RLH Industries, Inc.

USER GUIDE

The leader in rugged fiber optic technology.

U-003 2020-03-17

4 Channel T1 Mux Fiber Link Card System

SYSTEM INSTALLATION INFORMATION

4 Channel T1 Mux Fiber Link Card

Description

The 4 Channel T1 Mux Fiber Link System transports up to four T1 lines over two strands of fiber. It has B8ZS and AMI compatibility, with LED status indicators for system monitoring, and provides cost effective, high density T1 over fiber in a single card slot. This hardened, rugged system is covered by our **Limited Lifetime Warranty.**

Key Features

- Applications for critical, high voltage, remote or un-manned 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.
- One to four incoming T1 4-wire copper lines over one fiber pair.
- T-1 Applications where available fiber strands, enclosures or mounting space are limited.
- CO and Sub 4 Ch. T1 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
- RJ48C connection available.
- Loop back features with independent channel testing.
- 4x1 T1 cards will fit into all RLH housings except single card unit.
- Multiplexing and de-multiplexing of 4 asynchronous T1 channels.
- Receive frame integrity LED and remote T1 channel fault LED.
- Use inside or outside customer premise environment.
- Covered by our **Limited Lifetime Warranty**

Contents

Compliance Information

The RLH 4 Channel T1 Mux Fiber Link System is compliant with the following industry standards:

- **NEBS Level 3**
- **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

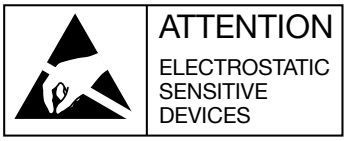
- Never install during a lightning storm or where unsafe high voltages are present.
- Active T1 lines carry high DC voltages up to 56V. Use caution when handling T1 wiring.
- Active UHDSL lines carry high DC voltages up to 210V. Use caution when handling UHDSL wiring.

Warning

The intra-building port(s) of the equipment or subassembly is suitable for connection to intra-building 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

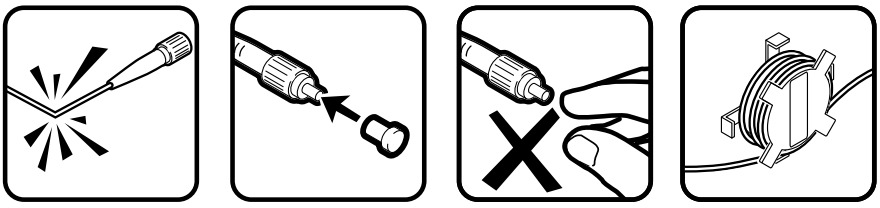
Be careful when handling electronic components



- 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

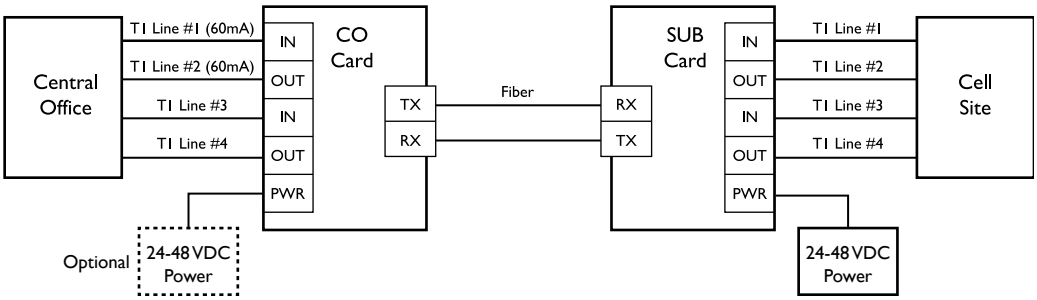


- Do not bend fiber cable sharply. Use gradual and smooth bends to avoid damaging glass fiber.
- Keep dust caps on fiber optic connectors at all times when disconnected.
- Do not remove dust caps from unused fiber.
- Keep fiber ends and fiber connectors clean and free from dust, dirt and debris. Contamination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

Installation

The 4 Channel T1 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 the signals back into the original DS1 signals at regenerated DS1 levels.

