

# RLH Single Channel T1 Fiber Link Card System

## Description

The Single Channel T1 Fiber Link Card converts electrical/copper T1(DS1) signals and transport them over optical fiber. The system can operate from T1 span power (60mA) or local 24/48VDC power. It has LED status and alarm output indicators for system monitoring, and is temperature hardened for use in extreme conditions.

All of the products in the RLH T1 Fiber Link family are designed for the utmost quality and reliability. Typical applications include high voltage GPR isolation, utility, wireless backhaul, and military communications. RLH single channel T1 systems are made in the USA and are covered by our **Unconditional Lifetime Warranty**.

### Key Features

- Single-mode (up to 60km/37mi.) or Multimode (2km/1.2mi.) fiber systems with either ST or SC fiber connector types.
- Dual power capable, line or local 24/48VDC.
- Simplex 60mA line powering from the T1 span or HDSL NIU/RT unit.
- Environmentally hardened to operate in -40°F to +158°F (-40°C to +70°C) environments.
- Compatible with 2 Channel DIN/Card and the Single Channel DIN modules.
- The same unit may be used at either end of the fiber system, simplifying spares and ordering.
- Loopback testing features.
- B8ZS or AMI compatible.
- NC/NO alarm contact for remote monitoring of system health.
- DIN rail or wall mountable compact modules are available.
- Can be used within or beyond customer premise environments.
- Covered by our **Unconditional Lifetime Warranty**.
- **Made in the USA**



RLH Single Channel T1 Fiber Link Card

### Contents

Description and Key Features	1
General Safety Practices	2
Application	3
Installation	5
Connections	8
Powering the System	8
Switch Settings	9
LED Indicators	10
NIU Compatibility	12
Specifications	13
Ordering Information	14
Technical Support	15
Warranty	15

### Compliance Information

The RLH Single Channel T1 Fiber Link Card System is compliant with the following industry standards:

- **FCC PART-15**
- **FCC PART-68B**
- **GR-1089**
- **IEEE-487**
- **IEEE-1590**
- **Motorola R56**

## 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 HDSL lines carry high DC voltages up to 210V. Use caution when handling HDSL wiring.

### Warning

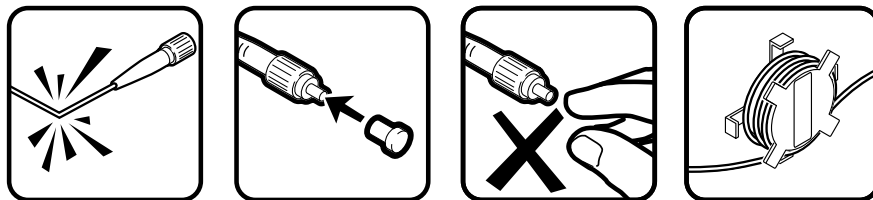
The intra-building port(s) of the equipment or subassembly is suitable for connection to intrabuilding or unexposed wiring or cabling only. The intra-building port(s) of the equipment **MUST NOT** be metalically connected to interfaces that connect to the OSP or its wiring. These interfaces are designed 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 metalically 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

