RLH Industries, Inc.

PRODUCT INFORMATION

The leader in rugged fiber optic technology.

✓ *Unconditional Lifetime Warranty*

U-002 2014A-0122

2 Channel T-1 Mux Fiber Link Card System

2 Channels of T-1 w/ Ethernet Over Fiber

2 Channel T-1 Mux Fiber Link Card

Description

The 2 Channel T1 Mux Fiber Link system transports up to two T1 lines over two strands of fiber. It has B8ZS and AMI compatibility, with LED status indicators for system monitoring.

It provides cost effective, high density regenerated T1 over fiber in a compact RLH Fiber Link card form factor, compatible with any of our fiber link card housings. This hardened, rugged system is covered by our **Exclusive Unconditional Lifetime Warranty.**

Key Features

- Applications for critical, high voltage, remote or un-manned locations that must remain operating 24/7/365.
- Simplex 60mA line powered on the drop side from the T-1 span or HDSL NIU/RT unit, eliminating costly external power arrangements.
- Compatible with 2 Channel T-1 Mux DIN Fiber Link system.
- May be powered externally with 24~56VDC 160mA local power.
- Environmentally hardened to operate in -40°F to +158°F (-40°C to +70°C) environments.
- Accommodates up to two incoming T-1 4 wire copper lines over one fiber pair.
- Ideal for T-1 applications where available fiber strands, card slots or powering options are limited.
- The same Fiber Link Card may be used at either end of the fiber system, simplifying spares and ordering.
- Will operate from any HDSL-1, HDSL-2 or HDSL-4 NIU/RT signal.
- RJ48C T1 connections with adapters for punch down wiring.
- Loop back features with independent channel testing.
- Provides simultaneous transmission of two asynchronous T-1 channels.
- Frame integrity LED and remote T1 channel fault LEDs.
- Compact modules are DIN rail or wall mountable.
- Can be used within or beyond customer premise environments.
- Covered by our **Exclusive Unconditional Lifetime Warranty**.

Contents

Compliance Information

The RLH 2 Channel T-1 Mux Fiber Link Card System is compliant with the following industry standards:

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

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 130V. Use caution when handling T1 wiring.
- Active UHDSL lines carry high DC voltages up to 210V. Use caution when handling UHDSL wiring.

Warning

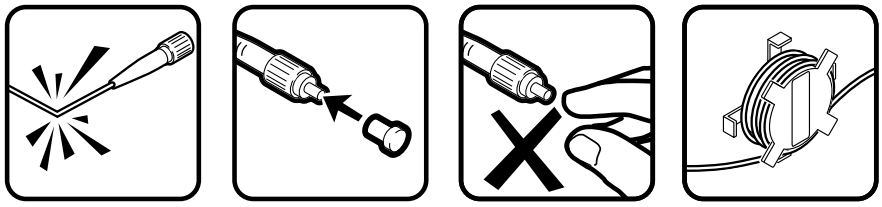
The intra-building port(s) of the equipment or subassembly is suitable for connection to intrabuilding or unexposed wiring or cabling only. The intra-building port(s) of the equipment MUST NOT be metallically connected to interfaces that connect to the OSP or its wiring. These interfaces are designed 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 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. There are no user serviceable parts on the card. Do not open or remove the housing or insert tools or other objects into any openings except to access switches or where otherwise intended. Doing so may permanently damage the card.

