SEL-2516 Remote I/O Module Instruction Manual

Features, Benefits, and Applications

The SEL-2516 Remote I/O Module has eight contact inputs and eight contact outputs. SEL Fast Messaging over the dedicated fiber-optic port communicates the status of these inputs and outputs between the SEL-2516 and an SEL communications processor. SEL Fast Operate messaging controls each of the eight Form C contact outputs. Use the transmitted contact input status for control and indication of a remote device.

- **Remote I/O** minimizes wiring and enables use of communications processor based systems instead of RTU based systems.
- **Fiber-Optic Data Link** improves safety by eliminating exposure to ground-potential rise and other dangerous voltages and reduces problems due to electromagnetic interference.
- **Rack Mount** houses a compact two-rack unit chassis.
- **Self-Testing** increases reliability of auxiliary relay functions.
- **Simple Diagnostics** consist of 21 LEDs that indicate contact input, output, channel, and device status.
- **Four Models** provide a wide range of applicable communication paths: 650 nm multimode fiber for communications paths ≤ 500 m, 850 nm multimode fiber for paths ≤ 15 km, 1300 nm single-mode fiber for paths ≤ 23 km, or 1300 nm single-mode fiber for paths ≤ 80 km.
- **User Configurable Labels** allow clear indication of system function and status.
- **Connectorized® Terminal Blocks** offer ease of service.
- **Increased Safety** is provided through fiber-optic isolation and locating all electrical connections behind the panel.

Product Overview

Figure 1 shows the functional overview of the SEL-2516.

The SEL-2516 is an excellent auxiliary relay or a simple way of expanding the number of I/O points available in an integrated system. It is superior to hard-wiring an I/O using electromechanical or static auxiliary relays, because you can monitor the performance of the communication channel. In addition, its self-testing ability ensures prompt notification of any device or communication channel problem.

