



SEL-2507 High-Speed Remote I/O Module Instruction Manual



Features, Benefits, and Applications

The SEL-2507 is a two-rack unit remote I/O module that has eight contact inputs and eight contact outputs. The status of these inputs and outputs is communicated between the SEL-2507 and a host device using Millisecond MIRRORING BITS® or standard MIRRORING BITS communications over a serial or fiber-optic port. Each contact input controls one of the eight MIRRORING BITS transmit bits, while each of the eight receive MIRRORING BITS controls a contact output. Use the transmitted contact input status for control indication of a remote device. The SEL-2507 provides the following features and benefits:

- **High-Speed Pilot Scheme** transfers I/O information as fast as 1 millisecond between locations with Millisecond MIRRORING BITS.
- **Ultra-Fast Operating Speed** with Millisecond MIRRORING BITS transmitting every 500 microseconds for a total back-to-back operate time of 1 millisecond.
- **High-Speed Contact Outputs** come as a standard option.
- **Increased Safety** is provided through fiber-optic isolation when equipped with fiber-optic communication.
- **Improve Reliability** through increased scheme security reliability with channel monitoring and alarm output.
- **Communications Flexibility** helps you simplify and improve existing or new installations.
 - Add simple pilot communication to existing two- or three-terminal line applications.
 - Isolate relay and breaker dc supplies for breaker failure trip distribution schemes.
 - Annunciate the status of remote contacts.
- **Rack Mount** with a compact two-rack unit chassis.
- **Self-Testing** increases reliability of auxiliary relay functions.
- **Simple Status Diagnostics** consist of 22 LEDs that indicate contact input, output, channel, and device status.
- **User-Configurable Labels** allow clear indication of system function and status.
- **Connectorized® Terminal Blocks** offer ease of service.
- **Two Serial Interface Options:** Fiber optic for superior COM insulation or EIA-232 for convenient connection to a relay.

Product Overview

Figure 1 and Figure 2 show the functional overview of the SEL-2507. Figure 3 shows the rear panel of a SEL-2507 with high-speed contact outputs.

The SEL-2507 is an excellent teleprotection device and provides a simple way of expanding the number of I/O points available in a system of relays. It is superior to hard-wiring relays together through electromechanical or static auxiliary relays because you can now monitor the performance of the communications channel. In addition, its self-testing ability ensures prompt notification of any device or communications channel problem.

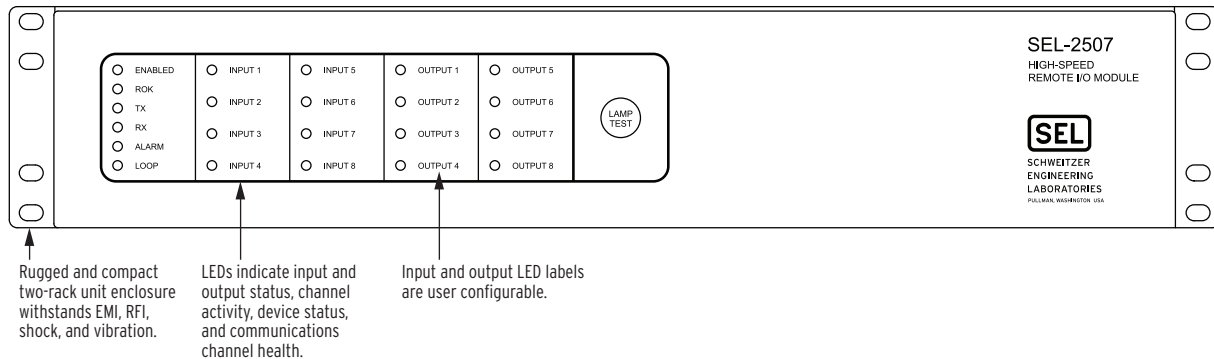


Figure 1 SEL-2507 Front Panel

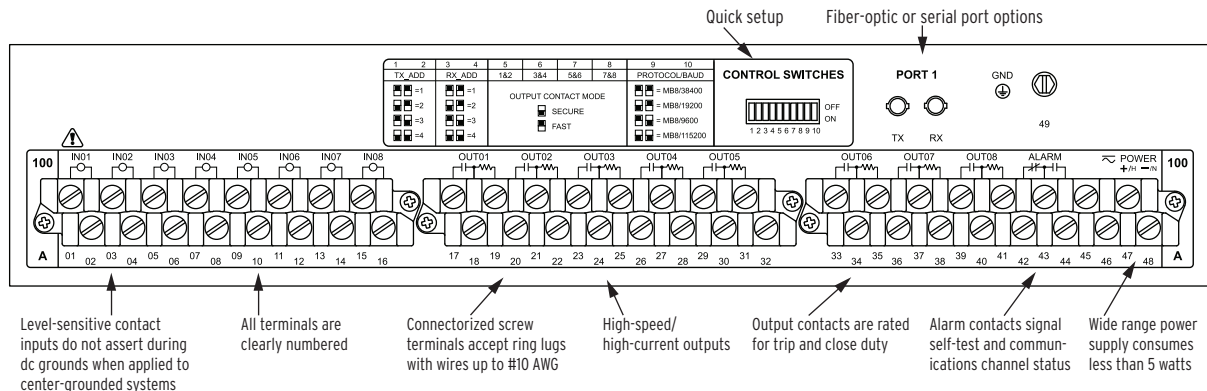


Figure 2 SEL-2507 Rear Panel (Shown With Fiber-Optic Port)

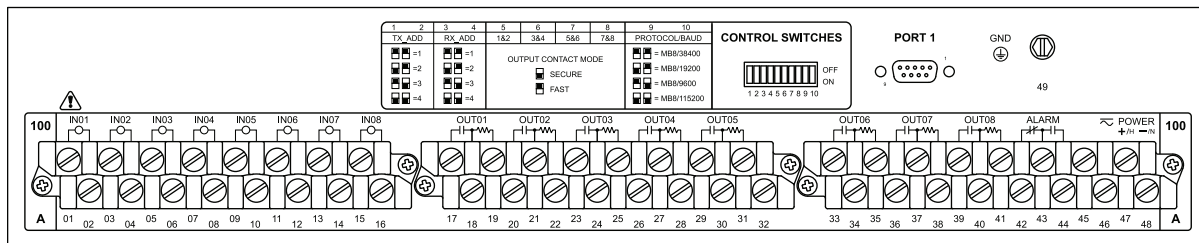


Figure 3 SEL-2507 Rear Panel (Shown With Serial Port)

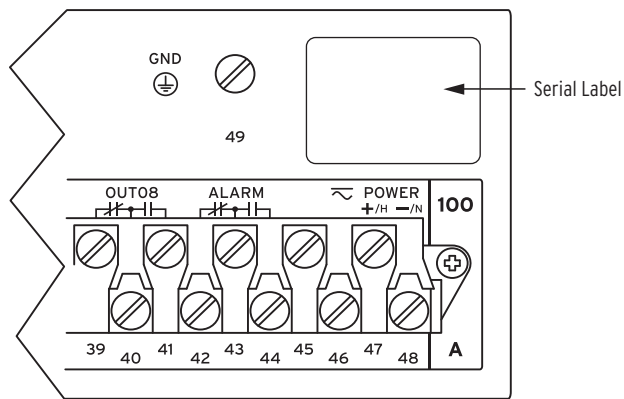


Figure 4 Serial Label

MIRRORED BITS Applications

The following application suggestions and examples represent only a few possible uses for the SEL-2507.

