RTAC SEL-3530-4 Real-Time Automation Controller

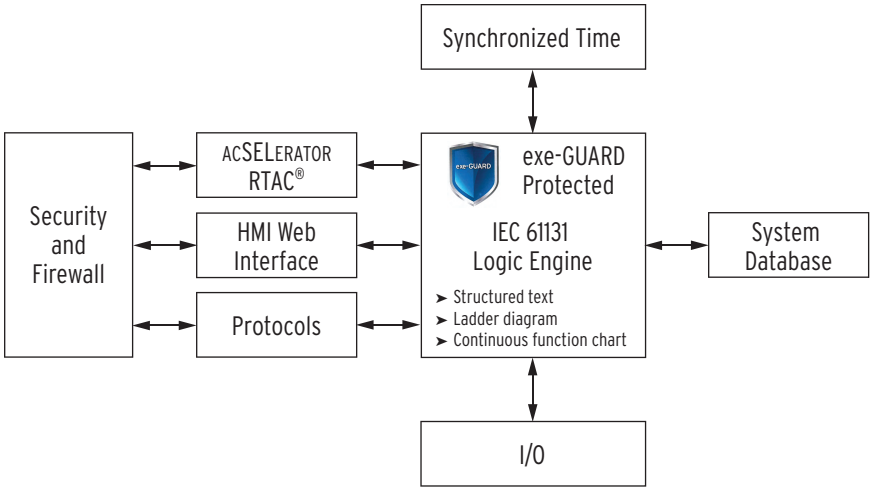
As a more compact version of the SEL-3530, the SEL-3530-4 Real-Time Automation Controller (RTAC) is also a powerful automation platform that combines the best features of the embedded microcomputer form factor, embedded real-time operating system, and secure communications framework with IEC 61131-3 PLC programmability.

Major Features and Benefits

- **Simple Setup With ACSELERATOR RTAC® SEL-5033 Software.** Build a system quickly using preconfigured device templates for SEL relays and other communications connections. The Tag Processor provides methods to map data relationships between communications protocols visually.
- **Multiple Device Functions in One Reliable Device.** Use a single RTAC as a protocol gateway, RTU, logic processor, PAC, engineering port server, event processor, and system-wide SER logger/viewer.
- **Proven Reliability.** Depend on a rugged device designed and tested to meet or exceed protective relay standards for vibration, electrical surges, fast transients, and extreme temperatures, as well as meet or exceed IEEE 1613, Standard Environmental and Testing Requirements for Communications Networking Devices in Electric Power Substations.
- **IEC 61850.** Integrate high-speed control schemes between the RTAC and relays with IEC 61850 GOOSE peer-to-peer messaging. Poll and send data sets and reports from other IEDs with IEC 61850 MMS client/server.
- **Integrated HMI.** Build custom human-machine interface (HMI) displays quickly and easily without the need for mapping data tags. Because it is web-based, no special software is needed for viewing HMI displays.
- **Protection Against Malware and Other Cybersecurity Threats.** Protect your RTAC system with exe-GUARD®, which uses advanced cryptographic algorithms to authorize the execution of any program or service on the system. Any tasks not approved by the whitelist are blocked from operation.
- **User Security.** Assign individual user and role-based account authentication and strong passwords. Use Lightweight Directory Access Protocol (LDAP) for central user authentication.
- **Integrated Security Management.** Comply with NERC/CIP user authentication, logging, and port control requirements.
- **Standard IEC 61131-3 Logic Design.** Create innovative logic solutions directly in ACSELERATOR RTAC using any of the editor tools: Tag Processor, Structured Text, Ladder Logic, or Continuous Function Chart.
- **Flexible Protocol Conversion.** Apply any available client or server protocol on any serial or Ethernet port. Each serial port can be used in software-selectable EIA-232 or EIA-485 mode. The two rear Ethernet ports can optionally be copper or fiber-optic connectors.
- **Synchrophasor Technology Included.** Use the IEEE C37.118 client protocol to integrate synchrophasor messages from relays or PMUs in your system. These messages can be used for logic and control in the station or converted to DNP3 or other protocol for SCADA usage.
- **Standard Data Management.** Map and scale data points easily between protocols in small and large systems. You can also normalize IED data into common data types, time-stamp formats, and time zones.
- **Single-Point Engineering Access.** Gain engineering access to station IEDs through a single serial port, external modem, or high-speed network connection.

Product Overview

Functional Diagram



IEC 61131 Logic Engine

As depicted in the functional diagram, each RTAC includes an IEC 61131 logic engine that is preconfigured to have access for all system tags, IED data, diagnostics, alarms, security events, and communications statistics for use integrating your system. The system has no functional separation between those tags mapped for communications protocols and those used in programmable logic. This architecture greatly simplifies system configuration effort because no additional selection is required to identify tags used by the logic engine. You simply use any needed IED data, calculated values, and system tags in deterministic logic for the control of critical applications.

Management of the task-processing sequence and solve rate in the RTAC is similar to that for traditional PLCs or PACs. The fastest processing rate is 4 ms. Optimize the processor utilization by setting the processing rate no faster than necessary for your application.

Task processing in the logic engine includes protocol I/O, system management, and any custom logic programs you create using Structured Text (ST), Ladder Logic Diagram (LD), or Continuous Function Charts (CFC). CFC programs are a type of IEC 61131-3 Function Block Diagram (FBD) that provide more programming flexibility than standard FBDs. ACSELERATOR RTAC includes the IEC 61131-3 and Tag Processor editors you will use to manage any protocol information and custom logic needed for your system.

Manage User Accounts and Alarms in Web Server

The built-in RTAC web interface provides the ability to manage user accounts and system alarms remotely. Each user account has a unique username, password, and assigned role that defines system permissions. You can also configure the RTAC to use LDAP central authentication for user account management. The system includes web pages for monitoring user logs and maintaining network policies.

Logged tag values and system events provide a system-wide Sequence of Events report. View the logs online or use ODBC connectivity to download them to a central database.

