SEL-2410 I/O Processor

Flexible I/O for Monitoring and Control

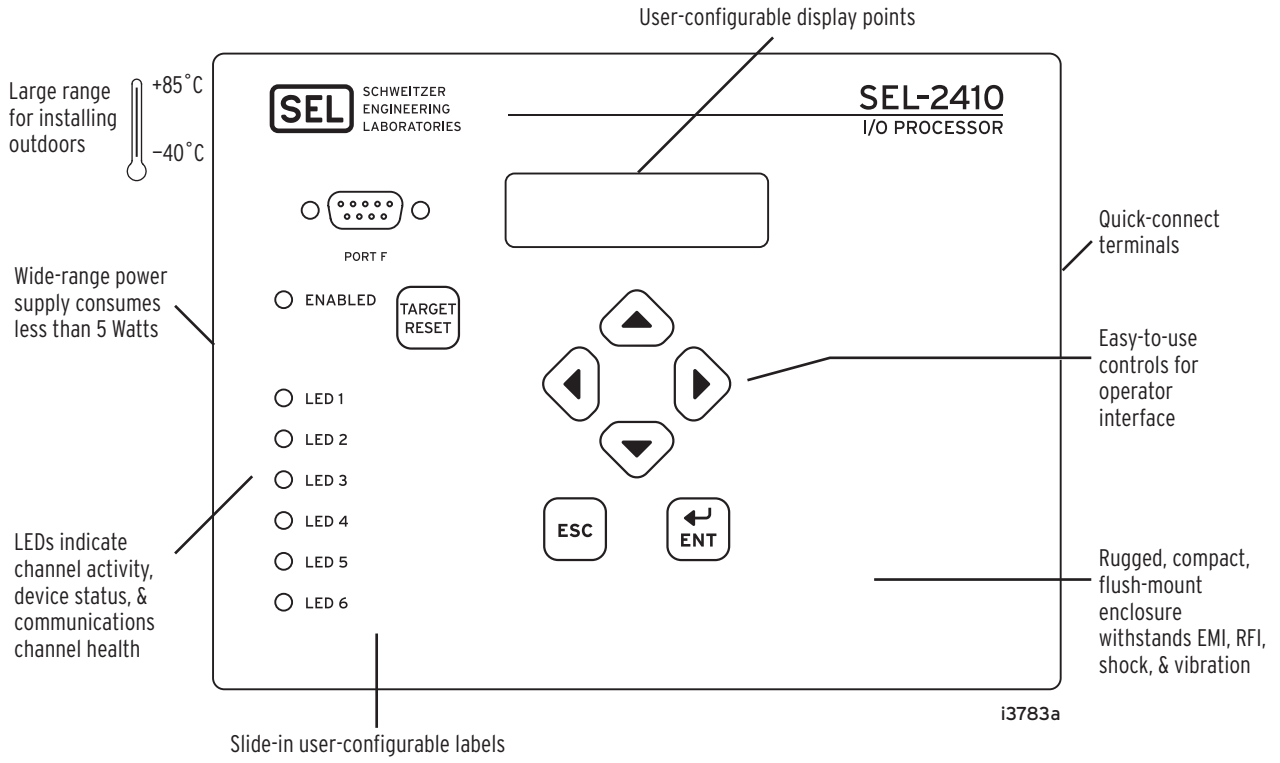
The SEL-2410 I/O Processor provides a unique combination of programmable logic, optional digital and analog I/O modules.

Features, Benefits, and Applications

Use the SEL-2410 to monitor substation or industrial equipment or as a hardened programmable logic device.

