	03h
+6	AI 3	2	Analog value channel 3	6401h/s+3	04h

Output area

No byte of the output area is used by the module.

5.4.1 Technical data

Order no.	EPM-S412
Type	EPM-S412 – analog input
Module ID	040D 1544
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Power loss	0.9 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	25 mA
Voltage inputs	✓
Min. input resistance (voltage range)	200 kΩ
Input voltage ranges	0 V ... +10 V
Operational limit of voltage ranges	+/-0.2%
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	+/-0.1%
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	max. 30V
Current inputs	-
Max. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Operational limit of current ranges with SFU	-
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	-

Order no.	EPM-S412
Destruction limit current inputs (electrical current)	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Temperature error internal compensation	-

Order no.	EPM-S412
Technical unit of temperature measurement	-
Resolution in bit	16
Measurement principle	successive approximation
Basic conversion time	480 µs all channels
Noise suppression for frequency	>80dB at 50Hz (UCM<9V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 9 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V

Order no.	EPM-S412
Datasizes	
Input bytes	8
Output bytes	0
Parameter bytes	32
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	61 g
Weight including accessories	61 g
Gross weight	75 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

5.4.2 Parameter data

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
DIAG_EN	1	Diagnostics[1]	00h	3100h	01h
RES1	1	reserved	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring[1]	00h	3102h	03h
SUPR	1	Interference frequency suppression (SFU)	00h	3103h	04h
CH0FN	1	Function number channel 0	10h	3104h	05h
RES7	1	reserved	00h	3105h	06h
CH0UL	2	Upper limit value channel 0	7FFFh	3106h...3107h	07h
CH0LL	2	Lower limit value channel 0	8000h	3108h...3109h	08h
CH1FN	1	Function number channel 1	10h	310Ah	09h
RES13	1	reserved	00h	310Bh	0Ah
CH1UL	2	Upper limit value channel 1	7FFFh	310Ch...310Dh	0Bh
CH1LL	2	Lower limit value channel 1	8000h	310Eh...310Fh	0Ch
CH2FN	1	Function number channel 2	10h	3110h	0Dh
RES19	1	reserved	00h	3111h	0Eh
CH2UL	2	Upper limit value channel 2	7FFFh	3112h...3113h	0Fh
CH2LL	2	Lower limit value channel 2	8000h	3114h...3115h	10h
CH3FN	1	Function number channel 3	10h	3116h	11h
RES25	1	reserved	00h	3117h	12h
CH3UL	2	Upper limit value channel 3	7FFFh	3118h...3119h	13h
CH3LL	2	Lower limit value channel 3	8000h	311Ah...311Bh	14h

1) This record set may only be transferred at STOP state.

DIAG_EN Diagnostic interrupt

Byte	Bit 7 ... 0
0	• Diagnostic interrupt – 00h: disabled – 40h: enabled

- Here you can enable respectively disable the diagnostic interrupt.

LIMIT_EN Limit value monitoring

Byte	Bit 7 ... 0
0	• Bit 0: Limit value monitoring channel 0 (1: on) • Bit 1: Limit value monitoring channel 1 (1: on) • Bit 2: Limit value monitoring channel 2 (1: on) • Bit 3: Limit value monitoring channel 3 (1: on) • Bit 7 ... 4: reserved

SUPR Interference frequency suppression (SFU)

Byte	Bit 7 ... 0
0	• Bit 1, 0: Interference frequency suppression channel 0 • Bit 3, 2: Interference frequency suppression channel 1 • Bit 5, 4: Interference frequency suppression channel 2 • Bit 7, 6: Interference frequency suppression channel 3 – 00: deactivated – 01: 60Hz – 10: 50Hz e.g.: 10101010: all channels frequency suppression 50Hz

CHxFN Function number channel x

In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module. With FFh the corresponding channel is deactivated. The formulas listed here allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range (analog value) and vice versa.

0 ... 10V

Meas. range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas
0 ... 10V Siemens S7 format (10h)	11.76V	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{10}$ $U = D \cdot \frac{10}{27648}$
	10V	27648	6C00h	nominal range	
	5V	13824	3600h		
	0V	0	0000h		
	-1.76V	-4864	ED00h	underrange	
0 ... 10V Siemens S5 format (20h)	12.5V	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{10}$ $U = D \cdot \frac{10}{16384}$
	10V	16384	4000h	nominal range	
	5V	8192	2000h		
	0V	0	0000h		
	-2V	-3277	F333h	underrange	

CHxUL CHxLL Upper limit value Lower limit value channel x

For each channel an upper and a lower limit may be defined. Here only values of the nominal range may be preset, otherwise you receive a parameterization error. By presetting 7FFFh for the upper respectively 8000h for the lower limit value the corresponding limit is deactivated. As soon as the measuring value is beyond the limits and the limit value monitoring is activated, a hardware interrupt is initialized.

5.4.3 Diagnostics and interrupt

Event	Process interrupt	Diagnostics interrupt	parameterizable
Error in project engineering/ parameterization	-	X	-
Measuring range overflow	-	X	-
Measuring range underflow	-	X	-
Limit overflow	X	-	X
Limit underflow	X	-	X
Diagnostic buffer overflow	-	X	-
Communication error	-	X	-
Hardware interrupt lost	-	X	-

Hardware interrupt

So you may react to asynchronous events, there is the possibility to activate a hardware interrupt. A hardware interrupt interrupts the linear program sequence and jumps depending on the master system to a corresponding Interrupt routine. Here you can react to the hardware interrupt accordingly.

With CANopen the hardware interrupt data a transferred via an emergency telegram.

SX - Subindex for access via EtherCAT with Index 5000h

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	SX
PRIT_OL	1	Upper limit overflow channel x	00h	02h
PRIT_UL	1	Lower limit underflow channel x	00h	03h
PRIT_US	2	µs-Ticker	00h	04h (High-Byte) 05h (Low-Byte)

PRIT_OL Limit overflow

Byte	Bit 7 ... 0
0	• Bit 0: Limit overflow channel 0 • Bit 1: Limit overflow channel 1 • Bit 2: Limit overflow channel 2 • Bit 3: Limit overflow channel 3 • Bit 7 ... 4: reserved

PRIT_UL Limit underflow

Byte	Bit 7 ... 0
0	• Bit 0: Limit underflow channel 0 • Bit 1: Limit underflow channel 1 • Bit 2: Limit underflow channel 2 • Bit 3: Limit underflow channel 3 • Bit 7 ... 4: reserved

PRIT_US µs ticker

Byte	Bit 7 ... 0
0 ... 1	Value of the µs ticker at the moment of the diagnostic.

µs ticker

In the I/O-1000 module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again. PRIT_US represents the lower 2 byte of the µs ticker value (0 ... 2^{16}-1).

Diagnostic data

Via the parametrization you may activate a diagnostic interrupt for the module. With a diagnostics interrupt the module serves for diagnostics data for diagnostic interrupt$_{incoming}$. As soon as the reason for releasing a diagnostic interrupt is no longer present, the diagnostic interrupt$_{going}$ automatically takes place. All events of a channel between diagnostic interrupt$_{incoming}$ and diagnostic interrupt$_{going}$ are not stored and get lost. Within this time window (1. diagnostic interrupt$_{incoming}$ until last diagnostic interrupt$_{going}$) the MF-LED of the module is on.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow
- Hardware interrupt lost
- Power supply failed

IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX - Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
ERR_A	1	Diagnostic	00h	2F01h	02h
MODTYP	1	Module information	15h		03h
ERR_C	1	reserved	00h		04h
ERR_D	1	Diagnostic	00h		05h
CHTYP	1	Channel type	71h		06h
NUMBIT	1	Number diagnostic bits per channel	08h		07h
NUMCH	1	Number of channels of a module	04h		08h
CHERR	1	Channel error	00h		09h
CH0ERR	1	Channel-specific error channel 0	00h		0Ah
CH1ERR	1	Channel-specific error channel 1	00h		0Bh
CH2ERR	1	Channel-specific error channel 2	00h		0Ch
CH3ERR	1	Channel-specific error channel 3	00h		0Dh
CH4ERR... CH7ERR	4	reserved	00h		0Eh ... 11h
DIAG_US	4	µs ticker	00h		13h

ERR_A Diagnostic

Byte	Bit 7 ... 0
0	• Bit 0: set at module failure • Bit 1: set at internal error • Bit 2: set at external error • Bit 3: set at channel error • Bit 4: set at external auxiliary supply missing • Bit 6 ... 5: reserved • Bit 7: set at error in parametrization

MODTYP Module information

Byte	Bit 7 ... 0
0	• Bit 3 ... 0: module class – 0101b analog module • Bit 4: set at channel information present • Bit 7 ... 5: reserved

ERR_D Diagnostic

Byte	Bit 7 ... 0
0	• Bit 2 ... 0: reserved • Bit 3: set at internal diagnostics buffer overflow • Bit 4: set at internal communication error • Bit 5: reserved • Bit 6: set at hardware interrupt lost • Bit 7: reserved

CHTYP Channel type

Byte	Bit 7 ... 0
0	• Bit 6 ... 0: Channel type – 70h: Digital input – 71h: Analog input – 72h: Digital output – 73h: Analog output – 74h: Analog input/-output – 76h: Counter • Bit 7: reserved

NUMBIT Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostic bits per channel (here 08h)

NUMCH Channels

Byte	Bit 7 ... 0
0	Number of channels of a module (here 04h)

CHERR Channel error

Byte	Bit 7 ... 0
0	• Bit 0: set at error in channel group 0 • Bit 1: set at error in channel group 1 • Bit 2: set at error in channel group 2 • Bit 3: set at error in channel group 3 • Bit 7 ... 4: reserved

CH0ERR ... CH3ERR Channel-specific

Byte	Bit 7 ... 0
0	Channel-specific error channel x: • Bit 0: set at configuring/parameter assignment error • Bit 4 ... 1: reserved • Bit 5: set at hardware interrupt lost • Bit 6: set at measuring range underflow • Bit 7: set at measuring range overflow

CH4ERR ... CH7ERR reserved

Byte	Bit 7 ... 0
0	reserved

DIAG_US µs ticker

Byte	Bit 7 ... 0
0...3	Value of the µs ticker at the moment of the diagnostic

µs ticker

In the I/O-1000 module there is a timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

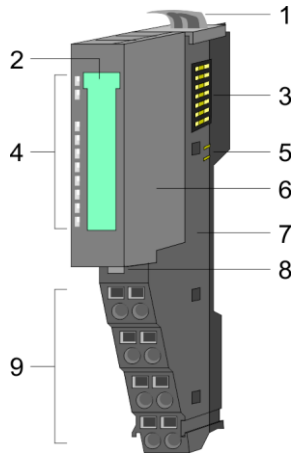
5.5 EPM-S413 - AI 4x16Bit 0(4)...20mA

Properties

The electronic module has 4 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

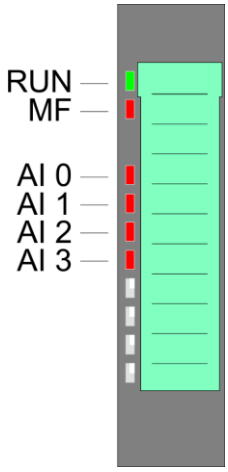
- 4 analog inputs
- Suited for sensors with 0 ... 20mA;
  4 ... 20mA with external supply
- Interrupt and diagnostics function
- Interference frequency suppression parameterizable (50/60Hz)
- 16bit resolution

Structure



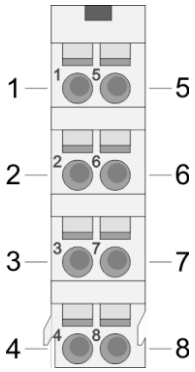
1	Locking lever terminal module
2	Labeling strip
3	Backplane bus
4	LED status indication
5	DC 24V power section supply
6	Electronic module
7	Terminal module
8	Locking lever electronic module
9	Terminal

Status indication

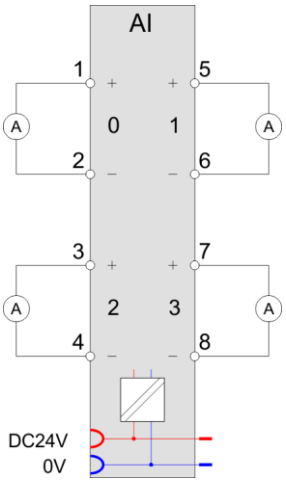


RUN green	MF red	AI x red	Description
■	□	X	Bus communication is OK Module status is OK
■	■	X	Bus communication is OK Module status reports an error
□	■	X	Bus communication is not possible Module status reports an error
□	□	X	Error at bus power supply
X	◪ 2Hz	X	Error in configuration
■	□	■	Error channel x • Signal leaves measuring range • Error in parameterization
not relevant: X			

Pin assignment



For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	+AI 0	I	+ Channel 0
2	-AI 0	I	Ground Channel 0
3	+AI 2	I	+ Channel 2
4	-AI 2	I	Ground Channel 2
5	+AI 1	I	+ Channel 1
6	-AI 1	I	Ground Channel 1
7	+AI 3	I	+ Channel 3
8	-AI 3	I	Ground Channel 3

I: Input

If a 2wire measuring transducer is used, you have to connect in line an external power supply.

In-/Output area

IX - Index for access via CANopen with s = Subindex, depends on number and type of analog modules

SX - Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h
+4	AI 2	2	Analog value channel 2	6401h/s+2	03h
+6	AI 3	2	Analog value channel 3	6401h/s+3	04h

Output area

No byte of the output area is used by the module.

5.5.1 Technical data

Order no.	EPM-S413
Type	EPM-S413 – analog input
Module ID	0412 1544
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Power loss	0.8 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	20 mA
Voltage inputs	-
Min. input resistance (voltage range)	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	-
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	-
Current inputs	✓
Max. input resistance (current range)	60 Ω
Input current ranges	0 mA ... +20 mA +4 mA ... +20 mA
Operational limit of current ranges	+/-0.2%
Operational limit of current ranges with SFU	-
Basic error limit current ranges	+/-0.1%
Radical error limit current ranges with SFU	-

Order no.	EPM-S413
Destruction limit current inputs (voltage)	max. 24V
Destruction limit current inputs (electrical current)	max. 40mA
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-

Order no.	EPM-S413
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	16
Measurement principle	successive approximation
Basic conversion time	240 µs all channels
Noise suppression for frequency	>80dB (UCM<4V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 4 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-

Order no.	EPM-S413
Insulation tested with	DC 500 V
Datasizes	
Input bytes	8
Output bytes	0
Parameter bytes	32
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	60 g
Weight including accessories	60 g
Gross weight	74 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

5.5.2 Parameter data

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
DIAG_EN	1	Diagnostics[1]	00h	3100h	01h
RES1	1	reserved	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring[1]	00h	3102h	03h
SUPR	1	Interference frequency suppression (SFU)	00h	3103h	04h
CH0FN	1	Function number channel 0	31h	3104h	05h
RES7	1	reserved	00h	3105h	06h
CH0UL	2	Upper limit value channel 0	7FFFh	3106h... 3107h	07h
CH0LL	2	Lower limit value channel 0	8000h	3108h... 3109h	08h
CH1FN	1	Function number channel 1	31h	310Ah	09h
RES13	1	reserved	00h	310Bh	0Ah
CH1UL	2	Upper limit value channel 1	7FFFh	310Ch... 310Dh	0Bh
CH1LL	2	Lower limit value channel 1	8000h	310Eh... 310Fh	0Ch
CH2FN	1	Function number channel 2	31h	3110h	0Dh
RES19	1	reserved	00h	3111h	0Eh
CH2UL	2	Upper limit value channel 2	7FFFh	3112h... 3113h	0Fh
CH2LL	2	Lower limit value channel 2	8000h	3114h... 3115h	10h
CH3FN	1	Function number channel 3	31h	3116h	11h
RES25	1	reserved	00h	3117h	12h
CH3UL	2	Upper limit value channel 3	7FFFh	3118h... 3119h	13h
CH3LL	2	Lower limit value channel 3	8000h	311Ah... 311Bh	14h

DIAG_EN Diagnostic interrupt

Byte	Bit 7 ... 0
0	• Diagnostic interrupt – 00h: disabled – 40h: enabled

- Here you can enable respectively disable the diagnostic interrupt.

LIMIT_EN Limit value monitoring

Byte	Bit 7 ... 0
0	• Bit 0: Limit value monitoring channel 0 (1: on) • Bit 1: Limit value monitoring channel 1 (1: on) • Bit 2: Limit value monitoring channel 2 (1: on) • Bit 3: Limit value monitoring channel 3 (1: on) • Bit 7 ... 4: reserved

SUPR Interference frequency suppression (SFU)

Byte	Bit 7 ... 0
0	• Bit 1, 0: Interference frequency suppression channel 0 • Bit 3, 2: Interference frequency suppression channel 1 • Bit 5, 4: Interference frequency suppression channel 2 • Bit 7, 6: Interference frequency suppression channel 3 – 00: deactivated – 01: 60Hz – 10: 50Hz e.g.: 10101010: all channels frequency suppression 50Hz

CHxFN Function number channel x

In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module. With FFh the corresponding channel is deactivated. The formulas listed here allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range (analog value) and vice versa.

