



RTAC SEL-3530 Real-Time Automation Controller



Available in a 1U or 3U chassis, the SEL-3530 Real-Time Automation Controller (RTAC) is 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.

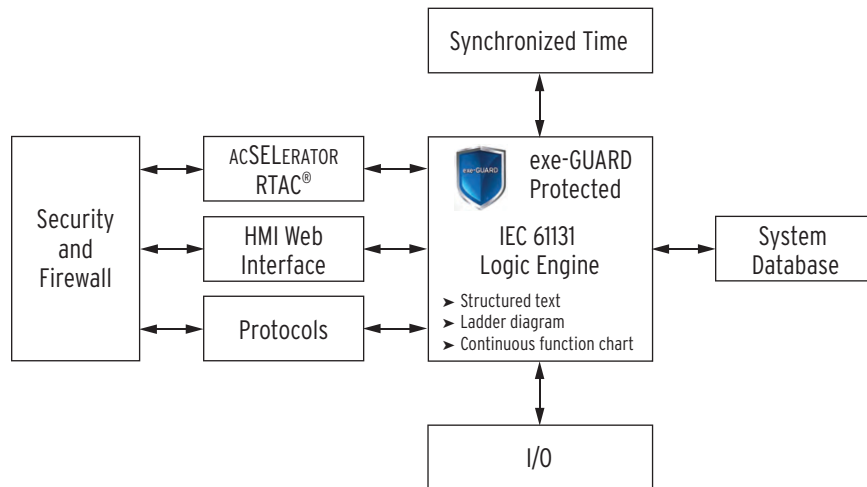
Major Features and Benefits

- ▶ **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.** The RTAC is designed and tested to withstand vibration, electrical surges, fast transients, and extreme temperatures that meet or exceed protective relay standards and 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 by 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 phasor measurement units (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. The ACSELERATOR RTAC software 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

ACCELERATOR RTAC is a Microsoft Windows compatible configuration software for offline and online use with the SEL-3530 RTAC. A project in ACCELERATOR 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. ACCELERATOR RTAC is compatible with Microsoft Excel and other programs, so you can save time and increase accuracy by copying SCADA maps from the source.

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 ACCELERATOR RTAC to develop custom IEC 61131 logic.

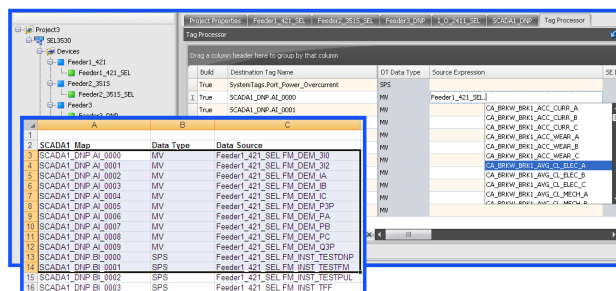


Figure 1 Map Source and Destination Tags Using the Tag Processor or Copy SCADA Maps Directly From a Spreadsheet

Optional Input/Output

If the optional I/O is installed in the RTAC, the system associates system data tags automatically with each input and output for use in the Tag Processor or IEC 61131 logic. You can program outputs to operate according to remote control signals or local logic. This powerful capability lets you build adaptive protection schemes, automate responses to alarms, and control power system apparatus directly.

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.