- **Programmable Logic.** Use SELOGIC® programming to program the SEL-2410. SELOGIC allows end-user programming of the equipment monitor. This provides flexibility in applying the product in a wide range of applications.
- **Expandable I/O**. Incorporates optional I/O expandability for a variety of monitoring and control applications. Optional I/O cards let the SEL-2410 be configured by the customer to fit their application needs. Analog input and digital I/O cards provide superior flexibility in the product application.
- **Compact and Efficient Hardware Package.** Features a small form factor and rapid disconnect capability. The small form factor allows the I/O Processor to be placed in cabinets with a minimal footprint, leaving space for other devices, or ultimately reducing overall cabinet sizing requirements. Quick disconnect terminals minimize installation time, saving startup and maintenance costs.
- **Sequential Events Recorder (SER).** Use the internal clock optionally synchronized to an IRIG-B time source to store up to 512 sequence-of-events records. Use the SER to provide system analysis, troubleshooting, and improve maintenance scheduling.

Product Overview



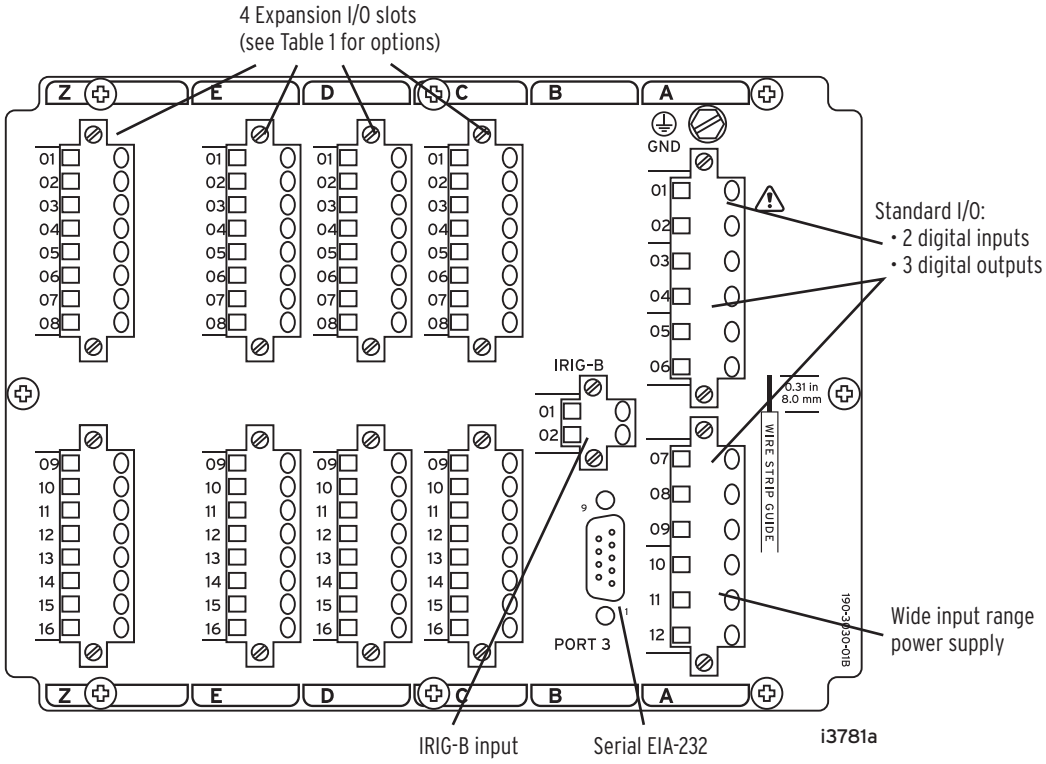


Figure 1 SEL-2410 Front and Back Views

SEL-2410 I/O Processor Description

The SEL-2410 provides loose digital and analog I/O to SEL communications processors, providing an alternative or replacement for SCADA Remote Terminal Units (RTU). The ability to accurately time stamp inputs and outputs also allows the SEL-2410 to add value to station sequence of event logs.

Programmable logic features allow you to use the SEL-2410 to automate transformer-cooling equipment and monitor the results of operation. Programmable logic functions also allow other logic to be included eliminating the need for additional programmable logic controllers.