Guidelines for handling terminated fiber cable

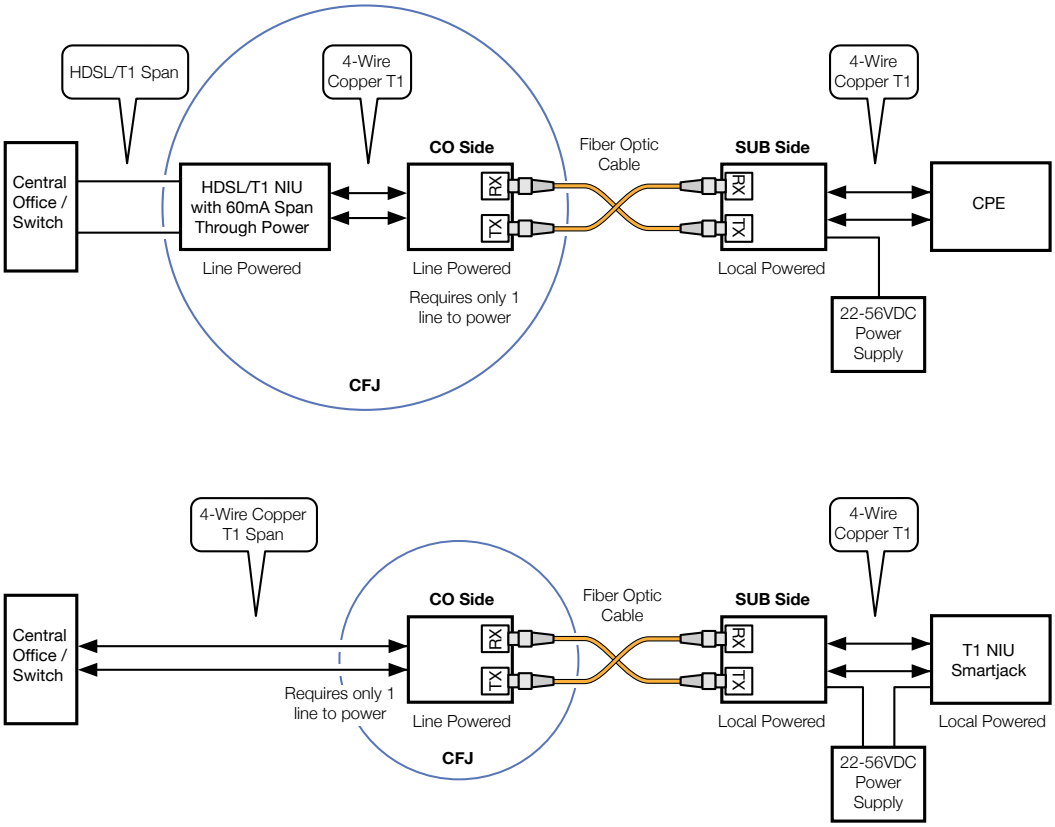


- Do not bend fiber cable sharply. Use gradual and smooth bends to avoid damaging glass fiber.
- Keep dust caps on fiber optic connectors at all times when disconnected.
- Do not remove dust caps from unused fiber.
- Keep fiber ends and fiber connectors clean and free from dust, dirt and debris. Contamination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

Application

The 2 Channel T1 Fiber Link system combines up to two incoming DS1 data signals at 1.544Mbps, and optically transmits this signal over fiber optic cable to the module at the opposite end, which converts the signals back into the original DS1 signals at regenerated DS1 levels.

Below are sample system diagrams illustrating typical T1 connections to and from the system. On the CO (Central Office) side, the 2 Channel T1 Mux system may be powered by a single T1 line carrying span power, or optionally by a local power source. The SUB side requires a local power source for operation.



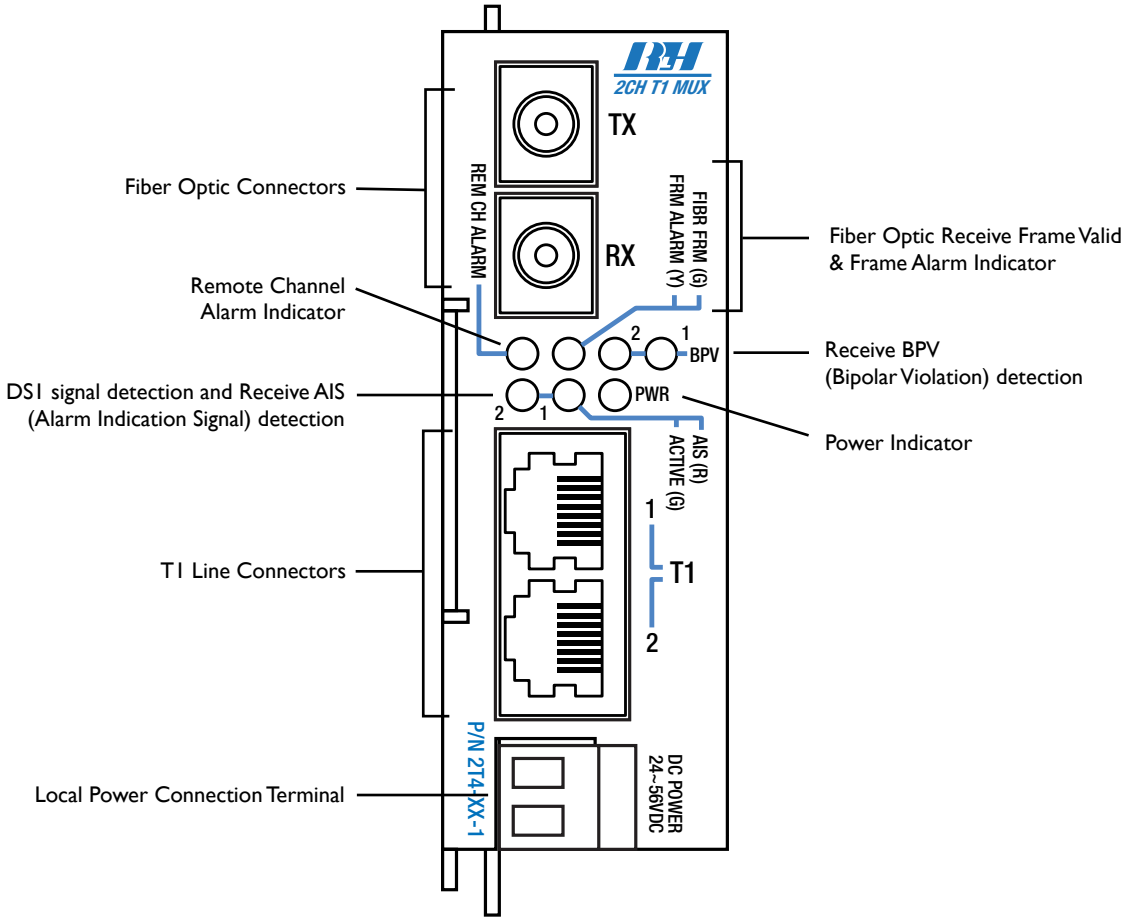
2 Channel T1 Mux System Diagram

The CO side

The 2 Channel T1 Fiber Link Card provides the interface between one or two Telco Central Office T-1 copper 4-wire lines over two strands of fiber optic cable.

