RLH Industries, Inc.

iMux Fiber Optic Multiplexer System

Quick Start Guide

QS-001 2014A-0911

RLH Industries, Inc.
936 North Main Street
Orange,CA 92867

Ph. 714-532-1672
email: info@fiberopticlink.com
www.fiberopticlink.com

Contents

1. Important Information

Intended Audience

This manual 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 manual is accurate. However, due to constant product improvement, specifications and information contained in this document are subject to change without notice. Please refer to the iMux User Guide for additional information.

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.

 Notes: Helpful information to assist in installation or operation.

 Attention: information essential to installation or operation.

 Caution: Important information that may result in equipment damage or injury if ignored.

General Safety Practices

The equipment discussed in this manual may require tools designed for the purpose being described. RLH recommends that installation and service personnel be familiar with the correct handling and use of any 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 T1 lines carry high DC voltages up to 56V. Use caution when handling T1 wiring.

Laser Safety

- Radiation emitted by laser devices is dangerous to to human eyes.
- Avoid eye exposure to direct or indirect radiation.
- Do not operate without fiber cable attached or dust caps installed.

2. Introduction

Product Description

The iMux is a powerful fiber optic modular multiplexer capable of providing up to 16 channels of T1, RS232, 2/4 wire data and analog phone FXO/FXS services, plus four built-in 10/100M Ethernet ports, over a single fiber.

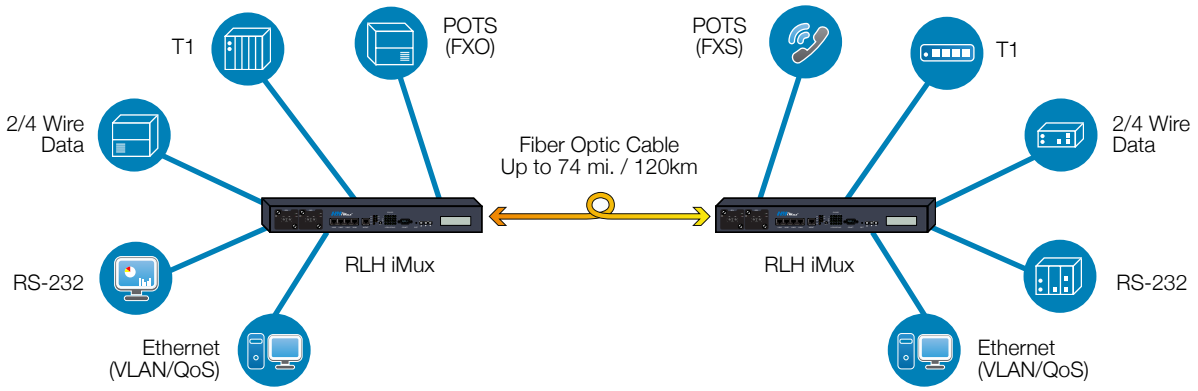
These services are supplied by the modules, up to four, that each offer four lines of communication and may be installed in any combination. Spares or add-on modules may be ordered separately and are field installable. The optical modules are available in both dual fiber and single bi-directional fiber (WDM), and up to 2 optical modules may be installed, providing 1+1 hot-swappable optical protection and making the best use of fiber availability.

The iMux may be managed through SNMP, web Interface, craft port or LCD/menu keys on the front panel. It also has an external alarm port for alarm input monitoring, as well as 4 programmable alarm contacts. The system provides local/remote loopback functions that are ideal for network testing and maintenance. The iMux takes up 1RU and comes complete with EIA19" and 23" rack ears, or it may be used on a desktop or shelf.

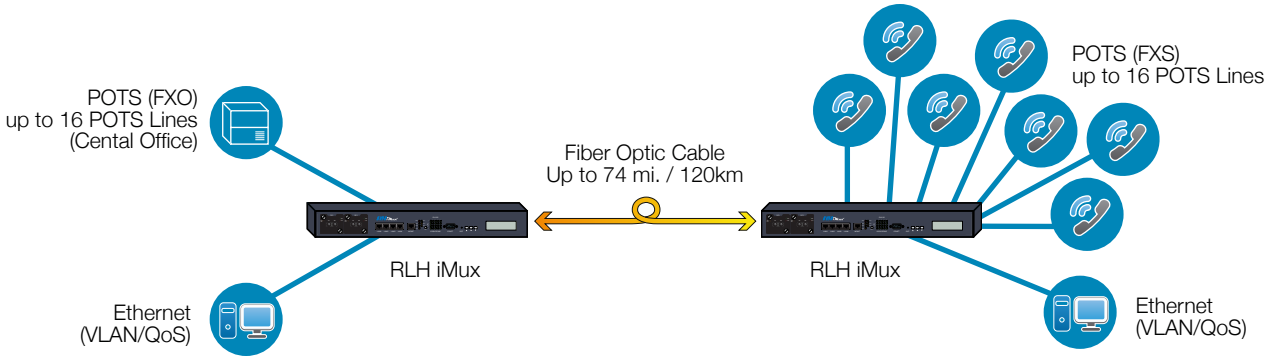
Standard Features

- Multiplexes up to 16 voice and data channels plus Ethernet over a single fiber
- Up to 4 modules (each with 4 lines) may be used in any combination to mix and match services
- Convenient front LED status indicators
- T1, RS232, POTS, & 2/4 wire Data service modules
- 4 built-in 10/100 Ethernet ports
- Aggregated Ethernet throughput up to 100Mbps
- Optical module auto laser shutdown (ALS), hot swappable 1+1 protection
- Alarm relay has major and minor alarms (audible and visible alarm output)
- Supports SNMP , HTTP / FTP / TFTP remote software upgradeable
- Supports TELNET function to configure and monitor local and remote devices through TCP/IP network
- Available with ringdown circuit operation
- Redundant 48VDC or AC/DC powering options

