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EN   Operating instructions. . . . . .pages 1 to 18
     Original

Content

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1. About this document

1.1 Function

This operating instructions manual provides all the information you need for the mounting, set-up and commissioning to ensure the safe operation and disassembly of the the product.
The operating instructions must be available in a legible condition and a complete version in the vicinity of the device.

1.2 Target group: authorised qualified personnel

All operations described in this operating instructions manual must be carried out by trained specialist personnel, authorised by the plant operator only.

Please make sure that you have read and understood these operating instructions and that you know all applicable legislations regarding occupational safety and accident prevention prior to installation and putting the component into operation.

The machine builder must carefully select the harmonised standards to be complied with as well as other technical specifications for the selection, mounting and integration of the components.

1.3 Explanation of the symbols used

i	**Information, hint, note:** This symbol is used for identifying useful additional information.
⚠	**Caution:** Failure to comply with this warning notice could lead to failures or malfunctions. **Warning:** Failure to comply with this warning notice could lead to physical injury and/or damage to the machine.

1.4 Appropriate use

The product must be exclusively used in accordance with the versions listed below or for the applications authorised by the manufacturer. Detailed information regarding the range of applications can be found in the chapter "Product description".

1.5 General safety instructions

The user must observe the safety instructions in this operating instructions manual, the country specific installation standards as well as all prevailing safety regulations and accident prevention rules.

> ℹ️ Further technical information can be found in the Schmersal catalogues or in the online catalogue on the Internet: www.schmersal.net.

The information contained in this operating instructions manual is provided without liability and is subject to technical modifications.

There are no residual risks, provided that the safety instructions as well as the instructions regarding mounting, commissioning, operation and maintenance are observed.

1.6 Warning about misuse

> ⚠️ In case of inadequate or improper use or manipulations of the component, personal hazards or damage to machinery or plant components cannot be excluded.

1.7 Exclusion of liability

We shall accept no liability for damages and malfunctions resulting from defective mounting or failure to comply with this operating instructions manual. The manufacturer shall accept no liability for damages resulting from the use of unauthorised spare parts or accessories.

For safety reasons, invasive work on the device as well as arbitrary repairs, conversions and modifications to the device are strictly forbidden; the manufacturer shall accept no liability for damages resulting from such invasive work, arbitrary repairs, conversions and/or modifications to the device.

2. Product description

2.1 Ordering code

This operating instructions manual applies to the following types:

SD-I-U-①

No.	Option	Description
①	PN	PROFINET IO
	2PN	PROFINET IRT (Integrated Switch)
	EIP	Ethernet/IP
	DN	DeviceNet
	CCL	CC-Link
	CAN	CANopen
	MT	Modbus/TCP
	EC	EtherCAT

2.2 Purpose

The SD-I-U-…UNIVERSAL gateway is used in conjunction with safety sensors, solenoid interlocks and control panels with serial diagnostics. In these components, the diagnostic output is replaced with a serial input and output cable.

If components with serial diagnostics are wired in series, the inputs and outputs of the diagnostic channels as well as the safety circuits are wired in series.

In this way, a series-wired chain of maximum 31 either identical or different components can be set up. For the evaluation, the serial diagnostic cable is connected to the here-described UNIVERSAL gateway. The gateway converts the serial information of the series wiring into the corresponding field bus protocol. The gateway is integrated as a slave into the available field bus system. The diagnostics signals of all SD devices can be evaluated by the control system via the field bus master.

Operational conditions can be read and control commands e.g. to unlock a solenoid interlock, which is installed on the components of the series-wired chain, can be transmitted. The status or failure information of each individual component of the series-wired chain is automatically loaded in the PLC.

> ⚠️ The UNIVERSAL gateway does not realise safety tasks. The safety monitoring of the safety switching appliances must be realised independently.

2.3 Technical data

Supply voltage:	24 VDC –15 % / +20 % (stabilised PELV)
Fuse rating:	external fuse 1 A slow blow
Power consumption at 24 VDC:	max. 500 mA, internally fused plus load current
Operating temperature:	– 5 °C to 55 °C, in case of vertical positioning
Storage temperature:	– 25 °C … + 70 °C
Climatic conditions:	Humidity 30 % … 85 %, no condensation
Protection class:	IP20
Installation location:	earthed, lockable switch cabinet with min. protection class IP54
Resistance to vibration:	in case of installation between two side terminal blocks on the standard DIN rail -in acc. with IEC 60068-2-6:10 to 57 Hz/0.35 mm and 57 to 150 Hz/5 g
Resistance to shock	
- to IEC 60068-2-29:	10 g
EMC rating:	
- in acc. with EN 61000-4-2 (ESD):	± 6 kV contact discharge / ± 8 kV air discharge
- in acc. with EN 61000-4-3 (HF field):	10 V/m/80% AM
- in acc. with EN 61000-4-4 (burst):	± 1 kV all connections
- in acc. with EN 61000-4-5 (surge):	± 1 kV all connections
- in acc. with EN 61000-4-6 (HF cables):	10 V all connections
- in acc. with EN 61000-6-2	
- in acc. with EN 61326-3-1	
EMC emitted interference	
- in acc. with EN 61000-6-4:	Emitted interference, industry
Rated insulation voltage U_i:	32 V
Rated impulse withstand voltage U_{imp}:	0.5 kV
Overvoltage category:	II
Degree of pollution:	2
Dimensions (width/height/depth):	50 x 100 x 80 mm (= height from standard DIN rail)
Time to readiness after switch-on:	6 s

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3. Mounting

3.1 General mounting instructions
The SD-I-U- … UNIVERSAL gateway is designed as a control cabinet device with protection class IP20 for snapping onto a standard DIN rail. The device must be secured to the side terminal blocks on the standard DIN rail.

