

## RLH POTS Fiber Mux System

16 CHANNEL VOICE WITH DATA  
OVER FIBER OPTICS

### Introduction

The RLH 16 x 1 POTS (Plain Old Telephone Service) Fiber Mux System provides a comprehensive method of multiplexing up to 16 analog phone (POTS) channels over a single pair of multimode or single mode fibers in dual fiber models, or a single fiber in bi-directional fiber models. This compact single rack unit (1RU) system solves the problem of adding POTS lines when available fiber is limited, reduces equipment space, and lowers overall equipment costs.

The system also includes four 10/100M Ethernet ports for LAN interconnection, and two asynchronous RS-232 (RJ-45 interface) data ports. 2/4-wire E&M/Analog Data/Audio ports are available options. All ports operate simultaneously over the fiber optic cable, and may be used with leased lines to build up private networks and private telephone networks.

### Key Features

- Low cost solution for delivering analog POTS lines over fiber
- Four integrated 10/100 Base-T Ethernet ports for LAN, VOIP, video over IP or other applications.
- 16 FXO/CO ports for connection to PABX or PSTN
- 16 FXS/Sub ports for connection of individual analog phones or faxes
- Ethernet switch is full/duplex, auto negotiation
- 4 voice channels are connected to a single RJ-45, using all 8 pins, and RJ-11 breakout cables are provided.
- Supports call forwarding.
- Available with ST, SC or FC connectors.
- Optional ring down circuit is available.
- Includes two asynchronous RS-232 ports (via RJ-45) for data.
- Available in Single or Multi-mode fiber, up to 120km fiber range.
- EIA 19" 1RU rack mountable.
- Convenient front panel LED Status monitoring.
- Ethernet interface is AUTO-MDIX (auto crossover adapting)
- May be powered by -48VDC power supply or 115VAC (Adapter included).
- -40°C ~ 70°C (-40°F ~ 158°F) temperature rated
- Exclusive Unconditional Lifetime Warranty



## ANALOG PHONE FIBER MUX SYSTEM

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### Compliance Information

The RLH POTS Fiber Mux System is compliant with the following industry standards:

- **FCC PART-68B, FCC PART-15**
- **IEEE-80, IEEE-367**
- **IEEE-1590, IEEE-1615**
- **Motorola R56**
- **BR 876-310-100 BT (Telcordia)**
- **Bellcore SR-3966**
- **GR-1089, GR-63**
- **IEEE 802.3, IEEE 802.1Q (VLAN)**
- **ITU-T V.24**
- **ROHS**

Specifications subject to change without notice.

# General Safety Practices

## Intended Audience

This guide is intended for use by knowledgeable telco/network installation, operation and repair personnel. Every effort has been made to ensure the accuracy of the information in this guide is accurate. However, due to constant product improvement, specifications and information contained in this document are subject to change without notice.

## Conventions

Symbols for notes, attention, and caution are used throughout this manual to provide readers with additional information, advice when special attention is needed, and caution to prevent injury or equipment damage.

The equipment discussed in this document may require tools designed for the purpose being described. RLH recommends that service personnel be familiar with the correct handling and use of any installation equipment used, and follow all safety precautions including the use of protective personal equipment as required.

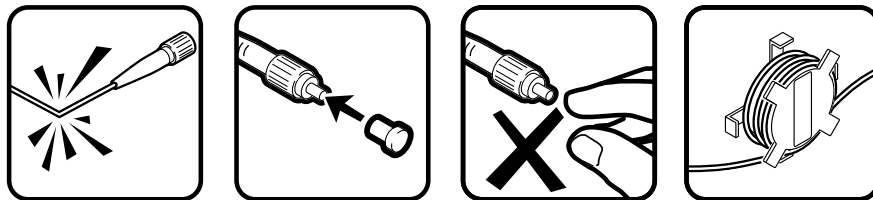
## Caution - Severe Shock Hazard

- Never install during a lightning storm or where unsafe high voltages are present.
- Active phone lines may carry high DC voltages. Use caution when handling copper wiring.
- The chassis must be grounded using the ground lug to reduce the risk of damage from lightning.

