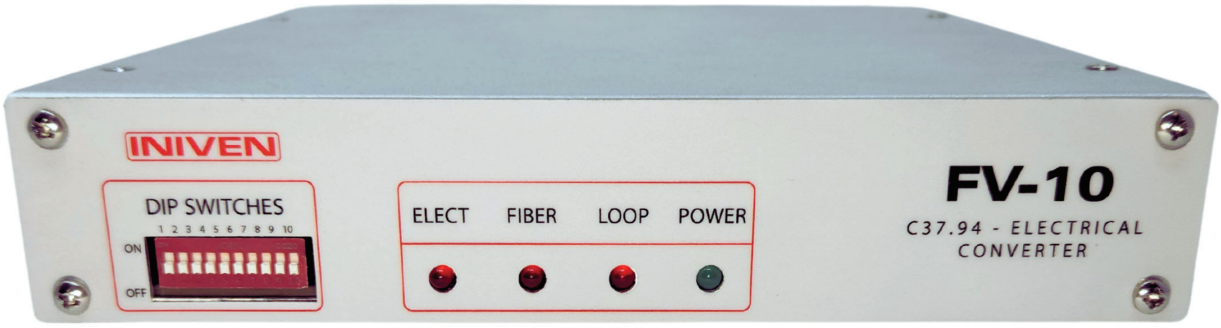
FV-10

C37.94 - ELECTRICAL CONVERTER

- Convert Serial to Fiber
- Supports V.35 and other Interfaces
- IEEE C37.94 Compliant
- Electrical and Fiber Loop Back
- Singlemode or Multimode Available
- Upgrade Existing Protection Channels



INTRODUCTION

The FV-10 is a fiber optic to serial electric protocol converter. It can be used to seamlessly connect legacy electrical protocols to IEEE Std C37.94 fiber optic interface.

This robust solution addresses the critical need for reliable and transparent data exchange between modern protective relay systems and legacy equipment in power utilities and industrial control environments. It is ideal for converting older serial interfaces, such as V.35, RS-449, and RS-530, to C37.94 compliant fiber optic interfaces. The FV-10 extends the life of existing equipment while enabling integration with next-generation protection and control systems.

The FV-10 is designed to work with an external clock source, as per the IEEE C37.94 Std. 850nm multimode LED TX/RX fiber optic heads are standard, and are commonly used for C37.94 communications. Optional 1310nm singlemode LED heads are available for longer direct fiber paths, and C37.94 applications requiring singlemode fiber. The optional 1550nm singlemode LASER option is intended for longer communication applications.

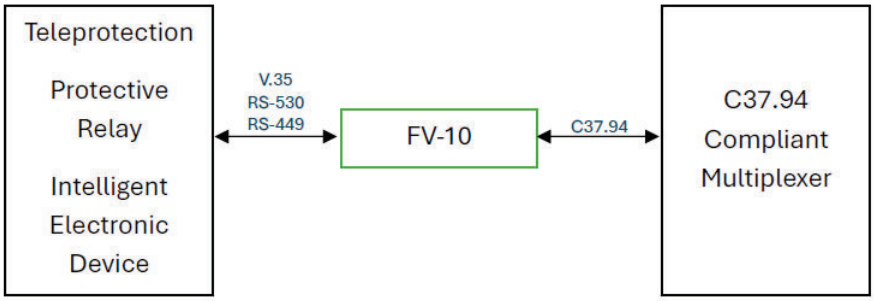
The FV-10 has limited programmability. It has been designed as a plug-and-play system. Programming is performed via DIP switches on the front panel. Communications are transparent, regardless of the brand of communications equipment interfacing with the FV-10.

Port monitoring of both the electrical and fiber signals is standard. Status alarms are indicated using LED's on the front panel and relays for remote monitoring. The FV-10 can loop back either the electrical or fiber ports for circuit testing.

The FV-10 comes standard with a 24 - 125 VDC wide range power supply. A 250 VDC power supply is available as an option.