0(4) ... 20mA

Meas. range (funct. no.)	Current (I)	Decimal (D)	Hex	Range	Formulas
0 ... 20mA Siemens S7 format (31h)	23.52mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I}{20}$ $I = D \cdot \frac{20}{27648}$
	20mA	27648	6C00h	nominal range	
	10mA	13824	3600h		
	0mA	0	0000h		
	-3.52mA	-4864	ED00h	underrange	
0 ... 20mA Siemens S5 format (41h)	25.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I}{20}$ $I = D \cdot \frac{20}{16384}$
	20mA	16384	4000h	nominal range	
	10mA	8192	2000h		
	0mA	0	0000h		
	-4,00mA	-3277	F333h	underrange	
4 ... 20mA Siemens S7 format (30h)	22.81mA	32511	7EFFh	overrange	$D = 27648 \cdot \frac{I-4}{16}$ $I = D \cdot \frac{16}{27648} + 4$
	20mA	27648	6C00h	nominal range	
	12mA	13824	3600h		
	4mA	0	0000h		
	1.19mA	-4864	ED00h	underrange	
4 ... 20mA Siemens S5 format (40h)	24.00mA	20480	5000h	overrange	$D = 16384 \cdot \frac{I-4}{16}$ $I = D \cdot \frac{16}{16384} + 4$
	20mA	16384	4000h	nominal range	
	12mA	8192	2000h		
	4mA	0	0000h		
	0.8mA	-3277	F333h	underrange	

CHxUL CHxLL Upper limit value Lower limit value channel x

For each channel an upper and a lower limit may be defined. Here only values of the nominal range may be preset, otherwise you receive a parameterization error. By presetting 7FFFh for the upper respectively 8000h for the lower limit value the corresponding limit is deactivated. As soon as the measuring value is beyond the limits and the limit value monitoring is activated, a hardware interrupt is initialized.

5.5.3 Diagnostics and interrupt

Event	Process interrupt	Diagnostics interrupt	parameterizable
Error in project engineering/ parameterization	-	X	-
Measuring range overflow	-	X	-
Measuring range underflow	-	X	-
Limit overflow	X	-	X
Limit underflow	X	-	X
Diagnostic buffer overflow	-	X	-
Communication error	-	X	-
Hardware interrupt lost	-	X	-

Hardware interrupt

So you may react to asynchronous events, there is the possibility to activate a hardware interrupt. A hardware interrupt interrupts the linear program sequence and jumps depending on the master system to a corresponding Interrupt routine. Here you can react to the hardware interrupt accordingly.
With CANopen the hardware interrupt data a transferred via an emergency telegram.

SX - Subindex for access via EtherCAT with Index 5000h

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	SX
PRIT_OL	1	Upper limit overflow channel x	00h	02h
PRIT_UL	1	Lower limit underflow channel x	00h	03h
PRIT_US	2	µs-Ticker	00h	04h (high byte) 05h (low byte)

PRIT_OL Limit overflow

Byte	Bit 7 ... 0
0	• Bit 0: Limit overflow channel 0 • Bit 1: Limit overflow channel 1 • Bit 2: Limit overflow channel 2 • Bit 3: Limit overflow channel 3 • Bit 7 ... 4: reserved

PRIT_UL Limit underflow

Byte	Bit 7 ... 0
0	• Bit 0: Limit underflow channel 0 • Bit 1: Limit underflow channel 1 • Bit 2: Limit underflow channel 2 • Bit 3: Limit underflow channel 3 • Bit 7 ... 4: reserved

PRIT_US µs ticker

Byte	Bit 7 ... 0
0 ... 1	Value of the µs ticker at the moment of the diagnostic.

µs ticker

In the I/O-1000 module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again. PRIT_US represents the lower 2 byte of the µs ticker value (0 ... 2^{16}-1).

Diagnostic data

Via the parametrization you may activate a diagnostic interrupt for the module. With a diagnostics interrupt the module serves for diagnostics data for diagnostic interrupt$_{incoming}$. As soon as the reason for releasing a diagnostic interrupt is no longer present, the diagnostic interrupt$_{going}$ automatically takes place. All events of a channel between diagnostic interrupt$_{incoming}$ and diagnostic interrupt$_{going}$ are not stored and get lost. Within this time window (1. diagnostic interrupt$_{incoming}$ until last diagnostic interrupt$_{going}$) the MF-LED of the module is on.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow
- Hardware interrupt lost
- Power supply failed

IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX - Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
ERR_A	1	Diagnostic	00h	2F01h	02h
MODTYP	1	Module information	15h		03h
ERR_C	1	reserved	00h		04h
ERR_D	1	Diagnostic	00h		05h
CHTYP	1	Channel type	71h		06h
NUMBIT	1	Number diagnostic bits per channel	08h		07h
NUMCH	1	Number of channels of a module	04h		08h
CHERR	1	Channel error	00h		09h
CH0ERR	1	Channel-specific error channel 0	00h		0Ah
CH1ERR	1	Channel-specific error channel 1	00h		0Bh
CH2ERR	1	Channel-specific error channel 2	00h		0Ch
CH3ERR	1	Channel-specific error channel 3	00h		0Dh
CH4ERR... CH7ERR	6	reserved	00h		0Eh ... 11h
DIAG_US	4	µs ticker	00h		13h

ERR_A Diagnostic

Byte	Bit 7 ... 0
0	• Bit 0: set at module failure • Bit 1: set at internal error • Bit 2: set at external error • Bit 3: set at channel error • Bit 4: set at external auxiliary supply missing • Bit 6 ... 5: reserved • Bit 7: set at error in parametrization

MODTYP Module information

Byte	Bit 7 ... 0
0	• Bit 3 ... 0: module class – 0101b analog module • Bit 4: set at channel information present • Bit 7 ... 5: reserved

ERR_D Diagnostic

Byte	Bit 7 ... 0
0	• Bit 2 ... 0: reserved • Bit 3: set at internal diagnostics buffer overflow • Bit 4: set at internal communication error • Bit 5: reserved • Bit 6: set at hardware interrupt lost • Bit 7: reserved

CHTYP Channel type

Byte	Bit 7 ... 0
0	• Bit 6 ... 0: Channel type – 70h: Digital input – 71h: Analog input – 72h: Digital output – 73h: Analog output – 74h: Analog input/-output – 76h: Counter • Bit 7: reserved

NUMBIT Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostic bits per channel (here 08h)

NUMCH Channels

Byte	Bit 7 ... 0
0	Number of channels of a module (here 04h)

CHERR Channel error

Byte	Bit 7 ... 0
0	• Bit 0: set at error in channel group 0 • Bit 1: set at error in channel group 1 • Bit 2: set at error in channel group 2 • Bit 3: set at error in channel group 3 • Bit 7 ... 4: reserved

CH0ERR ... CH3ERR Channel-specific

Byte	Bit 7 ... 0
0	Channel-specific error channel x: • Bit 0: set at configuring/parameter assignment error • Bit 4 ... 1: reserved • Bit 5: set at hardware interrupt lost • Bit 6: set at measuring range underflow • Bit 7: set at measuring range overflow

CH4ERR ... CH7ERR reserved

Byte	Bit 7 ... 0
0	reserved

DIAG_US µs ticker

Byte	Bit 7 ... 0
0...3	Value of the µs ticker at the moment of the diagnostic

µs ticker

In the I/O-1000 module there is a timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

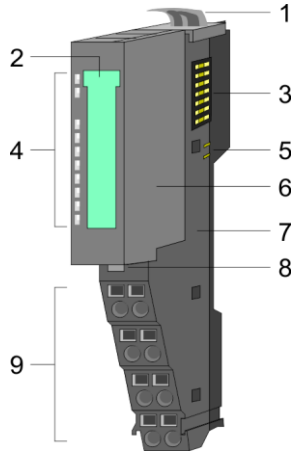
5.6 EPM-S414 - AI 4x16Bit ±10V

Properties

The electronic module has 4 inputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

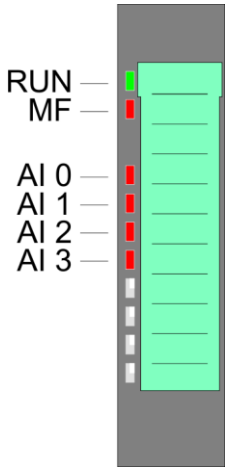
- 4 analog inputs
- Suited for sensors with ±10V, 0 ... 10V
- Interrupt and diagnostics function
- Interference frequency suppression parameterizable (50/60Hz)
- 16bit resolution

Structure



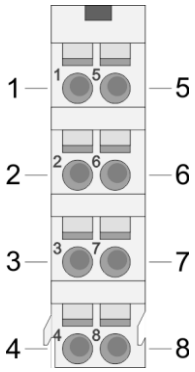
1	Locking lever terminal module
2	Labeling strip
3	Backplane bus
4	LED status indication
5	DC 24V power section supply
6	Electronic module
7	Terminal module
8	Locking lever electronic module
9	Terminal

Status indication

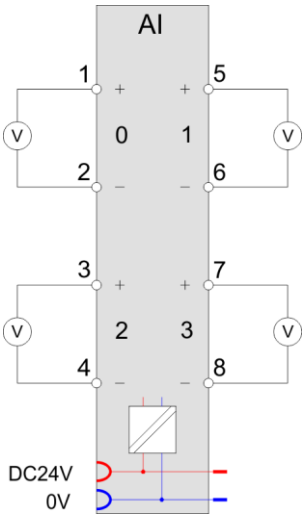


RUN green	MF red	AI x red	Description
		X	Bus communication is OK Module status is OK
		X	Bus communication is OK Module status reports an error
		X	Bus communication is not possible Module status reports an error
		X	Error at bus power supply
X	2Hz	X	Error in configuration
			Error channel x • Signal leaves measuring range • Error in parameterization
not relevant: X			

Pin assignment



For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	+AI 0	I	+ Channel 0
2	-AI 0	I	Ground Channel 0
3	+AI 2	I	+ Channel 2
4	-AI 2	I	Ground Channel 2
5	+AI 1	I	+ Channel 1
6	-AI 1	I	Ground Channel 1
7	+AI 3	I	+ Channel 3
8	-AI 3	I	Ground Channel 3

I: Input

In-/Output area

IX	-	Index for access via CANopen with s = Subindex, depends on number and type of analog modules
SX	-	Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h
+4	AI 2	2	Analog value channel 2	6401h/s+2	03h
+6	AI 3	2	Analog value channel 3	6401h/s+3	04h

Output area

No byte of the output area is used by the module.

5.6.1 Technical data

Order no.	EPM-S414
Type	EPM-S414 – analog input
Module ID	040E 1544
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Power loss	0.9 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	25 mA
Voltage inputs	✓
Min. input resistance (voltage range)	200 kΩ
Input voltage ranges	-10 V ... +10 V 0 V ... +10 V
Operational limit of voltage ranges	+/-0.2%
Operational limit of voltage ranges with SFU	-
Basic error limit voltage ranges	+/-0.1%
Basic error limit voltage ranges with SFU	-
Destruction limit voltage	max. 30V
Current inputs	-
Max. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Operational limit of current ranges with SFU	-
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-

Order no.	EPM-S414
Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical current)	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit thermoelement ranges	-
Basic error limit thermoelement ranges with SFU	-
Destruction limit thermocouple inputs	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-

Order no.	EPM-S414
Temperature error internal compensation	-
Technical unit of temperature measurement	-
Resolution in bit	16
Measurement principle	successive approximation
Basic conversion time	480 µs all channels
Noise suppression for frequency	>80dB at 50Hz (UCM<35V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 9 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-

Order no.	EPM-S414
Insulation tested with	DC 500 V
Datasizes	
Input bytes	8
Output bytes	0
Parameter bytes	32
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	61 g
Weight including accessories	61 g
Gross weight	75 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

5.6.2 Parameter data

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
DIAG_EN	1	Diagnostics[1]	00h	3100h	01h
RES1	1	reserved	00h	3101h	02h
LIMIT_EN	1	Limit value monitoring[1]	00h	3102h	03h
SUPR	1	Interference frequency suppression (SFU)	00h	3103h	04h
CH0FN	1	Function number channel 0	12h	3104h	05h
RES7	1	reserved	00h	3105h	06h
CH0UL	2	Upper limit value channel 0	7FFFh	3106h... 3107h	07h
CH0LL	2	Lower limit value channel 0	8000h	3108h... 3109h	08h
CH1FN	1	Function number channel 1	12h	310Ah	09h
RES13	1	reserved	00h	310Bh	0Ah
CH1UL	2	Upper limit value channel 1	7FFFh	310Ch... 310Dh	0Bh
CH1LL	2	Lower limit value channel 1	8000h	310Eh... 310Fh	0Ch
CH2FN	1	Function number channel 2	12h	3110h	0Dh
RES19	1	reserved	00h	3111h	0Eh
CH2UL	2	Upper limit value channel 2	7FFFh	3112h... 3113h	0Fh
CH2LL	2	Lower limit value channel 2	8000h	3114h... 3115h	10h
CH3FN	1	Function number channel 3	12h	3116h	11h
RES25	1	reserved	00h	3117h	12h
CH3UL	2	Upper limit value channel 3	7FFFh	3118h... 3119h	13h
CH3LL	2	Lower limit value channel 3	8000h	311Ah... 311Bh	14h

1) This record set may only be transferred at STOP state.

DIAG_EN Diagnostic interrupt

Byte	Bit 7 ... 0
0	• Diagnostic interrupt – 00h: disabled – 40h: enabled

- Here you can enable respectively disable the diagnostic interrupt.

LIMIT_EN Limit value monitoring

Byte	Bit 7 ... 0
0	• Bit 0: Limit value monitoring channel 0 (1: on) • Bit 1: Limit value monitoring channel 1 (1: on) • Bit 2: Limit value monitoring channel 2 (1: on) • Bit 3: Limit value monitoring channel 3 (1: on) • Bit 7 ... 4: reserved

SUPR Interference frequency suppression (SFU)

Byte	Bit 7 ... 0
0	• Bit 1, 0: Interference frequency suppression channel 0 • Bit 3, 2: Interference frequency suppression channel 1 • Bit 5, 4: Interference frequency suppression channel 2 • Bit 7, 6: Interference frequency suppression channel 3 – 00: deactivated – 01: 60Hz – 10: 50Hz e.g.: 10101010: all channels frequency suppression 50Hz

CHxFN Function number channel x

In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module. With FFh the corresponding channel is deactivated. The formulas listed here allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range (analog value) and vice versa.

±10V

Meas. range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas
±10V Siemens S7 format (12h)	11.76V	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{10}$ $U = D \cdot \frac{10}{27648}$
	10V	27648	6C00h	nominal range	
	5V	13824	3600h		
	0V	0	0000h		
	-5V	-13824	CA00h		
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V Siemens S5 format (22h)	12.5V	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{10}$ $U = D \cdot \frac{10}{16384}$
	10V	16384	4000h	nominal range	
	5V	8192	2000h		
	0V	0	0000h		
	-5V	-8192	E000h		
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

0 ... 10V

Meas. range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas
0 ... 10V Siemens S7 format (10h)	11.76V	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{10}$ $U = D \cdot \frac{10}{27648}$
	10V	27648	6C00h	nominal range	
	5V	13824	3600h		
	0V	0	0000h		
	-1.76V	-4864	ED00h	underrange	
0 ... 10V Siemens S5 format (20h)	12.5V	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{10}$ $U = D \cdot \frac{10}{16384}$
	10V	16384	4000h	nominal range	
	5V	8192	2000h		
	0V	0	0000h		
	-2V	-3277	F333h	underrange	

CHxUL CHxLL Upper limit value Lower limit value channel x

For each channel an upper and a lower limit may be defined. Here only values of the nominal range may be preset, otherwise you receive a parameterization error. By presetting 7FFFh for the upper respectively 8000h for the lower limit value the corresponding limit is deactivated. As soon as the measuring value is beyond the limits and the limit value monitoring is activated, a hardware interrupt is initialized.

5.6.3 Diagnostics and interrupt

Event	Hardware interrupt	Diagnostics interrupt	parameterizable
Error in project engineering/ parameterization	-	X	-
Measuring range overflow	-	X	-
Measuring range underflow	-	X	-
Limit overflow	X	-	X
Limit underflow	X	-	X
Diagnostic buffer overflow	-	X	-
Communication error	-	X	-
Hardware interrupt lost	-	X	-

Hardware interrupt

So you may react to asynchronous events, there is the possibility to activate a hardware interrupt. A hardware interrupt interrupts the linear program sequence and jumps depending on the master system to a corresponding Interrupt routine. Here you can react to the hardware interrupt accordingly.

With CANopen the hardware interrupt data a transferred via an emergency telegram.

SX - Subindex for access via EtherCAT with Index 5000h

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	SX
PRIT_OL	1	Upper limit overflow channel x	00h	02h
PRIT_UL	1	Lower limit underflow channel x	00h	03h
PRIT_US	2	µs-Ticker	00h	04h (High-Byte) 05h (Low-Byte)

PRIT_OL Limit overflow

Byte	Bit 7 ... 0
0	• Bit 0: Limit overflow channel 0 • Bit 1: Limit overflow channel 1 • Bit 2: Limit overflow channel 2 • Bit 3: Limit overflow channel 3 • Bit 7 ... 4: reserved

PRIT_UL Limit underflow

Byte	Bit 7 ... 0
0	• Bit 0: Limit underflow channel 0 • Bit 1: Limit underflow channel 1 • Bit 2: Limit underflow channel 2 • Bit 3: Limit underflow channel 3 • Bit 7 ... 4: reserved

PRIT_US µs ticker

Byte	Bit 7 ... 0
0 ... 1	Value of the µs ticker at the moment of the diagnostic.

µs ticker

In the I/O-1000 module there is a 32 bit timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again. PRIT_US represents the lower 2 byte of the µs ticker value (0 ... 2^{16}-1).

