



LRW-702-F2

Fibre Optic industrial converter/repeater
for LonWorks[®] TP/FT-10 point-to-point,
line and redundant ring

General information

Legal information

The contents of this document are provided “as is”. Except as required by applicable law, no warranties of any kind, either express or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose, are made in relation to the accuracy and reliability or contents of this document. Westermo reserves the right to revise this document or withdraw it at any time without prior notice.





Under no circumstances shall Westermo be responsible for any loss of data or income or any special, incidental, and consequential or indirect damages howsoever caused.

More information about Westermo can be found at www.westermo.com.

Safety and Regulations

Warning signs are provided to prevent personal injury and/or damages to the product.

The following levels are used:

Level of warning	Description	Consequence personal injury	Consequence material damage
 WARNING	Indicates a potentially hazardous situation	Possible death or major injury	Major damage to the product
 CAUTION	Indicates a potentially hazardous situation	Minor or moderate injury	Moderate damage to the product
 NOTICE	Provides information in order to avoid misuse of the product, confusion or misunderstanding	No personal injury	Minor damage to the product
 NOTE	Used for highlighting general, but important information	No personal injury	Minor damage to the product

Before Installation

Read this manual completely and gather all information on the product. Make sure that you understand it fully. Check that your application does not exceed the safe operating specifications for this product.



SAFETY DURING INSTALLATION

The product must be installed by qualified service personnel and built in to an apparatus cabinet or similar, where access is restricted to service personnel only.

During installation, ensure a protective earthing conductor is first connected to the protective earthing terminal (only valid for metallic housings). Westermo recommends a cross-sectional area of at least 4 mm².

Upon removal of the product, ensure that the protective earthing conductor is disconnected last.



HAZARDOUS VOLTAGE

Do not open an energized product. Hazardous voltage may occur when connected to a power supply.



PROTECTIVE FUSE

The power supply wiring must be sufficiently fused.

It must be possible to disconnect manually from the power supply. Ensure compliance to national installation regulations.

This product has no internal fuse and should be connected via an external fuse for protection.



CLASS 1 LASER PRODUCT

Do not look directly into a fibre optical port or any connected fibre, although the product is designed to meet the Class 1 Laser regulations and complies with 21 CFR 1040.10 and 1040.11.



FIBRE OPTIC HANDLING

Fibre optic equipment need special treatment. It is very sensitive to dust and dirt. If the fibre is disconnected from the product, the protective plugs on the transmitter/receiver must be connected. The protective plugs must be kept on during transportation. The fibre optics cables must be handled the same way.



ELECTROSTATIC DISCHARGE (ESD)

Prevent electrostatic discharge damages to internal electronic parts by discharging your body to a grounding point (e.g. use a wrist strap).

Care Recommendations

Follow the care recommendations below to maintain full operation of product and to fulfill the warranty obligations:

- Do not drop, knock or shake the product. Rough handling above the specification may cause damage to internal circuit boards.
- Use a dry or slightly water-damp cloth to clean the product. Do not use harsh chemicals, cleaning solvents or strong detergents.
- Do not paint the product. Paint can clog the product and prevent proper operation.

If the product is used in a manner not according to specification, the protection provided by the equipment may be impaired.

If the product is not working properly, contact the place of purchase, nearest Westermo distributor office or Westermo technical support.

Cleaning of the Optical Connectors

In the event of contamination, the optical connectors should be cleaned by the use of forced nitrogen and some kind of cleaning stick.

Recommended cleaning fluids:

- Methyl-, ethyl-, isopropyl- or isobutyl-alcohol
- Hexane
- Naphtha

Product Disposal



This symbol means that the product shall not be treated as unsorted municipal waste when disposing of it. It needs to be handed over to an applicable collection point for recycling electrical and electronic equipment.

By ensuring this product is disposed of correctly, you will help to reduce hazardous substances and prevent potential negative consequences to both environment and human health, which could be caused by inappropriate disposal.