## Warning

The intra-building port(s) of the equipment or subassembly is suitable for connection to intrabuilding or unexposed wiring or cabling only. The intra-building port(s) of the equipment **MUST NOT** be metallically connected to interfaces that connect to the OSP or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 4 ports as described in GR-1089-CORE, Issue 4) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

## Guidelines for handling terminated fiber cable



- Do not bend fiber cable sharply. Use gradual and smooth bends to avoid damaging glass fiber.
- Keep dust caps on fiber optic connectors at all times when disconnected.
- Do not remove dust caps from unused fiber.
- Keep fiber ends and fiber connectors clean and free from dust, dirt and debris. Contamination will cause signal loss.
- Do not touch fiber ends.
- Store excess fiber on housing spools or fiber spools at site

## Acronyms

Commonly used acronyms and abbreviations

Acronym/Abbreviation	Description
POTS	Plain Old Telephone Service (analog phone)
FXO/CO	Foreign Exchange Office or Central Office location
FXS/Sub	Foreign Exchange Station or Subscriber side location
PBX	Private Branch Exchange
TX	Transmit
RX	Receive
MM	Multimode
SM	Single Mode
2W	2 wire copper analog phone line
RU	EIA Rack Unit (1.75")
VOIP	Voice Over IP
LAN	Local Area Network
MUX	Multiplex
LED	Light Emitting Diode

## Front Panel

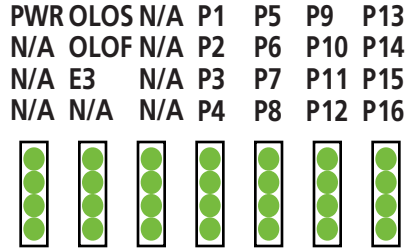
The POTS Mux System front panel contains the power switch, LED indicator display and SNMP connector (not used on the 16 line models). The DIP switches and USB port are reserved for future use and are not used.



**POTS Mux 16 Channel System Front Panel**

### LED status display

The LEDs on the front panel display status and activity. The LEDs labeled N/A are not applicable and are *not used* on the POTS Mux System and may be ignored.



**POTS Mux 16 Channel LED indicators**

LED No.	Name	Status	Description
1	PWR	ON	Power ON
2 ~ 4	NA	OFF	Not used
5	OLOS	ON	Optical Signal Lost
		Blinking	Remote device is powered OFF
6	OLOF	ON	Optical SYNC loss
7	E3	ON	Optical BER $\geq 10^{-3}$
8	N/A	OFF	Not used
9 ~12	N/A	OFF	Not used
13 ~ 28	P1 ~ P16	ON	POTS channel is on line or FXO side is in "off hook" state
		Blinking	Call initiated

## Back Panel

The POTS Mux System rear panel contains the power connections, Ethernet ports, fiber connectors, POTS ports, RS-232 Data ports and chassis ground lug.



**POTS Mux 16 Channel System Back Panel**

### Power Connection

The POTS Mux system operates off of -48VDC power and uses a 3 position screw down terminal. Use the included 115VAC power adapter when operating off of 115VAC mains. Any compatible -48VDC power source may be used to power the POTS Mux. Refer to the [General Specifications](#) section for power requirements.

**Note:** The power terminal is polarity sensitive. Verify the plus (+) and minus (-) wiring before connecting.

### Ethernet RJ-45 Ports

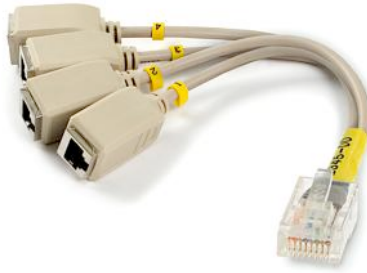
The four Ethernet ports use standard RJ-45 connectors. LED indicators on each port indicate if the port connection and speed. The LINK LED is ON when the port is connected to a LAN or other active link, and the SPD LED is ON when the port auto-detects 100M speed.

### Optical Ports

The optical ports may be equipped with ST, SC or FC fiber connectors. A fiber pair is required for operation with dual fiber models, TX is the signal output side and RX is the signal input side. Bi-directional single fiber models combine input and output, and require only a single fiber.