Programmable Logic (SELOGIC)

The monitor provides user-programmable logic to combine analog quantities, digital inputs, remote command inputs, and timers to control calculations, internal logic and digital outputs. The logic provides the following operators:

- Logic (OR, AND, NOT)
- Triggers (Rising Edge, Falling Edge)
- 32 latches
- 32 remote control logic units
- 64 programmable logic variable with associated pickup and dropout settings with ranges from 0–16000 seconds.

Human Machine Interface

A high-resolution display screen, and one reset pushbutton provide local access to metered values and options. Analog inputs, display points data, and configuration are locally displayed with no password required.

Protocols

The EIA-232 communication port supports the following protocols:

- SEL ASCII
- SEL Distributed Port Switch (LMD)
- SEL Fast Meter, Fast Operate, Fast SER

The communications ports are compatible with SEL-2032/2030/2020 communications processors.

Table 1 I/O Card Option[a]

Option	Description
2	Eight digital outputs
3	Eight digital inputs
5	Eight analog dc inputs

[a] Maximum of four optional I/O cards per SEL-2410.

Input and Output (I/O) Options

The base SEL-2410 includes three digital outputs and two digital inputs. The digital output contacts are suitable for alarms or control operations. The monitor has four optional I/O module slots as shown in *Figure 1*. The following optional I/O modules can be used in any combination in module slots as shown.

- Eight dc analog inputs (AI), slot C only
- Eight digital outputs (DO), slots C, D, E, and Z
- Eight digital inputs (DI), slots C, D, E, and Z

Communications Options

Standard serial ports include one front and one rear EIA-232 port. All electrical serial ports have an adjustable communications rate of 300–38400 bps.

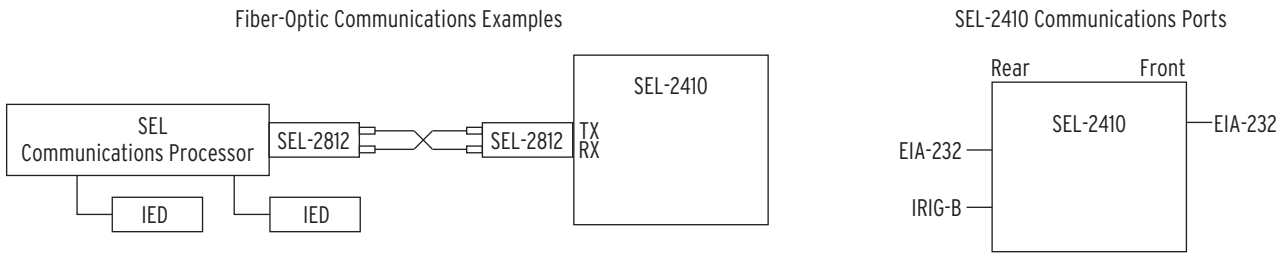


Figure 2 SEL-2410 Communications Options

Applications

Programmable Logic Control

Use the SEL-2410 as a hardened Programmable Logic Control (PLC) in a wide variety of systems.

SELOGIC programming, I/O card flexibility, and advanced communications combine to provide a remarkably capable product that is easy to apply.

Benefits

Small form factor. Easy to install.

