



RLH Industries, Inc.

USER GUIDE

The leader in rugged fiber optic technology.

U-066 2020-03-17

Single Channel T1 Fiber Link Card System

SYSTEM INSTALLATION INFORMATION

Description

The Single Channel T1 Fiber Link Card converts electrical/copper T1(DS1) signals for transport 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 **Limited 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.
- Use within or beyond customer premise environments.
- Covered by our **Limited Lifetime Warranty**.
- **Made in the USA**



Single Channel T1 Fiber Link Card

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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

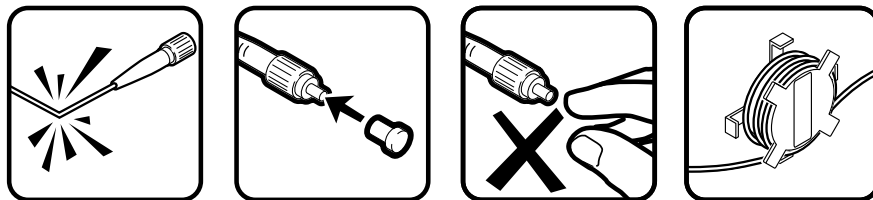
The intra-building port(s) of the equipment or subassembly is suitable for connection to intrabuilding or unexposed wiring or cabling only. The intra-building port(s) of the equipment **MUST NOT** be metallically connected to interfaces that connect to the OSP or its wiring. These interfaces are designed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

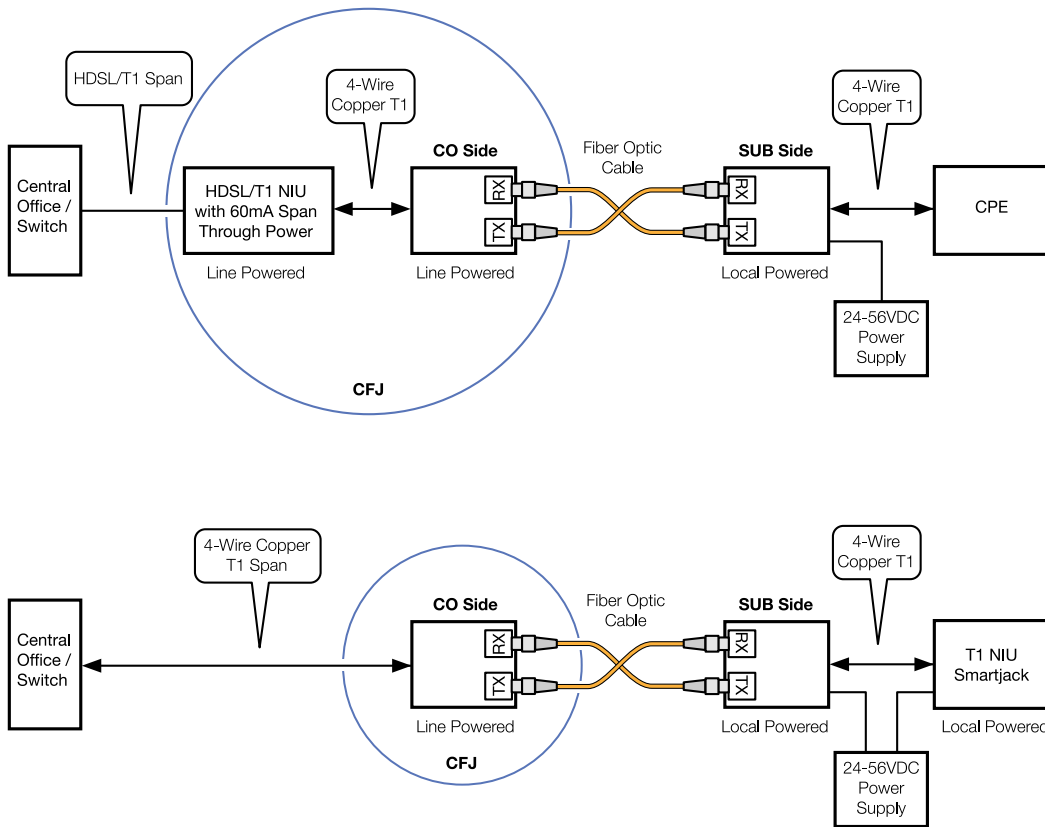


- Do not bend fiber cable sharply. Use gradual and smooth bends to avoid damaging glass fiber.
- Keep dust caps on fiber optic connectors at all times when disconnected.
- Do not remove dust caps from unused fiber.
- Keep fiber ends and fiber connectors clean and free from dust, dirt and debris. Contamination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

