RLH Industries, Inc.

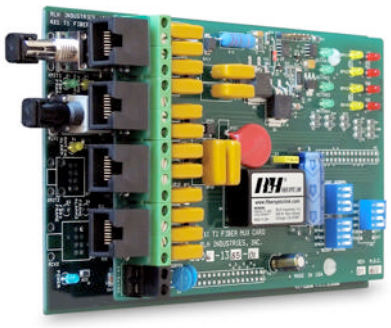
PRODUCT INFORMATION

The leader in fiber optic telecommunications technology.

R2009A-070909

4x1 T-1 Mux Interface Fiber Optic Link System

Product Information and Specifications



Key Features

- Applications for critical, high voltage, remote or unmanned locations that must remain operating 24/7/365.
- Simplex line powered on the drop side from the T-1 span or HDSL NIU/RT unit, eliminating costly external power arrangements. Power CO/Sub cards externally with 100mA @ 24Vdc or 64mA @ 48Vdc.
- Environmentally hardened to operate in -40°F to +158°F (-40°C to +70°C) environments.
- Accommodates from one to four incoming T-1 4 wire copper lines over one fiber pair.
- T-1 Applications where available fiber strands, enclosures or mounting space are limited.
- Co and Sub T-1 4X1 cards are electrically identical and can be used at either end of the fiber system.
- Will operate from any HDSL-1, HDSL-2 or HDSL-4 NIU/RT
- Unconditional lifetime warranty
- RJ48C connection available.
- Loop back features for independent channel testing.
- T-1 4X1 Fiber cards will fit into all RLH housings except single card unit.
- Multiplexing and de-multiplexing of four asynchronous T-1 channels.
- Receive frame integrity LED and remote T1 channel fault LED.
- Can be used inside or outside customer premise environment.

Contents

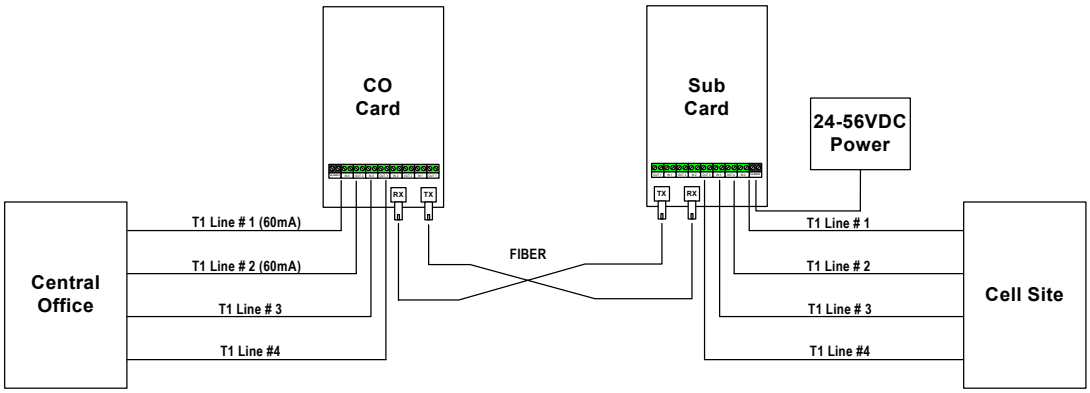
Key Features ____ 1
General Safety Practices ____ 2
Special Handling Requirements ____ 3
Description ____ 4
Connections ____ 5
Powering the System ____ 5
Switch Settings ____ 6
LED Indicators ____ 6
Ordering Information ____ 7
Specifications ____ 7
Warranty ____ 8
Technical Support ____ 8

Compliance Information

The RLH 4x1 T-1 Mux Fiber Optic Link System is compliant with the following industry standards:

- **NEBS Level 3**
- **FCC PART-15**
- **FCC PART-68B**
  IEEE-80 IEEE-367
- **IEEE-487**
  IEEE-1590
- **IEEE-1615**
- **Motorola R56**
- **BR 876-310-100 BT (Telcordia)**
- **Bellcore SR-3966**
- **GR-1089**
- **GR-63**

Specifications subject to change without notice.



4x1 T1 System Diagram

General safety practices

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

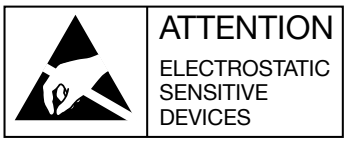
- Never install during a lightning storm or where unsafe high voltages are present.
- Active T1 lines carry high DC voltages up to 56V. Use caution when handling T1 wiring.
- Active UHDSL lines carry high DC voltages up to 210V. Use caution when handling UHDSL wiring.

