

UHDSL® Fiber Optic Link System

Specifications and Installation Information

Introduction

This practice provides installation and maintenance procedures for the RLH UHDSL Fiber Optic Link system.

The RLH Industries, Inc. UHDSL Fiber Optic Link System® interfaces directly with a standard HDSL1, 2 or 4 copper telephone line.

The CO UHDSL card converts the electrical signal from the CO side HDSL copper line for transmission over fiber optic cable (multimode or single mode) to the Sub UHDSL card. It also converts the fiber signal from the Sub Card back to an electrical signal for transmission over copper lines.

The Sub UHDSL Card operates in the same manner and is connected directly over copper to the HDSL remote Unit.

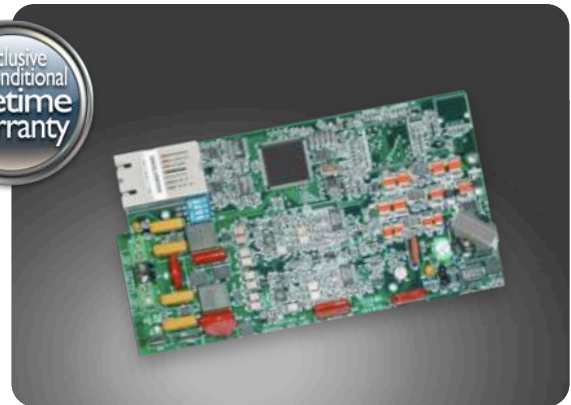
Users can also perform complete end-to-end HDSL system loop back to the locally powered HDSL RT/NIU directly after the UHDSL Sub card.

See diagrams on pages 2 and 3

HDSL-2 service uses one copper pair. Up to Two separate HDSL-2 systems will run on one UHDSL system. HDSL-1 or HDSL-4 uses 4 copper wires (2 pairs). One UHDSL-1 or HDSL-4 can be used on the RLH UHDSL system.

See the Scenarios diagram Fig. 2.1 and Fig 2.2

Note: The CO UHDSL Fiber Card is powered only via the HDSL copper span compared to the SUB UHDSL fiber card, which is powered by a local 44V-56V DC Power Source.



RLH UHDSL® 4RU Card

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Compliance Information

The RLH UHDSL Fiber Optic Link System is compliant with the following industry standards:

- **NEBS Level 3**
- **FCC PART-15**
- **FCC PART-68B**
- **IEEE-80 IEEE-367**
- **IEEE-487**
- **IEEE-1590**
- **IEEE-1615**
- **Motorola R56**
- **BR 876-310-100 BT (Telcordia)**
- **Bellcore SR-3966**
- **GR-1089**
- **GR-63**

Specifications subject to change without notice.

General Safety Practices

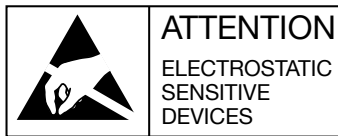
The equipment discussed in this manual may require tools designed for the purpose being described. RLH recommends that service personnel be familiar with the correct handling and use of any installation equipment used, and follow all safety precautions including the use of protective personal equipment as required.

Caution - Severe Shock Hazard

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

Special handling requirements

Be careful when handling electronic components



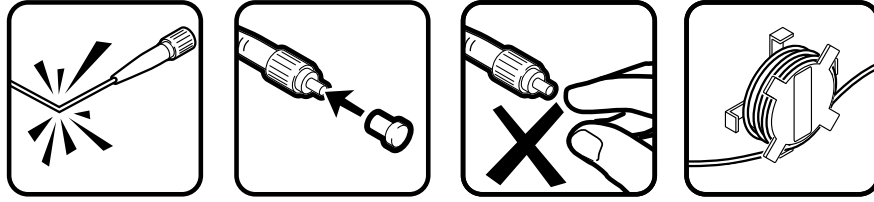
- This product contains static sensitive components.
- Handle the T1 cards at their edges only.
- Follow proper electrostatic discharge procedures.

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.

