INTERFACE

Data sheet
100514_en_04

1 Description

The PSI-MOS-DNET CAN/FO… modular fiber optic transmission system enables the transmission of CAN-based bus systems such as DeviceNet or CANopen via fiber optics.

The main advantage of this system is the electrically isolated connection of bus devices, which prevents the negative effects of voltage equalization currents and electromagnetic interference on the bus cables. In addition, bus cable short circuits only affect the specific potential segment. This increases the overall availability of the system, and improves flexibility in terms of the design of the bus topology in a linear, star or tree structure.

Up to 20 fiber optic modules can be connected side by side to form optical star couplers, which are tailored to the specific application. Cross-wiring within a modular star coupler is created automatically via the backplane.

Depending on the required transmission distance, modules for polymer/HCS fiber or glass fiber cables can be combined. Polymer and HCS fiber cables can be assembled locally using fast connection connectors. The system supports transmission speeds from 10 kbps to 800 kbps. Depending on the set transmission speed, distances up to 100 m can be covered using polymer fiber, up to 2800 m using HCS fiber, and up to 48

Please note that the specified distances ar performance of the optical interface of the converter in association with the type of op Please take into consideration the restrictio expansion due to the signal runtimes of the structure (see page 11).

The devices are also equipped with compr diagnostic functions to increase system av simplify startup. This means that faulty seg disconnected selectively.

The integrated fiber optic diagnostics perm the optical transmission quality. A drop in t is indicated by an integrated early warning transmission errors can occur. If necessary automatically switches to a redundant path

The PSI-MOS system can be used in a supp from 10 V DC to 58 V DC and in a tempera from -20°C to +60°C.

If you have any technical problems, which you cannot resolve with the aid of this documentation, us during the usual office hours at:

Phone: +49 - 52 35 - 31 98 90
Fax: +49 - 52 35 - 33 09 99
E-mail: interface-service@phoenixcontact.com

Make sure you always use the latest documentation.
It can be downloaded at www.phoenixcontact.net/catalog.

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

for:		
660 nm, for polymer/HCS fiber cable, F-SMA	PSI-MOS-D	054
850 nm, for glass fiber cable, B-FOC (ST®)	PSI-MOS-DNET CAN/FO 850 BM	2708083
Extension module for converting a CAN-based interface to a fiber optic interface for:		
660 nm, for polymer/HCS fiber cable, F-SMA	PSI-MOS-DNET CAN/FO 660 EM	2708067
850 nm, for glass fiber cable, B-FOC (ST®)	PSI-MOS-DNET CAN/FO 850 EM	2708096

Accessories

Description	Type	Order No.
Bus cable for CANopen and DeviceNet, sold by the meter	SAC-5P-920	1511504
End clamps	CLIPFIX 35	3022218
Polymer fiber connectors (4 connectors in the set)	PSM-SET-FSMA/4-KT	2799720
Polishing set for polymer fiber connectors (required to assemble polymer fiber connectors)	PSM-SET-FSMA-POLISH	2799348
Fiber optic polymer fiber cable for indoor installation	PSM-LWL-KDHEAVY	2744319
F-SMA HCS fiber connectors (4 connectors in the set)	PSM-SET-FSMA/4-HCS	2799487
B-FOC (ST®) HCS fiber connectors (4 connectors in the set)	PSM-SET-B-FOC/4-HCS	2708481
Tool set for HCS connectors (F-SMA) (required for HCS connector assembly)	PSM-HCS-KONFTOOL	2799526
Tool set for HCS connectors (B-FOC (ST®)) (required for HCS connector assembly)	PSM-HCS-KONFTOOL/B-FOC	2708465
Tool set for F-SMA and SCRJ connectors (polymer fiber)	PSM-POF-KONFTOOL	2744131
Fiber optic HCS cable for indoor installation	PSM-LWL-HCS RUGGED-200/230	2799885
Fiber optic HCS cable for outdoor installation	PSM-LWL-HCSO-200/230	2799445
Fiber optic glass fiber cable for indoor installation	PSM-LWL-GDM-RUGGED-50/125	2799322
Fiber optic glass fiber cable for outdoor installation	PSM-LWL-GDO-50/125	2799432
Measuring device for fiber optic power measurement	PSM-FO-POWERMETER	2799539