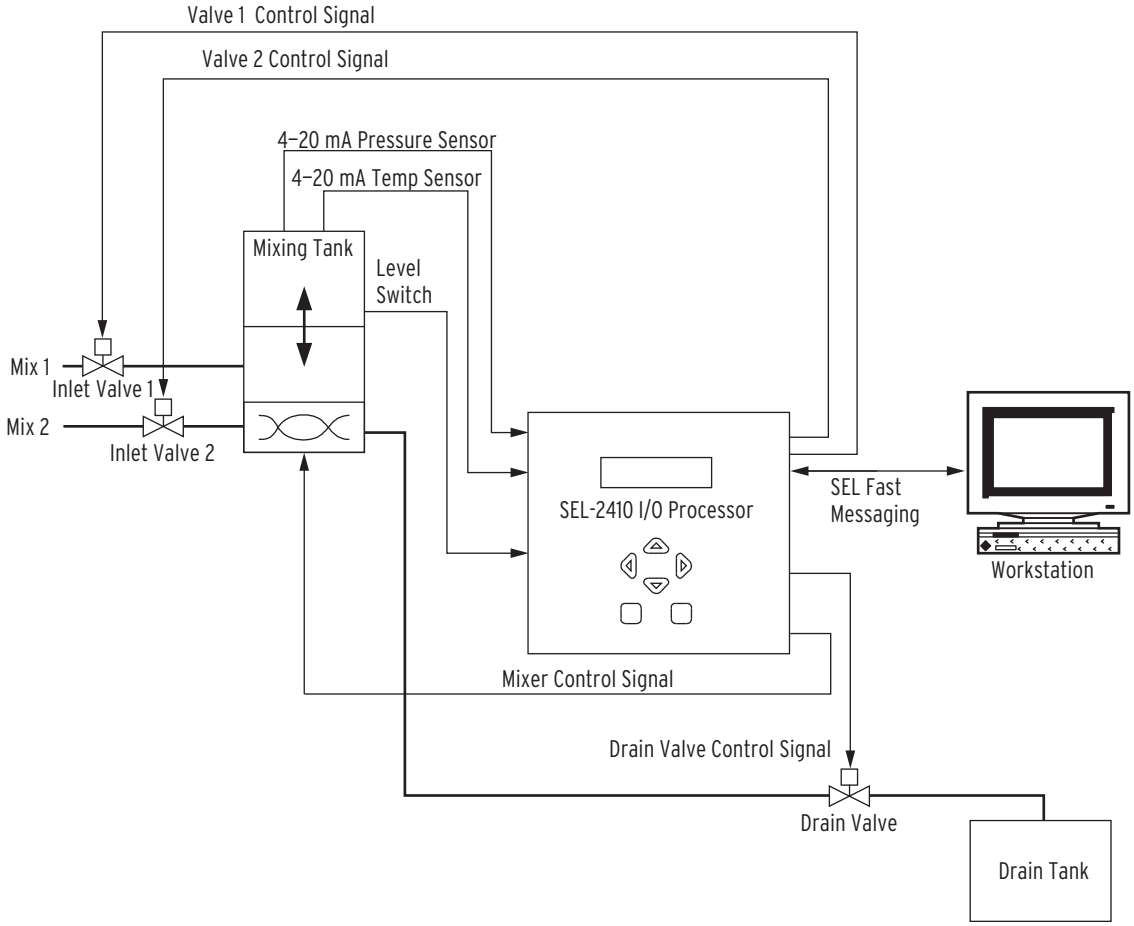


Figure 3 SEL-2410 Used as a PLC in a Batch Processing Application

Smart SEL-2032/SEL-2030/ SEL-2020 I/O Node

The SEL-2410 can be used as a remote I/O node that sends analog and digital input data to a central communications processor and receives and executes control commands. Use the wide selection of I/O cards to customize the SEL-2410 for a custom application that meets your needs.

Benefits

- Over 10 times more reliable than RTU or PLC approach.
- Integrated dc analog voltage and current inputs are useful in a wide variety of power and control applications. Stock one product to provide monitoring capabilities for a diverse mix of devices.
- Fiber-optic communications are immune to problems associated with EMI/RFI environments. This eliminates down time due to lost data communications between devices which would normally communicate over wire in these environments.