Diagnostic data

Via the parametrization you may activate a diagnostic interrupt for the module. With a diagnostics interrupt the module serves for diagnostics data for diagnostic interrupt$_{incoming}$. As soon as the reason for releasing a diagnostic interrupt is no longer present, the diagnostic interrupt$_{going}$ automatically takes place. All events of a channel between diagnostic interrupt$_{incoming}$ and diagnostic interrupt$_{going}$ are not stored and get lost. Within this time window (1. diagnostic interrupt$_{incoming}$ until last diagnostic interrupt$_{going}$) the MF-LED of the module is on.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow
- Hardware interrupt lost
- Power supply failed

IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX - Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
ERR_A	1	Diagnostic	00h	2F01h	02h
MODTYP	1	Module information	15h		03h
ERR_C	1	reserved	00h		04h
ERR_D	1	Diagnostic	00h		05h
CHTYP	1	Channel type	71h		06h
NUMBIT	1	Number diagnostic bits per channel	08h		07h
NUMCH	1	Number of channels of a module	04h		08h
CHERR	1	Channel error	00h		09h
CH0ERR	1	Channel-specific error channel 0	00h		0Ah
CH1ERR	1	Channel-specific error channel 1	00h		0Bh
CH2ERR	1	Channel-specific error channel 2	00h		0Ch
CH3ERR	1	Channel-specific error channel 3	00h		0Dh
CH4ERR... CH7ERR	4	reserved	00h		0Eh ... 11h
DIAG_US	4	µs ticker	00h		13h

ERR_A Diagnostic

Byte	Bit 7 ... 0
0	• Bit 0: set at module failure • Bit 1: set at internal error • Bit 2: set at external error • Bit 3: set at channel error • Bit 4: set at external auxiliary supply missing • Bit 6 ... 5: reserved • Bit 7: set at error in parametrization

MODTYP Module information

Byte	Bit 7 ... 0
0	• Bit 3 ... 0: module class – 0101b analog module • Bit 4: set at channel information present • Bit 7 ... 5: reserved

ERR_D Diagnostic

Byte	Bit 7 ... 0
0	• Bit 2 ... 0: reserved • Bit 3: set at internal diagnostics buffer overflow • Bit 4: set at internal communication error • Bit 5: reserved • Bit 6: set at hardware interrupt lost • Bit 7: reserved

CHTYP Channel type

Byte	Bit 7 ... 0
0	• Bit 6 ... 0: Channel type – 70h: Digital input – 71h: Analog input – 72h: Digital output – 73h: Analog output – 74h: Analog input/-output – 76h: Counter • Bit 7: reserved

NUMBIT Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostic bits per channel (here 08h)

NUMCH Channels

Byte	Bit 7 ... 0
0	Number of channels of a module (here 04h)

CHERR Channel error

Byte	Bit 7 ... 0
0	• Bit 0: set at error in channel group 0 • Bit 1: set at error in channel group 1 • Bit 2: set at error in channel group 2 • Bit 3: set at error in channel group 3 • Bit 7 ... 4: reserved

CH0ERR ... CH3ERR Channel-specific

Byte	Bit 7 ... 0
0	Channel-specific error channel x: • Bit 0: set at configuring/parameter assignment error • Bit 4 ... 1: reserved • Bit 5: set at hardware interrupt lost • Bit 6: set at measuring range underflow • Bit 7: set at measuring range overflow

CH4ERR ... CH7ERR reserved

Byte	Bit 7 ... 0
0	reserved

DIAG_US µs ticker

Byte	Bit 7 ... 0
0...3	Value of the µs ticker at the moment of the diagnostic

µs ticker

In the I/O-1000 module there is a timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

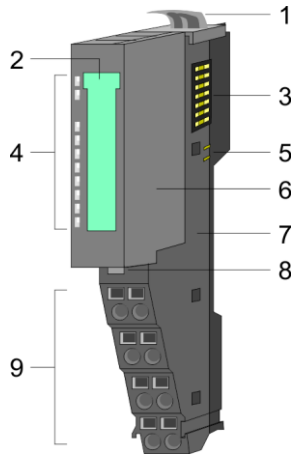
5.7 EPM-S415 - AI 2x16Bit TC

Properties

The electronic module has 2 inputs for temperature and voltage measuring with parameterizable functions. The channels of the module are isolated to the backplane bus.

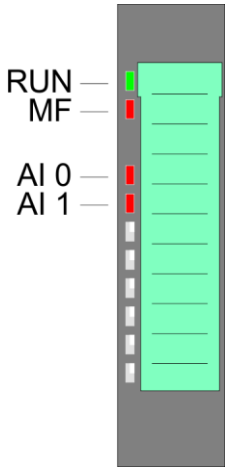
- 2 analog inputs
- Suited for sensors with type J, K, N, R, S, T, B, C, E, L and for voltage measuring ± 80mV
- Diagnostics function
- 16bit resolution
- Internal temperature compensation
- High potential gradient of DC140V/AC60V between the inputs

Structure



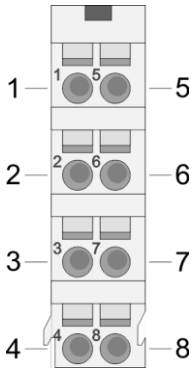
1	Locking lever terminal module
2	Labeling strip
3	Backplane bus
4	LED status indication
5	DC 24V power section supply
6	Electronic module
7	Terminal module
8	Locking lever electronic module
9	Terminal

Status indication

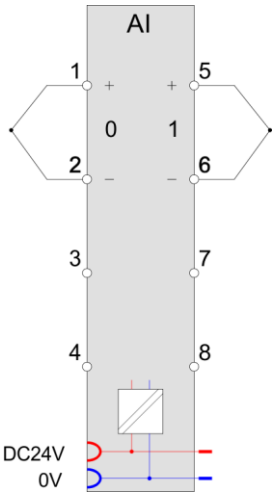


RUN green	MF red	AI x red	Description
		X	Bus communication is OK Module status is OK
		X	Bus communication is OK Module status reports an error
		X	Bus communication is not possible Module status reports an error
		X	Error at bus power supply
X	2Hz	X	Error in configuration
			Error channel x • Signal leaves measuring range • Error in parameterization • Wire break (if parameterized)
not relevant: X			

Pin assignment



For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	+TC 0	I	+ Channel 0
2	-TC 0	I	Ground Channel 0
3	---	---	not connected
4	---	---	not connected
5	+TC 1	I	+ Channel 1
6	-TC 1	I	Ground Channel 1
7	---	---	not connected
8	---	---	not connected

I: Input

CAUTION!

Please consider that the electronic module AI 2x16Bit TC may exclusively be used together with the terminal module 001-0AA20!

Please take care of the correct polarity when installing the sensors! Please install short circuits at non-used inputs by connecting the positive contact with the channel ground of the according channel.

Supplementation to the installation guidelines

To avoid variations in temperature within the module, which may affect the accuracy of the measurement, you should consider the following points when assembling:

- Do not arrange the module directly apart from a power module with a high feeding current.
- Do not install the module at the end of a line.
- The module should be in a static condition, i.e. the temperature should be as constant as possible in the environment of your module (closed switchgear cabinet free from air draught).
- The accuracy is reached after approx. 30 minutes after entering the static condition.

In-/Output area

IX	-	Index for access via CANopen with s = Subindex, depends on number and type of analog modules
SX	-	Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Input area

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value channel 0	6401h/s	01h
+2	AI 1	2	Analog value channel 1	6401h/s+1	02h

Output area

No byte of the output area is used by the module.

5.7.1 Technical data

Order no.	EPM-S415
Type	EPM-S415 – analog input
Module ID	040F 1543
Current consumption/power loss	
Current consumption from backplane bus	55 mA
Power loss	1 W
Technical data analog inputs	
Number of inputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Current consumption from load voltage L+ (without load)	30 mA
Voltage inputs	-
Min. input resistance (voltage range)	10 MΩ
Input voltage ranges	-80 mV ... +80 mV
Operational limit of voltage ranges	±0.3%
Operational limit of voltage ranges with SFU	±0.1%
Basic error limit voltage ranges	±0.25%
Basic error limit voltage ranges with SFU	±0.05%
Destruction limit voltage	max. 20V
Current inputs	-
Max. input resistance (current range)	-
Input current ranges	-
Operational limit of current ranges	-
Operational limit of current ranges with SFU	-
Basic error limit current ranges	-
Radical error limit current ranges with SFU	-
Destruction limit current inputs (voltage)	-
Destruction limit current inputs (electrical current)	-
Resistance inputs	-
Resistance ranges	-

Order no.	EPM-S415
Operational limit of resistor ranges	-
Operational limit of resistor ranges with SFU	-
Basic error limit	-
Basic error limit with SFU	-
Destruction limit resistance inputs	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance thermometer ranges with SFU	-
Basic error limit thermoresistor ranges	-
Basic error limit thermoresistor ranges with SFU	-
Destruction limit resistance thermometer inputs	-
Thermocouple inputs	✓
Thermocouple ranges	type B type C type E type J type K type L type N type R type S type T
Operational limit of thermocouple ranges	Type E, L, T, J, K, N: ±2.5K / Type B, C, R, S: ±8.0K
Operational limit of thermocouple ranges with SFU	Type E, L, T, J, K, N: ±1.5K / Type B, C, R, S: ±4.0K
Basic error limit thermoelement ranges	Type E, L, T, J, K, N: ±2.0K / Type B, C, R, S: ±7.0K
Basic error limit thermoelement ranges with SFU	Type E, L, T, J, K, N: ±1.0K / Type B, C, R, S: ±3.0K
Destruction limit thermocouple inputs	max. 20V
Programmable temperature compensation	✓
External temperature compensation	✓
Internal temperature compensation	✓
Temperature error internal compensation	1 K
Technical unit of temperature measurement	°C, °F, K

Order no.	EPM-S415
Resolution in bit	16
Measurement principle	Sigma-Delta
Basic conversion time	84.2 ms (50 Hz) 70.5 ms (60 Hz) per channel
Noise suppression for frequency	>90dB at 50Hz (UCM<10V)
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes
Process alarm	no
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	-
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 75 V/ AC 50 V
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	4
Output bytes	0
Parameter bytes	10

Order no.	EPM-S415
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	58 g
Weight including accessories	58 g
Gross weight	72 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

SFU - Interference frequency suppression

The indicated error limits are valid starting from the following temperatures:

- Thermoelement type T: -200 °C
- Thermoelement type K: -100 °C
- Thermoelement type B: +700 °C
- Thermoelement type N: -150 °C
- Thermoelement type E: -150 °C
- Thermoelement type R: +200 °C
- Thermoelement type S: +100 °C
- Thermoelement type J: -100 °C

5.7.2 Parameter data

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
DIAG_EN	1	Diagnostics[1]	00h	3100h	01h
WIBRK_EN	1	Wire break recognition[1]	00h	3101h	02h
TEMPCNF	1	Temperature system	00h	3102h	03h
SUPR	1	Interference frequency suppression (SFU)	02h	3103h	04h
CH0FN	1	Function number channel 0	C1h	3104h	05h
CH1FN	1	Function number channel 1	C1h	3105h	06h

1) This record set may only be transferred at STOP state.

DIAG_EN Diagnostic interrupt

Byte	Bit 7 ... 0
0	• Diagnostic interrupt – 00h: disabled – 40h: enabled

- Here you can enable respectively disable the diagnostic interrupt.

WIBRK_EN Wire break recognition

Byte	Bit 7 ... 0
0	• Bit 0: Wire break recognition channel 0 (1: on) • Bit 1: Wire break recognition channel 1 (1: on) • Bit 7 ... 2: reserved



Due to the high sensitivity of the inputs, unused inputs should be deactivated in the parametrization. Due to the high input impedance, open inputs can be influenced by adjacent channels or due to the measuring method during wire break detection. Since the entire measuring range moves in the mV range, open-loop inputs can already cause measuring range overshoots.

TEMPCNF Temperature system

Byte	Bit 7 ... 0
0	• Bit 0, 1: Temperature system – 00: °C – 01: °F – 10: K • Bit 7 ... 2: reserved

SUPR Interference frequency suppression (SFU)

Byte	Bit 7 ... 0
0	• Bit 0, 1: Interference frequency suppression – 01: 60Hz – 10: 50Hz • Bit 7 ... 2: reserved

CHxFN Function number channel x

In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module. With FFh the corresponding channel is deactivated.

Voltage

-80 ... 80mV

Meas. range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas
-80 ... 80mV Siemens S7 format (11h)	94.07mV	32511	7EFFh	overrange	$D = 27648 \cdot \frac{U}{80}$ $U = D \cdot \frac{80}{27648}$
	80mV	27648	6C00h	nominal range	
	0V	0	0000h		
	-80mV	-27648	9400h		
	-94.07mV	-32512	8100h	underrange	
-80 ... 80mV Siemens S5 format (21h)	100mV	20480	5000h	overrange	$D = 16384 \cdot \frac{U}{80}$ $U = D \cdot \frac{80}{16384}$
	80mV	16384	4000h	nominal range	
	0V	0	0000h		
	-80mV	-16384	C000h		
	-100mV	-20480	B000h	underrange	

Temperature

Measuring range (funct. no.)	Measuring value in °C (0.1°C/digit)	Measuring value in °F (0.1°F/digit)	Measuring value in K (0.1K/digit)	Range
Type J: [Fe-Cu-Ni IEC] -210 ... +1200°C -346 ... 2192°F 63.2 ... 1473.2K (B0h: ext. comp. 0°C) (C0h: int. comp. 0°C)	+14500	26420	17232	overrange
	-2100 ... +12000	-3460 ... 21920	632 ... 14732	nominal range
	---	---	---	underrange
Type K: [Ni-Cr-Ni] -270 ... +1372°C -454 ... 2501.6°F 0 ... 1645.2K (B1h: ext. comp. 0°C) (C1h: int. comp. 0°C)	+16220	29516	18952	overrange
	-2700 ... +13720	-4540 ... 25016	0 ... 16452	nominal range
	---	---	---	underrange

Measuring range (funct. no.)	Measuring value in °C (0.1°C/digit)	Measuring value in °F (0.1°F/digit)	Measuring value in K (0.1K/digit)	Range
Type N: [Ni-Cr-Si] -270 ... +1300°C -454 ... 2372°F 0 ... 1573.2K (B2h: ext. comp. 0°C) (C2h: int. comp. 0°C)	+15500	28220	18232	overrange
	-2700 ... +13000	-4540 ... 23720	0 ... 15732	nominal range
	---	---	---	underrange
Type R: [PtRh-Pt] -50 ... +1769°C -58 ... 3216.2°F 223.2 ... 2042.2K (B3h: ext. comp. 0°C) (C3h: int. comp. 0°C)	+20190	32766	22922	overrange
	-500 ... +17690	-580 ... 32162	2232 ... 20422	nominal range
	-1700	-2740	1032	underrange
Type S: [PtRh-Pt] -50 ... +1769°C -58 ... 3216.2°F 223.2 ... 2042.2K (B4h: ext. comp. 0°C) (C4h: int. comp. 0°C)	+20190	32766	22922	overrange
	-500 ... +17690	-580 ... 32162	2232 ... 20422	nominal range
	-1700	-2740	1032	underrange
Type T: [Cu-Cu-Ni] -270 ... +400°C -454 ... 752°F 3.2 ... 673.2K (B5h: ext. comp. 0°C) (C5h: int. comp. 0°C)	+5400	10040	8132	overrange
	-2700 ... +4000	-4540 ... 7520	32 ... 6732	nominal range
	---	---	---	underrange
Type B: [PtRh-PtRh] 0 ... +1820°C 32 ... 2786.5°F 273.2 ... 2093.2K (B6h: ext. comp. 0°C) (C6h: int. comp. 0°C)	+20700	32766	23432	overrange
	0 ... +18200	320 ... 27865	2732 ... 20932	nominal range
	-1200	-1840	1532	underrange

Measuring range (funct. no.)	Measuring value in °C (0.1°C/digit)	Measuring value in °F (0.1°F/digit)	Measuring value in K (0.1K/digit)	Range
Type C: [WRe5-WRe26] 0 ... +2315°C 32 ... 2786.5°F 273.2 ... 2093.2K (B7h: ext. comp. 0°C) (C7h: int. comp. 0°C)	+25000	32766	23432	overrange
	0 ... +23150	320 ... 27865	2732 ... 20932	nominal range
	-1200	-1840	1532	underrange
Type E: [Ni-Cr - Cu-Ni] -270 ... +1000°C -454 ... 1832°F 0 ... 1273.2K (B8h: ext. comp. 0°C) (C8h: int. comp. 0°C)	+12000	21920	14732	overrange
	-2700 ... +10000	-4540 ... 18320	0 ... 12732	nominal range
	---	---	---	underrange
Type L: [Fe-Cu-Ni] -200 ... +900°C -328 ... 1652°F 73.2 ... 1173.2K (B9h: ext. comp. 0°C) (C9h: int. comp. 0°C)	+11500	21020	14232	overrange
	-2000 ... +9000	-3280 ... 16520	732 ... 11732	nominal range
	---	---	---	underrange

5.7.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Measuring range overflow
- Measuring range underflow

IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX - Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
ERR_A	1	Diagnostic	00h	2F01h	02h
MODTYP	1	Module information	15h		03h
RES2	1	reserved	00h		04h
ERR_D	1	Diagnostic	00h		05h
CHTYP	1	Channel type	71h		06h
NUMBIT	1	Number diagnostic bits per channel	08h		07h
NUMCH	1	Number of channels of a module	02h		08h
CHERR	1	Channel error	00h		09h
CH0ERR	1	Channel-specific error channel 0	00h		0Ah
CH1ERR	1	Channel-specific error channel 1	00h		0Bh
CH2ERR… CH7ERR	6	reserved	00h		0Ch ... 11h
DIAG_US	4	µs ticker	00h		13h

ERR_A Diagnostic

Byte	Bit 7 ... 0
0	• Bit 0: set at module failure • Bit 1: set at internal error • Bit 2: set at external error • Bit 3: set at channel error • Bit 4: set at external auxiliary supply missing • Bit 6 ... 5: reserved • Bit 7: set at error in parametrization

MODTYP Module information

Byte	Bit 7 ... 0
0	• Bit 3 ... 0: module class – 0101b analog module • Bit 4: set at channel information present • Bit 7 ... 5: reserved

ERR_D Diagnostic

Byte	Bit 7 ... 0
0	• Bit 2 ... 0: reserved • Bit 3: set at internal diagnostics buffer overflow • Bit 4: set at internal communication error • Bit 7 ... 5: reserved

CHTYP Channel type

Byte	Bit 7 ... 0
0	• Bit 6 ... 0: Channel type – 70h: Digital input – 71h: Analog input – 72h: Digital output – 73h: Analog output – 74h: Analog input/-output – 76h: Counter • Bit 7: reserved

NUMBIT Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostic bits per channel (here 08h)

NUMCH Channels

Byte	Bit 7 ... 0
0	Number of channels of a module (here 02h)

CHERR Channel error

Byte	Bit 7 ... 0
0	• Bit 0: set at error in channel group 0 • Bit 1: set at error in channel group 1 • Bit 7 ... 2: reserved

CH0ERR / CH1ERR Channel-specific

Byte	Bit 7 ... 0
0	Channel-specific error: Channel x: • Bit 0: set at project engineering/parameterization error • Bit 3 ... 1: reserved • Bit 4: set at wire break • Bit 5: reserved • Bit 6: set at measuring range underflow • Bit 7: set at measuring range overflow

CH2ERR ... CH7ERR reserved

Byte	Bit 7 ... 0
0	reserved

DIAG_US µs ticker

Byte	Bit 7 ... 0
0...3	Value of the µs ticker at the moment of the diagnostic

µs ticker

In the I/O-1000 module there is a timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

5.8 EPM-S416 - AI1x 3Ph 230/400V

Properties

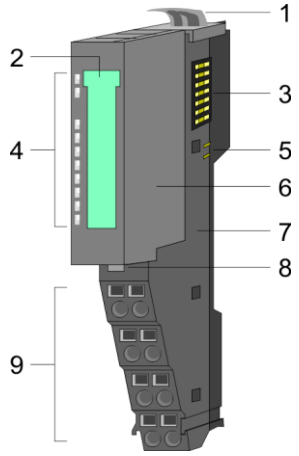
The following modules are available:

- EPM-S416: AI1x 3Ph 230/400V 5A

The modules allow the measurement of electric data for counting energy and power measurement. Here, the voltage measurement of the individual phases is done directly (or indirectly via voltage transformers) and the current measurement indirectly via current transformers. When 5A current transformers are used, energy measurement can only be performed on devices in 3-phase operation. When 1A current transformers are used, the measurement inputs can be fed from the same phase.

