

# **PowerLogic® I/O Expander**

External I/O Device for ION8600

Installation Guide

September 2006





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## Danger



This symbol indicates the presence of dangerous voltage within and outside the product enclosure that may constitute a risk of electric shock, serious injury or death to persons if proper precautions are not followed.

## Caution



This symbol alerts the user to the presence of hazards that may cause minor or moderate injury to persons, damage to property or damage to the device itself, if proper precautions are not followed.

## Note



This symbol directs the user's attention to important installation, operating and maintenance instructions.

# Installation Considerations

Installation and maintenance of the ION8600 meter should only be performed by qualified, competent personnel that have appropriate training and experience with high voltage and current devices. The meter must be installed in accordance with all local and national electrical codes.

## DANGER

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Failure to observe the following instructions may result in severe injury or death.

- ◆ During normal operation of the ION8600 meter, hazardous voltages are present on its terminal strips, and throughout the connected potential transformer (PT), current transformer (CT), digital (status) input, control power and external I/O circuits. PT and CT secondary circuits are capable of generating lethal voltages and currents with their primary circuit energized. Follow standard safety precautions while performing any installation or service work (i.e. removing PT fuses, shorting CT secondaries, etc).
- ◆ The terminal strips on the meter base should not be user-accessible after installation.
- ◆ Do not use digital output devices for primary protection functions. These include applications where the devices perform energy limiting functions or provide protection of people from injury. Do not use the ION8600 in situations where failure of the devices can cause injury or death, or cause sufficient energy to be released that can start a fire. The meter can be used for secondary protection functions.
- ◆ Do not HIPOT/Dielectric test the digital (status) inputs, digital outputs, or communications terminals. Refer to the label on the ION8600 meter for the maximum voltage level the device can withstand.

## CAUTION

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Observe the following instructions, or permanent damage to the meter may occur.

- ◆ The ION8600 meter offers a range of hardware options that affect input ratings. The ION8600 meter's serial number label lists all equipped options. Applying current levels incompatible with the current inputs will permanently damage the meter. This document provides installation instructions applicable to each hardware option.
- ◆ The ION8600 meter's chassis ground must be properly connected to the switchgear earth ground for the noise and surge protection circuitry to function correctly. Failure to do so will void the warranty.
- ◆ Terminal screw torque: Barrier-type (current, voltage, and relay terminal screws: 1.35 Nm (1.00 ft-lbf) max. Captured-wire type (digital inputs/outputs, communications, power supply: 0.90 Nm (0.66 ft.lbf) max.

## FCC Notice

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.

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The Ringer Equivalence Number (REN) for the ION8600 optional internal modem is 0.6. Connection to the ION8600 internal modem should be made via an FCC Part 68 compliant telephone cord (not supplied). The ION8600 cannot be used on a public coin phone service or party line services.

## Network Compatibility Notice for the Internal Modem

The internal modem in meters equipped with this option is compatible with the telephone systems of most countries in the world. Use in some countries may require modification of the internal modem's initialization strings. If problems using the modem on your phone system occur, please contact Schneider Electric Technical Support.

Made by Power Measurement Ltd.

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Covered by one or more of the following patents:

U.S. Patent No's 7010438, 7006934, 6990395, 6988182, 6988025, 6983211, 6961641, 6957158, 6944555, 6871150, 6853978, 6825776, 6813571, 6798191, 6798190, 6792364, 6792337, 6751562, 6745138, 6737855, 6694270, 6687627, 6671654, 6671635, 6615147, 6611922, 6611773, 6563697, 6493644, 6397155, 6236949, 6186842, 6185508, 6000034, 5995911, 5828576, 5736847, 5650936, D505087, D459259, D458863, D443541, D439535, D435471, D432934, D429655, D427533.

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# I/O Expander for ION8600

The PowerLogic I/O Expander is an external I/O (input/output) interface for the PowerLogic ION8600. The I/O Expander provides 8 digital inputs, 4 Form C digital outputs, and either 4 Form A digital outputs or 4 analog outputs, for applications such as energy pulsing, control, energy counting, status monitoring, and analog interface to SCADA.

The I/O Expander also provides convenient ports to connect the ION8600's RS-232 and RS-485 communications wiring.

