SEL-2126 Fiber-Optic Transfer Switch Instruction Manual

Features, Benefits, and Applications

The SEL-2126 Fiber-Optic Transfer Switch routes fiber-optic communication during breaker-bypass or station-bypass operations. Contact closures from a selector switch, protective relay, panel switch, or other device control the routing of current differential communication, MIRRORED BITS® communications, and many other types of data streams to a bus-tie relay or other temporary protection.

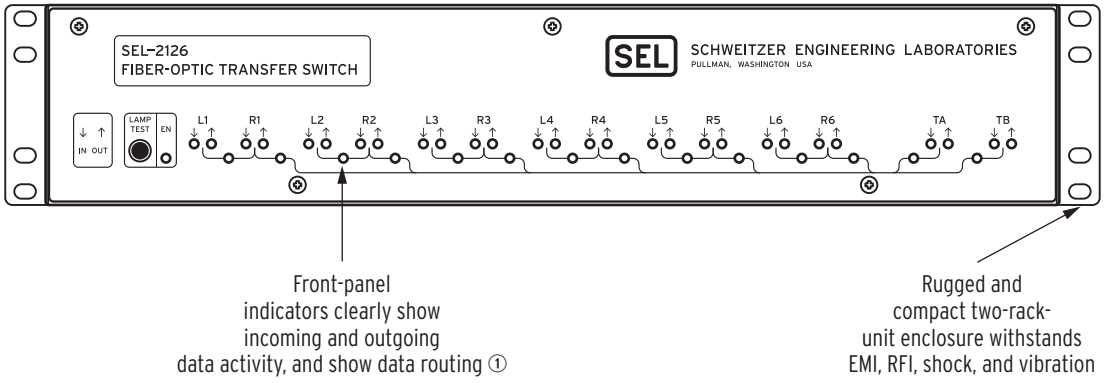
- **High-Speed Protection.** Maintains high-speed communications-assisted line protection during breaker- or station-bypass operations.
- **Fast, Transparent Routing.** Provides immediate (100 ms) or delayed (5 s) switching with a through delay of less than 10 µs.
- **Long-Distance, High-Isolation Fiber-Optic Communication.** Allows links as long as 2 km between the SEL-2126 and relays, and between the SEL-2126 and network equipment.
- **Channel Monitoring.** Maintains the capability of end-to-end channel monitoring to retain notification of lost or noisy channels.
- **Intuitive Front-Panel Display.** Indicates status of all used channels and shows where data are routed.
- **Easy Setup.** Ships with the most-common user settings already configured. Four jumper settings cover configuration and test modes.
- **Universal Power Supply.** Allows connection to 24 V communications battery, or 250 V station battery, or any intermediate voltage level.
- **Alarm Contact.** Notifies of self-test failure or power loss.
- **Supports IEEE C37.94.** Connects directly to any IED or multiplexer channel interface that is compliant with the IEEE C37.94 interface standard. These devices include the SEL-311L Relay, the SEL-2894 Interface Converter, the SEL-3094 Interface Converter, and the SEL-2595 Contact Transfer Module. Contact the SEL factory for non-C37.94 applications.
- **Expandable.** Each SEL-2126 accommodates as many as six lines. You can "stack" multiple SEL-2126 switches to provide data routing for a nearly unlimited number of lines.

Product Overview

Operation Basics

Figure 1 and *Figure 2* give an overview of the front and rear panels of the SEL-2126 Fiber-Optic Transfer Switch. Six local and remote (**L** and **R**) channel pairs connect to as many as six sets of line relays. Connect the local channel (**L1**, for example) directly to the local line relay, and connect the remote channel (**R1**, for example) to the remote line relay through your communications network. Front-panel LEDs indicate incoming and outgoing data status for every used channel and show data flow.

The local and remote line relays normally communicate with each other through the SEL-2126. There is less than 10 µs delay for data passing through the SEL-2126. The green link LED between the **L** and **R** ports illuminates to indicate that the local and remote relays are communicating with each other. During a breaker-bypass operation, the SEL-2126 connects the remote line relay to the bus-tie relay through either Port **TA** or **TB**, maintaining high-speed communications-assisted protection while the local line relay is out of service. The link LED between the **R** port and the **TA** and **TB** ports illuminates to indicate that the remote relay is communicating with the bus-tie relay through either the **TA** or **TB** port.



① See Figure 11.