You can also configure Ethernet connections and monitor system status from the web interface. All of the Ethernet ports can operate on independent networks, or you can bind them for failover operation.

Flexible Engineering Access

Access Point Routers in the RTAC provide a means for creating transparent connections between any two ports. A transparent connection is a method for using the RTAC as a port server to connect remotely to an IED. Simple logic in the RTAC enables remote engineering access only through supervisory commands.

Seamless System Configuration

ACSELERATOR RTAC is a Microsoft Windows compatible configuration software for offline and online use with the RTAC. A project in ACSELERATOR RTAC contains the complete configuration, settings, and logic for an individual RTAC device. Preconfigured device templates are available for you to add all device and master connections to the project tree view.

Once you create the settings for a specific device connection, improve engineering efficiency by saving a custom device template for later use with similar projects. Share custom templates via email or network for even greater savings.

The Tag Processor view facilitates the mapping of operational data quickly between IEDs and SCADA. ACSELERATOR RTAC is compatible with Microsoft Excel and other programs, so you can save time and increase accuracy by copying SCADA maps from the source.

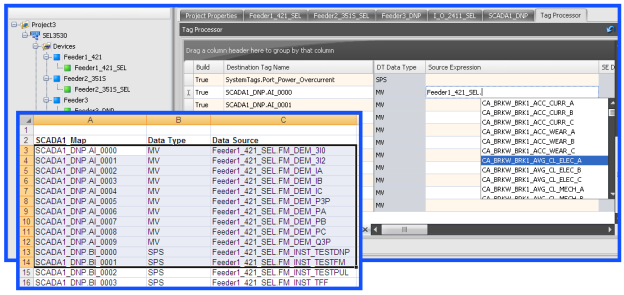


Figure 1 Map Source and Destination Tags Using the Tag Processor or Copy SCADA Maps Directly From a Spreadsheet

There is no need to install or learn more than one software interface. Use the Structured Text, Ladder Diagram, or Continuous Function Chart editors included with ACSELERATOR RTAC to develop custom IEC 61131 logic.

Data Concentration and Protocol Conversion

Configure each serial or Ethernet port to use any of the client, server, or peer-to-peer protocols available for the RTAC. For example, when you use IEEE C37.118 protocol to receive synchrophasor messages, you can map analog or Boolean tags and time stamps to DNP3 and send the data to SCADA very efficiently. You can also map data to IEC 61850 GOOSE messages for high-speed control schemes.

Additionally, when you need to define relay connections in a primary/backup arrangement, use the Tag Processor to map relay tags so that the master stations will receive power system information only from the active relay.

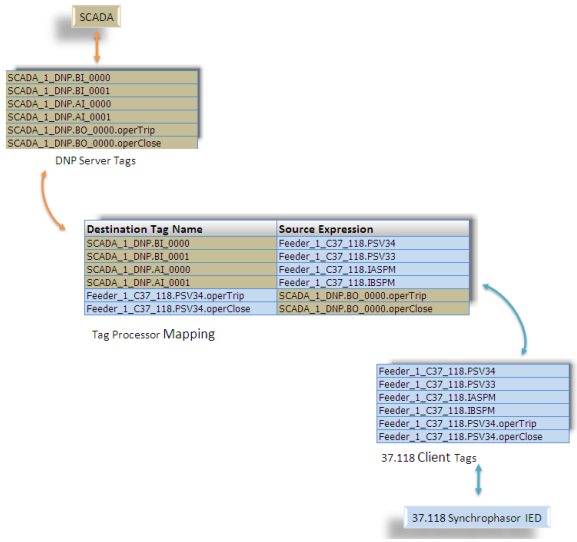


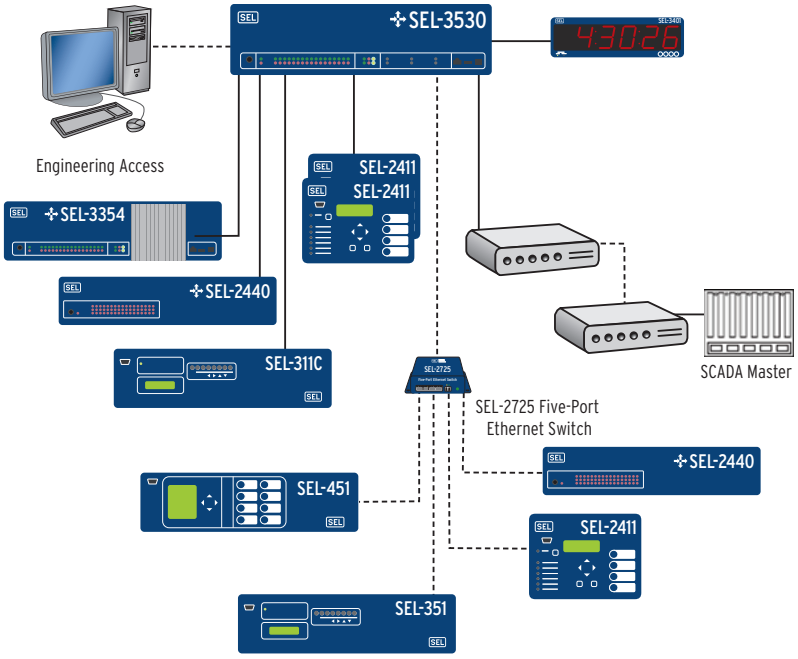
Figure 2 Synchrophasor Data Map Seamlessly Into SCADA Connections

Applications

Substation SCADA, Report Retrieval, Engineering Access, and Alarm Notification

The RTAC can act as a data concentrator by using protocols such as IEC 61850 MMS client, Modbus, DNP3, IEC 61850 GOOSE, or MIRRORED BITS® communications to integrate both serial and Ethernet IEDs. Enable logging on any system or IED tag to view and archive a station-wide event record.

