



LRW-702-F2

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

General information

Legal information

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www.westermo.com

Safety



Before installation:

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

This unit should only be installed by qualified personnel.

This unit should be built-in to an apparatus cabinet, or similar, where access is restricted to service personnel only.

The power supply wiring must be sufficiently fused, and if necessary it must be possible to disconnect manually from the power supply. Ensure compliance to national installation regulations.

This unit uses convection cooling. To avoid obstructing the airflow around the unit, follow the spacing recommendations (see Cooling section).



Before mounting, using or removing this unit:

Prevent access to hazardous voltage by disconnecting the unit from power supply. Warning! Do not open connected unit. Hazardous voltage may occur within this unit when connected to power supply.



Class 1 Laser Product

Do not look directly into fibre optical fibre port or any connected fibre although this unit is designed to meet the Class 1 Laser regulations.

Care recommendations

Follow the care recommendations below to maintain full operation of unit and to fulfil the warranty obligations.

This unit must not be operating with removed covers or lids.

Do not attempt to disassemble the unit. There are no user serviceable parts inside.

Do not drop, knock or shake the unit, rough handling above the specification may cause damage to internal circuit boards.

Do not use harsh chemicals, cleaning solvents or strong detergents to clean the unit.

Do not paint the unit. Paint can clog the unit and prevent proper operation.

Do not expose the unit to any kind of liquids (rain, beverages, etc). The unit is not waterproof. Keep the unit within the specified humidity levels.

Do not use or store the unit in dusty, dirty areas, connectors as well as other mechanical part may be damaged.

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

Fibre connectors are supplied with plugs to avoid contamination inside the optical port.

As long as no optical fibre is mounted on the connector, e.g. for storage, service or transportation, should the plug be applied.

Note. Fibre Optic Handling

Fibre optic equipment needs special treatment. It is very sensitive to dust and dirt. If the fibre will be disconnected from the modem the protective hood on the transmitter/receiver must be connected. The protective hood must be kept on during transportation. The fibre optic cable must also be handle the same way.

If this recommendation not will be followed it can jeopardise the warranty.

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.

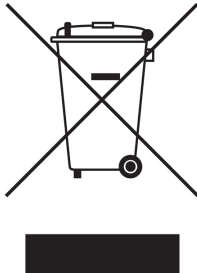
Recommended cleaning fluids:

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

Maintenance

No maintenance is required, as long as the unit is used as intended within the specified conditions.

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.

Simplified EU declaration of conformity

Hereby, Westermo declares that the equipment is in compliance with applicable EU directives. The full EU declaration of conformity and other detailed information are available at the respective product page at www.westermo.com.

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:

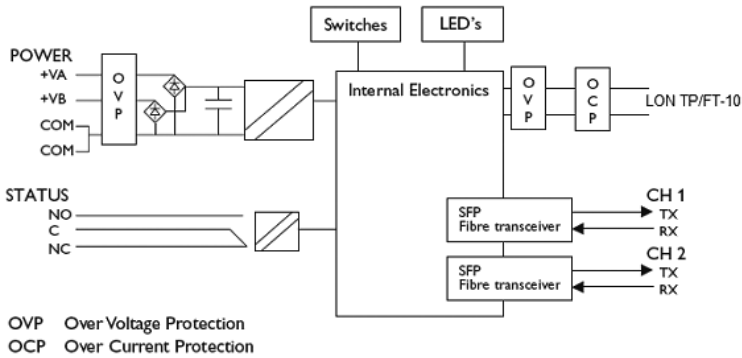
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

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 μ s 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.

