



RLH Industries, Inc.

USER GUIDE

*The leader in
rugged fiber optic
technology.*

U-151 2024C-1217

RS-232 Industrial Media Converter

COMPACT, RUGGED &
TEMPERATURE HARDENED

SERIAL DATA
OVER FIBER



RS-232 Industrial Media Converter

Introduction

This Industrial Serial Data media converter transports a full 9-Pin RS-232 copper signal over fiber optic cable. This is an ideal solution for extending serial data communications over long distances or near large electrical equipment. Fiber optics provide long distance communication up to 74 mi. (120km) and immunity to EMI/RFI and potential transient surges which can cause noise or damage equipment.

The system supports asynchronous serial data rates from 50 bps to 1Mbit/s and has an auto-sensing feature that eliminates the need to manually set serial data rates. A comprehensive set of LEDs on the front panel indicate power status, fiber status, and serial data activity. Powering options include standard 24-48VDC or high range DC powering of 125VDC. This rugged system is designed to operate over a wide operating temperature -40 to +70°C and features dual redundant power inputs, and a system alarm relay for maximum uptime and reliability. Included is a DIN clip and wall mount ears for easy installation into to a wide range of environments.

Standard Features

- Transmits a 9-Pin RS-232 Signal
- Supports baud rates of 50 bps to 1Mbit/s
- Selectable DTC/DCE switch for easy installation
- Each Pin is Optically Isolated
- Optional Breakout Cable for 3 channels of serial data
- Convenient LEDs for power, fiber, and serial signals
- ST and SC Connectors, Singlemode and Multimode options available
- Extends communication up to 74 mi. (120km) over Fiber
- DC power, fiber break, and/or system failure alarm relay
- Rugged design for wide operating temperature
- Limited Lifetime warranty

Made in U.S.A.



General Safety Practices

Intended Audience

This guide is intended for use by knowledgeable installation, operation and repair personnel. Every effort has been made to ensure the accuracy of the information in this guide. However, due to constant product improvement, specifications and information contained in this document are subject to change without notice.

Conventions

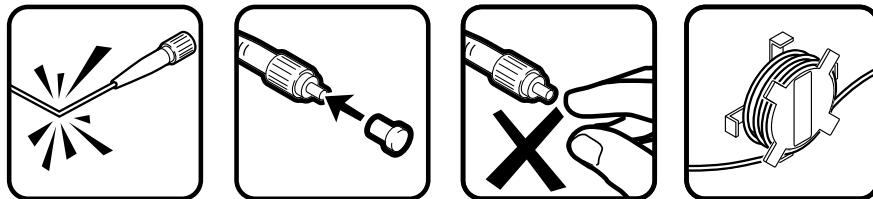
Symbols for notes, attention, and caution are used throughout this manual to provide readers with additional information, advice when special attention is needed, and caution to prevent injury or equipment damage.

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.
- Copper wires may carry high voltages. Use caution when handling.
- Do not open the product housing, there are no user serviceable parts.

Guidelines for handling terminated fiber cable

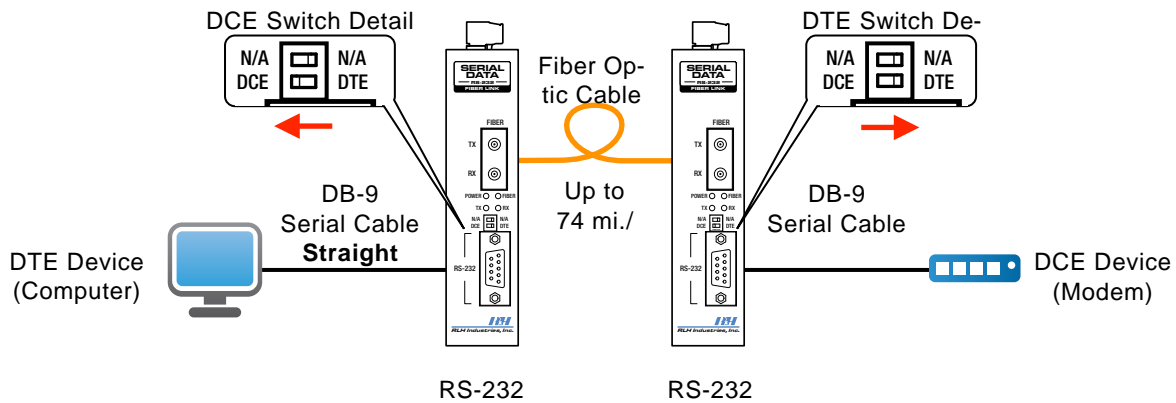


- Do not bend fiber cable sharply. Use gradual and smooth bends to avoid damaging glass fiber.
- Keep dust caps on fiber optic connectors at all times when disconnected.
- Do not remove dust caps from unused fiber.
- Keep fiber ends and fiber connectors clean and free from dust, dirt and debris. Contamination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