The RTAC Ethernet connection provides a means to remotely access the system to monitor logs and diagnostics. First establish a remote connection with any IED connected to the RTAC through Engineering Access communications channels. Then use the ACSELERATOR QuickSet® SEL-5030 Software suite to manage protection and control settings for these relays remotely.

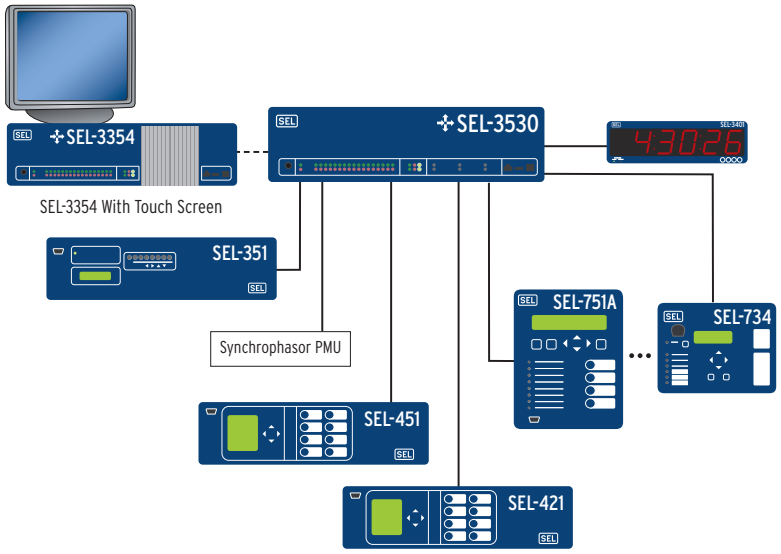


Synchrophasor Integration and Control

The RTAC can integrate synchrophasor messages from the IEEE C37.118 protocol into SCADA protocols, such as DNP3 or Modbus. Easily include the source PMU time stamps and time quality attributes in the SCADA message to allow for system-wide usage of synchrophasor data.

Within the RTAC logic engine, you can perform complex math and logic calculations on synchrophasor data from C37.118-compliant devices.

The RTAC also synchronizes the time clocks in attached devices that accept a demodulated IRIG-B time signal. The RTAC regenerates the demodulated IRIG-B signal from an external modulated or demodulated source; this signal is precise enough for synchrophasor applications.

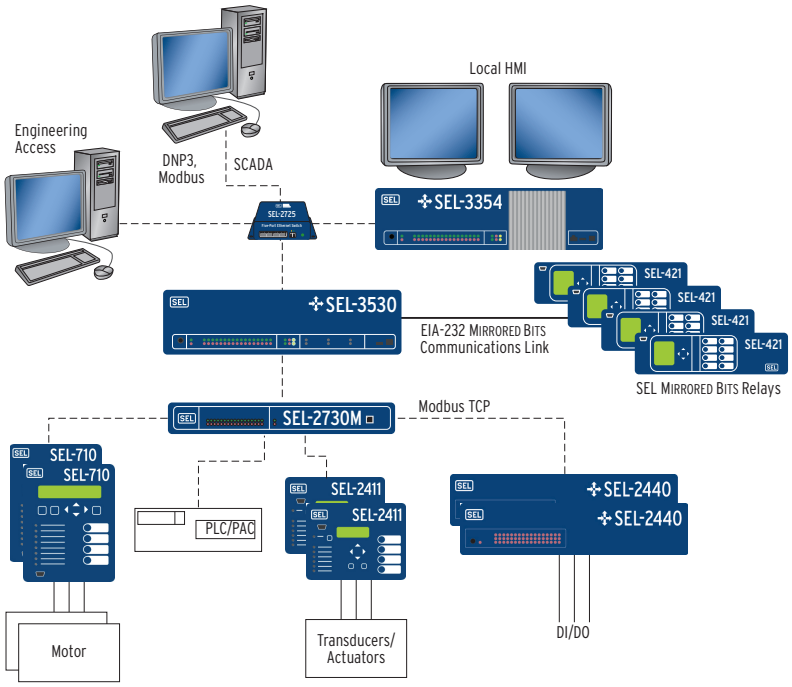


Real-Time Control and Logic Processing

The built-in logic processor provides high-speed control and transfer of signals from SEL MIRRORED BITS devices or devices using other protocols. The RTAC can serve as the system controller and SCADA gateway to eliminate costly equipment (such as breakers, interposing relays, and wiring) while also reducing engineering and labor costs.

The intuitive ACSELERATOR RTAC software provides simple setup of analog and binary tags from any device in the system. Integrated tools scale values and create logic in a flexible IEC 61131-3 configuration environment.

You can take advantage of multiprotocol support to collect SCADA information, process control commands, and use NTP time synchronization through a single communications link to each Ethernet device.

