PSI-MOS-RS232/FO 1300 E

Fiber optic converter for RS-232 interfaces

Data sheet
103266_en_02

1 Description

The **PSI-MOS-RS232/FO 1300 E** device can be used to convert RS-232 interfaces to fiber optics.

The main advantage of the PSI-MOS fiber optic transmission system is the electrically isolated connection of devices, which prevents the negative effects of voltage equalization currents and electromagnetic interference on the data cables. Result: increases the overall availability of the system and improves flexibility in terms of the design of the bus topology for point-to-point connections and in star structures.

Optical star couplers can be combined for a specific application by serially connecting up to ten FO modules. Cross-wiring within a modular star coupler occurs automatically via the backplane. The system supports progressive transmission speeds from 4.8 kbps to 115.2 kbps.

The devices are also equipped with comprehensive diagnostic functions to increase system availability and to simplify startup. The integrated fiber optic diagnostics permanently monitor the optical transmission quality.

Ranges:

– Up to 45 km with single-mode fiberglass
– Up to 27 km with multi-mode fiberglass

Connection is via SC duplex connectors.

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.

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.
FO converter with integrated optical diagnostics, alarm contact, for RS-232 interfaces, terminal device with one FO interface (SC duplex), 1300 nm, for multi-mode and single-mode fiberglass cable	PSI-MOS-RS232/FO 1300 E	2708588	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
Power supply unit for use in zone 2 potentially explosive areas (ATEX)	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
D-SUB connector with one cable entry, 9-pos., socket version	SUBCON 9/F-SH	2761499	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

Other fiber optic converters in the PSI-MOS system

PSI-MOS-RS232/FO 660... devices have the following ranges:

- Up to 100 m with polymer fiber
- Up to 800 m with HCS fiber

Connection: FSMA quick mounting plugs

PSI-MOS-RS232/FO 850... devices are available for longer distances:

- Up to 2800 m with HCS fiber
- Up to 4800 m with multimode

Connection: B-FOC(ST®)

Description	Type	Order No.	Pcs./Pkt.
Terminal device with integrated optical diagnostics for converting the RS-232 interface to one fiber optic cable			
660 nm	PSI-MOS-RS232/FO 660 E	2708368	1
850 nm	PSI-MOS-RS232/FO 850 E	2708371	1
T-couplers with integrated optical diagnostics for converting the RS-232 interface to two fiber optic cables			
660 nm	PSI-MOS-RS232/FO 660 T	2708410	1
850 nm	PSI-MOS-RS232/FO 850 T	2708423	1

4 Technical data

Interfaces	
Power supply	24 V DC (18 V DC ... 32 V DC)
Typical current consumption	100 mA (24 V DC)
Standby indicator	"VCC" LED (green)
Maximum star coupler expansion	10
Serial RS-232 interface	According to ITU-T V.28, EIA/TIA-232, DIN 66259-1
Operation mode	Full duplex
Data format/coding	UART (11 bits, NRZ)
Data direction changeover	Automatic
Transmission speed (automatic detection)	9.6 kbps ... 115.2 kbps
Transmission length	Max. 15 m
Connection	D-SUB 9-pos. (male)
Optical interface	
Transmission protocol	Transparent protocol to RS-232 interface
Connection technology	SC duplex
Wavelength	1300 nm
Minimum transmission power (fiber type)	-5.5 dBm (9/125 µm), single-mode fiberglass -4.7 dBm (62.5/125 µm), multi-mode fiberglass -3.4 dBm (50/125 µm), multi-mode fiberglass
Receiver sensitivity	
Minimum (single-mode fiberglass)	-26.5 dBm
Minimum (multi-mode fiberglass)	-25.5 dBm
Maximum (both fibers)	> 0 dBm
Transmission length including 3 dB system reserve	27 km with F-G 50/125; 0.7 dB/km 22 km with F-G 62.5/125; 0.8 dB/km 45 km with F-E 9/125; 0.4 dB/km