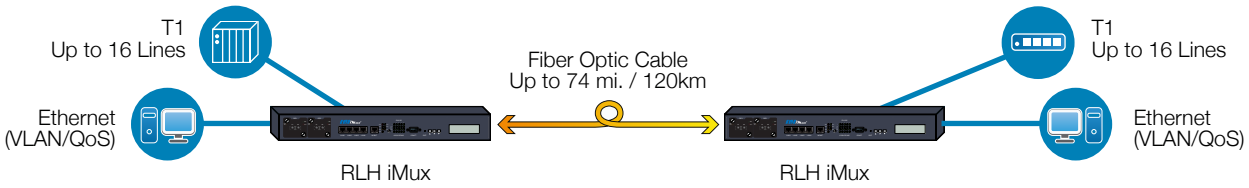
Application Diagrams



Multiple Service Example

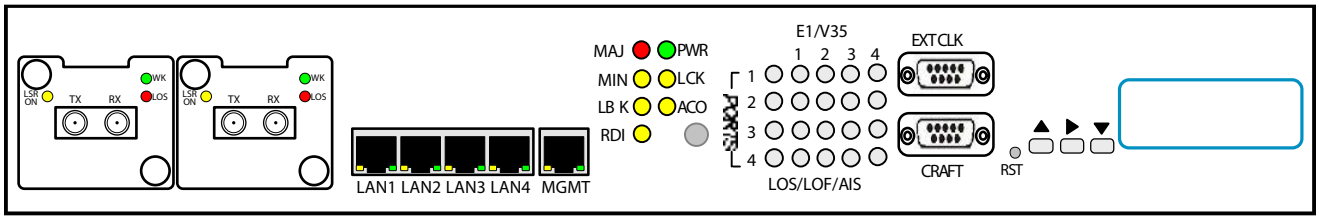


16 Channels of POTS Example



16 Channels of T1 Example

Front Panel

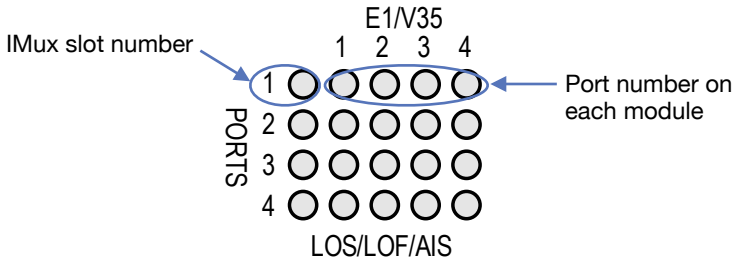


Front Panel LEDs

LED	Color	Name	ON condition	OFF condition
MAJ	RED	Major Alarm	Major alarm event is present and being signaled through rear panel alarm connector.	Normal operation
MIN	YEL	Minor Alarm	Minor alarm event is present and being signaled through rear panel alarm connector.	Normal operation
LBK	YEL	Loopback	E1 loopback signal received	Normal operation
RDI	YEL	Remote Defect Indication	Indicates a failure in the remote terminal.	Normal operation
PWR	GRN	Power	iMux is powered and ON	iMux is powered OFF, or no power is present
LCK	YEL	Optical Link Lock	The optical link is locked because it has switched to protect line mode.	Normal operation
ACO	YEL	Alarm Cut Off	Normal operation	ACO Button has been pressed. See note below.

Note: ACO Button and LED operation.
The ACO button mutes the audible alarm when a problem occurs. When the button is pressed the ACO LED illuminates. If any newer alarm is reposted after the ACP button has been pressed, the external alarm will activate again

Module Status LEDs



LED	Name	Color	Condition
PORT	Installed port slot	RED	No module is installed at this port number
		GRN	A module is installed at this port number
E1/V35	Module port status for any installed module	RED	No connection is detected to that port
		GRN	Active connection is attached to that module port

Note: Although the port status LEDs are labeled E1/V35, they will display the status of any module installed except the analog phone (POTS) modules. The phone module does not display connections made to each port on the module and the LEDs for those modules only will be GRN when off-hook and RED when ringing.

