SEL-3400 IRIG-B Distribution Module Instruction Manual

Features, Benefits, and Applications

The use of synchronized time has grown from basic Sequence of Events (SOE) and fault recorder time referencing to mission-critical roles, such as synchrophasor measurement and detailed event analysis. These new applications require that time-synchronization devices meet the same environmental standards and be as reliable as the protective relays and other high-reliability devices with which these clocks are used.

The SEL-3400 IRIG-B Distribution Module provides the following features:

- **Time Distribution.** Two demodulated IRIG-B inputs and twelve demodulated IRIG-B outputs can provide time synchronization to hundreds of devices.
- **Delay Compensation.** Compensate for long cable lengths and maintain high-level accuracy requirements for synchrophasor devices.
- **Two IRIG-B Inputs.** Source two separate time inputs and automatically select the best available source for maintaining time, or compare the two against each other to detect spoofing attacks.
- **Time Display.** LED time display makes time or date easily visible in the substation in all lighting conditions.
- **Reliable.** Apply in harsh substation environments. Exceeds IEEE and IEC 60255 protective relay standards. Reliable operation from –40° to +85°C (–40°F to +185°F). Backed by the SEL 10-year warranty and highly rated technical support.

Product Overview

Figure 1 provides a functional overview of the front and rear of the SEL-3400.

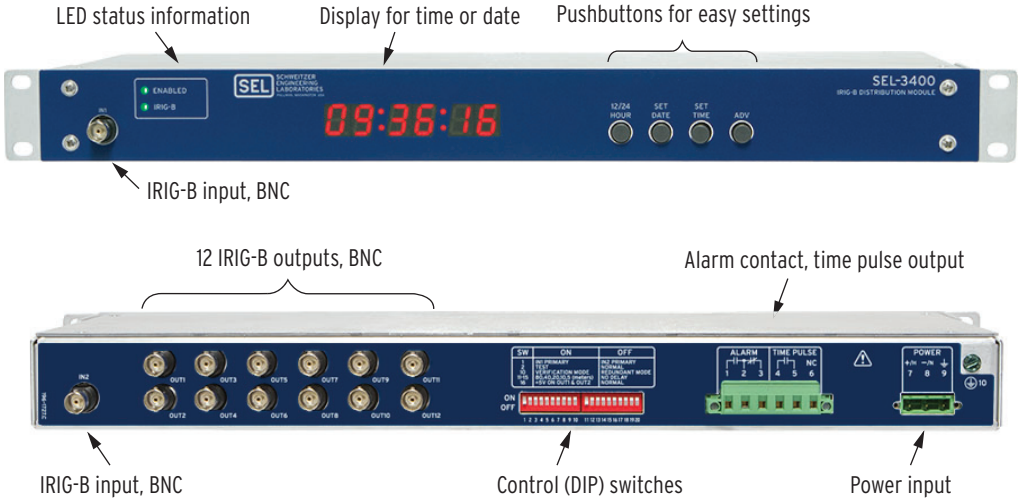

Figure 1 SEL-3400 Functional Overview

Accessories

Accessories enhance your SEL-3400 application. For a complete list of available accessories, refer to the *SEL Satellite-Synchronized Clocks Accessory Guide* at www.selinc.com.

Installation and Maintenance

Power Connections

The SEL-3400 has a wide input range power supply. The voltage ranges are listed in *Specifications on page 11*. The SEL-3400 should be installed in accordance with local electrical codes.

Use 1.5 mm^2 (16 AWG) wire (or heavier) with a minimum temperature rating of 90°C (194°F) 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 #**7**) and **–/N** (Terminal #**8**) symbols on the power terminals. Upon connecting power, you will see the **ENABLED** LED illuminate.

Disconnect Device

For installations requiring IEC compliance, place an external circuit breaker no more than 3.0 m (9.8 ft) 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 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.

Operational power is internally fused. This fuse is user replaceable. If a failure occurs, use the procedure described in *Testing and Troubleshooting on page 9*.

Rear-Panel Symbols

There are important safety symbols on the rear of the SEL-3400, as indicated in *Figure 2*.

Observe proper safety precautions when you connect the SEL-3400 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.

Limit access to terminals marked with the danger symbol.

Figure 2 Safety Symbols on the Rear of the SEL-3400

Compression Terminal Connectors

Terminate connections to the SEL-3400 compression terminal by stripping 8.0 mm (0.31 inches) of the wire insulation. Wire size minimum is 26 AWG, and wire size maximum is 16 AWG. Tightening torque for the terminal connector screws is 0.79 Nm (7 lb-in.).

