PowerLogic™ ION8800

Energy and power quality meter

User manual

7EN02-0296-03
05/2018



Schneider Electric

Safety information

Important information

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Please note

Electrical equipment should be installed, operated, serviced and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material. A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

Notices

FCC Part 15 notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that of the receiver.
- Consult the dealer or an experienced radio/TV technician for help.

The user is cautioned that any changes or modifications not expressly approved by Schneider Electric could void the user's authority to operate the equipment.

This digital apparatus complies with CAN ICES-3 (B) /NMB-3(B).

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, with the exception of Australia and New Zealand. 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.

About this manual

This manual discusses features of the PowerLogic™ ION8800 power meter and provides installation and configuration instructions. Throughout the manual, the term "meter" refers to all models of the ION8800. All differences between the models, such as a feature specific to one model, are indicated with the appropriate model identifier or a description.

This manual assumes you have an understanding of power metering and are familiar with the equipment and power system in which your meter is installed.

This manual does not provide configuration information for advanced features where an expert user would perform advanced configuration. It also does not include instructions on how to incorporate meter data or perform meter configuration using energy management systems or software, other than ION Setup. ION Setup is a free configuration tool available for download from www.powerlogic.com.

Please contact your local Schneider Electric representative to learn what additional training opportunities are available regarding ION meters.

The most up-to-date documentation about your meter is available for download from www.powerlogic.com.

Related documents

Document	Number
PowerLogic ION8800 installation guide	70002-0291
ION Reference	7EN02-0290
ION device template reference	-

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Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this publication.

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Chapter 1 Safety precautions

Installation, wiring, testing and service must be performed in accordance with all local and national electrical codes.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA, CSA Z462 or applicable local standards.
- Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Treat communications and I/O wiring connected to multiple devices as hazardous live until determined otherwise.
- Do not exceed the device's rating for maximum limits.
- Never short the secondary of a potential/voltage transformer (PT/VT).
- Never open circuit a current transformer (CT).
- Always use grounded external CTs for current inputs.
- Do not perform Dielectric (Hi-Pot) or Megger testing on this device.
- Connect protective ground (earth) before turning on any power supplying this device.
- Do not use the data from the meter to confirm the power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

NOTE: Do not perform Dielectric (Hi-Pot) or Megger testing on the ION8800 because its internal surge protection circuitry starts functioning at levels below typical Hi-Pot voltages. Contact your local Schneider Electric representative for more information on device specifications and factory testing.

NOTE: See IEC 60950-1:2005, Annex W for more information on communications and I/O wiring connected to multiple devices.

⚠ WARNING

UNINTENDED OPERATION

Do not use the meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death or serious injury or equipment damage.

⚠ WARNING

POTENTIAL COMPROMISE OF SYSTEM AVAILABILITY, INTEGRITY, AND CONFIDENTIALITY

- Change default passwords to help prevent unauthorized access to device settings and information.
- Disable unused ports/services and default accounts, where possible, to minimize pathways for malicious attacks.
- Place networked devices behind multiple layers of cyber defenses (such as firewalls, network segmentation, and network intrusion detection and protection).
- Use cybersecurity best practices (for example: least privilege, separation of duties) to help prevent unauthorized exposure, loss, modification of data and logs, interruption of services, or unintended operation.

Failure to follow these instructions can result in death or serious injury or equipment damage.

Chapter 2 Meter overview

ION8800 overview

The PowerLogic™ ION8800 meter provides revenue-accurate, true RMS measurements of voltage, current, power and energy, and are complemented by extensive I/O capabilities, comprehensive logging, and advanced power quality measurement and compliance verification functions. The meters come with an extensive selection of preconfigured data screens and measurements, so you can use the meters as they are shipped from the factory or customize them to fit your unique requirements.

You can integrate the meters with a meter configuration tool such as ION Setup or with other energy management, SCADA, automation and billing systems, using multiple industry-standard communication channels and protocols including IEC 61850.

Common meter applications

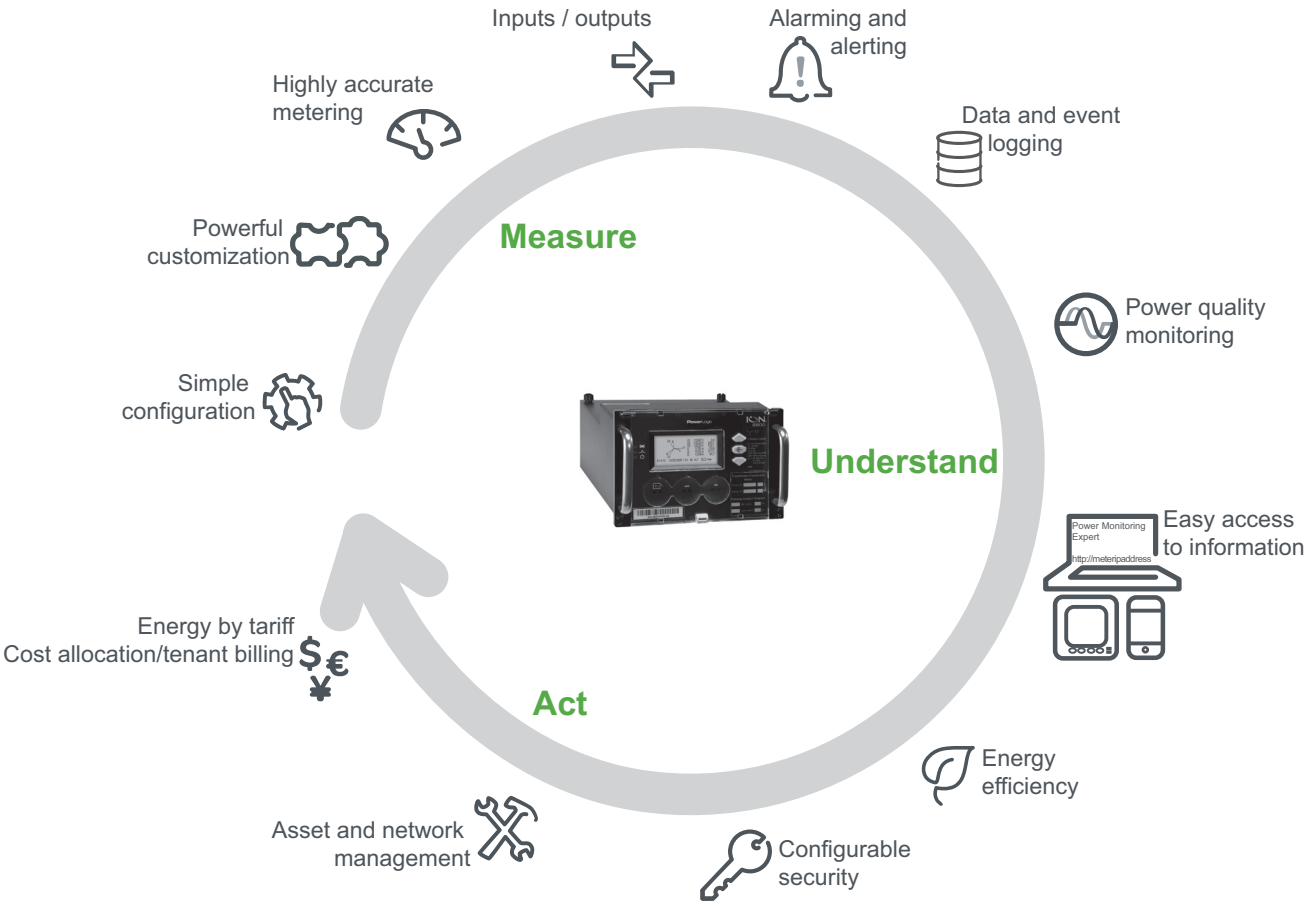
- Transmission and distribution metering
- Revenue and tariff metering
- Power quality compliance monitoring
- Power quality analysis
- Load management
- System stability monitoring
- Energy pulsing and totalization
- Instrument transformer calculation
- Transformer\line loss calculation
- Real-time system loss measurements

Your meter in an enterprise energy management system

In an energy management system your meter collects and aggregates data.

This data is used to perform non-critical control or shared with other equipment in the energy management system. Data from the meter can be used by energy management software to help with energy cost management, trending and forecasting, network management, power quality analysis and more.

The meter is user-configurable to adapt to many situations. Communications allow data to be shared simultaneously across multiple networks, built-in I/O provides monitoring and control capabilities, and a variety of display and analysis tools to monitor your system.



Perform basic setup using the LCD display or ION Setup	Configure meter to help protect against unauthorized configuration of your meter and access to your meter's data
Customize meter functionality using the power of ION	Improve energy efficiency and track compliance to green standards
Access highly accurate measurements and calculations for a wide variety of power system values	Help prolong asset life with proactive network management
Use the onboard or extendible I/O for non-critical control, WAGES and input metering, energy pulsing and system monitoring (for example, breaker status)	Log data in a number of onboard default logs, or customize your meter to log other parameters, and access that information using software
Receive notifications of predefined meter and system events or create custom alarms	Track energy by tariff and perform cost allocation/tenant billing revenue metering,
Monitor compliance to a variety of power quality standards using the meter's highly accurate metering Locate disturbances using disturbance direction detection	Easily access information after basic configuration using: • a variety of industry-standard protocols • software such as Power Monitoring Expert and PowerSCADA Expert • from downstream devices by using the meter as a gateway

Meter features

The ION8800 offers three base models: ION8800A, ION8800B, and ION8800C.

- Feature Set C -- Energy/tariff meter
- Feature Set B -- Feature Set C + EN50160 and IEC 61000-4-30 Class S compliant power quality monitoring
- Feature Set A -- Feature Set B + IEC 61000-4-30 Class A and power quality analysis (waveforms and transient capture with 1024 samples/cycle resolution)

Measured parameters

Energy

The meters provides active, reactive and apparent energy parameters.

- kWh, kVARh, kVAh delivered and received
- kWh, kVARh, kVAh net (delivered - received)
- kWh, kVARh, kVAh total (delivered + received)
- Volt-hours and amp-hours
- Integration of any instantaneous measurement

Energy registers can be logged automatically on a programmed schedule.

All energy parameters represent the total for all three phases. Energy readings are true RMS. Maximum range of energy readings is 999,999,999. Beyond this value, readings roll over to zero (0).

Demand

Your meter supports several standard demand calculation methods, including block, rolling block, and predicted demand.

It can measure demand on any instantaneous value and record peak (maximum) and minimum demand with date and time-stamps to the second. Peak demand registers can be reset manually (password protected) or logged and reset automatically on a programmed schedule. Measurements include:

- kW, kVAR, kVA demand, min/max
- Amps, Volts demand, min/max
- Demand on any instantaneous measurement

Instantaneous

Your meter provides high-accuracy 1 second, or high-speed 1/2 cycle measurements, including true RMS, per phase and total for many values.

- Voltage and current
- Active power (kW) and reactive power (kVAR)
- Apparent power (kVA)
- Power factor and frequency
- Voltage and current unbalance
- Phase reversal

Harmonics

Your meter offers harmonic distortion metering, recording and real-time reporting, up to the 63rd harmonic for all voltage and current inputs.

- Individual harmonics (including magnitude, phase and inter-harmonics for the ION8800A meter)
- Total even and odd harmonics
- K-factor, Crest factor

Min/max recording

Your meter records new minimum and new maximum value with date and timestamp for the following parameters:

- Voltage and current min/max
- kW, kvar, and kVA min/max
- Power factor
- Frequency
- Voltage unbalance
- Plus any measured value

Power quality

Your meter measures and records several power quality parameters.

- Sag/Swells
- Transients (feature set A only)

ION8800 meters with feature sets A and B comply with the following power quality standards:

- **Disturbance direction detection:** This feature allows the meter to analyze disturbance (sag/swell) information to help determine the direction of the disturbance relative to the meter.
- **EN50160**: Your meter measures and presents statistics for determining EN50160.
- **IEC 61000-4-30**: Your meter complies with the IEC 61000-4-30 standard (class A for ION8800A, class S for ION8800B).

Rack-mount installation

Your meter installs into new or existing IEC/DIN 43862 19" racks. The meter's rear Essailec connectors provide common voltage and current measurements and energy pulsing pin-outs for reduced installation costs.

Data display and analysis tools

Display and analyze meter data with a wide variety of tools.

Display

Use the meter's display interface for local monitoring and standalone applications.

The bright LCD display lets you view real-time values and perform basic device configuration. The front panel is often used in combination with an ION software system, providing an interface for field personnel.

WebMeter embedded web server feature

Ethernet-equipped meters include WebMeter™ functionality — an onboard web server that provides quick and easy access to real-time energy and basic power quality information without special software.

The built-in web pages display a range of energy and basic power quality information via an Ethernet connection, and support basic meter configuration tasks.

Email messaging feature

You can configure the meter to automatically email information, whether notification of a high-priority event or a regularly scheduled delivery of logged data, to an external email address.

Specify the type of event that triggers an email alert, such as power quality disturbances or an update to logged data. Email messages from your meter are received like any other email message.

XML compatibility

Your meter can exchange information using industry-standard XML format.

This simple machine-readable format supports easy integration with custom reporting, spreadsheets, databases, and other applications.

Alerting

The meter can be configured to send alerts in response to power system conditions that you define.

These can be conditions such as a power quality problem in your energy system (including surges, sags and swells), changes in relays, or required equipment maintenance. This allows you to automatically advise key people of problems to allow quick remedial action, notify software so logs can be uploaded from the site that initiated the alert, or service equipment on schedule.

You can configure the meter to send alerts to email, or to software.

For more information on configuring alerting on the meter, see the *ION meter alerts* technical note and the Alert module description in the *ION Reference*. For more information on configuring alerting in ION Enterprise, see the online *ION Enterprise help*.

Supported protocols

You can integrate the meter into various industry-standard networks.

Measured meter data can be made available to other devices using Modbus RTU, Modbus/TCP, IEC 61850, FTP, DLMS and DNP 3.0 protocols, as well as the MV-90 translation system. You can also configure the meter to import and log data from other devices on these networks. With these advanced communications functions, the power of the meter can be utilized in most existing power monitoring systems.

Any data display and analysis software that works with Modbus RTU, IEC 61850 or DNP 3.0 devices should also function with the meter.

MV-90

MV-90 software (by Utility Translation Systems) is a multi-vendor translation system that can collect and analyze data from a variety of different brands of meters, each with unique database formats. MV-90 manipulates this data without extensive knowledge of the device of origin.

For more information on using the meter in an MV-90 system, see the *MV-90 and ION Technology* technical note.

IEC 61850

IEC 61850 is an Ethernet-based protocol designed for electrical substations. It is a standard (vendor-independent) method of communications, developed to support integrated systems composed of multi-vendor, self-describing devices. When properly configured, the meter acts as a server in an IEC 61850 system. This meter supports IEC 61850 Edition 1 and 2.

ION Setup device configuration tool

ION Setup is a free configuration tool for your meter that allows you to remotely configure your meter's features over Ethernet or serial communications.

- Use the setup screens to guide you through the process of configuring your meter.
- Use the real-time data screens to verify your meter's configuration.
- Use the data screens to view your meter's recorded waveforms.

You can download ION Setup from www.powerlogic.com.

See the online ION Setup help, available from www.powerlogic.com for instructions on connecting your meter. It is recommended that you always upgrade to the latest version of ION Setup to help properly configure all the features available on your device.

Power Monitoring Expert software

Power Monitoring Expert allows the meter to be part of a fully networked information system with other meters and local and wide-area computer networks. Power Monitoring Expert is recommended for all power monitoring systems where advanced analysis and non-critical control capabilities are required.

Power Monitoring Expert provides tools for managing your power monitoring network, logging data, analyzing real-time and logged data, generating power system reports, and creating custom functionality at the meter level.

Power Monitoring Expert also offers ways to remotely view information through a web browser. For example, through the WebReach and Web Reporter components of Power Monitoring Expert, and through Microsoft Terminal Services.

See the Power Monitoring Expert Help for more information.

Communications options

The standard meter includes an IEC 1107 front optical port for communications in the field.

Ordering options include a Communications Module which offers a high-speed RS-485 port, a selectable RS-232/RS-485 port, an Ethernet port or fiber-optic port, and a 56

kbps internal modem. Depending on the hardware options purchased, up to five separate ports can communicate simultaneously.

NOTE: The communications module can be retrofit – it can be installed or replaced while the meter is in the field.

IRIG-B GPS time synchronization

Meters ordered with the optional IRIG-B configuration can receive input from GPS receivers that output unmodulated IRIG-B time code data, to help enable time synchronization with an accuracy of up to +/- 1 millisecond.

I/O options

The meter's digital inputs and outputs connect to the Essailec connector on the back of the meter. Two different I/O configurations are available, each providing different capabilities. Additionally, two infrared ports (and corresponding LEDs) on the front panel are configured by default for energy pulsing.

⚠ WARNING

HAZARD OF UNINTENDED OPERATION

Do not use the meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death or serious injury or equipment damage.

Digital inputs

The meter can be ordered with externally-excited digital inputs capable of detecting a pulse rate of 20 pulses/second and timestamping transitions with 1 ms resolution. They can be used for tariff inputs or other pulse counting applications.

Relay outputs

The meter can be ordered with both form C and form A solid-state outputs; one mechanical form C relay is standard on all meters. Refer to your meter's installation guide for specifications

Chapter 3 Basic setup

Basic meter setup can be performed by using the display or ION Setup.

Introduction

Basic configuration of the meter is provided by the Power Meter module. The Power Meter module is the main connection between the power system measurements and all other ION modules in the device. This module reports the values for all voltage, current and power measurements. The Power Meter module's setup registers describe details of the power system being monitored. Many of the Power Meter module's setup registers are configured when the meter is initially put into service, although the device cannot operate properly until the Volts Mode and PT and CT ratios are set. Some registers may need to be changed to refine the device's operation.

See the *ION Reference* for more details on the Power Meter module.

Configuring Basic Setup

Use the display or ION Setup software to perform basic meter setup.

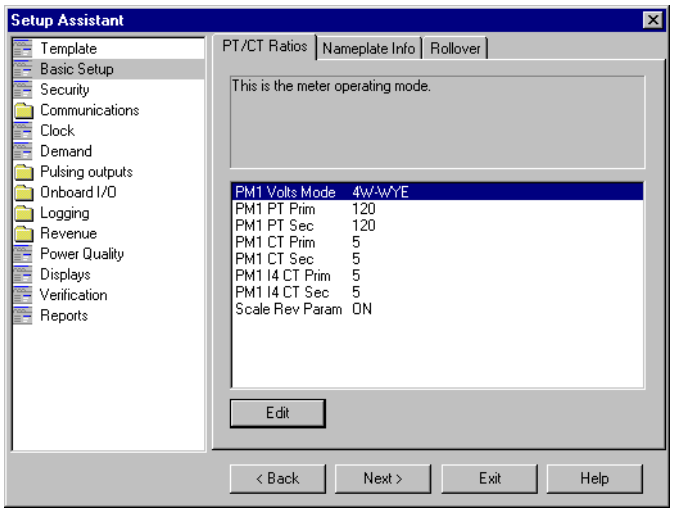
Using the display

The Basic Setup menu item provides access to the following power system settings.

Menu	Setting	Description	Range (values)	Default
Basic Setup	Volts Mode	The power system's configuration – WYE, DELTA, etc.	4W-WYE DELTA 3W-WYE SINGLE DEMO	4W-WYE
	PT Primary	The Potential Transformer's primary winding voltage rating	1 to 999 999 999	120,00
	PT Secondary	The Potential Transformer's secondary winding voltage rating	1 to 999 999 999	120,00
	CT Primary	The Current Transformer's primary winding current rating	1 to 999 999 999	5
	CT Secondary	The Current Transformer's secondary winding current rating	1 to 999 999 999	5
	I4 Primary	Primary rating for the I4 current transformer	1,0 - 999 999,00	5
	I4 Secondary	Secondary rating for the I4 current transformer	1,0 - 999 999,00	5
	V1 Polarity	The polarity of the Potential Transformer on U1	Normal or Inverted	Normal
	V2 Polarity	The polarity of the Potential Transformer on U2	Normal or Inverted	Normal
	V3 Polarity	The polarity of the Potential Transformer on U3	Normal or Inverted	Normal
	I1 Polarity	The polarity of the Current Transformer on I1	Normal or Inverted	Normal
	I2 Polarity	The polarity of the Current Transformer on I2	Normal or Inverted	Normal
	I3 Polarity	The polarity of the Current Transformer on I3	Normal or Inverted	Normal
	I4 Polarity	The polarity of the Current Transformer on I4	Normal or Inverted	Normal
	Phase Rotation	Power system's phase rotation	123, 132	123

Using ION Setup

1. Open the Setup Assistant for your meter. See the ION Setup help for instructions.
2. Select **Basic Setup**.
3. Click the **PT/CT Ratios** tab.



4. Configure each register as required by selecting the parameter and clicking **Edit**.

Power Meter module settings

The Power Meter module contains the following setup registers:

Setup register	Function	Default
Volts Mode [1]	The power system's configuration – WYE, DELTA, Single, etc	4W-WYE
PT Prim [1]	The Potential Transformer's primary winding rating for U1, U2, U3, and U4	120
PT Sec [1]	The Potential Transformer's secondary winding rating for U1, U2, U3, and U4	120
CT Prim [1]	The Current Transformer's primary winding rating for I1, I2 and I3	5
CT Sec [1]	The Current Transformer's secondary winding rating for I1, I2 and I3	5
I4 CT Prim [1]	The Current Transformer's primary winding rating for I4	5
I4 CT Sec [1]	The Current Transformer's secondary winding rating for I4	5
V1 Polarity	The polarity of the Potential Transformer on U1	Normal
V2 Polarity	The polarity of the Potential Transformer on U2	Normal
V3 Polarity	The polarity of the Potential Transformer on U3	Normal
I1 Polarity	The polarity of the Current Transformer on I1	Normal
I2 Polarity	The polarity of the Current Transformer on I2	Normal
I3 Polarity	The polarity of the Current Transformer on I3	Normal
I4 Polarity	The polarity of the Current Transformer on I4	Normal
Phase Order	The expected rotation of the voltage phases (ABC or ACB)	ABC
Phase Lbls	The phase label format assigned to the outputs (ABC, RST, XYZ, RYB, RWB or 123)	123
kVA tot Method	The method used to calculate kVA total (VECTOR SUM or SCALAR SUM)	Vector Sum

[1] The registers are typically set when the device is commissioned. Changing the values of these registers while the device is in service is not recommended.

Once basic setup is performed (i.e. the PT/CT and Volts mode settings), typically there is no need to make further changes to the Power Meter module's setup registers. Refer

to the *ION Reference* for a detailed description of the Power Meter module's setup registers.

Chapter 4 Meter display

Display overview

The display of the ION8800 provides an interface from which you can view system data or configure meter settings.

A scrollable display and three distinct modes (NORM, ALT and TEST) provide easy access to the meter's functions through a three-button keypad.

Another set of buttons, protected under a sealable cover, provides advanced functionality.



A	Main display
B	Navigation button (Up)
C	ALT/Enter button
D	Sealed buttons B1-B5 (under cover)
E	Navigation button (Down)
F	Wh pulser and LED
G	varh pulser and LED
H	Optical port
I	Status bar
J	Operational LEDs

Meter display

The meter's display shows numeric data screens, event logs, phasor diagrams, bar graphs and harmonics histograms. The display screen is divided into two sections: the main display area and the status bar.

The main display area presents meter data, while the status bar provides time, date, phase, quadrant and mode information. During normal operation, the main display area automatically cycles through a series of several displays. If you prefer, you can use the **Up** or **Down** arrow buttons to step manually through these displays. By default, the automatic scrolling resumes 60 seconds after you have last pressed a button.

Navigation buttons

The navigation buttons are the **Up** and **Down** arrow buttons and the round **Alt/Enter** button. Pressing the **Up** or **Down** arrow buttons to manually scroll back or

forth through the available displays temporarily halts the display screen's automatic scrolling function. Pressing **Alt/Enter** toggles between NORM and ALT display modes. The automatic scrolling resumes 60 seconds after you have pressed a button.

Hold the **Alt/Enter** button for approximately three seconds to display the Setup menu. You can then use the navigation buttons to view the device's configuration or edit communication settings. See "Setup menus" on page 31 for further instruction on modifying the device's configuration using the front panel buttons.

Energy pulser ports and LEDs

Two red LED pulsers located below the front panel display are used for energy pulsing. The Wh pulser is the one of the right, and the varh pulse is the one in the middle. On the left is the optical port.

These LEDs are preconfigured for energy pulsing. Located directly beneath each LED is an infrared output, which is connected to the LED and pulses at the same rate. Pulse rates can be adjusted by re-configuring the Calibration Pulser module; for a detailed description of LED pulser operation, see "Energy pulsing with infrared ports and LEDs" on page 113.

Optical port and LED

An optical port facilitates infrared communication with the device. For details on how to configure and use this port, see "Optical port connections (COM1)" on page 65 and your meter's installation guide.

A green LED pulser, located above the optical port, flashes to indicate communications activity on the port.The following buttons can only be accessed when the meter cover is open:

Operational LEDs

Three operational LEDs are located to the left of the display screen.

Alarm (top): The alarm output flashes to alert maintenance personnel should any internal diagnostic errors occur. Contact Technical Support if this happens.

Indicator (middle): This LED is user programmable and is not linked by default.

Power (bottom): This LED indicates the meter is powered. The light should always remain on when the meter is in service.

Demand reset button (B1)

The recessed Demand Reset button resets the peak demand values logged in the meter. When the meter is in TEST mode, the Demand Reset button resets the test demand parameters.

The ION setup register labeled Demand Lockout Time sets the minimum time allowed between consecutive demand resets; the meter ignores any attempts to reset the demand outside the bounds of the register. The default value for the Demand Lockout time is 25 days. For details on the Demand Lockout Time setup register, see "Demand and Peak Demand module overview" on page 101.

TEST mode button (B2)

The recessed TEST mode button is located under the meter's front cover; it places the meter into TEST mode. While in TEST mode, the meter ceases accumulation of billable quantities; energy and demand measurements are accumulated in TEST mode registers.

See “TEST mode” on page 28 for more details on this mode of operation. Billable quantities do not accumulate when the meter is in TEST mode.

ALT Config button (B3)

The recessed ALT Config button is located under the meter's front cover; press this button to access the Alternate Configuration menu.

Use the Alternate Configuration menu to configure setup access via the front optical port, lock and unlock the meter, and clear alarms.

Master Reset button (B4)

The recessed Master Reset button is located under the meter's front cover; it resets meter values. Use the Master Reset button to delete most accumulated values and all derived revenue measurements from the meter. Refer to “Resets” on page 149 for more information.

Spare button (B5)

This button is currently not used.

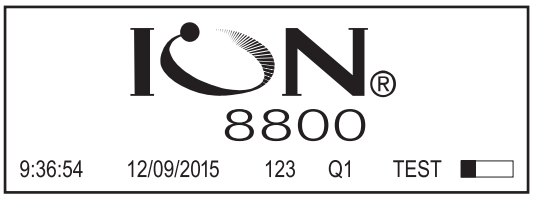
Display screen types

The front panel displays measurements, configured settings and configuration data in a variety of forms. The types of display screens are described below. For information on customizing the display on your meter, see “Configuring meter displays” on page 137.

The status bar

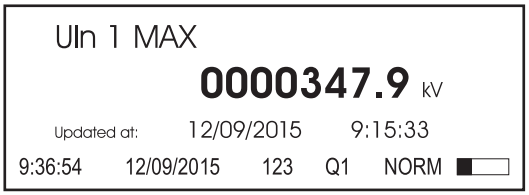
The status bar runs along the bottom of the front panel display and contains information about the following settings:

- Date and time.
- Voltage phases present. The labels and rotation of phases correspond to the configuration of the power monitoring system. 12 31 is for Delta configuration and 123 is four wire Wye configurations.
- Quadrant where the system power factor resides.
- Mode (NORM, ALT or TEST).
- Time remaining in the Rolling Block Demand interval. If the interval has counted to zero the letters **EOI** (End Of Interval) appear on the status bar. If the interval is counting down then a time remaining indicator appears.



Numeric displays

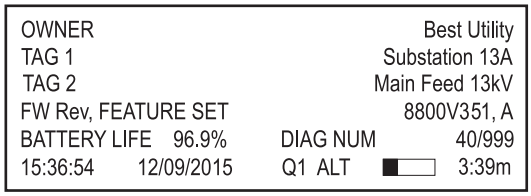
All NORM mode data and some of the ALT mode display screens use numeric displays. Numeric displays show up to four parameters at a time. If no numeric values are available for a parameter, N/A is displayed.



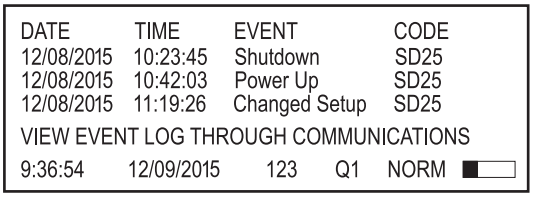
The front panel automatically scales the units for basic measurements (i.e. voltage, current and power parameters). For example, a measurement of 2,000 Watts is displayed as 2 kW. A measurement of 2,000,000 Watts is displayed as 2 MW. The meter makes these conversions using your PT and CT Ratios.

Nameplate display and event log

Nameplate displays and event logs appear in ALT mode and are organized in tabular format. Nameplate displays show owner, meter and power system details:

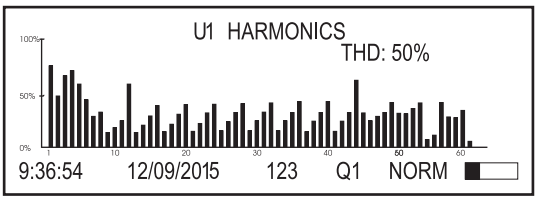


The Event Log displays recent high priority events. Use ION Setup to retrieve all logged data:



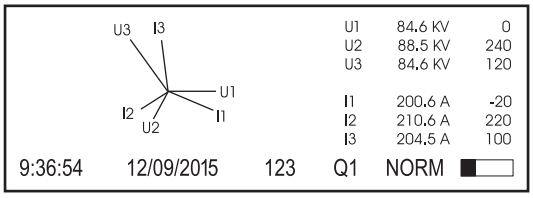
Histogram displays

Harmonic content is displayed in histogram format. The 2nd to the 63rd harmonics are displayed in the histogram. The total harmonic distortion (THD) is displayed above the histogram.



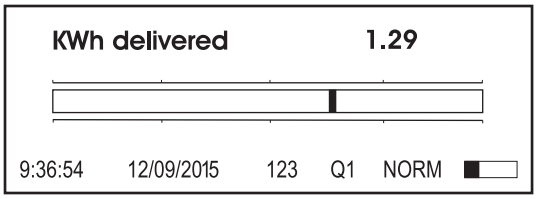
Phasor diagram displays

Phase information can be displayed in phasor diagram format. Phasor diagrams are accompanied by tables that show phase, voltage and current magnitudes. In cases where a phase vector is too small to be represented graphically, it is shown as a table entry only.



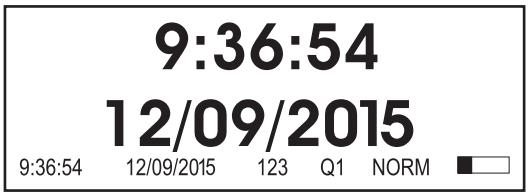
Disk simulator

This display simulates the behavior of a mechanical watt-hour meter indicating power received or delivered by the direction of the pulse.



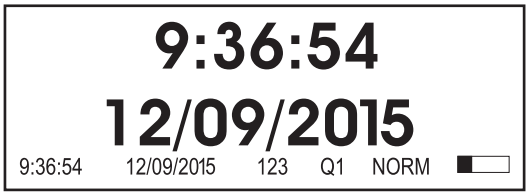
Time and date

This display supports time and date formats, enabling displays with nothing but date and/or time and/or time remaining in the current interval.



Time-stamped values

Up to three timestamped parameters can display on the same screen. The timestamp indicates the time that the displayed parameter was last updated.



Modes of operation

The ION8800 has three modes of operation: NORM, ALT and TEST.

Both NORM and ALT are display modes, providing various power system data and meter properties screens. TEST mode is used to perform diagnostics and verify the meter's calibration and function.

NOTE: If your meter has the optional hardware lock, you must open the meter's cover to put it into TEST mode. See "Security features on your meter" on page 43 for more information.

Basic operation (NORM mode)

The ION8800 meter defaults to NORM mode when powered up, and remains in this mode until you manually switch to ALT or TEST.

NOTE: You can customize NORM mode display screens and alter the front panel's scrolling characteristics by editing the configuration of the meter's Display and Scroll modules – see "Display Setup menu" on page 33 and "Display screens" on page 137 for more details.

If you have a meter without the hardware lock, all of the settings available in the front panel Setup menus can be configured while the meter is in NORM mode, provided you have the correct password. If you have a hardware-locked meter, only the basic communications parameters in the COM Setup menu can be changed in NORM mode.

NOTE: You must unlock the meter to change other meter parameters on the hardware-locked meter — see "ALT Config menu" on page 35 for more details.

ALT mode

ALT mode provides scrolling display screens that show power system data, billing information (including extensive Time of Use data) and meter properties such as Nameplate information.

See "ALT mode default display screens" on page 139 for a description of ALT mode screens.

Switching to ALT mode

Press the **Alt/Enter** button to switch to ALT mode. Press the **Alt/Enter** button again to switch back to NORM mode at any time. If no buttons are pressed, the meter automatically reverts to NORM mode after five minutes. As with any mode, pressing any button temporarily suspends display screen scrolling, allowing you to press the **Up** or **Down** arrow buttons to manually browse the available screens.

TEST mode

TEST mode is typically used for verifying meter calibration and function. The meter is usually reading data from a test power supply while these functions are performed.

All of the billing quantities that are recorded when the meter is in NORM and ALT mode will stop accumulating when the meter is switched to TEST mode — the data is sent to special TEST mode registers instead. The values accumulated in these test registers are shown on the display and in ION Setup.

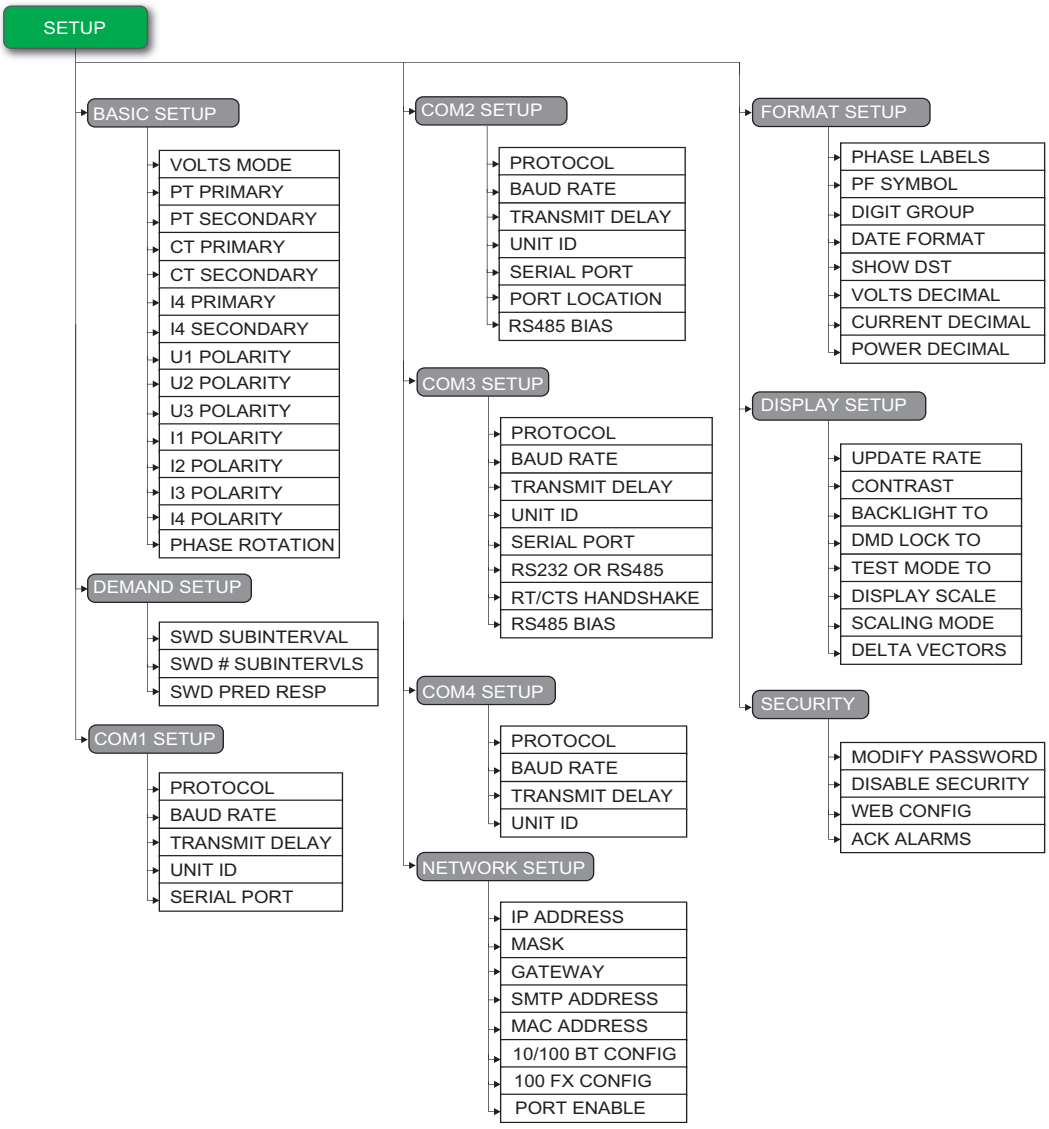
The regular NORM/ALT mode billing registers are unaffected while the meter is in TEST mode; accumulation of this data continues as soon as you exit TEST mode. All test registers are reset to zero when you exit TEST mode.