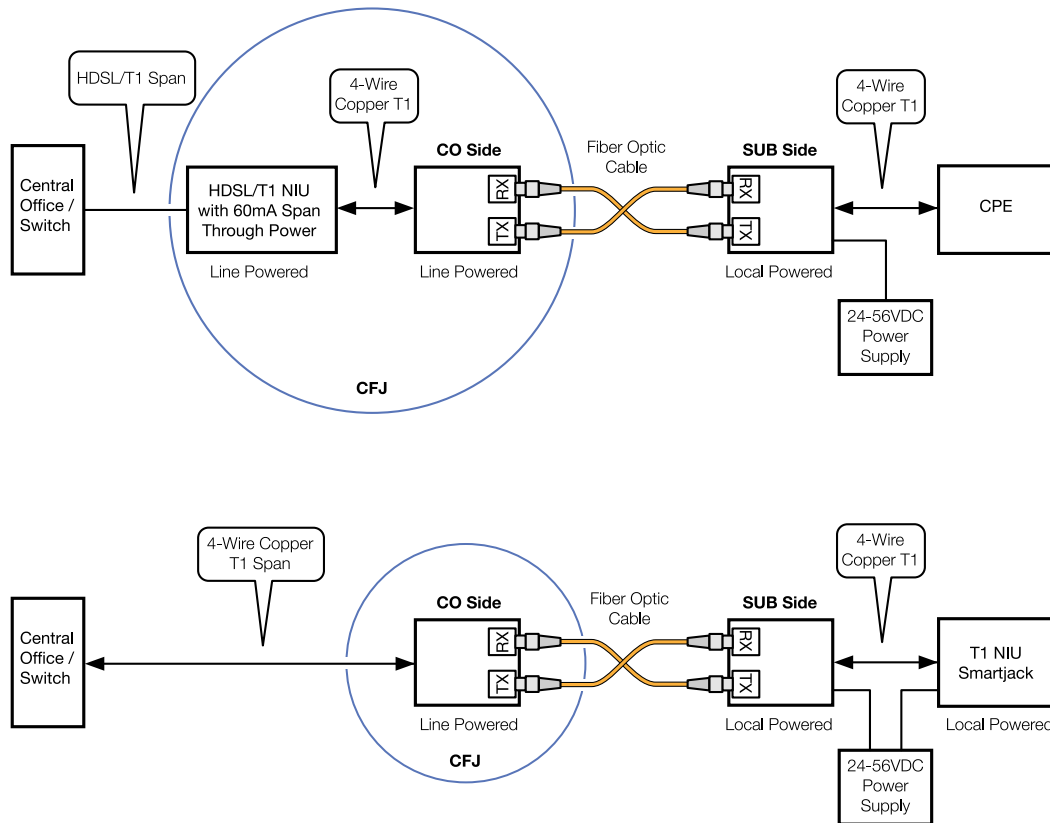


- Do not bend fiber cable sharply. Use gradual and smooth bends to avoid damaging glass fiber.
- Keep dust caps on fiber optic connectors at all times when disconnected.
- Do not remove dust caps from unused fiber.
- Keep fiber ends and fiber connectors clean and free from dust, dirt and debris. Contamination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

## Application

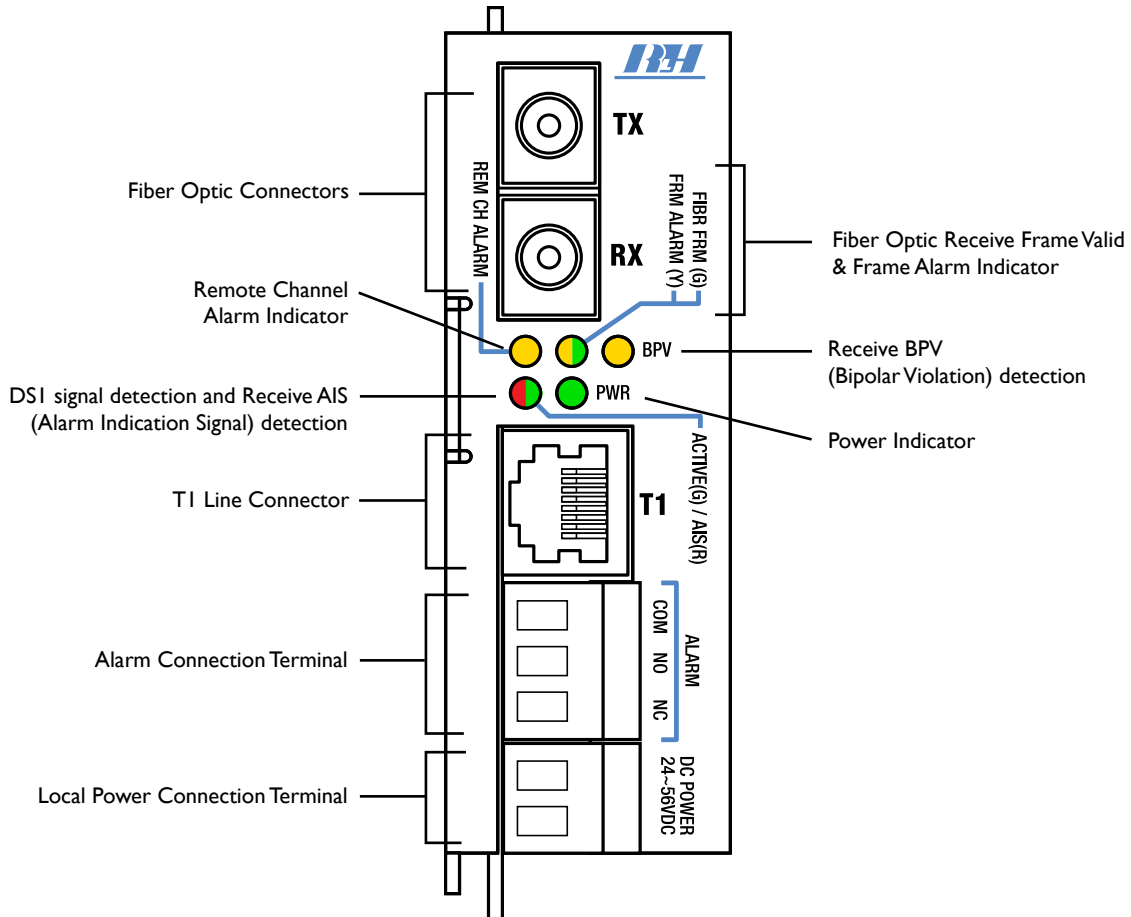
The RLH Single Channel T1 Fiber Link Card system transports the copper T1 line at 1.544Mbps, and optically transmits over fiber optic cable to the module at the opposite end, which then converts the optical signals back into the original copper T1 line.