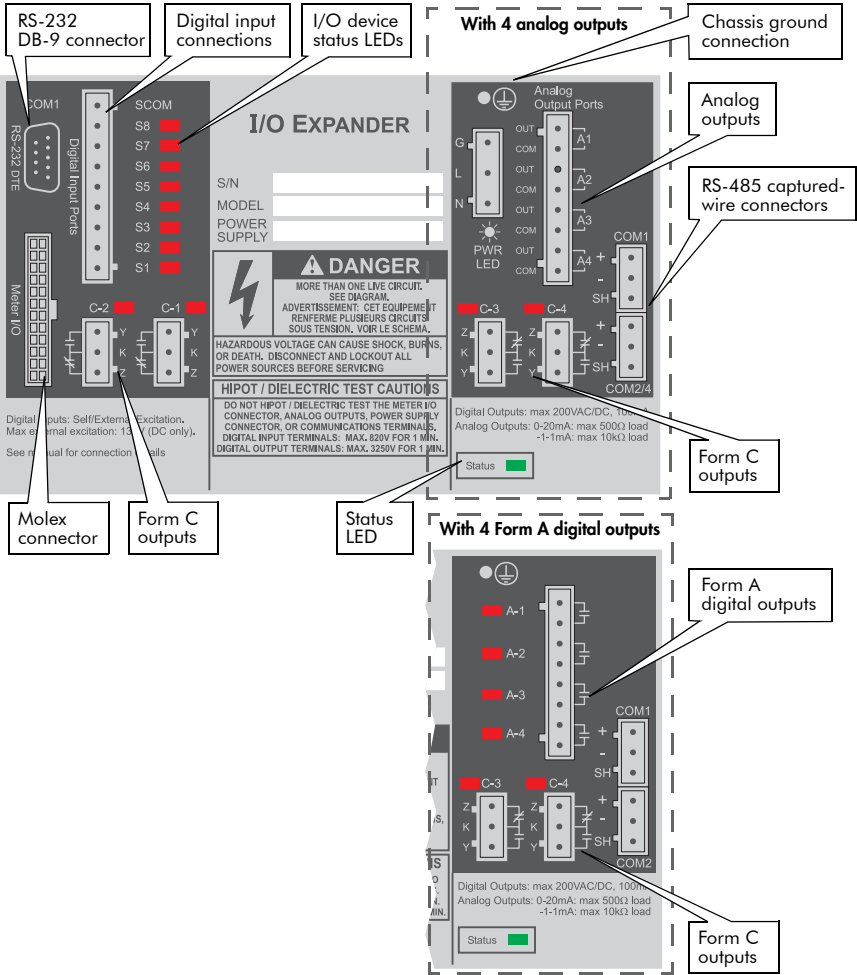
## Before You Begin

Familiarize yourself with the steps in this guide and read the safety precautions presented on the "Installation Considerations" page.

### Recommended Tools

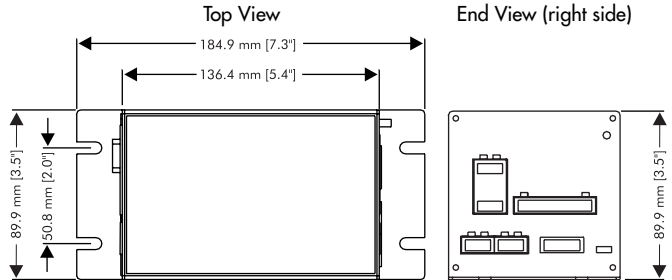
- ◆ Precision Torx T10 screwdriver
- ◆ Wire cutters / stripper

# I/O Expander Labels



# Step 1: Mount the I/O Expander

Review the steps in this section before installing the I/O Expander. Examine its label to verify its service type matches your intended application.

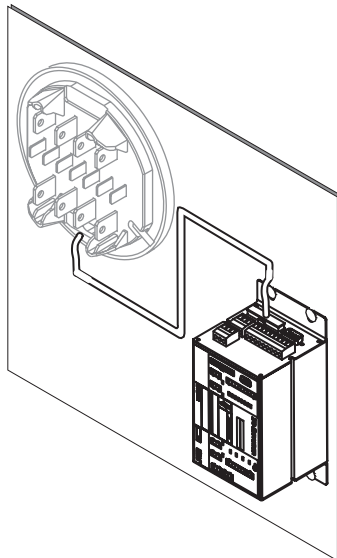


## ⚠ CAUTION

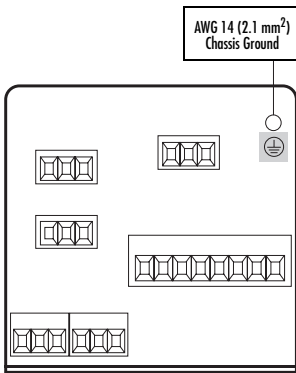
Include a switch or circuit breaker in the installation in close proximity to the unit and within easy reach of the operator. Mark it as the disconnecting device for the unit.