For detailed information on TEST mode, see “Switching to TEST mode” on page 143.

NOTE: The meter will always return to NORM mode when you exit TEST mode, even if you entered TEST mode from ALT mode.

Configuring the meter with the display

With the meter’s display, you can navigate through different menus to perform basic setup on your meter.

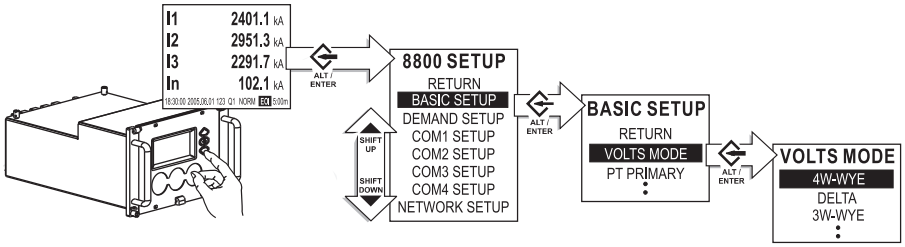


Accessing the setup menus

To access the Setup menu, press and hold the display's **Alt/Enter** button while the meter is displaying power system data. Within the Setup menu is a list of sub-menus that contain the meter’s configurable settings. Setup menu items are described in “Display overview” on page 23.

Press the **Up** or **Down** arrow buttons to navigate through the menu. Highlight a menu item and press the **Alt/Enter** button. When you select an item from the Setup menu, you are presented with another menu of the settings in the meter. You may need to navigate several layers of menus to access the setting you want to change.

The following diagram shows how the buttons are used to navigate the menus:



The main Setup menu contains the following settings:

Basic Setup:	settings for the power measurement system basic configuration.
Demand Setup:	settings for Rolling Block/Sliding Window Demand.
COM1 Setup:	settings for optical port setup.
COM2 Setup:	settings for optional RS-485 port setup.
COM3 Setup:	settings for optional RS-232/RS-485 multiplexed port setup.
COM4 Setup:	settings for the optional modem.
Network Setup:	settings for the optional Ethernet port.
Format Setup:	settings for customizing the style and values appearing on the display screens.
Display Setup:	settings for customizing display appearance, update time, and demand lockout time.
Security:	settings that allow you to modify your password, disable the password, disable meter configuration with a web browser, and acknowledge alarms.

Another setup menu, the ALT Config menu, is accessed by pressing a sealed button. See “ALT Config menu” on page 35 for more information.

Returning to previous setup screens

Use the **Up** or **Down** arrow buttons to scroll through the menu items. When the setting you want to change is highlighted, press the **Alt/Enter** button.

To return to a previous screen, highlight the RETURN menu item and press the **Alt/Enter** button.

Configuring parameters using the navigation buttons

Use the **Up** or **Down** arrow buttons to change the value (if numeric) or the setting (if enumerated) of the highlighted parameter.

To change the position of the cursor, press and hold the **Up** or **Down** arrow buttons for about one second. The **Up** arrow button moves the cursor one position to the left, and the **Down** arrow button moves the cursor one position to the right. Once you have the value you want, press the **Alt/Enter** button to select it.

NOTE: When setting Ethernet values (IP address, default gateway, etc.), press the Up arrow button to insert additional digit spaces. Press the Down arrow to remove digit spaces (see “Network Setup menu” on page 32 for more information).

Out of range screen

When editing numeric data the numbers below MIN and MAX indicate valid entry bounds. If you enter a value outside valid bounds, you will be presented with an OUT OF RANGE screen. You can then either return to the register you were editing or choose to exit.

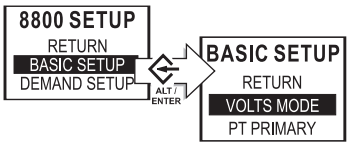


Confirming configuration changes

The CONFIRM screen appears whenever you attempt to change the meter’s settings through the front panel. This allows you to abort an unwanted configuration change. The front panel also informs you when an entry is out of range. In either case, you must press the **Alt/Enter** button to return to the previous setup screen.

Setup menus

The following sections describe the various front panel setup menus.



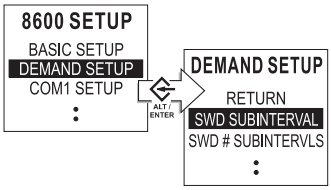
Basic Setup menu

To view the Basic Setup menu via the meter’s display, press and hold the **Alt/Enter** button. Press the **Up** or **Down** arrow buttons to highlight Basic Setup then press the **Alt/Enter** button.

The Basic Setup menu lets you set volts mode, potential transformer (PT) and current transformer (CT) ratios and various other settings (such as I4 and voltage and current polarities) to help you ensure that your meter is adequately set for your application.

Many of the settings will be configured when the meter is initially put into service (the device will not operate properly until Volts mode and PT and CT ratios are set), but some settings may need to be changed to refine the device’s operation.

See “Basic setup” on page 19 for more information on the Basic Setup menu.

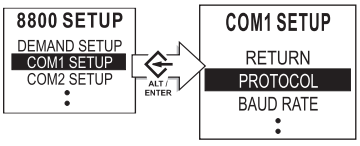


Demand Setup menu

To view the Demand Setup menu via the meter’s front panel, press and hold the **Alt/Enter** button. Press the **Up** or **Down** arrow buttons to highlight Demand Setup then press the **Alt/Enter** button.

The Demand Setup menu accesses the global settings for all of the revenue related Rolling Block (Sliding Window) Demand functionality in the ION8800 meter. The settings provided in the Demand Setup menu control the timing of these demand calculations.

See “Demand” on page 99 for more information on the Demand Setup menu.



COM Ports Setup menu

To make changes to communications settings via the meter’s front panel, hold down the **Alt/Enter** button for three seconds to enter the Setup menu, then press the **Down**

arrow button to select the COM Setup you want. Depending upon the communications options ordered with your meter, the parameter settings available are as follows:

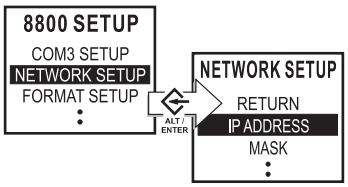
Menu item	Description
COM1 Setup	Settings for the optical communications port.
COM2 Setup	Settings for the dedicated RS-485 port.
COM3 Setup	Settings for the selectable RS-232 or RS-485 communications port.
COM4 Setup	Settings for the modem.
Network Setup	Settings for the Ethernet communications port.

Serial COM settings

There are three main parameters that you must set or verify if your meter is connected to a serial network (including modem communications): *Unit ID*, *Baud Rate*, and *Protocol*.

NOTE: Other parameters, such as TRANSMIT DELAY, are used in advanced configuration or fine-tuning your system. Settings for the parameters mentioned above are commonly required to get your meter communicating.

Network Setup menu



There are two main parameters that you must set or verify if your meter is connected to an Ethernet network: IP address and Subnet mask address.

NOTE: There are other parameters, such as GATEWAY ADDRESS and SMTP ADDRESS, that are used in advanced configuration or in fine tuning your system. The parameters discussed here are the most common parameters required to get your meter communicating.

Configuring network settings through the front panel

Typically, your Network Administrator will provide you with the appropriate IP Address for the meter. The Subnet Mask and Gateway settings are only required if you have communications between multiple Ethernet networks and if subnetting is implemented.

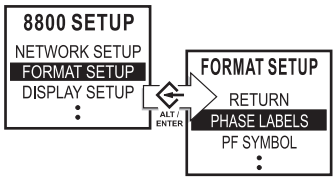
NOTE: Configuring the IP Address, Subnet Mask, and Gateway registers incorrectly can cause network disruptions. See your network administrator for more information.

Use the navigation buttons to edit the values of the network settings so that they match your system addresses. As you configure the network addresses, the front panel automatically discards unnecessary leading zeroes from each three-digit grouping. The hidden leading zeroes appear (and disappear again) as you move the position of cursor across the network address.

89.123.40.056

In the example above, the highlighted zero is discarded as soon as you change the position of the cursor.

NOTE: Your meter's MAC address is displayed for information purposes and is read-only.

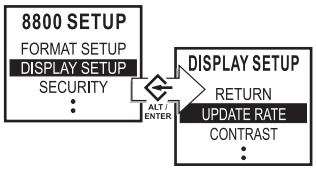


See “Communications” on page 63 for more information on the communications menus.

Format Setup menu

Format Setup contains the following values that set labeling and formatting preferences.

Menu	Setting	Description	Range (values)	Default
Format	Phase Labels	Specifies how phases are labelled	ABC, RST, XYZ, RYB, 123	123
	PF Symbol	LD (leading)/LG (lagging)	LD/LG, +/-, CAP/IND	LD/LG
	Digit Group	Specifies symbols used to delimit thousands and decimal place holder	1000.0 or 1,000.0 or 1000,0	1000,0
	Date Format	Specifies how dates are displayed	MM/DD/YYYY, DD/MM/YYYY, YYYY/MM/DD	MM/DD/YYYY
	Show DST	Determines if DST is shown or not	Yes or No	Yes
	Volts Decimal	Number of decimal places displayed for voltages	1 to 123 456 789,XXX	1,XX
	Current Decimal	Number of decimal places displayed for currents	1 to 123 456 789,XXX	1,XXX
	Power Decimal	Number of decimal places displayed for power measurements	1 to 123 456 789,XXX	1,XXX

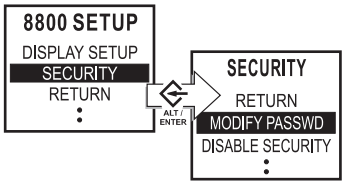


Display Setup menu

You can configure the following display preferences within Display Setup.

For more information, see “Display screens” on page 137.

Menu	Setting	Description	Range (values)	Default
Display	Update Rate	Sets when the display updates (in seconds)	1 to 6	1
	Contrast	Higher numbers are sharper	0 to 9	varies
	Backlight TO (Timeout)	Specifies the time it takes the backlight to turn off (zero value causes the display to stay lit indefinitely)	0 to 7 200 seconds (two hours)	300 seconds (five minutes)
	DMD Lock TO	Defines the minimum allowable time between consecutive demand resets (in seconds)	0 (disabled) to 5 184 000 (60 days)	2 160 000 (25 days)
	TEST Mode TO	Defines how long the meter remains in TEST mode before switching back to NORM mode (in seconds)	60 to 21 600	1800 (30 minutes)
	Display Scale	For display screens that are set to display scaled parameters, this determines the scale applied to displayed parameters	1 to 999 999	1000
	Scaling Mode	Specifies whether parameters are divided or multiplied by the scale before being displayed	Multiply or Divide	Divide
	Delta Vectors	Specifies how vector diagrams are displayed when in Delta mode	System or Instrument	System



Security menu

The settings in the front panel Security menu item allow you to:

- modify the existing meter password or reset it to the factory default
- disable the password security check
- enable web browser configuration on the meter
- acknowledge alarms

You require the valid password to enter the Security Settings menu. The default password is 0 (zero).

For more information, see “Security” on page 43.

NOTE: The password enables users to change the configuration of the meter. It is recommended that you change your password from the default when you put the meter into service

If you have not yet entered your password, the meter’s front panel requires that you enter it before you can view the Security Setup menu. Use the Navigation buttons to enter numerical data. If you enter an incorrect password, the front panel will display an “invalid password” message and you will have to try again.

Modify password sub-menu

Use this sub-menu to change the password or to reset the password to the factory default (0).

From the meter’s front panel select SECURITY, then MODIFY PASSWORD. Two choices appear: MODIFY PASSWORD or FACTORY DEFAULT. Use the Up button to select MODIFY PASSWORD, or the Down button to select FACTORY DEFAULT.

Disable security sub-menu

Use this sub-menu to enable and disable password security on the ION8800. Disabling the password allows changes to all the meter’s settings through the front panel without a security check.

NOTE: It is highly recommended that any meters in the field have the password security check enabled. Non-secure access to critical settings in the meter, such as PT and CT ratios, is not advisable.

When you re-enable password security, the password is reset to the factory default of 0 (zero). You should re-enter a custom password at this point.

Disabling the password security check is necessary to write to the meter when it is a Modbus Slave device. See “The meter as Modbus slave” on page 82 for details about configuring your meter for third-party systems.

Web Config

Use this setting to enable/disable web browser configuration of the meter. See “Enabling and disabling web config access” on page 49 for more information.

Ack alarms

Selecting this acknowledges alarms; it is not a configuration setting.

ALT Config menu

This advanced menu is accessible by pressing the ALT Config button, located under the meter cover.

Setting	Description	Range (Values)	Default
IR Config	Allows meter configuration via the front optical port	Disabled or Enabled	Enabled
Meter Lock[1]	When meter is locked, most meter configuration is prevented, as are meter resets	Locked or Unlocked	Locked[2]
Clear Alarms	Sends a pulse to clear alarms when pushed	-	-

[1] After a meter is unlocked, it automatically relocks if you do not perform any configuration for 30 minutes. This function is not available on non-hardware lockable meters.

[2] Default = 'Locked' on meters ordered with Hardware Lock option.
Default = 'Unlocked' on all other meters (setting is non-functioning).

Chapter 5 Maintenance

Firmware and templates

Firmware and template overview

You can load different firmware versions and templates onto your meter.

Firmware is your meter's operating system that enables the functions of your meter. Your meter's template defines the meter's features such as its power measurement and analyzing functionality. Your meter ships from the factory with a default template, or you can customize your meter's template to create features specific to your meter's application. You can save your customized template and upload it to other meters of the same type.

You can view your meters firmware version on your meter's display and through ION Setup.

You can upgrade your meter's firmware and template using ION Setup. Firmware updates and new factory templates are available for download from www.powerlogic.com.

For more information on templates, frameworks and ION modules, see the *ION Reference*.

NOTE: Firmwares and templates for the various meter types (ION8800A, ION8800B and ION8800C) are **not** interchangeable. When upgrading firmware or re-installing templates, make sure that you choose the correct files for your meter type.

Firmware overview

Firmware is your meter's operating system.

When new firmware is available for your meter, you can upgrade to the latest version to get the added features and functionality. the firmware version loaded on your meter is shown on your meter's display. You can use ION Setup to upgrade the firmware on your meter.

You must load a meter template as part of the firmware upgrade process. You can save your meter's existing framework before performing a firmware upgrade and then reload it back onto the meter if you do not want to change your meter's template.

See the online ION Setup help, available from www.powerlogic.com for more information on downloading, saving and loading your meter's template.

Typical workflows

To update your meter to the latest available firmware and factory template:

- Download the latest firmware and template for your meter.
- Load the latest firmware onto your meter; the firmware process includes upgrading the meter template.

To take an existing meter out of service and replace it with a new meter:

- Save the template from the existing meter

- Load the existing meter's template onto the new meter; the new meter will now have the customized features from the existing meter.

To update your meter's firmware without updating your meter's template:

- Save your meter's template
- Download the latest firmware.
- Load the firmware onto your meter. When prompted for a template file, select the template you saved from your meter.

Visit the company website at www.powerlogic.com and search form "ION8800" to see the available firmware and templates.

See the online ION Setup help for instructions on how to load meter templates.

Laptop computer upgrade considerations

The connection between the laptop at the device must be maintained in order for the upgrade to proceed.

Laptop computers generally have different default power properties than desktop computers.

If the laptop's hard disk shuts down or the laptop enters system standby mode, the connection is broken and the upgrade procedure must be restarted.

If you are upgrading your meter's firmware using a laptop computer, follow these guidelines:

- Plug the laptop computer into a wall outlet. Do not run the laptop on its battery.
- Configure the laptop hard disks so that they do not shut down after a certain period of time (for example, set to "never").
- Turn off the laptop's power suspension (for example, system stand-by) and hibernate options.
- Disable options that power down the laptop when it is closed. This prevents a shut down if the laptop is accidentally closed.
- Disable the laptop's option to power down when it is closed. This prevents a shut down if the laptop is accidentally closed.

Disable the screen saver; screen savers can burden the CPU.

Upgrade considerations

Ensure that the firmware version that you are upgrading to is compatible with your meter and that the version number is greater than your existing firmware (or else you will downgrade your meter).

Ensure that the template you are upgrading to matches the feature set of your meter (in other words, if your meter is an ION8800A, the template must be an A-variant template). The variant is indicated in the template filename.

Your meter's existing template may not work with difference firmware versions if significant meter feature have been added or modified.

Recording your device's usernames and passwords

Ensure that you record your device's usernames and password information in a secure location before to upgrading the meter's firmware. If your meter's front panel or user

password information is lost, you must return the meter for factory reconfiguration, which resets your device to its factory defaults and destroys all logged data.

NOTICE
DATA LOSS Record your device's front panel and user password information in a secure location. **Failure to follow these instructions can result in data loss.**

Upgrading devices via a ModemGate connection

The maximum acceptable baud rate for upgrading via ModemGate is 56.6 kbps. Ensure that the baud rate on the ModemGate communications port and the baud rate on the meter to be upgraded are set to this or lower.

Meter behavior after unsuccessful upgrade attempt

The meter allows three consecutive attempts to upgrade the meter. If the third attempt is unsuccessful, an error is generated and you must power cycle the meter before you try again. Wait 30 seconds for the meter to reset after power cycling it before you try to upgrade again.

Meter I/O module behavior

Your meter's I/O modules may change state during a firmware upgrade. The meter's I/O behavior is determined by how it is configured in the new template that has been loaded.

⚠ WARNING
HAZARD OF UNINTENDED OPERATION Do not use the meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit. **Failure to follow these instructions can result in death, serious injury or equipment damage.**

Loading meter template using ION Setup

You may need to update or restore the meter's template:

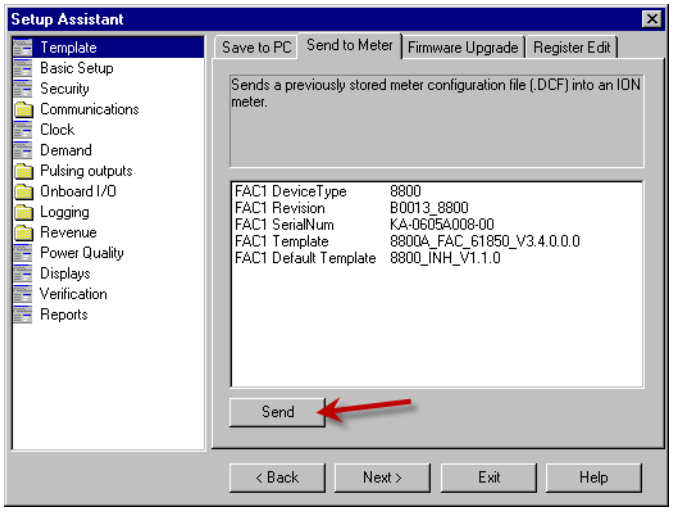
- If there is a new template with additional features or if you have configured one meter and want to configure others with the same settings.
- If you have made changes and want to return to the original configuration. The basic setup of the device can be retained, so the meter does not need to be taken out of service for a long period of time.

NOTE: If you restore the factory configuration, all recorded data and any custom features that you have created (such as custom alarms or custom data records) are lost.

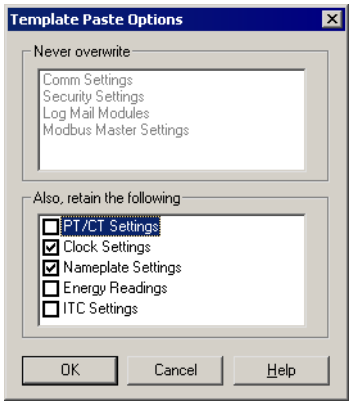
Use ION Setup to upgrade or restore the template.

1. Download your device's latest template from www.powerlogic.com. Save the .DCF file in the `.../ION Setup/TEMPLATE` folder for easy access.

2. Open the Setup Assistant for your meter. See the ION Setup help for instructions.
3. Select **Setup Assistant > Template**.
4. Click the **Send to Meter** tab and click **Send**.



5. Select the .DCF file from the TEMPLATE folder and click **Open**.
6. The Template Paste Options screen appears. Select the check boxes for the settings you want to retain (not overwrite) and click **OK**.



Rapid Meter Programming pastes the template onto your meter. A dialog box confirms the paste was successful.

Loading meter firmware using ION Setup

You can load firmware onto your meter using ION Setup.

You can download your device's latest firmware from www.powerlogic.com. Save the files in the `.../ION Setup/TEMPLATE` folder for easy access.

Loading firmware or template onto your meter clears the meter's recorded data.

NOTICE

DATA LOSS

Ensure that all important data has been recorded before uploading firmware or a template to your device.

Failure to follow these instructions can result in data loss.

Upgrading the device firmware and template

1. Open the Setup Assistant for your meter. See the ION Setup Help for instructions.
2. Select **Template** screen.
3. Click the **Firmware Upgrade** tab and click **Upgrade**. Enter your meter password (if prompted) and click **OK**.

NOTE: If you want to retain customized meter template settings, other than those listed in the Template Paste Options dialog box (see Step 6), click on the **Save to PC** tab and click **Save**. Save your template as a .DCF file. Select this file in Step 5 instead of the file obtained from the website.

4. Browse to the .UPG file (device firmware) that you downloaded from the website and click **Open**. Type your ION Setup password when prompted and click **OK**.
5. Browse to the .DCF file (device template) that you downloaded from the website (or saved from your meter in Step 3) and click **Open**. The **Template Paste Options** dialog box appears.
6. Clear any options that you do not want to retain then click **OK**.
7. Track the progress of the upgrade.

   After the firmware download is complete, ION Setup attempts to verify the firmware. If the verification fails, contact Technical Support.
8. Click **Exit** when you get a message that the upgrade is complete.

Factory information

The Factory module displays firmware version, serial number and other device information in read-only setup registers (read-only registers can be viewed but not changed).

Factory module settings

The device information provided is as follows:

Setup register	Description
Device Type	A device type identifier (e.g. “8800” for the ION8800)
Compliance	A statement of whether the device is ION compliant or not
Options	Shows model number of meter
Revision	The meter’s firmware version
Serial Num	The meter’s serial number
ION Version	The ION version supported by the device
Template	The name of the template (framework) installed on the device at the factory
Device Namespace	This configurable string is used as the namespace attribute in the GeneratedBy and Device elements of XML attachments.
Device Name	This configurable string is used as the name attribute in the GeneratedBy and Device elements of XML attachments.
Nom Freq	The expected frequency of the power system being monitored
MAC Address	Media Access Control address.[1]

[1] The MAC address of your meter cannot be changed, and is for information only.

The Factory module also contains numerous read-only setup registers that hold the calibration constants used at the factory.

How to tag your meter

Three configurable setup registers are provided for you to enter your company name and other text information you want stored in the meter:

Setup register	Description
Owner	This is a text register for storing user information (e.g. company name); it can be up to 255 characters in length.
Tag 1	This is a text register for storing user information (e.g. device location); it can be up to 15 characters in length.
Tag 2	This is a text register for storing user information (e.g. device number or identifier); it can be up to 15 characters in length.

Use ION Setup to configure these registers.

Chapter 6 Security

Security overview

Your Schneider Electric product is equipped with security-enabling features.

These features arrive in a default state and can be configured for your installation needs. Please note that disabling or modifying settings within the scope of these individual features can impact the overall security robustness of the device and ultimately the security posture of your network in either positive or negative ways. Review the security intent and recommendations for the optimal use of your device's security features. Products are hardened to increase security robustness. This is an ongoing process consisting of secure development practices, inclusion of security features and testing at our security test facilities. Following system hardening best practices is also necessary to help ensure your overall security system.

You can configure standard or advanced security on your meter, as well as additional security features for revenue meters.

Advanced security allows you to configure users with specific access levels and passwords. Your meter has security options such as communications lockouts to limit the number of invalid login attempts, and the ability to add up to 50 different users, each with unique access privileges. Your meter also supports revenue locking, which incorporates revenue security on all revenue-related parameters and revenue sealing.

Your meter ships from the factory with standard security enabled.

Security features on your meter

Your meter comes with security features that you can configure to help protect against unauthorized configuration and access to your meter's data through the meter's display or communication ports

Front panel security

Whether your meter has Standard or Advanced security, when you make configuration changes using the front panel of your meter you must enter a front panel password. Front panel password protection can be disabled, but this is not recommended. See "Configuring Standard security using the front panel" on page 47.

Meter security

Whether your meter has Standard or Advanced security, the protocol lockout, session timeout, meter access event logging and factory access features apply to the meter. By default, after eight invalid login attempts, the meter locks out (disables) access over that communication port or protocol. Invalid login attempts and lockouts are logged by default in the meter's event log.

NOTE: Use the ION Setup's Advanced security wizard or the advanced mode of ION Setup to configure these settings. Factory access can only be configured using the advanced mode of ION Setup.

Standard meter security

Anytime you make configuration changes to your meter you must enter a password. Standard security is enabled by default from the factory. See “Standard meter security” on page 46.

Advanced meter security

Advanced security allows configuration of up to 50 users (and the Factory user), each with unique access rights to the meter. Use the ION Setup Advanced security wizard to configure meter security settings that apply to both Standard and Advanced meter security. See “Configuring Advanced meter security” on page 52.

Revenue meter security

Your revenue meter can be protected by hardware locking and anti-tamper sealing. See “Revenue metering security” on page 60.

Software security

ION Setup security adds access-level security to the meter. With ION Setup you can configure the meter to accept multiple users with different passwords and specify their access rights on the meter. ION Setup security only applies to users who are accessing the meter via ION Setup. ION Setup can also be configured with users that have specific rights to use the software; refer to the software’s online help for more information.

Syslog

This meter can use Syslog to maintain meter log information for extended periods of time. Syslog uses the User Datagram Protocol (UDP) to transport event log information from the meter directly to a centralized Syslog server. The server can receive logs from many devices, then store and filter the logs as needed. See “Syslog” on page 78.

Enable/disable communication ports

Leaving unused ports open provides additional attack surfaces for a potential attacker. Minimizing the number of entry points into a device reduces the likelihood of unauthorized intrusions.

To minimize the number of entry points and assist in providing an additional level of security on your meter, you can disable your meter’s communication ports when they are not in use. This includes Ethernet ports and serial ports. The feature is accessible by using ION Setup. See “Disabling COM ports” on page 72.

Change port number assignment on Ethernet protocols

To assist in providing an additional level of security, you can configure port number assignment on Ethernet protocols. This feature can also assist in preventing port service overlap. This feature is accessible by using ION Setup. See “Ethernet protocol control” on page 79.

Security events in the event log

When a user produces a security-related event, such as a reset, successful or unsuccessful login attempts, user lockout or setup change, the event is recorded in the

meter's event log, along with the username associated with the event. See "User triggered events" on page 125.

Security recommendations and best practices

Recommended security configuration

There are recommended security configuration settings to help improve security on your meter.

- Enable front panel security on your meter.
- Enable Advanced security on your meter.
  - Disable web server programming to help prevent configuration access to your meter over the web.
  - Disable Modbus programming to help prevent configuration access to your meter using Modbus.
  - Configure the protocol lockouts to help minimize access to your meter.
  - Ensure that the Factory user is disabled.
  - Configure users and passwords to help minimize access to your meter.
- Disable all unused network ports.
- Disable all unused communication ports
- Change connection ports from their default values whenever possible.

Password best practices

There are recommended password best practices to help improve security on your meter.

- Change your meter's display password from the default value.
- Make your meter's display and user-specific passwords as complex as possible.

  NOTE: Make sure that the user password you enter is compatible with the software used to communicate with your device.
- Schedule regular changes to your meter's display and user passwords.
- Record the meter's display and user passwords in a secure location.

If your meter's user access information is lost, you must return the meter to the factory, where your meter is reset to its factory defaults and all logged data is lost.

NOTICE
DATA LOSS Record your device's user and password in a secure location. **Failure to follow these instructions can result in equipment damage.**

Additional security recommendations

There are additional security recommendations to help improve security on your meter.

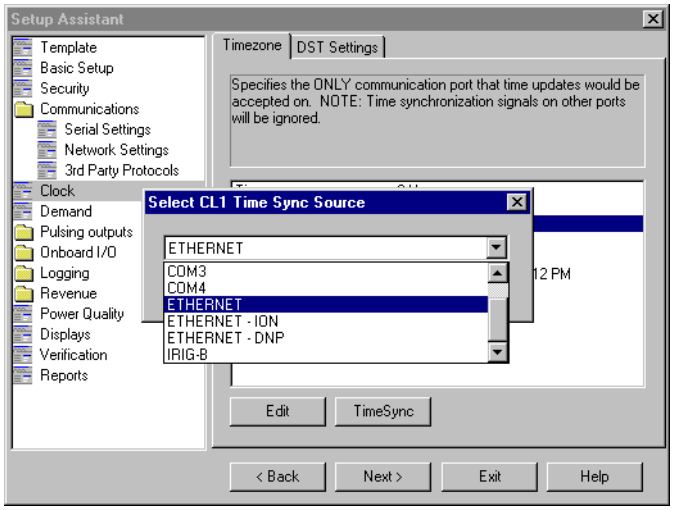
- Ethernet meters must be protected by a properly configured firewall that prevents Telnet access over port 23.
- Device communication ports must be set to the Factory protocol only when necessary to permit access to Schneider Electric Technical Services and returned to their original settings as soon as possible.

- Set your meter's time synchronization source to a secure communications port, and disable time synchronization on all other ports. Refer to "Configuring Standard security using ION Setup" on page 50.
- Save a copy of your meter's security configuration (*.scf) file in a secure location for future reference or troubleshooting. Your meter's security configuration file can be loaded onto other meters of the same type to configure their security settings.
- For the highest level of security, use a hardware-locked, sealed meter with Advanced security enabled and configured for minimum access.

Time synchronization security considerations

Depending on your ION Setup settings, a workstation that connects to an ION8800 device can send a time synchronization signal and synchronize the meter's internal clock with the workstation's clock. This could cause overlaps in the Demand intervals, and timestamps in the data logs may not be accurate.

Ensure that the *TimeSync Source* setup register in the Clock module is set to a secure communications port. By default, the *Time Sync Source* setup register in the Clock module is set to COM1 - the optical port. Time synchronization broadcasts are only accepted through the optical port in this configuration. Use the Clock Setup Assistant in ION Setup to change this setting.



Ensure that time synchronization is disabled on all other ports.

Standard meter security

Standard meter security is enabled by default on all ION8800 meters; all configuration functions in the front panel are password-protected. The default password is factory-set to 0 (zero). By default, the meter locks out a protocol for 24 hours after eight invalid login attempts. If you have modified protocol lockout settings using the Advanced security wizard, those settings will be used in Standard security even if Advanced security is not enabled. These settings can also be modified using the advanced mode of ION Setup to edit the register values in the Security Options module.

If you make configuration changes to the meter via the front panel, the meter prompts you for its password before accepting any configuration changes. Similarly, if you make any configuration changes via ION Setup, you are prompted by the meter for its password (in addition to the password used to access ION Setup). Once you enter the

correct meter password and confirm the new configuration, the change is set on the meter.

Configuring Standard security using the front panel

Navigate to the Security Setup menu. The following settings are available:

Menu	Setting	Description	Range (values)	Default
Security	Modify Passwd	Modifies standard password	0 to 999 999 999	0
	Disable Security	Disables meter security	Disabled or Enabled	Enabled
	Web Config	Allows configuration through web server interface	Disabled or Enabled	Enabled
	Ack Alarms	Sends a pulse to acknowledge alarms when pushed	-	-

Note that the front panel prompts you for the meter password before you make your first configuration change. You do not need to re-enter the password for each subsequent change. However, if you perform no additional configuration changes for five minutes, you will need to re-enter the Setup menu and provide the valid meter password to resume making changes. This is because the meter returns from setup mode to data display mode after five minutes of inactivity.

The meter password allows access to the meter's configuration through ION Setup and the meter display. The default password is 0 (zero).

Entering the password

The first time you try to make a change to any setting, you are presented with the password screen.



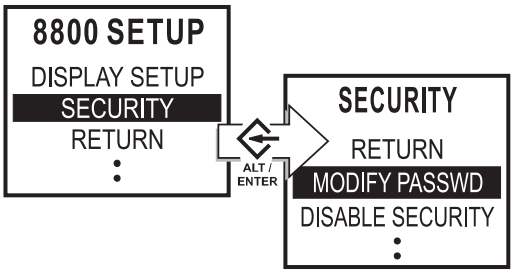
To enter the password:

1. To change the value of the highlighted digit, use the arrow buttons. The Up arrow increments the number and the Down arrow decrements it.
2. To change the position of the cursor, hold down an arrow button for about one second. The Up arrow moves the cursor left one position and the Down arrow moves the cursor right one position.
3. Once you have the value you want, press the **Alt/Enter** button.

Changing the password

By default, the meter's front panel password is set to 0 (zero) in the factory. The password can be changed to any number up to eight digits. Change the password from the default value to help improve meter security. To change the password:

1. Hold down the **Alt/Enter** button to access the Setup menu.
2. Scroll through the menu items using the arrow buttons, highlight SECURITY.
3. Press the **Alt/Enter** button to select SECURITY.



4. Enter the current meter password (see “Entering the password”, above). Once you enter the password, you are presented with the “MODIFY PASSWD” screen, as seen below:



5. Change the meter password.

   NOTE: If your meter’s front panel or user passwords are lost, you must return the meter for factory reconfiguration, which resets your meter to its factory defaults and destroys all logged data.

   – To change the value of the highlighted digit, use the arrow buttons. The Up arrow increments the number and the Down arrow decrements it.
   – To change the position of the cursor, hold down an arrow button for about one second. The Up arrow moves the cursor left one position and the Down arrow moves the cursor right one position.

6. Once you have the value you want, press the **Alt/Enter** button. You are prompted for your current password before the new password is saved.

Enabling & disabling the password security check

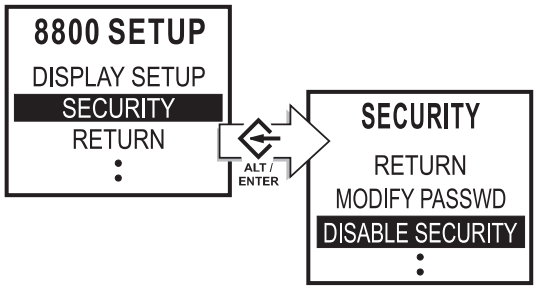
Disabling the password disables Standard security, allowing changes to all the meter's settings through the front panel or via communications without a security check. This procedure should only be used if the communications interface you are using does not support the meter’s security protocols, and you have ensured your meter’s configuration and data security using other means.

NOTE: Non-secure access to the meter is not advisable. It is highly recommended that any ION8800 meters in the field have the password security check enabled.

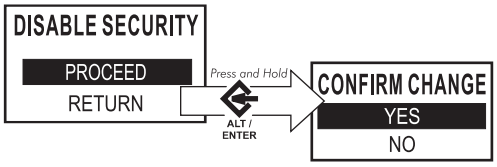
Disabling the password security check

Follow these steps to disable the password security check:

1. Press the **Alt/Enter** button to enter the Setup menu. Scroll down the menu with the arrow button. Press **Alt/Enter** again when SECURITY is highlighted.
2. Enter the valid meter password at the password prompt. You are then presented with the Security menu.
3. Scroll down and highlight the DISABLE SECURITY menu item and press the **Alt/Enter** button.



4. Select PROCEED then select YES at the following prompt.



   A message appears on screen notifying you of how to re-enable password security (refer to “Enabling the password security check” on page 49). Your meter’s password is now disabled; changes to settings in the meter do not require a valid password.

5. Press the **Alt/Enter** button to return to the Setup menu.

Enabling the password security check

When you re-enable the password security, you are required to enter a new password. To re-enable password security:

1. Press and hold down the **Alt/Enter** button to enter the Setup menu. Scroll down the menu and select SECURITY.
2. Select MODIFY PASSWD and press the **Alt/Enter** button. The Modify Password Screen appears.
3. The message FAC DEFAULT appears in the middle of the Modify Password screen. If you want to use the factory default password, press the **Alt/Enter** button. If you want to set the password to a different number, use the instructions in “Changing the password” on page 47.

NOTE: Refer to “Password best practices” on page 45 for recommendations on how to configure your meter’s passwords.

4. Once you have entered your new password, press the **Alt/Enter** button.
5. Select YES to confirm the change and return to the Setup menu.

The password security check is re-enabled and all changes to the device's configuration require the new meter password.

Enabling and disabling web config access

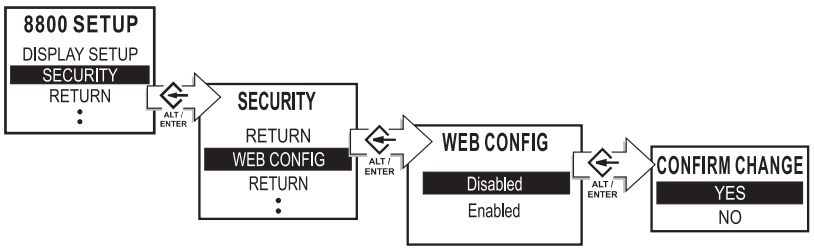
By default, remote configuration of the device via web browser is disabled, which is the recommended setting for improved meter security. Follow these steps to enable or disable your meter’s web configuration access.

1. Press the **Alt/Enter** button to enter the Setup menu. Scroll through the menu with the arrow buttons. Press **Alt/Enter** again when SECURITY is highlighted.
2. Enter the valid meter password at the password prompt. You are then presented with the Security menu.

