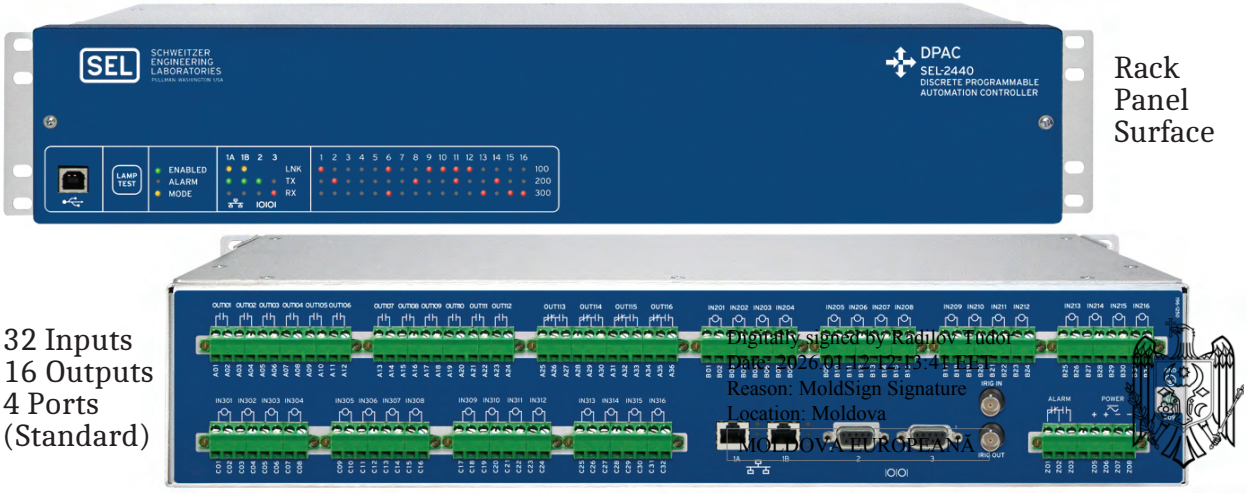
SEL-2440 Discrete Programmable Automation Controller

Complete System for Control and Monitoring



Rack Panel Surface

32 Inputs
16 Outputs
4 Ports
(Standard)

Major Features and Benefits

Fast and Powerful I/O

- Use an exceptional and compact combination of inputs, outputs, and communications.
- Analyze system events with inputs and other events timed to the microsecond.
- Synchronize control with outputs that are synchronized to IRIG-B, PTP, SNTP, or DNP time.
- Perform actions quickly with a processing interval of 2 ms.
- Program new features with logic, latches, timers, counters, edge-triggers, and math functions.
- Ensure safe operation by using an input with logic programmed for local/remote control.

Convenient Maintenance and Support

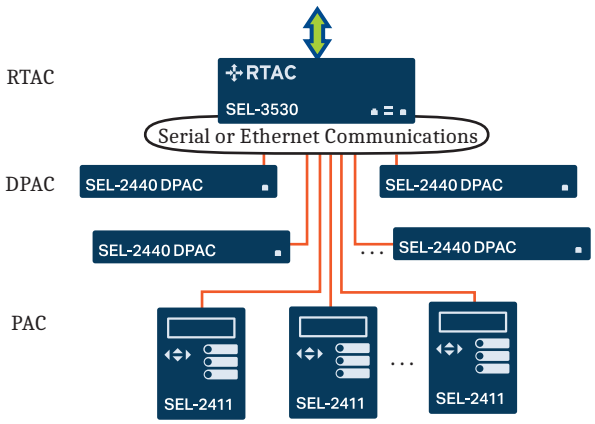
- LEDs provide status for every I/O point and communications port.
- Removable terminal blocks make installation and replacement quick and efficient.
- Positive retention connectors ensure that connections are not lost due to sagging cables.
- Front-panel management port makes device management convenient.

Flexible Communications and Integration

- Communicate with DNP3, Modbus®, and IEC 61850 protocols over Ethernet and serial connections. Direct and select-before-operate (SBO) outputs are supported.
- Automate systems with flexible communication options that provide easy integration with SCADA.
- Configure easily with preprogrammed register or object maps and front-panel control (DIP) switches.
- Alternatively, configure with ACSELERATOR QuickSet® SEL-5030 Software.

SEL Quality, Standards, and Global Support

- Designed and tested for harsh physical and electrical environments.
- Designed and tested to operate with dc grounded batteries and capacitive loads, and to trip breakers and interrupt inductive loads.
- Superior specification compliance, high reliability, low price, and worldwide, ten-year warranty.



Product Summary

The SEL-2440 Discrete Programmable Automation Controller (DPAC) withstands harsh physical and electrical environments and is built and tested to meet mission-critical IEEE and IEC protective relay standards. Apply the DPAC to satisfy stand-alone or distributed input, output, and communications needs. *Figure 1* shows the DPAC functionality.

Functional Diagram

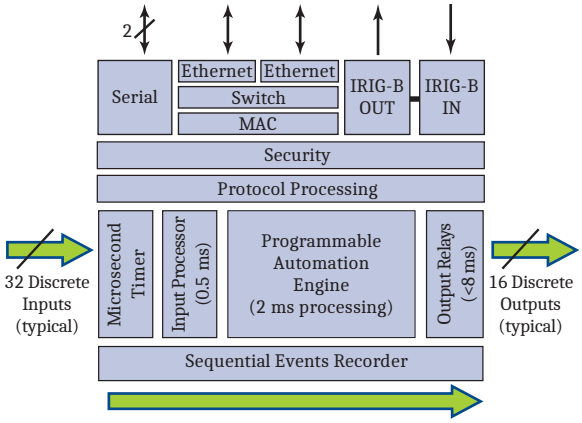


Figure 1 Functional Diagram

Configuration

- **Easy Mode.** Set address and communications parameters with DIP switches.
- **Flexible Mode.** Access additional flexibility using QuickSet software, shown in the following figure.

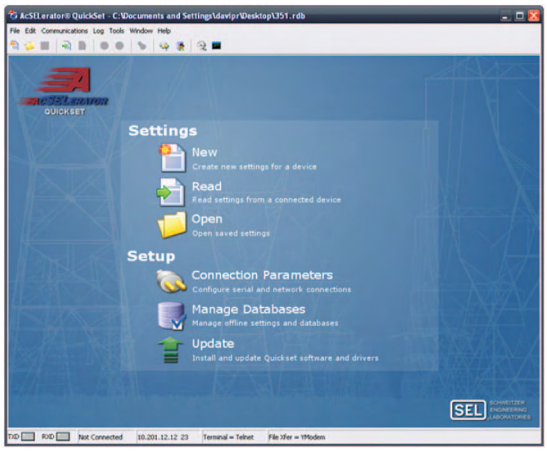


Figure 2 QuickSet Launchpad

Inputs/Outputs

DPAC devices can be ordered with different I/O and input voltage ratings as shown in the following tables.