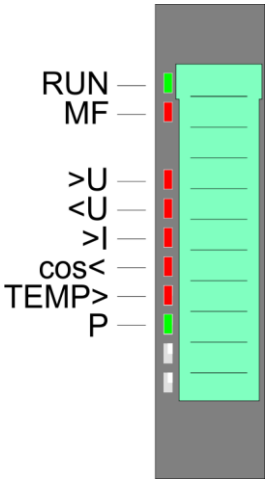
- Retentive storage of the energy values
- Diagnostic function
- Resolution of the measured value 24bit
- The following measurands can be found in 4-quadrant operation:
  - Voltage, current
  - Electrical power
  - Electrical work
  - Harmonics
  - Phase shift cos φ
  - Frequency

Structure



1	Locking lever terminal module
2	Labeling strip
3	Backplane bus
4	LED status indication
5	DC 24V power section supply
6	Electronic module
7	Terminal module
8	Locking lever electronic module
9	Terminal

Status indication

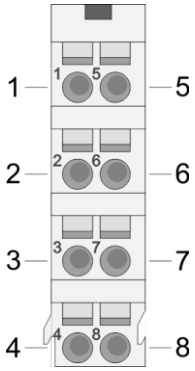


LED		Description
RUN	green	Bus communication is OK
		off: Error at bus power supply
MF	red	Module status reports an error Bus communication is not possible
		off: Module status is OK
	red 2Hz	Flashes: Error in configuration
>U		Voltage in the parametrized range
	red	Voltage limit value exceeded
<U		Voltage in the parametrized range
	red	Voltage limit value undershot (omitted in 1-phase operation)
>I		Current in the parametrized range
	red	Current limit value exceeded
cos<		Phase shift cos φ in the parametrized range
	red	Phase shift cos φ limit value undershot (omitted in 1-phase operation)
TEMP>		Temperature in the parametrized range
	red	Temperature limit value exceeded
P	green	P: Proportional power blinks with increasing frequency proportional to the active power at 20 pulses/Wh. The current transformer factor is not considered.

If the limit value is exceeded, the corresponding LED lights up. After the acknowledgment of the *'status bits'* the corresponding LED goes out again.

EPM-S416 ↬ 'Status bits' page 263

Pin assignment



For wires with a core cross-section of 0.08mm² up to 1.5mm². The measurement of current respectively voltage is done indirectly by current respectively voltage transformers. *Chap.* ‘Connection‘ p*age 254*

Pos.	Function	Type	Description
1	L1	I	Voltage measurement L1
2	L2	I	Voltage measurement L2
3	L3	I	Voltage measurement L3
4	N	I	Voltage measurement N
5	I_{L1}	I	Current measurement I_{L1}
6	I_{L2}	I	Current measurement I_{L2}
7	I_{L3}	I	Current measurement I_{L3}
8	I_N	I	Current measurement I_N
I: Input			

DANGER!

Please observe safety instructions!

With the energy measurement modules only AC voltages 230/400 V and currents can be measured. Please observe the safety instructions when handling an energy measuring module! *Chap. ‘*Safety precautions*‘ page 4.*

In-/Output area

IX - Index for access via CANopen with s = Subindex, depends on number and type of analog modules

SX - Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Input area

Addr.	Name	Byte	Function	IX	SX
+0	B0 ... B3	4	Header byte 0 ... 3	6401h/s	01h
+4	D00 ... D11	12	User data input byte 0 ... 11	6401h/s+1	02h

Output area

Addr.	Name	Byte	Function	IX	SX
+0	B0 ... B3	4	Header byte 0 ... 3	6401h/s	01h
+4	D00 ... D11	12	User data output byte 0 ... 11	6401h/s+1	02h

5.8.1 Technical data

Order no.	EPM-S416
Type	EPM-S416 – analog input
Module ID	0884 2880
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Power loss	0.9 W
Rated load voltage	-
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes, parameterizable
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	-
Isolation	
Between channels	-
Insulation tested with	AC 2200 V
Energy measurement	
Number of channels for measuring	1* 1..3 phases U/I
Voltage measuring range	0..300 V each phase
Coupling voltage measurement	directly or transformer
Current range	0..5 A each phase
Coupling current measurement	Transformer
Frequency range	46...64 Hz

Order no.	EPM-S416
Measurement accuracy	1 %
Available measurement	Active energy Temperature Frequency Voltage RMS Current RMS Active power Reactive power Apparent power Cos phi Harmonic voltage RMS Harmonic current RMS
Adjustable limits	Voltage RMS min/max Current RMS min/max Cos phi min Temperature max. Frequency min/max
Datasizes	
Input bytes	16
Output bytes	16
Parameter bytes	30
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	57 g
Weight including accessories	57 g
Gross weight	71 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C

Order no.	EPM-S416
Certifications	
UL certification	-
KC certification	-

The Measurement accuracy ±1 % is maintained from:

Measurand	Measuring range
Voltage	230 V ± 15%
Current	Current at measuring input ($I_{L1...L3}$ - I_N) 0 ... 5A
Cos φ	Current at measuring input ($I_{L1...L3}$ - I_N) ≥ 100mA
Power	Current at measuring input ($I_{L1...L3}$ - I_N) ≥ 2mA
Active energy	Current at measuring input ($I_{L1...L3}$ - I_N) ≥ 2mA

5.8.2 Basics

5.8.2.1 Terms

Measurand

A measurand is a physical quantity that can be measured such as current, voltage or temperature:

Measured value

A measured value is a value of a measurand, which is determined by measurement or by calculation.

ID

In the module each measurand one ID is assigned. The access to the measured value of a measurand happens by means of the corresponding ID.

DS-ID

As soon as the module is supplied by the DC 24V power section supply, the measurement is started and the counting of the energy counters is continued with the retentive stored counter values. The measured values of all the measurands are stored in the module with one record set ID DS-ID. The following must be observed:

- All measured values with the same DS-ID come from the same measurement and are consistent.
- By specifying the DS-ID you can address the individual measured values of the same measurement.
- The DS-ID covers the values 1 ... 15.
- To refresh the measured values the DS-ID is to be incremented by 1. The value 15 must be followed by 1.
- If the DS-ID is incremented and there is still no new value available, the current value is returned. Here the energy measurement module reports an error.
- DS-ID = 0 - Auto increment mode
  - With DS-ID = 0 there is a request with auto increment mode. Here the module always returns the current measured value. As soon as a new measured value is available, here the DS-ID is incremented by one within the values 1 ... 15. If there is no new measured value available, the DS-ID is not changed. Here the energy measurement module reports an error.
- The uniqueness of a measured value always consists of the ID of the measurand and the DS-ID.

Frame

In the module you can combine some measurands to one data package (Frame), which is transferred in one step. One data package consists of 12byte user data. Considering the data length of 12 bytes, you can define the content of a frame by specifying the ID of the measurands. Up to 256 frames may be configured (Frame 0 ... Frame 255). The following must be observed:

- The definition of Frame 1 to Frame 255 happens by the command Set_Frame.
- Frame 0 with the corresponding measurands can exclusively be specified by the parametrization.
- With telegram type Zero Frame the data package of Frame 0 can be accessed. After the start-up of the module there are automatic Zero Frame requests as long as the process data communication comes from the head module.

FR-ID

When defining frames by means of *'Set Frame'*, via the FR-ID these are assigned to a number between 0 ... 255. By specifying theFR-ID you can request the corresponding frame.

Data type

In the following the data types are listed, which are used in the module. The length is to be considered particularly by the definition of Frames.

Data type	Length in byte	Description
UINT_8	1	Integer 8bit
UINT_16	2	Integer 16bit
UINT_32	4	Integer 32bit
INT_8	1	Signed integer 8bit
INT_16	2	Signed integer 16bit
INT_32	4	Signed integer 32bit
FLOAT	4	32bit floating point IEEE 754

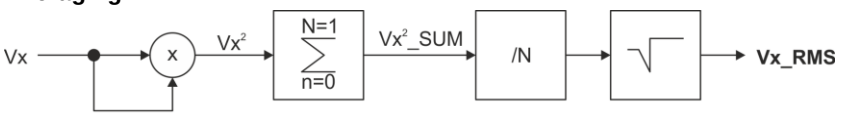
5.8.2.2 Principle of measurement

Calculation of the effective values of current and voltage

- For 3phase AC low-voltage networks the nominal voltage corresponds to the RMS voltage U_{RMS} e.g. $230V_{RMS}$ as star voltage between one of the three phase conductors (L1, L2 or L3) and the neutral conductor N.
- The module is used for detecting the current and voltage values and the energy values of all 3 phases. Here, the module measures the real effective value (True RMS) of voltages and currents.
- The sampling rate of the digitally processed measured values is 2.7 kHz. The time interval for the calculation of the actual values is 200 ms. This results in an evaluation window of the measured data of 540 measured values, which can be requested at any time.

Voltage measurement

Averaging



1. The square of the currently measured voltage Vx is calculated.
   ⇨ *Vx²*
2. The sum of *Vx²* is calculated via the time interval n = 0 ... *n* = *N*-1.
   ⇨ *Vx²_SUM*
3. *Vx²_SUM* is divided by N the number of measurements.
4. From the result of the division, the square root is drawn.
   ⇨ **Average*Vx_RMS***

Current measurement

For current measurement you have to use external current transformers!

CAUTION!

Consider the maximum current for current transformers!

Depending on the energy measuring module used, the following maximum current limits for the current transformers must be considered:

- EPM-S416: max. 5A

Please also consider the data sheet of your current transformer!

CAUTION!

Note characteristics of current transformers!

- Please consider the data sheet of your current transformer!
- Some current transformer must not be operated in idle mode!
- Before commissioning your module must be connected to the secondary winding of the current transformer!

- Please note that the overall accuracy of the assembly of measuring module and current transformers depends on the accuracy class of the transformers.
- The transformer factor is retentive stored and taken into account while counting.
- A change of the transformer factor is taken immediately recognized. Current counter values are not changed, new values are added.
- When the transformer factor was changed, current counter values are not changed, new values are added considering the new factor.

Calculating power, energy

To calculate the effective power P, each time synchronous sample value of the currents and voltages are used. In this case, phase shifts between the currents and voltages are considered. The energy is calculated from integration of the power by time.

For the power is valid:

- Positive sign (+): Consumed respectively received power
- Negative sign (-): Fed in power

Determine frequency

The frequency of the phases is determined by a zero crossing detection of the sampled signals and calculating from the frequency.

Apparent power

$$S = U \; x \; I$$

The apparent power S is calculated from the product of effective current I_{eff} and *effective voltage* U_{eff}. With the apparent power you get the total power of a power grid.

Reactive power

$$Q = U \; x \; I \; x \; sin \; \varphi$$

With AC voltage supplied, any electrical device generates an electromagnetic field. By AC voltage, the magnetic field is regularly built and removed. Because the power to build a field is returned to the grid as it is being removed, this power is called "reactive power". Reactive power oscillates between consumer and producer generator and pollutes the power grids. The reactive power is the product of current and voltage at a reactance. Reactances are all types of coils and capacitors. If these are connected to an AC voltage, they can absorb energy and release it phase-shifted as reactive power. The reactive power results of the phase-shift between current and voltage of the inductance respectively capacitance. With a pure ohmic resistance current and voltage are in the same phase, therefore, a purely resistive resistor has no reactive component.



The formula Q = U x I x sin φ applies only to purely sinusoidal currents.

Active power

$$P = U \; x \; I \; x \; cos \; \varphi$$

The active power P is the effectively used power. This is the part without phase shift between voltage and current and refers to a resistive load.

Calculation of the power factor cos φ (phi)

In real networks energy consumers / producers typically are not purely ohmic. There is a phase shift between current and voltage. The *cos φ* is a measure of the phase shift between current and voltage of the basic frequency of the corresponding phase. The *total cos φ* is calculated by dividing total active power P and total apparent power S.

Harmonics

Harmonics are oscillations of the voltages and currents, whose frequency is an integer multiple of the basic frequency. The 1. harmonic is the basic frequency or mains frequency, nominally 50Hz or 60Hz. The level of harmonics is a measure for the network quality. Harmonics or harmonic oscillations are caused by equipment with non-linear characteristics such as transformers, fluorescent lamps and power electronic equipment such as rectifiers and thyristors. The non-sinus-shaped currents of these consumers cause the net interference voltages, which distorts the nominal line voltage. During parametrization you can specify the level of the harmonic. With this frequency the *'harmonic'* current and voltage values are filtered.

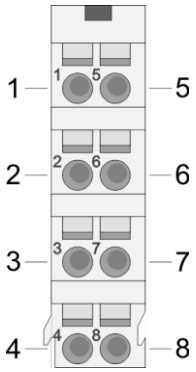
5.8.3 Connection

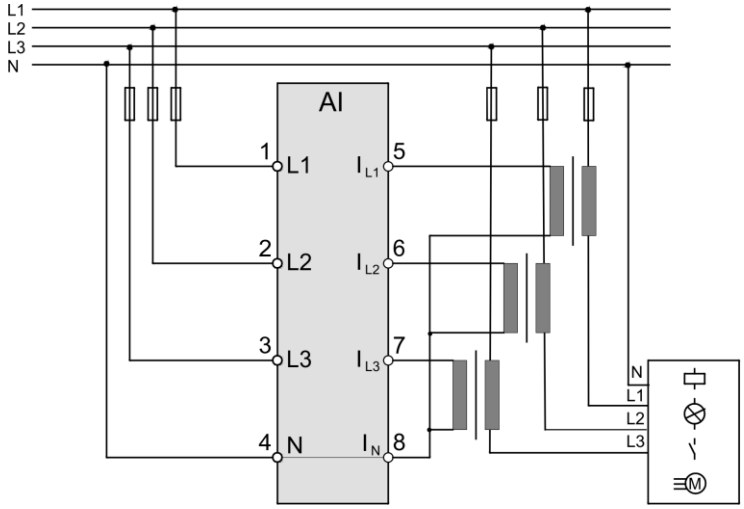
DANGER!

Please observe safety instructions!

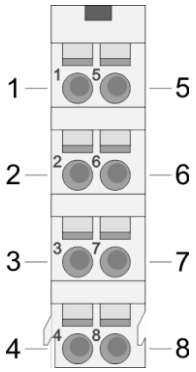
With the energy measurement modules only AC voltages 230/400 V and currents can be measured. Please observe the safety instructions when handling an energy measuring module!

Connection via current transformer

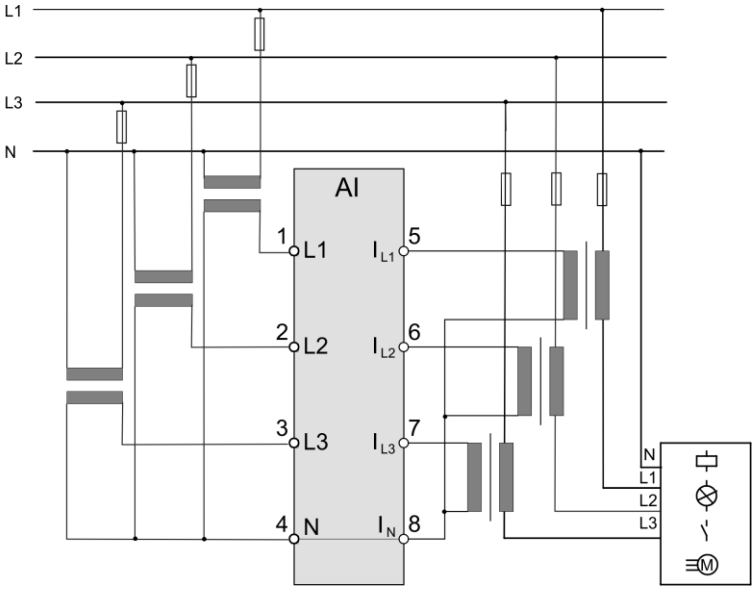




Connection via current- /voltage transformer



Please note that the use of a voltage transformer is only supported by the energy measurement module EPM-S416!