- Add communications-assisted tripping to existing relays.
- Add event annunciation to pilot trip schemes.
- Isolated remote-tripping via fiber-optic links.
- Cross-trigger event reports.
- Perform auxiliary relay functions while adding self-testing capabilities.

Figure 5 illustrates a typical SEL-T400L application with a generic relay, not capable of MIRRORED BITS communications, and a generic protection channel, such as a power-line carrier. In this application, the companion relay and the protection channel equipment use contact inputs and outputs to signal the SEL-T400L.

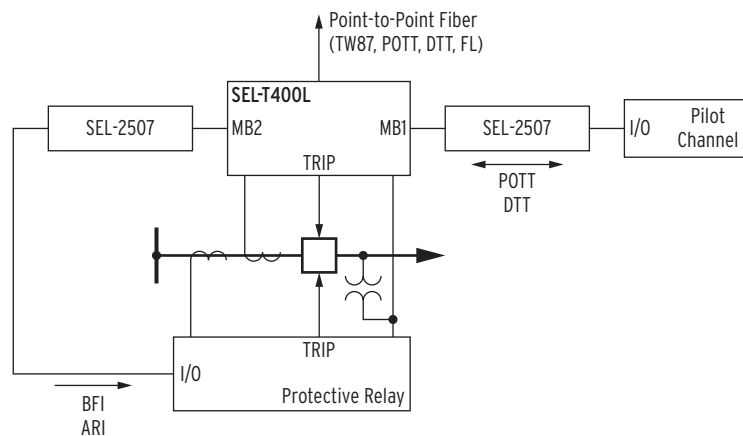


Figure 5 Application of the SEL-T400L Using SEL-2507 for Contact I/O Signaling

In this application, use the SEL-2507 to convert the fiber-optic MIRRORED BITS communications inputs and outputs to contact I/O, and wire the companion relay and the communications equipment accordingly.

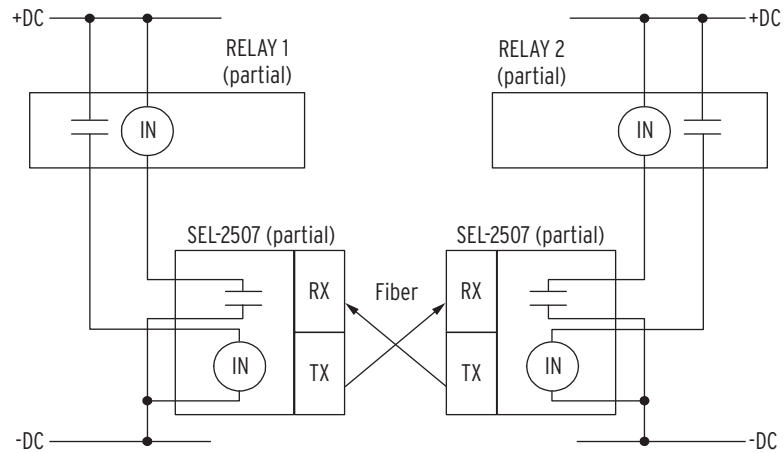


Figure 6 Channel Interface I/O for Relays Without MIRRORED BITS Protocol

- Create bus protection using existing protection relays for simple buses.
- Include an SEL RTAC for bus protection of larger buses.
- Add direct transfer trip to existing cogeneration interconnections.

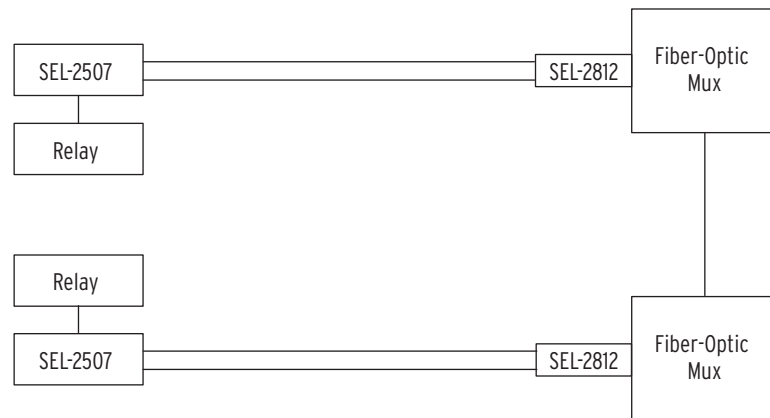


Figure 7 Provide Communications-Assisted Tripping Over Existing Digital Communications Networks

- Provide low-cost teleprotection over digital multiplexers.
- Provide a migration path from electromechanical relays to MIRRORED BITS relays.

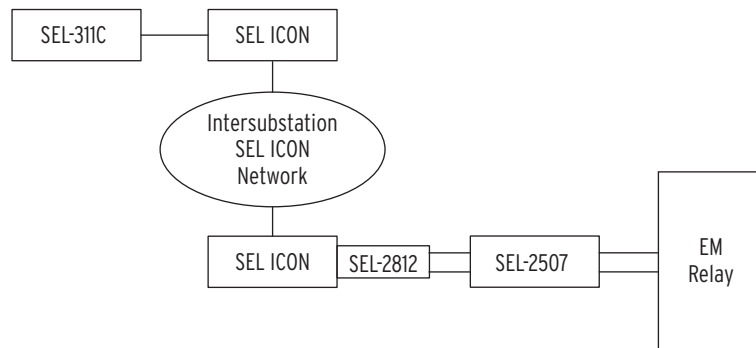


Figure 8 Interface Relays With MIRRORED BITS to Relays Without MIRRORED BITS

- Eliminate hard-wiring from control room to breaker or motor-operated disconnect switch.
- Reduce dc ground exposure.
- Add trip/close path continuity monitoring.
- Expand I/O capability of relays with MIRRORED BITS communications protocol.