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



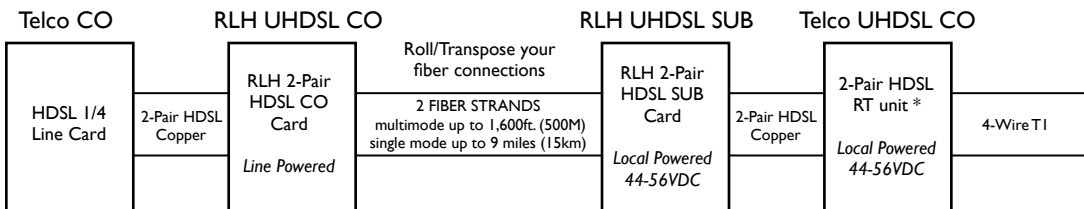
- Do not bend fiber cable sharply. Use gradual and smooth bends to avoid damaging glass fiber.
- Keep dust caps on fiber optic connectors at all times when disconnected.
- Do not remove dust caps from unused fiber.
- Keep fiber ends and fiber connectors clean and free from dust, dirt and debris. Contamination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

Application

Using non-conductive fiber cable in place of serving copper telephone cable

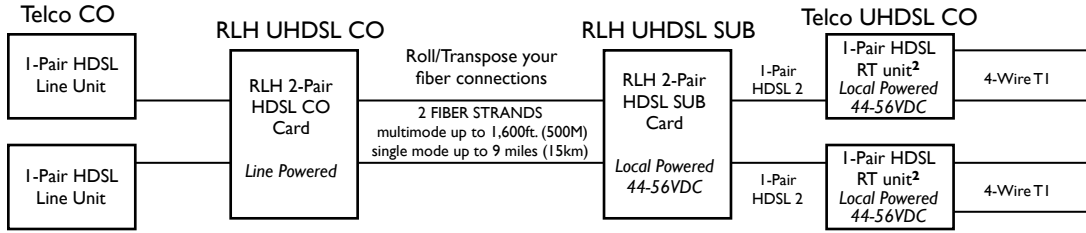
Telecommunication equipment in high voltage areas can be at risk due to Ground Potential Rise (GPR). A copper telephone line referenced to a remote ground can become a path for high voltages during a ground fault. Placement of an all-dielectric fiber optic cable and locating the CO UHDSL fiber card at either the 300 Volt Point as determined by a GPR Engineering study or at the nearest/safest telco service drop completely eliminates the presence of a copper telephone cable into a high voltage environment. This design will dramatically increase the overall safety of personnel and equipment involved.

Scenario A
HDSL 1 or HDSL 4 (2-Pair)
Fig. 2.1



(Application diagram continued on next page)

Scenario B
¹HDSL 2 (1-Pair)
Fig. 2.2



NOTE: ¹ HDSL-2 Telco services utilize only one copper pair. Up to two, HDSL-2 copper circuits can be applied thru one RLH UHDSL Fiber Optic System. Turn OFF unused Loop when using only one HDSL-2 (one pair) circuit.

NOTE: ² The RLH UHDSL Sub Card does not provide DC output/span power to operate an RT/NIU. Use an RT/NIU that will accept a local 48VDC power source, as per manufactures spec.

Housings

RLH CO and Sub cards are are designed to be mounted into a RLH housing. The UHDSL cards are compatible with all RLH Fiber Optic Link housings except the following: P/N 8806-1200-03 (single indoor card housing) & 8806-1200-04 (single outdoor card housing) due to a shield plate located on the backside of the UHDSL PCB. For more information please contact RLH Customer Service or go to www.fiberopticlink.com .

Inspection

- Inspect the contents of your RLH shipment.
- Verify that your UHDSL fiber cards match the fiber and connector type of your fiber optic cable i.e. single mode w/ST UHDSL cards for single mode fiber cable w/ ST connectors.

Installation

Copper Connections:

- Each copper pair LOOP 1/LOOP 2 is connected into the green screw-down terminal located at the front of the UHDSL board marked LOOP 1 and LOOP 2. *See Fig. 4.2*
- Use standard CAT-5E or better 22-26 ga. solid cable for both your LOOP 1/LOOP 2 connections
Use 22 to 26 ga. CAT5 for your DC power connection to the UHDSL Sub card. *See Fig. 4.3 and 4.4, Powering.* Strip back enough copper to insure a good connection to the UHDSL card.
- Note that the UHDSL CO card is Span/line powered only and lacks an AUX. P.S. terminal.