Application Diagrams

DTE Device (PC) To DCE Device (Modem)

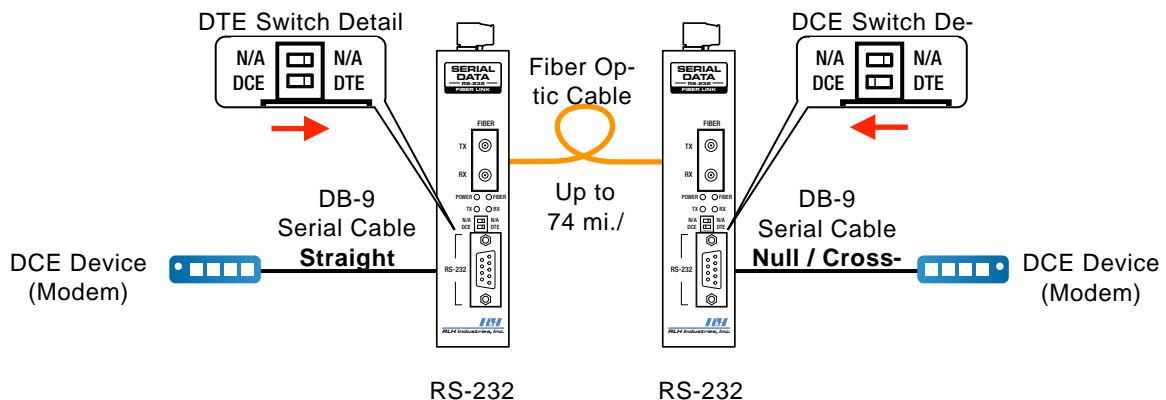
This Fiber Optic System is always used in a pair. One of the media converters must always be set to DTE mode via the dip switch and the other media converter must be set to DCE for proper operation. When connecting DCE and DTE end devices over fiber, pair the DCE end device with the media converter set to DTE mode, and pair the DTE end device with the media converter set to DCE mode. Then make the interconnections between each of the media converters and the end devices with a straight through serial cable as illustrated below.



Typical Application Diagram

DCE Device To DCE Device

This Fiber Optic System is always used in a pair. One of the media converters must always be set to DTE mode via the dip switch and the other media converter must be set to DCE for proper operation. When connecting two DCE end devices over fiber, where the DCE end device connects to the media converter set to DTE mode, use a straight through serial cable. Where the other DCE end device connects to the media converter in DCE mode use a null (crossover) serial cable. Below is an example of a system where both end devices are DCE devices and connected with the appropriate straight through and null (crossover) cables.



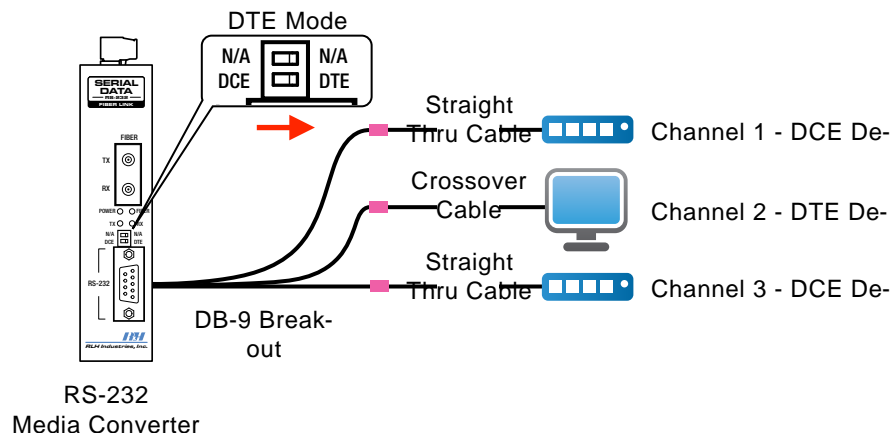
(DCE to DCE / DTE to DTE)
Same Device Type Application Diagram

DB-9 Breakout Cable (Straight Through Cable) – 3 Channel

The optional DB-9 Breakout cable will convert your 9-Pin RS-232 device to 3 separate channels of 3-Pin RS-232 serial data as illustrated below. The breakout cable is wired as a straight through cable, if the device is in DTE mode, all 3 connectors will be DTE type interfaces.

