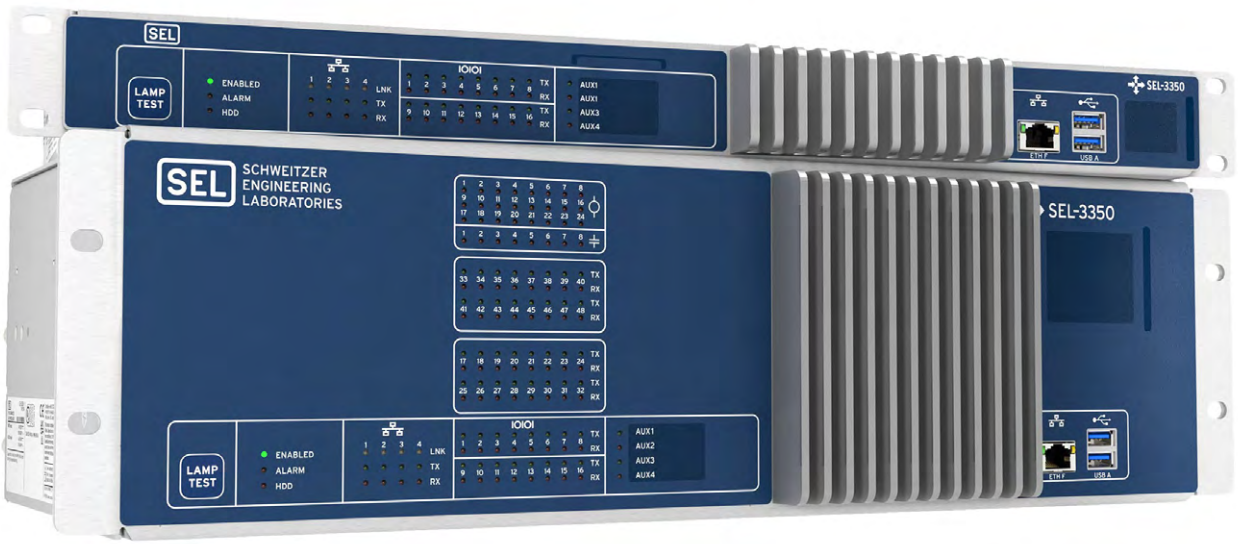
SEL-3350-1 Automation Controller

Powerful and Flexible Industrial Automation and Computing Platform

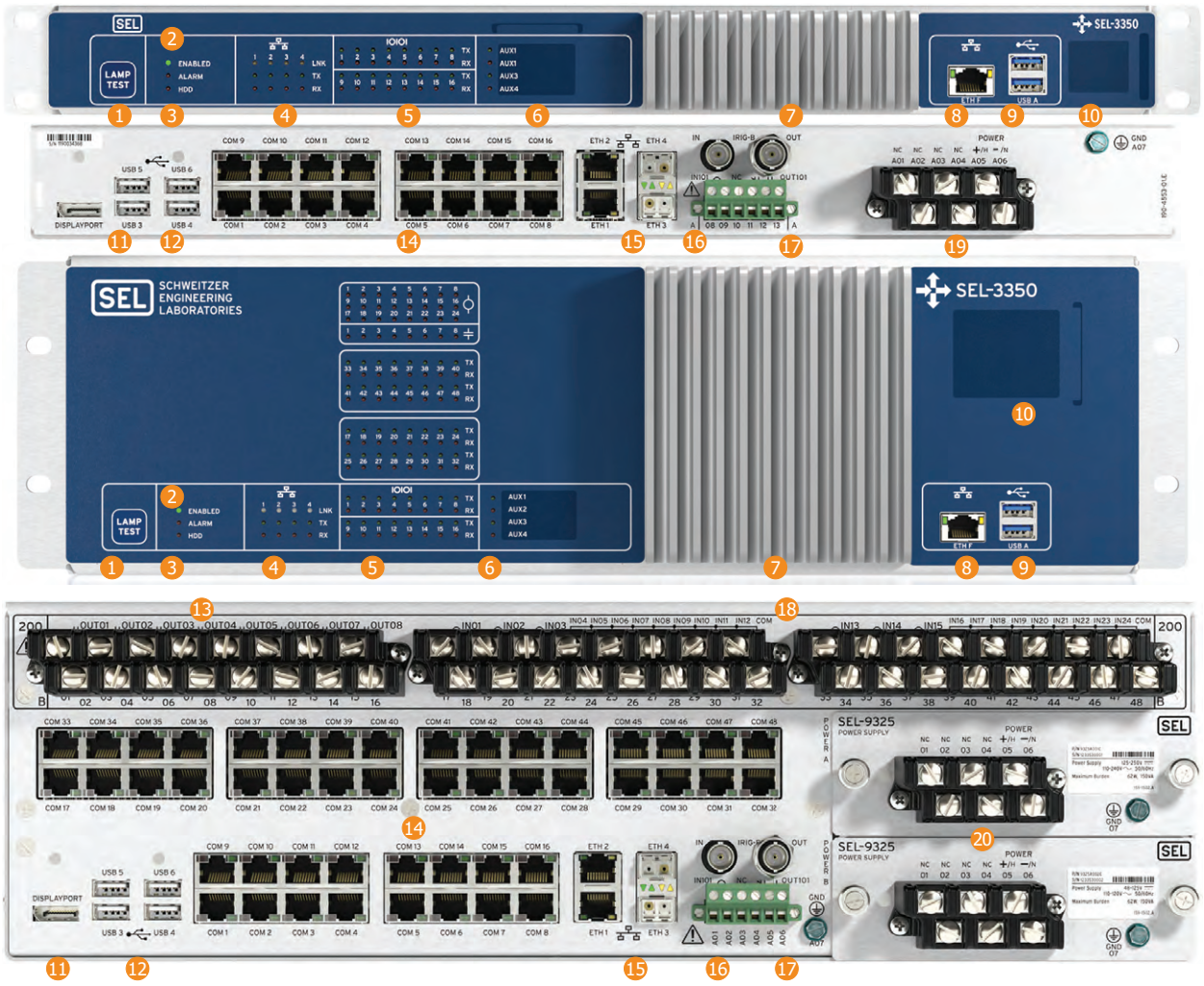


Key Features and Benefits

The SEL-3350 provides a powerful and flexible platform that you can configure as a Real-Time Automation Controller (RTAC), a Blueframe application platform, or a Microsoft Windows- or Linux-based solution. The rugged hardware of the SEL-3350 enables you to deploy fully customized automation and computing solutions into industrial environments that are not suitable for general purpose computers.

- **Flexible.** Run SEL RTAC, SEL Blueframe, Windows, or Linux operating systems—a single platform for all your control and automation needs.
- **SEL Worldwide, Ten-Year Product Warranty.** Have confidence in your solution and know that SEL will support you through the life of the product.
- **Full Industrial Temperature Range.** With a wide –40 to +85°C (–40 to +185°F) operating temperature range, the SEL-3350 will run your applications in harsh environmental conditions.
- **Extensive Communications.** Sixteen to forty-eight serial ports; configurable I/O interfaces for alarms, control, or measurements; and five Ethernet ports with copper and fiber configurations provide you with a variety of interfaces for your communications needs.
- **Maximum Value.** With its Intel Atom quad-core processor and dense communication interfaces, the SEL-3350 delivers substantially higher performance and capabilities than a comparably equipped SEL-3530 RTAC at a similar price.
- **Computing Capabilities.** Use the internal 2.5" SATA SSDs for reliable, long-term storage of event logs and operational data. Connect the DisplayPort and USB interfaces to high-resolution displays, touchscreens, or other human interface devices for local monitoring and control applications.

Product Overview



1 LED lamp test button
2 Alarm and Device Enabled LED indicators
3 Hard disk drive activity LED
4 Ethernet port link status and activity LEDs
5 Serial port and Contact I/O activity LEDs
6 Four programmable bicolor LEDs
7 Front heat sink
8 Front Gigabit Ethernet port
9 Two front-panel USB 3.1 ports
10 Device Slide-in Label area
11 DisplayPort monitor connection
12 Four USB 2.0 ports
13 8 Form A contact outputs
14 16 or 48 built-in RJ45 EIA-232/422/485 serial ports
15 Four Gigabit Ethernet ports with the following configuration options:
- 4 RJ45 copper ports
- 4 small form-factor pluggable (SFP) fiber-optic ports
- 2 RJ45 and 2 SFP ports

16 Software-configurable digital/analog input
17 Form C alarm contact output
18 24 Software-configurable digital inputs
19 Built-in power supply connections
20 Power supply modules

Features

The SEL-3350 is a rugged, easy-to-use automation controller designed for substation, industrial, or other harsh environments. The following features are included in the system:

x86-64 Architecture. The Intel Atom microprocessor architecture delivers high performance and broad operating system and software compatibility. Four processor cores and 8 GB of RAM enable running multiple time-critical applications simultaneously.

Operating System Choices. You can purchase the SEL-3350 with or without one of the optional operating systems, like SEL RTAC, SEL Blueframe, or Microsoft Windows, to add flexibility, functionality, and security.

Form Factor. The 19-inch rack-mount chassis is designed for substation and industrial control applications. The system includes I/O connections for linking to networks, peripherals, storage, video, alarm, and serial I/O—all with protection against electrical shock and surge.