	in screw terminal block	optional redunda COMBICON plu with 10 V t
Nominal current consumption	100 mA, maximum (at 24 V DC) per basic module/exten	
Bus interface	According to ISO/IS 11898 for DeviceNet and CANopen	
Connection	4-pos. COMBICON plug-in screw terminal block	Via backplane of
Bus termination resistor	120 Ω, integrated and can be connected	
Bus access method	CSMA/CA	
Data rate	10, 20, 50, 125, 250, 500, 800 kbps can be set via DIP swit	
Transmission length	1000 m, maximum; shielded cables	
Optical interface	According to technical guideline PNO No. 2.021	
Transmission protocol		
Connection method	**F-SMA**	**B-FOC (ST®)**
Wavelength	660 nm	850 nm
Minimum transmission power (fiber type)	-6.2 dBm (980/1000 µm) -16.9 dBm (200/230 µm)	-5.1 dBm (200/2 -17.9 dBm (50/1 -14.1 dBm (62.5/
Receiver sensitivity Minimum	-30.2 dBm	-32.5 dBm (50/1 -32.1 dBm (200/
Minimum 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 8 dB/km with qui connectors 4200 m with F-G 4800 m with F-G

General data	
Runtime equivalent/bit delay	24 m per individual device/120 ns
Maximum configuration	20 individual devices per star coupler topology at 24 V 12 individual devices per star coupler topology at 12 V
Cascading depth of fiber optic paths	60 fiber optic paths at 10 kbps, 30 at 20 kbps, 12 at 50 k 3 at 250 kbps, 1 at 500 - 800 kbps
Electrical isolation	Power supply//data interface
Test voltage	1.5 kV_{rms}, 50 Hz, 1 min.
Alarm output	60 V AC/DC, 1 A, maximum; relay contact opens if V_{CC} fails, the fiber optic performance limit is rea occurs at the fiber optic or copper bus interface
Status and diagnostic indicators	Power supply (VCC), bus activity, fiber optic bar graph (optic error (FO ERR)
Housing material	PA 6.6-FR, green
Connection data for screw terminal blocks	0.2 mm^2 ... 2.5 mm^2
Ambient temperature Operation Storage/transport	 -20°C ... +60°C -40°C ... +85°C
Humidity	10% ... 95%, no condensation
Dimensions (W x H x D)	22.5 mm x 105 mm x 115 mm
Degree of protection	IP20
Weight	120 g, approximately

Vibration resistance	5g accordin … x, y, and z
Shock resistance	15g according to IEC 60068-2-27 with 11 ms pulse lengt
Free fall	1 m without packaging according to IEC 60950
Air and creepage distances	DIN EN 60664-1/VDE 0110-1, DIN EN 50178, DIN EN 6

Tests/approvals

CE	CE
UL/CUL 1604 Ex listed	**PROCESS CONTROL EQUIPMENT FOR H LOCATIONS Class I, Zone 2, AEx nC IIC**
Conformity assessment according to Directive 94/9/EC	
Fiber optic interface as an associated item of equipment for zone 1 devices	II (2) GD [EX op is] IIC (PTB 06 ATEX 2042u)
Assembly and operation of the device in zone 2	II 3G Ex nAC IIC T4 X

Conformance with EMC Directive 2004/108/EC and Low Voltage Directive 2006/95/EC

Noise 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 load (surge)	EN 61000-4-5	Criterion B[2]	
Signal			1 kV/42 Ω
Power supply			0.5 kV/2 Ω
Conducted interference	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[5]

[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

[5] Class A: Industrial application, without special installation measures.

