



SEL-2411P Pump Automation Controller

Rugged Controller for Automating Water/Wastewater Stations



High Reliability, Low Price

- Ten-Year, Worldwide Warranty
- -40° to +85°C Operating Temperature
- Ruggedized to Meet Industrial and Utility Standards
- Class I, Division 2 Hazardous Location Approval

Automated Station Control and Monitoring

- Pump alternation supports as many as four pumps and four stages
- Pump-operation history including run times and start counts
- Pump-voltage monitoring

Flexible Input, Output, and Logic Choices

- Powerful Logic, Math, and Timer Functions
- Fast 4 ms Logic Loop Time
- Dual Ethernet and EIA-232 Communications
- Modbus RTU, Modbus TCP, DNP3, DNP3 LAN/WAN, MIRRORING BITS®, and SEL ASCII and Binary Communications

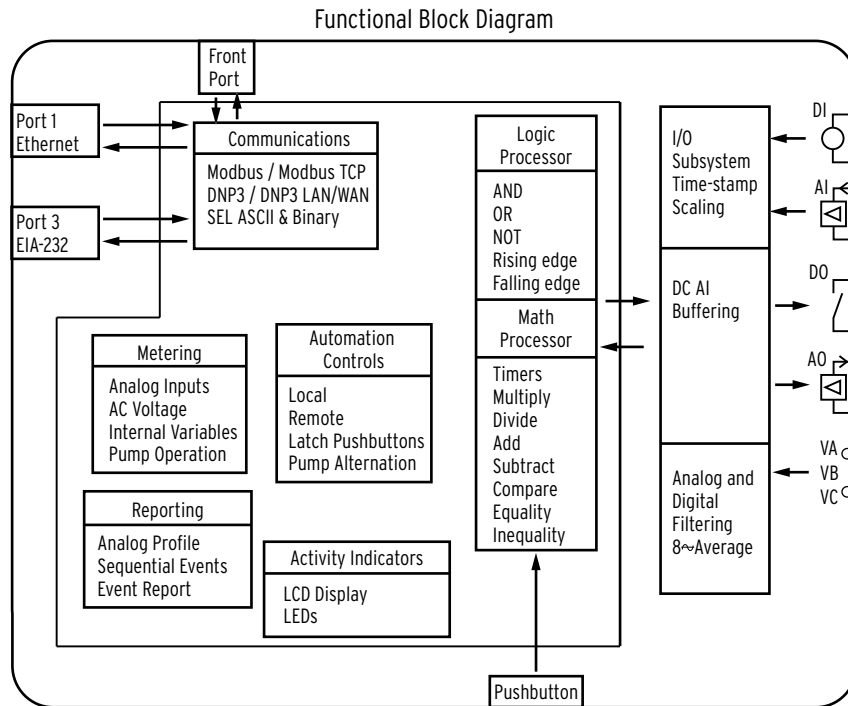
Simple Commissioning Tools

- Station settings provide fast and easy configuration
- Front-Panel Configuration and Measurement Display and Access
- Local LCD Display of Settings, Calculated Values, and Statuses
- Programmable Front-Panel Indication and Control
- Simple Programming With ACSELERATOR QuickSet® SEL-5030 Software

Product Summary

The SEL-2411P Pump Automation Controller automates continuous and discrete processes. A standalone SEL-2411P is a simple solution to monitor and control pump-up and pump-down applications such as lift stations (wastewater) and wells or reservoirs (pump-up). The SEL-2411P is capable of controlling constant

speed/variable speed pumps, alternating pumps, pump delays, and high/low level alarms. Station settings offer selectable pump-alternation schemes for single, duplex, and triplex pumping applications. Measure fluid level by using float switches or an analog fluid-level sensor (or both).



