

SMP™ IO-2230 Distributed I/O Platform



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Description

Eaton's SMP IO-2230 platform is the first device belonging to the new generation of substation-grade distributed I/O platforms, specially designed to meet modern industry and utility requirements.

This evolutionary I/O platform is now fully integrated with the SMP Manager's Software and Tools and includes many new features, greatly enhancing user experience.

Eaton relies on the same expertise and high industry standards used to develop our successful SMP Gateway product line to offer a highly reliable, easy to set up and flexible I/O module, at a very competitive price.

General features

Hardware

- Form factor: 2U
- Individual LEDs for each I/O
- No moving part
- Two built-in Form C relays for system alarm and control (configurable)
- System status LEDs
- Multi-function button (Test LED and Local/Remote switch)
- Front USB 2.0 maintenance port (Type B)
- Custom length cables available
- Protected against power supply cable inversion

Software

- Linux®-based operating system
- Seamless integration with the SMP Gateway
- Access to SMP Manager's Tools
 - Remote management (firmware upgrade, setting changes, license update)
 - Configuration with SMP Config (also for standalone units), multi protocols/instances, configurable point mapping
 - Offline and template-driven configuration
 - Use of SMP Stats, SMP Log and SMP Trace
- Micro PLC for local programmable logic (fast and complete PLC functions)
- Ready for remote management via Enterprise Management Software (IMS)
- System alarms

Communication and Web interface

- RS-485 serial interface
- 2 x 10/100 Mb/s Ethernet ports
- Daisy chain Ethernet capabilities
- Web interface for I/O commissioning
- Secured remote maintenance using transparent connection (SMP Gateway and IMS passthrough)

System

- Integrated self-diagnostics
- Integrated watchdog timer
- Real-time clock (with battery backup)
- Internal clock synchronization using IRIG-B, NTP or via protocols
- Local/Remote switching mechanism and state (logical points)
- Logs support (Security, System)

Protocols

- IEC 61850 and IEC 61850 GOOSE
- DNP3
- Coming soon Protocol: Modbus®
- DNP3 event queue (up to 1000 events/slave)
- Up to 5 slave instances

Mappings

- Predefined mappings
- Configurable mappings
- Serial number, version, internal status, current time, last reset time and more are available in the protocol mapping
- Exportable DNP3 protocol device XML profile

Cybersecurity features

- Certified under UL-2900-1 for firmware version 2.0
- Integrated Ethernet firewall
- Ability to disable any unused port (report enabled-disabled ports)
- Secure maintenance connection (TLS) via SMP Gateway Passthrough or via direct SMP Manager connection
- AES-128/256 encryption
- Secure USB maintenance port
- Secure command shell
- Account management:
 - Strong passwords
 - Single Admin account
 - User accounts and user groups
 - Detailed group permissions
- Access management (log, lockup, etc.)
- All system components digitally signed
- Settings integrity validation
- Factory reset in case of Admin password loss
- IEEE 1686-2013 compliant

Typical applications

The SMP IO-2230 platform deployed as a standalone unit can be connected directly to a DNP3 master station and used for asset monitoring and control with accurate IRIG-B time stamping.

Accessible by Eaton's IED Manager Suite (IMS) for configuration management and remote access and by Visual T&D for monitoring, alarm management and much more.

When deployed behind an SMP Gateway automation platform, the SMP IO-2230 platform also adds access to the SMP Gateway advanced logic and HMI's numerous functions like the status dashboard, name plate information, real-time data and the Commissioning Tool, for an enhanced device setup.

Eaton's RTU replacement solution is fully compatible with this new

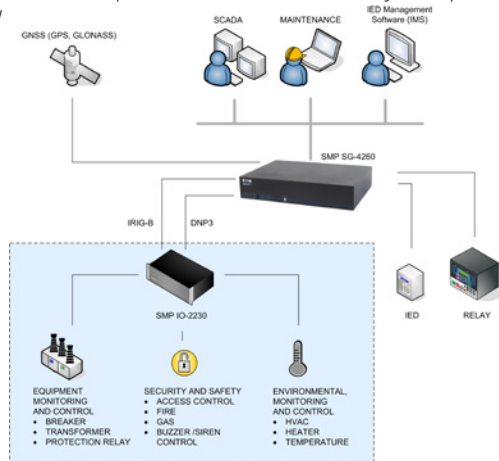


Figure 1. Typical application, deployed behind an SMP Gateway automation platform

Benefits

With its robust and scalable design, the SMP IO-2230 platform provides a flexible solution that adapts to evolving automation requirements.

Reliability

Designed to evolve through regular software and firmware updates, ensuring a future-proof automation system.

- Independently certified as per IEC 61850-3 and IEEE1613 standards

Easy integration

Complete support for the SMP Tools

- Easy configuration using SMP Manager's SMP Config

Scalability

Universal power supply (wide input ac and dc voltage range), for connection flexibility

- Software configurable voltage ranges on binary inputs

Cybersecurity

Secure remote maintenance accessible via SMP Gateway and IMS Passthrough

Productivity

Offline configuration tools

- Web interface for I/O commissioning

Product configuration

Flexible inputs and outputs configurations can be arranged together in rows of 16 I/O each, up to a full populated device with 64 I/O, making it adaptable to your evolving needs.

I/O configuration groups

I/O row	I/O groups	Possible I/O configuration
4 (top)	[49,56] and [57,64]	16 BI
3	[33,40] and [41,48]	16 BO (relays)
2	[17,24] and [25,32]	16 HBO
1 (bottom)	[1,8] and [9,16]	8 BI and 8 HAI

Where:

- HAI corresponds to high isolation analog input
- HBO corresponds to fast speed and high-current interrupting binary output

I/O features

The I/O rows must be filled starting at row 1 up to row 4 (if needed).

Analog Inputs

- High/Low warning support
- Deadband, scaling and units
- User calibration at fixed ambient temperature

Binary Inputs

- AC and DC inputs
- Tolerance/Intolerance filtering
- Chatter protection
- Fail safe circuit (active level in normal state)
- Binary points software polarity reversal
- Timetag at the beginning or end of the filtering (setting)
- Persisted counters (total transitions, up/down direction), with deadband, scaling and roll over detection.
- Freeze, clear, freeze and clear counters support

Binary Outputs

- Output protection against single component failure
- Trip/close pair, latch, pulse, pulse pair support
- Pulse train command support
- Persisted operation counter/operation time
- Binary points software polarity reversal
- Control queuing allows up to 10 parallel requests, sequentially processed when the same point is targeted