The SUB Side

The 2 Channel T1 Fiber Link Card provides the interface between one or two T-1 copper 4-wire lines over two strands of fiber optic cable. The SUB side uses the local power screw down terminal for powering.



2 Channel T1 Mux Fiber Link Card Front Panel Layout

Installation

Prior to installation:

- Check for shipping damage
- Check the contents to ensure correct model and fiber type
- Have a clean, dry installation environment ready
- Ensure that the fiber type at the site matches the system type

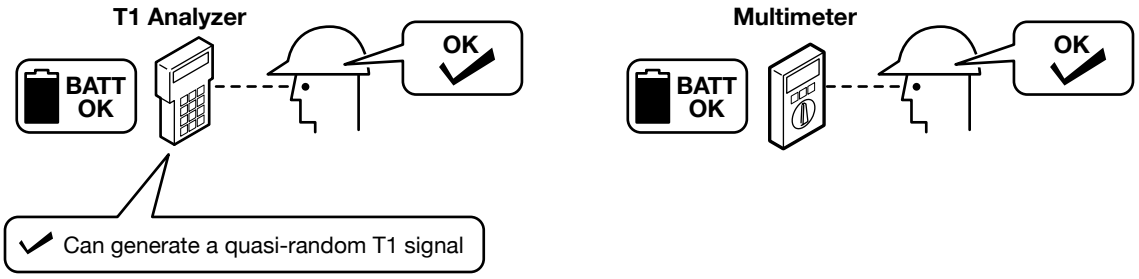
If damage is discovered file a claim immediately with the carrier, then contact RLH customer service.

Required for installation:

- 24-56VDC (60mA@24VDC minimum) line or local power source at the TX side.
- 24-56VDC (60mA@24VDC minimum) line or local power source at the RX side.
- Suitable RLH Fiber Link Card housing
- Active T1 line
- Multimeter

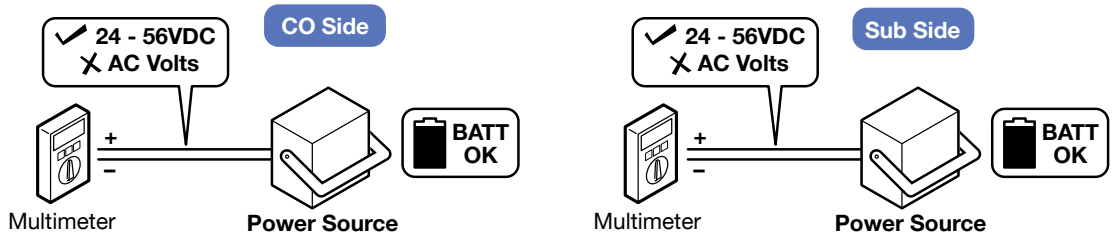
You will need a T1 analyzer such as a T-BERD and a multimeter

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.



Required power sources if installing before T-1 service is available at the site

You will need to power the system to test it. Use a separate power source for powering the CO and Sub side card. A battery may be used.



Use 22~24AWG solid wire for power supply connections.

Refer to the power supply connection and use information for fuse or circuit breaker requirements. Use caution when handling copper wiring. Power connections may carry high voltages.

Fuses must be installed within a finger safe housing to prevent electric shock from accidental contact or during fuse replacement.