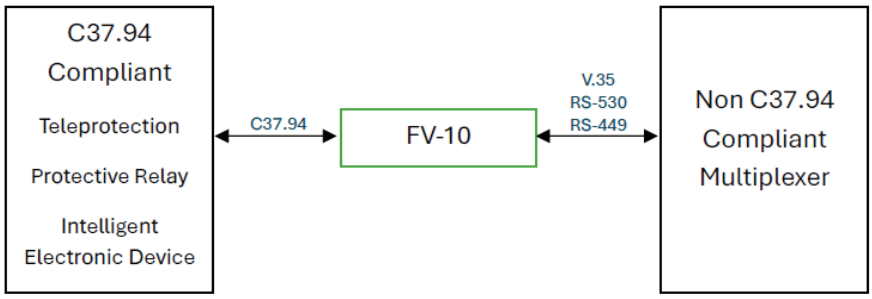
APPLICATIONS

The FV-10 may be used in many applications that require converting an Intelligent Electronic Device (IED) or multiplexer that does not support C37.94 to the common fiber standard. Fiber optic communications aids when the equipment being connected together are located farther apart. Fiber optic cable also eliminates environmental issues that may effect metal cables, such as RFI and grounding issues.



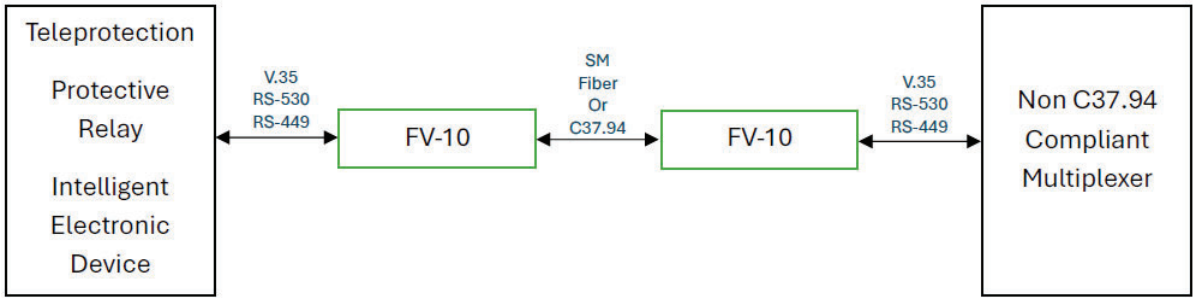
ELECTRICAL TO C37.94 CONVERSION

When connecting a device to a multiplexer that does not support C37.94, the FV-10 can be used to interace a C37.94 compliant IED to an electrical interface of the multiplexer. When the Source clock is connected to the electrical interface of the FV-10, DIP Switch 1 needs to be set to the Off position. When the Source clock is connected to the C37.94 interface, DIP Switch 1 needs to be in the On position.



C37.94 TO ELECTRICAL CONVERSION

When connecting two devices such as a protective relay and a multiplexer that are not equipped with C37.94 interfaces, the FV-10 can be utilized to create a fiber connection using multimode fiber up to 2 KM or singlemode fiber up to 100 KM.



FIBER OPTIC CONNECTION FOR NON-COMPLIANT DEVICES

PROGRAMMING AND CONNECTIONS

PROGRAMMING

The FV-10 is programmed using the a 10 position DIP switch located on the front panel.

Switches are On when in the up position and are Off in the down position.

Switch programming is as follows:

- Switch 1
  - OFF: Source clock is connected to the Electrical port of the FV-10.
  - ON: Source clock is connected to the C37.94 port of the FV-10.
- Switch 2
  - OFF: Electrical synchronous channel set to falling edge of the clocking signal.
  - ON: Electrical synchronous channel set to rising edge of the clocking signal.
- Switch 3
  - OFF: Fiber channel data set to Normal
  - ON: Fiber channel data inverted.
- Switch 9
  - OFF: Normal fiber optic routing
  - ON: Fiber optic circuit set to loop back.
- Switch 10
  - OFF: Normal electrical routing.
  - ON: Electrical circuit set to loop back.

The other switches are not used at this time, and are reserved for future use.

JUMPERS

Four jumpers that are used to set the control signals from the DCE for the V.35 Com port. The jumpers can be set to Logic, DSR, CTS, or DCD. When set to Logic, the port outputs a constant logic 1 (on), on the DTR or RTS output. When the jumper is set to DSR, CTS, or DCD, the DTR or RTS outputs will mimic the input from the selected pin. A jumper can be used to select the ground of the DCE. When the shunt is placed across the CGND pins, connector ground is selected. When SGND is selected, signal ground is used.

