SEL-2515 Remote I/O Module Instruction Manual

Features, Benefits, and Applications

The SEL-2515 is a remote I/O module that has eight input contacts and eight output contacts. The status of these inputs and outputs is communicated between the SEL-2515 and an SEL Communications Processor through the use of SEL Fast Messaging communications over a dedicated fiber-optic port. SEL Fast Operate controls each of the eight Form C contact outputs. Use the transmitted input contact status for control indication of a remote device.

- **Communications Flexibility** helps you simplify and improve existing or new installations.
  - Add simple pilot communications 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.
- **Compact Size** permits panel-mount replacement of existing auxiliary relays.
- **Self-Testing** increases reliability of auxiliary relay functions.
- **Simple Status Diagnostics** consist of 21 LEDs that indicate contact input, output, channel, and device status.
- **Improved Reliability** through increased scheme security reliability with channel monitoring and alarm output.
- **Increased Safety** is provided through fiber-optic isolation and placement of all electrical connections behind the front panel.
- **Four Serial Fiber Interface Options** provide a wide range of applicable communications paths.

Product Overview

Figure 1 shows the functional overview of the SEL-2515.

The SEL-2515 is an excellent auxiliary relay that provides a simple way of expanding the number of I/O points available in an integrated system. It is superior to hardwiring an I/O by using electromechanical or static auxiliary relays because you can monitor the performance of the communications channel. In addition, its self-testing ability ensures prompt notification of any device or communication channel problem. All SEL-2515 circuit boards are conformally coated for added reliability in harsh environments.

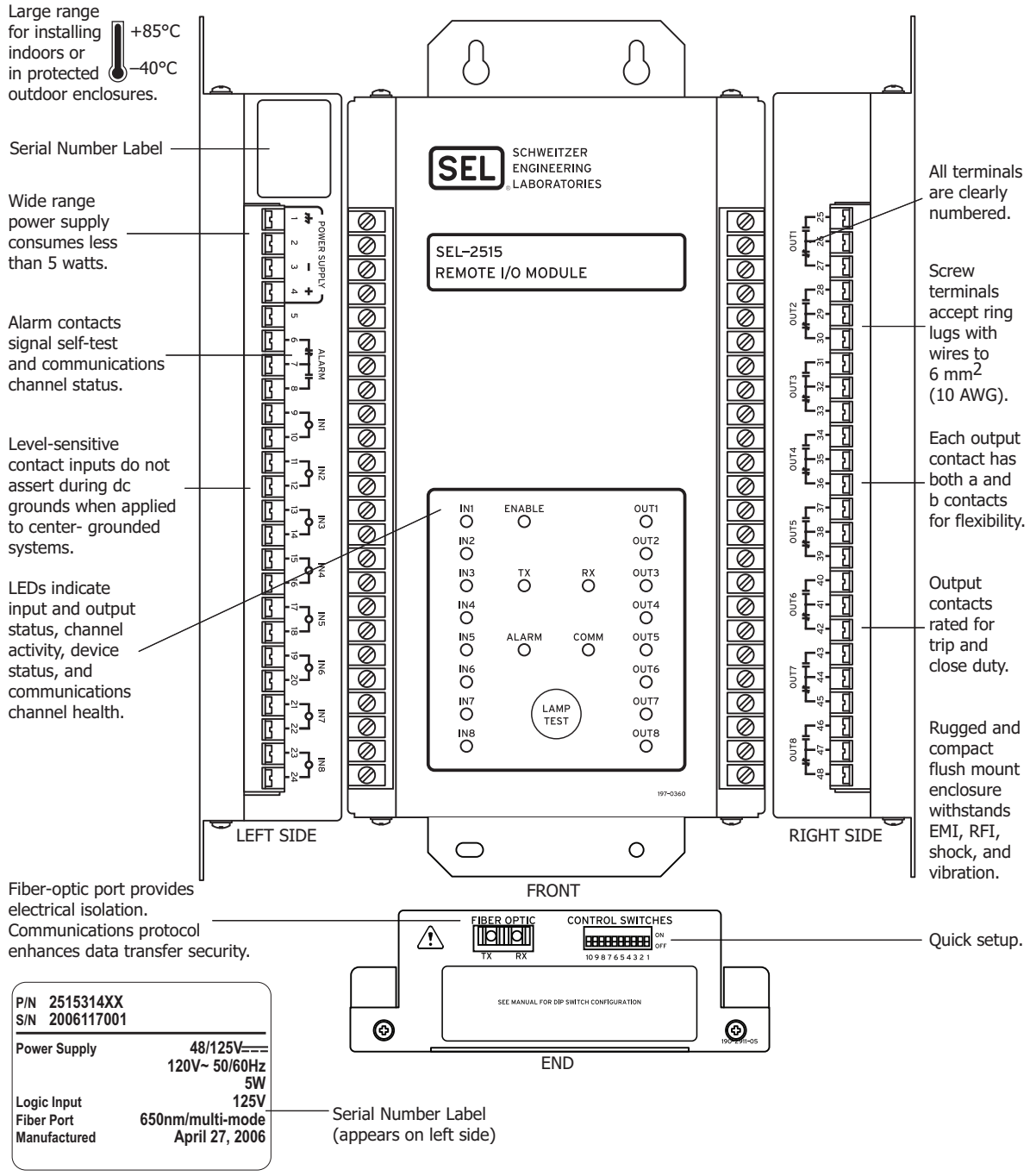


Figure 1 SEL-2515 Functional Overview (With Example Product Labels)

Table 1 Front-Panel LEDs

Indicator Function	Description
ENABLE	On when device powered and operating properly
TX	On when transmitting data
RX	On when receiving data
ALARM	Asserted when ALARM output is asserted for hardware or software failures
COMM	Communications watchdog—on when watchdog time-out detected; press Lamp Test to reset
IN1–IN8	On when input is asserted
OUT1–OUT8	On when output is asserted

Applications

- Eliminate hardwiring from control room to breaker or motor-operated disconnect switch.
- Reduce dc ground exposure.
- Add trip/close path continuity monitoring.
- Expand I/O capability with SEL Fast Message communications protocol.