LAN/MGMT Port LEDs

LED	Name	Color	ON condition	OFF condition
LAN 1 ~ LAN 4	LAN port activity	YEL	Data is being received	No data is being received
		GRN	Data is being sent	No data is being sent
MGMT	SNMP management port activity	YEL	Data is being received	No data is being received
		GRN	Data is being sent	No data is being sent

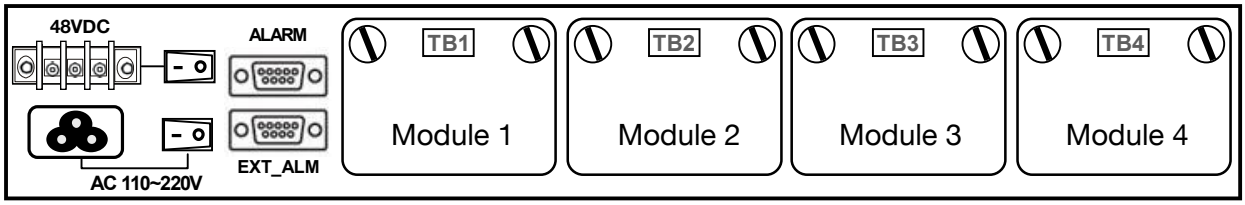
Optical Module LEDs

LED	Name	Color	ON condition	OFF condition
LSR	Laser	YEL	Laser condition is OK	Laser not operating
WK	Working	GRN	Activity over fiber	No activity over fiber
LOS	Loss of Signal	RED	Loss of fiber signal	Normal operation

Rear Panel

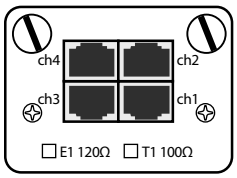
Any of the modules may be plugged into any position, called a Tributary Slot. These are referred to as TB1~TB4.

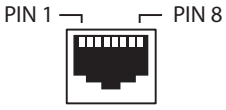
Refer to the Specifications section for additional information.



4 Channel E1 Module

Four RJ-45 connectors for input/output of 4 channels E1 signal at 120Ω.

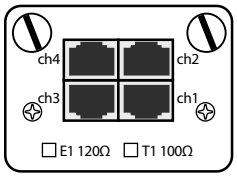


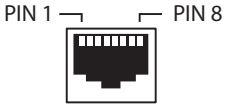


Pin	Name	Description
1	Rx Ring	
2	Rx Tip	Input to E1 Card
3	NC	
4	Tx Ring	
5	Tx Tip	Output from E1 Card
6	NC	
7	NC	
8	NC	

4 Channel T1 Module

Four RJ-45 connectors for input/output of 4 channels T1 signal at 100Ω.

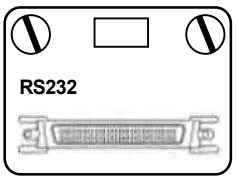


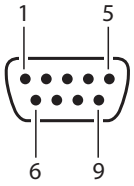


Pin	Name	Description
1	Rx Ring	
2	Rx Tip	Input to T1 Card
3	NC	
4	Tx Ring	
5	Tx Tip	Output from T1 Card
6	NC	
7	NC	
8	NC	

4 Channel RS-232 Module

4xRS-232 module, HD68 to 4 DB-9 connectors to RS-232 interface. Breakout adapter cable is included.

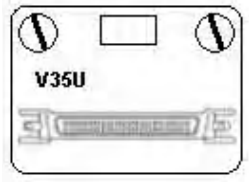


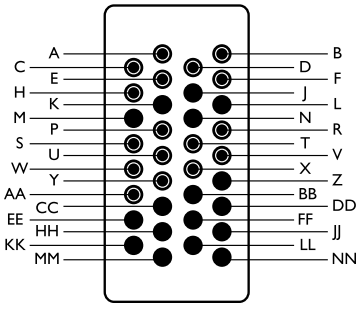


DB-9 Female DCE		
Pin	**Description**	**I/O**
1	DCD	Output
2	TXD	Output
3	RXD	Input
4	DTR	Output
5	SG	GND
6	DSR	Input
7	RTS	Output
8	CTS	Input
9	RI	Output

4 Channel V.35 Module

4xV35 module, HD68 to 4 M34 connectors to V.35 interface. Breakout adapter cable is included.

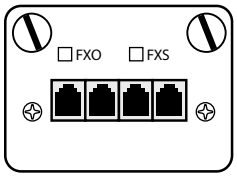


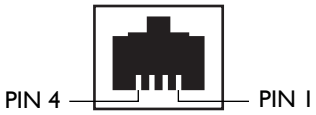


M/34 Female DCE					
Pin	**Signal**	**Description**	**Pin**	**Signal**	**Description**
A	Chassis Ground	-	V	Receive Timing A	Out
B	Signal Ground	-	W	Terminal Timing B	In
C	Request to Send	In	X	Receive Timing B	Out
D	Clear to Send	Out	Y	Send Timing A	Out
E	Data Set Ready	Out	Z	N/A	-
F	Data Carrier Detect	Out	AA	Send Timing B	Out
H	Data Terminal Ready	In	BB	N/A	-
J	Local Loop Back	Out	CC	N/A	-
K	Local Test	In	DD	N/A	-
L	N/A	-	EE	N/A	-
M	N/A	-	FF	N/A	-
N	N/A	-	HH	N/A	-
P	Send Data A	In	JJ	N/A	-
R	Receive Data A	Out	KK	N/A	-
S	Send Data B	In	LL	N/A	-
T	Receive Data B	Out	MM	N/A	-
U	Terminal Timing A	In	NN	N/A	-