5.8.4 Parameter data

5.8.4.1 Parameter

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

IDx	Name	Data type	Description	Default (dec.)	IX	SX
1	CFG	UINT_8	Choice of phases and data formats	0	3100h	01h
2	F0V1	UINT_8	Frame 0: Value 1 (IDx)	1	3101h	02h
3	F0V2	UINT_8	Frame 0: Value 2 (IDx)	9	3102h	03h
4	F0V3	UINT_8	Frame 0: Value 3 (IDx)	13	3103h	04h
5	F0V4	UINT_8	Frame 0: Value 4 (IDx)	12	3104h	05h
6	F0V5	UINT_8	Frame 0: Value 5 (IDx)	0	3105h	06h
102	IRMS_MAX[1]	UINT_32	Current upper limit [mA] Range of values: 0 ... 25000000	0[1]	3106h.. 3109h	07h
104	VRMS_MAX	UINT_16	Voltage upper limit [V] Range of values: 0 ... 30000	260	310Ah 310Bh	08h
105	VRMS_MIN	UINT_16	Voltage lower limit [V] Range of values: 0 ... 30000	200	310Ch.. 310Dh	09h
106	PF_MIN	UINT_8	Cos φ lower limit [0.01] Range of values: 0 ... 100	30	310Eh..	0Ah
107	T_MAX	UINT_16	Temperature upper limit [0.01 °C] Range of values: 0 ... 20000	7000	310Fh.. 3110h	0Bh
108	F_MAX	UINT_16	Frequency upper limit [0.01 Hz] Range of values: 0 ... 20000	5100	3111h.. 3112h	0Ch
109	F_MIN	UINT_16	Frequency lower limit [0.01 Hz] Range of values: 0 ... 20000	4900	3113h.. 3114h	0Dh
111	WANDLER_I	UINT_16	Current transformer factor Range of values: 1 ... 5000	1	3115h.. 3116h	0Eh
112	WANDLER_U	UINT_16	Voltage transformer factor Range of values: 1 ... 300	1	3117h.. 3118h	0Fh
113	HARM	UINT_8	Harmonic number ↳ *'Harmonics' page 253* Range of values: 1 ... 30	1	3119h	10h

- As long as no parameters have been sent from the head station to the module after a power cycle, default values are transmitted by the module during a read access and not the parameters stored in the module.
- After transferring the parameters to the module the status bits are reset and the measurement is interrupted for a short time!
- Please note when at least one phase is de-activated, the parameters PF_MIN and VRMS_MIN are ignored and set to "0".
- On error in the parametrization the MF LED blinks and you receive an error message.

Data type

↳ ‘Data type’ p*age 250*

CFG

Bit	Name	Description	Default
0	reserviert		0
1	Write Protect[1]	Write protection bit for parameterization via Web server • 0: Write Protect de-activated • 1: Write Protect activated Please see the following note!	1[1]
2	reserviert		0
3	Phase 1	Measurement phase L1 • 0: Measurement is activated • 1: Measurement is de-activated	0
4	Phase 2	Measurement phase L2 • 0: Measurement is activated • 1: Measurement is de-activated	0
5	Phase 3	Measurement phase L3 • 0: Measurement is activated • 1: Measurement is de-activated	0
6	Data type	Data type of the measured values in the user data • 0: Integer (INT) • 1: 32bit floating point (FLOAT) DIN IEEE 754	0
7	Byteorder	Data type of the measured values in the user data • 0: Big-Endian: Byte order: high byte, low byte • 1: Little-Endian: Byte order: low byte, high byte	0

1) Access to the *'Write Protect'* parameter is only possible via the Web server of the head module (not via GSD or GSDML).

1) Write Protect

The parameter *'Write Protect'* is only relevant, if the module is connected to a head module with an integrated Web server. If the module is parameterized via the Web server *'Write Protect'* must be set to "0", otherwise the changed parameters will not be used!

F0V1 ... F0V5

In the module you can combine some measurands to one data package (Frame), which is transferred in one step.

By specifying the ID of the corresponding measurand, via F0V1 ... F0V5 the data areas of Frame 0 can be defined. Please note that here the user data length of 12 bytes is not exceeded.

- Range of values: 0 ... 41
- Default:
  - F0V1: 1 (active energy consumer)
  - F0V2: 9 (total active power)
  - F0V3: 13 (total cos φ)
  - F0V4: 0
  - F0V5: 0

5.8.5 Measurands

Data type INT

ID	Description	Data type	Unit	Min. value	Max. value
1	Counter: Active energy consumer	UINT_32	1Wh[1]	0	4 294 967 295
2	Counter: Active energy producer	UINT_32	1Wh[1]	0	4 294 967 295
3	Counter: Active energy L1 consumer	UINT_32	1Wh[1]	0	4 294 967 295
4	Counter: Active energy L1 producer	UINT_32	1Wh[1]	0	4 294 967 295
5	Counter: Active energy L2 consumer	UINT_32	1Wh[1]	0	4 294 967 295
6	Counter: Active energy L2 producer	UINT_32	1Wh[1]	0	4 294 967 295
7	Counter: Active energy L3 consumer	UINT_32	1Wh[1]	0	4 294 967 295
8	Counter: Active energy L3 producer	UINT_32	1Wh[1]	0	4 294 967 295
9	Total active power	INT_32	1mW	-2 147 483 647	2 147 483 647
10	Total reactive power	INT_32	1mW	-2 147 483 647	2 147 483 647
11	Total apparent power	INT_32	1mW	-2 147 483 647	2 147 483 647
12	Frequency	UINT_16	0.01Hz	4600	6400
13	Total Cos φ[2]	INT_8	0.01	-100	100
14	Temperature	INT_16	0.01°C	-2500	8500
15	Active power L1	INT_32	1mW	-715 827 882	715 827 882
16	Reactive power L1	INT_32	1mW	-715 827 882	715 827 882
17	Total power L1	INT_32	1mW	-715 827 882	715 827 882
18	Voltage L1	UINT_32	1mV	0	30 000 000
19	Current L1	UINT_32	1mA	0	25 000 000
20	Cos φ L1[2]	INT_8	0.01	-100	100
21	Harmonic voltage L1	UINT_32	1mV	0	30 000 000
22	Harmonic current L1	UINT_32	1mA	0	25 000 000
23	Active power L2	INT_32	1mW	-715 827 882	715 827 882
24	Reactive power L2	INT_32	1mW	-715 827 882	715 827 882
25	Total power L2	INT_32	1mW	-715 827 882	715 827 882

ID	Description	Data type	Unit	Min. value	Max. value
26	Voltage L2	UINT_32	1mV	0	30 000 000
27	Current L2	UINT_32	1mA	0	25 000 000
28	Cos φ L2[2]	INT_8	0.01	-100	100
29	Harmonic voltage L2	UINT_32	1mV	0	30 000 000
30	Harmonic current L2	UINT_32	1mA	0	25 000 000
31	Active power L3	INT_32	1mW	-715 827 882	715 827 882
32	Reactive power L3	INT_32	1mW	-715 827 882	715 827 882
33	Total power L3	INT_32	1mW	-715 827 882	715 827 882
34	Voltage L3	UINT_32	1mV	0	30 000 000
35	Current L3	UINT_32	1mA	0	25 000 000
36	Cos φ L3[2]	INT_8	0.01	-100	100
37	Harmonic voltage L3	UINT_32	1mV	0	30 000 000
38	Harmonic current L3	UINT_32	1mA	0	25 000 000
39	Overflow energy meter consumer Is incremented by 1 in case of overflow of the energy meter (ID = 1)	UINT_32		0	4 294 967 295
40	Overflow energy meter producer Is incremented by 1 in case of overflow of the energy meter (ID = 2)	UINT_32		0	4 294 967 295
41	Status bits ↯ *'Status bits' page 263*	UINT_32			

1) The display resolution of the energy meter is 1Wh x WANDLER_I x WANDLER_U (current transformer factor x voltage transformer factor).

2) The measuring accuracy of the Cos φ is maintained from a minimum current of 100mA x *WANDLER_I* (current transformer factor).

Tolerance

See Technical data

ID

Each measurand one ID is assigned. The access to the measured value of a measurand happens by means of the corresponding ID.

Data type

'Data type' *page 250*

Max. Total power

- The max. Total power for 3 phases is
  - ±2 147 483 647mW (INT_32)
- 3 * Umax * WANDLER_U * Imax * WANDLER_I

If the Total power is exceeded by ±2 147 483 647mW (INT_32), the max value is output.

Overflow energy meter

- 0xXX112233
  - XX: not used
  - 11: Overflow phase L1
  - 22: Overflow phase L2
  - 33: Overflow phase L3

Measurands Data type FLOAT

ID	Description	Data type	Unit	Min. value	Max. value
1	Counter: Active energy consumer	FLOAT	1Wh[1]	0	5.497558×10^8
2	Counter: Active energy producer	FLOAT	1Wh[1]	0	5.497558×10^8
3	Counter: Active energy L1 consumer	FLOAT	1Wh[1]	0	5.497558×10^8
4	Counter: Active energy L1 producer	FLOAT	1Wh[1]	0	5.497558×10^8
5	Counter: Active energy L2 consumer	FLOAT	1Wh[1]	0	5.497558×10^8
6	Counter: Active energy L2 producer	FLOAT	1Wh[1]	0	5.497558×10^8
7	Counter: Active energy L3 consumer	FLOAT	1Wh[1]	0	5.497558×10^8
8	Counter: Active energy L3 producer	FLOAT	1Wh[1]	0	5.497558×10^8
9	Total active power	FLOAT	1W	-2.147484×10^6	2.147484×10^6
10	Total reactive power	FLOAT	1W	-2.147484×10^6	2.147484×10^6
11	Total apparent power	FLOAT	1W	-2.147484×10^6	2.147484×10^6
12	Frequency	FLOAT	10Hz	4.600×10^3	6.400×10^3
13	Total Cos φ[2]	FLOAT	10	-0.01	1.0
14	Temperature	FLOAT	10°C	-2.500×10^3	8.500×10^3
15	Active power L1	FLOAT	1W	-7.158278×10^5	7.158278×10^5
16	Reactive power L1	FLOAT	1W	-7.158278×10^5	7.158278×10^5
17	Total power L1	FLOAT	1W	-7.158278×10^5	7.158278×10^5
18	Voltage L1	FLOAT	1V	0	3.0×10^4
19	Current L1	FLOAT	1A	0	2.5×10^4
20	Cos φ L1[2]	FLOAT	10	-0.01	1.0

ID	Description	Data type	Unit	Min. value	Max. value
21	Harmonic voltage L1	FLOAT	1V	0	3.0×10^4
22	Harmonic current L1	FLOAT	1A	0	2.5×10^4
23	Active power L2	FLOAT	1W	-7.158278×10^5	7.158278×10^5
24	Reactive power L2	FLOAT	1W	-7.158278×10^5	7.158278×10^5
25	Total power L2	FLOAT	1W	-7.158278×10^5	7.158278×10^5
26	Voltage L2	FLOAT	1V	0	3.0×10^4
27	Current L2	FLOAT	1A	0	2.5×10^4
28	Cos φ L2[2]	FLOAT	10	-0.01	1.0
29	Harmonic voltage L2	FLOAT	1V	0	3.0×10^4
30	Harmonic current L2	FLOAT	1A	0	2.5×10^4
31	Active power L3	FLOAT	1W	-7.158278×10^5	7.158278×10^5
32	Reactive power L3	FLOAT	1W	-7.158278×10^5	7.158278×10^5
33	Total power L3	FLOAT	1W	-7.158278×10^5	7.158278×10^5
34	Voltage L3	FLOAT	1V	0	3.0×10^4
35	Current L3	FLOAT	1A	0	2.5×10^4
36	Cos φ L3[2]	FLOAT	10	-0.01	1.0
37	Harmonic voltage L3	FLOAT	1V	0	3.0×10^4
38	Harmonic current L3	FLOAT	1A	0	2.5×10^4
39	Overflow energy meter consumer Is incremented by 1 in case of overflow of the energy meter (ID = 1)	FLOAT		Overflow energy meter is at FLOAT not effective	
40	Overflow energy meter producer Is incremented by 1 in case of overflow of the energy meter (ID = 2)	FLOAT		Overflow energy meter is at FLOAT not effective	
41	Status bits ↳ *'Status bits' page 263*	UINT_32			

1) The display resolution of the energy meter is 1Wh x *WANDLER_I* x *WANDLER_U* (current transformer factor x voltage transformer factor).

2) The measuring accuracy of the Cos φ is maintained from a minimum current of 100mA x *WANDLER_I* (current transformer factor).

Tolerance

See Technical data

ID

Each measurand one ID is assigned. The access to the measured value of a measurand happens by means of the corresponding ID.

Data type

↳ 'Data type' *page 250*

Max. Total power

- The max. Total power for 3 phases is
  - ±2.147484 x 10^6W (FLOAT)
- 3 * Umax * WANDLER_U * Imax * WANDLER_I

If the Total power is exceeded by ±2.147484 x 10^6W (FLOAT), the max value is output.

Status bits

With status bits you get information about limit violations.

- The limit values can be defined via the parametrization.
- The status bits are refreshed together with the other measurement values, as soon as the DS-ID is incremented.
- Set bits of status bits remain set as long as they are acknowledged.
  - By acknowledging the status bits, the corresponding LEDs for exceeding the limit value will be deleted again.
- Byte order: high byte, low byte (at big endian)

Byte	Description
0	0: de-activated, 1: activated • Bit 0: Voltage at phase L2 below limit value (L2: VRMS_MIN) • Bit 1: Voltage at phase L3 below limit value (L3: VRMS_MIN) • Bit 2: Voltage at phase L1 above limit value (L1: VRMS_MAX) • Bit 3: Voltage at phase L2 above limit value (L2: VRMS_MAX) • Bit 4: Voltage at phase L3 above limit value (L3: VRMS_MAX) • Bit 5: Temperature above limit value (T_MAX) • Bit 6: Frequency below limit value (F_MIN) • Bit 7: Frequency above limit value (F_MAX)
1	0: de-activated, 1: activated • Bit 0 – 0: deleted via CMD Frame (0x04) – 1: if there was a RESET of the module. This happens after PowerON. • Bit 1: Current at phase L1 above limit value (L1: IRMS_MAX) • Bit 2: Current at phase L2 above limit value (L2: IRMS_MAX) • Bit 3: Current at phase L3 above limit value (L3: IRMS_MAX) • Bit 4: Efficiency cos φ phase L1 below limit value (L1: PF_MIN) • Bit 5: Efficiency cos φ phase L2 below limit value (L2: PF_MIN) • Bit 6: Efficiency cos φ phase L3 below limit value (L3: PF_MIN) • Bit 7: Voltage at phase L1 below limit value (L1: VRMS_MIN)
2, 3	reserved

5.8.6 Process data communication

Overview

During runtime the communication with the module happens via telegrams in the process image. Here you have the following possibilities:

- Read measured value
- Define Frame with measurands
- Read Frame with measured values
- Send control command

5.8.6.1 Structure

Telegram

The communication takes place via the I/O area of the head module. The head module sends via the output area a request telegram to the module. This responds with the requested data within the input area of the head module. Depending on the used head module this may take several cycles to complete, until the data are received in the input area. To ensure the consistency of all measured values, which originate from the same measurement, are stored in the module under one DS-ID.

For input and output data the telegram has a length of 16byte and the following structure:

Byte	Function
B0	B0: Header byte 0 • Bit 3 ... 0: Status communication • Bit 6 ... 4: Telegram type • Bit 7: 0 fix reserved
B1	B1: Header byte 1 • ID of the measurand (1 ... 41) – Each measurand one ID is assigned. The access to the measured value of a measurand happens by means of the corresponding ID
B2	B2: Header byte 2 • Bit 3 ... 0: Data set ID (DS-ID) of the measured value (1 ... 15) – The measured values of one measurement are accessible in the module via one DS-ID. • Bit 7 ... 4: Length of the user data (1 ... 12) – Depending on the telegram type, here up to 12 byte user data can be found.
B3	B3: Header byte 3 - Common status
D00 ... D11 ... D11	D00 ... D11: User data • User data for data to be sent and received Length of user data are specified from D00 ... D11: On error no user data are transferred i.e. the length of the user data is 0 and the module returns an error ID. Range of values: 0 ... 12

5.8.6.2 Status communication

Via the header byte (bit 3 ... 0) the status of the communication can be determined. On error no user data are transferred i.e. the length of the user data is 0. Please note that low error IDs are overridden by higher error IDs.

Status	Designation
0x00	OK (no error)
0x01	Error: Record set could not be refreshed
0x02	Error: DS-ID
0x03	Error: Telegram length
0x04	Error: Frame too big
0x05	Error: Frame not defined
0x06	Error: Measurand not available
0x07	Error: *'CMD Frame'* - Command could not be executed
0x08	Error: *'Set Frame'* - Frame definition is not valid (Set Frame)
0x09	Error: Telegram type not available - invalid request
0x0A	Error: Parameter - the last parameter set was not valid
0x0E	External error - Please contact our support
0x0F	Internal error: Due to a temporary disturbance during the processing of the measurement data, they could not be refreshed. If this error occurs more often, please contact our hotline.

5.8.6.3 Common status

With this byte you get an overview of possible error messages:

- Bit 0: Frequency F_MAX exceeded
- Bit 1: Frequency F_MIN undershot
- Bit 2: Temperature T_MAX exceeded
- Bit 3: Voltage VRMS_MAX exceeded
- Bit 4: Voltage VRMS_MIN undershot
- Bit 5: Efficiency PF_MIN undershot
- Bit 6: Current IRMS_MAX exceeded
- Bit 7: reserved

Detailed information about an error can be found in the Status bits:

- EPM-S416 ↳ *'*Status bits*' page 263*

5.8.6.4 Telegram type

By specifying the Telegram type the content of the responded data is defined. The following telegram types are available:

Type	Designation
0x00	*'Zero Frame'*: Accessing Frame 0
0x10	*'Read Value'*: Read the measured value of a measurand
0x20	*'Read Frame'*: Read a previously defined data package (Frame)
0x30	*'Set Frame'*: Define the data areas of a data package (Frame)
0x40	*'CMD Frame'*: Send a command
0x60	*'Read Param'*: Read Parameter

5.8.6.4.1 Zero Frame

This telegram type is the same as the telegram type *'Read Frame'* applied at Frame 0. After the start-up of the module there are automatic Zero Frame requests as long as the process data communication comes from the head module.