Below are sample system diagrams illustrating typical T1 connections to and from the system. On the CO (Central Office) side, the Single Channel T1 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.



**Single Channel T1 System Diagram**

## Front Panel



**Single Channel T1 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

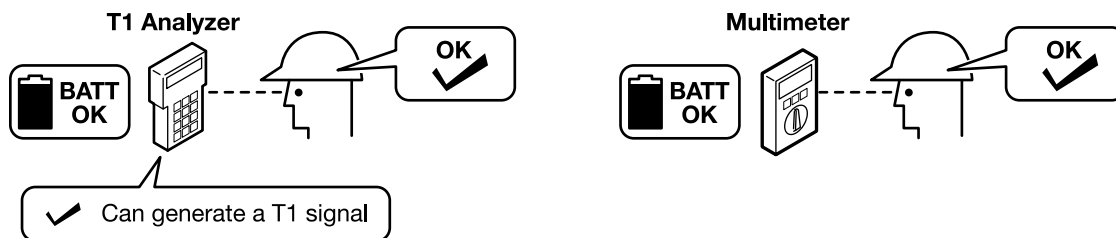
If damage is discovered file a claim immediately with the carrier, then contact RLH customer service.

## Required for installation:

- 24-56VDC (60mA@24VDC maximum) line or local power source at each side of the system.
- Suitable RLH Fiber Link Card housing
- Active T1 line
- Multimeter

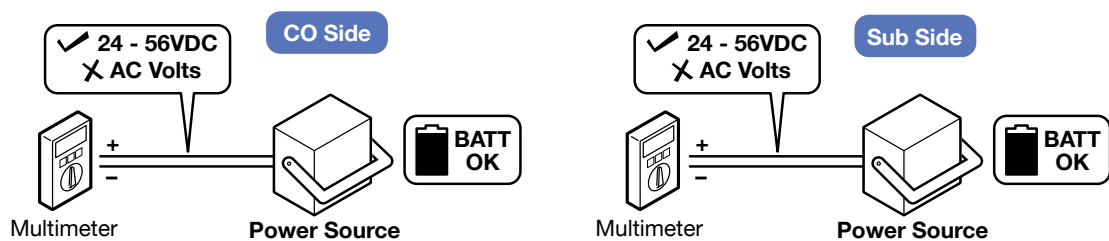
## You will need a T1 analyzer such as a T-BERD and a multimeter

Be familiar with the test settings. Some analyzers have line power and multimeter capability. For installation where no T1 signal is available, the analyzer must be capable of generating a T1 signal.



