

RLH POTS Fiber Mux System

4 & 8 CHANNEL VOICE WITH DATA
OVER FIBER OPTICS

Introduction

The 4 and 8 channel RLH POTS (Plain Old Telephone Service) Fiber Mux Systems provide a comprehensive method of multiplexing analog phone POTS channels over a single pair of multimode or single mode fibers. This compact single rack space unit (1RU) system solves the problem of adding POTS lines when available fiber is limited, reduces equipment space, and lowers overall equipment costs.

These systems are available in capacities of either 4 or 8 analog phone lines, and include four 10/100M Ethernet ports for LAN interconnection. 2/4-wire E&M/Analog Data/Audio and an E1 port are available options. One RS-232 asynchronous data port is standard on the 8 channel models, and optional on the 4 channel models. 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

- **Exclusive Unconditional Lifetime Warranty**
- 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.
- From 1 to 8 FXO ports for connection to PABX or PSTN
- From 1 to 8 FXS ports for connection of individual analog phones or faxes
- Options include 2/4-wire E&M/4-wire analog data/audio, RS-232, and E1 port
- Ethernet switch is full/duplex, auto negotiation
- Each voice channel is connected to a single RJ-45, using pins 4 & 5, and RJ-11 adapter cables are provided.
- Available with ST, SC or FC connectors
- 8 Channel model Includes one asynchronous RS-232 port (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)
- Redundant power supply +48/-48VDC or 115VAC local power
- -40°C ~ 70°C (-40°F ~ 158°F) temperature rated



**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.

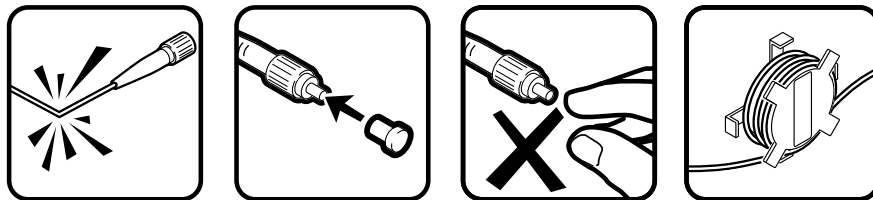
Caution - Severe Shock Hazard

- 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)
E&M	Lines that use DC signals on separate leads, called the "E" lead and "M" lead
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

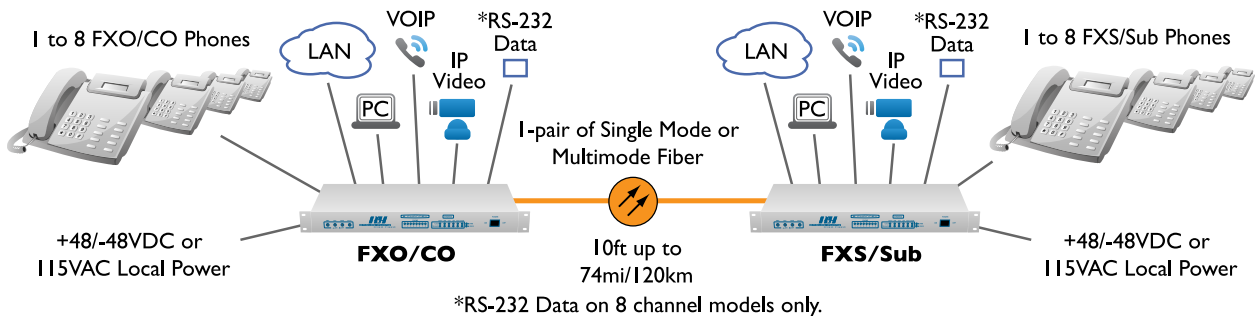
Installation

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
- Have a clean, dry installation environment ready

Required for installation:

- Install the POTS Mux System into a 19" equipment rack or other suitable location
- Check the polarity and voltage of the power with a multimeter before connecting to avoid damage
- Connect fiber cables to correct TX and RX ports, make sure the connections are flipped accordingly
- Do not remove fiber cable caps until you connect fiber to the unit, watch for contamination
- Observe anti-static precautions
- Ground the unit using a ground wire to the ground lug on the back panel



POTS Mux System Applications Diagram

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 (where applicable) and the optical fiber cable. Powering options include local 115-240VAC and/or +48/-48VDC power.

