

**fiberplex**  
TECHNOLOGIES, LLC

**USER MANUAL**

**T1 Fiber Transceiver  
FOI-5401 / TD-5401**



## Warning for Your Protection

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1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this apparatus near water.
6. Clean only with a dry cloth.
7. Do not block any of the ventilation openings. Install in accordance with the manufacturer's instructions.
8. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
9. Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
10. Protect the power cord from being walked on or pinched, particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
11. Only use attachments/accessories specified by the manufacturer.
12. Use only with the cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
13. Unplug this apparatus during lightning storms or when unused for long periods of time.
14. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

The apparatus shall not be exposed to dripping or splashing. No objects filled with liquids, such as vases, shall be placed on the apparatus.

**"WARNING: To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture."**

## General Installation Instructions

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Please consider these general instructions in addition to any product-specific instructions in the "Installation" chapter of this manual.

### Unpacking

Check the equipment for any transport damage. If the unit is mechanically damaged, if liquids have been spilled or if objects have fallen into the unit, it must not be connected to the AC power outlet, or it must be immediately disconnected by unplugging the power cable. Repair must only be performed by trained personnel in accordance with the applicable regulations.

### Installation Site

Install the unit in a place where the following conditions are met:

- The temperature and the relative humidity of the operating environment must be within the specified limits during operation of the unit. Values specified are applicable to the air inlets of the unit.
- Condensation may not be present during operation. If the unit is installed in a location subject to large variations of ambient temperature (e.g. in an OB-van), appropriate precautions must be taken.
- Unobstructed airflow is essential for proper operation. Ventilation openings of the unit are a functional part of the design and must not be obstructed in any way during operation (e.g. - by objects placed upon them, placement of the unit on a soft surface, or improper installation of the unit within a rack or piece of furniture).
- The unit must not be unduly exposed to external heat sources (direct sunlight, spot lights).

### Ambient Temperature

Units and systems by FiberPlex are generally designed for an ambient temperature range (i.e. temperature of the incoming air) of 5 °C to 40 °C (41 °F to 104 °F). When rack mounting the units, the following facts must be considered:

- The permissible ambient temperature range for operation of the semiconductor components is 0 °C to +70 °C (32 °F to 158 °F) (commercial temperature range for operation).
- The airflow through the installation must allow exhaust air to remain cooler than 70 °C (158 °F) at all times.
- Average temperature increase of the cooling air shall be about 20 °C (68 °F), allowing for an additional maximum 10 °C increase at the hottest components.

If the cooling function of the installation must be monitored (e.g. for fan failure or illumination with spot lamps), the exhaust air temperature must be measured directly above the modules at several places within the enclosure.

### Grounding and Power Supply

Grounding of units with mains supply (Class I equipment) is performed via the protective earth (PE) conductor integrated in three-pin Phoenix™ connector. Units with battery operation (< 60 V, Class III equipment) must be earthed separately. Grounding the unit is one of the measures for protection against electrical shock hazard (dangerous body currents). Hazardous voltage may not only be caused by defective power supply insulation, but may also be introduced by the connected audio or control cables.

This equipment may require the use of a different line cord, attachment plug, or both, depending on the available power source at installation. If the attachment plug needs to be changed, refer servicing to qualified personnel.

# Warranty, Service and Terms and Conditions of Sale

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For information about Warranty or Service information, please see our published 'Terms and Conditions of Sale'. This document is available on [fiberplex.com](http://fiberplex.com) or can be obtained by requesting it from [clients@fiberplex.com](mailto:clients@fiberplex.com) or calling 301.604.0100.

## Disposal

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### Disposal of Packing Materials

The packing materials have been selected with environmental and disposal issues in mind. All packing material can be recycled. Recycling packing saves raw materials and reduces the volume of waste. If you need to dispose of the transport packing materials, recycling is encouraged.

### Disposal of Used Equipment

Used equipment contains valuable raw materials as well as substances that must be disposed of professionally. Please dispose of used equipment via an authorized specialist dealer or via the public waste disposal system, ensuring any material that can be recycled has been. Please take care that your used equipment cannot be abused. After having disconnected your used equipment from the mains supply, make sure that the mains connector and the mains cable are made useless.