Power Supply. A wide range of ac/dc power supplies provide compatibility with a variety of power sources. The 1U chassis has a single built-in power supply, while the 3U chassis supports two replaceable power supply modules for redundant power sources.

Mass Storage. The SEL-3350 contains two 2.5-inch SATA drive slots that support field-servicing. High-performance, industrial-rated, solid-state drives (SSD) are available as ordering options.

Display Interface. A single DisplayPort interface enables connecting to as many as three independent high-definition displays simultaneously via DisplayPort Multi-Stream Transport (MST). Digital audio can be streamed through the DisplayPort interface for simple integration and high-definition surround-sound.

USB Connectivity. Front- and rear-panel USB ports provide connections to keyboards, mice, and many other USB peripherals. Each port has a current-limiting function to protect the system from external short circuits while still supporting high-power USB devices.

Ethernet. Five Ethernet ports provide high-speed network connectivity through five independent Ethernet controllers, enabling connections to independent networks or redundant paired network connections. The front Ethernet port provides quick and secure engineering access without connecting to the local network. Select from RJ45 copper and small form-factor pluggable (SFP) fiber-optic interfaces for the rear ports.

Serial I/O. With 16 EIA-232/422/485 serial ports standard and optional expansion to 48 ports (3U chassis only), the SEL-3350 can communicate with many electronic devices, such as automation controllers, protective relays, communications radios, and modems. Each port provides IRIG-B time distribution to the connected devices.

IRIG-B Input/Output. Synchronize the system time to a satellite clock by using the high-precision IRIG-B input. Distribute IRIG-B to downstream devices by using the IRIG-B output and serial ports.

Contact Inputs. The SEL-3350 includes one universal contact input (IN101) and supports an optional contact I/O board (3U chassis only) that provides 24 additional contact inputs. These configurable, wide-range inputs can be used to monitor status changes in switches and contact outputs. The universal contact input can also be used to measure actual voltage for applications, like battery monitoring.

Contact Outputs. The SEL-3350 includes one Form C contact output (OUT101) and supports an optional contact I/O board (3U chassis only) that provides eight additional Form A contact outputs. The OUT101 output is normally controlled by the SEL-3350 system alarm to notify external devices when the SEL-3350 is experiencing abnormal operating conditions. Reconfigure the OUT101 contact to control it with automation logic.

Watchdog. If a system lockup is detected, the watchdog can trigger a system reboot in order to attempt to return to a normal operating state.

Remote Management. The SEL-3350 supports remote access over Ethernet.

Models and Options

Models

The SEL-3350 is available in both a slim 1U form factor and a 3U form factor, which provides additional I/O capabilities. This datasheet provides an overview of the SEL-3350 model options. You can find the latest options and features at selinc.com.

Options

The SEL-3350 has the following options and features:

- Operating System—Order with no operating system or choose one of the following options:
  - SEL Real-Time Automation Controller (RTAC)
  - SEL Blueframe with optional SEL applications
  - Microsoft Windows with optional software applications
- Conformal Coating
  - Conformally coated circuit boards
- Chassis and Mounting
  - Horizontal 1U 19 in rack
  - Horizontal 3U 19 in rack
  - Horizontal 1U panel
  - Horizontal 3U panel
- Power Supply
  - 24–48 Vdc
  - 48–125 Vdc or 110–120 Vac
  - 125–250 Vdc or 120–240 Vac
  - Dual, hot-swappable power supplies (optional, 3U chassis only)
- Rear Ethernet Port Configurations
  - 4 RJ45 copper ports (10/100/1000 Mbps)
  - 4 SFP fiber-optic ports (supports 100 and 1000 Mbps modules)
  - 2 RJ45 copper ports and 2 SFP fiber-optic ports
  - Optional SFP fiber-optic modules
- SATA Drives—Select as many as two SATA drives
  - Industrial-grade single-level cell (SLC) drives: 32 to 256 GB, 10-year warranty
  - Industrial-grade multi-level cell (pSLC) drives: 120 to 480 GB, 5-year warranty
  - Industrial-grade 3D triple-level cell (3D TLC) drives: 240 to 7680 GB, 5-year warranty
  - Consumer-grade multi-level cell (MLC) drives: 240 GB to 1920 GB, 3-year warranty, reduced operating temperature rating
- Software
  - Software applications from SEL and third parties
  - Available options depend on operating system choice
- Serial Ports
  - 16 EIA-232/422/485 RJ45 ports (standard)
  - 48 EIA-232/422/485 RJ45 ports (optional, 3U chassis only)
- Contact I/O
  - 1 universal input and 1 alarm/contact output (standard)
  - 1 universal input and 1 alarm/contact output plus 24 input/8 output expansion board (optional, 3U chassis only)

Applications

The SEL-3350 is an extremely versatile and powerful automation controller that may be used for many applications. You can customize the SEL-3350 with factory-installed options and/or third-party software to meet the requirements of your application. Several of the most popular applications are listed in *Table 1* and shown later in this section.

Table 1 Popular Applications (Sheet 1 of 2)

Application	Description
Intelligent Port switch	Connects a single serial port to multiple serial ports.
Network Gateway	Connects a single network port to multiple serial ports.
Protocol Gateway	Connects multiple systems that use different protocols.
Time-Synchronization Source	Selects the best time from different sources and provides either or both IRIG-B and Network Time Protocol (NTP) outputs to connected devices.

Table 1 Popular Applications (Sheet 2 of 2)

Application	Description
Synchrophasor Processor	Connects phasor measurement unit (PMU) data to other devices and processes through protocol conversion.
SCADA Data Concentrator (Remote Terminal Unit (RTU)/Programmable Logic Controller (PLC))	Monitors digital and analog inputs to transmit to a central location with standard SCADA protocols.
Security Gateway	Provides firewall protection to incoming Ethernet communication as well as encryption for individual Ethernet sessions.
Logic Processor (Automation)	Monitors digital and analog inputs to transmit to a central location. It also performs IEC 61131-3 logic.

Intelligent Port Switch

The flexible communications parameters of the SEL RTAC operating system available on the SEL-3350 make it a great choice for almost any port switching application. Although RTAC multitasking/multiuser and data handling capabilities make the SEL-3350 a very powerful remote automation controller, it is still an economical choice for port switching applications. The time-synchronization capabilities of the SEL-3350 add to its value in this application. An example of this application is shown in *Figure 1*.

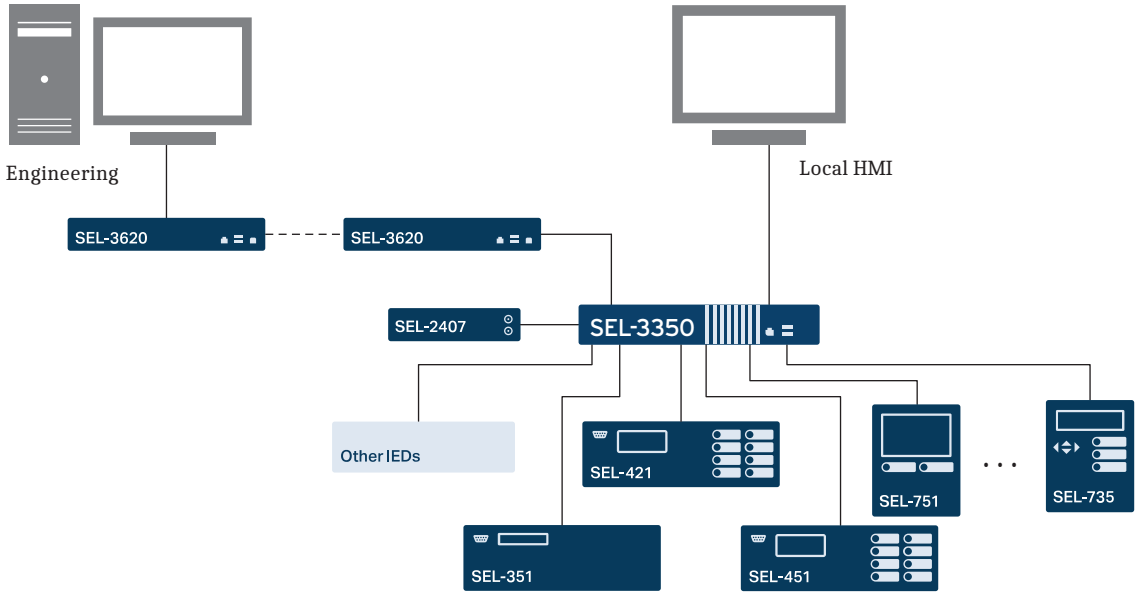


Figure 1 Engineering Communication Through a Serial Access Point

Network Gateway

The SEL-3350 comes standard with four rear Ethernet ports that you can configure to make serial-connected devices available to high-speed networks. The optional SEL RTAC operating system supports virtual terminal connections through the Ethernet ports. For example, you can establish secure Telnet sessions and communicate with an intelligent electronic device (IED) through an SEL-3350 with the SEL RTAC operating system. An example of this application is shown in *Figure 2*.