## Environmental Considerations

<b>Operating Temperature</b>	-40 to 85°C (-40 to 185°F) internal
<b>Storage Temperature</b>	-40 to 85°C (-40 to 185°F)
<b>Humidity</b>	5% to 95% non-condensing humidity



# Step 2: Wire the Ground Terminal

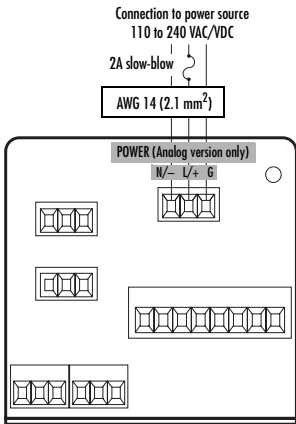


Chassis Ground Connection	Wire Size
Contact to the provided chassis ground terminal.	AWG 12 (3.31 mm <sup>2</sup> ) to AWG 14 (2.08 mm <sup>2</sup> )

## CAUTION

This device must be installed with an adequate chassis ground connection. Failure to properly connect the device chassis ground voids the I/O Expander's warranty. Do not use metal door hinges as a ground path.

# Step 2(A): Connect Internal Power Supply (Analog Model Only)



Power Supply	Independent, fused
Nominal power range	110 - 240 Vac/Vdc
Outside power range	80 - 264 Vac/Vdc
Supply Current	0.5 A (18 W)

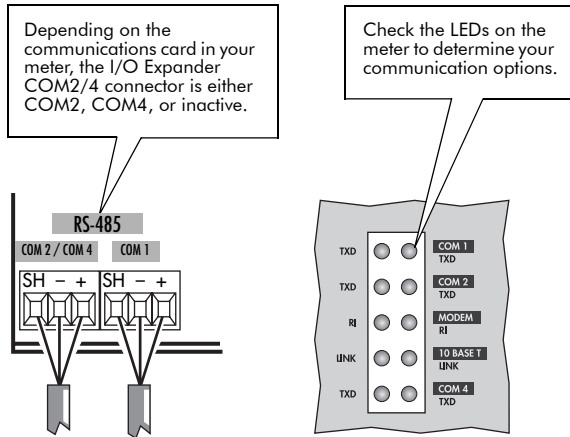
## CAUTION

Unit is not internally fused.  
Use a 2A slowblow fuse on the L/+ terminal.  
Applying power above 264 VAC/VDC damages power supply.

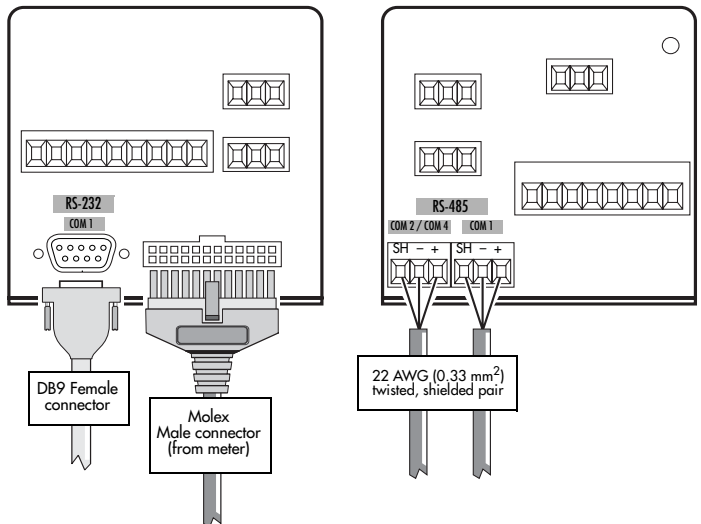


# Step 3: Wire Communications

## A. Examine meter LEDs to verify communications options.



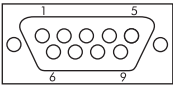
Communication LEDs (bottom right of meter)	Serial COM Port Designation
If COM4 and MODEM LEDs are <b>NOT</b> present	COM2
If COM4 LEDs are <b>NOT</b> present, and MODEM LEDs are present	COM2/4 port is inactive
If COM4 LEDs are present	COM4



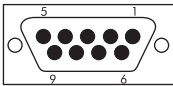
# RS-232 Connections

Specification	Value
Baud Rates	300 to 115200 bps (default: 9600 bps)
Duplex	Full
Supported Protocols	ION (default), MODBUS, DNP 3.0, FACTORY, GPS:ARBITER, GPS:TRUETIME/DATUM
Isolation	Optical isolation from all other inputs and outputs (excluding the COM1 RS-485 port); isolation voltage is 750 V peak for 10 seconds @ 60 Hz.
Cable Length	35 ft. (10 m) max.

