

FL MC 2000T...

Fiber optic converter for 10/100Base-Tx to single- or multi-mode fiberglass with SC-duplex and ST connections



Data sheet
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1 Description

Media converters provide a high level of immunity to interference and long transmission range in industrial applications by converting the 10/100Base-Tx Ethernet interface to fiber optics (100 Mbps according to FX standard).

The FL MC 2000T... provides a high level of diagnostics with remote alarm notification, and high performance with selectable latency. Compatible with legacy devices through configurable data rate and duplex options. Optional security frames restrict unauthorized access and cable changes. A wide temperature range allows it to be used in rugged as well as factory applications.

The RJ45 port offers an auto crossing function, which means it is not necessary to make a distinction between 1:1 and crossover cables.

2 Features

The FL MC 2000T... converters offer the following features:

- 10/100Base-Tx
- -40°C to 75°C operating range
- Auto crossing simplifies cabling
- Link fault pass through and port diagnostics
- Selectable pass through or store and forward operation for optimized performance and data integrity
- Layer 1 security for the RJ45 port
- Individual LEDs at each port indicate communication activity and data rate
- Redundant power supply capable with local (LED) and remote (dry contact) alarms to indicate failure of one or both power supplies
- Mounts on NS 35 DIN rails



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This document is valid for all products listed in the "Ordering data" on page 2.

3 Ordering data

Products

Description	Type	Order No.	Pcs./Pkt.
Fiber optic converter , SC connection (1310 nm), for converting 10/100Base-Tx to multi-mode fiberglass	FL MC 2000T SC	2891315	1
Fiber optic converter , ST connection (1310 nm), for converting 10/100Base-Tx to multi-mode fiberglass	FL MC 2000T ST	2891316	1
Fiber optic converter , SC connection (1310 nm), for converting 10/100Base-Tx to single-mode fiberglass	FL MC 2000T SM20 SC	2891317	1
Fiber optic converter , SC connection (1310 nm), for converting 10/100Base-Tx to single-mode fiberglass	FL MC 2000T SM40 SC	2891318	1

Accessories

Description	Type	Order No.	Pcs./Pkt.
Universal end clamp	E/NS 35 N	0800886	50
Patch cable, CAT 5, pre-assembled, 0.3 m long	FL CAT5 PATCH 0,3	2832250	10
Patch cable, CAT 5, pre-assembled, 0.5 m long	FL CAT5 PATCH 0,5	2832263	10
Patch cable, CAT 5, pre-assembled, 1.0 m long	FL CAT5 PATCH 1,0	2832276	10
Patch cable, CAT 5, pre-assembled, 1.5 m long	FL CAT5 PATCH 1,5	2832221	10
Patch cable, CAT 5, pre-assembled, 2.0 m long	FL CAT5 PATCH 2,0	2832289	10
Patch cable, CAT 5, pre-assembled, 3.0 m long	FL CAT5 PATCH 3,0	2832292	10
Patch cable, CAT 5, pre-assembled, 5.0 m long	FL CAT5 PATCH 5,0	2832580	10
Patch cable, CAT 5, pre-assembled, 7.5 m long	FL CAT5 PATCH 7,5	2832616	10
Patch cable, CAT 5, pre-assembled, 10.0 m long	FL CAT5 PATCH 10	2832629	10
Connector, printed-circuit board	MSTB 2,5/ 8-ST	1754562	1
Surge protection device	DT-LAN-CAT.6+	2881007	1
Cap, dust protection	FL RJ45 PROTECT CAP	2832991	1
Patch cable, CAT 6A, pre-assembled	NBC-R4AC-R4AC-IE8A/.../ ...	1411854	1
Patch cable, CAT 6A, pre-assembled, 2.0 m	NBC-R4AC/10G-R4AC/ 10G-94F/2,0	1408360	1
Patch cable, CAT 6A, pre-assembled, 3.0 m	NBC-R4AC/10G-R4AC/ 10G-94F/3,0	1408365	1
Patch cable, PROFINET, pre-assembled, 1.0 m	NBC-R4AC/1,0-93B/R4AC	1408968	1
Patch cable, PROFINET, pre-assembled, 2.0 m	NBC-R4AC/2,0-93B/R4AC	1408969	1
Patch cable, PROFINET, pre-assembled, 5.0 m	NBC-R4AC/5,0-93B/R4AC	1408970	1
Patch cable, fiber optic, pre-assembled	FOC-LC:PA-SC:PA- OM2:D01/1	1115607	1
Patch cable, fiber optic, pre-assembled	FOC-LC:PA-SC:PA- OM2:D01/2	1115605	1
Patch cable, fiber optic, pre-assembled, 1 m	FOC-SC:PA-SC:PA- OM2:D01/1	1115536	1
Patch cable, fiber optic, pre-assembled, 2 m	FOC-SC:PA-SC:PA- OM2:D01/2	1115535	1
Patch cable, fiber optic, pre-assembled, 1 m	FOC-ST:PA-SC:PA- OM2:D01/1	1115574	1
Patch cable, fiber optic, pre-assembled, 2 m	FOC-ST:PA-SC:PA- OM2:D01/2	1115573	1