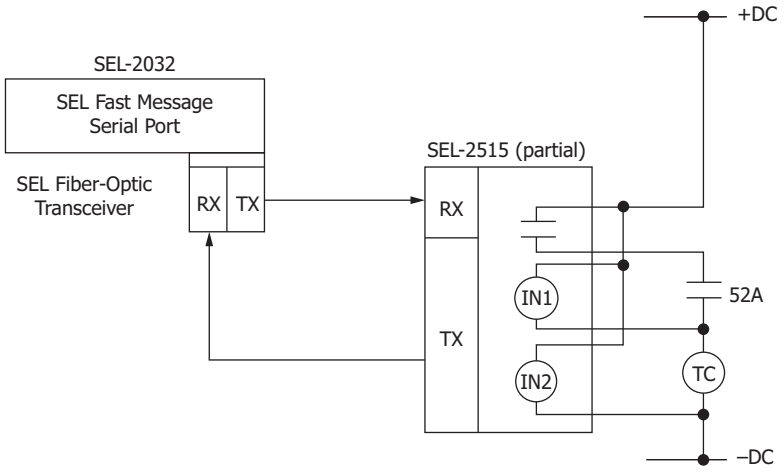


Figure 2 Reduce Wiring From Control House to Outdoor Cabinets

Example Distribution Substation I/O and Control

Figure 3 shows an SEL-2515 application that uses the SEL-2515 and an SEL-2032 Communications Processor to provide monitoring and control of the substation transformer and circuit breakers. Connect temperature and pressure alarm contacts from the substation equipment to the SEL-2515. SEL Fast Messaging communicates the status of the SEL-2515 input and outputs to the SEL-2032.

Additional examples of substation equipment monitoring are breaker and motor-operated switch statuses. The SEL-2515 contact outputs control the breakers, motor-operated switches, transformer fans, and other substation equipment. The outputs are controlled via the SEL-2032 by using SEL Fast Operate messages. SEL-2032 SELOGIC® control equations or the protocol interfaces of the communications processor, SEL Fast Message, DNP3, Modbus®, UCA2, or Modbus Plus® trigger the SEL Fast Operate control messages to the SEL-2515. Unlike conventional schemes, there is no control wiring between the control house with the communications processor and the SEL-2515 located at the substation equipment. Eliminating this wiring reduces dc ground exposure and replacing this wiring with SEL-2515 modules adds self-testing and automatic communications path checking.

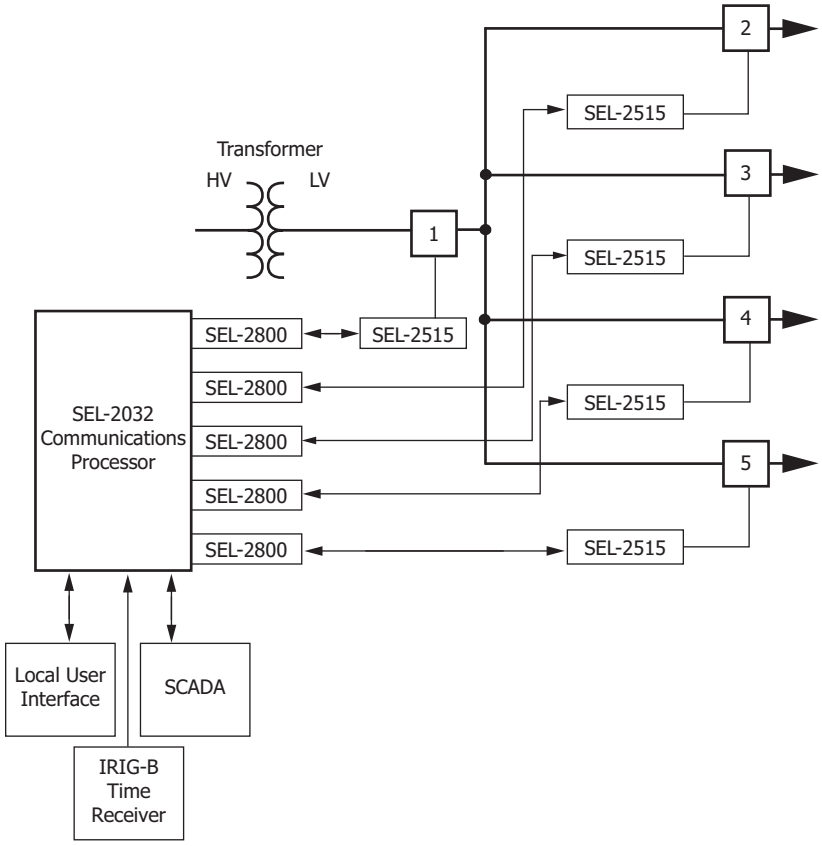


Figure 3 Distribution Application Example

Functional Description

SEL Fast Message and I/O Control

SEL Fast Message protocol provides access to the eight inputs and outputs. SEL Fast Meter messaging communicates the status of the eight inputs to the host device. *Figure 4* shows the functional block diagram of the SEL-2515. The SEL Fast Meter message from the SEL-2515 contains only binary status data. *Table 2* shows the map of binary data in the SEL Fast Meter message.