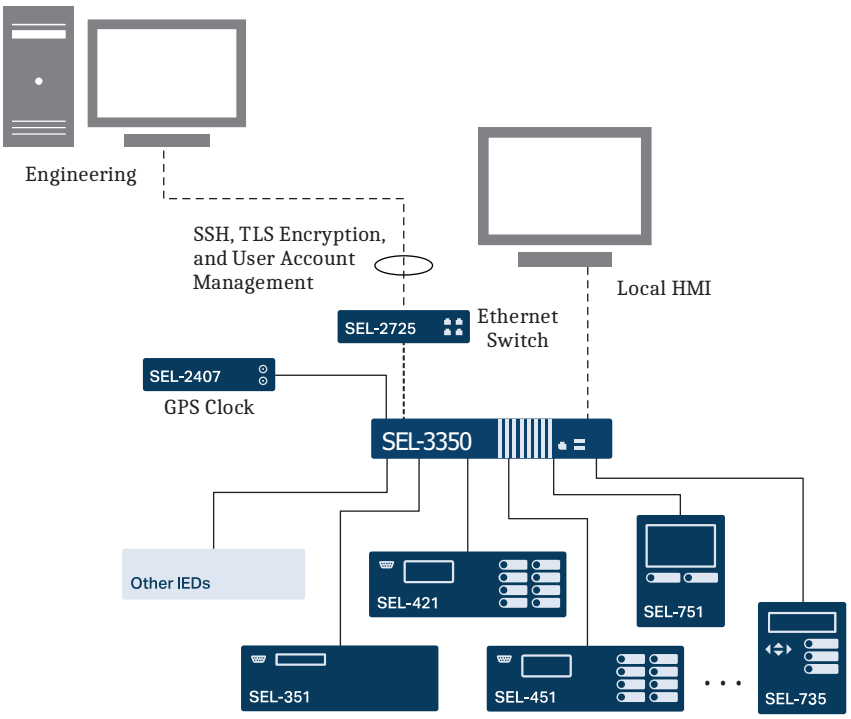


Figure 2 Engineering Communication Through a Network Access Point

Protocol Gateway

Collect downstream data with client protocols and send these data to your upstream HMI, RTU, or SCADA master with server protocols, converting the data from one protocol to another in the process. The SEL-3350 is great for data concentration when combined with the optional SEL RTAC operating system that provides multitasking/multiuser and data handling capabilities. An example of this application is shown in *Figure 3*.

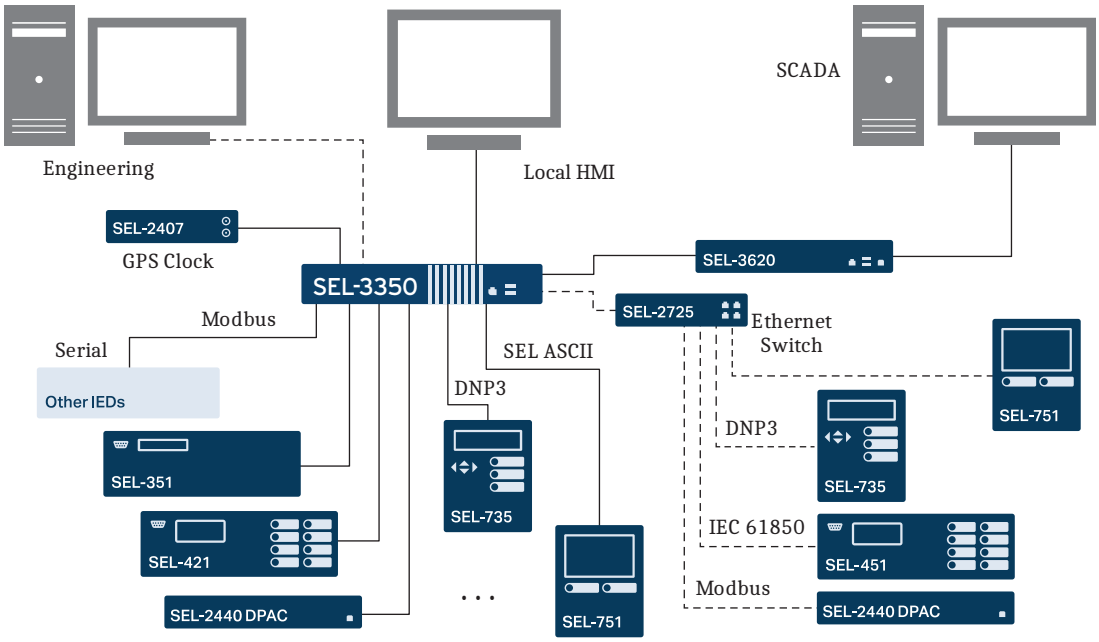


Figure 3 Protocol Conversion

Time-Synchronization Source

Synchronize the time clocks in attached devices that accept a demodulated IRIG-B time signal. The demodulated IRIG-B signal is regenerated in the SEL-3350 from an external modulated or demodulated source, such as a GPS satellite clock receiver or other serial or Ethernet communications. If an external clock source is not available, the SEL-3350 generates an IRIG-B signal from its internal clock, allowing device synchronization to a common clock for improved sequence-of-events analysis. An example of this application is shown in *Figure 4*. The system time may also be set on the SEL-3350 from a Simple Network Time Protocol (SNTP) source, a Network Time Protocol (NTP) source, or a Precision Time Protocol (PTP) source.

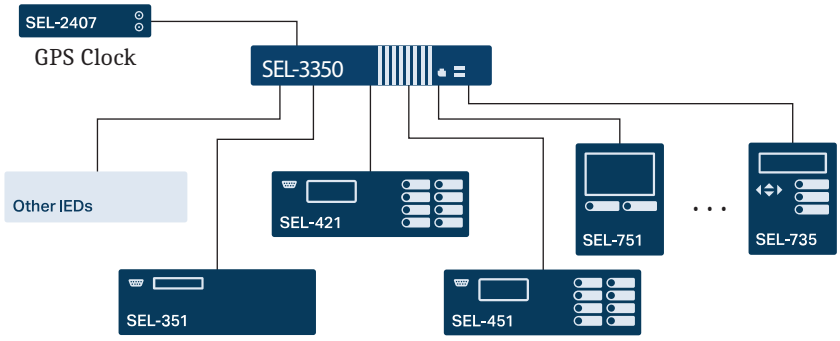


Figure 4 Distribute Time With Serial Communications Cable

Synchrophasor Processor

Move synchrophasor data to SCADA operations centers by using standard protocols, such as DNP3. Include time stamps and time quality in the SCADA message to allow for system-wide use of synchrophasor data. With the logic engine in the optional SEL RTAC operating system, you can perform complex math and logic calculations on synchrophasor data collected from SEL relays and other IEEE C37.118-compliant devices. An example of this application is shown in *Figure 5*.

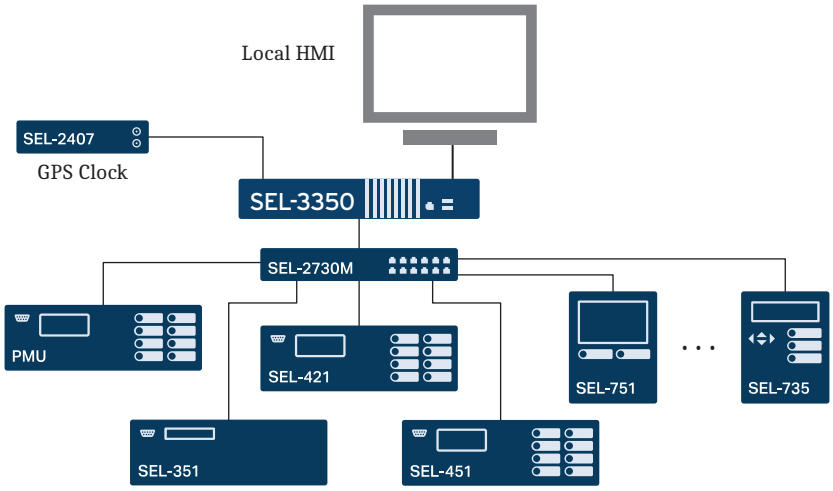


Figure 5 System Control and Synchrophasor Data Concentration

SCADA Data Concentrator

Use the SEL-3350 with your protective relays and other IEDs as the substation SCADA data concentrator (RTU/PLC). You can configure the SEL-3350 with SEL RTAC operating system to collect and view station-wide sequential events recorder (SER) records and event reports. Retrieve asset optimization data from SEL IEDs or other IEDs to maintain system reliability. Access the remote SEL-3350 through the Ethernet connection to manage users, view diagnostics, and access logs. Establish a remote connection with any IED connected to the SEL-3350 through engineering access communications channels. Use the SEL Fast Message protocol to maintain SCADA control and metering updates throughout the engineering access connection. Remotely manage protection and control settings in connected relays by using SEL-5037 Grid Configurator Software. An example of this application is shown in *Figure 6*.