I/O Quantity Options

	Inputs	Outputs
Standard	32	16
Option 1	16	32
Option 2	48	0
Option 3	16	32 (16 Standard and 16 High-Current Interrupting)
Option 4	16	26 (12 Form A, 4 Form C, 10 Fast High-Current Form A)
Option 5	32	10 (10 Fast High-Current Form A)

I/O Input Voltage Options

Digital Input Rating	
24 Vac/Vdc	125 Vac/Vdc
48 Vac/Vdc	220 Vac/Vdc
110 Vac/Vdc	250 Vac/Vdc

Communication and Time

Many communications ports and protocols are provided.

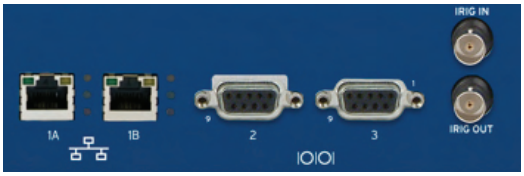


Figure 3 Rear-Panel Communications and IRIG-B Ports

Port	Port Interface
PORT F	USB 2.0 physical interface, serial port (e.g., COM1) software interface
PORT 1	Ethernet with switch/failover (copper or fiber)
PORT 2	Serial (EIA-232, EIA-485, or ST fiber)
PORT 3	Serial (EIA-232)

	Serial	Ethernet
DNP3	Yes	Yes
Modbus	Yes	Yes
IEC 61850		Yes
MIRRORED BITS®	Yes	
SEL Fast Message	Yes	

Input/Output Features

Inputs (Status and Alarms)

Use digital inputs to monitor critical alarms or status points and time-stamp to the microsecond.

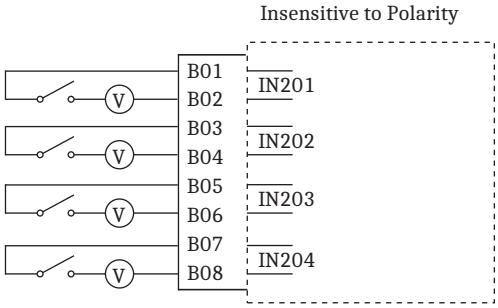


Figure 4 Independent and Isolated Inputs

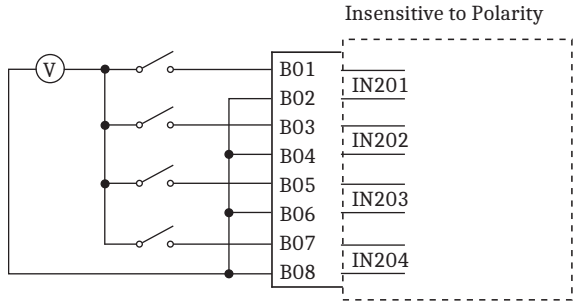


Figure 5 Bussed Inputs

SEL inputs are designed and tested to ensure they operate correctly for dc battery grounds and capacitive discharges.

The bold line in *Figure 6* shows how an earth fault completes the battery path through the input, bypassing the output. If the input is rated for 125 Vdc, the 65 Vdc that the fault causes across the input will assert the input. SEL level-sensitive inputs are designed so that they do not operate for this condition.

The bold line in *Figure 7* shows a discharge path from the wiring capacitance through the input when a knife switch is closed. This discharge can cause a temporary assertion of an input. SEL inputs are designed with debounce timers so that they do not operate for this condition.

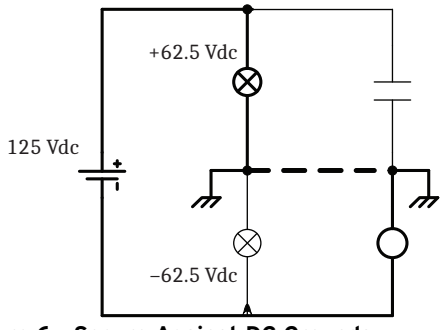


Figure 6 Secure Against DC Grounds

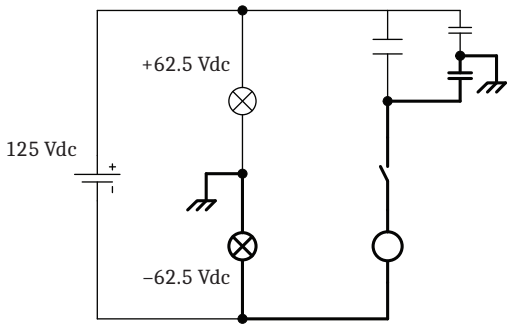


Figure 7 Secure Against Capacitive Discharges

Outputs (Relays)

Outputs are rated for 30 A make and inductive interrupt applications such as trip and close operations and motor control. See the *Output* specifications for more details.

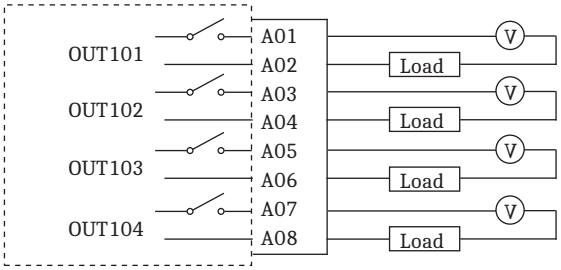
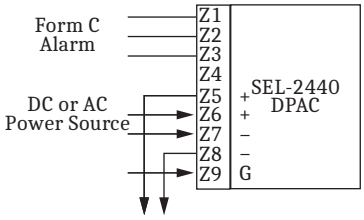


Figure 8 Independent and Isolated Outputs

Power

The **POWER** terminals on the rear panel must connect to 120–230 Vac or 24–250 Vdc with the proper polarity. These terminals are isolated from chassis ground. Extra terminals are provided so power can be daisy-chained from DPAC to DPAC.



IRIG-B

A demodulated IRIG-B input and output are provided so this signal can be daisy-chained between DPAC devices.

Connectors

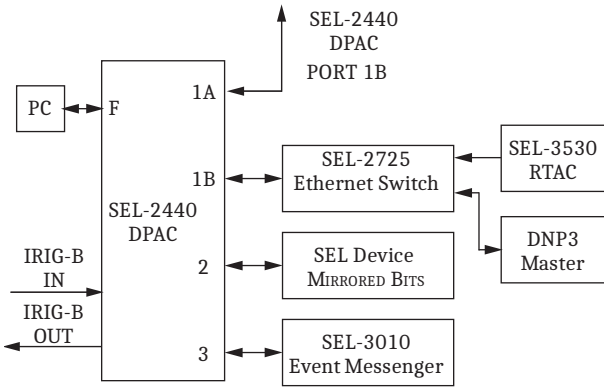
Removable terminal block connectors make installation and replacement quick and efficient but can result in intermittent or lost connections if positive retention means aren't provided. The following diagram shows one of the pluggable connectors used on the DPAC and points out the retention screws that ensure connections remain in place.

Conformal Coating

The optional conformal coating protects the DPAC printed circuit board from moisture and corrosive elements found in harsh installations. This conformal coating option conforms to Mil-1-46058C Type UR conformal coating requirements.