Likewise, if the Device is in DCE mode, all 3 connectors will be DCE type interfaces. If you are connecting DCE to DCE or DTE to DTE a crossover cable will need to be used on those connections.

NOTE: 3 Channel DB-9 Breakout Cables split the cables 9 wires into three DB-9 ports using only the 3 pins for sending the RS-232 Signal. See DB-9 Breakout Cable section for more pin and cable details.



Breakout Cable Application Diagram

Installation

Prior to installation:

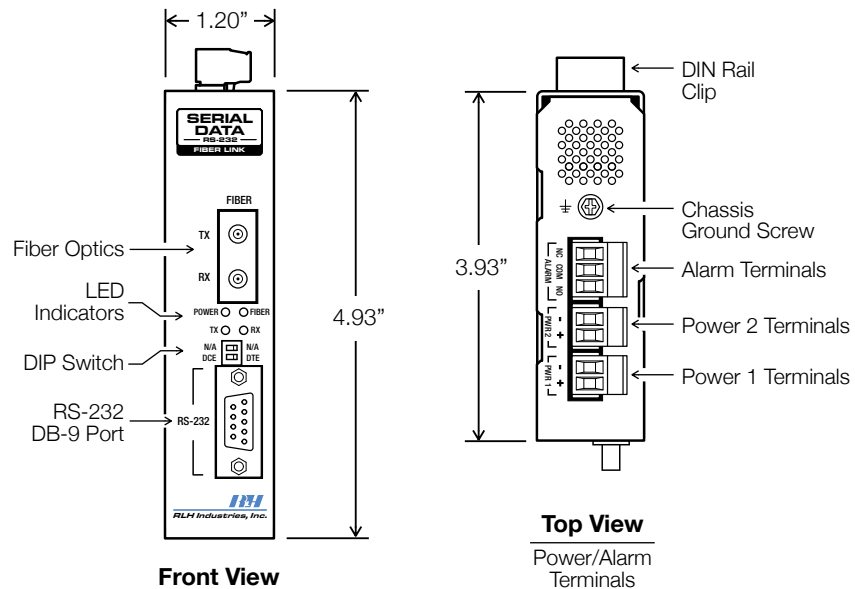
- Check for shipping damage.
- Check the contents to ensure correct model.
- Make sure you have the correct fiber type and power available.
- Have a clean, dry installation environment ready.

Required for installation:

- Suitable wall, panel, or DIN rail space.
- Local power source (24~48VDC or 125VDC depending on model).
- Flat head screwdriver for connecting wiring.
- Phillips screwdriver for attaching to wall (optional).

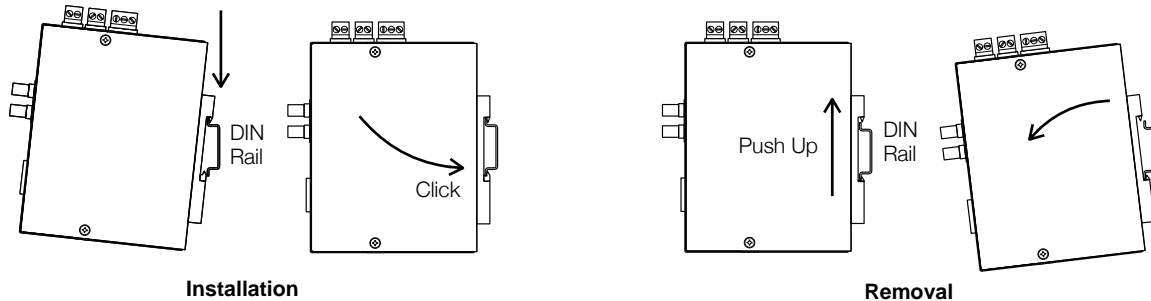
Physical Layout

RLH Industrial Media Converter's user ports, switch, and LED indicators are located on the front and top panels.



