

SEL-2815

Fiber-Optic Transceivers



Communicate 2 to 15 kilometers with EIA-232 port-powered transceivers

- Apply to any 9-pin RS-232 serial port without additional settings.
- Protect data communication from ground potential rise and electrical interference.
- Install in instrumentation, protection, and automation applications.



Features and Benefits

Provide Flexible, Long-Range Fiber-Optic Communication

Send serial data between 2 and 15 kilometers (9 miles) using multimode optical fiber with standard ST connectors. Use data rates from 0–40,000 bits per second.

Apply Easily

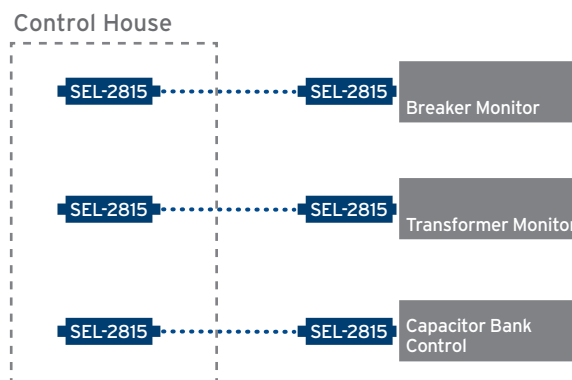
Plug the SEL-2815 directly onto a standard 9-pin serial connector (DB-9). No special mounting is required. The transceiver receives power from the host device via the connector; no separate power supply or power wiring is needed. Order transceivers with male or female DB-9 connectors. Use the switch to select DCE or DTE standard pin configurations, and eliminate the need for adapters. The transceiver transmits continuous light pulses for simpler testing with an optical meter. Apply with ST-terminated fiber cables.

Provide Secure and Reliable Data Transfer

Depend on a maximum bit error rate (BER) of 10^{-9} . Fiber-optic cables are far less susceptible to EMI/RFI than copper links. Vertical-cavity surface-emitting laser (VCSEL) technology provides component isolation and low power consumption.

Improve Safety

Provide improved isolation from ground potential rise and other electrical hazards compared to copper connections. This transceiver is an eye-safe, Class 1 laser product.



Transfer information between remote equipment and the control house in even the largest stations.

Product Overview



SEL-2815M



SEL-2815F

EIA-232		DCE ¹		DTE ¹	
PIN	FUNC.	DCE ¹	DTE ¹	DTE	DCE
1	DCD ³	→			
2	RXD	→	←		
3	TXD	←	→		
4	DTR ³	←	→		
5	GND				
6	DSR ³	→	←		
7	RTS ²	←	→		
8	CTS	→	←		
9	N/C				

← = INPUT TO SEL-2815
 → = OUTPUT FROM SEL-2815

1. THE DCE/DTE SWITCH DETERMINES WHETHER THE SEL-2815 IS A DCE OR DTE DEVICE.
 2. RTS MUST BE ACTIVE HIGH.
 3. CURRENT LIMITED TO 4mA AT DTR=12Vdc WHEN CONFIGURED AS DCE.

R T

Back Label With EIA-232 Pin Usage

Imprinted on the bottom of the device.

Application Information

Minimum Cable Length

The SEL-2815 is a long-distance fiber-optic transceiver that should not be applied with less than 2 km (1.25 miles) of fiber-optic cable. For cable distances up to 4 km, SEL recommends applying the SEL-2814 Fiber-Optic Transceiver.

Determining Maximum Cable Length

The table on the right shows maximum cable lengths based on typical fiber loss. The optical power budget includes transmit and receive connector coupling loss; therefore, the maximum cable length is determined by dividing the total optical power budget by the typical fiber loss/km specification.

To calculate the maximum cable length for your application, first ask your fiber cable supplier for fiber loss/km and connector/splice loss specifications (over expected temperature range) based on an 850 nm wavelength optical source. Calculate the available optical power budget by subtracting the total connector/splice attenuation from the power budget specification shown in the table. Divide the available optical power budget by the fiber loss/km specification to determine the maximum cable length.