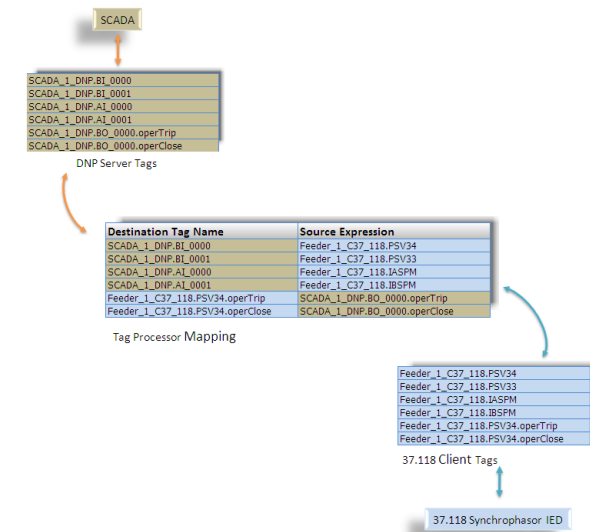


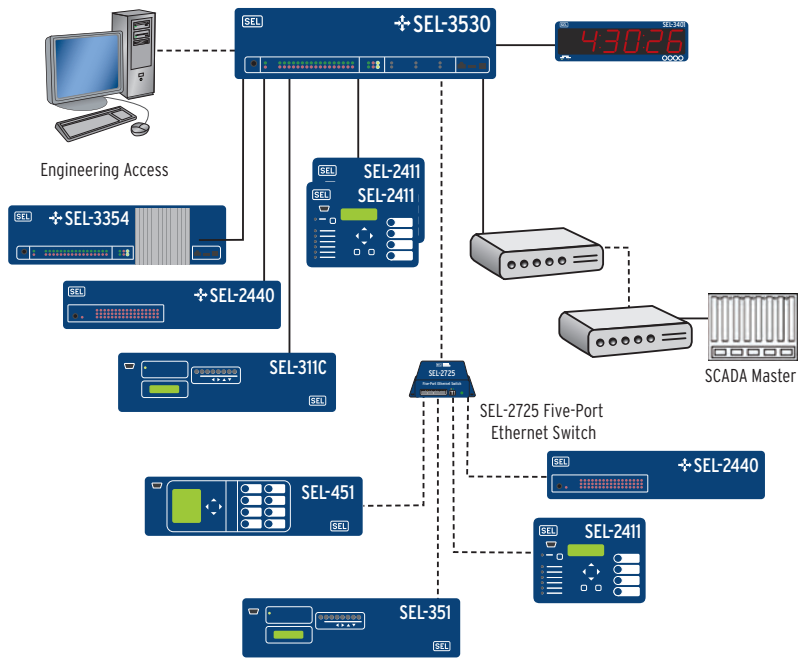
Figure 2 Synchrophasor Data Map Seamlessly Into SCADA Connections

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 MIRRORING 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 ACCELERATOR QuickSet® SEL-5030 Software suite to manage protection and control settings for these relays remotely.

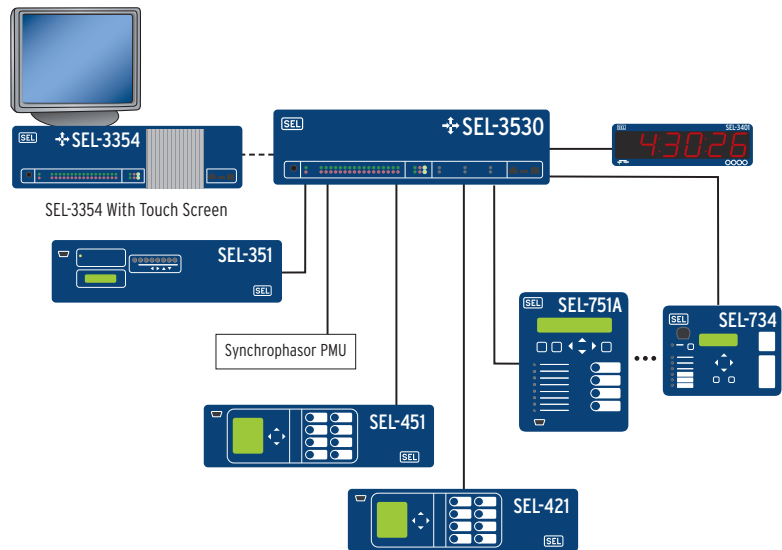


Synchrophasor Integration and Control

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 IEEE 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.