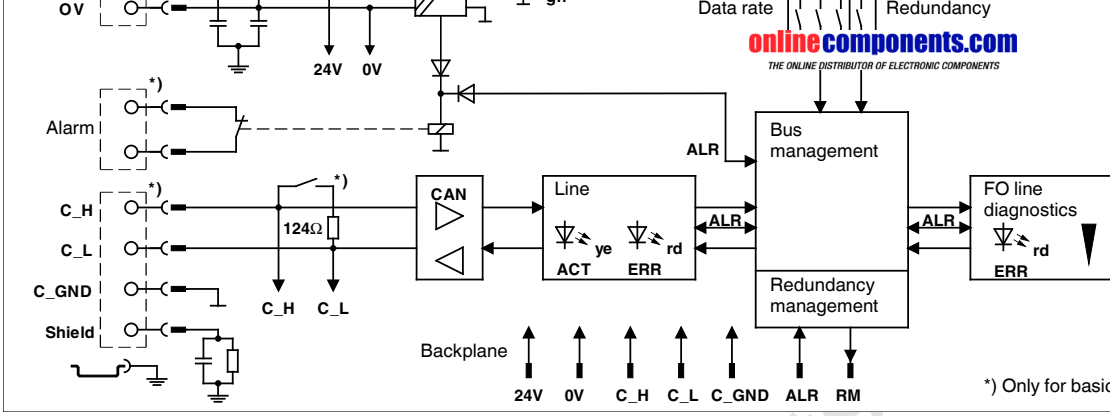


Figure 1 Block diagram

Housing dimensions

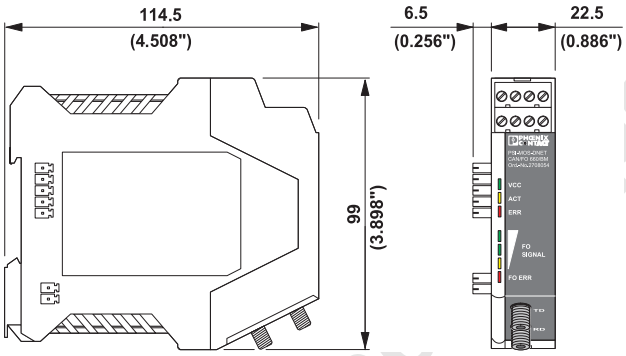


Figure 2 Housing dimensions (in mm)

NOTE: Installation, operation, and maintenance may only be carried out by qualified specialist personnel.

When installing and operating the device, the applicable safety directives (including national safety directives), accident prevention regulations, as well as general technical regulations, must be observed.

NOTE: The device must not be opened or modified apart from the configuration of the DIP switches.

NOTE: The switches that can be accessed may only be actuated when the power supply to the device is disconnected.

Do not repair the device yourself, replace it with an equivalent device. Repairs may only be carried out by the manufacturer.

NOTE: The IP20 degree of protection (IEC 60529/EN 60529) of the device is intended for use in a clean and dry environment. The device must not be subject to mechanical strain and/or thermal loads, which exceed the limits described.

For the safety data, please refer to the operating instructions and certificates (EC-type examination certificate, other approvals, if necessary).

The device is designed for install
reas.

Observe the specified conditions for use in explosive areas.

WARNING: Explosion hazard

Install the device in suitable **hous protection, minimum**, that mee requirements of EN 60079-15.

Observe the requirements of EN

WARNING: Explosion hazard

Disconnect the block power supp

– Snapping it on or disconnect
– Connecting or disconnecting

WARNING: Explosion hazard

Only devices which are designed zone 2 potentially explosive area suitable for the conditions at the i location may be connected to the signal circuits in zone 2.

WARNING: Explosion hazard

The device must be stopped and removed from the Ex area if it is d subject to an impermissible load incorrectly or if it malfunctions.

Installation in areas with a danger of d

WARNING: Explosion hazard

The device is **not** designed for in areas with a danger of dust explo

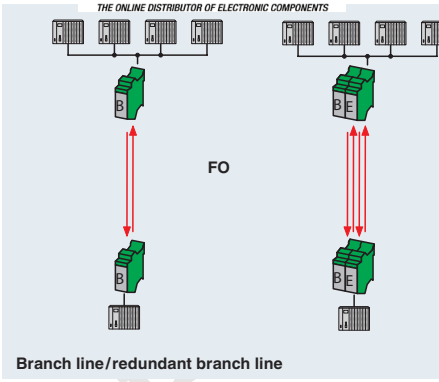
If dust is present, install the devic approved housing.

below.