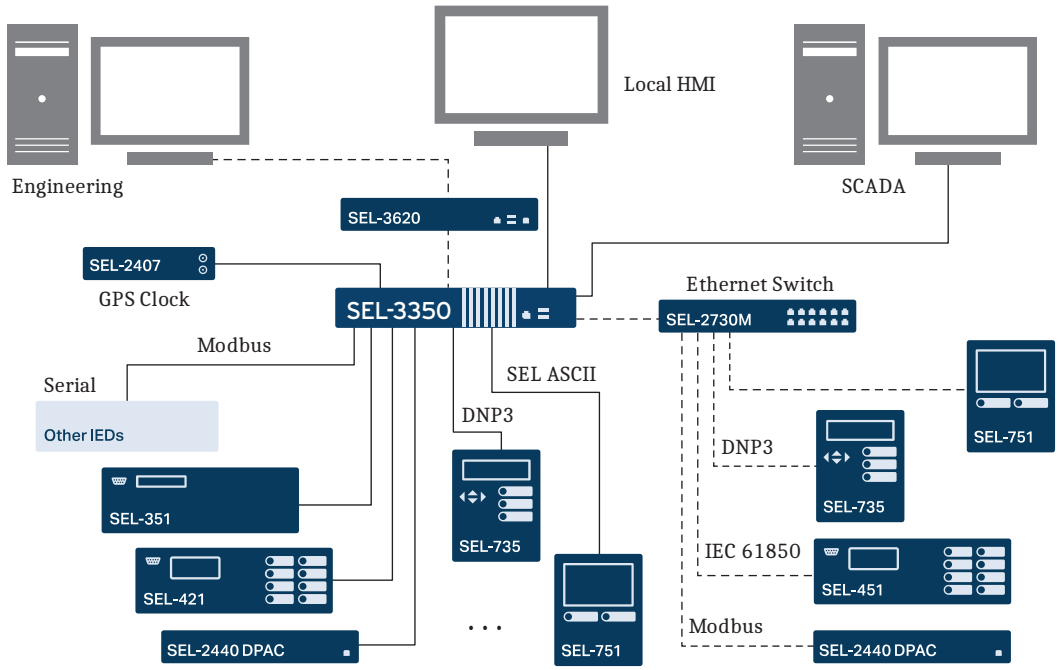


Figure 6 SCADA Communication Through a Single Access Point

Security Gateway

Combine the SEL-3350 with a secure operating system like the SEL RTAC operating system and third-party application software that can provide secure engineering access and other Ethernet tunneled serial communications on the automation network with SSL/TLS or SSH encryption. Implement system security auditing, logging, and password restrictions to enforce NERC standards. Comply with role-based requirements by implementing per-user security profiles. Optionally incorporate serial and wireless encrypting devices to further secure communication to any device. An example of this application is shown in *Figure 7*.

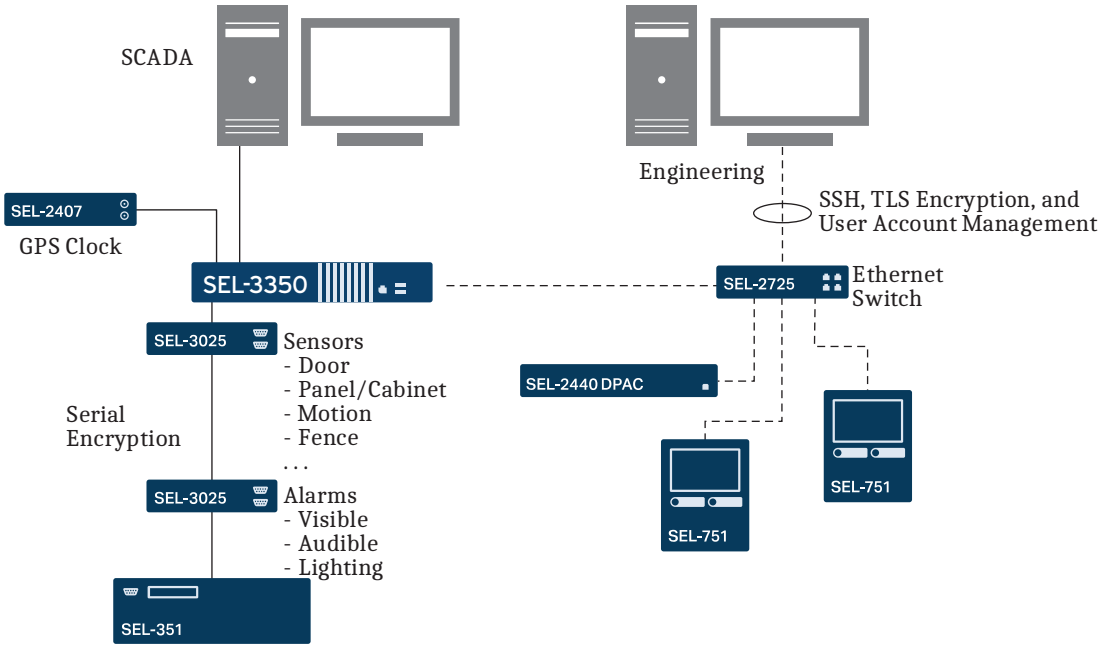


Figure 7 Security Through a Single Access Point

Logic Processor (Automation)

Combine the SEL-3350 with the powerful logic engine of the SEL RTAC operating system to automate existing installations with modern IEC 61131 applications. Ensure compatibility with any SEL device through the MIRRORED BITS protocol. Take advantage of multiprotocol support to collect SCADA information, process control commands, and SNTP/NTP time synchronization through a single communications link to each Ethernet device. Scale values and calculate logic in a familiar IEC 61131 configuration environment. The SEL RTAC operating system provides secure, encrypted communication to any device on the substation network or serial channel. An example of this application is shown in *Figure 8*.