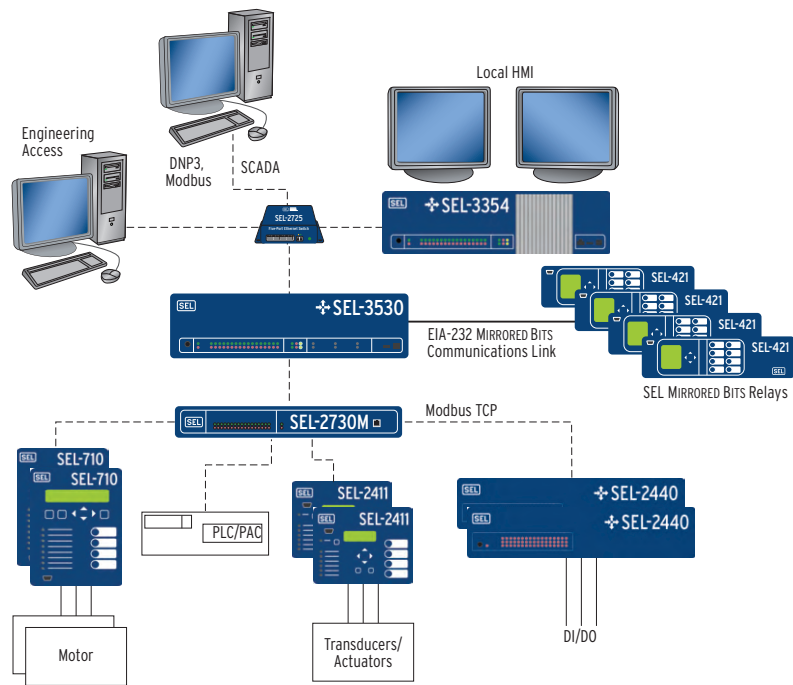


Real-Time Control and Logic Processing

The built-in logic processor provides high-speed control and transfer of signals from SEL MIRRORING BITS devices or 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 ACCELERATOR 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.

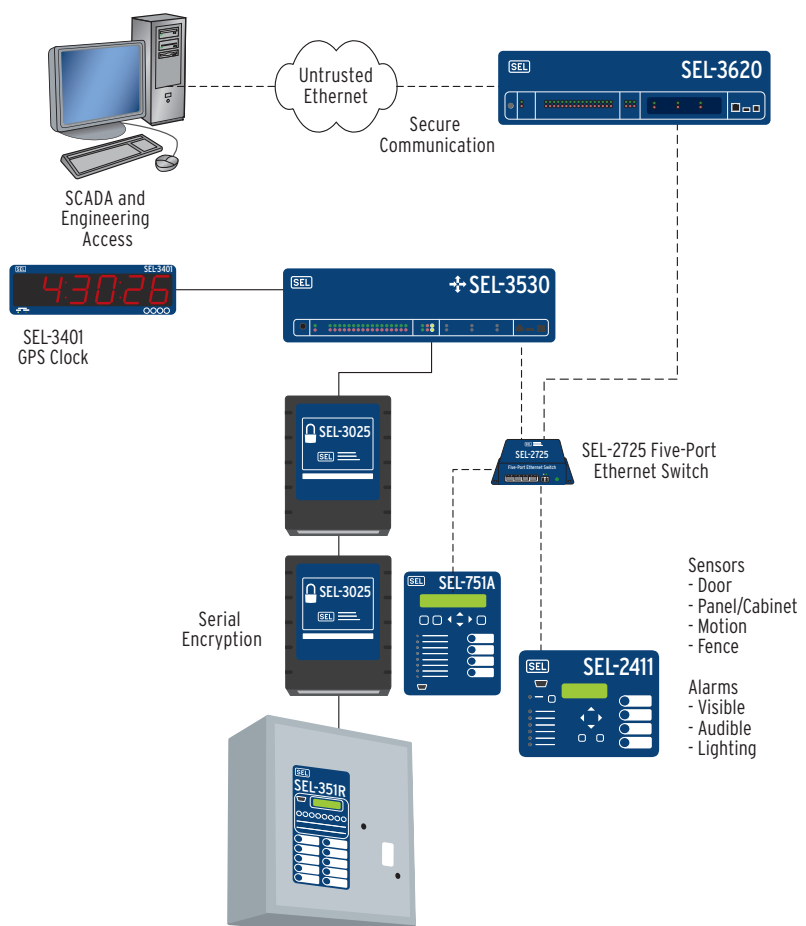


Secure Communications and User Management

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.