5.1 Branch/point-to-point connections

Two PSI-MOS…BM fiber optic basic modules can be used to easily convert a data link from copper cable to fiber optics. A PSI-MOS…BM basic module is used at the beginning and end of the line.

To increase system availability, the fiber optic line can also be designed redundantly. In this case, PSI-MOS…EM extension modules are connected either side of the basic modules and redundancy mode is configured.

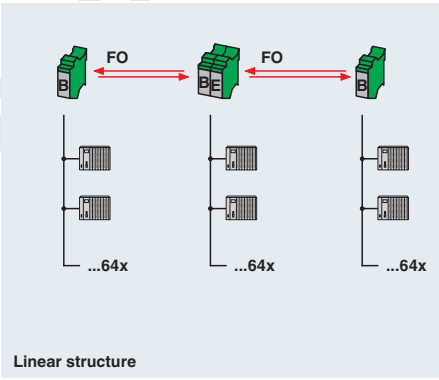


Branch line/redundant branch line

5.2 Linear structures

PSI-MOS…BM basic modules are used at the beginning and end of the fiber optic line.

Combinations of basic modules and extension modules are used along the line as fiber optic repeaters. Depending on the transmission speed, up to 60 fiber optic paths can be cascaded (see "Configuration rules" on page 11).



Linear structure

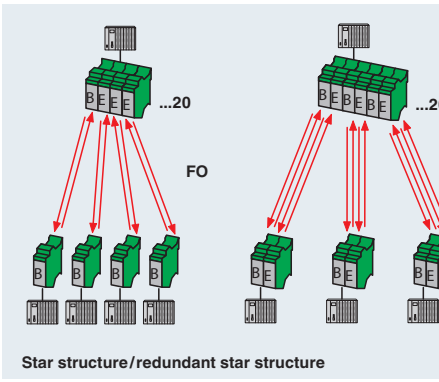
5.3 Star structures

Modular fiber optic star couplers can be created by combining a basic module with up to 19 extension modules. A basic module should always be used at the end of a star line.

This structure again offers the option of combining basic modules and extension modules to form redundant circuits on critical lines in order to increase system availability.

Modules with different transmission technologies (660 nm or 850 nm) can be freely combined within a star coupler topology. However, devices with the same transmission technology should always be used at the beginning and end of a fiber optic connection (PSI-MOS…660... or PSI-MOS…850...).

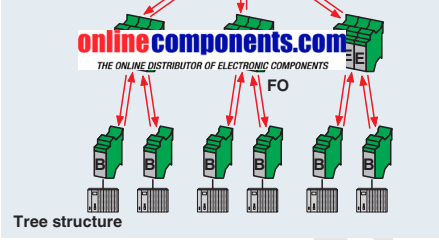
Please also refer to the configuration notes (see page 11) for the maximum network expansion.



Star structure/redundant star structure

of up to 60 fiber optic segments can be achieved.

Please also refer to the configuration notes (page 11) for the maximum network expansion.