4. Electrical connection

4.1 General information for electrical connection

A PELV power supply with 24 VDC must be used. The current draw is a maximum of 500 mA. The power supply must be secured with a 1 A slow-blow fuse.

Power connector:	24 V	+ 24 VDC Power supply
	GND	0 VDC, GND of power supply and GND of SD interface
	FE	Functional earth (optional)
SD connector:	SD	Connection of SD interface, with max. 31 devices

ℹ️ The UNIVERSAL gateway and all SD slaves must be connected to the same 24 V DC supply.

The SD interface is wired via standard control lines. The SD interface connecting cable connected to the UNIVERSAL gateway must have a maximum length of 200 m; its wiring capacitance must not exceed 50 nF. Standard control lines of type LiYY or H05VV-F with cross sections of 0.25 mm² to 1.5 mm² have a wiring capacitance of approx. 30 - 45 nF with a length of 200 m.

5. Installation and operation

5.1 Installation SD interface
Electronic safety sensors and solenoid interlocks must be interconnected in accordance with the technical data of the individual sensors. The safety channels and diagnostics channels are series wired.
To this end, the serial diagnostics cable is connected from device to device and fed to the UNIVERSAL gateway. The SD connection of the UNIVERSAL gateway is connected to the SD input on the first device in series. The SD output on the first device is connected to the SD input on the following device, and so on. The output on the final device is unused. **Under no circumstances** may the operating voltage or GND be connected to this output.

5.2 Installation field bus
The field bus must be connected via standard field bus cables and a standard field bus connector (if appl., with integrated deactivatable terminating resistor).

ℹ️ All specifications regarding wiring, required terminating resistors and the maximum cable lengths in the selected field bus system must be observed.

5.3 LED Signals
| SD-LED	Green ON	= SD interface normal operation
	Red ON	= SD interface fault
Teach-LED	yellow flashes	= SD interface teach error
	yellow ON	= SD initialisation error
	red flashes	= UNIVERSAL gateway warm start

ℹ️ For a precise description of both LED signals "SD" and "Teach", please see Table 2 "SD master diagnostics, SD system error".

ℹ️ For a description of the function of the LEDs on the field bus module,
see the description of the field bus modules from page 9

UNIVERSAL gateway
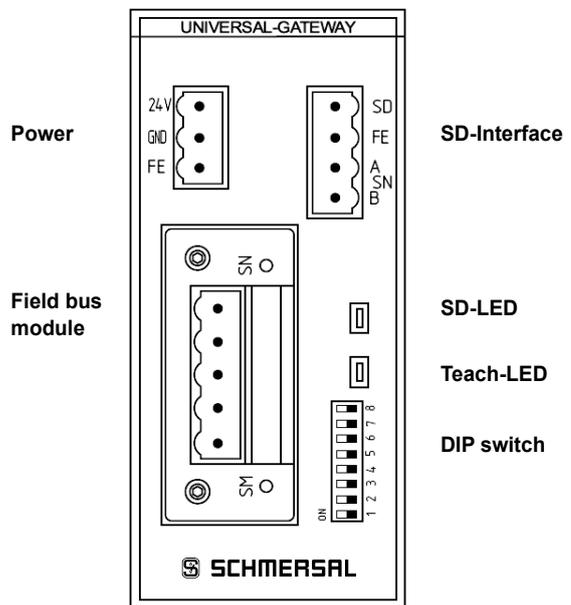
ℹ️ The "ON" setting of the DIP switch is always "left" (independent from marking on the DIP switch).

5.4 UNIVERSAL gateway commissioning
The UNIVERSAL gateway uses its Teach function to detect the connected SD devices and automatically assign addresses to the SD slaves. Up to 31 addresses are assigned. The first SD device as seen from the UNIVERSAL gateway is assigned address 1 in the SD interface. The address is increased by 1 with each additional device in the chain.

The device configuration on the SD interface is verified after each switch-on. The UNIVERSAL gateway requires 6 seconds for this task before operational readiness. If the SD chain is modified by the addition or removal of a device, the supply voltage of the UNIVERSAL gateway and all SD devices must be deactivated. Once the supply voltage is reactivated, the UNIVERSAL gateway will detect the change to the devices the SD chain. The Teach function must be executed again.

The requisite field bus system settings must be implemented before configuring the SD interface.

6. Settings

6.1 Field bus system settings

The field bus for communication with the control system is determined by the communication module integrated into the UNIVERSAL gateway. Address and transmission parameter (Baud rate) settings must be implemented on the UNIVERSAL gateway functioning as a field bus slave, according to the field bus being used. These settings must be made at the time of initial configuration, but may be modified later.

DIP-SW	Address value
8	Function selection
7	64
6	32
5	16
4	08
3	04
2	02
1	01

The "ON" setting of the DIP switch is always "left" (depending on the marking on the DIP switch).

To set the address of the UNIVERSAL gateway for the field bus being used, proceed as follows:

1. Move DIP-SW 8 to the ON position.

2. All of the following changes to DIP switches 1 - 7 modify the address assignment in the field bus. For IP-based field buses (EtherNet/IP, PROFINET, IO/IRT, MODBUS TCP), DIP switch 1 must be set according to the desired DHCP setting.
   ON means DHCP active: automatic address assignment by a DHCP server in the control.
   OFF means DHCP inactive: the IP address must be set by an external tool, e.g. "Anybus IPconfig Setup", which is available to download at www.schmersal.com.