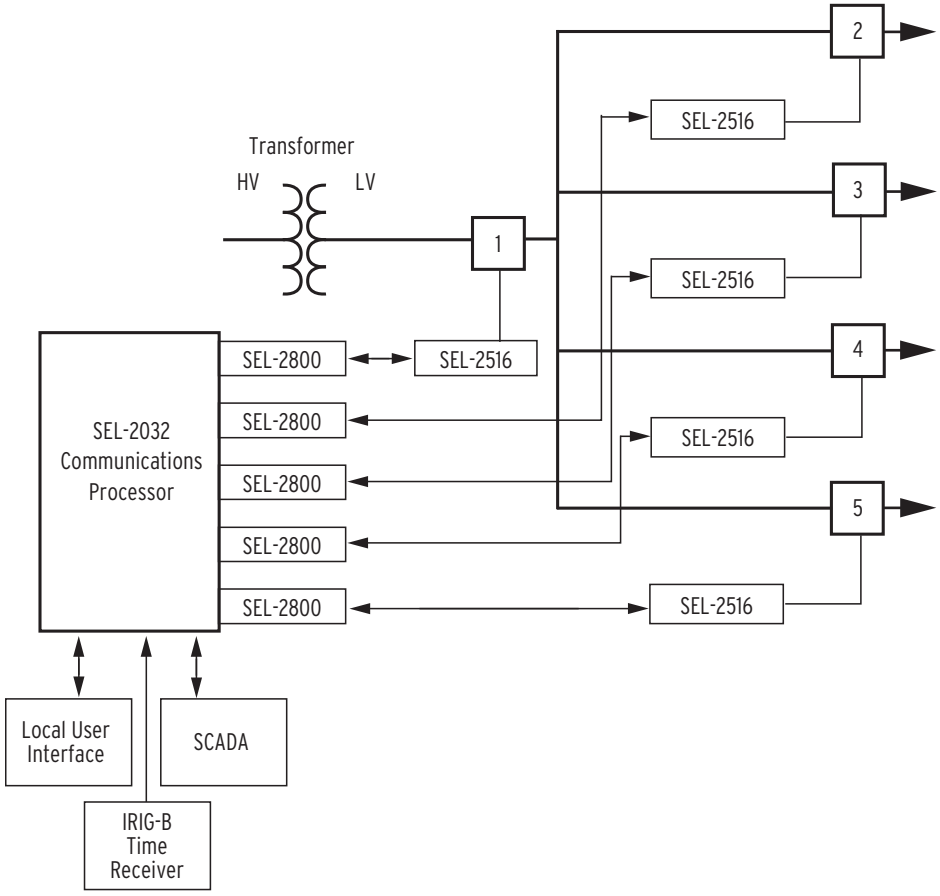

Figure 1 SEL-2516 Functional Overview

Table 1 Front-Panel LEDs

Indicator Function	Description
ENABLED	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
INPUT 1–INPUT 8	On when input is asserted
OUTPUT 1–OUTPUT 8	On when output is asserted

Applications

- 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 with Fast Message communications protocol.

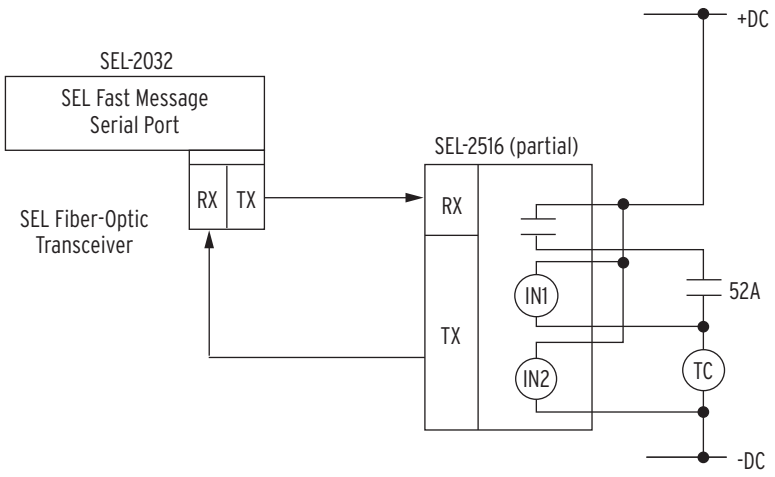

Figure 2 Reduce Wiring From Control House to Outdoor Cabinets

Example Distribution Substation I/O and Control

Figure 3 shows an SEL-2516 application using the SEL-2516 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-2516. SEL Fast Messaging communicates the status of the SEL-2516 input and outputs to the SEL-2032.

Additional examples of substation equipment monitoring are breaker and motor-operated switch statuses. The SEL-2516 contact outputs control the breakers, motor-operated switches, transformer fans, and other substation equipment. The outputs are controlled via the SEL-2032 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-2516. Unlike conventional schemes, there is no control wiring between the control house with the communications processor and the SEL-2516 located at the substation. Eliminating this wiring reduces dc ground exposure and replacing this wiring with SEL-2516 modules adds self-testing and automatic communications path checking.