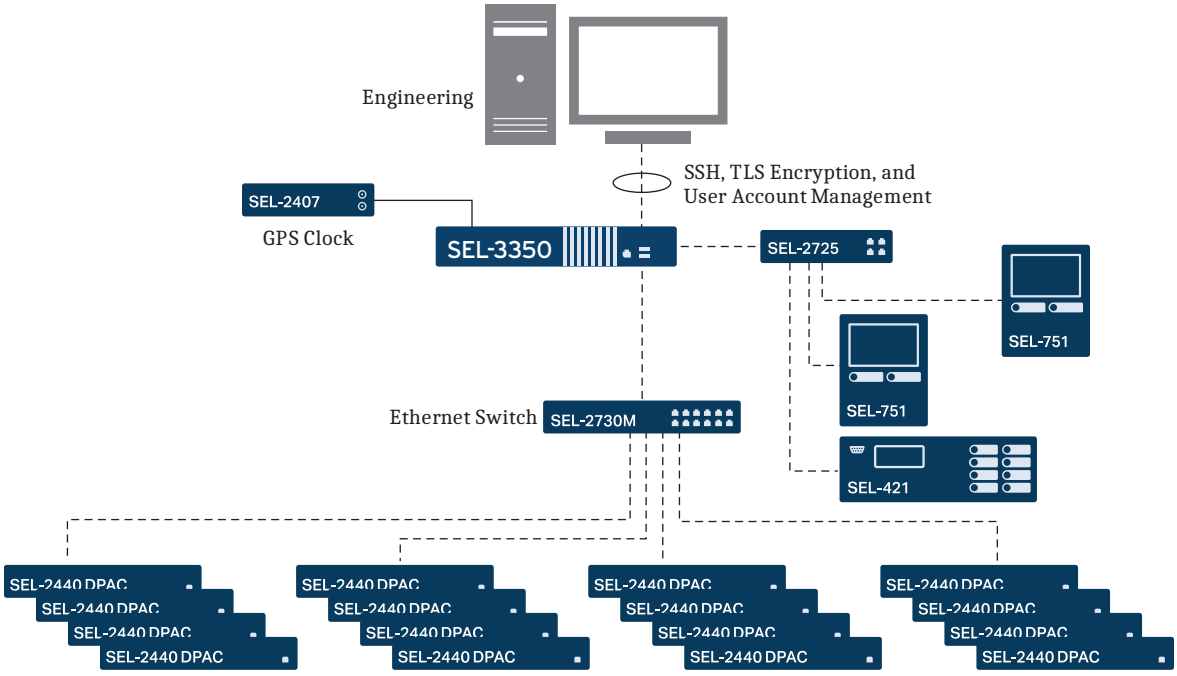


Figure 8 Automate and Integrate With Communication and Logic

Diagrams and Dimensions

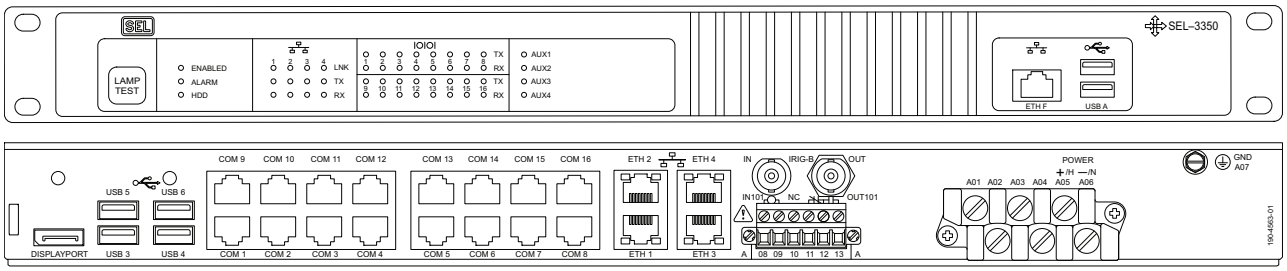


Figure 9 SEL-3350 1U Diagrams

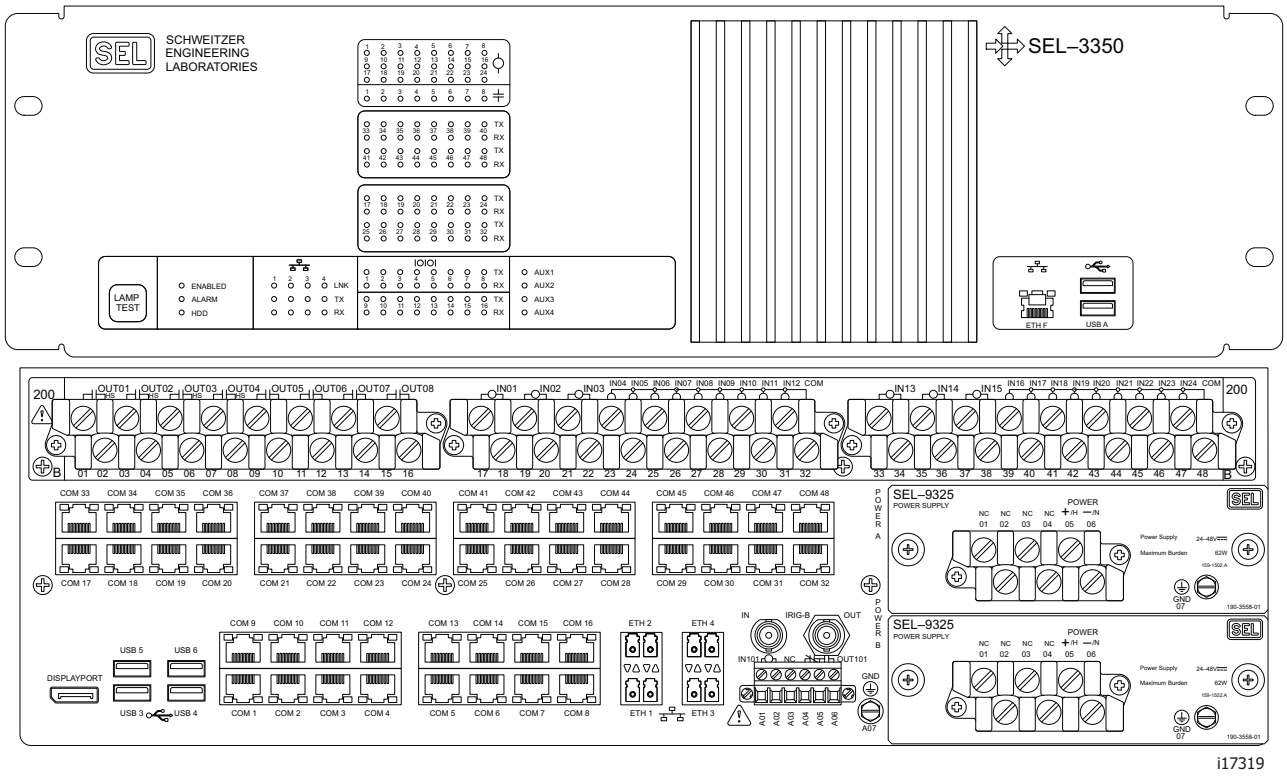


Figure 10 SEL-3350 3U Diagrams

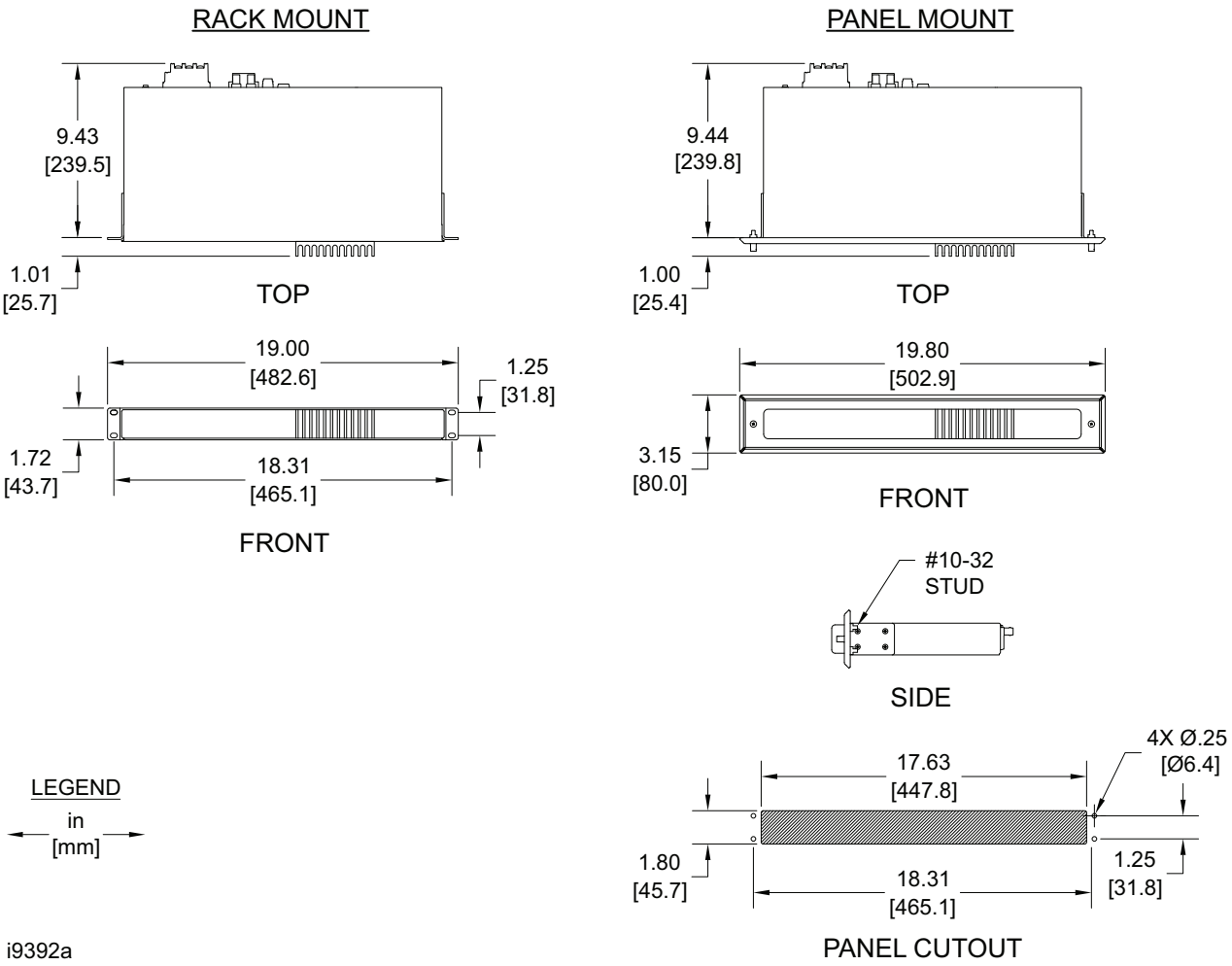


Figure 11 SEL-3350 Dimensions for 1U Rack- and Panel-Mount Models

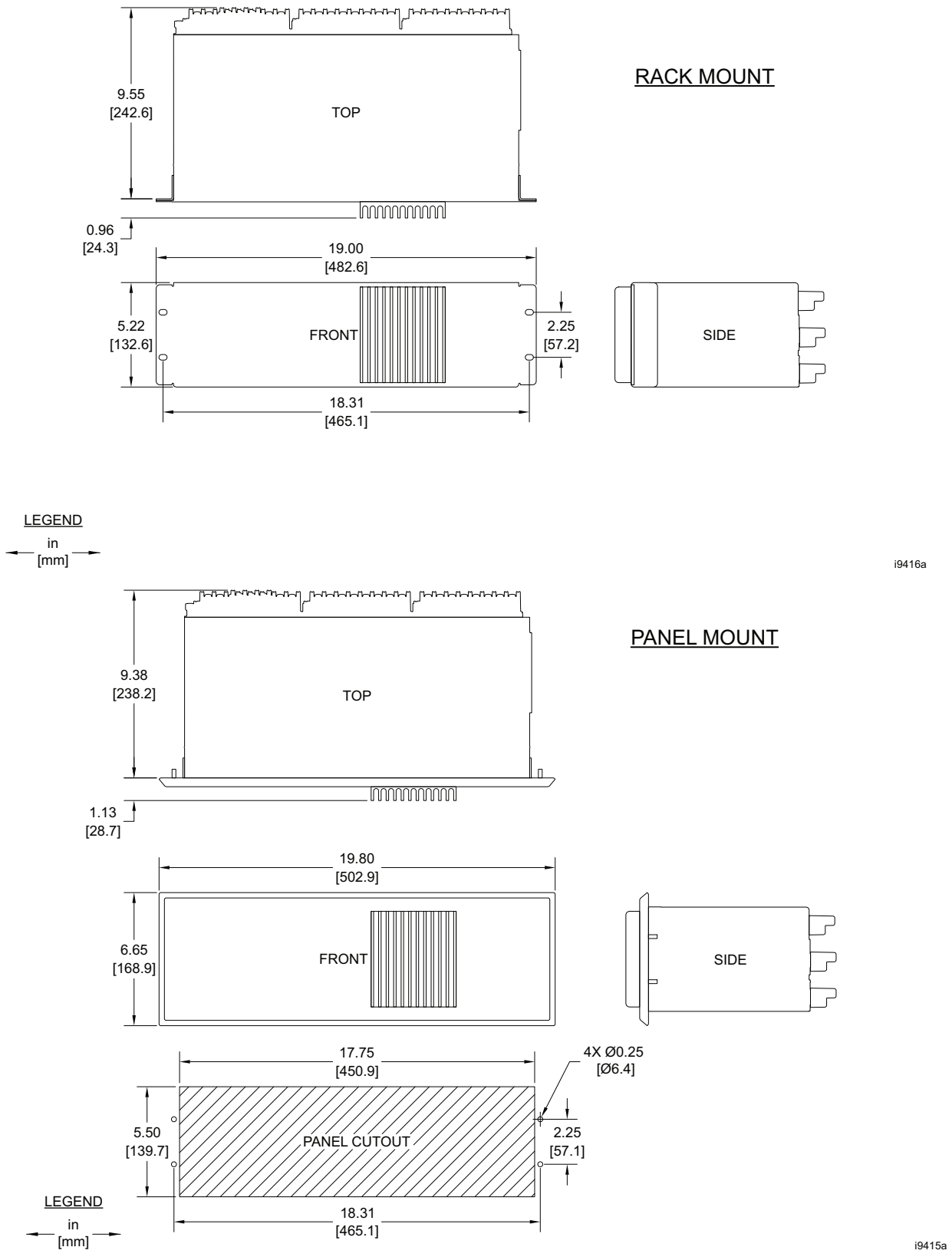


Figure 12 SEL-3350 Dimensions for 3U Rack- and Panel-Mount Model

Specifications

Compliance

Designed and manufactured under an ISO 9001 certified quality management system

47 CFR 15B Class A

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 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)

CE Mark

UKCA Mark

RCM Mark

RoHS Compliant

General

SEL Operating Systems

SEL Real-Time Automation Controller (RTAC)
SEL Blueframe

Supported Third-Party Operating Systems

Microsoft Windows 10*
Microsoft Windows Server 2019/2022/2025
Red Hat Enterprise Linux** 7/8/9
AlmaLinux** 8/9/10
Ubuntu Linux** 16.04/18.04/20.04/22.04/24.04/26.04 LTS
OpenSUSE: 15/16
SUSE Enterprise Linux: 15/16
* Factory-installed option
** Derivatives with same kernel versions also supported

CPU

Intel Atom x5-E3940

Cores/Threads:	4/4
Frequency:	1.6 GHz
Cache:	2 MB L2

RAM

8 GB ECC DDR3L-1600 (PC3-12800)

Mass Storage

Supports two 2.5 inch SATA Drives
SATA III 6.0 Gbps

Optional SATA Drives: Industrial-Grade SLC SSD, 32–256 GB, 10-year warranty
Industrial-Grade pSLC SSD, 120–480 GB, 5-year warranty
Industrial-Grade 3D TLC SSD, 240–7680 GB, 5-year warranty
Consumer-Grade MLC SSD, 240–1920 GB, 3-year warranty

BIOS

AMI UEFI

Real-Time Clock/Calendar

Battery Type:	IEC No. BR-2330A Lithium
Battery Life:	10 years with power 2 years without power
Drift:	200 ppm

Trusted Platform Module

Infineon SLM 9670AQ TPM 2.0

Network Time Protocol (NTP) Modes

NTP Client:	As many as three configurable servers

NTP Server

Simple Network Time Protocol (SNTP) Accuracy

±1 ms:	This does not take into account external factors such as network switches and topologies.

Precise Time Protocol (PTP)

PTP Client:	Peer delay request and end-to-end path delay supported

Operating Environment

Operating Temperature Range:	–40° to +85°C (–40° to +185°F)*

* Requires Industrial-Grade SSDs. See SEL Application Note, "Determining Solid-State Drive (SSD) Lifetimes for SEL Computing Platforms" (AN2016-03).

Note: UL maximum ambient 40°C. See the instruction manual safety information for additional restrictions.

Storage Temperature Range:	–40° to +85°C (–40° to +185°F)
Relative Humidity:	5%–95% noncondensing
Insulation Class:	1
Pollution Degree:	2

Overvoltage Category:

Category	Maximum Altitude	Atmospheric Pressure
Category II	5,000 m	54–110 kPa

Weight

1U Chassis:	2.72 kg (6 lb) maximum