   With the SD-I-U-EC EtherCAT UNIVERSAL gateway, DIP switch 1 is used instead of the DHCP function to switch between Schmersal and HMS-Vendor ID (for legacy systems)
   DIP switch 1 OFF (right): Schmersal ID
   DIP switch 1 ON (left): HMS ID

   This function is available from gateway firmware version V1.02. The FW version of the gateway can be retrieved with commands 4h and 5h (Table 1) of the acyclic commands.

   The HW version of the gateway can be retrieved with command 3h. This is the pre-decimal position of the overall software version on the type plate.

   Please note: The UNIVERSAL gateway will only respond when a modification to the DIP switch is detected. If DIP switch 1 is set to OFF and DHCP needs be inactive, DIP switch 1 must be moved to ON and then to OFF.

   For other field buses, manual address setting is required (see values in DIP switch depiction).
   Example address 50:
   50 results from 32 + 16 + 2, i.e. DIP switches 6, 5 and 2 must be set to ON and all others to OFF.

3. The UNIVERSAL gateway will restart 10 seconds after the last switch movement. The field bus setting is permanently stored in the internal memory; the field bus module is initialised with this setting. The Teach LED will flash red while the device is undergoing a warm start.

6.2 Transmission parameter setting (Baud rate)

DIP-SW 7	6	5	4	3	DeviceNet	CC-Link	CANopen
0	0	0	0	0	125 kBaud	156 kBaud	10 kBaud
0	0	0	0	1	250 kBaud	625 kBaud	20 kBaud
0	0	0	1	0	500 kBaud	2.5 MBaud	50 kBaud
0	0	0	1	1	AutoBaud	5 MBaud	100 kBaud
0	0	1	0	0		10 MBaud	125 kBaud
0	0	1	0	1			250 kBaud
0	0	1	1	0			500 kBaud
0	0	1	1	1			800 kBaud
0	1	0	0	0			1 MBaud
0	1	0	0	1			AutoBaud
next ..					not used	not used	not used

If the Ethernet-based field bus module is being used, DIP-SW 3 - 7 have no function.

1. DIP-SW 8 must be moved to OFF.
2. DIP switches 3 -7 must be set according to the desired transmission parameters (Baud rate only in this case) in accordance with the table above.
3. The UNIVERSAL gateway will restart 10 seconds after the last switch movement. The field bus setting is permanently stored in the internal memory; the field bus module is initialised with this setting. The Teach LED will flash red while the device is undergoing a warm start.

7. Teaching in SD devices

7.1 Teaching in SD devices (Teach function)
The Teach function must be executed at the time of initial configuration and in the event that a device is added, replaced or removed. A flashing yellow Teach LED indicates a change to the SD structure. The SD chain must be taught in again.
The Teach function can also be triggered by a command through the field bus, see Chapter 8.5 and 8.6.

Proceed as follows:
1. Switch off the UNIVERSAL gateway and SD bus devices.
2. Install the SD bus devices in the desired order.
3. Move DIP-SW 8 and DIP-SW 1 to the OFF position, leave DIP-SW 3 - 7 for Baud rate unchanged.
4. Switch on the UNIVERSAL gateway and SD bus devices. SD bus devices must be switched on before the gateway is switched on.
5. Wait until the SD LED lights up red continuously and the Teach LED flashes (SD bus scan complete).
6. Move DIP switch 1 from OFF to ON. This starts the Teach process. Arrangement and identification of the SD bus devices on the bus are then stored in the memory and compared with the devices on the SD interface after each switch-on.
7. If necessary, move DIP-SW 8 and DIP-SW 1 back to the desired field bus setting.
8. The gateway will restart 10 seconds after the last movement of the switch. The field bus setting is saved and the field bus module initialised with this setting.
   The SD bus is then started and its devices compared with the saved list.
   If the SD devices are consistent with the saved list, the SD LED will light up green and the yellow Teach LED will go out once start-up is complete.

> **i** Please note that when adding and removing devices, the reassignment of the SD addresses will also modify the address range in the downstream control. Following a change on the SD interface, the data of the connected SD devices accordingly have different addresses.

7.2 Teaching in SD devices (Teach function) with fixed address range
This option is available from UNIVERSAL gateway firmware version V1.04 or V2.04 for option 2PN and can only be activated with Ethernet-based buses. With a fixed address range, 64 bytes are always transmitted from the UNIVERSAL gateway to or from the superordinate PLC, irrespective of how many SD bus slave devices have been installed. The 64 bytes are made up of 2 bytes for the UNIVERSAL gateway and 31 x 2 bytes for each slave.

The following steps must be carried out:
1. Switch off the UNIVERSAL gateway and SD bus devices.
2. Install the SD bus devices in the desired order.
3. Switch on the SD bus devices and UNIVERSAL gateway. SD bus devices must be switched on before the gateway is switched on.
4. Wait until the SD LED lights up continuously and the Teach LED flashes yellow (SD bus scan complete).
5. Move DIP switch 8 to the OFF (right) position.
6. Move DIP switch 1 from OFF to ON.
7. The Teach process is started automatically after 10 seconds. The arrangement and identification of the SD bus devices on the bus are then saved in the memory.
8. Move DIP switch 2 to ON (left).
9. Move DIP switch 1 and 3 - 7 to OFF (right).
10. The field bus interface is reconfigured after a waiting period of 10 seconds. 64 bytes of input and output data are then replaced.
If this option has been activated and the Teach function is executed, the field bus interface is not reconfigured as 64 bytes have already been exchanged on the field bus side.