Communications Ports

A rich collection of communications ports and protocols are available with the DPAC as shown in the following figure, which also includes connection examples.



Analyze Sequence-of-Events

Record sequence-of-events with the Sequential Events Recorder (SER) function. With this function, you can analyze assertions and deassertions of digital inputs and outputs—as many as 512 state changes to the microsecond for as many as 96 different digital points. The function also captures when the device powers up and a settings change occurs.

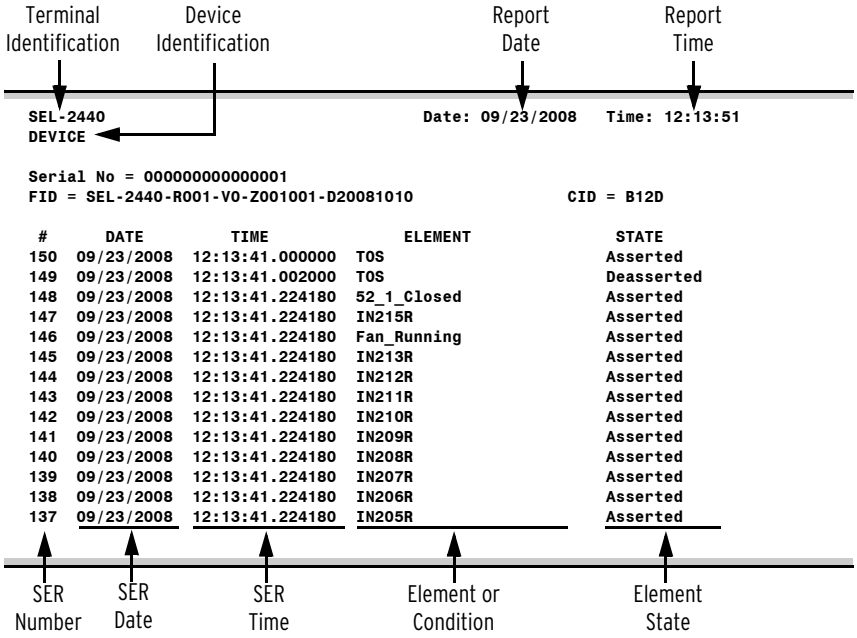


Figure 9 Sample SER Report

Combine SER data from individual SEL-2440 DPAC devices into a system-wide log. Synchronize the system with IRIG-B time code and the report data will align perfectly.

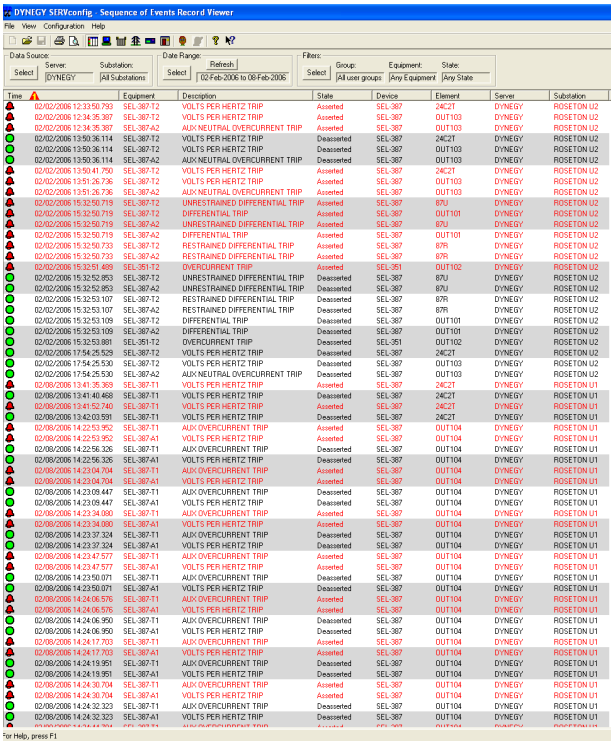


Figure 10 Combine SER Data From Multiple SEL-2440 DPAC devices for a System-Wide Log and Display

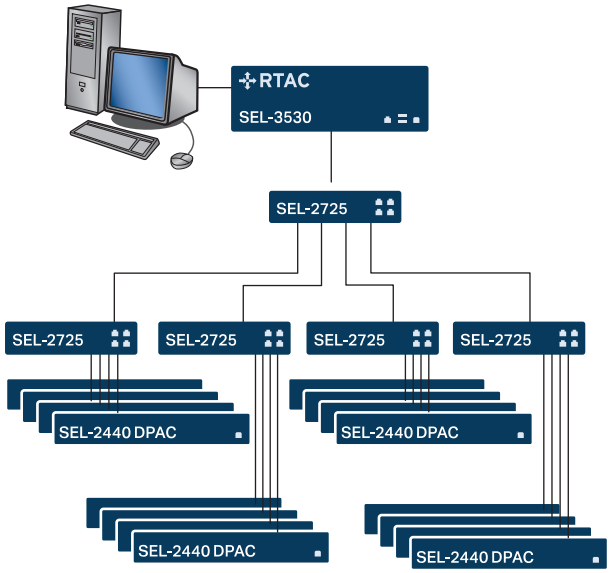


Figure 11 Example SER Collection Architecture

Automation Features

Flexible Control Logic and Integration Features

Eases Configuration

The DPAC does not require special communications software. Use any system that emulates a standard terminal system for engineering access to the device.

Simplifies Communications

The SEL-2440 is equipped with three independently operated serial ports. Establish communication by connecting computers, modems, protocol converters, printers, an SEL Communications Processor, SCADA serial port, and an RTU for local or remote communication. Apply an SEL communications processor as the hub of a star network, with point-to-point fiber or copper connection between the hub and the SEL-2440.

Supports Standard Protocols

As with most SEL devices, the DPAC comes standard with the communications protocols listed below.

- DNP3
- Modbus
- SEL ASCII
- SEL Compressed ASCII
- SEL Fast Meter
- SEL Fast Operate
- SEL Fast SER
- SEL Fast Message
- SEL MIRRORED BITS

Time Synchronization Protocols

The DPAC supports the following protocols for synchronizing your device to master clocks.

- Demodulated IRIG-B
- Firmware based PTP (IEEE 1588-2008)
- SNTP from High Priority or Low Priority servers
- DNP3

Simplifies SCADA

SEL devices provide proprietary but open, binary “fast” protocols. These protocols are self-describing and are interleaved with ASCII protocols on the same port. Simplify configuration, minimize communications wiring, and improve performance between the DPAC and other devices (e.g., communications processors) with these protocols.

Performs Logic and Math

Eliminate PLCs with Boolean logic, rising/falling edge triggers, and math (+, -, *, /).

Replaces Traditional Latching Relays

Replace as many as 32 traditional latching relays for such functions as “remote control enable” with latches. Program latch set and latch reset conditions with SELOGIC® control equations. Set or reset the nonvolatile latches using optoisolated inputs, Remote Bits, latches, or any programmable logic condition. The latches retain their state when the device loses power.