Declaration of Conformity

Hereby, Westermo declares that this product is in compliance with applicable EU directives and UK legislations. The full declaration of conformity and other detailed information is available at www.westermo.com/support/product-support.



Agency Approvals and Standards Compliance

Type	Approval / Compliance
EMC	EN 61000-6-2, Immunity industrial environments
	EN 61000-6-4, Emission industrial environments

FCC Part 15.105 Notice:

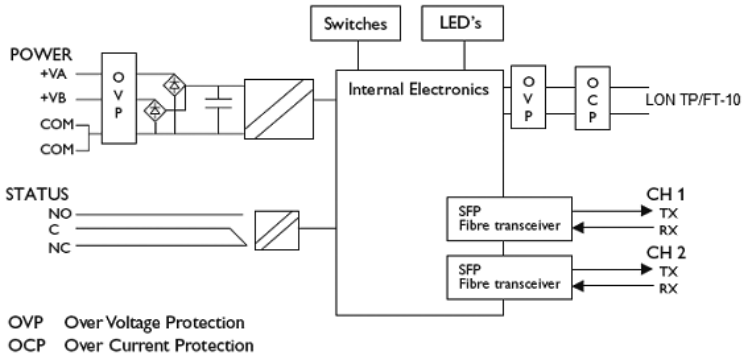
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Type Tests and Environmental Conditions

Electromagnetic Compatibility			
Phenomena	Test	Description	Level
ESD	EN 61000-4-2	Enclosure contact	± 4 kV
		Enclosure air	± 8 kV
RF field AM modulated	IEC 61000-4-3	Enclosure	10 V/m 80% AM (1 kHz)
Fast transient	EN 61000-4-4	Signal ports	± 1 kV
		Power ports	± 2 kV
Surge		Signal ports balanced	± 1 kV line to earth, ± 1 kV line to line
		Power ports	± 0.5 kV line to earth, ± 0.5 kV line to line
RF conducted	EN 61000-4-6	Signal ports	10 V 80% AM (1 kHz), 0.15 – 80 MHz
		Power ports	10 V 80% AM (1 kHz), 0.15 – 80 MHz
Power frequency magnetic field	EN 61000-4-8	Enclosure	100 A/m, 50 Hz, 16.7 Hz & 0 Hz
Pulse Magnetic field	EN 61000-4-9	Enclosure	300 A/m, 6.4 / 16 µs pulse
Voltage dips and interruption	EN 61000-4-11	AC power ports	10 & 5 000 ms, interruption 10 & 500 ms, 30% reduction 100 & 1 000 ms, 60% reduction
Mains freq. 50 Hz	EN 61000-4-16	Signal ports	100 V 50 Hz line to earth
Mains freq. 50 Hz	SS 436 15 03	Signal ports	250 V 50 Hz line to line
Voltage dips and interruption	EN 61000-4-29	DC power ports	10 & 100 ms, interruption 10 ms, 30% reduction 10 ms, 60% reduction +20% above & -20% below rated voltage
Radiated emission	CISPR 16-2-3 ANSI C63.4 (FCC part 15)	Enclosure	Class B
			Class A
Conducted emission	CISPR 16-2-1 ANSI C63.4 (FCC part 15b)	AC power ports	Class B
		AC power ports	Class B
		DC power ports	Class A
Dielectric strength	EN 60950	Signal port to all other isolated ports	1.5 kVrms 50 Hz 1min
		Power port to other isolated ports	2 kVrms 50 Hz 1min
Environmental			
Temperature	EN 60068-2-1	Operating	-40 to +60°C LRW-702-F2
	EN 60068-2-2	Storage & Transport	-40 to +70°C
Humidity	EN 60068-2-30	Operating	5 to 95% relative humidity
		Storage & Transport	5 to 95% relative humidity
Altitude		Operating	2 000 m / 70 kPa
Service life		Operating	10 years
Vibration	IEC 60068-2-6	Operating	7.5 mm, 5 – 8 Hz 2 g, 8 – 500 Hz
Shock	IEC 60068-2-27	Operating	15 g, 11 ms
Packaging			
Enclosure	UL 94	PC / ABS	Flammability class V-1
Dimension W x H x D			35 x 121 x 119 mm
Weight			0.26 kg
Degree of protection	IEC 529	Enclosure	IP 21
Cooling			Convection
Mounting			Horizontal on 35 mm DIN-rail