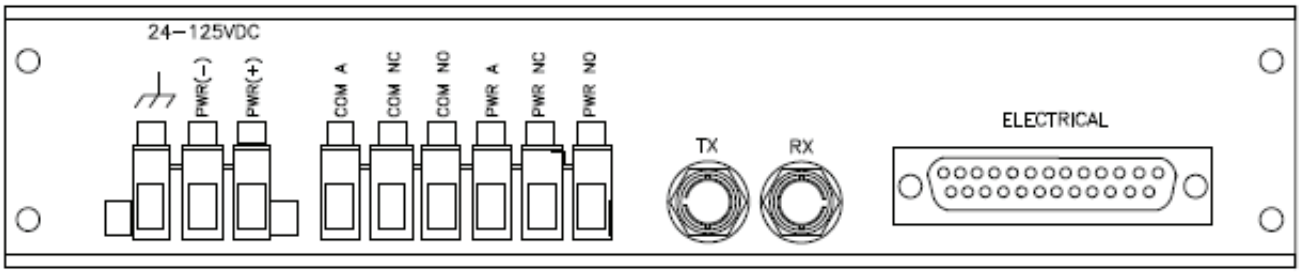
INPUTS AND OUTPUTS

The rear panel contains all the I/O connections. Communication interfaces consist of a 25 pin D-sub RS-530 connector and two ST fiber optic connectors. There is one transmit and one receive 850nm multimode head. A singlemode 1310nm LED or 1550nm LASER is available as an option. Both the LED interfaces may be used for C37.94 communications. LASER fiber optic heads are not included as an option in the IEEE C37.94 Standard, but will operate correctly if two matching LASER FV-10s are connected to each other. LASER heads will also work when an FV-10 is connected to an Iniven PDR-2000 or other Iniven product that supports the C37.94 protocol and is equipped with singlemode heads, regardless of whether the other Iniven product's heads are LASER or LED.

Two sets of removable terminal blocks, for wiring power and alarms, are located on the rear of the chassis. Each connection is labeled as indicated in the figured labled Chassis, Rear.

The FV-10 uses a wide range power supply capable of operating, between 24 and 125 VDC. A 250 VDC option is available. One of the two terminal blocks are dedicated for DC connections.

The second terminal block is used to connect the two, dry contact, Form C relay alarms. The alarms are for communication fail on any of the communication channels, electrical and/or fiber, and power fail. Each alarm has 3 connections: normally open (NO), normally closed (NC), and armature (A). This allows the user to select which type of output they would prefer, without the need to perform any programming or jumper settings. Simply connect the armature and your choice of NO or NC. The alarm relays do not have polarity, and accept voltages up to 125VDC.