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

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 (where applicable) and the optical fiber cable. Powering options include local 115-240VAC and/or +48/-48VDC power.

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

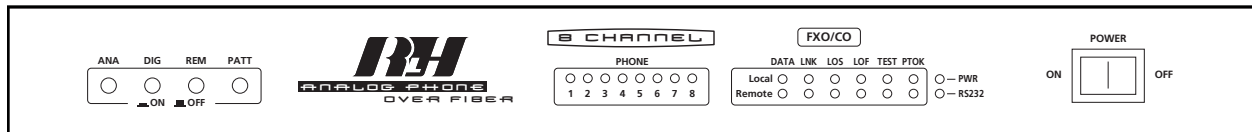
FXS/Sub units are electrically different from FXO/CO units and cannot be interchanged. Once all connections are checked, turn the unit ON using the power switch on the front panel.

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.

Front Panel

The POTS Mux System front panel contains the loop back test buttons, phone connection LED display, activity LED indicator display and power switch.



POTS Mux System Front Panel

(8 channel model shown)

Loop Back Test Buttons

The 4 switch buttons are used for loop back testing.

Button Name	Function
ANA	Fiber interface loopback
DIG	Ethernet loopback
REM	Remote ethernet loopback
PATT	Creates pseudo random code test for ethernet

Phone LED status display

The yellow PHONE LEDs on the front panel indicated which analog phone (POTS) lines are being actively used. E&M/Analog Data models will display active E&M/Analog Data lines in the phone LED status display.

Note: All LEDs are installed every unit, but only the LEDs corresponding to the actual lines installed in your unit will function. On the 4 Line model, only the LEDs corresponding to the first 4 lines will function.

Status and Activity LED display



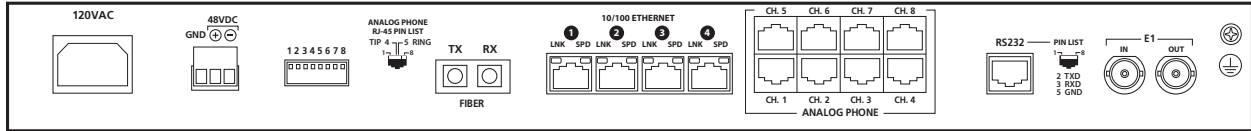
POTS Mux LED activity and status indicators

Name	Color	Status	Description
DATA	Yellow	ON	Ethernet data send and receive is OK
		Blinking fast	Ethernet data receive is OK, send is not OK
		Blinking slow	Ethernet data send is OK, receive is not OK
		OFF	No Ethernet data transmit and receive
LNK	Green	ON	Ethernet connected
		OFF	Ethernet disconnected
LOS	Red	ON	Fiber signal lost
		OFF	Fiber signal normal
LOF	Red	ON	Fiber frame lost
		OFF	Fiber frame good
TEST	Yellow	ON	Test in progress (When ANA, DIG, REM, PATT buttons ON)
		OFF	Working normally
PTOK	Green	ON	When PATT button ON, PBRS code test is normal
		OFF	When PATT button ON, PBRS code test is blocked
		Blinking	When PATT button ON, PBRS code test has error
PWR	Green	ON	Power is ON
		OFF	Power is OFF
RS232	Green	ON	RS232 data send and receive is OK
		Blinking fast	RS232 data receive is OK, send is not OK
		Blinking slow	RS232 data send is OK, receive is not OK
		OFF	No RS232 send or receive

Note: When all LED indicators continue to blink on and off, either:

- Test button is set for a dead loop
- The rate set for local and remote follow each other
- Rate is set by local, but both rates for local and remote are not the same.

Back Panel



POTS Mux System Back Panel

(8 channel POTS model with E1 option shown)

Note: All ports are installed every unit, but only the ports corresponding to the actual POTS lines installed in your unit will function. On the 4 Line model, only the ports corresponding to the first 4 lines will function, and the RS232 is inactive.