Indicators

The SEL-3400 has two status indicator LEDs. *Table 1* describes these indicators that annunciate the status of the clock.

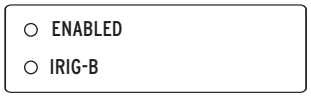

Table 1 Status Indicator LEDs—Redundant Mode

Label	LED Status	Description
ENABLED	Green	All self-tests passed
	Off	Device not enabled
IRIG-B	Green	SEL-3400 is receiving a valid IRIG-B signal with a time quality of 0–4
	Amber	SEL-3400 is receiving a valid IRIG-B signal with a time quality of >4
	Off	No valid IRIG-B input detected

Table 2 Status Indicator LEDs—Verification Mode

Label	LED Status	Description
ENABLED	Green	All self-tests passed
	Off	Device is not enabled
IRIG-B	Green	Verification has passed The two IRIG-B sources match and have a time quality of 0
	Red	Verification has failed One of the IRIG-B inputs is not present or One or both IRIG-B inputs have a time quality greater than zero or The two IRIG-B time inputs do not match
	Off	No valid IRIG-B input detected

Display

The SEL-3400 shows time information on the front-panel LEDs. The display positions are the time in HH:MM:SS format, where H is hours, M is minutes, and S is seconds. For setting the time display to local time, see *SET TIME on page 6*.

IRIG-B Input

The SEL-3400 has two IRIG-B inputs, located on the front and the back of the unit. Use Control Switch 1 to select the primary source of IRIG-B.

The SEL-3400 accepts a demodulated (also referred to as unmodulated) IRIG-B000, IRIG-B002, and IRIG-B004 input. The IRIG-B002 time-code format is binary-coded decimal (BCD) time code (HH,MM,SS,DDD); this time-code format is "regular" IRIG-B. The IRIG-B000 and IRIG-B004 time-code formats consist of BCD time code (HH,MM,SS,DDD), plus straight binary seconds (SBS) of the day (0–86400 s), and control functions that depend upon user applications. In addition, IRIG-B004 contains continuous time quality indication.

IRIG-B Output

The IRIG-B output provides demodulated IRIG-B on the twelve BNC outputs on the back of the device. If an IRIG-B000, IRIG-B002, or IRIG-B004 input is present, the IRIG-B input signal is passed to all twelve IRIG-B outputs with minimal delay (Control Switch 2 OFF). When no IRIG-B input signal is present, the SEL-3400 extinguishes the front-panel IRIG-B LED and does not transmit time. It will keep time internally and display it on the front panel.

Cleaning

Use care when cleaning the SEL-3400. Perform the following steps:

Step 1. Use a mild soap or detergent solution and a damp cloth to clean the enclosure.

Do not use abrasive materials, polishing compounds, or harsh chemical solvents (such as xylene or acetone) on any surface.

Step 2. Be careful cleaning the front and rear panels because a permanent plastic sheet covers the panel.

Settings and Commands

Settings

All settings for the SEL-3400 are performed through control (DIP) switches located on the back of the device (shown in *Figure 1*).

The switches are labeled **SW1**–**SW20** starting from the left side. The switch settings are listed in *Table 3*. Switches 17–20 are unused. The control switches are switched up for ON and down for the OFF position, as shown in *Figure 3*.

Table 3 Control (DIP) Switches and Functions

Switch	Function	
1	ON = Use **IN1** (front panel) as primary IRIG-B input source OFF = Use **IN2** (rear panel) as primary IRIG-B input source	
2	ON = "Only for testing purposes" IRIG-B outputs are driven from local clock OFF = IRIG-B outputs are driven directly from IRIG-B input signal	
3 4 5	**OUT1**, **OUT2**, **OUT3**, **OUT4** configuration: **OUT5**, **OUT6**, **OUT7**, **OUT8** configuration: **OUT9**, **OUT10**, **OUT11**, **OUT12** configuration:	ON = IRIG-B002 format OFF = IRIG-B000 format
6 7 8	**OUT1**, **OUT2**, **OUT3**, **OUT4** configuration: **OUT5**, **OUT6**, **OUT7**, **OUT8** configuration: **OUT9**, **OUT10**, **OUT11**, **OUT12** configuration:	ON = Set time quality of IRIG-B outputs to 0, locked OFF = Set time quality of IRIG-B outputs to selected IRIG-B input
9	ON = Time pulse contact pulses once every second OFF = Time pulse contact pulses once every minute	
10	ON = Verification mode—device reports failed time quality if time signals from two input sources do not match. OFF = Redundant mode—device outputs time from source with the best reported time quality	
11–15	Input and Output Cable Delay Compensation 11 ON = 80 m (262.5 ft) 12 ON = 40 m (131.2 ft) 13 ON = 20 m (65.6 ft) 14 ON = 10 m (32.8 ft) 15 ON = 5 m (16.4 ft) Note: Each Control Switch 11–15 that is turned ON will add to the total delay compensation.	
16	ON = **OUT1** and **OUT2** output 5 Vdc nominal OFF = Normal operation	