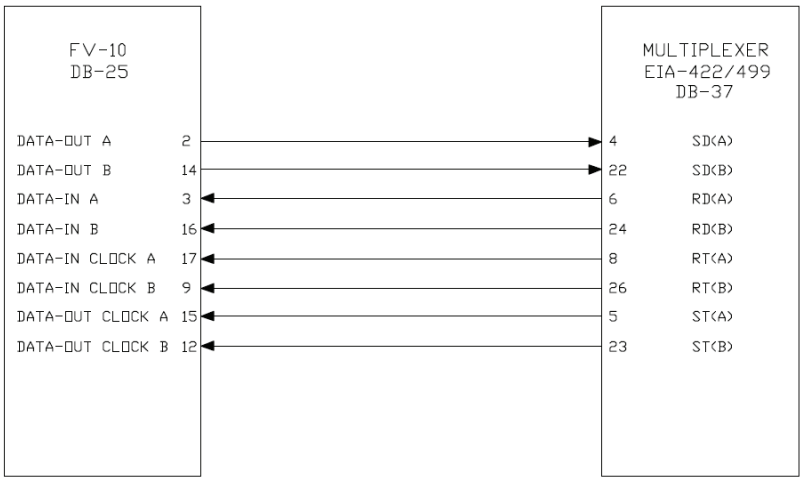


CHASSIS, REAR

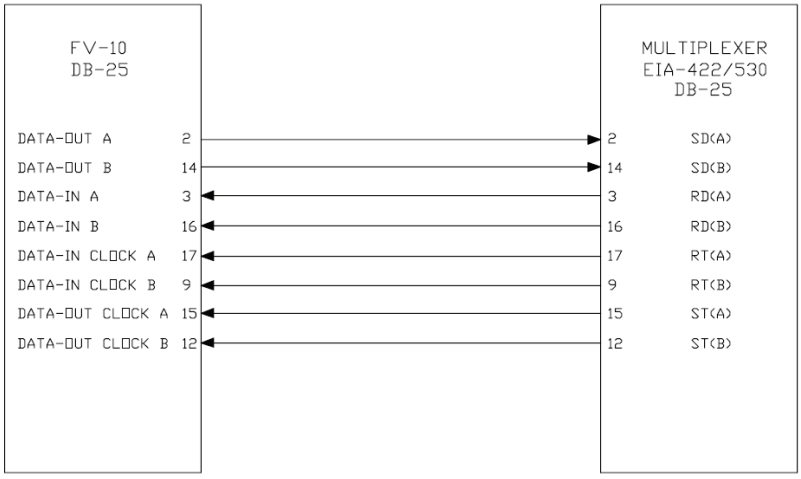
CABLING

The DB-25 electrical connector on the FV-10 may be used to connect to devices with RS-422, RS-449, RS-530, and V.35 interfaces. The FV-10 connector does not need to change. The cabling between the IED or multiplexer changes according to the application.

Below are the most common cable pin outs:



FV-10 (DTE) TO EIA-422 / EIA-449



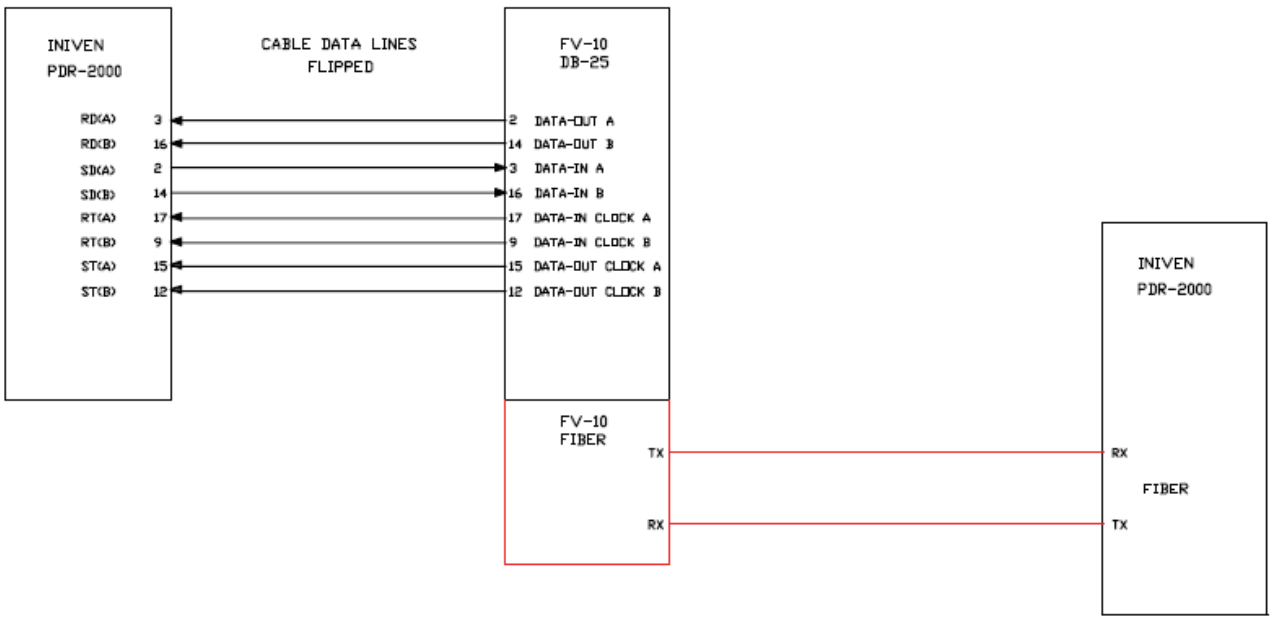
FV-10 (DTE) TO EIA-422 / EIA-530 V.35

DIRECT FIBER BETWEEN INIVEN PRODUCTS

A direct fiber connection is relevant if there is no multiplexer or similar device to act as the clock source. If one of the IEDs being connected has the ability to clock the circuit, they can be connected using an FV-10. This type of connection will typically be made using singlemode 1310 or 1550 nm LASER or LED fiber. The Iniven PDR-2000 teleprotection terminal has the option of acting as a source clock when equipped with fiber optic communication interfaces. Other Iniven products also have this feature. Additional manufacturers' equipment may also have this ability and will work with the FV-10 in a circuit without a multiplexer. Please check with the manufacturer to determine a particular equipment's clocking abilities.

For this type of application, DIP switch 1 will need to be in the On position. This will allow the clocking to come from the fiber optic device.

Below is an example of two Iniven PDR-2000 teleprotection units being connected by direct fiber with one PDR-2000 using a V.35 interface.



FV-10 V.35 TO PDR-2000 SINGLEMODE FIBER

ALARMS AND INDICATORS

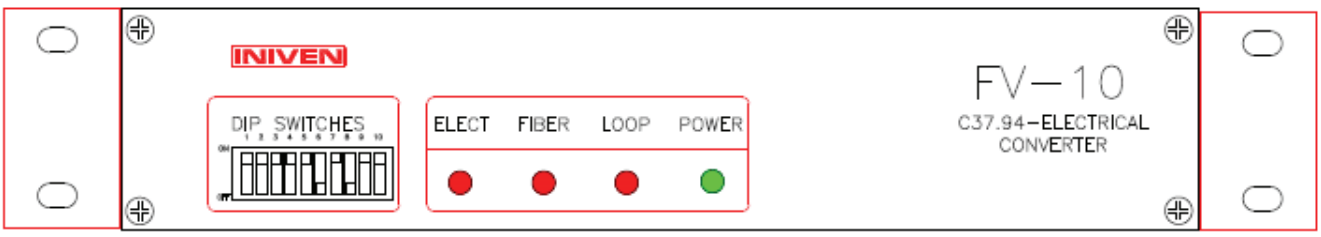
The FV-10 has two status relay alarms: Power Fail and Com Fail. Each alarm relay is a Form C relay and may be used as NO or NC.

Power Fail is used to indicate that the unit's power supply can no longer operate within acceptable parameters. In the case of a power failure, all status relays will return to their "normal" position and the green Power LED on the front panel will turn off. When power is being supplied to the unit, the green Power LED will remain illuminated.

Com Fail is a common alarm shared by the, electrical and fiber interfaces. If either of the communication channels were to stop communicating, the Com Fail relay will go to its "normal" state. This alarm will also return to normal if there is a power failure.

The FV-10 is equipped with C37.94 Yellow alarm capability. A yellow alarm is a far-end alarm. The FV-10 will transmit a yellow alarm bit on the C37.94 signal when the FV-10 has a loss of signal on its C37.94 receiver. The FV-10 will output a yellow alarm indication when its receiver does not have loss of signal and it receives a yellow alarm bit on the C37.94 signal. The yellow alarm is for C37.94 signals only. Electrical and point-to-point signals do not support Yellow alarm.