3. Scroll down and highlight the WEB CONFIG menu item and press the **Alt/Enter** button.
4. Select ENABLED or DISABLED as required.

NOTE: Disable web config access unless you are actively using this feature.

5. Confirm the change and select RETURN to go back to the Setup Menu.

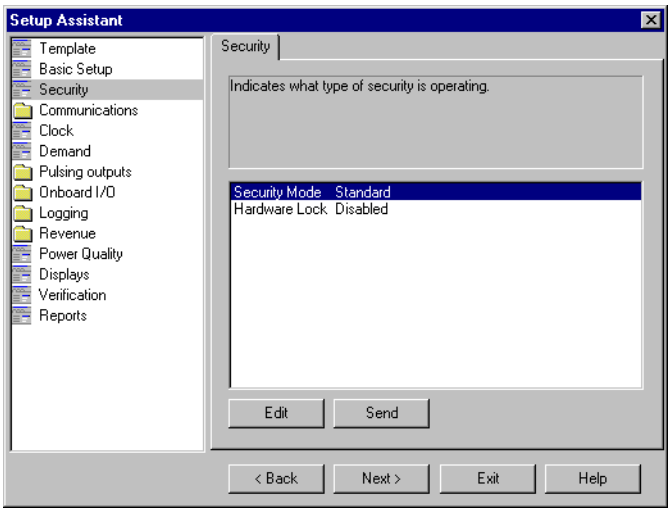


Configuring Standard security using ION Setup

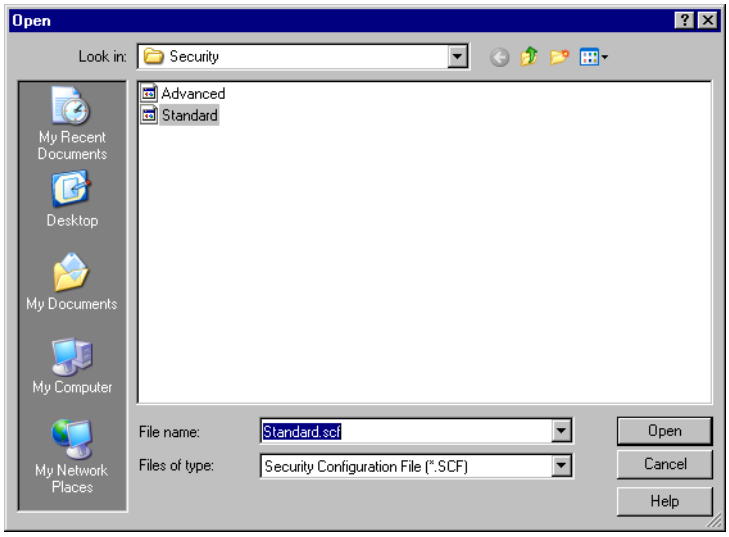
You must be logged into ION Setup with supervisor authority in order to configure security on your meter.

NOTE: If you are writing to Modbus registers on your meter, use Advanced security.

1. Open the Setup Assistant for your meter. See the ION Setup help for instructions.
2. Select **Security**.
3. Select Security Mode and click **Edit** (or double-click to edit). The **Open File** dialog box appears.



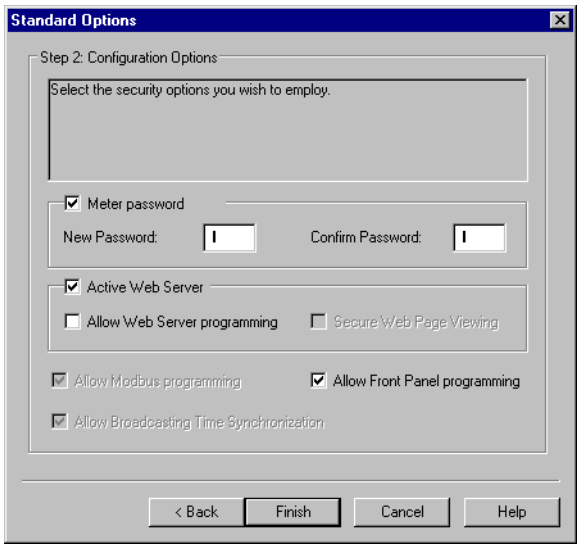
4. Select the Standard.scf file and click **Open** to edit. The configuration screen appears.



5. Select the check boxes of the security options you want enabled. Some options may be disabled (grayed out) because of existing security settings.
   – To change the password, type a new meter password, then confirm the new password by typing it again. Refer to “Password best practices” on page 45 for more information.

NOTE: By default, after eight invalid login attempts, the meter locks out (disables) access over that communication port or protocol. Use the Advanced security wizard or the advanced mode of ION Setup to configure invalid login attempts and protocol lockout duration. The configured settings will be used for both Standard and Advanced security.

   – **Allow Web Server programming** is disabled (cleared) by default. Disable web-based meter configuration for improved meter security.



NOTE: Changing communications port settings with the Allow Front Panel Programming setting cleared (unchecked) may cause loss of communications with your meter, and render it inoperable. In this case a factory reconfiguration of your meter is required, which resets your meter to its factory defaults and destroys all logged data.

6. Click **Finish** when you are done.
7. When prompted, you can save your security settings in a file.

– Click **Yes** to save the settings in the default file or in a new file.

NOTE: The default security configuration files are set to read-only by default. To overwrite, right-click on the file in the **Save As** screen and select **Properties**. In the General tab, remove the checkmark beside the Read-only attribute and click **OK**. You should now be able to overwrite the default security configuration file.

– Click **No** if you do not want to save the changes.

Configuring Advanced meter security

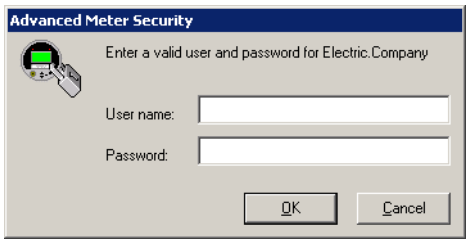
Advanced meter security is available on ION8800 meters. Advanced security allows you to:

- Enable or disable Modbus, front panel and web programming.
- Add up to 50 users, each with unique access privileges.
- Configure communications protocol lockouts to limit the number of invalid login attempts permitted for a user using a particular password, protocol and communications method combination.
- Set the priority of login-related meter events.

NOTE: Use ION Setup to configure Advanced security. ION Setup has a Setup Assistant that guides you through Advanced security setup.

Entering an Advanced security user name and password in ION Setup

When you attempt to view data or make a change to a meter that has advanced security enabled, you are prompted for a user name and password.



1. Select a user or enter a valid Advanced security user name.

NOTE: User names are fixed as USER1 through to USER50. There is also a FACTORY user which is intended for Schneider Electric Technical Support and must be disabled when not in use.

2. Enter the appropriate password and click **OK**.

NOTE: If your meter's front panel or user passwords are lost, you must return the meter for factory reconfiguration, which resets your meter to its factory defaults and destroys all logged data.

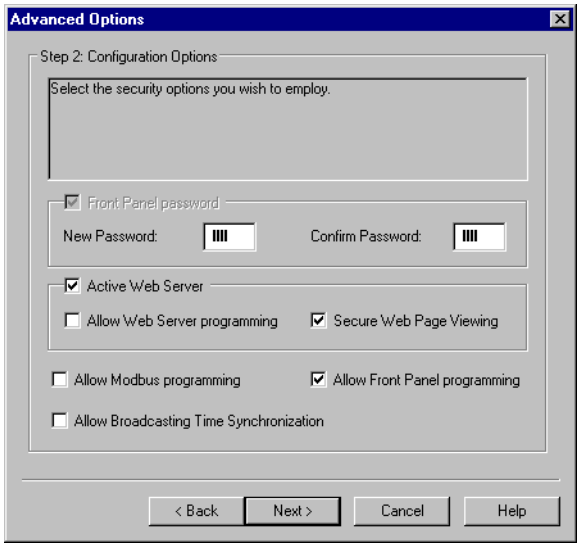
Configuring Advanced security using ION Setup

Use ION Setup to configure Advanced security on your meter.

Step 1: Set basic security options

1. Open the Setup Assistant for your meter. See the ION Setup Help for instructions.
2. Select the **Security** screen.
3. Select **Security Mode** from the **Security** tab and click **Edit**. The **Open** dialog box appears.

4. Select the Advanced.scf file and click **Open** to edit. The **Advanced Options** dialog box appears.
5. On the Advanced Options configuration screen, select the check boxes of the security options you want enabled. Some options may be disabled (grayed out) because of existing security settings.
   - To change the meter's password, type a new meter password, then confirm the new password by typing it again. Refer to "Password best practices" on page 45 for more information.
   - **Allow Web Server programming** is disabled (cleared) by default. Disable web-based meter configuration unless you are actively using this feature.
   - **Allow Modbus programming** is disabled (cleared) by default. Disable Modbus programming unless you are actively using this feature.



NOTE: Changing communications port settings with the Allow Front Panel Programming setting cleared (unchecked) may cause loss of communications with your meter, and render it inoperable. In this case a factory reconfiguration of your meter is required, which resets your meter to its factory defaults and destroys all logged data.

6. Click **Next**. The **Select protocol lockout options** screen appears; see "Step 2: Configure communications protocol lockout options" on page 53.

Step 2: Configure communications protocol lockout options

The communications protocol lockout security feature allows you to set the number of invalid login attempts that each user can make using a particular protocol and communications method before being locked out (a user is defined as a user login and password combination).

For protocols that are not session-based (ION and HTTP), you can configure how often the meter registers invalid login attempts by configuring the session timeout. You can also configure the lockout duration for all configurable protocols.

Once a user is locked out, the meter will not accept login attempts from that user on that protocol and communications method until the lockout duration has passed. For example, once USER01 has been locked out using ION over Ethernet, USER01 cannot access the meter using ION over Ethernet until the lockout duration has passed, even if USER01 enters the correct password. However, if the user enters the correct USER/

password combination before being locked out, the invalid attempt counter is reset to zero. Invalid login attempts accumulate until the user has completed a valid login or been locked out.

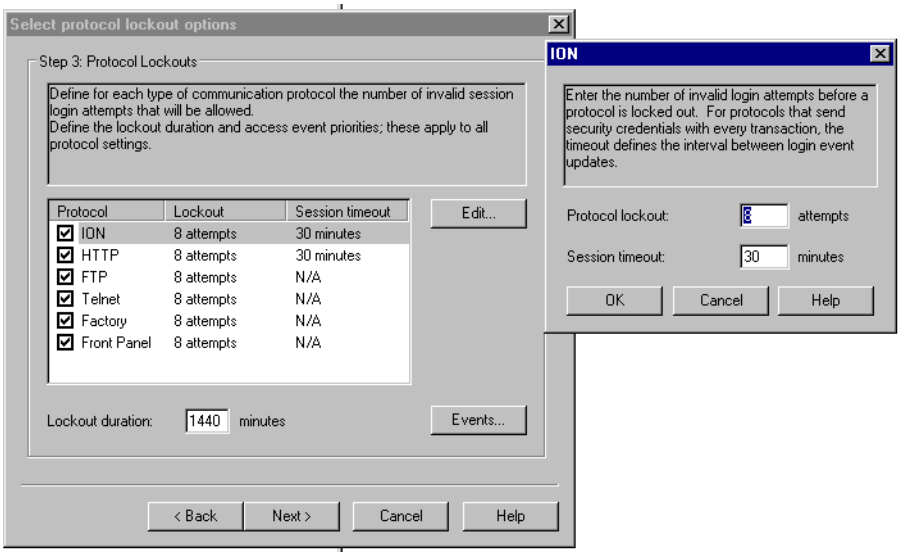
You can also configure the event priority for meter access and protocol lockout events, so they can be viewed in the meter's event log. By default, the Invalid login event priority is set to 128 and the lockout event priority is set to 255.

Configuring communications protocol lockout

1. Select the check boxes beside the protocols for which you want to enable communications protocol lockout. By default, all protocols are selected.
2. Highlight a selected protocol and click **Edit** to modify the lockout values for that protocol.
   – Protocol lockout attempts specifies the number of invalid login attempts allowed per user/password combination before access is denied to that user over that protocol and communications method. This value can range from 0 to 255.

NOTE: If Invalid logins is set to 0, there is no limit to the number of invalid login attempts and that protocol will never be locked out. However, the invalid login attempt events are recorded if the meter access events are configured to record invalid access attempts.

   – Session timeout specifies the active duration for a protocol; during this time, repeated invalid login attempts using the same USER/password combination are not registered (repeated invalid attempts with different combinations are still registered). This only applies to protocols which not session-based, and send credentials with each packet. Configuring this setting helps prevent accidental lockouts and the meter's event log from being filled with protocol access events. This value can range from 1 minute to 43200 minutes (30 days).



3. Click **OK**. Repeat for all protocols on which you want to enable communications protocol lockout.
4. Type the lockout duration, in minutes. The lockout duration specifies how long the meter ignores communication attempts by a user that is locked out. The lockout duration value applies to all lockout-enabled protocols, and has a default value of 24 hours.

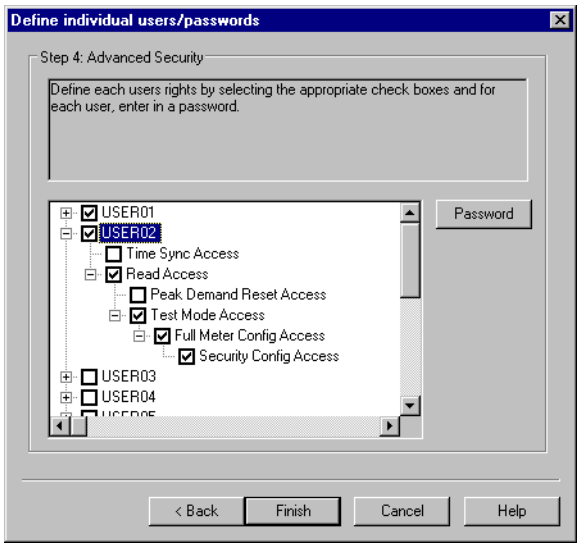
Once a user is locked out, the user cannot access the meter using the same protocol and communications method, regardless of whether or not the user enters the correct USER/password combination.

5. Click **Events** to enter the event priority for valid login attempts, invalid login attempts and protocol lockouts. The event priorities apply to all lockout-enabled protocols. Enter “0” (zero) to disable event logging for a particular type of login attempt. By default, valid login events are zero, invalid login events are 128 and lockout events are 255.
6. Click **Next**. The Define individual users/passwords screen appears. Refer to “Step 3: Configure users” on page 55 for the next step in configuring Advanced security, and “Step 3: Configure users” on page 55 for scenarios describing protocol lockout behavior.

Step 3: Configure users

Advanced security allows configuration of up to 50 users, each with unique access rights to the meter.

1. Select the check boxes of the users you want to configure (USER01 through USER50). Select the appropriate access for each user:.



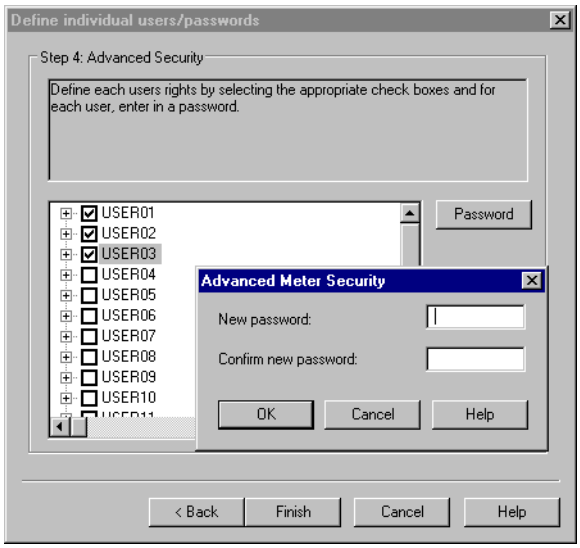
Access	Description
Time Sync	Set the meter’s time and time synchronization parameters.
Read	View all parameters except the security configuration.
Peak Demand reset	Reset the peak demand values (for example, sliding window demand for kW, kVAR, or kVA).
Comm Config	Configure the communication settings.
Test mode	Put the meter into Test mode.
Full Meter Config	Configure any programmable register on the meter except for registers related to the security setup, registers that result in a demand reset, or actions that place the meter in Test mode.
Security Config	Configure advanced security for the meter; Full Meter Config must also be selected.

When configuring users, in most cases, you must set Read access to YES. However, you can set up a user without read access; for example, you can create a user who can only timesync the meter. In some cases (such as Advanced security

configuration access), you must set multiple access options to YES. When you are configuring Advanced security, the software rejects unacceptable user configurations.

2. Select a user, then click **Password** to set a password for that user. Refer to “Password best practices” on page 45 for more information. Type the password in the **New Password** and **Confirm new password** fields and click **OK**.

NOTE: If your meter’s front panel or user passwords are lost, you must return the meter for factory reconfiguration, which resets your meter to its factory defaults and destroys all logged data.



3. Click **Finish** when you are done configuring users. A prompt appears asking if you want to save your security settings in a file.

   – Click **Yes** to save the settings in the default file or in a new file.

   NOTE: The default security configuration files are set to read-only by default. To overwrite, right-click on the file in the **Save As** screen and select **Properties**. In the General tab, remove the checkmark beside the Read-only attribute and click **OK**. You should now be able to overwrite the default security configuration file.

   – Click **No** if you do not want to save the changes.

Factory access

Factory access is restricted to Schneider Electric Technical Support, and should only be enabled when requested by Schneider Electric authorized personnel.

The factory access security feature interacts with Standard and Advanced security to enable factory-level access to the device for the specific period of time entered in the *Factory Access Minutes* setup register, located in the Security Options module. The *Factory Access Minutes* register value can range from one minute to 19 years, and is set to 0 (zero) by default, which disables all factory access. The *Factory Access Minutes* setup register is only available on ION8800 firmware version v340 or later.

If the meter uses Standard security, when you press any of the meter’s front panel buttons, power cycle the meter, or edit the *Factory Access Minutes* setup register, factory-level access is enabled on the meter for the duration specified in the *Factory Access Minutes* setup register. If the meter has Advanced security enabled, the Factory

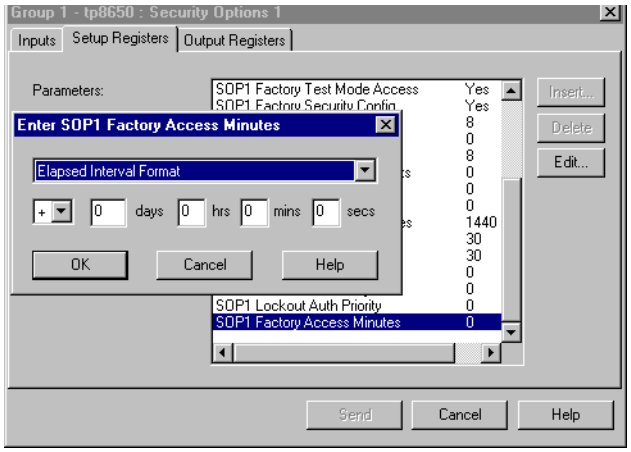
user must also enabled. The meter will only permit factory-level access, with the correct login credentials, during this period and at no other time.

Configuring the Factory Address Minutes setup register

You must use ION Setup in advanced mode to configure the *Factory Access Minutes* setup register, located in the Security Options module.

Using ION Setup:

1. Connect to your meter in advanced mode.
2. Navigate to the Security Options Modules folder and double-click on the module in the right-hand pane.
3. Select the **Setup Registers** tab.
4. Select *Factory Access Minutes* and click **Edit**. A dialog box appears.
5. Enter the desired duration (in minutes) for factory access to be enabled.
6. Select *Elapsed Interval Format* from the drop-down list to enter day and hour and minute values.



Factory access and Standard security

If a user tries to login to factory-level access (using Telnet or Hyperterminal), on a meter with Standard security, both of the following conditions must be met before the meter can proceed with subsequent checks:

1. *Factory Access Minutes* setup register is not 0 (zero).
2. The user and password information for factory-level access has been entered correctly.

If both conditions are met, the meter checks the following to determine if access will be granted:

- Front panel button: if the time since one of the meter's front panel buttons was pushed is less than the *Factory Access Minutes* register value, the user is given access.
- Power cycle: if the time since the meter was powered up is less than the *Factory Access Minutes* register value, the user is given access.
- Factory Access Minutes edit: if the time since the *Factory Access Minutes* register value was edited is less than the *Factory Access Minutes* value, the user is given access.

If any one of these conditions are met, the user is given access. If none of these conditions are met, the user is not given factory-level access on meters with Standard security even if they have entered appropriate user and password information.

Factory access and Advanced security

If a user tries to login to factory-level access (using Telnet or Hyperterminal) on a meter with Advanced security, all three of the following conditions must be met before the meter can proceed with subsequent checks:

1. *Factory Access Minutes* setup register is not 0 (zero).
2. The user and password information for factory-level access has been entered correctly.
3. The ION Factory user has been enabled.

NOTE: The Factory user can be enabled and disabled in the ION Setup Advanced security wizard, user configuration screen.

If all three of these conditions are met, the meter checks the following to determine if access will be granted:

- Front panel button: if the time since one of the meter's front panel buttons was pushed is less than the *Factory Access Minutes* register value, the user is given access.
- Power cycle: if the time since the meter was powered up is less than the *Factory Access Minutes* register value, the user is given access.
- Factory Access Minutes edit: if the time since the *Factory Access Minutes register* value was edited is less than the *Factory Access Minutes* value, the user is given access.

If any one of these conditions are met, the user is given access. If none of these conditions are met, the user is not given factory-level access on meters with Advanced security even if they have entered appropriate user and password information.

Factory access examples

Scenario 1

This example illustrates how factory access functions on a meter using Standard security, with a *Factory Access Minutes* setup register value of 10, over a protocol that is not session-based.

NOTE: A protocol that is not session-based actively communicates login credentials while you are connected to the meter (for example, ION and HTTP).

1. The user pushes a front panel button on the meter (T=0). This starts the factory access duration of ten minutes.
2. Two minutes after the button press (T=2), Schneider Electric Technical Services requests factory-level access to the meter, with the correct login credentials, over HTTP. Factory-level access is granted.
3. Ten minutes after the button press (T=10), factory-level access is automatically logged out.

Any attempt to connect to the meter using factory-level access is now denied.

Scenario 2

This example illustrates how factory access functions on a meter using Advanced security, with a *Factory Access Minutes* setup register value of 5, over a serial port (a session-based protocol).

1. The user connects to the meter using ION Setup with Supervisor-level access.
   – In the Advanced security wizard, he enables the ION Factory user.
   – In the Communications tab, he sets the appropriate serial port protocol to Factory.
2. The user power cycles the meter (T=0). This starts the factory access duration of five minutes.
3. Two minutes after the power cycle (T=2), Schneider Electric Technical Services requests factory-level access to the meter, with the correct login credentials, over the serial port. Factory-level access is granted.
4. An hour after the power cycle (T=60), Schneider Electric Technical Services logs off factory-level access.

NOTE: With session based protocols, once factory-level access has been granted, it does not matter if the logged-in time exceeds the value of the Factory Access Minutes setup register.

   The factory-level access period has expired, and must be restarted by pushing one of the meter's front panel buttons, power cycling the meter, or modifying the *Factory Access Minutes* setup register.

5. The user connects to the meter using ION Setup with Supervisor-level access.
   – In the Advanced security wizard, he disables the ION Factory user.
   – In the Communications tab, he changes the serial port protocol from Factory back to its original setting.

Scenario 3

This example illustrates how remote factory access functions on a meter using Advanced security, over a protocol that is not session-based.

NOTE: A protocol that is not session-based actively communicates login credentials while you are connected to the meter (for example, ION and HTTP).

1. The customer contacts Schneider Electric Technical Services to request that they connect to a meter using factory-level access using the following information:
   – the username and password of an Advanced security user that has meter security configuration access, and the front panel password of the meter.
   – the meter's Ethernet connection information.
2. Technical Services connects to the meter using ION Setup, entering the Advanced security username and password provided.
   – In the Advanced security wizard, he enables the ION Factory user.
   – Using the advanced mode of ION Setup, he changes the *Factory Access Minutes* setup register from 0 (default) to 30 (T=0).
3. Two minutes after editing the *Factory Access Minutes* setup register (T=2), Schneider Electric Technical Services requests factory-level access to the meter, with the correct login credentials, over HTTP. Factory-level access is granted.
4. Twenty minutes after editing the *Factory Access Minutes* setup register (T=20), Schneider Electric Technical Services finishes working on the meter and logs out of factory-level access.

5. Technical Services connects to the meter using ION Setup, entering the Advanced security username and password provided.
   – In the Advanced security wizard, he disables the ION Factory user.
   – Using the advanced mode of ION Setup, he changes the *Factory Access Minutes* setup register back to its default value of 0.

Schneider Electric Technical Services contacts the customer to indicate they are finished working on the meter and have restored the security settings, and recommends that the customer update their Advanced user password information and store their password information in a secure location.

Revenue metering security

Security features depend on the meter ordering options.

All ION8800 meters

All ION8800 meters come with traditional anti-tamper mechanical sealing points on the meter case and cover in addition to the ability to enable and configure Standard and Advanced security on the meter.

ION8800 meters with Revenue Security Option

ION8800 meters with the Revenue Security option have an additional hardware-locked security system that prevents modification of revenue quantities after the meter is sealed.

Hardware lock security option

To make configuration changes to billing parameters on a hardware-locked meter, you must first unlock the meter. The Meter Lock setting is located in the ALT Config menu, which is reached by pressing the **ALT Config** button under the anti-tamper sealed cover. You must physically press this button if you have a hardware locked meter; you cannot access the Alt Config menu through software.

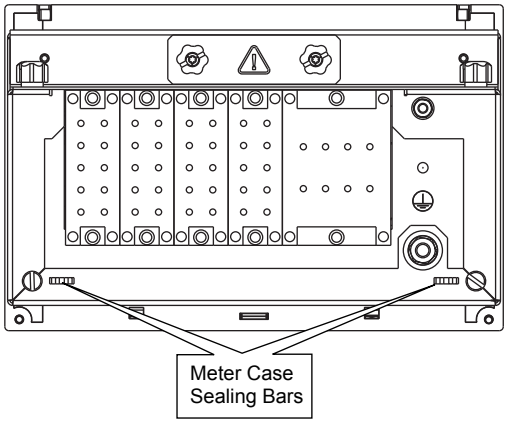
Typical values that are protected include:

- kWh, kvarh, kVAh delivered, received, del-rec, del+rec.
- kW, kvar, kVA Sliding Window demand min and max values.
- Digital Outputs controlling the energy pulsing applications.
- All Power system settings, including PT and CT ratios.

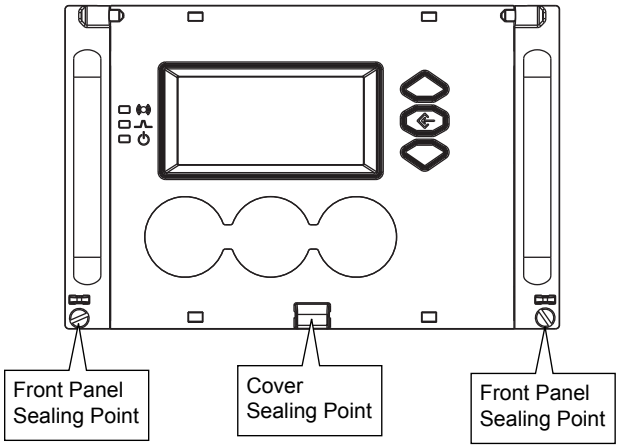
For a complete list of locked values specific to your meter and its firmware, refer to the *ION Device Template Reference*.

Meter seals

Rear of Meter



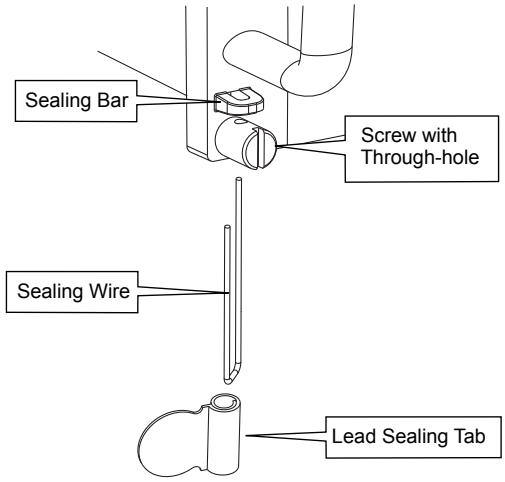
Front of Meter



The meter incorporates sealing bars and chassis screws with through-holes, through which traditional lead/wire seals can be inserted. When utilized, these lead/wire seals can help prevent unauthorized personnel from gaining access to meter internals or to buttons under the cover.

These seals are installed as follows:

1. Insert the sealing wire through **both** the screw hole and sealing bar.



2. Twist the wire and crimp the lead sealing tab on to the wire.

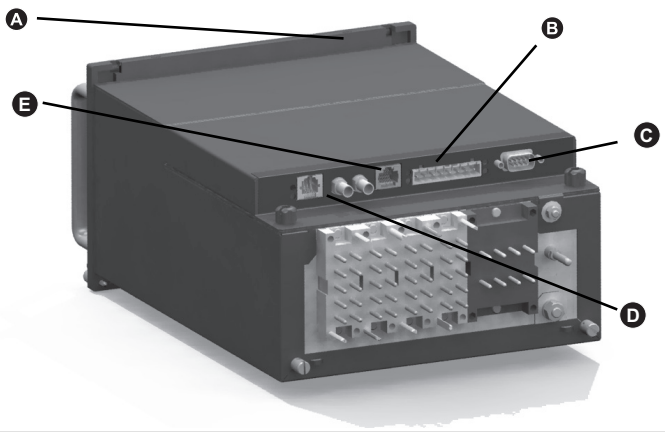
Chapter 7 Communications

This chapter includes general instructions for connecting and configuring all the communication ports on your meter.

For specific meter installation steps and specifications, consult your meter's installation guide.

Communications overview

The following illustration shows all the possible communications connections to the meter.



A	COM1: Optical port serial connection (front of meter)
B	COM2: Selectable RS-485 serial connection
C	COM3: Selectable RS-232 or RS-485 serial connection
D	COM4: Internal modem
E	Ethernet port (RJ45 or SC connector type fiber cable)

ION8800 meters have numerous communication possibilities depending on your ordering options. See the table below for details.

COM port	Interface type	Meter only	Meter with communications module
1	Optical	Standard	Standard
2	Selectable RS-485 (Essailec or Communications Module)	Optional	Optional
3	Selectable RS-232 or RS-485	N/A	Optional
4	Internal modem	N/A	Optional
Ethernet	Selectable Ethernet or SC fiber cable	N/A	Optional

Communications connections

The following section provides reference for connecting to the meter's various communication ports. For the most current communication specifications, see your meter's Installation Guide.

Communications connections are made to the Essailec connector and the Communication Module, both found on the rear of the meter. Optical connections are made to the port on the front of the meter.

NOTE: Meters ordered with I/O options B and C do not have RS-485 connections on the Essailec connector.

⚠ DANGER

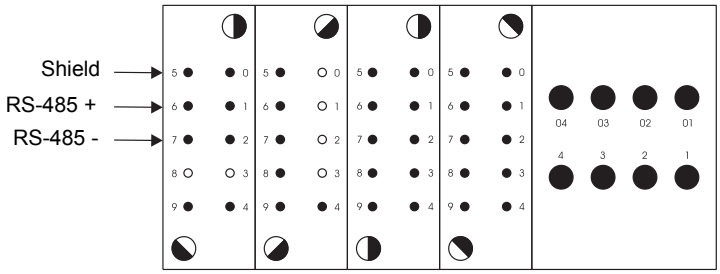
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA, CSA Z462 or applicable local standards.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
- Always use a properly rated voltage sensing device to confirm that all power is off.

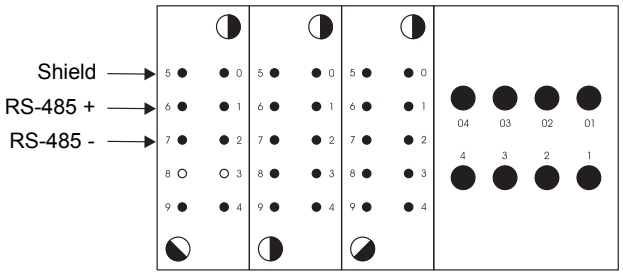
Failure to follow these instructions will result in death or serious injury.

Essailec connectors

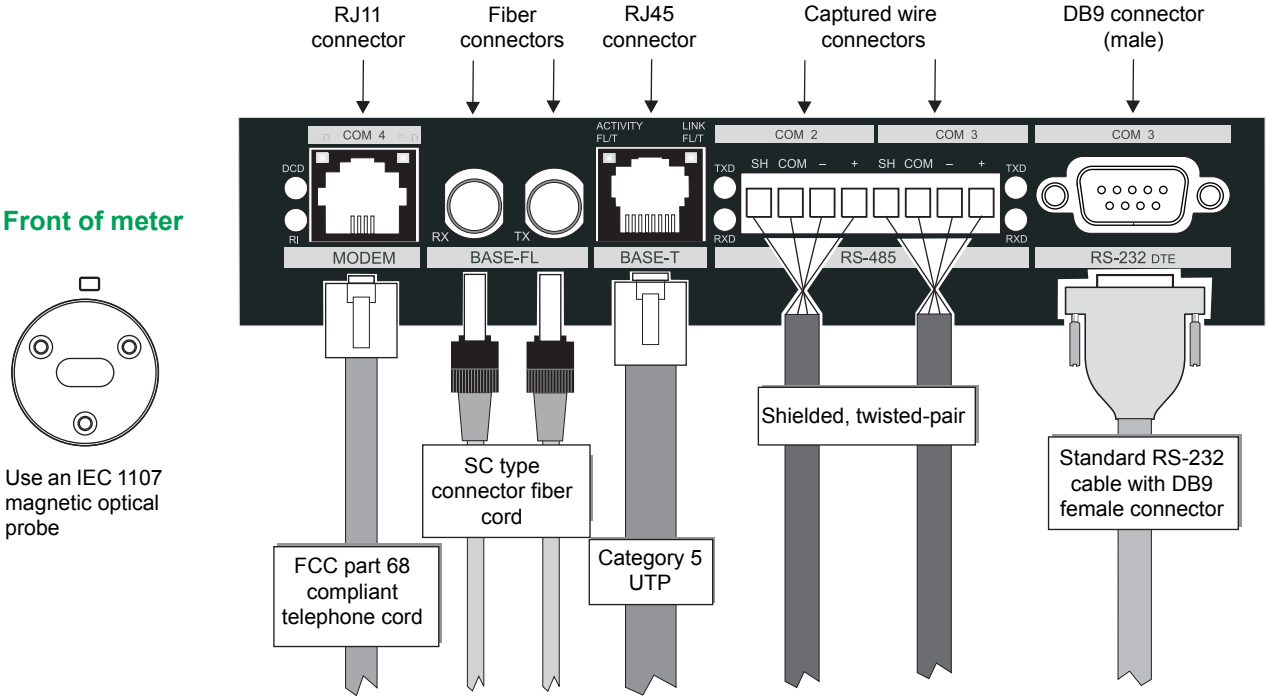
A option



D and E options

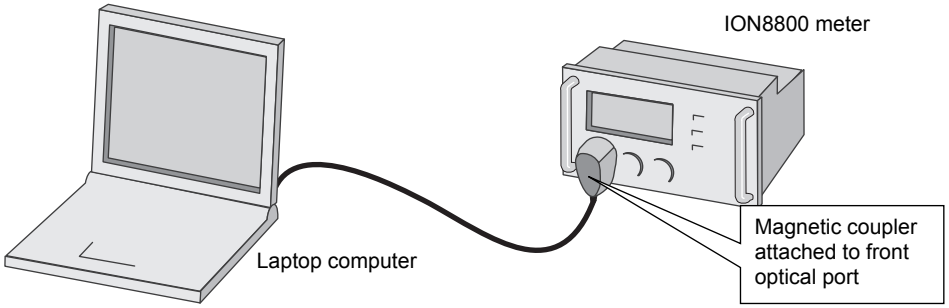


Communications module



Optical port connections (COM1)

The front optical port is designed to accept IEC 1107 magnetic couplers. It can be used to communicate real-time measurements to a laptop computer for basic meter configuration.



To enable communications from the optical port, configure the Comm 1 Communications module. The *Protocol*, the *Baud Rate* and *Unit ID* setup registers must properly match your system. When creating an ION site, ensure that RtsCts is disabled (set to No) in the COM1 serial site.

NOTE: To allow meter configuration via the optical port, you must ensure IR Configuration is set to Enabled. See “ALT Config menu” on page 35 for more information.

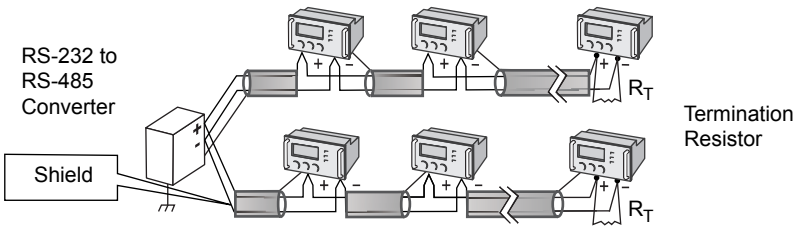
RS-485 connections (COM2 and COM3)

RS-485 connections are made to the Essailec connector and the optional Communications Module, both found on the rear of the meter.