Figure 1 SEL-2126 Front Panel—Rack Mount

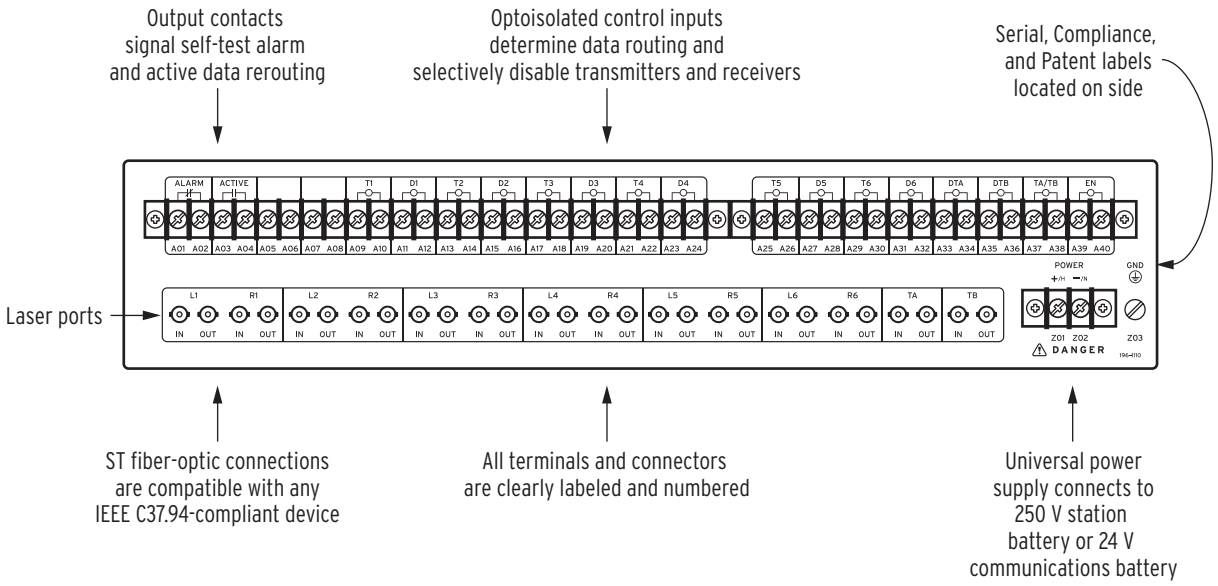


Figure 2 SEL-2126 Rear Panel

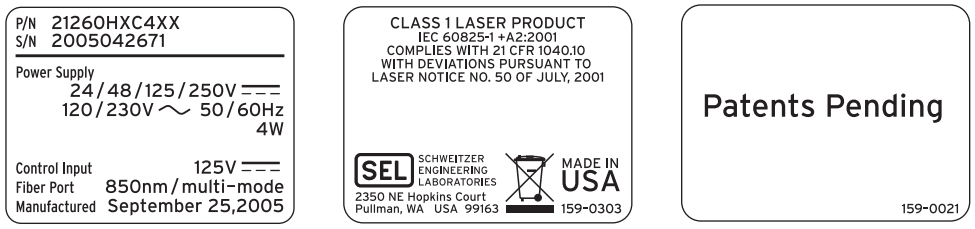


Figure 3 Serial Label (a), Compliance Label (b), and Patent Label (c)

Control Inputs

Transfer Inputs T1–T6 and TA/TB

Control Inputs **T1**–**T6** control data routing within the SEL-2126. For example, energize Input **T1** to disconnect Port **R1** from Port **L1**, and connect Port **R1** to either Port **TA** or **TB**.

The **TA/TB** control input selects the transfer port, **TA** or **TB**, that the SEL-2126 uses during bypass operations. Energize **TA/TB** to select **TB**, and de-energize it to select **TA**. An example in *Applications on page 5* shows how to reroute two data links simultaneously through the use of both **TA** and **TB**.

Disable Inputs D1–D6, DTA, DTB, and EN

Control Inputs **D1**–**D6** squelch outgoing and incoming data for local Port **L1**–Port **L6**. Control Inputs **DTA** and **DTB** squelch outgoing and incoming data for Ports **TA** and **TB**. Control Input **EN** squelches outgoing and incoming data on all ports.

Installation and Maintenance

Fiber-Optic Port

The SEL-2126 uses an 850 nm VCSEL (vertical-cavity surface-emitting laser) transmitter. When working with this device, observe the following safety precautions:

- Do not look into the fiber (laser) 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.
- During installation, maintenance, or testing of the optical ports, use only test equipment qualified for Class 1 laser products.
- Incorporated components, such as transceivers and laser emitters, are not user serviceable. Return units to SEL for repair or replacement.

IMPORTANT: Do not connect power to the SEL-2126 until you have completed these procedures.

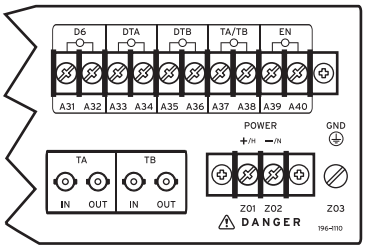


Figure 4 SEL-2126 Rear-Panel Power and Ground Connections

Rear-Panel Symbols

There are important safety symbols on the rear of the SEL-2126.

Observe proper safety precautions when you connect the SEL-2126 at terminals marked by these symbols. In particular, the danger symbol located on the rear panel corresponds to the following:

> **Contact with instrument terminals may cause electrical shock which can result in injury or death.**

Be careful to limit access to these terminals.

DANGER
Contact with instrument terminals may cause electrical shock which can result in injury or death.

Figure 5 Rear-Panel Safety Symbols

Grounding

Connect the grounding terminal (**Z03**) labeled **GND** on the rear panel to a rack-frame ground or main station ground for proper safety and performance. Use 12 AWG (4 mm^2) or heavier wire less than 2 m (6.6 feet) in length for this connection. Connect the device to ground before connecting the device to a power source.

Power Connections

Use 16 AWG (1.5 mm^2) 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 the **+** (Terminal **Z01**) and **–** (Terminal **Z02**) symbols on the power terminals indicate. Upon connecting power, you will see the **EN** LED illuminate.

Disconnect Device

For installations that comply with IEC regulations, place an external circuit breaker no more than 3.0 m (9.8 feet) from the equipment. The circuit breaker must comply with IEC 60947-1 and IEC 60947-3 or an equivalent approved disconnect device appropriate for the country of installation. You must also identify the circuit breaker as the disconnect device for this equipment.

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 SEL-2126.

Fuse

An internal fuse provides protection for operational power. You cannot replace this fuse. Should failure occur, return the unit to the SEL factory for repair.

Screw Terminals

Terminate connections to the SEL-2126 screw terminals with ring-type crimp lugs. Use a #6 ring lug with a maximum width of 8.1 mm (0.320 in.). The screws in the rear-panel screw terminals are #6-32 phil-slot pan-head, zinc-plated steel screws. Tightening torque for the terminal screws is 1.0 Nm

(9 in-lb). Minimum wire size is 18 AWG with a minimum temperature rating of 105°C.

Cleaning

Use care when cleaning the SEL-2126. 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.

Applications

SEL Application Guide AG2004-01 *Using the* SEL-*2100 Logic Processor in Bypass Breaker* MIRRORED BITS *Communications-Assisted Tripping Schemes* describes how to use the SEL-2100 to reroute MIRRORED BITS during breaker-bypass operations.

For the same application, there are advantages to using the SEL-2126 instead of the SEL-2100. These advantages include increased availability, decreased through delay, and end-to-end channel monitoring. Application Guide AG2005-09 *Using the SEL-2126 Fiber-Optic Transfer Switch and the* SEL-*321-1 in Bypass Breaker* MIRRORED BITS *Communications-Assisted Tripping Schemes* and the application examples which follow in this manual show how to apply the SEL-2126 to reroute MIRRORED BITS and current differential communications during breaker-bypass operations.

Breaker-Bypass Operation Using MIRRORED BITS Communications

In *Figure 6*, an SEL-2126 reroutes MIRRORED BITS communications during a breaker-bypass operation. The figure shows two transmission lines for which communications-assisted tripping with MIRRORED BITS provides protection.