4 Channel Analog Phone (POTS) Modules

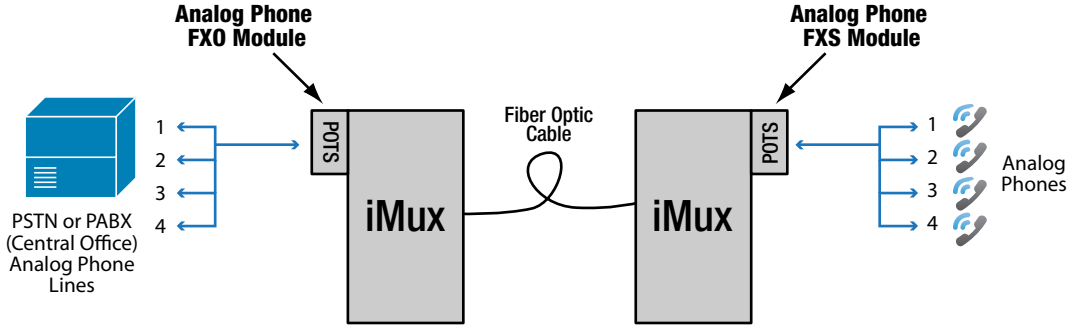
Analog phone uses RJ-11 connectors and are supplied as FXS/Sub side and FXO/CO side modules. The FXO/CO module is connected to a central office or PBX, and the FXS/Sub module is connected to the customer telephone. Each line number FXO raises the same line number FXS, and provides 64k voice bandwidth. Use an FXS module on each end for ringdown operation where connection to phones on both ends of the system is desired.



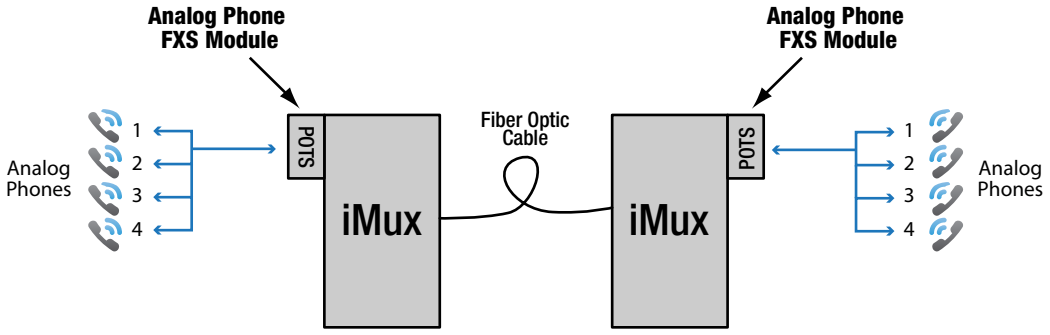


4 PIN RJ-11 Female

Analog Channel	Pin	Description
Analog Voice	3	Tip
	2	Ring



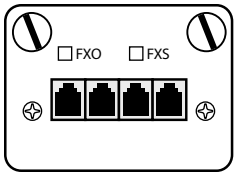
4 Channel Analog Phone Module Connection Diagram

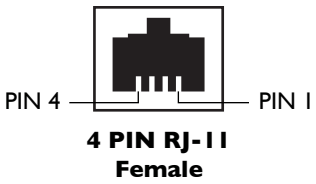


4 Channel Analog Phone Module Ringdown Connection Diagram

4 Channel 2/4 Wire Analog Data/Audio/SCADA Module

Four Analog 2/4 Wire Data/Audio/SCADA modules use RJ-11 connectors.
Each channel has 300Hz ~ 3.4kHz bandwidth.





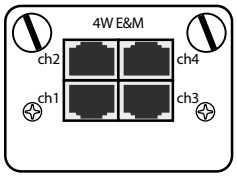
4 PIN RJ-11
Female

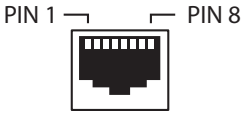
Analog Channel	Pin	Description
Input	1	Tip
	4	Ring
Output	2	Tip
	3	Ring

4 Channel 2/4 Wire Analog Data/Audio/SCADA/E&M Module

Four Analog 2/4 Wire Data/Audio/SCADA/E&M modules use RJ-45 connectors.
Each channel has 300Hz ~ 3.4kHz bandwidth. E&M type is set in software.

Master and Slave settings are set using the jumper and DIP switches on the module itself. Refer to the following pages.





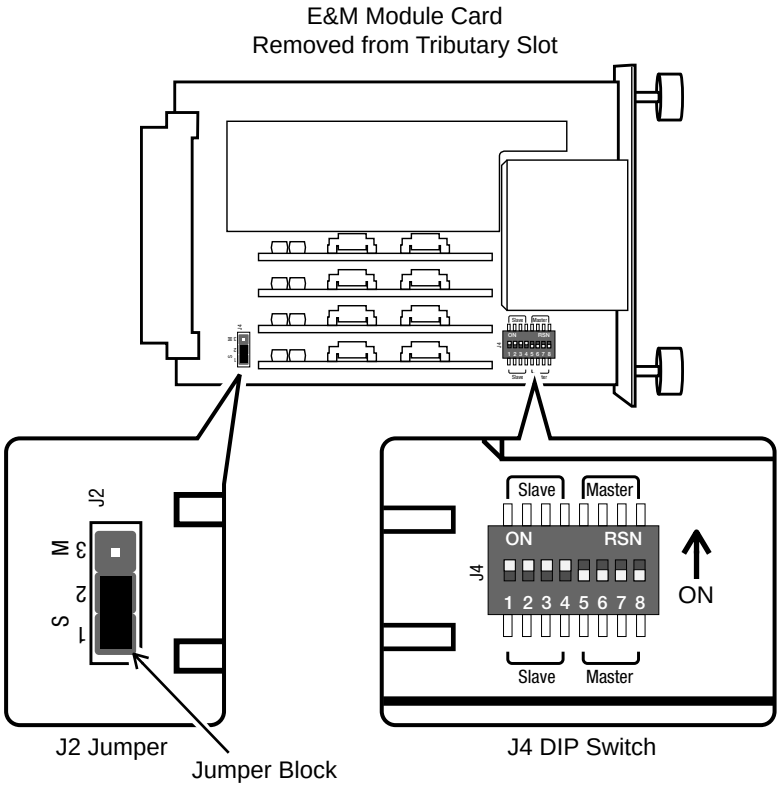
Pin	Name	Description
1	NC	NC
2	Rx Tip	Input
3	Rx Ring	Input
4	Tx Ring	Output
5	Tx Tip	Output
6	M	M Lead
7	E	E Lead
8	GND	Signal Ground

