

# PSI-MOS-RS485W2/FO...

## FO converters for RS-485 2-wire bus systems



Data sheet  
101973\_en\_06

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### 1 Description

**PSI-MOS-RS485W2/FO...** devices can be used to convert RS-485 2-wire bus systems to fiber optics.

All bus systems with 10/11-bit UART data format and NRZ data coding are supported. This includes popular bus systems such as:

- Modbus ASCII/MODBUS RTU
- SUCONET K
- S-BUS
- DH-485
- Various other company-specific bus systems

A transparent protocol is used to convert all common transmission speeds up to a maximum of 500 kbps. The integrated optical diagnostics enable fiber optic paths to be monitored continuously during installation and even during operation. The floating switch contact is activated when the signal output on the fiber optic paths drops to a critical level. This early alarm generation enables critical system states to be diagnosed before they result in failure.

**PSI-MOS-RS485W2/FO... E terminal devices** convert an RS-485 interface to a fiber optic cable. They are ideal for point-to-point connections.

**PSI-MOS-RS485W2/FO...** fiber optic **T-couplers** convert to two fiber optic cables.

You can create virtually any cascable star and tree structures, including redundant configurations, using integrated bit retiming. In this case, devices are simply snapped onto DIN rail connectors. The DIN rail connectors route the supply voltage and the data signals.

Devices with different transmission technologies (polymer, HCS, and fiberglass) can be freely combined within a star coupler.

You can network **PSI-MOS-RS485W2/FO 660...** devices

- Up to 100 m using polymer fiber cables
- Up to 800 m using HCS fiber cables

They are connected via FSMA quick mounting connectors, which can be assembled locally within a few minutes.

**PSI-MOS-RS485W2/FO 850 ...** devices with B-FOC(ST®) fast connection technology are available for longer distances:

- Up to 2800 m with HCS fiber cables
- Up to 4200 m with multimode fiberglass cables



#### **WARNING: Explosion hazard when used in potentially explosive areas**

This device is a category 3 item of electrical equipment. Follow the instructions provided here during installation and observe the safety notes.



Make sure you always use the latest documentation. It can be downloaded at [phoenixcontact.net/products](http://phoenixcontact.net/products).



This data sheet is valid for all products listed on the following page:

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### 3 Ordering data

#### FO converter

Description	Type	Order No.	Pcs./Pkt.
Terminal device with one fiber optic interface			
Fiber optic converter with integrated optical diagnostics, alarm contact, for RS-485 2-wire bus systems (SUCONET K, Modbus, etc.) up to 500 kbps, NRZ coding			
660 nm, for polymer/HCS fiber cable, FSMA	PSI-MOS-RS485W2/FO 660 E	2708313	1
850 nm, for HCS/fiberglass cable, B-FOC(ST <sup>®</sup> )	PSI-MOS-RS485W2/FO 850 E	2708339	1
T-coupler with two fiber optic interfaces			
FO converter with integrated optical diagnostics, alarm contact, for RS-485 2-wire bus systems (SUCONET K, Modbus, etc.) up to 500 kbps, NRZ coding,			
660 nm, for polymer/HCS fiber cable, FSMA	PSI-MOS-RS485W2/FO 660 T	2708300	1
850 nm, for HCS/fiberglass cable, B-FOC(ST <sup>®</sup> )	PSI-MOS-RS485W2/FO 850 T	2708326	1

#### Accessories

Description	Type	Order No.	Pcs./Pkt.
System power supply unit for supplying a modular star coupler topology	MINI-SYS-PS 100-240AC/24DC/1.5	2866983	1
System power supply unit for supplying a modular star coupler topology, for potentially explosive areas	MINI-PS-100-240AC/24DC/1.5/EX	2866653	1
End bracket	CLIPFIX 35	3022218	50
DIN rail connector, power supply and data (2 per device)	ME 17.5 TBUS1.5/5-ST-3.81GN	2709561	10
DIN rail connector, power supply only (2 per device)	ME 17.5 TBUS1.5/PP000-3.81BK	2890014	10
Polymer fiber connectors (4 connectors in a set)	PSM-SET-FSMA/4-KT	2799720	1
Polishing set for polymer fiber connectors (required to assemble polymer fiber connectors)	PSM-SET-FSMA-POLISH	2799348	1
Polymer fiber cable (fiber optic) for indoor installation	PSM-LWL-KDHEAVY	2744319	1
FSMA HCS fiber connectors (4 connectors in the set)	PSM-SET-FSMA/4-HCS	2799487	1
B-FOC(ST <sup>®</sup> ) HCS fiber connectors (4 connectors in the set)	PSM-SET-B-FOC/4-HCS	2708481	1
Tool set for HCS connectors (FSMA) (required for HCS connector assembly)	PSM-HCS-KONFTOOL	2799526	1
Tool set for HCS connectors, B-FOC(ST <sup>®</sup> ) (required for HCS connector assembly)	PSM-HCS-KONFTOOL/B-FOC	2708465	1
HCS cable (fiber optic) for indoor installation	PSM-LWL-HCS RUGGED-200/230	2799885	1
HCS cable (fiber optic) for outdoor installation	PSM-LWL-HCSO-200/230	2799445	1
Fiber optic fiberglass cable for indoor installation	PSM-LWL-GDM-RUGGED-50/125	2799322	1
Fiber optic fiberglass cable for outdoor installation	PSM-LWL-GDO-50/125	2799432	1
Measuring instrument for fiber optic power measurement	PSM-FO-POWERMETER	2799539	1

**Other fiber optic converters**

Description	Type	Order No.	Pcs./Pkt.
Fiber optic converter with integrated optical diagnostics, alarm contact, for RS-485 2-wire bus systems (SUCONET K, Modbus, etc.) up to 500 kbps, NRZ coding, terminal device with one fiber optic interface (SC duplex), 1300 nm, for fiber-glass cable Transmission length: – 25 km with multi-mode fiberglass – 45 km with single-mode fiberglass	PSI-MOS-RS485W2/FO 130 0 E	2708562	1