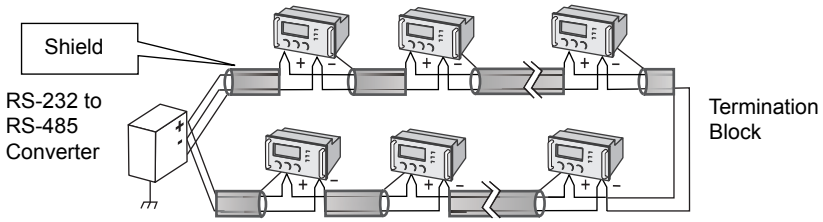
NOTE: COM2 is a selectable channel, which allows RS-485 communications via the Essailec connector OR the Communications Module. You cannot use both ports at the same time.

Up to 32 devices can be connected on a single RS-485 bus. Use a good quality, shielded twisted pair cable for each RS-485 bus. The overall length of the RS-485 cable connecting all devices cannot exceed 1219 m (4000 ft.). The RS-485 bus can be configured in straight-line or loop topologies:

Straight-line topology



Loop topology



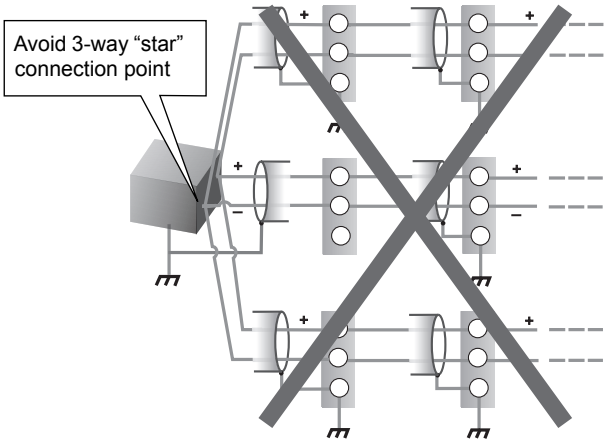
General bus wiring considerations

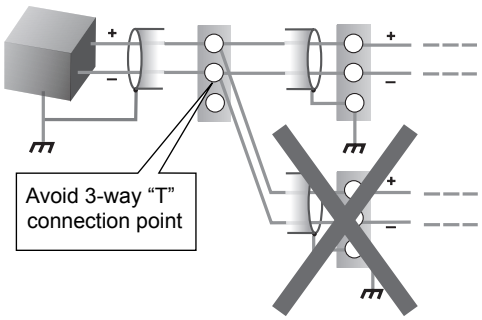
Devices connected on the bus, including the meter, converter(s) and other instrumentation, must be wired as follows:

- Connect the shield of each segment of the cable to ground at *one end only*.
- Isolate cables as much as possible from sources of electrical noise.
- Use an intermediate terminal strip to connect each device to the bus. This allows for easy removal of a device for servicing if necessary.
- Install a ¼ Watt termination resistor (**RT**) between the (+) and (-) terminals of the device at each end point of a straight-line bus. The resistor should match the nominal impedance of the RS-485 cable (typically 120 ohms – consult the manufacturer's documentation for the cable's impedance value).

RS-485 connection methods to avoid

Any device connection that causes a branch in the main RS-485 bus should be avoided. This includes *star* and *tee (T)* methods. These wiring methods cause signal reflections that may result in interference. At any connection point on the RS-485 bus, no more than two cables should be connected. This includes connection points on instruments, converters, and terminal strips. Following this guideline helps ensure that both star and tee connections are avoided.





RS-485 biasing

The RS-485 +/- wires are floating (ungrounded) so there can be voltage signals on the wires even when there is no device communicating on the bus. The amount of floating voltage depends on many factors, such as capacitive effects in the RS-485 bus and noise in nearby systems. If the floating voltage is high enough, it can be incorrectly interpreted as an RS-485 signal and cause your meter to stop communicating. The meter has an RS-485 biasing option to prevent the RS-485 bus from floating when devices are not sending data.

Setting RS-485 biasing using the display

1. Press and hold the **ALT/ENTER** button for a few seconds. The SETUP menu appears.
2. Use the navigation buttons to highlight the RS-485 COM port that you want to configure (COM2 or COM3) and press **ALT/ENTER** to select.
3. Use the navigation buttons to highlight RS485 BIAS and press ALT/ENTER to select.
4. Select either ON (RS-485 biasing applied) or OFF (RS-485 biasing not applied).

Setting RS-485 biasing using ION Setup

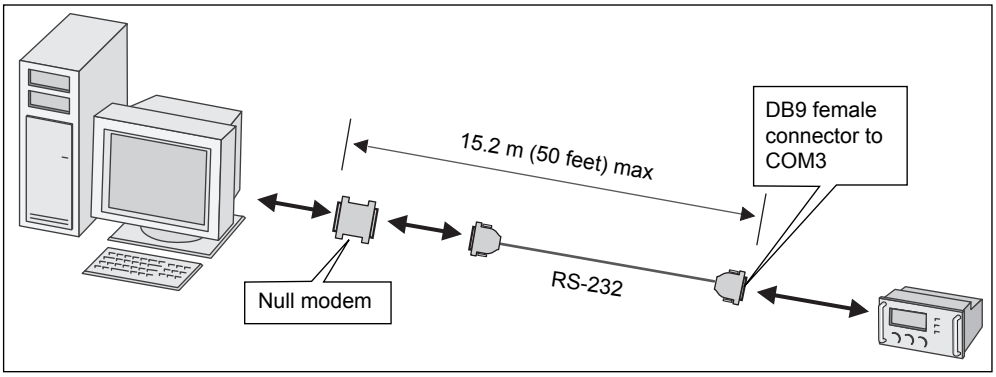
1. Open the Setup Assistant for your meter. See the ION Setup Help for instructions.
2. Select **Communications > Serial Settings.**
3. Click the **COM2** or **COM3** tab. Select RS485 Bias and click **Edit**.
4. Select either ON (RS-485 biasing applied) or OFF (RS-485 biasing not applied).
5. Click **OK**.

RS-232 connections (COM3)

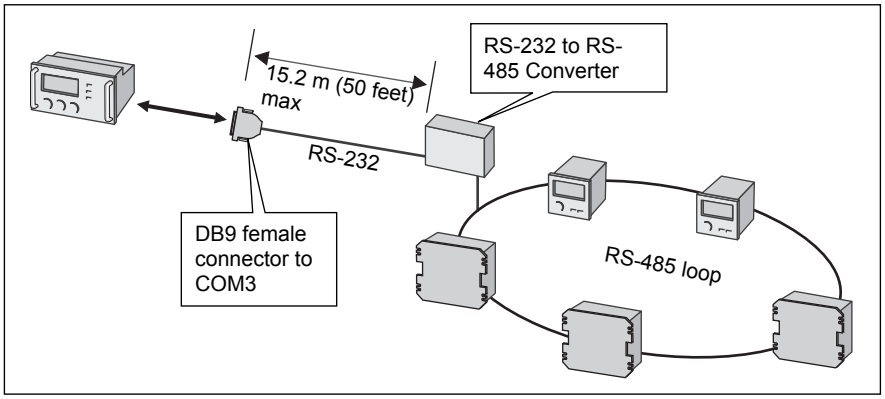
An RS-232 connection is made to the male DB9 connector (COM3) on the optional Communications Module, at the back of the meter. The meter acts as a DTE device in all RS-232 connections. Use a null modem cable for connecting a meter to a workstation or use a standard straight-through RS-232 cable for connecting to an external modem. In either case, one end of the cable must be equipped with DB9 female connector for mating with the meter. The maximum cable length is 15.2 m (50 feet).

NOTE: For RS-232 communications, COM3 hardware mode must be set to ‘RS-232’.

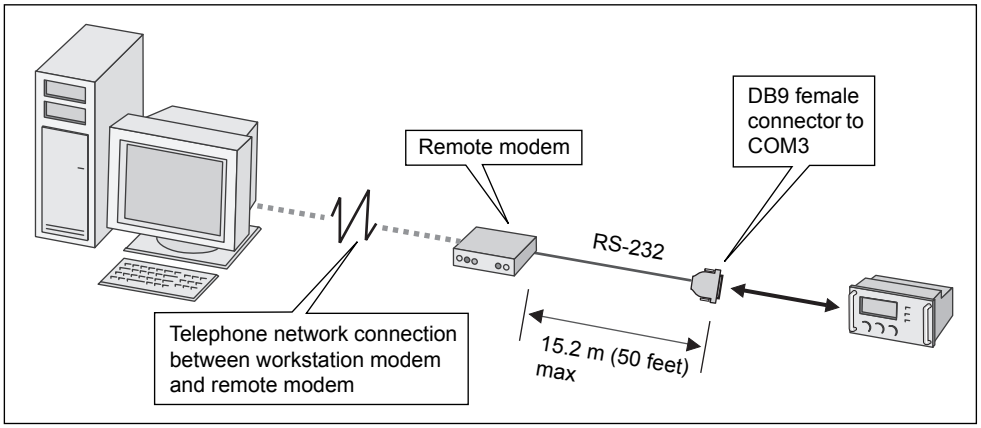
Computer connections



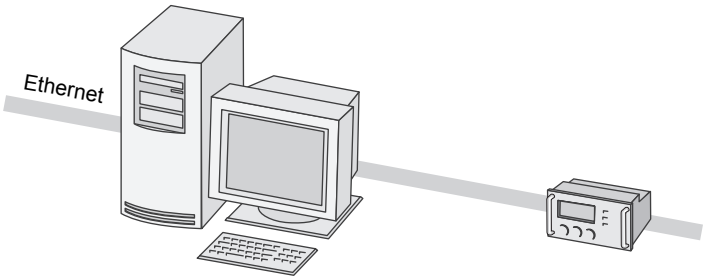
Meter connections



External modem connections

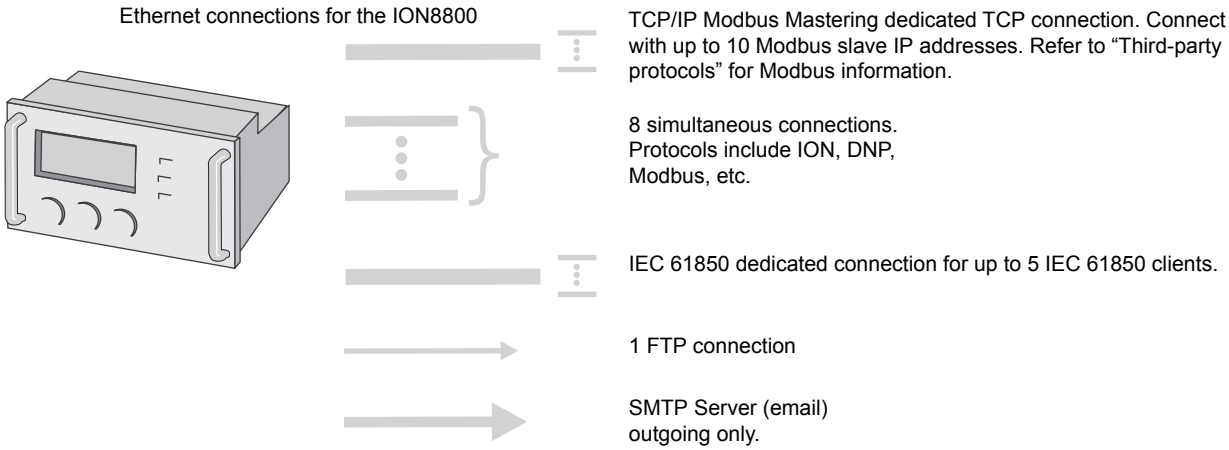


Ethernet connections



There are two Ethernet port ordering options available: Ethernet or fiberoptic. Both types of connectors plug into the Communications module on the back of the meter.

The meter supports a maximum of eight simultaneous generic Ethernet connections with additional dedicated connections for Modbus Master over TCP/IP and IEC 61850.



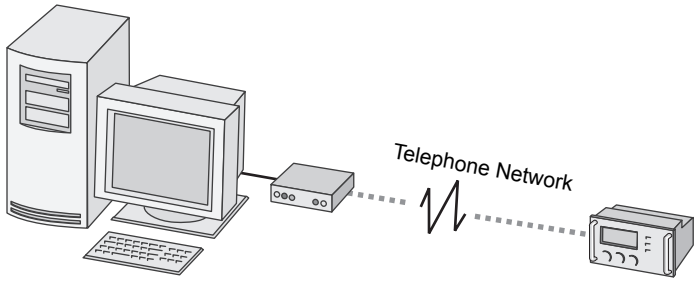
The optional Ethernet port:

- is capable of data rates up to 100 Mbps
- supports TCP/IP, ION, Telnet, DNP 3.0, IEC 61850, FTP and Modbus/TCP protocols.

NOTE: Ethernet connection should be made to **either** the Fiber port or RJ45 port, not both, or communications conflicts may result.

The EtherGate feature provides communications through an Ethernet connected device to a connected serial network (see “The EtherGate protocol” on page 74). Only one EtherGate connection is allowed per meter port at any given time.

Internal modem connections (COM 4)



The meter’s optional internal modem is manufactured for use in most countries — refer to the Notices at the start of this document for more details.

Modem connections are made to the Communication module on the back of the meter, via an RJ11 connector.

To enable communications through the meter’s internal modem, you must configure the Comm 4 Communications module. The *Baud Rate, Unit ID,* and *Protocol* setup registers must properly match your system, and the initialization string for the internal modem must be set up using the *ModemInit* register. See “Modem communications setup” on page 75 for more information.

Configuring meter communications

Communication settings are typically configured when the meter is initially put into service. A single Communications module controls each communications port on the meter. The modules' setup registers define the parameters used for each port; these parameters vary according to the type of communications channel selected (i.e. RS-232, RS-485, Modem, Optical, Ethernet).

The Communication modules configure the following channels:

Module name	Settings
Comm 1	Optical port on COM1
Comm 2	Selectable RS-485 port on COM2
Comm 3	Selectable RS-232 or RS-485 port on COM3
Comm 4	Internal modem on COM4
Ethernet	Selectable Fiber or Ethernet port

Use the meter's front panel or ION Setup to initially configure the meter's communications.

NOTE: Altering some settings of a communications channel that is in use can cause a loss of communications with the meter.

Refer to the Communications module description in the *ION Reference* for details about the setup registers in the Communications module.

Communications protocols

By default, all communication ports are configured to use the ION protocol. Using other protocols requires configuration of the *Protocol* setup register for the Communications module that controls the port you want to use. Not all protocols are available on all ports or on all meter types.

Protocols Available - ION8800

- ION
- Modbus RTU
- Modbus Master
- DNP 3.0
- DLMS
- GPS
- EtherGate
- ModemGate
- Factory (reserved for use by Technical Support)
- IRIG-B
- IEC 61850 (does not require port configuration)
- None (Disables the port. See "Disabling COM ports" on page 72)

Serial Communications Setup

Serial communications are available on COM1, COM2, COM3, and COM4. To enable communications through the meter's serial ports, configure the applicable Communications module. The *Protocol*, *Tran Delay*, *Baud Rate* and *Unit ID* setup

registers must properly match your system and can be set through the meter's front panel or ION Setup.

NOTE: The total number of possible serial connections is limited by the number of physical serial ports on the meter. The ION8800 has two physical serial ports.

Using the Display

The current configuration of the meter's communication ports are found in the various COM Setup menu items. Ethernet settings are located under Network Setup.

Menu	Setting	Description	Range (values)	Default
COM1	Protocol	Specifies which protocol is active	ION, Modbus RTU, DNP, DLMS, Factory, None	ION
	Baud Rate	Specifies COM port baud rate during serial communications	1 200 to 19 200	9 600
	Transmit Delay	Specifies the meter's transmit delay setting (in seconds)	0 to 1,0	0,010
	Unit ID	Identifies the meter during serial communications	1 to 9 999	From serial number[2]
	Serial Port	Parity and stop bits for the port	8N1,8N2,8E1,8E2,8O1,8O2	8N1
COM2	Protocol	Specifies which protocol is active	ION, Modbus RTU, Modbus Master[3], DNP, DLMS, EtherGate, ModemGate, GPS: Truetime/Datum, GPS: Arbiter, GPS: Arbiter/Vorne, Factory, None	ION
	Baud Rate[1]	Specifies COM port baud rate during serial communications	300 to 57 600	9 600
	Transmit Delay	Specifies the meter's transmit delay setting (in seconds)	0 to 1,0	0,010
	Unit ID	Identifies the meter during serial communications	1 to 9 999	From serial number[2]
	Serial Port	Parity and stop bits for the port	8N1,8N2,8E1,8E2,8O1,8O2	8N1
	Port Location	Specifies physical connection point for COM2	Essailec or Comm Module	Essailec
	RS485 Bias	Specifies if RS-485 biasing is applied to port	On or Off	Off
COM3	Protocol	Specifies which protocol is active	ION, Modbus RTU, Modbus Master[3], DNP, DLMS, EtherGate, ModemGate, GPS: Truetime/Datum, GPS: Arbiter, GPS: Arbiter/Vorne, Factory, None	ION
	Baud Rate[1]	Specifies COM port baud rate during serial communications	300 to 115 200	9 600
	Transmit Delay	Specifies the meter's transmit delay setting (in seconds)	0 to 1,0	0,010
	Unit ID	Identifies the meter during serial communications	1 to 9999	From serial number[2]
	Serial Port	Parity and stop bits for the port	8N1,8N2,8E1,8E2,8O1,8O2	8N1
	RS232 or RS485	Specifies RS-232 or RS-485	RS-232, RS-485	RS-232
	RTS/CTS Handshake	Specifies if hardware flow control is used during RS-232 communication	RTS with delay RTS/CTS	RTS + delay
	RS485 Bias	Specifies if RS-485 biasing is applied to port	On or Off	Off

Menu	Setting	Description	Range (values)	Default
COM4	Protocol	Specifies which protocol is active	ION, Modbus RTU, DNP, DLMS, GPS: Truetime/Datum, GPS: Arbiter, GPS: Arbiter/Vorne, Factory, None	ION
	Baud Rate[1]	Specifies COM port baud rate during serial communications	300 to 115 200	9 600
	Transmit Delay	Specifies the meter's transmit delay setting (in seconds)	0 to 1,0	0,010
	Unit ID	Identifies the meter during serial communications	1 to 9 999	From serial number[2]

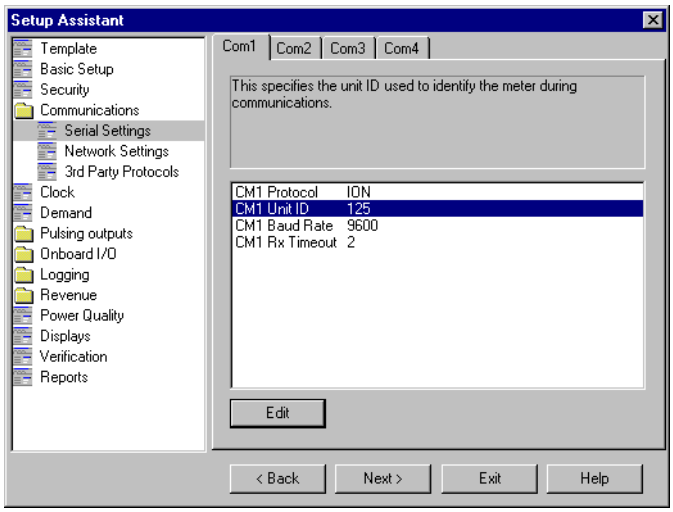
1 300 baud rate is only intended for paging applications.

2 The factory set Unit ID is based on the serial number of the meter, using the last four numbers before the dash. For example, if the serial number is PA-0009B263-01, the Unit ID is set in the factory to 9263. After a factory reset, the unit ID number will default to 100.

3 Modbus Master is only available on ION8800A and ION8800B meters.

Using ION Setup

1. Open the Setup Assistant for your meter. See the ION Setup help for instructions.
2. Select **Communications > Serial Settings**.
3. Click on the various tabs to configure the four serial ports (Com1, Com2, Com 3 and Com4). To change a setting, select the parameter and click **Edit**.



Disabling COM ports

To help improve security on your meter, it is recommended that you disable all unused COM ports. You can do this using the meter's display or by using ION Setup.

Disabling COM ports through the display

1. Press and hold the **ALT/ENTER** button for several seconds. The SETUP menu appears.
2. Use the navigation buttons to highlight the COM port you want to disable and press **ALT/ENTER** to select.
3. Use the navigation buttons to highlight the Protocol setting and press **ALT/ENTER** to select.
4. Select None from the list of available protocols.
5. Select YES to confirm the change.

Disabling COM ports through ION Setup

1. Open the Setup Assistant for your meter. See the ION Setup Help for instructions.
2. Select **Communications > Serial Settings**.
3. Click the tab for the COM tab you want to disable (COM1 - COM4), select Protocol from the list of settings and click **Edit**.
4. Select None from the dropdown list and click **OK**.

Ethernet communications setup

To enable communications through the meter's Ethernet port, configure the Ethernet Communications module. The *IP Address*, *Subnet Mask, Gateway,* and *SMTP Address* setup registers must properly match your system and can be set through the meter's front panel or ION Setup.

Using the front panel

The current configuration of the meter's communication ports are found in the various COM Setup menu items. Ethernet settings are located under Network Setup.

Menu	Setting	Description	Range (values)	Default
Network Setup	IP Address	Specifies TCP/IP Ethernet address	000.000.000.000 to 255.255.255.255	None
	Mask	Specifies Subnet Mask	0.0.0.0 to 255.255.255.0	None
	Gateway	Specifies Ethernet gateway (if used)	000.000.000.000 to 255.255.255.255	None
	SMTP Address	Specifies location of SMTP Server	000.000.000.000 to 255.255.255.255	None
	MAC Address	Machine Access Control address	hexadecimal	N/A[1]
	10/100 BT Config	Switch between 10 Base-T and 100 Base-TX	10 Base-T, 100 Base TX, Auto	Auto
	100 FX Config	Enable fiber optic connection	Full-Duplex, Half-duplex	Half-duplex
	Port Enable	Enables and disables network ports	WebServer, DNP over TCP, ION over TCP, Modbus over TCP, Modbus TCP, Telnet	Ports Enabled

[1] MAC address is factory set and is for reference only.

Use the front panel navigation buttons to edit the values of the network settings so that they match your system addresses.

As you configure the network addresses, the front panel automatically hides unnecessary leading zeroes from each three-digit grouping. The hidden leading zeroes appear (and disappear again) as you move the position of cursor across the network address.



In the example above, the highlighted zero is hidden as soon as you change the position of the cursor.

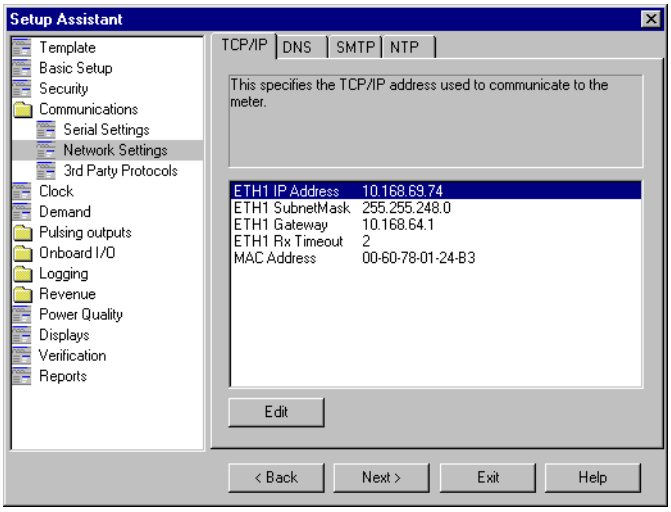
Using the meter display

1. Press and hold the **ALT/ENTER** button for a few seconds. The SETUP menu appears.
2. Use the navigation buttons to select NETWORK SETUP and press **ALT/ENTER**.

3. Configure the Ethernet communications settings (For example, IP Address, Mask, Gateway, SMTP Address and Port Enable) to match your communications system.

Using ION Setup

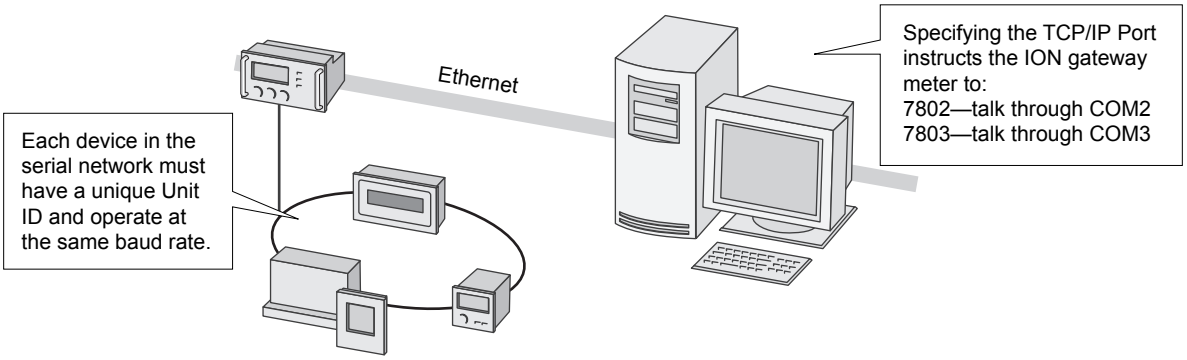
1. Open ION Setup and connect to your meter, using Basic Mode.
2. In the Setup Assistant, navigate to the Communications folder.
3. Click on the Network Settings folder to configure Ethernet communications.



4. Click on the various tabs to configure the meter's TCP/IP, DNS, NTP and SMTP settings. To change a setting, select the parameter and click **Edit**.

The EtherGate protocol

When a meter installed on the Ethernet network has EtherGate enabled, a master device can communicate through the meter to a serial network of devices wired to the meter's COM port. EtherGate is available on serial ports COM2 and COM3. The protocol permits the direct transfer of data from up to 62 devices (31 devices per COM port).



Once you have the chain of serial devices installed, use ION Setup or the meter's front panel to change the COM2 or COM3 Protocol setting to EtherGate. The transfer of data between protocols is then handled automatically.

Refer to *The ION Meter as an Ethernet Gateway* technical note for information on configuring your meter for EtherGate.

Modem communications setup

See “Serial Communications Setup” on page 70 for configuring COM4. Additional modem configuration required is explained in the following section.

ModemInit setup register

The *ModemInit* string register defines the initialization string for the internal modem, with a maximum of 47 characters. Edit the *ModemInit* register and enter the initialization string desired. The string is sent to the modem as soon as you download the COM4 module. Note that the string is also sent to the modem whenever the meter is powered up, or whenever the baud rate in the Comm 4 Communications module is changed. Any changes to the *Modem Init* or *Baud Rate* setup registers while the modem is online will cause the modem to disconnect from the phone line.

Modem initialization strings

Refer to the *Modem AT Commands* technical note for a complete list of AT commands for your modem.

Adjusting the modem initialization string for CTR-21 compliant modems

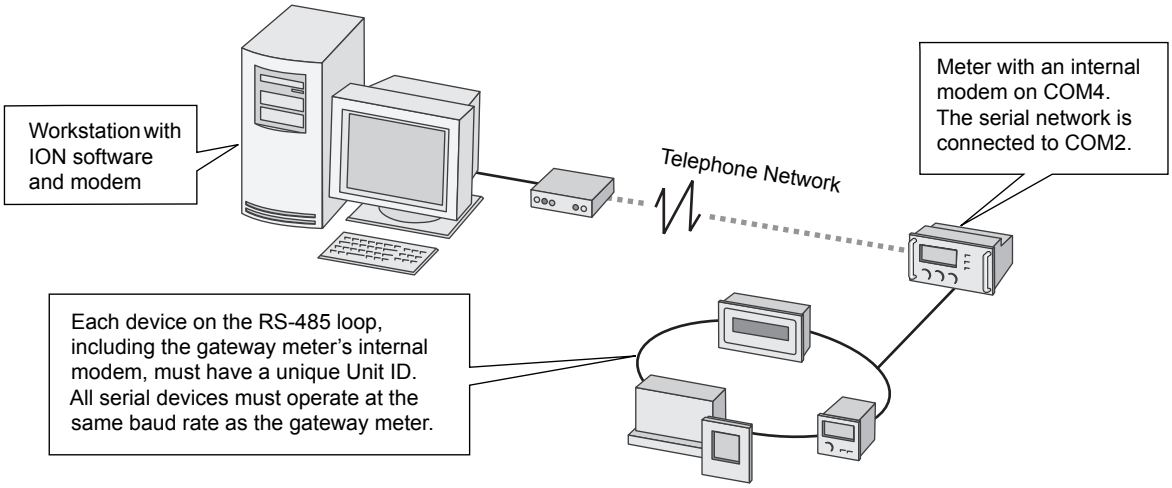
The table below shows the strings to add to the end of your modem configuration string setup register for each of three possible problems.

Problem	Add to modem initialization string
Does not answer (modem does not detect ring tone)	*NC70
Does not dial (modem does not detect dial tone)	In order of preference: *NC70, *NC70X0, *NC8 (Italy only)
Does not detect busy signal	*NC70

If your **local** modem (not the internal modem) is not already set up, configure it with the Remote Modem Configuration Utility according to the instructions in the online help. After the meter is installed and the internal modem is connected to the telephone network, the Com4 module can be configured using the meter’s front panel or ION software. To learn how to connect the internal modem to the telephone network, consult your meter’s Installation Guide.

The ModemGate protocol

The ModemGate feature creates a communications connection between the telephone network and an RS-485 serial network of devices. When you specify the protocol for a meter’s COM port as MODEMGATE, all data received by the meter’s internal modem is automatically transferred to the serial network. ModemGate is available on either COM2 and COM3, but you cannot use the protocol on both ports simultaneously.



ModemGate connections do not connect a workstation with a master device to the gateway meter's COM2 or COM3 port, but rather the gateway meter's internal modem port (COM4).

Refer to *The ION Meter as a ModemGate* technical note for information on configuring your meter for ModemGate.

Internet connectivity

Ethernet-equipped ION8800 meters allow you to connect to the internet so that you can receive meter emails, view real-time data, and configure your system through a web browser from anywhere in the world. Your meter provides the following internet connectivity options:

- WebMeter feature — this onboard web server allows you to view real-time data and configure the meter through a web browser.
- Meter internal email server feature — receive data logs and email alerts from the meter.

WebMeter feature

WebMeter-enabled meters have an on-board web server. Built-in web pages display certain energy and basic power quality information and also support basic meter configuration tasks. A meter with the WebMeter feature can be connected to your corporate Ethernet network like any other network device, and you can access it with a standard web browser like Internet Explorer.

Refer to the *WebMeter Internal Web Server Feature* technical note to learn how to:

- view your WebMeter data on the Internet
- configure your WebMeter-enabled meter
- set up your network for the WebMeter feature
- enable/disable web browser configuration of the meter

Meter email feature

The meter e-mail feature allows your meter to send data logs as email attachments to a workstation, pager, cell phone, or PDA. In addition to the log export function, your meter can send email alerts.

Refer to the *Meter Internal Email Client Feature* technical note to learn how to:

- view meter email data
- set up your network for meter email data
- configure your meter to use meter email
  - set up the meter for your SMTP Server
  - set up the meter email feature to send alerts
  - set up the meter email feature to send data logs

FTP for IEC 61850 and COMTRADE

The meter can function as an FTP server, supporting IEC 61850 protocols and COMTRADE formatted waveform files. The FTP timeout period is 90 seconds on a control port. Only one simultaneous FTP transfer connection is permitted. To connect to your meter, ensure that your FTP software is configured to only use a single FTP connection. The recommended FTP software is Windows Explorer or WinSCP running on a Windows-based machine.

NOTE: To connect to your meter using Windows Explorer, you must include the login and password in the FTP connection string. For example:

- Standard meter security (no user configured)
- Front panel password changed from the default password (0) to **2**

To connect to a meter with an IP address of **123.45.6.78**, the Windows Explorer connection string would be **ftp://0:2@123.45.6.78**.

The meter communicates via FTP on the following port:

Port	Description
21	Incoming commands connections
20	Active data connections
3000-3020	Passive data connections

File names are limited to ASCII characters that do not contain a blank space or /, \, “, *, ?, <, >, and have a maximum length of 64 characters.

For more information about using FTP for IEC 61850 or COMTRADE, refer to the *IEC 61850 and ION Technology* protocol document or the *COMTRADE and ION Technology* technical note.

Communications LEDs

The following table explains what the flashing LED lights on the back of the Communications module signify.

LED	Color	Function
Ethernet ACTIVITY	Green[1]	Flashes as signals are transmitted and received for both Ethernet and Fiber ports
Ethernet LINK	Green[1]	On as long as there is an active connection to either the 10/100 Base or 100 FX ports
Internal Modem DCD	Green	Carrier Detect – Indicates the presence of a carrier signal (active connection to the modem)
Internal Modem RI	Green	Flashes when the modem detects rings (Ring Indicator)
COM4 TRANSMIT	Yellow[1]	Flashes as signals are transmitted from the COM4 internal modem
COM4 RECEIVE	Yellow	Flashes as signals are received on COM4 internal modem
COM2 TRANSMIT	Yellow	Flashes as signals are transmitted from the COM2 RS-485 loop
COM2 RECEIVE	Yellow	Flashes as signals are received on COM2 RS-485 loop

LED	Color	Function
COM3 TRANSMIT	Yellow	Flashes as signals are transmitted from the COM3 RS-232 connection or the COM3 RS-485 loop
COM3 RECEIVE	Yellow	Flashes as signals are received on COM3 RS-232 connection or the COM3 RS-485 loop

[1] LED colors may differ from the standard yellow and green.

Syslog

Syslog uses the User Datagram Protocol (UDP) to transport event log information from the meter directly to a centralized syslog server. The server can receive logs from many devices, then store and filter the logs as needed. You can use ION Setup to modify the syslog network settings for your device. Syslog is a useful feature to help maintain meter log information for extended periods of time.

NOTE: Ethernet is required to use the Syslog feature.

Syslog server

Syslog is an open standard, which allows you to use any one of a number of syslog server applications currently available. The decision regarding which syslog server solution to use is based on your budget and technical requirements. See the individual syslog server's documentation for more information.

Once you have the syslog server installed and configured, record the location (IP address) of the server. This information is needed when configuring the meter's syslog network settings in ION Setup.

NOTE: Syslog is not accessible through the meter's display.

Configuring Syslog network settings using ION Setup

1. Open the Setup Assistant for your meter. See the ION Setup Help for instructions.
2. Select **Communications > Network Settings** and click the **SysLog** tab.
3. Select **Enable Syslog** and click **Edit**. Select **Yes** to enable the syslog feature or select **No** to disable. Click **OK**.
4. Select **Syslog Server** and click **Edit**. Enter the location for the syslog server. This value is entered as an IP address in the format aaa.bbb.ccc.ddd. Click **OK**.
5. Verify that the syslog server is receiving log information from the meter.

NOTE: If the *Enable Syslog* register is enabled but the *Syslog Server* register does not contain an IP address, an event is created in the event log that informs you that the syslog is enabled with no server IP.

Event log priority to syslog severity

The table below shows the mapping between ION event priorities (0-255) and the syslog severities. Only four of the syslog severities are used in the mapping.

ION event priority range	ION event priority name	Syslog severity
0-63	None	6 - Informational
64-127	Low	5 - Normal but significant condition
128-191	Medium	4 - Warning condition
192-255	High	2 - Critical condition

Ethernet protocol control

The Ethernet protocol control feature allows you to enable, disable, or change the port number of the Ethernet protocols supported on your meter.

If you are connected to your device over Ethernet, changing Ethernet configuration parameters without another method of configuration enabled may cause loss of communications with your device and render it inoperable. In this case a factory reconfiguration of your device is required, which resets your device to its factory defaults and all logged data is lost.

NOTICE
DATA LOSS Ensure you maintain sufficient access to communicate to and configure your device. **Failure to follow these instruction can result in data loss.**

NOTE: The protocol port number may not be configurable on all protocols.

NOTE: You cannot change the Ethernet port assignments through the meter's display.

Using the display

1. Press and hold the ALT/ENTER button for a few seconds. The SETUP menu appears.
2. Use the navigation buttons to highlight NETWORK SETUP and press ALT/ENTER to select.
3. Use the navigation buttons to highlight PORT ENABLE and press ALT/ENTER to select.
4. Use the navigations buttons to highlight the protocol you want to disable and press ALT/ENTER to select.
5. Select Yes or No to enable or disable the protocol and click ALT/ENTER. Enter password if required.

Using ION Setup

1. Open the Setup Assistant for your meter. See the ION Setup Help for instructions.
2. Select **Communications** > **Network Settings** and click the **Protocols** tab.
3. Select a protocol from the list and click **Edit**.
4. Select the **Enabled** checkbox to enable the port.

NOTE: The IEC 61850 port is enabled when a valid CID file is uploaded to the meter. The port is disabled by removing the CID file.

NOTE: The EtherGate port is enabled if the applicable serial port is set to EtherGate. If the serial port is set to a different protocol, the EtherGate port is closed.

5. Select a port number from the **Port Number** dropdown list or by clicking in the **Port Number** field and entering a port number. Existing connection are not affected by the change, but any new connections must comply with the meter's latest settings.
6. Click **OK**. If multiple ports are set to the same number, ION Setup responds with a message indicating that the port is already in use by another protocol.

NOTE: When configuring the FTP ports, the data connection port is automatically assigned to the command connection port number minus 1. For example, if the command connection port number is 21, the data connection port number is 20.

Chapter 8 Third-party protocols

This chapter explains how Modbus, IEC 61850 and DNP 3.0 protocols are implemented on the meter.