Eliminates External Timers

Eliminate external timers for custom protection or control schemes with 32 general purpose SELOGIC control equation timers. Each timer has independent time-delay pickup and dropout settings. Program each timer input with any desired element. Assign the timer output to trip logic, transfer trip communications, or other control scheme logic.

Eliminates External Counters

Eliminate external counters for custom control schemes with 32 counters, updated every 2 ms processing interval. Each counter element consists of five inputs (preset value; load preset value, count up, count down, and reset to zero) and three outputs (counter value; count as many as preset reached, count down to zero reached).

Eliminates RTU-to-Device Wiring

Eliminate RTU-to-Device wiring with 32 Remote Bits. Set, clear, or pulse Remote Bits using serial or Ethernet port commands. Program the Remote Bits into your control scheme with SELOGIC control equations. Use Remote Bits for SCADA-type control operations such as trip, close, and settings group selection.

Provides Annunciation

Indicators (LEDs) provide annunciation of I/O status for each input and output. In addition, device status and port activity indicators simplify commissioning and troubleshooting.

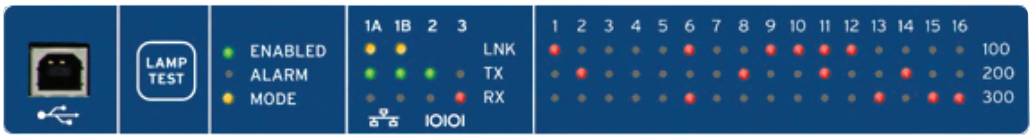


Figure 12 Annunciation Indicators

Communications Architectures

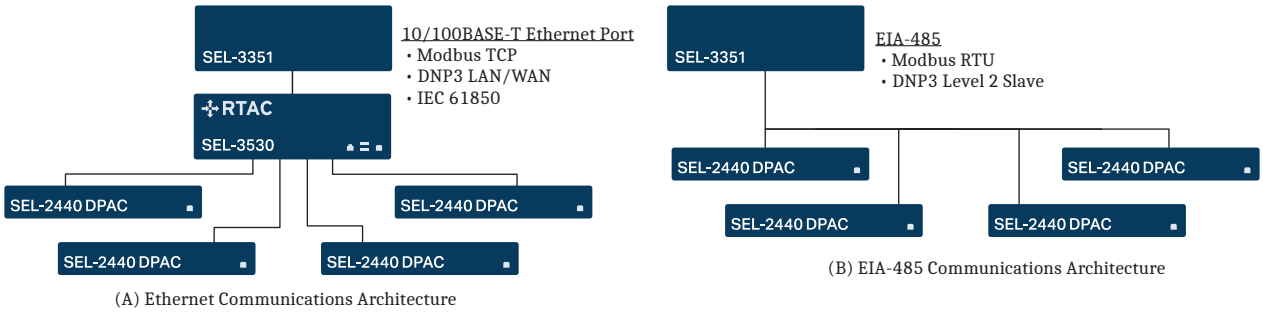


Figure 13 Typical Ethernet and EIA-485 Communications Architectures

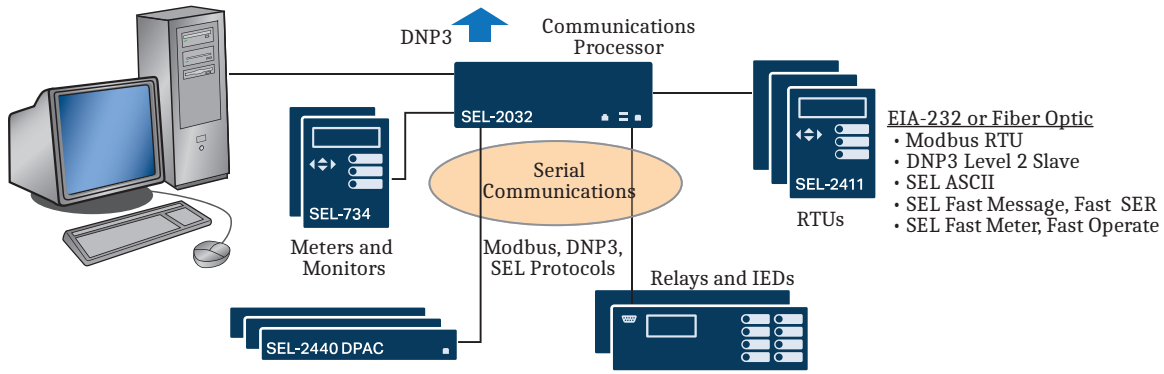


Figure 14 Typical EIA-232 and Fiber-Optic Communications Architecture

Additional Ordering Options

The following options can be ordered for any SEL-2440 model (see the SEL-2440 Model Option Table for details):