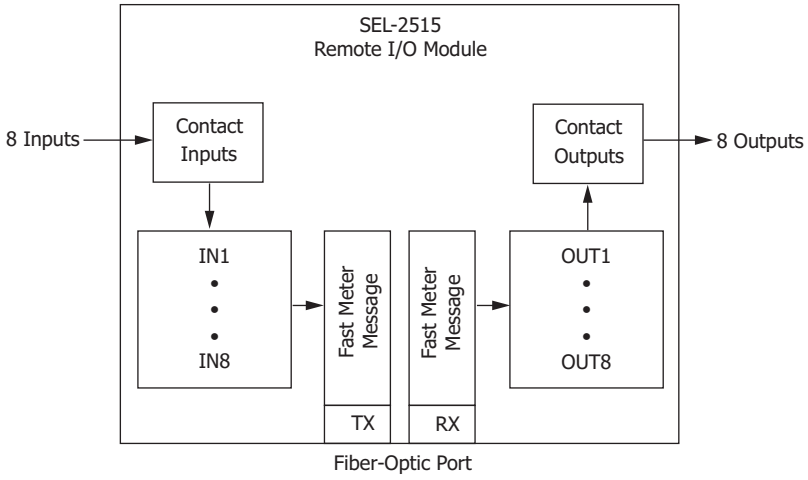


Figure 4 SEL-2515 Functional Block Diagram

Table 2 Binary Data Map (2OTARGET)

0	EN	TX	RX	ALARM	COMM	*	*	*
1	IN8	IN7	IN6	IN5	IN4	IN3	IN2	IN1
2	OUT8	OUT7	OUT6	OUT5	OUT4	OUT3	OUT2	OUT1
3	RB08	RB07	RB06	RB05	RB04	RB03	RB02	RB01
4	RB16	RB15	RB14	RB13	RB12	RB11	RB10	RB09
5	OC4	OC3	OC2	OC1	CC4	CC3	CC2	CC1

Control the SEL-2515 outputs by using SEL Fast Operate messages. The SEL-2515 accepts two types of control messages: remote bit control or breaker control.

Breaker control messages are either Open or Close commands that control SEL-2515 outputs. When a valid Fast Operate breaker control message is received, the SEL-2515 outputs operate as shown in *Table 3*.

NOTE: Pulse duration is controlled via Control (DIP) Switch 3 = 0, pulse 500 ms; otherwise, pulse 1000 ms.

Table 3 Output Point Operation in Response to Fast Operate Breaker Control

Control Message	Control Bit	Output Action
Open breaker1	Pulse OC1	Pulse OUT1
Close breaker1	Pulse CC1	Pulse OUT2
Open breaker2	Pulse OC2	Pulse OUT3
Close breaker2	Pulse CC2	Pulse OUT4
Open breaker3	Pulse OC3	Pulse OUT5
Close breaker3	Pulse CC3	Pulse OUT6
Open breaker4	Pulse OC4	Pulse OUT7
Close breaker4	Pulse CC4	Pulse OUT8

Remote bit control messages can be either set, clear, or pulse commands. You can configure the remote bit control in the SEL-2515 to operate in pair mode by adjusting the position of Control (DIP) Switch 2. When a valid Fast Operate remote bit control message is received, the SEL-2515 outputs operate as shown in *Table 4*.

Table 4 Remote Bit Operations With Switch 2 Off, Pair Mode = Off (Sheet 1 of 2)

Control Message	Output Action
Set RB1	Set OUT1
Clear RB1	Clear OUT1
Pulse RB1	Pulse OUT1
Set RB2	Set OUT2
Clear RB2	Clear OUT2
Pulse RB2	Pulse OUT2
Set RB3	Set OUT3
Clear RB3	Clear OUT3
Pulse RB3	Pulse OUT3
Set RB4	Set OUT4
Clear RB4	Clear OUT4
Pulse RB4	Pulse OUT4
Set RB5	Set OUT5

Table 4 Remote Bit Operations With Switch 2 Off, Pair Mode = Off (Sheet 2 of 2)

Control Message	Output Action
Clear RB5	Clear OUT5
Pulse RB5	Pulse OUT5
Set RB6	Set OUT6
Clear RB6	Clear OUT6
Pulse RB6	Pulse OUT6
Set RB7	Set OUT7
Clear RB7	Clear OUT7
Pulse RB7	Pulse OUT7
Set RB8	Set OUT8
Clear RB8	Clear OUT8
Pulse RB8	Pulse OUT8

NOTE: Pulse duration is controlled by Control (DIP) Switch 3 = 0, pulse 500 ms; otherwise, pulse 1000 ms.

Table 5 Remote Bit Operations With Switch 2 On, Pair Mode = On (Sheet 1 of 2)

Control Message	Output Action
Set RB1	Set OUT1
Clear RB1	None
Pulse RB1	Pulse OUT1
Set RB2	Clear OUT1
Clear RB2	None
Pulse RB2	Pulse OUT2
Set RB3	Set OUT2
Clear RB3	None
Pulse RB3	Pulse OUT3
Set RB4	Clear OUT2
Clear RB4	None
Pulse RB4	Pulse OUT4
Set RB5	Set OUT3
Clear RB5	None
Pulse RB5	Pulse OUT5
Set RB6	Clear OUT3
Clear RB6	None
Pulse RB6	Pulse OUT6
Set RB7	Set OUT4
Clear RB7	None
Pulse RB7	Pulse OUT7
Set RB8	Clear OUT4
Clear RB8	None
Pulse RB8	Pulse OUT8
Set RB9	Set OUT5
Clear RB9	None
Pulse RB9	None

Table 5 Remote Bit Operations With Switch 2 On, Pair Mode = On (Sheet 2 of 2)

Control Message	Output Action
Set RB10	Clear OUT5
Clear RB10	None
Pulse RB10	None
Set RB11	Set OUT6
Clear RB11	None
Pulse RB11	None
Set RB12	Clear OUT6
Clear RB12	None
Pulse RB12	None
Set RB13	Set OUT7
Clear RB13	None
Pulse RB13	None
Set RB14	Clear OUT7
Clear RB14	None
Pulse RB14	None
Set RB15	Set OUT8
Clear RB15	None
Pulse RB15	None
Set RB16	Clear OUT8
Clear RB16	None
Pulse RB16	None

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

CAUTION Use supply wires suitable for 9°C (16°F) above ambient.	**ATTENTION** Utilisez des fils d'alimentation appropriés pour 9 °C (16 °F) au-dessus ambiante.

