PowerLogic™ ION7550/ION7650

Power and energy meters

User guide

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www.se.com

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 manual 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

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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.

FCC

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 the 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 to which the receiver is connected.
- 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).

This equipment complies with Part 68 of the FCC rules and the requirements adopted by the Administrative Council for Terminal Attachments (ACTA). On the side of this equipment is a label that contains, among other information, a product identifier in the

format US: AAAEQ##TXXXX. If requested, this number must be provided to the telephone company.

This equipment uses the following Universal Service Order Codes (“USOC”) jacks: RJ11.

A plug and jack used to connect this equipment to the premises wiring and telephone network must comply with the applicable FCC Part 68 rules and requirements adopted by the ACTA. A compliant telephone cord and modular plug or compliant modular jack is provided with this product.

The REN is used to determine the number of devices that may be connected to a telephone line. Excessive RENs on a telephone line may result in the devices not ringing in response to an incoming call. In most but not all areas, the sum of RENs should not exceed five (5.0). To be certain of the number of devices that may be connected to a line, as determined by the total RENs, contact the local telephone company. The REN for this product is part of the product identifier that has the format US: AAAEQ##TXXXX. The digits represented by ## are the REN without a decimal point (e.g., 03 is a REN of 0.3).

If this equipment, Digital Power Meter with Internal Modem, causes harm to the telephone network, the telephone company will notify you in advance that service may be temporarily discontinued. When advance notice is not practical, the telephone company will notify you as soon as possible. You will also be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operations or procedures that could affect the operation of this equipment. If this happens, the telephone company will provide advance notice in order for you to make necessary modifications to maintain uninterrupted service.

If you experience trouble with this equipment, Digital Power Meter with Internal Modem, please contact Schneider Electric Technical Support. If this equipment is causing harm to the telephone network, the telephone company may request that you disconnect this equipment until the problem is resolved.

There are no user serviceable parts in this equipment.

Connection to party line service is subject to state tariffs. Contact the state public utility commission, public service commission or corporation commission for information.

If your premises has specially wired alarm equipment connected to the telephone line, ensure that the installation of this Digital Power Meter with Internal Modem does not disable your alarm equipment. If you have questions about what will disable alarm equipment, consult your telephone company or a qualified installer.

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.

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 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.
- Ensure the meter base terminal strips cannot be accessed once the meter is installed.
- This meter can only be used as a permanently installed device with permanent electrical connections including earth ground.
- 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.
- Incorrectly configured ION modules may render the meter non-functional. Do not modify a module's configuration without understanding the impact to the meter and any associated devices.
- 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: See IEC 60950-1:2005, Annex W for more information on communications and I/O wiring connected to multiple devices.

NOTE: Do not perform Dielectric (Hi-Pot) or Megger testing on the power supply 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.

⚠ 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.

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Chapter 1 Introduction

This manual discusses features of the PowerLogic™ ION7550 and ION7650 meter and provides configuration instructions. Throughout the manual, the term “meter” refers to both meter models. All differences between the models, such as a feature specific to one model, are indicated with the appropriate model number.

NOTE: This user guide also covers the ION7550 RTU. Differences between the RTU and standard model
ION7550/ION7650 meters are detailed in the *PowerLogic ION7550 RTU Option* document.

By the time you are ready to use this guide, your meter should be installed, most basic setup should have been performed, and communications/basic operation should have been verified. If the unit is not yet installed and operational, refer to the *Installation Guide* shipped with the meter.

This chapter provides an overview of ION7550 and ION7650 meters, and summarizes many of their key features.

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ION7550 and ION7650 Meters

ION7550 and ION7650 intelligent metering and control devices provide 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 pre-configured data screens and measurements, so you can use the meters “out of the box” or customize them to fit your unique requirements.

ION7550 and ION7650 meters can replace numerous transducers, traditional meters, and non-critical control circuits. You can integrate the meters with ION™ software or other energy management, SCADA, automation and billing systems, using multiple industry-standard communication channels and protocols.