Port 2 Physical Interface	Mounting
EIA-232	Rack
EIA-485	Panel
ST fiber	Surface

Diagrams and Dimensions

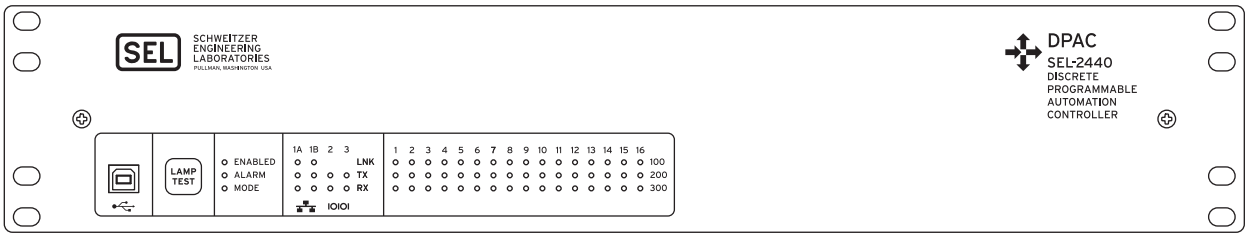


Figure 15 Rack-Mount Drawing

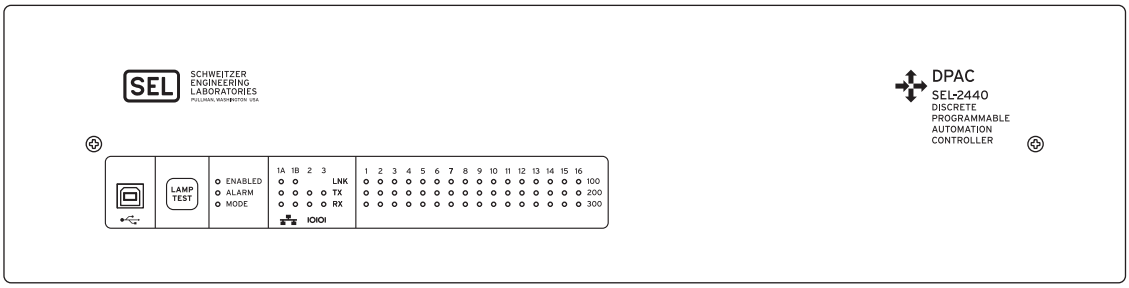


Figure 16 Panel-Mount Drawing

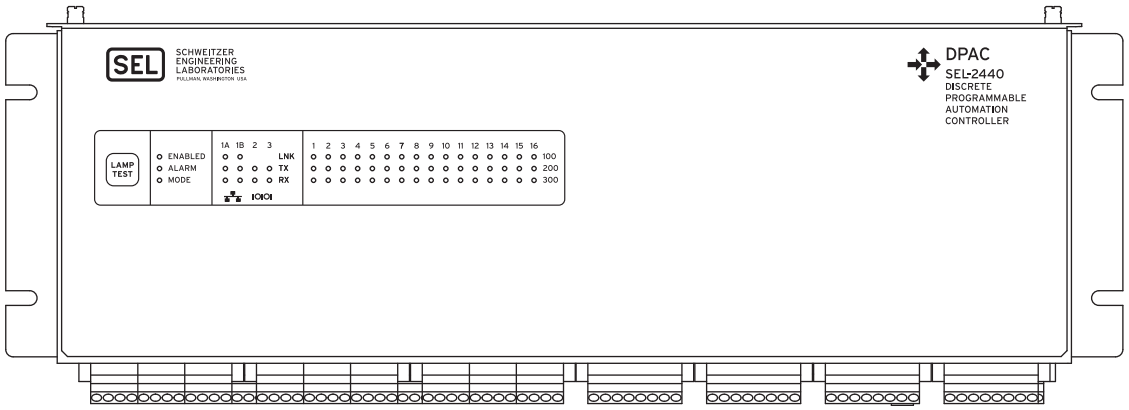


Figure 17 Surface-Mount Drawings

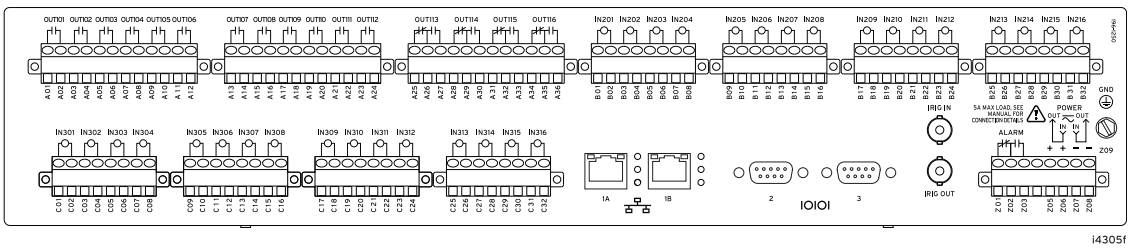


Figure 18 32 Input, 16 Output Rear-Panel Drawing

High-current interrupting outputs are polarity sensitive. This is indicated with a + next to the contact on the overlay to indicate the positive side of the contact.

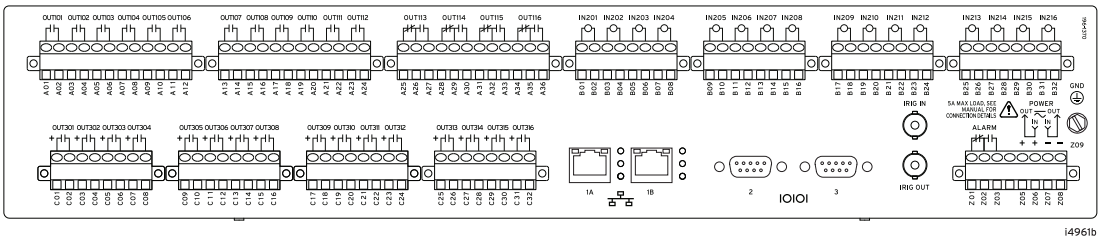


Figure 19 High-Current Interrupting Option Rear-Panel Drawing

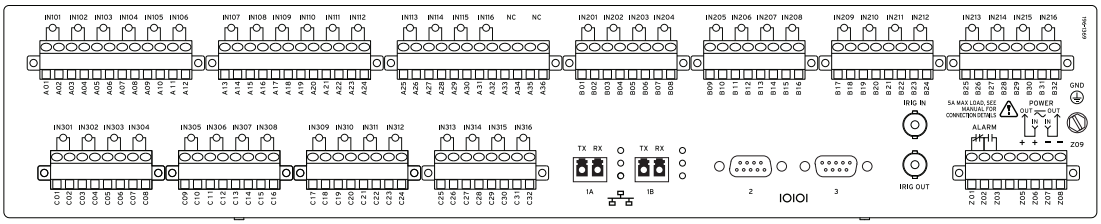


Figure 20 Port 2 EIA-485 and Fiber-Optic Ethernet Option Rear-Panel Drawing

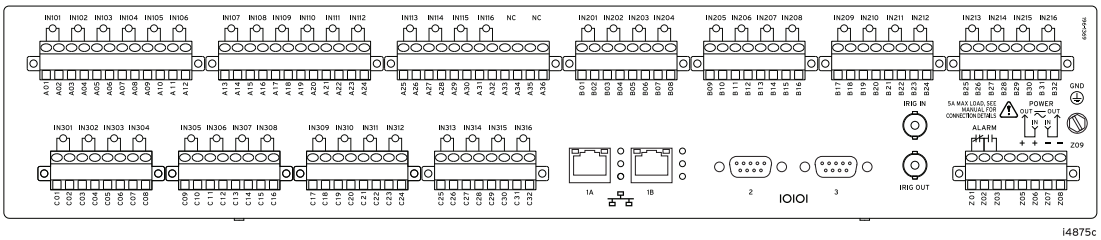


Figure 21 48DI Option Rear-Panel Drawing

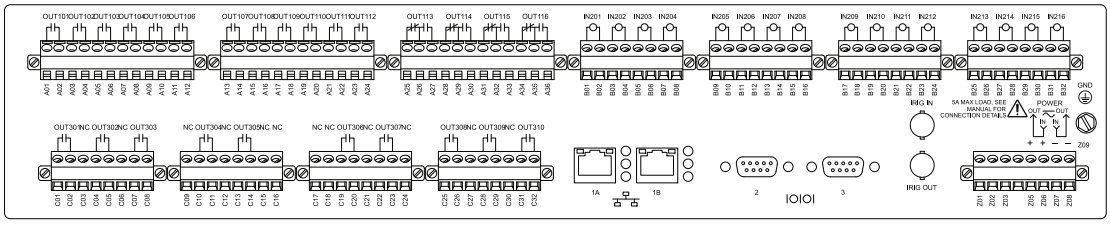


Figure 22 16 Input, 16 Standard Output, and 10 Fast High-Current Output Rear-Panel Drawing