**4 Technical data**

Interfaces		
Power supply	24 V DC (18 V DC ... 30 V DC)	
Typical current consumption	100 mA (24 V DC)	
Maximum current consumption	130 mA	
Standby indicator	VCC LED (green)	
Maximum star coupler expansion	10	
Serial RS-485 interface		
Operation mode	Half duplex	
Bus termination resistor	390 Ω / 220 Ω / 390 Ω (switchable)	
Data format/coding	UART (10/11-bit switchable, NRZ)	
Data direction changeover	Automatic	
Transmission speed (set via DIP switches)	4.8/9.6/19.2/38.4/57.6/75/93.75/115.2/136/187.5/375/500 kbps	
Transmission length	Up to 1200 m, maximum depending on the transmission speed, with shielded, twisted pair data cable	
Connection	COMBICON plug-in screw terminal block	
Optical interface		
Transmission protocol	Transparent protocol to RS-485 interface	
Connection technology	<b>FSMA</b>	<b>B-FOC(ST®)</b>
Wavelength	660 nm	850 nm
Minimum transmission power (fiber type)	-5.3 dBm (980/1000 μm)	-4.0 dBm (200/230 μm)
	-16.0 dBm (200/230 μm)	-17.6 dBm (50/125 μm) -14.6 dBm (62.5/125 μm)

**Interfaces**

<b>Receiver sensitivity</b>		
Minimum	-30.1 dBm	-32.5 dBm (50/125 $\mu\text{m}$ / 62.5/125 $\mu\text{m}$ )
Maximum	-3.0 dBm (980/1000 $\mu\text{m}$ )	-32.1 dBm (200/230 $\mu\text{m}$ ) -3.0 dBm (200/230 $\mu\text{m}$ )
Transmission length including 3 dB system reserve	100 m with F-P 980/1000; 230 dB/km 800 m with F-K 200/230; 10 dB/km with quick mounting connectors	2800 m with F-K 200/230; 8.0 dB/km 3300 m with F-G 62.5/125; 3.0 dB/km 4200 m with F-G 50/125; 2.5 dB/km
Minimum transmission length	1 m with F-K 200/230; 8.0 dB/km	

**General data**

Bit distortion, input	$\pm 35\%$ , maximum		
Bit distortion, output	<6.25 %		
Bit delay	<1 bit		
Electrical isolation	VCC // RS-485		
Test voltage	1.5 kV <sub>rms</sub> , 50 Hz, 1 min.		
Signaling output	60 V DC/42 V AC, 0.46 A, maximum		
Status and diagnostics indicators	Power supply (VCC), transmit/receive data RS-485, fiber optic bar graph (FO SIGNAL), fiber optic error (FO ERR)		
Enclosure material	PA 6.6 FR, green		
Ambient temperature			
Operation	-20°C ... +60°C		
Storage/transport	-40°C ... +85°C		
Humidity	30% to 95%, no condensation		
Dimensions (W x H x D)	35 mm x 99 mm x 105 mm		
Degree of protection	IP20		
Weight	190 g, approximately		
MTBF according to Telcordia standard	<b>Terminal devices (E)</b>		<b>T-coupler (T)</b>
	<b>660 nm</b>	<b>850 nm</b>	<b>660 nm</b>
Ambient temperature 25 °C	358 years	272 years	220 years
Ambient temperature 40 °C	73 years	44 years	44 years
Free from substances that would hinder coating with paint or varnish	According to VW-AUDI-Seat central standard P-VW 3.10.7 57 65 0		
Vibration resistance according to EN 60068-2-6/IEC 60068-2-6	5g, 10 - 150 Hz, 2.5 h, in XYZ direction		
Shock according to EN 60068-2-27/IEC 60068-2-27	15g, 11 ms period, half-sine shock pulse		
Free fall	1 m without packaging according to IEC60950		
Air clearances and creepage distances	DIN EN 60664-1/VDE 0110-1, DIN EN 50178, DIN EN 60950		

**Tests/approvals**

Conformance	CE-compliant, EAC
Shipbuilding	DNV
ATEX (Please follow the special installation instructions in the documentation)	Ⓢ II 3 G Ex nA nC IIC T4 Gc X Ⓢ II (2) G [Ex op is Gb] IIC (PTB 06 ATEX 2042 U) Ⓢ II (2) D [Ex op is Db] IIIC (PTB 06 ATEX 2042 U)
UL, USA/Canada	Class I, Zone 2, AEx nc IIC T5 Class I, zone 2, Ex nC nL IIC T5 X Class I, Div. 2, Groups A, B, C, D

**Conformity with EMC Directive 2014/30/EU****Immunity test according to EN 61000-6-2<sup>1</sup>**

Electrostatic discharge (ESD)	EN 61000-4-2	Criterion B <sup>2</sup>	
Air discharge			8 kV
Contact discharge			6 kV
Electromagnetic HF field	EN 61000-4-3	Criterion A <sup>3</sup>	
Amplitude modulation			10 V/m
Fast transients (burst)	EN 61000-4-4	Criterion B <sup>2</sup>	
Signal			2 kV/5 kHz
Power supply			2 kV/5 kHz
Surge current loads (surge)	EN 61000-4-5	Criterion B <sup>2</sup>	
Signal			1 kV/42 W
Power supply			0.5 kV/2 Ω
Conducted disturbance variables	EN 61000-4-6	Criterion A <sup>3</sup>	10 V

**Noise emission test according to EN 61000-6-4**

Noise emission of housing	EN 55011 <sup>4</sup>	Class A: Industrial application, without special installation measures
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<sup>1</sup> EN 61000 corresponds to IEC 61000

<sup>2</sup> Criterion B: Temporary adverse effects on the operating behavior, which the device corrects automatically