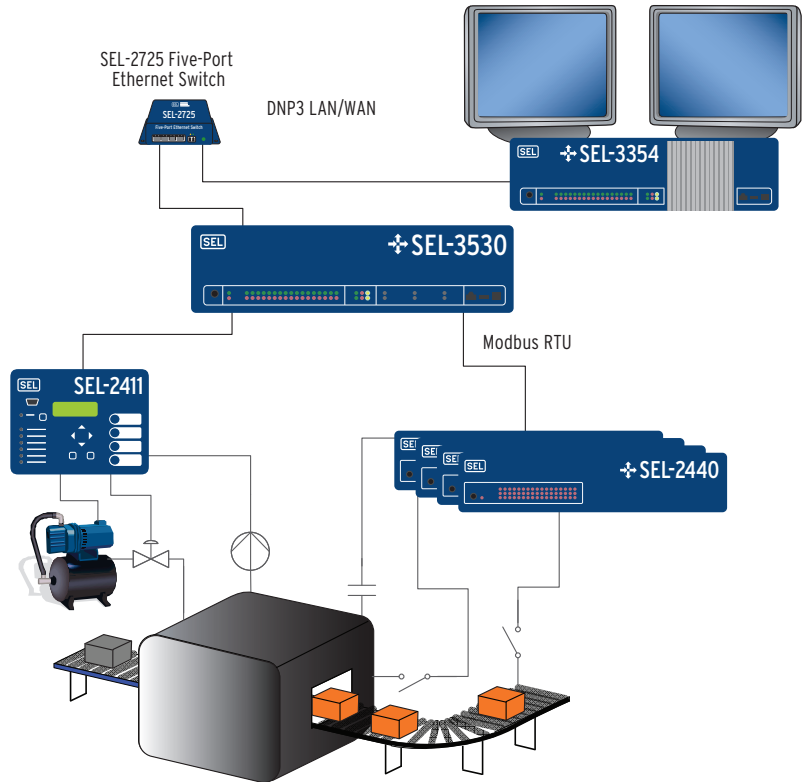


Control Systems

The custom logic, communications protocols, and I/O in the SEL-3530, SEL-2411, and SEL-2440 permit you to implement complete control systems, whether you perform discrete control 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

| | |
|------------------------|--|
| Ethernet Communication | 2 rear Ethernet ports, 10/100BASE-T copper (standard), 100BASE-FX multi-mode 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 |
| I/O Board | 8 contact outputs 24 contact inputs |
| 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 |

| | |
|----------------------|--|
| Digital Input Rating | 24 Vac/Vdc 48 Vac/Vdc 110 Vac/Vdc 125 Vac/Vdc 220 Vac/Vdc 250 Vac/Vdc |
| Mounting | Horizontal rack mount, 3U Horizontal panel mount, 3U Horizontal rack mount, 1U Horizontal panel mount, 1U |
| Serial Expansion | 33 nonisolated DB-9 serial ports, 3U |