### POTS Ports

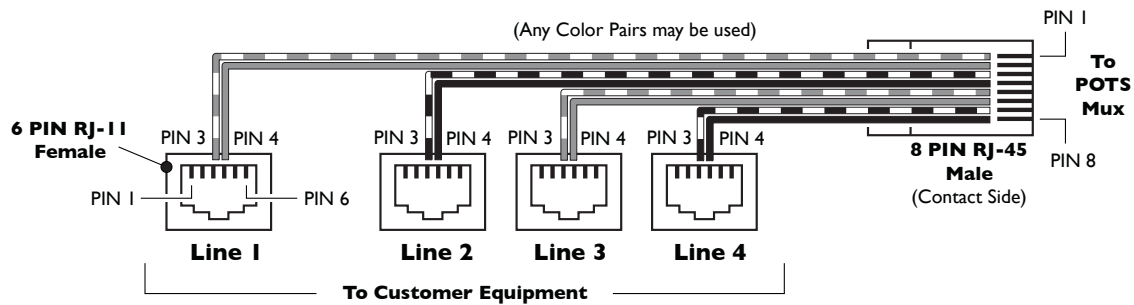
The POTS ports use all 8 pins of RJ-45 connectors. Although RJ-45 jacks are not standard for POTS lines, RJ-45 connectors allow for a denser system design. Use the included breakout adapters to attach standard RJ-11 connectors to the POTS Mux.



**RJ-45 male to RJ-11 female breakout cable adapter (Included)**

### Breakout Cable Adapter

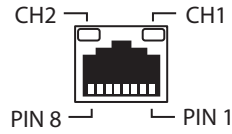
The POTS Mux breakout cable adapter wiring diagram is show below.



**RJ-45 to RJ-11 breakout adapter cable diagram**

## Data Ports

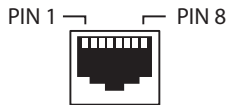
The POTS Mux includes two RS-232 channels in a single data port. The data channels use RJ-45 ports with indicator LEDs to show status. ON/Blinking indicates data transfer.



CH 1		CH2	
1	NC	5	NC
2	RS-232 TXD (Output)	6	RS-232 TXD (Output)
3	RS-232 RXD (Input)	7	RS-232 RXD (Input)
4	RS-232 GND	8	RS-232 GND

## 2/4W E&M/Analog Data/Audio Ports

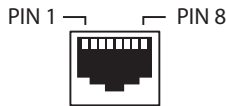
The E&M/Analog Data/Audio ports are identified on the E&M models. The ports are compatible with 2/4-wire E&M, Analog Audio and 4-wire Analog Data. Use the following connection diagram for E&M.



Pin Description			
1	NC	5	2/4-Wire Send
2	4-Wire Receive	6	MWire
3	4-Wire Receive	7	EWire
4	2/4-Wire Send	8	Signal

### 2/4W E&M Data RJ-45 Pin Chart

Use the following connection diagram for 2/4-wire Analog Audio and 4-wire Analog Data.



Pin Description			
1	NC	5	2/4-Wire Send
2	4-Wire Receive	6	NC
3	4-Wire Receive	7	NC
4	2/4-Wire Send	8	NC