<sup>3</sup> Criterion A: Normal operating behavior within the specified limits

<sup>4</sup> EN 55011 corresponds to CISPR11

Block diagram

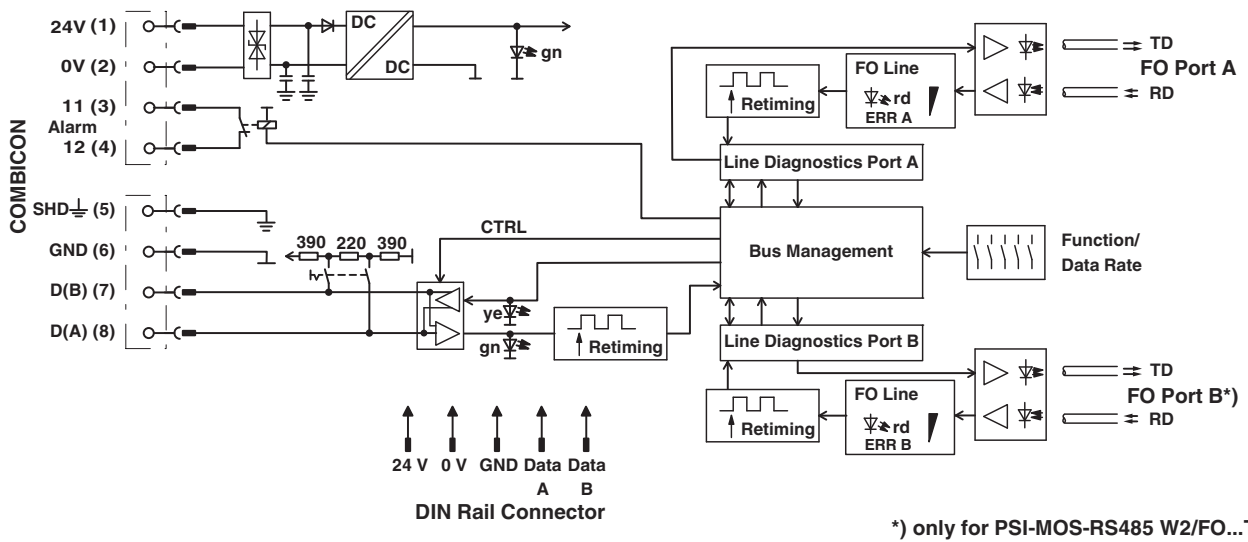


Figure 1 Block diagram

Housing dimensions

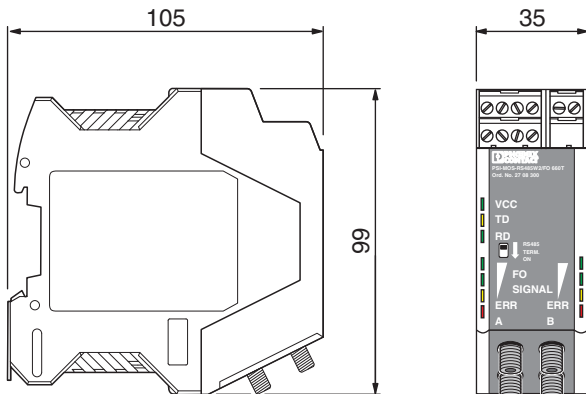


Figure 2 Housing dimensions

## 5 Safety regulations and installation notes

### 5.1 Installation notes



**WARNING:**

Observe the following safety notes when using the FO converter.

- The category 3 device is suitable for installation in Zone 2 potentially explosive areas. It meets the requirements of EN 60079-0:2012+A11:2013 and EN 60079-15:2010.
- The FO components of type PSI-MOS transmitter control 660 or 850 are a part of the module. The fibre optics interface is used for optical communication with devices used in the potentially explosive area of zone 1 or zone 21. It is used in accordance with the EC examination certificate.
- Installation, operation, and maintenance may only be carried out by qualified electricians. Follow the installation instructions as described. When installing and operating the device, the applicable regulations and safety directives (including national safety directives), as well as the general codes of practice, must be observed. The safety data is provided in the packing slip and on the certificates (conformity assessment, additional approvals where applicable).
- The device must not be opened or modified apart from the configuration of the DIP switches. Do not repair the device yourself; replace it with an equivalent device instead. Repairs may only be carried out by the manufacturer. The manufacturer is not liable for damage resulting from non-compliance.
- The IP20 degree of protection (IEC 60529/EN 60529) of the device is intended for use in a clean and dry environment. Do not subject the device to mechanical and/or thermal loads that exceed the specified limits.

- The switches of the device that can be accessed may only be actuated when power to the device is disconnected.
- The device is designed exclusively for operation with safety extra-low voltage (SELV) according to IEC 60950/EN 60950/VDE 0805. The device may only be connected to devices that meet the requirements of EN 60950.

### 5.2 Installation in zone 2



**WARNING: Explosion hazard when used in potentially explosive areas**

Make sure that the following notes and instructions are observed.

- Observe the specified conditions for use in potentially explosive areas!
- Install the device in a suitable, approved housing (with at least IP54 protection) that meets the requirements of EN 60079-15. For this purpose, observe the requirements of IEC 60079-14 / EN 60079-14.
- Only connect devices to the supply and signal circuits in zone 2 that are suitable for operation in Ex zone 2 and for the conditions at the installation location.
- In potentially explosive areas, only snap the device onto or off the DIN rail connector and connect/disconnect cables when the power is disconnected.
- The device must be stopped and immediately removed from the Ex area if it is damaged, was subjected to an impermissible load, stored incorrectly or if it malfunctions.

### 5.3 UL notes

**PROCESS CONTROL EQUIPMENT FOR HAZARDOUS LOCATIONS 31ZN**

- This equipment is suitable for use in Class I, Zone 2, AEx nC IIC T5, Ex nC nL IIC T5 X; and Class I, Division 2, Groups A, B, C and D or non-hazardous locations only.
- WARNING - EXPLOSION HAZARD** - substitution of components may impair suitability for Class I, Zone 2/Division 2.
- WARNING - EXPLOSION HAZARD** - do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
- This device must be installed in an enclosure rated IP54 and used in an area of not more than pollution degree 2.