## Required power sources if installing before T1 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.

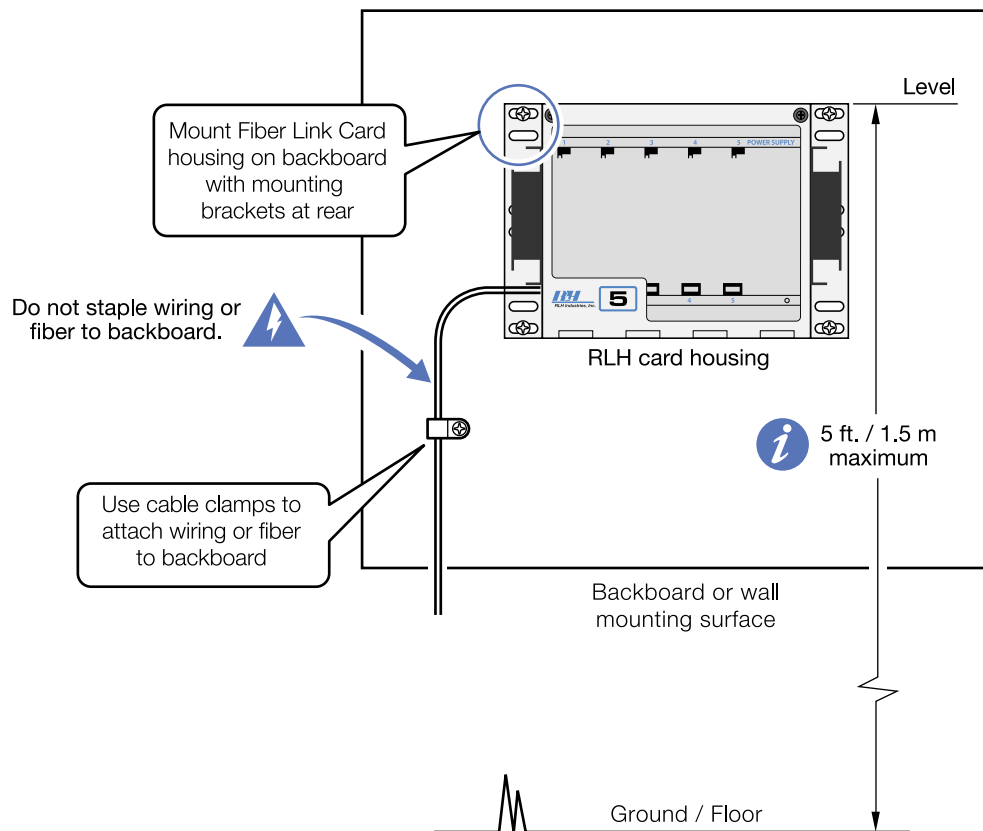
## Line Powering

The Single Channel T1 card can be line powered via 60mA simplex current on the T1 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 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 22-30VDC 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 compatibility.

## Installing card housing

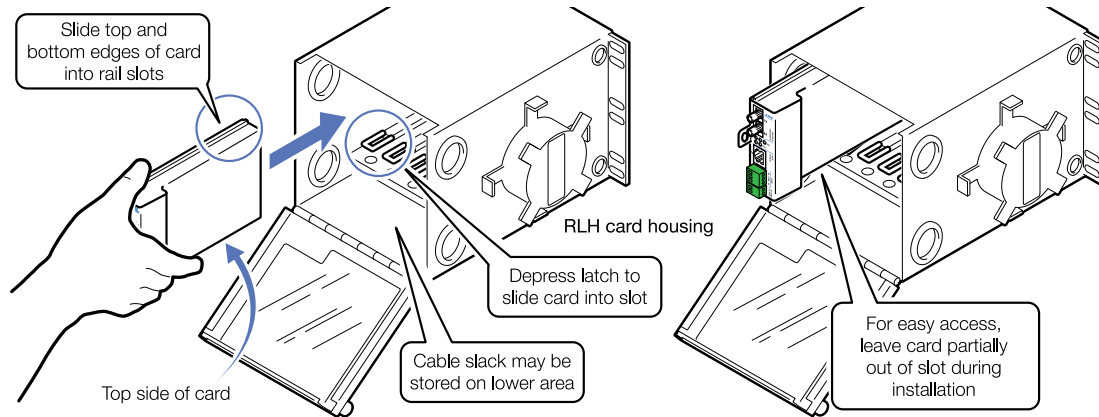
### Mount housing in equipment rack or attach to backboard.