8. Communication

8.1 Communication with downstream PLC
The UNIVERSAL gateway must be integrated into the field bus system as a SLAVE. Once the electrical connection has been completed, the field bus system and control must be configured.

The following specifications must be configured:
1. Configure the PLC system hardware.
2. Add and configure the field bus master.
3. Install the corresponding device description files (ESI, GSD, GSDML or EDS files).
4. Integrate the UNIVERSAL gateway as a slave and configure the number of SD slaves.
5. Access to the input and output data must be defined word for word in the control manufacturer's engineering framework. In the frameworks that permit free mapping of the data, the output data (control outputs) must firstly be assigned, followed by the input data (control inputs).

> **i** The ESI, GSD, GSDML or EDS files for the various field bus modules are available for download at www.schmersal.com.

The UNIVERSAL gateway functions as an interface between the control system and the electronic safety sensors and solenoid interlocks with serial diagnostics connected to the SD interface (of which there may be up to 31).

The switching conditions of the connected SD devices can be read in various detail into the PLC.
1. SD master diagnostics, SD system error
2. SD slave condition data
3. SD slave diagnostics data
4. Acyclic data request from SD slave

In addition, control commands can be transmitted from the PLC to the SD devices. (See Table 3 and Table 4).

8.2 UNIVERSAL gateway field bus data
2 bytes are reserved for both the request and response of the field bus protocol for gateway diagnostics and the acyclic data request from SD slaves.

Request	Byte 00	Command byte, acyclic data request
	Byte 01	SD slave address for acyclic data request
Response:	Byte 00	Gateway diagnostics byte (see Table 2)
	Byte 01	Data byte, acyclic data request

The precise description of the acyclic data request from SD slaves can be found on page 6.

8.3 SD slave field bus data
2 bytes are reserved for both the request and response of the field bus protocol for each SD slave.
- SD slave 01 uses byte 02 and byte 03 from the field bus
- SD slave 02 uses byte 04 and byte 05 from the field bus... etc.
- SD slave 31 uses byte 62 and byte 63 from the field bus

In the **request**, only the first byte is required as the request byte for an SD slave on the field bus. The second byte is unused.
In the **response**, the response byte is transferred from each SD slave on the field bus, followed by the diagnostics byte.

8.4 Arrangement of the SD bytes in the field bus protocol

Request for all field bus systems (OUTPUT byte control, sending of request data to SD slaves)

Byte no.	Byte 00	Byte 01	Byte 02	Byte 03	...	Byte 62	Byte 63
SD device	Gateway	Gateway	Slave 01	Slave 01	...	Slave 31	Slave 31
Content	Command byte	SD adr. (0, 1 - 31)	Request byte	---	Request byte	---	

Response for all field bus systems (INPUT byte control, receipt of response data from SD slaves)

Byte no.	Byte 00	Byte 01	Byte 02	Byte 03	...	Byte 62	Byte 63
SD device	Gateway	Gateway	Slave 01	Slave 01	...	Slave 31	Slave 31
Content	Diagnostics byte	Data byte	Response byte	Diagnostics byte	Response byte	Diagnostics byte	

The content of the diagnostic byte of an SD slave is dependent on the status of the warning and error bits in the respective response byte.
(Bit 6 = error warning and bit 7 = error)
The exact meaning of the individual bits in the SD byte can be found in the respective operating instructions of an SD device.

8.5 Reading acyclic data from an SD slave
A fixed process can be used to request acyclic data from the individual SD slaves via the 2 request bytes (field bus request byte 00 and byte 01) and the data byte (field bus response byte 01).
The command byte is used to determine which data should be requested from a slave. The SD address byte is used to define the SD device from which the data is requested in the SD interface. The response data of the SD slave is then saved in the field bus response byte 01.

The data request process is defined as follows:
1) The control deletes the data byte before or after each order.
   Feedback is received via the response byte, indicating whether or not the data was deleted:
   HEX FF: data deleted, acyclic data service ready
2) The control firstly writes the SD address to field bus request byte 01.
   The control then writes the command byte to field bus request byte 00.
3) The response data is made available to the control in field bus response byte 01.
   The data byte may also contain an error message as the response:
   Hex FE: command error, undefined command invoked
   Hex FD: address error, invalid slave address for the selected command
              or slave address of an unavailable SD slave selected.