NOTE: Control Switches 3–8 are for testing purposes only. Control Switch 2 must be ON to enable use of Control Switches 3–8.

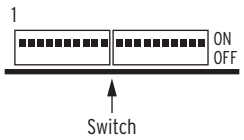

Figure 3 Control Switch ON/OFF Direction

Primary Input

Control Switch 1 selects which IRIG-B input is the primary source if both IRIG-B inputs have a time quality of zero. The purpose of Control Switch 1 is to break a tie condition when both sources have good time with "locked" time quality indication.

Set Mode of Operation

The SEL-3400 offers two IRIG-B inputs. Using Control Switch 10, these inputs can be configured in one of the two following ways:

Redundant Mode

Leaving Control Switch 10 in the down (OFF) position puts the SEL-3400 in redundant mode. In this mode, the device will output time from whichever input source has the best reported time quality. In the event that the time quality of the two sources is equal, the SEL-3400 will default to the primary input as dictated by Control Switch 1. If the primary source is no longer sending time or its time quality is worse than the secondary source for three or more seconds, the SEL-3400 will assert the alarm contact and switch to the secondary source. The SEL-3400 will only switch back to the primary source once the primary source has a time quality equal to or better than the secondary source. This offers protection against the failure or degradation of one of the two time sources.

Verification Mode

Switching Control Switch 10 to the up (ON) position puts the SEL-3400 in verification mode. In this mode, the device compares the two IRIG-B inputs and checks for abnormalities. If the two sources are reporting the same time data with a time quality of zero, the SEL-3400 will distribute IRIG-B from the primary input. If the sources are reporting different times, or if either source is absent or reports a time quality greater than zero, the device will alarm and output failed time quality.

Delay Compensation

The SEL-3400 allows a user to extend the distance and number of IRIG-B connected devices. In order to maintain accurate time to the end IRIG-B devices, the SEL-3400 can compensate for cable delays. A single time compensation adjustment will be applied for the device so using output cables of the same lengths improves accuracy. If this is not practical, and you need output cables of different lengths, use the average cable length to each end device as your cable delay compensation setting. Control Switches 11–15 allow the user to compensate for the total cable delays of up to 155 m (508.5 ft) in 5-meter (16.4-foot) increments. To make settings easier, the user sets cable delay in terms of cable length instead of trying to calculate the cable delay. The SEL-3400 compensates for 5 ns of delay for every meter of cable, corresponding with the SEL-C953 RG-58 IRIG-B distribution cable. This means the minimum compensation is 25 ns and maximum compensation is 775 ns. When any of the Control Switches 11–15 are switched ON, the SEL-3400 will add delay compensation for the specified cable length. This cable length is added as each of the control switches are switched ON. For example, if someone were using 30-meter cables to one device and 60-meter

NOTE: Users can also set cable delay compensation to account for input cables. If the input cable length is known, the output length can be overcompensated to take the input delay into account.

cables to another device (see *Figure 4*), they would set Control Switches 12 and 15 to ON to adjust for 45 m of delay (the average of the two lengths). This would account for 225 ns of delay.

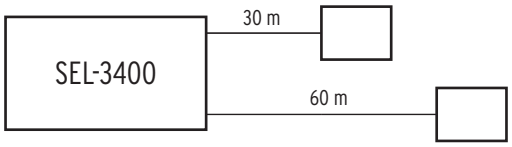

Figure 4 Cable Delay Compensation Example

12/24 HOUR

Pressing the **12/24 HOUR** pushbutton toggles the clock display between 12- and 24-hour time. For instance, if the time is 11:30:00 p.m., pressing the **12/24 HOUR** pushbutton toggles between 23:30:00 and 11:30:00.