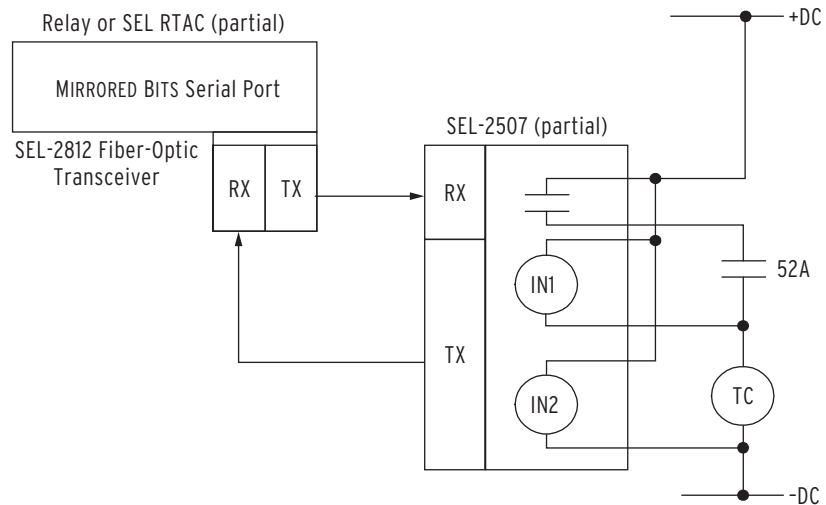


Figure 9 Reduce Wiring From Control House to Outdoor Cabinets

Example Distribution Bus Protection: Radial Feeders

Figure 10 shows an SEL-2507 application using existing distribution relays and an SEL RTAC to provide bus and line protection for the radial system. When the overcurrent elements of the transformer low-side relay pickup and the overcurrent elements in the feeder relays do not, the detected fault must be located on the bus. Using relay overcurrent element status transmitted by the SEL-2507 modules, the SEL RTAC uses IEC 61131-3 logic to issue a bus trip via a MIRRORED BITS message to the protective relays through the SEL-2507 modules. Unlike conventional schemes, there is no switch-board wiring between relays. Eliminating this wiring reduces dc ground exposure, and replacing this wiring with SEL-2507 remote I/O modules adds self-testing and automatic communications path checking.

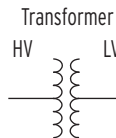


Figure 10 Distribution Bus Protection Application Example

Functional Description

MIRRORED BITS Decoder/Encoder and I/O Control

Figure 11 shows the functional block diagram of the SEL-2507. There is a MIRRORING BITS decoder associated with the receive (RX) port and an encoder for the transmit (TX) port. The decoder receives MIRRORING BITS messages, checks that the receive address matches that set by switches 3–4, checks for data message errors, and then decodes each message. If a Receive MIRRORING BITS (RMB) is a logical one for the number of message frames set by switches 5–8, the SEL-2507 asserts the corresponding output contact.

If an RMB is a logical 0 for the number of message frames set by switches 5–8, the SEL-2507 deasserts the corresponding output contact. If the communications channel is faulty or power is removed from the device, the contact outputs are deasserted.

The decoder also monitors the received data and channel integrity. Detected errors include: data errors, resynchronization, data over- and underrun, parity, and framing errors. When it detects an error, the SEL-2507 turns off the **ROK** LED and de-energizes the **ALARM** relay (closing the alarm contact) after a 100 ms delay. If the SEL-2507 detects two errors in a row, it begins resynchronizing with the remote device. Once the remote device receives this resynch message, it also deasserts its **ROK** message to indicate a problem with the communications path.

The encoder converts the eight contact inputs into the MIRRORED BITS protocol and outputs this data to the transmit fiber-optic or serial port.

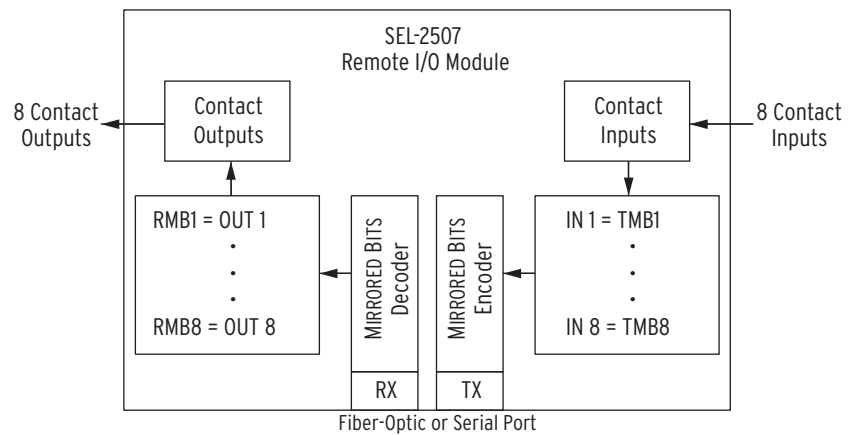


Figure 11 SEL-2507 Functional Block Diagram

Safety Information

Dangers, Warnings, and Cautions

This manual uses three kinds of hazard statements, defined as follows:

DANGER

Indicates an imminently hazardous situation that, if not avoided, **will** result in death or serious injury.

WARNING










Indicates a potentially hazardous situation that, if not avoided, **could** result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation that, if not avoided, **may** result in minor or moderate injury or equipment damage.

Safety Symbols

The following symbols are often marked on SEL products.

|  |  CAUTION Refer to accompanying documents. |  ATTENTION Se reporter à la documentation. |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
|  | Earth (ground) | Terre |
|  | Protective earth (ground) | Terre de protection |
|  | Direct current | Courant continu |
|  | Alternating current | Courant alternatif |
|  | Both direct and alternating current | Courant continu et alternatif |
|  | Instruction manual | Manuel d'instructions |

Safety Marks

The following statements apply to this device.

General Safety Marks

| | |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| For use in Pollution Degree 2 environment. | Pour l'utilisation dans un environnement de Degré de Pollution 2. |
| Ambient air temperature shall not exceed 40°C (104°F). | La température de l'air ambiant ne doit pas dépasser 40°C (104°F). |
| Terminal Ratings Tightening Torque Terminal Blocks: 1.0–2.0 Nm (9–18 in-lb) | Spécifications des bornes Couple de serrage Borniers : 1,0–2,0 Nm (9–18 livres-pouce) |

Environmental Conditions and Voltage Information

| Condition | Range/Description |
|----------------------------------|-------------------------------------|
| Indoor/outdoor use | Indoor |
| Altitude | Up to 2000 m |
| Temperature | −40 to +85°C |
| Relative humidity | 5 to 95% |
| Main supply voltage fluctuations | Up to $\pm 10\%$ of Nominal voltage |
| Overvoltage | Category II |
| Pollution | Degree 2 |
| Fuse | 1 A (nonreplaceable) |
| Insulation Class | Class I |

Installation and Maintenance



Do not connect power to the SEL-2507 until you have completed initial connection procedures.