Refer to the sample E&M setting and application diagrams on the following pages.

Setting E&M Jumpers and Switches

Use the J2 jumper and the J4 DIP switches to set the E&M module mode to Master or Slave depending on the placement of the iMux in the network. The diagram on the following pages will help you determine the correct settings for your application.

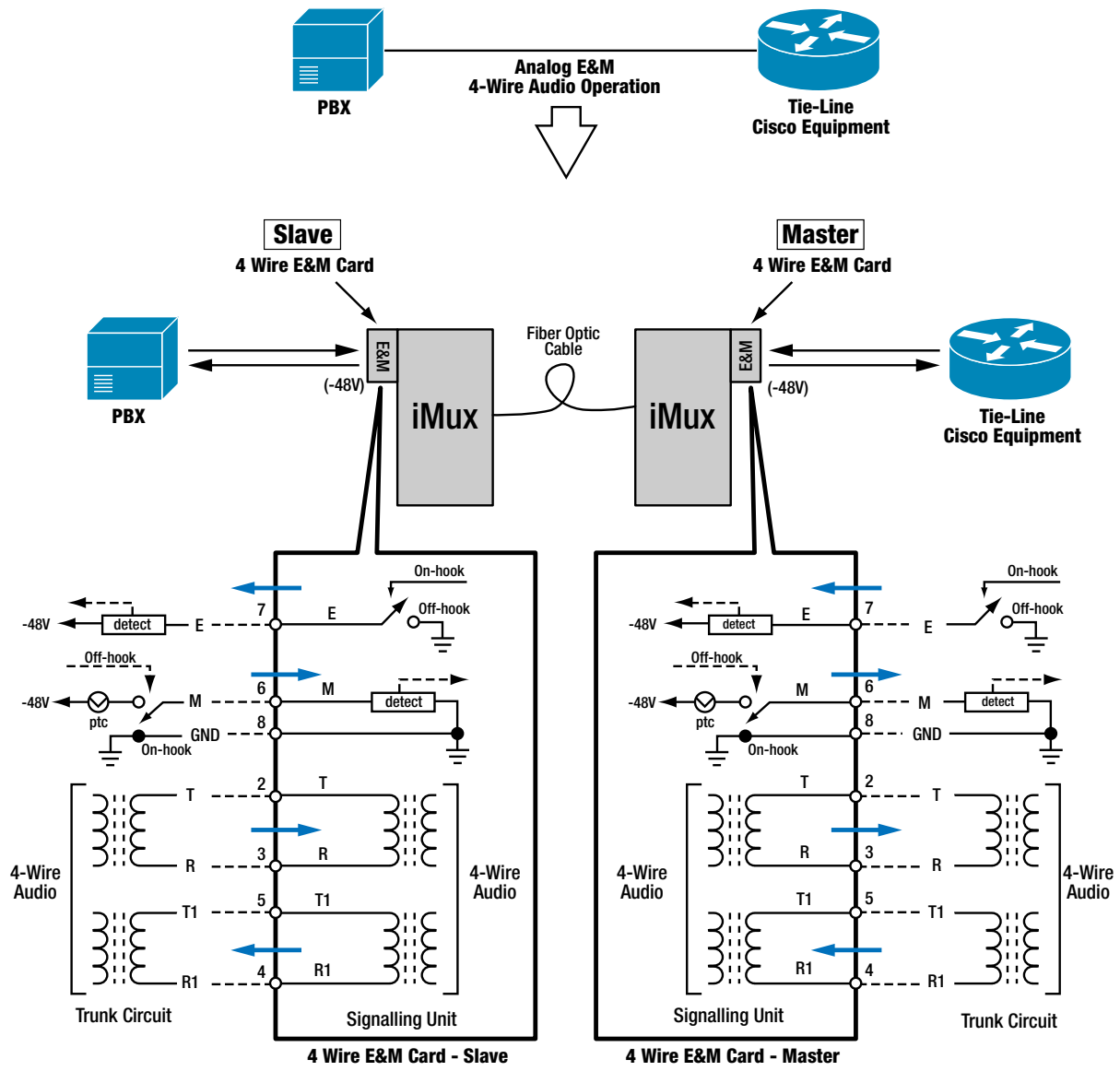
Refer to the diagram below for configuration settings.