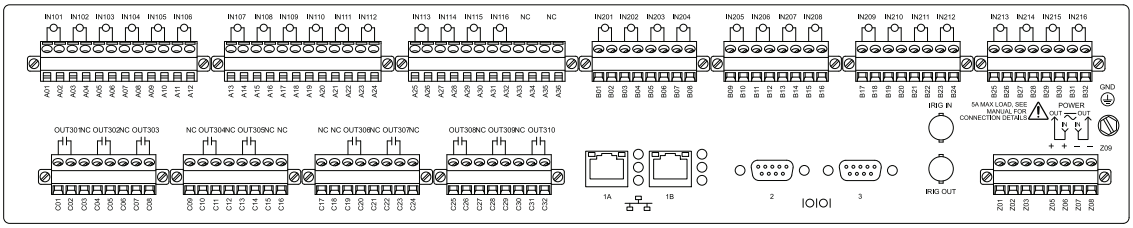
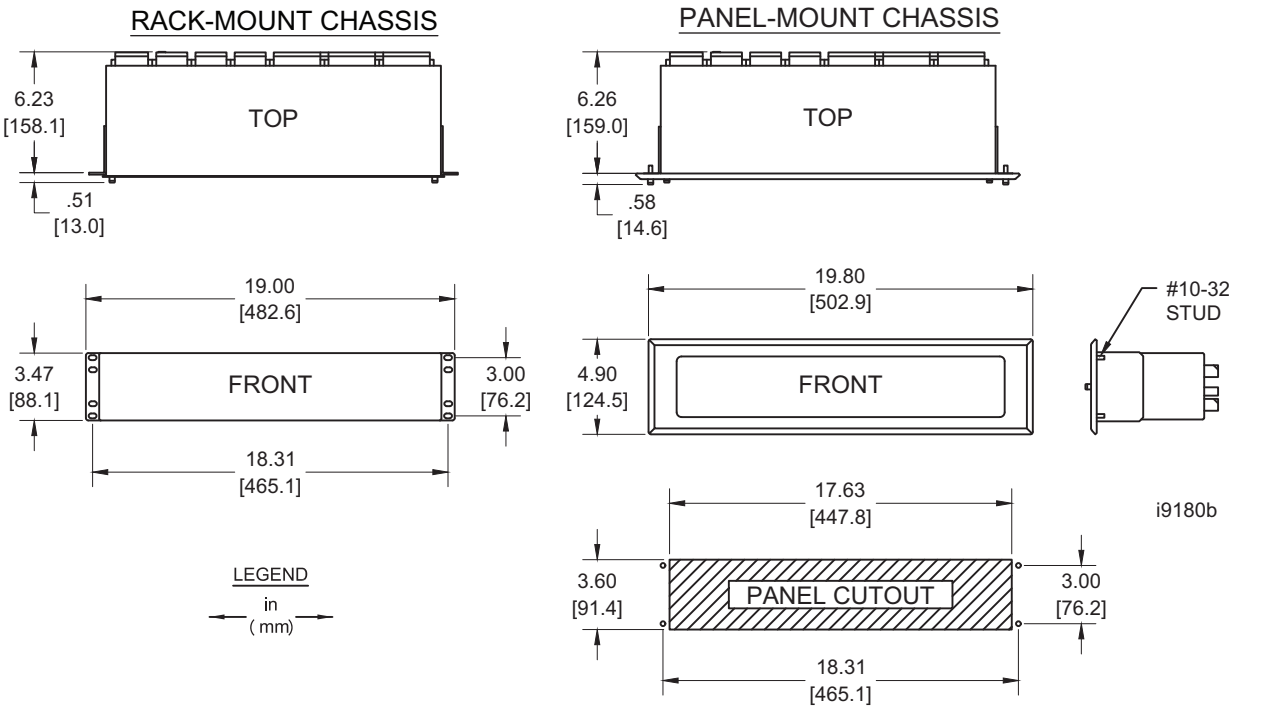
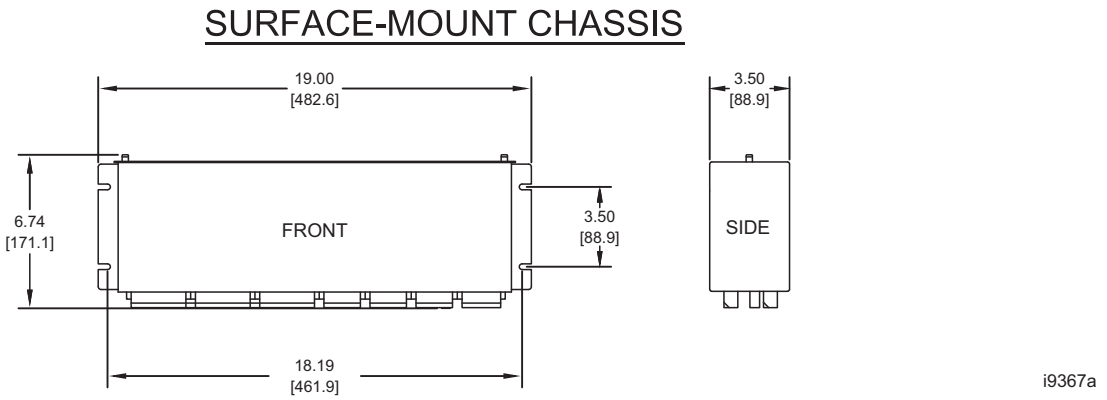


Figure 23 32 Input and 10 Fast High-Current Output Rear-Panel Drawing





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)
Note: DC output ratings not evaluated by UL61010.

CE Mark

UKCA Mark

RCM Mark

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

General

Operating Temperature Range

–40° to +85°C (–40° to +185°F)
(not applicable to UL installations. UL rated 40°C)

When Powered by 24 V, the SEL-2440 Supports the Following Conditions:

70°C:	Operate 32 outputs and 2.5 W max on +5 V pin (Port 2/3)
Conformal Coated:	Derate operating temperature by 10°C.

Operating Environment

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

Weight

2.0 kg (4.4 lb)

Inputs

Optoisolated Control Inputs

When Used With DC Control Signals:

250 V	ON for 200–275 Vdc	OFF below 150 Vdc
220 V	ON for 176–242 Vdc	OFF below 132 Vdc
125 V	ON for 100–135.5 Vdc	OFF below 75 Vdc
110 V	ON for 88–121 Vdc	OFF below 66 Vdc
48 V	ON for 38.4–52.8 Vdc	OFF below 28.8 Vdc
24 V	ON for 15–30 Vdc	OFF below 5 Vdc

When Used With AC Control Signals:

250 V	ON for 170.6–275 Vac	OFF below 106 Vac
220 V	ON for 150.3–264 Vac	OFF below 93.2 Vac
125 V	ON for 85–150 Vac	OFF below 53 Vac
110 V	ON for 75.1–132 Vac	OFF below 46.6 Vac
48 V	ON for 32.8–60 Vac	OFF below 20.3 Vac
24 V	ON for 14–27 Vac	OFF below 5 Vac

Current Draw at Nominal DC Voltage: 2–6 mA (except for 24 V, 8 mA)

Outputs

Mechanical Durability

10 M no-load operations

DC Output Ratings

Standard Output Option

Rated Operational Voltage: 24–250 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:

24 V	0.75 A	L/R = 40 ms
48 V	0.50 A	L/R = 40 ms
125 V	0.30 A	L/R = 40 ms
250 V	0.20 A	L/R = 40 ms

Cyclic Capacity (2.5 Cycles/Second) per IEC 60255-0-20:1974:

24 V	0.75 A	L/R = 40 ms
48 V	0.50 A	L/R = 40 ms
125 V	0.30 A	L/R = 40 ms
250 V	0.20 A	L/R = 40 ms

High-Current Interrupting Output Option

Rated Operational Voltage: 24–250 Vdc

Rated Voltage Range: 19.2–275 Vdc

Rated Insulation Voltage: 300 Vdc

Make: 30 A

Carry: 6 A continuous carry at 70°C
4 A continuous carry at 85°C

1 s Rating: 50 A

MOV Protection: 330 Vdc/145 J

Pickup Time: Less than 5 ms

Dropout Time: Less than 8 ms, typical

Breaking Capacity (10,000 Operations):

24 V	10 A	L/R = 40 ms
48 V	10 A	L/R = 40 ms
125 V	10 A	L/R = 40 ms
250 V	10 A	L/R = 20 ms

Cyclic Capacity (4 Cycles in 1 Second, Followed by 2 Minutes Idle for Thermal Dissipation):

24 V	10 A	L/R = 40 ms
48 V	10 A	L/R = 40 ms
125 V	10 A	L/R = 40 ms
250 V	10 A	L/R = 20 ms

Note: Make per IEEE C37.90-1989.
Note: Do not use high-current interrupting output contacts to switch ac control signals. These outputs are polarity-dependent.
Note: Breaking and Cyclic Capacity per IEC 60255-0-20:1974.

Fast High-Current Interrupting Output Option

Rated Operational Voltage: 24–250 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

Continuous Carry (UL/CSA Derating With All Outputs Asserted): 5 A @ < 60°C; 2.5 A 60 to 70°C

Thermal: 50 A for 1 s

Contact Protection: 330 Vdc, 145 J MOV protection across open contacts

Operating Time (Coil Energization to Contact Closure, Resistive Load)

Pickup Time: ~16 µs at 250 Vdc, 22 µs at 125 Vdc, 85 µs at 19.2 Vdc typical (results with 100 kΩ resistive load)

Dropout Time: < 8 ms typical

Inductive Breaking Capacity (100,000 Operations) per IEC 60255-0-20:1974

24 Vdc	10 A	L/R = 40 ms
48 Vdc	10 A	L/R = 40 ms
125 Vdc	10 A	L/R = 40 ms
250 Vdc	10 A	L/R = 20 ms

Cyclic Capacity (4 Cycles/Second Followed by 2 Minutes Idle Thermal Dissipation) per IEC 60255-0-20:1974

24 Vdc	10 A	L/R = 40 ms
48 Vdc	10 A	L/R = 40 ms
125 Vdc	10 A	L/R = 40 ms
250 Vdc	10 A	L/R = 20 ms

AC Output Ratings

Standard Output Option

Rated Operational Voltage: 110–240 Vac

Rated Voltage Range: 19.2–264 Vac

Rated Insulation Voltage: 270 Vac

Rated Frequency: 50/60 ± 5 Hz

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: 6 A @ 70°C; 4 A @ 85°C

Continuous Carry (UL/CSA Derating With All Outputs Asserted): 5 A @ < 60°C; 2.5 A 60–70°C

Operating Time (Coil Energization to Contact Closure): Pickup/Dropout Time: ≤ 8 ms

Electrical Durability Make VA Rating: 3600 VA, $\cos\phi = 0.3$

Electrical Durability Break VA Rating: 360 VA, $\cos\phi = 0.3$

Fast High-Current Output Option

Rated Operational Voltage: 110–240 Vac

Voltage Range: 19.2–250 Vac

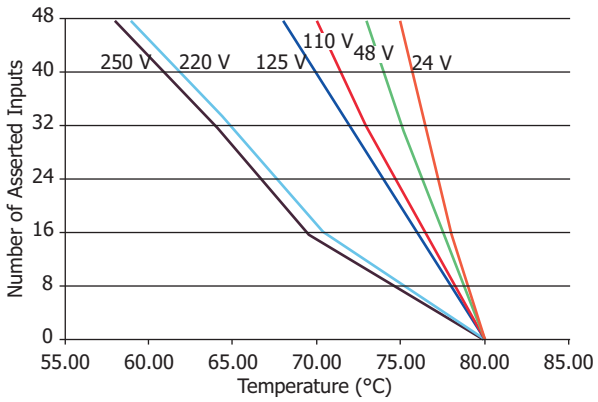
Rated Insulation Voltage:	250 Vdc
Rated Frequency:	50/60 ± 5 Hz
Make:	30 A @ 240 Vac
Utilization Category:	AC-15 (control of electromagnetic loads > 72 VA)
Contact Rating Designation:	B300 (B = 5 A, 300 = rated insulation voltage)
Continuous Carry:	6 A @ 70°C; 4 A @ 85°C
Continuous Carry (UL/CSA Derating With All Outputs Asserted):	5 A @ < 60°C; 2.5 A 60 to 70°C
Thermal:	50 A for 1 s
Contact Protection:	250 Vac, 145 J MOV protection across open contacts

Operating Time (Coil Energization to Contact Closure, Resistive Load)

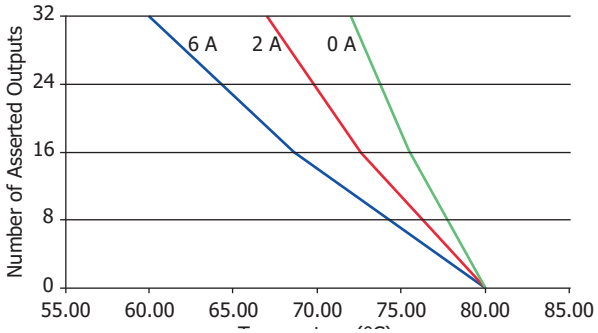
Pickup Time:	~16 µs at 250 Vac, 22 µs at 125 Vac, 85 µs at 19.2 Vac typical (results with 100 kΩ resistive load)
Dropout Time:	< 8 ms typical

Note: Per IEC 60255-23:1994, using the simplified method of assessment.
Note: Making rating per IEEE C37.90-1989.