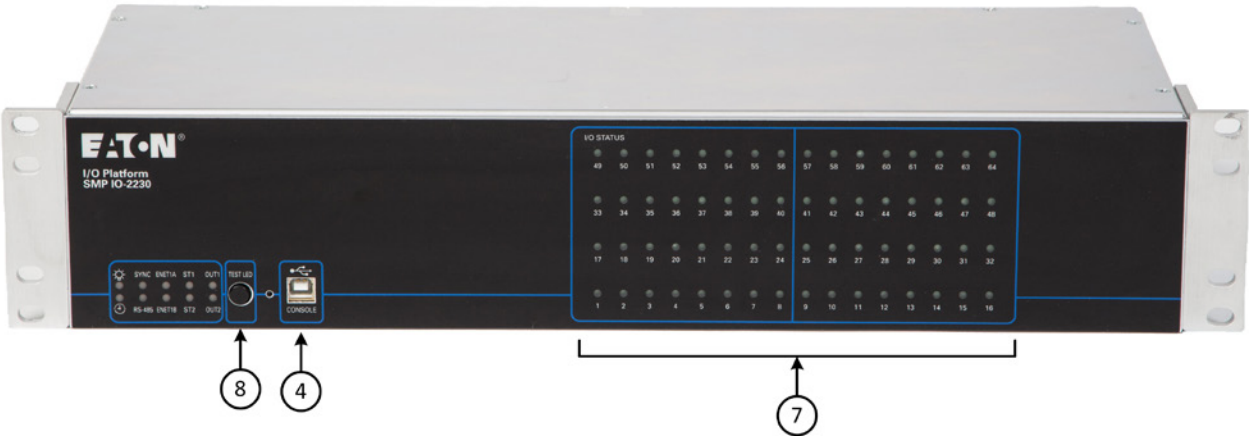


Figure 2. SMP IO-2230 platform front view

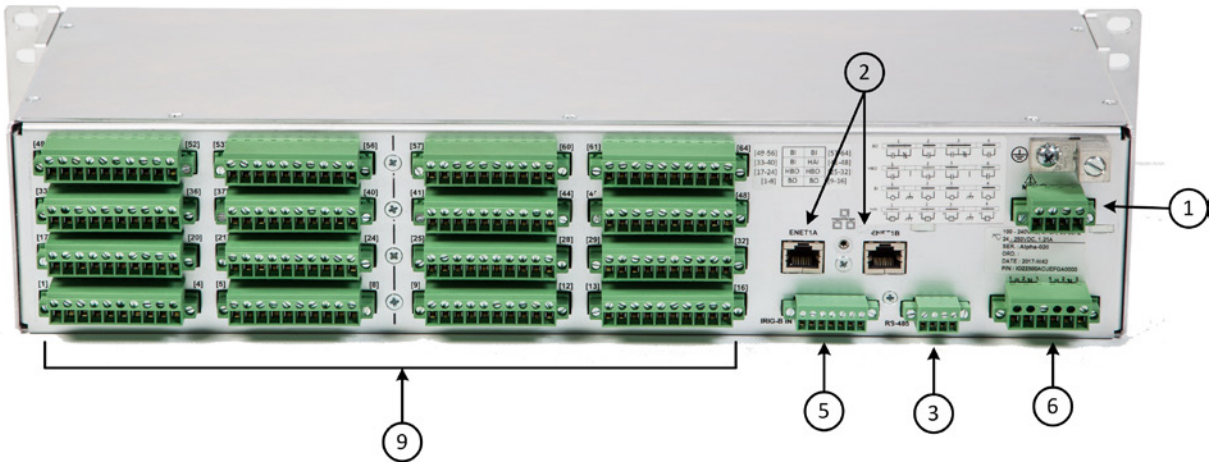


Figure 3. SMP IO-2230 platform rear view

Base unit includes:

- Rack unit, 2U
- Universal power supply (100-240 Vac / 24-250 Vdc) **(1)**
- Two built-in Ethernet port switches metallic, RJ-45 connectors (rear panel) **(2)**
- One serial port (RS-485); COM1 **(3)**
- One USB port, type B (CONSOLE port) **(4)**
- IRIG-B demodulated input (rear panel) **(5)**
- Two Form C output relays, Normally Open/Normally Closed contacts **(6)**
- Individual LED for each I/O **(7)**
- Test LED and Local/Remote button **(8)**

Options:

- Two (2) built-in Ethernet port switches, optical with LC connectors (2, metallic shown on picture)
- Up to 64 inputs and outputs configured according to the following table **(9)**

I/O row	I/O groups	Possible I/O configuration
4 (top)	[49,56] and [57,64]	
3	[33,40] and [41,48]	16 BI 16 BO (relays)
2	[17,24] and [25,32]	16 HBO 8 BI and 8 HAI
1 (bottom)	[1,8] and [9,16]	

Note: Conformal coating is available on demand.

SMP IO-2230 platform specifications

This section presents the complete specifications of the SMP IO-2230 platform.

Table 1. General specifications




Dimensions SMP IO-2230 platform	Rack unit: 2U 3.470 in. H x 19 in. W x 7.1 in. L 84.1 mm H x 482.6 mm W x 183.3 mm L 10 lbs (4,52 kg) max	
Warranty	10-year limited	
Operating temperature	-40 °F to 185 °F* (-40 °C to 85 °C) Typical use	*Safety marking is based on temperature derating table
Storage temperature	-40 °F to 185 °F (-40 °C to 85 °C)	
Humidity	5% to 95%, non-condensing	
Degrees of protection provided by enclosure	IP30	IEC60529: 2013
MTBF	Real MTBF (practical): > 100 years	The MTBF value is obtained from the ratio of the number of devices in operation over the actual number of failures observed on devices of the same SMP family.
Maximum altitude	6761.7  (2000 m)	
Status LED display	Power () Watchdog () Clock synchronization (SYNC) Build-in serial port (RS-485) Build-in Ethernet ports (ENET1A, ENET1B) Status (ST1, ST2) Relay state (OUT1, OUT2) I/O activity/state (1-64)	
Internal Battery	Lifetime: > 20 years (Rechargeable lithium battery)	Not serviceable Battery autonomy > 20 days Battery charging time < 24 hr

Table 2. Power Supply

Universal Power Supply		
Note: The power cable is not shipped with the device. The cable must be ordered separately or supplied by the customer. Refer to section Accessories and Cables options for details about the power cable.		
Specifications		
Rated supply voltage Input voltage range Frequency range Inrush current	100–240 Vac / 24–250 Vdc 88–264 Vac / 19.2–287.5 Vdc 50 / 60 Hz 40 A at 28 Vdc (t<1 ms) 110 A at 125 Vdc (t<1 ms) 160 A at 120 Vac (t<1 ms) 30 W (max)	
Power consumption		100–240 Vac, 0.6 A 24–250 Vdc, 1.25 A
Dielectric	2000 Vrms Dielectric	
Terminal block power	4-pin	Jumper MOV are installed at the factory on power supply's terminal block connectors (pin 1-2)
Wire size	12–30 AWG solid wire 12–30 AWG stranded wire	
Wire screw max torque	4 lbf-in (0.44 N-m)	
Internal fuses	2 x 3.15 A TL fuses	Not serviceable Fuse on both L(+) and N(-)
Ground lug	External ground lug on rear panel	
Wire size	14–2 AWG	
Protection	300 Vac/385 Vdc, 60 J Differential MOV Protection 300 Vac/385 Vdc, 60 J Common MOV Protection by external jumper placed on terminal block connectors (pin 1-2)	The SMP IO-2230 platform requires the MOV protection to be compliant with electrical standards. The SMP IO-2230 is shipped with the MOV already installed on the power supply terminal block (pin 1-2).

