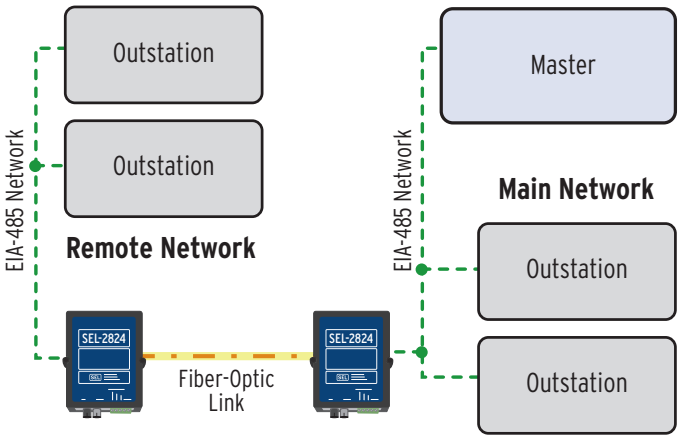
SEL-2824

EIA-485 Fiber-Optic ST® Transceiver

Safely extend EIA-485 networks via fiber-optic links.

Add isolated segments to EIA-485 networks.



Features and Benefits

Increases Safety

Isolate devices from ground potential rise and fault current in the communications connections by using an eye-safe, Class 1 laser product.

Improves Signal Integrity

Prevent electromagnetic interference and signal ground loops by using optical connections instead of copper wires.

Withstands Harsh Conditions

Operates over −40° to +85°C temperature range, and meets or surpasses electric utility and industrial type-test standards for instrumentation, control, and communications equipment.

Easily Applied

Implement fiber-optic links between two- and four-wire EIA-485 network segments. Set operating modes via control (DIP) switches. Simplify network commissioning and repair with LED traffic indicators for each port. Connect power through terminal block or jack.

Application Information

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 . . . . . 62.5 µm

Splice Loss (fusion) . . . . . 0.2 dB/splice

Fiber Loss @ 850 nm . . . . . 3.2 dB/km

SEL-2824 Optical Budget . . . . . 16 dB

Less Splice Loss (1 • 0.2 dB) . . . . . 0.2 dB

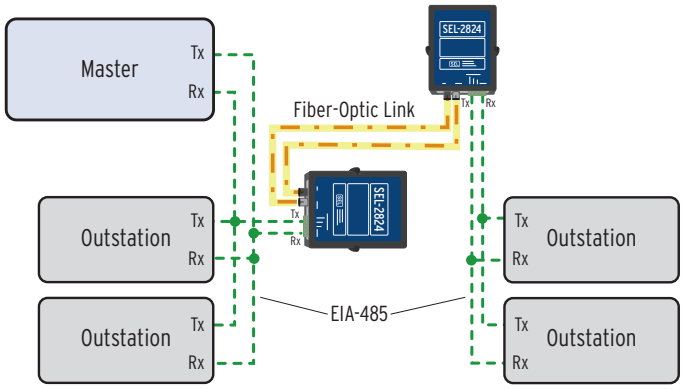
Available Power. . . . . 15.8 dB

Maximum Cable Length. . . . . 15.8 dB ÷ 3.2 dB/km = 4.9 km

Typical Cable Length

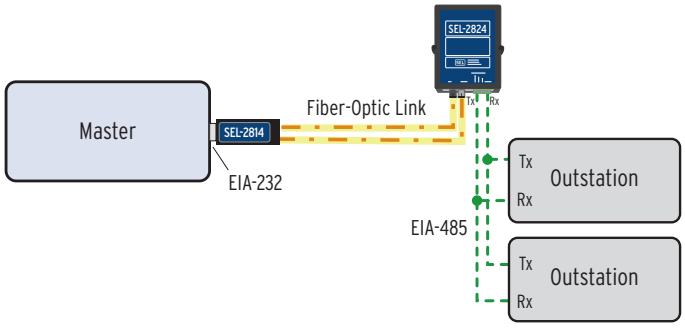
Fiber Diameter (µm)	Power Budget (dB)	Typical Fiber Loss (dB/km) at 25°C	Maximum Cable Length (km)
50	16	2.7	5.85
62.5	16	3.2	4.9
200	16	6.5	2.4

Add a Segment to an Existing EIA-485 Network



Mount one SEL-2824 EIA-485 Fiber-Optic ST Transceiver near the existing network and connect the EIA-485 wires to the EIA-485 compression block terminal strips, exactly as you would connect another slave/outstation device. Install a two-fiber SEL-C808 Fiber-Optic Cable with ST connectors between this SEL-2824 and the location of the new segment, up to 4 kilometers away. Connect the transmit (T) fiber-optic connector of each SEL-2824 to the receive (R) fiber-optic connector of the other SEL-2824. Wire the compression block terminals of the new-segment SEL-2824 to serve as the master of the new segment.

Connect an EIA-232 Port to an EIA-485 Network



Use an SEL-2814 Fiber-Optic Transceiver, SEL-C808, or SEL-C807 Fiber-Optic Cable, and an SEL-2824 for a safe, isolated connection to an EIA-485 network. Mount the SEL-2814 on an EIA-232 port on a relay, information processor, or other device. Install a two-fiber SEL-C807 or SEL-C808 Fiber-Optic Cable with ST connectors between this SEL-2814 and an SEL-2824 on the EIA-485 network, up to 4 kilometers away. Connect the transmit (T) fiber-optic connector of each transceiver to the receive (R) fiber-optic connector of the other. If the EIA-232 device is the master for the network, wire the compression block terminals of the SEL-2824 to serve as the master of the new segment. If the EIA-232 device is a slave/outstation device, wire the SEL-2824 as an outstation. If the EIA-232 protocol uses the RTS signal to control the network transmitter, set the SEL-2824 control switch number 4 to "ON."