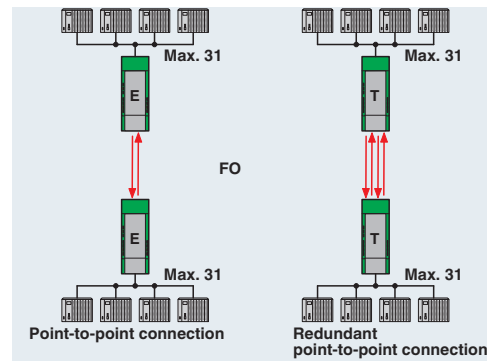
## 6 Supported network structures

The PSI-MOS-RS485W2/FO... system can be used to create network topologies that are optimally adapted to the relevant application. The structures are described briefly below.

### 6.1 Point-to-point connections

You can use two PSI-MOS-RS485W2/FO... E FO terminal devices to easily convert a data link from copper cable to fiber optics.

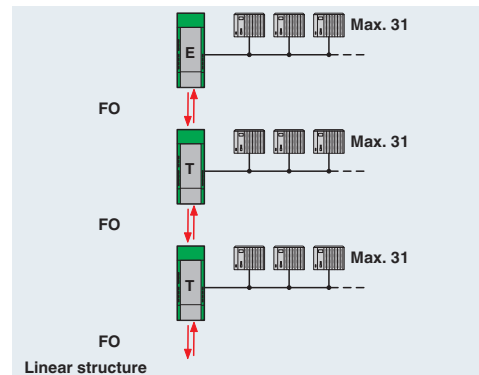
For increased availability, the point-to-point connection can be designed redundantly using PSI-MOS-RS485W2/FO... T T-couplers.



### 6.2 Linear structures

You can use PSI-MOS-RS485W2/FO... devices to network several RS-485 devices to form a line structure. PSI-MOS-RS485W2/FO... E terminal devices are used at the beginning and end of the fiber optic line.

PSI-MOS-RS485W2/FO... T T-couplers with two fiber optic ports are used along the line.

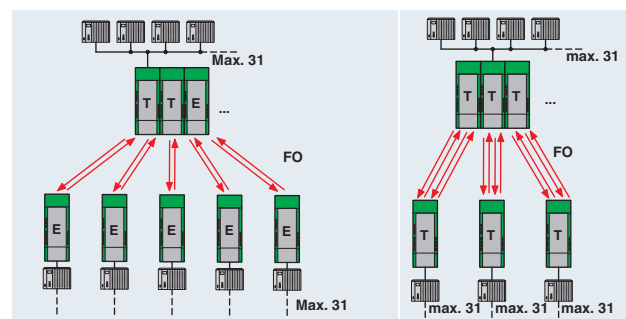


### 6.3 Star structures

You can network RS-485 devices in a star structure. Depending on the number of star lines required, several T-couplers or terminal devices are connected to an active star coupler.

You can connect up to ten PSI-MOS-RS485W2/FO... devices per star coupler. Cross-wiring for RS-485 data and for the supply voltage is provided automatically by the DIN rail connector (installation accessory, see Page 3).

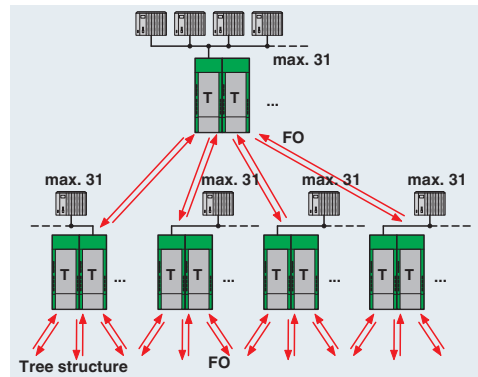
If increased availability is required, redundant star distributors can also be created using PSI-MOS-RS485W2/FO... T T-couplers.



### 6.4 Tree structures

Linear and star structures can be cascaded to create complex tree structures, even in a redundant configuration.

The number of devices that can be cascaded is only limited by the timing response (timeout) of the bus system used due to the bit retiming of the fiber optic converter.



## 7 Function elements

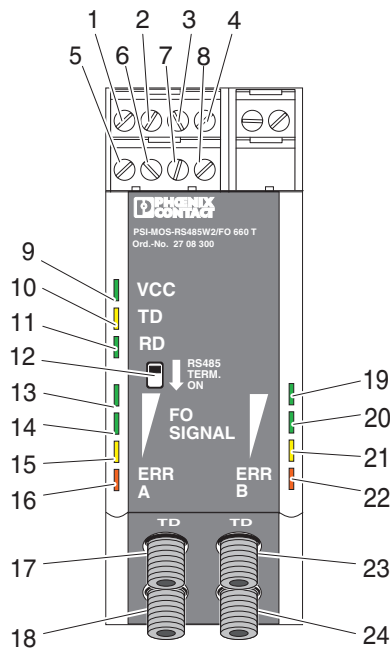


Figure 3 Function elements

- 1 24 V DC supply voltage connection
- 2 0 V DC supply voltage connection
- 3 Switch contact, connection 11
- 4 Switch contact, connection 12
- 5 SHD, shield
- 6 GND, ground
- 7 D (B), transmit/receive positive
- 8 D (A), transmit/receive negative
- 9 "VCC" LED

- 10 "TD" LED
- 11 "RD" LED
- 12 Bus termination ON/OFF
- 13 "FO SIGNAL" LED (port A)
- 14 "FO SIGNAL" LED (port A)
- 15 "FO SIGNAL" LED (port A)
- 16 "ERR" LED (port A)
- 17 Fiber optic transmitter (port A)
- 18 Fiber optic receiver (port A)

#### Port B only with PSI-MOS-RS485W2/FO... T T-couplers:

- 19 "FO SIGNAL" LED (port B)
- 20 "FO SIGNAL" LED (port B)
- 21 "FO SIGNAL" LED (port B)
- 22 "ERR" LED (port B)
- 23 Fiber optic transmitter (port B)
- 24 Fiber optic receiver (port B)

#### Diagnostic and status indicators

Des.	Color	Meaning	
VCC	Green	Ready to operate	
TD	Yellow	Data is sent at the RS-485 copper interface	
RD	Green	Data is received at the RS-485 copper interface	
FO SIGNAL	Green	Power received at fiber optic port A/B (see Page 11)	Very good
	Green		Good
	Yellow		Critical
ERR	Red	Insufficient, broken fiber	

## 8 Definition of fiber optic diagnostics

The quality of the path is determined using the incoming optical power  $P_{opt}$  and displayed using the LED bar graph.