8.6 Table 1: Command overview and response data

Commands, acyclic data request	Command byte Field bus byte 00 (request)	SD address Field bus byte 01 (request)	Data byte Field bus byte 01 (response)	Data description
Delete data byte	Hex: 00	Hex: xx	Hex: FF	Data deleted, ready for new command
Read number of project SD slaves	Hex: 01	Hex: 00	Hex: 01 to Hex: 1F	Number of projected SD slaves 1 - 31
Read device category of an SD slave	Hex: 02	Hex: 01 to Hex: 1F	Hex: 30 to Hex: F8	SD slave device category (see below)
Read hardware revision of an SD slave	Hex: 03	Hex: 01 to Hex: 1F	Hex: 41 bis Hex: 5A	Hardware revision A - Z, as ASCII characters
Read hardware revision of the UNIVERSAL gateway (adr.: 00)	Hex: 03	Hex: 00	Hex: 01 to Hex: 63	Hardware version 1 - 99 (= pre-decimal position of software version)
Read the software version of the UNIVERSAL gateway (adr.: 00) or of the SD slave (high byte)	Hex: 04	Hex: 00 to Hex: 1F	Hex: 00 to Hex: 63	Software version, high byte: 0 - 99
Read the software version of the UNIVERSAL gateway (adr.: 00) or of the SD slave (low byte)	Hex: 05	Hex: 00 to Hex: 1F	Hex: 00 to Hex: 63	Software version, low byte 0 - 99
Read the number of SD slaves actually available	Hex: 06	Hex: 00	Hex: 01 to Hex: 1F	Number of SD slaves 0 - 31 on the SD interface
Read byte 0 of the SD slave serial number	Hex: 07	Hex: 01 to Hex: 1F	Hex: 30 to Hex: 39 Hex: 41 bis Hex: 5A	Serial number 0 - 9, A - Z, as ASCII characters
Read byte 1 of SD slave serial number	Hex: 08	Hex: 01 to Hex: 1F	Hex: 30 to Hex: 39 Hex: 41 bis Hex: 5A	Serial number 0 - 9, A - Z, as ASCII characters
Read byte 2 of SD slave serial number	Hex: 09	Hex: 01 to Hex: 1F	Hex: 30 to Hex: 39 Hex: 41 bis Hex: 5A	Serial number 0 - 9, A - Z, as ASCII characters
Read byte 3 of SD slave serial number	Hex: 0A	Hex: 01 to Hex: 1F	Hex: 30 to Hex: 39 Hex: 41 bis Hex: 5A	Serial number 0 - 9, A - Z, as ASCII characters
Read byte 4 of SD slave serial number	Hex: 0B	Hex: 01 to Hex: 1F	Hex: 30 to Hex: 39 Hex: 41 bis Hex: 5A	Serial number 0 - 9, A - Z, as ASCII characters
TEACH command for SD chain	Hex: 63	Hex: 00	Hex: 00	SD chain was taught in again

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The device category of an SD slave can be found in the respective operating instructions for the device.

The following device categories have already been defined:

Device categories	
Hex: 30	CSS 34, Safety sensor
Hex: 31	AZM 200, Solenoid interlock "Z" version
Hex: 32	MZM 100, Solenoid interlock "Z" version
Hex: 33	AZ 200, Safety switch
Hex: 34	CSS 30S, Safety sensor
Hex: 35	MZM 100, Solenoid interlock "B" version
Hex: 36	AZM 300 B, Solenoid interlock "B" version
Hex: 37	RSS 36, Safety sensor
Hex: 38	AZM 300 Z, Solenoid interlock "Z" version
Hex: 39	RSS 16, Safety sensor
Hex: 3A	RSS 260, Safety sensor
Hex: 3D	MZM 120 B, Solenoid interlock "B" version
Hex: 3E	MZM 120 BM, Solenoid interlock "B" version
Hex: 3F	AZM 201Z, Solenoid interlock "Z" version
Hex: 40	AZM 201B, Solenoid interlock "B" version
Hex: 41	BDF200-SD, Control panel
Hex: 43	AZ 201, Safety switch

8.7 Table 2: SD master diagnostics, SD system error
Content of response byte 00, gateway diagnostics byte

BIT	Error	Description	LED display	
			SD (red)	Teach (yellow)
Bit 0:	SD interface fault	Collective fault message, message 1 sec. delayed, SD data no longer valid	ON	OFF/ON/Flashes
Bit 1:	–			
Bit 2:	–			
Bit 3:	–			
Bit 4:	SD initialisation error	SD chain must be reinitialised! Switch off gateway and SD slave operating voltage. There may be no SD slave connected!	ON	ON
Bit 5:	SD Teach-in error	Structure of SD chain changed after power-on! If OK, actuate TEACH.	ON	Flashes
Bit 6:	SD-Short-circuit	Short-circuit to SD interface cables. Switch off and rectify error.	ON	Off
Bit 7:	SD Communication error	One or more SD slaves cannot be contacted. SD slave data no longer valid. Check SD installation, if necessary.	ON	Off

8.8 Table 3: SD slave condition data

Content of SD slave request byte
1st byte of SD slave in request in each case

SD slave request byte PLC output byte	
Bit 0:	Device-specific, e.g. AZM, MZM interlocks: "Magnet ON"
Bit 1:	---
Bit 2:	---
Bit 3:	---
Bit 4:	---
Bit 5:	---
Bit 6:	---
Bit 7:	Error reset

Content of SD slave response byte
1st byte of SD slave in response in each case

Response byte SD slave PLC input byte	
Bit 0:	safety outputs enabled
Bit 1:	Actuator detected
Bit 2:	Device-specific (see SD device operating instructions)
Bit 3:	Device-specific, e.g. CSS 34F: ready for release or reset signal
Bit 4:	Input condition X1 AND X2
Bit 5:	Device-specific (see SD device operating instructions)
Bit 6:	Error warning present
Bit 7:	Error (enabling path switched off)

8.9 Table 4: SD slave diagnostics data
2nd byte of SD slave in response in each case

Depending on the status of bit 6 (warning) and 7 (error) in the response byte of the corresponding SD slave, the diagnostics byte contains the following data:

Response byte		Content of diagnostics byte
Bit 7:	Bit 6:	
0	0	---
0	1	Warning message (error warning)
1	0	Error message (Error)
1	1	Error message (Error)

The individual bits in the diagnostics byte of the SD slave have the following meaning:

Bit	Error warning	Error
Bit 0:	Error output Y1	Error output Y1
Bit 1:	Error output Y2	Error output Y2
Bit 2:	Cross-wire short output	Cross-wire short output
Bit 3:	Temperature too high SD slave	Temperature too high SD slave
Bit 4:	---	incorrect or defective actuator
Bit 5:	Internal device error	Internal device error
Bit 6:	SD communication error, e.g. SD slave does not respond	Device-specific (see device operating instructions)
Bit 7:	SD slave operating voltage too low	---

