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

Features and Benefits

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.

Easy Application
Plug the SEL-2815 Transceiver 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.

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.

Improved Safety
Increase safety with this eye-safe, Class 1 laser product. Fiber-optic connections provide improved isolation from ground potential rise and other electrical hazards compared to copper connections.

Making Electric Power Safer, More Reliable, and More Economical®
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 below 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 below. Divide the available optical power budget by the fiber loss/km specification to determine the maximum cable length.

Example
Fiber Type: .............................................. 50 μm
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

Fiber Loss Test With Optical Meter
1. Configure your optical meter to measure 850 nm wavelength.
2. Temporarily connect optical meter to transmit ST connector (T) of local transceiver, and note 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 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 transmit ST connector (T) of remote transceiver and receive ST connector (R) of local transceiver.

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 Mirrored 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 Mirrored Bits communications.

Typical Cable Length

<table>
<thead>
<tr>
<th>Fiber Diameter (μm)</th>
<th>Power Budget (dB) (−40°C to +85°C)</th>
<th>Typical Fiber Loss (dB/km) at 25°C</th>
<th>Maximum Cable Length (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>41</td>
<td>2.7</td>
<td>15.2</td>
</tr>
<tr>
<td>62.5</td>
<td>41</td>
<td>3.2</td>
<td>12.8</td>
</tr>
<tr>
<td>100</td>
<td>41</td>
<td>4.0</td>
<td>10.2</td>
</tr>
<tr>
<td>200</td>
<td>41</td>
<td>6.5</td>
<td>6.3</td>
</tr>
</tbody>
</table>
Technical Specifications

**Connect Directly to DB-9 Serial Ports**
Compatible with SEL-200, -300, -400, -500, and -700 series relays, SEL-3530 RTAC, SEL-2411 PAC, SEL-2240 Axion®, SEL-2440 DPAC, SEL-2032/2030/2020, and SEL-2100

**Projection From DB-9 Connector**
127 mm (5.0 in) typical, including fiber-optic connector and minimum cable bend radius

**Data Rate**
0–40,000 bits per second, full duplex, no jumpers or settings

**Data Delay**
36 μs plus 5 μs/km of fiber

**Optical Source**
850 nm (infrared) VCSEL transmitter
Typical transmit level: —10 dBm

**Operating Temperature**
—40° to +85°C (—40° to +185°F)

**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**
Apply multimode fiber (50–200 μm) with ST connectors.
SEL provides ST-terminated 62.5 μm (SEL-C808) and 200 μm (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.

**Transceiver Dimensions**

- SEL-2815M
  - Dimensions: 63.754 mm (2.510 in)
  - Projection from DB-9 connector: 31.75 mm (.1250 in)
  - DCE/DTE Switch: 19.05 mm (.750 in)

- SEL-2815F
  - Dimensions: 86.995 mm (3.425 in)

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Back Label With EIA-232 Pin Usage

```
<table>
<thead>
<tr>
<th>EIA-232</th>
<th>PIN</th>
<th>FUNC.</th>
<th>DCE</th>
<th>DTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DCD</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>2</td>
<td>RXD</td>
<td>—</td>
<td>—</td>
<td>—</td>
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<tr>
<td>3</td>
<td>TXD</td>
<td>—</td>
<td>—</td>
<td>—</td>
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<tr>
<td>4</td>
<td>DTR</td>
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<td>5</td>
<td>GND</td>
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<td>6</td>
<td>DSR</td>
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<tr>
<td>7</td>
<td>RTS</td>
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<tr>
<td>8</td>
<td>CTS</td>
<td>—</td>
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<td>—</td>
</tr>
<tr>
<td>9</td>
<td>N/C</td>
<td>—</td>
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<td>—</td>
</tr>
</tbody>
</table>
```

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 4 mA at DTR=12 Vdc when configured as DCE.

Imprinted on back of device.
**SEL-2815 Fiber-Optic Transceiver**

**Type Tests and Standards**

<table>
<thead>
<tr>
<th>Standard/Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC 60255-22-6:2001</td>
<td>EMC Conducted Immunity</td>
</tr>
<tr>
<td>IEC 61000-4-6:2006</td>
<td>EMC Radiated Radio Frequency Immunity</td>
</tr>
<tr>
<td>IEEE C37.90.2-2004</td>
<td>EMC Radiated Radio Frequency Immunity</td>
</tr>
<tr>
<td>IEC 60068-2-1 Fifth Edition 2007</td>
<td>Cold, –40°C</td>
</tr>
<tr>
<td>IEC 60255-21-1 First Edition 1988</td>
<td>Vibration Endurance Class I</td>
</tr>
<tr>
<td>IEC 60255-21-3 First Edition 1993</td>
<td>Quake Response Class I</td>
</tr>
<tr>
<td>ANSI Z136.1 1993</td>
<td>Optical Safety Standard Class 1</td>
</tr>
<tr>
<td>ANSI Z136.2 1988</td>
<td>Optical Safety Standard Service Group 1</td>
</tr>
<tr>
<td>CEI/IEC 60825-1 First Edition 1993</td>
<td>Optical Safety Standard Class 1</td>
</tr>
<tr>
<td>21 CFR 1040.10</td>
<td>Optical Safety Standard Class 1</td>
</tr>
</tbody>
</table>

**FCC CFR 47 Part 15 Class B**

This Class B device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

**Fiber-Compatible Products**

**SEL-2505 Remote I/O Module, ST Option**

Provides Mirrored Bits communications for eight logic inputs and eight contact outputs.

**SEL-2506 Rack-Mount Remote I/O Module**

Provides Mirrored Bits communications for eight logic inputs and eight contact outputs.

**Related Products**

**SEL-2812 Fiber-Optic Transceiver With IRIG-B**

Electrically isolated, EIA-232 full-duplex communications for 4 km (2.5 mi), at up to 115200 bps, and multiplexed IRIG-B timing signals on a single pair of multimode fibers with ST connectors.

**SEL-2814 Fiber-Optic Transceiver With Hardware Handshaking**

Electrically isolated, EIA-232 full-duplex communications for up to 4 km (2.5 mi), at up to 115,200 bps, with ST connectors and multimode fiber. Serial communications may be controlled with hardware handshaking.

**SEL-2829, -2830, -2831 Single-Mode Fiber-Optic Transceivers**

Electrically isolated, EIA-232 full-duplex communications for up to 110 km (68 miles) at up to 40,000 bits per second using ST connectors and single-mode fiber.

**Note:** Although Class 1 lasers are considered to be eye-safe, avoid staring into the transmitter or fiber-end infrared radiation.