If DIP 7 = "OFF" is set, idle transmitters (rest period between sending data) are switched to continuous illumination (INVERS). This allows for continuous FO diagnostics.

LED bar graph	Receive status	Optical power $P_{opt}$
Green Green Yellow	Very good	$P_{opt}$ is significantly greater than the system reserve
Green Yellow	Good	$P_{opt}$ is still greater than the system reserve
Yellow	Critical	$P_{opt}$ has reached the system reserve
Red	Error	$P_{opt}$ has sapped the system reserve/broken fiber

As soon as the system reserve is reached, only the yellow LED remains lit. At the same time, the signaling relay drops and the switch contact opens. Data communication is still possible.

In "Redundancy" mode, the affected fiber optic port is already switched off when the LED goes to yellow.

### Echo evaluation

If you switch DIP 7 to "ON" (NORM), the echo evaluation (DIP 6 = OFF) is available as diagnostics (see "Connection to fiber optic interfaces from third-party suppliers (DIP 6/7)" on page 13).

Echo evaluation is used to detect broken fibers for the devices. During the idle phase (rest period between transmitting data), the fiber optics between directly connected devices are monitored for broken fibers.

In the event of broken fiber, the relevant optical fiber is switched off. The error LED is then set (16 in Figure 3 on page 10) and the switching output is activated.

If the default setting for DIP 7 = "OFF" (INVERSE) is used, echo evaluation is switched off because the built-in diagnostics (FO signal) permanently evaluates the received signal and therefore also detects a broken fiber.

If you also switch off the echo evaluation (DIP 6 = "ON"), fiber optic diagnostics are not available.

DIP 6	DIP 7	Meaning
Not relevant	OFF (INVERS)	Continuous fiber optic diagnostics, broken fiber detection disabled
OFF	ON (NORM)	Continuous fiber optic diagnostics, broken fiber detection active
ON (MIXED)	ON (NORM)	Continuous fiber optic diagnostics and broken fiber detection disabled. Diagnostics are no longer available.

### Basic method of operation

PSI-MOS devices have a maximum of four interfaces for the RS-485 signal:

- Electrical interface (COMBICON)
- Fiber optic ports (port B only with T-couplers)
- DIN rail connector

All interfaces communicate with one another with the same rights. A signal available at one of the interfaces is also available at all other interfaces.

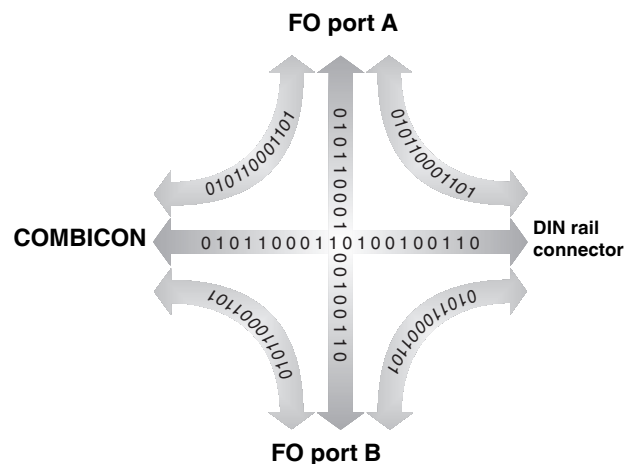


Figure 4 Communication between the interfaces

## 9 Configuration



**NOTE: Electrostatic discharge**

The device contains components that can be damaged or destroyed by electrostatic discharge. When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) according to EN 61340-5-1.

- For configuration, release the housing cover using a screwdriver (A in Figure 5).
- Then carefully pull the PCB out of the housing as far as possible (B).

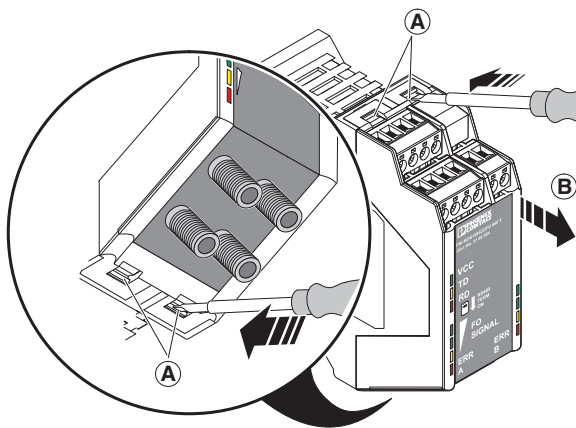


Figure 5 Opening the housing

DIP switches 1 to 10 are then freely accessible.

- Configure the DIP switches according to the planned application.

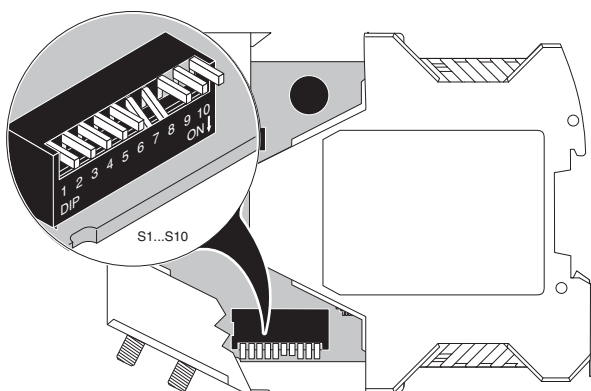


Figure 6 Setting the DIP switches

The following tables provide an overview of the DIP switch functions. By default upon delivery, all DIP switches are in the "OFF" position.