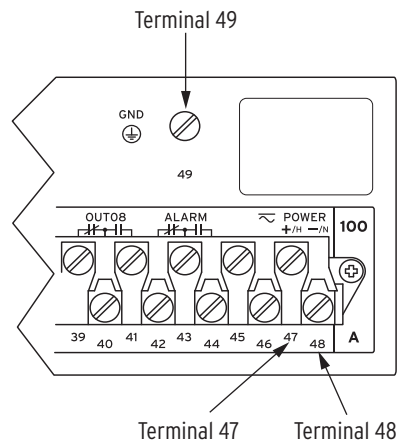


Figure 12 SEL-2507 Rear-Panel Power and Ground Connections

You can order the SEL-2507 with one of two power supply voltage ranges listed in *Specifications on page 18*. The serial number label on the back of the device lists the power supply voltage equipped.

Power Connections

Use 16 AWG (1.5 mm²) wire (or heavier) to connect to the **POWER** terminals. When you use a dc power source, you must connect the source with the proper polarity, as indicated by the + (Terminal 47) and - (Terminal 48) symbols on the power terminals. Upon connecting power, you will see the **ENABLED** LED illuminate.

⚠ DANGER

Contact with instrument terminals can cause electrical shock that can result in injury or death.

Connection to external power must comply with IEC 947-1 and IEC 947-3. Place an external switch, circuit breaker, or overcurrent device in the **POWER** leads for the SEL-2507; this device must interrupt both the hot (H) and neutral (N) power leads.

The maximum current rating for the power disconnect circuit breaker or overcurrent device must be 20 A. Be sure to locate this device within 3.0 m (9.8 feet) of the relay. Operational power is internally fused. This fuse is rated for 1 A and is not user replaceable. Should failure occur return the unit to the factory for repair.

Rear-Panel Symbols

There are important safety symbols on the rear of the SEL-2507.

Observe proper safety precautions when you connect the SEL-2507 at terminals marked by these symbols. In particular, the danger symbol located on the rear panel corresponds to the following: **Contact with instrument terminals can cause electrical shock that can result in injury or death.** Be careful to limit access to these terminals.



Figure 13 Rear-Panel Safety Symbols

Fast Hybrid Control Outputs

Figure 14 shows connections for Fast Hybrid (high-speed high-current interrupting) control output when equipped.

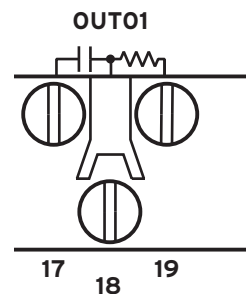


Figure 14 Fast Hybrid Control Output Connection

NOTE: You can use ac or dc circuits with Fast Hybrid (fast high-current-interrupting) outputs.

The Fast Hybrid control output uses three terminal positions. The third terminal of the Fast Hybrid control output is connected to resistors used to mitigate transient inrush current conditions. Connecting the third terminal is optional based on your particular application.

Short transient inrush current can flow at the closing of an external switch in series with open Fast Hybrid contacts. This transient will not energize the circuits in typical relay-coil control applications (trip coils and close coils), and standard auxiliary relays will not pick up. However, an extremely sensitive digital input or light-duty, high-speed auxiliary relay can pick up for this condition. This false pickup transient occurs when the capacitance of the Fast Hybrid output circuitry charges (creating a momentary short circuit that a fast, sensitive device sees as a contact closure). A third terminal (19 in Figure 15) provides an internal path for precharging the Fast Hybrid output circuit capacitance when the circuit is open.

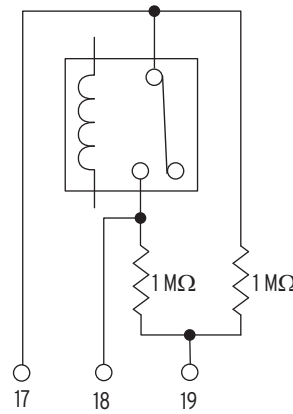


Figure 15 Fast Hybrid Control Output Typical Terminals

Figure 16 shows some possible connections for this third terminal that will eliminate the false pickup transients when closing an external switch. In general, you must connect the third terminal to the dc rail (positive or negative) that is on the same side as the open external switch condition. If an open switch exists on either side of the output contact, then you can accommodate only one condition.

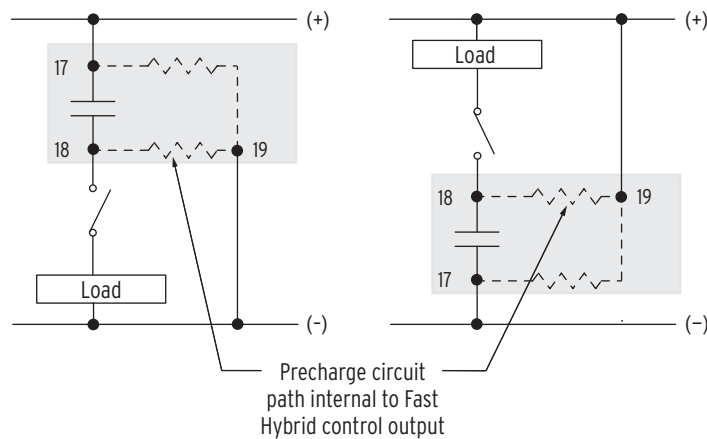


Figure 16 Precharging Internal Capacitance of Fast Hybrid Output Contacts

Screw-Terminal Connectors

Terminate connections to the SEL-2507 screw-terminal connectors with ring-type crimp lugs. Use a #8 ring lug with a maximum width of 9.1 mm (0.360 in). The screws in the rear-panel screw-terminal connectors are #8-32 binding head, slotted, nickel-plated brass screws. Tightening torque for the terminal connector screws is 1.0 Nm to 2.0 Nm (9 in-lb to 18 in-lb).

Grounding

Connect the grounding terminal (49) labeled **GND** on the rear panel to a rack frame ground or main station ground for proper safety and performance. Use 12 AWG (4 mm²) or heavier wire less than 2 m (6.6 feet) in length for this connection. The ground connection should be made before the power connections.

Cleaning

Use care when cleaning the SEL-2507. Use a mild soap or detergent solution and a damp cloth to clean the chassis. Be careful cleaning the front and rear panels because a permanent plastic sheet covers each panel; do not use abrasive materials, polishing compounds, or harsh chemical solvents (such as xylene or acetone) on any surface.