Mode	J2 Jumper
Slave	Jumper Pins 1 & 2
Master	Jumper Pins 2 & 3

Mode	J4 DIP Switch Setting	
Slave	Switches 1~4 ON	Switches 5~8 OFF
Master	Switches 5~8 ON	Switches 1~4 OFF

E&M module Master and Slave settings



E&M Application Diagram

Acronyms

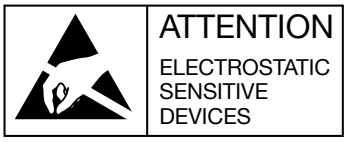
Commonly used acronyms and abbreviations

Acronym/Abbreviation	Description
B8ZS	Bipolar 8 Zero Substitution
FXO/CO	Central Office Side Equipment
FXS/Sub	Subscriber side equipment
LED	Light Emitting Diode
RX	Receive
TX	Transmit
RED	Red LED color
YEL	Yellow LED color
GRN	Green LED color

3. Before Installing

Observe Special Handling Requirements

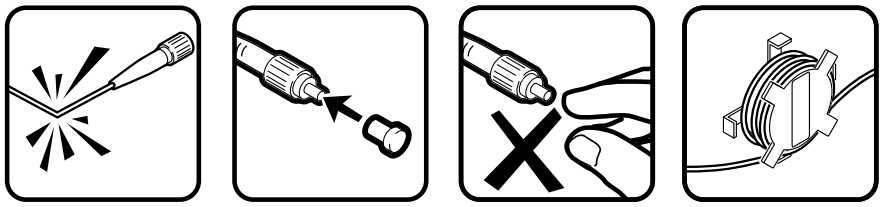
Be careful when handling electronic components



- This product contains static sensitive components.
- Handle the T1/E1 cards and optical modules by their faceplates only.
- Follow proper electrostatic discharge procedures.

This card utilizes circuitry that can be damaged by static electricity. When transporting the card, carry it in an ESD safe container such as the antistatic bag provided with the card. Before handling cards, discharge yourself of static electricity by physical bodily contact with earth ground. When handling cards, hold by outer edges and avoid touching circuitry. Failure to follow ESD precautions may cause serious damage to the card and prevent proper operation.

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

Prepare for Installation

Check for shipping damage

Carefully unpack and inspect the unit and accessories. Contact RLH immediately if any components are damaged or missing. Electronic components, fiber optic cable, and accessories have special handling requirements to prevent damage and enhance system reliability.

If the iMux will be relocated in the future, save the cartons and protective packaging material.

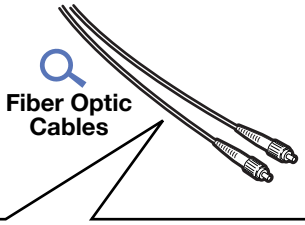
Verify system contents

The following items are shipped with your iMux system (as applicable)

- User manual CD and Quick Start Guide
- AC power converter and cord
- DB9 cable
- T1/RS-232 breakout adapter cables

Verify matching optical module and fiber modes

Fiber mode and optical module mode must be the same.



Fiber Type	Color	Identifier
Single Mode	Yellow	9/125µm
Multimode	Orange	50 /125µm, 62.5/125µm

Site Requirements

Site selection

Locate the iMux to allow easy access to the equipment. Leave at least 36 inches (90 cm) clearance in the front and at least 4 inches (10.2 cm) at the rear.

To avoid overheating, do not block the cooling fan. Leave at least 1 inch (2.5 cm) clearance on either side of iMux. Do not stack other equipment directly on top of the iMux when rack or shelf mounting.

Typical application environments

Install the fiber optic cable prior to installing the iMux system.

Required power sources

You will need an acceptable power source. The iMux system accepts 90 ~ 240VAC (47Hz ~ 63Hz) and 12, 24 or 48VDC (9 ~ 75VDC) depending on the model.

The F.C.C. requires telecommunication equipment to withstand electrical surge that may result from lighting strikes. This equipment has been tested and found to comply with the F.C.C. requirement. Users should follow the precautions below to insure the safety and minimize the risk of damage to the equipment

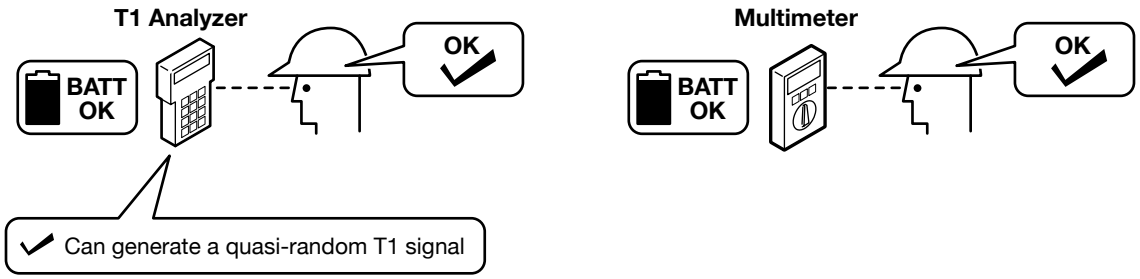
Make sure that the AC power outlet is properly grounded. Proper grounding should include a minimum of a grounded rod buried outside the building at least 8 feet (2.44 meters) deep.

Test Equipment

For T1 service

You will need a T1 analyzer such as a T-BERD.