Tree structure

6 Function elements

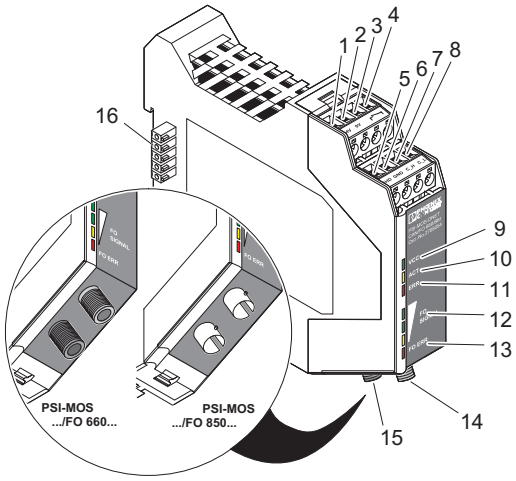


Figure 3 Function elements

1 24 V DC supply voltage connection
2 0 V DC supply voltage connection
3 Switch contact, connection 11 (basic module only)
4 Switch contact, connection 12 (basic module only)
5 CAN connection: SHD (basic module only)
6 CAN connection: GND (basic module only)
7 CAN connection: C_H (basic module only)
8 CAN connection: C_L (basic module only)
9 "VCC" LED
10 "ACT" LED
11 "RD" LED
12 "FO SIGNAL" LED (3 LEDs)
13 "FO ERR" LED
14 Fiber optic transmitter
15 Fiber optic receiver
16 Backplane

Diagnostic and status indicators

Des.	Color	Mea
VCC	Green	Ready to operate
	Flashing green (1 Hz)	Ready to operate mode in standby
	OFF	No supply voltag
ACT	Yellow	CAN bus active
	OFF	CAN bus not act
ERR	Red	CAN bus error (c
FO SIGNAL	Green	Receiving power at the fiber optic port
	Green	
	Yellow	
FO ERR	Red	

The quality of the path is determined using optical power P_{opt} and displayed using the

LED bar graph	Receive status	Optical p
Green Green Yellow	Very good	P_{opt} is consid than the sys
Green Yellow	Good	P_{opt} is still gr system
Yellow	Critical	P_{opt} has reach res
Red	Error	P_{opt} has sapp reserve/b

In the event of a supply voltage failure, a c receive level ("FO SIGNAL" = yellow) or an optic path ("FO ERR" = red), the floating w also opens (see "Wiring the switch contact

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 and EN 61340-5-2.

- For configuration, release the housing cover using a screwdriver (A in Figure 4).
- Then carefully pull the PCB out of the housing as far as possible (B).

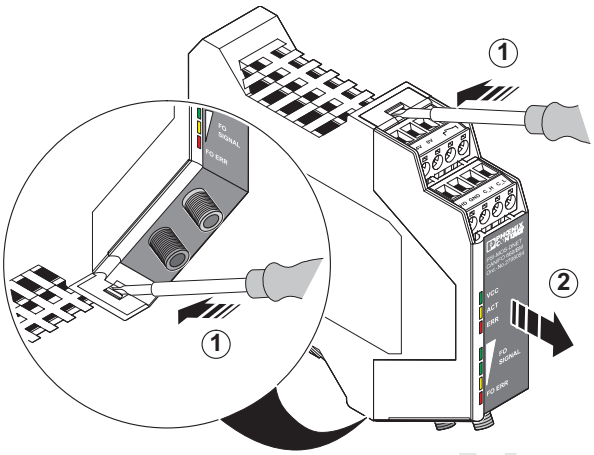


Figure 4 Opening the housing

The DIP switches can then be freely accessed.

- Configure the DIP switches according to the planned application.

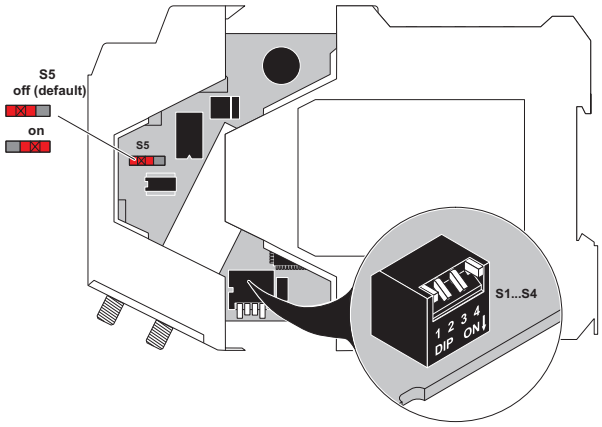


Figure 5 Setting the DIP switches

7.2 Activating the termination resis

If the PSI-MOS…BM basic module is used copper segment, the integrated termination activated.

- Set slide switch S5 to the "ON" positio

7.3 Activating the redundancy func

A PSI-MOS…BM basic module can be co PSI-MOS…EM extension module to create optic connections.