Fiber-Optic Port

The SEL-2507 uses a fiber-optic transmitter unless ordered with the EIA-232 option. See *Specifications* for details about use of a 91560 attenuator on some shorter fiber links. When working with this device, observe the following safety precautions:

- Do not look into the fiber ports/connectors.
- Do not look into the end of an optical cable connected to an optical output.
- Do not perform any procedures or adjustments that this instruction manual does not describe.
- Do not use controls or adjustments, or perform procedures other than those specified in this instruction manual; these actions might result in hazardous radiation exposure.
- Incorporated components, such as transceivers and emitters, are not user serviceable. Return units to SEL for repair or replacement.

EIA-232 Option

The EIA-232 port is a female 9-pin connector with the pin numbering shown in *Figure 17*. The pin functions are listed in *Table 1*.



Figure 17 EIA-232 Connector Pin Numbers

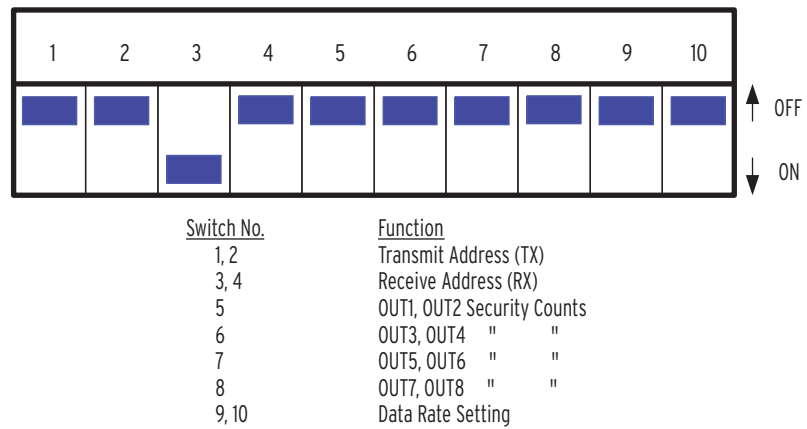
NOTE: EIA-232 cables used with the SEL-2507 should be less than 3 meters in length to ensure proper functionality.

Table 1 EIA-232 Pin Assignments

| Pin | Signal Name | Description |
|-----|-------------|--------------------------------------------------------------------------------|
| 1 | 5 Vdc | SEL transceiver power (when Jumper J1 is installed on the communications card) |
| 2 | RXD | Receive data |
| 3 | TXD | Transmit data |
| 4 | N/C | None |
| 5 | GND | Signal ground |
| 6 | N/C | None |
| 7 | N/C | None |
| 8 | N/C | None |
| 9 | N/C | None |

Configuring the SEL-2507

The SEL-2507 uses a ten-position control (DIP) switch to set the TX and RX addresses, to determine the number of received correct consecutive messages for output contact control, and to program the data rate of the MIRRORING BITS communications (see *Table 3*). The contact consecutive messages feature is intended to increase the system security for applications requiring higher security, such as direct transfer tripping.

**Figure 18 SEL-2507 Control Switch Position Identifications**

Setting the Transmit and Receive Addresses

You must set the TX address of each local SEL-2507 to match the receive address of the remote device. Further, the TX and RX addresses of each device should not be set to the same number. The SEL-2507 detects a loopback condition when it receives its own transmit address in the MIRRORING BITS message. When the SEL-2507 detects loopback, it illuminates the LOOP LED and extinguishes the ROK LED. The SEL-2507 disables the contact outputs to prevent acting on its own message during loopback (i.e., output contacts go to their de-energized state). *Table 2* lists the address settings.

Table 2 Transmit and Receive Address Settings

| Switch 4 | Switch 3 | RX Address | Switch 2 | Switch 1 | TX Address |
|----------|----------|------------|----------|----------|------------|
| OFF | OFF | 1 | OFF | OFF | 1 |
| OFF | ON | 2 | OFF | ON | 2 |
| ON | OFF | 3 | ON | OFF | 3 |
| ON | ON | 4 | ON | ON | 4 |

Setting Security Counts for Received Data

Table 3 lists the data security count setting possibilities. When the data security switch is set to OFF, the contact output follows its associated RMB logical status. When the data security switch is set to ON, two consecutive RMB messages of the same logical state are required to assert/deassert the associated contact output. Note that each setting switch controls an adjacent pair of contact outputs.

Table 3 Data Security Count Settings

| Switch | Message 1 | Message 2 |
|-----------------------|-----------|-----------|
| Switch 5 (OUT1, OUT2) | OFF | ON |
| Switch 6 (OUT3, OUT4) | OFF | ON |
| Switch 7 (OUT5, OUT6) | OFF | ON |
| Switch 8 (OUT7, OUT8) | OFF | ON |

For example, when switch 7 is set to ON this requires two consecutive messages to be confirmed before asserting and/or deasserting OUT5 and OUT6, while all other outputs require only one message.

Setting the Data Rate

Table 4 lists the settings for the four data rate options. For high-speed applications like with the SEL-T400L, select data rate 115200 to use Millisecond MIRRORING BITS. This recommendation is based on operating time. For applications where a multiplexer or other communications device is

between the two MIRRORRED BITS devices, data rates 38400, 19200, or 9600 are recommended. If the channel is operating intermittently, lowering the data rate will provide more stable performance in most cases.

Table 4 Protocol/Data Rate Settings

| Switch 9 | Switch 10 | |
|----------|-----------|-----------------------------------------------------------|
| OFF | OFF | MB8 Protocol @ 38400 bps |
| ON | OFF | MB8 Protocol @ 19200 bps |
| OFF | ON | MB8 Protocol @ 9600 bps |
| ON | ON | MB8 Protocol @ 115200 bps (Millisecond MIRRORRED BITS) |

Connecting the SEL-2507 to Other SEL Devices

The SEL-2507 uses the MB8 MIRRORRED BITS protocol, and the module transmits and receives data at the data rate set by switches 9 and 10.

The following examples show how to configure several SEL devices to operate with the SEL-2507. Only the minimum settings required are shown. Consult the appropriate instruction manual to ensure proper settings for your particular MIRRORRED BITS application.

For fiber-optic ports, connect a fiber-optic cable to a compatible transceiver or built-in fiber-optic port on the other device (see *Fiber-Optic Serial Port Options on page 18*). For the EIA-232 option, connect to the other device using a copper cable less than 3 meters in length within the same cabinet as the SEL-2507.