Technical Specifications

Data Rate
Up to 115.2 kbps, full-duplex

Data Delay
5 µs plus 5 µs/km of fiber

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

Power Requirements
5 to 30 Vdc 5% tolerance, <1.5 W

Fiber-Optic Port

Connectors	Two ST female
Wavelength	850 nm
Typical Tx Power	–13 dBm
Min Rx Sensitivity	–29 dBm
Optical Budget	16 dB
Compatible Optical Fiber	50, 62.5, or 200 µm core diameter

Electrical Port

Connector	5 position compression terminal block
Connections	4-wire full-duplex or 2-wire half-duplex
Operation	EIA-485 multidrop or EIA-422 point-to-point

LED Indicators

Enable	Powered and operating
Fiber Tx	Data sent to T fiber
Fiber Rx	Data received from R fiber
EIA-485 Tx	Data sent to EIA-485 network
EIA-485 Rx	Data received from EIA-485 network

Dimensions

Height (without DIN mount)	25.4 mm (1.0 in)
Width	93.35 mm (3.675 in)
Depth	121.9 mm (4.8 in)

Type Tests and Standards

Cold
IEC 60068-2-1:2007
Severity Level: 16 hours at –40°C

Dry Heat
IEC 60068-2-2:2007
Severity Level: 16 hours at +85°C
IEEE 1613:2003

Damp Heat, Cyclic
IEC 60068-2-30:2005
Severity Level: 95% r.h., +25° to +55°C, 6 cycles (12 + 12 hour cycle)

Vibration and Shock Resistance
IEC 60255-21-1:1988
Severity Level: Class 1 Endurance, Class 2 Response
IEC 60255-21-2:1988
Severity Level: Class 1 Bump Withstand, Class 2 Shock Response
IEC 60255-21-3:1993
Severity Level: Class 2 Quake Response

Communications Product Testing
Substation Products: IEEE 1613

Note: The SEL-2824 is compliant to a performance class of Class 1 of IEEE Standard 1613-2003, *Environmental and Testing Requirements for Communications Networking Devices in Electric Power Substations.*

SEL-2824 EIA-485 Fiber-Optic ST Transceiver

Type Tests and Standards, Continued

Electrostatic Discharge Immunity

IEC 60255-22-2:2008
Severity Level: 2, 4, 6, 8 kV contact; 2, 4, 8, 15 kV air
IEC 61000-4-2:2008
Severity Level: 2, 4, 6, 8 kV contact; 2, 4, 8, 15 kV air
IEEE C37.90.3-2001
Severity Level: 2, 4, 8 kV contact; 2, 8, 15 kV air

Conducted Radio Frequency Interference Immunity

IEC 61000-4-6:2008
IEC 60255-22-6:2001
Severity Level: 10 V/m

Radiated Radio Frequency Immunity

IEC 61000-4-3:2010
Severity Level: 10 V/m
IEC 60255-22-3:2007
Severity Level: 10 V/m
IEEE C37.90.2-2004
Severity Level: 35 V/m

Electromagnetic Compatibility Emissions

IEC 60255-25:2000
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.

Eye Safety

IEC 60825-1:2007 Class 1 Laser Product
21 CFR 1040.10 and 1041.11

Class 1 laser complies with 21 CFR 1040.10 and 1041.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

Safety Notes: Although Class 1 lasers are considered to be eye-safe, avoid staring into the transmitter or fiber-end infrared radiation. The lasers are not user-serviceable. Return to the factory for repair or replacement.

Caution: Use of controls or adjustments, or performance of procedures other than those specified herein, may result in hazardous radiation exposure.

Fast Transient/Burst Immunity

IEC 60255-22-4:2008
Severity Level: Class A 2 kV, 5 kHz on EIA-485 port; 4 kV, 5 kHz on power supply inputs
IEC 61000-4-4:2011
Severity Level: 4 kV, 5 kHz

Power Supply Immunity

IEC 60255-11:2008, IEC 61000-4-29:2000
IEC 61000-4-11:2004, IEC 61000-4-17:2002

Surge Withstand Capability Immunity

IEC 60255-22-1:2007
Severity Level: 2.5 kV peak common mode, 1 kV peak differential mode
IEEE C37.90.1-2002
Severity Level: 2.5 kV oscillatory, 4 kV fast transient waveform

Accessories

AC Power Adapter

Use the 230-0604 AC Power Adapter to provide power from 90 to 264 Vac.

SEL-9321 Low-Voltage DC Power Supply

Use the SEL-9321 to power SEL-2824 Transceivers from higher voltage power sources, including 48, 125, and 250 Vdc station batteries, and 125 and 250 Vac sources. Mount the SEL-9321 on a wall, cabinet, or DIN rail.

SEL-C577 EIA-232 Port Power Cable

Provide power to an SEL-2824 from an SEL relay or controller that has a 5 Vdc pin-one power jumper. Connect the tinned leads of an SEL-C577 Cable to an SEL-2824 before plugging the 9-pin connector into an unused EIA-232 serial port.

SEL-C807 62.5/200 µm and SEL-C808 62.5/125 µm Multimode Fiber-Optic Cables

Choose the cable type that matches your application:

- Standard-duty duplex zipcord for indoor riser applications (Do not use where exposed to direct sunlight.)
- Heavy-duty waterblocked round cable for outdoor applications
- Plenum-rated, standard-duty duplex SEL-C808 zipcord cable for air duct and dropped-ceiling applications

Each link between SEL-2824 Transceivers uses two fibers. Specify the length when ordering optical cables, terminated at the SEL factory with ST connectors. Or, order bulk unterminated cable, a termination kit, and connectors to terminate your own cables.

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