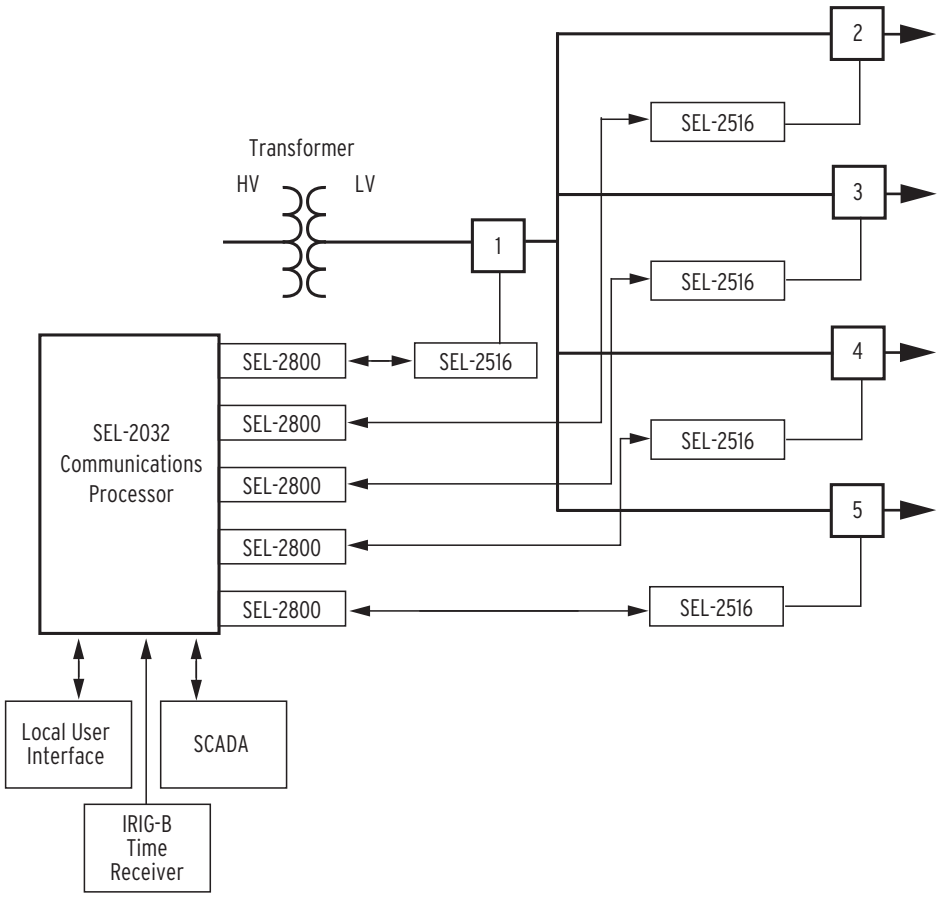

Figure 3 Distribution Application Example

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-2516. The SEL Fast Meter message from the SEL-2516 contains only binary status data. *Table 2* shows the map of binary data in the SEL Fast Meter message.

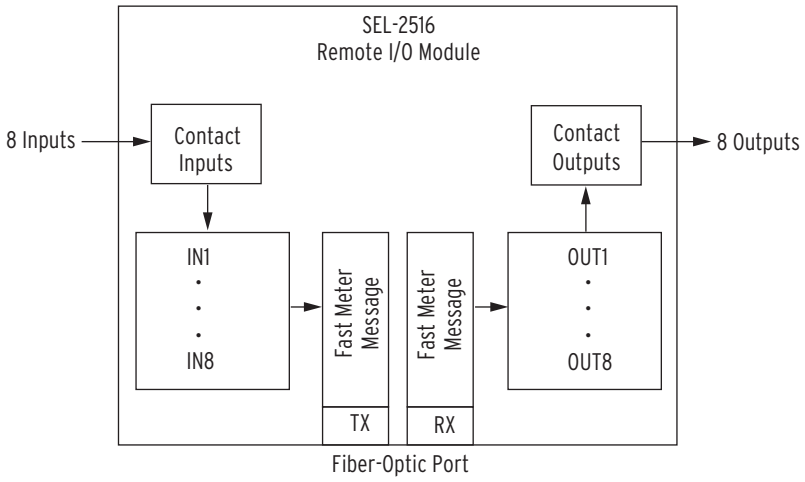

Figure 4 SEL-2516 Functional Block Diagram

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-2516 outputs using the SEL Fast Operate messages. The SEL-2516 accepts two types of control messages, remote bit control or breaker control messages.

Breaker control messages are either Open or Close commands that control SEL-2516 outputs. When the SEL-2516 receives a valid Fast Operate breaker control message, it controls its output, as shown in *Table 3*.