Example

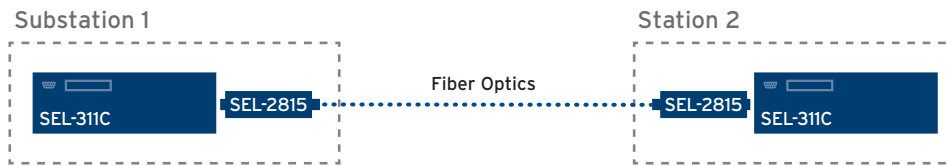
Fiber Type	50 μ m
Connector/Splice Loss Specification	2 dB/Connector
Number of Connectors/Splices (not including SEL-2815 TX/RX connectors)	2
Fiber Loss Specification	2.7 dB/km
Available Optical Power Budget	41 dB - (2 x 2 dB) = 37 dB
Maximum Cable Length	37 dB/2.7 dB/km = 13.7 km

Typical Cable Length

Fiber Diameter (μ m)	Power Budget (dB) (-40° to +85°C)	Typical Fiber Loss (dB/km) at 25°C	Maximum Cable Length (km)
50	41	2.7	15.2
62.5	41	3.2	12.8
100	41	4.0	10.2
200	41	6.5	6.3

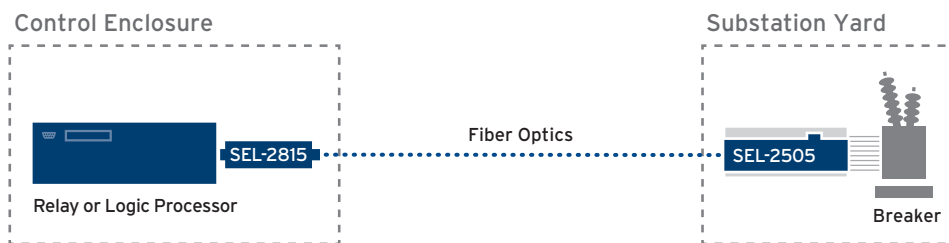


Application Examples



Relay-to-Relay Teleprotection

Connect the SEL-2815 to the EIA-232 port of SEL relays on opposite ends of a protected line, and connect them with two fibers. Use MIRRORRED BITS[®] communications for teleprotection schemes, including POTT, DCUB, or DCB.



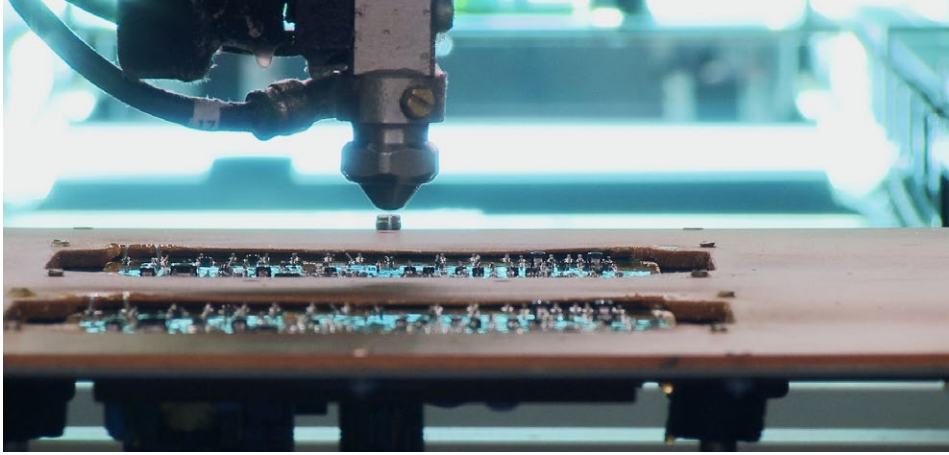
Communications With SEL-2505 Remote I/O Module

Connect the SEL-2815 to the EIA-232 port of an SEL relay or SEL-2100 Logic Processor. Connect via fiber to an SEL-2505 Remote I/O Module with the ST connectors option. The SEL-2505 provides eight contact outputs and eight logic inputs and uses MIRRORRED BITS communications.