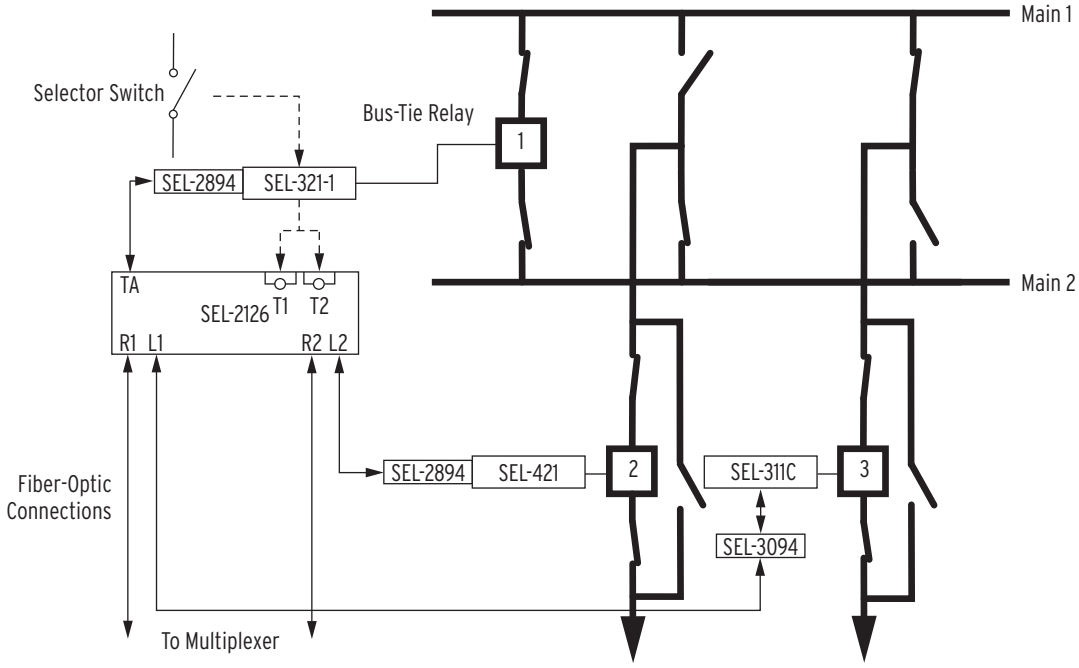


Figure 6 SEL-2126 Reroutes MIRRORED BITS Communications During Breaker-Bypass Operation

Tie-Relay Configuration

A selector switch energizes control inputs on the SEL-321-1 bus-tie relay. The SEL-321 qualifies the group delay timer selection of a selector switch position. When the timer expires, the relay changes to the appropriate settings group. The new settings group contains settings optimized to protect the transmission line you selected, and it also contains output SELOGIC® control equations to energize the selected transfer control input (**T1** or **T2**) on the SEL-2126.

Circuit Breaker 2 Bypass Operation

The SEL-2126 requires no new steps in the breaker-bypass operation. Consider the operations necessary to bypass Breaker 2 in *Figure 6*. In normal operation, the bus-tie relay does not communicate with any other relays. Do not route the MIRRORED BITS channel alarms to any contact outputs in the default settings group, Group 1, of the bus-tie relay. This prevents the bus-tie relay from issuing nuisance channel alarms during normal operation.

To bypass Breaker 2, reconfigure the bus to feed Line 2 through both the bus-tie breaker (Breaker 1) and Breaker 2 as shown in *Figure 6*. Then rotate the selector switch to select Settings Group 2 in the SEL-321-1 bus-tie relay.

The bus-tie relay transitions to Settings Group 2 after it qualifies the new group change timer setting selection. Settings Group 2 contains the correct protection settings, including line parameters and communications-assisted tripping logic (e.g., POTT, DCB, etc.), for the bus-tie relay to protect Line 2. Settings Group 2 also contains output SELOGIC control equations to energize Control Input **T2** on the SEL-2126.

The SEL-2126 responds immediately to energized Control Input **T2** and internally connects Port **R2** to Port **TA**. This connection establishes a MIRRORED BITS link between the remote relay on Line 2 and the bus-tie relay, and there is now no MIRRORED BITS link to the local SEL-421 Relay on Line 2. Line 2 has protection now from the same communications-assisted tripping scheme that the SEL-421 normally employs to protect Line 2. Bypass, open, and isolate Breaker 2, and take the SEL-421 out of service to complete the bypass operation.

Updated SEL-321-1 Firmware

The SEL-321-1 has features specifically intended for this application. In newer SEL-321-1 firmware releases, you can move all MIRRORED BITS and control input assignment settings to group settings. The ability to move these settings makes it possible to assign unique MIRRORED BITS channel address settings TX_ID and RX_ID per settings group to facilitate MIRRORED BITS communications with several possible remote line relays. Contact the SEL factory for availability of other relay models with these special features.

Transfer Operation Using Current Differential Protection

Figure 7 shows one method for using the SEL-2126 with current differential protection. This application shows a bus configuration that momentarily places the bus-tie breaker (Breaker 1) in parallel with a line breaker (Breaker 2) during reconfiguration to isolate the line breaker. The **DTA** input on the SEL-2126 prevents 87L problems during the time that current splits between the bus-tie breaker and the line breaker.

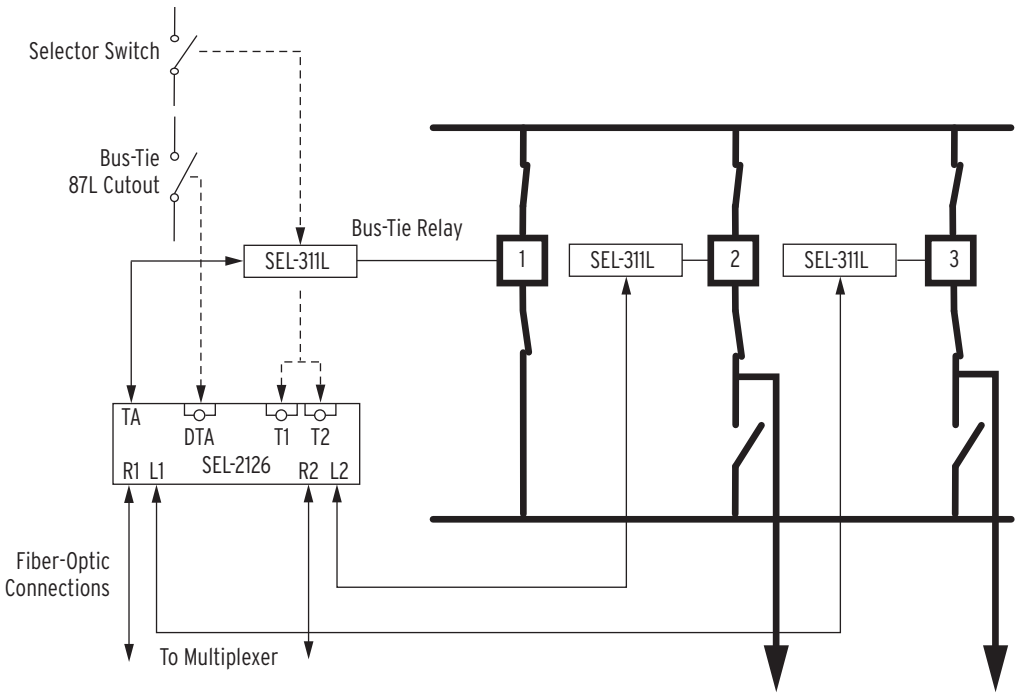


Figure 7 SEL-2126 Reroutes Current Differential Communications During Transfer Operation

Tie-Relay Configuration

One would normally place the bus-tie relay, an SEL-311L Line Current Differential Relay, in a settings group with 87L protection disabled. Such a configuration prevents a nuisance communications alarm.