Automation and Control Features

Standard Features

- Chassis
- Front panel
- LCD display
 - Four programmable pushbuttons with LEDs
 - Seven programmable LEDs
 - Operator control interface
 - EIA-232 port
- Main board
 - EIA-232 port
 - Dual 10/100BASE-T
- Power supply
- 2 DI, 3 DO on power-supply board
- QuickSet software
- Instruction manual, printed or on CD-ROM
- Protocols
 - DNP3
 - Modbus RTU
 - SEL MIRRORED BITS
 - SEL ASCII and Compressed ASCII
 - SEL Fast Protocols
- Float-Level-Sensing Card (14 digital inputs)
 - Float-switch inputs
 - Auto/hand pump control
 - Intrusion detection input
 - Power-supply alarm input
- Pump Control and Status Card (4 DI/4 DO)
 - Start/stop pump outputs
 - Pump-running feedback inputs

Additional Ordering Options

The following options can be ordered for any SEL-2411P model (see the SEL-2411P Model Option Table for details):

Digital Inputs	14 DI (PN 1476)
Analog I/O	8 AI (PN9762), 4 AI/4 AO (PN 9763)
Pump-Voltage Monitoring	3 AVI (PN 9771)
Environment	Conformal coating for chemically harsh and high-moisture environments

Flexible Control Logic and Integration Features

The SEL-2411P is equipped with two independently operated serial ports: one EIA-232 port on the front and one EIA-232 port on the rear. The device does not require special communications software. Use any system that emulates a standard terminal system for engineering access to the device. 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-2411P. Included communications protocols are listed.

Standard Protocols

- DNP3
- Modbus
- SEL ASCII
- SEL Compressed ASCII
- SEL Fast Protocols
- SEL MIRRORING BITS

Simplify Your Setup and Commissioning

The SEL-2411P front panel simplifies commissioning and troubleshooting with the following features:

- Configure pump control and alternation by using as few as three station settings
- View field data and calculated values
- Diagnose data flow problems in seconds instead of hours
- Dramatically reduce troubleshooting time
- Eliminate the need for out-of-service time