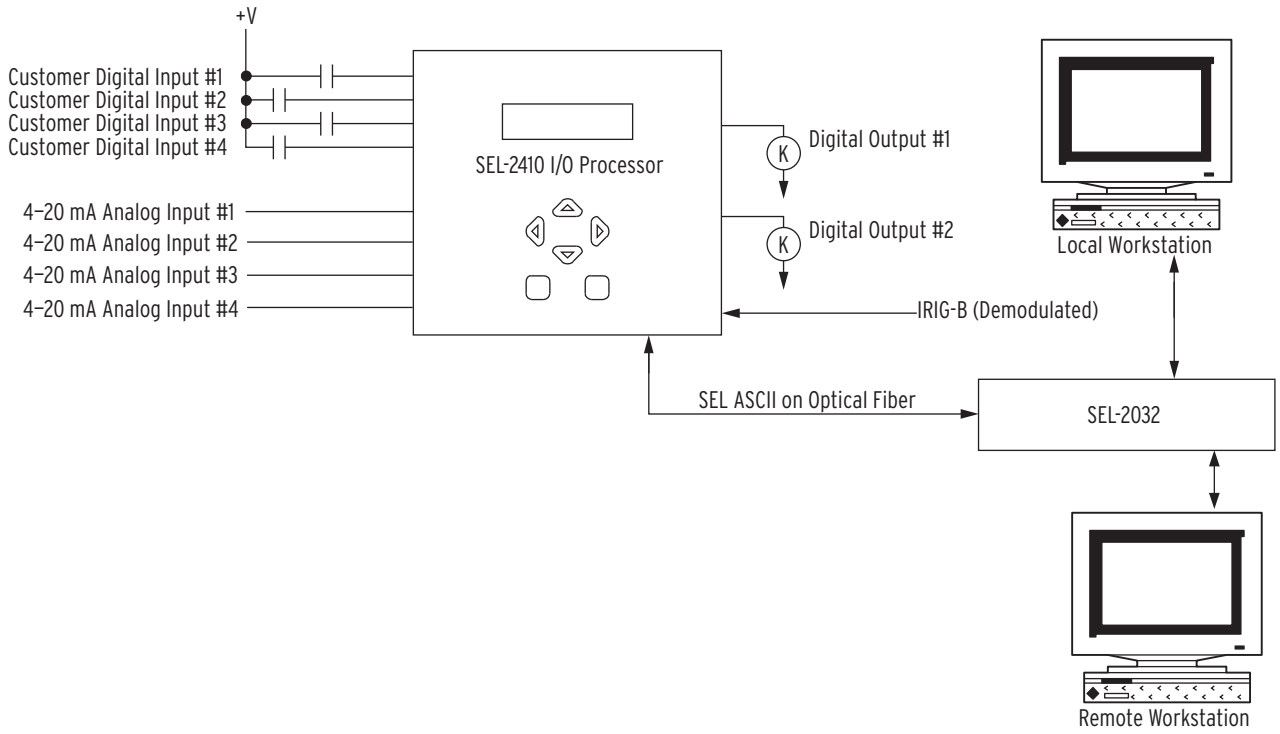


Figure 4 SEL-2410 Used as a Custom I/O Node in a Distributed System

Guideform Specification

The microprocessor-based I/O processor shall provide monitoring, control, and automation. Self-checking functions shall be included. Specific requirements are as follows:

- **SELOGIC Programming Language**. The I/O processor shall be capable of implementing a wide variety of logic and control functions using the tools available in the SELOGIC Programming Language.
- **Small Form Factor.** A compact case with quick disconnect connectors for analog and digital I/O shall be used to simplify installation.
- **Flexible I/O.** Configure the I/O processor based upon end user application requirements.
- **Analog Inputs.** As an option the I/O processor shall have the ability to support eight ±1, ±2.5, ±5, ±10, ±20, +4 to 20mA or ±1, ±2.5, ±5, or ±10 Vdc (field selectable) analog inputs.
- **IRIG-B Synchronized, Time-Stamped Events.** Up to 512 event records with IRIG-B synchronized time stamps shall be available. An internal real time clock shall be used for time stamping if an IRIG-B signal is not available.
- **Sequential Event Recorder.** A chronological report shall be provided by the I/O processor to help determine the order and cause of events and assist in troubleshooting. The last 512 input, output, and element events shall be recorded.
- The module shall have an operating temperature range of –40° to +85°C (–40° to +185°F) and a power supply input operating voltage range of 85–264 Vac/85–275 Vdc.
- The front panel shall meet NEMA 12/IP54.