Circuit Breaker 2 Bypass Operation

To bypass Breaker 2 in *Figure 7*, first disable SEL-2126 Transfer Port **TA** by closing the Bus-Tie 87L Cutout panel switch. Control Input **DTA** squelches incoming and outgoing data on Port **TA** in the SEL-2126. Verify that Port **TA** is disabled by ensuring that the front-panel outgoing and incoming data indicators for the **TA** port are red.

Rotate the selector switch to select Settings Group 2 in the bus-tie relay. After the bus-tie relay qualifies the group change timer selection for the selector switch position, it transitions to Settings Group 2. Settings Group 2 enables 87L protection and also enables backup step-distance and overcurrent protection for Line 2. However, Control Input **DTA** on the SEL-2126 squelches communications with the bus-tie relay, so 87L protection remains defeated in the bus-tie relay.

When the bus-tie relay enables Settings Group 2, SELOGIC control equations in the bus-tie relay close a contact to energize Control Input **T2** on the SEL-2126. The SEL-2126 responds immediately to Control Input **T2** and connects Port **R2** to Port **TA**. There is now no link between Ports **L2** and **R2**, and this broken link disables current differential protection in the line relay connected to Port **L2**. The SEL-311L connected to Breaker 2 continues to provide step-distance and overcurrent protection for Line 2.

Reconfigure the bus to parallel the bus-tie breaker and Breaker 2, then open and isolate Breaker 2. After Breaker 2 opens, open the Bus-Tie 87L Cutout panel switch to enable Port **TA** on the SEL-2126. By enabling Port **TA**, you enable a current differential communications link between the bus-tie relay

and the remote relay protecting Line 2, and establish 87L protection for Line 2.

Breaker-Bypass Operation Using Both Current Differential and MIRRORED BITS Protection

The SEL-2126 supports simultaneous use of two protection communications protocols. For example, in *Figure 8* an SEL-2126 reroutes either MIRRORED BITS or current differential protection communications to two bus-tie relays. A pair of SEL-311L current differential relays protect Line 2. A pair of SEL-421 relays protect Line 3 through the use of enhanced MIRRORED BITS exchanging analog values, virtual terminal connections, and time synchronization between remote and local relays. The SEL-2126 transfers the enhanced MIRRORED BITS communications to the SEL-421 bus-tie relay and also transfers current differential communications to the SEL-311L bus-tie relay.

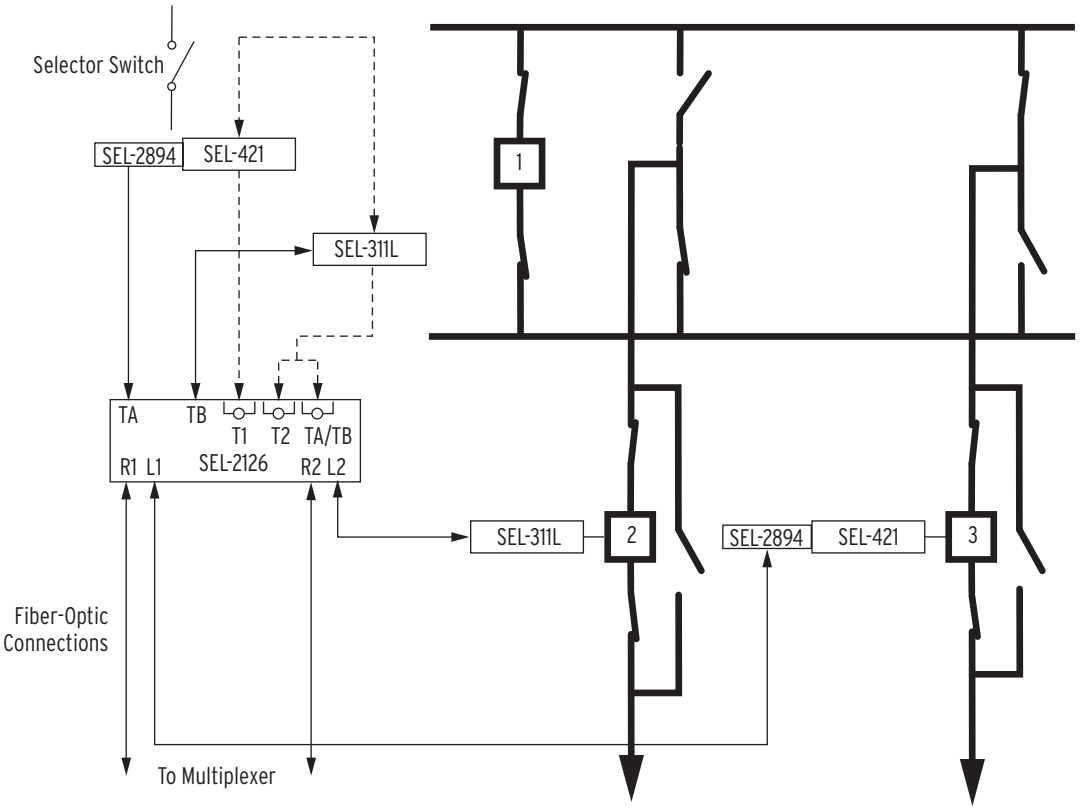


Figure 8 SEL-2126 Reroutes MIRRORED BITS and Current Differential Communications

Current Differential Tie-Relay Configuration and Bypass Operation

A selector switch selects settings groups in both bus-tie relays. The SEL-311L bus-tie relay contains SELOGIC control equations in Settings Group 2 that energize the **T2** and **TA/TB** control inputs in the SEL-2126. With **T2** and **TA/TB** energized, the SEL-2126 routes **R2** to Transfer Port **TB**, establishing a current differential communications link between the bus-tie SEL-311L and the remote line relay.