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

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

Remote bit control messages can be either set, clear, or pulse commands. You can configure the remote bit control in the SEL-2516 to operate in pair mode by adjusting the position of Control (DIP) Switch 2. When the SEL-2516 receives a valid Fast Operate remote bit control message, it controls its outputs, 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

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

Control Message	Output Action
Set RB5	Set OUT5
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

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

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

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

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

Control Message	Output Action
Pulse RB9	None
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

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)

Other Safety Marks (Sheet 1 of 2)

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.
DANGER Contact with this circuitry may cause electrical shock that can result in injury or death.	**DANGER** Tout contact avec ce circuit peut être la cause d'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.

Other Safety Marks (Sheet 2 of 2)

⚠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.
⚠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 Removal of enclosure panels exposes circuitry which may cause electrical shock which can result in injury or death.	**⚠ATTENTION** Le retrait des panneaux du boîtier expose le circuit qui peut causer des chocos électriques pouvant entraîner des blessures ou la mort
⚠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

⚠CAUTION
Do not connect power to the SEL-2516 until you have completed these procedures.

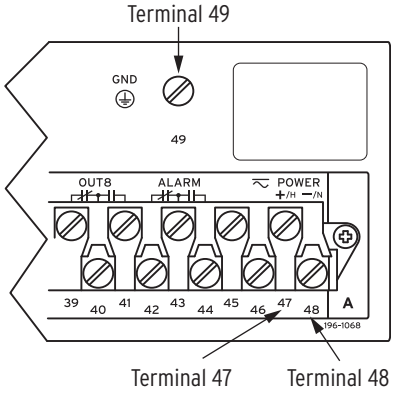

Figure 5 SEL-2516 Rear-Panel Power and Ground Connections

You can order the SEL-2516 with one of two power supply voltages listed in *Specifications on page 19*. The serial number label on the back of the device lists the power supply voltage equipped.

Rear-Panel Symbols

There are important safety symbols on the rear of the SEL-2516.

Observe proper safety precautions when you connect the SEL-2516 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 6 Rear-Panel Safety Symbols

Power Connections

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

Use 1.5 mm^2 (16 AWG) 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.

Connection to external power must comply with IEC 60947-1 and IEC 60947-3. Place an external switch, circuit breaker, or overcurrent device in the **POWER** leads for the SEL-2516; 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 not user replaceable. Should failure occur return the unit to the factory for repair.

Screw Terminal Connectors

Terminate connections to the SEL-2516 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 4 mm^2 (12 AWG) or heavier wire less than 2 m (6.6 ft) in length for this connection. The ground connection should be made before the power connections.

Cleaning

Use care when cleaning the SEL-2516. 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.

Configuring the SEL-2516

The SEL-2516 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.

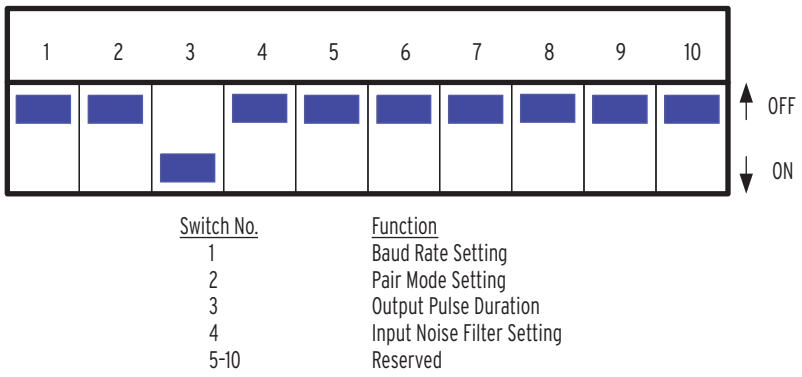

Figure 7 SEL-2516 Control Switch Position Identifications

Setting the Baud Rate

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

Table 6 Baud Rate Settings

Switch 1	Baud Rate
OFF	19200 bps
ON	9600 bps

Setting Remote Bit Pair Mode

Enable remote bit pair mode using Control (DIP) Switch 2. Remote Bit pair mode controls the output contacts via Fast Operate remote bit control messages, as described in *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

The position of Control (DIP) Switch 3 controls the pulse duration of the output contacts of the SEL-2516, as shown in *Table 8*.