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.

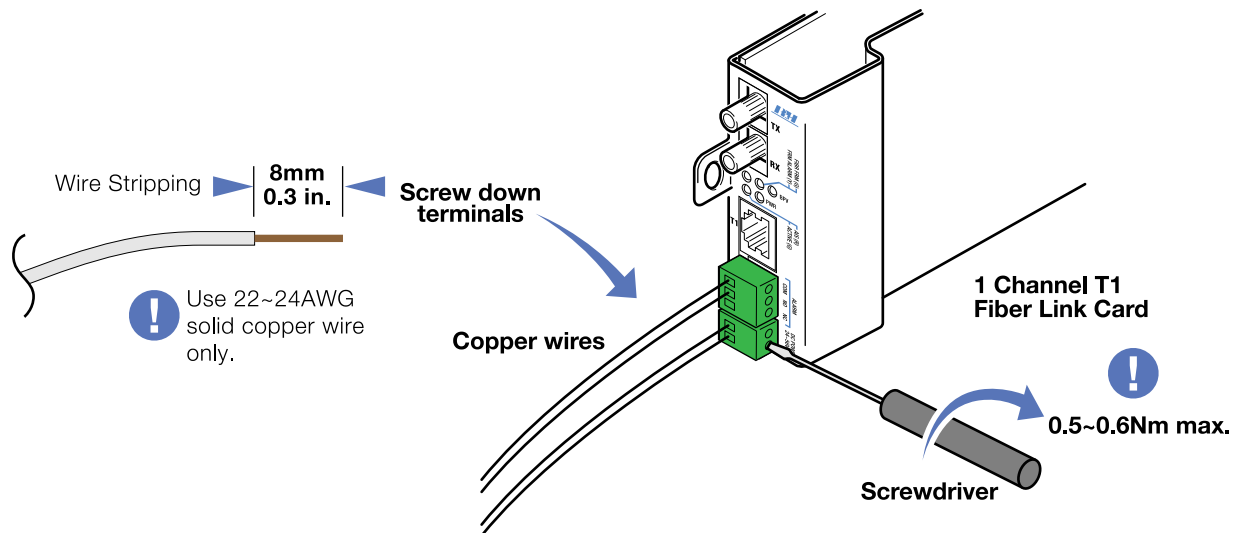


## Copper wiring requirements

### Copper wiring to the T1 cards

The connectors on the T1 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. The system will not operate if TX is connected to TX or RX to RX.

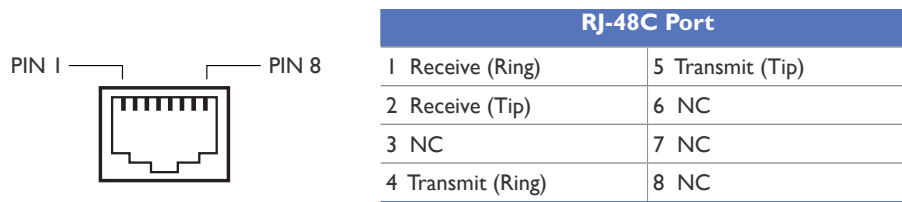
Fiber cables should be routed loosely avoiding tight bends to prevent excessive optical loss.

**Note:** The Single Channel T1 Fiber Link cards are compatible with the Single Channel T1 Fiber Link DIN units. Refer to the DIN mount user guides for information related to the DIN mount modules.