Front-Panel Visualization and Control

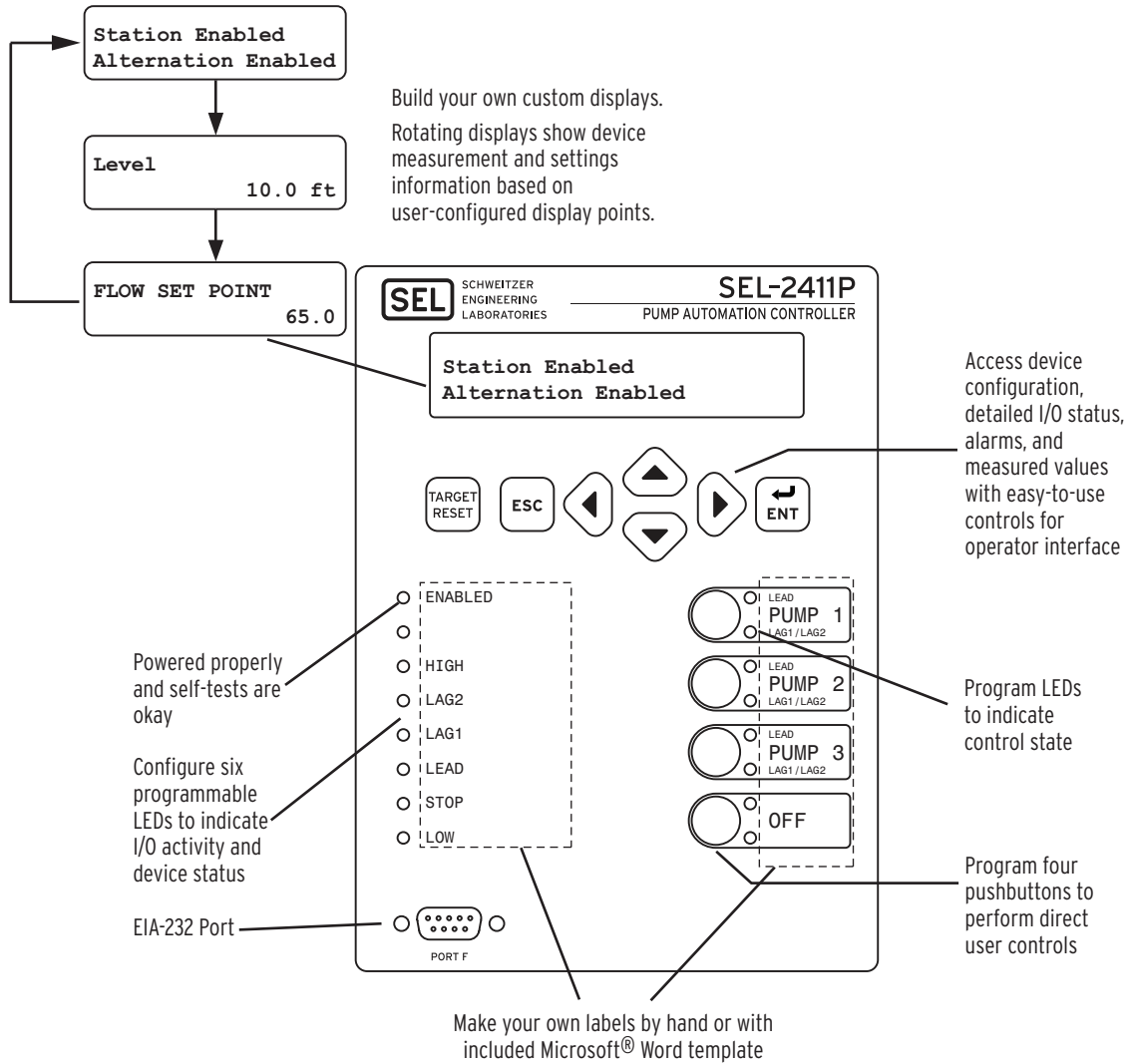
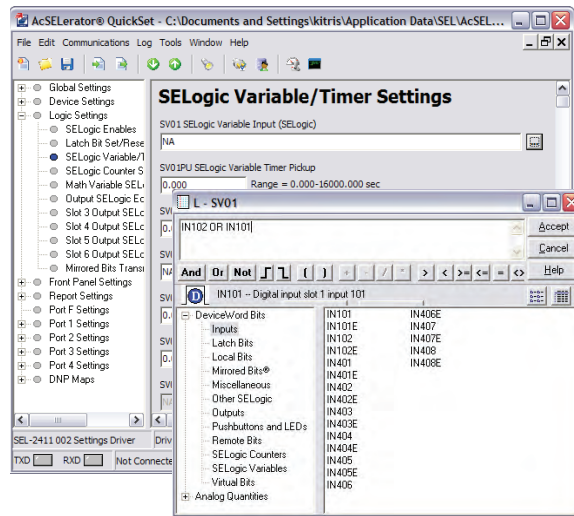


Figure 1 Simplify Your Commissioning

Configuration Software

The included QuickSet software program simplifies device configuration in addition to providing commissioning and analysis support for the SEL-2411P.

- Access settings creation help online.
- Organize settings with the device database manager.
- Load and retrieve settings by using a simple PC communications link.
- Customize logic to optimize lift-station operation and control.



Settings-create SELogic control equations with a drag and drop editor and/or text editor

Monitoring and Metering

The SEL-2411P provides extensive metering capabilities. See *Specifications* on page 8 for metering accuracies. As shown in *Table 1*, metering includes pump-operation status, voltage-based metering and analog input, math variable and remote analog metering. Pump-operation status includes two-hour, one-day, two-day, and total pump start-count and run-time quantities. Fundamental, maximum, and minimum metering includes phase voltages, line-to-line voltages, sequence voltages, and voltage frequency.

