RFL Fiber Service Units

T1/E1 and C37.94

T1/E1 FSU

C37.94 FSU

RFL offers two types Fiber Service Units (FSU) for substation or industrial applications, this includes one for protective relaying that complies to the IEEE C37.94 standard and another for T1/E1 applications.The C37.94 units offer a multitude of electrical interfaces for diverse applications (X.21, V.35, RS-449, G.703 and E1) and are also available with non-standard single mode fiber options. The T1/E1 units can be used with multi-mode and single mode fiber over varying distances and are also compatible with the optics on IMUX 2000 multiplexers. Both standard units are designed for wall mounting, however, rack mount options are available for both FSU's with 1RU (1.75") and 3RU (5.25") 19" rack mount chassis.

Benefits and Features:

T1/E1 FSU

- Low cost fiber solution for T1/E1 fiber extension or point-to-point long haul applications
- T1 or E1 all in the same package
- Wide range of LED and LASER optics for multimode and singlemode with distance up to 90Km (55.9 miles)
- Wide range power supply (38-150Vdc)
- Rugged, easy-to-mount enclosure for flexibility of installation
- Designed for harsh environments such as substations of exterior equipment buildings
- Rack mount options available (3U x 19")

C37.94 Short Haul FSU

- Compliant to IEEE C37.94 Fiber Standard
- Low cost solution to interface compliant teleprotection equipment to existing noncompliant digital communication equipment
- Wide range power supply (38-150Vdc)
- Rugged, easy-to-mount enclosure for flexibility of installation
- Available with five digital interfaces; RS-449, G.703, V.35, X.21 and E1
- SM Fiber options are available
- Rack mount options available (1U or 3U x 19")

Description:

T1/E1 FSU

The RFL T1/E1 Fiber Service Unit (FSU) offers economical fiber extensions for the IMUX 2000/4000 family of products, along with the ability to add fiber connectivity to other manufacturer's multiplexers.

The RFL T1/E1 FSU is a DC powered, environmentally hardened T1/E1 FSU that can be electrically interfaced to a SONET or SDH multiplexer to extend via fiber the communication signal to a IMUX 2000 T1 or E1 multiplexer. Additionally, by using two of the FSUs end-to-end, this product can provide an interface between a T1 or E1 multiplexer with compliant electrical T1 or E1 interfaces.

The RFL T1/E1 FSU is easy to set up and configure and offers switch selectable T1 (ANSI T1.104) or E1 (ITU G.703/704) operation. Line coding is also switch selectable for T1 (AMI or B8ZS) and E1 (AMI or HDB3). The fiber optic modules utilize an efficient and economical Code Mark Inversion (CMI) light modulation scheme.

For commissioning and maintenance, the RFL T1/E1 FSU supports digital and optical loopbacks along with the internal or loop timing modules. The unit also has the ability to transmit "All Ones" pattern and offers a Variable Line Build Out (LBO) to make the unit easy to apply and monitor.

The front interface panel (Figure 1) offers a DB-15 connector for the T1 and E1 (120 Ohm) interface. BNC coax connectors are provided for the E1 75 Ohm connections. The RFL T1/E1 FSU can be configured with 1300nm multimode or singlemode LED emitters or 1300nm and 1550nm LASER singlemode emitters. Depending on the fiber emitters used, T1 or E1 signals can be transmitted up to a maximum of 90 km (55.9 miles) based on typical loss calculations. All fiber options feature automatic gain adjust so the receiver cannot be saturated, meaning no attenuators are required.

C37.94 Short Haul FSU

The RFL C37.94 Short Haul Fiber Interface allows IEEE compliant teleprotection devices to be interfaced to noncompliant multiplexers, channel banks, or leased digital services.

The RFL C37.94 Short Haul Fiber Interface is designed to interface IEEE DS compliant teleprotection devices such as protective relays, protection signaling, status and control, and other devices found in the high voltage substation environment to a multiplexer that does not support the standard.