Application

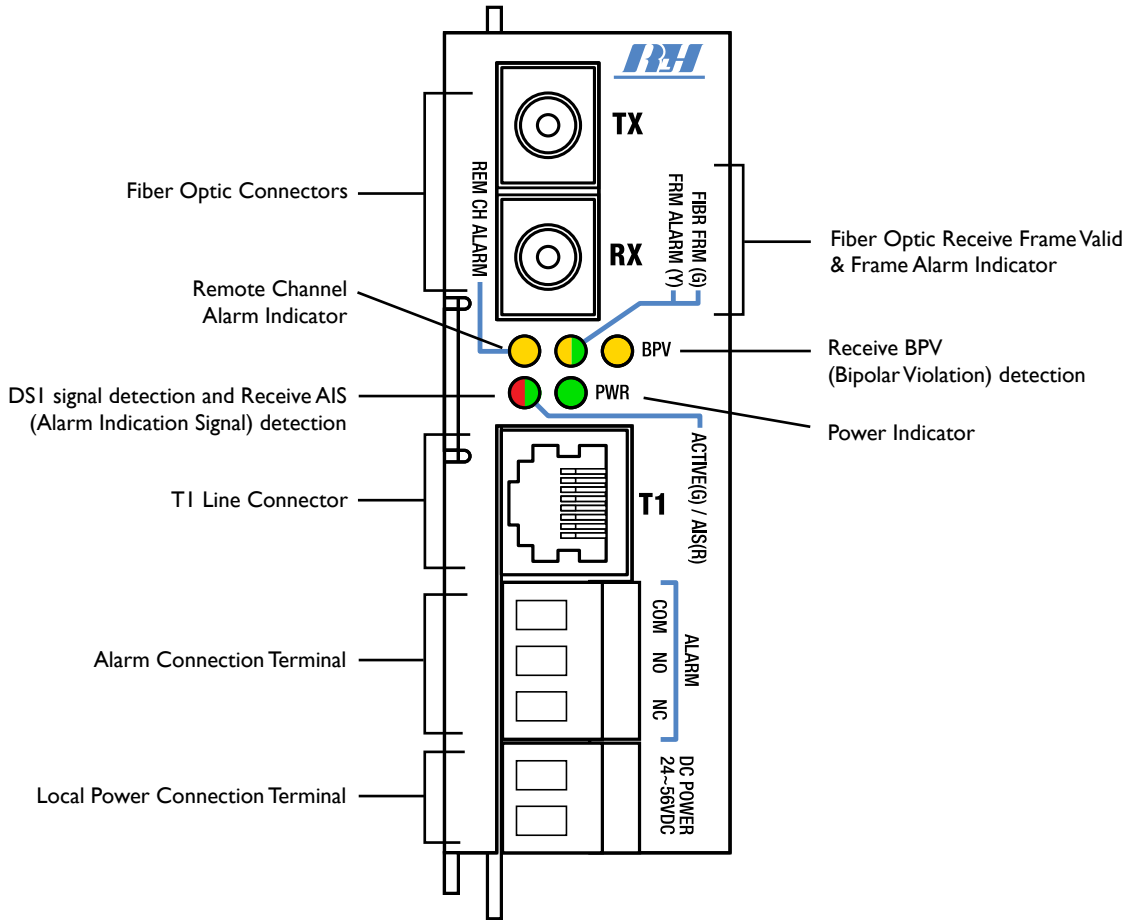
The RLH Single Channel T1 Fiber Link Card system transports the copper T1 line at 1.544Mbps, and optically transmits over fiber optic cable to the module at the opposite end, which then converts the optical signals back into the original copper T1 line.

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

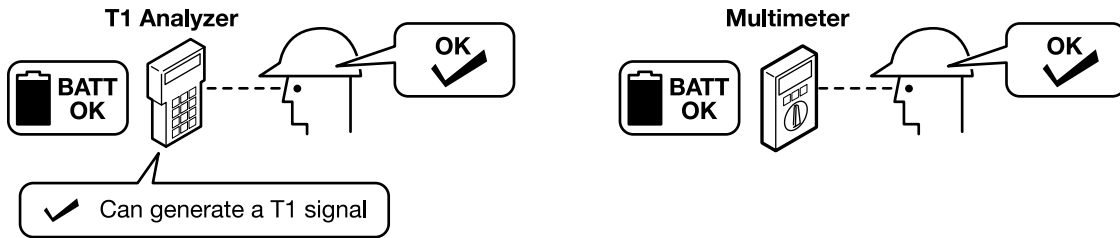
If damage is discovered file a claim immediately with the carrier, then contact RLH customer service.