- Place a basic module/extension modul both the beginning and end of the redu line.
- On all the devices in a redundancy lin "ON" to activate redundancy mode (de

7.4 Setting the transmission speed

The transmission speed is set using DIP s (default: 500 kbps).

NOTE: Set all fiber optic converte connected bus devices to the sar speed.

Transmission speed (kbps)	DIP s 2	
10	OFF	O
20	OFF	C
50	OFF	C
125	ON	O
250	ON	O
500	ON	C
800	OFF	O

use shielded two-wire cables for transmission.

The bus devices are passively connected to the main bus cable, which must be terminated at the ends using termination resistors.

Due to the CSMA/CA bus access method, the total network expansion is limited by the data rate used. This restriction also applies when the network is implemented with fiber optics.

Data rate	Maximum network expansion (copper)		Maximum FO cascading (paths)
	DeviceNet	CANopen	
10 kbps	–	5000 m[1]	60
20 kbps	–	2500 m[1]	30
50 kbps	–	1000 m	12
125 kbps	500 m	500 m	6
250 kbps	250 m	250 m	3
500 kbps	100 m	100 m	1
800 kbps	–	50 m	1

[1] Only when using repeaters, otherwise copper ≤ 1000 m

At the lowest data rate, the maximum expansion for a copper segment without repeater is 1000 m.

In addition to the general conditions, which depend on the data rate (see Section 8.2), the following parameters should always be considered:

- A maximum of 64 CAN devices can be operated per copper segment.
- The maximum length of a fiber optic path from converter to converter is:
  - Polymer fiber: 100 m, maximum
  - HCS fiber: 800 m (660 nm) or 2800 m (850 nm), maximum
  - Glass fiber: 4800 m, maximum

8.2 Configuring networks using PSI-MOS-DNET CAN/FO ...

When configuring a network using PSI-MOS-... modules, the signal delay caused by the fiber optic modules must be taken into account.

This signal delay reduces the maximum transmission distance by 48 m per fiber optic segment used.

When configuring your CAN installation, proceed as follows:

In some cases, several signal paths co
corIn this ca
points should be considered for each

- Determine the total length of all coppe
segments $L_{Cable, total}$ and the number
optic segments n_{FO} in this line.
Note the maximum cascadability of fib
segments depending on the data rate
- Calculate the effective total length $L_{eff,}$
line.
Add 48 m per planned fiber optic segm
length $L_{Cable, total}$.
(This delay is caused by signal runtim
optic converters.)
$L_{eff, total} = L_{Cable, total} + n_{FO} \times 48$ m
- Finally, compare this calculated effect
$L_{eff, total}$ with the maximum network ex
data rate.
If the effective total length is less than
expansion, the CSMA/CA mechanism
properly.

8.3 Configuration example

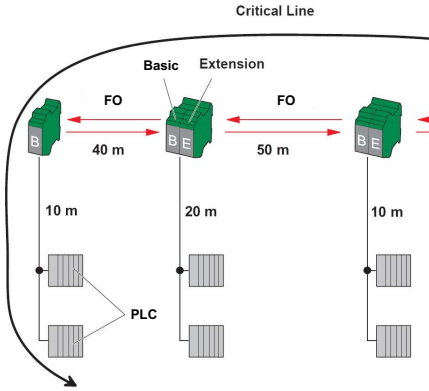


Figure 6 Configuration example

CANopen, 125 kbps

$L_{eff, total}$ = 20 m (Cu) + 130 m (FO) + 3 x

A maximum network expansion of 500 m is selected data rate of 125 kbps. This config

WARNING: PSI-MOS-... devices are designed for SELV operation according to IEC 60950/EN 60950/VDE 0805.

- 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 clamps can be mounted on both sides of the device to stop the devices from slipping on the DIN rail (for ordering data see page 3).

WARNING: Connect the DIN rail to protective earth ground using 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.

9.1 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 7).
- 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.