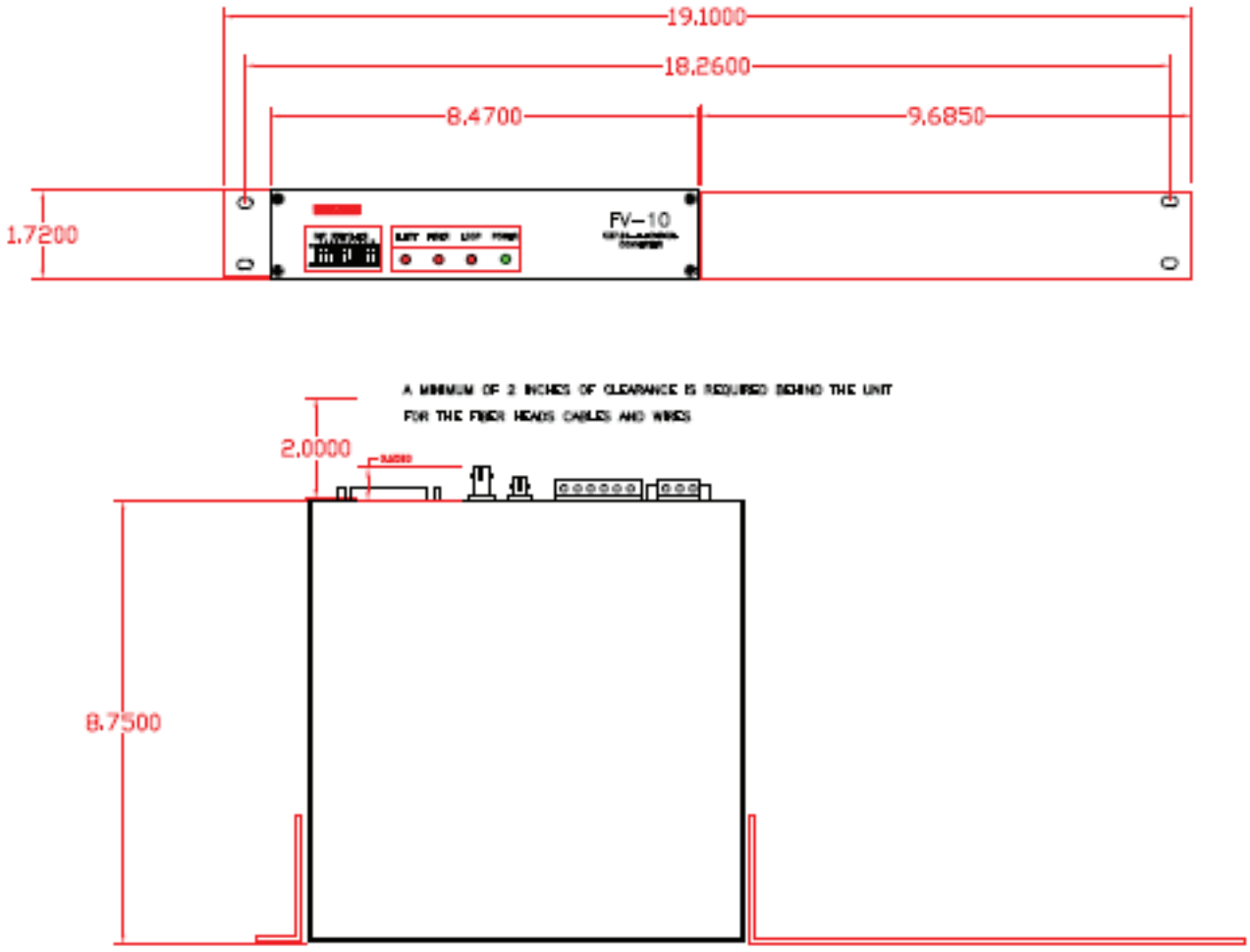
The front panel contains four communication status LEDs: ELEC, FIBER, LOOP, and POWER. A red ELEC LED indicates a loss of communications on the electrical port. A red FIBER LED indicates a loss of communications on the fiber circuit. A blinking red FIBER LED indicates a C37.94 yellow alarm. A red LOOP LED means that either the electrical or fiber ports have been placed in loop back. The associated LED, ELEC or FIBER will blink when LOOP is illuminated indicating which circuit is in loop back. A green POWER LED indicates the power supply is operating normally.