### 2/4W Analog Data & 4W Analog Audio RJ-45 Pin Chart

# Installation

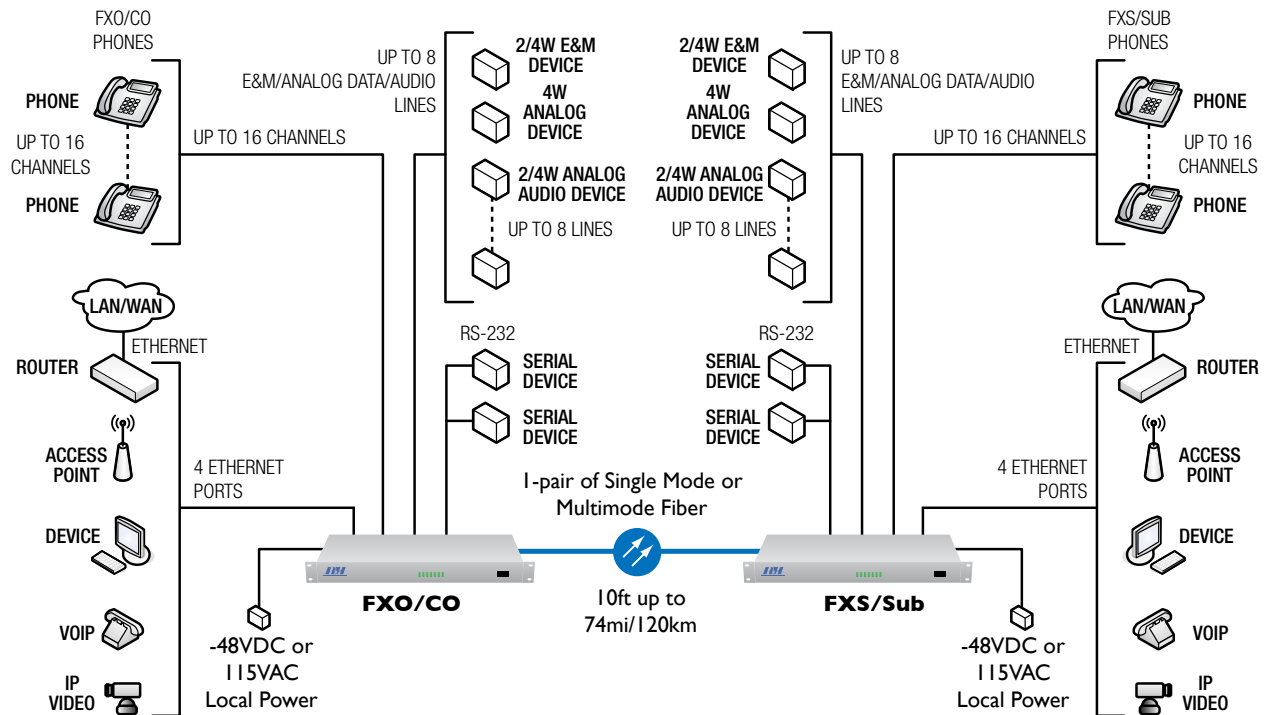
## FXO/CO (Central Office) Side Unit

The FXO/CO side unit provides the electrical-optical interface between PSTN or PABX 2-wire copper POTS lines, Ethernet devices or LAN, RS-232 data devices and the optical fiber cable. Powering options include local 115~240VAC or -48VDC power.

## FXS/Sub (Subscriber Side) Side Unit

The FXS/Sub side provides the electrical-optical interface between the copper 2-wire POTS line devices (phones, fax, modem), Ethernet devices or LAN, RS-232 devices and the optical fiber cable. Powering options include local 115~240VAC or -48VDC power.

**Note:** FXS/Sub units are electrically different from FXO/CO units and cannot be interchanged.



**POTS Mux System Applications Diagram**

### Prior to installation:

- Check for shipping damage
- Check the contents to ensure correct model and powering options
- Make sure you have the correct fiber type and power available
- Check the polarity and voltage of the power with a multimeter before connecting to avoid damage
- Have a clean, dry installation environment ready

### Install the POTS Mux System into a 19" equipment rack or other suitable location

Use the rack ears and hardware provided, or place onto an equipment shelf or table. The POTS mux is indoor rated only and must be protected from the elements. Make sure the power switch is OFF.

## Connect fiber and communications connectors

Connect fiber cables to correct TX and RX ports. Make sure the connections are flipped accordingly so the TX port of one unit attaches to the RX port of the other unit. Do not remove fiber cable caps until you connect fiber to the unit. Watch for contamination and do not touch fiber ends.

Connect the RJ-45 to RJ-11 breakout cables. The male end of the 4x1 adapter cable connects to the POTS Mux ports marked ANALOG PHONE. Each port breaks out into 4 phone channels. Connect the RJ-11 phone lines to the female RJ-11 ports on the adapter cable. The ports on the adapter cable are numbered for ease of installation.

Connect the RJ-45 serial data breakout cable to the port marked RS-232. Attach RS-232 data connectors to the adapter cable. Each connector is marked with the channel number.

## Connect Power

Make sure the power switch on the front panel is OFF. Attach a ground wire to ground lug on the back panel. The chassis must be grounded using the ground lug to reduce the risk of damage from lightning.