Other Safety Marks (Sheet 1 of 2)

DANGER Disconnect or de-energize all external connections before opening this device. Contact with hazardous voltages and currents inside this device can cause electrical shock resulting in injury or death.	**DANGER** Débrancher tous les raccordements externes avant d'ouvrir cet appareil. Tout contact avec des tensions ou courants internes à l'appareil peut causer un choc électrique pouvant entraîner des blessures ou la mort.
DANGER Contact with instrument terminals can cause electrical shock that can result in injury or death.	**DANGER** Tout contact avec les bornes de l'appareil peut causer un choc électrique pouvant entraîner des blessures ou la mort.
WARNING Use of this equipment in a manner other than specified in this manual can impair operator safety safeguards provided by this equipment.	**AVERTISSEMENT** L'utilisation de cet appareil suivant des procédures différentes de celles indiquées dans ce manuel peut désarmer les dispositifs de protection d'opérateur normalement actifs sur cet équipement.
WARNING Have only qualified personnel service this equipment. If you are not qualified to service this equipment, you can injure yourself or others, or cause equipment damage.	**AVERTISSEMENT** Seules des personnes qualifiées peuvent travailler sur cet appareil. Si vous n'êtes pas qualifiés pour ce travail, vous pourriez vous blesser avec d'autres personnes ou endommager l'équipement.
WARNING Do not look into the fiber ports/connectors.	**AVERTISSEMENT** Ne pas regarder vers les ports ou connecteurs de fibres optiques.
WARNING Do not look into the end of an optical cable connected to an optical output.	**AVERTISSEMENT** Ne pas regarder vers l'extrémité d'un câble optique raccordé à une sortie optique.
WARNING During installation, maintenance, or testing of the optical ports, use only test equipment qualified for Class 1 laser products.	**AVERTISSEMENT** Durant l'installation, la maintenance ou le test des ports optiques, utilisez exclusivement des équipements de test homologués comme produits de type laser de Classe 1.

Other Safety Marks (Sheet 2 of 2)

⚠WARNING For UL compliance, install this product only in restricted-access locations (for example, dedicated equipment rooms, equipment closets, or similar). This directive is in accordance with Articles 110.26, 110.27, and 110.18 of the National Electrical Code, ANSI/NFPA 70 (2005).	**⚠AVERTISSEMENT** Pour être conforme aux normes "UL", installer cet équipement uniquement dans des espaces à accès limité (chambres dédiées aux équipements, cabinets pour équipements ou équivalent). Cette directive est conforme aux articles 110.26, 110.27 et 110.18 du Code National de l'Électricité, ANSI/NFPA 70 (2005).
⚠CAUTION Equipment components are sensitive to electrostatic discharge (ESD). Undetectable permanent damage can result if you do not use proper ESD procedures. Ground yourself, your work surface, and this equipment before removing any cover from this equipment. If your facility is not equipped to work with these components, contact SEL about returning this device and related SEL equipment for service.	**⚠ATTENTION** Les composants de cet équipement sont sensibles aux décharges électrostatiques (DES). Des dommages permanents non-décelables peuvent résulter de l'absence de précautions contre les DES. Raccordez-vous correctement à la terre, ainsi que la surface de travail et l'appareil avant d'en retirer un panneau. Si vous n'êtes pas équipés pour travailler avec ce type de composants, contacter SEL afin de retourner l'appareil pour un service en usine.
⚠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.	**⚠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.
⚠CAUTION Use of controls or adjustments, or performance of procedures other than those specified herein, may result in hazardous radiation exposure.	**⚠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.

Installation and Maintenance

IMPORTANT: This equipment must be used in the manner specified in this instruction manual; failure to do so might impair the protection provided by the equipment.

IMPORTANT: Do not connect power to the SEL-2515 until you have completed the installation procedures.

Follow these installation and maintenance instructions for years of reliable, trouble-free service from the SEL-2515.

Mounting

Mount the SEL-2515 in a protected environment (i.e., inside a building or in an outdoor weatherproof cabinet). Refer to *Figure 14* for mounting hole locations. Use dimension B to place mounting hole at X whenever possible. This helps prevent interference between fiber-optic cables or connectors and mounting tools.

⚠WARNING
For UL compliance, install this product only in restricted-access locations (for example, dedicated equipment rooms, equipment closets, or similar). This directive is in accordance with Articles 110.26, 110.27, and 110.18 of the National Electrical Code, ANSI/NFPA 70 (2005).

Restrict access to the module and the exposed terminal strips. This is a requirement for a UL-compliant installation.

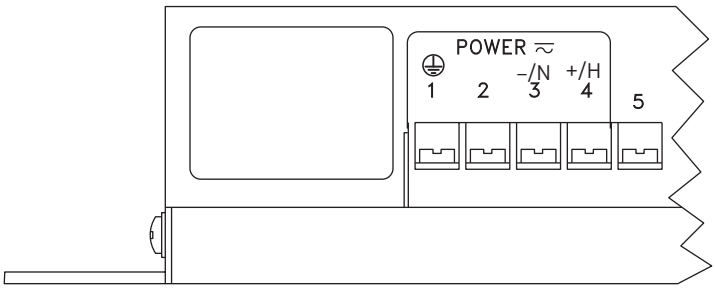


Figure 5 SEL-2515 Power and Ground Connections

Side-Panel Symbols

There are important safety symbols on the side of the SEL-2515.

Observe proper safety precautions when you connect the SEL-2515 at terminals marked by these symbols. In particular, the danger symbol located on the side 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 6 Safety Symbols

Grounding

Connect the grounding terminal (**1**) labeled ⏚ 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 ft) in length for this connection. Make the ground connection before making the power connections.

Power Connections

You can order the SEL-2515 with one of three power supply voltages listed in *Specifications*. The serial number label on the back of the device lists the power supply voltage.

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 indicated by the **+/H** (Terminal **4**) and **–/N** (Terminal **3**) symbols on the power terminals. Upon connecting power, you will see the **ENABLE** LED illuminate.