3U Chassis:	7.26 kg (16 lb) maximum

Peripheral Connections

Video and Audio

Intel HD Graphics 500 Controller

DisplayPort 1.2 output

Up to three displays via DisplayPort MST

Intel Display Audio digital audio output

Maximum resolution*: 4096 x 2160 @ 60 Hz, one display
1920 x 1200 @ 60 Hz, three displays

Cable length <7.5 m for Surge Immunity compliance

*High-resolution displays require high-quality cables. Ensure your display cables are as short as possible and rated for the required screen resolution.

USB

2 front-panel ports, USB 3.2 Gen 1 (SuperSpeed USB 5 Gbps)
4 rear-panel ports, USB 2.0 (High-Speed USB 480 Mbps)
1 internal Type-A port, USB 2.0 (High-Speed USB 480 Mbps)
1,500 mA maximum combined current
Cable length <2 m for Electromagnetic Compatibility Immunity compliance

Communications Ports

Ethernet

SEL Gigabit Ethernet controllers

1 front-panel 10/100/1000 Mbps port, RJ45

4 rear-panel 10/100/1000 Mbps ports

Configurations: 4 RJ45 copper ports
4 SFP fiber-optic ports
2 RJ45 and 2 SFP fiber-optic ports

Jumbo Frame MTU: 9000 bytes (Linux only)

See *Surge Immunity* for cable length restrictions.

Serial

SEL multiport serial controller

EIA-232/422/485 Ports: 16 ports standard; 48 ports optional
RJ45 connectors
300–115,200 bps
256 byte TX and RX FIFOs each port
+5 Vdc port power
COM 1–16:
0.5 A, 2.5 W, total
COM 17–48:
1.0 A, 5 W, total
IRIG-B output

See *Surge Immunity* for cable length restrictions.

Time-Code Inputs and Outputs

Time-Code Inputs

One BNC IRIG-B Input

Format: IRIG-B002 or -B004 (demodulated)

On (1) State: $V_{ih} \geq 2.2$ V

Off (0) State: $V_{il} \leq 0.8$ V

Nominal Input Impedance: 3.3 kΩ

Note: IRIG-B004 control bits comply with IEEE C37.118.1-2011 (reverse compatible with IRIG-B000 and IEEE C37.118-2005).

Time-Code Outputs

One BNC IRIG-B Output, All RJ45 Serial Ports

Format: IRIG-B004 (demodulated)

On (1) State: $V_{oh} \geq 2.4$ V

Off (0) State: $V_{ol} \leq 0.8$ V

Output Drive Capacity

BNC IRIG-B Out: TTL 240 mA (>20 Ω)

Each Serial Port: TTL 6 mA (>400 Ω)

Note: IRIG-B004 control bits comply with IEEE C37.118.1-2011 (reverse compatible with IRIG-B000 and IEEE C37.118-2005).

Contact Inputs and Outputs

Universal Contact Input IN101 (Bipolar Operation)

Rated Voltage Range: 24–250 Vdc, 24–240 Vac, 50/60 Hz

Operational Voltage Range: 0–300 Vdc, 0–264 Vac, 45–65 Hz

DC Measurement Accuracy*: ±0.5%, ±250 mV

AC Measurement Accuracy*: ±2.5%, ±500 mV

RMS Filter Period: 1 s

Pickup/Dropout Level Setting Range: 15–265 Vdc/Vac rms

Pickup/Dropout Delay Setting Range: 0–4,000 ms**

Continuous Current Draw: 1.0–4.0 mA @ > 24 Vdc/Vac

Initial Current Draw: <50 mA for < 8 ms

* Intended as a measurement function only.
** Type tested with delay settings of 8 ms at <48 V and 2 ms at ≥48 V.