Functional Description



Converter TP/FT Interface – Optical Fibre

The LRW-702-F2 is a fibre optic converter that converts between LONWORKS® TP/FT, and fibre optical link.

Repeater – Optical Fibre Links

The LRW-702-F2 is a fibre optic repeater that repeats received data from one fibre link out to the other link. This is useful e.g. for long distance communication, where electromagnetic interference may occur or when isolation of the electrical network is needed.

Singlemode or Multimode LC Fibre Connectors

The LRW-702-F2 uses Small Form Factor Pluggable (SFP) transceivers that are in compliance with Multi-Sourcing Agreement (MSA). A wide range of different fibre transceivers and connectors can be used.

Interface Specifications

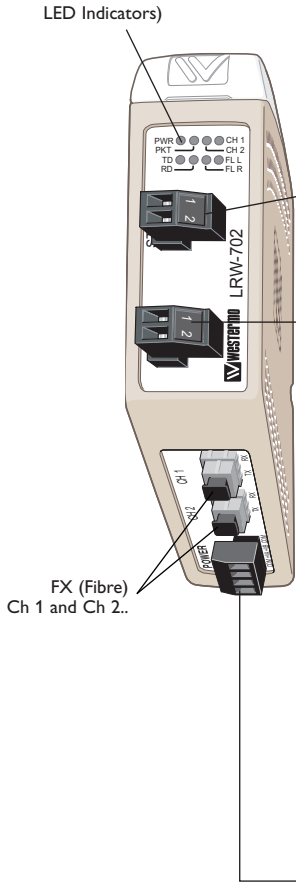
Power	
Rated voltage	12 to 48 VDC 24 VAC
Operating voltage	10 to 60 VDC 20 to 30 VAC
Rated current	400 mA @ 12 VDC 200 mA @ 24 VDC 100 mA @ 48 VDC
Rated frequency	DC AC: 48 to 62 Hz
Inrush current I ² t	0.2 A ² s
Startup current*	1.0 A _{peak}
Polarity	Reverse polarity protected
Redundant power input	Yes
Isolation to	TP/FT-10 port and status port
Connection	4-position detachable screw terminal
Connector size	0.2 – 2.5 mm ² (AWG 24 – 12)
Shielded cable	Not required

* External supply current capability for proper startup.

Status	
Port type	Solid state relay
Operating voltage	Up to 60 VDC
Load current	Up to 100 mA
Contact resistance	8 Ω
Isolation to	TP/FT-10 port and power port
Connection	2-position detachable screw terminal
Connector size	0.2 – 2.5 mm ² (AWG 24 – 12)

TP/FT-10	
Electrical specification	LONWORKS® TP/FT-10 using FTT-10A transceiver
Data rate	78.5 kbit/s
Data format	Synchronous
Protocol	LonTalk®
Transmission range	Up to 2700 m
Termination	Single or double external termination according to TP/FT-10 specification
Isolation to	Power port and status port
Connection	2-position detachable screw terminal
Connector size	0.2 – 2.5 mm ² (AWG 24 – 12)
Shielded cable	Not required
Conductive housing	No

Location of Interface Ports, LEDs and DIP-switches



Status

Position	Direction*	Description	Product marking
1	In/Out	Contact with position 2 when fibre optical links are in operation	1
2	In/Out	Common	2

TP/FT-10

Position	Direction*	Description	Product marking
1	In/Out	TP/FT-10 connection	N1
2	In/Out	TP/FT-10 connection	N2