Conformal-Coating Option

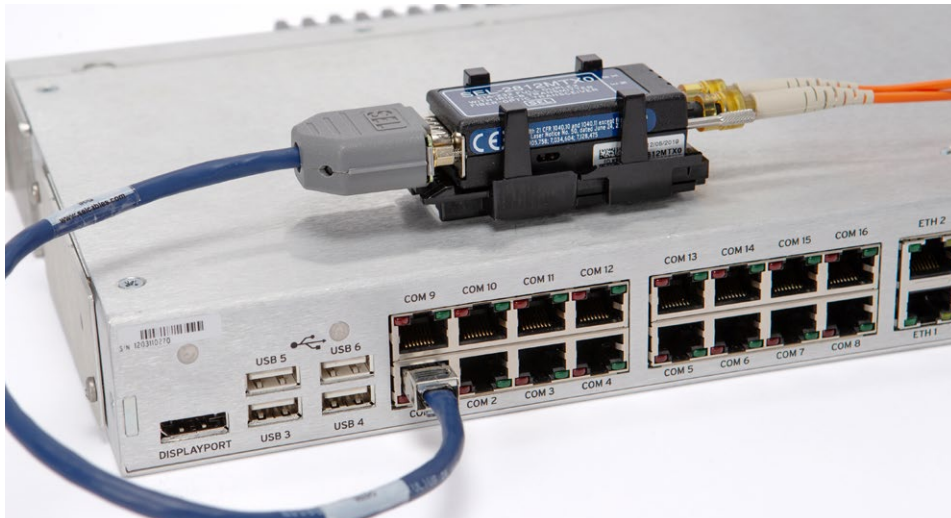
Use an SEL-2815M or SEL-2815F with optional conformal coating for additional protection against environmental and chemical contaminants.



Transceiver Mounting Options

Use an SEL Transceiver Mounting Kit and adapter cable when connecting the SEL-2815 to IEDs with an RJ45 male serial connector or when the mounting depth is an issue (e.g., in switchgear applications). These kits provide a simple and secure way to remote-mount the transceiver away from the host connector:

- 915900573—Mounting Kit for SEL Transceiver; includes mount only
- 915900574—Mounting Kit for SEL Transceiver; includes mount and SEL-C478A cable (6 ft, DB-9 female to RJ45 male)
- 915900575—Mounting Kit for SEL Transceiver; includes mount and SEL-C641 cable (6 ft, DB-9 female to DB-9 male)



SEL Multimode Fiber-Optic Cable

Choose SEL-C805 200 μm Core Fiber-Optic Cables for the lowest price at distances under 2 km. Select SEL-C807 Multimode 62.5/200 μm or SEL-C808 Multimode 62.5/125 μm Core Fiber-Optic Cables for distances up to 4 km.

- Standard-duty duplex zipcord for indoor riser applications (2 fibers). Do not use where exposed to direct sunlight.
- Heavy-duty waterblocked round cable for indoor and outdoor applications (2 or 4 fibers).

Each link between SEL-2815 transceivers uses two fibers. Specify the length when ordering optical cables that are terminated at the SEL factory with ST connectors. Or, order bulk unterminated cable, a termination kit, and connectors to easily terminate your own cables.



Fiber Loss Test With Optical Meter

1. Configure your optical meter to measure an 850 nm wavelength.
2. Temporarily connect the optical meter to the transmit ST connector (T) of the local transceiver, and note the dBm reading.
3. Temporarily connect the fiber-optic cable that would go to the receive ST connector (R) of the remote transceiver to the meter, and note the dBm reading.

Note: The difference between the readings in Steps 2 and 3 should not exceed 41 dB. If measured readings exceed 41 dB, the fiber's attenuation is too great.

4. Repeat Steps 1–3 using the transmit ST connector (T) of the remote transceiver and the receive ST connector (R) of the local transceiver.

Specifications

General	
Data Rate	0–40,000 bits per second, full duplex, no jumpers or settings
Link Data Delay	Serial data 36 μ s plus 5 μ s/km of fiber Note: Link includes two transceivers and fibers.
Optical Source	850 nm (infrared) VCSEL transmitter Typical transmit level –10.0 dBm
Operating Temperature	–40° to +85°C (–40° to +185°F)
Projection From DB-9 Connector	127 mm (5 in) typical, including fiber-optic connector and minimum cable bend radius
Power Requirements	The SEL-2815 typically receives adequate power from a single EIA-232 TXD data line connected to Pin 2 or 3 of the DB-9 connector. Additionally, the SEL-2815 accepts power applied to the following pins: Pins 4, 6: –4.9 Vdc (10 mA) to –12 Vdc (25 mA) Pins 7, 8: +4.9 Vdc (10 mA) to +12 Vdc (25 mA) The SEL-2815 does not support hardware handshaking.
Fiber-Optic Cable and Connectors	ST connectors Multimode fiber (50–200 μ m) SEL provides ST-terminated 62.5 μ m (SEL-C808) and 200 μ m (SEL-C805) fiber-optic cables. Use a minimum of 2 km (1.24 miles) of fiber-optic cable. For shorter cable distances, use the SEL-2814 Fiber-Optic Transceiver, instead.