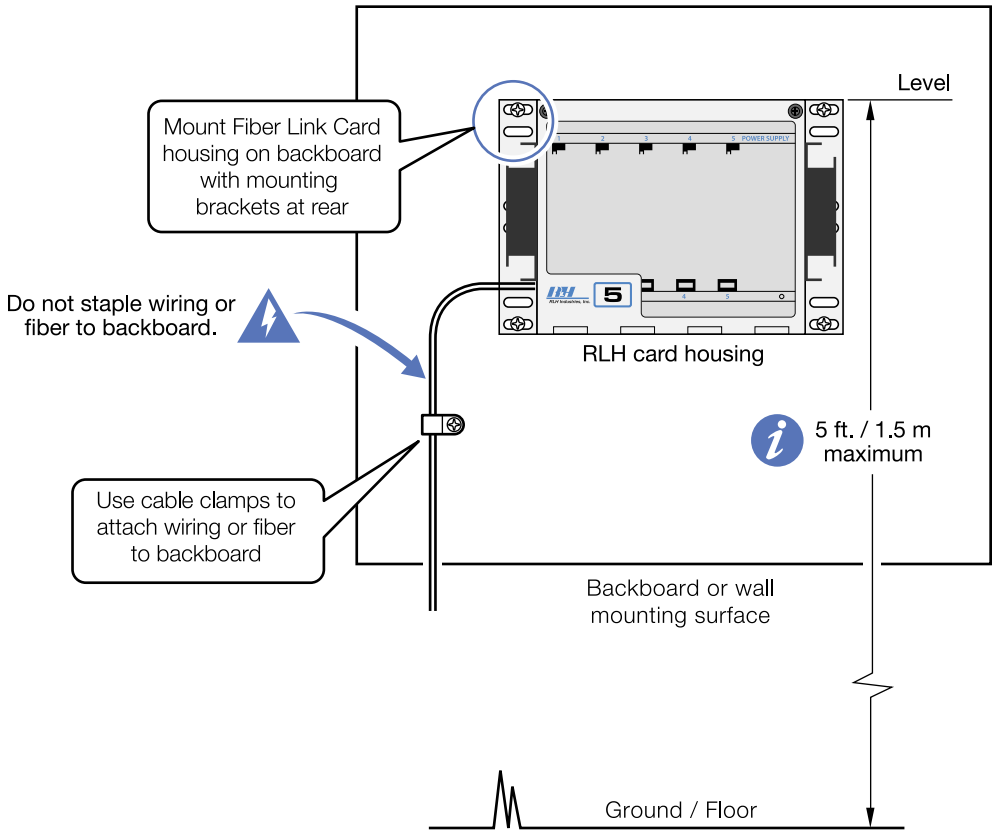
Line Powering

The 2 Channel T1 CO card can be line powered via 60mA simplex current on the line. When an HDSL or T1 NIU is placed at the CO side of the Fiber Link it must provide span-through line power to the T1 CO fiber interface card. When line power is available, no external or local power is required to operate the fiber card. An active T1 line with 60mA line power connected to the fiber interface card should typically measure 28-30VDC between transmit and receive pairs. If voltage is not present verify the NIU model number using the **NIU Compatibility Chart** listed in this document, or contact RLH to ensure span-through power capability.

Installing card housing

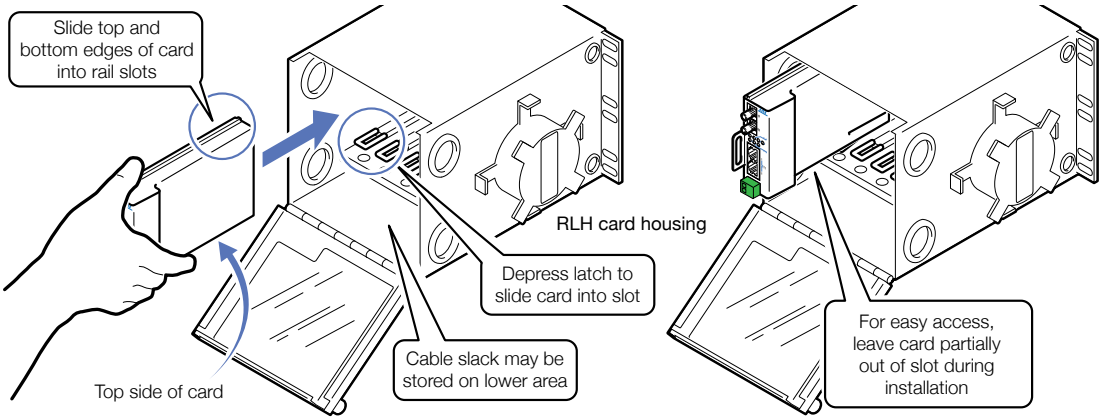
Mount housing in equipment rack or attach to backboard.

When installing an RLH card housing, leave room for the door to open and provide enough slack in wiring and fiber to allow for card access.



Note card orientation in housing during installation

Handle card by edges. Install in slot 1 or next available card slot. Install card into housing before connecting fiber or copper wiring.

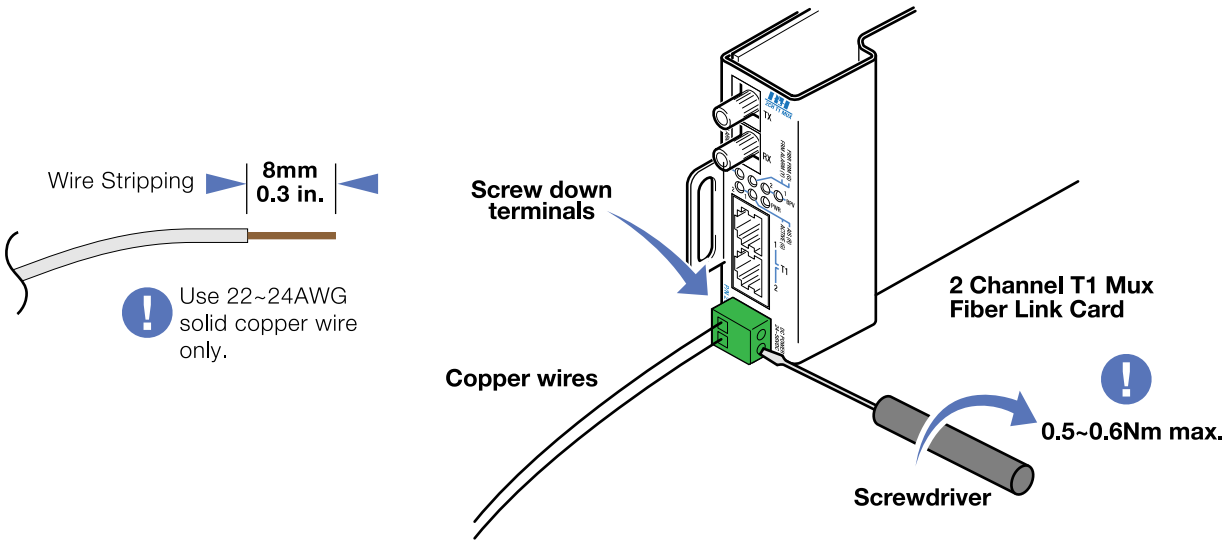


Copper wiring requirements

Copper wiring to the T-1 cards

The connectors on the T-1 cards are designed for specific wire sizes and mechanical connections at the terminals.