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

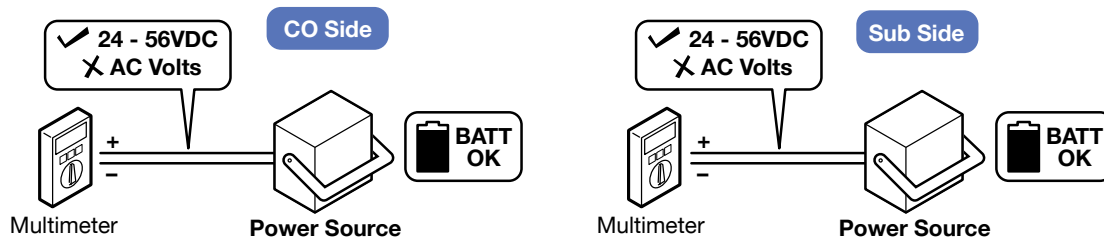
You will need a T1 analyzer such as a T-BERD and a multimeter

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

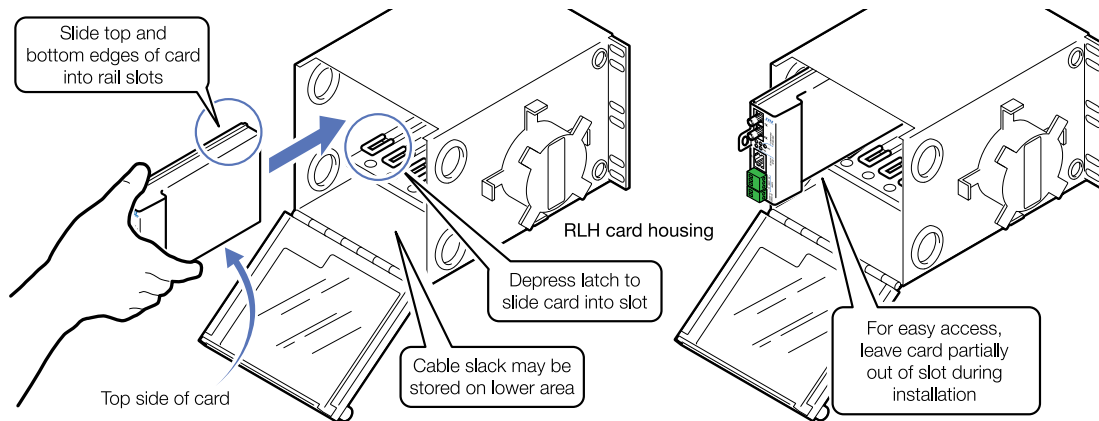
Mount housing in equipment rack or attach to backboard.

Mount the desired card housing in an equipment rack, or to a wall or backboard using the mounting brackets provided.

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. For ease of installation, install the card into housing before connecting fiber or copper wiring.