5.8.6.4.2 Read Value

With *'Read Value'* all the measured values can be requested.

Request

Byte	Value	Description
B0	0x10	• Bit 3 ... 0: Error code (not relevant) • Bit 6 ... 4: 001 Telegram type *'Read Value'* • Bit 7: 0 fix reserved
B1	...	• ID of the measurand. *'ID' page 249*
B2	...	• Bit 7 ... 4: Length user data (0)
		• Bit 3 ... 0: Data set ID DS-ID of the measured value to be read. *'DS-ID' page 249*
B3	0x00	• Common status (not relevant).
D00	-	• User data (not relevant).
...		
D11		
...		
D11		

Response

Byte	Value	Description
B0	0x10	• Bit 3 ... 0: Status communication • Bit 6 ... 4: 001 Telegram type *'Read Value'* • Bit 7: 0 fix reserved
B1	...	• ID of the measurand from the request.
B2	...	• Bit 7 ... 4: Length of the user data with measured values in byte.
		• Bit 3 ... 0: DS-ID of the measured value from the request, which was read.
B3	...	• Common status
D00	...	• User data with the requested measured value • depending on the parameterized data format – Byte order: high byte, low byte (big endian) – Byte order: low byte, high byte (little endian)
...		
D11		
...		
D11		

Example *'Read Value'*

In the example with ID = 14 the temperature of the module for DS-ID = 1 is requested.

Request

Byte	Value	Description
B0	0x10	Telegram type *'Read Value'*.
B1	0x0E	ID of the measurand. ↳ *'ID' page 249*
B2	0x01	DS-ID of the measured value to be read (DS-ID = 1). ↳ *'DS-ID' page 249*
B3	0x00	Common status (not relevant).
D00	-	User data (not relevant).
...		
D11		

Response

Byte	Value	Description
B0	0x10	Telegram type *'Read value'* from the request.
B1	0x0E	ID of the measurand from the request.
B2	0x21	Length of the user data here temperature 2 byte.
		DS-ID of the measured value from the request, which was read.
B3	0x00	Common status: OK
D00	0x00	User data with the requested temperature e.g. 35°C.
D01	0x23	

5.8.6.4.3 Set Frame

Overview

In the module you can combine some measurands to one data package (Frame), which is transferred in one step. With *'Set Frame'* a Frame can be built.

Request

Byte	Value	Description
B0	0x30	• Bit 3 ... 0: Error code (not relevant) • Bit 6 ... 4: 011 Telegram type *'Set Frame'* • Bit 7: 0 fix reserved
B1	...	• FR-ID of the Frame to be set. *'FR-ID' page 250*
B2	...	• Bit 7 ... 4: Length user data: 1 byte each measurand
		• Bit 3 ... 0: DS-ID
B3	0x00	• Common status (not relevant).
D00	...	• 1byte each measurand regarding that the measured values do not exceed the total length of 12byte. Here, the format of the measured values is taken into account (depending on the parameterized data type: INT or FLOAT). *'Data type' page 250*
...		
D11		
...		
D11		

Response

Byte	Value	Description
B0	0x30	• Bit 3 ... 0: Status communication • Bit 6 ... 4: 011 Telegram type *'Set Frame'* • Bit 7: 0 fix reserved
B1	...	• FR-ID of the Frame from the request.
B2	...	• Bit 7 ... 4: Length of the user data (0).
		• Bit 3 ... 0: DS-ID
B3	...	• Common status
D00	...	• User data (not relevant).
...		
D11		

Example *'Set Frame'*

Here a Frame with FR-ID 0x01 is defined. The Frame contains the following measurands:

- ID: 03: Counter: Active energy L1 (consumer)
- ID: 13: total cos φ
- ID: 12: Frequency

Request

Byte	Value	Description
B0	0x30	Telegram type *'Set Frame'*.
B1	0x01	FR-ID of the Frame to be read (FR-ID = 1). ↳ *'FR-ID' page 250*
B2	0x30	Bit 7 ... 4: Length user data (3). Bit 3 ... 0: data set ID DS-ID of the measurands (0).
B3	0x00	Common status (not relevant).
D00	0x03	User data with the ID of the measurands.
D01	0x0D	
D02	0x0C	
D03	-	Remaining user data are not relevant.
...		
D11		

Response

Byte	Value	Description
B0	0x30	Telegram type *'Set Frame'* from the request.
B1	0x01	FR-ID of the Frame from the request.
B2	0x00	Bit 7 ... 4: Length of the user data (0). Bit 3 ... 0: data set ID DS-ID of the measurands (0).
B3	0x00	Common status: OK
D00	-	User data (not relevant).
...	...	
D11	-	

5.8.6.4.4 Read Frame

Overview

In the module you can combine some measurands to one data package (Frame), which is transferred in one step.

With *'Read Frame'* a Frame can be requested.

Request

Byte	Value	Description
B0	0x20	• Bit 3 ... 0: Error code (not relevant) • Bit 6 ... 4: 010 Telegram type *'Read Frame'* • Bit 7: 0 fix reserved
B1	...	• FR-ID of the Frame to be read. ↳ *'FR-ID' page 250*
B2	0x00	• Bit 7 ... 4: Length of the user data is 0.
	...	• Bit 3 ... 0: DS-ID of the measured value to be read. ↳ *'DS-ID' page 249*
B3	0x00	• Common status (not relevant).
D00	-	• User data (not relevant).
...		
D11		

Response

Byte	Value	Description
B0	0x20	• Bit 3 ... 0: Status communication • Bit 6 ... 4: 010 Telegram type *'Read Frame'* • Bit 7: 0 fix reserved
B1	...	• FR-ID of the Frame from the request.
B2	...	• Bit 7 ... 4: Length of the user data with measured values in byte
	...	• Bit 3 ... 0: DS-ID of the measured value from the request, which was read.
B3	...	• Common status
D00	...	• User data with the requested Frame with measured values. – Depending on the parameterized data format.
...		
D11		

Example *'Read Frame'*

In the example the previously via *'Set Frame'* defined FR-ID (0x01) is requested with the following measurands:

- ID: 03: Counter: Active energy L1 (consumer): 4byte
- ID: 13: total cos φ: 1byte
- ID: 12: Frequency 2byte

Request

Byte	Value	Description
B0	0x20	Telegram type *'Read Frame'*
B1	0x01	FR-ID of the Frame to be read (FR-ID = 1). ↳ *'FR-ID' page 250*
B2	0x01	Bit 7 ... 4: Length of the user data (0). Bit 3 ... 0: DS-ID of the measured value to be read (DS-ID = 1). ↳ *'DS-ID' page 249*
B3	0x00	Common status (not relevant).
D00	-	User data (not relevant).
...		
D11		

Response

Byte	Value	Description
B0	0x20	Telegram type *'Read value'* from the request.
B1	0x01	FR-ID of the Frame from the request
B2	0x71	Bit 7 ... 4: Length of the Frame with measured values (7) Bit 3 ... 0: DS-ID of the measured value from the request (1).
B3	0x00	Common status: OK
D00	0x00	Counter: Active energy L1 (consumer): 500kWh
D01	0x07	
D02	0xA1	
D03	0x20	
D04	0x5A	Total cos φ: 0.9
D05	0x13	Frequency: 50Hz
D06	0x88	
D07	-	Remaining user data are not relevant.
...		
D11		

5.8.6.4.5 CMD Frame

With *'CMD Frame'* you can send control commands to the module. This can trigger various actions or be used for reading and writing of control registers. The following control commands are available:

- Reset the energy counter
- Reset the status bits
- Request the firmware version
- Read holding register
- Write counter values respectively set the active energy meters L1 - L3



Please note that energy values must always be written in INTEGER format, even if you have set the module to FLOAT mode.

Request

Byte	Value	Description
B0	0x40	• Bit 3 ... 0: Error code (not relevant) • Bit 6 ... 4: 100 Telegram type *'CMD Frame'* • Bit 7: reserved
B1	...	• CMD-ID of the control command, which is to be executed: – 0x01: Reset of all energy counters – 0x03: Reset the status bits – 0x04: Request the firmware version – 0x06[1]: Read holding register – 0x07[1]: Write in active energy meter
B2	...	• Bit 7 ... 4: Length of the user data depending on CMD-ID: – 0x01: Reset of all energy counters (length user data: 0byte) – 0x03: Reset the status bits (length user data: 4byte) – 0x04: Request the firmware version (length user data: 0byte) – 0x06[1]: Read holding register (length user data: 0byte) – 0x07[1]: Write in active energy meter (length user data: 6byte)
	...	• Bit 3 ... 0: Data set ID DS-ID of the measured value (3 ... 7).
B3	0x00	• Common status (not relevant).
D00 ... D11	-	• User data depending on CMD-ID – 0x01: Reset of all energy counters (user data: not relevant) – 0x03: Reset the status bits (user data: 4byte with the corresponding set bits) – 0x04: Request the firmware version (user data: not relevant) – 0x06[1]: Read holding register (user data: not relevant) – 0x07[1]: Write in active energy meter – ID (1byte) of the measured value (ID 3 ... 8) – Overflow counter (1byte) – New value (4byte)

Response

Byte	Value	Description
B0	0x40	• Bit 3 ... 0: Status communication • Bit 6 ... 4: 100 Telegram type *'CMD Frame'* • Bit 7: 0 fix reserved
B1	...	• CMD-ID from the request.
B2	...	• Bit 7 ... 4: Length of the user data depending on CMD-ID: – 0x01: Reset of all energy counters (length user data: 0byte) – 0x03: Reset the status bits: (length user data: 4byte) – 0x04: Request the firmware version (Length user data: 10byte) – 0x06[1]: Read holding register – 0x07[1]: Write in active energy meter
		• Bit 3 ... 0: DS-ID (not relevant)
B3	...	• Common status
D00	...	• User data depending on CMD-ID: – 0x01: Reset of all energy counters (user data: nothing) – 0x03: Reset the status bits: (User data: 4byte with the corresponding set bits) – 0x04: Request the firmware version (user data: 10byte with the version information) – 0x06[1]: Read holding register – 0x07[1]: Write in active energy meter – ID (1byte) of the measured value (ID 3 ... 8) – Overflow counter (1byte) – New value (4byte) • Byte order: high byte, low byte (big endian) Byte order: low byte, high byte (little endian)
...		
D11		
D11		

Firmware version

- Byte 2... 0: Firmware version
- Byte 5 ... 3: Protocol version
  - Byte 3: Major
  - Byte 4: Minor
  - Byte 5: Revision
- Byte 9 ... 6: Measuring chip version
  - Byte 6: Day
  - Byte 7: Month
  - Byte 8: Year (hundreds)
  - Byte 9: Year (one)

Write in active energy meter

Setting active energy meters L1 - L3 (consumers, producers)

- Byte 0: ID of the measured value to be written (ID: 3 ... 8).
- Byte 1: Overflow counter
- Byte 5 ... 2: New measured value

Example *'CMD Frame'*

In this example all the status bits are reset.

Request

Byte	Value	Description
B0	0x40	Telegram type *'CMD Frame'*
B1	0x03	CMD-ID: Reset the status bits
B2	0x40	Reset the status bits: (length user data: 4byte)
B3	0x00	Common status (not relevant).
D00	0xFF	User data: Reset the status bits
D01	0xFF	
D02	0xFF	
D03	0xFF	

Response

Byte	Value	Description
B0	0x40	Telegram type *'CMD Frame'* from the request.
B1	0x03	CMD-ID from the request.
B2	0x40	Length of the user data from the request.
B3	0x00	Common status: OK
D00	0xFF	User data from the request.
D01	0xFF	
D02	0xFF	
D03	0xFF	

5.8.6.4.6 Read Param



This telegram type is not supported by the energy measurement module.

With *'Read Param'* (0x60) the parameters can be read via the process image.

Request

Byte	Value	Description
B0	0x60	• Bit 3 ... 0: Error code (not relevant) • Bit 6 ... 4: 110 Telegram type *'Read Param'* • Bit 7: reserved
B1	...	• IDx of the parameter to be read.
B2	...	• Bit 7 ... 4: Length user data (0)
		• Bit 3 ... 0: Data set ID DS-ID (relevant for one time reading).
B3		• Common status (not relevant).
D00	...	• User data (not relevant).
...		
D11		

Response

Byte	Value	Description
B0	0x60	• Bit 3 ... 0: Status communication • Bit 6 ... 4: 110 Telegram type *'Read Param'* • Bit 7: reserved
B1	...	• IDx of the read parameter.
B2	...	• Bit 7 ... 4: Length of the user data (0)
		• Bit 3 ... 0: Data set ID DS-ID
B3	...	• Common status
D00	...	• Parameter value that was read.
...		
D11		

5.8.6.5 Example

Communication

Here the communication and the query of the status bits (ID = 41) are described on an example.

No.	Request	Response	Description
1	0x10 0x01 0x03 0x00		An ID and DS-ID is requested: e.g.: M 1-3 M (ID)-(DS-ID)
3		0x10 0x01 0x43 0x01 (4 byte data)	M 1-3 indicates frequency exceeded.
4	0x10 0x29 0x03 0x00		Query the status bits M 41-3.
5		0x10 0x29 0x43 0x05 0x00 0x00 0x80 0x00	Frequency exceeded and temperature exceeded is reported.
6	0x10 0x29 0x04 0x00		Query the status bits M 41-4.
7		0x10 0x29 0x44 0x05 0x00 0x00 0xA0 0x00	The status bit were refreshed (ID = 41) and temperature exceeded is reported.
8	0x40 0x03 0x45 0x00 0x00 0x00 0xA0 0x00		Reset the status bits (frequency exceeded and temperature exceeded).
9		0x40 0x03 0x45 0x00 0x00 0x00 0xA0 0x00	Status bits have been reset.
10	0x10 0x29 0x05 0x00		Query the status bits M 41-5.
11		0x10 0x29 0x45 0x00 0x00 0x00 0x20 0x00	Status bits have been reset. Temperature exceeded is reported.

5.8.7 Error messages and diagnostics

5.8.7.1 Status and error messages

Common status Page 266
Status Communication Chap. ‘Status communication‘ *page 265*
Status bits Chap. ‘Status bits’ p*age 263*

5.8.7.2 Diagnostic data

This module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in configuration / parametrization

IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX - Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
ERR_A	1	Diagnostic	00h	2F01h	02h
MODTYP	1	Module information	15h		03h
ERR_C	1	reserved	00h		04h
ERR_D	1	Diagnostic	00h		05h
CHTYP	1	Channel type	71h		06h
NUMBIT	1	Number diagnostic bits per channel	08h		07h
NUMCH	1	Number of channels of a module	03h		08h
CHERR	1	Channel error	00h		09h
CH0ERR	1	Channel-specific error channel 0	00h		0Ah
CH1ERR	1	Channel-specific error channel 1	00h		0Bh
CH2ERR	1	Channel-specific error channel 2	00h		0Ch
CH3ERR…CH7 ERR	5	reserved	00h		0Dh ... 11h
DIAG_US	4	µs ticker	00h		13h

ERR_A Diagnostic

Byte	Bit 7 ... 0
0	• Bit 0: set at module failure • Bit 1: set at internal error • Bit 2: set at external error • Bit 3: set at channel error • Bit 4: set at external auxiliary supply missing • Bit 6 ... 5: reserved • Bit 7: set at error in parametrization

MODTYP Module information

Byte	Bit 7 ... 0
0	• Bit 3 ... 0: module class – 0101b analog module • Bit 4: set at channel information present • Bit 7 ... 5: reserved

ERR_D Diagnostic

Byte	Bit 7 ... 0
0	• Bit 2 ... 0: reserved • Bit 3: set at internal diagnostics buffer overflow • Bit 4: set at internal communication error • Bit 7 ... 5: reserved

CHTYP Channel type

Byte	Bit 7 ... 0
0	• Bit 6 ... 0: Channel type – 70h: Digital input – 71h: Analog input – 72h: Digital output – 73h: Analog output – 74h: Analog input/-output – 76h: Counter • Bit 7: reserved

NUMBIT Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostic bits per channel (here 08h)

NUMCH Channels

Byte	Bit 7 ... 0
0	Number of channels of the module (here 03h)

CHERR Channel error

Byte	Bit 7 ... 0
0	• Bit 0: set at error in channel 0 • Bit 1: set at error in channel 1 • Bit 2: set at error in channel 2 • Bit 7 ... 3: reserved

CHxERR Channel-specific

Byte	Bit 7 ... 0
0	Channel-specific error channel x • Bit 0: set at configuration / parametrization error • Bit 7 ... 1: reserved

CH3ERR ... CH7ERR reserved

Byte	Bit 7 ... 0
0	reserved

DIAG_US µs ticker

Byte	Bit 7 ... 0
0...3	Value of the µs ticker at the moment of the diagnostic

µs ticker

In the I/O-1000 module there is a timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

6 Analog output modules

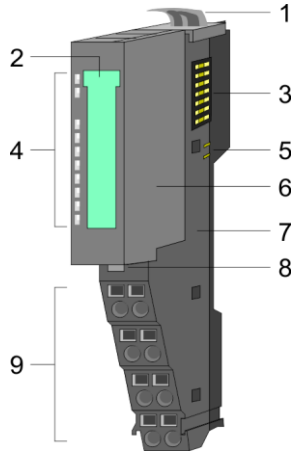
6.1 EPM-S504 - AO 2x16Bit 0(4)...20mA

Properties

The electronic module has 2 outputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

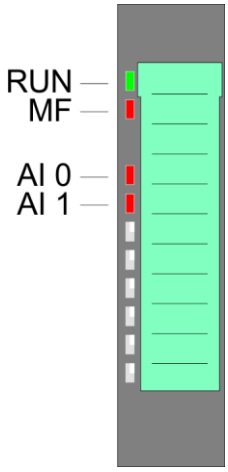
- 2 analog outputs
- Suited for sensors with 0 ... 20mA; 4 ... 20mA
- Diagnostics function
- 16bit resolution

Structure



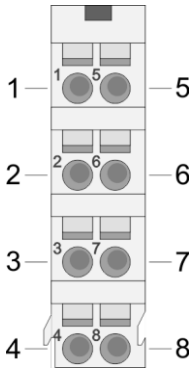
1	Locking lever terminal module
2	Labeling strip
3	Backplane bus
4	LED status indication
5	DC 24V power section supply
6	Electronic module
7	Terminal module
8	Locking lever electronic module
9	Terminal

Status indication

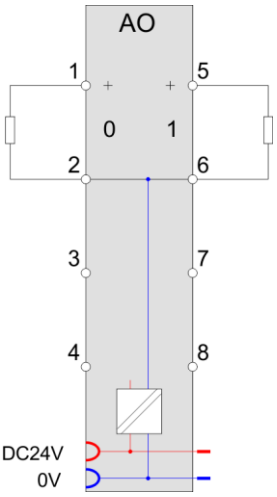


RUN green	MF red	AO x red	Description
		X	Bus communication is OK Module status is OK
		X	Bus communication is OK Module status reports an error
		X	Bus communication is not possible Module status reports an error
		X	Error at bus power supply
X	2Hz	X	Error in configuration
			Error channel x • Error in parameterization • Wire break (if parameterized)
not relevant: X			

Pin assignment



For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	AO 0	O	Channel 0
2	AGND	O	Ground channels
3	---	---	not connected
4	---	---	not connected
5	AO 1	O	Channel 1
6	AGND	O	Ground channels
7	---	---	not connected
8	---	---	not connected

O: Output

Input area

No byte of the input area is used by the module.

