RLH Industries, Inc.

USER GUIDE

The leader in rugged fiber optic technology.

2 Channel T1 Mux DIN Fiber Link System

SYSTEM INSTALLATION INFORMATION

Description

The T1 Multiplexer (or Fiber Mux 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, alarm and dual power inputs.

It provides cost effective, high density regenerated T1 over fiber in a compact DIN form factor. This hardened, rugged system is covered by our **Limited Lifetime Warranty**.

2 Channel T1 Mux DIN Mount Module

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 T1 Fiber Link Card.
- May be powered externally with 24~56VDC 100mA local power on dual redundant power connectors.
- 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, enclosures or mounting space are limited.
- The same module may be used at either end of the fiber system, simplifying spares and ordering.
- Operates from any HDSL-1, HDSL-2 or HDSL-4 NIU/RT signal.
- RJ48C T1 connections.
- Loop back features with independent channel testing.
- Provides simultaneous multiplexing and de-multiplexing 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 environment.

Contents

Compliance Information

The RLH 2 Channel T-1 Mux DIN Fiber Link 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 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.

**Guidelines for handling terminated fiber cable**
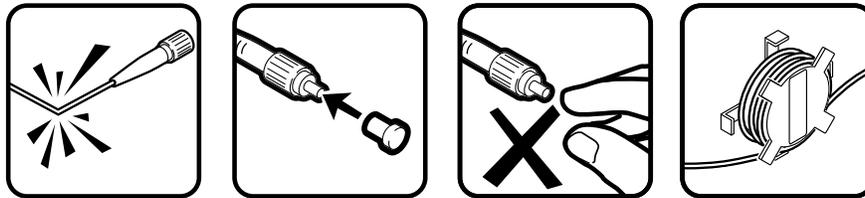
- Do not bend fiber cable sharply. Use gradual and smooth bends to avoid damaging glass fiber.
- Keep dust caps on fiber optic connectors at all times when disconnected.
- Do not remove dust caps from unused fiber.
- Keep fiber ends and fiber connectors clean and free from dust, dirt and debris. Contamination 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 Mux 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. The 2x1 T1 Mux system may be powered by a single T1 line carrying span power, or optionally by a local power source on the CO side. The SUB side requires a local power source for operation.
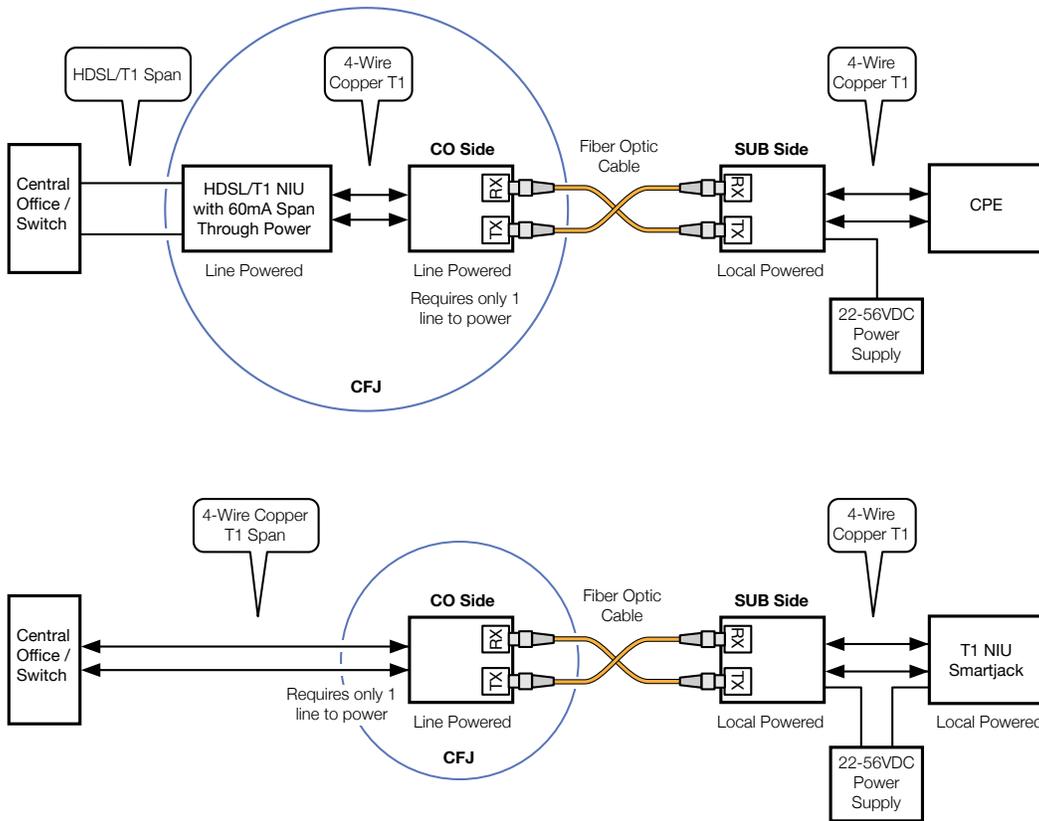
2 Channel T1 System Diagram