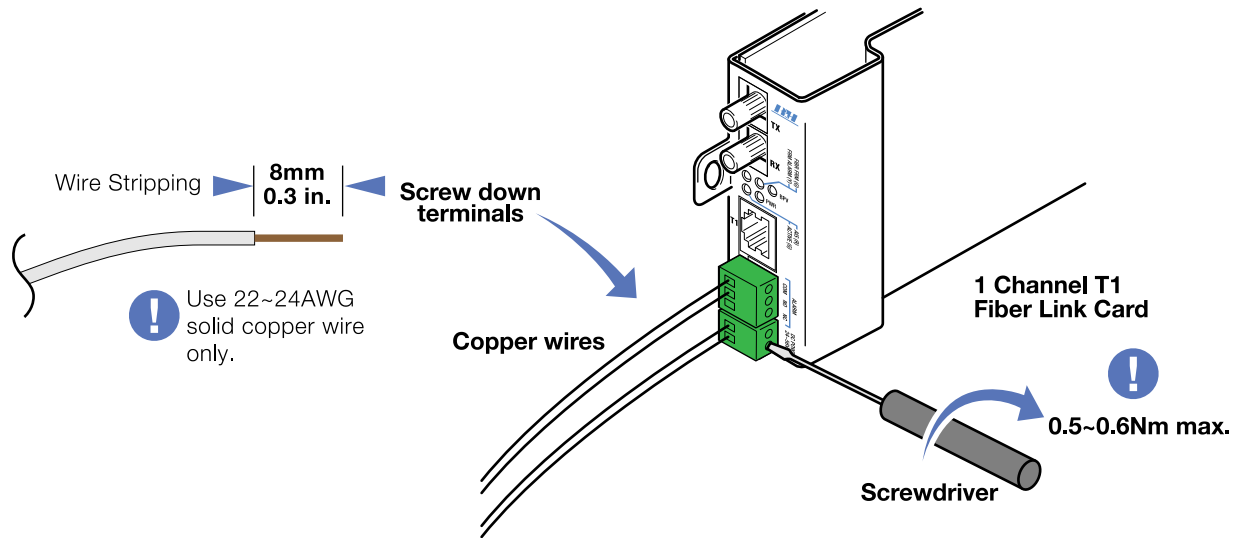
Installing into Card Housing

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.



Attaching Copper Wiring to T1 Card

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 receive 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.

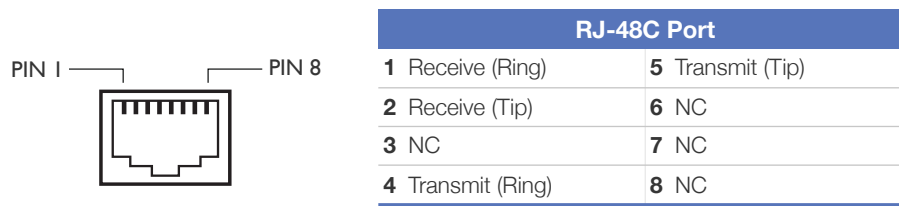
Fiber cables should be routed loosely avoiding tight bends to prevent excessive optical loss.

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.

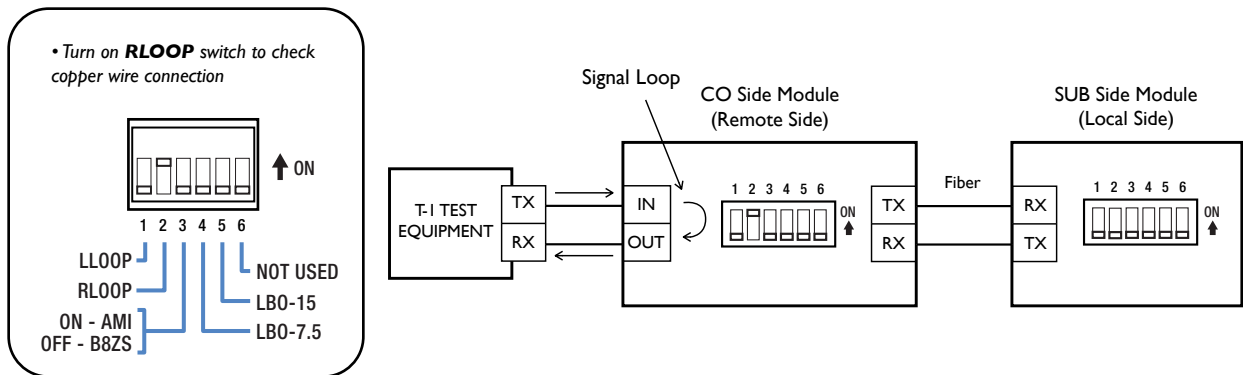
B8ZS or AMI Encoding

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.

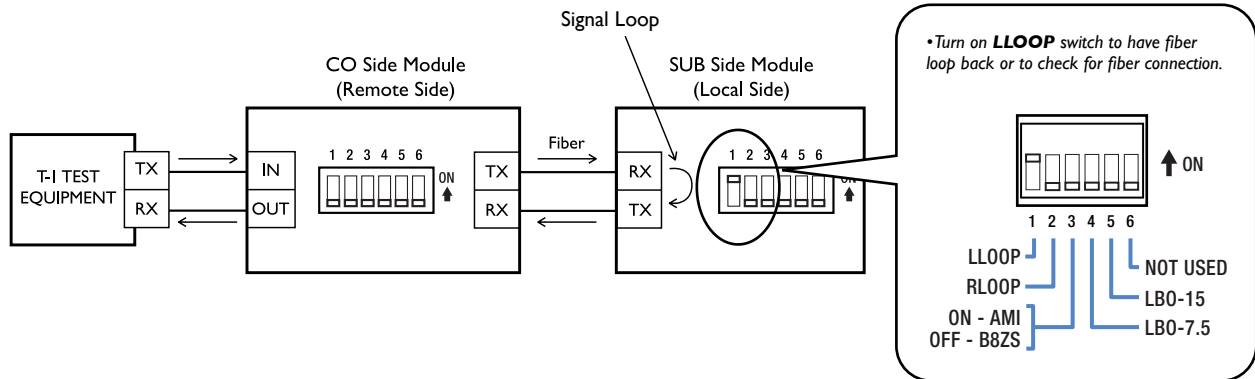


RLOOP (Remote Loopback) Switch Diagram

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.