Table 8 Pulse Duration Settings

Switch 3	Pulse Duration (ms)
OFF	500
ON	1000

Setting Input Noise Filter

Debounce the inputs of the SEL-2516 for 5 or 10 milliseconds using Control (DIP) Switch 4. The inputs must remain in an on or off state for the debounce period before being reported in Fast Meter data.

Table 9 Input Filter Settings

Switch 4	Filter Time (ms)
OFF	5
ON	10

Connecting the SEL-2516 to the Communications Processor

Apply power to the SEL communications processor and SEL-2516 and perform the following steps. 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 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 your computer 9-pin serial port.

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-set password, which is **OTTER**, and press **<Enter>**. You will see a screen similar to *Figure 8*.

The password is case sensitive. Either enable **<Caps Lock>**, or use 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-2516

Step 1. Connect the SEL-2516 Relay to an SEL-2032 port; this example uses Port 2.

Use an SEL-28XX fiber-optic transceiver and fiber that matches the fiber optic configuration of the SEL-2516.

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

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

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

c. To begin configuring the communications port for the SEL-2516, 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 auto-configure the port, and press **<Enter>** to confirm the configuration prompts.

b. The SEL-2032 establishes communication with the SEL-2516; 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 auto-configuration is complete.

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

Step 4. Issue the **AUTO 2** command to see what Fast Message features are supported by the SEL-2516 Relay. *Figure 9* shows an example output for the **AUTO 2** command.

```
*>>AUTO 2 <Enter>
FID:       FID=SEL-2516-R100-V0-Z000000-D20040615
DEVICE ID: SEL-2516
BAUD RATE: 19200
OPERATE SUPPORT: Binary (4 Breakers, 16 Remote Bits S-C-P)
COMMANDS SUPPORTED:
  B 20METER
  B 20TARGET
  A 20STATUS

*>>
```

Figure 9 AUTO 2 Command Displays Fast Message Features

Step 5. Issue the command **SET A 2** to set an auto-message to collect the SEL-2516 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 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-2516 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-2516  SEL        19200,8,2,N SEL-2516
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-2516. 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 bit labels, the labels of the individual Relay Word bits collected and 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-2516. 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-2516 is connected to Port 2 of the SEL-2032, which is shown with Active status and 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

Front-Panel Labels

The SEL-2516 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 14*, is included with the SEL-2516.