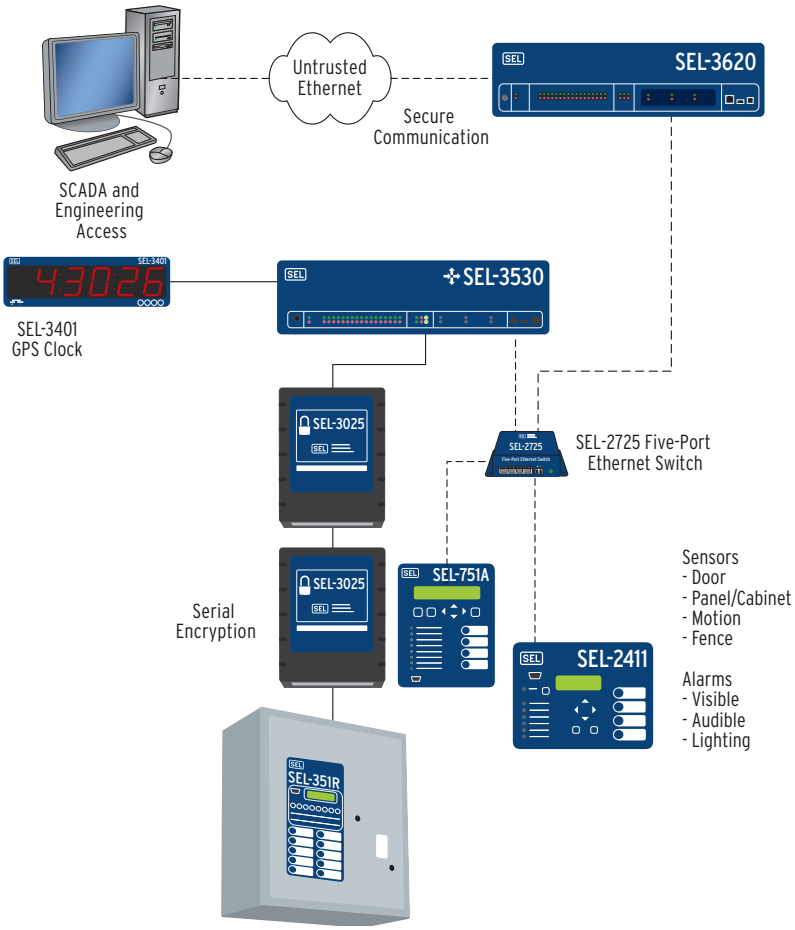


Secure Communications and User Management

The RTAC and SEL accessories offer security for your automation network. Per-user security profiles provide compliance with role-based requirements. The system can employ intrusion detection, notification, and logging to help maintain perimeter integrity.

The RTAC includes security features so that your system complies with NERC/CIP requirements for auditing, logging, port control, web authentication, and password restrictions. The RTAC also supports central authentication through your existing LDAP server.

By including SEL serial and wireless encrypting devices with the RTAC, you can protect remote serial communications to recloser controls or other connected devices.

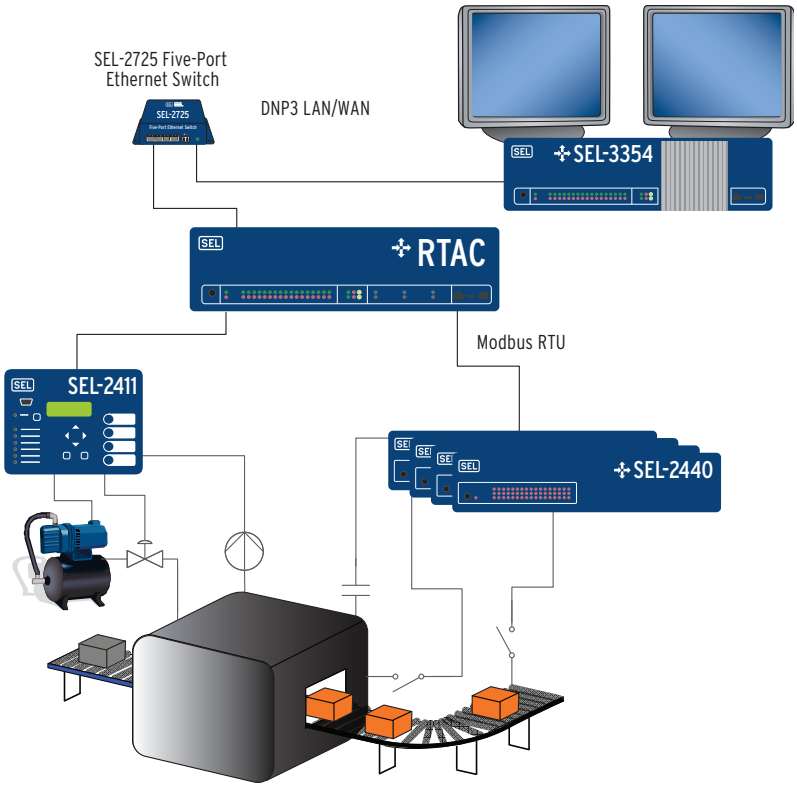


Control Systems

The custom logic, communications protocols, and I/O in the RTAC, SEL-2411, and SEL-2440 permit you to implement complete control systems, whether you perform discrete sequences, continuous control, monitoring, or asset management. SEL subjects its products to tests for harsh environments, so you can be confident that your control system will work reliably in tough applications. Minimize loop wiring and simplify commissioning by installing controls close to process equipment and integrating them with industry standard communications protocols. Additionally, the SEL-3354 Embedded Automation Computer can provide HMI and data archiving functions.

Use a powerful IEC 61131 logic engine to design custom control programs in the RTAC. You can set the logic solve rate and program execution order to meet your system requirements. Operate the RTAC as a master controller, and use SELOGIC® control equations in the SEL-2411 and SEL-2440 to perform distributed sequential or continuous control algorithms.

With a variety of physical interfaces and open protocol options, such as IEC 61850 GOOSE messaging, the RTAC makes system integration simple. It will reduce engineering time and complexity, so that you can focus on improving productivity and efficiency rather than on fixing communications problems.



Ordering Options

Table 1 SEL-3530-4 Ordering Options

Ethernet Communication	Two rear Ethernet ports, 10/100BASE-T copper (standard), 100BASE-FX multimode fiber optics (optional), 100BASE-LX single-mode fiber optics (optional)
Power Supply	125/250 Vdc; 120/240 Vac 48/125 Vdc; 120 Vac 24–48 Vdc
Environment	Conformal coating for chemically harsh and high-moisture environments
Software Options	Human-Machine Interface (HMI) IEC 61850 GOOSE IEC 61850 MMS client IEC 61850 MMS server

Mounting	Horizontal rack mount with side bracket Horizontal panel mount Horizontal half-rack mount Horizontal half-rack with side-by-side mounting bracket DIN-rail mount Surface mount