## Disclaimer

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The information in this document has been carefully checked and is believed to be accurate at the time of publication. However, no liability is assumed by FiberPlex for inaccuracies, errors, or omissions, nor for loss or damage resulting either directly or indirectly from use of the information contained herein.

# Introduction

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When you need to realize the many benefits of fiber optic communication across a T1 connection, the FOI-5401/TD-5401 is a perfect drop-in solution. There is no need to reconfigure your devices; simply plug the device at each end of your T1 line into one of these modules, and enjoy a secure, stable, and electrically isolated connection.

## Key Features

- Data Rate: 1.544 Mbps(T1) - 2.048 (E1)
- Supports ISDN PRI (Primary Rate Interface) services, also known as PRA (Primary Rate Access)
- 23B+D data passes transparently

## Theory of Operation

The FOI-5401 provides complete electrical isolation for T1 communications. It is functionally similar to the obsolete FiberPlex product, the FOI-4544, the physical difference being that the electrical data connection is made through a RJ-45 connector instead of the DA-15 connector on the FOI-4544.

**The FOI-5401 is NOT backward compatible with the FOI-4544.**

The FOI unit can be used in areas of high electrical noise or in and out of RF shielded enclosures. The fiber optic cable is not susceptible to interference caused by impulse noise, crosstalk, or EMI. Privacy of communications is also enhanced because the fiber optic cable does not radiate any emissions.

In addition, fiber optic cable offers much longer transmission distances than copper wiring. Traditional T1 cabling is limited to a maximum distance of 6200ft (1.89km), but multimode optics on the unit can extend the distance to 2km, while singlemode optics can further extend the distance to 20km. A typical link consists of two FOI-5401 units, one at each end of the network, with a duplex fiber optic cable between them.

## Differences between FOI-5401 and TD-5401

Functionally, the FOI-5401 and TD-5401 are identical. The only differences are the packaging and power supply compatibility. The FOI-5401 is part of the FOI line of products designed for ruggedized military applications. It is housed in a RF-shielded can enclosure. For standalone applications it can be powered by adding a PSQ-4909 AC supply or a PSQ-4920 DC power supply (not included). Optionally, up to 8 FOI units can be mounted on CMA chassis adapters and installed in an RMC-3101 or RMC-2101 rack mount chassis, which provide redundant power to the units through a common backplane connection.

The TD-5401 is housed in the commercial 'Throw Down' packaging. This version is designed to be a workhorse unit in various commercial and industrial environments. It is powered either by a 9VDC wall adapter (included) or via bussed power supplied through an integrated three-pin Phoenix™ connector. Up to six TD-5401 units can be installed in the optional 1U TDR-01 rack shelf.

## Getting Started

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### Initial Inspection

Immediately upon receipt, inspect the shipping container for damage. The container should be retained until the shipment has been checked for completeness and the equipment has been checked mechanically and electrically. If the shipment is incomplete, if there is mechanical damage, or if the unit fails to operate notify FiberPlex and make the shipping materials available for the carrier's inspection.

## Front Indicators/Connections

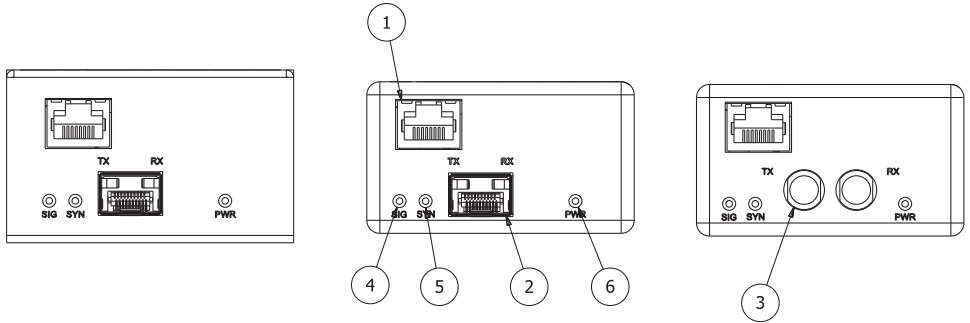


Figure 1 TD-5401 (left), FOI-5401 (middle), and FOI-5401 with ST connectors (Right) Front Face

- ① **RJ-45 Port** – Used to connect your copper T1 line to the TD/FOI-5401. This port accepts a standard RJ-45 male connector.