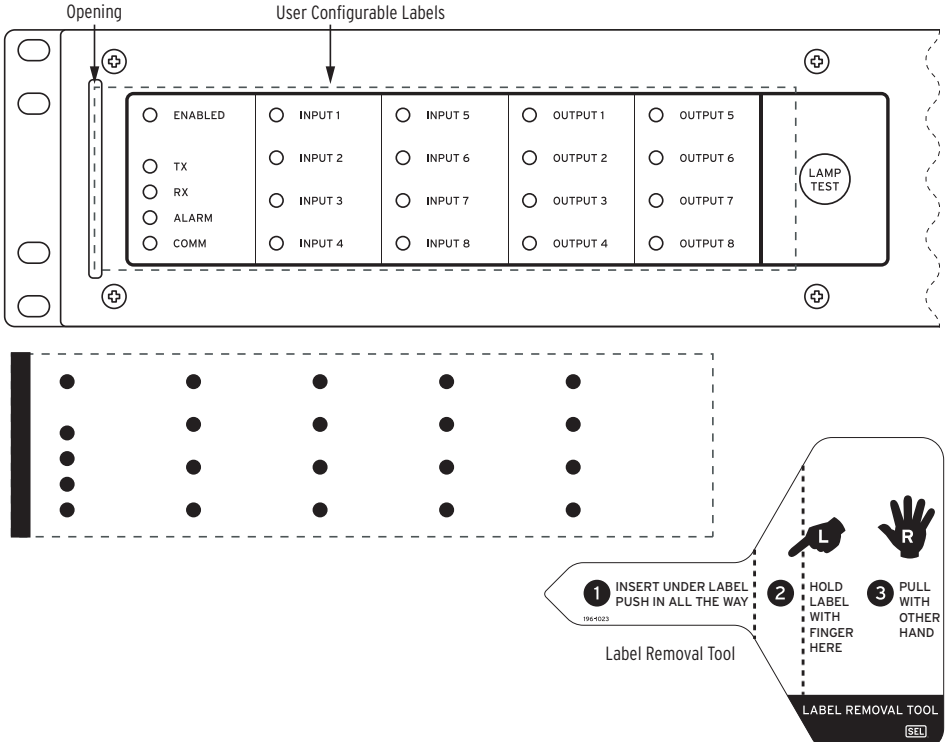

Figure 14 Blank Slide-In Label Set and Label Removal Tool

If you need additional configurable front-panel label supplies, order the labels kit or individual kit components using the part number listed in *Table 10*. Contact your Technical Service Center or the SEL factory to obtain these kits.

Table 10 Configurable Front-Panel Label Kits

Content Descriptions	Quantity
SEL-2516 Labels Kit (9260018)	One
Blank Customer Label Templates on perforated paper for laser printing	Two set–two labels for each set
Blank slide-in label sets for labeling by hand (use only a fine point permanent marker)	One
Label Removal Tool	One

Removing Configurable Front-Panel Labels

Included with the relay is the Label Removal Tool, also shown in *Figure 14*. Use this tool to remove labels from the front-panel pockets. Use the procedure in the following steps to remove a slide-in front-panel label:

Step 1. Push the existing label all the way inside the label pocket.

Step 2. Slide the tip of the tool under the label at the label pocket opening (see *Figure 14* for opening locations).

Step 3. Push the exposed edge of the label against the Label Removal Tool while pulling out the combined label and Label Removal Tool to extract the label.

For the Target LED Label, slide the Label Removal Tool from side to side to extract the label.

Changing Configurable Front-Panel Labels

There are four options for producing custom labels for the SEL-2516 front panel:

- Use factory default labels
- Use handwritten labels on factory default labels
- Use handwritten labels on blank labels
- Use laser-printed labels on perforated paper labels

Creating Laser-Printed Labels

The purpose of this procedure is to create laser-printed configurable front-panel labels on blank Customer Label Templates (supplied).

The source for label template files and test sheet files is the SEL-2516 Configurable Labels CD. In addition, you can find these files on the SEL website (visit selinc.com).

Step 1. Open Microsoft® Windows® Explorer and find the Microsoft Word label template files (2516_Horizontal.dot) in the Customer Label Template folder on the SEL-2516 Configurable Labels CD.

a. In the Word program, use the **Tools > Options > File Locations** menu to locate the **User templates** folder on your computer; note the directory path to this folder.

b. Open another Windows Explorer window and navigate to the **Templates** folder noted earlier.

c. Copy the template files from the SEL-2516 Configurable Labels CD (in the first Explorer window) to the **Templates** folder on your computer (in the second Windows Explorer window).