SEL-T400L

SPEED = 115200
TX_ID = 2 RX_ID = 1

SEL-2507

TX_ADD = 1 (Switch 1 and 2 = OFF)
RX_ADD = 2 (Switch 3 = ON, Switch 4 = OFF)
PROTO/SPEED = 115200 (Switch 9 = ON, Switch 10 = ON)

SEL-2505/SEL-2506

TX_ADD = 1 (Switch 1 and 2 = OFF)
RX_ADD = 2 (Switch 3 = ON, Switch 4 = OFF)
PROTO/SPEED = 38400 (Switch 9 = OFF, Switch 10 = OFF)

SEL Relays Except SEL-321 and SEL-400 Series Relays

PROTO = MB8A*
SPEED = 38400
RXID = 1 TXID = 2

* = MB8A or MB8B may be used

SEL-321

PROTO= MB8
SPEED = 38400
TX_ID = 2 RX_ID = 1

SEL-400 Series Relays

PROTO= MBA*
 SPEED = 38400
 STOPBIT = 2
 TX_ID = 2 RX_ID = 1
 TX MODE = N

SEL RTAC

PROTO = MB8
 SPEED = 38400
 TXID = 2 RXID = 1

* = MBA or MBB may be used

Testing the SEL-2507

Testing an SEL-2507 requires another communicating device. Examples include an SEL-2505, SEL-2507, SEL RTAC, or a relay with MIRRORING BITS protocol and the appropriate fiber-optic transceiver or data cable. The following test procedure assumes you are using another SEL-2507 as the remote communicating device. The test procedure for other communicating devices is similar.

- Step 1. Check the SEL-2507 dip-switch configuration settings.
 Make certain the transmit address matches the receive address of the remote device and that the data rate is identical.
- Step 2. Connect the chassis ground terminal of the SEL-2507 to ground (Terminal 49).
- Step 3. Connect and apply rated voltage to the power supply inputs of the SEL-2507 (positive to Terminal 47, negative to Terminal 48).
 The **ENABLED** LED should illuminate. The b form of the **ALARM** contact should remain closed and the **ALARM** LED illuminates due to no communications.
- Step 4. Press the **LAMP TEST** pushbutton.
 All LEDs should illuminate. When you release the pushbutton, the LEDs should extinguish.
- Step 5. Connect the communications interface between the SEL-2507 modules.
 The **ROK**, **TX**, and **RX** LEDs on both devices should illuminate. In addition, the b contacts of the **ALARM** contact should open and the **ALARM** LED should extinguish.
- Step 6. Apply rated voltage to IN1 on one device.
 The **INPUT1** LED should illuminate on this device. On the other SEL-2507, the OUT1 contact should close and **OUTPUT1** LED should illuminate.
- Step 7. Repeat *Step 6* for the remaining contacts.
- Step 8. To test the loopback feature, connect a single fiber between the **TX** to **RX** on the same device. The **LOOP** LED should illuminate and the **ROK** LED should extinguish. Energize each input. No output contact should assert.

Front-Panel Labels

The SEL-2507 features a versatile front panel that you can customize for your needs. Use the slide-in configurable front-panel label to change the identification of target LEDs to match the function indicated.

The blank slide-in label set, shown in *Figure 19*, is included with the SEL-2507.

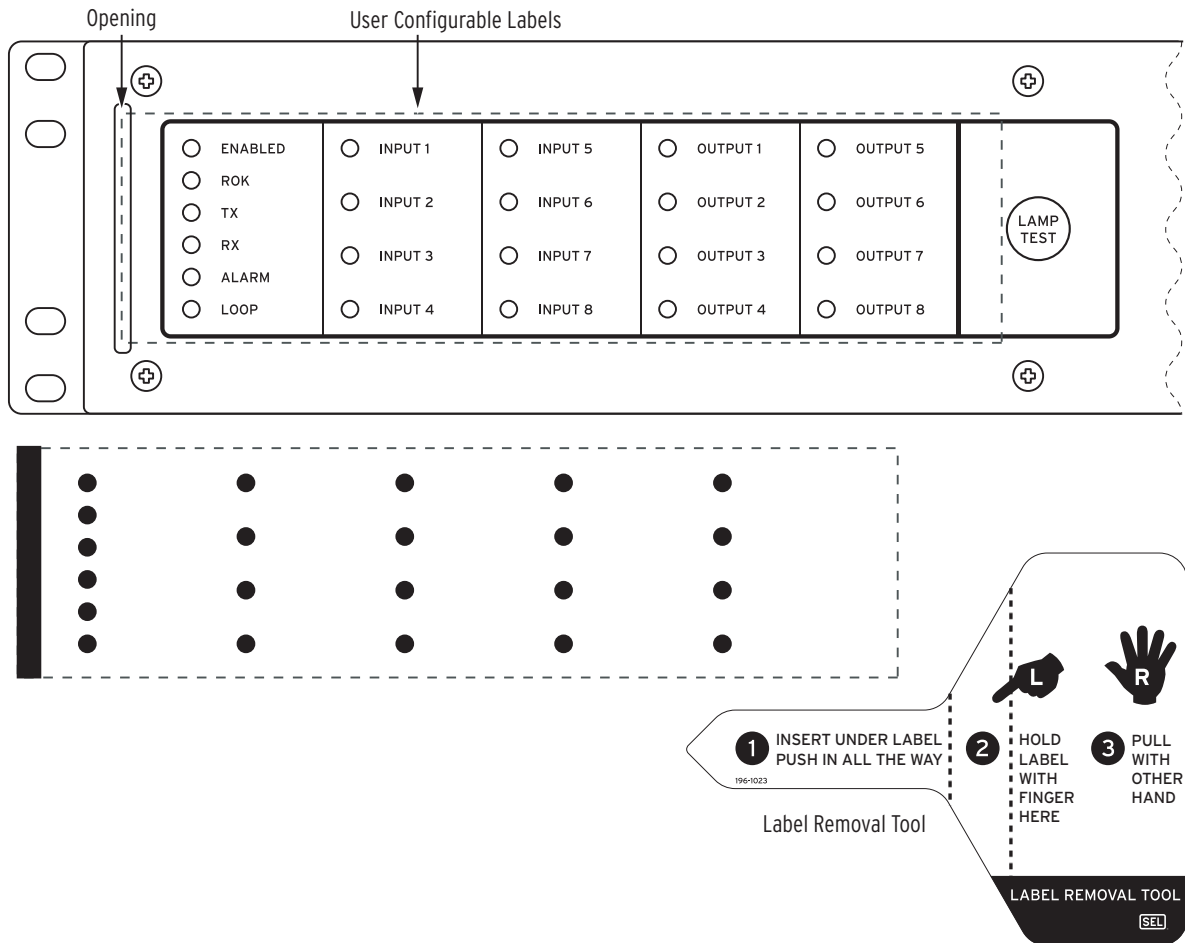


Figure 19 Blank Slide-In Label Set and Label Removal Tool

If you need additional configurable front-panel label supplies, order the labels kit or individual kit components using the part numbers listed in *Table 5*. Contact your Technical Service Center or the SEL factory to obtain these kits.