DIN Rail Mounting

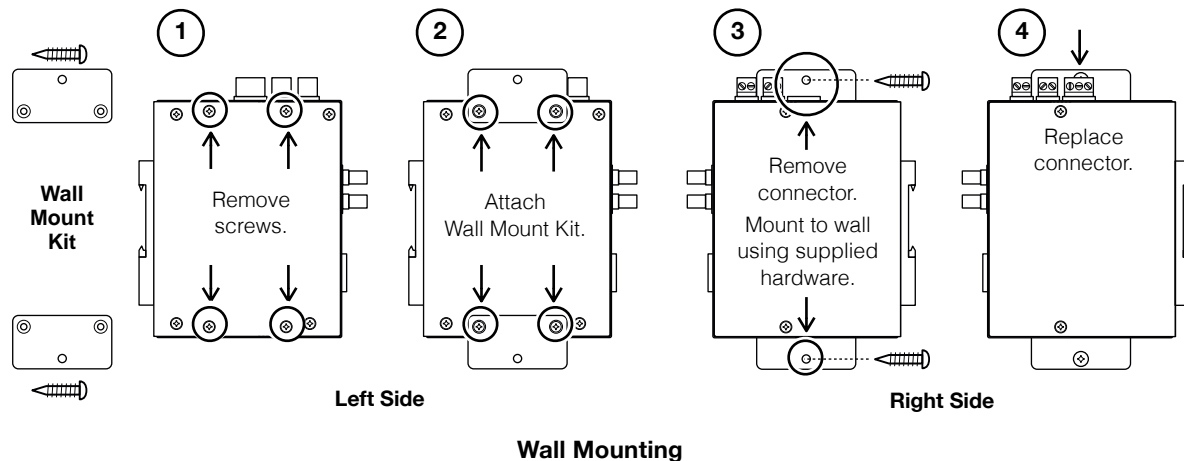
The DIN clip for mounting the system is mounted onto the rear panel. Hook the DIN clip on the top flange of the DIN rail and rotate to the locked position to install. To remove, push up to depress the spring latch and rotate off of the DIN rail.



DIN Rail Mounting

Wall Mounting

The system can be easily wall mounted by attaching the provided wall mount ears and hardware. Attach the wall mount ears by following the instructions below.



Connect Optical Fiber Cable

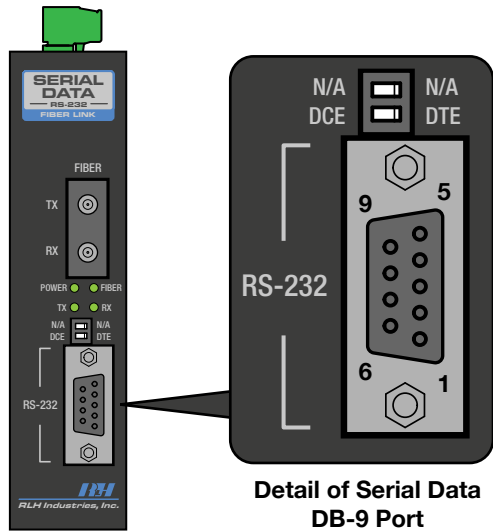
The optical ports may be equipped with ST or SC fiber connectors. A fiber pair is required for operation with dual fiber models, TX is the signal output side and RX is the signal input side. Single fiber models (bi-directional) combine input and output, by using different wavelengths over one fiber.

Connect fiber cables to correct TX and RX ports. On dual fiber models, Verify that the TX fiber at one module is connected to the RX port on the opposite end. On single fiber systems there will be an **A** and **B** side. The **A** side must connect to the **B** side.

Do not remove fiber cable caps until you connect fiber to the unit, watch for dust and contamination. Fiber cables should be routed loosely avoiding tight bends to prevent excessive optical loss.

Connect Serial Port

The RLH Serial Data Fiber Link transports all 9-Pins of RS-232 copper serial data over fiber optic cable. Serial connections are made to the provided female DB-9 serial port. Please refer to the below pinouts to ensure the appropriate connections are being made.