Pinout	
PIN	Signal
1	TIP
2	RING
3	-
4	TIP1
5	RING1
6	-
7	-
8	-

- ② **SFP Port** – An SFP optical transceiver module installed in this port when ordered with the LC optic option. A pair of fiber optic cables connects to these to link two TD/FOI-5401s.
- ③ **ST Optical Connectors** – ST optical connectors in place of the SFP port when ordered with the ST optic option.
- ④ **Signal** – LED which indicates the presence of a receive signal from the RJ-45 port.

Signal Indicator	
<b>Off</b>	No receive signal detected from RJ-45 port
<b>On</b>	Receive signal is present

- ⑤ **Sync** – LED which indicates the presence of a receive signal from the fiber optic line.

Power Indicator	
<b>Off</b>	No receive signal detected over fiber optic line
<b>Flashing</b>	Receive signal is present, but not frame-locked
<b>On (Solid)</b>	Receive signal is present and frame-locked

- ⑥ **Power** – LED which indicates the presence of DC power in the unit.

Power Indicator	
<b>Off</b>	No power from the external supply or internal fault
<b>On</b>	Power supply is operating properly

## Rear Indicators/Connections

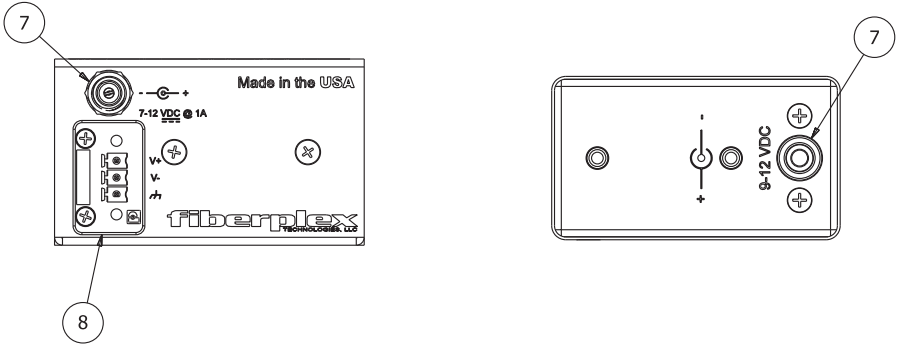


Figure 2 TD-5401 (left) and FOI-5401 (right) Rear Face

- 7 **Circular DC Power Connection** – DC power entry for the unit. On the FOI-5401 this is a Lemo connector designed to interface with either a PSQ power module or RMC chassis. On the TD-5401 this is a standard DC connection for use with the included DC wall power supply.
- 8 **Phoenix CD Power Connection** – Secondary power option for the TD-5401. This is wired in direct parallel with the Circular connector and has the addition of a positive earth chassis ground connection. This can be used to power the unit on a client supplied power buss.

## Power Requirements and Mounting

Flexible mounting allows the FOI-5401 to be chassis mounted or standalone configuration. Any combination of 8 FiberPlex FOI units can be mounted in a RMC-3101 using CMA-3002 chassis mount adapters. The RMC-3101 can accommodate hot swapped redundant power. Alternately, the FOI-5401 can be used in a standalone application when paired with a PSQ-4909 for full range AC operation or the PSQ-4920 for 12-48VDC operation.