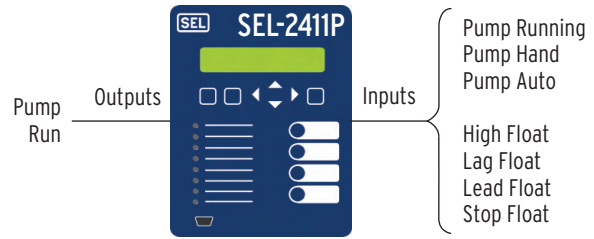
Table 1 Metering Types

Standard	
Pump Operation Status	Run-time, start-count, time since last start, and stage cycle run-time
Fundamental	VA, VB, VC
Maximum and Minimum	Frequency, Voltages (VA, VB, VC)
Analog Input	AI601–AI608
Math Variable	MV01–MV64
Remote Analog	RA001–RA128

Application

Pump Controller

Regulate the level in tanks for lift stations and reservoirs for single, duplex, or triplex pumping applications. Alternate pumps to balance starts, maximize longevity, reduce wear on equipment, and make maintenance more predictable. Use both analog level sensors and float switches to provide redundancy in fluid-level sensing and increase reliability for station control.



Front- and Rear-Panel Diagrams

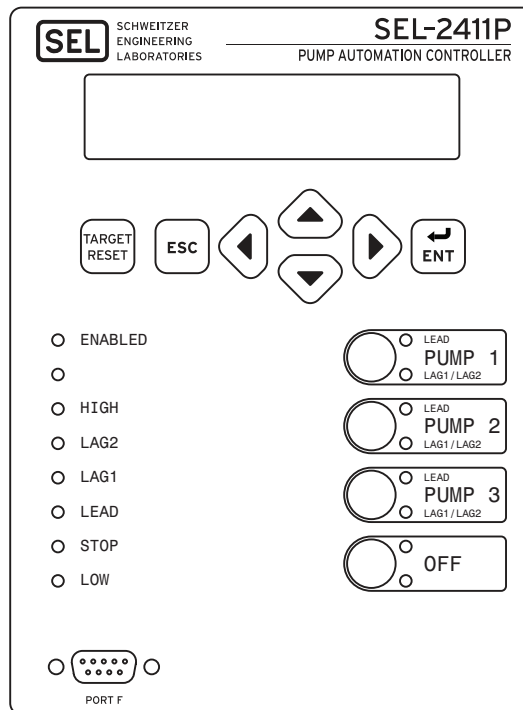
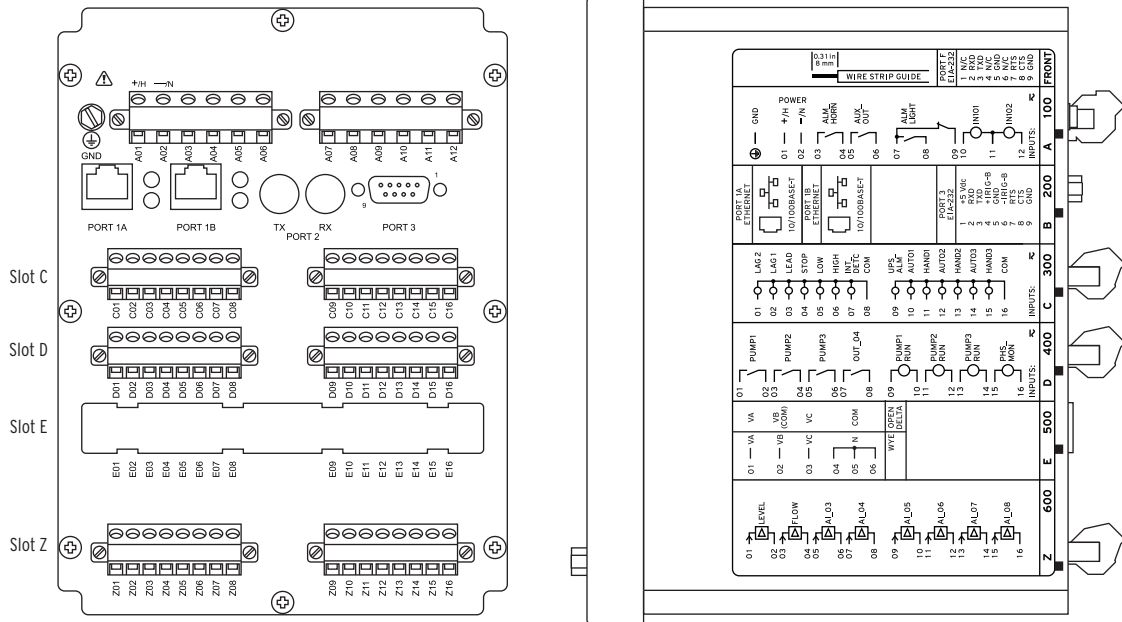