Panel Features

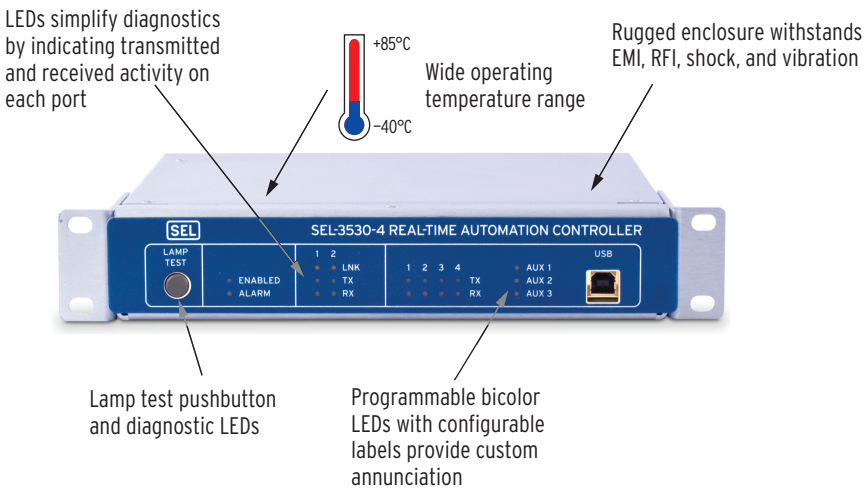


Figure 3 SEL-3530-4 Front-Panel View

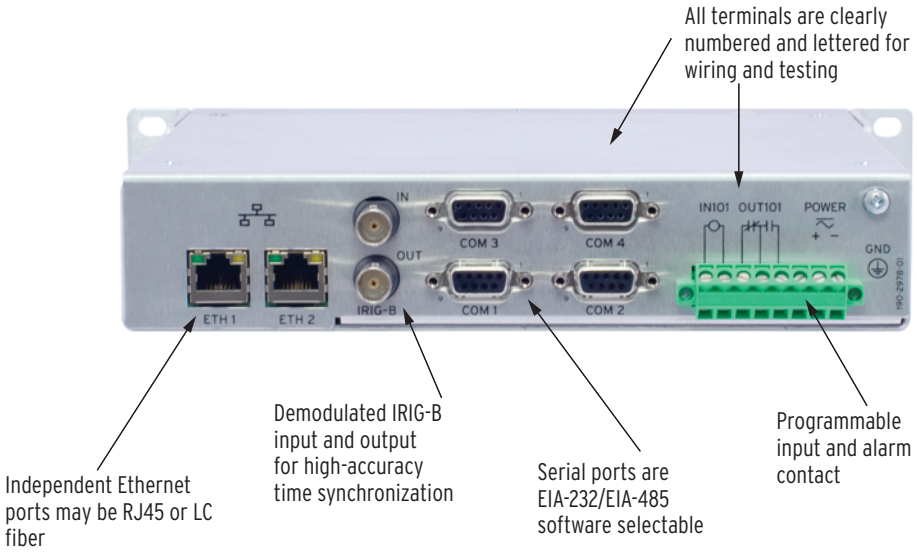


Figure 4 SEL-3530-4 Rear-Panel View

Dimensions

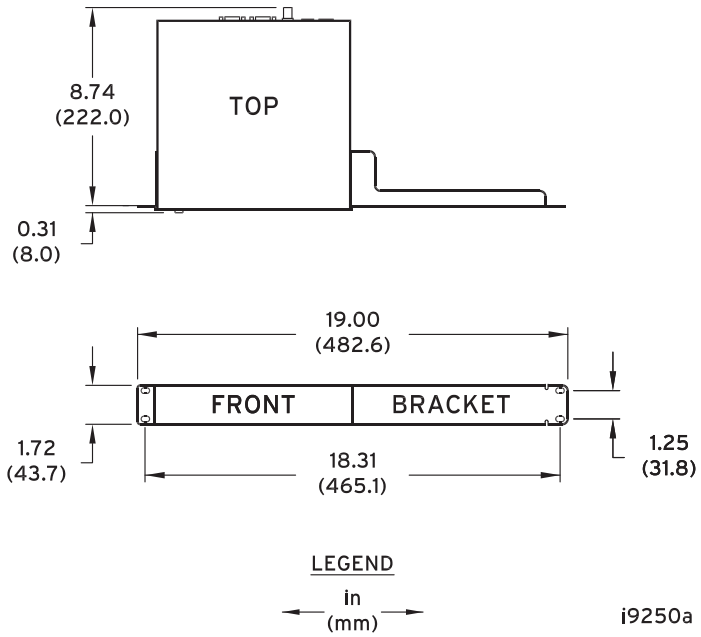


Figure 5 SEL-3530-4 Horizontal Rack-Mount With Bracket Dimensions

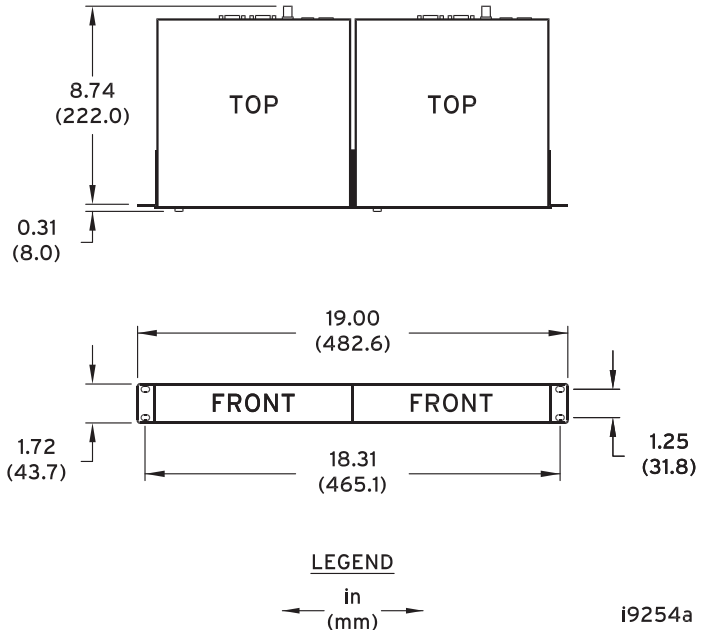


Figure 6 SEL-3530-4 Horizontal Rack-Mount (Side-by-Side) Dimensions