The CO side

The 2 Channel T1 Mux DIN Fiber Link system 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 Mux DIN Fiber Link system provides the interface between one or two Subscriber side (SUB) equipment T-1 copper 4-wire lines over two strands of fiber optic cable. The SUB side permits the use of the alarm feature which monitors all system functions, and may use dual power inputs for redundant powering.
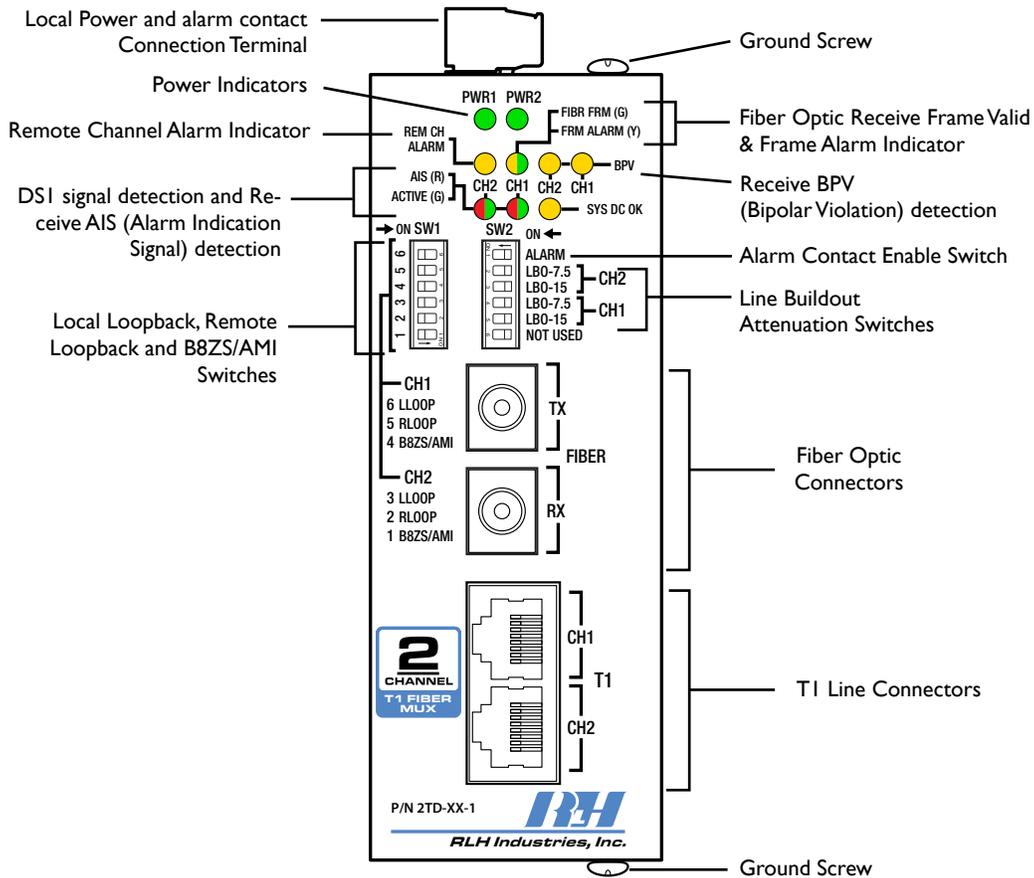
Front Panel Layout

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 wall or DIN rail space
- Active T1 line
- T1 Analyzer (T-BERD)
- Multimeter

Measure power source

Measure the DC voltage of the source power to ensure that it is 24-56VDC. All electrical and fiber optic connection are made directly into the module. The 2 Channel T1 Mux DIN Fiber Link system is designed to be installed onto any standard DIN rail, plugged in and ready to transmit.