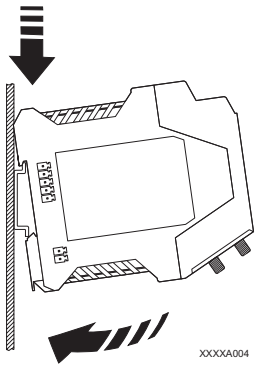


Figure 7 Assembly in the control cabinet

sides of both modules lie flush with on
- Now together as described above.

9.2 Assembly in potentially explosi

WARNING: Observe the safety r

– Areas with a danger of gas explosions

  The devices are suitable for use in zon
  are installed in zone 1 can be connect
  optic interface. The fiber optic interface
  item of equipment with protection type
– Areas with a danger of dust explosion

  The devices are not designed for insta
  with a danger of dust explosions.
  If dust is present, install the device in su
  housing.
  When installed outside areas with a da
  explosions, devices installed in zone 2
  be connected to the fiber optic interfac

9.3 Removal

- To remove a PSI-MOS… unit, the PSI on the right-hand side must be pushed the entire male connector/female conn released.
- Pull the locking latch down using a scre nose pliers or similar.
- Pull the bottom edge of the module aw mounting surface.
- Pull the module diagonally upwards aw rail.
- If removing a complete star distributor, rail connectors from the DIN rail as we

DC SELV.

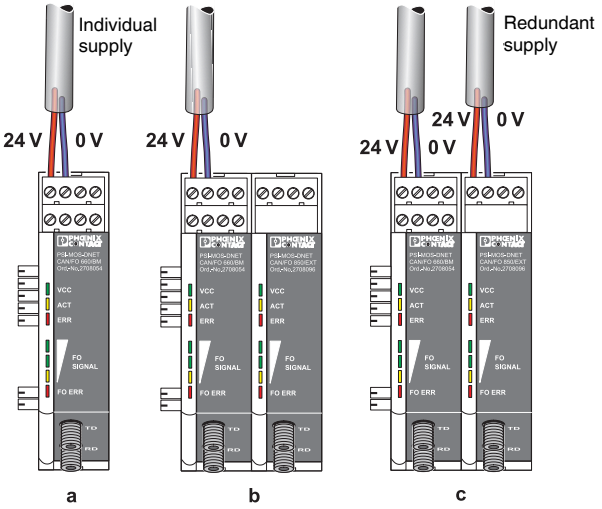


Figure 8 Individual/redundant supply

Operation as an individual device

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

Operation in a star coupler topology

When the devices are operated 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 backplane. A redundant supply concept can be created by connecting a second power supply unit to another device in the topology.

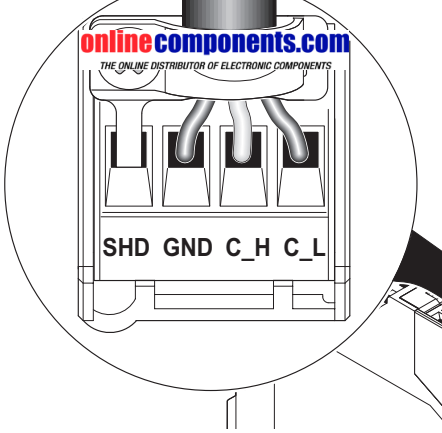


Figure 9 Connecting the data cables

NOTE: Use CAN-compatible bus
Connect the cable shielding at bo
transmission path.

- Connect the CAN cable to the COMBI of the basic module.

Contact	Function
1	+24 V
2	+ 0 V
3	Switch contact connection
4	Switch contact connection
5	CAN_Shield
6	CAN_GND
7	CAN_High
8	CAN_Low

In a star coupler topology, the CAN da automatically forwarded to adjacent ex via the backplane.

- For optimum shield connection, use th connection clamp.

messages via the backplane (Figure 10).

The switch contact on the basic module opens if one of the following occurs on the basic module itself or on a connected extension module:

– The supply voltage fails
– The optical threshold on the fiber optic path is not reached
– The fiber optic path is interrupted

If several basic modules are used in a star coupler topology, a new group message segment begins at each basic module. This means that when redundant structures are used, each redundant line can be monitored separately for errors via its basic module.

To create a single group message for an entire topology, the switching outputs (N/O contacts) should be connected externally in series.