Accessories

Description	Type	Order No.	Pcs./Pkt.
Patch cable, fiber optic, pre-assembled, 1 m	FOC-LC:PA-SC:PA-OM4:D01/1	1115601	1
Patch cable, fiber optic, pre-assembled, 2 m	FOC-LC:PA-SC:PA-OM4:D01/2	1115600	1
Patch cable, fiber optic, pre-assembled, 1 m	FOC-SC:PA-SC:PA-OM4:D01/1	1115424	1
Patch cable, fiber optic, pre-assembled, 2 m	FOC-SC:PA-SC:PA-OM4:D01/2	1115423	1
Key	FL PATCH GUARD KEY	2891521	1
Port guard security element	FL PATCH GUARD	2891424	1

4 Technical data**General data**

Function	Converter, Ethernet 10/100Base-Tx to fiber optic; conforms to standard IEEE 802.3
Housing dimensions (width x height x depth)	28 x 110 x 70 mm
Weight, without connectors	315 g
Operating temperature	-40°C ... 75°C
Storage temperature	-40°C ... 85°C
Degree of protection	IP20, DIN 40050, IEC 60529
Protection class	Class 3 VDE 0106; IEC 60536
Humidity (operation and storage)	5% to 95%, no condensation
Air pressure (operation)	66 kPa ... 108 kPa, 4850 m above sea level
Air pressure (storage)	66 kPa ... 108 kPa, 4850 m above sea level
Mounting	NS 35 (EN 60715)
Preferred mounting position	Perpendicular to a standard mounting rail
Connection to protective earth ground	Snapped onto a grounded mounting rail
Latency (pass through mode)	865 ns

Supply voltage (U_S)

Connection type	Removable, screw-clamp connector
Wire size (solid/stranded/AWG)	0.2 ... 2.5 mm ² / 0.2 ... 2.5 mm ² / 24 ... 12 AWG
Recommended PE wire size	2.5 mm ²
Nominal power supply	24 V DC, 48 V DC
Permissible ripple	3.6 V _{pp} within the permissible voltage range
Permissible voltage range	12 V DC ... 57 V DC
Current consumption, typical	75.5 mA @ 24 V DC
Inrush current at 48 V DC	8.4 A (400 μs)
Test voltage	500 V AC for one minute
Protection against polarity reversal	Present

Interfaces**Properties of RJ45 port**

Total number of RJ45 Ethernet interfaces	1
Connection format	RJ45 female
Connection medium	Twisted-pair cable with a conductor cross section of 0.14 mm ² to 0.22 mm ²
Cable impedance	100 Ω
Transmission speed	10/100 Mbps
Maximum network segment length	100 m
MDI/MDIX switchover	Automatic (auto MDI/MDIX)