After changing the device settings, disconnect the power to the device so that the settings can be applied.

### 9.1 Setting the transmission speed

- Set the transmission speed using DIP switches 1 ... 4.



Set all fiber optic converters and all connected RS-485 devices to the same transmission speed.

• = ON Transmission rate	DIP switch			
	1	2	3	4
500 kbps				
375 kbps				•
187.5 kbps			•	
136 kbps			•	•
115.2 kbps		•		
93.75 kbps		•		•
75 kbps		•	•	
57.6 kbps		•	•	•
38.4 kbps	•			
19.2 kbps	•			•
9.6 kbps	•		•	
4.8 kbps	•		•	•

DIP switch	ON	OFF
5	10 BIT	11 BIT
6	MIXED	–
7	STANDARD	INVERSE
8 <sup>1</sup>	REDUNDANCY	–
9 <sup>2</sup>	END	NEXT
10 <sup>2</sup>	N.C.	

<sup>1</sup> No function for PSI-MOS-RS485W2/FO...E terminal devices.

<sup>2</sup> Not available for PSI-MOS-RS485W2/FO...E terminal devices.

**9.2 10/11-bit selection (DIP 5)**



Please always observe the UART character word length specified by the control system manufacturer.

The standard word length of a UART character is 11 bits. However, some bus systems, such as Modbus in ASCII mode transmit 10-bit word lengths.

- Set DIP switch 5 to "ON" ("10 BIT") (default setting: "OFF").

If operating Modbus in RTU mode, leave DIP switch 5 set to "OFF" ("11 bits").

If you are using the Inline multiplexer system, select a word length of 11 bits and 75 kbps.

**9.3 Connection to fiber optic interfaces from third-party suppliers (DIP 6/7)**

During the idle phase, fiber optic interfaces return to an idle setting defined by the manufacturer. This idle setting may vary for different manufacturers and devices. As fiber optic interfaces can only be operated together if they have the same idle setting, this should be set using the DIP switches.

For mixed operation of PSI-MOS with fiber optic interfaces from other manufacturers, observe the following specifications:

- Deactivate the echo evaluation.  
To do this, set DIP 6 to "ON".
- Check the idle setting for the third-party interface:
  - Logic 1 = Light off or
  - Logic 1 = Light on
- If necessary, adjust the idle setting of the PSI-MOS device using DIP 7.

DIP 7	Idle setting	Meaning
OFF = INVERS	Light on <sup>1</sup>	Logic 1
ON = NORM	Light off	Logic 1

<sup>1</sup> Default setting



If you set DIP 7 to "ON", the FO diagnostics are not available via the LED bar graphs. The LED bar graph can light up at high transmission speeds or flash at low transmission speeds. This display does **not** correspond to continuous evaluation of the optical power.



When connecting third-party devices, observe the receiver sensitivity and overrange limits of the fiber optic interfaces.

**9.4 Activating the redundancy function (DIP 8)**

For increased availability, you can create redundant fiber optic connections using T-couplers. In this case, the redundancy function must be activated at the start and end of the redundant fiber optic connection.

- To do this, set DIP switch 8 (REDUNDANCY) to "ON".

When the redundancy function is enabled, data communication takes place via fiber optic port A by default. In the event that the signal level of the standard cable drops to a critical level, it automatically switches to port B.



Always connect redundant fiber optic connections from fiber optic port A to port A of the opposite device or from port B to port B of the opposite device.

**9.5 Disabling the second fiber optic port (DIP 9)**

If you do not use the second fiber optics port (B) when using PSI-MOS-RS485W2/FO... T-couplers, you have to switch it off. Otherwise the red "ERR" LED will light up.

- Set DIP 9 to "ON" (END).

**9.6 Switch with no function (DIP 10)**

This switch currently has no function. It is reserved for later additional functions.

## 9.7 Mixed operation of PSI-MOS and PSM-EG

Mixed operation of the old PSM-EG series with the new PSI-MOS is generally possible. Note the following settings and restrictions:

### Device configuration

The setting of the DIP switch depends on the requirements of the application. Note that the light idle setting of all devices must be the same throughout the system. You can set the light idle setting via the DIP switches. Set all devices to the same data rate.

### Overload or underload of the FO interfaces

In rare cases (usually in the case of very short fiber optic connections of just a few meters), an overload of the PSI-MOS devices may occur in mixed operation. This is caused by the highly sensitive PSI-MOS receivers. They ensure high ranges but can be overridden in the case of short fiber optic paths.

When overloads occur, you can increase the attenuation via a patch cable with FO coupling.

In mixed operation, observe the following ranges:

Fiber	Wavelength	Maximum range
Glass 50/125	850 nm	1600 m
Glass 62.5/125	850 nm	2200 m
HCS	Not permissible for PSM-EG	
POF	660 nm	70 m

## 10 Connection notes



### CAUTION: Electrical voltage

The device is only intended for operation with SELV according to IEC 60950/EN 60950/VDE 0805.



### NOTE: Malfunction

Use a grounding terminal block to connect the DIN rail to protective earth ground. The devices are grounded when they are snapped onto the DIN rail (installation according to PELV).

This ensures that the shielding is effective. Connect protective earth ground with low impedance.



### NOTE: Device damage

Only mount and remove devices when the power supply is disconnected.

- Install the device on a 35 mm DIN rail according to DIN EN 60715.
- To avoid contact resistance, only use clean, corrosion-free DIN rails.
- End brackets can be mounted on both sides of the device to stop the devices from slipping on the DIN rail (see Page 3 for ordering details).

### 10.1 Combined assembly (modular star coupler)

- Connect together the required number of DIN rail connectors for the connection station. Two DIN rail connectors are required for each device (see A in Figure 7). A maximum of ten devices are permitted in a connection station.
- Push the connected DIN rail connectors onto the DIN rail (B and C).
- Place the device onto the DIN rail from above. The upper holding keyway of the device must be hooked onto the top edge of the DIN rail (see Figure 7). Make sure that it is aligned correctly with the DIN rail connectors.
- Once the device has been snapped on properly, check that it is fixed securely on the DIN rail.