Figure 2 Front Panel With Default Configurable Labels



(A) Rear-Panel Layout

(B) Side-Panel Input and Output Designations

Figure 3 Rear-Panel Connections and Labels

Dimensions

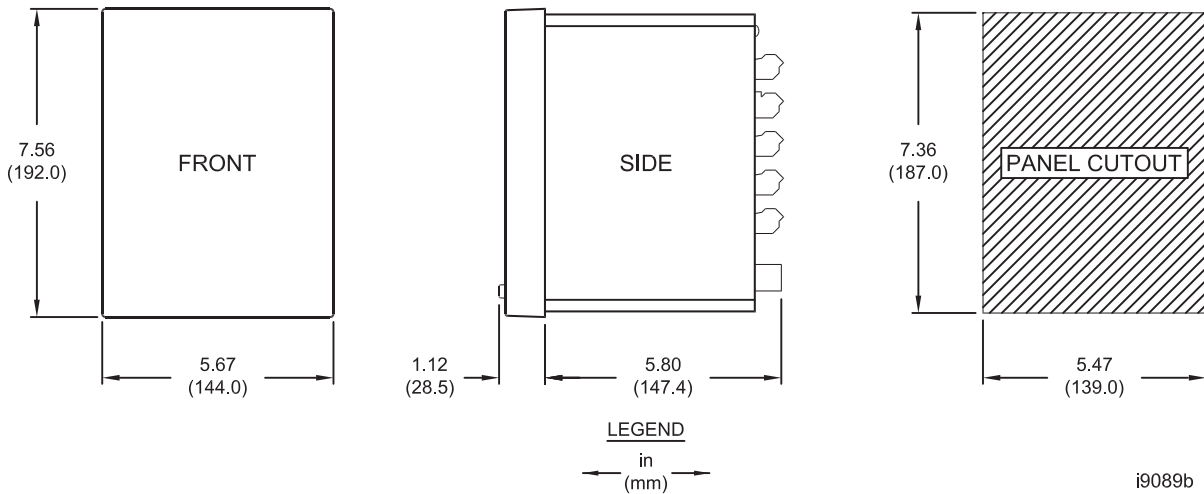


Figure 4 Pump Automation Controller Vertical Panel Mount

i9089b

Specifications

Compliance

Designed and manufactured under an ISO 9001 certified quality management system.

47 CFR 15B, Class A

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to 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; NWWGQ2, NWWGQ8)

UL Listed to U.S. and Canadian safety standards (File E220228; NRAQ, NRAQ7)

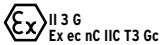
UL Listed for Hazardous Locations to Canadian and U.S. Standards (File 475839; Nrag, Nrag7)

CE Mark

Hazardous Locations

UL Listed for Hazardous Locations to Canadian and U.S. standards

EU



EN 60079-0:2018

EN 60079-7:2015/A1:2018

EN 60079-15:2019

Note: Where so marked, ATEX and UL Hazardous Locations Certification tests are applicable to rated supply specifications only and do not apply to the absolute operating ranges, continuous thermal, or short circuit duration specifications.

General

Operating Temperature Range

-40° to +85°C (-40° to +185°F), per IEC 60068-2-1 and 60068-2-2.

Operating Environment

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

Processing and Memory

32-bit 200 MHz Processor
32 MB DDR RAM
Battery-Backed Real-Time Clock

Dimensions

See Figure 2.1 and Figure 2.2.