Pressing the **12/24 HOUR** pushbutton for longer than three seconds displays the SEL-3400 Firmware ID (FID). Release the pushbutton to return to normal operation.

SET DATE

Pressing the **SET DATE** pushbutton for less than three seconds displays the present date. When displaying the date, the clock does not light the colon separators. To revert to the time display, press the **SET TIME** pushbutton.

NOTE: If a valid IRIG-B signal is present, the SEL-3400 automatically displays the IRIG-B date and overrides the battery-backed settings you enter.

Pressing the **SET DATE** pushbutton for longer than three seconds causes the SEL-3400 to enter the date-set mode. In the date-set mode, the most significant digit of the year flashes first, indicating that the value can be changed. Set the year, month, and day in order. You can change the value of the flashing LED by pressing the **ADV** pushbutton. Pressing the **SET DATE** pushbutton again sets the flashing LED and advances to the next digit. To advance past the flashing digit, press the **SET DATE** pushbutton. Continue this process until you have set the correct date. When you have set the last seven-segment LED, the SEL-3400 returns to normal operation and stores the date in the battery-backed clock.

SET TIME

Pressing the **SET TIME** pushbutton for less than three seconds causes the clock to display the present time and illuminate the colons used to separate hours/minutes and minutes/seconds.

NOTE: If a valid IRIG-B signal is present, the SEL-3400 automatically displays the IRIG-B time and overrides all battery-backed settings you enter.

Pressing the **SET TIME** pushbutton for longer than three seconds causes the SEL-3400 to enter the time-set mode. In time-set mode, the most significant digit hour LED begins to flash, indicating that you can change the value. Set the hour, minutes, and seconds in order. You can change the value of the flashing LED by pressing the **ADV** pushbutton. Pressing the **SET TIME** pushbutton again sets the flashing LED value and advances to the next digit. To advance past the flashing digit, press the **SET TIME** pushbutton. Continue this process until you have set the correct time. When you have set the last seven-segment LED, the SEL-3400 returns to normal operation and stores the time in the battery-backed clock.

ADV

While in time-set and date-set modes, pressing the **ADV** pushbutton increments the value indicated for the flashing digits. Pressing the **ADV** pushbutton for longer than three seconds when the SEL-3400 is not in a setting mode begins the LED self-test. See *Self-Test on page 9* for details.

Applications

Time-Code Distribution

The SEL-3400 has sufficient driving capacity to provide demodulated time-code signals to multiple products simultaneously.

Demodulated Time Code

Table 4 shows typical drive capabilities per demodulated BNC output for the SEL-3400 connected to other SEL equipment. The demodulated BNC outputs provide a standard IRIG-B00X DC level-shift (TTL) signal. The accuracy of this signal through the SEL-3400 is <50 ns, average. The drive capability of each output is 120 mA into 25 ohms at a nominal level of 3.5 V.
A series/parallel connection of SEL-100 and SEL-200 series products consists of two relays in series, with as many as 10 of these series pairs connected in parallel.

Table 4 Output Drive Capacity

Product	Input Impedance	Units Per SEL-3400
SEL-100 Series	Very low	Two series, 20 series/parallel[a]
SEL-200 Series	Very low	Two series, 20 series/parallel[a]
SEL-300 Series	Low	10[b]
SEL-400 Series	High[c]	20[d]
SEL-500 Series	Low	10[b]
SEL-651R	High[c]	20[d]
SEL-700 Series	High[c]	20[d]
SEL-2020, SEL-2030, SEL-2032	Low	10[b]
SEL-2240	High[c]	20[d]
SEL-2411	High[c]	20[d]
SEL-2414	High[c]	20[d]
SEL-2431	Low	10[b]
SEL-2440	High[c]	20[d]
SEL-2523, SEL-2533	High[c]	20[d]
SEL-2810MT, SEL-2812MT	High[c]	20[d]
SEL-3031	Low	10[b]
SEL-3350 Series	High[c]	20[d]
SEL-3530	High[c]	20[d]
SEL-3610, SEL-3620, SEL-3622	High[c]	20[d]
SEL-3400	High[c]	20[d]
SEL-3401 manufactured before Sept. 2011	Low	10[b]
SEL-3401 manufactured Sept. 2011 or later	High[c]	20[d]

[a] Do not add external terminating resistor.
[b] Install 50-ohm termination resistor on farthest device for four or fewer devices.
[c] High Impedance is greater than or equal to 1 kΩ.
[d] Install 50-ohm termination resistor on farthest device.