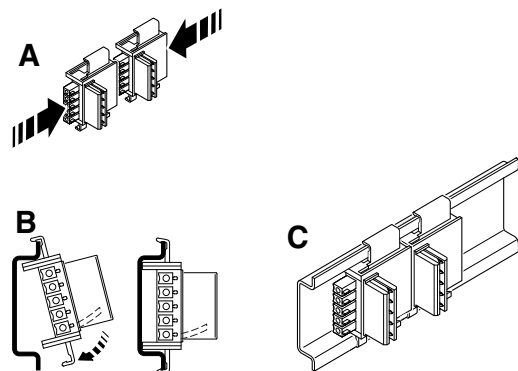


Figure 7 Combined assembly

### 10.2 Assembly as an individual device in the control cabinet (stand-alone)

- Place the device onto the DIN rail from above. The upper holding keyway of the device must be hooked onto the top edge of the DIN rail (see Figure 8).
- Push the device from the front towards the mounting surface.
- Once the device has been snapped on properly, check that it is fixed securely on the DIN rail.

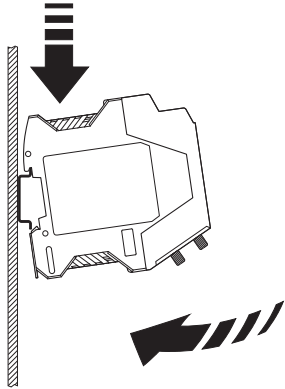


Figure 8 Assembly in the control cabinet

### 10.3 Assembly in potentially explosive areas



**WARNING:** Observe the safety notes on Page 8.

#### – Areas with a danger of gas explosions

The devices are suitable for use in zone 2. Devices that are installed in zone 1 can be connected to the fiber optics interface. The fiber optic interface is an associated item of equipment with protection type "Ex op is".

#### – Area with a danger of dust explosions

The device is **not** designed for installation in areas with a danger of dust explosions. If dust is present, install the device in suitable, approved housing.

When installed outside areas with a danger of dust explosions, devices installed in zone 22 or 21 can also be connected to the fiber optic interface.

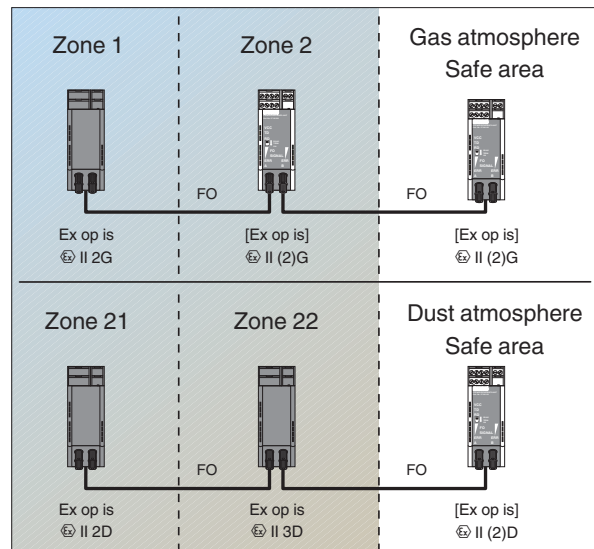


Figure 9 Installation in potentially explosive areas

### 10.4 Dismantling

- Push down locking latch using a screwdriver, needle-nose pliers or similar.
- Pull the bottom edge of the module away from the mounting surface.
- Pull the module diagonally upwards away from the DIN rail.
- If removing a complete star distributor, remove the DIN rail connectors from the DIN rail as well.



## 11 Cabling notes

### 11.1 Connecting the supply voltage



**CAUTION: Electrical voltage**

The device is only intended for operation with SELV according to IEC 60950/EN 60950/VDE 0805.

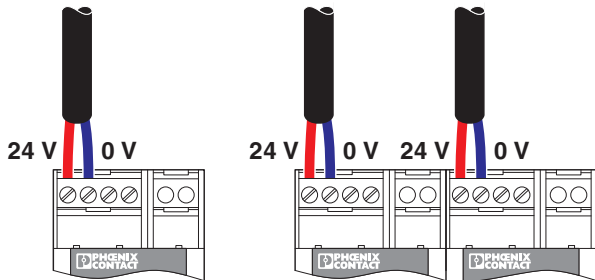


Figure 10 Individual or redundant supply

#### Operation as a single device

Supply the supply voltage to the module via terminal blocks 1 (24 V) and 2 (0 V).

#### Operation in a star coupler topology

If you operate the devices in a star coupler topology, the supply voltage must only be supplied to the first device in the station. The remaining devices are supplied via the DIN rail connector. You can create a redundant supply concept by connecting a second power supply unit to another device in the topology.

#### Supply via system power supply

Alternatively, you can supply the star coupler topology using the MINI-SYS-PS 100-240AC/24DC/1.5 (order no. 2866983) or MINI-PS-100-240AC/24DC/1.5/EX (order no. 2866653) system power supply. It is connected via two DIN rail connectors.

Usually the system power supply is mounted as the first device in a topology. A second power supply unit can be used to create a redundant supply concept.

### 11.2 Connecting the data cables and bus termination



**NOTE: Device damage**

Use shielded twisted pair data cables. Connect the cable shielding at both ends of the transmission path.