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.

Special handling requirements

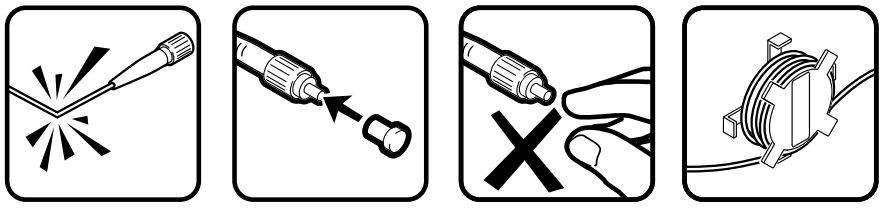
Be careful when handling electronic components



- This product contains static sensitive components.
- Handle the T1 cards at their edges 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

Description

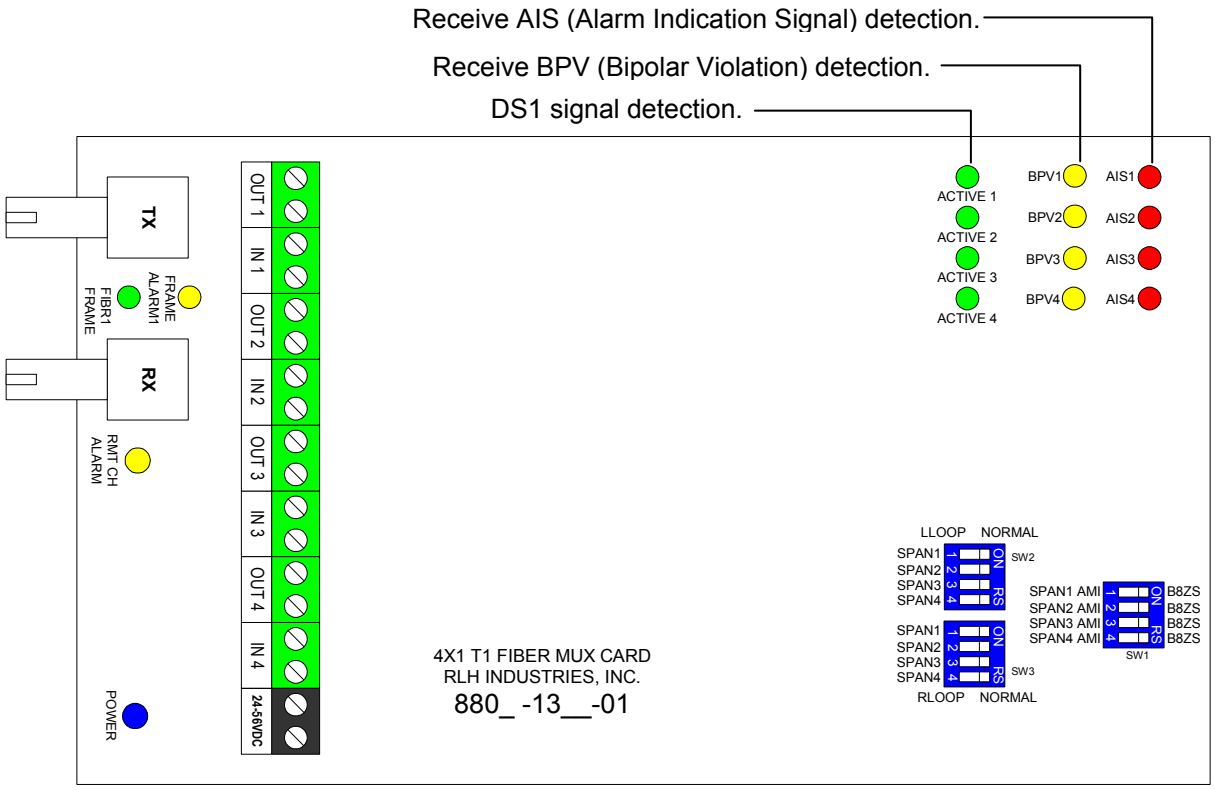
The Fiber Optic 4X1 MUX combines up to four incoming DS1 data signals at 1.544Mbps and optically transmits this signal via fiber optic cable to the opposite end card which converts this signal to the original DS1 signals at regenerated DS1 levels.

4X1 MUX CO Side Card

The 4X1 MUX CO Card provides the interface between as many as FOUR Telco Central Office T-1 copper 4-wire lines over a TWO-STRAND fiber optic cable.