Fiber Connections:

- The UHDSL Card is equipped with one ST or SC female duplex fiber optic connector.
- Remove rubber plug from connector and save for later use if card is removed from service.
- When inserting the fiber connections into the duplex UHDSL connector, be sure to not touch fiber connector ends to avoid contamination that may affect optical signal performance.
- Seat each fiber connector firmly but carefully into the UHDSL fiber connector.
- The excess Fiber cable should be routed & stored loosely without tight bends to avoid excessive optical signal loss. *See Fig. 4.1*
- Make sure the CO and Sub UHDSL cards fiber connections are rolled or transposed. Example if you use the #1 fiber on the CO cards TX, then insert #1 fiber into the RX on the Sub UHDSL card.

See section 6. for powering the UHDSL cards.



Fig. 4.1 RLH UHDSL CO Card installed inside RLH 2-card indoor/outdoor housing.

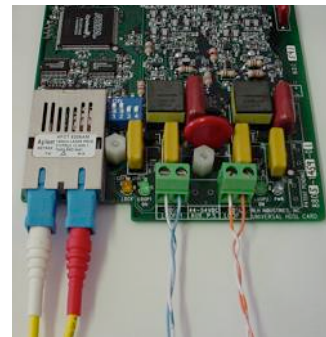
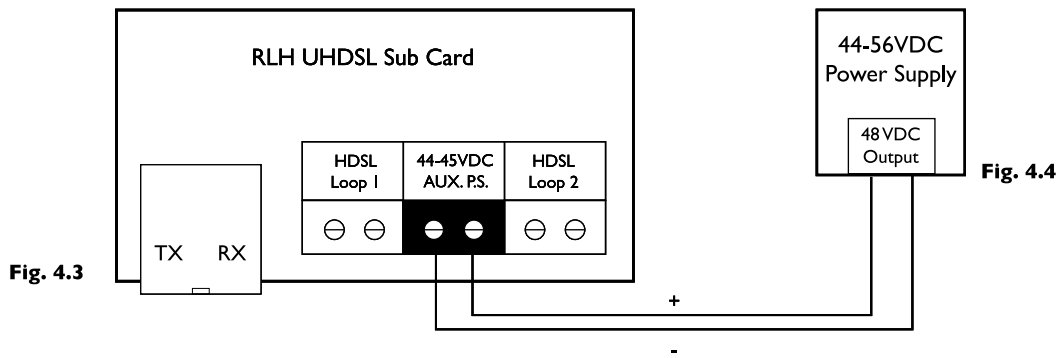


Fig. 4.2 Close up view of CO Cards copper and fiber connections. LOOP 1 left connection, LOOP 2 right connection. RJ-45 input copper input option is available instead of screwdown terminal.

NOTE: When using just one HDSL-2 one pair line, utilize the LOOP 1 Terminal only and & turn LP2 DIP Switch OFF to conserve power and reduce noise and crosstalk.

Powering

- The RLH UHDSL CO card is line powered via the HDSL Telco span power (90-210V DC) and lacks an AUX. P.S. DC Input.
- The RLH UHDSL Sub card requires a local DC source of 44-56 Volts and draws 5 Watts. Power is connected to the black screw down terminal labeled: (44-56VDC AUX. P.S.). The AUX. P.S. input is not polarity sensitive.
- For UHDSL DC power connections standard 24-26 AWG CAT-5 or equiv. Cable is sufficient. Strip back enough insulation to insure a good DC power connection to UHDSL Sub card.
- RLH manufactures reliable AC/DC or DC/DC power supplies designed for this application if one is not available to you. See *table 4.5* for a listing of RLH AC/DC & DC/DC power supplies.