Table 3. Communication ports

2 Ethernet Ports	Rear access	No LED indicators on rear panel
Metallic connectors (standard)	2 x 10/100/BASE-T/TX	RJ-45 connectors
Fiber-optic (option)	2 x 100BASE-FX, up to 2 km	LC connectors Multimode 1300 nm
Serial Port	1 x RS-485 terminal block connectors	
2-wire RS-485 support (multidrop)	Up to 1200 m (4000 ft.) 32 devices and 115200 b/s 16 - 28 AWG	
Wire size		
Wire screw maximum torque	2.2 lbf-in (0.25 N-m)	
Protection	Differential mode TVS	40 A 8.3 ms

Table 4. Auxiliary Port

USB USB 2.0 client (CONSOLE)	Type B connector (front panel)	
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Table 5. Time Synchronization

Demodulated IRIG-B	Via terminal block (rear panel)	Isolated
Input	2 V high-level detection, V_{IH} max up to 12 Vdc, Opto-isolated IEEE 1344, C37.118, B002, B003, B004, B006, B007 Accuracy: $\pm 100 \mu s$	Current sink at 5 V IRIG-B; 5 mA Current sink at 10 V IRIG-B; 11 mA Input impedance = $1000 \Omega \pm 10\%$
Protection	Differential mode TVS 2000 Vrms dielectric	40 A 8.3 ms
Terminal block IRIG-B		
Wire size	16 - 28 AWG	
Wire screw maximum torque	2.2 lbf-in (0.25 N-m)	
Real-time clock (with battery backup)	Drift: ± 10 sec/day on normal operating temperature range and ± 20 sec/day outside the operating temperature range, when unit is powered off. Drift: < 3 sec/day on all temperature ranges when unit is running.	

Table 6. Auxiliary Relays (Alarm Relays)

2 Form C relays	Normally open and normally closed relays contacts (NO/NC) 1st relay is pre-configured for system health monitoring. Both relays are available for system applications and can be activated through a system data point.	8A 250 Vac / 24 Vdc resistive 0.2 A at 250 Vdc resistive 2000 Vrms dielectric 300 Vac / 385 Vdc, 60 J MOV Protection across contacts
Terminal block	6-pin connector	2 Form-C contacts
Wire size	12–30 AWG solid wire 12–30 AWG stranded wire	
Wire screw max torque	4 lbf-in (0.44 N-m)	

Table 7. CPU

Processor Architecture	ARM
Operating System	LINUX
Processor	ARM® Cortex® -A8 600 MHz, 56 MB DDR3 RAM
Memory	256 MB DDR3 RAM

Table 8. Binary Inputs

Binary input module		
Voltage range selectable by software	24–48 (± 19.2 to ± 60) Vdc 24–48 (± 19.2 to ± 60) Vac 50/60 Hz ± 5 Hz 110–125 Vdc (see note) 100–120 Vac 50/60 Hz ± 5 Hz Note: Contact Eaton if you need voltage greater than 125 Vdc or 120 Vac	On: ± 19.2 – 60 Vdc, Off: ± 7 Vdc On: 15 – 60 Vac, Off: 5 Vac On: ± 88 – 150 Vdc, Off: ± 18 Vdc On: 70 – 150 Vac, Off: 20 Vac
Current draw at nominal	24–48 Vdc	2.5–5.4 mA, 0.26 W maximum
	24–48 Vac	2.6–5.5 mA, 0.26 W maximum
	110–125 Vdc	2.5–2.9 mA, 0.36 W maximum
	100–120 Vac	2.3–2.8 mA, 0.33 W maximum
Sampling rate	500 μ s	
Debouncer delay	Software configurable up to 127 ms	No hardware filter
Protection	2000 Vrms dielectric	
	300 Vac / 385 Vdc, 60 J differential MOV protection	
Terminal Block Binary Input		
Wire size	12–30 AWG solid wire	
Wire screw maximum torque	4 lbf-in (0.44 N-m)	

Table 9. Binary Outputs (relays)

Output relays	Form C relays (all BO# odd) Form A relays (all BO# even)	
Protection	2000 Vrms dielectric 300 Vac/ 385 Vdc, 60 J MOV protection across contact pairs	
Operating time	Pickup 10 ms Dropout 6 ms maximum	
Electromechanical relay CSA rating	8 A at 24 Vdc resistive	All relay types
	8 A at 250 Vac resistive	
	10 A at 30 Vdc resistive	
	10 A at 250 Vac resistive	
	0.4 A at 125 Vdc resistive	
	0.2 A at 250 Vdc resistive	
	3 A at 250 Vac $\cos\phi = 0.7$	
	½ HP at 250 Vac, ⅓ HP at 125 Vac	
Rated insulation voltage	250 Vrms	All relay types
Maximum voltage	400 Vac / 250 Vdc	All relay types
Continuous carry	6 A @ 70 °C 4 A @ 85 °C	All relay types
Continuous carry AC/DC UL/CSA derating	5 A @ < 60 °C 2.5 A 60 °C to 70 °C	
Minimum load	10 mA at 5 Vdc	All relay types
Thermal current rating DC	50 A for 1 second	All relay types
Cycling capacity (1 cycle/second) per IEC 60255-0-20:1974	24 Vdc / 0.8 A L/R= 40 ms	All relay types
	48 Vdc / 0.5 A L/R= 40 ms	
	125 Vdc / 0.3 A L/R= 40 ms	

Table 15. Binary Outputs (relays, continued)

Breaking capacity (10 000 operations) per IEC 60255-0-20:1974	24 Vdc / 0.8 A L/R= 40 ms	All relay types
	48 Vdc / 0.5 A L/R= 40 ms	
	125 Vdc / 0.3 A L/R= 40 ms	
Terminal Block Binary Output		
Wire size	12–30 AWG solid wire	
Wire screw maximum torque	4 lbf-in (0.44 N-m)	

Table 10. Fast Speed and High-Current Interrupting Output (HBO)

Continuous carry DC	6 A @ 70 °C 4 A @ 85 °C	
Continuous carry DC UL/CSA derating	5 A @ < 60 °C 2.5 A 60 °C to 70 °C	
Thermal current rating DC	50 A for 1 sec	
Contact protection	2000 Vrms dielectric 385 Vdc, 120 J MOV protection across contacts	
Inductive breaking DC Capacity (10 000 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 = 40 ms	
Cycling capacity DC 4 cycles/second followed by 2 minutes idle for thermal dissipation as 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	
Pickup DC	< 50 µs @ 48–250 Vdc < 10 ms @ 24 Vdc	Resistive load Fast operation is not supported at 24 Vdc
Droupout DC	10 ms	Resistive load
Rated operational voltage AC	100/110/120/220/240 Vac 19.2–250 Vac	
Rated insulation voltage AC	250 Vac	
Continuous carry AC	6 A @ 70 °C 4 A @ 85 °C	
Continuous carry AC UL/CSA derating	5 A @ < 60°C 2.5 A @ 60°C to 70°C	
Inductive breaking AC Capacity (10 000 operations) as per EC 60255-0-20:1974	24 Vac 10 A L/R = 40 ms 48 Vac 10 A L/R = 40 ms 125 Vac 10 A L/R = 40 ms 250 Vac 10 A L/R = 20 ms	
Terminal Block		
Wire size	12 – 30 AWG solid wire 12 – 30 AWG stranded wire	
Wire screw maximum torque	4 lbf-in (0.44 N-m)	
Note	The Normally Close contact is not suitable for Fast and High Current output. See Binary Outputs specifications.	