Power Connection

The POTS Mux system accepts a standard 3 prong 115VAC power plug, or +48/-48VDC power attached to the screw down terminal. Both inputs may be used at the same time, providing redundant power for the unit.

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

DIP Switch

The DIP switches are for factory settings and testings and should not be changed by the end user. For proper operation set all the DIP switches must be set to the **OFF**, or UP position.

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.

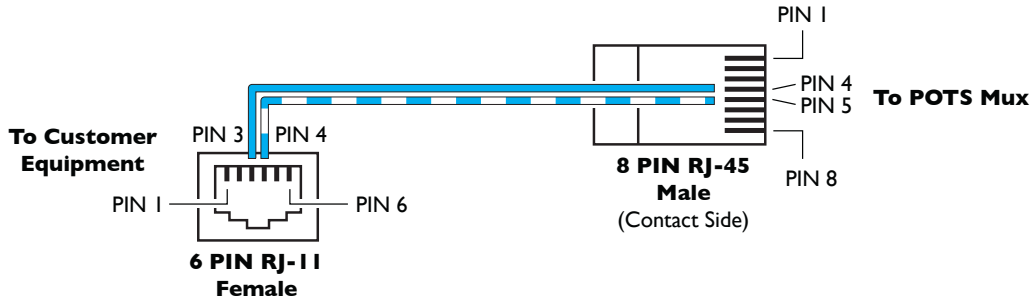
Ethernet RJ-45 Ports

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.

Analog Phone Ports

The POTS ports use the center 2 pins of RJ-45 connectors. Use the included adapter connectors to attach RJ-11 connectors to the POTS Mux.

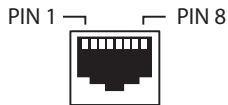
Note: All ports are included on each unit, but only the ports that are installed on your unit are active, the unused ports are inactive. Refer to the product label to see the POTS channel capacity on your unit.



RJ-45 to RJ-11 Adapter Connection Diagram

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

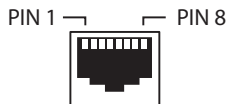
The E&M/Analog Data/Audio ports are identified on the E&M models. The ports are compatible with 2/4-wire E&M, Analog Audio and 4-wire Analog Data. Use the following connection diagram for E&M.



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.

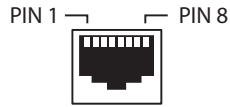


Pin Description	
1 NC	5 2/4-Wire Send
2 4-Wire Receive	6 NC
3 4-Wire Receive	7 NC
4 2/4-Wire Send	8 NC

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

RS-232 Data Port

The 8 line POTS Mux model includes one channel of RS-232 data. The port uses a RJ-45 connector.

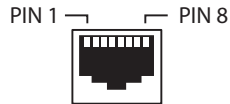


Pin Description	
1 NC	5 NC
2 NC	6 RS-232 TXD (Output)
3 NC	7 RS-232 RXD (Input)
4 NC	8 GND

RS-232 RJ-45 Pin Chart

E1 Port

The optional E1 port uses either standard BNC connectors for 75Ω (unbalanced), or a RJ-45 120Ω Hi-Z (balanced) connector, depending on the configuration ordered. Attach the BNC connectors to their corresponding IN and OUT ports. Refer to the following connection diagram when using RJ-45 ports.



Pin Description	
1 Tx tip	5 Rx ring
2 Tx ring	6 Rx shield
3 Tx shield	7 NC
4 Rx tip	8 NC

E1 RJ-45 (balanced) Pin Chart

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

POTS Mux Model	2 Wire Phone Lines	E&M Analog Data/Audio Ports	Ethernet Ports	RS-232 Data Ports	Front Panel Test Controls	AC or DC Power	E1 Data Port Option
4 Channel POTS Mux over Fiber	4	-	4	-	✓	✓	✓
4 Channel POTS Mux over Fiber + RS-232	4	-	4		✓	✓	✓
8 Channel POTS Mux over Fiber + RS-232	8	-	4		✓	✓	✓
2 Channel POTS + 2 Channel E&M Mux over Fiber	2	2	4	-	✓	✓	✓
2 Channel POTS + 2 Channel E&M Mux over Fiber + RS-232	2	2	4		✓	✓	✓
4 Channel POTS + 4 Channel E&M Mux over Fiber + RS-232	4	4	4		✓	✓	✓