DB9 Male



DB9 Female

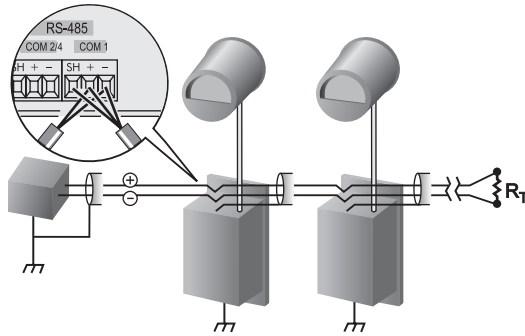


## RS-232 Serial Cable Pin Assignments

Pin Number	DTE Function	Description
1	RLSD	Carrier Detect
2	RXD	Receive Data (i.e. data into device)
3	TXD	Transmit Data (i.e. data out of device)
4	DTR	Data Terminal Ready
5	Ground	Ground
6	N/A	Not connected
7	RTS	Request To Send
8	CTS	Clear To Send
9	N/A	Not connected

# RS-485 Connections

Specification	Value
Baud Rates	300 to 57600 bps (default: 9600 bps)
Duplex	Half
Supported Protocols	ION, MODBUS, DNP 3.0, FACTORY, GPS:ARBITER, GPS:TRUETIME/DATUM (default: ION)
Isolation	Optical isolation from all inputs and outputs (the COM1 RS-485 port is not isolated from the COM1 RS-232 port); isolation voltage is 750 V peak for 10 seconds @ 60 Hz.
Cable Length	4000 ft. (1219 m) max.
Cable	16 to 22 AWG (1.31 to 0.33 mm <sup>2</sup> )



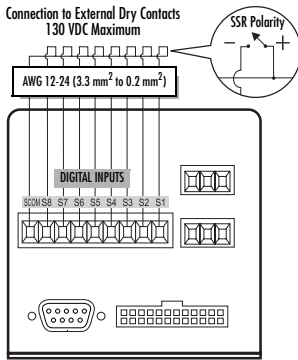
# Step 4: Wire the I/O

## A. Connect the Digital Inputs

Excitation for the I/O Expander's digital inputs can be either internal or external.

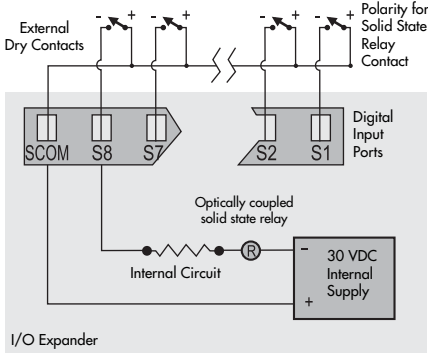
### ⚠ CAUTION

The Digital Input Ports of the I/O Expander have a 30 - 70 VDC wetting voltage range. Therefore, any external output sources connected to Digital Input Ports must be rated in accordance with the wetting voltage range of 30 - 70 VDC.

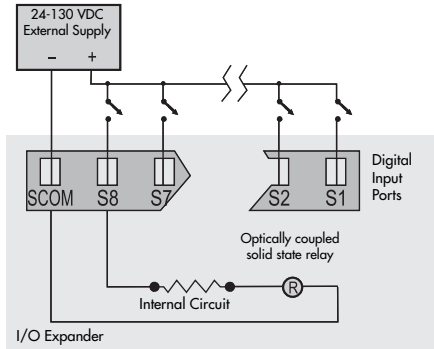


I/O Expander components are sensitive to electrostatic discharge (ESD). Wear an anti-static wrist strap when working inside the unit. Failure to do so voids your warranty.

### Internal Excitation



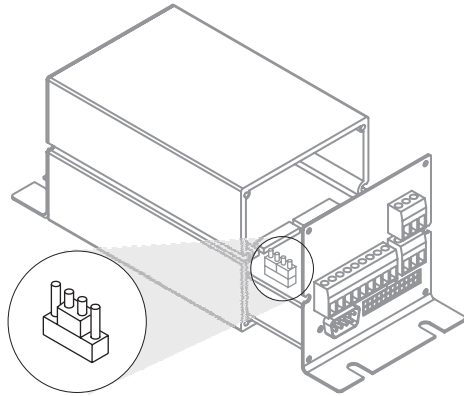
### External Excitation



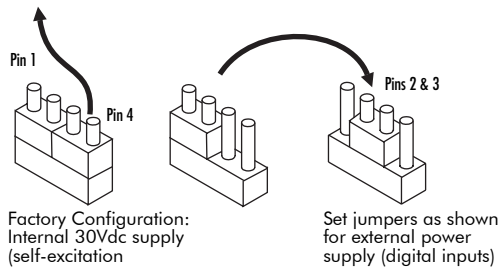
### To set jumper blocks for external excitation:

1. Disconnect power supply (if using analog model).
2. Detach the Molex connector from the I/O Expander.
3. From the end of the I/O Expander that contains the DB-9 and Molex connection ports, remove the four T10 Torx screws.

4. Slowly slide the left end plate out to reveal the four-pin jumper header located on the unit's top circuit board panel. **Do not pull the plate out further**; this could damage the internal wiring of the device.