Visual Example of Sub/CPE Side Setup with AC/DC Power Supply

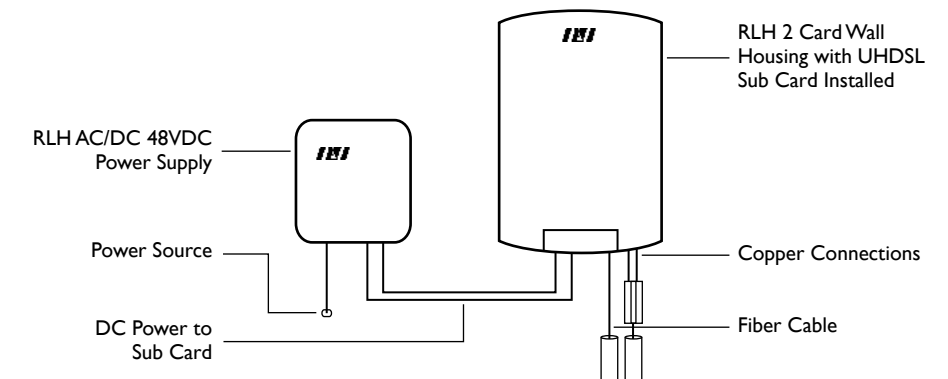


Fig. 4.5 Common RLH AC/DC & DC/DC power supplies, see also www.fiberoptick.com

Part Number	Description
8806-1204-01	115/48V AC/DC Power Supply w/ 1.2A Battery backup, can power up to Five UHDSL Cards.
8806-1214-01	115/48V AC/DC Power Supply w/ 7.0A Battery backup, can power up to 17 UHDSL Cards.
8806-1276-02	130/48V DC/DC Converter can power up to 12 UHDSL Cards.
8806-1266-02	24/48V DC/DC Converter can power up to 12 UHDSL Cards.

LED Status

There are four (4) Light Emitting Diodes (L.E.D.s) that display operational status of the RLH UHDSL Card. On the topside of the card near the Optical Transceiver is the LOCK and Channel 1 LEDS. Below the connectors are the Channel 2 and Power LEDS.

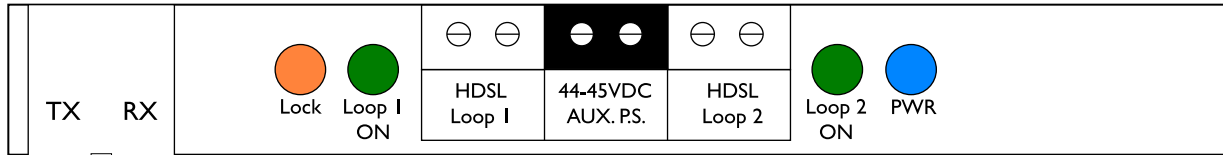
Normal operation – When both cards are powered and connected through fiber, Orange LOCK LED is ON, Blue Power LED is ON and Optional Green Channel LEDS are ON if selected.

Parameters indicated by LEDs:

LOCK (Orange LED): **ON** (STEADY) --- CO and Sub UHDSL Cards are in sync.
FLASHING --- CO and Sub UHDSL Cards are not in sync (check that fiber connector is fully inserted into optical connectors. Fibers may be reversed).

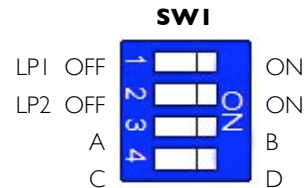
LOOP 1 & LOOP 2 (Green LED's): **ON** --- Green LED's are lit if corresponding Dip Switch is in the ON position.
OFF--- Dip Switch Position is OFF.

POWER (Blue LED): **ON** --- Power is operational.
OFF --- Power not applied to card or power supply is not working.



DIP Switch Settings

Switch	Setting	Description
LPI	ON	Turns LOOP 1 ON
	OFF	Turns LOOP 1 OFF
LP2	ON	Turns LOOP 2 ON
	OFF	Turns LOOP 2 OFF



Dip switches 3 and 4 are used for setting the gain depending on the type of circuit the HDSL system is connected to. To determine what to set these switches at, calculate the effective maximum length of copper in your circuit using the worksheet formula in the next section, then use the appropriate chart to set the CO and SUB card switches accordingly.

- Setting a gain switch on the CO card affects gain in the direction of the CO to SUB card.
- Setting a gain switch on the SUB card affects gain in the direction of the SUB to CO card.

For CO Card			For Sub Card		
Switch 3	Switch 4	Gain/Attenuation	Switch 3	Switch 4	Gain/Attenuation
A - OFF	C - OFF	0dB	A - OFF	C - OFF	0dB
A - OFF	D - ON	+6dB	A - OFF	D - ON	-6dB
B - ON	C - OFF	-6dB	B - ON	C - OFF	-3dB
B - ON	D - ON	+9dB	B - ON	D - ON	-9dB

Determining Effective Maximum Copper Cable Length

Use the following worksheet to determine the maximum length of copper cable in kilofeet, between the Central Office and UHDSL CO Fiber Card, or last repeater, and the CO UHDSL Fiber Card.