Mechanical Diagram

RACK-MOUNT CHASSIS

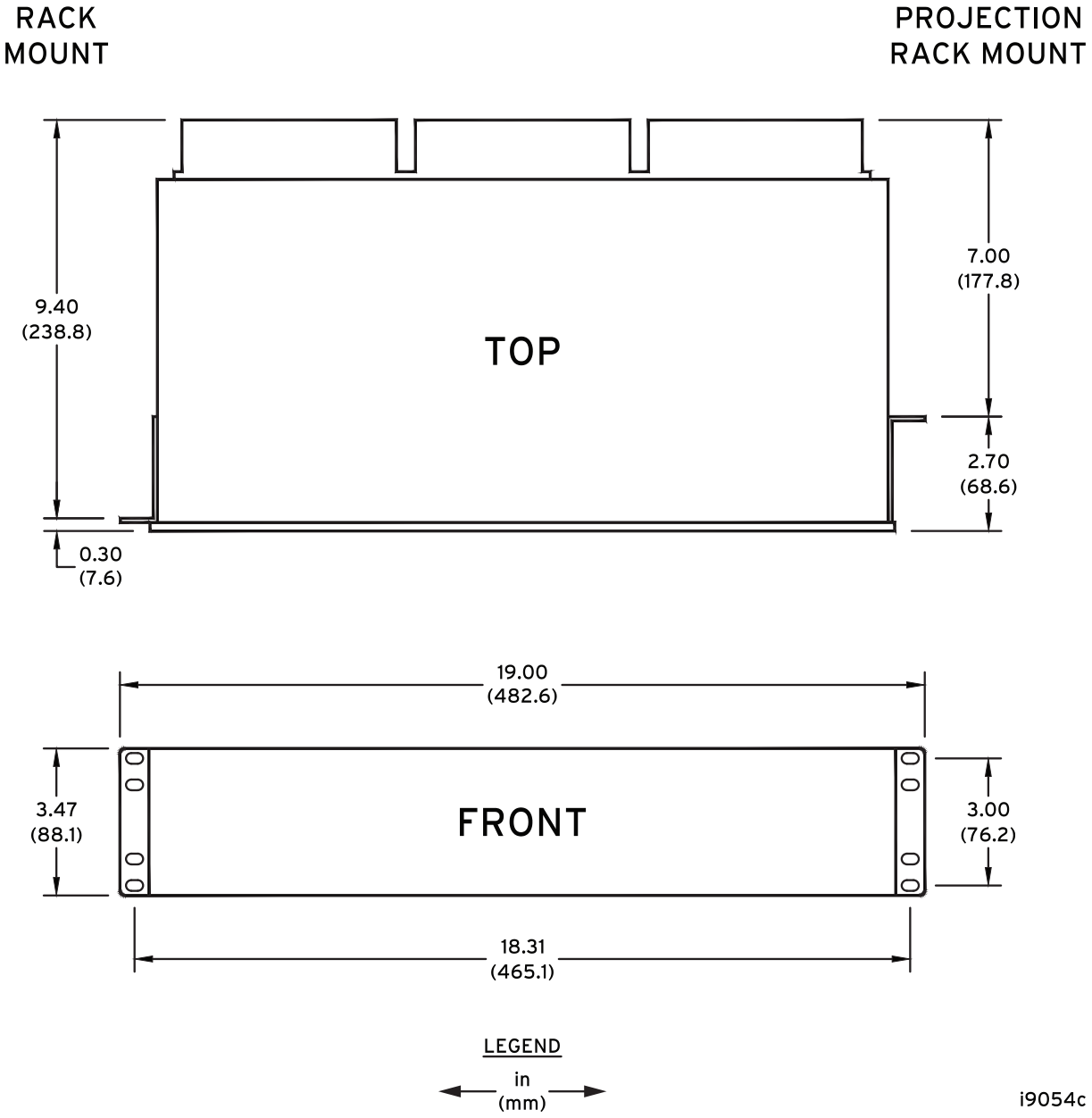

Figure 15 SEL-2516 Dimensions and Drill Diagram

Specifications

Compliance

Designed and manufactured under an ISO 9001 certified quality management system

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

Tightening Torque

I/O and Power Connectors: 1.0–2.0 Nm (9–18 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

IEEE C37.90 Tripping Output Performance

Make: 30 A

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.