## Connect Copper T1 Send and Receive pairs

The T1 pairs from the Telco connect to the RJ-48C connector on the face of the card.

**Note:** At the CO side, the Single Channel T1 modules are designed to operate on standard T1 lines that are current limited at 60mA. Open circuit voltage on T1 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 Connector Pinout Diagram**

# Powering the System

## Powering at the CO end

Typically, the CO side module is span powered by a single 60mA simplex current sources derived from the T1 Telco Span Transmit and Receive copper pairs.

The CO side module may also be powered externally by connecting a 24-56VDC 60mA power source to the power terminal on the unit. The 1 Channel T1 Cards are polarity insensitive to the DC input power source.

## Powering at the SUB end

To local power, connect a 24-56VDC 60mA power source to the power terminal on the unit. The cards are polarity insensitive to the DC input power source.

To span power the SUB side module you must have a minimum of one 60mA simplex current source on the T1 Send and Receive pairs on a working circuit.

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



## T1 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.

## T1 Alarm Contact

The Single Channel T1 System alarm contact allows you to monitor the health of your T1 Fiber Link system. If any of the below faults are present the alarm contact will revert to its normal state:

- **BPV** - Bi-polar Violations
- **AIS** - All One's Condition
- **FRM Alarm** - Fiber Frame Loss
- **PWR** - DC Power Loss

When all of the above conditions are OK the contact will change from its resting state to indicate that the system is running and healthy.

## Switch Settings

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

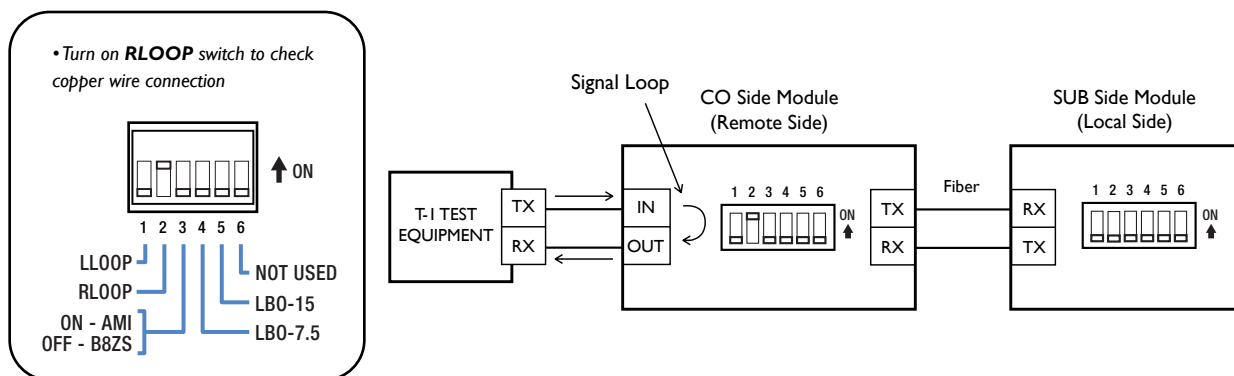
## B8ZS or AMI Encoding

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 the T1 input.

## Remote Loopback

The remote (RLOOP) loopback DIP switch is provided to allow for remote loop back of the copper T1 line for trouble shooting purposes.

The loop back function begins at the T1 receive twisted pair, through the T1 LIU (Line Interface Unit), and then back out the T1 transmit twisted pair. Normal operating position is OFF for All switch positions.