Table 5 Configurable Front-Panel Label Kits

| Content Descriptions | Quantity | Part Number |
|-----------------------------------------------------------------------------------------|----------------------------------|-------------|
| Label Kit | One | 9260010 |
| Blank Customer Label Templates on perforated paper for laser printing | Two sets—two labels for each set | 196-1048 |
| Blank slide-in label sets for labeling by hand (use only a fine point permanent marker) | One | 196-1049 |
| Label Removal Tool | One | 196-1023 |

Removing Labels

Use the label removal tool (shown in *Figure 19*) to remove labels from the front-panel pockets.

- Step 1. Slide the tip of the tool under the label at the pocket opening (see *Figure 19* for example opening locations).
- Step 2. Push the exposed edge of the label against the label removal tool while pulling out both the label and label removal tool.

Changing Configurable Front-Panel Labels

There are four options for producing custom labels for the SEL-2507 front panel.

- Use factory-default labels
- Use handwritten labels on factory-default labels
- Use handwritten labels on blank labels
- Creating laser-printed labels

NOTE: The default template font is from the Arial family. You can use this font or choose a different font that is available on your computer system.

NOTE: You can adjust the font size to accommodate more text within the cell.

Use the following procedure to create laser-printed labels. You can find label template files on the SEL website (selinc.com). In addition, these files are included on the SEL-2507 Product Literature CD.

Step 1. Open the appropriate Microsoft® Word template.

Step 2. Fill in the fields.

Use the Tab and Arrow keys or your mouse to move from field to field. Field space is limited; only the text that displays on the screen prints on the label.

Save the file often to preserve your work in progress.

Step 3. Test the position of the label text.

- a. Print the template file to plain paper.
- b. Examine the printed sheet for proper alignment. Carefully compare the printed page to the perforated stock sheets.
- c. If the printed sheet is not aligned properly, proceed to *Step 4*.
- d. If the labels appear as desired, proceed to *Step 5*.

Step 4. Make adjustments to margin settings, as necessary, to print in the proper location on the test sheet.

- a. Use the **Page Setup** dialog box to adjust only the top or left margins as needed to correct the alignment. DO NOT adjust the right or bottom margins.
- b. Do another test print on plain paper.
- c. Examine the label position.
- d. Repeat as necessary until the alignment is correct.

Save the file often to preserve your work in progress.

Step 5. Print the labels on the perforated stock sheets.

If the labels printed incorrectly, repeat this procedure beginning with *Step 3*.

Step 6. Fold and tear the perforated edges of the stock paper to remove the labels from the sheet.

NOTE: Place the perforated stock sheet in the printer tray as indicated by the printer (either face up or face down).

Also, if your printer has duplex capability, be sure to set the printer to print single sided.

- Step 7. Remove the existing labels from the front-panel label pockets with the label removal tool.
- Step 8. Insert the newly created labels in the appropriate pockets on the front panel.

Mechanical Diagram

RACK-MOUNT CHASSIS

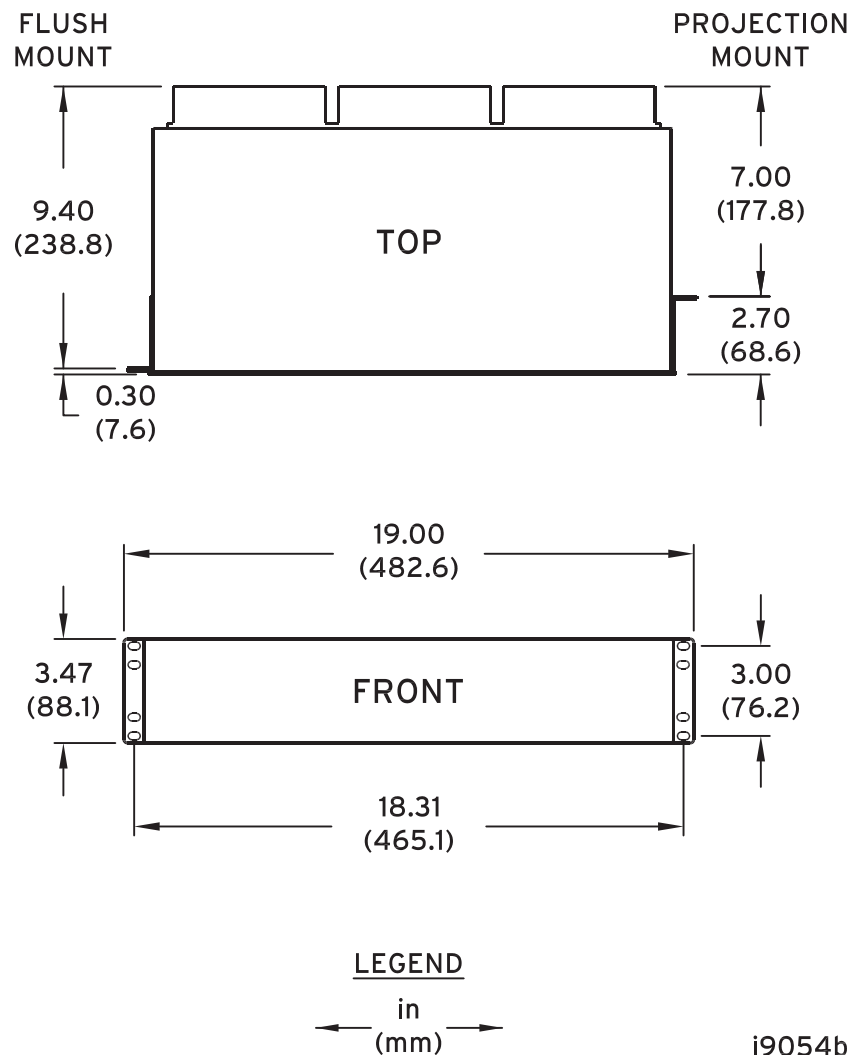


Figure 20 SEL-2507 Dimensions and Drill Diagram

Specifications

Compliance

Designed and manufactured under an ISO 9001 certified quality management system

47 CFR 15B, Class A

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment under FCC rules.

CE Mark: EMC Directive
Low Voltage Directive

UKCA Mark

Tightening Torque

I/O and Power Connectors: 1.0–2.0 Nm (9–18 in-lb)

Serial Ports: 0.6–0.8 Nm (5–7 in-lb)

Terminal Connections

Terminals or stranded copper wire. Ring terminals are recommended. Minimum temperature rating of 90°C (194°F).