SEL-421 Tie-Relay Configuration and Bypass Operation

The SEL-421 bus-tie relay contains SELOGIC control equations in Settings Group 2 that energize **T1** in the SEL-2126. When the SEL-2126 transfers MIRRORED BITS communications, Control Input **TA/TB** on the SEL-2126 remains de-energized. With Control Input **T1** energized and **TA/TB** de-energized, the SEL-2126 routes Port **R1** to Transfer Port **TA**, establishing an enhanced MIRRORED BITS link between the bus-tie SEL-421 Relay and the remote line relay.

Figure 8 shows the SEL-2126 rerouting either current differential or MIRRORED BITS communications. The SEL-2126 is also capable of rerouting any two communications channels simultaneously, maintaining primary and backup communications-assisted tripping schemes during breaker-bypass operations.

Testing the Local Relay During Breaker-Bypass Operation

During a transfer or breaker-bypass operation, the SEL-2126 normally disables communications with the local line relay while it establishes the communications link between the remote line relay and the bus-tie relay. You can also use the SEL-2126 to transfer communications from the local line relay to either Transfer Port (**TA** or **TB**) depending on the state of the **TA/TB** control input.

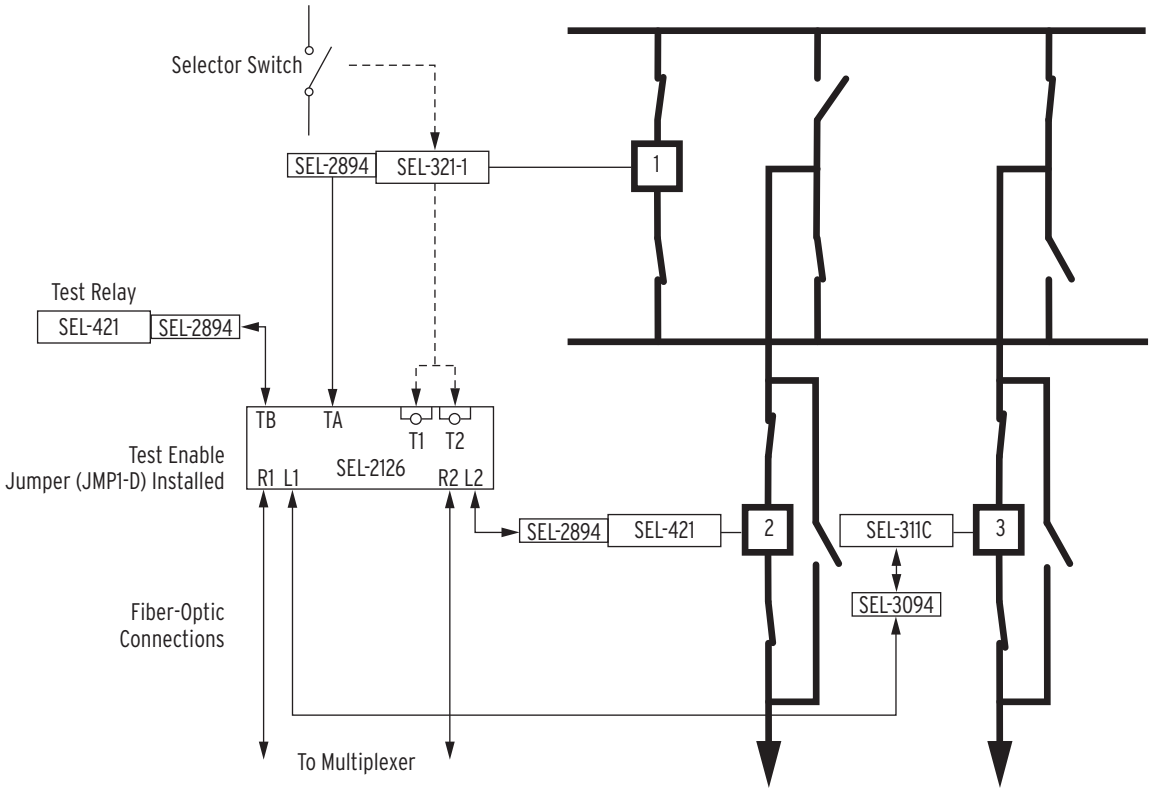


Figure 9 SEL-2126 Routes Protection Data During Bypass Operation and Connects Line Relay to Test Relay

To enable routing of local and remote data with the SEL-2126, install the Test Enable jumper described in *Configuration on page 12*. When the Test Enable jumper is installed, you can assert any transfer Control Input **T1**–**T6** to route the remote port to the transfer port the **TA/TB** input selected. The SEL-2126 routes the local port to the transfer port the **TA/TB** input did not select. As *Figure 9* shows, this configuration enables you to test the communications functions of the local line relay while it is out of service. For example, in *Figure 9* when **T1** asserts in the SEL-2126, Port **R1** connects to Transfer Port **TA**, and Port **L1** connects to Transfer Port **TB**. Connect a test relay directly to Transfer Port **TB**, as shown, to facilitate testing the local line relay, or connect Transfer Port **TB** to the communications network and route the port to your relay test lab for remote testing.

Functional Description

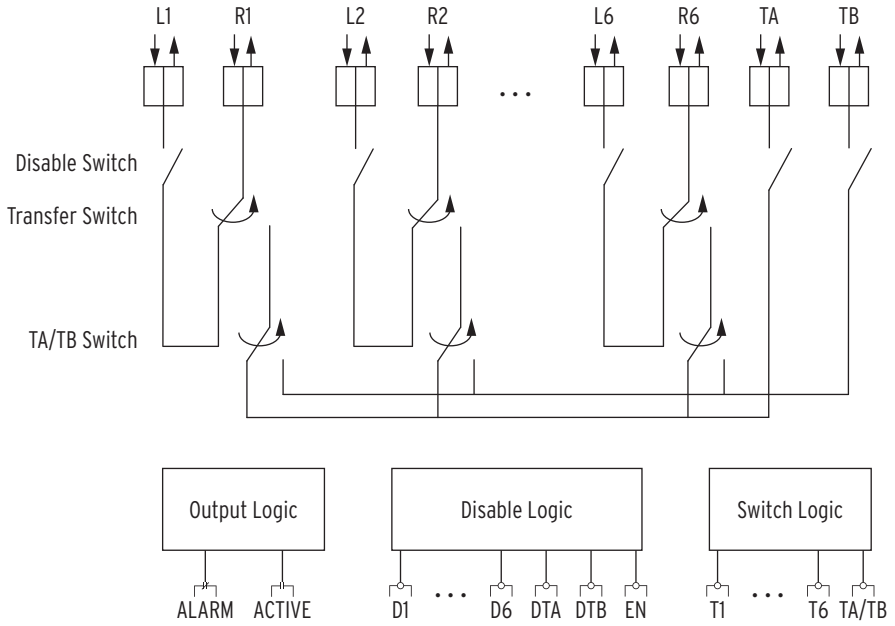


Figure 10 SEL-2126 Functional Diagram

Transfer Switch Logic

The SEL-2126 is a reliable and cost-effective transfer switch. Seven control inputs, **T1**–**T6** and **TA/TB**, determine how data travel inside the switch, as *Figure 10* shows.