Table 11. Analog Inputs

Input range		Operation mode (voltage or current)
Voltage mode	± 10 V	
Current mode	± 20 mA (4–20 mA transducers)	Current mode requires external resistors
	± 2 mA (0–1 mA transducers)	
Input impedance		
Voltage mode	> 100 k Ω	± 10 V
Current mode	499 Ω 5 k Ω 10 k Ω	± 20 mA ± 2 mA ± 1 mA
Resolution	16 Bits + sign	
Accuracy		
Voltage mode	± 0.02 % of full scale @ 25°C	Factory calibrated (25 °C)
Current mode	± 0.15 % of full scale @ 25°C ± 0.05 % of full scale @ 25°C	With 0.1% external resistor With 0.01% external resistor No factory calibration for current mode
Accuracy variation	± 0.015 % /°C of full scale @ 25 °C	Customer calibration possible (zero offset)
Isolation		
Protection	2000 Vrms dielectric	14 Vdc MOV protection across terminals
High isolation model		Each input channel is totally electrically independent (galvanic isolation)
Common Mode Rejection DC (CMR) @ 50/60 Hz	> 90 dB	
Sampling rate	200 ms	
Terminal Block Analog Inputs		
Wire size	12–30 AWG solid wire	
Wire screw maximum torque	4 lbf-in (0.44 N-m)	
Accessories for AI	Current mode external resistor ± 1 mA Current mode external resistor ± 2 mA Current mode external resistor ± 20 mA OR Analog Input current mode external module option ± 1 mA - 1 input (resistor included) Analog Input current mode external module option ± 2 mA - 1 input (resistor included) Analog Input current mode external module option ± 20 mA - 1 input (resistor included)	See ordering information section for part number

Table 12. Accessories

Jumper straps	10 poles, 30 A, 5.08 mm, UL-94 V0	
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Table 13. Certification and standard compliancy

Cybersecurity for Network-Connectable Products	UL-2900-1 for firmware version 2.0	
cTUVus Marking	IEC 61010-1 ed3.0 (2010-06, CAN/CSA-C22.2 No. 61010-1-12 and ANSI/UL 61010-1-2012)	
RoHS	2002/95/EC	
REACH	Regulation (EC) No 1907/2006	
ISO : Equipment is designed and manufactured using ISO 9001 certified quality program		ISO 9001:2008 certificate of conformance was awarded by an independent certification authority. The corresponding certificate, quality manual and quality policy are available on demand.
CE Marking	2006/95/EC Low Voltage Directive 2004/108/CE EMC Directive 2006/1907(EC) (REACH) 2011/65/EU (ROHS)	
Substation Grade	IEC 61850-3 ed2.0(2013) IEEE Std 1613™-2009 IEEE Std 1613a™-2011 IEEE Std 1613.1™-2013 IEC 60255-1 ed1.0 (2009)	EMC : Class 2, Profile 2 Location : G, H, P Signal connections : l, f, p, h Mechanical: Class 2 Class 2 on all ports (error free), Profile 2 Zone A & B Zone A & B

Table 14. Substation-grade compliancy notes

Compliance element	Notes
IEC 61850-3 ed2.0	<p>The SMP IO-2230 platform is a communication device designed to achieve the highest immunity required in power stations to provide local, field and high voltage signal port connections. It can be installed in low, medium and high voltage substations, in any weather-protected unconditioned environment.</p> <p>It meets or surpasses IEC 61850-3 ed2.0. A class 2 is achieved with the Ethernet optical LC link.</p> <p>Due to the importance of selecting good cable quality, EMC test has been performed with EATON cables.</p> <p>The SMP IO-2230 platform compliance with the IEC 61850-3 standard was validated by an independent certified testing laboratory. The compliance test reports are available on demand.</p>
IEEE Std 1613™-2009 IEEE Std 1613a™-2011 IEEE Std 1613.1™-2013	<p>The SMP IO-2230 platform can be installed in Zone A&B. It also meets or surpasses IEEE Std 1613 requirements as Class 2 networking device for Ethernet communications (LC fiber-optic).</p> <p>Due to the importance of selecting good cable quality, EMC test has been performed with EATON cables.</p> <p>The SMP IO-2230 platform compliance with the IEEE 1613 standard was validated by an independent certified testing laboratory. The compliance test reports are available on demand.</p>
IEC 60255-1	The SMP IO-2230 platform also meets or surpasses IEC 60255-1. Per IEC 60255-26 the SMP IO-2230 platform is a command & control device and is compliant to be installed in Zone A & B.
cTUVus	<p>The SMP IO-2230 platform is cTUVus marked. It ensures the end user that uses the SMP IO-2230 platform is safe.</p> <p>The SMP IO-2230 platform cTUVus certification was validated by an independent certified testing laboratory. The marking reports are available on demand.</p>

Type test details

This section presents all tests that were conducted on the SMP IO-2230 platform.