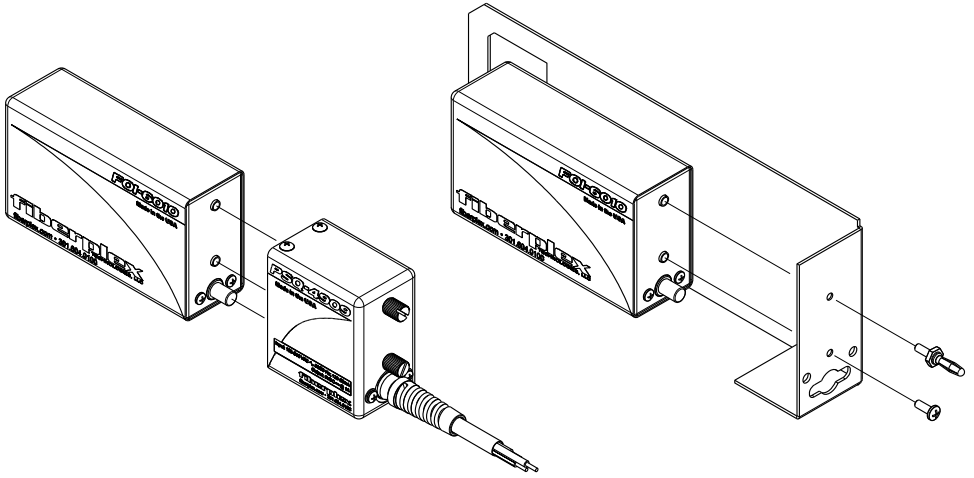


Figure 3 FOI Unit with PSQ-4909 (left) and with CMA-3002 (right)

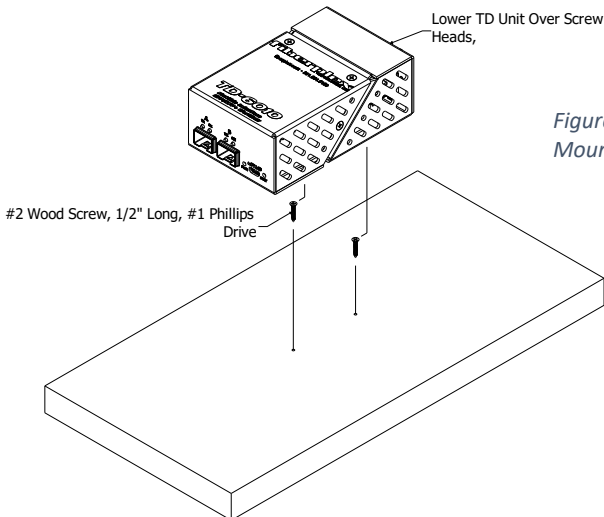
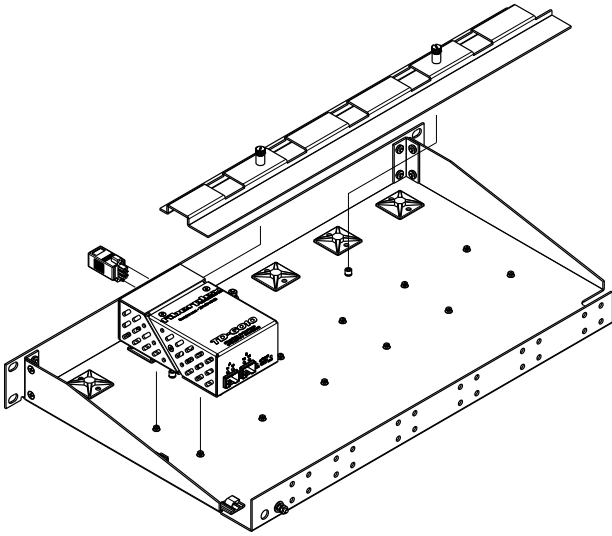
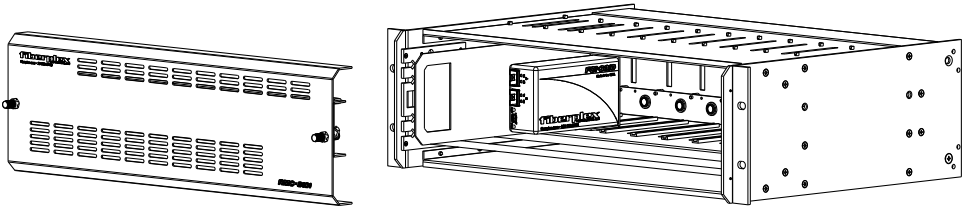