General data	
Bit distortion, input	±35%, maximum
Bit distortion, output	< 6.25 %
Bit delay	< 1 bits
Electrical isolation	RS-232//power supply
Test voltage	1.5 kV_{rms}, 50 Hz, 1 min.
Signaling output	60 V DC/42 V AC, 1 A, maximum
Status and diagnostics indicators	Power supply (VCC), transmit/receive data RS-232, 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 105 mm x 99 mm
Degree of protection	IP20
Weight	190 g, approximately

General data [...]	
MTBF according to Telcordia standard	
Ambient temperature 25 °C	549 years
Ambient temperature 40 °C	113 years
Free from substances that would hinder coating with paint or varnish	According to P-VW 3.10.7 57 65 0 VW-AUDI-Seat central standard
Vibration resistance	5g according to IEC 60068-2-6, 2.5 h each in XYZ direction, criterion A
Shock resistance	15g according to IEC 60068-2-27 with 11 ms pulse length, criterion C
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	
CE	CE-compliant
ATEX (Please follow the special installation instructions in the documentation.)	Ⓔx II 3 G Ex nA nC IIC T4 Gc X
UL	508 listed 508 recognized

Conformity with EMC Directive 2014/30/EU			
Immunity test according to EN 61000-6-2[1]			
Electrostatic discharge (ESD)	EN 61000-4-2	Criterion B[2]	
Air discharge			8 kV
Contact discharge			6 kV
Electromagnetic HF field	EN 61000-4-3	Criterion A[3]	
Amplitude modulation			10 V/m
Fast transients (burst)	EN 61000-4-4	Criterion B[2]	
Signal			2 kV/5 kHz
Power supply			2 kV/5 kHz
Surge current loads (surge)	EN 61000-4-5	Criterion B[2]	
Signal			1 kV/42 Ω
Power supply			0.5 kV/2 Ω
Conducted disturbance variables	EN 61000-4-6	Criterion A[3]	10 V
Noise emission test according to EN 61000-6-4			
Noise emission of housing	EN 55011[4]	Class A, Industrial application, without special installation measures	

[1] EN 61000 corresponds to IEC 61000

[2] Criterion B: Temporary adverse effects on the operating behavior, which the device corrects automatically