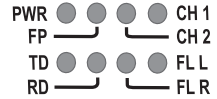
Power

Position	Direction*	Description	Product marking
1	In	Common voltage	COM
2	In	Voltage A	+VA
3	In	Voltage B	+VB
4	In	Common voltage	COM

* Direction relative this unit

LED Indicators

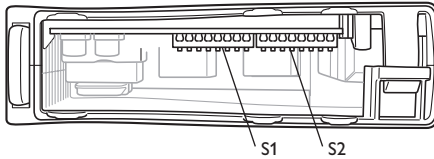
LED	Status	Description
PWR Power	ON	Power is on.
	OFF	Power is off.
FP	ON	Focal point
	OFF	Redundant ring member or multidrop unit.
CH 2 Channel 2 link status	ON	Fiber link to other unit has been established at CH 2.
	Flashing	Optical power detected but link to other unit has not been established at CH 2.
	OFF	No optical power detected and no link to other unit has been established at CH 2.
CH 1 Channel 1 link status	ON	Fiber link to other unit has been established at CH 1.
	Flashing	Optical power detected but link to other unit has not been established at CH 1.
	OFF	No optical power detected and no link to other unit has been established at CH 1.
TD	Flash	Data received on the TP/FT-10 interface and transmitted out on the optical interface.
	OFF	No data received on the TP/FT-10 interface.
RD	Flash	Data received on the optical interface and transmitted out on the TP/FT-10 interface.
	OFF	No data received on the optical interface.
FL R Failure link remote	ON	Remote fibre link failure. A fibre link is out of operation at any other unit than this one.
	Flashing	Hardware error or invalid configuration.
FL L Failure link local	ON	Local fibre link failure. A fibre link is out of operation at this unit.
	Flashing	Hardware error or invalid configuration.



Note: During power up, all LED's will turn on for about 1 second.

Configuration

All needed configurations and parameter settings are done by the DIP-switches, located under the top lid of the LRW-702-F2.



ELECTROSTATIC DISCHARGE (ESD)

Prevent electrostatic discharge damages to internal electronic parts by discharging your body to a grounding point (e.g. use a wrist strap).



BEFORE EDITING THE DIP-SWITCH SETTINGS

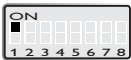
Disconnect the power before editing the DIP-switch settings.

S1 DIP-switch

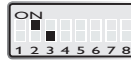


Not used

S2 DIP-switch



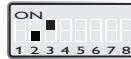
Set status port on local fibre link (FL L) error only.



Point to point or multidrop end unit, e.g. the first or last unit in a multidrop network.



Set status port on both local fibre link (FL L) and remote fibre link (FLR) errors.



Redundant ring focal point. Only one focal point allowed in a ring.



Multidrop mid unit or redundant ring member.