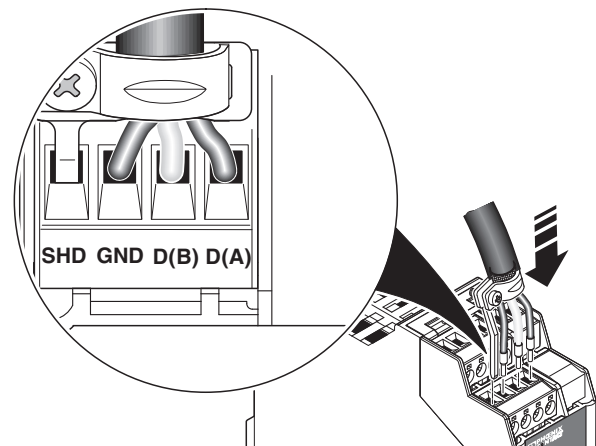


Figure 11 Connecting the data cables

- Connect the data cables as well as the shield of the data cable to the corresponding contacts on the COMBICON connector. For optimum shield connection, use the supplied terminal clamp.
- If the the FO converter is used at the start or end of an electrical RS-485 segment, activate the termination on the top of the device (12 in Figure 3 on page 10).



The maximum length of the RS-485 cables depends on the transmission speed. Do not exceed the following maximum values.

Transmission speed [kbps]	Maximum range [m]
≤ 93.75	1200
≤ 500	400

### 11.3 Wiring the switch contact



**NOTE: Device damage**

The maximum capacity of the relay contact is 60 V DC/42 V AC, 0.46 A.

The device is equipped with a floating switching output for error diagnostics (terminals **3** (11) and **4** (12)).

The switch contact opens on the relevant device in the event of the following:

- Supply voltage failure
- An interrupt is detected on the fiber optic path
- System reserve of the fiber optic path not reached

The switching output is an N/C contact. It can be connected to a local digital input, e.g. on a PLC, for error detection.

When a topology is used, the individual switching outputs can be connected to separate input points or the individual contacts can be looped through to generate a group message.

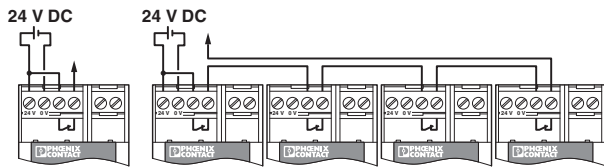


Figure 12 Individual and group message

## 12 Connecting the fiber optic cables



### WARNING: Danger of eye injuries

During operation, do not look directly into the transmitter diodes or use optical aids to look into the fiberglass! The infrared light is not visible.



### NOTE: Malfunction

Do not exceed the following FO lengths:

#### PSI-MOS-RS485W2/FO 660 ...

- 100 m with F-P 980/1000; 230 dB/km
- 800 m with F-K 200/230; 10 dB/km

#### PSI-MOS-RS485W2/FO 850 ...

- 2800 m with F-K 200/230; 8 dB/km
- 4200 m with F-G 50/125; 2.5 dB/km
- 3300 m with F-G 62.5/125; 3.0 dB/km



Avoid contamination.

Do not remove the dust protection caps until just before the connectors are connected.



When using fiber optic cables, observe the installation guideline  
DB GB IBS SYS FOC ASSEMBLY, Order No. 9423439.

### FSMA connection (PSI-MOS-RS485W2/FO 660 ...)

PSI-MOS-RS485W2/FO 660 ... devices use FSMA connectors for the FO connection. FSMA is a standardized FO connection.

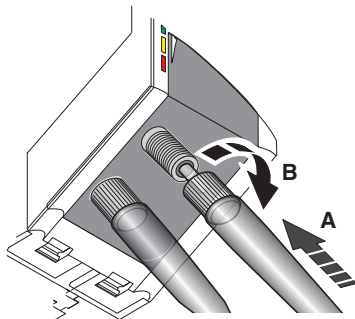


Figure 13 FSMA connection

- To attach the connector to the device, hand-tighten the sleeve nut.

### B-FOC(ST<sup>®</sup>) connection (PSI-MOS-RS485W2/FO 850 ...)

Standardized B-FOC(ST<sup>®</sup>) connectors are used for PSI-MOS-RS485W2/FO 850 ... devices.

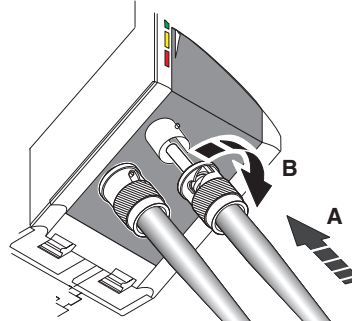


Figure 14 B-FOC(ST<sup>®</sup>) connection

- Connect the FO cable to the B-FOC(ST<sup>®</sup>) connector for the transmit and receive channel and push the spring mechanism of the connector downward (A). Secure the connection with a quarter turn to the right.

### Coupling the devices

Due to the integrated optical diagnostics, there is no need to measure the path.

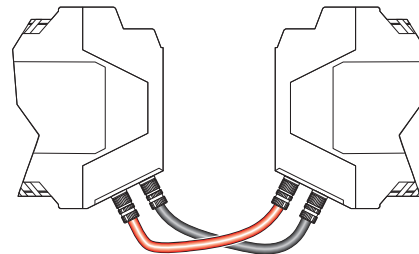


Figure 15 Crossed cables

When connecting two FO converters, note the signal direction of the fiber optics:

- Fiber connection "TD" (transmitter) at device 1
- Fiber connection "RD" (receiver) at device 2



Please note the transmit and receive channel crossover.

Due to different operating wavelengths, the PSI-MOS-RS485W2/FO 660 ..., PSI-MOS-RS485W2/FO 850 ... and PSI-MOS-RS485W2/FO 1300 E devices should not be connected directly via fiber optic cables.

### 13 Signal delay

Data transmission cables and network components lead to signal delays. You may need to consider these delays when setting timeout times for your bus system.

The signal delay **dT** can be calculated as follows:

$$dT = b \times L + 2 \times N$$

with

dT= Signal delay in bit periods for one complete signal cycle

b = Length parameter (see table)

L = Network expansion in km

N = Number of fiber optic converters

If necessary, adjust the timeout of your bus system to the signal delay.

Transmission speed [kbps]	Length parameter b
500	5.00
300	3.00
187.5	1.88
136	1.36
115.2	1.16
93.75	0.94
75	0.75
57.6	0.58
38.4	0.38
19.2	0.19
9.6	0.10
4.8	0.05