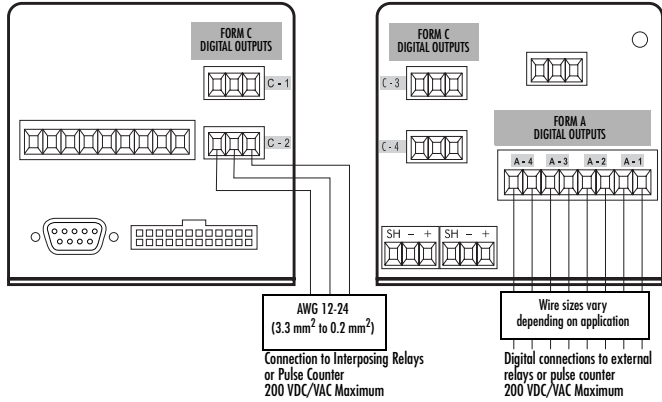
5. Remove one jumper block, and place the other jumper block on pins 2 and 3 of the four-pin header (as shown).



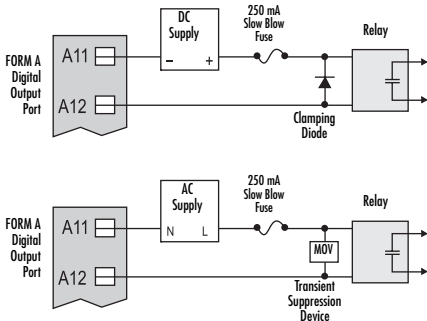
6. Slide the left end plate back onto the side of the I/O Expander. Re-attach supply power (for Analog models if required).  
The I/O Expander's internal excitation is now disabled, and an external supply can now be used for external contacts.

## B. Connect the Digital Outputs

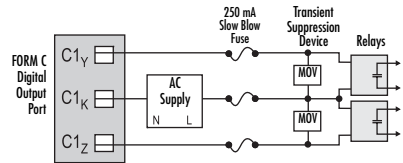
The four Form C digital output ports suitable for KYZ pulsing applications. The four Form A digital outputs are suitable for controlling external relays, performing end of interval pulsing, load control and alarm annunciation.



### Typical Form A Digital Output Connections



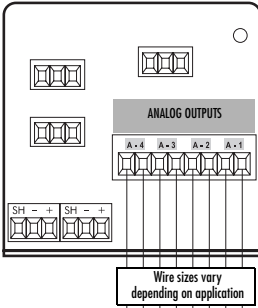
### Typical Form C Digital Output Connections



Type	Form C outputs (4), Form A outputs (4)
Max Load Voltage	200 VAC/VDC
Max Load Current	100 mA
ON Resistance	30 Ω typical, 50 Ω maximum
OFF Resistance	400M Ω minimum
Isolation	3250 V rms, 60 Hz for 1 minute (to meter) 1000 V rms, 60 Hz for 1 minute (btwn outputs)
Update Rate	20 ms (accuracy = +/- 7 ms) <sup>1</sup>
Signal Type	Continuous or pulse
Precautions	Use a clamping diode for DC supplies Use an MOV for AC supplies Protect with 250 mA slow-blow fuse
Max Output Transition	50 per second
Lifetime	No load = 10,000,000 operations Rated voltage and load = 100,000 operations

<sup>1</sup> Not including communication lag time; state changes occur within 20ms.

## C. Connect the Analog Outputs



Analog Connections to analog transducers  
 0 to 20 mA: 500 ohm load maximum  
 -1 to 1 mA: 10k ohm load maximum  
 -20 to 20 mA: 500 ohm load maximum

Type Options	0 - 20 mA output, or -1 to 1 mA output
DC outputs accuracy	+/- 0.30% of full scale 500 (0-20 mA)
OFF Resistance	500 $\Omega$ (0-20 mA option) 10 K $\Omega$ (-1 to 1 mA option)

## I/O Application Precautions

Consider the following when digital input/output devices are used for fast control schemes or are used to perform critical equipment control operations (e.g., breaker trip, etc.):

- ◆ Connect to external equipment with an intermediate mechanism, allowing relay control to be completely disabled for servicing.
- ◆ The worst-case state change latency for the I/O Expander's digital output devices is 20 ms; worst-case state change latency for digital input ION modules in the meter is 40 ms.
- ◆ When power or communications to the device is lost, the meter cycles power in the I/O Expander and all digital outputs switch to an off state. Once the I/O Expander regains power or restores communications to the meter, the digital outputs' states is updated by the meter.
- ◆ When the I/O Expander has powered down and powered back up, test the digital outputs of the I/O Expander to ensure that all control conditions occur as expected.
- ◆ After all control operations are verified, enable relay control of the external equipment.