Alarm and Output Contacts

Fast Hybrid (High-Speed High-Current Interrupting)

| | |
|----------------------------------------|--------------------------------------------------------------|
| Make: | 30 A |
| Carry: | 6 A continuous carry at 70°C 4 A continuous carry at 85°C |
| 1 s Rating: | 50 A |
| MOV Protection (Maximum Voltage): | 250 Vac/330 Vdc |
| Pickup Time: | 10 µs, resistive load |
| Dropout Time: | 8 ms, resistive load |
| Breaking Capacity (10,000 Operations): | |
| 48 Vdc | 10.0 A L/R = 40 ms |
| 125 Vdc | 10.0 A L/R = 40 ms |
| 250 Vdc | 10.0 A L/R = 20 ms |

Cyclic Capacity (4 cycles/second, followed by 2 minutes idle for thermal dissipation):

| | | |
|---------|--------|-------------|
| 48 Vdc | 10.0 A | L/R = 40 ms |
| 125 Vdc | 10.0 A | L/R = 40 ms |
| 250 Vdc | 10.0 A | L/R = 20 ms |

Note: Per IEC 60255-23:1994, using the simplified method of assessment.

Note: Make rating per IEEE C37.90-1989.

Optoisolated Inputs

| | |
|----------|----------------------------------------|
| 250 Vdc: | Pickup 210–300 Vdc Dropout <150 Vdc |
| 125 Vdc: | Pickup 105–150 Vdc Dropout <75 Vdc |

Note: 125 Vdc optoisolated inputs draw approximately 4 mA of current; 250 Vdc inputs draw approximately 5 mA of current. All current ratings are at nominal input voltages.

Power Supply

125–250 Vdc or 120–240 Vac

Range: 85–350 Vdc or 85–264 Vac
(50 Hz/60 Hz)

Burden: <5 W

48–125 Vdc or 120 Vac

Range: 36–200 Vdc or 85–140 Vac
(50 Hz/60 Hz)

Burden: <5 W

Back-to-Back Operate Time

(SEL-2507 input to SEL-2507 remote output transfer time)

| Data Rate | High-Speed Outputs Avg. ms. |
|-----------|-----------------------------|
| 115200 | 1 |
| 38400 | 4 |
| 19200 | 6 |
| 9600 | 12 |

MIRRORED BITS Protocol

MB8 (only)

Port Speed (Data Rate)

115200 bps (Millisecond MIRRORED BITS)
38400 bps
19200 bps
9600 bps

Fiber-Optic Serial Port Options

| Ordering Options | 6 |
|---------------------------|----------|
| Mode | Multi |
| Wavelength (nm) | 850 |
| Source | LED |
| Connector type | ST |
| Min TX Pwr. (dBm) | –13 |
| Max TX Pwr. (dBm) | –3 |
| RX Sens. (dBm) | –29 |
| Sys. Gain (dB) | 16 |
| Compatible Transceiver | SEL-2812 |
| 91560 Attenuator Required | No |

IEC 60825-1:2014 Class 1

IEC 60825-2:2014 Class 1

Operating Temperature Range

–40° to +85°C (–40° to +185°F)

Humidity

0% to 95% Without Condensation

Altitude

2000 m Maximum

Unit Weight

1.36 kg (3 lb)

Dimensions

88.1 mm x 455.1 mm x 223.5 mm
(3.47" H x 18.31" W x 8.80" D)

Contact Input Update Rate

500 μ s

Type Tests

| | |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Radiated and Conducted Emissions: | IEC 60255-26:2013 Class A |
| Conducted RF Immunity: | IEC 60255-26:2013 IEC 61000-4-6:2009 10 Vrms |
| Electrostatic Discharge: | IEC 60255-26:2013 IEC 61000-4-2:2009 IEEE C37.90.3-2001 2, 4, 6, and 8 kV contact discharge 2, 4, 6, 8, and 15 kV air discharge |
| Fast Transient Burst: | IEC 60255-26:2013 IEC 61000-4-4:2012 Class A 4 kV, 5 kHz 2 kV, 5 kHz on communication ports |
| Radio Frequency Immunity: | IEC 60255-26:2013 10 V/m (unmodulated) IEEE C37.90.2-2004 20 V/m (unmodulated) |
| Surge Immunity: | IEC 60255-26:2013 IEC 61000-4-5:2005 Level 0.5, 1.0, 2.0 kV Line to Line 0.5, 1.0, 2.0, 4.0 kV Line to Earth |
| Surge Withstand: | IEC 60255-26:2013 2.5 kV peak common mode 1.0 kV peak differential mode IEEE C37.90.1-2012 2.5 kV, 1 MHz oscillatory 4.0 kV, 5 kHz fast transient |
| Power Frequency Immunity: | IEC 60255-26:2013 IEC 61000-4-16:1998 + A2:2009 |
| Power Frequency Magnetic Field Immunity: | IEC 60255-26:2013 IEC 61000-4-8:2010 Level 5 1000 A/m for 3 s 100 A/m for 60 s |
| Pulse Magnetic Field Immunity: | IEC 61000-4-9:2001 Level 5 1000 A/m |
| Damped Oscillatory Magnetic Field: | IEC 61000-4-10:2001 Level 5 100 A/m |
| Power Supply Immunity: | IEC 60255-26:2013 IEC 60255-27:2013 |

| | |
|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| Cold Operational: | IEC 60255-27:2013 IEC 60068-2-1:2007 16 hours at -40°C |
| Cold Storage: | IEC 60255-27:2013 IEC 60068-2-1:2007 |
| Dry Heat Operational: | IEC 60255-27:2013 IEC 60068-2-2:2007 16 hours at +85°C |
| Dry Heat Storage: | IEC 60255-27:2013 IEC 60068-2-2:2007 |
| Damp Heat, Cyclic: | IEC 60255-27:2013 IEC 60068-2-30:2005 +25°C to +55°C, 6 cycles (12 + 12 hour cycle), 95% Relative Humidity |
| Damp Heat, Steady State: | IEC 60255-27:2013 IEC 60068-2-78:2005 +40°C, 10 days 93% Relative Humidity |
| Vibration: | IEC 60255-21-1:1988 Class 2 Endurance Class 2 Response |
| Shock: | IEC 60255-21-2:1988 Class 1 Shock Withstand Class 1 Bump Response Class 2 Shock Response |
| Seismic: | IEC 60255-21-3:1993 Class 2 Quake Response |
| Object Penetration: | IEC 60255-27:2014 IEC 60529:1989 + A1:1999 IP3X IP4X on top front |
| Insulation Resistance: | IEC 60255-27:2013 |
| Flammability: | IEC 60255-27:2013 |
| Max Temperature of Parts and Materials: | IEC 60255-27:2013 |
| Protective Bonding Continuity: | IEC 60255-27:2013 |
| Dielectric: | IEC 60255-27:2013 IEEE C37.90-2005 2.5 kVrms Digital Inputs and Outputs 3.6 kVdc Power Supply |
| Impulse: | IEC 60255-27:2013 IEEE C37.90-2005 0.5 Joule, 5 kV Digital Inputs and Outputs and Power Supply |

Factory Assistance

We appreciate your interest in SEL products and services. If you have questions or comments, please contact us at:

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