9. Wiring example

### 9.1 Series wiring evaluation
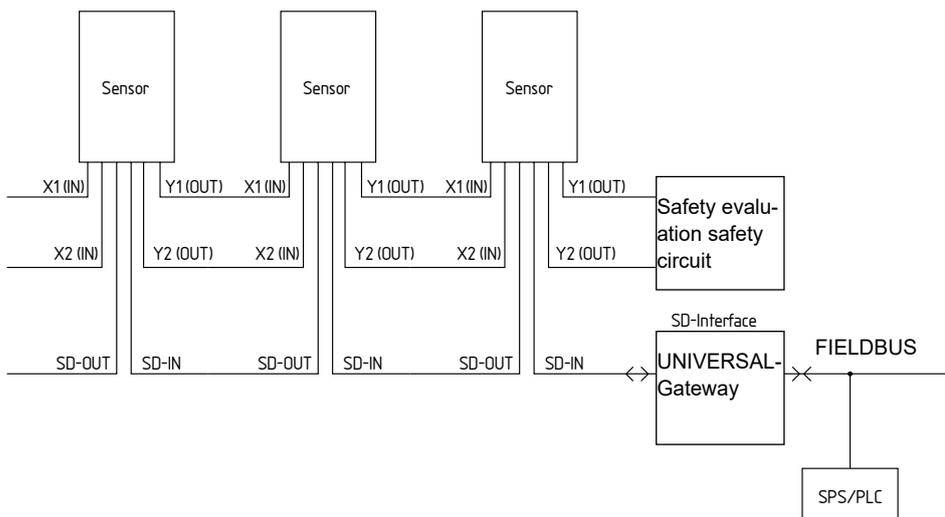
ℹ️ **Accessories for the series-wiring**
For convenient wiring and series-wiring of SD devices, the SD junction boxes PFB-SD-4M12-SD (variant for the field) and PDM-SD-4CC-SD (variant for control cabinet on carrier rail) are available along with additional comprehensive accessories. Detailed information is available on the Internet, www.schmersal.net.

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10.   Description of field bus modules

10.1   PROFINET IO
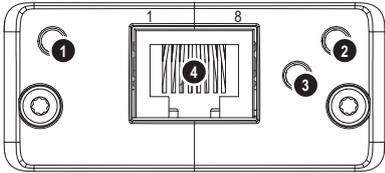
#	Item
1	Network Status LED
2	Module Status LED
3	Link/Activity LED
4	Ethernet Interface

Network Status LED

Note: A test sequence is performed on this LED during startup.

LED State	Description	Comments
Off	Offline	- No power - No connection with IO Controller
Green	Online (RUN)	- Connection with IO Controller established - IO Controller in RUN state
Green, flashing	Online (STOP)	- Connection with IO Controller established - IO Controller in STOP state

Module Status LED

Note: A test sequence is performed on this LED during startup.

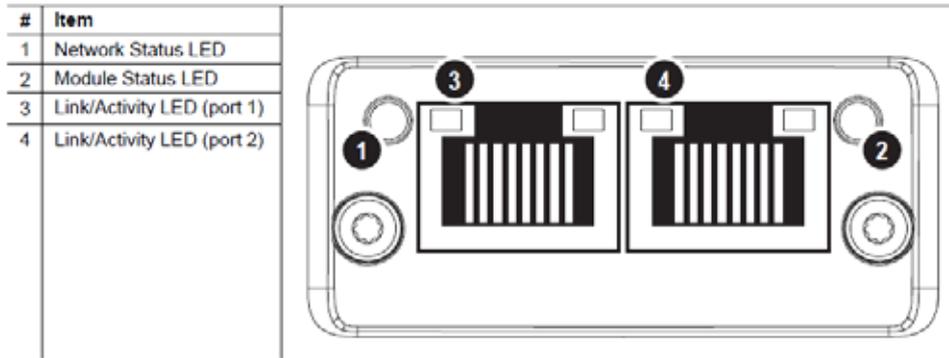| LED State	Description	Comments
Off	Not Initialized	No power - *or* - Module in 'SETUP' or 'NW_INIT' state
Green	Normal Operation	Module has shifted from the 'NW_INIT' state
Green, 1 flash	Diagnostic Event(s)	Diagnostic event(s) present
Green, 2 flashes	Blink	Used by engineering tools to identify the node on the network
Red	Exception Error	Module in state 'EXCEPTION'
Red, 1 flash	Configuration Error	Expected Identification differs from Real Identification
Red, 2 flashes	IP Address Error	IP address not set
Red, 3 flashes	Station Name Error	Station Name not set
Red, 4 flashes	Internal Error	Module has encountered a major internal error

LINK/Activity LED

LED State	Description	Comments
Off	No Link	No link, no communication present
Green	Link	Ethernet link established, no communication present
Green, flickering	Activity	Ethernet link established, communication present

Ethernet Interface

The ethernet interface operates at 100Mbit, full duplex, as required by PROFINET.