### NOTE

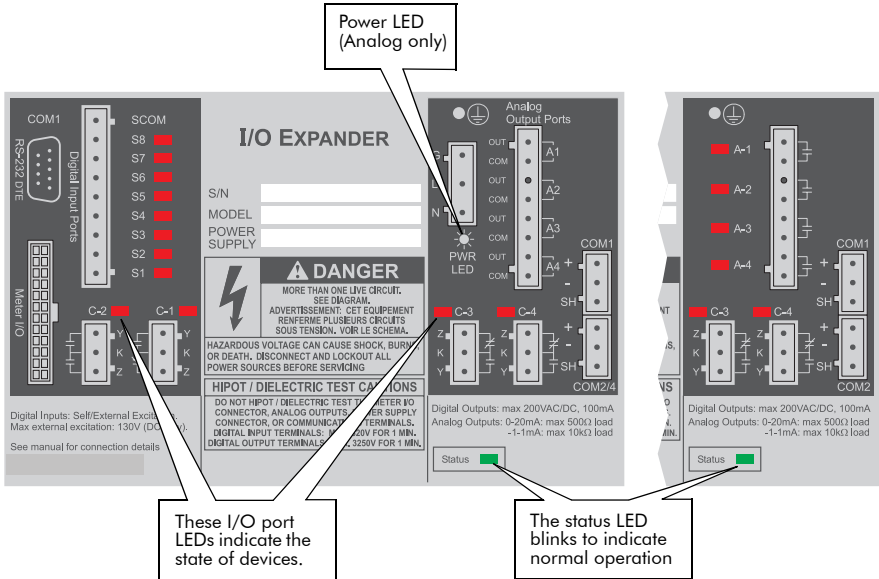
Timestamp resolution for device state changes is  $\pm 2$  ms.

# Step 5: Verify Operation

Use the LEDs on the I/O Expander and on the meter to verify correct operation.

LED	Location	Action
Status LED	Top of I/O Expander	Blinks green, approximately once/second <sup>1</sup>
I/O LEDs	Label of I/O Expander	Steady on (none for Analog devices)
Power LED (Analog only)	End of I/O Expander	Steady on
Meter Communications LEDs	Bottom right side of meter	Blinks to confirm data exchange

<sup>1</sup> If the LED turns on for one second, then off for five seconds, there is a problem with communications. Check your communications wiring connections and settings. If the LED does not function at all, contact Power Measurement.



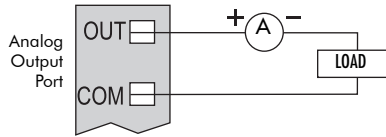


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# Verify Analog Output Operation

Follow these steps to determine the port's correct operation with your connected meter:

1. Ensure the meter is properly configured. Disconnect supply power from the I/O Expander and ensure no static charge remains in the circuit. If you leave the meter powered, the status and digital I/O LEDs continue to function.
2. Place an ammeter in series with the analog output port.



3. Power up the I/O Expander and measure the output current.

If the analog outputs do not produce the expected output current, contact Power Measurement.

# Step 6: Configure the I/O Expander

## A. Set Communications

Use the meter's front panel or ION Setup software to configure the communications ports. COM ports are as follows:

COM Port	Description
COM1 Setup	Settings for the variable RS-232/ RS-485 communications port
COM2 Setup <sup>1</sup>	Settings for the dedicated RS-485 / optional modem port
COM4 Setup <sup>2</sup>	Settings for the optional dedicated RS-485 port

<sup>1</sup> If the internal modem is present on your meter, RS-485 communications on COM2 is disabled.

<sup>2</sup> This port is optional.

Since each COM port controls different communications hardware, some settings between the COM ports vary. All of the settings you encounter in the COM1, COM2 and COM4 ports are as follows:

Communications Port Setting	Description	Default
Protocol	ION, Modbus RTU, Factory, DNP 3.0, GPS:ARBITER, GPS:TRUETIME/DATUM protocols.	ION
Baud Rate	You can select the following baud rates: 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200.	9600 bps
Transmit Delay	The bounds are 0.0 to 1.0 s	0.01 (10 ms)
Unit ID	Sets the meter's Unit ID – a unique Unit ID is required for each COM port on a network. *	101 (COM2) 103 (COM4)
Comm Mode (COM1 only)	The communications mode selected, either RS-232 or RS-485	RS-485
RTS/CTS Handshake (COM1 only)	The two selections are 'RTS/CTS', and 'RTS with Delay'	RTS with Delay

<sup>1</sup> The factory set Unit ID for COM1 of the meter is based on the serial number of the meter — Serial number: PQ-0009A263-06; Unit ID: 9263.

### NOTE

Each meter connected to an RS-485 network must have a unique Unit ID. Check the value of this register when setting up your meter to ensure it is unique on the network.