Single 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 |

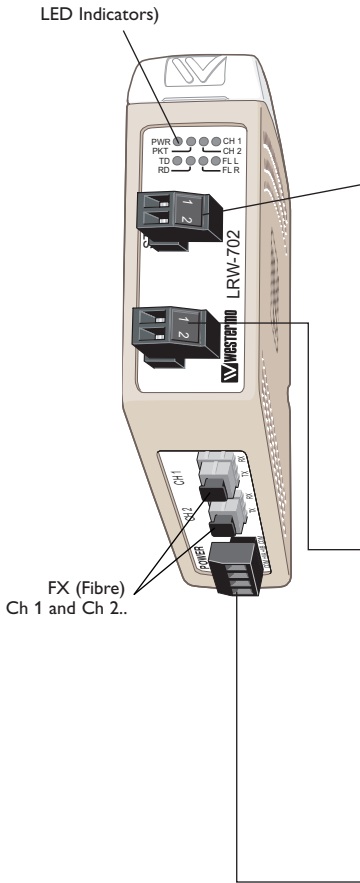
* External supply current capability for proper startup.

| 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

LRW-702-F2



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 |

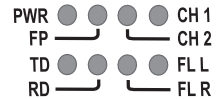
Power

| 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

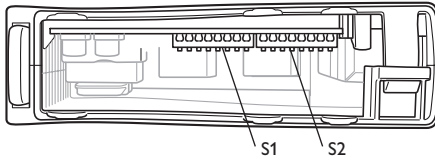
| LED | Status | Description |
|-------------------------------|----------|---|
| PWR Power | ON | Power is on. |
| | OFF | Power is off. |
| FP | ON | Focal point |
| | OFF | Redundant ring member or multidrop unit. |
| CH 2 Channel 2 link status | ON | Fiber link to other unit has been established 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.



DIP-switch settings

Before DIP-switch settings:

Prevent damage to internal electronics from electrostatic discharges (ESD) by discharging your body to a grounding point (e.g. use of wrist strap)

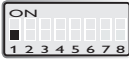
Note: Disconnect power before DIP-switch settings.

S1 DIP-switch



Not used

S2 DIP-switch



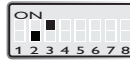
Set status port on local fibre link (FL L) error only.



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

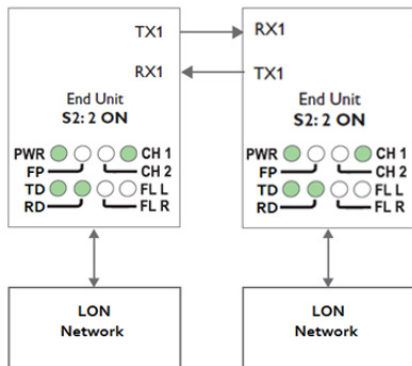


S1



S2

Point to Point configuration



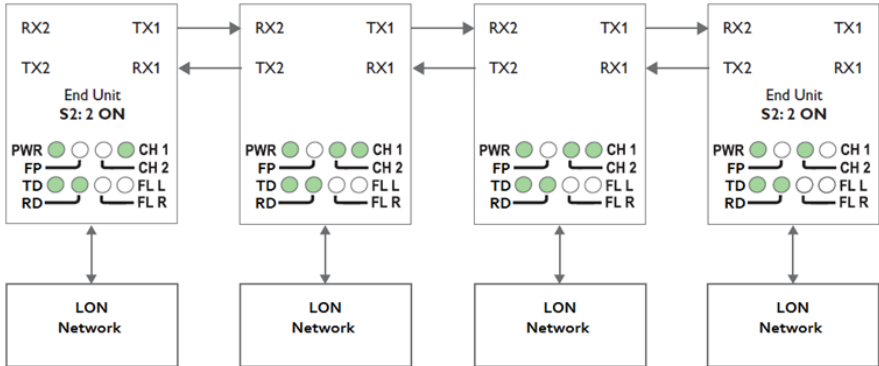
Prepare the fibre optical network

- 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.

Note: 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



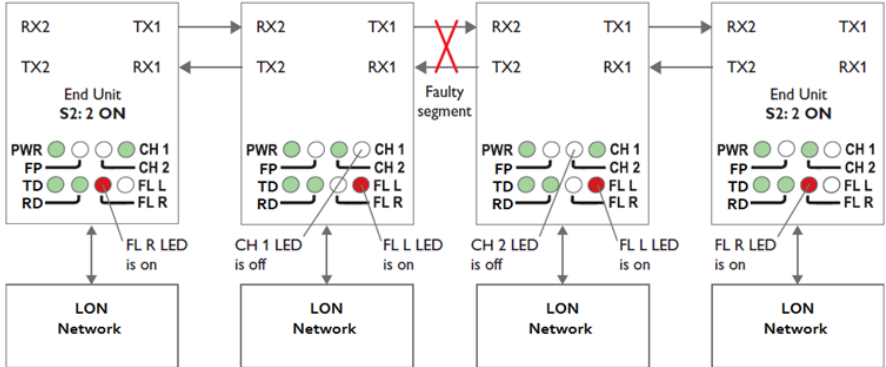
Prepare the fibre optical network

- 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.