- Use 22~24AWG solid copper wire
- Stripping length: 8mm
- Connector tightening torque: 0.5~0.6 Nm. Do not over-tighten screw down wire terminals.



Connections

Connect Fiber Optic Cable

The T1 cards are equipped with two optical connectors. Connect the fiber to the Transmit and Receive fiber connectors. The transmit port is marked TX, and the receiver port is marked RX. Verify that the TX fiber at one card is connected to the RX port on the opposite end. Connecting TX to TX will not function properly.

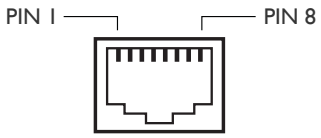
Fiber cables should be routed loosely avoiding tight bends to prevent excessive optical loss.

Note: The 2 Channel T1 Mux Fiber Link cards are compatible with the DIN 2 Channel T1 Mux Fiber Link Systems. Refer to the DIN mount user guides for information related to the DIN mount modules.

Connect Copper T1 Send and Receive pairs

The T-1 pairs from the Telco connect to the RJ-45C connectors on the face of the card.

Note: At the CO side, the 2 Channel T-1 MUX modules 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 module when operating will be 30VDC or less.



RJ-45 Port	
1 RX (Input)	5 TX (Output)
2 RX (Input)	6 NC
3 NC	7 NC
4 TX (Output)	8 NC

RJ Connector Pinout Diagram

Powering the System

Powering at the CO end

Typically, the CO module is span powered by a single 60mA simplex current sources derived from the T1 Telco Span Transmit and Receive copper pairs. A single simplex current source will support both T1 channels.

The CO side module may also be powered externally by connecting a 24-56VDC 60mA power source to the power terminal on the top of the unit. The 2x1 T1 cards are polarity insensitive to all electrical connections.

Powering at the SUB end

To span power the SUB side module you must have a minimum of one 60mA simplex current source on the T-1 Send and Receive pairs on a working circuit.

For remote power, connect a 24-56VDC 60mA power source to the power terminal on the top of the unit. The 2X1 MUX modules are polarity insensitive to all electrical connections.

Note: The CO and SUB units must be powered by separate isolated power sources to maintain high voltage protection characteristics.

T-1 Surge Protection

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

Switch Settings

DIP switches are located on the top surface of the card. You may need to pull the card slightly out the card housing to gain sufficient access to the switches.

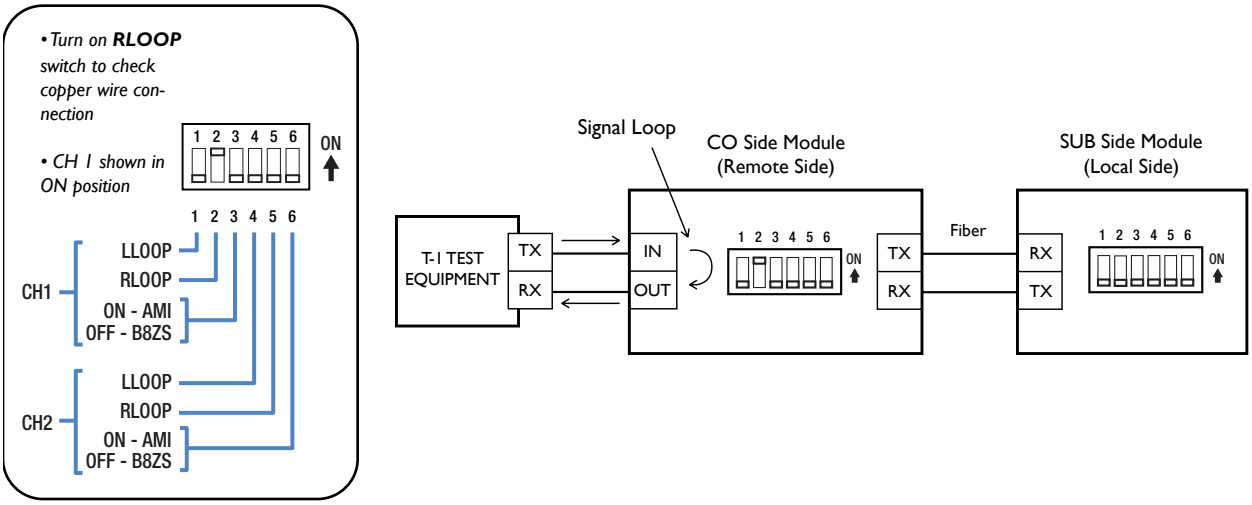
B8ZS or AMI Encoding

The AMI/B8ZS DIP switch 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.