The maximum cable length is 40 m (131.2 ft). Connect multiple devices as illustrated in *Figure 5*.

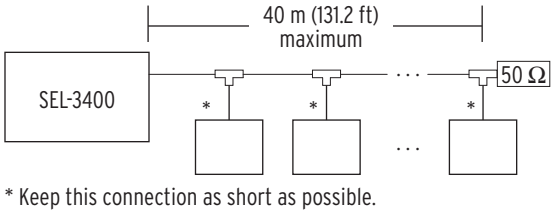

Figure 5 Multiple Device Connections

Dual-Input Sources

The SEL-3400 provides the ability to accept two separate IRIG-B time inputs (see *Figure 6*) and automatically select the best available source for maintaining time. Alternatively, the user can choose to compare the two sources against each other to detect spoofing attacks. Using two input sources for the SEL-3400 provides increased reliability for time distribution to downstream devices.

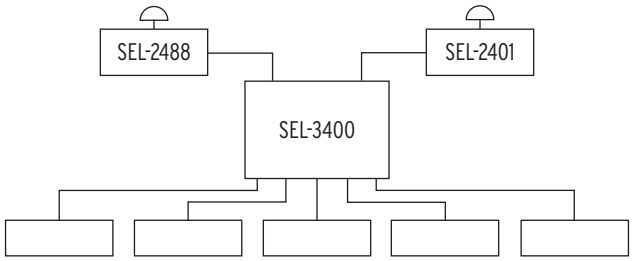

Figure 6 Using Two IRIG-B Inputs

Failover

NOTE: IRIG-B000 or IRIG-B004 format with IEEE C31.118 extensions must be used to fully enable the SEL-3400 failover feature.

Either one of the IRIG-B inputs are available to source demodulated IRIG-B formatted time to the SEL-3400. When using two input sources in redundant mode, the SEL-3400 provides failover to the best IRIG-B source available. If the primary source is either no longer sending time or the time quality is worse than the secondary source, the SEL-3400 will assert the alarm contact and switch over to the secondary source. The SEL-3400 will only switch back to the primary source once the primary source has a time quality equal to or better than the secondary source.

Verification

NOTE: Time quality and continuous time quality definitions can be found in the IEEE C37.118-2011 standard.

In verification mode, the SEL-3400 compares the two input sources and checks for discrepancies. If either source reports a time quality above zero, or if both sources are reporting a time quality of zero but the signals have a phase difference greater than 5 µs, the device will assert the alarm contact and force its time quality and continuous time quality settings to the failed condition, and the IRIG-B LED will be illuminated and in the red state.

Table 5 Verification Mode Truth Table Examples

Data Verified	IN1, IN2 TQ = 0	|IN1 - IN2| < 5 µs	Output TQ	Alarm	Source
Yes	Yes	Yes	0	No	Pri
Fail	—	—	Fail	Yes	Pri
—	> 0	—	Fail	Yes	Pri
—	—	No	Fail	Yes	Pri

Testing and Troubleshooting

Self-Test

The SEL-3400 has a display self-test that you can activate by pressing the **ADV** pushbutton for longer than three seconds. When the SEL-3400 is in display-test mode, each LED position counts from 0 to 9, illuminating the appropriate segments. After the last display test, the SEL-3400 returns to normal operation.

While the SEL-3400 is in display-test mode, pressing the **ADV** pushbutton ends the test and restores normal operation.

Battery Replacement

A battery maintains the time if the external power is lost or removed. The battery is a 3 V lithium carbon monofluoride coin cell, IEC No. BR2335 or equivalent. At room temperature (25°C), the battery will last for at least two years if there is no other power to the SEL-3400. The battery cannot be recharged.

⚠CAUTION
There is danger of explosion if the battery is incorrectly replaced. Replace only with Ray-O-Vac® no. BR2335 or equivalent recommended by manufacturer. See Owner's Manual for safety instructions. The battery used in this device may present a fire or chemical burn hazard if mistreated. Do not recharge, disassemble, heat above 100°C or incinerate. Dispose of used batteries according to the manufacturer's instructions. Keep battery out of reach of children.

To change the battery, perform the following steps:

Step 1. Remove power (and IRIG-B signal, if applied) from the SEL-3400.

Step 2. Remove the top panel by removing the five top-panel screws and the four front-panel screws.