When the Test Enable Jumper Is Not Installed

If only one transfer input (**T1**–**T6**) is energized, the associated remote port routes to the transfer port that the **TA/TB** input selects. For example, if **T1** is energized, the **TA/TB** input determines the routing of **R1**. If **TA/TB** is not energized, **R1** routes to **TA.** Otherwise, **R1** routes to **TB**.

You can route as many as two remote ports simultaneously to the **TA** and **TB** transfer ports. Input **TA/TB** determines the routing of the lower-numbered remote port. For example, if Control Inputs **T1** and **T2** are both energized, **R1** routes to the transfer port the **TA/TB** input selected, and **R2** routes to the other transfer port. If **TA/TB** is not energized, then **R1** routes to **TA** and **R2** routes to **TB**. If **TA/TB** is energized, **R1** routes to **TB** and **R2** routes to **TA**.

If more than two transfer inputs (**T1**–**T6**) are energized, only the remote ports associated with the lower-numbered energized transfer inputs route to transfer ports, and the other ports are unaffected. Essentially, the SEL-2126 ignores higher-numbered transfer inputs.

When the Test Enable Jumper Is Installed

You can route only one remote port to a transfer port. The associated local port routes to the other transfer port. For example, if **T3** is energized, the **TA/TB** input determines the routing of Port **R3**. If **TA/TB** is not energized, **R3** routes to **TA** and **L3** routes to **TB**. If **TA/TB** is energized, **R3** routes to **TB** and **L3** routes to **TA**. By rerouting both the local and remote ports, you maintain communications-assisted tripping during the bypass operation and can allow connection of the local line relay to a test relay for back-to-back testing.

If more than one transfer input (T1–T6) is energized, the SEL-2126 reroutes local and remote ports associated with the lower-numbered energized input. The higher-numbered ports are unaffected. Essentially, the SEL-2126 ignores the higher-numbered transfer inputs.

Disable Logic

Depending on the state of the D Sense configuration jumper (JMP1–C), energizing Control Input D*n* squelches outgoing and incoming data on Port L*n*. Control Inputs DTA and DTB squelch outgoing and incoming data on Ports TA and TB. These inputs are also dependent on the state of the D Sense configuration jumper. Depending on the state of the EN Sense configuration jumper (JMP1-B), Control Input EN squelches outgoing and incoming data on all ports. See *Configuration on page 12* for more information about configuration jumpers.

ALARM and ACTIVE Output Logic

The ALARM contact closes, the Enabled LED EN extinguishes, and the SEL-2126 squelches all outgoing and incoming data if the following occur:

- The internal control input/output board fails.
- A hardware initialization failure occurs at power up.
- A power supply rail is out of tolerance.
- The EN input disables the SEL-2126.

The ACTIVE contact closes if any port reroutes or if a disable control input squelches data.

Front-Panel Interface

The front panel of the SEL-2126 provides indications of outgoing and incoming data activity on all used ports and shows how data route through the device. Each pair of L and R ports and the TA and TB ports have six associated indicators, as *Figure 11* illustrates. Incoming (down arrow) and outgoing (up arrow) indicators are green when the associated data stream is active. These indicators are red when disable logic squelches the associated port data. If any port has outgoing data but no incoming data, the associated incoming data indicator is red.

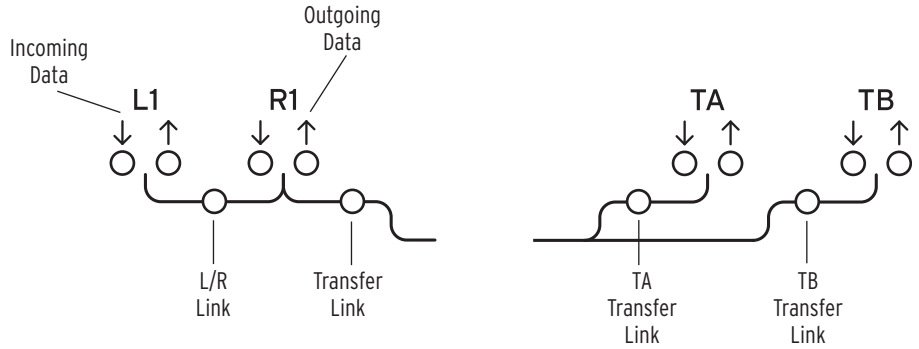


Figure 11 SEL-2126 Front-Panel Indicators

The L/R link indicator is green when any of the outgoing or incoming data indicators are illuminated and when the SEL-2126 does not reroute the corresponding remote port. The transfer link indicator is orange for the lowest-numbered port that the SEL-2126 reroutes, and the indicator is green for the highest-numbered port the SEL-2126 reroutes.

The TA and TB transfer link indicators illuminate either orange or green to indicate which remote port routes to which transfer port.

All LEDs alternate red and green when you depress the LAMP TEST pushbutton.

Configuration

As *Table 1* shows, four jumpers determine the configuration of the SEL-2126. The SEL-2126 ships from the SEL factory without any jumpers in place. For most applications, the default configuration is appropriate. All application descriptions in *Applications on page 5* assume that no jumpers are installed.

Table 1 SEL-2126 Configuration

Jumper	Name	Removed (Default)	Installed
JMP1-A	Delay	Data routing changes 0.1 seconds after **T1**–**T6**, **TA**, and **TB** control inputs stabilize. Use this option when you control the SEL-2126 from IED outputs.	Data routing changes 5 seconds after **T1**–**T6**, **TA**, and **TB** control inputs stabilize. Use this option when you control the SEL-2126 directly with a selector switch.
JMP1-B	EN Sense	Control Input **EN** enables all transmitters when de-energized. Use this option when the **EN** input is unused or to disable all transmitters by closing a cutout switch.	Control Input **EN** enables all transmitters when energized. Use this option to disable all transmitters by opening a cutout switch.
JMP1-C	D Sense	Control Inputs **D1**–**D6**, **DTA**, and **DTB** squelch selected transmitters when energized.	Control Inputs **D1**–**D6**, **DTA**, and **DTB** squelch selected transmitters and receivers when de-energized.
JMP1-D	Test Enable	Assert **T** input to reroute **R** port to Transfer Port **TA** or **TB**, and disconnect **L** port. Use this option to use both **TA** and **TB** transfer ports for data routing during bypass operations.	Assert **T** input to reroute **R** port to Transfer Port **TA** or **TB**, and reroute **L** port to the other transfer port. Use this option to test the local line relay during bypass operations.