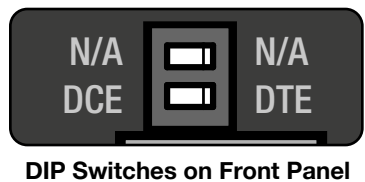


DB-9 Port Pinouts		
Pin	Name	Function
1	DCD	Data Carrier Detect
2	RXD	Receive Data
3	TXD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Ground Signal
6	DSR	Data Set Ready
7	RTS	Request to Send
8	CTS	Clear to Send
9	RI	Ring Indicator

DCE / DTE Selection Switch

This DIP switch is used to determine the flow of data to and from the device. When set to the DTE Position the device's DB-9 Serial Port will behave as a DTE type device. When Set to the DCE position the device's DB-9 Serial Port will behave as a DCE type device.

This Fiber Optic System is always used in a pair, one device must always be set to DTE and the other device must be set to DCE. Please use null or straight thru cables to appropriately connect to end devices. Consult our application diagrams for deployment examples.












RS-232 DB-9 Switch	
Setting	Switch Position
DCE	←
DTE	→

DB-9 Serial Cables

Straight Through 9-Pin Serial Cable








A Straight Through or One-to-One cable is used to connect a DTE device (PC) to a DCE device (modem or other communications device). The transmit and receive lines are not cross-connected in this case, hence the name.

DTE Device		STRAIGHT THROUGH CABLE				DCE Device	
Function	Name	Pin	Signal Direction	Pin	Name	Function	
Data Carrier Detect	DCD	1		1	DCD	Data Carrier Detect	
Receive Data	RXD	2		2	RXD	Receive Data	
Transmit Data	TXD	3		3	TXD	Transmit Data	
Data Terminal Ready	DTR	4		4	DTR	Data Terminal Ready	
Ground Signal	GND	5		5	GND	Ground Signal	
Data Set Ready	DSR	6		6	DSR	Data Set Ready	
Request to Send	RTS	7		7	RTS	Request to Send	
Clear to Send	CTS	8		8	CTS	Clear to Send	
Ring Indicator	RI	9		9	RI	Ring Indicator	

Null (Crossover) 9-Pin Serial Cable

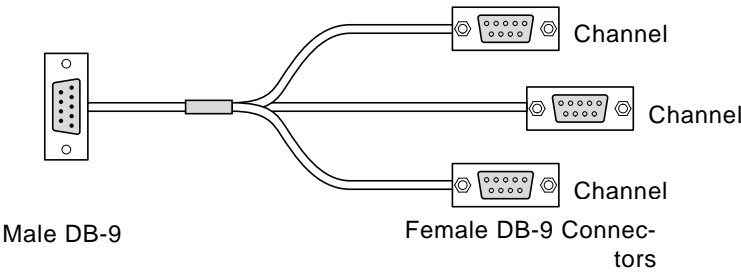
A Null Modem or Crossover cable is used to connect a pair of the same devices, DTE to DTE devices or DCE to DCE devices, together. For this to work, the Transmit (TXD) pin of one device needs to be connected to the Receive (RXD) pin of the other device, and vice versa.

To enable handshaking between the two devices, the Request to Send (RTS) pin of one device must be connected to the Clear to Send (CTS) pin of the other device, and the Data Set Ready (DSR) pin is connected to the Data Terminal Ready (DTR) pin of the other.

DCE Device		NULL / CROSSOVER CABLE				DCE Device	
Function	Name	Pin	Signal Direction	Pin	Name	Function	
Data Carrier Detect	DCD	1		1	DCD	Data Carrier Detect	
Receive Data	RXD	2		3	RXD	Receive Data	
Transmit Data	TXD	3		2	TXD	Transmit Data	
Data Terminal Ready	DTR	4		6	DTR	Data Terminal Ready	
Ground Signal	GND	5		5	GND	Ground Signal	
Data Set Ready	DSR	6		4	DSR	Data Set Ready	
Request to Send	RTS	7		8	RTS	Request to Send	
Clear to Send	CTS	8		7	CTS	Clear to Send	
Ring Indicator	RI	9		9	RI	Ring Indicator	

DB-9 Breakout Cable (Straight Thru Cable) – 3 Channels

The optional DB-9 Breakout cable will convert your 9-PIN RS-232 device to 3 separate channels of 3-PIN RS-232 serial data as illustrated below. The break-out cable is wired as a straight through cable, if the device is in DTE mode, all 3 connectors will be DTE type interfaces. Likewise, if the Device is in DCE mode, all 3 connectors will be DCE type interfaces. If you are connecting DCE to DCE or DTE to DTE a crossover cable will need to be used on those connections.