Step 3. Locate the battery in the middle of the circuit board.

Step 4. Remove the battery from beneath its retaining clip and install a new battery, being careful not to deform the clip.

The positive side (**+**) of the battery faces up.

Step 5. Replace the top panel. Reinstall the top-panel and front-panel screws and tighten securely.

Step 6. Apply power to the SEL-3400.

Step 7. If an IRIG-B signal is not connected to the SEL-3400, use the **SET DATE** and **SET TIME** pushbuttons to set the date and time (see *Settings and Commands on page 4* for details).

Fuse Replacement

If it appears that there is no power to the SEL-3400 (for example, all display indications are off), perform the following steps:

Step 1. Verify that a supply voltage within the power supply range is present on terminals 7 and 8.

Step 2. If the correct supply voltage is present, remove power and then remove the SEL-3400 from the equipment rack.

⚠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.

Step 3. Remove the top panel by removing the five top-panel screws and the four front-panel screws.

Step 4. Replace the fuse with a BUSS S505 2 A (ceramic), Schurter T2 A 250 V, or equivalent.

Step 5. Replace the top panel and secure it with the top-panel and front-panel screws.

Step 6. Reinstall the SEL-3400.

Step 7. Apply power to the SEL-3400.

Mechanical Diagrams

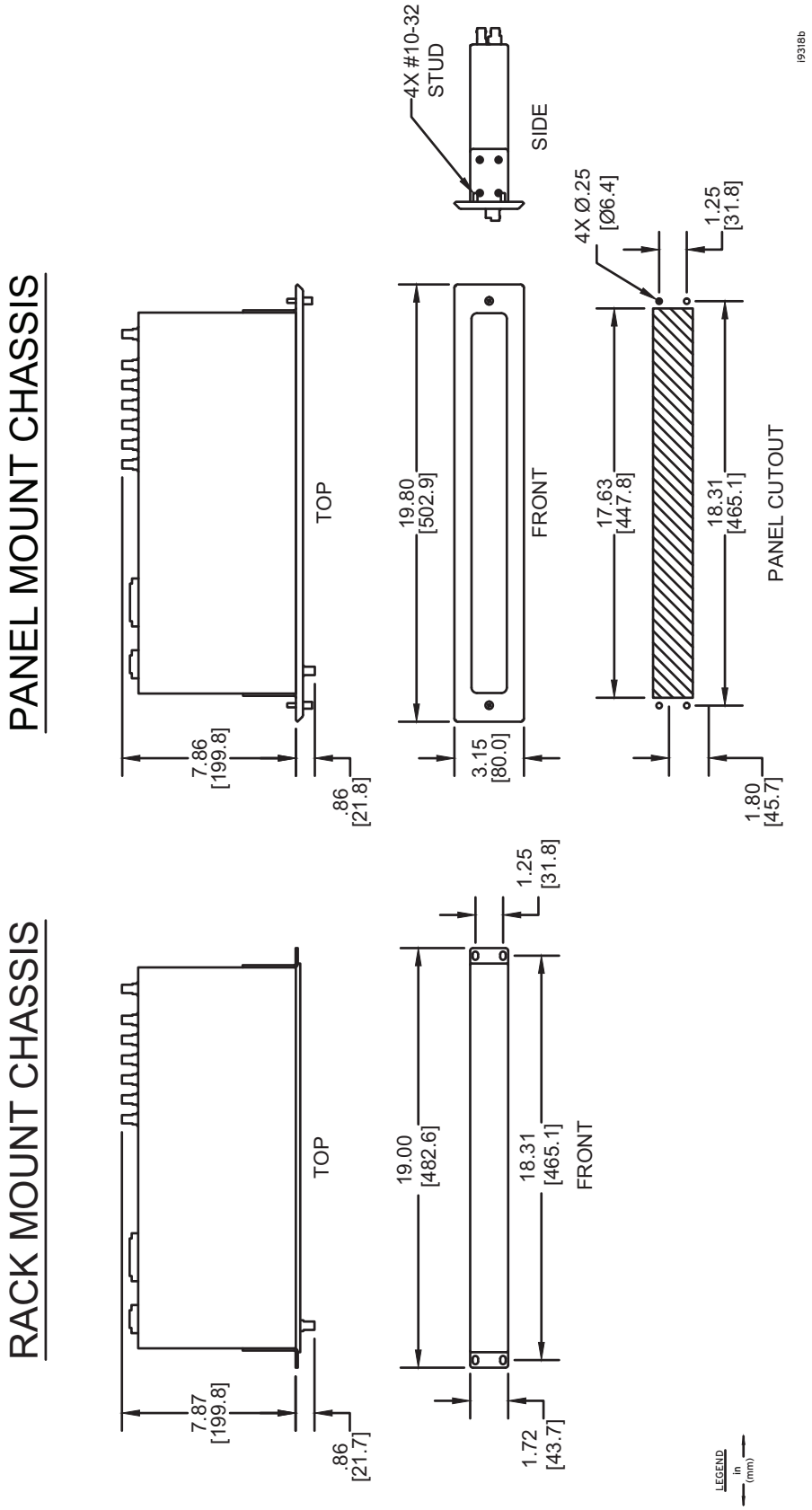

Figure 7 SEL-3400 Dimensions for Rack- and Panel-Mount Models

Specifications

Compliance

ISO 9001:2008 Certified
FCC CFR 47 Part 15, 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 may be likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. Any changes or modifications not expressly approved by the manufacturer can void the user's authority to operate the equipment.

Power Input

Rating:	24, 48, 125, 250 Vdc 120 and 230 Vac 50/60 Hz
Range:	18–300 Vdc or 75–264 Vac
Burden:	<10 W

IRIG-B Time Input

Demodulated IRIG-B000, IRIG-B002, or IRIG-B004

Input Impedance:	1.33 kΩ

IRIG-B Output Drive Level

Demodulated IRIG-B TTL:	120 mA, 3.5 Vdc, 25 ohms (5.0 Vdc nominal)
Accuracy:	<50 ns