[3] Criterion A: Normal operating behavior within the specified limits

[4] EN 55011 corresponds to CISPR11

Block diagram

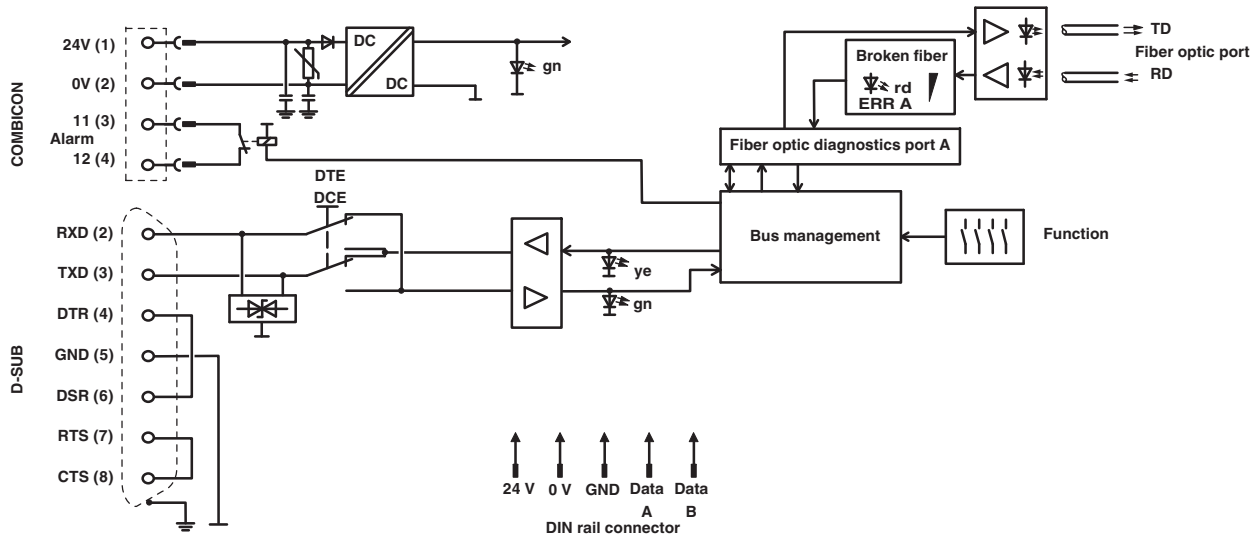


Figure 1 Block diagram

Housing dimensions

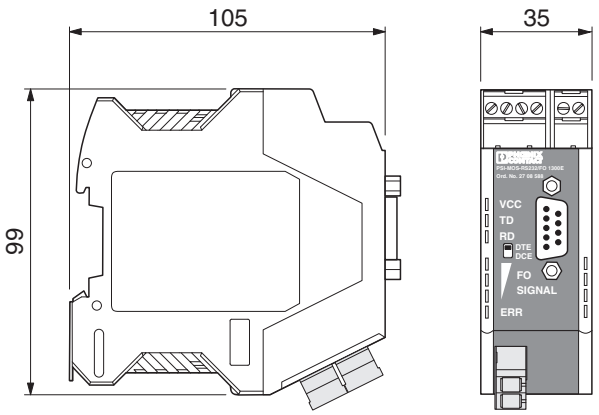


Figure 2 Housing dimensions (in mm)

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.
- 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.
- This device is not designed for use in atmospheres with a risk of dust explosions.
- The switches of the device that can be accessed may only be actuated when power to the device is disconnected.
- The device is only intended for operation with 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.
- Connection to the D-SUB interface is only permitted if the screw connection is tightened.

5.3 UL notes

c UL us LISTED

INDUSTRIAL CONTROL EQUIPMENT 11AE

Wire Range: 24-14 AWG

Cu Copper Wire, 60/75C

Terminal tightening torque value: 5-7 (Lbs-Ins)

Environmental designation: "Open Type Device"

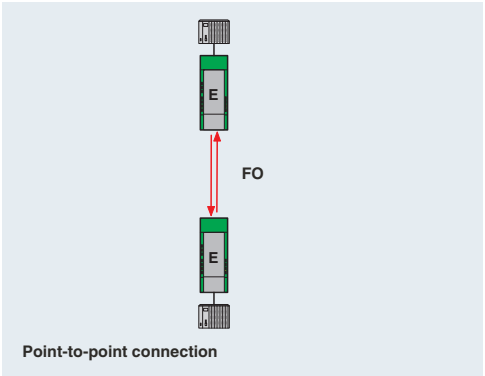
"Pollution Degree 2 Installation Environment"

6 Supported network structures

The PSI-MOS-RS232/FO 1300 E can be used to create network topologies that are ideally adapted to the relevant application:

6.1 Point-to-point connections

You can use two PSI-MOS-RS232/FO 1300 E FO terminal devices to easily convert a data link from copper cable to fiber optics.



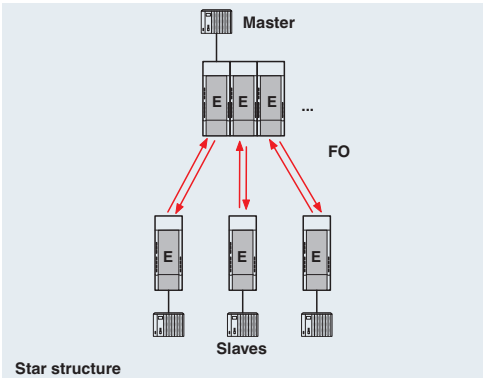
Point-to-point connection

6.2 Star structures

You can network addressable RS-232 devices within a star structure as a master/slave network. Depending on the number of star lines required, several terminal devices are connected to an active star coupler.