# Step 7: Configure I/O Devices

## A. Set up the Digital Inputs

Each status input is controlled by the Digital Input modules. These modules can be linked with other modules for counting status changes.

### To create and configure Digital Input modules:

1. Launch Designer and open the meter template.
2. If required create one Digital Input module for each input port you are going to use.
3. Configure the Digital Input Port setup register to match the input port you want to monitor.

Available settings are as follows:

Digital Input Module Settings			
Setup Register	Available Settings	Default	Description
Input Mode	Pulse, KYZ	Pulse	Specifies complete pulse or KYZ transition pulse
EvLog Mode	Log On, Log Off	Log Off	Specifies whether or not to log status changes
Debounce	numeric	0.015	Setting for the mechanical contact bounce, in seconds
Polarity	<i>Fixed at</i> NON-INVERTING	NON-INVERTING	Specifies a Non-inverted (or level) pulse
Port	I/O MODULE IN1 <i>to</i> I/O MODULE IN 8, NOT USED	NOT USED	Specifies which hardware port the module controls

## B. Set up the Digital Outputs

The Digital Output and Pulser modules control the digital output hardware ports. You must use Designer to create and configure these ION modules.

### NOTE

Your meter template may have factory configured Digital Output, Calibration Pulser or Pulser modules.

### To setup the digital outputs:

1. Once you have connected the external I/O field equipment to the digital output ports, run Designer, and open the meter template.
2. If required, create a Digital Output, Calibration Pulser, or Pulser module for each output port you are going to use.
3. Link the Source input of these modules to a value you want to reflect through the digital outputs.

4. Configure the settings of the controlling module to match your requirements. The settings in these modules are as follows:

ION Module	Setup Registers	Available Settings	Default	Description
Calibration Pulser Module	Port	I/O EXP FormA 1 to I/O EXP FormA 4, I/O EXP FormC 1 to I/O EXP FormC 4, NOT USED	NOT USED	Specifies the output hardware channel
	Pulse Width	numeric	0.05 (5A meter) 0.02 (1A meter)	Pulse Width, in seconds
	Kt	0.01 to $1 \times 10^9$	Depends on Meter's Form Factor	Specifies Watts per pulse
Digital Output Module	Port	As above	NOT USED	See above
	Pulse Width	numeric	0	Pulse Width, in seconds (set to 0 for continuous pulse)
	Polarity	<i>Fixed at</i> NON-INVERTING	NON-Inverting	Specifies non-inverted pulse
	EvLog Mode	LOG ON or LOG OFF	LOG OFF	Specifies to store state changes in the Event Log
Pulser Module	Port	As above	NOT USED	See above
	PulseWidth	numeric	1	Pulse width, in seconds
	OutputMode	PULSE or KYZ	PULSE	Specifies full pulse or KYZ
	Polarity	<i>Fixed at</i> NON-INVERTING	NON-Inverting	Specifies non-inverted pulse

Ensure that the module Port setup register matches the I/O Expander output you want to control. If the port you want to use does not appear in the Port setup register list, that port is in use by another module. Edit the Port setup register of the module using that port and set it to NOT USED – the port is then available to other modules.

# Step 8: Configure Analog Outputs

## A. Set up the analog outputs

1. Once you have connected the external I/O field equipment to the analog output ports on the I/O Expander, run Designer, and open the meter template.
2. If required, create an Analog Output module for each output port you are going to use.
3. Link the Source input of these modules to a value you want to reflect through the analog outputs.
4. Use ION Setup to configure the settings of the controlling module to match requirements. Settings in these modules are:

Analog Output Module			
Setup Registers	Available Settings	Default	Description
Port	I/O EXP AnOut 1 to I/O EXP AnOut 4, NOT USED	NOT USED	Specifies the output hardware channel.
Full Scale	$-1 \times 10^9$ to $1 \times 10^9$	N/A	Sets the measured value that will create the maximum possible output on the analog output hardware port.
Zero Scale	$-1 \times 10^9$ to $1 \times 10^9$	N/A	Sets the measured value that will create the minimum possible output on the analog output hardware port.

Ensure that the module's *Port* setup register matches the I/O Expander's output you want to control. If the port you want to use does not appear in the *Port* setup register list, that port is in use by another module. Edit the *Port* setup register of the module using that port and set it to NOT USED – the port is then available to other modules.

## B: Set the Zero and Full Scales

You control external devices by delivering a specific current or voltage that is proportional to the source input. This is done by setting the Full and Zero Scale setup registers and the hardware Port that the output is sent to. You use Designer software to configure these setup registers in the Analog Output module.

The Zero Scale setup register defines the source input value that creates the *minimum* current output on the analog device.