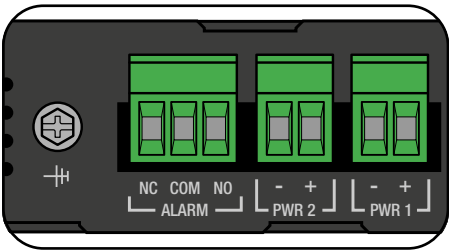
RS-232 DB-9 Breakout Cable

Breakout	Channel 1			Channel 2			Channel 3		
DB-9 Pins	2	3	5	2	3	5	2	3	5
	RXD	TXD	GND	RXD	TXD	GND	RXD	TXD	GND

Connect Power

The system has redundant power terminals that accommodates a backup power supply in the event of an outage. Follow these steps when attaching wires to power terminals located on the top of the module.

- Check that DC power source voltage matches the accepted voltage range of the device to avoid damaging the unit.
- Disconnect power from the DC power source prior to connecting to the Fiber Link.
- Connect the DC power cables to the terminal pairs labeled PWR 1 or PWR 2. The system is NOT polarity sensitive.
- Energize the power source. The POWER LED will be ON indicating that the system has power.



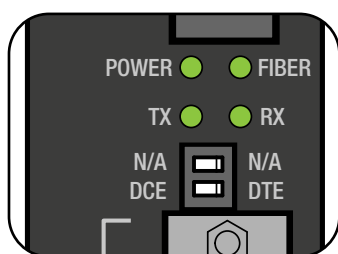
Detail of Power Terminals, Alarm Terminals, and Ground Screw

Connect Alarm Contact

Connect wires from the equipment monitoring the Serial Data Fiber Link to the alarm terminals located on the top of the unit next to the power terminals. The alarm relay offers a Common, Normally Open, and Normally Closed position.

When the system is communicating and properly functioning the Fiber LED will turn ON and the alarm relay will energize. If DC Power is lost, Fiber is broken, or one side of the system stops functioning the alarm relay will de-energize and the FIBER LED will be OFF.

Front Panel LED Indicators and Dip Switches



Detail of LED Indicators

Indicator	Color	LED	Description
POWER	Green	OFF	System has NO power
		ON	System has power
FIBER	Green	OFF	No Fiber Link detected
		ON	Fiber Link detected
TX	Green	OFF	No activity
		ON/BLINKING	Copper signal transmitting
RX	Green	OFF	No activity
		ON/BLINKING	Copper signal receiving

Troubleshooting

If problems occur, please follow the troubleshooting steps below prior to contacting technical support.

POWER LED Indicator OFF

- Check power supply voltage and rated device voltage.
- If correct, check connections at the power terminals.

FIBER LED Indicator Off

- Optic port connection may be incorrect.
- Make sure fiber cable from the TX optic is connected to the RX optic on both ends of the system.
- Make sure single-mode equipment is using single-mode fiber and multimode equipment is using multimode fiber.
- Check to ensure the fiber path is within the dB Loss and distance specifications of the model being installed.

TX and RX LED Indicators Off

- Verify serial data pinouts of each end device.
- The fiber optic media converters must always be set to DTE on one side, and DCE on the other.
- Null or straight through cables will need to be appropriately used to connect to the end devices.

If all connections and indicators has been verified please contact the RLH support team for further assistance.

Ordering Information

RS-232 Industrial Media Converters

Optics	Side	Distance	Wavelength	Fiber	Part Number
Dual Fiber Multimode SC	-	2 km/1.2 mi	1310nm	50/62.5 µm	SED-03-2
Dual Fiber Multimode ST	-	2 km/1.2 mi	1310nm	50/62.5 µm	SED-04-2
Single Fiber Single-mode SC	A	20km/12.4mi.	Tx 1310nm Rx 1550nm	8~9 µm	SED-10-2
	B	20km/12.4mi.	Tx 1550nm Rx 1310nm	8~9 µm	SED-11-2
	A	60km / 37mi.	Tx 1310nm Rx 1550nm	8~9 µm	SED-14-2
	B	60km / 37mi.	Tx 1550nm Rx 1310nm	8~9 µm	SED-15-2
Dual Fiber Single-mode SC	-	20km/12.4mi.	1310nm	8~9 µm	SED-40-2
	-	60km / 37mi.	1310nm	8~9 µm	SED-41-2
	-	120km / 74 mi.	1550nm	8~9 µm	SED-45-2
Dual Fiber Single-mode ST	-	20km/12.4mi.	1310nm	8~9 µm	SED-50-2
	-	60km / 37mi.	1310nm	8~9 µm	SED-51-2
	-	120km / 74 mi.	1550nm	8~9 µm	SED-55-2