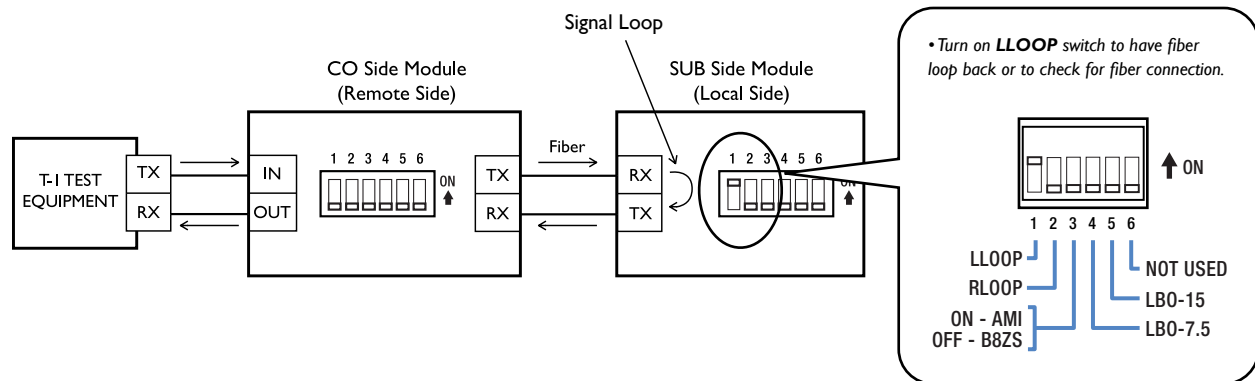


**RLOOP (Remote Loopback) Switch Diagram**

## Local Loopback

The local (LLOOP) loopback DIP switch is provided to allow for local loop back of the fiber T1 line for troubleshooting purposes.

The loop back function begins with the T1 fiber transmit data coming from the remote side module, through the fiber cable to the local receiver, then back out from the local fiber transmitter 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 switch simulates cable loss of the signal for compatibility with different installation scenarios. There are switches corresponding to -7.5dB and -15dB attenuation level. Select a level appropriate for your particular application by setting one of the switches to the ON position.

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 the T1 LIU.

### 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 Single Channel 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 Single Channel 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.

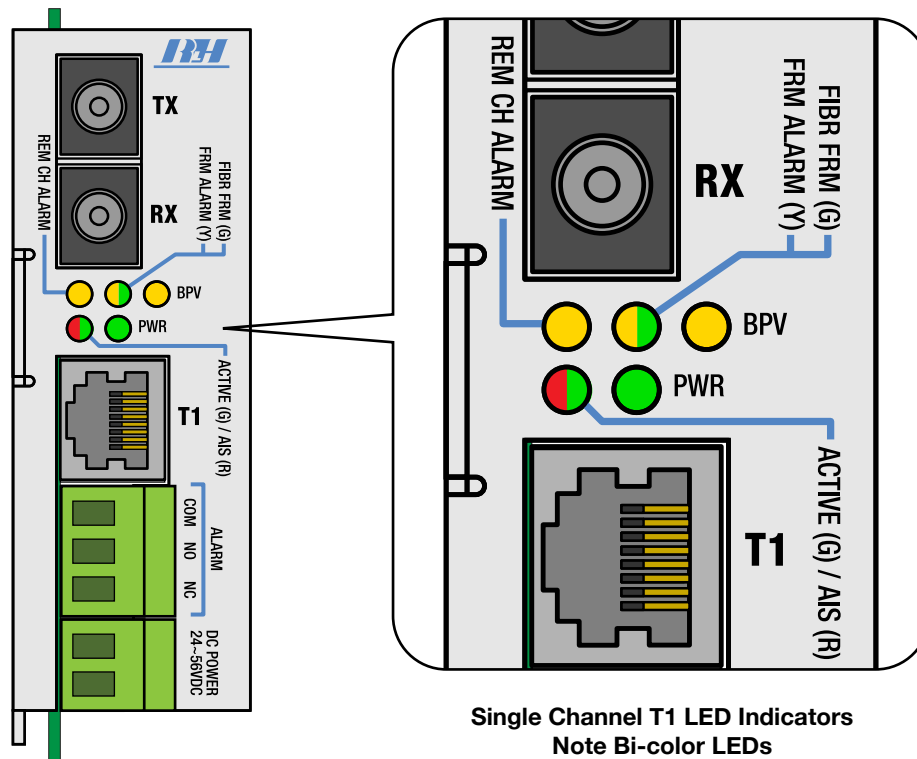
## Alarm Indication Signal

The AIS alarm (red) LED will be ON whenever a series of unframed all-ones are received at the input of the T1 LIU. 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