### For DC power

Remove power from the -48VDC source before making connections. Attach the DC input wires to the POTS Mux power terminals. The connector block may be removed from the chassis for ease of installation by pulling straight out. Make sure the connector block is fully seated when reattaching.

### For AC power

Use the included AC/DC power adapter. Connect the DC output from the adapter to the terminals on the POTS Mux. Remove power from the AC source supply, then attach the AC input wires to the AC input terminals on the power adapter. Power may be applied to the AC mains once wiring is complete.

**Note:** The power terminals are polarity sensitive. Observe the ⊕ and ⊖ terminals on the DC input terminal.

Once all connections are checked and power is applied, turn the unit **ON** using the power switch on the front panel.

**Note:** The FXO and FXS units normally take a few minutes to sync with each other during initial setup or when power is turned OFF then ON.

See your RLH representative for RS-232 to RS-485 converters, power supplies with redundant power and battery backup, fiber optic cable, patch panels and other accessories compatible with the POTS Mux System.

## Troubleshooting

If trouble is encountered, verify all copper and fiber connections. Refer to the LED Indicators on of the unit. They show availability of power, modes of operation, and data being received by the fiber and TP ports. If trouble persists, replace the unit and retest. If technical assistance is required, contact the RLH Industries, inc. technical support department:

800-877-1672 (6 am to 6 pm- PST),  
or call our 24/7 Technical/Customer Service: (714) 366-2503 or (714) 457-5740

## Ordering Information

### 16 Channel POTS Mux Part Number Matrix

RLH - PM - XX XX - XX X - 01

#### Fiber Type

MM = Multimode, 2km range, Dual Fiber  
MB = Multimode, 2km range, Bi-Di (SC Only)  
S1 = Single Mode, 20km range, Bi-Di  
S2 = Single Mode, 20km range, Dual Fiber  
S3 = Single Mode, 40km range, Bi-Di  
S4 = Single Mode, 60km range, Dual Fiber  
S5 = Single Mode, 120km range, Dual Fiber

#### Fiber Connector Style

ST = ST Connector  
SC = SC Connector  
FC = FC Connector

#### Configuration

C = FXO/CO side unit  
S = FXS/Sub side unit

#### POTS Line Capacity

09 = 8 POTS lines  
+ 8 2/4W E&M/Analog Data/Audio lines  
16 = 16 POTS Lines

#### Example: RLH-PM-S2ST-16C-01

RLH POTS Mux configured with Single Mode fiber, 20km distance, dual fiber ST connectors, 16 POTS lines, FXO/CO side unit.

- ▶ Four RJ-45 to RJ-11 break-out cables are included for easy connection to existing POTS lines
- ▶ One RJ-45 to DB-9 break-out cable are included for easy connection to existing RS-232 data lines
- ▶ E&M ports are compatible with 2/4-wire E&M, 4-wire Analog Data & 2/4-wire Analog Audio
- ▶ 115VAC to -48VDC power adapter included
- ▶ Please contact your RLH sales representative for pricing and delivery information