Front- and Rear-Panel Diagrams

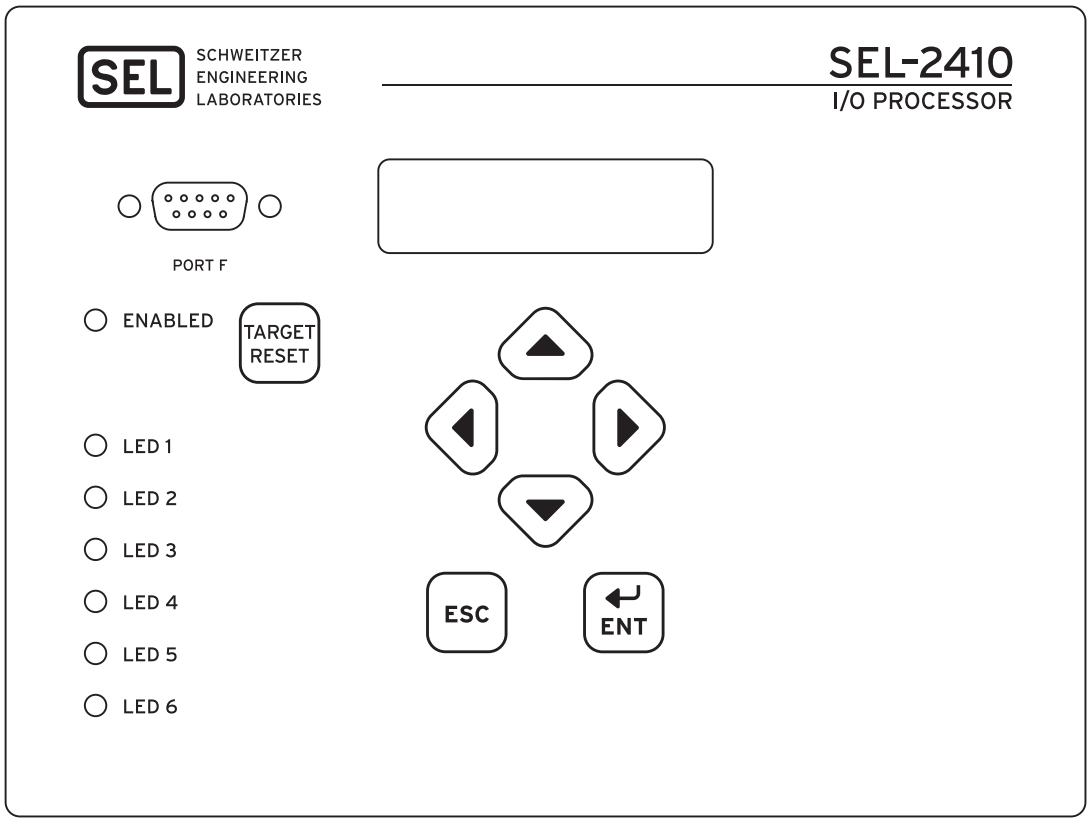


Figure 5 Front-Panel Diagram

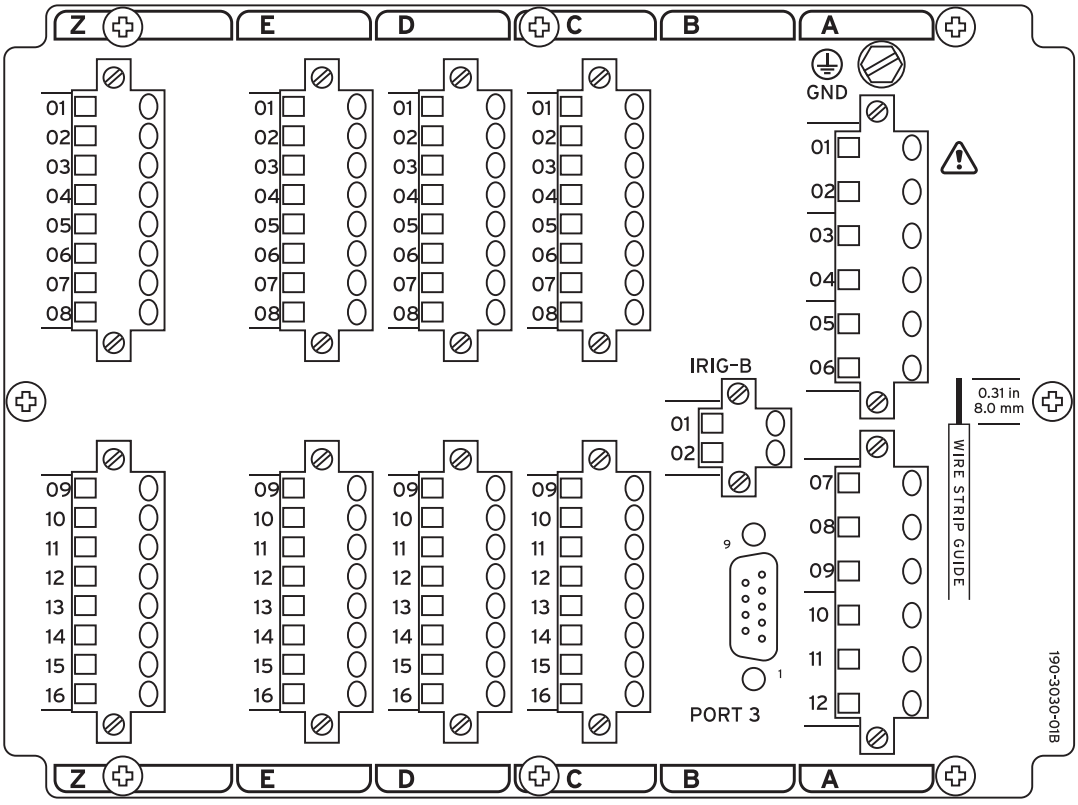


Figure 6 Rear-Panel Diagram

Specifications

General

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

Digital Output

See *Table 2* for derating.

Conventional Enclosed Thermal Current (I_{the}) Rating:	5 A
Operational Current (I_e) Rating:	3 A @ 120 Vac 1.5 A @ 240 Vac
Utilization Category:	AC-15
Contact Rating Designation:	B300
Operational Voltage (U_e) Rating:	240 Vac
Insulation Voltage (U_i) Rating:	300 Vac
Rated Impulse Withstand Voltage (U_{imp}):	4000 V

Digital Inputs

Rated Operating Voltage (U_e) [External Wetting Voltage] and Current Drawn:	24 Vac/Vdc (10 mA) 48 Vac/Vdc (4 mA) 110 Vac/Vdc (4 mA) 120 Vac/Vdc (4 mA) 220 Vac/Vdc (2 mA) 250 Vac/Vdc (2 mA)

Assertion/Deassertion

Nominal Rating (Vdc)	Deassertion (Vdc) / Assertion (Vdc)	
24 V	< 5.0	15.0-30.0
48 V	< 28.8	38.4–52.8
110 V	< 66.0	88.0–121.0
125 V	< 75.0	100.0–137.5