DIN rail mounting

To install the module onto the provided DIN rail, hook the mounting clip over the bottom part of the rail flange first, then rotate and snap the clip onto the top rail flange. To remove, lift up on the module and disengage the top of the DIN rail clip first.

Hook bottom of
DIN clip first

Rotate and snap into position

2 Ch. T1   DIN Rail   2 Ch. T1   DIN Rail
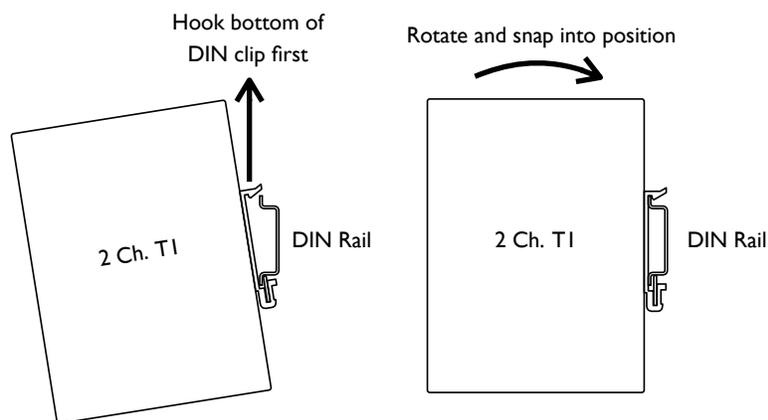
DIN Rail Mounting
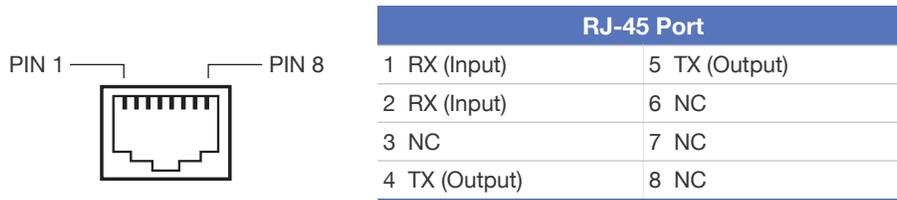
Connections

Connect fiber optic cable

DIN Fiber Link systems 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 module 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.

Connect copper T1 send and receive pairs

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

Note: At the CO side, the 2 Channel T1 Mux DIN Fiber Link system is 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.

PIN 1 ——   —— PIN 8

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

Optional connection - Ground wire

Ground wire attachment screws are located on both the top and the bottom of the housing. Ground the system appropriately for the application.

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.

Note: Alarm function requires 24-56VDC 100mA power source. (Turn SW2 ALARM off if line powered.)

The CO side module may also be powered externally by connecting a 24-56VDC 100mA power source to the power terminal on the top of the unit. There are 2 power inputs and either or both may be used for a redundant power system. The 2 Channel T1 Mux DIN Fiber Link system iss 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 100mA power source to the power terminal on the top of the unit. There are 2 power inputs and either or both may be used for a redundant power system. The 2 Channel T1 Mux DIN Fiber Link system is 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