Panel Features

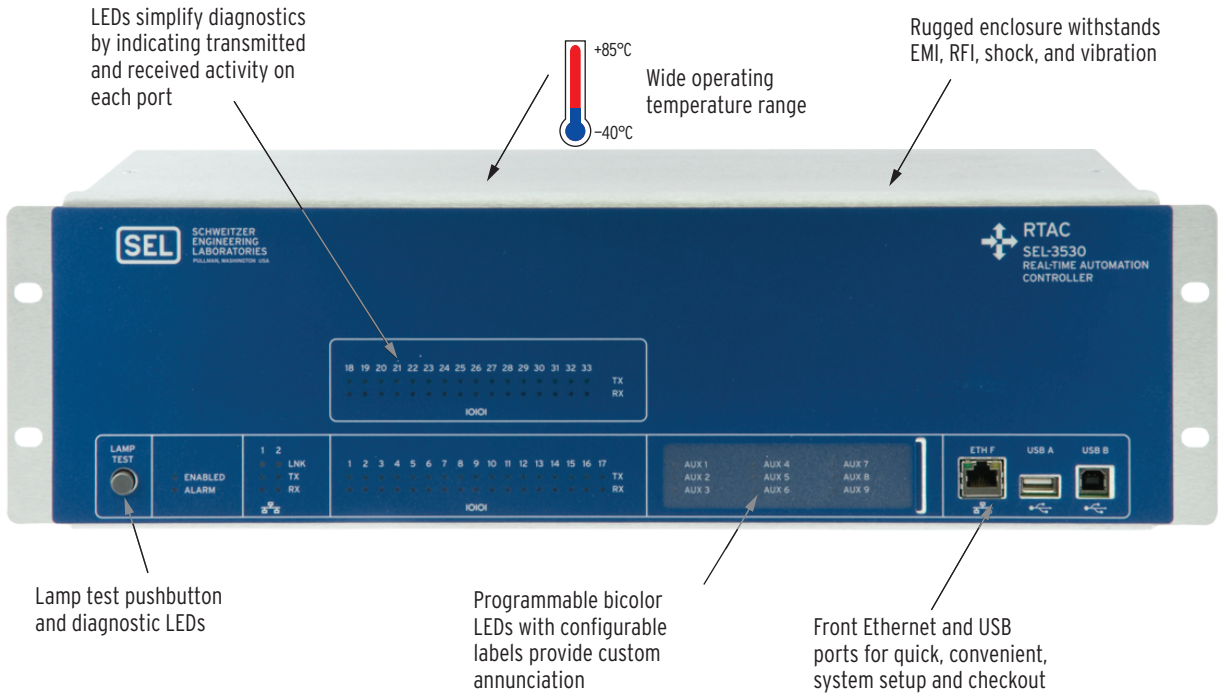


Figure 3 Front-Panel View (3U Chassis Only)

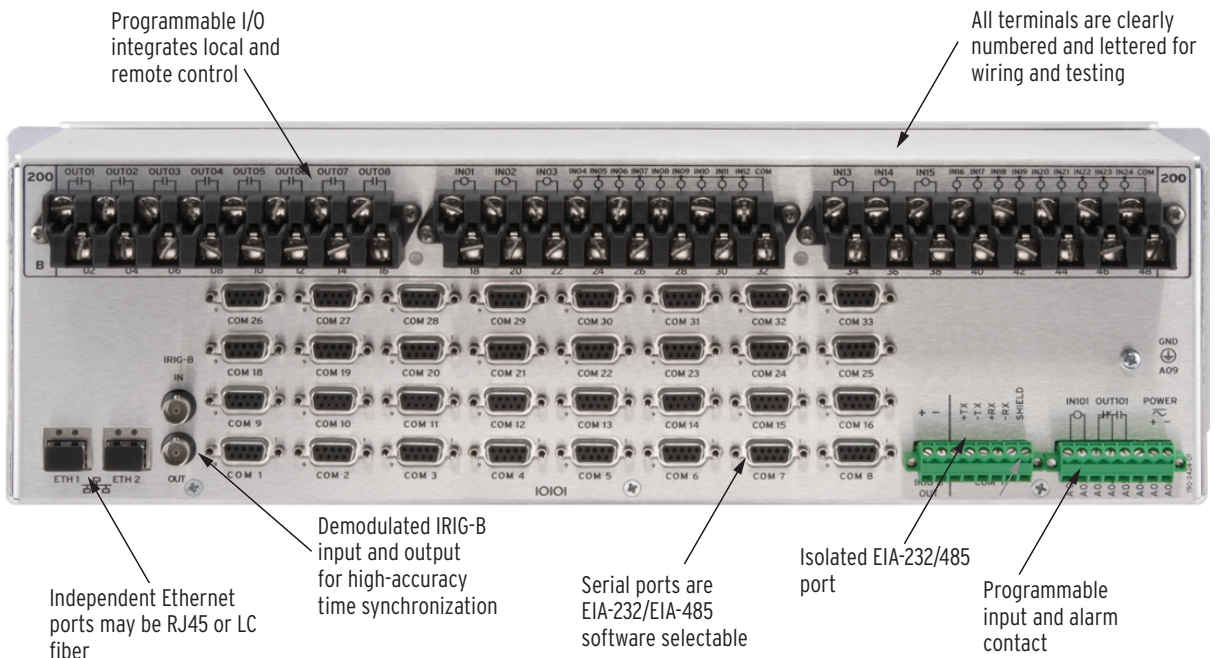
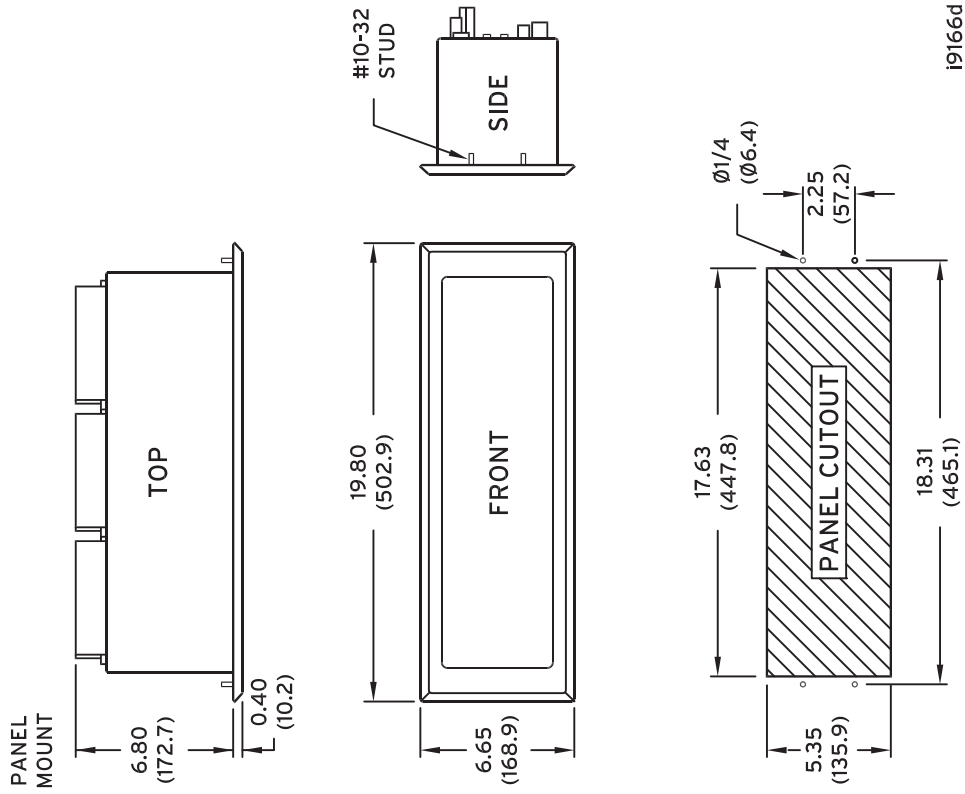