Figure 4 Installing a TD Module Using Mounting Slots





*Figure 5 TD Module Installation on a TDR-01 Tray*



*Figure 6 FOI unit Installed in an RMC-3101 Chassis*

## Inserting and Removing SFP Modules



### Handling Warnings

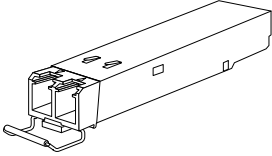
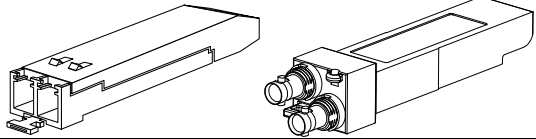
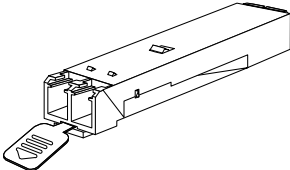
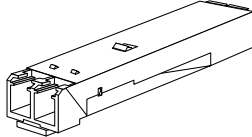
SFP Modules are static sensitive. To prevent damage from electrostatic discharge (ESD), it is recommended to attach an ESD preventative wrist strap to your wrist and to a bare metal surface when you install or remove an SFP Module.

Disconnect all optical or copper cables from SFP Modules prior to installing or removing the SFP Module. Failure to do so could result in damage to the cable, cable connector or the SFP Module itself. Removing and inserting an SFP Module can shorten its useful life, so you should not remove and insert SFP Modules any more often than is absolutely necessary.

Protect optical SFP modules by inserting clean dust covers into them after the cables are removed. Be sure to clean the optic surfaces of the fiber cables before you plug them back into the optical ports of another SFP module. Avoid getting dust and other contaminants into the optical ports of your SFP modules, because the optics will not work correctly when obstructed with dust.

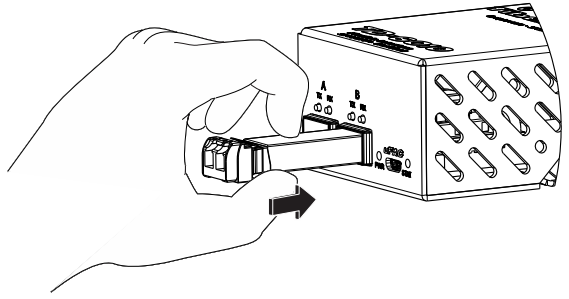
### Identify the Latch Type of the SFP Module

SFP Modules have various latching mechanisms to secure them into the SFP Cage of a device. FiberPlex fiber optic products can support a host of manufacturers and brands of SFP Modules, so the user may encounter any number of different latches. Some of these are described below.

<p><b>Bail Clasp</b></p> <p>The bail clasp SFP module has a clasp that you use to remove or install the SFP module.</p> 	<p><b>Actuator Button</b></p> <p>The actuator button SFP module includes a button that you push in order to remove the SFP module from a port. This button can either lift 'Up' or press 'In' to release the SFP Module depending on the manufacturer.</p> 
<p><b>Mylar Tab</b></p> <p>The Mylar tab SFP module has a tab that you pull to remove the module from a port.</p> 	<p><b>Slide Tab</b></p> <p>The slide tab SFP module has a tab underneath the front of the SFP module that you use to disengage the module from a port.</p> 

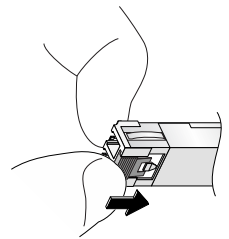
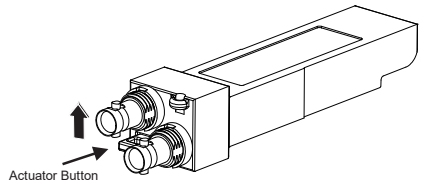
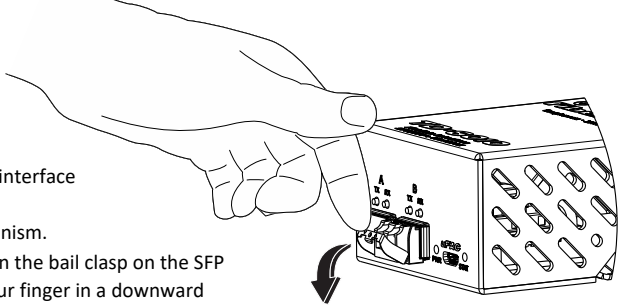
## Inserting a SFP Module

- 1) Attach an ESD-preventative wrist or ankle strap, following its instructions for use.
- 2) Disconnect and remove all interface cables from SFP Module.
- 3) If the SFP Module has a Bail Clasp, close the Bail Clasp before inserting the SFP Module.
- 4) With the gold finger connector on the bottom and the label on the top, line up the SFP Module with the empty cage and slide it in making sure that it is completely inserted and seated in the cage.