Table 15. Type Tests

Communication profile	Profile 2 (IEC) Profile 3 (IEEE)	Heavy load on all communication ports with error free (Class 2).
IEC 61850-3 ed2.0 (2013)		
Electromagnetic Compatibility (EMC)		
Conducted Emissions	CISPR 32 (2015) FCC part 15 (2016) subpart B ICES-003 (2016)	Class A 150 kHz – 30 MHz
Radiated Emissions	CISPR 32 (2015) FCC part 15 (2016) subpart B ICES-003 (2016)	Class A 30 MHz – 6 GHz
Harmonic Current Emission Limits	EN61000-3-2 (2014)	Class A
Voltage Fluctuations and Flicker Limitations	EN61000-3-3 (2013)	Observation period for Pst: 10 min Observation period for Plt: 120 min
Electrostatic Discharge Immunity	IEC 61000-4-2 (2008)	Contact : ±6 kV Air : ±8 kV
Radiated Electromagnetic Field Immunity	IEC 61000-4-3 (2006) A1 (2008) A2 (2010)	Frequency sweep 80 MHz – 1 GHz : 20 V/m 1 GHz – 3 GHz : 10 V/m Spot frequencies 80 MHz, 160 MHz, 380 MHz, 450 MHz, 900 MHz, 1850 MHz, 2150 MHz: 10 V/m
Electrical Fast Transient Immunity	IEC 61000-4-4 (2012)	Power: ±4 kV / 5 kHz I/O ports: ±4 kV / 5 kHz Communication ports : ±4 kV / 5 kHz
Surge Immunity	IEC 61000-4-5 (2014)	Power: ±4 kV L-PE / ±2 kV L-L I/O ports: ±4 kV Communication Ports: ±4 kV
Conducted Immunity	IEC 61000-4-6 (2013)	Power : 10 V I/O Ports : 10 V Communication Ports : 10 V
Power Frequency Magnetic Field Immunity	IEC 61000-4-8 (2009)	Continuous field : 100 A/m, 50 Hz & 60 Hz Short duration field : 1000 A/m, 50 Hz & 60 Hz
Voltage Dips, Short Interruptions and Voltage Variation Immunity	IEC 61000-4-11 (2004)	Voltage dips: 0% Un / 5 cycles 70% Un / cycle
Conducted Common Mode Disturbances in the Frequency Range 0Hz-150kHz	IEC 61000-4-16 (2015)	Continuous: 30 Vrms , 50 Hz & 60 Hz Short duration: 300 Vrms, 50 Hz & 60 Hz Variation 15 Hz–150 Hz: level 4
Ripple on DC Input Power Port Immunity	IEC 61000-4-17 (1999) A1 (2002) A2 (2009)	% of nominal DC voltage: 15 % Test duration: 10 min
Damped Oscillatory Wave Immunity	IEC 61000-4-18 (2006) A1 (2010)	2.5 kV common mode 2.5 kV differential mode Oscillation Frequency = 1 MHz
Voltage Dips, Short Interruptions and Voltage Variation on DC Power Port Immunity	IEC 61000-4-29 (2000)	Voltage dips: 40% Un during 100 ms 70% Un during 100 ms Voltage short interruptions: 0% during 200 ms 0% during 5s
Protective bonding resistance	IEC 61850-3 ed2.0 (2013)	20 A < 0.1A
Climatic Environment Conditions		
Dry heat & Operational Storage	IEC 60068-2-2 (2007) Test Bd, Bb	Bd 85 °C, 16 h Operational, including warm boot Bb 85 °C, 16 h Storage
Cold Operational & Storage	IEC 60068-2-1 (2007) Test Ad, Ab	Ad -40 °C, 16 h Operational, including cold boot Ab -40 °C, 16 h Storage
Damp Heat, Steady State	IEC 60068-2-78 (2001) Test Cab	40 °C, 93%, 10 days

Table 15. Type Tests (continued)

Damp Heat, Cyclic	IEC 60068-2-30 (2005) Test Db	40 °C, 2 cycles (12 h + 12 h) Lower temp 25 °C, 97% RH Upper temp 55 °C, 93% RH
Change of temperature	IEC 60068-2-14 (2009) Test Nb	-40 °F + 185 °F (-40 °C + 85 °C) 5 cycles, 1 °C/min
Mechanical Environmental Conditions		
Sinusoidal Vibration Endurance & Response	IEC 60255-21-1 (1988)	Endurance 20 cycles, 2 g, 10-150 Hz, 3 axes Response: 1 cycle, 1 g, 10–150 Hz, 3 axes
Shock-Bump Endurance & Response	IEC 60255-21-2 (1988)	Endurance 30 cycles, 11 ms, 3 impulsions, 3 axes Response: 10 g, 11 ms, 3 impulsions, 3 axes
Sinusoidal Vibration - Seismic	IEC 60255-21-3 (1993)	Class 2, method A X = 7.5 mm (2 g), Y = 3.5 mm (1 g)
Safety		
Product Safety requirements	IEC 61850-3 (2013): IEC 60255-27 (2013) IEC 60529 (2013) IEC 61180-1 (1992) IEC 60664-1 (2007) IEC 60695-11-10 (2013)	The product SMP IO-2230 platform is certified cTUVus on IEC 61010-1 for the safety requirement.
IEEE 1613 (2009) + AMD (2011) + IEEE 1613.1 (2013)		
Electromagnetic Compatibility (EMC)		
Electrostatic Discharge Immunity	C37.90.3 (2001)	Contact : ±8 kV Air : ±15 kV
Radiated Electromagnetic Field Immunity	C37.90.2 (2004)	80 MHz–1 GHz: 20 V/m 1 GHz–3 GHz: 10 V/m Spot frequencies: 80 MHz, 160 MHz, 450 MHz, 900 MHz 20 V/m (AM) Spot frequencies: 900 MHz 20 V/m (PM) Spot frequencies: 900 MHz, 1.6 GHz & 3.8 GHz 10 V/m (AM) Spot frequencies: 1.732 GHz, 1.8 GHz, 2.31GHz, 2.45 GHz, 5.8 GHz 8.5 V/m (PM)
SWC : Fast Transient Waveform	C37.90.1 (2002)	Power: ±4 kV / 2.5 kHz I/O Ports: ±4 kV Communication Ports: ±4 kV
Surge Immunity	EC 61000-4-5 (2014)	Power: ±4 kV L-PE / 2 kV I/O Ports: ±4 kV / 2.5 kHz Communication Ports: ±4kV / 2.5kHz
Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields	IEC 61000-4-6 (2013)	Power: 10 Vrms I/O Ports: 10 Vrms Communication Ports: 10 Vrms
Power Frequency Magnetic Field Immunity	IEC 61000-4-8 (2009)	Continuous field : 100 A/m / 50 Hz & 60 Hz Short duration field : 1000 A/m / 50 Hz & 60 Hz
Damped Oscillatory Magnetic Field Immunity Test	IEC 61000-4-10 (1993) A1 (2000)	Field Strength: 100 A/m Oscillation Frequency: 100 kHz & 1 MHz
Conducted Common Mode Disturbances in the Frequency Range 0Hz-150kHz	IEC 61000-4-16 (2015)	Continuous: 30 Vrms / 60 Hz & 50 Hz Short duration: 300 Vrms / 60 Hz & 50 Hz Variation 15 Hz-150 kHz: level 4
Ripple on DC Input Power Port Immunity	IEC61000-4-17 (1999) A1 (2002) A2 (2009)	% of nominal DC voltage : 15 % Test duration : 1 min
SWC : Oscillatory Waveform	C37.90.2 (2002)	2.5 kV common mode 2.5 kV differential mode Oscillation Frequency: 1 MHz
Impulse Voltage Withstand Test	IEC60255-5 (2000)	All ports: ±4 kV
Dielectric Test	IEC60255-5 (2000)	Universal Supply 24-250 Vdc: 2 kVrms Enet: 1.5 kVrms IRIG-B In Demodulated: 1.5 kVrms Auxiliary Relays (alarm relays): 2.0 kVrms BI (Binary Input): 2.0 kVrms HAI (Analog Input): 2.0 kVrms HBO (Hybrid Binary Output): 2.0 kVrms BO (Binary Output): 2.0 kVrms

Table 15. Type Tests (continued)