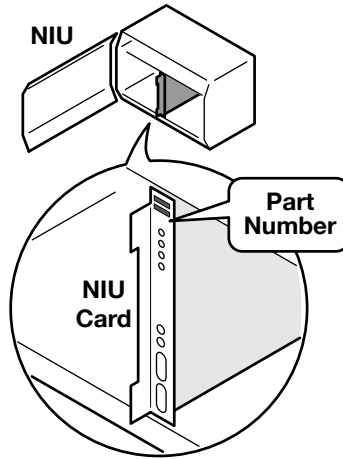
The BPV alarm (yellow) LED will be looking for any bipolar violations at the receive T1 LIU. The LED will remain ON for a visible period per detected event. BPV detection can indicate loss of line integrity at the receiver.

**Note:** If the transmitting equipment is using encoded B8ZS, and the card is configured for AMI, the channel BPV alarm LED will turn ON.



## NIU Compatibility

Check for compatible NIU systems that supply Span Through-Power to the Single Channel T1 Fiber Link cards. Contact RLH for T1 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

<b>Transmission method</b>	Amplitude modulated light via two optical fibers	
	Multimode:	850nm (Tx level: -16dB $\pm$ 1dB)
	Single-mode:	1310nm (Tx level: -23dB $\pm$ 1dB)
	Single-mode Long Haul:	1310nm (Tx level: -8dB $\pm$ 2dB)
<b>Maximum Fiber Attenuation / Distance</b>	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.	
<b>Fiber Type</b>	(ST or SC connectors) Multimode: 62.5/125 $\mu$ m, 50/125 $\mu$ m Single-mode: 8-9/125 $\mu$ m	
<b>Temperature Limits</b>	-40°F to +158°F (-40°C to +70°C)	
<b>Humidity</b>	95% non-condensing	
<b>Dimensions</b>	RLH Standard Fiber Link Card Form Factor L7" x W4"x H1.2"	
<b>Mounting</b>	Installed into any RLH Fiber Link Card Housing. Rack, DIN mount and wall mount housings are available.	
<b>BER</b>	<10 <sup>-9</sup>	
<b>Surge Protection</b>	Fuses, thyristors, PTC thermistors, zeners, and MOVs	
<b>Local Power Requirement</b>	24-56 VDC, 60mA maximum	
<b>Powering Method</b>	60mA line power simplex on Send and Receive pairs, or an isolated DC power source connected to power input terminals.	
<b>Power Connector</b>	Non-polarity sensitive local power input via removable screw down terminal block	
<b>Compatibility</b>	Compatible with RLH 1 & 2 Channel Fiber Link Card and DIN systems.	



Part Number	Description	Distance	Fiber	Part Number
Multimode ST	Single Channel T1 (CO/SUB)	2km/ 1.2 mi	62.5/50µm	1T4-02-1
Multimode SC	Single Channel T1 (CO/SUB)	2km/ 1.2 mi	62.5/50µm	1T4-01-1
Single-mode ST	Single Channel T1 (CO/SUB)	15km/ 9 mi	8~9µm	1T4-20-1
	Single Channel T1 (CO/SUB)	60km/ 37mi	8~9µm	1T4-21-1
Single-mode SC	Single Channel T1 (CO/SUB)	15km/ 9 mi	8~9µm	1T4-10-1
	Single Channel T1 (CO/SUB)	60km/ 37mi	8~9µm	1T4-11-1

- RLH Industries, Inc. • Tel. 866-DO-FIBER • Fax 714 532-1885 • [www.fiberopticlink.com](http://www.fiberopticlink.com)

## 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

<b>Normal technical support:</b> (Mon - Fri 6am - 6pm PST)	(714) 532-1672 Toll Free 1-800-877-1672 Toll Free 1-866-DO-FIBER
<b>Email:</b>	support@fiberopticlink.com
<b>24/7 technical support:</b> (Outside normal business hours)	Toll Free 1-855-RLH-24X7 Toll Free 1-855-754-2497

## Contact Information

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

A handwritten signature in blue ink that reads '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.