B8ZS or AMI Encoding

The B8ZS/AMI 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.
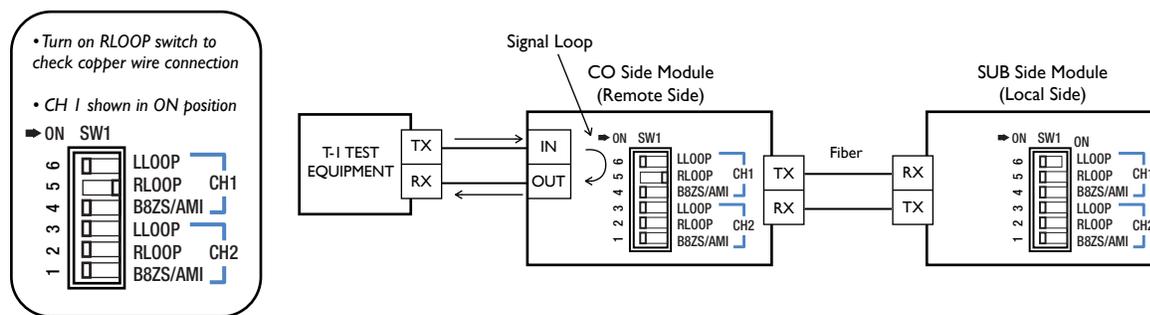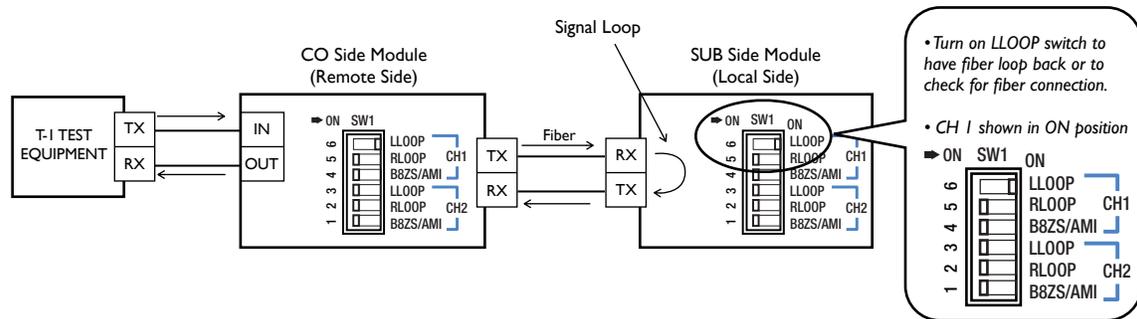

RLOOP (Remote Loopback) Switch Diagram

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

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. 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 0 set to OFF, -7.5 and -15 set to 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 2 Channel T1 Mux DIN Fiber Link. 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 system 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.

Alarm Contact Connection Terminal

The alarm terminal has 3 corresponding terminals (common, normally closed and normally open). System is ok when the output on the relay is normally open.

Power Indicator

The PWR1 and PWR2 (green) LED will be ON when acceptable power is detected at the fiber ink. 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 2x1 MUX module is configured for AMI, the channel BPV alarm LED will turn ON.