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

Place an external switch, circuit breaker, or overcurrent device in the **POWER** leads for the SEL-2515; this device must interrupt both the hot (**H**) and neutral (**N**) power leads. The circuit breaker (or an equivalent approved disconnect device appropriate for the country of installation) must comply with EN 60947-1 and EN 60947-3, and be identified 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 ft) of the relay. Operational power is internally fused. This fuse is not user replaceable. Should failure occur, return the unit to the factory for repair.

Terminal Connections

Terminate connections to the SEL-2515 screw terminals with ring-type crimp lugs. Use a #6 ring lug with a maximum width of 8.2 mm (0.325 in.). Tightening torque for the screws is 1.4 Nm (12 in-lb) maximum. Minimum wire size is 0.75 mm^2 (18 AWG) with a minimum temperature rating of 105°C (221°F).

I/O interfaces are isolated for a maximum 2500-Vpk transient rating, consistent with a maximum Overvoltage Category III environment, with a maximum working voltage of 250 Vac rms.

Cleaning

Use care when cleaning the SEL-2515. 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

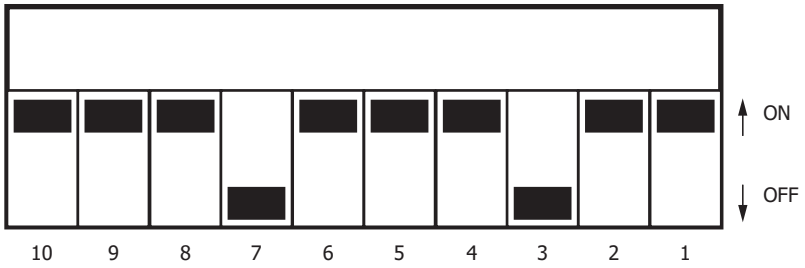
⚠CAUTION
Use of controls or adjustments, or performance of procedures other than those specified herein, may result in hazardous radiation exposure.

The SEL-2515 uses a fiber-optic transmitter. 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 (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, and 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.

Settings

The SEL-2515 uses a 10-position control (DIP) switch to set output contact pulse duration, remote bit pair mode, input contact noise filter duration, and to program the baud rate of the SEL Fast Message communications.



Switch No.	Function
1	Baud Rate Setting
2	Pair Mode Setting
3	Output Pulse Duration
4	Input Noise Filter Setting
5–10	Reserved

Figure 7 SEL-2515 Control (DIP) Switch Position Identifications

Setting the Baud Rate

Table 6 lists the settings for the two baud rate options. For applications that use fiber connections between SEL devices, use baud rate 19200. If the channel is operating intermittently, lowering the baud rate may provide more stable performance.

Table 6 Baud Rate Settings

Switch 1	Baud Rate
OFF	19200 Bps
ON	9600 Bps

Setting Remote Bit Pair Mode

Control (DIP) Switch 2 enables or disables remote bit pair mode as shown in *Table 7*. For more information on remote bit pair mode, see *Table 4* and *Table 5*.

Table 7 Remote Bit Pair Mode Settings

Switch 2	Pair Mode
OFF	OFF
ON	ON

Setting Output Contact Pulse Duration

Control (DIP) Switch 3 controls the pulse duration of the output contacts of the SEL-2515, as shown in *Table 8*.

Table 8 Pulse Duration Settings

Switch 3	Pulse Duration (ms)
OFF	500
ON	1000

Setting Input Noise Filter

Control (DIP) Switch 4 controls the input noise filter as shown in *Table 9*. The inputs must remain in an on or off state for the duration of the input noise filter setting before being reported in Fast Meter data.

Table 9 Input Filter Settings

Switch 4	Filter Time (ms)
OFF	5
ON	10

Connecting the SEL-2515 to the Communications Processor

Power the SEL Communications Processor and SEL-2515 and follow the steps in initial checkout. For this example we will use the SEL-2032.

Step 1. Connect a computer equipped with terminal emulation software to the front-panel connector Port F of the SEL-2032 by using an SEL-C234A cable or equivalent.

Step 2. Connect the end of the cable labeled SEL (DTE) to the SEL-2032 and the end labeled Computer/Terminal to a DB-9 serial port on the computer.

Step 3. Set the computer terminal emulation software to operate at the following settings:

a. 2400 bits per second (sometimes called baud)

b. 8 data bits

c. 1 stop bit

d. no parity

Step 4. Press **<Enter>** and verify that the SEL-2032 returns an asterisk (*) prompt.

Step 5. Type **ACCESS <Enter>** to change to Access Level 1.

If you have not yet changed the password, enter the factory-default password, which is **OTTER**, and press **<Enter>**. You will see a screen similar to *Figure 8*.

The password is case-sensitive. If necessary, enable **<Caps Lock>** or hold the **<Shift>** key during password entry.

```
*ACCESS<Enter>

Password: ? ******<Enter>

EXAMPLE 2032                                    Date: 10/31/02 Time: 13:45:03

Level 1
*>
```

Figure 8 ACCESS Command Screen

Collecting Data With the SEL-2515

Step 1. Connect the SEL-2515 to an SEL-2032 port; this example uses Port 2.

Use an SEL-2800 series fiber-optic transceiver and fiber-optic cables that match the fiber-optic configuration of the SEL-2515.

Step 2. Enter Access Level 2 on the SEL-2032.

a. Enter the command **2ACC <Enter>**.

b. Enter the factory-default Access Level 2 password, **TAIL**, and press **<Enter>**.

c. To begin configuring the communications port for the SEL-2515, type **SET P 2 <Enter>**.

Step 3. Respond to the SEL-2032 prompt for the type of device connected to the port.

a. Type **S** for SEL IED, **Y** to autoconfigure the port, and then press **<Enter>** to confirm the configuration prompts.

b. The SEL-2032 establishes communication with the SEL-2515; determines the type of relay, relay ID, and communication baud rate; and determines if the relay is capable of Fast Meter, Fast Operate, and Fast Messages. This process can take a few minutes depending on the baud rate.

c. To accept settings changes, type **END** and press **<Enter>** at the first setting prompt after autoconfiguration is complete.

d. Enter **Y** to save port configuration changes at the final prompt.