Climatic Environment Conditions		
Dry heat Operational & Storage	IEC 60068-2-2 (2007) Test Bd, Bb	Bd 85 °C, 16 h Operational, including warm boot Bb 85 °C, 16 h Storage
Cold Operational & Storage	IEC 60068-2-1 (2007) Test Ad, Ab	Ad -40 °C, 16 h Operational including cold boot Ab -40 °C, 16 h Storage
Damp Heat, Steady state	IEC 60068-2-78 (2012) Test Cab	40 °C, 93%, 10 days
Damp heat, cyclic	IEC 60068-2-30 (2005) Test Db	40 °C, 2 cycles (12 h + 12 h) Lower temp 25 °C, 97% RH Upper temp 55 °C, 93% RH
Mechanical Environmental Conditions		
Sinusoidal Vibration Endurance & Response	IEC 60255-21-1 (1988)	Endurance: 20 cycles, 2 g, 10-150 Hz, 3 axes Response: 1 cycle, 1 g, 10-150 Hz, 3 axes
Shock-Bump Endurance & Response	IEC 60255-21-2 (1988)	Endurance: 30 g, 11 ms, 3 impulsions, 3 axes Response: 10 g, 11 ms, 3 impulsions, 3 axes
Free fall	IEC 60068-2-31 (2008)	1m with packaging
IEC 60255-1 series		
Electromagnetic Compatibility (IEC 60255-26 (2013))		
RF conducted emission	CISPR32 FCC part 15 (2016) subpart B ICES-003 (2016)	Class A 150 kHz-30 MHz
RF radiated emission	CISPR32 FCC part 15 (2016) subpart B ICES-003 (2016)	Class A 30 MHz-6 GHz
Electrostatic Discharge Immunity	IEC 61000-4-2 (2008)	Contact: ±6 kV Air : ±8 kV
RF electromagnetic field immunity test	IEC 61000-4-3 (2006) A1 (2007) A2 (2010)	80 MHz-1 GHz: 20 V/m 1GHz-3GHz: 10 V/m Spot frequencies: 80 MHz, 160 MHz, 380 MHz, 450 MHz, 900 MHz, 1850 MHz, 2150 MHz: 10 V/m
Electrical Fast Transient Immunity	IEC 61000-4-4 (2012)	Power: ±4 kV / 5 kHz I/O Ports: ±4 kV / 5 kHz Communication Ports: ±4 kV / 5 kHz
Surge Immunity	IEC 61000-4-5 (2014)	Power: ±4 kV L-PE / ±2 kV L-L I/O Ports: ±4 kV Communication Ports: ±4 kV
Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields	IEC 61000-4-6 (2013)	Power : 10 Vrms I/O ports : 10 Vrms Communication ports : 10 Vrms
Power Frequency Magnetic Field Immunity	IEC 61000-4-8 (2009)	Continuous field: 100 A/m, 50 Hz & 60 Hz Short duration field : 1000 A/m, 50 Hz & 60 Hz
Voltage Dips, Short Interruptions and Voltage Variation Immunity	IEC 61000-4-11 (2004)	Voltage dips: 0% Un: 0.5 to 25 cycles 40% Un / 10 cycles (at 50 Hz) 40% Un / 12 cycles (at 60 Hz) 70% Un / 25 cycles (at 50 Hz) 70% Un / 30 cycles (at 60 Hz) Short interruptions: 0% Un during 250 cycles (at 50 Hz) 0% Un during 300 cycles (at 60 Hz)
Conducted Common Mode Disturbances in the Frequency Range 0Hz-150kHz	IEC 61000-4-16 (2015)	Continuous: 30 Vrms, 60 Hz & 50 Hz Short duration: 300 Vrms, 60 Hz & 50 Hz Variation 15 Hz-150 kHz: level 4
Ripple on DC Input Power Port Immunity	IEC 61000-4-17 (1999) A1 (2002) A2 (2009)	% of nominal DC voltage: 15 % Test duration: 1 min
Damped Oscillatory Wave Immunity	IEC 61000-4-18 (2006) A1 (2010)	2.5 kV common mode 2.5 kV differential mode Oscillation Frequency: 1 MHz

Table 15. Type Tests (continued)

Voltage Dips, Short Interruptions and Voltage Variation on DC Power Port Immunity	IEC 61000-4-29 (2000)	Voltage dips: 40% Un during 200 ms 70% Un during 500 ms Voltage interruptions : 0% during 5 s
Gradual shut-down/start-up for DC power supply	IEC 60255-26 (2013)	≥0.8 Un to 0 V to ≥0.8 Un
Impulse Voltage Withstand Test	IEC60255-5 (2000)	All ports: ±4 kV
Dielectric Test	IEC60255-5 (2000)	Universal Supply 24-250 Vdc: 2 kVrms Enet: 1.5 kVrms IRIG-B In Demodulated: 1.5 kVrms CPU Relay: 2.0 kVrms BI (Binary Input): 2.0 kVrms HAI (Analog Input): 2.0kVrms HBO (Hybrid Binary Output): 2.0 kVrms BO (Binary Output): 2.0 kVrms
Protective Bonding Resistance	IEC60255-1 (2009)	20 A < 0.1 A
Climatic Environment Conditions		
Dry heat Operational & Storage	IEC 60068-2-2 (2007) Test Bd, Bb	Bd 85 °C, 16 h Operational, including warm boot Bb 85 °C, 16 h Storage
Cold Operational & Storage	IEC 60068-2-1 (2007) Test Ad, Ab	Ad -40 °C, 16 h Operational, including cold boot Ab -40 °C, 16 h Storage
Damp heat, steady state	IEC 60068-2-78 (2001) Test Cab	40 °C, 93%, 10 days
Damp heat, cyclic	IEC 60068-2-30 (2005) Test Db	40 °C, 2 cycles (12 h + 12 h) Lower temp 25 °C, 97% RH Upper temp 55 °C, 93% RH
Change of temperature	IEC 60068-2-14 (2009) Test Nb	-40 °F + 185 °F (-40 °C +85 °C) 5 cycles, 1 °C/min
Mechanical Environmental Conditions		
Sinusoidal Vibration Endurance & Response	IEC 60255-21-1 (1988)	Endurance: 20 cycles, 2 g, 10-150 Hz, 3 axes Response: 1 cycle, 1 g, 10-150 Hz, 3 axes
Shock-Bump Endurance & Response	IEC 60255-21-2 (1988)	Endurance: 30 g, 11 ms, 3 impulses, 3 axes Response: 10 g, 11 ms, 3 impulses, 3 axes
Sinusoidal Vibration - Seismic	IEC 60255-21-3 (1993)	Class 2, method A X = 7.5 mm (2 g) Y = 3.5 mm (1 g)
Product Safety		
Product safety requirements	IEC 60255-27 (2013)	The product SMP IO-2230 platform is certified cTUVus on IEC 61010-1 for the safety requirement.

The SMP IO-2230 platform is rugged, reliable, and tailored to our customer's requirements. It is easy to setup and use. Eaton has decades of experience in substation-grade platforms design for grid automation systems, making our SMP IO-2230 a product line that utilities can rely on.

Temperature derating and resistor

Due to the large number of different configurations, Eaton provides a Microsoft Excel™ calculator tool in order to enable our customers to easily calculate the total power in the device as well as the operational maximum temperature allowed, according to a specific SMP IO-2230 platform configuration.

The tool also allows to calculate and resolve the resistor value according to the current range for the analog inputs. The calculator tool can be downloaded from the web site, in the Resources page of the product.