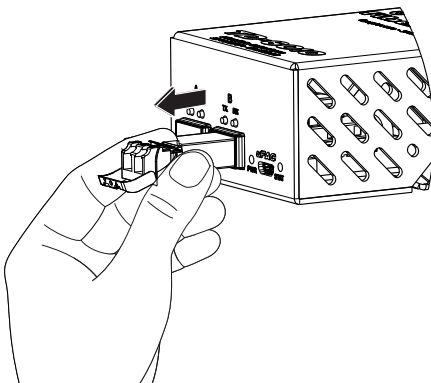


## Removing a SFP Module

- 1) Attach an ESD-preventative wrist or ankle strap, following its instructions for use.
- 2) Disconnect and remove all interface cables from SFP Module.
- 3) Release the latching mechanism.
  - Bail Clasp – Open the bail clasp on the SFP Module with your finger in a downward direction.
  - Actuator Button – Gently press the actuator up (or in) while pulling the body of the SFP Module to release the SFP Module from the cage.
  - Mylar Tab – Pull the tab gently in a straight outward motion until it disengages from the port. Make sure the tab is not twisted when pulling as it may become disconnected from the SFP Module.
  - Slide Tab - With your thumb, push the slide tab on the bottom front of the SFP module in the direction of the line card port. If you pull on the SFP module without disengaging the tab, you can damage the SFP module.



- 4) Grasp the SFP Module between your thumb and index finger and carefully remove it from the port
- 5) Place the SFP Module on an antistatic mat, or immediately place it in a static shielding bag or container