Output Contacts

ALARM Contact

Form C Carry:	6 A
Rated Voltage:	250 Vdc or 190 Vac

Time Pulse Contact

Form A Carry:	100 mA
Rated Voltage:	250 Vdc

Internal Clock Accuracy

±15 seconds per month when power is present
±5 minutes per month when power is not present

Operating Temperature

–40° to +85°C (–40° to +185°F)

Humidity

0% to 95% without condensation

Altitude

2000 m (6600 ft) maximum

Unit Weight

1.735 kg (3.83 lb)

Dimensions

1U Rack Mount

Height:	43.7 mm (1.72 in)
Depth:	199.8 mm (7.87 in)
Width:	482.6 mm (19.00 in)

1U Panel Mount:

Height:	80.0 mm (3.15 in)
Depth:	199.8 mm (7.86 in)
Width:	502.9 mm (19.80 in)

Type Tests

Electromagnetic Compatibility Emissions

IEC 60255-25:2000
CISPR 11:2009 + A1:2010
CISPR 22:2008
Canada ICES-001 (A) / NMB-001 (A)
47 CFR Part 15.107 and 109
Severity Level: Class A

Electromagnetic Compatibility Immunity

Standard:	IEEE 1613, Class 1
Conducted RF Immunity:	IEC 60255-22-6:2001 IEC 61000-4-6:2008 Severity Level: 10 Vrms
Electrostatic Discharge Immunity:	IEC 60255-22-2:2008 IEC 61000-4-2:2008 Severity Level: 2, 4, 6, 8 kV contact; 2, 4, 8, 15 kV air IEEE C37.90.3-2001 Severity Level: 2, 4, and 8 kV contact; 4, 8, and 15 kV air
Fast Transient/Burst Immunity:	IEC 60255-22-4:2008 Severity Level: Class A: 4 kV, 5 kHz; 2 kV 5 kHz on communication ports IEC 61000-4-4:2011 Severity Level: 4 kV, 5 kHz
Magnetic Field Immunity:	IEC 61000-4-8:2009 Severity Level: 1000 A/m for 3 seconds, 100 A/m for 1 minute IEC 61000-4-9:2001 Severity Level: 1000 A/m
Power Supply Immunity:	IEC 60255-11:2008 IEC 61000-4-11:2004 IEC 61000-4-29:2000
Radiated Digital Radio Telephone RF Immunity:	ENV 50204:1995
Radiated Radio Frequency Immunity:	IEC 60255-22-3:2007 IEC 61000-4-3:2010 Severity Level: 10 V/m IEEE C37.90.2-2004 Severity Level: 35 V/m
Surge Immunity:	IEC 60255-22-5:2008 IEC 61000-4-5:2005 Severity Level: 1 kV Line to Line, 2 kV Line to Earth
Surge Withstand Capability Immunity:	IEC 60255-22-1:2007 Severity Level: 2.5 kV peak common mode, 1.0 kV peak differential mode IEEE C37.90.1: 2002 Severity Level: 2.5 kV oscillatory, 4 kV fast transient waveform