Be familiar with the test settings. Some analyzers have line power and multimeter capability. For installation where no T-1 signal is available, the analyzer must be capable of generating a quasi-random T-1 signal.



For analog phone service (POTS)

You will need a working POTS line or an analog phone signal generator.

Be familiar with the test settings. Some analyzers have line power and multimeter capability. For installation where no T-1 signal is available, the analyzer must be capable of generating a quasi-random T-1 signal.

For RS-232 service

You will need a working RS-232 interface data connection.

4. Quick Start

Easy Installation

Before starting

- Review the safety information in section **1. Important Information**
- Familiarize yourself with the iMux and it's modules as described in section **2. Introduction**
- Know how to handle fiber optic cable, have a suitable installation environment with the correct power, and have the necessary test equipment as described in section **3. Before Installing**

Install the iMux

The iMux is pre-configured at the factory for your particular requirements, and will operate without any setup. For additional configuration instructions please refer to the iMux User Guide.

- Mount the iMux in a 19" equipment rack, on a shelf or table
- Make sure the power switches are OFF

Connect power

For AC Power units

Remove power from AC mains supply. Connect the AC power cord to the terminals on the iMux and plug into 110/240VAC, 50/60Hz mains outlet.

- Alternately, wire AC mains power directly from AC power source

For DC Power supply

- Check that DC power source voltage matches voltage range of DC power input.
- Remove power from the DC power source prior to connecting to the iMux.
- Connect the DC power cables to the iMux. Check the positive and negative polarity of the connection.
- Energize the power source.

Connect fiber cables

- The fiber cable(s) must be the right type of cable, with the correct connectors and suitable length.
- Attach the connector(s) carefully using care to avoid bending the fiber cable too sharply and damaging the fiber.
- Do not touch fiber connector ends which could cause contamination and lower signal performance.

Caution

Radiation emitted by laser devices is dangerous to to human eyes. Avoid eye exposure to direct or indirect radiation. Do not operate without fiber cable attached.

Connect ethernet cables

- Attach ethernet cables to the RJ-45 ethernet ports labeled LAN1 through LAN4 on the front panel of the iMux.

Connect data/phone equipment

Attach the breakout adapters and cables depending on your iMux module configuration.

Connect T1 cables

- Attach the breakout adapter cable to the DB-25 connector on the T1 module.
- Connect the RJ-45 T1 connectors to the breakout adapter cables.

Connect Analog Phone (POTS) FXO/FXS cables

- Attach the phone cables directly to the RJ-11 connectors on the analog phone module.

Attach RS-232 Data Cables

- Attach the breakout adapter cable to the connector on the RS-232 module.
- Connect the RS-232 data connectors to the DB-9 connectors on the breakout adapter cable.

Attach 2/4W Data/SCADA Cables

- Attach the data cables directly to the RJ-11 connectors on the analog phone module.

Refer to the iMux User Guide for pin out and port configuration information.

Start the system

Turn each iMux ON using the power switch on the rear panel. The system will initialize and start up. The LED indicators on the front panel will flash during initializing and stop flashing after setup is done. The iMux is now operational and may be configured as desired.

Refer to the iMux User Guide for additional configuration information.

5. Specifications

General Specifications

Alarm	Contact Capacity	4 relay contacts (DB-9 connector)
	External Alarm	DB-9 connector
Power Supply	AC	115/240V (90~240V) (47Hz~63Hz)
	DC	48V (36~75V)
	Power consumption	30W maximum
Environment	Working Temp.	0℃ ~ +50℃ (32℉ ~ 122℉)
	Working Humidity	5% ~ 95% RH non-condensing
	Storage Temp., Humidity	-20℃ ~ 60℃ (-4℉ ~ 140℉), 5% ~ 95% RH
Other	EMI	Comply with CISPR 22 class A (EN55022), FCC part 15 class A subpart B
	MTBF	48,000 hours minimum
	Dimensions	W 17.3" x D 11.2" x H 1.75" (440 x 285 x 44.5mm)

Optical Module Specifications

Optical Interface Module	Optical Source	MLM 850/1310/1550nm				
	System Gain	19~30dB				
	Data Rate	155 Mb/s				
Fiber connector	100BaseFX ports, ST, SC or FC connectors, single or multi mode					
	Dual fiber or single fiber (bi-directional) connectors (multimode single fiber is SC only)					
Fiber Type	Multimode	50 /125µm, 62.5/125µm				
	Single mode	9/125µm				
Dual Fiber Optics	Fiber Type	Multimode		Single-mode		
	Wavelength TX/RX (nm)	1310	850	1310~1550	1310~1550	1310~1550
	Distance	2km / 1.2mi.	2km / 1.2mi.	20km / 12mi.	60km / 36mi.	120km / 74mi.
	Min. TX PWR (dBm)	-18	-15	-15	-6	0
	Max. TX PWR (dBm)	-10	-5	-8	-3	+5
	RX Sensitivity (dBm)	-31	-27	-34	-34	-34
	Link Loss Budget (dB)	13	10	19	28	34
Single Fiber Optics (Bi-directional)	Fiber Type	Multimode		Single-mode		
	Wavelength TX/RX (nm)	1310/1550		1310/1550	1310/1550	1310/1550
		1550/1310		1550/1310	1550/1310	1550/1310
	Distance	2km / 1.2mi.		20km / 12mi.	40km / 25mi.	60km / 36mi.
	Min. TX PWR (dBm)	-18		-10	-5	-3
	Max. TX PWR (dBm)	-8		-3	0	+2
	RX Sensitivity (dBm)	-38		-38	-38	-38
	Link Loss Budget (dB)	20		28	33	35