Below is a typical system digram illustrating typical T1 connection to and from the system. The 4 Channel T1 Mux system may be powered by either two T1 lines carrying span power, or optionally by a local power source on the CO side. The Sub side requires a local power source for operation.



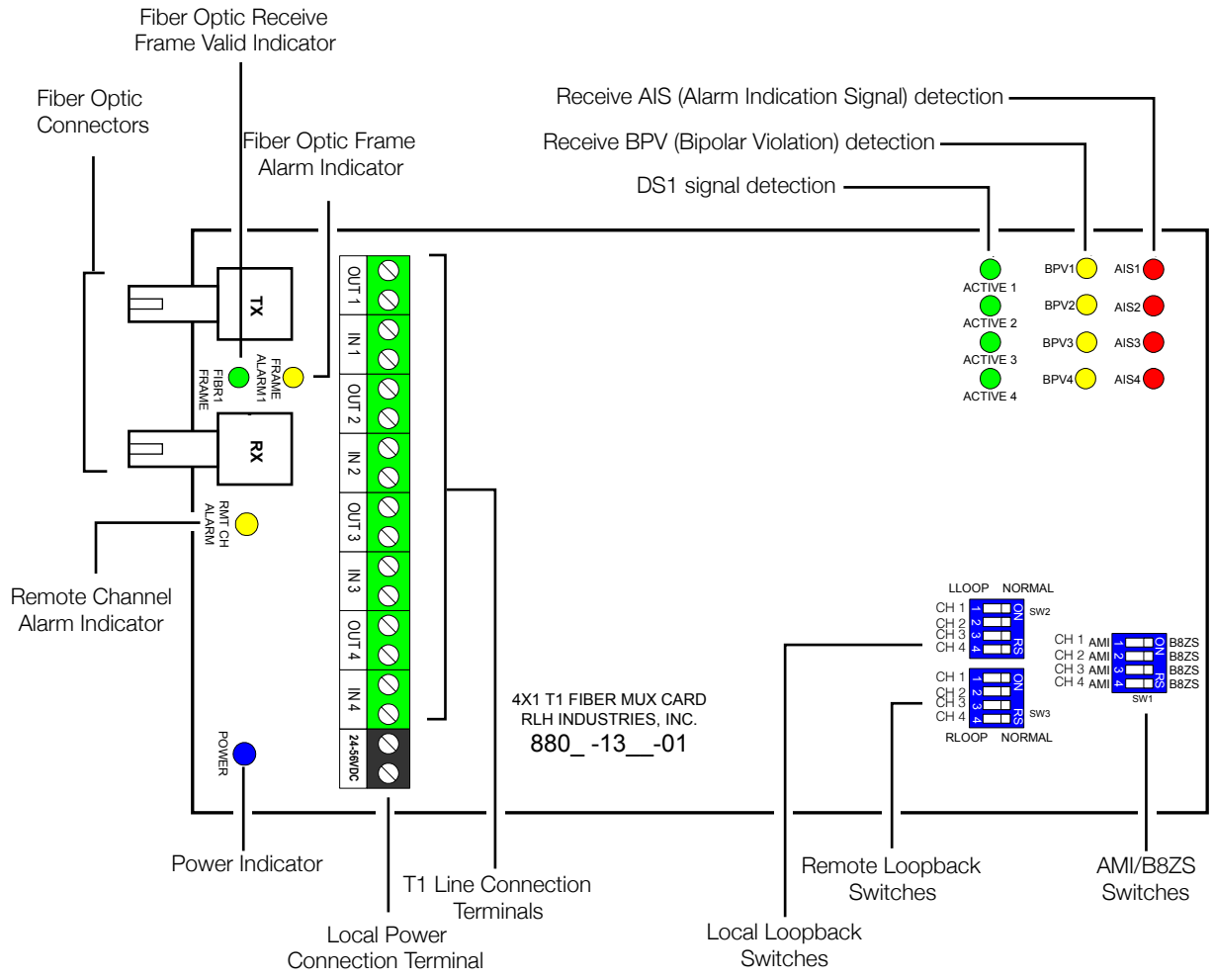
4 Channel T1 Mux System Diagram

CO Side Card

The CO Card provides the interface between as many as **FOUR** Telco Central Office T1 copper 4-wire lines over a two strand fiber optic cable.