The RFL unit converts the optical signal into an electrical signal that will be accepted by the multiplexer. The digital output to the Fiber Optic Service Unit is connected to the communications equipment by a short electrical cable as shown in Figure 2. The unit is available with RS449, G.703, V.35, X.21 and E1 interfaces.

The C37.94 standard defines a point-to-point optical link for synchronous data between a multiplexer and a teleprotec-tion device. This data is typically 64kb/s but the standard provides for speeds up to 768kb/s or (12 x 64 kb/s). The clocking is generated by the multiplexer and is recovered and reused by the teleprotection. A fixed framing pattern and some variable overhead bits are provided in the frame structure. The data is of alternating polarity to ensure clock edges regardless of the ones density. The gross bit rate is 2.048 Mb/x and the frame complies with G.704 (E1) rules.

Technical Specifications:

T1/E1 FSU

Electrical & Environmental

Operating Temperature	-20 C to +55 C
Operating Humidity	90% RH Non-Condensing @ 40 CSupply Voltage
38-150Vdc	
Power Consumption	Less than 5W
ESD Withstand	ANSI C.37.90.3
RFI Withstand	ANSI C.37.90.2
SWC Withstand	ANSI C.37.90.1
Dielectric Withstand	2500 VDC (Power and Alarm Inputs)

Regulatory Requirements

MTBF	
Bellcore TR332 Issue 5, Method 1 Case 3, Temp = 25 C	>1,000,000 Hours

Alarms

Alarm Relay Output Form	“C” (SPDT)
Alarm Relay Open Circuit Voltage	300 VDC
Alarm Relay Current (Continuous)	1 Amp
Alarm Relay Breaking Current	1 Amp, Non-inductive

T1 Interface

Electrical Specification	ANSI T1.104
Frame Format	ANSI T1.104
Line Coding	AMI/B8ZS (Jumper/Switch selectable)
Signaling	Transparent to product
Interface Impedance	120 Ohm Twisted pair
Connector	D-Subminiature 15 position male connector
Multiframe Format	ESF or SF

E1 Interface

Electrical Specification	ITU G.703
Frame Format	ITU G.704
Line Coding	AMI/HDB3 (Jumper/Switch selectable)
Interface Impedance	120 Ohm Twisted Pair or 75 Ohm Coax (selectable)
Connector	D-Subminiature 15 position male connector and 2 BNC coax connectors.

C37.94 Short Haul FSU

Electrical & Environmental

Operating Temperature	-30 C to +60 C
Operating Humidity	95% RH Non-Condensing @ 40C
Supply Voltage	38-150Vdc
Power Consumption	Less than 5W
ESD Withstand	ANSI C.37.90.3
RFI Withstand	ANSI C.37.90.2
SWC Withstand	ANSI C.37.90.1
Dielectric Withstand	C37.90

Regulatory Requirements

Bellcore TR332 Issue 5, Method 1 Case 3, Temp = 25 C	>1,000,000 Hours
Wavelength and Emitter Type	820/850nm LED (Short Haul)
Fiber Type	50 or 62.5 Micron Multimode
Optical Budget	62.5 Micron Core: 13db
Digital Connectors	RS-449, 64kbps, DB37 Male Connector V.35, 64Kbps, DB15 yG.703, 64-768Kbps, DB15 Male Connector E1 120/75Ohm Connector and DB15 Male Connector
Optical Connector Type	ST

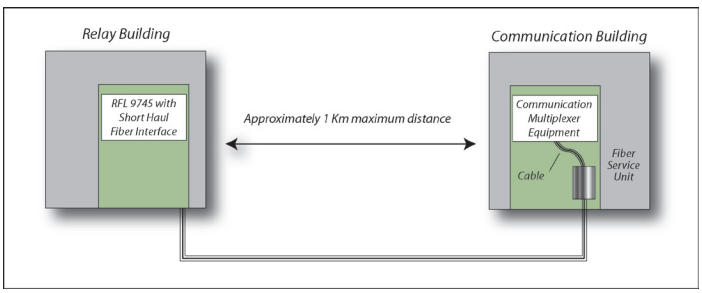

Figure 2. Typical IEEE Compliant Teleprotection Device with RFL Fiber Service Unit