Following are some captures taken from the tool for two typical SMP IO-2230 platform configurations. The blue fields correspond to values entered or selected by the customer and the grey fields on the right side of the table contain the calculated results.


Eaton provides three calculator on the tool, they are used:

- to calculate the permitted operation temperature and the power consumption of the device
- to calculate the resistor value for a specific current range for analog inputs
- to resolve the current range according to a resistor value for analog inputs

Temperature derating

To be compliant with the IEC 61010-1 certification, the SMP IO-2230 platform can be used within the temperature range that is function of the total power dissipated in the unit, as per the result of the table or in the Microsoft Excel™ calculator tool.

According to the standard, the SMP IO-2230 platform can support operating temperatures between -40 °F and +158 °F (-40 °C and +70 °C).



SMP IO-2230 temperature derating calculator

Description	Configuration	Power dissipation (W)
Main Supply Voltage SMPIO	125V	1,15
Ethernet	Optical	2,75
IO Row [1-8] [9-16]	16 BI	0,72
IO Row [17-24] [25-32]	16 BO	0,12
IO Row [33-40] [41-48]	8BI 8HAI	1,33
IO Row [49-56] [57-64]	None	0
SMP IO-2230 power (Watt)		6,07
Wetting voltage for input	125V	
Maximum number of Binary Inputs available	24	
Binary Input steady ON in same time	0	0
Maximum number of outputs available	16	
Output steady ON in same time	0	
Average Current per Output stay ON	0,00	0
Total power in device (Watt)		7,6
Operational maximum ambient temprature		70°C
Power Supply efficiency		1,25

Figure 4. Temperature derating and power for typical application (Example 1)



SMP IO-2230 temperature derating calculator

Description	Configuration	Power dissipation (W)
Main Supply Voltage SMPIO	48V	1,15
Ethernet	Copper	0,65
IO Row [1-8] [9-16]	16 BI	0,72
IO Row [17-24] [25-32]	16 BI	0,72
IO Row [33-40] [41-48]	16 HBO	0,12
IO Row [49-56] [57-64]	None	0
SMP IO-2230 power (Watt)		3,36
Wetting voltage for input	125V	
Maximum number of Binary Inputs available	32	
Binary Input steady ON in same time	0	0
Maximum number of outputs available	16	
Output steady ON in same time	0	
Average Current per Output stay ON	0,00	0
Total power in device (Watt)		5,0
Operational maximum ambient temprature		70°C
Power Supply efficiency		1,5

Figure 5. Temperature derating and power for typical application (Example 2)

Analog input current range and resistance calculator



SMP IO-2230 Analog Input Current range to resistor calculator

Analog input range (± mA)	20	
Maximum resistor value allowed (Ω)		502
ADC resolution (uA)		305
Power dissipated (W), single analog input		0,2

Figure 6. Resistor calculation for a typical application (Example 1)



SMP IO-2230 Analog Input Current range to resistor calculator

Analog input range (± mA)	1	
Maximum resistor value allowed (Ω)		11031
ADC resolution (uA)		15
Power dissipated (W), single analog input		0,01

Figure 7. Resistor calculation for a typical application (Example 2)

Analog input resistor to current range calculator



SMP IO-2230 Analog Input Resistor to current range calculator

Resistor value (Ω)	499	
Maximum analog input range (± mA)		20,13
ADC resolution (uA)		307
Power dissipated (W), single analog input		0,2

Figure 8. Current range resolution for a typical application (Example 1)



SMP IO-2230 Analog Input Resistor to current range calculator

Resistor value (Ω)	10000	
Maximum analog input range (± mA)		1,09
ADC resolution (uA)		17
Power dissipated (W), single analog input		0,01

Figure 9. Current range resolution for a typical application (Example 2)