Up to ten fiber optic ports are available per star coupler. Cross-wiring for RS-232 data and for the supply voltage is provided automatically by the DIN rail connector (installation accessory, see Page 3).

You can connect only **one** copper-based device to a star coupler.



Star structure

7 Function elements

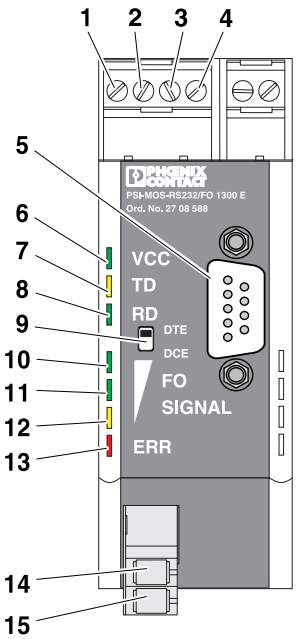


Figure 3 Function elements

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 D-SUB 9: RS-232 interface
6 "VCC" LED
7 "TD" LED
8 "RD" LED
9 Slide switch for DTE/DCE adaptation
10 "FO SIGNAL" LED
11 "FO SIGNAL" LED
12 "FO SIGNAL" LED
13 "ERR" LED
14 Fiber optic transmitter
15 Fiber optic receiver

Diagnostic and status indicators

Des.	Color	Meaning	
VCC	Green	Ready to operate	
TD	Yellow	Sending data at the RS-232 (D-SUB 9) copper interface	
RD	Green	Receiving data at the RS-232 (D-SUB 9) copper interface	
FO SIGNAL	Green	Power received at fiber optic port (see Page 10)	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.

You use DIP 2 to switch idle senders (reset period between sending data) to continuous illumination (INVERS). This allows for continuous fiber optic diagnostics.

If you switch DIP 2 to "ON" (NORM), the diagnostics are not available via the LED bar graph.

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.

If you switch DIP 2 to "ON", the FO diagnostics are not available via the LED bar graph.

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.

Basic method of operation

The device has three interfaces for the RS-232 signal:

– Electrical interface (D-SUB)
– Fiber optic port
– DIN rail connector

You can change communication between the ports via DIP 1. This allows you to implement point-to-point or star structures.

8.1 Port assignment for point-to-point connections

The electrical interface communicates with the fiber optic port by means of full duplex mode. Internal data communication is disabled via the DIN rail connector.

Terms

– DIP 1 = "OFF" (LINE)
– One RS-232 device at each fiber optic coupler
– The RS-232 devices can be addressed via communication software.
– Up to 6 fiber optic converters in a linear structure

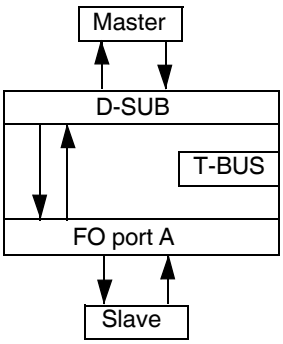


Figure 4 Port assignment for point-to-point connections

8.2 Port assignment for star structures

By means of full duplex mode, the electrical interface communicates with all connected fiber optic ports of the star coupler via the DIN rail connector. Therefore internal data communication is in the direction of the master (electrical interface). Telegrams from the master are output to the fiber optic ports of all connected devices via the DIN rail connector.

The telegrams received at the fiber optic ports of the slaves are forwarded to the master exclusively via the DIN rail connector. No telegrams are exchanged between the slaves.

Terms

– DIP 1 = "ON" (STAR)
– One RS-232 device at each fiber optic port
– Only connect the master to the star coupler.
– The RS-232 devices can be addressed via communication software.