Factory settings

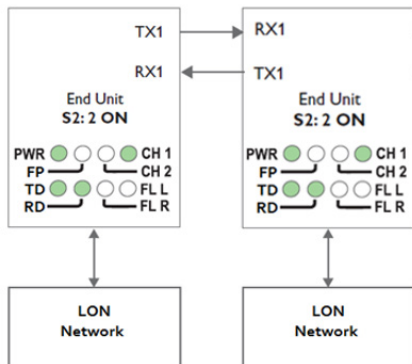


S1



S2

Point-to-Point Configuration



Prepare the Fibre Optical Network

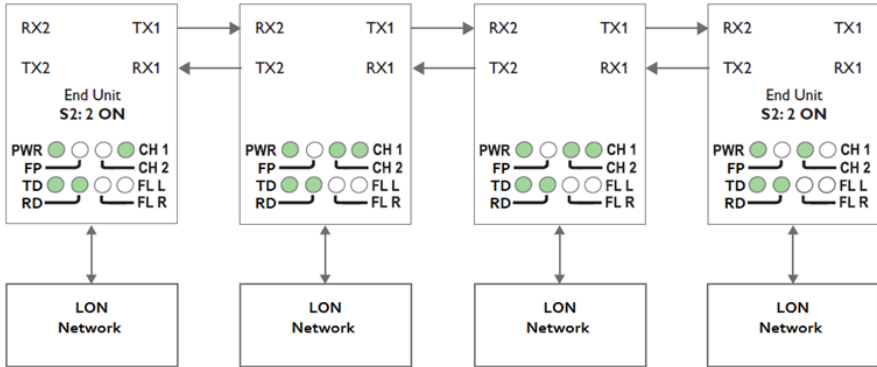
- Both units must be configured for point to point application by setting DIP-switch S2:2 to the ON position.
- Set DIP-switch and S2:1 as desired. See page with “Status port” for more information.
- Verify that DIP-switch S2:3 is in the OFF position.
- Connect the fibre pairs between the units. Always connect CH 1 as shown in the picture above.
- Connect the power supply to all units and verify that all fibre links become active. (CH 1 on both units are on, FL L off).
- Connect the LON devices to the corresponding LRW-702-F2 unit.
- The network is now up and running.



PROCESSING DELAYS

In an LRW-70-F2 fibre optic network there will be some additional processing delays that do not exist in an electrical bus. It is possible that the application must be adjusted to accommodate these delays if using many LRW-702-F2 units in a large network. See page with “Calculating system delay” for more information on how to determine the overall system delay time.

Multidrop Configuration



Prepare the Fibre Optical Network

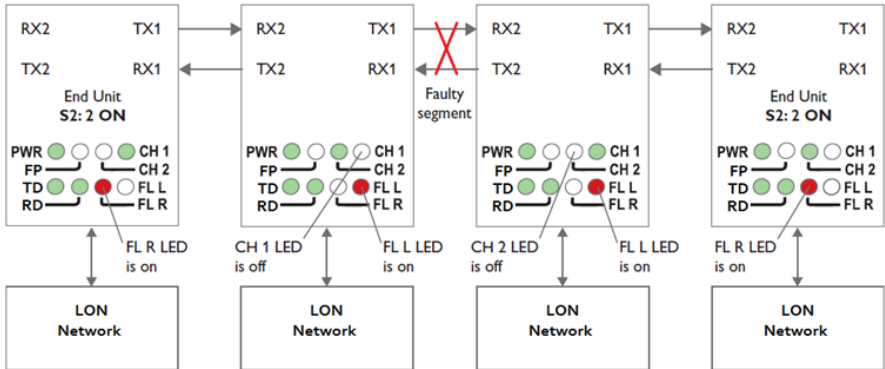
- The first and last LRW-702-F2 units must be configured as Multidrop end units by setting DIP-switch S2:2 to the ON position. (End units only have one fibre pair each and must know that this is a fact)
- Set DIP-switch and S2:1 as desired. See page with “Status port” for more information.
- Verify that DIP-switch S2:3 is in the OFF position.
- Connect the fibre pairs between the units. Always connect CH 1 from one unit to CH 2 on the next unit as shown in the picture above.
- Connect the power supply to all units and verify that all fibre links become active. (CH 1 and CH 2 LEDs are on, FL L and FL R LEDs are off).
- Connect the LON devices to the corresponding LRW-702-F2 unit.
- The network is now up and running.