CAUTION
The module contains devices sensitive to Electrostatic Discharge (ESD). When working on the module with the front panel removed, work surfaces and personnel must be properly grounded or equipment damage may result.

To change a jumper position, proceed with the following steps:

Step 1. Remove the front panel.

Step 2. Locate jumpers JMP1A–JMP1D left of the **LAMP TEST** pushbutton.

Step 3. Install or remove the required jumpers.

Step 4. Reinstall the front panel.

The new jumper configuration becomes active immediately (i.e., you do not need to cycle power or take any other action).

Testing

NOTE: You can measure fiber-optic transmit power at any time. Disable functions squelch only the data; port transmission occurs continuously.

To test the SEL-2126, connect IEEE C37.94-compliant devices such as an SEL-311L to the local, remote, and transfer ports. Then use control inputs on the SEL-2126 to route data and verify that data transmit properly to the device you intended.

Step 1. Connect SEL-311L relays with an IEEE C37.94 interface to Ports **L1**, **R1**, and **TA** of the SEL-2126.

De-energize all control inputs.

a. Verify that the outgoing and incoming data indicators for both **L1** and **R1** are green, and that the L/R link indicator between **L1** and **R1** is illuminated.

b. Verify that the incoming data indicator for Port **TA** is illuminated, and that the outgoing data indicator and the **TA** transfer link indicator are extinguished.

c. Verify the existence of current differential protection in the relays that connect to **L1** and **R1**.

d. Verify that the **ACTIVE** and **ALARM** outputs are open.

Step 2. Energize Control Input **D1**.

a. Verify that there is no current differential protection in any relays.

b. Verify that the outgoing and incoming data indicators for Port **L1** are red.

c. Verify that the L/R link indicator between **L1** and **R1** is illuminated.

d. Verify that the incoming data indicator for Port **R1** is green, and that the outgoing data indicator for Port **R1** is extinguished.

e. Verify that the **ACTIVE** output closes.

Step 3. De-energize Control Input **D1** and energize Control Input **T1**.

a. Verify that the incoming data indicator for Port **L1** is green, and that the outgoing data indicator for Port **L1** is extinguished.

b. Verify that the L/R link indicator between Ports **L1** and **R1** is extinguished.

c. Verify that the transfer link indicator to the right of **R1** is orange and that the transfer link indicator to the left of **TA** is orange.

d. Verify that the outgoing and incoming data indicators for both **R1** and **TA** are green.

e. Verify that current differential protection exists in the relays that connect to **R1** and **TA**.

f. Verify that the **ACTIVE** output closes.

Step 4. Energize Control Input **DTA**.

a. Verify that there is no current differential protection in any relays.

b. Verify that the outgoing and incoming data indicators for Port **TA** are red.

c. Verify that the outgoing data indicator for Port **R1** is extinguished and that the incoming data indicator for Port **R1** is green.

Step 5. De-energize Control Input **DTA** and energize Control Input **EN**.

Verify that all outgoing and incoming data indicators are red, that current differential protection is absent from all relays, and that the **ALARM** output closes.

Step 6. Repeat *Step 1–Step 5* as required for other **L** and **R** port pairs, and for Port **TB**.

Step 7. Remove power from the SEL-2126.

Verify that the **ALARM** output closes.