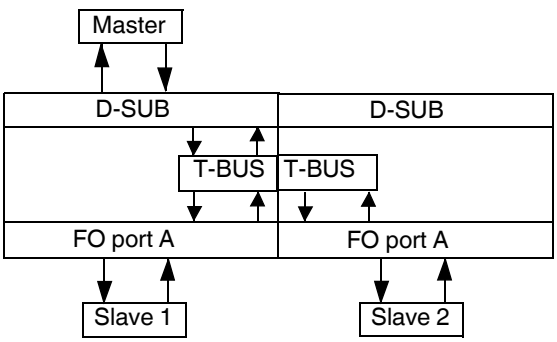


Figure 5 Star structure port assignment

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 6).
- Then carefully pull the PCB out of the housing as far as possible (B).

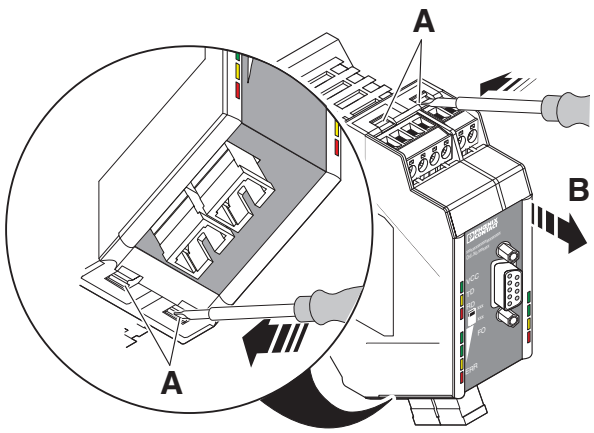


Figure 6 Opening the housing

DIP switches 1 to 6 are then freely accessible.

- Configure the DIP switches according to the planned application.

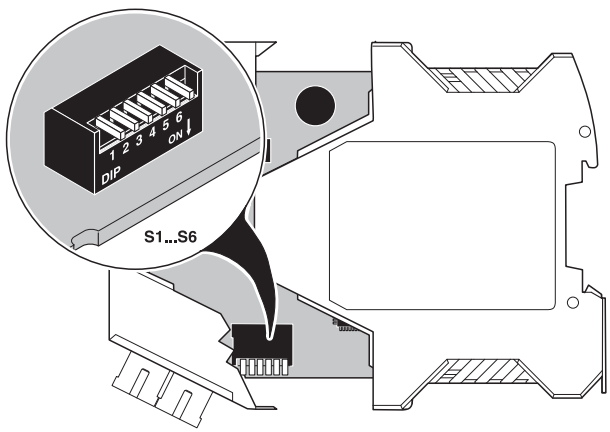


Figure 7 Setting the DIP switches

The following table provides 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.

DIP switch	ON	OFF
1	STAR	LINE[1]
2	STANDARD	INVERSE[1]
3	N.C.	
4	N.C.	
5	N.C.	
6	Multi mode	Single mode[1]

[1] Default setting

9.1 Operation in a point-to-point connection (DIP 1)

If you use two terminal devices, no additional settings are required with the factory settings.

9.2 Operation in a star structure (DIP 1)

Addressable RS-232 devices and a suitable communication protocol are required for a star structure.

– Devices in the **star coupler topology**

  For each device in the star coupler topology, set DIP 1 to "ON" (STAR).

– Devices at the **end of a star line**

  No further settings are required in the default setting.

9.3 Connection to fiber optic interfaces from third-party suppliers (DIP 2)

- 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 PSI-MOS using DIP 2.

DIP 2	Idle setting	Meaning
OFF = INVERS	Light on[1]	Logic 1
ON = NORM	Light off	Logic 1

[1] Default setting

- If you switch DIP 2 to "ON," the FO diagnostics are not available via the LED bar graph.
- 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 Switches with no function (DIP 3, 4, and 5)

These switches are currently without function. They are reserved for later additional functions.

9.5 Adjusting the transmission power (DIP 6)

If you use multimode fiberglass cables, you can adjust the transmission power via DIP switches.