PROCESSING DELAYS

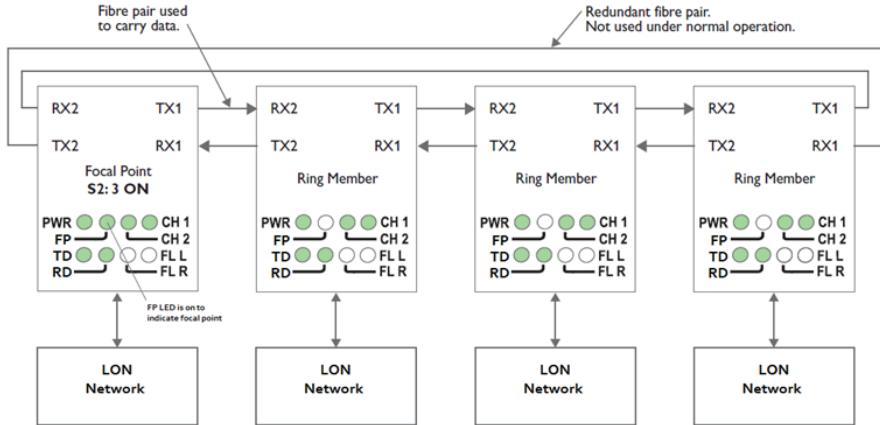
In an LRW-70-F2 fibre optic network there will be some additional processing delays that do not exist in an electrical bus. It is possible that the application must be adjusted to accommodate these delays if using many LRW-702-F2 units in a large network. See page with “Calculating system delay” for more information on how to determine the overall system delay time.

Behavior During Optical Link Failure



If an optical fibre segment fails, all communication with units beyond the faulty fibre segment will be lost. To determine which fibre segment has failed, look at the FL L, CH 1 and CH 2 LEDs as show in the picture above.

Redundant Ring Configuration



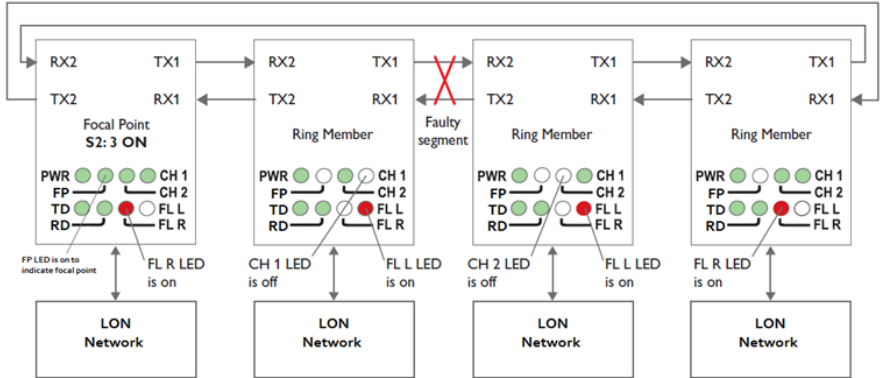
Prepare the Fibre Optical Network

- One, and only one, of the LRW-702-F2 units must be configured as a ring focal point by setting DIP-switch S2:3 to the ON position. (The ring focal point acts as a logical end point in the optical fibre ring, thus forming a bus type of structure)
- Connect the fibre pairs between the units. Always connect CH 1 from one unit to CH 2 on the next unit as shown in the picture above.
- Connect the power supply to all units and verify that all fibre links become active. (CH 1 and CH 2 LEDs are on, FL L and FL R LEDs are off).
- Connect the LON devices to the corresponding LRW-702-F2 unit.
- The network is now up and running.

Note: In an LRW-702-F2 fibre optic network there will be some additional processing delays that do not exist in an electrical bus. It is possible that the application must be adjusted to accommodate these delays if using many LRW-702-F2 units in a large network.

See page with “Calculating system delay” for more information on how to determine the overall system delay time.

Behavior During Optical Link Failure



If an optical fibre segment fails, the LRW-702-F2 unit configured as focal point will reconfigure the system so that data is sent and received over the otherwise redundant fibre pair.

To determine which fibre segment has failed, look at the FL L, CH 1 and CH 2 LEDs as show in the picture above.



IN CASE OF FIBRE LINK FAILURE

If a fibre link fails, there will be some time before the system reconfigures itself during witch data may be corrupted or lost. See "Reconfiguration time under faulty condition" for more information on how to determine the system reconfiguration time.