Standard Contact Inputs IN201–IN224 (Bipolar Operation)

Input Type: IN201–IN203, IN213–IN215
electrically isolated, dedicated returns
IN204–IN212, IN216–IN224
electrically isolated, common returns

Rated Voltage Range: 24–250 Vdc, 24–240 Vac, 50/60 Hz

Operational Voltage Range: 0–300 Vdc, 0–264 Vac, 45–65 Hz

Pickup/Dropout Level:

Nominal Voltage Setting	Dropout Voltage	Pickup Voltage
24 Vdc	0.0–14.4 Vdc	19.2–30.0 Vdc
48 Vdc	0.0–28.8 Vdc	38.4–60.0 Vdc
110 Vdc	0.0–66.0 Vdc	88.0–132.0 Vdc
125 Vdc	0.0–75.0 Vdc	105.0–150.0 Vdc
220 Vdc	0.0–132.0 Vdc	176.0–264.0 Vdc
250 Vdc	0.0–150.0 Vdc	200.0–300.0 Vdc
24 Vac	0.0–10.1 Vac	16.4–30.0 Vac
48 Vac	0.0–20.3 Vac	32.8–60.0 Vac
110 Vac	0.0–46.6 Vac	75.1–132.0 Vac
120 Vac	0.0–53.0 Vac	89.6–150.0 Vac
220 Vac	0.0–93.2 Vac	150.3–264.0 Vac
240 Vac	0.0–106.0 Vac	170.6–264.0 Vac

Pickup/Dropout Delay Setting Range: 2–4000 ms @ >24 Vdc/Vac
4–4000 ms @ 24 Vdc/Vac

Continuous Current Draw: 1.0–4.0 mA

Initial Current Draw: <170 mA for 2 ms @ >24 Vdc/Vac
<170 mA for 4 ms @ 24 Vdc/Vac

Fuse Ratings IN201–IN224 (F1–F24)

Type: 3x10.1 mm Time-Lag T

Current Rating: 0.160 A

Voltage Rating: 250 Vac/Vdc

Breaking Capacity: 20 A @ 250 Vac/Vdc

Note: These fuses are not serviceable.

Standard Contact Outputs OUT101, OUT205–OUT208

Output Type: OUT101/Alarm:
Relay Form C Break Before Make
OUT205–OUT208:
Relay Form A

Pilot Duty Ratings*: B300 (UL), AC-15 (IEC)
R300 (UL), DC-13 (IEC)

Rated Voltage**: 24–250 Vdc
110–240 Vrms

Note: The voltage across any of the contact output terminals must not exceed the operational voltage.

Operational Voltage**: 0–300 Vdc
0–264 Vrms

Contact Protection: MOV protection across open contacts
264 Vrms continuous voltage
300 Vdc continuous voltage

Continuous Carry**: 6 A @ 70°C, 4 A @ 85°C

Pickup/Dropout Time**: ≤6 ms (resistive load)

Power Supply Burden**: ≤1 W

Mechanical Endurance**: 10,000 no-load operations

Make (Short Duration Contact Current)**: 30 Adc
1,000 operations @ 250 Vdc
2,000 operations @ 125 Vdc

Note: 200 ms on, 15 s off, current interrupted by independent means.

Short-Time Thermal Withstand**: 50 A for 1 s

Limiting Making Capacity**: 1,000 W @ 250 Vdc (L/R = 40 ms)

Limiting Breaking Capacity/ Electrical Endurance**: 10,000 operations
10 operations in 4 s, followed by 2 min idle

Rated Voltage	Resistive Break	Inductive Break L/R = 40 ms (DC) PF = 0.4 (AC)
24 Vdc	1.25 Adc	1.25 Adc
48 Vdc	0.63 Adc	0.63 Adc
125 Vdc	0.30 Adc	0.30 Adc
250 Vdc	0.20 Adc	0.20 Adc
110 Vrms	0.30 Arms	0.30 Arms
240 Vrms	0.20 Arms	0.20 Arms

* Per UL 508 and IEC 60947-5-1 for IEC 61010-2-201 compliance.
** Parameters verified by SEL per IEC 60255-1:2009 and IEEE C37.90-2005.

Fast Hybrid Contact Outputs OUT201–OUT204

Output Type: OUT201–OUT204; Fast Hybrid, Form A

Pilot Duty Ratings*: B300 (UL), AC-15 (IEC)
R300 (UL), DC-13 (IEC)

Rated Voltage**: 24–250 Vdc

Note: The voltage across any of the contact output terminals must not exceed the operational voltage.

Operational Voltage: 0–300 Vdc

Contact Protection: MOV protection across open contacts
300 Vdc continuous voltage

Continuous Carry**: 6 Adc @ 70°C, 4 Adc @ 85°C

Pickup Time**: ≤ 50 µs (resistive load)

Dropout Time**: ≤ 8 ms (resistive load)

Power Supply Burden**: <1 W

Mechanical Endurance**: 10,000 no-load operations

Make (Short Duration Contact Current)**: 30 Adc
1,000 operations @ 250 Vdc
2,000 operations @ 125 Vdc

Note: 200 ms on, 15 s off, current interrupted by independent means.

Short-Time Thermal Withstand**: 50 Adc for 1 s

Limiting Making Capacity**: 1,000 W @ 250 Vdc (L/R = 40 ms)

Limiting Breaking Capacity/ Electrical Endurance**: 10,000 operations
4 operations in 1 s, followed by 2 min idle

* Per UL 508 and IEC 60947-5-1 for IEC 61010-2-201 compliance.
** Parameters verified by SEL per IEC 60255-1:2009 and IEEE C37.90-2005.

Rated Voltage	Resistive Break	Inductive Break
24 Vdc	10 Adc	10 Adc (L/R = 40 ms)
48 Vdc	10 Adc	10 Adc (L/R = 40 ms)
125 Vdc	10 Adc	10 Adc (L/R = 40 ms)
250 Vdc	10 Adc	10 Adc (L/R = 20 ms)

Power Supplies

General

Typical Burden*: 20 W, 45 VA (pf = 0.4)

Maximum Burden*: 62 W, 150 VA (pf = 0.4)

DC Ripple: 15% per IEC 60255-26:2013

Input Isolated From Chassis Ground: Yes

*See *Surge Immunity Cable Length Requirements* for additional burden information.

Low Voltage 24–48 Vdc

Voltage Rating: 24–48 Vdc

Voltage Range: 18–60 Vdc

Interruption*: 50 ms @ 24 Vdc, 300 ms @ 48 Vdc

Peak Inrush: 5.4 A for 57 ms @ 24 Vdc
10.9 A for 77 ms @ 48 Vdc

Medium Voltage 48–125 Vdc or 110–120 Vac

Voltage Rating: 48–125 Vdc, 110–120 Vac

Operational Voltage Range: 38–140 Vdc, 85–140 Vac

Frequency Rating: 50/60 Hz

Operational Frequency Range: 30–120 Hz

Interruption*: 50 ms @ 48 Vdc,
500 ms @ 125 Vdc/110 Vac

High Voltage 125–250 Vdc or 110–240 Vac

Voltage Rating: 125–250 Vdc, 110–240 Vac

Operational Voltage Range: 85–300 Vdc, 85–264 Vac

Frequency Rating: 50/60 Hz

Operational Frequency Range: 30–120 Hz

Interruption*: 100 ms @ 125 Vdc/110 Vac
500 ms @ 250 Vdc/220 Vac

Peak Inrush: 5.4 A for 36 ms @ 125 Vdc
10.9 A for 49 ms @ 250 Vdc
6.7 A for 45 ms @ 110 Vac (156 Vdc)
14.6 A for 53 ms @ 240 Vac (339 Vdc)

* Tested per IEC 60255-26:2013 with a typical workload.

Recommended External Overcurrent Protection

Breaker Type: Standard

Breaker Rating: 20 A @ 250 Vdc

Current Breaking Capacity: 10 kA

Grounded Neutral Systems: Device in series with the energized conductor

DC and Isolated Systems: Device in series with both conductors

Fuse Ratings

Low-Voltage Power Supply F1

Type: 5x20 mm Time-Lag T

Current Rating: 5.0 A

Voltage Rating: 150 Vdc

Breaking Capacity: 1,500 A @ 150 Vdc

Medium-Voltage Power Supply F1

Type: 5x20 mm Time-Lag T

Current Rating: 3.15 A

Voltage Rating: 250 Vac, 300 Vdc

Breaking Capacity: 1,500 A @ 250 Vac, 300 Vdc

High-Voltage Power Supply F1

Type: 5x20 mm Time-Lag T

Current Rating: 3.15 A

Voltage Rating: 250 Vac, 300 Vdc

Breaking Capacity: 1,500 A @ 250 Vac, 300 Vdc

Terminal Connections

Ring Lug Screw Terminal

#8 Ring Terminal Recommended

Power Wiring

Insulation:	300 V min
Size:	14–16 AWG
Wire Type:	Copper

Ring Lug Tightening Torque

Minimum:	1.0 Nm (9 in-lb)
Maximum:	2.0 Nm (18 in-lb)

Mounting Ear Tightening Torque

Minimum:	0.9 Nm (8 in-lb)
Maximum:	1.4 Nm (12 in-lb)

Compression Screw Terminal

Crimp Ferrule Recommended

Input/Output Wiring

Insulation:	300 V min
Size:	14–18 AWG
Wire Type:	Copper

Compression Screw Tightening Torque

Minimum:	0.6 Nm (5 in-lb)
Maximum:	0.8 Nm (7 in-lb)

Mounting Ear Tightening Torque

Minimum:	0.18 Nm (1.6 in-lb)
Maximum:	0.25 Nm (2.2 in-lb)

Grounding Screw

#6 Ring Terminal Recommended

Ground Wiring

Insulation:	300 V min
Size:	14 AWG, length <3 m
Wire Type:	Copper

Tightening Torque

Minimum:	0.9 Nm (8 in-lb)
Maximum:	1.4 Nm (12 in-lb)

Product Standards

Communications Equipment in Utility Substations:	IEC 61850-3:2013 Performance Class 1 IEEE 1613-2009 Performance Class 1

Note: The following exceptions are applicable to the IEC61850-3 acceptance criteria regarding equipment operation during AC power dips and interruptions (refer to IEC 61850-3 subclause 7.5.5, Equipment function, and 7.5.6, Exceptions).