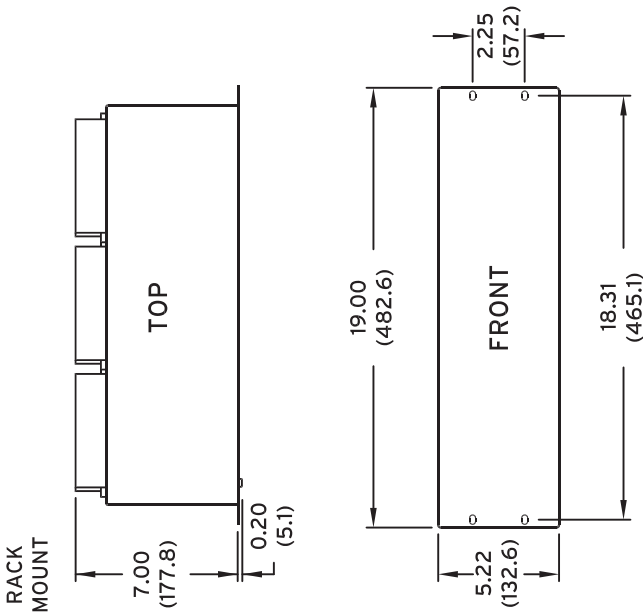
Figure 4 Rear-Panel View (3U Chassis Only)