4X1 MUX SUB Side Card

The 4X1 MUX SUB Card provides the interface between as many as FOUR Subscribers equipment T-1 copper 4-wire lines over a TWO- STRAND fiber optic cable.



4x1 T1 Card Layout

Connections

Connect Fiber Optic Cable

Fiber Optic Link Cards are equipped with two optical connectors. Connect fiber to the Transmit and Receive. The transmit terminal is marked “XMIT”, and the receive terminal is marked “RCV”. Be sure the XMIT connector is connected to the RCV connector on the opposite end of the fiber, and the RCV connector is connected to the XMIT connector on the opposite end of the fiber.

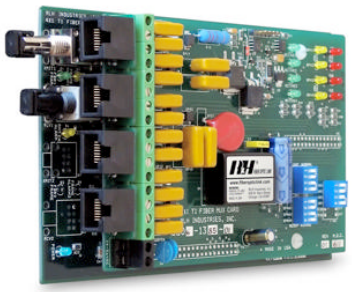
Fiber cables should be routed loosely avoiding tight bends to prevent excessive optical loss.

Connect Copper T1 Send and Receive pairs

The T-1 pairs from the Telco connect to the green screw-down terminals provided on the T-1 CO Card. The Telco Receive connects to the OUT terminal (signal comes out of card). The Telco Send connects to the IN terminal (signal goes into card).

Note: Fiber Optic Link 4X1 MUX CO Cards are designed to operate on standard T-1 lines that are current limited at 60mA. Open circuit voltage on T-1 lines can vary from 30V to 130V across send and receive pairs depending on the number of repeaters in the line. However, voltage across the Fiber Optic Link card when operating will be 30VDC or less.

Note: Optional RJ48C adapters are available to connect cards via standard RJ connector, see figure 4. RJ jacks are gel filled to prevent corrosion. CO side RJ adapters connect pins 1,2 to the card input connector and pins 4,5 to the card output. Sub side RJ adapters connect pins 1,2 to the card input and 4,5 to the card output. RJ adapter part numbers: RLH-RJ4X1-CO and RLH-RJ4X1-SUB



Card with RJ48C Adapter

Powering the System

Powering at the CO end

The CO Fiber MUX Card is typically span powered by two 60mA simplex current sources derived from the T1 Telco Span Transmit and receive copper pairs. To span power the 4X1 MUX Sub Card you must have a minimum of two 60mA simplex current sources (two working T-1 circuits). The CO 4X1 card can also be powered externally by connecting a 24-56VDC, 100mA power source to the black terminal on the 4X1 MUX Sub Card labeled “24 - 56VDC”. The 4X1 MUX CO card is polarity insensitive to all electrical connections.

Connect a 24-56 VDC, 100mA external power source to the black terminal on the 4X1 MUX Sub Card labeled “24 - 56VDC”. Alternately the card can be powered by two 60mA simplex current sources on the T-1 Send and Receive pairs. To span power the 4X1 MUX Sub Card you must have a minimum of two 60mA simplex current sources (two working T-1 circuits). The 4X1 MUX Sub Card is polarity insensitive to all electrical connections.

T-1 Surge Protection

Thermistors, and Sidactors limit transients appearing between the Tip and Ring of each pair. Transients appearing at the “24 – 56VDC” terminals or between input and output pairs are limited by PTC thermistors and a metal oxide varistor

Switch Settings

Switch SW1

A four-position dipswitch is used to establish the selection of B8ZS (bit 8 zero substitution) or AMI (alternate mark inversion) line encoding for each of the T-1 inputs.

Switch SW2

A four-position dipswitch is provided to allow for remote loop back of each of the four T-1 lines for trouble shooting purposes. The loop back function begins at the T-1 receive twisted pair, through the T-1 LIU (Line Interface Unit), and then back out the T-1 transmit twisted pair. Normal operating position is ON/NORMAL for All four DIP positions.

Switch SW3

A four-position dipswitch is provided to allow for local loop back of each of the four T-1 lines for trouble shooting purposes. The loop back function begins at the 4X1 MUXT-1 transmitter data coming from the optic fiber link, through the T-1 LIU, and then back out to the fiber optic transmit link. Normal operating position is ON/NORMAL for All four DIP positions.

Note: Upon detection of LOSS (loss of signal), the unit will turned off that channels signal active LED (green). This condition will continue to exist until the error condition has been removed.