2 Channel T1 LED Indicators
Note Bi-color LEDs
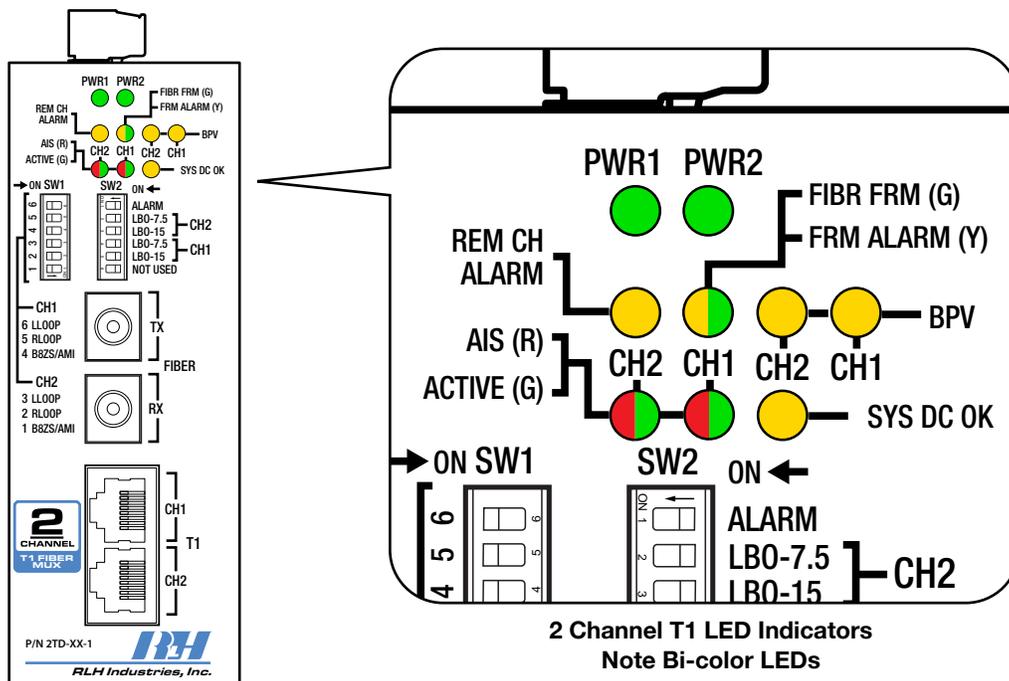
NIU Compatibility

Check for compatible NIU systems that supply Span Through-Power to the 2 Channel T-1 Fiber Link Cards. Contact RLH for T-1 compatibility with systems not listed.
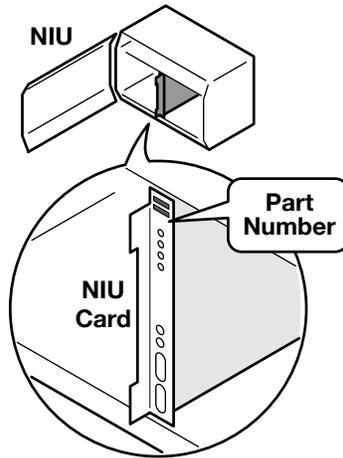
HDSL/T1 Span Through Power NIU Compatibility Chart			
Manufacturer	**Part Number**	**Description and Material ID**	**CLEI Code**
HDSL1			
Adtran	1246026L4	T200 HTU-R (VZ# 594993)	T1L2C8J8AA
Adtran	1246026L5	T200 HTU-R (BST# 98001580)	T1L3KD5AAA
Adtran	1245024L1	T400 HTU-R	T1L2C8J8AA
Adtran	1247026L1	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 + maximum solar load)	
Humidity	95% non-condensing	
BER	$<10^{-9}$	
Surge Protection	Fuses, thyristors, PTC thermistors, zeners, and MOVs	
Local Power Requirement	24-56 VDC,100mA	
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 dual redundant power Input via removable screw down terminal block	
Mounting	Standard T35 DIN rail or wall mount with included brackets	
Dimensions	H5" x W1.9" x D3.9" (127mm x 48mm x 100mm) - Not including connectors	
Warranty	Limited Lifetime	*Visit* www.fiberopticlink.com *for warranty details*

Value	Min.	Type	Max.	Unit
T1 Output Pulse Amplitude (FCC Part 68)	2.7	3	3.3	Volts Pk
T1 Receiver Frequency Tolerance	±130	-	-	ppm
T1 Receiver Resistance	-	100	-	Ohm

Ordering Information

Each 2 Channel T1 Card is identified with a part number.

Optics	Description	Distance	Fiber	Part Number
Multimode SC	CO/SUB DIN Fiber Link	2km/ 1.2 mi	62.5/50 µm	**2TD-01-1**
Multimode ST	CO/SUB DIN Fiber Link	2km/ 1.2 mi	62.5/50 µm	**2TD-02-1**
Single-mode SC	CO/SUB DIN Fiber Link	15km / 9 mi.	8~9 µm	**2TD-10-1**
	CO/SUB DIN Fiber Link	60km / 37mi.	8~9 µm	**2TD-11-1**
Single-mode ST	CO/SUB DIN Fiber Link	15km / 9 mi.	8~9 µm	**2TD-20-1**
	CO/SUB DIN Fiber Link	60km / 37mi.	8~9 µm	**2TD-21-1**

▶ A complete system requires 2 modules.
▶ Please contact your RLH sales representative for pricing and delivery information.

Technical Support

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	Toll Free 1-855-754-2497

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

Specifications subject to change without notice.

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