## General Specifications

<b>Standards</b>	FCC PART-68B, FCC PART-15, IEEE-80, IEEE-367, IEEE-1590, IEEE-1615, Motorola R56, BR 876-310-100 BT (Telcordia), Bellcore SR-3966, GR-1089, GR-63, IEEE 802.3, IEEE 802.1Q (VLAN), ITU-T V.24, ROHS	
<b>Transmission method</b>	Frequency modulated light via two optical fibers Multimode: 850nm/1310nm Single-mode: 1310nm/1550nm	
<b>Maximum Fiber Attenuation / Distance</b>	Multimode (62.5/125µm)	2km/1.25 miles
	Single-mode (9/125µm)	20km/12.4 miles; 40km/24.9 miles; 60km/37 miles; 120km/74 miles
<b>Fiber Type</b>	(ST, SC or FC connectors) Multimode: 62.5/125µm, Single-mode: 8-9/125µm	
<b>Operating Temperature</b>	-40°C to +70°C (-40°F to +158°F)	
<b>Humidity</b>	95% non-condensing	
<b>BER</b>	<10 <sup>-9</sup>	
<b>Dimensions</b>	W 19in. x D 10in. x H 1.7 (1RU) (W 485mm x D 250mm x H 43mm)	
<b>Ethernet</b>	10/100M, full/duplex, auto negotiation	
<b>Protocol</b>	IEEE 802.3, IEEE 802.1Q (VLAN)	
<b>MAC Address Entries</b>	4096	
<b>Ethernet Connector</b>	RJ-45	
<b>E&amp;M/Analog Data/Audio Ports</b>	2/4 Wire E&M, 4 Wire Analog Data, 2/4 Wire Analog Data	
<b>E Wire Index</b>	Max. electric current	22mA
	Saturation voltage	3V
	Dial speed	>20pps
<b>M Wire Index</b>	Constant current	7mA
	Min. detecting current	5mA
	Pulse dial identify	>20pps
<b>Bandwidth</b>	300Hz ~ 3.4KHz	
<b>Connector</b>	RJ-45	
<b>Impedance</b>	600 Ohm	
<b>Longitudinal Conversion Loss</b>	>60dB	
<b>Return Loss</b>	>30dB	
<b>Idle Channel Noise</b>	75dB	
<b>CMRR</b>	>60dB	
<b>Insertion Loss</b>	0dB ± 0.5dB each direction	
<b>Overload Level</b>	8dBm into 600 Ohms	
<b>RS-232 Port Interface</b>	ITU-T V.24 Standard	
<b>Data Rate</b>	9600Kbps (Asynchronous)	
<b>Connector</b>	RJ-45	
<b>Power</b>	-48VDC, 110VAC ~ 260VAC power adapter included	
<b>Consumption</b>	≤5W	

## Warranty

RLH is recognized throughout the world and offers the only **UNCONDITIONAL LIFETIME WARRANTY** in the industry. We are very proud of our warranty which simply states that the product is warranted to be free of defects in material and workmanship for the **LIFE OF THE PRODUCT**.

RLH will replace this product, or part thereof, if it fails FOR ANY REASON, provided the defective part is returned to RLH Freight prepaid. This warranty is UNCONDITIONAL and valid even when this product has been abused, mishandled, or damaged as a result of a natural disaster. This warranty will reduce your costs and simplify your maintenance activities. Not all RLH products are covered by this warranty.

**To make a warranty claim, or schedule repair or replacement of your RLH product, please contact us for an RMA number.** You will be promptly assisted by one of our warranty specialists. All returns must have an RMA number before we can receive any items.

## Technical Support

<b>Normal technical support:</b> (Mon - Fri 6am - 6pm PST)	Local (714) 532-1672 Toll Free (800) 877-1672 Toll Free (866) DO-FIBER
<b>24/7 Technical support:</b>	(714) 366-2503 (714) 396-8982 (714) 457-5740

## Contact Information

<b>Corporate Headquarters:</b>	RLH Industries, Inc. 936 N. Main Street Orange, CA 92867 USA
<b>Phone:</b>	Local (714) 532-1672 Toll Free (800) 877-1672 Toll Free (866) DO-FIBER
<b>Fax:</b>	(714) 532-1885
<b>Email:</b>	info@fiberopticlink.com
<b>Web site:</b>	www.fiberopticlink.com

# RLH FIBER OPTIC LINK

RLH Industries, Inc. The Leader in Fiber Optic Telecom Isolation Technology

LIFETIME

## UNCONDITIONAL WARRANTY

RLH INDUSTRIES, INC. FIBER OPTIC LINK assemblies are warranted to be free of defects in materials and workmanship for the life of the product. This lifetime warranty is effective for RLH products sold from February 2, 1988, to the present, with the exception of fiber optic cable assemblies which are warranted only to be free of defects in manufacturing and batteries, which carry a 5-year unconditional replacement warranty.

RLH Industries, Inc. will repair or replace any product, or part thereof, that fails for any reason, provided the defective part is returned to RLH, freight prepaid.

This warranty is UNCONDITIONAL and is valid even when RLH Fiber Optic Link assemblies have been abused or mishandled, where unauthorized repairs have been attempted or performed, or product has been damaged as a result of a natural disaster.

Authorized by:



J. RANDALL MEARS, Vice President, Engineering



RLH Industries, Inc.  
936 N. Main Street, Orange, CA 92867 USA  
T: (714) 532-1672  
F: (714) 532-1885

Please contact your RLH sales representative  
for pricing and delivery information.

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