LED Indicators

Bipolar Violation

The BPV alarm LED (yellow) will be looking for any bipolar violations at the receive T1 LIU. The LED will be turned on for a visible period of time per detected event. BPV detection can be an indication of loss of line integrity at the receiver. It should be noted that if the transmitting equipment is using encoded B8ZS, and the 4X1 MUX Fiber unit is configured for AMI, the channel BPV alarm LED will turn on.

Alarm Indication Signal

The AIS alarm LED (red) will light up whenever a series of unframed all-ones are received at the input of any of the T-1 LIUs. The reception of this alarm indicates that equipment down the line from the T1 receiver has detected a loss of signal and is transmitting an unframed all-ones alarm signal.

Fiber Optic Receive Frame Valid

The fiber frame LED (green) will remain on as long as the fiber optic receiver stays in frame with the far end 4X1 MUX fiber optic transmitter. Only if there is a problem with the receive frame does the green LED turn off. When this LED does turn off then both of the 4X1 MUX end units will begin a system resynchronization. This resynchronization requires about ten milliseconds to accomplish. Also a second fiber optic fault “FRAME ALARM” LED (yellow) is provided that turns on if the fiber optic receive frame is lost. This yellow LED is continuously on if the local receiver cannot detect receive frame from the fiber. The loss of the far end receive frame will cause this yellow LED to blink on and off.

Remote Channel Alarm

This yellow LED indicates that the far end unit has detected a LOSS, BPV, or AIS fault condition from one of its four T-1 LIUs.

Ordering Information

Fiber Type	Connector Style	4 Wire T1/E1 CO Card	4 Wire T1/E1 Sub Card
Multimode	ST	8806-1345-01	8806-1355-01
Multimode	SC	8805-1345-01	8805-1355-01
Single-mode	ST	8806-1385-01	8806-1395-02
Single-mode	SC	8805-1385-01	8805-1395-02
Single-mode (Long Haul)	ST	8806-1385-01LH	8806-1395-02LH
Single-mode (Long Haul)	SC	8805-1385-01LH	8805-1395-02LH

* Note: Add -RJ to part number to include RJ adapter with the card

Part Number	Description
RLH-RJT1-CO	RJ-48C Adapter for CO 4 Wire T1 Card
RLH-RJT1-SUB	RJ-48C Adapter for SUB 4 Wire T1 Card

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

General Specifications

Transmission method	Amplitude modulated light via two optical fibers Multimode: 850nm (Tx level: -14dB +/- 1dB) Single-mode: 1310nm (Tx level: -23dB +/- 1dB) Single-mode Long Haul: 1310nm (Tx level: -6dB +/- 2dB)
Maximum Fiber Attenuation / Distance	Multimode: 10dB / 1.5 miles (2.5 km) Single-mode: 8dB / 9 miles (15 km) SM Long Haul: 26dB* / 37 mi. (60 km), *min. required loss -8dB
Fiber Type	(ST or SC connectors) Multimode: 62.5/125µm, 50/125µm Single-mode: 8-9/125µm
Temperature Limits	-40°F to +158°F (-40°C to +70°C + maximum solar load)
Humidity	95% non-condensing
Dimensions	RLH Standard Form Factor L7" x W4"x H1.1"
BER	$<10^{-9}$
Transmit Level	6V P-P Nominal
Surge Protection	Fuses, thyristors, PTC thermistors, zeners, and MOVs
Power Requirements	CO/ Sub Cards: 24-56 VDC, 57-66mA
Powering Method	Line power simplexed on Send and Receive pairs, or an isolated DC power source connected to AUX. P.S. input.

Value	Min.	Type	Max.	Unit
T1 Output Pulse Amplitude (FCC Part 68)	2.7	3.0	3.3	Volts Pk
T1 Receiver Sensitivity (0dB=2.4V)	-13.6	-	-	dB
T1 Receiver Frequency	1.5438	1.544	1.5442	Mbps
T1 Receiver Frequency Tolerance	±130	-	-	ppm
T1 Receiver Resistance	-	100	-	-

Warranty

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

We can offer this warranty because:

- We believe our customers shouldn't have to incur additional costs due to failure or damage
- We engineer and manufacture our Fiber Optic Links in the USA, with total confidence in our quality
- We understand how safety and reliability impact the total cost of ownership
- We know that customer support extends beyond the initial sale, so **we stand behind our products**

RLH will 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 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. Compare this warranty to our competitors and see how our warranty will reduce your costs and simplify your maintenance activities.

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

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) 366-2503 (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

RLH Industries, Inc.