Step 4. Issue the **AUTO 2** command to see which Fast Message features are supported by the SEL-2515. *Figure 9* shows an example output for the **AUTO 2** command.

```
*>>AUTO 2<Enter>

FID:       FID=SEL-2515-R100-V0-Z000000-D20030122
DEVICE ID: SEL-2515
BAUD RATE: 19200
OPERATE SUPPORT: Binary (4 Breakers, 16 Remote Bits S-C-P)
COMMANDS SUPPORTED:
  B 2OMETER
  B 2OTARGET
  A 2OSTATUS

*>>
```

Figure 9 AUTO 2 Command Displays Fast Message Features

Step 5. Issue the command **SET A 2** to set an automessage to collect the SEL-2515 target data.

a. Press **<Enter>** to respond to prompts about saving unsolicited messages (**AUTOBUF**), the startup string (**STARTUP**), operate command enable (**SENDOPER**), and receive SER enable (**RECSER**).

b. Enter **1** when prompted for the message count.

c. At the ISSUE1 prompt, enter **P00:00:01** to set the message to trigger once every second.

d. At the MESG1 prompt, enter **20TARGET** to send the request for target data to the SEL relay.

e. Type **END <Enter>** to accept the default for remaining settings and **Y <Enter>** to save changes.

As soon as the SEL-2032 accepts the setting change, the TXD and RXD Port 2 LEDs on the SEL-2032 begin to flash as the SEL-2032 requests and receives target data every second.

Step 6. Verify connection, configuration, and data transfer by using the SEL-2032 commands **WHO**, **MAP**, **VIEW**, and **STATUS**.

a. Verify that the relay is connected to the desired port and configured properly by issuing the **WHO** command.

The SEL-2032 responds to this command with some basic information about the SEL-2032 and a list of the devices and device identification strings associated with each port. In this case, the list shows that an SEL-2515 is connected to Port 2.

```
*>>WHO<Enter>
                                                  Date: 11/19/02 Time: 14:56:16
FID=SEL-2032-R100-V0-Z000000-D20030115 FID=SLBT-2030-R103-V0-Z000000-D20010122

Port#  Device    Protocol   Parameters  Identification
1      Master    SEL        9600,8,2,N
2      SEL-2515  SEL        19200,8,2,N SEL-2515
3      SEL IED   SEL        9600,8,2,N
4      SEL IED   SEL        9600,8,2,N
5      SEL IED   SEL        9600,8,2,N
6      SEL IED   SEL        9600,8,2,N
7      SEL IED   SEL        9600,8,2,N
8      SEL IED   SEL        9600,8,2,N
9      SEL IED   SEL        9600,8,2,N
10     SEL IED   SEL        9600,8,2,N
11     SEL IED   SEL        9600,8,2,N
12     SEL IED   SEL        9600,8,2,N
13     SEL IED   SEL        9600,8,2,N
14     SEL IED   SEL        9600,8,2,N
15     SEL IED   SEL        9600,8,2,N
16     SEL IED   SEL        9600,8,2,N
17     SEL-2701  Ethernet   VTm:HS,CTl:HS,TIm:S,SBt:S
F*     Master    SEL        9600,8,2,N

*>>
```

Figure 10 Issue the WHO Command to Verify Relay Port Connection

The displayed response to the **WHO** command also identifies that Master port currently in use by placing an asterisk (*) next to its port number, Port F in the current example.

b. Issue the command **MAP 2** to verify the location and type of data being collected on Port 2 of the SEL-2032.

The SEL-2032 responds with a database map of the Port 2 data regions (see *Figure 11*). This map shows that target data are being collected in Port 2 region D1, which is associated with Port 2 Message 1. The B in

front of TARGET indicates that the SEL-2032 is receiving binary, or Fast Meter, data from the SEL-2515. You can refer to the specific region by the region name (D1) or the data name (TARGET).

```
*>>MAP 2<Enter>

Port 2 Database Assignments

  Region    Data Type   # Records
  GLOBAL    --
  LOCAL     --
  BUF       --
  D1      B TARGET
  D2        Unused
  D3        Unused
  D4        Unused
  D5        Unused
  D6        Unused
  D7        Unused
  D8        Unused
  A1        Unused
  A2        Unused
  A3        Unused
  USER      Unused

*>>
```

Figure 11 MAP 2 Command Verifies Data Types and Locations

c. Use the **MAP 2:TARGET BL** command to display a list of the data collected in the TARGET region. The BL option displays the bit labels of the individual Relay Word bits that have been collected and are available.

```
*>> MAP 2:TARGET BL<Enter>

Port 2,  Data Region TARGET  Map

Data Item    Starting Address   Type   Bit Labels

_YEAR        2000h              int
DAY_OF_YEAR  2001h              int
TIME(ms)     2002h              int[2]
TARGET       2004h              char[7]
             2004h              *     *     *     STSET *     *     *     *
             2005h              EN    TX    RX    ALARM COMM  *     *     *
             2006h              IN8   IN7   IN6   IN5   IN4   IN3   IN2   IN1
             2007h              OUT8  OUT7  OUT6  OUT5  OUT4  OUT3  OUT2  OUT1
             2008h              RB08  RB07  RB06  RB05  RB04  RB03  RB02  RB01
             2009h              RB16  RB15  RB14  RB13  RB12  RB11  RB10  RB09
             200Ah              OC4   OC3   OC2   OC1   CC4   CC3   CC2   CC1
*>>
```

Figure 12 MAP 2:TARGET Command Displays TARGET Region Data

d. Press the LAMP TEST pushbutton. All LEDs should illuminate. When you release the pushbutton, the LEDs should extinguish. Apply rated voltage to IN1 on the SEL-2515. The IN1 LED should illuminate.

e. Repeat *Step 6* for the remaining inputs.

f. View the data stored in the Port 2 TARGET region by issuing the command string **VIEW 2:TARGET BL**. IN1 should be 1.

g. Check the communication and data retrieval performance by issuing the **STATUS** command.