SUB Side Card

The SUB Card provides the interface between as many as **FOUR** Subscribers equipment T1 copper 4-wire lines over a two strand fiber optic cable.



4 Channel T1 Card Layout

Connections

Connect Fiber Optic Cable

Fiber 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.

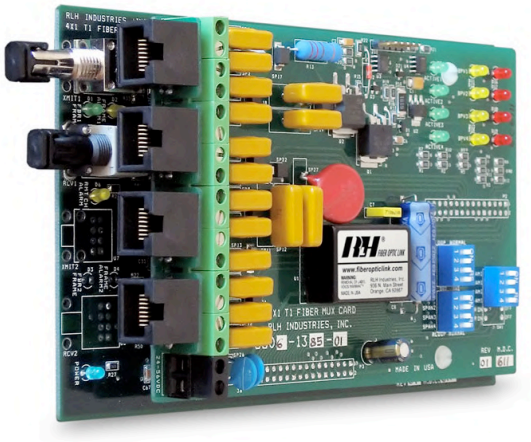
Connect Copper T1 Send and Receive pairs

The T1 pairs from the Telco connect to the green screw-down terminals provided on the T1 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: CO Cards 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 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. Please refer to the Ordering Information section.



Card with RJ48C Adapter

Powering the System

Powering at the CO end

Typically, the CO Card is span powered by two 60mA simplex current sources derived from the T1 Telco Span Transmit and receive copper pairs. To span power the Sub Card you must have a minimum of two 60mA simplex current sources (two working T-1 circuits).

The CO card can also be powered externally by connecting a 24-48VDC, 100mA power source to the black terminal on the Sub Card labeled “24 - 56VDC”. The 4 Channel T1 MUX CO card is polarity insensitive to all electrical connections.

Powering at the Sub end

Connect a 24-48VDC, 100mA external power source to the black terminal on the Sub Card labeled “24 - 56VDC”. Alternately the card can be powered by two 60mA simplex current sources on the T1 Send and Receive pairs. To span power the Sub Card you must have a minimum of two 60mA simplex current sources (two working T-1 circuits). The 4 Channel T1 MUX Sub Card is polarity insensitive to all electrical connections.

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

T1 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

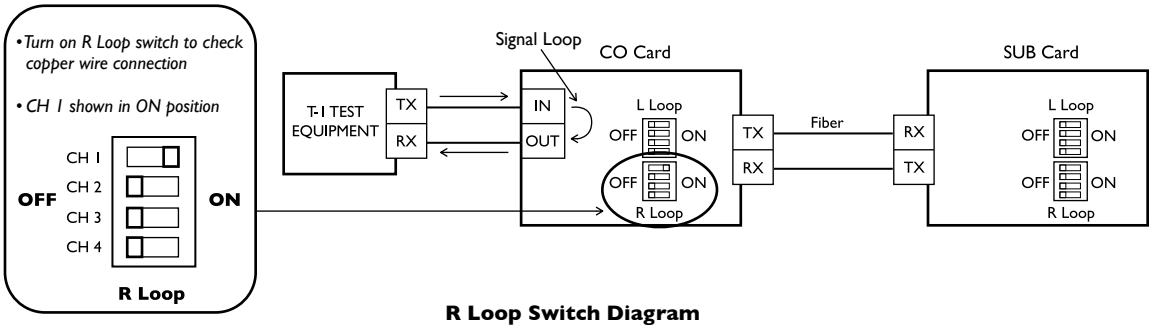
Switch Settings

Switch SW1 - B8ZS or AMI Encoding

A four-position 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 T1 inputs.