Weight

2.0 kg (4.4 lb)

Frequency

System Frequency: 50, 60 Hz

Inputs

AC Voltage Input V_{NOM}

Rated Operating Voltage (U_e):	100–250 Vac
Rated Insulation Voltage:	300 Vac

10-Second Thermal:	600 Vac
Rated Frequency:	50/60 ± 5 Hz
Burden:	<0.1 W

DC Transducer (Analog) Inputs

Input Impedance:	
Current Mode:	200 Ω
Voltage Mode:	>10 kΩ
Input Range (Maximum):	±20 mA (transducers: 4–20 mA, 0–20 mA, or 0–1 mA typical) ±10 V (transducers: 0–5 V or 0–10 V typical)
Sampling Rate:	At least 5 ms
Step Response:	1 s
Accuracy at 25°C:	
ADC:	16 bit
With user calibration:	0.05% of full scale (current mode) 0.025% of full scale (voltage mode)
Without calibration:	Better than 0.5% of full scale at 25°C
Accuracy Variation With Temperature:	±0.015% per °C of full scale (±20 mA or ±10 V)

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 for < 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

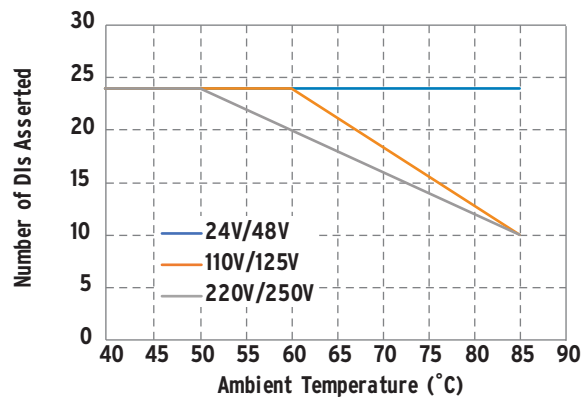
Current Draw at Nominal

DC Voltage: 2–4 mA (Except for 240 V, 8 mA)

Rated Insulation Voltage: 300 Vac

Rated Impulse

Withstand Voltage (U_{imp}): 4000 V



Time-Code Input (SNTF)

High-Priority Server Accuracy:	±5 ms
Accuracy:	±25 ms

Outputs

General

OUT103 is Form C Trip Output, all other outputs are Form A.

Dielectric Test Voltage: 2000 Vac

Impulse Withstand

Voltage (U_{imp}): 4000 V

Mechanical Durability: 10M no load operations

DC Output Ratings

Electromechanical

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

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: 360 Vdc, 40 J MOV protection across open contacts

Operating Time (coil

energization to contact

closure, resistive load): Pickup or Dropout time \leq 8 ms typical

Breaking Capacity 24 Vdc 0.75 A L/R = 40 ms

(10,000 operations) per 48 Vdc 0.50 A L/R = 40 ms

IEC 60255-0-20:1974: 125 Vdc 0.30 A L/R = 40 ms

250 Vdc 0.20 A L/R = 40 ms

Cyclic Capacity 24 Vdc 0.75 A L/R = 40 ms

(2.5 cycles/second) per 48 Vdc 0.50 A L/R = 40 ms

IEC 60255-0-20:1974: 125 Vdc 0.30 A L/R = 40 ms

250 Vdc 0.20 A L/R = 40 ms

Fast Hybrid (High-Speed High-Current Interrupting)

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

(Maximum Voltage): 250 Vac/330 Vdc

Pickup Time: <50 μ s, resistive load

Dropout Time: 8 ms, resistive load

Update Rate: 1/8 cycle

Breaking Capacity (10,000 Operations):

48 Vdc 10.0 A L/R = 40 ms

125 Vdc 10.0 A L/R = 40 ms

250 Vdc 10.0 A L/R = 20 ms

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

48 Vdc 10.0 A L/R = 40 ms

125 Vdc 10.0 A L/R = 40 ms

250 Vdc 10.0 A L/R = 20 ms

Note: Per IEC 60255-23:1994, using the simplified method of assessment.

Note: Make rating per IEEE C37.90-1989.