The SEL-2032 responds with SEL-2032 general information, optional equipment information, and communication performance, including a listing of ports with their respective communication status, communication success rate, and database delays.

In *Figure 13*, the SEL-2515 is connected to Port 2 of the SEL-2032, which is shown with Active status and a 100 percent communication success rate. If the relay is disconnected or turned off, the status changes to Inactive.

```
*>>STATUS<Enter>
                                                Date: 11/19/02 Time: 15:13:55
FID=SEL-2032-R100-V0-Z000000-D20030115 FID=SLBT-2030-R103-V0-Z000000-D20010122

SELF-TESTS

RAM      SRAM     CODE     ARCH     EEPROM  P.S.    SET      BATTERY  SETM
512 kb   1024 kb  OK       1792 kb  OK      OK      OK       OK       OK

IRIG-B Input: Absent
I/O Board: Absent

Port   Status           Success Rate   SET M     Database Delays
1      Active                100%      None
2      Active                100%      None
3      Inactive                        None
4      Inactive                        None
5      Inactive                        None
6      Inactive                        None
7      Inactive                        None
8      Active                          None
9      Active                          None
10     Inactive                        None
11     Inactive                        None
12     Inactive                        None
13     Inactive                        None
14     Inactive                        None
15     Inactive                        None
16     Inactive                        None
17     Normal(0h)            NORM      None
F      Active                100%      None

*>>
```

Figure 13 STATUS Command Checks Communication and Data Retrieval

Mechanical Diagram

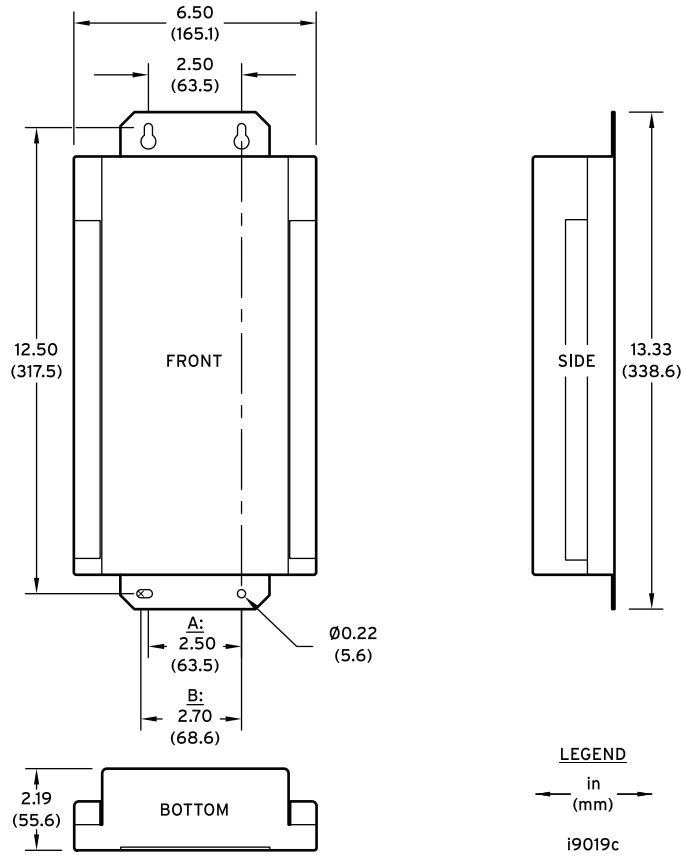


Figure 14 SEL-2515 Dimensions and Drill Diagram

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.

UL Listed to U.S. and Canadian safety standards (File E220228; NRAQ, NRAQ7)

Tightening Torque

I/O and Power Connectors: 1.0–1.4 Nm (9–12 in-lb)

Terminal Connections

Terminals or stranded copper wire. Ring terminals are recommended. Minimum temperature rating of 105°C (221°F).

Output Contacts

IEEE C37.90 Tripping Output Performance

Make:	30 A
Carry:	6 A
MOV Protection:	270 Vac rms 360 Vdc continuous

Breaking Capacity (10,000 Operations):

48 Vdc	0.5 A	L/R = 40 ms
125 Vdc	0.3 A	L/R = 40 ms
250 Vdc	0.2 A	L/R = 40 ms

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.

Power Supply

Rating

125/250 Vdc or 120/240 Vac

Range:	85–300 Vdc or 85–264 Vac (50–60 Hz)
Burden:	<7 W

48/125 Vdc or 120 Vac

Range:	36–200 Vdc or 85–140 Vac (50 Hz–60 Hz)
Burden:	<6 W

24 Vdc

Range:	16–36 Vdc, polarity-dependent
Burden:	<6.2 W
Ripple:	5%

Note: Ripple per IEC 60255-11:1979

Port Speed (Data Rate)

19200 baud
9600 baud

Fiber Optics

Ordering Options	1	2	3	6
Mode	Multi	Multi	Single	Multi
Wavelength (nm)	650	850	1300	850
Source	LED	LASER	LASER	LASER
Connector type	V-pin	ST	ST	ST
Min TX Pwr. (dBm)	–30	–10	–10	–15.5
Max TX Pwr. (dBm)*	–15	–2	3	–9
RX Sens. (dBm)	–39	–49	–50	–29
Sys. Gain (dB)	9	39	40	16
Compatible Transceiver	SEL-2800	SEL-2815	SEL-2830	SEL-2812
91560 Attenuator Required	No	<2 km	<16 km	No

* This is a failure mode rating.