4 & 8 Channel POTS Mux Part Number Matrix

RLH - PM - XX XX - X X X - 02

Fiber Type

MM = Multimode, 2km range, Dual Fiber
 MB = Multitmode, 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

E1 Port Option

N = None
 B = E1 port, 75Ω BNC connectors
 R = E1 port, 120Ω, RJ-45 connector

POTS/Data Lines

1 = 2 POTS lines
 + 2 2/4W E&M/Analog Data/Audio lines
 2 = 4 POTS lines + 1 RS-232
 + 4 2/4W E&M/Analog Data/Audio lines
 3 = 2 POTS lines + 1 RS-232
 + 2 2/4W E&M/Analog Data/Audio lines
 4 = 4 POTS lines
 5 = 4 POTS lines + 1 RS-232
 8 = 8 POTS lines + 1 RS-232

Example: RLH-PM-S2ST-4C-01

RLH POTS Mux configured with Single Mode fiber, 20km distance, dual fiber ST connectors, 4 POTS lines, FXO/CO side unit.

- ▶ 4 channel POTS models do not include RS-232 data ports
- ▶ Redundant power supply may be +48/-48VDC or 115VAC local power
- ▶ All models include RJ-11 breakout adapter cables for easy connection to existing POTS lines
- ▶ One RJ-45 to DB-9 break-out cable is included when applicable for easy connection to existing RS-232 data lines
- ▶ E&M models are compatible with 2/4-wire E&M, 4-wire Analog Data & 2/4-wire Analog Audio
- ▶ Please contact your RLH sales representative for pricing and delivery information

General Specifications

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
Transmission method	Frequency modulated light via two optical fibers Multimode: 850nm/1310nm Single-mode: 1310nm/1550nm
Maximum Fiber Attenuation / Distance	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
Fiber Type	ST, SC or FC connectors Multimode: 62.5/125µm, Single-mode: 8-9/125µm
Operating Temperature	-40°C to +70°C (-40°F to +158°F)
Humidity	95% non-condensing
BER	<10 ⁻⁹
Dimensions	W 19in. x D 10in. x H 1.7 (1RU) (W 485mm x D 250mm x H 43mm)
Ethernet	10/100M, full/duplex, auto negotiation
Protocol	IEEE 802.3, IEEE 802.1Q (VLAN)
MAC Address Entries	4096
Ethernet Connector	RJ-45
RS-232 Port	ITU-T V.24 Standard
Data Rate	9600Kbps (Asynchronous)
Connector	RJ-45
E&M/Analog Data Ports	2/4 Wire E&M, 4 Wire Analog Data, 2/4 Wire Analog Data
E Wire Index	Max. electric current 22mA Saturation voltage 3V Dial speed >20pps
M Wire Index	Constant current 7mA Min. detecting current 5mA Pulse dial identify >20pps
Bandwidth	300Hz ~ 3.4KHz
Connector	RJ-45
Impedance	600 Ohm
Longitudinal Conversion Loss	>60dB
Return Loss	>30dB
Idle Channel Noise	75dB
CMRR	>60dB
Insertion Loss	0dB ± 0.5dB each direction
Overload Level	8dBm into 600 Ohms

General Specifications (cont'd)

E1 Channel Capacity	1
Compliance Standard	ITU G.703
Data Rate	2048kbps
Line Code	HDB3
Frame Format	SF, ESF, Unframed
Interface Impedance	75Ω (unbalanced) or 120Ω (balanced)
Connector	BNC (unbalanced) or RJ-45 (balanced)
Jitter Tolerance	Compliant with ITU-T G.823
Jitter Transfer	Compliant with ITU-T G.742
Clock	Internal clock, line clock
Power	110VAC ~ 260VAC; +48/-48VDC local power
Consumption	≤5W

Technical Support

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

Contact Information

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

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.



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

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