Description of field bus modules

10.2 PROFINET IRT (Integrated Switch)

#	Item
1	Network Status LED
2	Module Status LED
3	Link/Activity LED (port 1)
4	Link/Activity LED (port 2)

Network Status LED

LED State	Description	Comments
Off	Offline	• No power • No connection with IO Controller
Green	Online (RUN)	• Connection with IO Controller established • IO Controller in RUN state
Green, 1 flash	Online (STOP)	• Connection with IO Controller established • IO Controller in STOP state or IO data bad • IRT synchronization not finished
Green, blinking	Blink	Used by engineering tools to identify the node on the network
Red	Fatal event	Major internal error (this indication is combined with a red module status LED)

Red, 1 flash	Station Name error	Station Name not set
Red, 2 flashes	IP address error	IP address not set
Red, 3 flashes	Configuration error	Expected Identification differs from Real Identification

Module Status LED

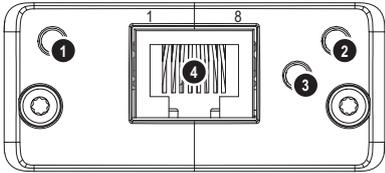| LED State	Description	Comments
Off	Not Initialized	No power OR Module in SETUP or NW_INIT state.
Green	Normal Operation	Module has shifted from the NW_INIT state.
Green, 1 flash	Diagnostic Event(s)	Diagnostic event(s) present
Red	Exception error	Device in state EXCEPTION.
	Fatal event	Major internal error (this indication is combined with a red network status LED)
Alternating Red/Greed	Firmware update	Do NOT power off the module. Turning the module off during this phase could cause permanent damage.

LINK/Activity LED

LED State	Description	Comments
Off	No Link	No link, no communication present
Green	Link	Ethernet link established, no communication present
Green, flickering	Activity	Ethernet link established, communication present

10.3   Ethernet/IP

#	Item
1	Network Status LED
2	Module Status LED
3	Link/Activity
4	Ethernet Interface

Network Status LED

Note: A test sequence is performed on this LED during startup.

LED State	Description
Off	No power or no IP address
Green	On-line, one or more connections established (CIP Class 1 or 3)
Green, flashing	On-line, no connections established
Red	Duplicate IP address, FATAL error
Red, flashing	One or more connections timed out (CIP Class 1 or 3)

Module Status LED

Note: A test sequence is performed on this LED during startup.

LED State	Description
Off	No power
Green	Controlled by a Scanner in Run state
Green, flashing	Not configured, or Scanner in Idle state
Red	Major fault (EXCEPTION-state, FATAL error etc.)
Red, flashing	Recoverable fault(s)

LINK/Activity LED

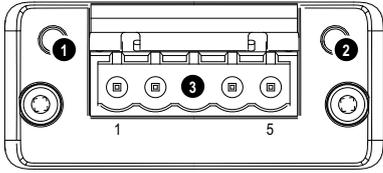| LED State	Description
Off	No link, no activity
Green	Link established
Green, flickering	Activity

Ethernet Interface

The ethernet interface supports 10/100Mbit, full or half duplex operation.

Description of field bus modules

10.4   DeviceNet

#	Item
1	Network Status LED
2	Module Status LED
3	DeviceNet Connector

Network Status

State	Indication
Off	Not online / No power
Green	On-line, one or more connections are established
Flashing Green (1 Hz)	On-line, no connections established
Red	Critical link failure
Flashing Red (1 Hz)	One or more connections timed-out
Alternating Red/Green	Self test

Module Status

State	Indication
Off	No power
Green	Operating in normal condition
Flashing Green (1 Hz)	Missing or incomplete configuration, device needs commissioning
Red	Unrecoverable Fault(s)
Flashing Red (1 Hz)	Recoverable Fault(s)
Alternating Red/Green	Self test

DeviceNet Connector

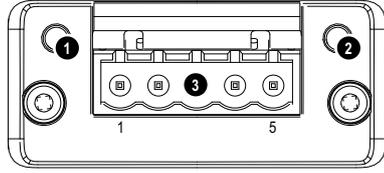This connector provides DeviceNet connectivity.

Pin	Signal	Description
1	V-	Negative bus supply voltage[a]
2	CAN_L	CAN low bus line
3	SHIELD	Cable shield
4	CAN_H	CAN high bus line
5	V+	Positive bus supply voltage[a]

a. DeviceNet bus power. For more information, see C-1 "Technical Specification".

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10.5   CC-Link

#	Item
1	Run LED
2	Error LED
3	CC-Link Interface

Run LED

State	Meaning
Off	- No network participation, timeout status (no power)
Green	- Participating, normal operation
Red	- Major fault (FATAL error)

Error LED

| State	Meaning
Off	- No error detected (no power)
Red	- Major fault (Exception or FATAL event)
Red, flickering	- CRC error (temporary flickering)
Red, flashing	- Station Number or Baud rate has changed since startup (flashing)

CC-Link Interface

Pin	Signal	Comment
1	DA	Positive RS485 RxD/TxD
2	DB	Negative RS485 RxD/TxD
3	DG	Signal Ground
4	SLD	Cable Shield
5	FG	Protective Earth

10.6 CANopen

#	Item
1	RUN LED[a]
2	ERROR LED[a]
3	CANopen Interface
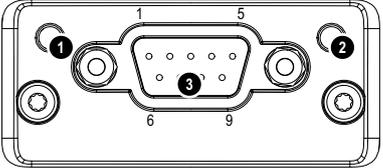
a. The flash sequences for these LEDs are defined in DR303-3 (CiA).

RUN LED

LED State	Indication	Description
Off	-	No power.
Green	OPERATIONAL	The module is in the 'operational' state.
Green, blinking	PRE-OPERATIONAL	The module is in the 'pre-operational' state.
Green, single flash	STOPPED	The module is in the 'stopped' state.
Green, flickering	Autobaud	Baudrate detection in progress.
Red[a]	EXCEPTON state (Fatal Event)	The module has shifted into the EXCEPTION state.

a. If both LEDs turns red, this indicates a fatal event; the bus interface is shifted into a physically passive state.