Dimensions

PANEL-MOUNT CHASSIS



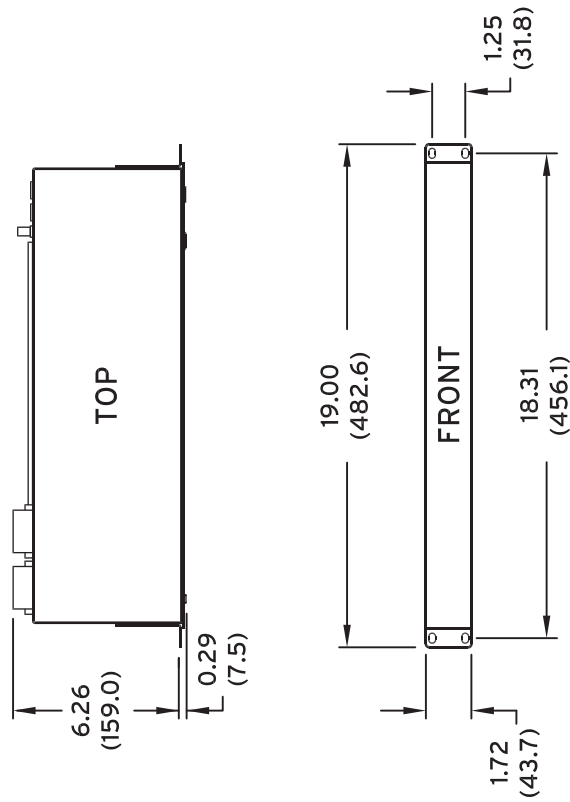
RACK-MOUNT CHASSIS



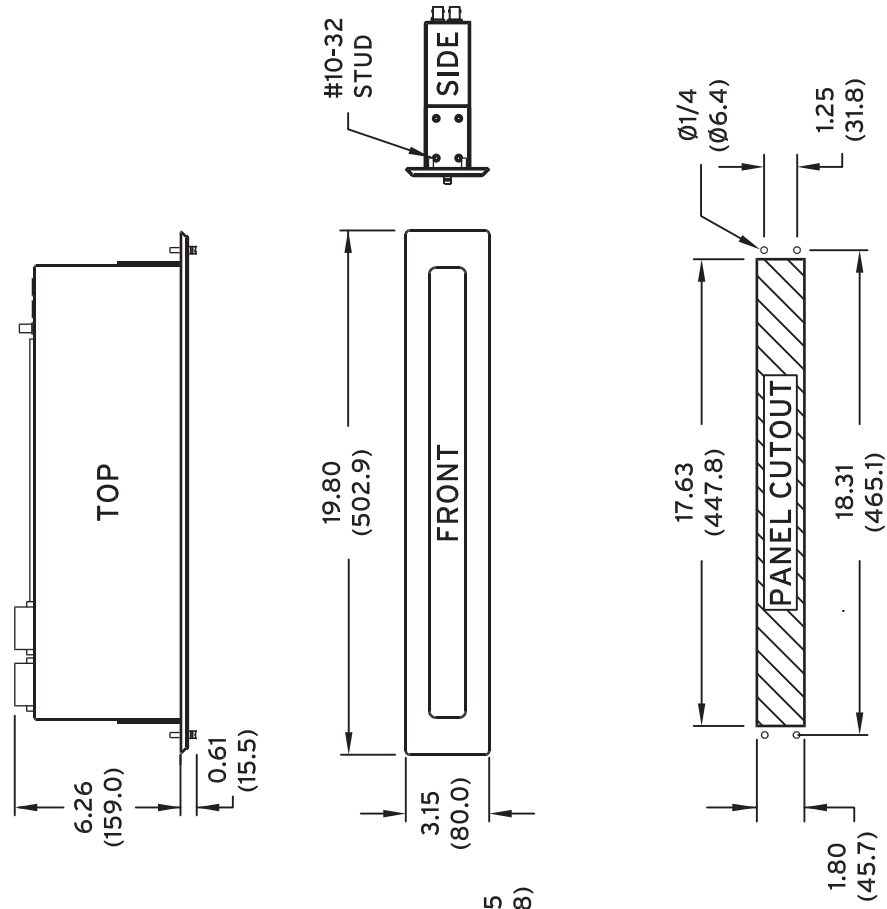
LEGEND
 in
 (mm)

19166d

RACK-MOUNT CHASSIS



PANEL-MOUNT CHASSIS



LEGEND
 in
 (mm)

Figure 6 1U Rack- and 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 Yellowstone running Linux kernel 3.x 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)

5.44 kg (12 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 MIRRORING 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 k Ω

Accuracy: 500 μ s

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 k Ω

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 k Ω

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, 1 front

Data Rate: 10 or 100 Mbps

Front Connector: RJ45 Female

Rear Connectors: RJ45 Female or LC Fiber (single-mode or multimode, 100 Mbps only)

Serial Ports

Ports: 17 (33 with optional expansion)

Type: EIA-232/EIA-485 (software selectable)

Data Rate: 300 to 115200 bps (Ports 1–16, 18–33)
300 to 57600 bps (Port 17)

Connector: DB-9 Female (Ports 1–16, 18–33),
Isolated 8 pin (Port 17)

Time Synchronization: IRIG-B

Power: +5 Vdc power on Pin 1 (500 mA maximum cumulative for 16 ports)