Common meter applications

- Revenue metering
- Substation automation
- Power quality monitoring (with Flicker)
- Commercial/industrial operations metering
- Demand and power factor control
- SCADA (supervisory control and data acquisition)
- Distributed generation (generator) monitoring and control

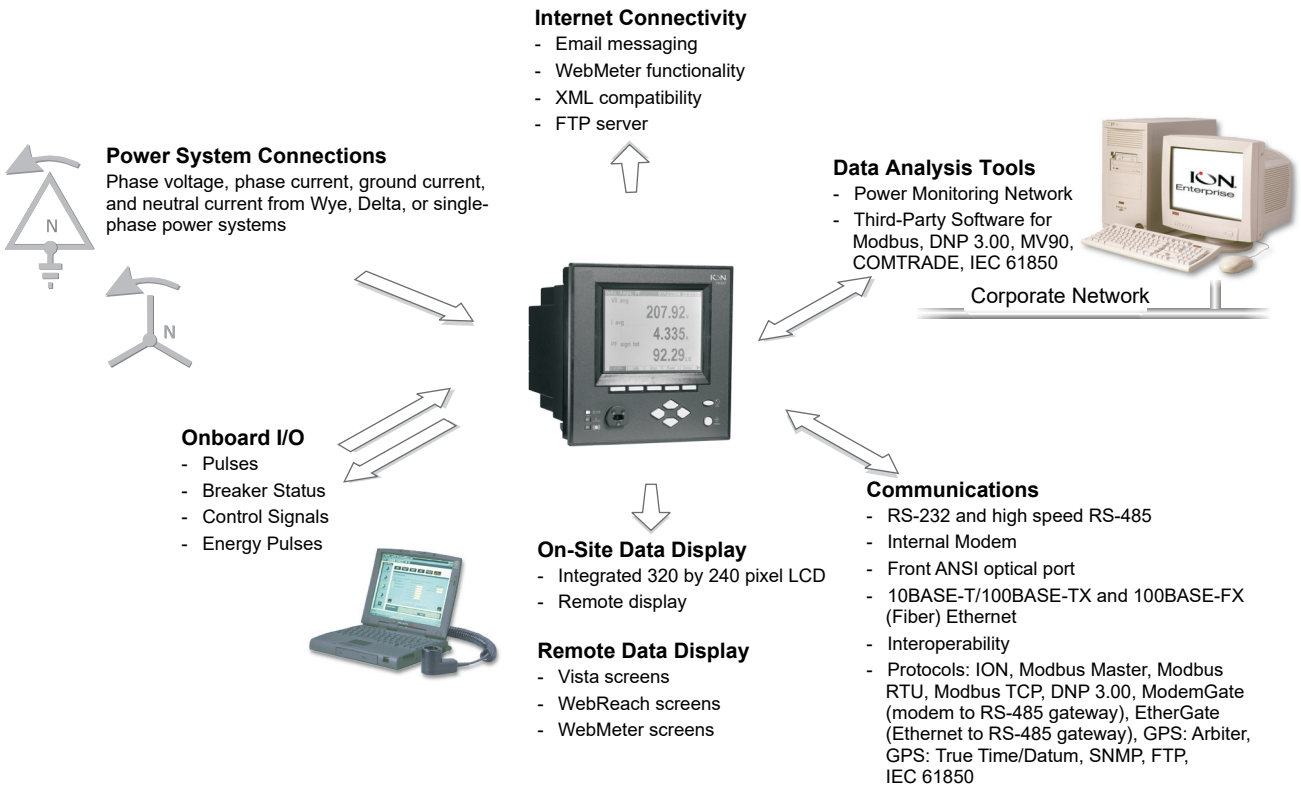
The ION Meter in an Enterprise Energy Management System

You can use ION7550 and ION7650 meters as standalone devices, but their extensive capabilities are fully realized when used with ION software as part of an enterprise energy management (EEM) system.

EEM systems give energy suppliers, service providers, and large industrial and commercial energy consumers the tools to meet all the challenges and opportunities of the new energy environment. EEM systems use real-time information and control to directly address a broad range of requirements throughout the power delivery chain and across an entire enterprise. These systems offer an integrated solution to managing new billing structures, distributed generation, energy purchasing, energy cost control, operational efficiency, and power quality and reliability.

Applications that include the meter typically require additional equipment. Display and analysis software tools are almost always used to manage, interpret and distribute the data measured or logged by a meter. There are usually a variety of tools used, and often these tools are connected using different communications standards and protocols. In many cases, a meter must also provide non-critical control capabilities and device-level data sharing.

The meter can adapt to many situations. Advanced 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 monitor your power system.



Meter Features

Your meter includes a wide range of standard features. The following is an overview of those features.

Measured Parameters

ION7550/ION7650 meters provide fully bi-directional, 4-quadrant, revenue-accurate or revenue-certified energy metering. The following is a selection of some parameters measured by these meters.

Energy

The meters provide all common active, reactive and apparent energy parameters.