ERROR LED

LED State	Indication	Description
Off	-	No power - *or* - device is in working condition.
Red, single flash	Warning limit reached	A bus error counter reached or exceeded its warning level.
Red, flickering	LSS	LSS services in progress.
Red, double flash	Error Control Event	A guard- (NMT-Slave or NMT-master) or heartbeat event (Heartbeat consumer) has occurred.
Red[a]	Bus off (Fatal Event)	Bus off.

a. If both LEDs turns red, this indicates a fatal event; the bus interface is shifted into a physically passive state.

CANopen Interface
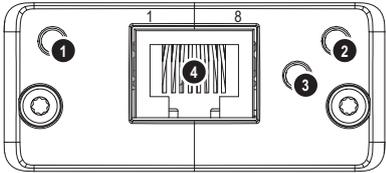
Pin	Signal	Comments
1	-	-
2	CAN_L	-
3	CAN_GND	-
4	-	-
5	CAN_SHLD	-
6	-	-
7	CAN_H	-
8	-	-
9	-	-
Housing	CAN_SHIELD	-

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10.7   Modbus/TCP

#	Item
1	Network Status LED
2	Module Status LED
3	Link/Activity
4	Ethernet Interface

Network Status LED

Note: A test sequence is performed on this LED during startup.

LED State	Description
Off	No power or no IP address
Green	Module is in Process Active or Idle state
Green, flashing	Waiting for connections
Red	Duplicate IP address, or FATAL event
Red, flashing	Process Active Timeout.

Module Status LED

Note: A test sequence is performed on this LED during startup.

LED State	Description
Off	No power
Green	Normal operation
Red	Major fault; module is in state EXCEPTION (or FATAL event)
Red, flashing	Minor fault; the present IP settings differs from the settings in the net.cfg.ob

LINK/Activity LED

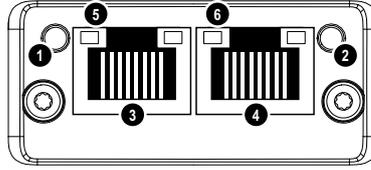| LED State	Description
Off	No link, no activity
Green	Link established
Green, flickering	Activity

Ethernet Interface

The ethernet interface supports 10/100Mbit, full or half duplex operation.

Description of field bus modules

10.8   EtherCAT

#	Item
1	RUN LED[a]
2	ERROR LED[a]
3	EtherCAT (port 1)
4	EtherCAT (port 2)
5	Link/Activity (port 1)
6	Link/Activity (port 2)

a. The flash sequences for these LEDs are defined in DR303-3 (CiA).

RUN LED

This LED reflects the status of the CoE (CANopen over EtherCAT) communication.

LED State	Indication	Description
Off	INIT	CoE device in 'INIT'-state (or no power)
Green	OPERATIONAL	CoE device in 'OPERATIONAL'-state
Green, blinking	PRE-OPERATIONAL	CoE device in 'PRE-OPERATIONAL'-state
Green, single flash	SAFE-OPERATIONAL	CoE device in 'SAFE-OPERATIONAL'-state
Red[a]	(Fatal Event)	-

a. If RUN and ERR turns red, this indicates a fatal event, forcing the bus interface to a physically passive state. Contact HMS technical support.

ERR LED

This LED indicates EtherCAT communication errors etc.

LED State	Indication	Description
Off	No error	No error (or no power)
Red, blinking	Invalid configuration	State change received from master is not possible due to invalid register or object settings.
Red, double flash	Application watchdog timeout	Sync manager watchdog timeout
Red[a]	Application controller failure	Anybus module in EXCEPTION

a. If RUN and ERR turns red, this indicates a fatal event, forcing the bus interface to a physically passive state. Contact HMS technical support.
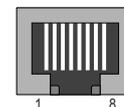
Link/Activity

These LEDs indicate the EtherCAT link status and activity.

LED State	Indication	Description
Off	No link	Link not sensed (or no power)
Green	Link sensed, no activity	Link sensed, no traffic detected
Green, flickering	Link sensed, activity detected	Link sensed, traffic detected

Ethernet Connector (RJ45)

Pin	Signal	Notes
1	Tx+	-
2	Tx-	-
3	Rx+	-
4	-	Normally left unused; to ensure signal integrity, these pins are tied together and terminated to PE via a filter circuit in the module.
5	-	
6	Rx-	-
7	-	Normally left unused; to ensure signal integrity, these pins are tied together and terminated to PE via a filter circuit in the module.
8	-	

11.   EU Declaration of conformity

EU Declaration of conformity   ⑤ **SCHMERSAL**

Original   K.A. Schmersal GmbH & Co. KG
                                                  Möddinghofe 30
                                                  42279 Wuppertal
                                                  Germany
                                                  Internet: www.schmersal.com

We hereby certify that the hereafter described components both in their basic design and construction conform
to the applicable European Directives.

Name of the component: SD-I-U-…

Type: See ordering code

Description of the component: UNIVERSAL gateway for serial diagnostic (SD-I-U-..)

Relevant Directives: EMC-Directive   2014/30/EU
                                                  RoHS-Directive   2011/65/EU

Applied standards: DIN EN 61000-6-2:2006
                                                  DIN EN 61000-6-4:2011
                                                  EN 61326-3-1:2008

Person authorised for the compilation   Oliver Wacker
of the technical documentation: Möddinghofe 30
                                                  42279 Wuppertal

Place and date of issue: Wuppertal, November 12, 2018

                                                  Authorised signature
                                                  Philip Schmersal
                                                  Managing Director

SD-I-U-C-DE

ⓘ The currently valid declaration of conformity can be
    downloaded from the internet at www.schmersal.net.   🗑 C €