Remote Loopback

The remote (RLOOP) loopback DIP switches are provided to allow for remote loop back of each of the T-1 channels 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 OFF for All switch positions.

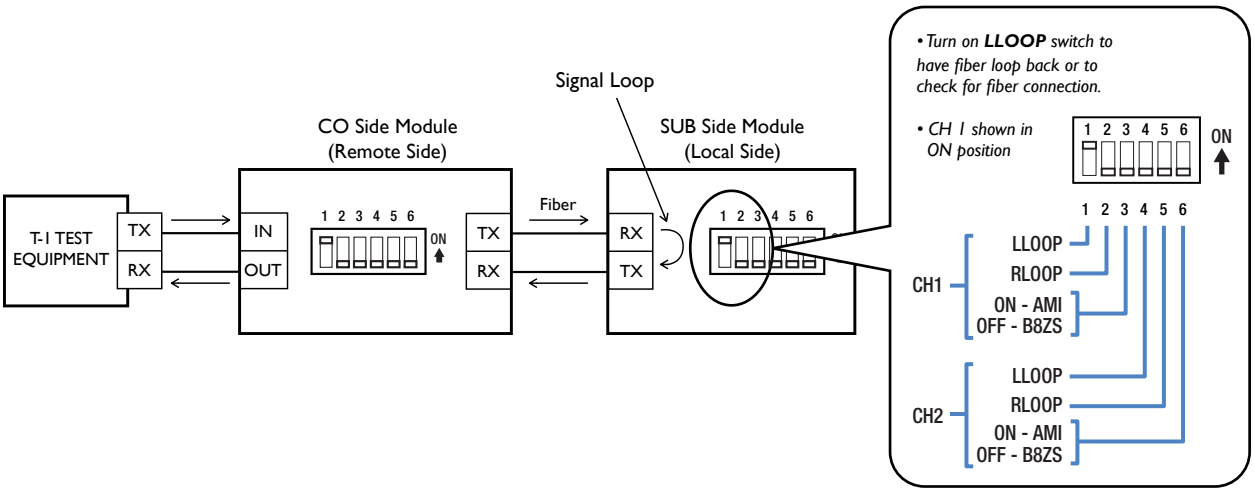


RLOOP (Remote Loopback) Switch Diagram

Local Loopback

The local (LLOOP) loopback DIP switch is provided to allow for local loop back of each of the T-1 lines for troubleshooting purposes.

The loop back function begins with the 2 Channel T-1 transmitter data coming from the remote side module, through the fiber cable to the local side, then back out through the fiber cable to the remote side. Normal operating position is OFF for All switch positions.



LLOOP (Local Loopback) Switch Diagram

Note: The LEDs will indicate the matching conditions upon detection of errors or alarms. The LEDs will remain ON until the error condition has been removed.

Line Build Out (LBO)

The Line Build Out switches simulate cable loss of the signal for compatibility with different installation scenarios. There are 2 switches corresponding to -7.5dB and -15dB attenuation levels for each channel. Select a level appropriate for your particular application by setting one of the switches to the ON position.

Only one switch may set to ON at a time. The default position is OFF.

LED Indicators

Remote Channel Alarm

The REM CH ALARM (yellow) LED indicates that the far end unit has detected a loss of fiber signal, BPV, or AIS fault condition from one of its T-1 LIUs.

Fiber Optic Receive Frame Valid / Frame Alarm

The FIBR FRM (green) LED will remain ON as long as the fiber optic receiver stays in frame with the far end 2x1 T1 card. Only if there is a problem with the receive frame does the green LED turn yellow. When this LED does turn yellow then both of the 2x1 T1 end units will begin a system resynchronization. This resynchronization requires about ten milliseconds to accomplish.

The 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 LED to blink on and off.

Power Indicator

The PWR (green) LED will be ON when acceptable power is detected at the card. Span power or a local power source can provide enough power for the system. When the power LED is off, the system is not detecting enough power to operate.