Properties of fiber optic port

Total number of FO ports	1
Connection format	SC-duplex, ST
Wavelength	1310 nm
Transmission speed	100 Mbps
Transmission length	
FL MC 2000T SC, FL MC 2000T ST	8 km with F-G 62.5/125 0.7 dB/km F1000 3.3 km with F-G 62.5/125 2.6 dB/km F600 9.6 km with F-G 50/125 0.7 dB/km F1200 5.3 km with F-G 62.5/125 1.6 dB/km F800 2 km with HCS GI fiber with F-GK 200/230
FL MC 2000T SM40 SC	40 km with F-G 9/125.0 0.36 dB/km 36 km with F-G 9/125.0 0.4 dB/km 29 km with F-G 9/125.0 0.5 dB/km
FL MC 2000T SM20 SC	20 km with F-G 9/125.0 0.36 dB/km

Alarm contacts

Voltage, maximum	24 V DC
Current carrying capacity, maximum	100 mA (including inrush)

Mechanical tests

Vibration resistance according to IEC 60068-2	10 ... 150 Hz, 5g
Shock test according to IEC 60068-2	30g, 11 ms
Free fall according to IEC 60068-2-32	100 cm

Conformance

IEC 61000-6.2

Approvals

General	CE ROHS WEEE 2002/96/EC
Hazardous location	cUL _{US} cUL _{US}

5 Dimensions

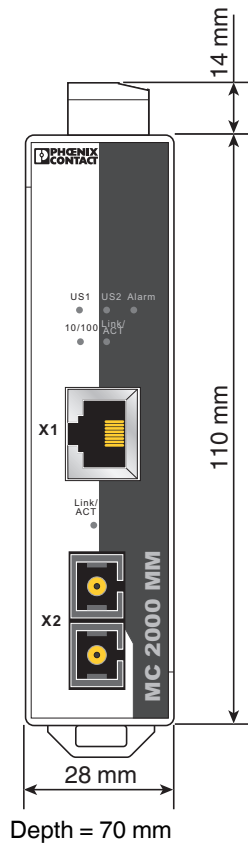


Figure 1 Housing dimensions

6 Overview

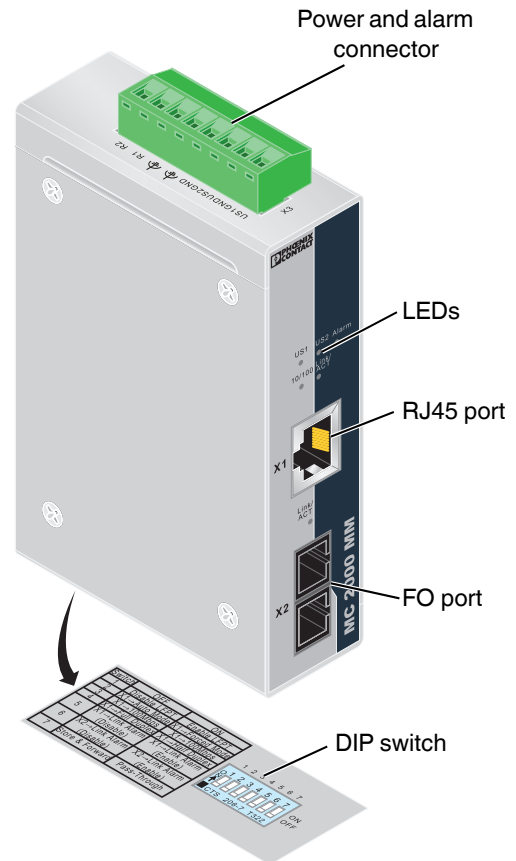


Figure 2 Connectors and LEDs

6.1 Diagnostic and status indicators

Des.	Color	Status	Meaning
US1 and US2	green	On	Supply voltage (US) in the tolerance range
		Off	Supply voltage (US) too low
Alarm	red	On	US1 or US2 is too low or missing
			Port link failure
		Off	Normal operation

6.2 Data transmission LEDs

LED	Status	Meaning
LNK/ACT	On	Indicates an electrical link
	Flashing	Data transmission is in process
10/100 (RJ45 port only)	On	Port is operating at 100 Mbps
	Off	Port is operating at 10 Mbps

i LNK/ACT LED:
 ON: indicates an electrical link
 Flashing: indicates network traffic (at high data rates the blinking is in a constant rate)

7 Installation



CAUTION:

Only qualified personnel may start up and operate this device. Qualified personnel are persons authorized to start up, ground and mark devices, systems and equipment according to the standards of safety technology.