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

Port Speed (Data Rate)

19200 baud
9600 baud

Fiber Optics

Ordering Options	1	2	3	4
Mode	Multi	Multi	Single	Single
Wavelength (nm)	650	820	1300	1300
Source	LED	LASER	LASER	LED
Connector type	V-pin	ST	ST	ST
Min TX Pwr. (dBm)	–30	–10	–10	–36
Max TX Pwr. (dBm)	–15	–2	3	–16
RX Sens. (dBm)	–39	–49	–50	–50
Sys. Gain (dB)	9	39	40	14
91560 Attenuator Required	No	< 2 km	< 16 km	No

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.

Operating Temperature Range

–40° to +85°C (–40° to +185°F)
Note: Not applicable to UL applications.

Humidity

0% to 95% Without Condensation

Altitude

2000 m Maximum

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)

Contact Input Update Rate

2 ms

Type Tests

Radiated and Conducted Emissions: IEC 60255-25:2000

Conducted RF Immunity: IEC 61000-4-6:2008
IEC 60255-22-6:2001

Electrostatic Discharge: IEC 61000-4-2:2008, Level 4
IEEE C37.90.3:2001
IEC 60255-22-2:2008, Level 4

Fast Transient Burst: IEC 61000-4-4:1995
IEC 60255-22-4:2002

Radio Frequency Immunity: IEC 61000-4-3:2010
IEC 60255-22-3:2007

Surge Immunity IEC 60255-22-5:2008,
Level 0.5, 1.0kV Line-to-Line
0.5 1.0, 2.0 kV Line-to-Earth
IEC 61000-4-5:2005

Surge Withstand: IEC 60255-22-1:2007
IEEE C37.90.1:2002

Environmental:	IEC 60068-2-1:2007 IEC 60068-2-2:2007
Damp Heat Cycle:	IEC 60068-2-30:2005
Vibration:	IEC 60255-21-1:1988
Endurance:	Class 1
Response:	Class 2
Shock and Bump:	IEC 60255-21-2:1988
Bump:	Class 1
Shock Withstand:	Class 1
Shock Response:	Class 2
Seismic:	IEC 60255-21-3:1993
Quake Response:	Class 2
Dielectric:	IEC 60255-5:2000, IEEE C37.90 2.5 kV rms, 1 min
Impulse:	IEC 60255-5:2000, IEEE C37.90 5 kV 0.5 J

Firmware and Manual Versions

Determining the Firmware Version in Your Device

To find the firmware version number in your SEL-2516 Remote I/O Module, use the **STA** command. The firmware revision number is after the R, and the release date is after the D. For example, the following is firmware revision number 100, release date June 9, 2004.

FID=SEL-2516-R100-V0-Z000000-D20040609

Table 11 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 11 Firmware Revision History

Firmware Identification (FID) Number	Summary of Revisions	Manual Date Code
SEL-2516-R101-V0-Z000000-D20060915	➤ Improved response to multiple **PULSE** control commands sent to the SEL-2516 at a fast rate.	20060915
SEL-2516-R100-V0-Z000000-D20040609	➤ Initial version.	20040609

Determining the Manual Version

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

Table 12 lists the instruction manual release dates and a description of modifications. The most recent product manual revisions are listed at the top.

Table 12 Manual Revision History

Revision Date	Summary of Revisions
20241120	➤ Updated *Fiber Optics* in *Specifications*.
20170526	➤ Updated *Compliance* in *Specifications*.
20150123	➤ Added *Safety Information*. ➤ Updated *Screw Terminal Connectors* information in *Installation and Maintenance*. ➤ Updated *Compliance* and *Tightening Torque* information in *Specifications*.
20140307	➤ Updated *Certifications* in *Specifications*.
20130329	➤ Updated *Fiber Optic* in *Specifications*.
20110915	➤ Updated Power Supply, Operating Temperature Range, and Type Tests in *Specifications*. ➤ Updated UL and cUL certifications in *Specifications.*
20060915	➤ Added Firmware and Manual Versions history.
20040707	➤ Updated manual.
20040609	➤ Initial version.

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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