NOTE: The maximum load capacity of the relay contact is 60 V DC/42 V AC, 1 A.

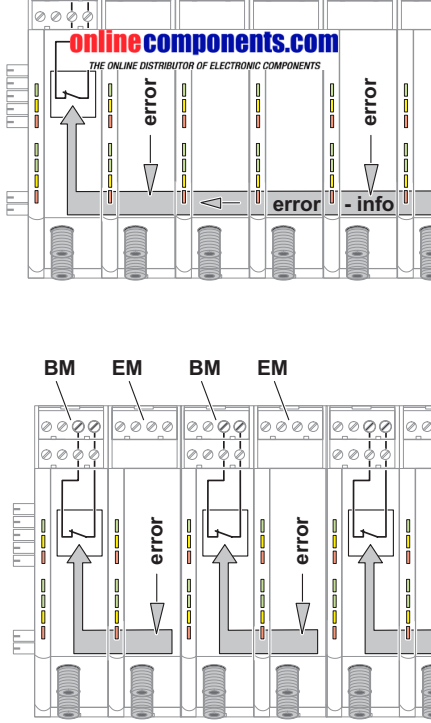


Figure 10 Early warning contact

the glass fibers.
The infrared light is not visible.

NOTE: Dust protection caps should only be removed just before the connectors are connected. They prevent contamination of the transmit and receive elements.

The same applies for the protective caps on the connectors.

NOTE: The following fiber optic lengths must not be exceeded:

PSI-MOS-DNET CAN/FO 660 ...

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

PSI-MOS-DNET CAN/FO 850 ...

– 2800 m with F-K 200/230; 8 dB/km
– 4200 m with F-G 50/125; 2.5 dB/km
– 4800 m with F-G 62.5/125; 3.0 dB/km

NOTE: When using fiber optics, observe the fiber optic installation guidelines,
DB GB IBS SYS FOC ASSEMBLY
(Order No. 9393909).

F-SMA connection (PSI-MOS-DNET CAN/FO 660 ...)

PSI-MOS-DNET CAN/FO 660 ... devices use F-SMA connectors for the fiber optic connection. F-SMA is a standardized fiber optic connection.

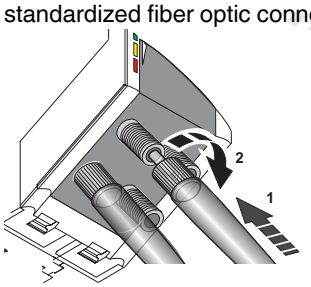


Figure 11 F-SMA connection

- The connectors are secured on the device by manually tightening the screw collar (see 2 in Figure 11).

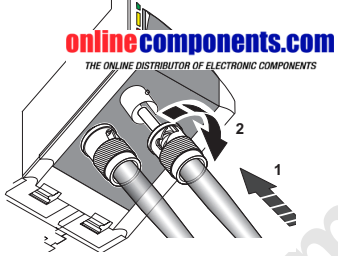


Figure 12 B-FOC connection

- Connect the fiber optic cable to the B- connector for the transmit and receive push the connector clamp mechanism
- Secure the connection with a quarter t (see 2 in Figure 12).

Measuring and connecting devices

Due to the integrated optical diagnostics, th measure the path.

NOTE: Note the fiber optic cable when coupling two PSI-MOS dev

Device 1 fiber connection "TD" (t device 2 fiber connection "RD" (r (Figure 13).

NOTE: Due to different operating PSI-MOS-DNET CAN/FO 660 ... PSI-MOS-DNET CAN/FO 850 de not be connected directly with on fiber optic cables.

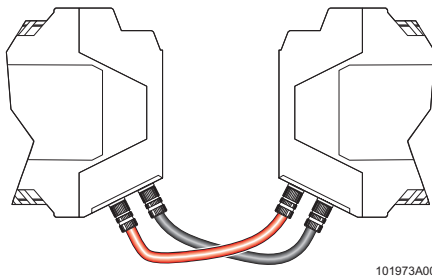


Figure 13 Crossed cables

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