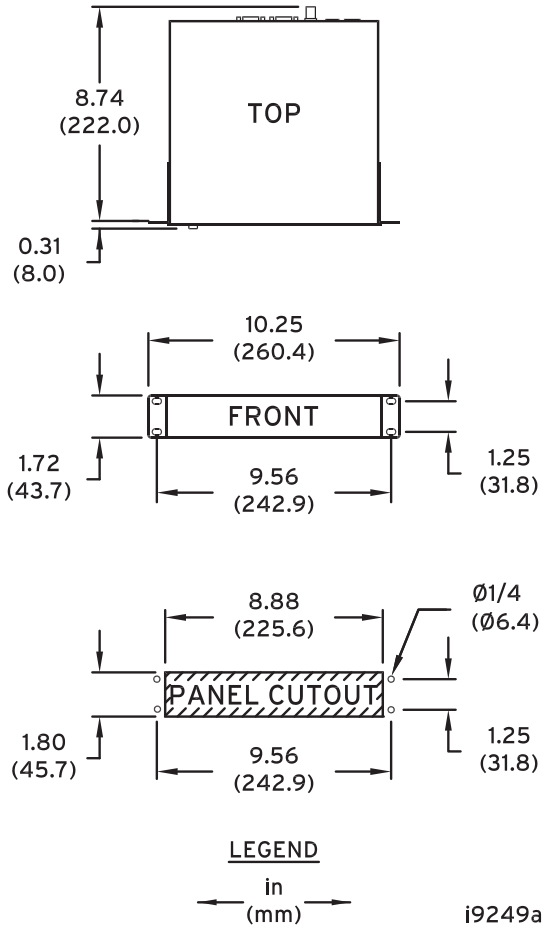


Figure 7 SEL-3530-4 Horizontal Rack-Mount (Half Rack) Dimensions

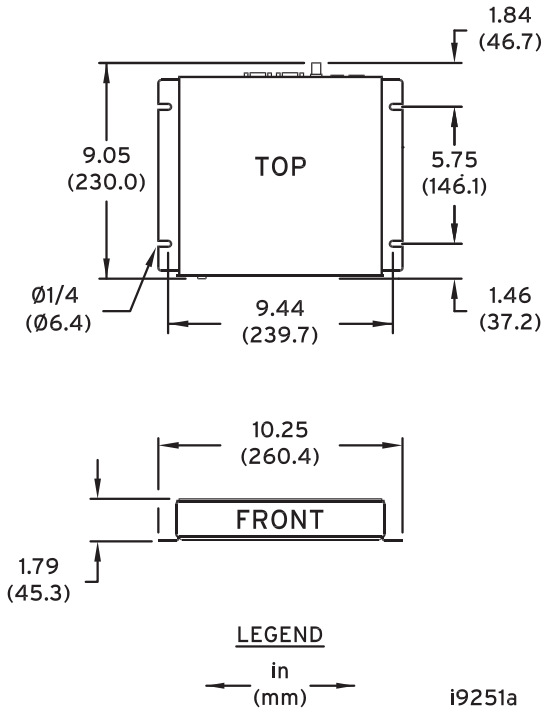


Figure 8 SEL-3530-4 Surface-Mount Dimensions

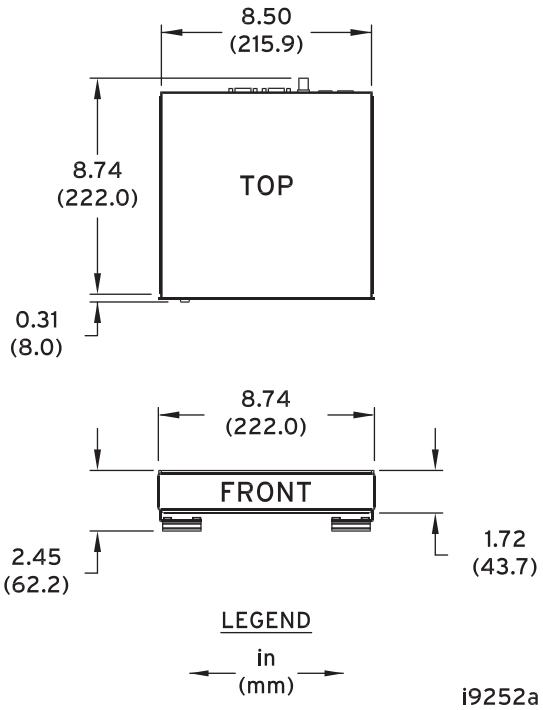


Figure 9 SEL-3530-4 DIN-Mount Dimensions

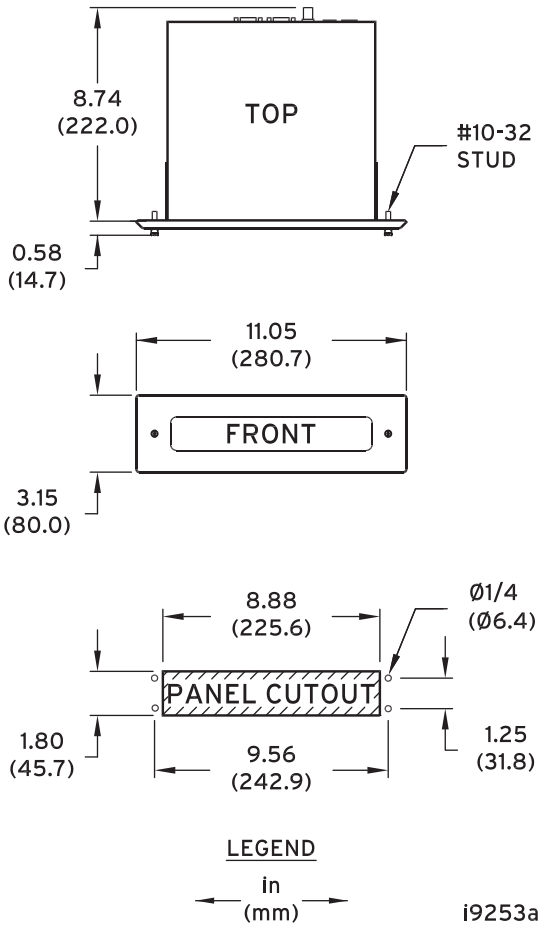


Figure 10 SEL-3530-4 Panel-Mount Dimensions

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)