Switch SW2 - Remote Loopback

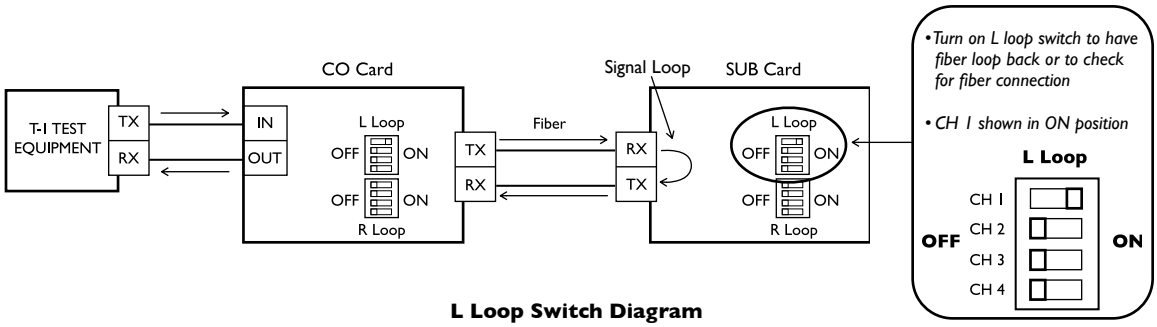
A four-position DIP switch is provided to allow for remote loop back of each of the four T1 lines for trouble shooting purposes. The loop back function begins at the T1 receive twisted pair, through the T1 LIU (Line Interface Unit), and then back out the T1 transmit twisted pair. Normal operating position is **ON/NORMAL** for **All** four DIP positions.



R Loop Switch Diagram

Switch SW3 - Local Loopback

A four-position DIP switch is provided to allow for local loop back of each of the four T1 lines for trouble shooting purposes. The loop back function begins at the T1 transmitter data coming from the fiber link, through the T1 LIU, and then back out to the transmit fiber link. Normal operating position is **ON/NORMAL** for **All** four DIP positions.



L Loop Switch Diagram

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 indicate loss of line integrity at the receiver. It should be noted that if the transmitting equipment is using encoded B8ZS, and the 4 Ch. T1 Fiber Link 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 T1 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/Frame Alarm

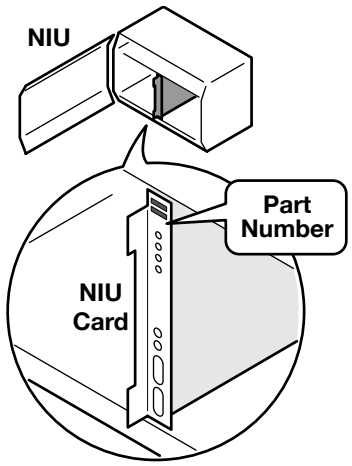
The fiber frame LED (green) will remain on as long as the fiber optic receiver stays in frame with the far end T1 fiber optic transmitter. Only if there is a problem with the receive frame does the green LED turn off. When this LED does turn off then both of the 4 Channel T1 MUX end units will begin 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 T1 LIUs.

NIU Compatibility

Check for compatible NIU systems that supply Span Through-Power to the 4 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

Ordering Information

Each 4 Channel T1 Fiber Link Card is identified with the part number.

Optics	Distance	Fiber	Description	Part Number	CLEI
Multimode ST	2km/ 1.2 mi	62.5 µm	CO Card	**8806-1345-01**	VAI2AAFBAA
			SUB Card	**8806-1355-01**	VAI2AAGBAA
Single-mode ST	15km/ 9 mi	8~9 µm	CO Card	**8806-1385-01**	VAI2AAHBAA
			SUB Card	**8806-1395-01**	VAI2AAJBAA
Single-mode SC	15km/ 9 mi	8~9 µm	CO Card	**8805-1385-01**	VAI2AABBAA
			SUB Card	**8805-1395-01**	VAI2AACBAA
Long Haul Single-mode ST	60km/ 37mi	8~9 µm	CO Card	**8806-1385-01-LH**	-
			SUB Card	**8806-1395-01-LH**	-
Long Haul Single-mode SC	60km/ 37mi	8~9 µm	CO Card	**8805-1385-01-LH**	-
			SUB Card	**8805-1395-01-LH**	-

- 62.5µm multimode fiber compatibility is standard, add **-50** to part number for 50µm fiber compatibility.
- Add **-RJ** to part number to include RJ Adapter with the card.
- Please contact your RLH sales representative for pricing and delivery information.

RJ-48C Adapter Part Number Information

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: -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	
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: 24-48VDC, 120mA	
Powering Method	Line power simplexed on Send and Receive pairs, or an isolated DC power source connected to AUX. P.S. input.	
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 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	-	-

Technical Support

Email:	support@fiberopticlink.com
24/7 technical support:	Toll Free 1-855-RLH-24X7 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.