T1 Activity

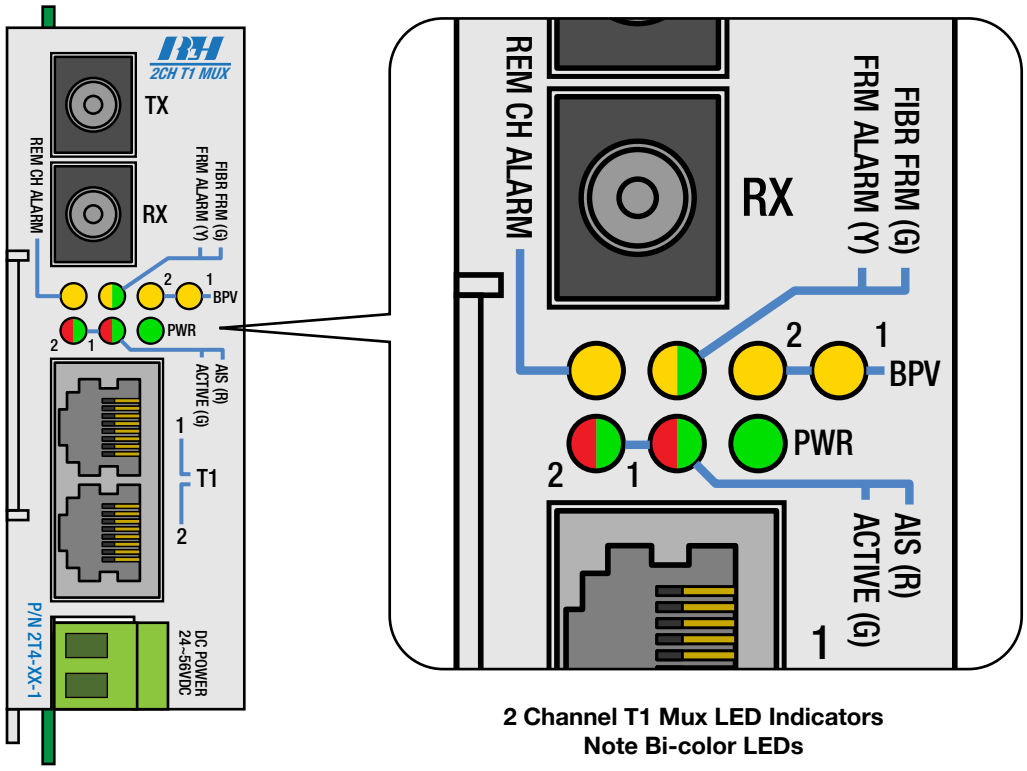
The ACTIVE (green) LED will be ON when a valid DS1 signal is detected at the RJ connector.

Alarm Indication Signal

The AIS alarm (red) LED will be ON whenever a series of unframed all-ones are received at the input of any of the T-1 LIUs. 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.

Bipolar Violation

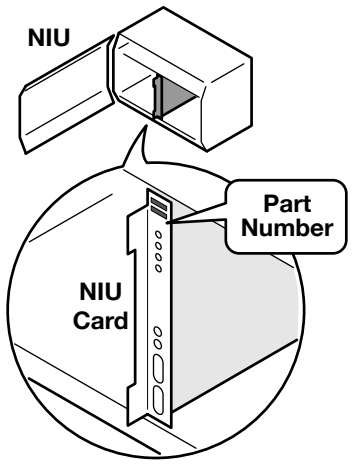
The BPV alarm (yellow) LED will be looking for any bipolar violations at the receive T1 LIU. The LED will remain ON for a visible period per detected event. BPV detection can indicate loss of line integrity at the receiver. It should be noted that if the transmitting equipment is using encoded B8ZS, and the card is configured for AMI, the channel BPV alarm LED will turn ON.



2 Channel T1 Mux LED Indicators
Note Bi-color LEDs

NIU Compatibility

Check for compatible NIU systems that supply Span Through-Power to the 2 Channel T-1 Mux Fiber Link cards. Contact RLH for T-1 compatibility with systems not listed.

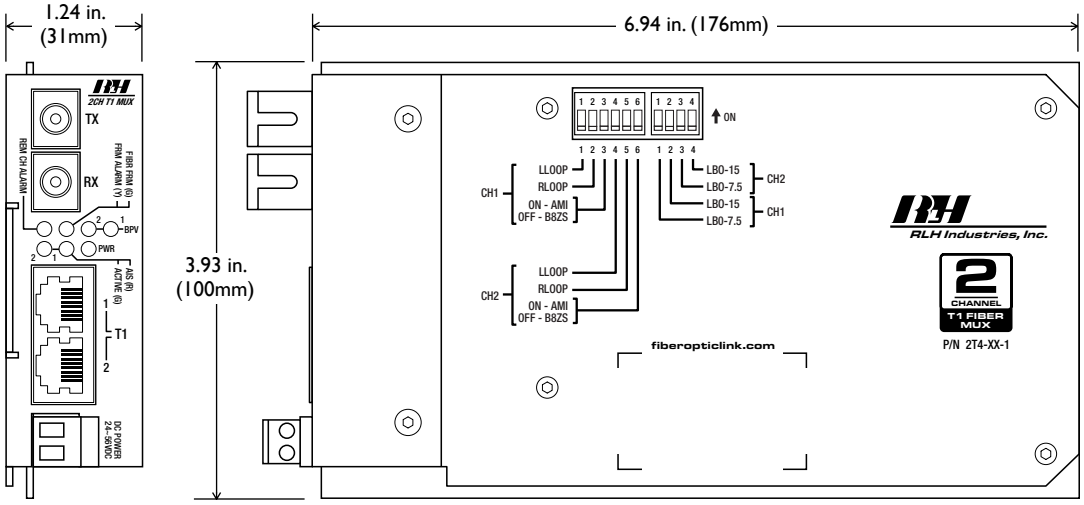


HDSL/T1 Span Through Power NIU Compatibility Chart			
Manufacturer	**Part Number**	**Description and Material ID**	**CLEI Code**
HDSL1			
Adtran	1246026L4	T200 HTU-R (VZ# 594993)	T1L2C8J8AA
Adtran	1246026L5	T200 HTU-R (BST# 98001580)	T1L3KD5AAA
Adtran	1245024L1	T400 HTU-R	T1L2C8J8AA
Adtran	1247026L1	T200 HTU-R,	
ADC	SPX-HLXRD11	T400 HLXR	SND1FJRAAA
HDSL2			
Adtran	1223024L1	H2TU-R (VZ# 11018736)	T1L6VR8B_ _
HDSL4			
Adtran	1223424L1	H4TU-R (VZ# 11018731)	T1L6EYHB_ _
Repeated T1			
Adtran	1181315L1-5B	T1 NIU, Total Access	T1L3PU0A
Hyperedge	520-10-SWI3	T200 T1 NIU (BST# 300058336)	
Westell	DNI5760LNI3	T1 NIU (VZ# NCIUV9A)	NCIUV9A4AA
Westell	A90-3128-70	T1 NIU (VZ# T1L3P96)	T1L3P96CAA
Westell	A90-3115-31	T1 NIU (VZ# T1S1AEF)	T1S1AEFAAA