Mounting:

T1/E1 FSU & C37.94 Short Haul FSU

FSU	A	B
C37.94	7.34" in. (18.54	8.51" in. (21.61
T1/E1	9.75" in. (24.76	11.14" in. (28.3 CM)

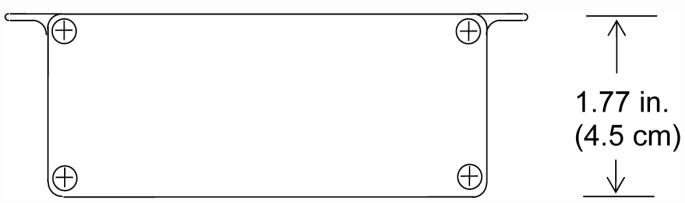

Figure 3. Fiber service unit front view

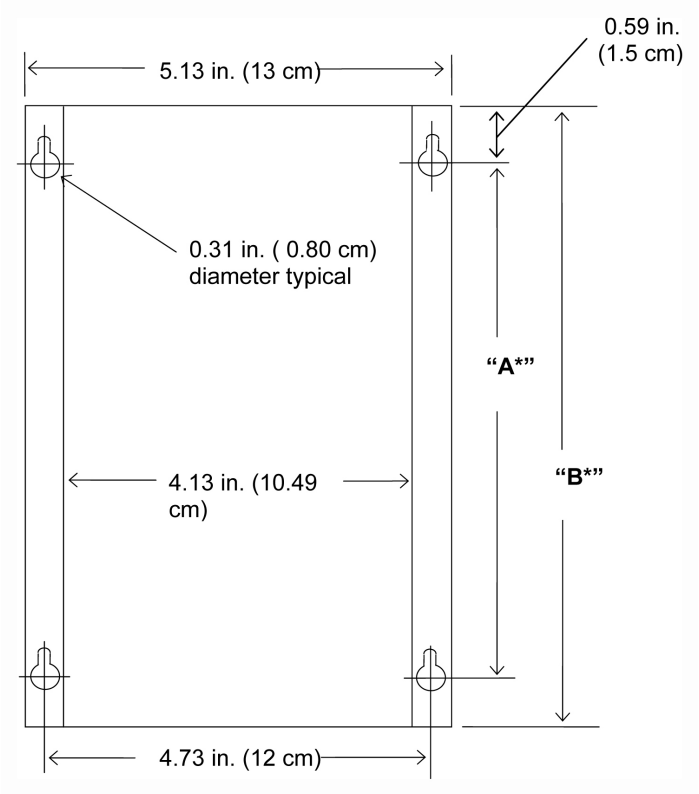

Figure 4. Fiber service unit top view

Ordering Information:

T1/E1 FSU

Source	Wavelength	Fiber	System Gain	Typical Distance
LED #107600-300	1300 nm	MM	25db	19.5 Km / 12.1 Miles
LED #107600-200	1300 nm	SM	19db	26.6 Km / 16.5 Miles
LED #107600-400	1300 nm	SM	36db	58.9 Km / 36.6 Miles
LED #107600-500	1550 nm	SM	35db	90 Km / 55.9 Miles

** The stated "Typical Distances" are based on the following assumptions:*

- *0.05 db splice loss every 2Km*
- *2 db Connector loss for ST connector (total both ends)*
- *1 db/Km loss for 1300 nm Multimode fiber*
- *0.5 db/Km loss for 1300 nm Singlemode fiber*
- *0.25 db/Km loss for 1550 nm Singlemode fiber*

C37.94 Short Haul FSU

Description	Multi-Mode Part Number	Smart-Mode Part Number
C37.94 FSU RS-449	107460-1	108015-1
C37.94 FSU V.35	107460-2	108015-2
C37.94 FSU G.703	107460-3	108015-3
C37.94 FSU X.21	107460-4	108015-4
C37.94 FSU E1	107460-5	108015-5

** Contact RFL if rackmount options required.*

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