- Set DIP 6 to "ON" (multi-mode) for operation on a multimode fiberglass (50/125 µm or 62.5/125 µm).
- Leave DIP 6 set to "OFF" (single mode) for operation on a single mode fiberglass (9/125 µm) (factory setting).

If you are not sure which type of fiberglass is used in your projects, contact your cable supplier.

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

Connect the DIN rail with the protective earth via a grounding terminal block. 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)

NOTE: Device damage

The maximum current load in a star coupler must not be exceed 2 A.

Therefore, a star coupler must not consist of more than ten (10) devices.

- 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 8).
- 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 9). 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.

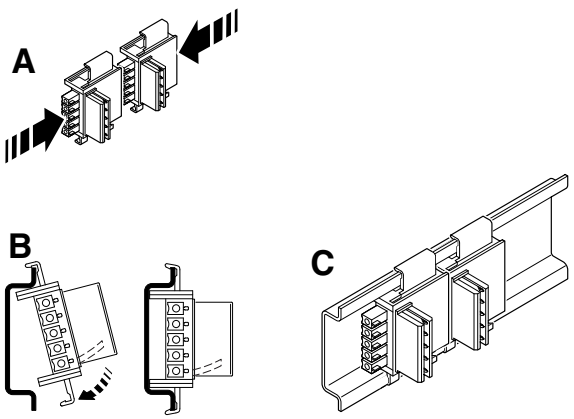


Figure 8 Combined assembly

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 9).
- 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.

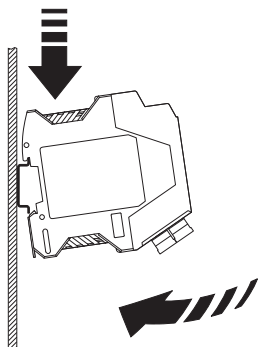


Figure 9 Assembly in the control cabinet

10.3 Assembly in potentially explosive areas

WARNING: Observe the safety notes on Page 7.

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

The devices are suitable for use in zone 2. Devices that are installed in zone 1 must **not** be connected to the fiber optic interface.

– **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 can be connected to the fiber optic interface.

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.

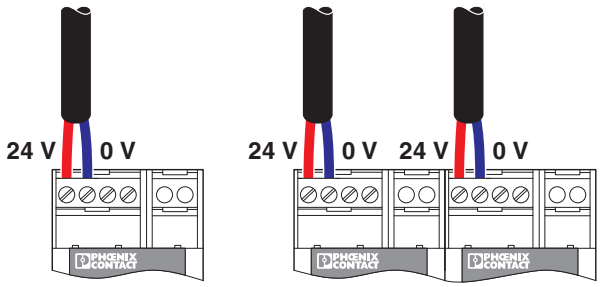


Figure 10 Individual or redundant supply

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

NOTE: Device damage

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

Notes on star structures:

Always connect the master station to the RS-232 interface of the first PSI-MOS device in the star coupler topology. The other RS-232 interfaces cannot be used.

Always connect only one RS-232 slave device to each FO converter at the end of a star line.

- Connect the RS-232 connection via the D-SUB 9 pin strip on the top of the device (see Figure 12).