For instructions on using the meter with Modbus, DLMS, IRIG-B, IEC 61850 and MV-90 protocols, see the following documents:

- *Modbus protocol and register map for ION devices* protocol document
- *Modbus and ION Technology* technical note
- *DLMS/COSEM and ION technology* protocol document
- *IRIG-B GPS Time Synchronization* technical note
- *IEC 61850 and ION technology* protocol document
- *MV90 and ION technology* technical note

Protocol overview

All ION8800 meters support DNP 3.0, Modbus RTU and Modbus/TCP protocols; only ION8800A and ION8800B meters support Modbus Mastering, and only meters with Ethernet support IEC 61850.

While your meter is factory configured to **send** data (acting as Modbus Slave), it is not ready to **receive** data as a Modbus Master until you set up the necessary framework. The meter is also pre-configured to **send** DNP 3.0 data to a DNP Master. To configure your meter to act as an IEC 61850 server, you must load an IEC 61850 configuration file into the meter and configure and enable the IEC 61850 client connections.

Most Modbus and DNP slave modules, and IEC 61850 mapping modules on the meter are factory pre-set and only require basic configuration, such as communications setup.

NOTE: Changing the default factory third-party protocol frameworks and modules (or creating new frameworks to enable receive functionality) is an advanced setup procedure that requires an understanding of the protocol, as well as an understanding of the meter's internal operation. Refer to the DNP modules, IEC 61850 modules and Modbus modules descriptions in the *ION Reference*, as well as the technical notes *Multiport DNP 3.0 and ION technology, IEC 61850 and ION technology* and *Modbus and ION technology,* as well as the protocol documents *Modbus protocol and register map for ION devices*, *IEC 61850 and ION technology* and the *ION8800 DNP 3.0 Device Profile* before proceeding.

Communications protocol configuration

In order to use the factory Modbus or DNP configuration, you must first assign the communications channel you want to use. By default, all communications ports are configured to use the ION protocol. Choose the 3rd-party protocol you want from the list of available protocols in the Communications module's Protocol setup register. See "Communications" on page 63 for instructions.

Modbus RTU is available on each of the meter's communications ports, and multiple ports can communicate using Modbus simultaneously. Up to three ports can use the DNP 3.0 protocol at any one time. Additional configuration is required to enable DNP slave functionality on multiple ports, beyond selecting the protocol on a communications port (see the *Multiport DNP 3.0 and ION technology* technical note for more information). IEC 61850 has dedicated Ethernet communications connections,

and the IEC 61850 configuration process is detailed in the *IEC 61850 and ION technology* protocol document.

The meter as Modbus slave

All ION8800 meters can act as a Modbus Slave, using both the Modbus RTU and Modbus/TCP protocols.

See the *Modbus and ION Technology* technical note for more information on using your meter as a Modbus slave, and the *Modbus protocol and register map for ION devices* protocol document.

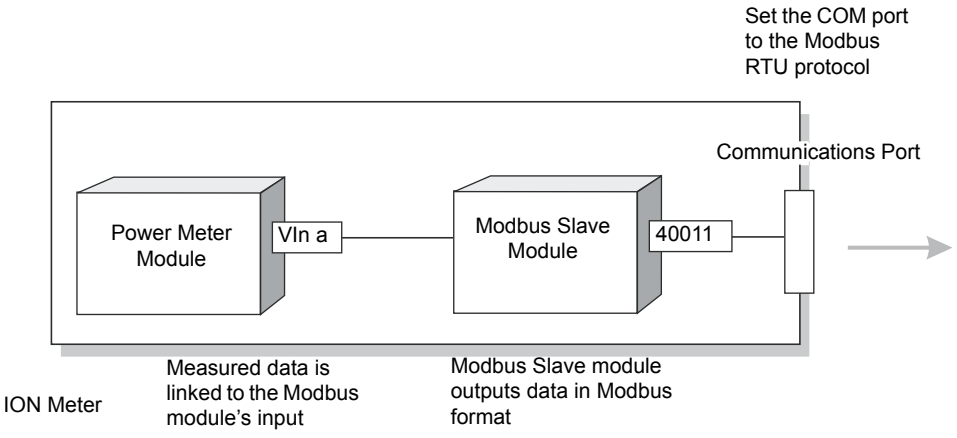
Using the Modbus RTU protocol

ION8800 meters acting as Modbus Slave devices can make any real-time data available through the Modicon Modbus RTU protocol. Modbus Master devices connected to the meter can access (read) this data or write data to the meter's ION registers to make device configuration changes.

The factory Modbus slave configuration

The meter makes data available to Modbus Master devices using pre-configured Modbus Slave modules. These modules are linked to other modules in the meter that provide the energy, power and demand data. Once a communications channel is configured to use Modbus RTU protocol, the data is available to Modbus Master devices.

NOTE: Connect to TCP Port 7701 for Modbus RTU communications over Ethernet. The default Modbus unit ID of the meter over Ethernet is 100 but it can be changed to any value.



As the data available through the Modbus Slave modules is in a specific format, knowledge of the Modbus protocol and an understanding of the settings used in the meter are required to interpret the data provided.

Changing the Modbus configuration

If the factory Modbus configuration does not suit your needs, the existing Modbus Slave modules can be relinked to other parameters that you want to access through Modbus.

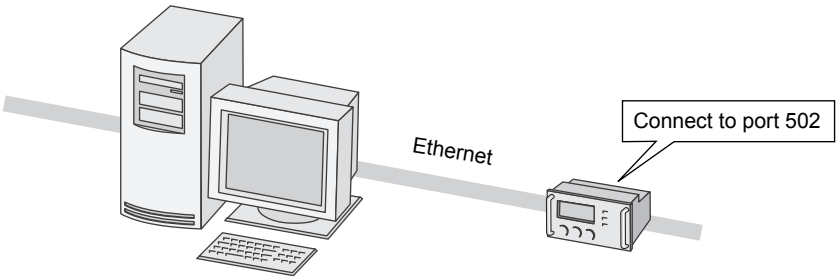
If your Modbus Master device requires data in a format different than that provided by the factory Modbus configuration, you can edit the setup registers in the Modbus Slave modules. These setup registers specify the Modbus format, scaling and base address settings. Refer to the *ION Reference* for details on the Modbus Slave module.

Using the Modbus/TCP protocol

Modbus/TCP defines the packet structure and connection port (port 502) for the industry standard TCP/IP protocol. The structure of a Modbus/TCP packet is very similar to the Modbus RTU packet except that it has an extra six-byte header and does not require the cyclic redundancy check (CRC). Modbus/TCP retains the Modbus RTU limit of 256 bytes to a packet.

Modbus/TCP communications

You can communicate to the meter using Modbus/TCP. Your meter must have the optional Ethernet port. Configure the meter to connect using port **502** to use Modbus TCP communications protocols.



NOTE: You cannot make an EtherGate connection to the Modbus/TCP network.

Configuring the meter as a Modbus slave

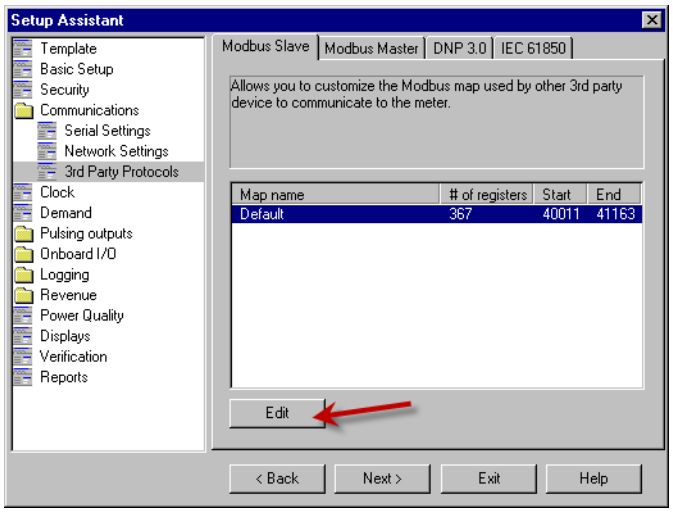
Using the front panel

You cannot configure Modbus through the meter's front panel; you can only assign the Modbus protocol to communication ports (see "Communications" on page 63 for details).

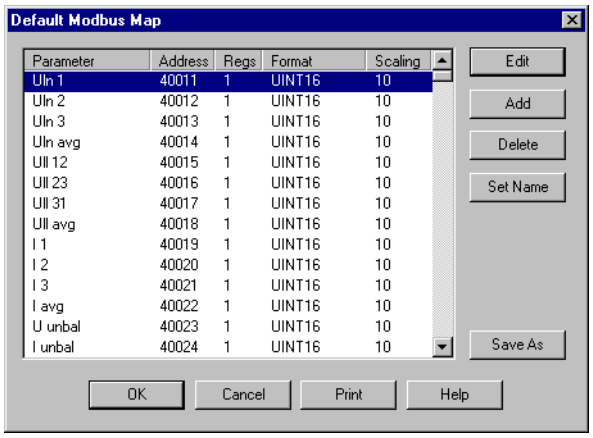
Use ION Setup to perform full Modbus configuration.

Using ION Setup

1. Open the Setup Assistant for your meter. See the ION Setup help for instructions.
2. Select **Communications > 3rd Party Protocols**.
3. Click the **Modbus Slave** tab.
4. Select the map name (in this example, the Default) and click **Edit**. Enter the meter password, if prompted. The Default map is displayed.



5. Edit, add, delete or set the name of Modbus Slave module registers as required.



Modbus slave modules

Your meter is pre-configured with five modules. (ION8800 meters with the EN50160 ordering option have 11 additional modules). The Modbus registers and their parameters are described in the *Modbus protocol and register map for ION devices* protocol document, available from www.powerlogic.com.

Importing data using Modbus RTU

It is possible to bring data into the meter using Modbus. Various ION registers can be written by Modbus Master devices by correlating the Modbus register number with the address of the ION register you want to write. When a Modbus register is written with a value, the corresponding ION register will be written, provided the Modbus RTU protocol is active on the communications channel that connects the Modbus Master to the meter.

You can use the Modbus RTU protocol to write values into ION external numeric, pulse and Boolean registers, allowing you to enable, disable and reset meter functions. You can also use the Modbus protocol to change setup register values in various ION modules to configure the meter's operation.

NOTE: To bring data into the meter with Modbus RTU, you must disable the meter's Standard (password) security.

NOTE: Writing to ION external Boolean or external numeric registers via communications at a high rate (faster than once per minute) can cause loss of data in the event of a power failure. Use of an uninterruptible power supply (UPS) is recommended for such heavy logging configurations.

The meter as Modbus Master

ION8800A and ION8800B meters can act as a Modbus Master using the Modbus RTU and Modbus/TCP protocols, and can support Modbus Mastering through serial connections between the ION8800 meter's COM2 and COM3 ports and the Modbus Slave devices. Firmware versions 332 (v332) and later allow your meter to Modbus Master over TCP/IP using up to ten available TCP sockets.

The ION meter acting as Modbus Master can write data to (export) and read data from (import) Modbus Slave devices, using various ION modules. The data can be processed by the meter and sent out using other communications methods (email, ION Setup, etc.). The meter can also send control commands or data directly to other devices on a Modbus network.

The factory Modbus Master configuration

There is no pre-configured framework for Modbus mastering on your meter. This functionality must be enabled by configuring the following modules in your meter's framework.

ION modules for Modbus Mastering

Several ION modules work together to create Modbus mastering functionality on the meter. Your meter has some or all of these modules, depending on the model and firmware version. See the *ION Reference* for more information on these and other ION modules:

- **Modbus Master Device module:** reads data from a Modbus slave, which can be an ION meter or third-party device. This imported data can be used by other ION modules. The Modbus Master Device module references a Modbus Master Map module setup register to specify the Modbus format, scaling, and base address settings.
- **Modbus Master Map module:** provides a common place to hold setup information (used to decode a Modbus response) for specific device types. This information can then be referenced by multiple Modbus Master Device modules.
- **Modbus Master Options module:** maps any serial connection or Ethernet TCP socket from the Modbus Import, Modbus Export and Modbus Master Device modules to any serial communications port or unique IP address and port number.
- **Modbus Export module:** provides write functionality.
- **Modbus Import module:** provides read functionality. This data can then be used by other ION modules.

See the *Modbus and ION Technology* technical note for more information on configuring Modbus mastering.

Configuring the meter as Modbus Master

Using the front panel

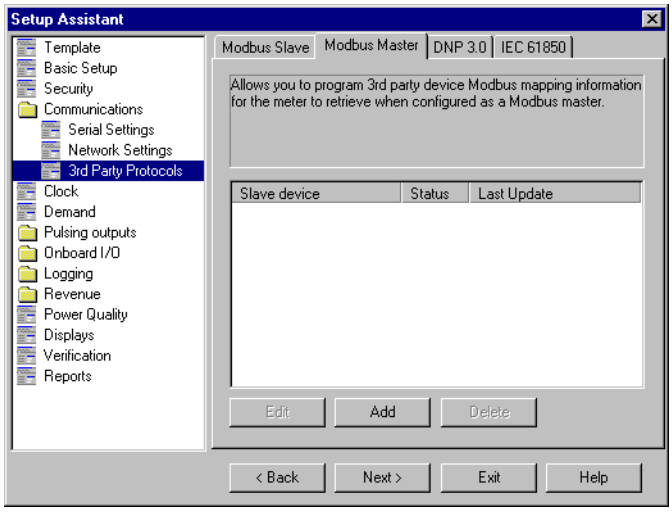
You cannot configure Modbus through the meter's front panel; you can only assign the Modbus protocol to communication ports (see "Communications" on page 63 for details).

Use ION Setup to perform full Modbus configuration.

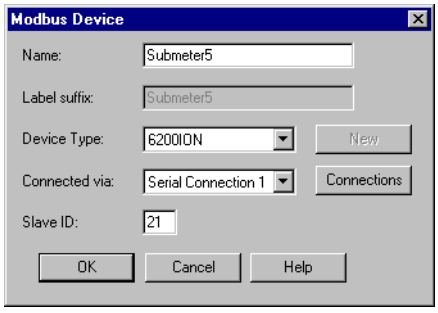
Using ION Setup

The Modbus Setup Assistant helps you configure Modbus Master functionality for your meter.

1. Open the Setup Assistant for your meter. See the ION Setup help for instructions.
2. Select **Communications > 3rd Party Protocols**.
3. Click on the **Modbus Master** tab.
4. Click **Add** to add a Modbus Slave device or **Edit** to modify an existing device. The **Modbus Device** screen appears.



5. Enter the Slave device's name and a label suffix, and select the device type of the slave device (in this example, an ION6200).

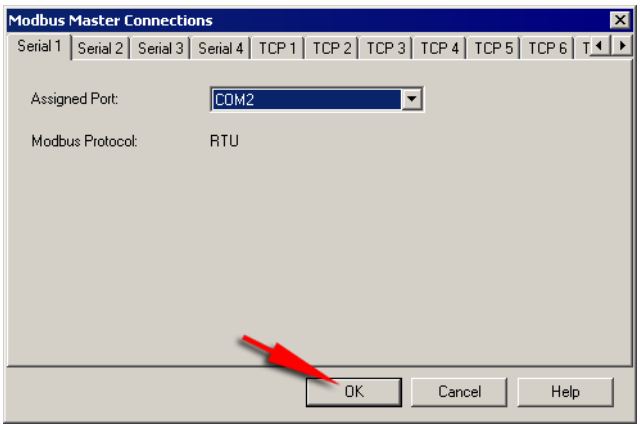


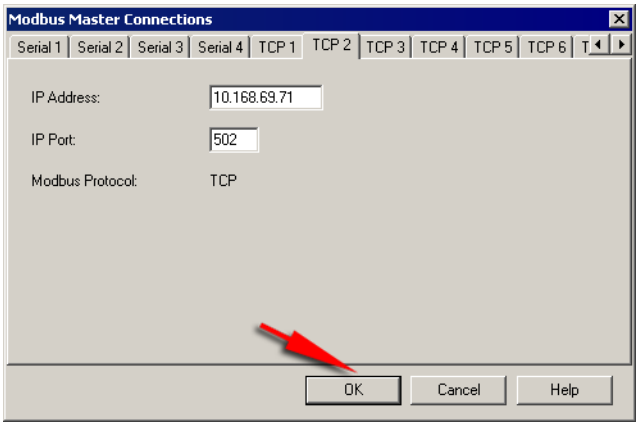
6. Click **Connections** to edit the connection used by the Modbus Master to connect to this Slave device.
   – Serial Connections: Select the appropriate port from the drop-down list.

NOTE: The total number of possible serial connections is limited by the number of physical serial ports on the meter that support Modbus Mastering. The ION8800 has two physical serial ports that support Modbus Mastering.

– TCP Connections: Enter the IP address of the Modbus slave device, followed by the IP port (502). Up to ten unique IP addresses can be entered.

NOTE: The meter as a Modbus Master over TCP/IP will attempt to communicate to a slave for up to 100 seconds (as per the RFC1122 standard) before moving on to the next slave device.





7. Click **OK** to add the Slave device. The device now appears in the list. Continue adding devices by clicking **Add** until all your devices are entered.

See the *Modbus and ION Technology* technical note for more information.

Using the DNP 3.0 protocol

The Distributed Network Protocol Version 3.0 (DNP 3.0) is an open protocol used in the electric utility industry for communications and interoperability among substation computers, Remote Terminal Units (RTUs), Intelligent Electronic Devices (IEDs, e.g. meters), and Master Stations.

The ION8800 meter can be integrated into a DNP network as a DNP Slave, using the DNP Slave Import, DNP Slave Export and DNP Slave Options modules. For more information on the various DNP modules, see the *ION Reference*.

Your meter supports a maximum of three concurrent connections (or “sessions”) using the DNP 3.0 protocol; one for each serial port, up to three using Ethernet, or a combination of both. Available combinations depend on the meter's communications options. A session consists of all incoming and outgoing DNP Master/Slave traffic on one of the meter's communications ports.

Consult the DNP User’s Group at http://www.dnp.org/ to learn more about the protocol.

The factory DNP 3.0 configuration

Your meter is pre-configured with a DNP framework that allows for basic DNP Slave functionality. DNP Slave Export modules are used to send data to the DNP Master while DNP Slave Options modules provide per-session settings such as communications options. Although some minor setup of the framework is necessary before it becomes enabled (assigning the DNP protocol to the communications ports etc.), most module settings should not require alteration.

For information on your meter’s default DNP map and factory configuration, see the *ION8800 DNP 3.0 Device Profile*.

Importing data using DNP 3.0

Data can be imported into the meter from a DNP control relay or analog output device. DNP Slave Import modules are used to take a DNP Analog output or Binary output object and map them into ION registers.

NOTE: DNP Slave Import modules are not part of the factory DNP framework and must be added manually. Refer to the DNP Slave Import module description in the *ION Reference* for details.

Configuring DNP 3.0

If the factory DNP configuration does not suit your needs, you can relink the existing DNP Slave Export modules to access a different set of parameters through DNP. Alternately, you can add additional DNP Slave Export modules and link the desired ION parameters to them.

If your DNP network requires data in a format different than that provided by the factory DNP configuration, you can edit the setup registers in the DNP Slave Export modules and the DNP Slave Options modules. Do not make any changes to the DNP Slave Options modules' setup registers unless you understand the effects each change will cause. Refer to the *ION Reference* for complete details on DNP Slave Export and DNP Slave Options module function.

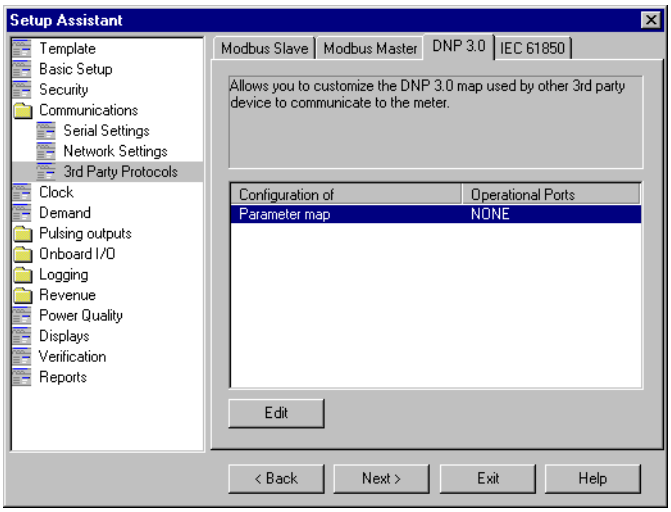
For detailed information on configuring your meter to use DNP, see the *Multiport DNP 3.0 and ION Technology* technical note.

Using the front panel

You cannot configure DNP through the meter's front panel. You can only assign the DNP 3.0 protocol to communication ports. See "Communications" on page 63.

Using ION Setup

1. Open the Setup Assistant for your meter. See the ION Setup help for instructions.
2. Select **Communications > 3rd Party Protocols.**
3. Click the **DNP 3.0** tab.
4. Select the DNP feature you want to configure (Parameter Map in this example) and click **Edit**.



5. The Setup Assistant guides you through DNP configuration. See the *ION Setup Online Help* for more information.

Using the IEC 61850 protocol

IEC 61850 is an Ethernet-based protocol designed for electrical substations. It is a standardized method of communications, developed to support integrated systems composed of multi-vendor, self-describing IEDs (intelligent electronic devices) that are networked together to perform monitoring, metering, and real-time, non-critical protection and control. The ION8800 meter supports Edition 1 and 2 of the IEC 61850 protocol.

NOTE: You must have an Ethernet connection on your meter to use IEC 61850.

Your meter can be integrated into an IEC 61850 system as an IED (or server), supporting a maximum of four concurrent IEC 61850 client connections and one FTP connection (used for transferring data or configuration files).

Use ION Setup to enable IEC 61850 control of your meter's optional I/O ports and to map additional meter values into IEC 61850. See "Configuring IEC 61850" on page 90 for more information and safety precautions. All other IEC 61850-specific configuration is done using an IEC 61850 configuration tool and your IEC 61850 client software.

Additional information

For more information, refer to the following:

- *IEC 61850 and ION Technology* protocol document provides more information about how IEC 61850 is implemented on your meter.
- *ION Reference* describes the IEC 61850 ION modules.
- The IEC (International Electrotechnical Commission) website at www.iec.ch provides general information about the IEC 61850 protocol.

The default IEC 61850 configuration

Your meter's factory template includes an IEC 61850 framework already configured with a default set of meter data mapped into IEC 61850. This default set of meter data is used in the default data sets and reports in the ICD files available from the website.

You must load a valid IEC 61850 configuration (CID) file into the meter in order to activate the IEC 61850 features of your meter.

Your meter has five (5) dedicated IEC 61850 client connections and one FTP connection.

Configuring IEC 61850

No meter port configuration is required for IEC 61850, but the meter must have an operating Ethernet connection for IEC 61850 client connections and for FTP transmission of configuration and data files.

Configuring additional ION data into IEC 61850

The IEC 61850 ICD file for your meter contains a comprehensive set of default data values. Additional meter data values can be made available in IEC 61850 by mapping the ION data to the GGIO Custom Analog or GGIO Custom Digital modules.

Using the front panel

You cannot configure IEC 61850 through the meter's front panel.

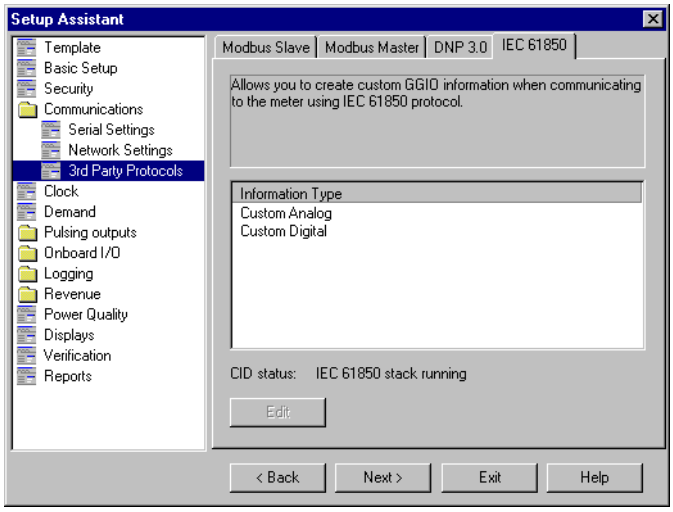
Using ION Setup

In ION Setup:

1. Open the Setup Assistant for your meter. See the ION Setup Help for instructions.
2. Select **Communications > 3rd Party Protocols** and select the **IEC 61850** tab.

   The CID status line indicates whether the meter has received and validated an IEC 61850 CID file and is operating as an IEC 61850 server:

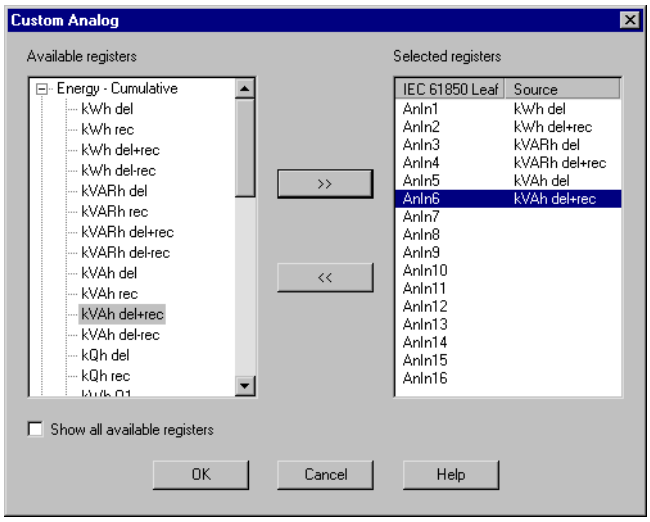
   – **IEC 61850 stack running**: the meter has received and validated an IEC 61850 CID file and is operating as an IEC 61850 server.
   – **Missing CID file**: no IEC 61850 CID file is loaded into the meter.
   – **Invalid CID file**: the IEC 61850 CID file is invalid.



3. Select the custom option that matches the data you want to map and click **Edit**. Custom Analog allows you to map additional numeric (analog) values, and Custom Digital allows you to map additional Boolean/binary (digital) values into IEC 61850.

NOTE: Because Custom Analog and Custom Digital are ION modules, they can be configured at any time, regardless of CID status.

4. Expand the Available registers list and select the meter's analog or digital value that you want to map into IEC 61850. Highlight the IEC 61850 leaf you want to map onto and click the **>>** button to map the meter's value to IEC 61850. Click the **<<** button to remove the value. Select **Show all available registers** to show all the ION modules and their registers. Click **OK** to send your changes to the meter.



Configuring meter digital I/O control via IEC 61850

By default, your meter's I/O status values are available via IEC 61850. You can configure the meter to provide IEC 61850 control of the meter's optional digital output hardware ports by configuring the GGIO Onboard module (in ION Setup advanced mode) and the Digital Output module (through the ION Setup Assistant).

NOTE: Refer to "Configuring inputs and outputs" on page 110 for details on how to configure your meter's digital inputs and outputs.

To control your meter's digital outputs via IEC 61850, you must configure the Digital Output module's *Source* register to be the IEC 61850 digital status value (*SPCS.stVal*) output register. This output register is written by the IEC 61850 system into the IEC 61850 GGIO Onboard module. You must also disconnect the Digital Input module's *Status* output register from the IEC 61850 GGIO Onboard *Digital Output Status* input register or else you will create a circular reference and the modules will go offline. Refer to the *ION Reference* for details of the IEC 61850 GGIO Onboard module.

⚠ WARNING

HAZARD OF UNINTENDED OPERATION

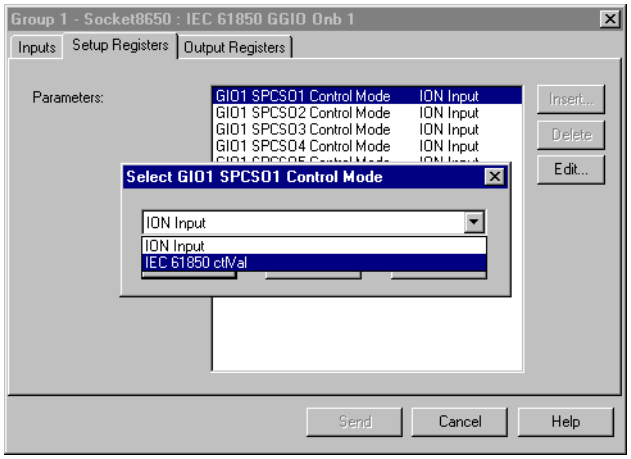
- Do not use the meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Using ION Setup

1. Connect to your meter in Advanced Mode. See the ION Setup Help for instructions.

2. Navigate to the GGIO Onboard folder and double-click on the module in the right-hand pane.
3. Select the **Setup Registers** tab.
4. Select the *SPCS Control Mode* register that corresponds to the digital output you want to control through IEC 61850 and click **Edit**. A dialog box appears.
5. Select IEC 61850 CTLVAL from the dropdown list and click **OK**.

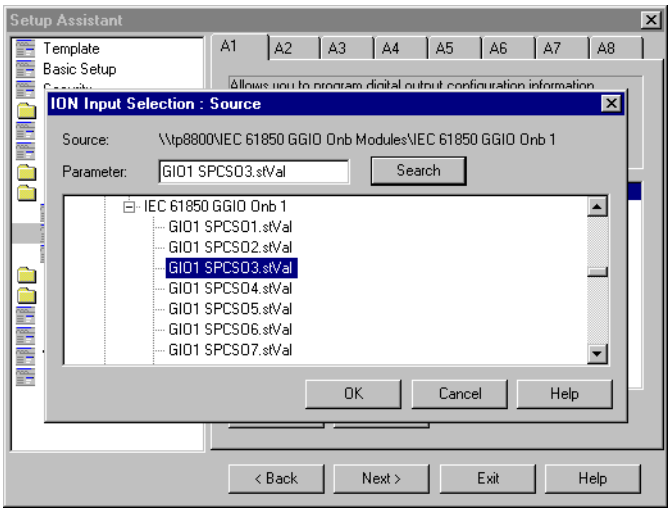


6. Select the **Inputs** tab.
7. Select the digital output *Status* register for the digital output that you want to control through IEC 61850. Click **Delete**.

NOTE: The digital input *Status* register must be deleted in order to prevent a circular reference that will cause the affected modules to go offline.

8. Click **Send** to send your changes to the meter.
9. Open the Setup Assistant for your meter. See the ION Setup help for instructions.
10. Select either:
    - **Onboard I/O > Form A Outputs** to configure a form A digital output for IEC 61850 control.
    - **Onboard I/O > Form C Outputs** to configure a form C digital output for IEC 61850 control.
11. Click the tab corresponding to the digital output that you want to control through IEC 61850.
12. Select *Source* and click **Edit**. The **Input Selection** screen appears.

13. Navigate to the IEC 61850 GGIO Onboard module and select the *SPCS.stVal* output register that corresponds to the digital input..



14. Click **OK** and **Send** to save your changes to the meter.

Chapter 9 Time and timekeeping

Your meter supports different time types and time synchronization methods to adjust its internal clock.

Time overview

The Clock module controls the meter's internal clock, which provides timestamps for data logged by the device. The clock needs to be configured properly to help ensure that logged data has accurate timestamp information. The Clock module also receives the time synchronization signals sent to it by the workstation running ION software, updating the device's clock when required.

The Clock module's *Clock Source* setup register defines how the meter's internal clock auto-corrects drift from its internally calculated time. A separate time source (such as a GPS receiver or a DNP Master) can be used to synchronize the clock through a communications channel. By default, the clock is set to synchronize from the line frequency.

Go to www.powerlogic.com and download the *Time synchronization and timekeeping* technical note for information about time formats and settings, and the *ION Reference* for a detailed description of the Clock module and its operation.

NOTE: References to NTP in ION devices or documentation should be interpreted as SNTP.

Configuring the meter clock

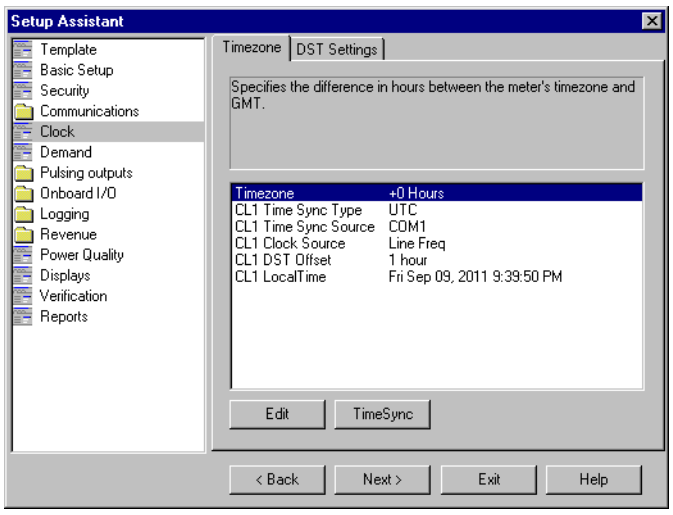
Use ION software to change the meter's clock settings.

Using the meter display

You cannot configure the time via the meter's display.

Using ION Setup

1. Open the Setup Assistant for your meter. See the ION Setup help for instructions.
2. Select **Clock**.



3. Click the **Timezone** tab to configure your meter's clock settings. Select a parameter and click **Edit** to change.
4. Click the **DST Settings** tab to configure your meter's daylight savings periods for up to 20 years. Select a parameter and click **Edit** to change.

NOTE: Typically, the *DST Start* and *DST End* registers do not have to be reconfigured for users in North America. The factory defaults are the DST start and end dates for 20 years, in UNIX time (the number of seconds since 00:00:00 UTC on Jan. 1, 1970).

Time synchronization

Time synchronization lets you synchronize your meter's internal clock with all of the other meters, devices, and software in a network. Once synchronized, all data logs have timestamps that are relative to a uniform time base. This helps you achieve more precise sequence-of-events and power quality analyses. Use ION software to broadcast time signals across the network or utilize an external source (such as an NTP server or DNP Master) to synchronize your meter's clock.

Refer to the *Time Synchronization & Timekeeping* technical note for more information on implementing time synchronization.

Refer to the *DLMS/COSEM and ION Technology* protocol document for information on time synchronization with DLMS.

For meters with the IRIG-B ordering option, refer the *IRIG-B GPS Time Synchronization* technical note that came with your meter.

IRIG-B time synchronization

ION8800 meters that come with an IRIG-B connection for GPS time synchronization use unmodulated IRIG-B time code data. The meter is configured to synchronize via IRIG-B GPS after you wire the meter to a GPS receiver and set the clock *Time Sync Source* and *Clock Source* parameters.

Any GPS receiver that outputs unmodulated IRIG-B time code data can be used as a time synchronization source.

You can configure IRIG-B time synchronization to update if the GPS receiver is locked onto a satellite source or to update regardless of whether or not the GPS receiver is locked onto a satellite source. Refer to the Clock module description in the *ION Reference* for more information on this setting.

IRIG-B standard and specifications

The standard is outlined in the IRIG-STANDARD 200-04 "IRIG Time Code Formats" prepared by the Time Committee, Telecommunications and Timing Group, Range Commanders Council.

Accuracy	+/- 1 ms
Format	IRIG-B00x[1] format (unmodulated IRIG-B time code)
Nominal Voltage	5 Vdc +/- 10%
Maximum Voltage	8 Vdc

[1]Coded expressions 0 to 7 are supported but the year data is not used by the meters.

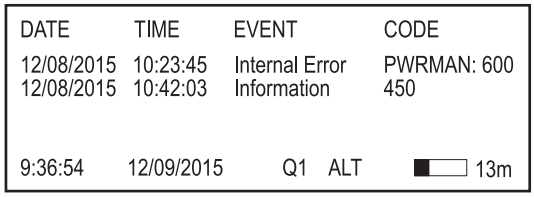
Meter battery

The battery in the ION8800 meter keeps the real-time clock running when supply power is lost. Replace the battery if the meter has been stored for an extended period of time without power (longer than two years). If the meter will be without power for an extended length of time, disconnect the battery cable to help the battery maintain its shelf life of up to 10 years.

Refer to your meter's *Installation guide* for instructions on replacing the meter battery.

Event Screen/Event Log confirmation (unpowered meter)

On an unpowered meter, the battery powers the internal clock. Removing the old battery effectively stops the meter's clock until the battery is replaced. Once replaced, the clock restarts at its last known power-down time. The ION8800 logs this as an event, which can be viewed from the Event Log on the meter's front panel (see "ALT mode default display screens" on page 139 for more information on navigating to the Event Screen). The Event Log appears as the following screen:



NOTE: Error codes are written at the time of power up, as indicated by their ION event timestamp

The meter records the following event codes after battery replacement on an unpowered meter:

Error code	Explanation	Recommended action
450	Seen only in combination with a '600' event.	Refer to 600, below.
600	Loss of up to 10 minutes of billing data and time late by as much as 10 minutes	Connect to the meter with ION software and synchronize the meter's internal clock. See "Configuring the meter clock" on page 95 for more information. Double-check battery installation (if required).

For details on resetting the meter's internal clock, see "Configuring the meter clock" on page 95.

Chapter 10 Demand

This chapter explains how to configure and view demand values on your meter.

Demand overview

Demand is a measure of average power consumption over a fixed time interval. Peak (or maximum) demand is the highest demand level recorded over the billing period. Sliding Window Demand modules are configured to calculate the average current demand and kW, kvar and kVA demand. The setup registers in the demand modules define time intervals for demand calculations, setting the sensitivity of the module's operation.

See the *ION Reference* for more information about these modules.

Configuring demand

Use the front panel or ION Setup to change your meter's demand settings.