Note: 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.

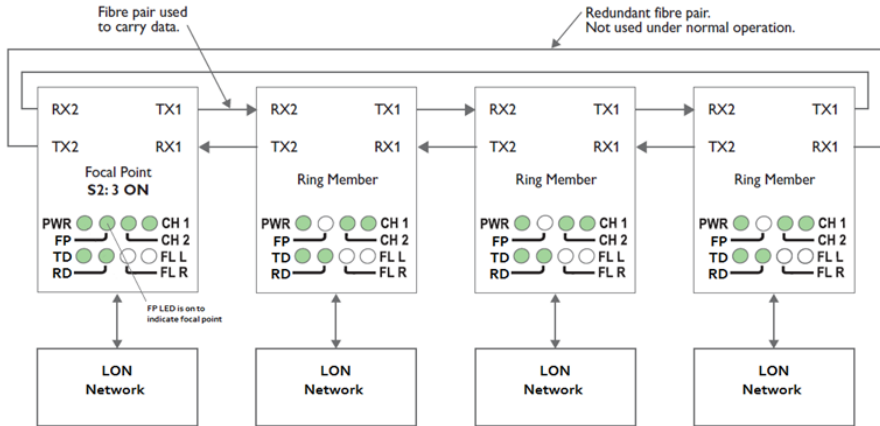
See page with “Calculating system delay” for more information on how to determine the overall system delay time.

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



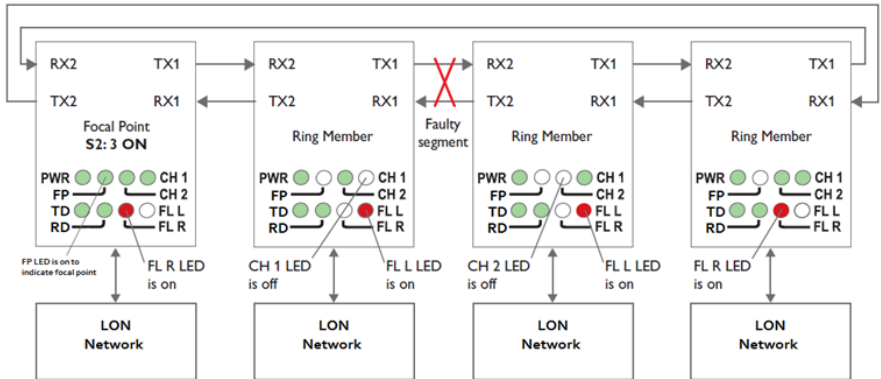
Prepare the fibre optical network

- 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.

Note: 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

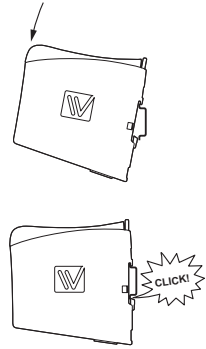
The status port connects to an internal solid state relay which may be used to trigger an external alarm if a fault condition occurs. During normal operation pins 1 and 2 are in contact with each other. During an optical link failure, or power failure, pins 1 and 2 are isolated from each other.

Optical link failures can be classified into 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 S1:1 to the ON position, the status port will only trigger when a local link failure has occurred.

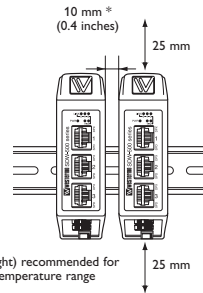
Mounting

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.



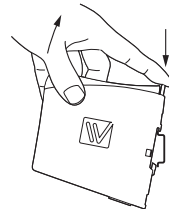
Cooling

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.





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