- ▶ Add **-A** to the end of the part number for 125VDC input power option.
- ▶ Bidirectional single fiber models require an **A** Side and **B** Side unit for a complete system.
- ▶ Please contact your RLH sales representative for pricing and delivery information.

DB-9 Serial Cables

Description	Length	Connector Ends	Part Number
Straight Through Cable (DB-9 Serial)	6 Feet	Male / Male	DB9-S-MM-06FT
		Male / Female	DB9-S-MF-06FT
		Female / Female	DB9-S-FF-06FT
Null / Crossover Cable (DB-9 Serial)	6 Feet	Male / Female	DB9-X-MF-06FT
		Female / Female	DB9-X-FF-06FT
DB-9 Breakout Cable	4 Feet	Male / 3 Female	DB9-BREAKOUT-MF-04FT
DB-9 Gender Changer (M/M)	N/A	Male to Male	DB9-GENDER-MM

- ▶ See *DB-9 Serial Cables* section for more information.
- ▶ Please contact your RLH sales representative for pricing and delivery information.

General Specifications

Transmission method	Frequency modulated light via two optical fibers		
	Multimode	1310nm	
	Single-mode	1310nm/1550nm	
Maximum Fiber Attenuation / Distance*	Single Fiber	Single-mode (8~9/125μm):	Up to 37 mi./60km range
	Dual Fiber	Multimode (50/62.5/125μm):	1.25mi./2 km range
		Single-mode (9/125μm):	Up to 74 mi./120km range
		*Note: Distances equated using industry standard fiber and connector attenuation. Fiber condition, splices and connectors may affect actual range.	
Connector Type	ST or SC Multimode or Single-mode		
Power Margin	11dB(2Km, M/M), 12dB ~ 35dB (20 ~ 120Km, S/M)		
Protocols	RS-232		
Latency	100ns		
DB-9 Port (Female)	RS-232	DCD, RXD, TXD, DTR, GND, DSR, RTS, CTS, RI	
Signal Isolation	Optical Isolation 3000 Vrms		
Baud Rates	50bps-1Mbit/s Automatic Detection		
DIP Switches	DCE / DTE	Specifies the DB-9 Ports Operational Mode (DCE or DTE)	
LED	POWER	DC Power OK	See Front Panel LED Indicators section in User Guide for more detailed information.
	FIBER	Fiber Connection OK	
	TX	RS-232 Copper Transmit	
	RX	RS-232 Copper Receive	
Power Input	24~48VDC or 125VDC nominal		
	Dual redundant power inputs		
Power Consumption	150mA @ 24VDC or 3.6 Watt		
DC Input Isolation (In/Out)	1.5KV		
Voltage Reversal Protection	Will operate with V+ or V- in either power terminal		
Over Current Protection	1.0A (Automatic Recovery)		
Temperature	Storage	-40°C to +85°C (-40°F to +185°F)	
	Operating	-40°C to +70°C (-40°F to +158°F)	
Dimensions/Mounting	H 4.93" x W 1.20" x D 3.93" (not including DIN clip)		
	Standard T-35 DIN rail mounting or wall mount with included brackets		
Warranty	Limited Lifetime		

Technical Support

Corporate Headquarters:	RLH Industries, Inc. 936 N. Main Street Orange, CA 92867 USA
Phone:	(714) 532-1672 Toll Free 1-800-877-1672 Toll Free 1-866-DO-FIBER
Fax:	(714) 532-1885
Email:	info@fiberopticlink.com
Web site:	www.fiberopticlink.com
Email:	support@fiberopticlink.com
24/7 technical support:	Toll Free 1-855-RLH-24X7 Toll Free 1-855-754-2497

Contact Information



RLH Industries, Inc.
936 N. Main Street, Orange, CA 92867 USA
T: (714) 532-1672
F: (714) 532-1885

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