# Specifications

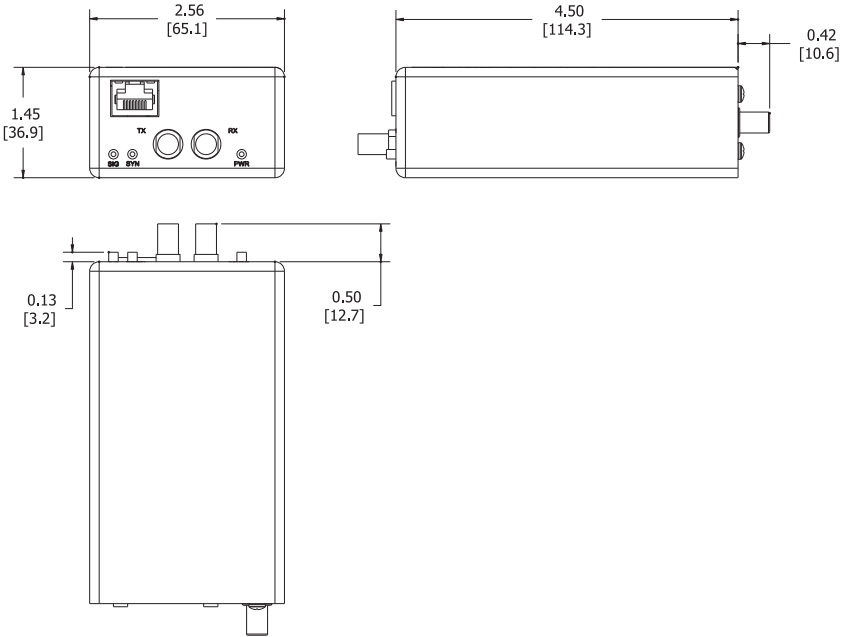


Figure 7 FOI-5401 Dimensions

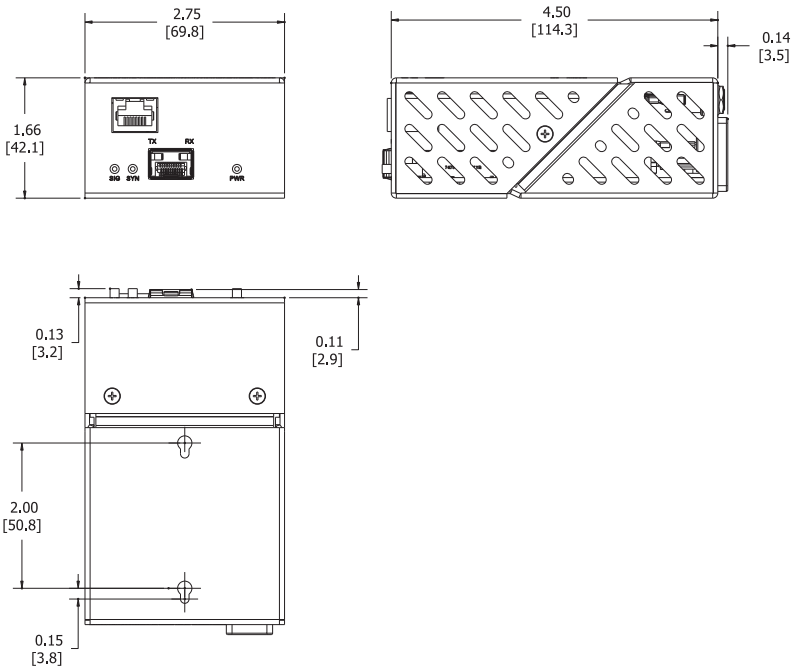


Figure 8 TD-5401 Dimensions

ELECTRICAL SPECIFICATIONS					
		Min	Typ	Max	Unit
Power Requirement	Voltage Range	7	9	32	VDC
	Supply Current	-	600	-	mA
T1 Interface	Data Rate	0.75	1.544	2.048	Mbps
	Line Encoding	AMI (Alternate Mark Inversion) / B8ZS (Binary 8 Zero Substitution)			
	Interface Connector	RJ-45			
Environmental	Storage Temperature	-40	-	85	°C
	Operating Temperature	0	-	50	°C

OPTICAL SPECIFICATIONS							
Order Suffix	Connector	Fiber Type	$\lambda$ (nm)	Transmitter Power (dBm)		Receiver Sensitivity (dBm)	Max Distance
				Min	Max		
L22	LC/PC	Multimode	1310	-15	-8	-24	2 km
T22	ST			-12	-6	-26	2 km
L5B	LC/PC	Singlemode	1310	-9	-3	-25	20 km
T5B	ST			-12	-6	-23	20 km
C	SFP Cage with no Optical Module Installed						
External SFP Interface				Min	Typ	Max	Unit
Data Rate				-	270	-	Mbps
Recommended Jitter				-	-	40	Psec
Operating Voltage				3.2	3.3	3.4	VDC
Maximum Current				-	-	500	mA
Optical Modules		SFP MSA (SFF-8431, SFF-8432, SFF-8433) compliant slot, data rate 266 – 1.25 Gbps					

PHYSICAL SPECIFICATIONS				
Case Dimensions	Length	Width	Height	Weight
FOI-5401 (Size 4)	4.5 in (114 mm)	1.453 in (37 mm)	2.56 in (65 mm)	2 lb (0.9 kg)
TD-5401	4.5 in (114 mm)	2.75 in (70 mm)	1.66 in (42 mm)	0.4 lb (0.2 kg)

## Other Considerations

### SFP MSA Compliance

The SFP Multi-Source Agreement (MSA) is an agreement that was drafted among competing manufacturers of SFP optical modules. The SFF Committee was formed to oversee the creation and maintenance of these agreements including the SFP MSA designated as INF-8074i. This agreement describes a mutually agreed upon standard for the form and function of SFP modules. However, not all SFPs produced are MSA compliant. The MSA provides for a transceiver (TX/RX) pinout. Other industries such as broadcast had the need for dual TX and dual RX SFP for unidirectional applications such as video. Naturally, a non-MSA standard was introduced allocating pinout assignments for dual output and dual input I/O configurations. In addition, the some of the internal serial communication pins were reassigned.

**The FOI/TD-5401 will only accept MSA compliant SFP Modules.**

## NOTES

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18040-412 Guilford Rd. • Annapolis Junction, MD 20701  
fiberplex.com • [clients@fiberplex.com](mailto:clients@fiberplex.com) • 301.604.0100