220 V	< 132.0	176.0–242.0
250 V	< 150.0	200.0–275.0

Nominal Rating (Vac)	Deassertion (Vac) / Assertion (Vac)	
24 V	< 5.00	14.00–27.00
48 V	< 20.16	32.64–57.60
110 V	< 46.20	74.80–132.00
125 V	< 52.50	85.00–150.00
220 V	< 92.40	149.60–264.00
250 V	< 105.00	170.00–300.00

Rated Insulation Voltage (U_i):	300 Vac/Vdc
Rated Impulse Withstand Voltage (U_{imp}):	4000 V

Analog Inputs

Input Impedance	
Current Mode:	200 Ω
Voltage Mode:	>10 kΩ
Input Ranges	
Current Mode:	±20 mA
Voltage Mode:	±10 V
Sampling Rate:	At least 4 ms
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)

Communications Ports

Standard EIA-232 (2 ports)

Location:	Front Panel Rear Panel
Data Speed:	300–38400 bps

Operating Temperature Range

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

UL/CSA Safety Rating:	+70°C (158°F) maximum
UL CSA Conformal Coated:	–40° to +70°C (–40° to +158°F)

Operating Environment

Pollution Degree:	2
Overvoltage Category:	II

Dimensions

Refer to *Figure 2.1* for I/O processor dimensions.