Service Module Specifications

T1 Interface Module	Channel Capacity	4 x T1
	Bit Rate	1.544 Mbs
	Line Code	B8ZS per ANSI T1.408 and AMI
	Line Framing	Extended superframe format (ESF 24-Frame multiframe) per ANSI T1.408
	Input Jitter Tolerance	Per AT&T TR 62411
	Output Jitter Tolerance	Per AT&T TR 62411
	Line impedance	120Ω Balanced
10/100M Ethernet Interface	Compliance	IEEE 802.3/802.3u
	Configuration modes	10/100M, full/half-duplex, auto-negotiation and auto MDI/MDIX
	Maximum packet length	1536/1522 Bytes
	Frame buffer	329 frames, IEEE 802.3X standard
	MAC Table	1024-entry MAC address mapping table
	VLAN/QOS function	Supported
	Port Rate Control	Supported
	Connector	RJ-45
	Ports	4 Ethernet
RS232 Module (DCE)	Channel Capacity	4 x RS232
	Bit Rate	115200 bps
		TXD/RXD 1.536Mbit/s
		DTR/DSR 128Kbit/s
		RTS/CTS 128Kbit/s
		DCD/RI 64Kbit/s
	Local loopback	Supported
	Remote loopback	Supported
2/4W Data/SCADA Module	Channel capacity	4 x Analog 2 wire or 4 wire data/SCADA
	Connector	4 x RJ-11
	Bandwidth	300Hz ~ 3.4KHz
	Impedance	600Ohm
	Longitudinal Conversion Loss	>60dB
	Return Loss	>30dB
	Idle Channel noise	75dB
	CMRR	>60dB

6. Ordering Information

Base Systems

Part Number	Description	Power 1	Power 2	Dimensions (1RU)
RLH-IMUX-V-2	iMUX BASE SYSTEM DUAL 48 VDC INPUT PWR	48VDC	48VDC	W17.3in x D11.2in x H1.75in (440mm x 285mm x 44.5mm)
RLH-IMUX-A-2	iMUX BASE SYSTEM AC/DC & 48VDC INPUT PWR	115/220VAC	48VDC	W17.3in x D11.2in x H1.75in (440mm x 285mm x 44.5mm)

- Optics and Service Modules are ordered separately and are pre-installed.
- System is pre-configured before shipping for quick and easy operation.
- 2 multiplexers are required for a complete system.
- Bidirectional single fiber models require an A side unit and a B side unit for a complete system.
- Please contact your RLH sales representative for pricing and delivery information.

Port Modules

Part Number	Description
RLH-MM-T1	T-1 4X1 MODULE
RLH-MM-D1	R-232 4X1 MODULE
RLH-MM-AO	2 WIRE (POTS) FXO/CO 4X1 MODULE
RLH-MM-AS	2 WIRE (POTS) FXS/SUB 4X1 MODULE
RLH-MM-D2	2/4 WIRE ANALOG DATA/AUDIO/SCADA 4X1 MODULE

- Service Modules are ordered at same time as base system and are pre-installed.
- System is pre-configured before shipping for quick and easy operation.
- Please contact your RLH sales representative for pricing and delivery information.

Optical Modules

Part Number	Description	Side	Distance	Fiber	Part Number
Multimode ST	iMux Optical Module	-	2 km/1.2 mi	62.5 µm	**RLH-OM-04-1**
Bi-Directional Single-mode SC	iMux Optical Module	A	20km/12.4mi.	8~9 µm	**RLH-OM-10-1**
	iMux Optical Module	B	20km/12.4mi.	8~9 µm	**RLH-OM-11-1**
	iMux Optical Module	A	60km / 37mi.	8~9 µm	**RLH-OM-14-1**
	iMux Optical Module	B	60km / 37mi.	8~9 µm	**RLH-OM-15-1**
Single-mode SC	iMux Optical Module	-	20km/12.4mi.	8~9 µm	**RLH-OM-40-1**
	iMux Optical Module	-	60km / 37mi.	8~9 µm	**RLH-OM-41-1**
	iMux Optical Module	-	120km / 74 mi.	8~9 µm	**RLH-OM-42-1**
Single-mode ST	iMux Optical Module	-	20km/12.4mi.	8~9 µm	**RLH-OM-50-1**

- Optics Modules ordered at same time as base system and are pre-installed.
- System is pre-configured before shipping for quick and easy operation.
- Bidirectional single fiber models require an A side unit and a B side unit for a complete system
- Please contact your RLH sales representative for pricing and delivery information

7. Support

Technical Support

Email:	support@fiberopticlink.com
24/7 technical support:	Toll Free 1-855-RLH-24X7 Toll Free 1-855-754-2497

Contact Information

Corporate Headquarters:	RLH Industries, Inc. 936 N. Main Street Orange, CA 92867 USA
Phone:	(714) 532-1672 Toll Free 1-800-877-1672 Toll Free 1-866-DO-FIBER
Fax:	(714) 532-1885
Email:	info@fiberopticlink.com
Web site:	www.fiberopticlink.com

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

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