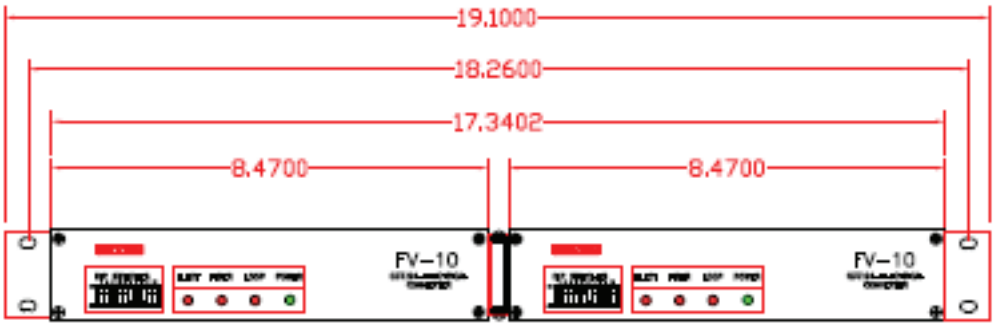
FRONT PANEL INDICATORS

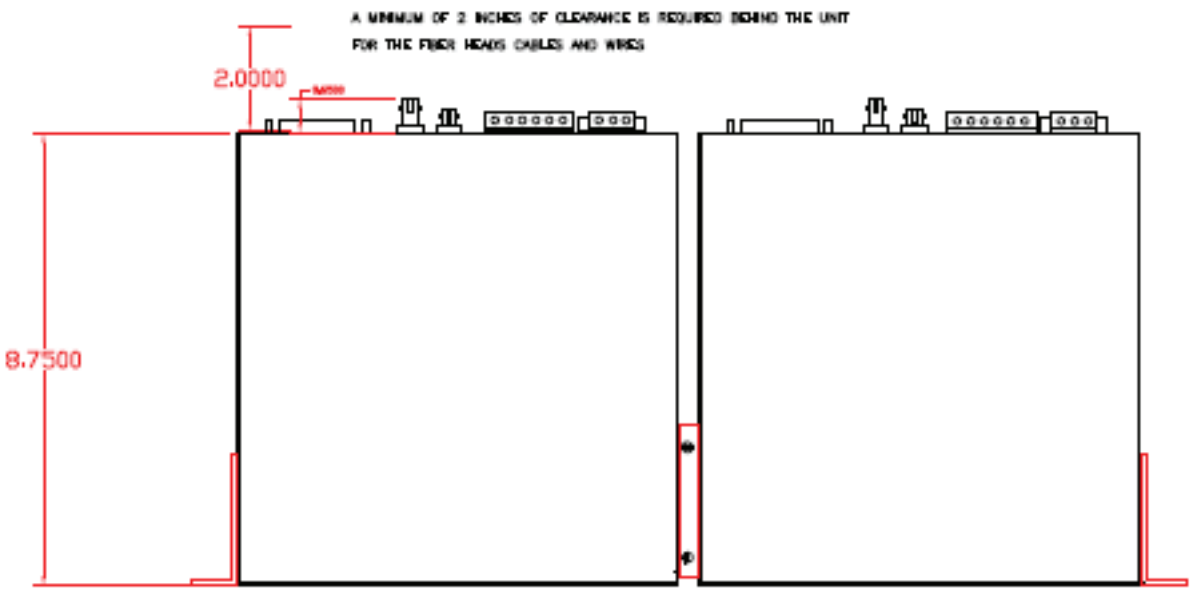
CHASSIS

A single FV-10 aluminum enclosure is 1U tall and half the width of a standard 19”rack. It can be mounted alone in a 19” rack, using an extended bracket, side by side with standard brackets, or the unit can be shelf mounted. An FV-10 can be mounted side by side with another FV-10, a CT-100, or AC-20 in a single 1U 19” rack.



19” RACK MOUNTING DIMENSIONS, SINGLE UNIT





19" RACK MOUNTING DIMENSIONS, DUAL UNITS

SPECIFICATIONS

Power Supply	24-125 VDC or 250 VDC Current Draw Max, 195 ma @ 24 VDC
Optical	ST, 850 nm LED, 1310 nm LED, 1550 nm LASER
Electrical Interface	RS-422 RS-449 RS-530 V.35
Relays	Form C, 1 Amp max contact rating 24, 48, or 125 VDC Optional: 250 VDC @ 0.5 A
Alarms	Power Fail Communication Fail (Electrical and/or Fiber)
Environmental	DC Rated Control Power Inputs Interface Dielectric Strength Impulse Voltage Surge Withstand Capability (SWC) Radio Frequency Susceptibility (RF) Electrostatic Discharge (ESD) Vibration and Shock IEEE Standard 1613-2003 Class 2 95% relative humidity, non-condensing
Chassis Dimensions	Dimension: Height: 1.72 inches (43.69 mm) Width 8.5 inches (215.9 mm) Depth 9.5 inches (241.3 mm) Weight: 2.5 pounds (1.1 kg)


12
YEAR WARRANTY