For HDSL1 and HDSL2

Description	Value	Name	What to Enter
Bridge Taps	*	BT	Total length in feet of bridge taps (max 2500 ft)
Length of Non-24G	*	L	Total length in feet of non-24 gauge cable (max 6000 ft)
Gauge changes	*	J	Number of gauge changes that exceed 100 ft.

$$\text{Effective Length} = 120 - (\text{BT} \times .01) - (\text{L} \times .005) - (\text{J} \times 3) \times 75$$

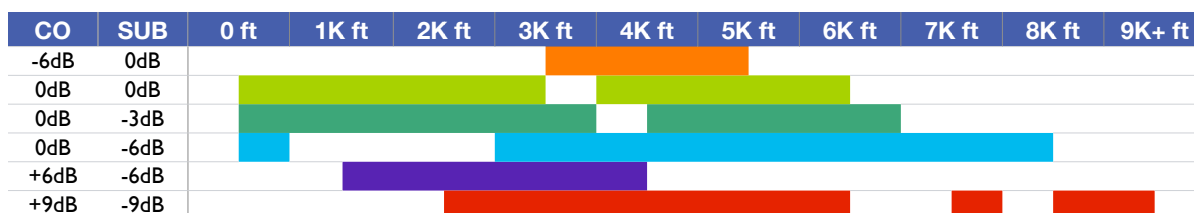
For HDSL4

Description	Value	Name	What to Enter
Bridge Taps	*	BT	Total length in feet of bridge taps (max 2500 ft)
Length of Non-24G	*	L	Total length in feet of non-24 gauge cable (max 8000 ft)
Gauge changes	*	J	Number of gauge changes that exceed 100 ft.

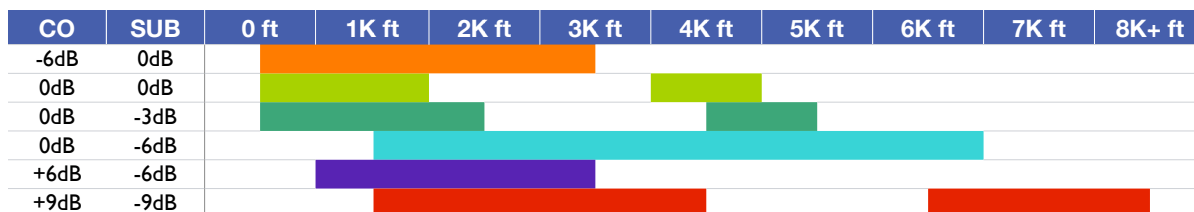
$$\text{Effective Length} = 120 - (\text{BT} \times .01) - (\text{L} \times .005) - (\text{J} \times 3) \times 100$$

Next, using the graphs below, chose the switch where the color bar is closest to the middle of the effective length.

For 24 AWG



For 26 AWG



Ordering Information

RLH Fiber Optic Link products are available directly through RLH Industries, Inc. or one of its distributors nationwide. Please call RLH customer service for ordering assistance.

UHDSL part numbers are located at the lower front area of UHDSL card.

Card Description	Part Number	CLEI Code
UHDSL CO Multimode w/ SC Connectors *	8805-1439-01	See RLH Web Site www.fiberopticlink.com
UHDSL CO Multimode w/ ST Connectors *	8806-1439-01	
UHDSL Sub Multimode w/ SC Connectors *	8805-1449-01	See RLH Web Site www.fiberopticlink.com
UHDSL Sub Multimode w/ ST Connectors *	8806-1449-01	
UHDSL CO Single-mode w/ SC Connectors	8805-1459-01	See RLH Web Site www.fiberopticlink.com
UHDSL CO Single-mode w/ ST Connectors	8806-1459-01	
UHDSL Sub Single-mode w/ SC Connectors	8805-1469-01	See RLH Web Site www.fiberopticlink.com
UHDSL Sub Single-mode w/ ST Connectors	8806-1469-01	

- ▶ * 62.5µm multimode fiber compatibility is standard, add **-50** to part number for 50µm fiber compatibility
- ▶ To add RJ-45 copper input instead of screw-down input, add **-RJ** at the end of the UHDSL card part number.
- ▶ Example part number: 8806-1439-01-RJ =UHDSL CO Multimode w/ ST fiber connectors and RJ-45

Compatibility

The RLH UHDSL Fiber Optic Link System is compatible with HDSL 1,2 & 4 systems but may not be compatible with some early version HDSL copper telco equipment such as the PairGain HI-Gain HDSL-1, 4 wire system. Verify compatibility with RLH prior to ordering.