NOTE:

The FL MC 2000T... module is designed for SELV and PELV operation according to IEC 61140/EN 61140.

Install the module on a clean NS 35 rail. To avoid contact resistance use only clean, corrosion-free rails that meet the EN 60715 standard. End clamps can be mounted on both sides of the module to stop the modules from slipping on the rail.



NOTE:

Connect the mounting rail to protective earth ground using a grounding terminal block. The modules are grounded when they are snapped onto the rail. Connect protective earth ground with low impedance.

7.1 Assembly

1. Place the module onto the rail from above. The upper holding keyway must be hooked onto the top edge of the rail.
2. Push the module from the front towards the mounting surface.
3. Once the module has been snapped on properly, check that it is fixed securely on the rail.

7.2 Removal

1. Insert a suitable tool (e.g., screwdriver) into the arresting latch and pull it down.
2. Pull the module slightly away from the mounting surface.
3. Lift the module from the rail.

7.3 Power connection

The device is designed for SELV and PELV operation at +24 V DC according to IEC 61140/EN 61140. Only SELV and PELV according to the defined standards may be used for supply purposes.

Snapping the device onto a grounded rail connects it to the ground potential.

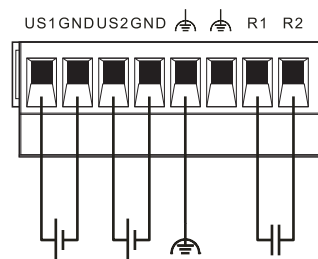


Figure 3 Power connections for redundant power supply

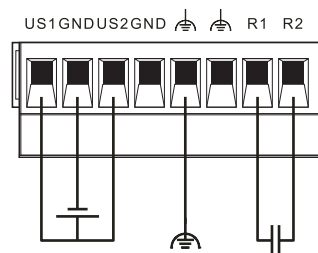


Figure 4 Power connections for single power supply

Use power conductors between 0.2 - 2.5 mm² (24 -12 AWG). Torque connection screws to 0.5 - 0.6 Nm (5 - 7 lb-in.).

7.4 Alarm contact

The FL MC 2000T... provides contacts (R1, R2) for a remote alarm if a failure is detected. The alarm is triggered if one or both power supplies fail. An alarm can be triggered if a port link fails. Individual port alarms can be enabled via a DIP switch located on the bottom of the device.

The alarm relay is a normally closed type. When there are no faults, the contact is held open. When a fault occurs, the relay is de-energized to close the contact.

i In addition to the remote alarm, failure is also indicated by turning the alarm LED on.

7.5 Ethernet interface

The FL MC 2000T... has one Ethernet port on the front in RJ45 format to which a twisted-pair cable with an impedance of 100 Ω can be connected. The data transmission speed is 10/100 Mbps. This port has an auto crossing function: it is not necessary to make a distinction between 1:1 or crossover Ethernet cables.

- Connect the twisted-pair cable to the RJ45 connector.
- Ensure the connection is secure by gently pulling it.

7.6 Fiber optic interface

WARNING: During operation, do not look directly into transmitter diodes or use visual aids to look into the glass fibers. The infrared light is not visible.

NOTE: Do not remove dust protection caps until just before the plug-in connectors are connected. They prevent contamination of the transmit and receive elements.

NOTE: Observe the cable manufacturer's technical data when handling the various fiber optic cables. In order for the communication path to be immune to interference, the permissible values for bending radius, tensile force and pressure force must not be exceeded.

- Connect the fiber optic cable to the SC-duplex or ST plug-in connector for the transmit and receive channel. Make sure the keying is in the correct position.
- Ensure the connection is secure by gently pulling it.