CE Mark

UKCA Mark

General

Operating System

SEL Linux with real-time preemption patches

Operating Temperature Range

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

Operating Environment

Pollution Degree:	2
Overvoltage Category:	II
Insulation Class:	1
Relative Humidity:	5%–95%, noncondensing
Maximum Altitude:	2000 m

Weight (Maximum)

2.27 kg (5 lb)

Processing and Memory

Processor Speed:	533 MHz
Memory:	1024 MB DDR2 ECC RAM
Storage:	2 GB

Security Features

Account Management:	User Accounts User Roles LDAP Central Authentication RADIUS Central Authentication Strong Passwords Inactive Account Logouts
Intrusion Detection:	Access/Audit Logs Alarm LED Alarm Contact
Encrypted Communications:	SSL/TLS, SSH HTTPS

Automation Features

Protocols

Client

DNP3 Serial, DNP3 LAN/WAN, Modbus RTU, Modbus TCP, SEL ASCII, SEL Fast Messaging, LG 8979, IEEE C37.118, IEC 61850 MMS, CP2179, IEC 60870-5-101/104, SNMP, SES-92, CDC Type II, Courier, IEC 60870-5-103, EtherNet/IP Explicit Message Client

Server

DNP3 Serial, DNP3 LAN/WAN, Modbus RTU, Modbus TCP, SEL Fast Messaging, LG 8979, SES-92, IEC 61850 MMS, IEC 60870-5-101/104, IEEE C37.118, FTP, SFTP, CDC Type II, EtherNet/IP Implicit Message Adapter

Peer-to-Peer

IEC 61850 GOOSE, SEL MIRRORED BITS Communications, Network Global Variables (NGVL), Parallel Redundancy Protocol

Fieldbus

EtherCAT Client

Engineering Access

Modes:	SEL Interleaved, Direct
Port Server:	Map Serial Ports to IP Ports
Secure Web Server:	Diagnostic and Communications Data

Time-Code Input (Modulated IRIG-B)

Input Impedance:	2 kΩ
Accuracy:	500 µs

Time-Code Input (Demodulated IRIG-B)

On (1) State:	$V_{ih} \geq 2.2$ V
Off (0) State:	$V_{il} \leq 0.8$ V
Input Impedance:	1.5 kΩ
Accuracy:	250 ns

Time-Code Output (Demodulated IRIG-B)

On (1) State:	$V_{oh} \geq 2.4$ V
Off (0) State:	$V_{ol} \leq 0.8$ V
Load:	50 Ω
Output Drive Levels	
Demodulated IRIG-B:	TTL 120 mA, 3.5 Vdc, 25 Ω
Serial Port:	TTL 2.5 mA, 2.4 Vdc, 1 kΩ

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

Communications Ports

Ethernet Ports

Ports:	2 rear
Data Rate:	10 or 100 Mbps
Rear Connectors:	RJ45 Female or LC Fiber (single-mode or multimode, 100 Mbps only)

Serial Ports

Ports:	4
Type:	EIA-232/EIA-485 (software selectable)
Data Rate:	300 to 115200 bps
Connector:	DB-9 Female
Time Synchronization:	IRIG-B
Power:	+5 Vdc power on Pin 1 (500 mA maximum cumulative for four ports)

USB Ports

Ports:	1
1 Device Port:	Type B

Fiber Optics

Class 1 LASER/LED

Product:	IEC 60825-1:1993 + A1:1997 + A2:2001
Data Rate:	100 Mbps
Connector Type:	LC
Wavelength:	1300 nm
Multimode Option:	62.5 µm fiber

TX Max. Power:	–14 dBm
TX Min. Power:	–20 dBm
RX Sensitivity:	–31 dBm
RX Overload:	–14 dBm
Min. TX Level:	–20 dBm
Min. RX Sensitivity:	–31 dBm
Optical Budget:	11 dBm
Max. Distance:	2 km
Single-Mode Option:	9 µm fiber
TX Max. Power:	–8 dBm
TX Min. Power:	–15 dBm
RX Sensitivity:	–25 dBm
RX Overload:	–8 dBm
Min. TX Level:	–15 dBm
Min. RX Sensitivity:	–25 dBm
Optical Budget:	10 dBm
Max Distance:	15 km

Input

Isolated Control Input

Software settings:

Pickup Level:	17–265 Vac/Vdc, within 5%
Dropout Level:	15–238 Vac/Vdc, within 5%
Pickup/Dropout Delay:	1–30000 ms
Current draw at nominal dc voltage:	2–4 mA

Output

Mechanical Durability:	10 M no-load operations

DC Output Ratings

Rated Operational Voltage:	250 Vdc		
Rated Voltage Range:	19.2–275 Vdc		
Rated Insulation Voltage:	300 Vdc		
Make:	30 A @ 250 Vdc per IEEE C37.90		
Continuous Carry:	6 A @ 70°C; 4 A @ 85°C		
Thermal:	50 A for 1 s		
Contact Protection:	360 Vdc, 40 J MOV protection across open contacts		
Operating Time (coil energization to contact closure, resistive load):	Pickup/Dropout time ≤ 8 ms typical		
Breaking Capacity (10,000 Operations) per IEC 60255-0-20:1974:	48 V 125 V	0.50 A 0.30 A	L/R = 40 ms L/R = 40 ms
Cyclic Capacity (2.5 Cycles/Second) per IEC 60255-0-20:1974:	48 V 125 V	0.50 A 0.30 A	L/R = 40 ms L/R = 40 ms