AC Output Ratings

Electromechanical

Maximum Operational

Voltage (U_e) Rating: 240 Vac

Insulation Voltage (U_i)

Rating (excluding

EN 61010-1): 300 Vac

Utilization Category:

AC-15 (control of electromagnetic loads >72 VA)

Contact Rating

Designation: B300 (B = 5 A, 300 = rated insulation

voltage)

Voltage Protection Across

Open Contacts: 270 Vac, 40 J

Rated Operational Current

(I_e): 3 A @ 120 Vac

1.5 A @ 240 Vac

Conventional Enclosed

Thermal Current (I_{the})

Rating: 5 A

Rated Frequency: 50/60 \pm 5 Hz

Pickup/Dropout Time: \leq 8 ms (coil energization to contact closure)

Electrical Durability Make

VA Rating: 3600 VA, $\cos\phi = 0.3$

Electrical Durability

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

Fast Hybrid (High-Speed High-Current Interrupting)

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

(Maximum Voltage): 250 Vac/330 Vdc

Pickup Time: <50 μ s, resistive load

Dropout Time: 8 ms, resistive load

Update Rate: 1/8 cycle

Breaking Capacity (10,000 Operations):

48 Vac 10.0 A L/R = 40 ms

125 Vac 10.0 A L/R = 40 ms

250 Vac 10.0 A L/R = 20 ms

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

48 Vac 10.0 A L/R = 40 ms

125 Vac 10.0 A L/R = 40 ms

250 Vac 10.0 A L/R = 20 ms

Note: Per IEC 60255-23:1994, using the simplified method of assessment.

Note: Make rating per IEEE C37.90-1989.

Analog Outputs

Current Ranges (Max): \pm 20 mA

Voltage Ranges (Max): \pm 10 V

Output Impedance For Current Outputs: \geq 100 k Ω

Output Impedance For Voltage Outputs: \leq 20 Ω

Maximum Load: 0–750 Ω current mode

>2 k Ω voltage mode

Accuracy: \pm 0.55% of full-scale at 25°C

Step Response: 100 ms

Communications

Communications Ports

Standard EIA-232 (2 Ports)

Location (fixed): Front Panel
Rear Panel

Data Speed: 300–38400 bps

Ethernet Port

Dual 10/100BASE-T copper (RJ45 connector)

Communications Protocols

Modbus RTU slave or Modbus TCP
 DNP3 Level 2 Outstation (LAN/WAN and Serial)
 Ethernet FTP
 Telnet
 SEL MIRRORED BITS (MBA, MBB, MB8A, MB8B, MBTB)
 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

Maximum Concurrent Connections

Modbus Slave: 2^a
 DNP3 Level 2 Outstation: 5^a
 Ethernet FTP: 2
 Telnet: 3

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

Power Supply

Rated Supply Voltage

Low-Voltage Model: 24/48 Vdc
 High-Voltage Model: 125/250 Vdc
 120/240 Vac, 50/60 Hz

Input Voltage Range

Low-Voltage Model: 18–60 Vdc
 High-Voltage Model: 85–275 Vdc
 85–264 Vac

Power Consumption

AC: <40 VA
 DC: <15 W

Interruptions

Low-Voltage Model: 10 ms @ 24 Vdc
 50 ms @ 48 Vdc
 High-Voltage Model: 50 ms @ 125 Vac/Vdc
 100 ms @ 250 Vac/Vdc

Fuse Rating

High-Voltage Model: 3.15 A, high breaking capacity, time lag T, 250 V (5x20 mm, T3.15AH 250 V)
 Low-Voltage Model: 3.15 A, high breaking capacity, time lag T, 250 V (5x20 mm, T3.15AH 250 V)

AC Metering Accuracies

Voltage

Line-to-Neutral Voltage: ±0.08% typical, 25°C, 60 Hz, nominal voltage
 Line-to-Line Voltage: ±0.08% typical, 25°C, 60 Hz, nominal voltage
 Negative Sequence (3V2): ± 0.5% typical, 25°C, 60 Hz, nominal voltage (calculated)