Power Supply	Requirement	Exception
High Voltage 125–250 Vdc or 110–240 Vac	50 cycle voltage interruptions or dips of 60%	Not Applicable[a]
Medium Voltage 48–125 Vdc or 110-120 Vac	50 cycle voltage interruptions or dips of 60%	Not Applicable[a]

[a] Voltage dips or interruptions that are longer than the power supply interruption specification result in a device restart. For critical process applications that require no restarts for power source interruptions or dips longer than 100 ms, equipment is not intended to be directly connected to a public AC low-voltage power supply network. For those applications, an uninterruptable power supply is recommended.

Industrial Environment:	IEC 61000-6-2:2005 IEC 61000-6-4:2006
Electrical Equipment for Measurement, Control, and Laboratory Use:	IEC 61010-1:2010/AMD1:2016/COR:2019 UL 61010-1:2019, C22.2 No. 61010-1:12 IEC 61010-2-201:2017 UL 61010-2-201:2018, C22.2 No. 61010-2-201:14
Measuring Relays and Protection Equipment:	IEC 60255-1:2009 IEC 60255-26:2013 (Zone A) IEC 60255-27:2013

Note: To meet Zone A performance, cables must meet length requirements in *Surge Immunity Cable Length Requirements* and shielding requirements in *Ethernet Ports* on page 3.7 and *Serial Ports* on page 3.10.

Programmable Controllers:	IEC 61131-2:2007 subclauses 8–14
Electrical Equipment for Measurement, Control, and Laboratory Use:	IEC 61326-1:2012
EMC Immunity for Industrial Environments:	IEC 61000-6-2:2005+AC:2005
EMC Emissions for Industrial Environments:	IEC 61000-6-4:2006+A1:2010
Safety of Laser Products:	EN 60825-1:2014 EN 60825-2:2004+A1:2007+A2:2010
Product Ecology:	EN 63000:2016 RoHS Compliant

Type Tests

Note: To ensure protection-level EMI and EMC performance, type tests were performed using shielded Ethernet and serial cables with the shield grounded at both ends of the cable and using USB and video cables with ferrite chokes. Double-shielded cables are recommended for best EMI and EMC performance and required for protection-level performance on Ethernet ports.

Electromagnetic Compatibility Emissions

Conducted and Radiated Emissions (Class A):	CISPR 11:2009+A1:2010 CISPR 22:2008 IEC 61000-6-4:2006 IEC 61850-3:2013 FCC 15.107:2014 FCC 15.109:2014 47 CFR Part 15.109 47 CFR Part 15.107 Canada ICES-001 (A) / NMB-001 (A)
Harmonic Current:	IEC 61000-3-2:2014
Voltage Flicker:	IEC 61000-3-3:2013

Electromagnetic Compatibility Immunity

Conducted RF Immunity:	IEC 61000-4-6:2013 Severity Level: 10 Vrms
Electrostatic Discharge Immunity:	IEC 61000-4-2:2008 IEEE C37.90.3-2001 Severity Level: 2, 4, 6, 8 kV contact discharge 2, 4, 8, 15 kV air discharge
Fast Transient/Burst Immunity:	IEC 61000-4-4:2012 Severity Level: 4 kV, 5 kHz on power supply and contact I/O 2 kV, 5 kHz on communications lines

Note: Ports with lengths limited to <2 m (e.g., USB ports) are not evaluated in Fast Transient/Burst.

Power Frequency Immunity on Binary Inputs:	IEC 60255-26:2013 Severity Level: 300 V common mode 150 V differential mode 50/60 Hz
Conducted Common Mode Disturbance:	IEC 61850-3:2013 Severity Level (Power Input Port): 30 V continuous 300 V for 1 s 50/60 Hz

Magnetic Field Immunity: IEC 61000-4-8:2009
Severity Level:
1,000 A/m for 3 s
100 A/m for 60 s
IEC 61000-4-9:2016
Severity Level:
1,000 A/m
IEC 61000-4-10:2016
Severity Level:
100 A/m for 2 s at
100 kHz and 1 MHz

Power Supply Immunity: IEC 61000-4-11:2004
IEC 61000-4-17:1999
+A1:2001+A2:2008
IEC 61000-4-29:2000

Radiated Radio Frequency: IEC 61000-4-3:2006+A1:2007+A2:2010
Severity Level: 10 V/m
IEEE C37.90.2-2004
Severity Level: 20 V/m

Slow Damped Oscillatory Waves: IEC 61000-4-18:2006+A1:2010
Severity Level:
Power supply and contact I/O
2.5 kV peak common mode
1.0 kV peak differential mode
Communications ports
1.0 kV peak common mode

Surge Withstand Capability: IEEE C37.90.1-2012
Severity Level:
2.5 kV oscillatory
4 kV fast transient

Note: Ports with lengths limited to <2 m (e.g., USB ports) are not evaluated in Surge Withstand Capability and Slow Damped Oscillatory Waves.

Surge Immunity: IEC 61000-4-5:2005
Severity Level per IEC 60255-26:2013*:
Zone A:
2 kV line-to-line
4 kV line-to-earth
Zone B:
1 kV line-to-line
2 kV line-to-earth

Surge Immunity Cable Length Requirements:

IEC 60255-26 Port Classification	Ethernet Length Restrictions	Serial Length Restrictions
Zone A Protection	<10 m	<10 m
Zone A Communication	None	<10 m
Zone B Protection	<10 m	<10 m
Zone B Communication	None	None

* Ports or applications with cable lengths limited to <10 m are excluded from the Surge test.

Environmental

Change of Temperature: IEC 60068-2-14:2009
Severity Level:
5 cycles, 1°C per minute ramp
–40° to +85°C

Cold, Operational: IEC 60068-2-1:2007
Severity Level: 16 hours at –40°C

Cold, Storage: IEC 60068-2-1:2007
Severity Level: 16 hours at –40°C

Damp Heat, Cyclic: IEC 60068-2-30:2005
Severity Level:
12 + 12-hour cycle
25° to 55°C, 6 cycles, >93% RH

Damp Heat, Steady: IEC 60068-2-78:2012
Severity Level:
40°C, 240 hours, >93% RH

Dry Heat, Operational: IEC 60255-1:2009
IEC 61850-3:2013
IEC 60068-2-2:2007
Severity Level: 16 hours at 85°C

Dry Heat, Storage: IEC 60255-1:2009
IEC 61850-3:2013
IEC 60068-2-2:2007
Severity Level: 16 hours at 85°C

Vibration: IEC 60255-21-1:1988
Severity Level:
Endurance Class 2
Response Class 2
IEC 60255-21-2:1988
Severity Level:
Shock Withstand, Bump Class 1
Shock Response Class 2
IEC 60255-21-3:1993
Severity Level:
Quake Response Class 2

Safety

Enclosure Protection*: IEC 60255-27:2013
Severity Level:
IP3X on all surfaces except:
IP4X on front surface
IP2X on SFP cage
IP1X on wiring terminals

Note: The SFP cage is IP4X-compatible when an SFP module or dust cover is installed.

Dielectric Strength: IEC 60255-27:2013
IEEE C37.90-2005
Severity Level:
3600 Vdc on power supply and OUT201–OUT208
2500 Vac on contact inputs, OUT101, and BNC IRIG-B IN
1500 Vac on Ethernet ports
Type tested for one minute

Impulse: IEC 60255-27:2013
IEEE C37.90-2005
Severity Level:
5 kV power supply, contact I/O, BNC IRIG-B IN
1.5 kV Ethernet ports

* Self-declared rating.

Table 2 System Power Consumption

Power Consumption (Watts)[a]			
Component	**Minimum**	**Typical**	**Maximum**
Base System (1 PSU, 1 SATA Drive)	17 W	20 W	33 W[b]
Additional Consumption From Optional Components			
2nd Power Supply	+1 W	+1 W	+1 W
2nd SATA Drive	+1 W	+2 W	+3 W
32-Port Serial Expansion Board	+2 W	+5 W	+14 W[b]
I/O Expansion Board (8 DO/24 DI)	+1 W	+2 W	+4 W
USB Peripherals	+0 W	+1 W	+7 W

[a] Minimum: 0% load on all components; minimum power consumption started and idle. Typical: 25–50% load on all components; good indication of most application loads. Maximum: 100% load on all components; generally cannot be reached in normal applications.

[b] Includes component power and maximum +5 Vdc serial port power output (see *Table 3*) to port-powered devices (modems, transceivers).

Table 3 Peripheral Connection Rated Current Output

Connection	Current Limit
Display Port	0.5 A, +3.3 Vdc, 1.6 W
COM 1–16	0.5 A, +5 Vdc, 2.5 W all ports combined
COM 17–48	1.0 A, +5 Vdc, 5 W all ports combined
USB Ports	1.5 A, +5 Vdc, 7.5 W all ports combined

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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