Environmental

Cold:	IEC 60068-2-1:2007 Severity Level: 16 hours at –40°C
Damp Heat, Cyclic:	IEC 60068-2-30:2005 Severity Level: 25°C to 55°C, 6 cycles, Relative Humidity: 95%

Dry Heat:	IEC 60068-2-2:2007 Severity Level: 16 hours at +85°C
Vibration:	IEC 60255-21-1:1988 Severity Level: Class 1 Endurance, Class 2 Response IEC 60255-21-2:1988 Severity Level: Class 1 – Shock withstand, Bump, and Class 2 – Shock Response IEC 60255-21-3:1993 Severity Level: Class 2 (Quake Response)

Safety

Dielectric Strength:	IEC 60255-5:2000 IEEE C37.90-2005 Severity Level: 2500 Vac on contact inputs, contact outputs, and analog inputs. 3100 Vdc on power supply. Type Tested for 1 minute
Impulse:	IEC 60255-5:2000 IEEE C37.90-2005 Severity Level: 0.5 Joule, 5 kV
IP Code:	IEC 60529: 2001 + CRGD:2003 Severity Level: IP30

Firmware

NOTE: The SEL-3400 is not field upgradeable. The unit must be returned to the factory if a firmware upgrade is required.

To find the firmware revision number in your digital clock, press and hold the **12/24 HOUR** pushbutton for longer than three seconds. The SEL-3400 displays the firmware ID (FID) on the six, 7-segment LEDs until the pushbutton is released.

The firmware revision number is after the "r".

For example:

```
r100
```

Table 1 lists the firmware versions, a description of modifications, and the product manual date codes corresponding to firmware versions. The most recent firmware version is listed first.

Table 1 Firmware Revision History

Firmware ID (FID) Number	Summary of Revisions	Manual Date Code
R102	➤ Added IRIG-B verification capabilities when using dual time-input sources.	20150218
R101	➤ Added delay compensation for long cable runs. ➤ Added IRIG-B failover capabilities when using dual time-input sources.	20140418
R100	➤ Initial version.	20130906

Instruction Manual

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

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

Table 2 Instruction Manual Revision History

Revision Date	Summary of Revisions
20210806	➤ Updated *Specifications.*
20210727	➤ Updated *Figure 7: SEL-3400 Dimensions for Rack- and Panel-Mount Models*. ➤ Updated *Specifications*.
20150218	➤ Updated *Features, Benefits, and Applications*. ➤ Updated *Figure 1: SEL-3400 Functional Overview.* ➤ Added *Table 2: Status Indicator LEDs—Verification Mode*. ➤ Updated *Table 3: Control (DIP) Switches and Functions*. ➤ Updated *Table 4: Output Drive Capacity.* ➤ Updated *Settings and Commands*. ➤ Updated *Applications*. ➤ Updated *Specifications*.
20140418	➤ Added delay compensation information. ➤ Added IRIG-B failover information.
20130906	➤ 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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Fax: +1.509.332.7990
Internet: www.selinc.com
Email: info@selinc.com

Notes

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

⚠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.

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

⚠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.

⚠CAUTION
There is danger of explosion if the battery is incorrectly replaced. Replace only with Ray-O-Vac® no. BR2335 or equivalent recommended by manufacturer. See Owner's Manual for safety instructions. The battery used in this device may present a fire or chemical burn hazard if mistreated. Do not recharge, disassemble, heat above 100°C or incinerate. Dispose of used batteries according to the manufacturer's instructions. Keep battery out of reach of children.

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

⚠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.

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

⚠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.

⚠ATTENTION
Une pile remplacée incorrectement pose des risques d'explosion. Remplacez seulement avec un Ray-O-Vac® no BR2335 ou un produit équivalent recommandé par le fabricant. Voir le guide d'utilisateur pour les instructions de sécurité. La pile utilisée dans cet appareil peut présenter un risque d'incendie ou de brûlure chimique si vous en faites mauvais usage. Ne pas recharger, démonter, chauffer à plus de 100°C ou incinérer. Éliminez les vieilles piles suivant les instructions du fabricant. Gardez la pile hors de la portée des enfants.

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