USB Ports

Ports: 2

1 Host Port: Type A

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 μ m 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 μ m 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 |

Inputs

Optoisolated Control Inputs

When used with dc control signals:

| | |
|----------|---|
| 24 Vdc: | Pickup 19.2–30.0 Vdc Dropout < 5.0 Vdc |
| 48 Vdc: | Pickup 38.4–60.0 Vdc Dropout < 28.8 Vdc |
| 110 Vdc: | Pickup 88.0–132.0 Vdc Dropout < 66.0 Vdc |
| 125 Vdc: | Pickup 105–150 Vdc Dropout < 75.0 Vdc |
| 220 Vdc: | Pickup 176–264 Vdc Dropout < 132 Vdc |
| 250 Vdc: | Pickup 200–300 Vdc Dropout < 150 Vdc |

When used with ac control signals:

| | |
|----------|---|
| 24 Vac: | Pickup 16.4–30.0 Vac rms Dropout < 5.0 Vac rms |
| 48 Vac: | Pickup 32.8–60.0 Vac rms Dropout < 20.3 Vac rms |
| 110 Vac: | Pickup 75.1–132.0 Vac rms Dropout < 46.6 Vac rms |
| 125 Vac: | Pickup 89.6–150 Vac rms Dropout < 53 Vac rms |
| 220 Vac: | Pickup 150.3–264 Vac rms Dropout < 93.2 Vac rms |
| 250 Vac: | Pickup 170.6–300 Vac rms Dropout < 106 Vac rms |

Current draw at nominal dc voltage: <5 mA at nominal voltage
<8 mA for 110 V option

Outputs

Mechanical Durability: 10 M no-load operations

DC Output Ratings

| | |
|----------------------------|------------|
| Rated Operational Voltage: | 250 Vdc |
| Rated Voltage Range*: | 24–250 Vdc |
| Rated Insulation Voltage: | 300 Vdc |

| | |
|---|---|
| Pilot Duty Rating**: | R300, 250 Vdc |
| Make (Short Duration Contact Current)*: | 30 A @ 250 Vdc per IEEE C37.90 |
| Continuous Carry*: | 6 A @ 70°C; 4 A @ 85°C |
| Short-Time Thermal Withstand*: | 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: \leq 8 ms typical |
| Breaking Capacity* (10,000 Operations) per IEC 60255-0-20:1974: | 48 V 0.50 A L/R = 40 ms 125 V 0.30 A L/R = 40 ms |
| Cyclic Capacity* (2.5 Cycles/Second) per IEC 60255-0-20:1974: | 48 V 0.50 A L/R = 40 ms 125 V 0.30 A L/R = 40 ms |

AC Output Ratings

| | |
|---|--|
| Rated Operational Voltage: | 240 Vac |
| Rated Voltage Range*: | 110–240 Vrms |
| Rated Insulation Voltage: | 300 Vac |
| Utilization Category: | AC-15 (control of electromagnetic loads > 72 VA) |
| Pilot Duty Rating**: | B300, 240 Vac |
| Contact Protection: | 270 Vac, 40 J |
| Continuous Carry*: | 3 A @ 120 Vac 1.5 A @ 240 Vac 5 A |
| Rated Frequency: | 50/60 \pm 5 Hz |
| Operating Time (Coil Energization to Contact Closure, Resistive Load)*: | Pickup/Dropout Time: \leq 8 ms |
| Electrical Durability Make VA Rating*: | 3600 VA, $\cos\phi = 0.3$ |
| Electrical Durability Break VA Rating*: | 360 VA, $\cos\phi = 0.3$ |

* Parameters verified by SEL per IEC 60255-0-20:1974 and IEEE C37.90-2005.
** Per UL 508.

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: | <40 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

Communication Product Testing

IEEE 1613

Environmental

| | |
|-----------------------|--|
| 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 C37.90.3-2001 IEEE 1613-2009 + A1-2011 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 IEEE 1613-2009 + A1-2011 RFI IEC 61000-4-3:2008, 10 V/m IEEE C37.90.2-2004, 35 V/m |
| Fast Transient, Burst Immunity: | IEC 60255-22-4:2008 IEC 61000-4-4:2004 + CRGD:2006 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 C37.90.1-2002, 2.5 kV oscillatory, 4 kV fast transient IEEE 1613-2009 + A1-2011 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 |

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