Please contact the following Telco Central Office/NIU OEM's for part numbers & technical support.

- Adtran (800) 726-8663
- ADC/PairGain (800) 638-0031

General Specifications

Transmission method	Serial Bit Stream via two optical fibers	
	Multimode	1310nm
	Single-mode	1310nm
Maximum Fiber Loss / Distance*	Multimode	12dB / 1,600 feet (500m)
	Single-mode	17dB / 9 miles (15km)
Fiber Type	Multimode	62.5/125µm, 50/125µm
	Single-mode	9/125µm
Fiber Connector Types	ST or SC	
Maximum Copper Length	8kft of 26GA, 12kft of 24GA Cable	
	(Between HDSL-1, 2 or 4 CO Line or Repeater card and RLH CO UHDSL Card)	
HDSL Signal Format	Full duplex 2B1Q or TC-PAM w/Spectral Shaping	
End-to-End Sync	Typically 30 seconds additional for HDSL system to train.	
Maximum Data Rate	3.152 Mbps	
BER	<10 ⁻⁸	
Transmit Level	Equal to opposite end receive level +/- 1.5dB (Dip switch SW1 position 4A)	
Surge Protection	PTC thermistors, Surgectors™ and varistors	
Power Methods	CO Card Typical HDSL line powering 85-210VDC.	
	Sub Card 44-56VDC, local power 8kft of 26GA, 12kft of 24GA Cable	
Powering Requirements	5.5 Watts Maximum	
Operating Temperature	-40° to +160° F (-40° to +70° C)	
Humidity	5-95% non-condensing	
<p>Other company and product names mentioned herein are trademarks of their respective companies. Mention of third-party products is for informational purposes only and constitutes neither an endorsement nor a recommendation. RLH assumes no responsibility with regard to the performance or use of these products.</p>		

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 Fiber Optic Link Assemblies are warranted to be free of defects in material and workmanship for the **LIFE OF THE PRODUCT**.

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 any product, or part thereof, that fails **FOR ANY REASON**, provided the defective part is returned to RLH Freight prepaid. This warranty is **UNCONDITIONAL** and valid even when RLH Fiber Optic Link Assemblies have been abused or mishandled, where unauthorized repairs have been attempted or performed, or product has been damaged as a result of a natural disaster. Compare this warranty to our competitors and see how our warranty will reduce your costs and simplify your maintenance activities.

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

Technical Support

Normal technical support: (Mon - Fri 6am - 6pm PST)	Local (714) 532-1672 Toll Free (800) 877-1672 Toll Free (866) DO-FIBER
24/7 Technical support:	(714) 396-8982 (714) 457-5740

Contact Information

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

RLH FIBER OPTIC LINK

RLH Industries, Inc., The Leader in Fiber Optic Telecom Isolation Technology

LIFETIME

UNCONDITIONAL WARRANTY

RLH INDUSTRIES, INC. FIBER OPTIC LINK assemblies are warranted to be free of defects in materials and workmanship for the life of the product. This lifetime warranty is effective for RLH products sold from February 2, 1988, to the present, with the exception of fiber optic cable assemblies which are warranted only to be free of defects in manufacturing and batteries, which carry a 5-year unconditional replacement warranty.

RLH Industries, Inc. will repair or replace any product, or part thereof, that fails for any reason, provided the defective part is returned to RLH, freight prepaid.

This warranty is UNCONDITIONAL and is valid even when RLH Fiber Optic Link assemblies have been abused or mishandled, where unauthorized repairs have been attempted or performed, or product has been damaged as a result of a natural disaster.

Authorized by:



J. RANDALL MEARS, Vice President, Engineering



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

Specifications subject to change without notice.