Using the front panel

1. Press and hold the **Alt/Enter** button for a few seconds to access the Setup Menu.
2. Scroll using the **Up** or **Down** arrow buttons to select Demand Setup. Press the **Alt/Enter** button to access the Demand Setup menu.

Menu	Setting	Description	Range (values)	Default
Demand	SWD Subinterval	Intervals used to compute your Sliding Window Demand (SWD) values	1 to 5 940	600
	SWD # Subintervals	The number of SWD periods in use	1 to 15	3
	SWD Pred Resp	The speed of the predicted demand output	0,00 to 99,00	70

3. Scroll to the desired parameters using the **Up** or **Down** arrow buttons. Press the **Alt/Enter** button to access each parameter.

   Use the **Up** or **Down** buttons to edit the value of each parameter.

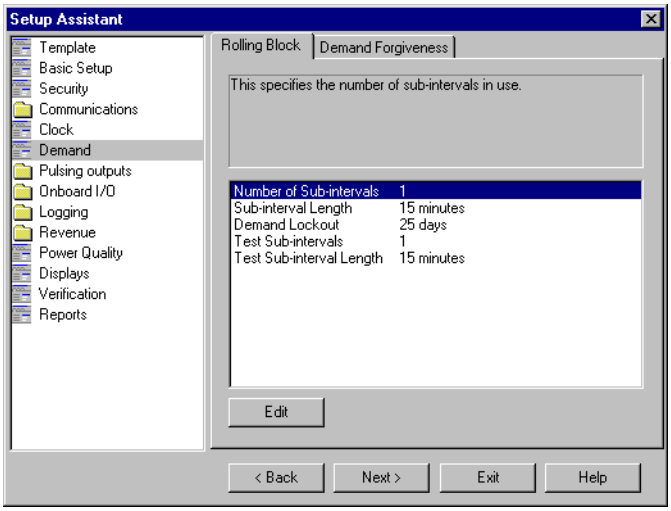
NOTE: You may be prompted for the meter's password the first time you attempt to change any values.

4. Select YES to confirm the change.

Using ION Setup

The Demand Setup Assistant helps you configure Sliding Window Demand. This screen also contains two registers used for configuring Sliding Window Demand while the meter is in TEST mode.

1. Open the Setup Assistant for your meter. See the ION Setup help for instructions.
2. Click **Demand**.



3. Click the **Rolling Block** tab.
4. Select a parameter to configure and click **Edit** (or double-click a parameter to edit).

Sliding Window Demand module settings

Sliding Window Demand is often referred to as Rolling Block Demand. To compute sliding window demand values, the Sliding Window Demand module uses the sliding window averaging (or rolling interval) technique which divides the demand interval into sub-intervals. Refer to the ION Reference for a detailed description.

The demand is measured electronically based on the average load level over the most recent set of sub-intervals. This method offers better response time than fixed interval methods.

Setup register	Function	Default
Sub Intvl	The time, in seconds, in the sliding window demand sub-interval.	Varies
#SubIntvls	The number of sub-intervals in the sliding window.	3
Pred Resp	The speed of Predicted Demand calculations; use higher values for faster prediction (70 to 99 recommended).	70
Update Rate	Defines the update rate of the *SWinDemand* output register	End of sub-interval

Demand Forgiveness

Demand Forgiveness is the time programmed into the meter during which demand (and therefore peak demand) will not be calculated in the power restoration period following a total power outage.

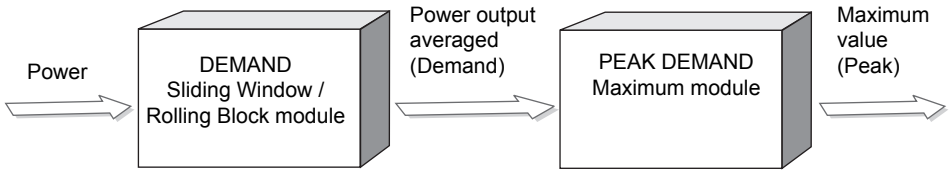
During power-up following a complete power outage, customer equipment consumes a higher than normal amount of power. The Demand Forgiveness feature lets a utility forgive the customer for peak demand penalties that may arise from power-up following a power outage (should the outage exceed a user-specified period of time).

Demand and Peak Demand module overview

Power utilities generally bill commercial customers based on their peak usage levels, called *peak demand* (in kW), and *energy consumption* (in kWh). Demand is a measure of average power consumption over a fixed time interval, typically 15 minutes. Peak (or maximum) demand is the highest demand level recorded over the billing period. *Sliding window/rolling block demand* is one method of measuring demand.

To compute sliding window demand values, the Sliding Window/Rolling Block Demand module uses the *sliding window averaging* (or *rolling interval*) technique which divides the demand interval into sub-intervals. The demand is measured electronically based on the average load level over the most recent set of sub-intervals.

In the following diagram, the Sliding Window/Rolling Block module labeled “Demand” calculates demand from the power input by measuring and averaging the power over a set interval. The demand value is then output to a Maximum module labeled “Peak Demand” that records the highest demand value over time (peak demand).



For information on ION modules, refer to the *ION Reference.*

Demand and Peak Demand module behavior during Demand Forgiveness

A peak demand value is the highest demand value since the last peak demand reset. The Demand Forgiveness framework sets the Sliding Window/Rolling Block module inputs to zero during a Demand Forgiveness period. This method allows demand interval data to accurately reflect a complete interval that includes data:

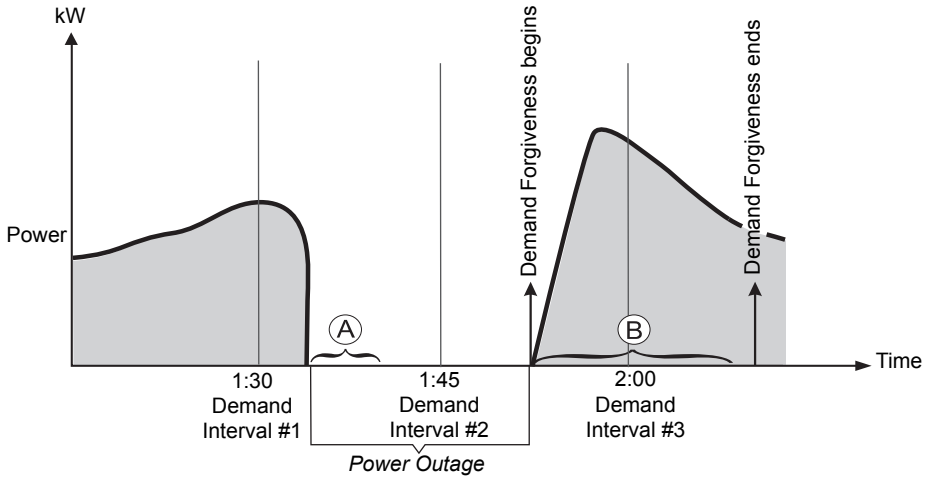
- prior to an outage
- during the Demand Forgiveness period (zero values)
- after the Demand Forgiveness period

NOTE: During a Demand Forgiveness period, Demand module inputs are set to zero and do not reflect actual demand. *These values should not be used to calculate energy for billing purposes*. Energy values are not affected and will reflect actual energy consumption during the Demand Forgiveness period.

The settings listed below must be made for Demand Forgiveness functionality. These settings can be accessed from ION Setup software; see “Using ION Setup” on page 104.

- *Minimum Outage Duration* lets you specify the amount of time (in seconds) that the power must be out before the Demand Forgiveness period begins.
- *Demand Forgiveness Duration* lets you specify the amount of time (in seconds) that demand is forgiven (demand inputs are zero).
- *Update Rate* lets you define the update rate of the *SWinDemand* output register and is set to EVERY SECOND by default for revenue-related demand modules. With this setting, demand value measured is updated once per second.

- *Outage Voltage* (line-to-line average in unscaled meter units) lets you define a voltage level that is considered an outage. This is set to 20 volts by default.



Ⓐ The specified amount of time that the power must be out before demand is forgiven
Ⓑ The specified amount of time that demand is delayed during the Demand Forgiveness period

The preceding diagram shows an example of a meter that is set up for Demand Forgiveness. The Sliding Window/Rolling Block Demand module is averaging demand values at 15 minute intervals. During interval #1, the meter has a power outage that lasts for 18 minutes. The power outage is defined by a system voltage of 20 volts which has been specified in the *Outage Voltage* setting. The *Minimum Outage Duration* setting is specified as 10 minutes, so this is amount of time that the power must be out before demand can be forgiven. The *Demand Forgiveness Duration* setting is specified as 1800 seconds (30 minutes), so for 30 minutes following power restoration, demand inputs are zero. The power is restored during interval #2, where the surge of power consumption during power-up is included in the Demand Forgiveness period and has a value of zero.

Additional information

The following points are important to note:

- The following demand input values are zero for kQ, kW, kVA, and kvar during the Demand Forgiveness period:
  - Delivered
  - Received
  - Delivered + received
  - Delivered – received
  - Q1, Q2, Q3, Q4
- If a new peak is set prior to a power outage, it will persist.
- Even though demand is zero during the Demand Forgiveness period, a new peak could be set if the demand was very high prior to the power outage or after the Demand Forgiveness period ends.
- Demand Forgiveness works for both single-phase and 3-phase powered meters.
- All ION modules in the Demand Forgiveness framework are fully locked.
- If a Demand Forgiveness period is initiated and another power outage occurs that is less than the time specified in the *Minimum Outage Duration* setting, the Demand

Forgiveness period continues. If a second outage is greater than the time specified in the *Minimum Outage Duration* setting, the Demand Forgiveness period restarts.

- Both the power outage downtime and the Demand Forgiveness downtime are stored within the Demand Forgiveness framework. The Store modules preserve a timestamp that is viewable in Vista.
- The Sliding Window/Rolling Block demand module *Update Rate* setup register must be set to EVERY SECOND (default).
- If Demand Forgiveness is enabled on a single-phase powered meter and there is no power from the line, the meter assumes that this is an outage. When power is applied from the line again, demand is forgiven for the specified time.
- If Demand Forgiveness is enabled and the meter is unplugged for servicing or other reasons, the Demand Forgiveness framework assumes there was an outage and demand is forgiven for the specified time.
- For meters where Demand Forgiveness is enabled at the factory (e.g. RMICAN Canadian revenue meters), demand will not be measured when the meter is first put into service. Instead demand is forgiven for the specified time.

Configuring Demand Forgiveness

Demand Forgiveness is disabled by default. To enable Demand Forgiveness, use ION Setup software to set the:

- External Boolean module named “Demand Forgiveness Enable” to ENABLE.
- minimum outage duration.
- demand forgiveness duration.
- outage voltage.

NOTE: If Demand Forgiveness is enabled, do not use demand values to calculate energy for billing purposes.

Using the front panel

You cannot enable or edit Demand Forgiveness settings via the front panel.

Using ION Setup

ION Setup version 1.1 and later supports the Demand Forgiveness feature:

1. Open the Setup Assistant for your meter. See the ION Setup help for instructions.
2. Click **Demand**.
3. Click the **Demand Forgiveness** tab.
4. Select *Demand Forgiveness Enable*.

   Click **Edit** (provide a password if requested) and select ON.
5. Select *Min Outage Duration*, and click **Edit**.

   Select either *Elapsed Interval Format* or *Numeric Bounded Format* then enter the amount of time that the power must be out before the Demand Forgiveness period starts. Click **OK**.

   – Elapsed Interval Format: Enter the amount of time in days, hours, minutes and seconds.
   – Numeric Bounded Format: Enter the amount of time in seconds.
6. Select *Demand Forgiveness Duration* and click **Edit**.

   Select either *Elasped Interval Format* or *Numeric Bounded Format* from then enter the amount of time that demand is forgiven (demand inputs are zero). Click **OK**.

   – Elapsed Interval Format: Enter the amount of time in days, hours, minutes and seconds.
   – Numeric Bounded Format: Enter the amount of time in seconds.
7. If required, select *Outage Voltage* and click **Edit**.

   Type the minimum voltage (line-to-line average in unscaled meter units) that is considered an outage (this is set to 20 volts by default but you can adjust this.)

Chapter 11 Inputs / Outputs

This chapter provides information on the meter's various inputs and outputs (I/O).

All I/O connections are made to the meter's Essailec connector, located on the rear of the meter. Refer to your Installation Guide for instructions on wiring inputs and outputs and for the general meter I/O specifications.

Digital I/O

ION8800 meters offer a variety of I/O combinations depending on the option ordered. The following options are available:

I/O order option	Outputs	Digital inputs	Com
A	– 8 digital Form A solid-state outputs – 1 Form C mechanical relay – 4 Form C solid-state outputs	None	One RS-485 port on Essailec connector
B	– 8 digital Form A solid-state outputs – 1 Form C mechanical relay – 4 Form C solid-state outputs	3 Low voltage	None
C	– 8 digital Form A solid-state outputs – 1 Form C mechanical relay – 4 Form C solid-state outputs	3 High voltage	None
D	– 1 Form C mechanical relay – 4 Form C solid-state outputs – IRIG-B	3 Low voltage	One RS-485 port on Essailec connector
E	– 1 Form C mechanical relay – 4 Form C solid-state outputs – IRIG-B	3 High voltage	One RS-485 port on Essailec connector

Two front panel infrared/LED outputs are also standard for all meters.

The digital inputs are ideal for monitoring status or counting pulses from external dry contacts. Use the Form A outputs for performing end of interval pulsing, load control and alarm annunciation, and the Form C solid-state outputs for load switching applications. The infrared/LED outputs are used for energy pulsing (watt-hours and var-hours).

Digital Input modules control the meter's digital inputs. The meter's outputs can be controlled by Digital Output modules, Pulser modules, or Calibration Pulser modules. All of these modules act as intermediaries between the hardware port and the other modules in the meter; they define the characteristics of outgoing signals or tell the meter how to interpret incoming signals.

Refer to the *Digital and Analog I/O* technical note for more information on digital inputs and outputs.

Specifying an I/O port in a module

For detailed information regarding Digital Output, Digital Input and Calibration Pulser modules, see the *ION Reference*.

Configure the Digital Output, Digital Input and Calibration Pulser modules' *Port* setup registers to specify which port handles the outgoing or incoming signals. To assign a

port to one of these modules, simply modify the *Port* setup register by picking a port from the enumerated list. This can be done with ION Setup.

Be aware that the enumerated list only displays those ports that are not yet assigned to another module. To make a port available, you must first locate the module controlling the port and set its *Port* setup register to NOT USED (or delete the module entirely). The port now appears in the enumerated list.

The following table describes the ports that can be configured (in the Digital Output, Digital Input, and Calibration Pulser modules) to handle digital outgoing or incoming signals.

NOTE: You must confirm the meter's I/O options to determine which of the following apply to your meter.

ION module type	ION module name	Port name (ION label)	Meter port (installation guide)	Description
Digital Input	Digital In 1 to Digital In 3	Port DI1 to Port DI3	Digital Input DI1 to Digital Input DI3	The Digital Input modules are created and assigned to the hardware ports in the default framework.
Digital Output	DO1-C to DO4-C	Port DO1 (Form C) to Port DO4 (Form C)	Form C output DO1 to Form C output DO4	The Digital Output modules are created in the default framework, but the ports are not assigned (set to NOT USED). These ports can also be assigned to Calibration Pulser modules for energy pulsing.
	DO5-A to DO12-A	Port DO7 (Form A) to Port DO12 (Form A)	Form A output DO5 to Form A output DO12	The Digital Output modules are created in the default framework, but the ports are not assigned (set to NOT USED).
	AlarmLED	Alarm LED	Alarm LED (located on front panel)	This Digital Output module is created and assigned to the front panel Alarm LED in the default framework.
	Power Up Alarm	Alarm Relay	Form C mechanical relay Alarm	This Digital Output module is created in the default framework, but the port is not assigned (set to NOT USED).
Calibration Pulser	varh del pulse	Port DO1 (Form C) to Port DO4 (Form C)	Form C output DO1 to Form C output DO4	The Calibration Pulser modules are created in the default framework, but the ports are not assigned (set to NOT USED). These ports can also be assigned to Digital Output modules. Refer to the "Energy pulsing" chapter for more information.
	varh rec pulse			
	Wh del pulse			
	Wh rec pulse			
	varh Pulse LED	kvarh Pulse/LED	varh LED (located on front panel)	These Calibration Pulser modules are created and assigned to the front panel LED pulsers in the default framework. Refer to the "Energy pulsing" chapter for more information.
	Wh Pulse LED	kWh Pulse/LED	Wh LED (located on front panel)	
None	None	Indicator LED	Indicator LED (located on front panel)	This port can be used in a custom framework.

Using the digital outputs

Use the meter's digital outputs for hardware relay control or pulse counting applications. For example, your meter's digital outputs can provide on/off control signals for capacitor banks, generators, and other equipment. The digital output ports can also send out status signals or Wh pulses, if the receiving device determines energy usage by counting pulses or monitoring functions.

All digital outputs can deliver a continuous signal or a pulse.

Contact Schneider Electric for complete information regarding relay applications.

Digital Output modules

⚠ WARNING

HAZARD OF UNINTENDED OPERATION

Do not use the meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

The meter's outputs can be controlled by Digital Output modules, Pulser modules, or Calibration Pulser modules, depending on the application. For relay and control, use the Digital Output module. For pulsing applications, the Calibration Pulser or Pulser modules are generally used.

⚠ CAUTION

HAZARD OF MISAPPLICATION (MISUSE)

Because mechanical relays have limited lifetimes, mechanical KYZ relays are typically not suitable for energy pulsing applications. For energy pulsing applications, use a Form A output in KYZ mode.

Failure to follow these instructions can result in equipment damage.

Digital Output and Calibration Pulser modules are already created in the meter's default framework, you just need to assign the appropriate port and configure the module to match your requirements using ION Setup. You can use the existing modules, or create and configure other modules to control the output ports.

- **Calibration Pulser modules** allow you to generate high accuracy energy pulses for calibration testing purposes. They integrate instantaneous power appearing at their inputs.
- **Digital Output modules** accept Boolean inputs, and output a continuous signal or pulses.
- **Pulser modules** convert instantaneous pulses to pulses or transitions.

Refer to the *ION Reference* for more information about these ION modules.

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

NOTE: You must confirm the meter I/O options to determine which of the following apply to your meter.

ION module	Setup registers	Available settings	Creation default	Description
Digital Output	Port	Refer to “Specifying an I/O port in a module” on page 105.		The output hardware channel
	PulseWidth	0 to 2000000	0	Pulse Width, in seconds (0 for continuous pulse)
	Polarity	Inverting or Non-Inverting	Non-Inverting	Inverted or non-inverted output
	EvLog Mode	Log On or Log Off	Log Off	Whether or not to log status changes in the Event Log
Calibration Pulser	Port	Refer to “Specifying an I/O port in a module” on page 105.		The output hardware channel
	Pulse Width	0.010 to 1.000	0.05	Pulse Width, in seconds
	Kt	0.01 to 1000000000	1.8*	Watts per pulse
	Int Mode	Forward, Reverse, Absolute, or Net	Depends (see section below)	Integration modes that may be selected
	OutputMode	Pulse or KYZ	Pulse	Full pulse or KYZ (transition pulse)
Pulser	Port	Refer to “Specifying an I/O port in a module” on page 105.		The output hardware channel
	PulseWidth	0.020 to 2000000	1	Pulse width, in seconds
	OutputMode	Pulse or KYZ	Pulse	Full pulse or KYZ (transition pulse)
	Polarity	Inverting or Non-Inverting	Non-Inverting	Inverted or non-inverted output

* Value depends on meter’s nominal current option.

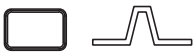
Ensure that the module’s *Port* setup register matches the meter’s output you want to control. If the port you want to use does not appear in the *Port* setup register’s list, it means that port is in use by another module. Edit the *Port* setup register of the module using that port and set it to NOT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

Alarm LED



The red (top) LED on the front panel of the meter is configured in the meter’s default template to flash if the meter does not complete its startup self tests. Contact Technical Support if this occurs.

Indicator LED



Use the green (middle) LED on the front panel of the meter for custom applications. It can be linked to a framework to provide event notification. Possible applications include sag/swell alarming, setpoint annunciation, and tariff notification. Like all outputs on the meter, this port can be controlled by a Digital Output, Pulser, or Calibration Pulser module.

Using the digital inputs

Use the meter's digital inputs for status monitoring or pulse counting applications. Status monitoring can help you prevent equipment damage, improve maintenance, or track security breaches. Some common status monitoring applications are monitoring the closed/open positions of breakers, on/off status of generators, armed/unarmed conditions in a building alarm system, and over/under pressures of transformers.

Digital Input modules control the function of each status input, telling the meter how to interpret incoming signals. Digital Input modules can be linked with other modules for counting status changes.

Digital Input modules

The meter provides three default Digital Input modules for the status inputs. Configure the settings of the controlling module to match your requirements. Refer to the *ION Reference* for detailed module information.

The settings in the Digital Input modules are as follows:

NOTE: Confirm that your meter's I/O option includes the digital inputs to determine if these settings apply to your meter.

Setup register	Available settings	Creation default	Description
Input Mode	Pulse, KYZ or A/C	Pulse	Complete pulse, KYZ transition pulse, or A/C input mode – Pulse: detects when the signal makes a complete pulse (changes from OFF to ON and back to OFF, or vice versa. – KYZ: detects when the signal changes from OFF to ON, or from ON to OFF. – A/C: detects analog signals (the ON condition is based on the presence of an AC signal with a frequency range of 5 to 210 Hz)
EvLog Mode	Log Off or Log On	Log Off	Whether or not to log status changes in the Event output register
Event Priority	0 to 255	20	The event priority of the status changes in the meter's Event Log. To record status changes in the meter's Event Log: – the EvLog Mode register must be set to LOG ON. – the Event Priority value must be greater that the value set in the Event Log Controller module's Cutoff register. If Event Priority is set to zero, status changes will not be logged.
Polarity	Non-Inverting or Inverting	Non-Inverting	Non-inverted (or level) pulse
Debounce	0 to 65.525	0.000	Mechanical contact bounce, in seconds
Port	Refer to "Specifying an I/O port in a module" on page 105.		The input hardware channel controlled

Configuring inputs and outputs

Use ION software to configure the meter's I/O framework. Your meter's I/O option will determine which physical input and output port settings apply to your meter.

⚠ WARNING

HAZARD OF UNINTENDED OPERATION

Do not use the meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

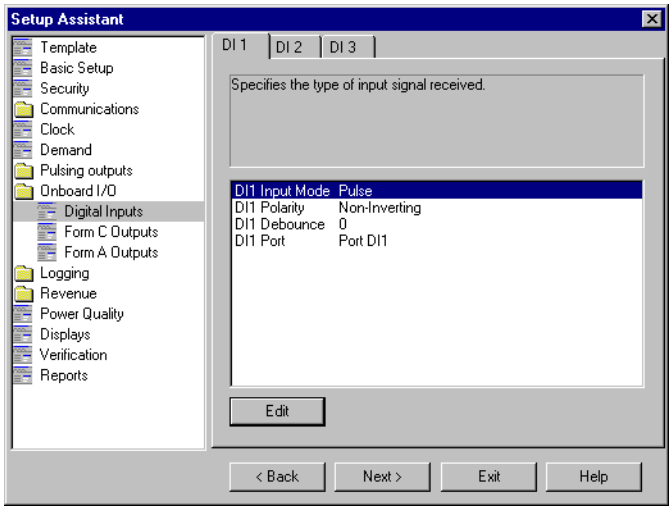
Using the front panel

You cannot configure I/O using the Front Panel.

Using ION Setup

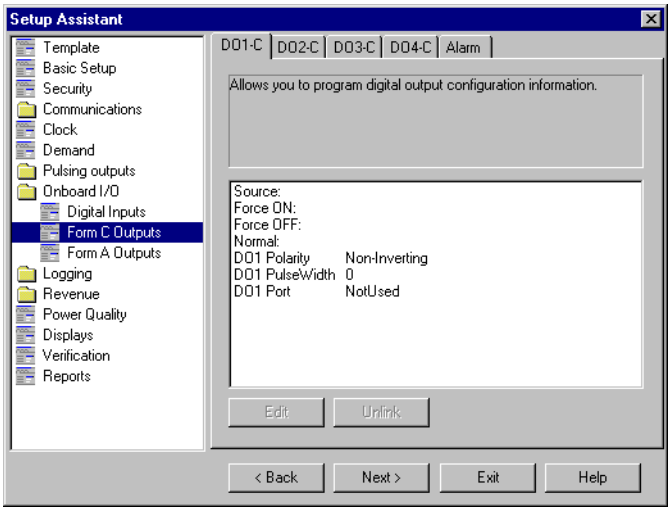
You can use ION Setup to configure the Digital Input and Digital Output modules created in your meter's default template.

1. Open the Setup Assistant for your meter. Refer to the ION Setup help for instructions.
2. Select: **Onboard I/O > Digital Inputs** to configure the Digital Input modules.
3. Click the tab that corresponds to the digital input that you want to configure.
4. Select the parameter that you want to configure and click **Edit** (or double-click the parameter). Select the desired setting from the selection screens. Refer to "Using the digital inputs" on page 109 for details on the Digital Input module settings.

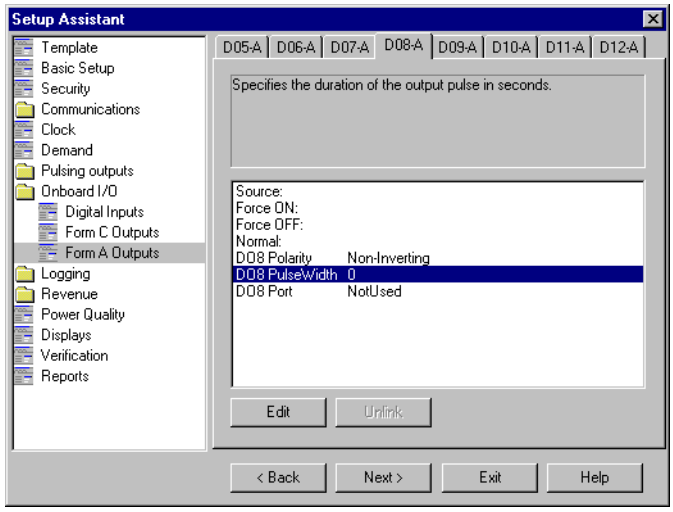


5. Select **Onboard I/O > Form C Outputs** to configure the Digital Output modules associated with the Form C digital output ports.
6. Click the tab that corresponds to the digital output that you want to configure.
7. Select the parameter you want to configure and click **Edit** (or double-click the parameter). Select the desired setting from the selection screens. Refer to "Using the digital outputs" on page 107 for more detail on Digital Output module settings.

Click **OK** to send your changes to the meter.



8. Select **Onboard I/O > Form A Outputs** to configure the Digital Output module associated with the Form A digital outputs.
9. Select the parameter you want to configure and click **Edit** (or double-click the parameter). Select the desired setting from the selection screens. Refer to “Using the digital outputs” on page 107 for more detail on Digital Output module settings. Click **OK** to send your changes to the meter.



Chapter 12 Energy pulsing

You can configure the meter's front panel LEDs or digital output ports for energy pulsing applications.

Energy pulsing overview

Your meter uses Calibration Pulser modules for energy pulsing.

The Calibration Pulser module is an energy pulser used for verifying accuracy on meters employed in billing applications. This module type serves as an intermediary between the power (kW, kvar or kVA) outputs of the Power Meter module and a device's hardware output channel. Refer to "Verifying accuracy" on page 157 for instructions on how to verify the accuracy of your meter. See the *ION Reference* for more information on this modules

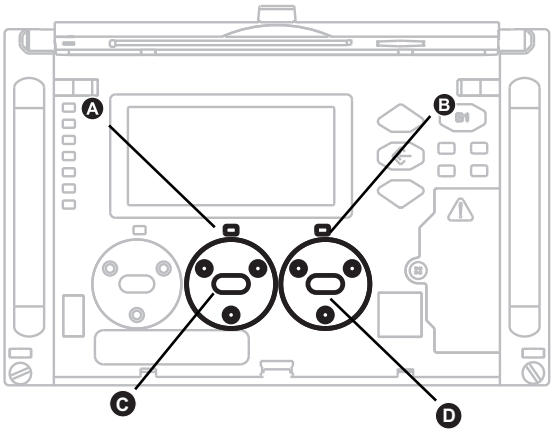
There are two types of outputs used for energy pulsing: your meter's front panel Wh and varh LEDs, and its digital outputs. Your meter's default framework contains six Calibration Pulser modules. Two Calibration Pulser modules are completely configured and operate the front panel LEDs; you have to manually assign a digital output port to the other four Calibration Pulser modules to receive energy pulsing from your meter's digital outputs.

Energy pulsing with infrared ports and LEDs

Two LEDs on the front panel are preconfigured for energy pulsing. Matching infrared outputs are located below each LED and pulse at the same rate.

The LED's pulse rate can be adjusted by modifying the Kt setup register in the Calibration Pulser module. The value entered defines how much energy the module accumulates before a pulse is sent to the hardware channel. The front panel Wh and varh LEDs are factory set to the same pulse rate (1 Watt-hour).

If the Wh or varh LEDs are not capable of pulsing quickly enough, they will remain on (not blink) and the pulse overload registers (shown on the LED pulsing screens in ION Setup) will indicate the LED pulsing has been suspended. You can reduce the LED pulse rate by modifying the pulse rate (Kt value).



A	LED varh pulse indicator
B	LED Wh pulse indicator
C	Infrared varh pulser
D	Infrared Wh pulser

Wh – LED and varh – LED

In the meter's default framework, the Wh – LED is controlled by a Calibration Pulser module that has its *Source* input linked to the *kW del+rec* output of the Arithmetic module labeled "kW del, rec".

Similarly, the varh – LED is controlled by a Calibration Pulser module that has its *Source* input linked to the *kvar del+rec* output of the Arithmetic module labeled "kvar del, rec".

Customizing energy pulsing

Changing the value for the *Kt* setup register of the controlling Calibration Pulser module lets you modify the pulsing rate of either channel. If you want to configure the LED port for a different pulsing application, you must re-link the *Source* input to the output register of a different instantaneous power quantity in one of the Arithmetic modules. Ensure that the quantity you choose originates from the MU (meter units) Power Meter module.

Configuring LED pulsing

Use ION Setup to change your meter's energy pulsing settings.

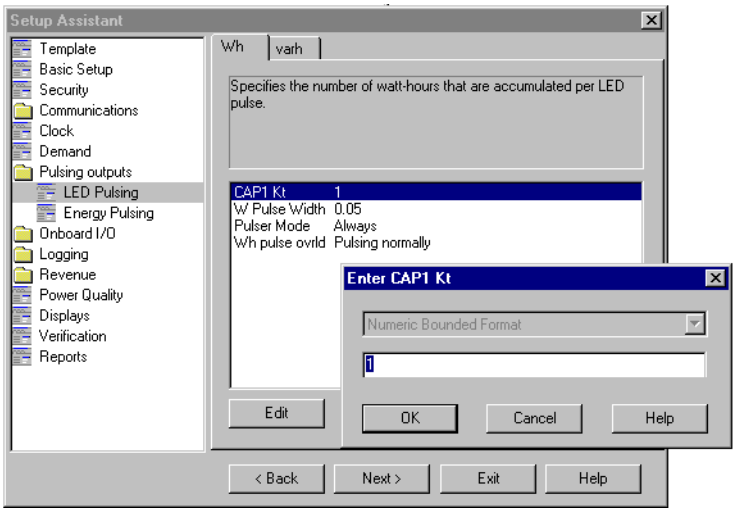
Using the front panel

You cannot configure LED pulsing using the front panel.

Using ION Setup

1. Open the Setup Assistant for your meter. See the ION Setup help for instructions.

2. Select **Pulsing Outputs > LED Pulsing**.



3. Click on the tab that corresponds to the LED that you want to configure.
4. Configure the settings as required. See “Calibration Pulser module settings” on page 116 for settings information.
5. Check that the pulse overload parameter reads PULSING NORMALLY to help ensure that the LED can pulse with the new settings.

Energy pulsing with digital outputs

The meter’s default framework includes four Calibration Pulser modules already configured for energy pulsing using the meter’s digital outputs, you just need to assign a value to their Port registers using ION Setup. It is recommended that these Calibration Pulser modules be configured as follows for energy pulsing applications:

Calibration module	Setup registers	Setting
varh del pulse	Port	DO3 FormC
	Int Mode	Forward
varh rec pulse	Port	DO4 FormC
	Int Mode	Reverse
Wh del pulse	Port	DO1 FormC
	Int Mode	Forward
Wh rec pulse	Port	DO2 FormC
	Int Mode	Reverse

NOTE: No hardware channel is preselected. To make use of these links, you must configure the Calibration Pulser modules’ *Port* setup registers to the appropriate hardware port that receives the output using ION Setup.

Using this configuration, the Calibration Pulser module labeled *varh rec pulse* controls port 4. By default, the module is linked to the *kW del+rec* output of the Arithmetic module labeled “del, rec” in the Demand Framework. This Arithmetic module is linked to the MU Power Meter module’s *MU kW tot* output. The port pulses for every 1 Wh accumulated (in Normal or TEST mode); this is the same pulsing rate as the middle LED on the front panel of the meter, and the front panel varh pulsing port and WH pulsing port (controlled by Calibration Pulser modules labeled “varh Pulse LED” and Wh Pulse LED). See “Calibration Pulser module settings” on page 116 for more information.

Calibration Pulser module settings

You can modify an LED, pulsing port or digital output's pulsing rate by changing the value of the *Kt* setup register of the Calibration Pulser module controlling them (see below).

Other register defaults vary depending on the Calibration Pulser module. Refer to the *ION Reference* for a detailed description of the Calibration Pulser module.

The following setup registers are available in the Calibration Pulser module:

Setup register	Function
Pulse Width	This register specifies the width of the pulses sent to the hardware channel (in seconds). The Calibration Pulser module maintains a minimum duty cycle of 50% on the output pulse train.
Kt	The numeric bounded register defines how much energy (watt-hours) the module accumulates before a pulse is sent to the hardware channel.
Int Mode	Specifies the modes of integration that may be selected.
OutputMode	This register specifies whether the output is a complete pulse (Pulse) or a change of state transition (KYZ).
Port	This register specifies which hardware port the pulse/KYZ transition appears on. Only those hardware channels that are still available appear in this list. To make a hardware port available, you must first locate the module controlling the port and set its *Port* setup register to NOT USED (or delete the module). The port now appears in the list.

The appropriate Kt value depends on Scaled Rev Param, located on the Basic Setup tab of the ION Setup Assistant.

- If *Scaled Rev Param* is OFF, the Kt value must be the primary value and the Calibration Pulser module pulses based on primary kWh and kvarh.
- If *Scaled Rev Param* is ON, the Kt value must be the secondary value, and the Calibration Pulser module pulses based on secondary kWh and kvarh.

Configuring energy pulsing

⚠ CAUTION

HAZARD OF MISAPPLICATION (MISUSE)

Because mechanical relays have limited lifetimes, mechanical KYZ relays are typically not suitable for energy pulsing applications. For energy pulsing applications, use a Form A output in KYZ mode.

Failure to follow these instructions can result in equipment damage.

Use ION Setup to change your meter's energy pulsing settings.

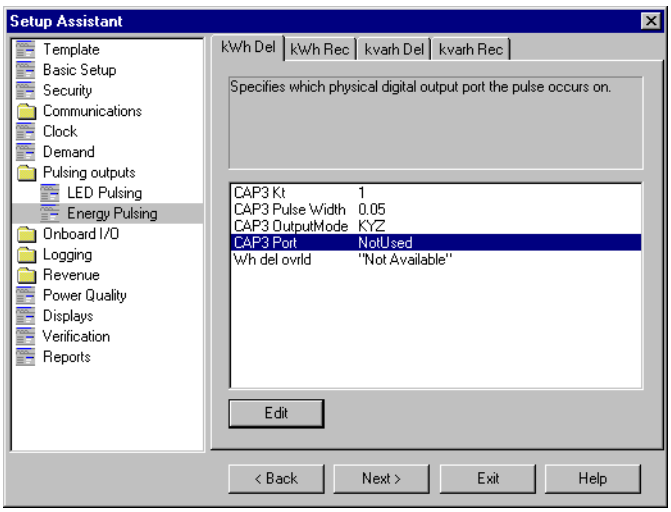
Using the front panel

You cannot configure Energy Pulsing using the front panel.

Using ION Setup

1. Open the Setup Assistant for your meter. See the ION Setup help for instructions.

2. Select **Pulsing Outputs > Energy Pulsing**.



3. Click any of the tabs; each tab corresponds to a Calibration Pulser module. Configure the other default Calibration Pulser modules for energy pulsing applications, if required. By default, these modules are not linked to an output. See “Calibration Pulser module settings” on page 116 for settings information.

NOTE: You can also configure the Calibration Pulser and Pulser modules using Advanced Mode.

Chapter 13 Logging

Your meter includes data logging and event recording capabilities. Data and event logs recorded by the meter are prioritized and stored onboard. Data logging

Your meter ships with a comprehensive data-logging configuration that differs depending on your meter type. The data recording frameworks contain Data Recorder modules, Waveform Recorder modules (ION8800A meters only) and Periodic Timer modules.

Data Recorder and Waveform Recorder modules are responsible for logging the power system data, while Periodic Timer modules determine the recording frequency of the recorder modules to which they are linked.

To learn more about these modules, consult the *ION Reference*.

NOTE: Changing logging settings resets logged values. Ensure that all important data has been recorded before you make changes.

See “Default logging configuration — ION8800A Meter” for more information about the preconfigured Data Recorder modules for feature set A.

Configuring data logging

Use ION Setup to change your meter’s logging settings.

Using the meter display

You cannot configure Logging using the meter display.