AC Output Ratings

Rated Operational Voltage:	240 Vac
Rated Insulation Voltage:	300 Vac
Utilization Category:	AC-15 (control of electromagnetic loads > 72 VA)
Contact Rating Designation:	B300 (B = 5 A, 300 = rated insulation voltage)
Contact Protection:	270 Vac, 40 J
Continuous Carry:	3 A @ 120 Vac 1.5 A @ 240 Vac 5 A
Rated Frequency:	50/60 ± 5 Hz
Operating Time (coil energization to contact closure):	Pickup/Dropout Time: ≤ 8 ms
Electrical Durability Make VA Rating:	3600 VA, cosϕ = 0.3
Electrical Durability Break VA Rating:	360 VA, cosϕ = 0.3

Power Supply

Input Voltage

Rated Supply Voltage:	125–250 Vdc; 110–240 Vac, 50/60 Hz 48–125 Vdc; 120 Vac, 50/60 Hz, 24–48 Vdc
Input Voltage Range:	85–300 Vdc or 85–264 Vac 38–140 Vdc; 85–140 Vac 18–60 Vdc polarity dependent

Power Consumption

AC:	<30 VA
DC:	<30 W

Interruptions

20 ms @ 24 Vdc
20 ms @ 48 Vdc
50 ms @ 125 Vac/Vdc
100 ms @ 250 Vac/Vdc

Fuse Rating

125–250 V Model:	2.5 A, high breaking capacity, time lag T, 250 V (5x20 mm, T2.5AH 250 V)
48–125 V Model:	2.5 A, high breaking capacity, time lag T, 250 V (5x20 mm, T2.5AH 250 V)
24–48 V Model:	7.0 A, high breaking capacity, time lag T, 250 V (5x20 mm, T7.0AH 60 V)

Type Tests

Environmental Tests

Enclosure Protection:	IEC 60529:2001 + CRGD:2003 IP20 excluding the terminal blocks
Vibration Resistance:	IEEE 1613-2009 + A1-2011 Vibration and Shock IEC 60255-21-1:1988 Vibration Endurance, Severity: Class 1 Vibration Response, Severity: Class 2
Shock Resistance:	IEEE 1613-2009 + A1-2011 Vibration and Shock IEC 60255-21-2:1988 Bump Test, Severity: Class 1 Shock Withstand, Severity: Class 1 Shock Response, Severity: Class 2
Seismic:	IEC 60255-21-3:1993 Quake Response, Severity: Class 2
Cold:	IEEE 1613-2009 + A1-2011 Service Conditions IEC 60068-2-1:2007 –40°C, 16 hours
Dry Heat:	IEEE 1613-2009 + A1-2011 Service Conditions IEC 60068-2-2:2007 85°C, 16 hours
Damp Heat, Cyclic:	IEC 60068-2-30:2005 25°–55°C, 6 cycles, 95% relative humidity

Dielectric Strength and Impulse Tests

Dielectric (HiPot):	IEEE 1613-2009 + A1-2011 IEC 60255-5:2000 Section 5: Dielectric Tests IEEE C37.90-2005, Section 8: Dielectric Tests Dielectric Strength Section 2500 Vac for one minute on contact inputs, contact outputs 3100 Vdc for one minute on power supply
Impulse:	IEEE 1613-2009 + A1-2011, Impulse Section IEC 60255-5:2000, Impulse Section IEEE C37.90-2005, Impulse Section Severity Level: 0.5 J, 5 kV

RFI and Interference Tests

EMC Immunity

Electrostatic Discharge Immunity:	IEEE 1613-2009 + A1-2011 IEEE 1613-2003 ESD IEC 60255-22-2:2008 IEC 61000-4-2:2008 Severity Level 4 8 kV contact discharge 15 kV air discharge
Magnetic Field Immunity:	IEC 61000-4-8:2001 1000 A/m for 3 seconds, 100 A/m for 1 minute IEC 61000-4-9:2001 1000 A/m
Power Supply Immunity:	IEC 60255-11:2008 IEC 61000-4-11:2004 IEC 61000-4-29:2000
Radiated RF Immunity:	IEC 60255-22-3:2007; 10 V/m IEEE 1613-2009 + A1-2011 RFI IEC 61000-4-3:2010, 10 V/m IEEE C37.90.2-2004, 35 V/m
Fast Transient, Burst Immunity:	IEC 60255-22-4:2008 IEC 61000-4-4:2011 4 kV @ 5.0 kHz 2 kV @ 5.0 kHz for comm. ports
Surge Immunity:	IEC 60255-22-5:2008 IEC 61000-4-5:2005 1 kV line-to-line 2 kV line-to-earth
Surge Withstand Capability Immunity:	IEEE 1613-2009 + A1-2011, 2.5 kV oscillatory, 4 kV fast transient IEEE 1613-2003 SWC IEC 60255-22-1:2007 2.5 kV common-mode 1.0 kV differential-mode 1 kV common-mode on comm. ports
Conducted RF Immunity:	IEC 60255-22-6:2001 IEC 61000-4-6:2008 10 Vrms
Digital Radio Telephone RF Immunity:	ENV 50204:1995 10 V/m at 900 MHz and 1.89 GHz

EMC Emissions

Radiated and Conducted Emissions:	IEC 60255-25:2000 EN 55011:1998 + A1:1999 + A2:2002; Class A FCC 15-107:2014 FCC 15-109:2014 Severity Level: Class A

Notes

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SCHWEITZER ENGINEERING LABORATORIES, INC.
2350 NE Hopkins Court • Pullman, WA 99163-5603 U.S.A.
Tel: +1.509.332.1890 • Fax: +1.509.332.7990
selinc.com • info@selinc.com

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