48DI Input Derating Curve:



32DO/16DI Output Derating Curve:



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:	2 kΩ
Accuracy:	microsecond

Time-Code Input (SNTP)

High-Priority Server Accuracy:	±1 ms (in an ideal network)
Low-Priority Server Accuracy:	±25 ms

Time-Code Input (PTP)

IEEE 1588-2008 Firmware-Based Accuracy:	±1 ms

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

Communications

Communications Ports

USB 2.0 Port:	Port F; front-panel port
Ethernet Ports:	Port 1A, 1B; rear-panel 10/100BASE-T or 100BASE-FX ports
Optional Port:	300–115200 bps Port 2; rear panel available as: EIA-232 with IRIG-B EIA-485 with IRIG-B ST fiber with IRIG-B
EIA-232 Port:	300–115200 bps Port 3; rear-panel port with IRIG-B

Fiber-Optic Ports Characteristics

Port 1 (or 1A, 1B) Ethernet

Wavelength:	1300 nm
Data Rate:	100 Mbps
Optical Connector Type:	LC
Fiber Type:	Multimode
Link Budget:	16.1 dB
Typical TX Power:	–15.7 dBm
Min RX Sensitivity:	–31.8 dBm
Fiber Size:	50–200 µm
Approximate Range:	~6.4 km
Typical Fiber Attenuation:	–2 dBm/km

Port 2 Serial ST (SEL-2812 Compatible)

Baud Rate:	300–115200 bps
Wavelength:	850 nm
Optical Connector Type:	ST
Fiber Type:	Multimode
Link Budget:	16 dBm
Min TX Power:	–13 dBm
Max TX Power:	–3 dBm
Min RX Sensitivity:	–29 dBm
Fiber Size:	50–200 µm
Approximate Range:	~4 km with 62.5 µm ~1 km with 200 µm
Typical Fiber Attenuation:	–4 dBm/km

Communications Protocols

Modbus Slave (TCP and RTU)
DNP3 Level 2 Outstation (LAN/WAN and Serial)
IEC 61850 communications
FTP
SNTP
PTP (firmware based)
Telnet
SEL MIRRORED BITS
Ymodem file transfer on the front and rear port
Xmodem file transfer on the front port
SEL ASCII and Compressed ASCII
SEL Fast Meter
SEL Fast Operate
SEL Fast SER
SEL Fast Message unsolicited write
SEL Fast Message read request
SEL Event Messenger points

Maximum Concurrent Connections

Modbus Slave:	2
DNP3 Level 2 Outstation:	5[a]
Ethernet FTP:	2
Telnet:	2
IEC 61850 MMS:	7
IEC 61850 Goose:	16 incoming 8 outgoing

[a] Maximum in any combination of serial and/or LAN/WAN links.

Power Supply

Input Voltage

Rated Voltage:	24–250 Vdc 110–230 Vac, 50/60 Hz
Voltage Range:	19.2–275 Vdc 85–264 Vac
Inrush Current:	< 20 A pk

Power Consumption

AC:	< 50 VA
DC:	< 20 W

Interruptions:
10 ms @ 24 Vdc
25 ms @ 48 Vdc
125 ms @ 125 Vdc
160 ms @ 120 Vac
600 ms @ 250 Vdc
1000 ms @ 230 Vac

Fuse Rating: 3.15 A, high breaking capacity, time lag T, 250 V (5 x 20 mm, T3.15AH 250 V)

Sampling and Processing Specifications

Digital Inputs

Sampling Rate: 2 kHz

Contact Outputs

Refresh Rate:	2 kHz
Logic Update:	Every 4 ms

Timer Accuracy

±2 ms and ±0.001% of settings

Processing Specifications

Processing Interval:	2 ms
Control Processing:	2 ms (except for math variables and, with default settings, remote analogs which are processed at 100 ms)

Product Standards

Electrical Equipment for Measurement, Control, and Laboratory Use:	IEC 61010-1:2013 UL 508:2018 C22.2 No. 61010-1:12 IEC 61010-2-201:2013 UL 61010-2-201:2017 C22.2 No. 61010-2-201:14
Measuring Relays and Protection Equipment:	IEC 60255-26:2013 IEC 60255-27:2013

Type Tests

Note: To ensure good EMI and EMC performance, type tests were performed using shielded copper Ethernet cables with the shell grounded at both ends of the cable. Additionally, digital inputs were configured with 4 millisecond pickup and dropout time settings. Double-shielded cables and 4 millisecond or greater pickup and dropout times are recommended for best EMI and EMC performance.

Environmental Tests

Enclosure Protection:	IEC 60529:1989 + A1:1999 + A2:2013 IP4X Front IP2X Product **Note:** If rear terminals are accessible during normal use, the product must be mounted in a locked enclosure or restricted area accessible by trained maintenance or operation personnel only.
Vibration Endurance:	Class 2
Response:	Class 2
Shock Withstand:	Class 1
Response:	Class 2
Bump Withstand:	Class 1
Seismic Response:	Class 2
Cold:	IEC 60068-2-1:2007 –40°C, 16 hours
Damp Heat, Steady State:	IEC 60068-2-78:2001 40°C, 93% relative humidity, 4 days
Damp Heat, Cyclic:	IEC 60068-2-30:2005 25°C–55°C, 6 cycles, 95% relative humidity
Dry Heat:	IEC 60068-2-2:2007 85°C, 16 hours

Power Interruption Tests

AC Power:	61000-4-11:2004
DC Power:	61000-4-29:2001

Dielectric Strength and Impulse Tests

Dielectric (HiPot):	IEC 60255-27:2013 IEEE C37.90-2005 3.6 kVdc on power supply 2.5 kVac on contact I/O 1.5 kVac on Ethernet/IRIG IN
Impulse:	IEC 60255-27:2013 5 kV on power supply, contact I/O 2.2 kV on Ethernet

RFI and Interference Tests

EMC Immunity

Electrostatic Discharge Immunity:	IEC 61000-4-2:2008 Severity Level: 2, 4, 6, 8 kV contact discharge 2, 4, 8, 15 kV air discharge
Radiated RF Immunity:	IEC 61000-4-3:2006 + A1:2007 + A2:2010 10 V/m IEEE C37.90.2-2004 20 V/m

Fast Transient, Burst Immunity:	IEC 61000-4-4:2012 4 kV @ 5 kHz on power supply and contact I/O 2 kV @ 5 kHz for communication ports
Surge Immunity:	IEC 61000-4-5:2005 1 kV on power supply, contact I/O 2 kV on power supply, contact I/O, Ethernet and serial ports, IRIG
Surge Withstand Capability:	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 Communication ports 1.0 kV peak common mode IEEE C37.90.1-2012 2.5 kV oscillatory, 4 kV fast transient
Conducted RF Immunity:	IEC 61000-4-6:2013, 10 Vrms
Power Frequency Magnetic Field:	IEC 61000-4-8:2009 1000A/m for 3 s 100A/m for 1 min
Pulse Magnetic Field:	IEC 61000-4-9:2016 1000 A/m
Damped Oscillatory Magnetic Field:	IEC 61000-4-10:2016 100 A/m

EMC Emissions

Note: Test performed using serial cables with shield grounded at both ends.

Conducted and Radiated Severity Level:	Class A EN 55011:2009 + A1:2010 EN 55022:2010 + AC:2011 EN 55032:2012 + AC:2013 CISPR 11:2009 + A1:2010 CISPR 22:2008 CISPR 32:2015 ANSI C63.4:2014 Canada ICES-001 (A) / NMB-001 (A)

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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