General Specifications

Transmission method	Amplitude modulated light via two optical fibers	
	Multimode:	850nm (Tx level: -16dB ± 1dB)
	Single-mode:	1310nm (Tx level: -23dB ± 1dB)
	Single-mode Long Haul:	1310nm (Tx level: -8dB ± 2dB)
Maximum Fiber Attenuation / Distance	Multimode:	10dB / 1.2 miles (2 km)
	Single-mode:	8dB / 9 miles (15 km)
	Single-mode Long Haul:	26dB* / 37 mi. (60 km), *min. required loss -8dB
	*Note: Distances equated using industry standard fiber and connector attenuation of 3dB/Km. Fiber condition, splices and connectors may affect actual range.	
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)	
Humidity	95% non-condensing	
Dimensions	RLH Standard Fiber Link Card Form Factor L7" x W4"x H1.2"	
Mounting	Installed into any RLH Fiber Link Card Housing. Rack, DIN mount and wall mount housings are available.	
BER	$<10^{-9}$	
Surge Protection	Fuses, thyristors, PTC thermistors, zeners, and MOVs	
Local Power Requirement	24-56 VDC, 60mA	
Powering Method	60mA line power simplexed on Send and Receive pairs, or an isolated DC power source connected to power input terminals.	
Power Connector	Non-polarity sensitive local power input via removable screw down terminal block	
Compatibility	Compatible with RLH 2 Channel T1 Mux DIN mount modules	

Dimensions



Ordering Information

2 Channel T-1 Mux Fiber Link Card System

Part Number	Description	Distance	Fiber	Part Number
Multimode ST	2 Channel T-1 MUX (CO/SUB)	2km/ 1.2 mi	62.5 µm	2T4-02-1
	2 Channel T-1 MUX (CO/SUB)	2km/ 1.2 mi	50 µm	2T4-04-1
Multimode SC	2 Channel T-1 MUX (CO/SUB)	2km/ 1.2 mi	62.5 µm	2T4-01-1
	2 Channel T-1 MUX (CO/SUB)	2km/ 1.2 mi	50 µm	2T4-03-1
Single-mode ST	2 Channel T-1 MUX (CO/SUB)	15km/ 9 mi	8~9 µm	2T4-20-1
	2 Channel T-1 MUX (CO/SUB)	60km/ 37mi	8~9 µm	2T4-21-1
Single-mode SC	2 Channel T-1 MUX (CO/SUB)	15km/ 9 mi	8~9 µm	2T4-10-1
	2 Channel T-1 MUX (CO/SUB)	60km/ 37mi	8~9 µm	2T4-11-1

- A complete system requires 2 cards.
- Plug and play compatible with RLH 2 Channel T1 Mux DIN Fiber Link systems.
- Please contact your RLH sales representative for pricing and delivery information.

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 transmission products are guaranteed to be free of defects in material and workmanship for the **LIFE OF THE PRODUCT**. Look for the warranty badge.

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 these products or components that fail **FOR ANY REASON**. This warranty is **UNCONDITIONAL** and valid even when products have been abused or mishandled, when unauthorized repairs have been attempted or performed, or as a result of a natural disaster. Compare this warranty to our competitors and it becomes clear how RLH products will reduce your costs and simplify your maintenance activities.

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

Technical Support

Normal technical support: (Mon - Fri 6am - 6pm PST)	(714) 532-1672 Toll Free 1-800-877-1672 Toll Free 1-866-DO-FIBER
Email:	support@fiberopticlink.com
24/7 technical support: (Outside normal business hours)	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.

UNCONDITIONAL LIFETIME WARRANTY

RLH INDUSTRIES, INC. FIBER OPTIC LINK products are warranted to be free of defects in materials and workmanship for the LIFE OF THE PRODUCT. This lifetime warranty is effective for RLH fiber optic link products sold since the date RLH was founded, February 2, 1988, with the exception of fiber cable products which are warranted to free of defects in manufacturing, and batteries which carry a 10-year unconditional replacement warranty.

RLH Industries, Inc. will repair or replace these products that fail FOR ANY REASON, provided the defective part is returned to RLH freight prepaid.

This warranty is UNCONDITIONAL and valid even when products have been abused or mishandled, when unauthorized repairs have been attempted or performed, or damaged as a result of a natural disaster.

Authorized by: J. Randall Mears

J. RANDALL MEARS, Vice President, Engineering

MADE IN U.S.A.

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.

Specifications subject to change without notice.