8 Configuration

A seven-position DIP switch on the bottom surface of the FL MC 2000T... allows configuration of operating characteristics.

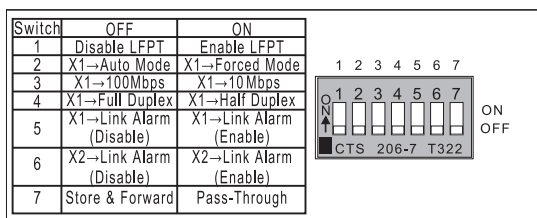


Figure 5 DIP switch

8.1 Link fault pass through (DIP 1)

Link fault pass through is a function that allows diagnostics from one port to pass through to the other port.

The link status of the RJ45 port is always forwarded to the fiber optic port. However, link fault pass through from the fiber optic port to the RJ45 port is selectable (via DIP 1). When link fault pass through is disabled, devices may not be able to detect that the fiber optic network connection is interrupted. The connected device either doesn't know it is not communicating (diagnostics cannot be generated) or it continually attempts to re-establish communication, increasing the network load and application response time.

When enabled, a link loss at the fiber optic port is forwarded to the RJ45 port, so both ports of the converter are disabled.

i Link fault pass through should only be used when two media converters are connected in series.

DIP 1 can be used to enable link fault pass through (LFPT), which allows faults to propagate globally through the system, or stay local to each link segment.

DIP	Position	Function
1	ON	LFPT enabled (global): in the event of a fault, the entire connection is disabled.
	OFF	LFPT disabled (local): in the event of a fault, only the interrupted part is disabled. This is useful during startup and in the event of an error.

i In pass through mode with link fault pass through enabled, the media converter boot-up time is 26 s.

In pass through mode with link fault pass through disabled, the media converter boot-up time is less than 2 s.

The time to transmit the TX port link status from the first converter, through the fiber optic cable to the TX port of the second converter is 3 μs.

8.2 Data communication parameters

DIP switches 2, 3, and 4 set the data rate and duplex parameters. When communicating with devices that have auto negotiation capability, the FL MC 2000T... should have auto negotiation enabled (DIP switch 2 is OFF). In auto-negotiation mode, DIP switches 3 and 4 are ignored.

When connecting to older legacy devices without auto negotiation, it may need to be disabled on the switch (DIP switch 2 set to ON). DIP switches 3 and 4 then need to be configured for proper communication to the device.

8.3 Alarm enabling

The alarm contacts are configurable on a port basis. DIP 5 controls port X1 (RJ45) and DIP 6 controls port X2 (fiber optic).

DIP	Position	Function
2	ON	X1 port mode is set by DIP switches 3 and 4
	OFF	X1 port mode is in auto-negotiation mode
3	ON	X1 port data rate set to 10 Mbps
	OFF	X1 port data rate set to 100 Mbps
4	ON	X1 port is set to half duplex
	OFF	X1 port is set to full duplex
5	ON	In the event of a fault on the X1 port, the alarm LED lights and the alarm relay is closed, generating a remote alarm
	OFF	Faults are not monitored on the X1 port
6	ON	In the event of a fault on the X2 port, the alarm LED lights and the alarm relay is closed, generating a remote alarm
	OFF	Faults are not monitored on the X2 port
7	ON	Enables pass-through mode
	OFF	Enables store and forward mode

8.4 Operating mode

DIP switch 7 configures the Ethernet packet processing mode. When disabled (DIP switch 7 is OFF), the store-and-forward mode checks the packet before forwarding it on. This provides a high level of integrity in the data transfer.

When enabled (DIP switch 7 is ON), the FL MC 2000T... operates in a pass-through mode, providing the least delay (latency) for time-critical applications that can tolerate occasional packet errors.



Operating mode configuration is independent of the data communication parameters auto negotiation, speed, and duplex.

8.5 Security frames

The RJ45 port accepts security frames. FL PLUG GUARD... security frames lock the RJ45 cable in place, reducing the chance of an unauthorized change or network access.