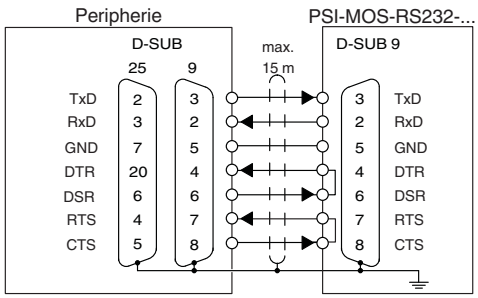


Figure 11 Wiring the D-SUB pin strip

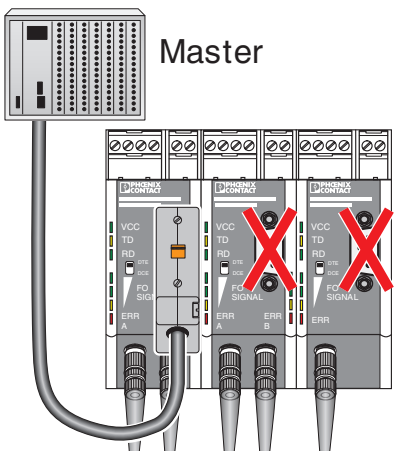


Figure 12 Connecting the data cables

11.3 DTE/DCE adjustment

You can use the DTE/DCE slide switch (9 in Figure 3 on page 9) to cross the TxD and RxD cables internally. This allows for easy adjustment to DTE or DCE interfaces.

– **DTE:** Connection to data terminal equipment
  Set the switch to "DTE" (default setting for most applications).
– **DCE:** Connection to data communication equipment
  Set the switch to "DCE."

If you do not know which type of interface is connected, you can determine the right configuration by testing the DTE/DCE slide switch.

11.4 Wiring the switch contact

NOTE: Device damage

The maximum load capacity of the relay contact is 1 A at 18...32 V DC.

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.

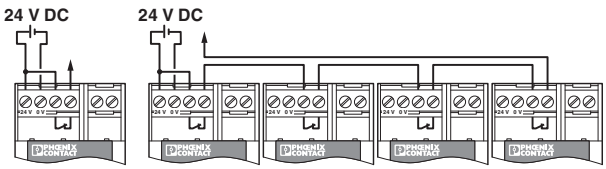


Figure 13 Individual and group message

12 Connecting the fiber optic cables (SC duplex)

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:

– 22 km with F-G 62.5/125; 0.8 dB/km
– 27 km with F-G 50/125; 0.7 dB/km
– 45 km with F-E 9/125; 0.4 dB/km

Avoid contamination.

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

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

Standardized SC duplex connectors are used with the PSI-MOS-RS232/FO 1300 E.

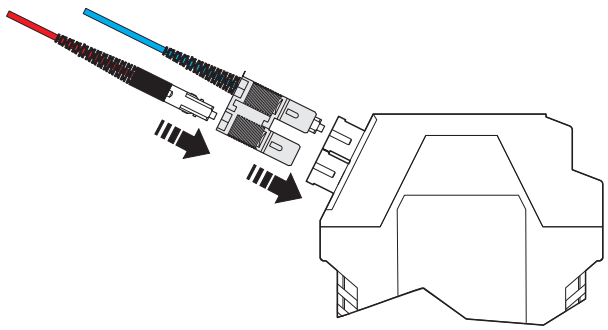


Figure 14 Fiber optic connection

- Connect the fiber optic cable to the SC duplex connector for the transmit and receive channel. Push the connector down until it you hear it snap into place.

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

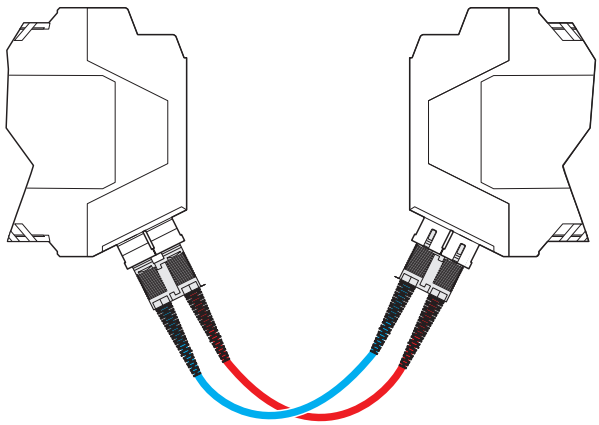


Figure 15 Crossed cables

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,
PSI-MOS-RS232/FO 660 ...,
PSI-MOS-RS232/FO 850 ... and
PSI-MOS-RS232/FO 1300 E
devices should not be connected directly with one another via fiber optic cables.