The Full Scale setup register defines the source input value that creates the *maximum* current output on the analog device. The Full Scale is determined by the input to the Analog Output ION module (which is commonly connected to kW). The Full Scale value is the maximum kW expected.

The following table describes setting your Zero Scale and Full Scale to use a limited portion of the output's range.

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 **NOTE**

This table assumes the source input varies between zero and the full scale setting. If the source input falls below zero the output will not be within the desired Output Range.

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<b>Output Type</b>	<b>Desired Output Range</b>	<b>Zero Scale setting</b>	<b>Full Scale setting</b>
<b>-1 to 1 mA</b>	0 to 1 mA	negative value of Full Scale (e.g. -1000)	e.g. 1000
	-1 to 1 mA	e.g. 0	e.g. 1000
<b>0 to 20 mA</b>	0 to 20 mA	e.g. 0	e.g. 1000
	4 to 20 mA	-0.25 times value of Full Scale (e.g. -250)	e.g. 1000

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# Step 9: Configure Advanced I/O

ION Modules facilitate the operation of the I/O Expander Digital Input, Digital Output, and optional Analog Output ports. You can configure many meter setup functions using ION software. You can customize the meter template using Designer.

## A. Set up Energy Pulsing

The area labeled “Energy Pulse (Hardware Port RC1-4)” contains four Integrator modules (labeled kWh del, kWh rec, kVARh del, kVARh rec) and four Pulser modules (labeled kWh del pulse, kWh rec pulse, kVARh del pulse, kVARh rec pulse).

An Integrator module integrates its Source input, then sends a pulse to its Trigger output when the integrated value reaches the Value/Pulse setting. The Pulser receives the trigger, and sends the pulses with the Pulse Widths to the hardware channel specified in the Port setup register.

Configure the values as follows:

Parameter to change	Action
Pulsing	By default, these eight modules are not configured. Right-click near the center of the modules to access the setup registers.
Port	Modify the Port setup register and choose another hardware channel from the list. <sup>1</sup>
Pulse rate	Change an Integrator module Value/Pulse setup register to adjust how much energy the module accumulates before it sends a pulse to a Pulser module.
Pulse width	The Pulse Width setting specifies the width of the pulses that the Pulser module sends to the hardware channel. Modify the Pulse Width value to change the width, in seconds, of these pulses.
Parameters pulsed	You cannot change the energy values that are pulsed by configuring a setup register; you must change the links between modules.

<sup>1</sup> Once an I/O Expander port is in use by a Pulser module, the port is not available to other modules. To make a port available, you must change the Port setting of the module using the port to “NOT USED”.

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## Digital Input Framework

This sub-framework is located in the Advanced folder. This folder contains the ION modules that control the behavior of the I/O Expander digital input ports. Included in this folder are eight Digital Input modules, eight Counter modules, two External Pulser modules, and two Pulse Merge modules.

The Counter modules are used to count the number of state changes occurring in the Digital Input modules. The Pulser module, when pulsed, resets the Counter modules to zero. Master Reset also resets the Counter modules to zero.

The Digital Inputs are pre-configured to read pulses from the digital input ports on the I/O Expander. Using Designer, right-click near the center of the Digital Input modules to check the settings of the Port setup registers to ensure the appropriate ports are in use.

## Digital Outputs Framework

This sub-framework is located in the Advanced folder. This folder contains the ION modules that control the behavior of the I/O Expander's digital output and analog output ports. Two areas in this folder are labeled "Form C Relays" and "Form A Relays or Analog Outputs".

### Form C Relays

To configure the Form C relays, refer to "Energy Pulsing Setup" described above.

### Form A Relays

The Form A relays are controlled by the three Digital Output Modules and a Pulser module.

By default, the Pulser module generates a pulse when the Sliding Window (Rolling Block) Demand interval is reached. Set this Pulser module's Port setup register to an appropriate I/O Expander's Form A port.

The three Digital Output modules are not linked to any parameters. Link an ION module's output to an input of the Digital Output. Set the Digital Output's Port setup register to an appropriate I/O Expander Form A digital output. You may want to change the Digital Output's Pulse Width setup register.









## **PowerLogic I/O Expander Installation Guide**

For further assistance  
please contact us at:

### **Schneider Electric**

Power Monitoring and Control  
2195 Keating Cross Road  
Saanichton, BC  
Canada V8M 2A5  
Tel: 1-250-652-7100

295 Tech Park Drive, Suite 100  
Lavergne, TN 37086  
USA  
Tel: 1-615-287-3400

Electropole (38 EQI)  
31, rue Pierre Mendès France  
F - 38050 Grenoble Cédex 9  
Tel : + 33 (0) 4 76 57 60 60

Getting technical support:  
Contact your local Schneider Electric sales  
representative for assistance or go to the  
[www.powerlogic.com](http://www.powerlogic.com) website.

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