Frequency

±0.05 Hz (V1 > 60 V) with voltage tracking from 44.00–66.00 Hz

Fast Analog Alarm Pickup

Voltage: ±5% of setting ±0.5 V

Sampling and Processing Specifications

Without Voltage Card

Analog Inputs
 Sampling Rate: Every 4 ms
 Digital Inputs
 Sampling Rate: 2 kHz
 Contact Outputs
 Refresh Rate: 2 kHz
 Logic Update: Every 4 ms
 Analog Outputs
 Refresh Rate: Every 4 ms
 New Value: Every 100 ms
 Timer Accuracy
 ± 0.5% of settings and ± 1/4 cycle

With Voltage Card

Analog Inputs
 Sampling Rate: 4 times/cycle
 Digital Inputs
 Sampling Rate: 32 times/cycle
 Contact Outputs
 Refresh Rate: 32 times/cycle
 Logic Update: 4 times/cycle
 Analog Outputs
 Refresh Rate: 4 times/cycle
 New Value: Every 100 ms
 Timer Accuracy
 ± 0.5% of settings and ± 1/4 cycle

Processing Specifications

AC Voltage Inputs: 16 samples per power system cycle
 Frequency Tracking Range: 44–66 Hz
 Digital Filtering: Cycle cosine after low-pass analog filtering. Net filtering (analog plus digital) rejects dc and all harmonics greater than the fundamental.
 Control Processing: 4 times per power system cycle or 4 ms if no voltage card (except for math variables and analog signals used in logic, which are processed every 100 ms)

Type Tests

Environmental Tests

Enclosure Protection: IEC 60529:2001
 IP65 enclosed in panel
 IP20 for terminals
 Vibration Resistance: IEC 60255-21-1:1988, Class 1
 IEC 60255-21-3:1993, Class 2
 Shock Resistance: IEC 60255-21-2:1988, Class 1
 Cold: IEC 60068-2-1:1990 + A1:1993
 + A2:1994
 –40°C, 16 hours
 Damp Heat, Steady State: IEC 60068-2-78:2001
 40°C, 93% relative humidity, 4 days
 Damp Heat, Cyclic: IEC 60068-2-30:1980 + A1:1985
 25–55°C, 6 cycles,
 95% relative humidity
 Dry Heat: IEC 60068-2-2:1974 + A1:1993
 + A2:1994
 85°C, 16 hours

Dielectric Strength and Impulse Tests

Dielectric (HIPOT):	IEC 60255-5:2000 IEEE C37.90-1989 2.0 kVac on analog inputs, contact I/O 2.5 kVac on ac current inputs 2.83 kVdc on power supply and analog outputs
Impulse:	IEC 60255-5:2000 0.5 J, 4.7 kV on power supply, contact I/O, voltage and current inputs 0.5 J, 530 V on analog inputs and analog outputs

RFI and Interference Tests

EMC Immunity

Electrostatic Discharge Immunity:	IEC 61000-4-2:2001 Severity Level 4 8 kV contact discharge 15 kV air discharge
Radiated RF Immunity:	IEC 61000-4-3:2002, 10 V/m IEEE C37.90.2-1995, 35 V/m
Fast Transient, Burst Immunity:	IEC 61000-4-4:1995 + A1:2001 4 kV @ 2.5 kHz 2 kV @ 5.0 kHz for comm. ports
Surge Immunity:	IEC 61000-4-5:2001 2 kV line-to-line 4 kV line-to-earth
Surge Withstand Capability Immunity:	IEC 60255-22-1:2005 2.5 kV common-mode 2.5 kV differential-mode 1 kV common-mode on comm. ports IEEE C37.90.1-2002 2.5 kV oscillatory, 4 kV fast transient
Conducted RF Immunity:	IEC 61000-4-6:2004, 10 Vrms
Magnetic Field Immunity:	IEC 61000-4-8:2001 1000 A/m for 3 seconds 100 A/m for 1 minute

EMC Emissions

Conducted Emissions:	EN 55011:1998 + A1:1999 + A2:2002, Class A
Radiated Emissions:	EN 55011:1998 + A1:1999 + A2:2002, Class A

Notes

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This product is covered by the standard SEL 10-year warranty. For warranty details, visit selinc.com or contact your customer service representative.

SEL-2411P Pump Automation Controller Data Sheet

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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