Calculating System Delay

Data exchange between LONWORKS devices via a LRW-702-F2 fibre optic link will be delayed due to the length of the optical fibre and the signal processing within the LRW-702-F2 units. The following equation can be used to calculate the overall system delay:

$$\text{Maximum delay } (\mu\text{s}) = \text{Total fibre distance (m)} / 200 + \text{Number of LRW-702-F2 units}$$

For example, in a multidrop system comprising four LRW-702-F2 units connected together using three 1,5 km fibre links, the end to end delay will be: $3 \times 1500 / 200 + 4 = 26,5 \mu\text{s}$

Reconfiguration Time under Faulty Condition

The reconfiguration time is determined by the time it takes to detect a faulty fibre segment plus the time it takes to transport an error status message through to the LRW-702-F2 focal point unit. The time to transport an error status message to the focal point unit is dependent on how many units the error status message has to be repeated through and the total fibre length delay. The following equation can be used to calculate the reconfiguration time:

$$\text{Reconfiguration time } (\mu\text{s}) = \text{Total fibre distance (m)} / 200 + \text{Number of LRW-702-F2 units} + 3\mu\text{s}$$

About the Interfaces

Power

The power terminal has two independent inputs, +VA and +VB, allowing redundant power input. The LRW-702-F2 power supply is galvanically isolated from all other interfaces.

Optical Fibre Interfaces

LRW-702-F2 uses Small Form Factor Pluggable (SFP) transceivers. This means that a wide range of different fibre transceivers and connectors can be used.

LONWORKS TP/FT-10 Interface

Connection terminal to a LONWORKS TP/FT-10 transceiver. TP/FT-10 is a twisted pair communications at 78 kbps with distances to 2700 meters in a doubly terminated bus topology. The TP/FT-10 also supports free-topology wiring to 500 meters which eliminates the need to install an exact multi-drop arrangement. Star, home run, multi-drop, and loop wiring, or any combination, are supported by the TP/FT-10.

Status Port

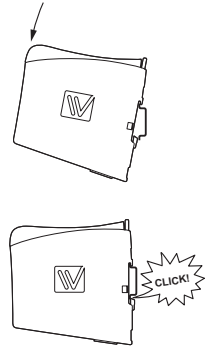
The status port connects to an internal solid state relay which may be used to trigger an external alarm if a fault condition occurs. During normal operation pins 1 and 2 are in contact with each other. During an optical link failure, or power failure, pins 1 and 2 are isolated from each other.

Optical link failures can be classified in to two categories, local or remote, as indicated by the FL L and FL R LEDs. A local link failure is when an optical link is down at this particular unit. A remote link failure is when an optical link is down at some other unit.

From the factory, the status port is set to trigger on both types of link failures. However, by setting DIP-switch S2:1 to the ON position, the status port will only trigger when a local link failure has occurred.

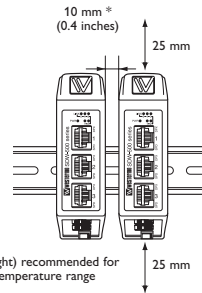
Mounting

This unit should be mounted on 35 mm DIN-rail, which is horizontally mounted inside an apparatus cabinet, or similar. Snap on mounting, see figure.



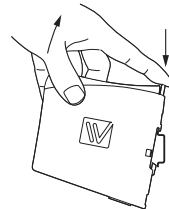
Cooling

This unit uses convection cooling. To avoid obstructing the air-flow around the unit, use the following spacing rules. Minimum spacing 25 mm (1.0 inch) above /below and 10 mm (0.4 inches) left /right the unit. Spacing is recommended for the use of unit in full operating temperature range and service life.



Removal

Press down the black support at the top of the unit. See figure.



WESTERMO

Westermo • Metallverksgatan 6, SE-721 30 Västerås, Sweden

Tel +46 16 42 80 00 Fax +46 16 42 80 01

E-mail: info@westermo.com

www.westermo.com