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.
EN 60825-1:1994 + A1 + A2

Operating Temperature Range

–40° to +85°C (–40° to +185°F)

Humidity

0% to 95% Without Condensation

Altitude

2000 m Maximum

Pollution Degree

2

Installation Category

II

Object Penetration

IP10

Overvoltage Category

II

Unit Weight

1.36 kg (3.0 lb)

Dimensions

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

Input Contact Update Rate

2 ms

Type Tests

Environmental

Cold:	IEC 60068-2-1:1990 + A1:1993 + A2:1994 [BS EN 60068-2-1:1993 + A2:1995] Test Ad: Cold Severity Level: 16 hours at –40°C
Damp Heat Cyclic:	IEC 60068-2-30:1980 + A1:1985 [BS EN 60068-2-30:1999] Test Db and guidance: Damp heat, cyclic Severity Level: 25°C to 55°C, 6 cycles, Relative Humidity: 95%
Dry Heat:	IEC 60068-2-2:1974 + A1:1993 + A2:1994 [BS EN 60068-2-2:1993 + A1:1995] Test Bd: Dry heat Severity Level: 16 hours at + 85°C
Vibration:	IEC 60255-21-1:1988 [BS EN 60255-21-1:1996 + A1:1996] Severity Level: Class 1 Endurance, Class 2 Response IEC 60255-21-2:1988 [BS EN 60255-21-2:1996 + A1:1996] Severity Level: Class 1 - Shock withstand, Bump, and Class 2 - Shock Response IEC 60255-21-3:1993 [BS EN 60255-21-3:1995 + A1:1995] Severity Level: Class 2 (Quake Response)

Electromagnetic Compatibility

EN 50263:1999 [BS EN 50263:2000]

Electromagnetic Compatibility Emissions

EN 55011:1998 + A1:1999 + A2:2002
IEC 60255-25:2000 [BS EN 60255-25:2000]

Electromagnetic Compatibility Immunity

Conducted RF:	IEC 60255-22-6:2001 [BS EN 60255-22-6:2001] IEC 61000-4-6:2004 [BS EN 61000-4-6:1996 CDRG:2001] Severity Level: 10 Vrms
Digital Radio Telephone RF Immunity:	ENV 50204:1995
Electrostatic Discharge:	IEC 60255-22-2:1996 [BS EN 60255-22-2:1997] IEC 61000-4-2:2001 [BS EN 61000-4-2:1995 + A1:1999 + A2 IEEE C37.90.3-2001 Severity Level: 2, 4, and 8 kV contact; 4, 8 and 15 kV air
Fast Transient Burst Immunity:	IEC 60255-22-4:2002 [BS EN 60255-22-4:2002] IEC 61000-4-4:1995 + A1:2000 + A2:2001 [BS EN 61000-4-4:1995 + A1:2001 + A2:2002] Severity Level: 4 kV at 2.5 kHz and 5 kHz
Power Supply Immunity:	IEC 60255-11:1979
Radiated Radio Frequency Immunity:	IEC 60255-22-3:2000 [BS EN 60255-22-3:2001] IEC 61000-4-3:2002 [BS EN 61000-4-3:2002] IEC 61000-4-3:2002 [BS EN 61000-4-3:2002] Severity Level: 10 V/m
Surge Immunity:	IEC 60255-22-5:2002 [BS EN 60255-22-5:2002] IEC 61000-4-5:1995 + A1:2001 [BS EN 61000-4-5:1995 + A1:1996] Severity Level: 1 kV Line-to-Line, 2 kV Line-to-Earth
Surge Withstand Capability Immunity:	IEC 60255-22-1:2005 Severity Level: 2.5 kV peak common mode, 1.0 kV peak differential IEEE C37.90.1-2002 Severity Level: 2.5 kV oscillatory, 4 kV fast transient waveform

Safety

Dielectric Strength:	IEC 60255-5:2000 Severity Level: 2500 Vac on contact inputs and contact outputs IEEE C37.90-1989 Severity Level: 2500 Vac on contact inputs and contact outputs. 3100 Vdc on power supply. Type tested for 1 minute.
Impulse:	IEC 60255-5:2000 Severity Level: 0.5 Joule, 5 kV

Firmware and Manual Versions

Determining the Firmware Version in Your Device

To find the firmware version number in your SEL-2515 Remote I/O Module, use the **STA** command. The firmware revision number is after the R, and the date code is after the D. For example, the following is firmware revision number 100, date code January 16, 2003.

FID=SEL-2515-R100-V0-Z000000-D20030116

Table 1 lists the firmware versions, a description of modifications, and the instruction manual date code that corresponds to firmware versions. The most recent firmware version is listed first.

Table 1 Firmware Revision History

Firmware Part/Revision No.	Description of Firmware	Manual Date Code
SEL-2515-R101-V0-Z000000-D20060915	➤ Improved response to multiple PULSE control commands sent to the SEL-2515 at a fast rate.	20060915
SEL-2515-R100-V0-Z000000-D20030122	➤ Initial firmware release.	20030116

Determining the Manual Version

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

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

Table 2 Manual Revision History

Revision Date	Summary of Revisions
20241120	➤ Updated *Specifications*.
20240703	➤ Updated *Specifications*. ➤ Updated *Determining the Firmware Version in Your Device*.
20210810	➤ Updated *Power Supply* in *Specifications*.
20190927	➤ Updated *Specifications*.
20190916	➤ Updated *Overvoltage Category* in *Specifications*.
20170526	➤ Updated *Compliance* in *Specifications*.
20150903	➤ Updated *Compliance* in *Specifications*.
20150123	➤ Added *Safety Information*. ➤ Updated *Mechanical Diagram*. ➤ Updated *Compliance* and *Tightening Torque* information in *Specifications*.
20130329	➤ Updated *Fiber-Optic Ports* section. ➤ Updated Fiber Optic information in *Specifications*.
20120601	➤ Updated *Figure 1: SEL-2515 Functional Overview (with example product labels).*
20080116	➤ Updated *Features, Benefits, and Applications* section. ➤ Updated Fiber Optic information in *Specifications*.
20070912	➤ Updated *Figure 1: SEL-2515 Functional Overview (with example product labels).* ➤ Added *Installation* and *Maintenance* section. ➤ Changed section title from Configuring the SEL-2515 to *Settings*. ➤ Added 24 Vdc option under *Power Supply* section in *Specifications*. ➤ Updated *Specifications*.
20060915	➤ Added *Firmware and Manual Versions* history.
20040429	➤ Updated manual.
20030116	➤ Initial manual release.

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

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