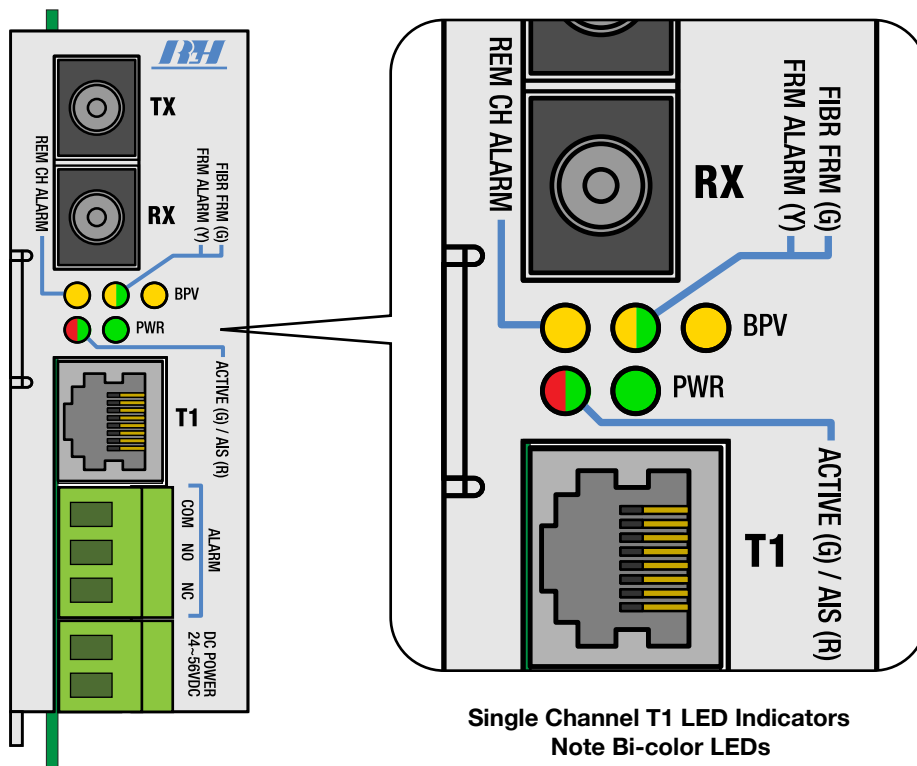
Alarm Indication Signal

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

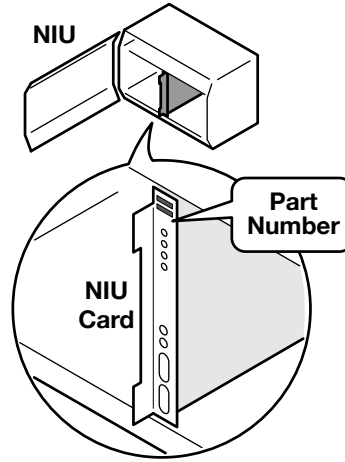
The BPV alarm (yellow) LED will be looking for any bipolar violations at the receive T1 LIU. The LED will remain ON for a visible period per detected event. BPV detection can indicate loss of line integrity at the receiver.

Note: If the transmitting equipment is using encoded B8ZS, and the card is configured for AML, 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
HDSL 1			
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 maximum	
Powering Method	60mA line power simplex 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 1 & 2 Channel Fiber Link Card and DIN systems.	
Warranty	Limited Lifetime	Visit www.fiberopticlink.com for warranty details

Ordering Information

Each Single Channel T1 Card is identified with a part number.

Optics	Description	Distance	Fiber	Part Number
Multimode ST	Single Channel T1 (CO/SUB)	2km/ 1.2 mi	62.5/50µm	1T4-02-1
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

- ▶ A complete system requires a card on both ends of fiber.
- ▶ Plug and play compatible with RLH 1 & 2 Channel Fiber Link Card and DIN systems.
- ▶ Please contact your RLH sales representative for pricing and delivery information.

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

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Specifications subject to change without notice.