Mechanical Diagram

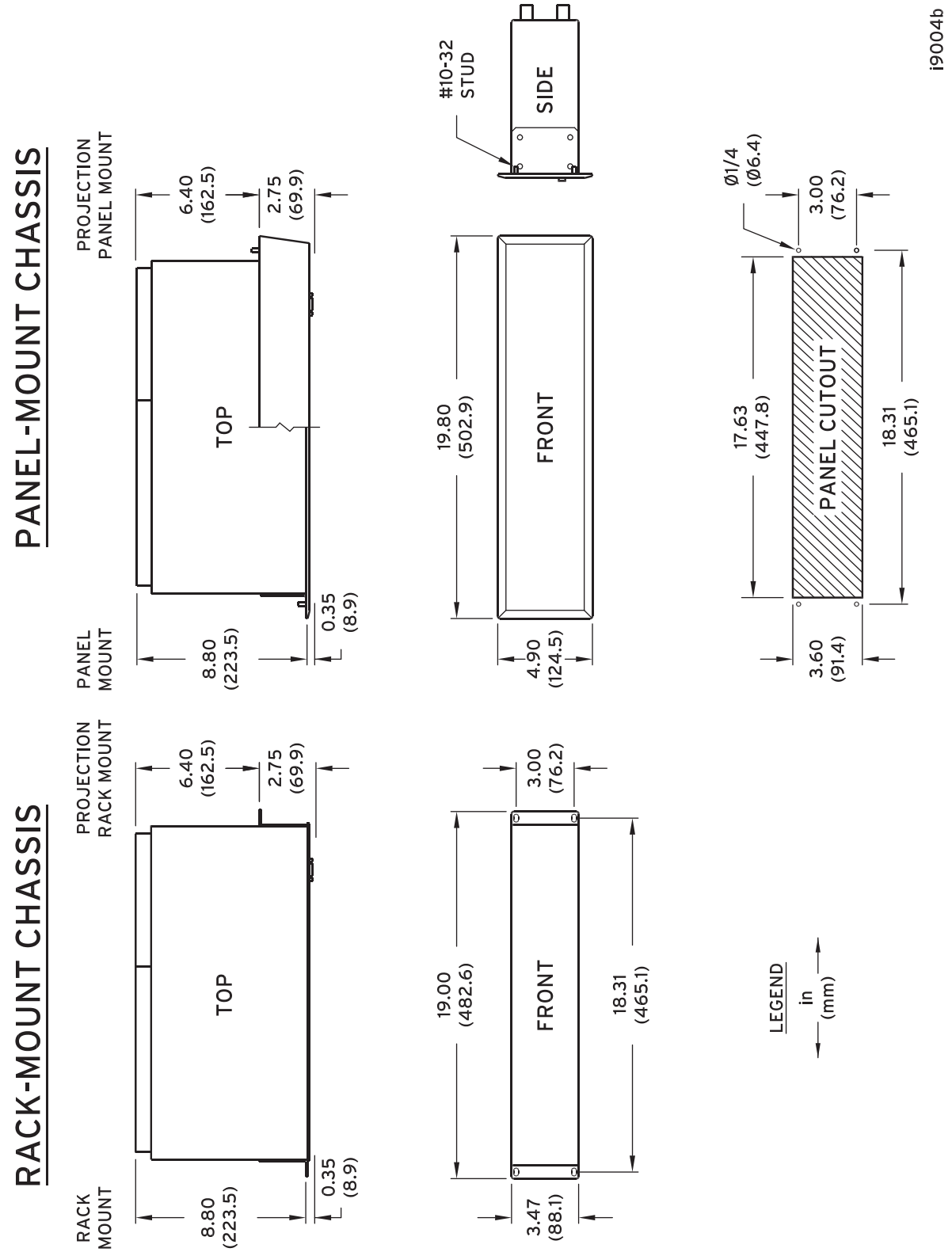


Figure 12 SEL-2126 Dimensions and Drill Plan

Specifications

Certifications

Designed and manufactured under an ISO 9001 certified quality management system

Alarm Contact

Form B

Carry:	6 A
MOV Protection:	270 Vac rms 360 Vdc continuous

Optoisolated Inputs

250 Vdc:	Pickup 210–300 Vdc; Dropout <150 Vdc
220 Vdc:	Pickup 176–264 Vdc; Dropout <132 Vdc
125 Vdc:	Pickup 105–150 Vdc; Dropout <75 Vdc
110 Vdc:	Pickup 88–132 Vdc; Dropout <66 Vdc
48 Vdc:	Pickup 38.4–60 Vdc; Dropout <28.8 Vdc
24 Vdc:	Pickup 15–30 Vdc

Note: 24, 48, and 125 Vdc optoisolated inputs draw approximately 4 mA of current.

Contact Input Update Rate

T1–T6 and TA/TB:	0.1 or 5 s, jumper configurable
All Others:	0.1 s

Maximum Data Delay

10 µs

Power Supply

Range:	18–300 Vdc or 85–264 Vac
Burden:	<15 W

Fiber Optic

Mode:	Multimode
Wavelength (nm):	850
Connector Type:	ST
Typical TX Pwr. Level (dBm):	–23 to –11, into 50 µm fiber
RX Sens. (dBm):	–32, at 2.048 Mbps
Sys. Gain (dB):	9 with 50 µm fiber
Jitter Plus Distortion:	Output has less than 50 ns jitter plus distortion when input has less than 100 ns jitter plus distortion.

Operating Temperature

–40° to +85°C (–40° to +185°F)

Humidity

0% to 95% without condensation

Altitude

2000 m maximum

Tightening Torque

Terminal Block

Minimum:	0.9 Nm (8 in-lb)
Maximum:	1.3 Nm (12 in-lb)

Unit Weight

3.2 kg (7.1 lb)

Dimensions

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

Type Tests

Electromagnetic Compatibility Immunity

Conducted RF Immunity:	IEC 60255-22-6:2001 IEC 61000-4-6:1996

Dielectric Strength and Impulse Tests

Dielectric:	IEC 60255-5:2000 IEEE C37.90-1989
Impulse:	IEC 60255-5:2000

Electrostatic Discharge Immunity

ESD:	IEC 60255-22-2:1992 IEC 61000-4-2:1995 IEEE C37.90.3

RFI and Interference Tests

Fast Transient/Burst Immunity:	IEC 60255-22-4:2001 IEC 61000-4-4:1996
Radiated Radio Frequency Immunity:	IEC 60255-22-3:2000 IEC 61000-4-3:1998 IEEE C37.90.2-2004
Power Supply Immunity:	IEC 60255-11:1979 IEC 61000-4-11:1994
Surge Immunity:	IEC 60255-22-5:2002 IEC 61000-4-5:1995
Surge Withstand:	IEC 60255-22-1:1988 IEEE C37.90.1-1989

Environmental Tests

Cold:	IEC 60068-2-1:1990
Damp Heat, Cyclic:	IEC 60068-2-30:1980
Dry Heat:	IEC 60068-2-2:1974

Vibration and Shock Tests

Shock and Bump:	IEC 60255-21-2:1988 IEC 60255-21-3:1993
Sinusoidal Vibration:	IEC 60255-21-1:1988

Safety

Laser Safety:	Complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019.
Maximum (Faulted) Laser Transmit Level (dBm):	–2.7 dBm

Hardware and Manual Versions

The date code at the bottom of each page of this manual reflects the creation or revision date.

Table 2 lists the product release dates and a description of modifications. The most recent product revisions are listed at the top.

Table 2 Hardware and Manual Revision History

Revision Date	Summary of Revisions
20241216	**Manual** ➤ Updated *Specifications*.
20170109	**Hardware** SEL-2126 units built after April 8, 2016: ➤ Updated to eliminate ground potential rise on dc battery systems. **Manual** ➤ Added *Hardware and Manual Versions* and *Factory Assistance*.
20051031	➤ Initial version.

Technical Support

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

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Notes

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

⚠DANGER
Removal of enclosure panels exposes circuitry which may cause electrical shock which can result in injury or death.

⚠WARNING
Operator safety may be impaired if the device is used in a manner not specified by SEL.

⚠CAUTION
The module contains devices sensitive to Electrostatic Discharge (ESD). When working on the module with the front panel removed, work surfaces and personnel must be properly grounded or equipment damage may result.

⚠CAUTION
Class 1 LASER Product. This product uses visible or invisible LASERs based on model option. Looking into optical connections, fiber ends, or bulkhead connections can result in hazardous radiation exposure.

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

⚠DANGER
Tout contact avec les bornes de raccordement de l'appareil peut causer un choc électrique pouvant entraîner des blessures ou la mort.

⚠DANGER
Le retrait des panneaux du boîtier expose le circuit qui peut causer des chocos électriques pouvant entraîner des blessures ou la mort.

⚠AVERTISSEMENT
La sécurité de l'opérateur peut être compromise si l'appareil est utilisé d'une façon non indiquée par SEL.

⚠ATTENTION
Le module contient des pièces sensibles aux décharges électrostatiques. Quand on travaille sur le module avec les panneaux avant ou du dessus enlevés, toutes les surfaces et le personnel doivent être mis à la terre convenablement pour éviter les dommages à l'équipement.

⚠ATTENTION
Produit LASER de Classe 1. Ce produit utilise des LASERS visibles ou invisibles dépendant des options du modèle. Regarder vers les connecteurs optiques, les extrémités des fibres ou les connecteurs de cloison peut entraîner une exposition à des rayonnements dangereux.

⚠ATTENTION
L'utilisation de commandes ou de réglages, ou l'application de tests de fonctionnement différents de ceux décrits ci-après peuvent entraîner l'exposition à des radiations dangereuses.

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PM2126-01