Dimension drawings

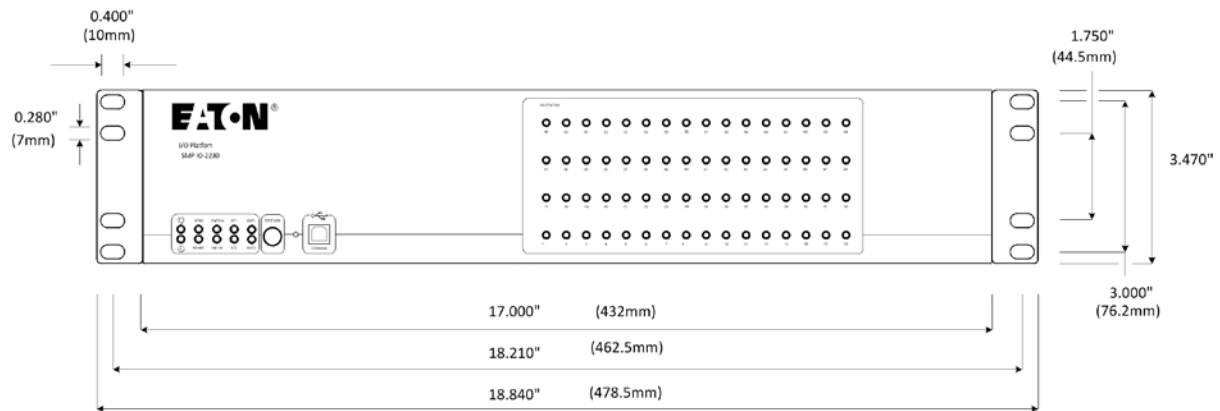


Figure 10. SMP IO-2230 platform front view

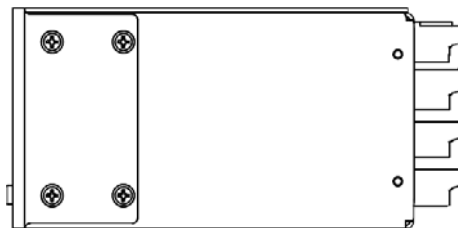


Figure 11. SMP IO-2230 platform side view

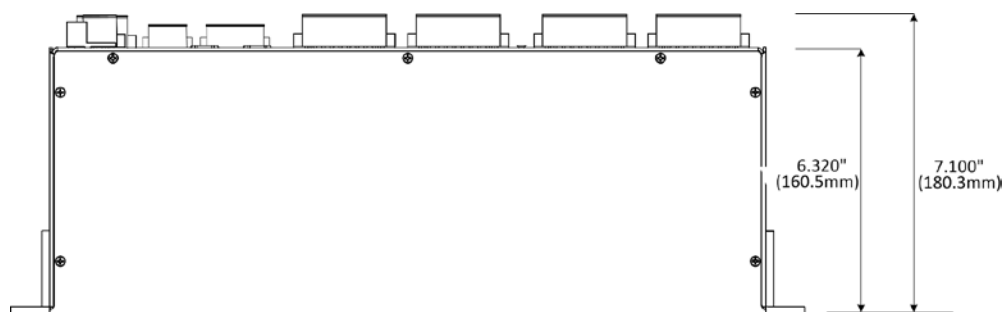


Figure 12. SMP IO-2230 platform top view

Table 16. System Configuration Chart

Description	SMP	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Family																	
[I02] I/O Platform		I02															
Format																	
Rack mount 2U Base Unit			2														
Model																	
Basic - I/O Acquisition (Monitoring & Control)				3													
Custom hardware configuration #1																	
NONE					0												
Custom hardware configuration #2																	
NONE						0											
Internal Flash Memory																	
2 Gb NAND Flash							A										
Ethernet																	
2 Ethernet 10/100/1000 BASE-TX (basic)								C									
2 Ethernet 100 Optical, LC connectors (option)								L									
Power Supply																	
100-240 Vac, 24-250 Vdc									U								
I/O group 1 to 16																	
16 Binary Inputs										A							
16 Binary Outputs										E							
16 Binary Outputs High & Fast Current										F							
8 Binary Inputs; 8 Analog Inputs High Isolation										G							
I/O group 17 to 32 (optional)																	
NONE											0						
16 Binary Inputs											A						
16 Binary Outputs											E						
16 Binary Outputs High & Fast Current											F						
8 Binary Inputs; 8 Analog Inputs High Isolation											G						
I/O group 33 to 48 (optional, available only if I/O 1 to 32 are populated)																	
NONE												0					
16 Binary Inputs												A					
16 Binary Outputs												E					
16 Binary Outputs High & Fast Current												F					
8 Binary Inputs; 8 Analog Input High Isolation												G					
I/O group 49 to 64 (optional, available only if I/O 1 to 48 are populated)																	
NONE													0				
16 Binary Inputs													A				
16 Binary Outputs													E				
16 Binary Outputs High & Fast Current													F				
8 Binary Inputs ; 8 Analog Inputs High Isolation													G				
Internal																	
NONE														0			
Internal																	
NONE															0		
Internal																	
NONE																0	

Table 16. System Configuration Chart (continued)

Description	SMP	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Software package																	
SMP IO-2200 basic profile <ul style="list-style-type: none"> DNP3 Server IEC 61850 GOOSE (publisher/subscriber) Basic SoftPLC capabilities 																	0
SMP IO-2200 61850 profile <ul style="list-style-type: none"> DNP3 Server IEC 61850 Server IEC 61850 GOOSE (publisher/subscriber) Basic SoftPLC capabilities 																	A

Accessories & Cable options

Table 17. Accessories

Part number	Description
SMP-AICR-0001	Analog Input current mode external Resistor option for ± 1 mA, qty 1
SMP-AICR-0002	Analog Input current mode external Resistor option for ± 2 mA, qty 1
SMP-AICR-0003	Analog Input current mode external Resistor option for ± 20 mA, qty 1
SMP-AICR-0-1MA	Analog Input current mode external module option ± 1 mA - 1 input (resistor included)
SMP-AICR-0-2MA	Analog Input current mode external module option ± 2 mA - 1 input (resistor included)
SMP-AICR-0-20MA	Analog Input current mode external module option ± 20 mA - 1 input (resistor included)
SMP-JS-0001-FULL	Jumper Straps, 10 Pole, 5.08 mm, qty 1 (covers 4 inputs)
SMP-JS-0001-CUT	Jumper Straps, 10 Pole, 5.08 mm, qty 1, Cut for SMP IO-2000 Pinout

Table 18. Cables

Part number	Description
Shielded Power Cable	
P-CABC-0303-00	AC Power Cable Shielded Nema 5-15-Wire * Must be used for Demo or laboratory only
P-CABC-0306-00	Power Cable Shielded Wire-Wire 1.8 m
P-CABC-0318-10	Power Cable Shielded Wire-Wire 10 m
P-CABC-0318-03	Power Cable Shielded Wire-Wire 3 m
P-CABC-0318-01	Power Cable Shielded Wire-Wire 1 m
P-CABC-0318-xx	Power Cable Shielded Wire-Wire x m
USB cable	
600AB0008R	Replacement USB Cable, Shielded Note: For USB Console Port
Ethernet Multimode Fiber	
-LC-LC	
P-CABC-0315-0050	Multimode Fiber OM1 62.5/125um LC-LC 50 m
P-CABC-0315-0025	Multimode Fiber OM1 62.5/125um LC-LC 25 m
P-CABC-0315-0010	Multimode Fiber OM1 62.5/125um LC-LC 10 m

Table 18. Cables (continued)

P-CABC-0315-0003	Multimode Fiber OM1 62.5/125um LC-LC 3 m
P-CABC-0315-0001	Multimode Fiber OM1 62.5/125um LC-LC 1 m
P-CABC-0315-xxxx	Multimode Fiber OM1 62.5/125um LC-LC x m
-ST-LC	
P-CABC-0316-0050	Multimode Fiber OM1 62.5/125um ST-LC 50 m
P-CABC-0316-0025	Multimode Fiber OM1 62.5/125um ST-LC 25 m
P-CABC-0316-0010	Multimode Fiber OM1 62.5/125um ST-LC 10 m
P-CABC-0316-0003	Multimode Fiber OM1 62.5/125um ST-LC 3 m
P-CABC-0316-0001	Multimode Fiber OM1 62.5/125um ST-LC 1 m
P-CABC-0316-xxxx	Multimode Fiber OM1 62.5/125um ST-LC x m
Ethernet RJ45 Shielded Cable	
P-CABC-0310-025	Copper Ethernet Cable RJ45 CAT6 25 m
P-CABC-0310-010	Copper Ethernet Cable RJ45 CAT6 10 m
P-CABC-0310-003	Copper Ethernet Cable RJ45 CAT6 3 m
P-CABC-0310-001	Copper Ethernet Cable RJ45 CAT6 1 m
P-CABC-0310-xxx	Copper Ethernet Cable RJ45 CAT6 x m
DB9 Serial Shielded Cable	
RS-485 2-wires + IRIG-B shielded cable DB9-Wires	
P-CABC-0309-0010	RS485-2wires Serial Cable DB9M-Wire 10 m
P-CABC-0309-0003	RS485-2wires Serial Cable DB9M-Wire 3 m
P-CABC-0309-0001	RS485-2wires Serial Cable DB9M-Wire 1 m
P-CABC-0309-xxxx	RS485-2wires Serial Cable DB9M-Wire x m
Time Synchronization Shielded Cable	
4 Twisted Pairs Shielded cable : IRIG-B ; RS-485 4-Wires/2-Wires Wire-Wire	
P-CABC-0320-25	4 Twisted Pairs Cable Wire-Wire 25 m
P-CABC-0320-10	4 Twisted Pairs Cable Wire-Wire 10 m
P-CABC-0320-03	4 Twisted Pairs Cable Wire-Wire 3 m
P-CABC-0320-01	4 Twisted Pairs Cable Wire-Wire 1 m
P-CABC-0320-xx	4 Twisted Pairs Cable Wire-Wire x m

Some cables can be provided with custom lengths, according to customer request. For a custom length-cable, use the required length to create your own cable code.

Contact your Eaton representative to validate the maximum length for your application.

Example: a cable P-CABC-0310-xxx with 2 meters length will be P-CABC-0310-002 (always use length in meters)

Contact Eaton for other cable requirements.

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