Using ION Setup

1. Open the Setup Assistant for your meter. See the ION Setup help for instructions.
2. Select **Logging > Memory**.

   Select the Log you want to configure and click **Edit**. You can change both the Log Duration (days) and the Log Size (records). Changing these parameters affects the meter memory allocated to that log.
3. Select **Logging > Revenue Log** to configure Data Recorder #1.
   - Click the **Channels** tab to edit, link and unlink revenue parameters.
   - Click the **Interval/Depth** tab to edit the interval and duration of the revenue log.
4. Select **Logging > EnergyDemand Log**.
   - Click the **Channels** tab to edit, link and unlink energy demand log parameters.
   - Click the **Interval/Depth** tab to edit the interval and duration of the revenue log.

Changing the parameters that are logged

The meter’s factory configuration logs a comprehensive set of energy, power and harmonics parameters. Changing which parameters are logged is an advanced procedure because you must configure the links to the module’s input registers. If you are comfortable editing module links, you can change the logged parameters by linking the output registers you want logged to the inputs of an Data Recorder module.

NOTE: Adding or deleting a log's parameters is an advanced procedure, as it requires changes to the links between modules.

Changing waveform recording (if supported)

The Waveform Recorder modules do not require changes to their default settings. If you want to change the format of the recorded waveforms, refer to the Waveform Recorder module description in the *ION Reference*.

NOTE: If you are generating COMTRADE waveform data records, the associated Waveform Recorder modules cannot be modified unless the COMTRADE module's *Enable/Disable* register is set to DISABLE. If the Waveform Recorder modules are not configured identically (have the same setup register values) the COMTRADE module will not go online and COMTRADE waveform data will not be generated.

Default logging capacity — ION8800A meter

The table below summarizes the default recording depths and intervals of the various data and waveform recorders in the ION8800A meter.

NOTE: Default logging depth is set differently for 5 MEG on-board memory ("one-month") and 10 MEG ("three-month") option meters.

Data Recorder number	Log name	Depth		Interval
		5 MEG	10 MEG	
1	Revenue Log	3360 (35 days)	9120 (95 days)	900 seconds (15 minutes)
2	Dip/Swell Log	100	3000	Triggered on demand
9, 13	Loss Log, Loss Log UII	3360 (35 days)	3360 (35 days)	900 seconds (15 minutes)
3, 4, 5	Historic Logs (3 data recorders)	3360 (35 days)	3360 (35 days)	900 seconds (15 minutes)
6	Transient Log	100	3000	Triggered on demand
7, 8	Harmonics Logs (2 data recorders)	840 (35 days)	840 (35 days)	3600 seconds (1 hour)
N/A	Waveform recording (6 data recorders)	30	50	Triggered on demand
N/A	COMTRADE records[1]	1	1	Triggered by Waveform recording
10	Report Generator Log (EgyDmd Log)	3360 (35 days)	9120 (95 days)	900 seconds (15 minutes)
11-12, 17-16	EN50160 Logs (EN50160 ordering option only)	Varies[2]	Varies[2]	Daily, weekly, 10 minutes, ...
N/A	Event Log (Event Log Controller module)	100	500	Triggered on demand
14, 16, 37-38	4-30 logs (4 data recorders)	Varies[3]	Varies[3]	3 second, 10 minute, 2 hour
15	Interrupt log	2400	2400	Triggered on demand

[1] See the *COMTRADE and ION technology* technical note for more details.

[2] See "EN50160 compliance logging (EN50160 ordering option only)" on page 123 and the *Power Quality: ION Meters and EN50160:2010* technical note for more details.

[3] See the *4-30 compliance and ION meters* technical note for more details.

Log depth configuration

Change the value in the Data Recorder's *Depth* setup register to increase the number of records stored in the recorder. The *RecordMode* setup register controls how the Data

Recorder overwrites old records; refer to the Data Recorder module description in the *ION Reference* before changing this setup register.

Log interval configuration

The five Periodic Timer modules that control the frequency of different data recording are as follows:

- “Revenue Log Trg” controls the frequency of the logging of revenue values
- “Loss Log Trg” controls the frequency of Loss Compensation Data logging
- “EgyDmd Log Trg” controls the frequency of logging for the Energy and Demand Log (this log is used for generating reports using Reporter)
- “Hist Log Trg” controls the frequency of Historic Data logging
- “Harm Log Trg” controls the frequency of Harmonics logging

Programming your meter to write any data recorder at continuous intervals lower than 60 seconds (heavy logging configuration) can cause loss of data in the event of a power failure.

NOTICE
DATA LOSS Use an uninterruptible power supply (UPS) if you program your meter for heavy logging. **Failure to follow these instructions can result in data loss.**

Change the value in the *Period* setup register to change the frequency of data logging (Period values are specified in seconds).

Default logging configuration — ION8800A Meter

Your meter is equipped with preconfigured data logs which you can modify.

The default data logging configuration might be used by other components of your power monitoring system. Do not change the default configuration of any of the logs unless you understand the impact of the changes on these power monitoring system components and the data they use and on your meter’s memory.

Revenue Log

The Revenue Log is configured for use with MV-90 billing software. The default values logged by the Revenue Log are as follows:

Parameter	Description
kWh del int	Interval kWh delivered
kWh rec int	Interval kWh received
kvarh del int	Interval kvarh delivered
kvarh rec int	Interval kvarh received

Historic data logging

Three data recorders are used to record standard power system quantities, such as phase current, phase voltage and power factor. These recorders are labeled *Hist Mean*

Log, *Hist High Log*, and *Hist Low Log*. By default, they log the following ION output register values:

Hist mean log	
Ull 12 mean	I avg mean
Ull 23 mean	I 4 mean
Ull 31 mean	kW tot mean
Ull avg mean	kvar tot mean
U unbal mean	kVA tot mean
I1 mean	PF lag mean
I2 mean	PF lead mean
I3 mean	Freq mean

Hist high log	
Ull 12 high	I avg high
Ull 23 high	I 4 high
Ull 31 high	kW tot high
Ull avg high	kvar tot high
U unbal high	kVA tot high
I1 high	PF lag high
I2 high	PF lead high
I3 high	Freq high

Hist low log	
Ull 12 low	I avg low
Ull 23 low	I 4 low
Ull 31 low	kW tot low
Ull avg low	kvar tot low
U unbal low	kVA tot low
I1 low	PF lag low
I2 low	PF lead low
I3 low	Freq low

Loss logs

The *Loss Log* and the *Loss Log Ull* recorders are configured to record loss values. The Loss Log is used for line-to-neutral values and logs the following ION parameters by default:

Parameter	Description
MU I1^2h int	Phase 1 interval current squared hours
MU I2^2h int	Phase 2 interval current squared hours
MU I3^2h int	Phase 3 interval current squared hours
MU Uln 12^2h int	Phase 1 interval voltage line-to-neutral squared hours
MU Uln 23^2h int	Phase 2 interval voltage line-to-neutral squared hours
MU Uln 31^2h int	Phase 3 interval voltage line-to-neutral squared hours

The Loss Log Ull is used for line-to-line values and logs the following ION parameters by default:

Parameter	Description
MU I1^2h int	Phase 1 interval current squared hours
MU I2^2h int	Phase 2 interval current squared hours
MU I3^2h int	Phase 3 interval current squared hours
MU Ull 12^2h int	Phase 1 interval voltage line-to-line squared hours
MU Ull 23^2h int	Phase 2 interval voltage line-to-line squared hours
MU Ull 31^2h int	Phase 3 interval voltage line-to-line squared hours

Harmonics logs

Two recorders provide various harmonics logs, including K-factor and Total Harmonics Distortion (THD). These recorders are labeled *Harm Mean Log* and *Harm High Log*. By default, they log the following ION output register values:

Harm mean log	
U1 THD mean	I1 K Fac mean
U2 THD mean	I2 K Fac mean

Harm high log	
U1 THD high	I1 K Fac high
U2 THD high	I2 K Fac high

U3 THD mean	I3 K Fac mean
I1 THD mean	
I2 THD mean	
I3 THD mean	

U3 THD high	I3 K Fac high
I1 THD high	
I2 THD high	
I3 THD high	

Energy Demand Log

One recorder is configured to provide power system data used by energy management software to generate reports..

EgyDmd Log	
kWh del	kVAh del+rec
kWh rec	kW sd del-rec
kWh del-rec	kvar sd del-rec
kvarh del	kVA sd del+rec
kvarh rec	PF sign mean
kvarh del-rec	

Dip/Swell and Transient logging

The meter logs the following ION output register values:

Dip/Swell log			
DistDur	DistU2Engy	DistU1Engy	DistU3Engy
DistU1Min	DistU3Min	DistU2Min	DistNominal
DistU1Max	DistU3Max	DistU2Max	SwellLim
DistU1Avg	DistU3Avg	DistU2Avg	SagLim

Transient log			
TranU1Dur	TranNominal	TranU2Max	PT Sec
TranU1Max	Threshold	TranU3Dur	CT Prim
TranU2Dur	PT Prim	TranU3Max	CT Sec

EN50160 compliance logging (EN50160 ordering option only)

By default, 22 Data Recorders are used for logging EN50160 compliance parameters.

Data Recorder	EN50160 Component Logged
EN50160 Frq/Mg	Power Frequency and Supply Magnitude

Data Recorder	EN50160 Component Logged
EN50160 Uunbal	Voltage Unbalance

Data Recorder	EN50160 Component Logged
EN50160 Flicker	Flicker
EN50160 Vlt Dp1	Supply Voltage Dips
EN50160 Vlt Dp2	
EN50160 Vlt Dp3	
EN50160 Vlt Dp4	
EN50160 Vlt Dp5	
EN50160 Intrp	Short/Long Interruptions
EN50160 Ovrvlt1	Temporary Overvoltages
EN50160 Ovrvlt2	
EN50160 Ovrvlt3	

Data Recorder	EN50160 Component Logged
EN50160 Hrm Vlt	Harmonics (up to 40th)
EN50160 Ihm Vlt	
EN50160 MSignal	Mains Signalling Voltage
EN50160 Prm-f/V	Parameter data These data recorders are disabled by default (see below).
EN50160 Prm-Flk	
EN50160 Prm-VDp	
EN50160 Prm-Vlr	
EN50160 Prm-OV	
EN50160 PrmHrm1	
EN50160 PrmHrm2	

The meter logs EN50160 counter data for present and previous observation periods as well as EN50160 events. EN50160 parameter data logging (from seven “Prm” data recorders) is disabled by default. The EN50160 Parameter Logging enable is accessible in the default Power Quality Vista diagram and in ION Setup Advanced mode.

For more information about EN50160 data logging, refer to the *Power Quality: ION Meters and EN50160:2010* technical note.

Viewing data logs

See “Reports” on page 155 for more information. You can also view Data Logs using ION Setup.

1. Open your meter in ION Setup, using Basic Mode. Refer to the ION Setup help for more information.
2. Navigate to **View > Data Screens > Data Recorders**. The following logs are available for viewing:
   - Average Harmonics
   - Energy & Demand
   - Historic Average, Historic Highs, Historic Lows
   - Maximum Harmonics
   - Revenue Log
   - Sags & Swells
   - Transformer Losses
   - Transients (if supported)
   - IEC 61000-4-30, four logs (if supported)

Event logging

Events produced by a meter’s various ION modules are prioritized and grouped to facilitate custom logging. Each event is assigned a priority group number based on its type and severity.

ION event priority groups

Some event groups are preset with a priority number as shown in the table below. You can also define your own priority number for some modules. Priority numbers from 128-191 appear in the global event log viewer in Power Monitoring Expert software. Priority numbers from 192-255 are logged, initiate a beep and cause the window to flash. You can customize these responses to display messages or perform *netsend* messages, for example.

Event group	Description	Priority number
Reset	Module reset or re-synchronized	5
Setup Change	Module setup changes (setup register changes, label changes, input handle changes)	10
Input Register Change	Inputs of certain modules change value (ie, input to And/Or module changes)	15
I/O State Change	I/O state changes (ie, relay closes)	20
Information	Module produces important user information	25
Warning	Module produces a warning	30
EN50160 Event (EN50160 ordering option only)	An EN50160 Counter (N_1 or N_2) increases	50
Loss of Potential	Loss of Potential has occurred	128
Error Detected	An error has been detected	255
Setpoint	Setpoint condition goes Active or Inactive (ie, Sag/Swell module detects a disturbance)	programmable via module setup

The Event Log Controller module allows you to set a priority cutoff for event logging. Any events with a priority number greater than the cutoff value are logged and events with lower priorities are discarded. Refer to the individual module descriptions and the Event Log Controller module description in the *ION Reference* for more details.

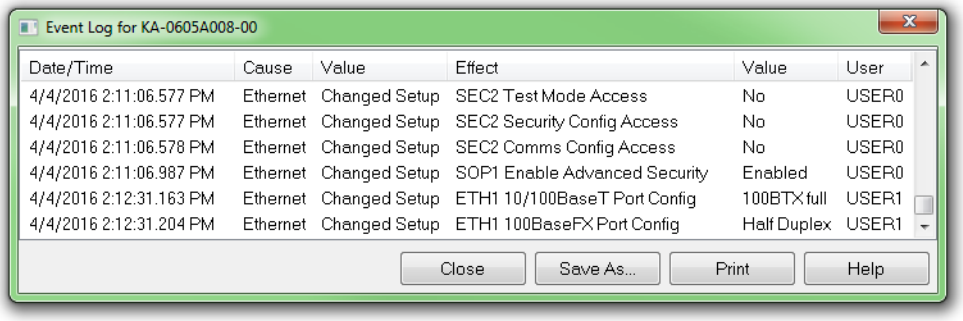
Events external to the module

Some events are not produced by a specific module. These events are generated internally by the meter. Their associated priority levels are shown in the table below.

Event group	Description	Priority number
Warning	Factory initialize performed	30
	Firmware or memory upgrade performed	
	Meter power-up or power-down	
	Internal modem not responding or modem recovered	
	Battery low	
	Telnet or serial terminal locked out	
	Security disabled or enabled	
Failure	Communications not able to allocate required memory	255

User triggered events

When a user produces an event, such as a reset, successful or unsuccessful login attempts, user lockout or setup change, the event log displays the username associated with the event. Events created in basic security through the display have the username USER0. Events created in advanced security through ION Setup are associated with the username that was logged into the meter (USER1 - USER50).



Displaying events

You can view events in the following locations:

Application	Menu / Screen	Navigation
Front panel	Event Log	ALT Display Mode > Events Screen
ION Setup	Event	Display Mode > Data Recorders folder > Event
Vista	Meter Events	System & Logs tab > Meter Events object
WebMeter	N/A	N/A

Logging and recording capacity

The meter provides both data and event logs. The amount of memory required to store these logs depends on the number of parameters being logged and the frequency with which these parameters are logged.

The following equation can help determine the amount of memory required to store **data and event logs**:

each record consumes (in Bytes) = [(number of parameters * 5) + 8]

The meter can also perform waveform recording. It can simultaneously capture events on all channels to a maximum of 96 cycles each.

To calculate the **waveform memory** usage use the following formula:

waveform memory usage (in Bytes) = [2*(number of samples per cycle) + 10]* (number of cycles in waveform) + 30

NOTE: Round up to the next kilobyte after each of the above calculations.

Chapter 14 Revenue

This chapter provides instructions for configuring PT/CT correction, Transformer line Loss Compensation (TLC), and Time Of Use (TOU).

PT/CT correction

PT/CT (potential transformer/current transformer) correction, also called instrument transformer correction, can help reduce the need to replace transformers in installations where high accuracy is required.

The primary application for PT/CT correction is to apply correction factors for ratio and phase angle inaccuracies in instrument transformers.

While ION8800 meters are shipped with ITC-capable firmware, its ITC modules (Instr Xformer Correction in the firmware) must be configured using accurate measurements to help ensure valid calculations. There is one Instr Xformer Correction module for each current and voltage input into the meter. The correction affects only the 1-second values in the Power Meter module. No high-speed, harmonics or waveform values are affected by the correction.

NOTE: The operation of this feature requires the correct configuration of the ITC modules according to your meter's power supply and operating ranges.

See the ION Reference, available from www.powerlogic.com for detailed information about the Instr Xformer Correction (ITC) module and how it applies PT/CT correction for your meter.

Configuring PT/CT correction

PT/CT Correction (the *Instr Xformer* module in the meter's firmware) can be configured in the ION8800 via ION Setup.

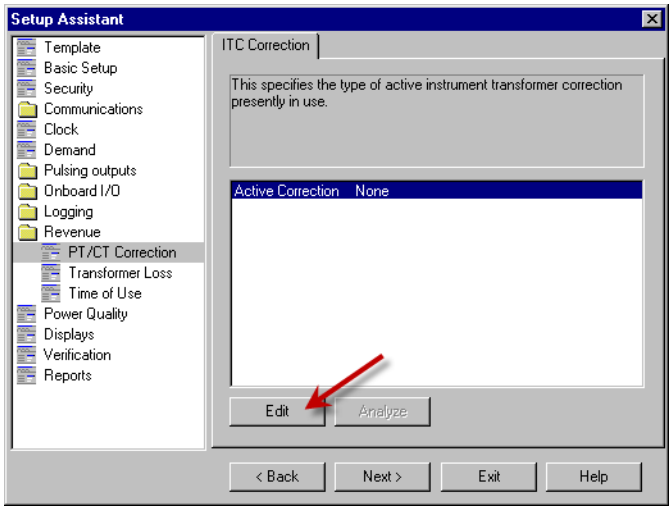
Using the front panel

You cannot configure PT/CT Correction using the front panel.

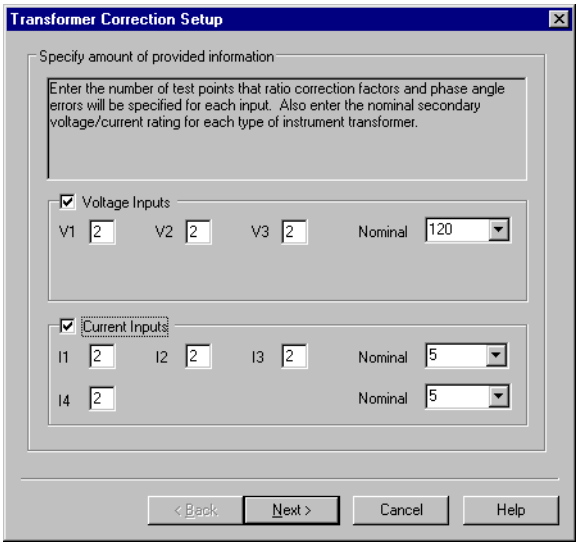
Using ION Setup

In the following ION Setupexample, the PT/CT Correction Setup Assistant allows you to configure the *Instr Xformer* modules on the meter.

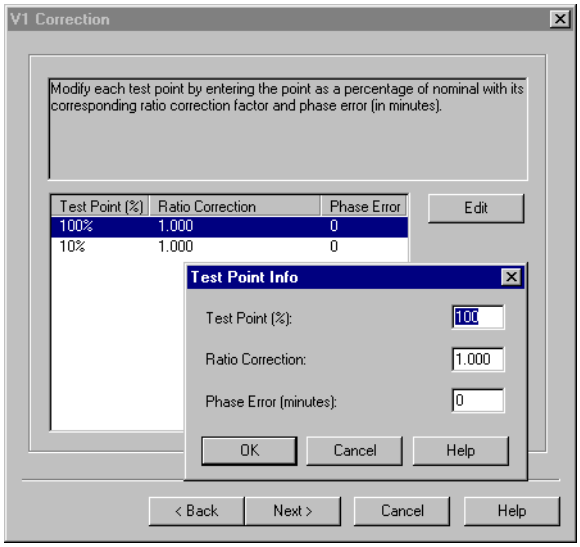
1. Open the Setup Assistant for your meter. See the ION Setup help for instructions.
2. Select **Revenue > PT/CT Correction**.
3. Select Active Correction and click **Edit**. The Transformer Correction Setup wizard is displayed.



4. Select the Voltage Inputs check box to turn on voltage (PT) correction and the Current Inputs check box to turn on current (CT) correction.



5. Enter the number of test points for each (four maximum) and the nominal voltage/current. Click **Next** to proceed.



6. On the Correction screen, select a U1 Test Point and click **Edit**. Enter the Test Point Info into the dialog box and click **OK**. Click **Next**.
7. Repeat previous step for each voltage and current phase. Click **Next** to finish.

Transformer Line Loss Compensation (TLC)

Transformer Loss Compensation is used when a meter's actual location is different from the electrical location where change of ownership occurs; for example, where meters are connected on the low-voltage side of power transformers when the ownership change occurs on the high-side of the transformer. This physical separation between meter and actual billing point results in measurable losses. Compensating for this loss - Loss Compensation - is the means of correcting this meter reading. Losses may be added to or subtracted from the meter registration.

Meters are usually installed on the low-voltage side of a transformer because it is more cost-effective. There are also cases where change of ownership may occur halfway along a transmission line where it is impractical to install a meter. In this case, power metering must again be compensated.

NOTE: Due to the variation in installations, **advanced knowledge of power systems and connection methods is required before transformer loss compensation can be properly implemented.** Data parameters should only be programmed by qualified personnel that have appropriate training and experience with Transformer Loss Compensation calculations.

See the *Transformer / Line Loss Calculations* technical note for more information.

Configuring TLC

Use ION Setup to change your meter's TLC settings.

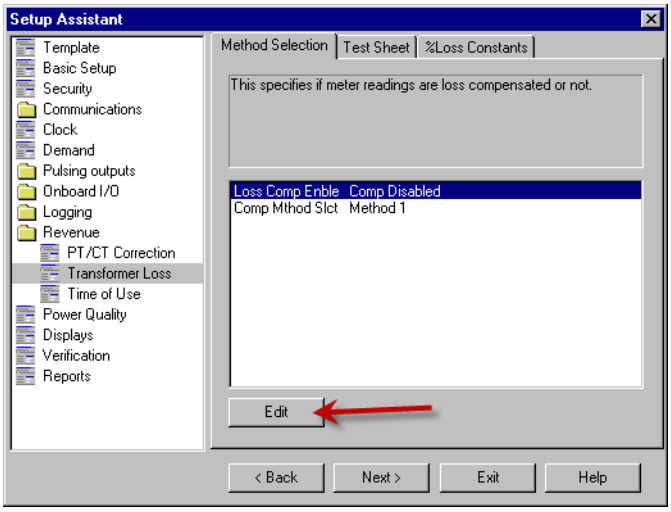
Using the front panel

You cannot configure Transformer Line Loss Compensation using the front panel.

Using ION Setup

The Revenue Setup Assistant helps you configure TLC. The Transformer Loss screen allows you to enable/disable TLC, choose which method you prefer (1 or 2) and configure TLC settings.

1. Open the Setup Assistant for your meter. See the ION Setup help for instructions.
2. Select **Revenue > Transformer Loss**. Click the **Method Selection** tab.
3. Select **Loss Comp Enble** and click **Edit**.



4. Select Comp Enabled from the drop-down list and click **OK**.
5. Next choose the TLC method you want to use by selecting Comp Mthod Slct and clicking the **Edit** button.

   Select Method 1 to use the Test Sheet method and Method 2 to use the %Loss Constants method.
6. Click the tab of the TLC method you chose in the previous step and configure the settings for that method.

Time of Use

Time of Use (TOU) is often used when a utility has set up schedules with different rates based on time of day, type of day and date when energy is consumed.

The Time of Use module may only be important if you are using the meter in a billing application (i.e. you are a power provider), as the module contains the meter's seasonal rate schedules. Typically, power consumers do not need to configure the Time Of Use module.

See the *ION Reference* for more information on the Time of Use module.

Configuring Time of Use

Use ION Setup to change your meter's Time of Use settings.

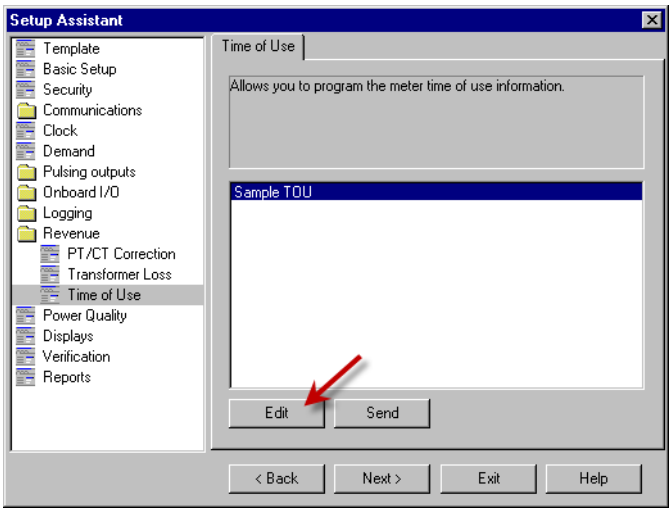
Using the display

You cannot configure Time of Use using the meter's display.

Using ION Setup

The Time of Use Setup Assistant helps you configure the Time of Use module.

1. Open the Setup Assistant for your meter. See the ION Setup help for instructions.
2. Select **Revenue > Time of Use**.



3. Select a Time of Use program from the list (in this example, Sample TOU) and click **Edit**. The Time of User Setup wizard is displayed.
4. Follow the instructions in the Time of Use Wizard to configure your program and click **Finish**. Click **Send** to save the TOU program on your meter.

Displaying Time of Use

View Time of Use module values in the following locations:

Application	Menu	Navigation
Front panel	Active TOU Rate, Active TOU Season and TOU Energy by Rate screens	ALT displays
ION Setup	N/A	N/A
Vista	Time of Use Screen	Revenue tab > Time of use object
WebMeter	N/A	N/A

Chapter 15 Power quality

Power quality configuration is provided by a number of modules, including the Sag/Swell module, the Transient module, and the Mains Signaling Evaluation modules. Your meter may not have all these modules. Refer to the *ION Device Template Reference* for a list of modules provided based on meter type and firmware version.

See the *ION Reference* for more information on these modules.

The power quality capabilities of your meter depend on the feature set ordered:

Meter type	Sag/Swell	EN50160/IEC 61000-4-30	Transients and waveform capture
C	X		
B	X	X[1]	
A	X	X[1]	X

[1] The ION8800A complies with 4-30 Class A, and the ION8800B complies with 4-30 Class S.

Configuring power quality

Use ION Setup to change your meter's power quality settings.

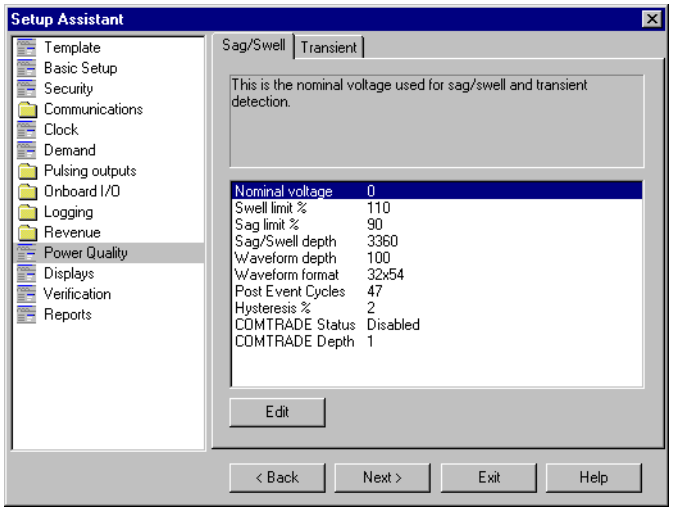
Using the front panel

You cannot configure power quality from the front panel.

Using ION Setup

The Power Quality Setup Assistant helps you configure the various power quality modules.

1. Open the Setup Assistant for your meter. See the ION Setup help for instructions.
2. Select **Power Quality**.



3. Select the **Sag/Swell** tab to set sag and swell limits, configure sag/swell waveform recorder settings, enable COMTRADE waveform records, and, most importantly, record your system's nominal voltage.

4. Select the **Transient** tab to configure various settings such as voltage deviation threshold, transient waveform recorder depth and frequency and enable COMTRADE waveform records.

NOTE: The meter features dual waveform capture: Sags are recorded at 32 samples x 54 cycles. Transients waveform capture at 256 samples x 7 cycles.

NOTE: COMTRADE Status must be DISABLED in order to change the Waveform format or Post Event Cycles values. Refer to the *COMTRADE and ION technology* technical note for more information about COMTRADE format waveform records.

Power quality standards compliance

The ION8800 has additional frameworks and settings related to the power quality standards below.

EN50160 settings (ION8800A and ION8800B)

The EN50160 framework is composed of numerous ION modules including: Mains Signaling Evaluation, Harmonics Evaluation, Voltage Harmonics, Flicker, and more.

See “EN50160 compliance logging (EN50160 ordering option only)” on page 123 for information on EN50160 parameter logging.

See the *Power Quality: ION meters and EN50160:2010* technical note for details.

4-30 settings (ION8800A and ION8800B)

The ION8800 meter complies with IEC 61000-4-30 power quality standard: the ION8800A meets class A, and the ION8800B meets class S. 4-30 compliance is provided by a variety of ION modules including: Power Quality Aggregator, Harmonics Measurement, Symmetrical Components, Sag/Swell and more.

See the *4-30 compliance and ION meters* technical note for details.

COMTRADE settings (ION8800A only)

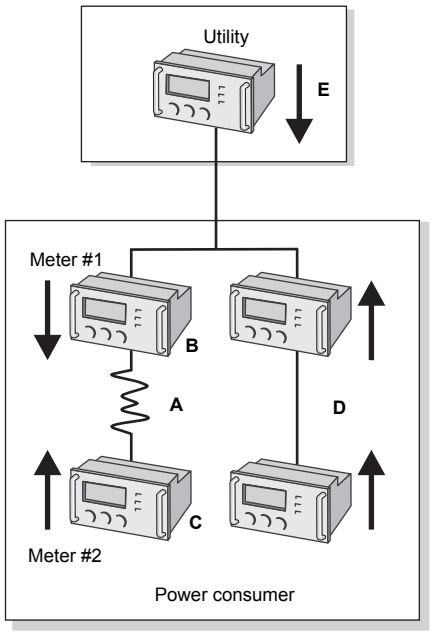
The meter can provide waveforms in COMmon format for TRAnsient Data Exchange (COMTRADE) format. COMTRADE records are created from the existing Waveform Recorder modules, which are connected to the COMTRADE module(s).

See the *COMTRADE and ION Technology* technical note for details.

Disturbance Direction Detection

Your meter has disturbance direction detection capabilities to help you determine the location of a power system disturbance. When a disturbance occurs, the meter analyzes the disturbance information to determine the direction of the disturbance relative to the meter. This analysis includes a confidence level indicating the level of certainty that the disturbance is in the determined direction, and is stored in your meter’s event log.

Disturbance direction detection can help locate the source of a disturbance when used in a system of disturbance direction detection devices, as shown in the diagram below.



A	Disturbance location
B	Meter #1 reports downstream disturbance
C	Meter #2 reports upstream disturbance
D	Meters report upstream disturbance
E	Meter reports downstream disturbance

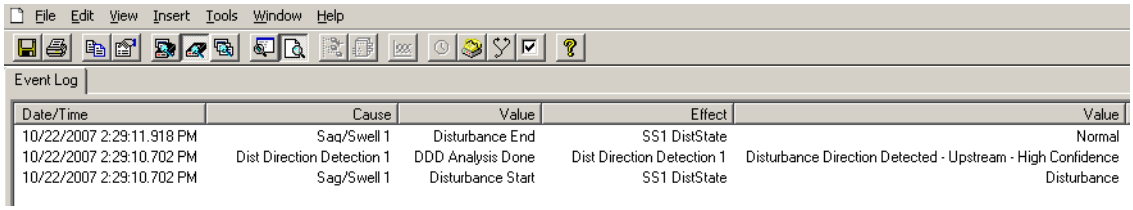
The arrows show the direction the meters have determined for the disturbance. With this information, you can focus on the section between meter #1 and meter #2 to find the cause of the disturbance.

NOTE: The disturbance direction detection feature is only available on the ION8800A and ION8800B meter models.

Viewing disturbance direction detection events

The results of the disturbance direction detection algorithm appear in the meter's event log. The image below shows an example of how the Disturbance Direction Detection event appears in your meter's event log when viewed using ION Setup.

NOTE: You can view your meter's event log through the display or ION Setup.



Chapter 16 Display screens

This chapter explains the available front panel display screens. It also includes procedures for customizing displays using ION Setup.

The ION8800 ships with preconfigured display screens designed to suit the data needs of most users. Different types of screens are available depending upon the meter's current mode of operation. See "Modes of operation" on page 28 for more information.

Display screens can also be customized on your meter to show virtually any measurement or calculation. For example, you could do one or all of the following:

- change displayed parameters, such as from *Ull* to *Uln* or *Ull12* to *Uln1*
- adjust character size to be different on each screen
- change data display settings such as backlight timeout, automatic display scrolling, parameter update rate and display mode

Use ION Setup software to customize your display.

Configuring meter displays

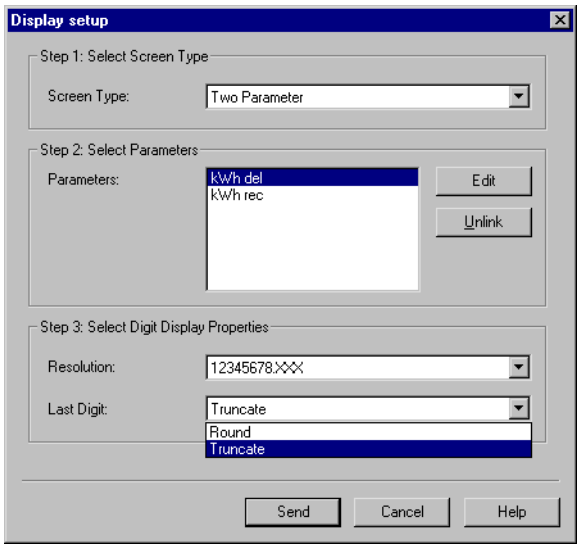
Using the front panel

Display settings are located in the Display Setup menu. See "Display Setup menu" on page 33 for more information.

Using ION Setup

1. Open the Setup Assistant for your meter. See the ION Setup help for instructions.
2. Click **Displays**.
3. Click the **Front Panel** tab.
4. Select Displays and click **Edit**.

   ION Setup uploads your meter's display information to the Display Editor. This may take a few moments.
5. Edit, rename, delete or rearrange displays as desired. You can also select in which mode the display will be shown.
6. If you choose to edit or create a new display, the Display Editor wizard contains three steps for creating or editing display screens.



– Choose the screen type.
– Select the parameters available for your chosen screen type.
– Select your display qualities, including digit resolution and truncated or rounded last digits.

7. Click **Send** to save the changes in the meter.

Default display screens

Each mode of operation (NORM, ALT and TEST) has its own display screens, providing various power system data and meter properties screens.

NORM mode display screens

The factory-configured ION8800 meter scrolls through nine displays detailed below. If the settings in the Scroll module have not been altered, each screen is displayed for five seconds if no front panel buttons are pressed.

Display scrolling is suspended when a front panel button is pressed, and you can manually scroll through the display screens using the **Up** or **Down** arrow buttons. If required, see “Display overview” on page 23 for more instructions on using the front panel buttons.

- **kWh**: This screen displays kWh delivered and received values.
- **kvarh**: This screen displays kvarh delivered and received values.
- **kVAh**: This screen displays kVAh delivered and received values.
- **Peak Demand Delivered**: This screen displays the maximum delivered kW value and a timestamp of when the peak occurred. This value is a Sliding Window (Rolling Block) demand calculation.
- **Peak Demand Reset Count**: This screen displays a count of the number of Demand Resets executed as well as a timestamp of the latest Peak Demand Reset.
- **Q Metering**: This screen displays approximated varh measurements, one phase (60 degrees) behind the normal watthour connection (90° - 330° and 150° - 270°).
- **kWh Disk Simulator**: This display simulates the behavior of a mechanical watt-hour meter indicating power received or delivered by the direction of the pulse.
- **All Segments**: This is a screen test where a black screen showing all segments (all pixels on) indicates that the display is functioning properly.

ALT mode default display screens

The meter scrolls through the following ALT mode displays. If the settings in the Scroll module have not been altered, each screen is displayed for five seconds if no front panel buttons are pressed (until five minutes have elapsed).

Viewing ALT display modes

1. Press the **Alt/Enter** button once to toggle between the NORM and ALT display modes.
2. Press the **Up** or **Down** arrow buttons to scroll back or forth through the displays.

If no buttons are pressed the meter reverts back to NORM mode after five minutes.

NOTE: These screens vary depending on the firmware version on the meter and custom display configuration.

- **Name Plate 1**: The Name Plate 1 screen contains this information:
  - Owner
  - TAG1 from Factory module
  - TAG2 from Factory module
  - Firmware revision of the meter
  - Battery life indicator
  - Meter serial number

  TAG1 and TAG2 typically identify the meter's user and installed location. The Owner and TAG registers are configurable with ION software. See "How to tag your meter" on page 42.
- **Name Plate 2**: This screen displays the following information for the current Sliding Window (Rolling Block) demand settings:

CONFIG	Length of the demand period multiplied by the number of demand periods
UPDATE	Length of the demand period
SYNC	Clock synchronization source
MAX (kW)	Maximum kW Demand[1]

1 The MAX (kW) value is a maximum allowable demand level based on installed transformer configurations and nominal voltages and currents.

- **Event Log**: The Event Log screen displays up to four of the most recent, highest priority events (priority 255 only). The date, a timestamp, an event description, and an event code are provided for each event displayed.