Output area

IX - Index for access via CANopen with s = Subindex, depends on number and type of analog modules

SX - Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h

6.1.1 Technical data

Order no.	EPM-S504
Type	EPM-S504 – analog output
Module ID	050B 25D8
Current consumption/power loss	
Current consumption from backplane bus	60 mA
Current consumption from load voltage L+ (without load)	15 mA
Power loss	0.7 W
Technical data analog outputs	
Number of outputs	2
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Reverse polarity protection of rated load voltage	✓
Current consumption from rated load voltage	-
Voltage output short-circuit protection	-
Voltage outputs	-
Min. load resistance (voltage range)	-
Max. capacitive load (current range)	-
Max. inductive load (current range)	-
Output voltage ranges	-
Operational limit of voltage ranges	-
Basic error limit voltage ranges	-
Destruction limit against external applied voltage	-
Current outputs	✓
Max. in load resistance (current range)	350 Ω
Max. inductive load (current range)	10 mH
Typ. open circuit voltage current output	12 V

Order no.	EPM-S504
Output current ranges	0 mA ... +20 mA +4 mA ... +20 mA
Operational limit of current ranges	+/-0.2%
Basic error limit current ranges	+/-0.1%
Destruction limit against external applied voltage	max. 12V (30V for 1s)
Settling time for ohmic load	0.25 ms
Settling time for capacitive load	-
Settling time for inductive load	1.5 ms
Resolution in bit	16
Conversion time	400 µs all channels
Substitute value can be applied	no
Output data size	4 Byte
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	green LED
Group error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓

Order no.	EPM-S504
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	4
Parameter bytes	8
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	61 g
Weight including accessories	61 g
Gross weight	75 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

6.1.2 Parameter data

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
RES0	1	reserved	00h	3100h	01h
WIBRK_EN	1	Wire-break recognition	00h	3101h	02h
CH0FN	1	Function number channel 0	31h	3102h	03h
CH1FN	1	Function number channel 1	31h	3103h	04h

WIBRK_EN Wire-break recognition

Byte	Bit 7 ... 0
0	• Bit 0: Wire-break recognition channel 0 (1: on) • Bit 1: Wire-break recognition channel 1 (1: on) • Bit 7 ... 2: reserved



Please consider with enabled wire break recognition with the output range 0 ... 20mA, when the current goes below of 40µA (100 Digits), this can may lead to sporadic wire break messages!

CHxFN Function number channel x

In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module. With FFh the corresponding channel is deactivated. The formulas listed here allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range (analog value) and vice versa.

0 ... 20mA

Output range (funct. no.)	Current (I)	Decimal (D)	Hex	Range	Formulas
0 ... 20mA Siemens S7 format (31h)	23.52mA	32511	7EFFh	overrange	$I = D \times \frac{20}{27648}$ $D = 27648 \times \frac{I}{20}$
	20mA	27648	6C00h	nominal range	
	10mA	13824	3600h		
	0mA	0	0000h		
	Not possible, is limited to 0mA.			underrange	
0 ... 20mA Siemens S5 format (41h)	25.00mA	20480	5000h	overrange	$I = D \times \frac{20}{16384}$ $D = 16384 \times \frac{I}{20}$
	20mA	16384	4000h	nominal range	
	10mA	8192	2000h		
	0mA	0	0000h		
	Not possible, is limited to 0mA.			underrange	

4 ... 20mA

Output range (funct. no.)	Current (I)	Decimal (D)	Hex	Range	Formulas
4 ... 20mA Siemens S7 format (30h)	22.81mA	32511	7EFFh	overrange	$I = D \times \frac{16}{27648} + 4$ $D = 27648 \times \frac{I-4}{16}$
	20mA	27648	6C00h	nominal range	
	12mA	13824	3600h		
	4mA	0	0000h		
	0mA	-6912	E500h	underrange	
4 ... 20mA Siemens S5 format (40h)	24.00mA	20480	5000h	overrange	$I = D \times \frac{16}{16384} + 4$ $D = 16384 \times \frac{I-4}{16}$
	20mA	16384	4000h	nominal range	
	12mA	8192	2000h		
	4mA	0	0000h		
	0mA	-4096	F000h	underrange	

6.1.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Wire-break (if parameterized)

IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX - Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
ERR_A	1	Diagnostic	00h	2F01h	02h
MODTYP	1	Module information	15h		03h
ERR_C	1	reserved	00h		04h
ERR_D	1	Diagnostic	00h		05h
CHTYP	1	Channel type	73h		06h
NUMBIT	1	Number diagnostic bits per channel	08h		07h
NUMCH	1	Number of channels of a module	02h		08h
CHERR	1	Channel error	00h		09h
CH0ERR	1	Channel-specific error channel 0	00h		0Ah
CH1ERR	1	Channel-specific error channel 1	00h		0Bh
CH2ERR…CH7ERR	6	reserved	00h		0Ch ... 11h
DIAG_US	4	µs ticker	00h		13h

ERR_A Diagnostic

Byte	Bit 7 ... 0
0	• Bit 0: set at module failure • Bit 1: set at internal error • Bit 2: set at external error • Bit 3: set at channel error • Bit 4: set at external auxiliary supply missing • Bit 6 ... 5: reserved • Bit 7: set at error in parametrization

MODTYP Module information

Byte	Bit 7 ... 0
0	• Bit 3 ... 0: module class – 0101b analog module • Bit 4: set at channel information present • Bit 7 ... 5: reserved

ERR_D Diagnostic

Byte	Bit 7 ... 0
0	• Bit 2 ... 0: reserved • Bit 3: set at internal diagnostics buffer overflow • Bit 4: set at internal communication error • Bit 7 ... 5: reserved

CHTYP Channel type

Byte	Bit 7 ... 0
0	• Bit 6 ... 0: Channel type – 70h: Digital input – 71h: Analog input – 72h: Digital output – 73h: Analog output – 74h: Analog input/-output – 76h: Counter • Bit 7: reserved

NUMBIT Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostic bits per channel (here 08h)

NUMCH Channels

Byte	Bit 7 ... 0
0	Number of channels of a module (here 02h)

CHERR Channel error

Byte	Bit 7 ... 0
0	• Bit 0: set at error in channel group 0 • Bit 1: set at error in channel group 1 • Bit 7 ... 2: reserved

CH0ERR / CH1ERR Channel-specific

Byte	Bit 7 ... 0
0	Channel-specific error channel x • Bit 0: set at configuring/parameter assignment error • Bit 3 ... 1: reserved • Bit 4: set at wire-break • Bit 7 ... 5: reserved

CH2ERR ... CH7ERR reserved

Byte	Bit 7 ... 0
0	reserved

DIAG_US µs ticker

Byte	Bit 7 ... 0
0...3	Value of the µs ticker at the moment of the diagnostic

µs ticker

In the I/O-1000 module there is a timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

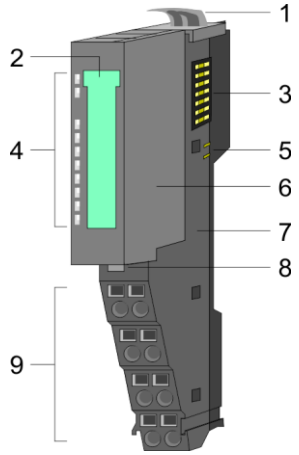
6.2 EPM-S505 - AO 4x16Bit ±10V

Properties

The electronic module has 4 outputs with parameterizable functions. The channels of the module are electrically isolated from the backplane bus. In addition, the channels are isolated to the DC 24V power supply by means of DC/DC converter.

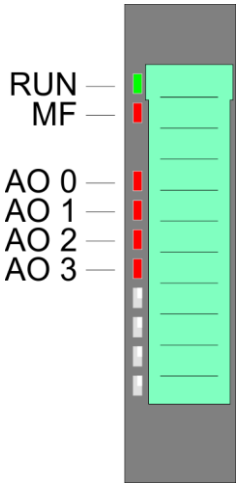
- 4 analog outputs
- Suited for sensors with ±10V, 0 ... 10V
- Diagnostics function
- 16bit resolution

Structure



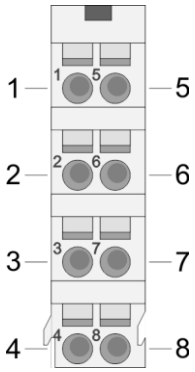
1	Locking lever terminal module
2	Labeling strip
3	Backplane bus
4	LED status indication
5	DC 24V power section supply
6	Electronic module
7	Terminal module
8	Locking lever electronic module
9	Terminal

Status indication

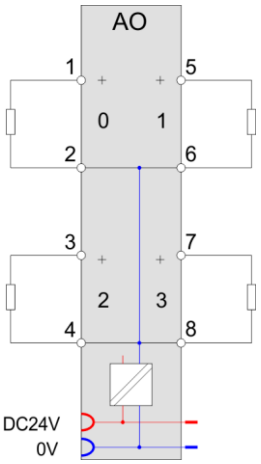


RUN green	MF red	AO x red	Description
■	□	X	Bus communication is OK Module status is OK
■	■	X	Bus communication is OK Module status reports an error
□	■	X	Bus communication is not possible Module status reports an error
□	□	X	Error at bus power supply
X	◪ 2Hz	X	Error in configuration
■	□	■	Error channel x • Overload, short-circuit • Error in parameterization
not relevant: X			

Pin assignment



For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	AO 0	O	Channel 0
2	AGND	O	Ground channels
3	AO 2	O	Channel 2
4	AGND	O	Ground channels
5	AO 1	O	Channel 1
6	AGND	O	Ground channels
7	AO 3	O	Channel 3
8	AGND	O	Ground channels

O: Output

Input area

No byte of the input area is used by the module.

Output area

IX - Index for access via CANopen with s = Subindex, depends on number and type of analog modules

SX - Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	AO 0	2	Analog value channel 0	6411h/s	01h
+2	AO 1	2	Analog value channel 1	6411h/s+1	02h
+4	AO 2	2	Analog value channel 2	6411h/s+2	03h
+6	AO 3	2	Analog value channel 3	6411h/s+3	04h

6.2.1 Technical data

Order no.	EPM-S505
Type	EPM-S505 – analog output
Module ID	050A 2560
Current consumption/power loss	
Current consumption from backplane bus	65 mA
Current consumption from load voltage L+ (without load)	20 mA
Power loss	0.8 W
Technical data analog outputs	
Number of outputs	4
Cable length, shielded	200 m
Rated load voltage	DC 24 V
Reverse polarity protection of rated load voltage	✓
Current consumption from rated load voltage	-
Voltage output short-circuit protection	✓
Voltage outputs	✓
Min. load resistance (voltage range)	5 kΩ
Max. capacitive load (current range)	1 µF
Max. inductive load (current range)	10 mA
Output voltage ranges	-10 V ... +10 V 0 V ... +10 V
Operational limit of voltage ranges	+/-0.2%
Basic error limit voltage ranges	+/-0.1%
Destruction limit against external applied voltage	max. 24V
Current outputs	-
Max. in load resistance (current range)	-
Max. inductive load (current range)	-
Typ. open circuit voltage current output	-

Order no.	EPM-S505
Output current ranges	-
Operational limit of current ranges	-
Basic error limit current ranges	-
Destruction limit against external applied voltage	-
Settling time for ohmic load	300 µs
Settling time for capacitive load	3 ms
Settling time for inductive load	-
Resolution in bit	16
Conversion time	200 µs all channels
Substitute value can be applied	no
Output data size	8 Byte
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	green LED
Group error display	red LED
Channel error display	red LED per channel
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-

Order no.	EPM-S505
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 50 V
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	0
Output bytes	8
Parameter bytes	10
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	61 g
Weight including accessories	61 g
Gross weight	75 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

6.2.2 Parameter data

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
RES0	1	reserved	00h	3100h	01h
SHORT_EN	1	Short-circuit recognition	00h	3101h	02h
CH0FN	1	Function number channel 0	12h	3102h	03h
CH1FN	1	Function number channel 1	12h	3103h	04h
CH2FN	1	Function number channel 2	12h	3104h	05h
CH3FN	1	Function number channel 3	12h	3105h	06h

SHORT_EN Short-circuit recognition

Byte	Bit 7 ... 0
0	• Bit 0: Short-circuit recognition channel 0 (1:on) • Bit 1: Short-circuit recognition channel 1 (1:on) • Bit 2: Short-circuit recognition channel 2 (1:on) • Bit 3: Short-circuit recognition channel 3 (1:on) • Bit 7 ... 4: reserved

CHxFN Function number channel x

In the following there are the measuring ranges with corresponding function number listed, which were supported by the analog module. With FFh the corresponding channel is deactivated. The formulas listed here allow you to transform an evaluated measuring value (digital value) to a value assigned to the measuring range (analog value) and vice versa.

±10V

Output range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas
±10V Siemens S format (12h)	11.76V	32511	7EFFh	overrange	$U = D \ x \ \frac{10}{27648}$ $D = 27648 \ x \ \frac{U}{10}$
	10V	27648	6C00h	nominal range	
	5V	13824	3600h		
	0V	0	0000h		
	-5V	-13824	CA00h		
	-10V	-27648	9400h		
	-11.76V	-32512	8100h	underrange	
±10V Siemens S5 format (22h)	12.5V	20480	5000h	overrange	$U = D \ x \ \frac{10}{16384}$ $D = 16384 \ x \ \frac{U}{10}$
	10V	16384	4000h	nominal range	
	5V	8192	2000h		
	0V	0	0000h		
	-5V	-8192	E000h		
	-10V	-16384	C000h		
	-12.5V	-20480	B000h	underrange	

0 ... 10V

Output range (funct. no.)	Voltage (U)	Decimal (D)	Hex	Range	Formulas
0 ... 10V Siemens S7 format (10h)	11,76V	32511	7EFFh	overrange	$U = D \ x \ \frac{10}{27648}$ $D = 27648 \ x \ \frac{U}{10}$
	10V	27648	6C00h	nominal range	
	5V	13824	3600h		
	0V	0	0000h		
	Not possible, is limited to 0V.			underrange	
0 ... 10V Siemens S5 format (20h)	12,5V	20480	5000h	overrange	$U = D \ x \ \frac{10}{16384}$ $D = 16384 \ x \ \frac{U}{10}$
	10V	16384	4000h	nominal range	
	5V	8192	2000h		
	0V	0	0000h		
	Not possible, is limited to 0V.			underrange	

6.2.3 Diagnostic data

So this module does not support diagnostic interrupt functions, the diagnostics data serve for information about this module. On error the corresponding channel LED of the module is activated and the error is registered in the diagnostics data.

The following errors are listed in the diagnostics data:

- Error in project engineering / parameterization
- Short-circuit/overload (if parameterized)

IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX - Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
ERR_A	1	Diagnostic	00h	2F01h	02h
MODTYP	1	Module information	15h		03h
RES2	1	reserved	00h		04h
ERR_D	1	Diagnostic	00h		05h
CHTYP	1	Channel type	73h		06h
NUMBIT	1	Number diagnostic bits per channel	08h		07h
NUMCH	1	Number of channels of a module	04h		08h
CHERR	1	Channel error	00h		09h
CH0ERR	1	Channel-specific error channel 0	00h		0Ah
CH1ERR	1	Channel-specific error channel 1	00h		0Ch
CH2ERR	1	Channel-specific error channel 2	00h		0Dh
CH3ERR	1	Channel-specific error channel 3	00h		0Bh
CH4ERR…CH7ERR	4	reserved	00h		0Eh ... 11h
DIAG_US	4	µs ticker	00h		13h

ERR_A Diagnostic

Byte	Bit 7 ... 0
0	• Bit 0: set at module failure • Bit 1: set at internal error • Bit 2: set at external error • Bit 3: set at channel error • Bit 4: set at external auxiliary supply missing • Bit 6 ... 5: reserved • Bit 7: set at error in parametrization

MODTYP Module information

Byte	Bit 7 ... 0
0	• Bit 3 ... 0: module class – 0101b analog module • Bit 4: set at channel information present • Bit 7 ... 5: reserved

ERR_D Diagnostic

Byte	Bit 7 ... 0
0	• Bit 2 ... 0: reserved • Bit 3: set at internal diagnostics buffer overflow • Bit 4: set at internal communication error • Bit 7 ... 5: reserved

CHTYP Channel type

Byte	Bit 7 ... 0
0	• Bit 6 ... 0: Channel type – 70h: Digital input – 71h: Analog input – 72h: Digital output – 73h: Analog output – 74h: Analog input/-output – 76h: Counter • Bit 7: reserved

NUMBIT Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostic bits per channel (here 08h)

NUMCH Channels

Byte	Bit 7 ... 0
0	Number of channels of a module (here 04h)

CHERR Channel error

Byte	Bit 7 ... 0
0	• Bit 0: set at error in channel group 0 • Bit 1: set at error in channel group 1 • Bit 2: set at error in channel group 2 • Bit 3: set at error in channel group 3 • Bit 7 ... 4: reserved

CH0ERR ... CH3ERR Channel-specific

Byte	Bit 7 ... 0
0	Channel-specific error channel x: • Bit 0: set at configuring/parameter assignment error • Bit 2 ... 1: reserved • Bit 3: set at short-circuit to ground • Bit 7 ... 4: reserved

CH4ERR ... CH7ERR reserved

Byte	Bit 7 ... 0
0	reserved

DIAG_US µs ticker

Byte	Bit 7 ... 0
0...3	Value of the µs ticker at the moment of the diagnostic

µs ticker

In the I/O-1000 module there is a timer (µs ticker). With PowerON the timer starts counting with 0. After 2^{32}-1µs the timer starts with 0 again.