Weight

2.0 kg (4.4 lbs)

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 –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 25–55°C, 6 cycles, 95% relative humidity
Dry Heat:	IEC 60068-2-2:1993 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, digital I/O 2.83 kVdc on power supply
Impulse:	IEC 60255-5:2000 0.5 J, 4.7 kV on power supply, digital I/O

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 61000-4-4:2001 4 kV @ 2.5 kHz 2 kV @ 5.0 kHz for comm. ports IEEE C37.90.1-1989, 5 kV
Surge Immunity:	IEC 61000-4-5:2001 2 kV line-to-line 4 kV line-to-earth
Surge Withstand Capability Immunity:	IEC 60255-22-1:1988 2.5 kV common-mode 2.5 kV differential-mode 1 kV common-mode on comm. ports IEEE C37.90.1-1989 3 kV oscillatory 5 kV fast transient
Conducted RF Immunity:	IEC 61000-4-6:2003, 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, Class A
Radiated Emissions:	EN 55011:1998, Class A

Electromagnetic Compatibility

Product Specific:	EN 50263:1999 EN 60947-4-1:2001 EN 60947-5-1:1997

Certifications

ISO 9001:	This product was designed and manufactured under an ISO 9001 certified quality management system.
UL/CSA:	UL 61010-1 and CAN/CSA 22.2 No. 1010-1-03
CE:	CE Mark–EMC Directive Low Voltage Directive EN 61010-1:2001
Hazardous Locations Approvals:	Complies with UL1604, ISA 12.12.01, CSA 22.2 No. 213, and EN 60079-15.

Processing Specifications

Digital inputs sampled and debounced every 0.5 ms.
Analog (Transducer) inputs sampled every 4 ms.
Timers (SELOGIC Equations) sampled every 4 ms.

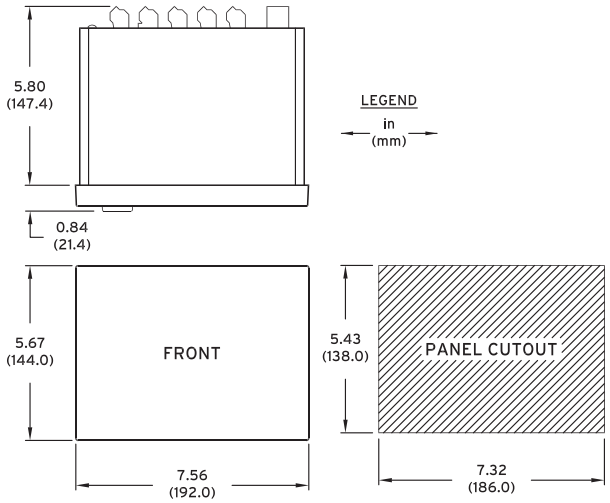


Figure 7 I/O Processor Panel-Mount Dimensions

Table 2 UL/CSA Digital Output Temperature Derating for Operating at Elevated Temperatures

Number of Digital Output (DO) cards Installed	Operating Ambient	Maximum Value of Current (Ithe)	Duty Factor	Special Conditions
1–3	less than or equal to 65°C	5.0 A	Continuous	na
1–3	between 65° and 80°C	2.5 A	Continuous	OUT101–OUT103 deasserted and carrying no current
4	less than or equal to 60°C	5.0 A	Continuous	na
4	between 60° and 70°C	2.5 A	Continuous	OUT101–OUT103 deasserted and carrying no current

Notes

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