  If more than four high priority events have been recorded, then the Event Log screen will indicate additional logs exist. See "Your meter includes data logging and event recording capabilities. Data and event logs recorded by the meter are prioritized and stored onboard. Data logging" on page 119 for more information.
- **Vector Diagram**: This screen shows phasors and numeric values for each phase current and phase voltage measurement.
- **Instantaneous Voltage**: This screen shows average voltage, line-to-neutral and/or line-to-line voltage (depending on the meter's service type).
- **Instantaneous Current**: This screen shows the phase current and average current values.
- **Instantaneous Power**: This screen shows kW total, kvar total, kVA total and signed Power Factor total values.

- **Instantaneous Demand**: This screen shows kW delivered and received from the Sliding Window (Rolling Block) demand calculation.
- **Voltage Harmonics**: These screens show histograms of the per phase voltage harmonic content.
- **Current Harmonics**: These screens show histograms of the per phase current harmonic content.

ALT mode Time of Use (TOU) display screens

Some ALT mode display screens are factory-configured to show Time of Use (TOU) data. The measurements displayed originate from frameworks of ION modules that are linked to a TOU module. For details about the TOU module, refer to the *ION Reference*.

By default, all demand values result from Sliding Window (Rolling Block) calculations.

- **Active TOU Rate**: This screen shows which of the valid TOU billing rates is active.
- **Active TOU Season**: This screen shows which TOU billing season is currently active.
- **TOU Energy by Rate**: This screen shows kWh delivered values for each TOU rate.
- **kW Peak Demand**: These screens display the maximum kW delivered value for each TOU rate. These values result from Sliding Window (Rolling Block) demand calculations.
- **Past Billing Energy**: This screen displays the kWh delivered values for each TOU rate in the previous billing period.

NOTE: PB = Past (Previous) Billing period. A billing period is the time between two consecutive meter readings for billing purposes by a utility.

- **Past Billing Peak Demand**: These screens display the maximum kW delivered value for each TOU rate in the previous billing period. These values result from Sliding Window (Rolling Block) demand calculations.
- **Past Season Energy**: This screen displays the kWh delivered for each TOU rate in the previous billing season. These values result from Sliding Window (Rolling Block) demand calculations.

NOTE: PS = Past (Previous) Season. Billing Seasons are defined in the TOU module description in the
ION Reference.

- **Past Season Peak Demand**: These screens display the maximum kW delivered for each TOU rate in the previous billing season.
- **Past Billing/Season Energy**: These screens display the kWh delivered and received values in the previous billing period and billing season.
- **Past Bill/ Season Pk Demand**: These screens show the maximum kW sd received values in the previous billing period and billing season. These values result from a Sliding Window (Rolling Block) demand calculation.
- **Past Billing/Season Energy**: These screens display the kvarh delivered and received values in the previous billing period and billing season.
- **Past Bill/Season Pk Demand**: These screens display the kvar delivered and received values in the previous billing period and billing season. These values result from a Sliding Window (Rolling Block) demand calculation.
- **Past Billing/Season Energy**: These screens display the kVAh delivered and received values in the previous billing period and billing season.
- **Past Bill/Season Pk Demand**: These screens display the kVA delivered and received values in the previous billing period and billing season. These values result from a Sliding Window (Rolling Block) demand calculation.
- **Frequency**: This screen displays frequency information.

TEST mode default display screens

Values shown in the TEST mode display screens represent different accumulators than those shown in NORM mode (although they perform some of the same basic measurements). The TEST mode display values are for calibration checking purposes; they will only accumulate while the meter is in TEST mode.

Viewing TEST mode

There are two ways to switch the meter into TEST mode depending on the type of meter you have:

- Unlocked meter: You can use ION Setup or press a button on the front panel; see “Switching to TEST mode” on page 143.
- Hardware-locked meter: You must open the cover on the meter and press the TEST Mode button.

Once the meter is in TEST mode the front panel cycles through the three TEST mode display screens summarized below.

- **kWh Test**: This screen shows TEST mode kWh delivered and received values.
- **kvarh/KVAh Test**: This screen shows TEST mode kvarh/KVAh delivered and received values.
- **Instantaneous Demand Test**: This screen shows TEST mode kW delivered and received values. Both quantities are produced from a Sliding Window (Rolling Block) demand calculation. This value is reset if the Demand Reset button is pressed while the device is in TEST mode.

Chapter 17 TEST Mode

This chapter describes your meter's TEST mode and explains how to switch from Normal mode to TEST mode.

Introduction

TEST mode is typically used for verifying meter calibration and function. The meter is usually reading data from a test power supply while these functions are performed.

Several things to note about TEST mode:

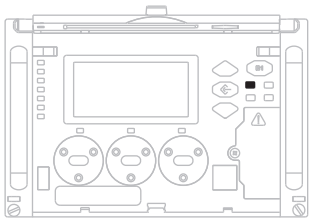
- All of the billing quantities that are recorded when the meter is in normal mode will stop accumulating when the meter is switched to TEST mode — the data is sent to special TEST mode registers instead.
- The values accumulated in these test registers are displayed on the front panel and in ION software.
- The regular normal mode billing registers are unaffected while the meter is in TEST mode; accumulation of this data continues as soon as you exit TEST mode.
- All test registers are reset to zero when you exit TEST mode.

NOTE: The meter will always return to NORM mode when you exit TEST mode, even if you entered TEST mode from ALT mode.

Switching to TEST mode

Place the meter into TEST mode using the display or ION Setup. The meter's front panel informs you when the meter is in TEST mode with a special display screen.

NOTE: You cannot place a hardware-locked meter in TEST mode using ION software. The meter must be placed in TEST mode by pressing the TEST Mode button.



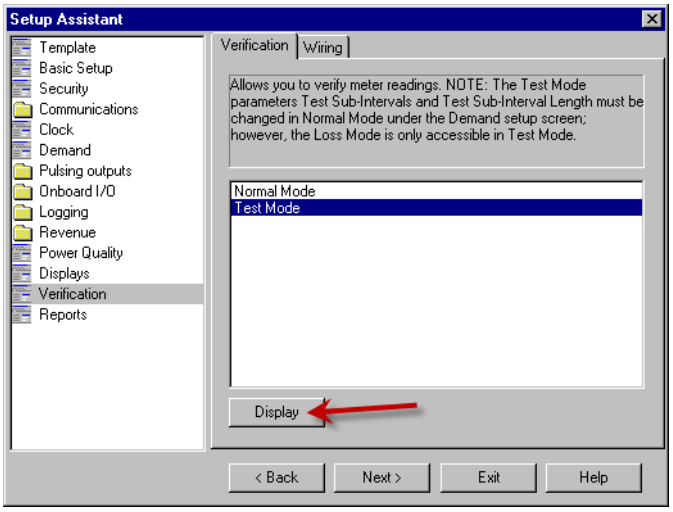
Using the front panel (all meters)

The **TEST Mode** button on the meter is located under the meter cover. You must open the cover to access it. For sealed meters, you must first break the cover seal.

Once you have opened the outer cover, press the **TEST Mode** button.

Using ION Setup (unlocked meter)

1. Open the Setup Assistant for your meter. See the ION Setup help for instructions.
2. Click **Verification**.



3. Select TEST Mode from the **Verification** tab and click **Display**. If meter security is enabled, you are prompted for password. A dialog box informs you the meter is in TEST mode.
4. Click **OK**. The TEST Mode screen appears and test values are displayed.
5. Click on the tabs to perform various test-related tasks. See the *ION Setup* online help for more information.
6. Click **Close**. A dialog box informs you the meter is back in Normal Mode.

Using ION Setup (hardware-locked meter)

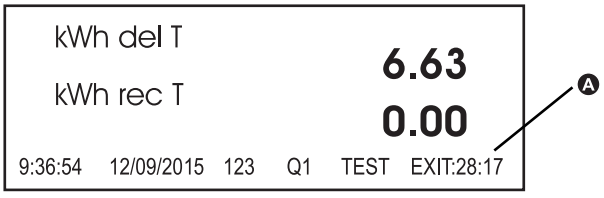
You cannot place a hardware-locked meter in TEST mode using ION Setup. The meter must be placed in TEST mode via the front panel. See “Switching to TEST mode” on page 143.

7. Select the TEST Mode radio button. You are prompted for the ION Setup user password. If standard meter security is enabled, you are also prompted for the meter password.

   Use this screen to reset the registers that accumulate real-time data.
8. To view test mode values, navigate to the **Revenue** tab and click the **Test Mode Values** button.

Changing TEST mode timeout

If no front panel buttons are pressed, the meter will exit TEST mode after 30 minutes (unless the default TEST mode timeout value has been changed). While in TEST mode, the value on the bottom right of the status bar (A) indicates the amount of time before TEST mode times out. The meter always returns to NORM mode when the TEST mode timeout elapses.



The time-out value resets to 30 minutes each time you press any front panel button. By default the TEST mode time-out value is 30 minutes.

You can change the value of the TEST mode timeout using ION Setup or the front panel.

Using the display

Follow these steps if you are using the display:

NOTE: On hardware-lockable meters, the meter must be unlocked to change the TEST mode timeout.

1. Enter the Setup menu by holding down the **Alt/Enter** button.
2. Scroll through the menu items, highlight DISPLAY OPTIONS, and press the **Alt/Enter** button.
3. Scroll down and highlight the TEST MODE TO menu item. Press **Alt/Enter**.
4. The current TEST mode time-out is displayed. Use the **Up** or **Down** arrow buttons to change the value of the highlighted digit. Press the **Up** or **Down** arrow button to move the cursor left or right. When you have entered the new value of the TEST mode time-out in seconds, press the **Alt/Enter** button.
5. Select YES to confirm the change and enter the meter password, if required.

Using ION Setup

Follow these steps if you are using ION Setup:

1. Start ION Setup and connect to the meter in Advanced Mode.
2. Locate the Display Options module in the module list and double-click to open the module.
3. In the Display Options module, click the Setup Registers tab and double-click the *TEST Mode Timeout* setup register. The default setting for this setup register is 1800 seconds (30 minutes).
4. Choose from numeric bounded format or elapsed interval format and set the TEST mode timeout to the desired time.
5. Click **Send** to transmit the changes to the meter.

TEST mode default display screens

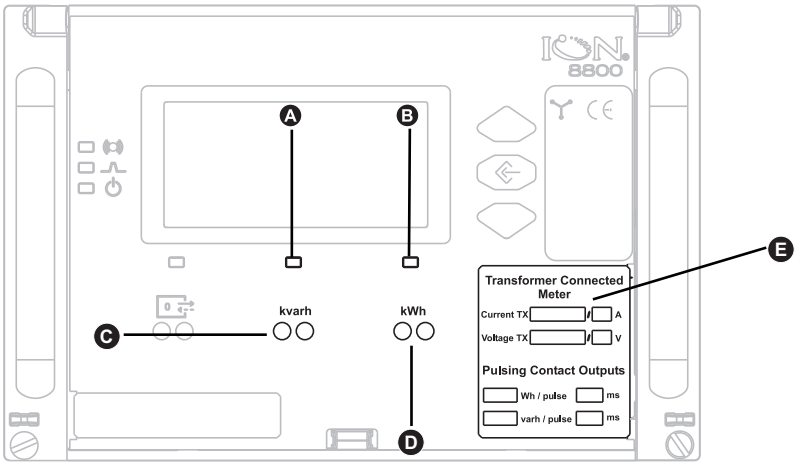
Values shown in the TEST mode display screens represent different accumulators than those shown in NORM mode (although they perform some of the same basic measurements). The TEST mode display values are for calibration checking purposes; they will only accumulate while the meter is in TEST mode.

Once the meter is in TEST mode the front panel cycles through three TEST mode display screens:

- **kWh TEST**: This screen shows TEST mode kWh delivered and received values.
- **kvarh/KVAh TEST**: This screen shows TEST mode kvarh/KVAh delivered and received values.
- **Instantaneous Demand TEST**: These screens show TEST mode kW delivered and received values. Both quantities are produced from a Sliding Window (Rolling Block) demand calculation. This value is reset if the Demand Reset switch is turned while the device is in TEST mode.

TEST mode LED energy pulsing

Below the display screen are two pairs of energy pulsing LEDs and infrared outputs. The LEDs and IR outputs are factory-configured to pulse while the meter is in TEST mode.



A	varh LED
B	Wh LED
C	varh infrared output
D	Wh infrared output
E	Pulsing Contact Outputs label (indicates the default pulsing rate)

The energy pulsing LEDs provide an ideal interface for accuracy verification instruments. The Pulsing Contact Outputs label (bottom right corner) indicates the factory-configured pulsing rate. (You can change the energy pulsing frequency with ION Setup.)

See “TEST mode” on page 28 for basic information about TEST mode.

Chapter 18 Resets

Resets allow you to clear various accumulated parameters stored on your meter or reinitialize the meter or meter accessories.

Meter resets clear your meter's onboard data logs and other related information. Resets are typically performed after you make changes to the meter's basic setup parameters (such as frequency, VT/PT or CT settings) to clear invalid or obsolete data in preparation for putting the meter into active service.

NOTE: Be sure to record any important data before performing a meter reset.

Available resets

You can perform various meter resets through the meter's display or ION Setup.

Reset	Description
Master Reset	– Energy and demand, peak demand, loss calculation, power quality disturbance counters and time of use parameters are all reset to zero – Event log, all data recorders, waveform recorders and COMTRADE waveform records are cleared.
Demand Reset	– Revenue peak demand reset to zero – TOU peak demand reset to zero – TOU previous billing peak demand reset to zero – Test peak demand reset to zero

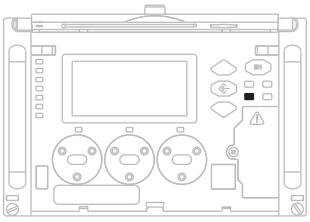
NOTE: *If PKDemandMnMaxReset* is enabled, all long term Min/Max values will also be reset (disabled by default).

Performing meter resets using the display

You can perform meter resets on your meter using the display.

The following resets can be performed via the display:

- Master Reset:
  - deletes most accumulated values and all derived revenue measurements from the meter.
- Demand Reset:
  - resets the peak demand values logged in the meter.

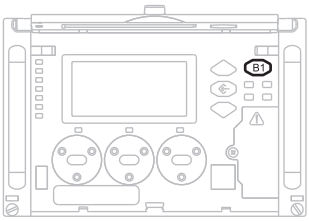


Performing a Master Reset from the front panel

The Master Reset button is recessed to avoid accidental activation. You must open the meter's cover before you can perform a Master Reset:

1. Remove the cover seal (if applicable).
2. Open the meter cover.
3. Using a pencil or similar instrument, press the **Master Reset** button.
4. At the confirmation screen, select YES to confirm the reset.

NOTE: Do not configure or power down your meter until the meter's front panel displays a message stating that the master reset is complete. If you configure or power down your meter during a master reset, the affected parameters may not be completely reset.



Performing a Demand Reset from the front panel

The Demand Reset button is recessed to avoid accidental activation. You must open the meter's cover before you can perform a Demand Reset.

NOTICE

DATA LOSS

Ensure all important data from the device has been retrieved before performing a reset.

Failure to follow these instructions can result in data loss.

1. Remove the cover seal (if applicable).
2. Open the meter cover.
3. Using a pencil or similar instrument, press the **Demand Reset** button.
4. At the confirmation screen, select YES to confirm the reset.

Hardware-locked meters and Master Reset

A hardware-locked ION8800 meter must first be unlocked to perform a Master Reset. To perform a Master Reset on a hardware-locked meter, you must first unlock the meter via the ALT Config menu (refer to "ALT Config button (B3)" on page 25). Then you can continue the Master Reset using the previous instructions.

Demand lockout timeout

The setup register labeled *Demand Lockout Timeout* (Display Options module) sets the minimum time allowed between consecutive Demand Resets; the meter ignores any attempts to reset the demand outside the bounds of the register.

The default value for the Demand Lockout timeout is 25 days. For more information on the *Demand Lockout Timeout* setup register, refer to "Display Setup menu" on page 33.

For more details on the Display Options module, see the *ION Reference*.

Performing meter resets using ION Setup

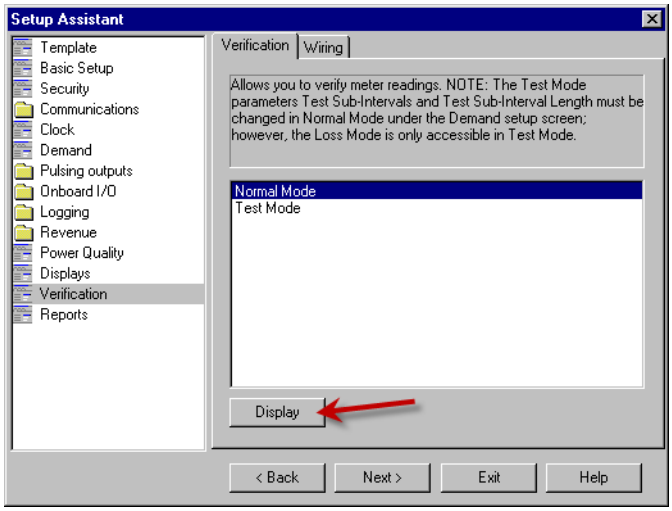
You can perform meter resets on your meter using ION Setup.

Revenue-locked meters must be unlocked to perform resets that impact revenue data.

Meter resets clear the meter's onboard data logs and other related information

NOTICE
DATA LOSS Ensure all important data from the device has been retrieved before performing a reset. **Failure to follow these instructions can result in data loss.**

1. Open the Setup Assistant for your meter. See the ION Setup help for instructions.
2. Select the Verification screen.
3. Select **Normal Mode** and click **Display**.



4. Select the desired tab in the **Normal Mode** dialog box. Depending on the tab selected, different resets are available.

Tab	Reset available
Energy	Master Reset
Rolling Demand	Peak Reset Master Reset
Volts, Amps and Power	Master Reset
Power Quality	Master Reset

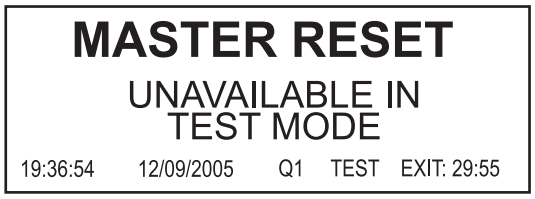
5. Click the appropriate button to perform the reset.

Master Resets and hardware-locked meters

A Master Reset on a hardware-locked meter can only be performed from the front panel. The meter must also be unlocked first.

TEST mode

In TEST mode, the following screen is displayed:


MASTER RESET
UNAVAILABLE IN
TEST MODE
19:36:54 12/09/2005 Q1 TEST EXIT: 29:55

Chapter 19 Setpoints

This chapter provides instructions for configuring meter setpoints.

Introduction

The Relative Setpoint module provides extensive non-critical control, secondary protection, and analysis capabilities by allowing you to initiate an action in response to a specific condition.

It is particularly useful for performing actions based on differences between a value (e.g. kW on phase 1) relative to a reference value (e.g., kW demand for all three phases). Use this module's outputs for demand control of equipment or any other applications requiring setpoint activity relative to a varying value. See the *ION Reference* for more information on the Relative Setpoint module.

Configuring setpoints

Use ION Setup software to change your meter's setpoints.

Using the front panel

You cannot configure setpoints using the front panel.

Using ION Setup

1. Connect to your meter in ION Setup, using Advanced Mode.
2. Navigate to the Relative Setpoint module you want to configure.

Relative Setpoint module settings

Several Relative Setpoint modules monitor the following for "over" conditions: phase current, kW demand, and voltage unbalance. Other modules are used only for EN50160 operation. See the table for details.

Module	Label	Description
Relative Setpoint 1	Over KW sd	When active, this annunciates when the total kW SWDemand exceeds a specified amount.
Relative Setpoint 2	Over I 1	When active, this annunciates when the current on phase 1 exceeds a specified amount.
Relative Setpoint 3	Over I 2	When active, this annunciates when the current on phase 2 exceeds a specified amount.
Relative Setpoint 4	Over I 3	When active, this annunciates when the current on phase 3 exceeds a specified amount.
Relative Setpoint 5	Over U unbal	When active, this annunciates if the voltage unbalance exceeds a specified percentage.
Relative Setpoint 8-16	<voltage phase> (+/-15%) -<time period>	These nine modules are used for EN50160 operation. For more information, see the *Power Quality: ION Meters and EN50160:2010* technical note.

NOTE: There is usually no need to change any of the Relative Setpoint modules' setup registers for normal operation of the meter.

See the *ION Reference* for more information on the Relative Setpoint module.

Fine tuning over condition monitoring

If you want to fine-tune over condition monitoring, the only setup registers you should change are *SusUntlON* and *SusUntlOFF*.

SusUntlON determines how long the modules wait after an over condition is detected before reporting it. This gives the monitored value a short period to correct itself before the event is registered with the module so that very brief over conditions are ignored. Similarly, *SusUntlOFF* is the amount of time a normal value must be present before the module considers normal operation to be restored. Both *SusUntlON* and *SusUntlOFF* values are entered in seconds (the default value for both is 30 seconds).

Chapter 20 Reports

This chapter provides instructions for viewing various meter reports and logs.

Introduction

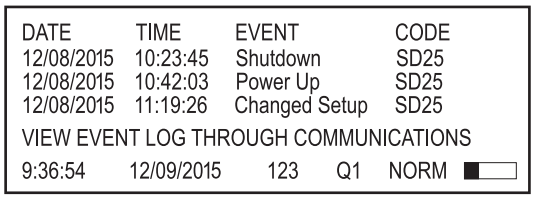
Accumulated meter values are saved in logs. These **logs** are acquired by your energy management software and saved in its database for analysis and reporting.

Viewing meter logs

View meter logs using ION Setup software or the front panel.

Using the meter display

The meter display shows recent high priority events (Event Log screen).

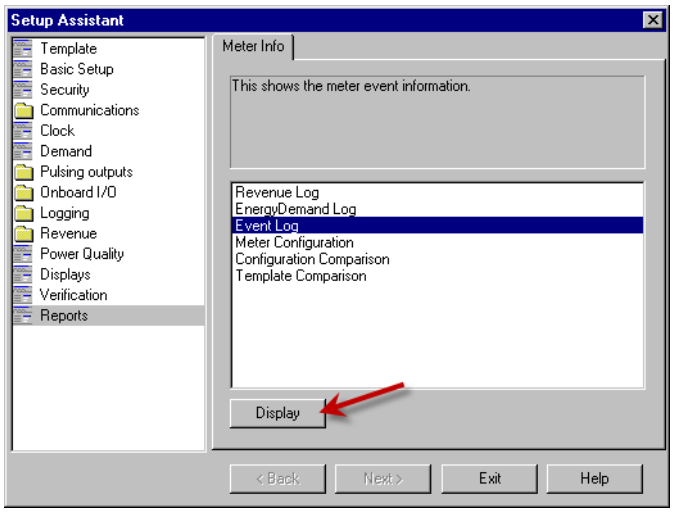


Press the **Up** and **Down** buttons to navigate to the Event Log.

Using ION Setup

Display various meter logs or reports using the Report Assistant.

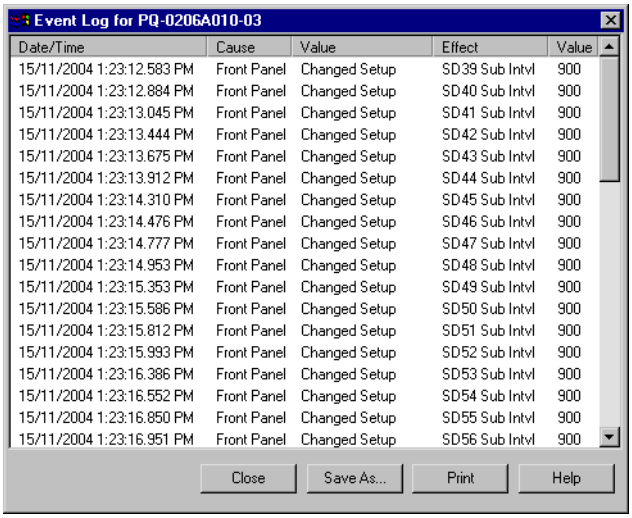
1. Open the Setup Assistant for your meter. See the ION Setup help for instructions.
2. Select **Reports**.



3. Select one of the logs or comparisons in the list and click **Display** to view the associated log.
4. Select which records you want to view (all, specific number, or date range) and click **OK**.



Below is an example of an Event Log.



5. You can view, save, or print the logs or comparisons. Click **Close** to exit.

Chapter 21 Verifying accuracy

Overview of meter accuracy

All meters are tested and verified at the factory according to ANSI (American National Standards Institute) and IEC (International Electrotechnical Commission) standards; however, before a new revenue meter is installed it is important to perform a final accuracy verification.

Your digital power meter typically does not require recalibration. However, in some installations a final accuracy verification of the meters is required, especially if the meters are used for revenue or billing applications.

Introduction

The revenue-accurate ION meter is digital and therefore needs no servicing. It is tested for accuracy at the factory and remains accurate for the life of the meter. In contrast, electro-mechanical meters need mechanical adjustment before installation and periodic calibration thereafter. This procedure of 'calibration testing' is unnecessary for digital meters.

Digital meters require verification testing to help ensure the meter meets required accuracy specification. If you know your meter is within required accuracy specification before installation, errors observed in the field could be attributed to incorrect connections or instrument transformer ratio settings.

Accuracy standards

The meter conforms to the following accuracy standards:

- IEC 62053-22 Class 0.2S (for 1 A and 5 A)
- ANSI C12.20 Class 0.2

Current ranges

The meter meets the following current ranges:

- Compatible with CTs in the range of 10 mA to 10 A
- Over-range current of 14 A
- Starting current of 1 mA

Accuracy test requirements

The most common method for testing meter accuracy is to apply test voltages and currents from a stable power source in combination with a reference meter. Although meter shops use different methods for testing revenue meters, most test equipment requirements are similar.

Test harness

A test harness is essential for non-socket meters. Ensure that the test harness for the meter is wired properly. Any current and voltage transformers must be accurately rated and must perform within specifications to provide accurate results.

Power source

It is important to have a steady power source. Power that energizes the meter must be reliable and provide: the rated voltage of the meter, unity power factor (1) and lagging power factor of 0.0 (for varh testing) or 0.5.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

Verify the device's power source meets the specifications for your device's power supply.

Failure to follow these instructions will result in death or serious injury.

Test loads

There are three methods of current loading: customer's load (a meter in service), resistance load (characteristics similar to a lighting load), and phantom loading (a test board). Your test load device or other loading circuit must be set within the current capacity ranges for the meter. The procedure outlined in this chapter describes verification using a phantom load or test board.

The meter maintains its accuracy during signal source variations, but its energy pulsing output needs a stable test signal to produce accurate test pulses. The meter energy pulsing mechanism needs approximately three to four seconds to stabilize after every source adjustment; the meter measurements are accurate during the signal source transitions, but the pulse output should be allowed to stabilize before the start of every test to help ensure accuracy.

Control equipment

Control equipment is required for counting and timing the pulse outputs (revolutions) from the front panel LEDs. Most standard test benches have an arm with infrared sensors used for this purpose.

NOTE: The optical sensors on the test bench can be disrupted by strong sources of ambient light (such as camera flashes, fluorescent tubes, sunlight reflections, floodlights, etc.) and cause test errors. Use a hood if necessary to block out ambient light.

Environment

The meter should be tested at the same temperature as the testing equipment. The ideal temperature is about 22°C (73°F). Ensure the meter is warmed-up sufficiently before testing.

A warm up time of 30 minutes is recommended for meters before energy accuracy verification testing. At the factory, the meters are warmed up to their typical operating temperature before calibration. to help ensure that the meters reach their optimal accuracy at operating temperature.

Most high precision electronic equipment requires a warm up time before it reaches its specified performance levels. Energy meter standards allow the manufacturers to specify meter accuracy derating caused by ambient temperature changes and self-heating.

The meter accuracy derating specifications exceed the requirements of these energy meter standards.

Grounding

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

Connect protective ground (earth) before turning on any power supplying this device.

Failure to follow these instructions will result in death or serious injury.

Your meter's safety ground terminal must be connected to a low impedance grounding system to help ensure meter accuracy. The signal source and the reference meter (or energy standard) should also be grounded as recommended by their respective manufacturers.

If the test configuration allows, the meter's neutral voltage terminal should be grounded in any test configuration with unbalanced phase voltages.

Reference meter or energy standard

To help ensure verification testing accuracy, it is recommended that a reference meter or a reference energy standard, with a specified accuracy of ±0.025% or better, be used.

Before the start of testing, the reference meter or energy standard should be warmed up as recommended by its manufacturer.

NOTE: Verify the accuracy and precision of any measurement equipment used in accuracy testing (for example, voltmeters, ammeters, power factor meters).

Verifying accuracy test

The following are guidelines for testing the meter; your meter shop may have other testing methods:

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA, CSA Z462 or applicable local standards.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Connect protective ground (earth) before turning on any power supplying this device.
- Do not exceed the device's ratings for maximum limits.
- Verify the device's power source meets the specifications for your device's power supply.

these instructions will result in death or serious injury.

1. Turn off all power to the test harness or other standard measuring device to help prevent hazardous voltages on meter terminals and connected equipment.
2. Use a properly rated voltage sensing device to confirm power is off.
3. Place the meter into the test harness or other standard measuring device. Ensure all voltages are in parallel with the meter being tested and all currents are in series (see "Connecting the test harness" on page 161). Ensure the meter's protective ground (earth) is connected to the installation's protective ground (earth).
4. Connect the control equipment used for switching the voltage to the test standard device.
5. Connect the control equipment used for counting the standard output pulses using either method:
   - align the infrared sensor on the standard test bench armature over the appropriate front panel LED pulser (Wh or varh).

   OR

   - connect to the meter's digital outputs (see "Connecting the control equipment" on page 162).
6. Apply the rated current and voltage to the terminals of the meter.
7. Before performing the verification test, let the test equipment power up the meter. Apply voltage for at least 20 seconds. The warm-up allows the internal circuity and capacitors to stabilize.
8. Set the meter's volts mode to 4W-WYE.
9. Place the meter in Test mode (see Test Mode chapter for more details). This allows the meter to enter the field with no kWh values in the registers. If you are performing field testing, put the meter in Test mode to avoid incorrect customer billing.

10. Perform testing on the test points (see “Accuracy verification test points” on page 163).
11. Run each test point for at least 30 seconds to allow the test bench equipment to read an adequate number of pulses. Allow 10 seconds of dwell time between test points.

Connecting the test harness

The WECO model 8CA-1 adapter provides an easy means of connecting an ION8800 meter to a WECO test machine.

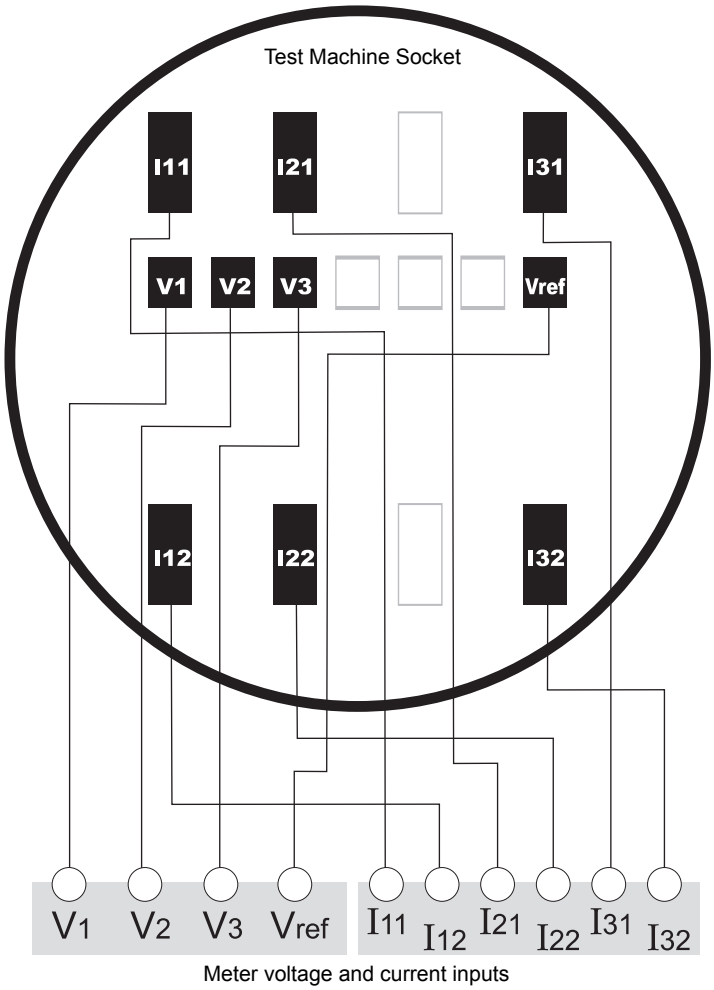
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA or applicable local standards.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Connect protective ground (earth) before turning on any power supplying this device.
- Replace all devices, doors and covers before turning on power to this equipment.

these instructions will result in death or serious injury.

1. Turn off all power to the test harness to help prevent hazardous voltages on meter terminals and connected equipment. Use a properly rated voltage sensing device to confirm power is off.
2. Connect the harness wires to the meter’s voltage and current inputs:



Meter voltage and current inputs

3. Plug the adapter into the WECO test machine's socket.
4. Ensure the meter's ground terminal (earth) and the test set ground (earth) are connected to each other.
5. Apply power to the test harness.
6. Set the WECO machine to **9S**.

NOTE: Non-specified connections can be left floating (not connected).

Connecting the control equipment

You can use either the meter's front panel LEDs or the digital outputs for control purposes. Refer to the "Energy pulsing" chapter for detailed descriptions and instructions for configuring your meter's front panel LEDs or digital outputs for energy pulsing applications.

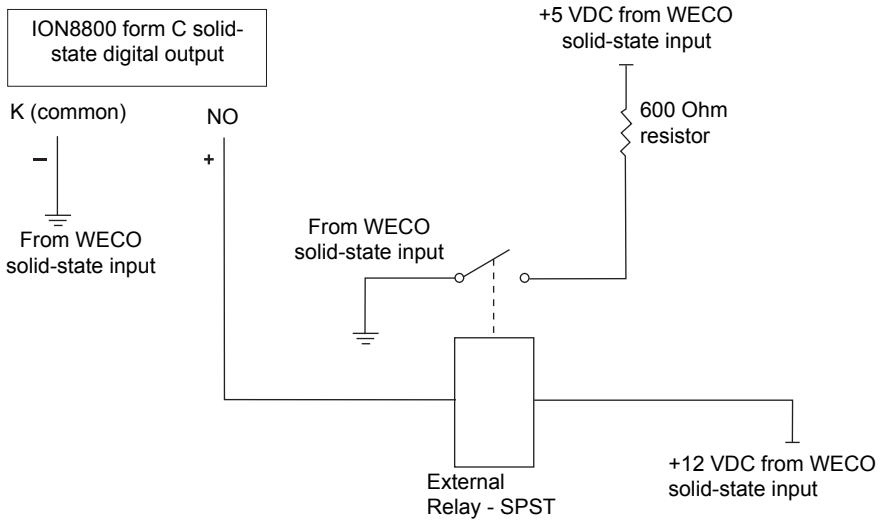
Option A: using the meter's front panel LEDs

1. Carefully position the test machine's optical arm over the appropriate LED pulser (Wh or varh).
2. Set test machine to "adjust optics" and check to ensure that the meter's LED pulses are being read.

NOTE: Refer to “Energy pulsing with infrared ports and LEDs” on page 113 for detailed information.

Using the meter’s digital outputs

Connect the meter’s form C solid-state digital outputs to the WECO test machine. The Essailec connectors are found on the rear of the meter. See your meter’s Installation guide for details on your specific I/O wiring configuration. Refer to the “Energy pulsing with digital outputs” on page 115 for information on configuring your meter’s digital output hardware ports for energy pulsing.



Configuring test settings

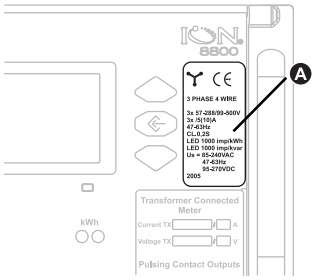
When testing the meter, ensure the test parameters are suited to your testing methods. You may need to adjust the energy pulsing outputs’ pulse rate (Kt value), pulse width, and the test mode timeout.

Refer to the “Energy pulsing” chapter for information on how to modify your meter’s front panel Wh or varh LEDs or for instructions on how to configure your meter’s digital output hardware ports for energy pulsing. Refer to “Changing TEST mode timeout” on page 144 for instructions on how to modify your meter’s test mode timeout settings.

Accuracy verification test points

The meter should be tested at full and light loads and at lagging (inductive) power factors to help ensure testing over the entire range of the meter.

The rated test current (A) is found on the meter’s front panel.



Watt-hour test point	Sample accuracy verification test point
Full load	100% of the rated current, test voltage and rated frequency at unity power factor, or one (1).[1]
Light load	10% of the rated current, test voltage and rated frequency at unity power factor, or one (1).
Lagging power factor	100% of the rated current, test voltage and rated frequency at 0.50 lagging power factor (current lagging voltage by 60° phase angle).

[1] The rated test current is found on the ION8800 meter front panel label.

kvarh test point	Sample accuracy verification test point
Full load	100% of the rated current, test voltage and rated frequency at zero power factor (current lagging voltage by 90° phase angle).
Light load	10% of the rated current, test voltage and rated frequency at zero power factor (current lagging voltage by 90° phase angle).
Lagging power factor	100% of the rated current, test voltage and rated frequency at 0.50 lagging power factor (current lagging voltage by 60° phase angle).

PowerLogic™ ION8800
User guide

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