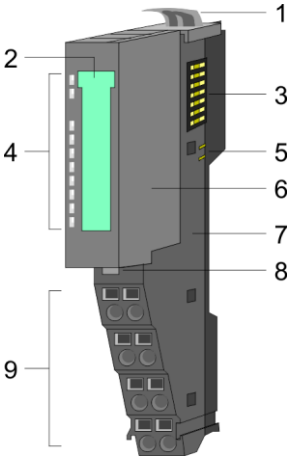
7 Frequency measurement module

7.1 Properties

Features

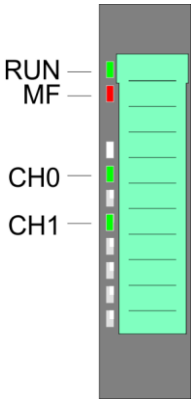
- Frequency measurement module
- 2 channels 24bit, DC 24V
- Input frequency max. 600kHz (rising edge)
- Evaluation of period duration in 1µs, range 1µs ... 8s
- Evaluation of frequency in mHz, range 60mHz ... 600kHz
- Evaluation of speed in rpm
- Input filter (configurable)

Structure



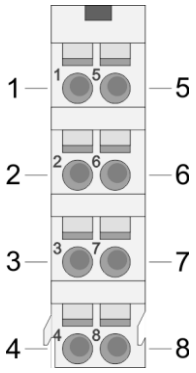
1	Locking lever terminal module
2	Labeling strip
3	Backplane bus
4	LED status indication
5	DC 24V power section supply
6	Electronic module
7	Terminal module
8	Locking lever electronic module
9	Terminal

Status indication

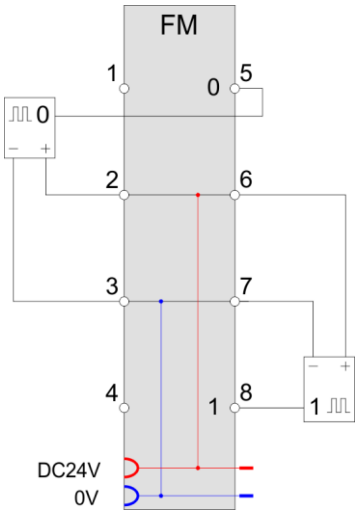


LED			Description
RUN green	MF red		
●	○		Bus communication is OK Module status is OK
●	●		Bus communication is OK Module status reports an error
○	●		Bus communication is not possible Module status reports an error
○	○		Error at bus power supply
X	B		Error in configuration
CH0	green	●	Channel 0: pulse input triggered
CH1	green	●	Channel 1: pulse input triggered
on: ● | off: ○ | blinks with 2Hz: B | not relevant: X			

Pin assignment



For wires with a cross section of 0.08mm² up to 1.5mm².



Pos.	Function	Type	Description
1	---	---	not connected.
2	DC 24V	O	DC 24V for encoder
3	0V	O	GND
4	---	---	not connected.
5	CH0	I	Channel 0: pulse input
6	DC 24V	O	DC 24V for encoder
7	0V	O	GND
8	CH1	I	Channel 1: pulse input

I: Input, O: Output

7.1.2 Technical data

Order no.	EPM-S606
Type	EPM-S606 – frequency measurement
Module ID	0881 2880
Current consumption/power loss	
Current consumption from backplane bus	35 mA
Power loss	0.5 W
Technical data digital inputs	
Number of inputs	2
Cable length, shielded	100 m
Cable length, unshielded	-
Rated load voltage	DC 20.4...28.8 V
Reverse polarity protection of rated load voltage	-
Current consumption from load voltage L+ (without load)	5 mA
Rated value	DC 20.4...28.8 V
Input voltage for signal "0"	DC 0...5 V
Input voltage for signal "1"	DC 15...28.8 V
Input voltage hysteresis	-
Signal logic input	-
Frequency range	-
Input resistance	-
Input current for signal "1"	3 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	0.5 mA
Input delay of "0" to "1"	0.8 µs
Input delay of "1" to "0"	0.8 µs
Number of simultaneously utilizable inputs horizontal configuration	2

Order no.	EPM-S606
Number of simultaneously utilizable inputs vertical configuration	2
Input characteristic curve	IEC 61131-2, type 1
Initial data size	20 Byte
Technical data digital outputs	
Number of outputs	-
Cable length, shielded	-
Cable length, unshielded	-
Rated load voltage	-
Current consumption from load voltage L+ (without load)	-
Output delay of "0" to "1"	-
Output delay of "1" to "0"	-
Minimum load current	-
Lamp load	-
Parallel switching of outputs for redundant control of a load	-
Parallel switching of outputs for increased power	-
Actuation of digital input	-
Switching frequency with resistive load	-
Switching frequency with inductive load	-
Switching frequency on lamp load	-
Internal limitation of inductive shut-off voltage	-
Short-circuit protection of output	-
Trigger level	-
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	12 Byte
Technical data counters	

Frequency measurement module · Properties

Order no.	EPM-S606
Number of counters	2
Counter width	24 Bit
Maximum input frequency	600 kHz
Maximum count frequency	600 kHz
Mode incremental encoder	-
Mode pulse / direction	-
Mode pulse	-
Mode frequency counter	✓
Mode period measurement	✓
Gate input available	-
Latch input available	-
Reset input available	-
Counter output available	-
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓

Order no.	EPM-S606
Between channels and power supply	-
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	20
Output bytes	12
Parameter bytes	8
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	55 g
Weight including accessories	55 g
Gross weight	70 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

7.1.3 Deployment

7.1.3.1 Fast instruction

Frequency range

Limits	Value
Lower frequency limit	60mHz
Upper frequency limit	600kHz
Min. pulse time	800ns
Min. pause time	800ns

Address areas

Input area

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	FM_PERIOD_CH0	4	Channel 0: Measured time value	5460h/s	01h
+4	FM_RISING_EDGES_CH0	4	Channel 0: Number of pulses	5461h/s	02h
+8	FM_PERIOD_CH1	4	Channel 1: Measured time value	5460h/s+1	03h
+12	FM_RISING_EDGES_CH1	4	Channel 1: Number of pulses	5461h/s+1	04h
+16	FM_STATUS_CH0	2	Channel 0: State	5462h/s	05h
+18	FM_STATUS_CH1	2	Channel 1: State	5462h/s+1	06h

FM_STATUS_ CHx State

Bit	Name	Function
7 ... 0	-	reserved
8	STS_FM	is set if the according channel is enabled.
15 ... 9	-	reserved

Output area

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	FM_PRESET_PERIOD_CH0	4	Channel 0: Measured time value	5660h/s	01h
+2	FM_PRESET_PERIOD_CH1	4	Channel 0: Number of pulses	5660h/s+1	02h
+8	FM_CONTROL_CH0	2	Channel 1: Measured time value	5661h/s	03h
+10	FM_CONTROL_CH1	2	Channel 1: Number of pulses	5661h/s+1	04h

FM_CONTROL_CHx Control word

Bit	Name	Function
7 ... 0	-	reserved
8	CTRL_FM_START	Start frequency measurement
9	CTRL_FM_STOP	Stop frequency measurement
15 ... 10	-	reserved

Parameters

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
-	1	reserved	00h	3100h	01h
CH0_FLT	1	Channel 0: Input filter	00h	3101h	02h
-	1	reserved	00h	3102h	03h
CH1_FLT	1	Channel 1: Input filter	00h	3103h	04h

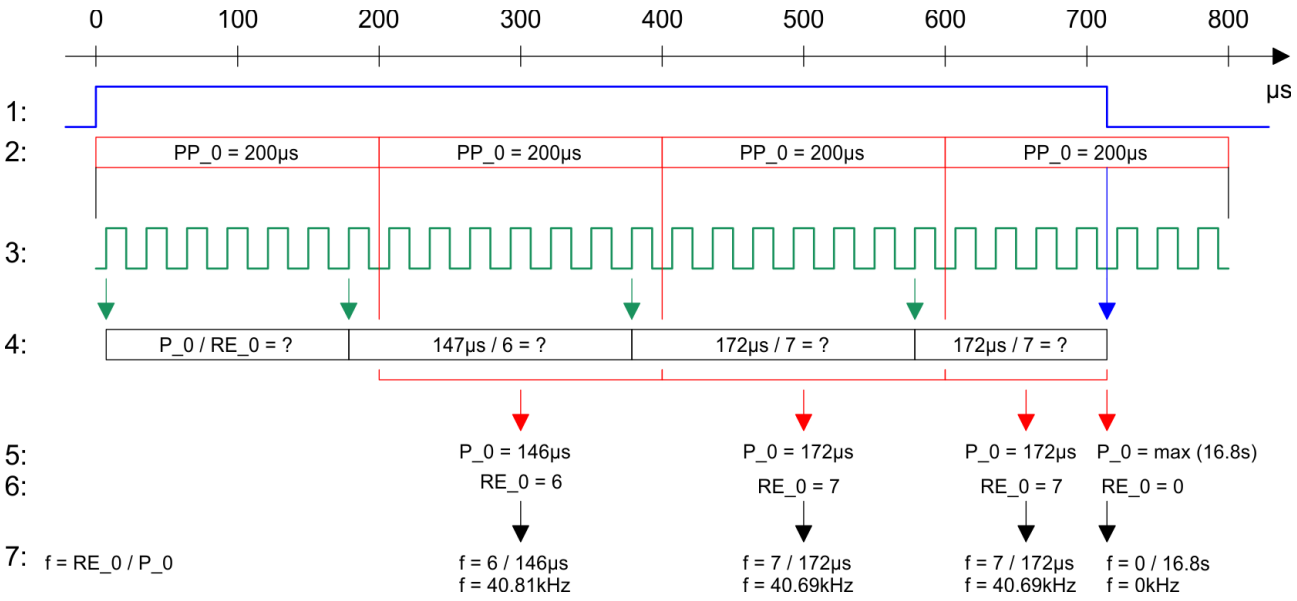
7.1.3.2 Principle of operation

Overview

The FM module is a frequency measurement module with 2 channels. For measurement DC 24V Signals can be connected to the channels. The module can be accessed via process image or by means of handling blocks.

Frequency measurement

The following diagram shows the timing of the frequency measurement on the example of channel 0:



1. Measurement active:
   FM_CONTROL_CH0: CTRL_FM_START = 1:
   Measurement is started
   FM_CONTROL_CH0: CTRL_FM_STOP = 1:
   Measurement is stopped
2. Measurement period (here 200µs), preset via FM_PRESET_PERIOD_CH0 (PP_0).
3. Signal to be measured, which is connected to channel 0.
4. The 1. rising edge within the measurement period starts counting of the rising edges and time measurement. With the end of the measurement period end counting and time measurement.
5. Measured value in the previous measurement period [125ns]. By dividing the value by 8, you get the value in µs.
6. Measured time value and number of rising edges of the previous measurement period.
7. The frequency [kHz] can be determined by dividing number of edges and measured time value [µs].

Only as long the measurement is active, the measured values are represented as FM_PERIOD_CH0 (P_0) and FM_RISING_EDGES_CH0 (RE_0) in the input process image. Otherwise FM_PERIOD_CH0 = 16.8s and FM_RISING_EDGES_CH0 = 0.

7.1.3.3 Input area 20 Byte

Input area

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 6000h + EtherCAT-Slot More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	FM_PERIOD_CH0	4	Channel 0: measured time value	5460h/s	01h
+4	FM_RISING_EDGES_CH0	4	Channel 0: number of pulses	5461h/s	02h
+8	FM_PERIOD_CH1	4	Channel 1: measured time value	5460h/s+1	03h
+12	FM_RISING_EDGES_CH1	4	Channel 1: number of pulses	5461h/s+1	04h
+16	FM_STATUS_CH0	2	Channel 0: status	5462h/s	05h
+18	FM_STATUS_CH1	2	Channel 1: status	5462h/s+1	06h

7.1.3.4 Input / Output area > Output area 12 Byte

FM_PERIOD_CHx Period duration

The measured time value is the time between the last rising edge of the previous measuring period and the last rising edge of the current measuring period. This value is represented with 125ns resolution, this means divided by 8 you get the value in µs.

Max. value: 134217720 x 125ns = 16777215µs

FM_RISING_EDGES_CHx Number of pulses

Number of pulses (positive edge) of the measured time value. Always the number of pulses of the previous measurement is shown.

FM_STATUS_CHx State

Bit	Name	Function
7 ... 0	-	reserved
8	STS_FM	is set if the according channel is enabled.
15 ... 9	-	reserved

7.1.3.5 Output area 12 Byte

Output area

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	FM_PRESET_PERIOD_CH0	4	Channel 0: Measurement period	5660h/s	01h
+4	FM_PRESET_PERIOD_CH1	4	Channel 1: Measurement period	5660h/s+1	02h
+8	FM_CONTROL_CH0	2	Channel 0: control word	5661h/s	03h
+10	FM_CONTROL_CH1	2	Channel 1: control word	5661h/s+1	04h

FM_PRESET_PERIOD_CHx Measurement period

Enter here as measurement period the time window for the frequency measurement. It is specified as a 23bit value with a resolution of 1µs.

Range of values: 1µs ... 8388607µs

FM_CONTROL_CHx Control word

Bit	Name	Function
7 ... 0	-	reserved
8	CTRL_FM_START	Start frequency measurement
9	CTRL_FM_STOP	Stop frequency measurement
15 ... 10	-	reserved

7.1.3.6 Determining the magnitude of the measurement periode

The frequency measurement module measures the time between the last rising edge of the previous measurement period and the last rising edge of the current measurement period and counts rising edges during this time. The tolerance of the frequency measurement is ± 1µs per measurement period. You can increase the accuracy by increasing the time window of the measurement period MP. But this increases the time to provide the measured data. The rule is: The longer the measurement period MP, the smaller the measurement error F_{max} and the greater the delay of the measurement result. The size of the time window of the measurement period MP must have more than twice of the expected period duration PD of the input signal. If the period duration PD of the input signal is unknown, the measurement period MP must be set to maximum value. The measurement period MP can be determined by specifying a maximum valid measurement error F_{max} in % by means of the following formula:

$MP = 100 / F_{max}$ [µs]

here it is mandatory: MP > 2 x PD

Example

The following table shows the measurement period MP in response to the expected period duration PD of the input signal and the maximum valid measurement error F_{max}:

Measurement periode MP						
Input signal		Valid measurement error F_{max} in %				
f in kHz	PD in µs	10	1	0,1	0,01	0,001
600	1,67	10	100	1000	10 000	100 000
250	4,00	10	100	1000	10 000	100 000
100	10,00	10	100	1000	10 000	100 000
10	100,00	- *	- *	1000	10 000	100 000
5	200,00	- *	- *	1000	10 000	100 000
1	1000,00	- *	- *	- *	10 000	100 000

*) prohibited, since MP ≤ 2 x PD

7.1.4 Parameter data

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Parameters

Name	Bytes	Function	Default	IX	SX
---	1	reserved	00h	3100h	01h
CH0_FLT	1	Channel 0: Input filter	00h	3101h	02h
---	1	reserved	00h	3102h	03h
CH1_FLT	1	Channel 1: Input filter	00h	3103h	04h

CHx_FLT Input filter

Byte	Bit 7 ... 0
0	• Bit 7 ... 0: Input filter – 0x00: 600kHz (Default) – 0x01: 250kHz – 0x02: 100kHz – 0x03: 60kHz – 0x04: 30kHz – 0x06: 10kHz – 0x07: 5kHz – 0x08: 2kHz – 0x09: 1kHz

- By presetting an input frequency you can specify a filter for the according input. E.g. signal peaks of a faulted input signal may be filtered by means of a filter.

7.1.5 Diagnostic data

Overview

So this module does not support process interrupts, the diagnostics data serve for information about this module.

IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX - Subindex for access via EtherCAT with Index 5005h

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	IX	SX
ERR_A	1	reserved	00h	2F01h	02h
MODTYP	1	Module information	18h		03h
ERR_C	1	reserved	00h		04h
ERR_D	1	reserved	00h		05h
CHTYP	1	Channel type	76h		06h
NUMBIT	1	Number diagnostics bits per channel	00h		07h
NUMCH	1	Number channels of the module	02h		08h
CHERR	1	reserved	00h		09h
CH0ERR… CH7ERR	8	reserved	00h		0Ah ... 11h
DIAG_US	4	µs ticker	00h		13h

MODTYP Module information

Byte	Bit 7 ... 0
0	• Bit 3 ... 0: Module class – 1000b: Function module • Bit 4: set at channel information present • Bit 7 ... 5: reserved

CHTYP Channel type

Byte	Bit 7 ... 0
0	• Bit 6 ... 0: Channel type – 76h: Counter module • Bit 7: reserved

NUMBIT Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostics bits of the module per channel (here 00h)

NUMCH Channels

Byte	Bit 7 ... 0
0	Number of channels of the module (here 02h)

DIAG_US µs ticker

Byte	Bit 7 ... 0
0 ... 3	Value of the µs ticker at the moment of the diagnostic

ERR_A/C/D, CHERR, CHxERR reserved

Byte	Bit 7 ... 0
0	reserved