- kWh delivered and received
- kWh, kVARh, kVAh net (delivered - received)
- kWh, kVARh, kVAh total (delivered + received)
- kVARh, kVAh delivered and 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

The meters support standard demand calculation methods, including block, rolling block, and predicted demand. They 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

Both meters provide a choice of high accuracy, 1 second or high-speed, 1/2 cycle measurements, including true RMS, per phase and total for:

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

Harmonics

Complete harmonic distortion metering, recording and real-time reporting, up to the 63rd harmonic (511th for ION7650 via Power Monitoring Expert software) for all voltage and current inputs.

- Individual harmonics (including magnitude, phase and interharmonics for the ION7650)
- Total even harmonics and total odd harmonics
- Total harmonics (even + odd)
- Total interharmonics distortion
- K-factor, Crest factor

Min/Max recording

The meters record each new minimum and new maximum value with date and time-stamp 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

The meters measure and record the following parameters:

- Sag/Swells
- Transients (ION7650 only)

ION7650 meters comply with the following power quality standards:

- EN50160 including Flicker (with ordering option only)
- IEC 61000-4-30 Class A

The meters also have the following power quality related features:

- Disturbance Direction Detection: This allows the meter to analyze disturbance information and determine the direction of the disturbance, relative to the meter, with an accompanying degree of confidence. When used in conjunction with other meters with the feature, this enables you to determine the source of a disturbance more quickly and accurately, prevent repeat occurrences and minimize facility downtime.
- Setpoint Learning: This allows you to configure your meter to learn certain disturbance-related values, such as what constitutes a sag, swell, transient, or high or low setpoint.
- COMTRADE: This allows you to save waveform data in COMmon Format for TRAnsient Data Exchange (COMTRADE) format, available for download via FTP. This is intended for use in conjunction with IEC 61850 and is only available on meters with an Ethernet port.

Localization Options

The meter can be customized to use different regional settings, including:

- the language used for the display
- the currency symbols used
- time, date and digit formats
- IEC/IEEE symbols and calculations

Data Display and Analysis Tools

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

The front panel

Use the meter's front panel 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.

NOTE: TRAN (transducer) model meters do not have a front panel.

Remote display

The optional Remote Display is an interactive graphics terminal with a color touchscreen. The display communicates with ION7550/ION7650 meters (including remote terminal unit (RTU) and transducer (TRAN) models) through a serial or Ethernet connection.

WebMeter embedded web server feature

Ethernet meters include WebMeter™ functionality, an on-board web server that provides quick and easy access to real-time energy, basic power quality and trending and forecasting information without special software. The built-in web pages display a range of energy and basic power quality information through the web-enabled device. These pages also support basic meter configuration tasks.

Email messaging feature

Configure the meter to automatically email high-priority alarm notifications or scheduled system-status update messages to anyone, anywhere within the facility or around the world. Specify the type of event that triggers an email alert, such as power quality disturbances or logged data at any pre-determined interval, and have your ION software administrator program the meter to respond with an email message when these events occur. Email messages from your meter are received like any email message over a workstation, cell phone, pager, or PDA.

XML compatibility

Your meter can exchange information using industry-standard XML format. This simple machine-readable format supports easy integration with custom reporting, spreadsheet, database, and other applications.

Supported Protocols

You can integrate the meter into various industry-standard networks. Data that the meter measures can be made available to other devices using Modbus RTU, Modbus/

TCP, DNP 3.00, FTP, IEC 61850 and SNMP protocols, as well the MV-90 translation system. You can configure the meter to import 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 also functions with the meter.

Alerting

The meter can be configured to send alerts in response to power system conditions that you define, such as a power quality problem (including surges, sags and swells), changes in relays, power outages 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, pagers or to software such as Power Monitoring Expert.

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 Power Monitoring Expert, see the online Power Monitoring Expert help.

Communications Options

The standard meter includes a selectable RS-232/RS-485 port (the factory default is RS-232), a high-speed RS-485 port, and an ANSI Type II front optical port for communications in the field. Ordering options include 10BASE-T/100BASE–TX and 100BASE-FX (fiber) Ethernet ports and a 56 kbps internal modem (both FCC and CTR-21 compliant). Depending on the hardware options purchased, up to five separate ports can communicate simultaneously.

NOTE: The communications card is retrofittable – it can be replaced while the meter is in the field.

Security

This meter offers standard and advanced security. Standard security is enabled by default from the factory, and advanced security allows you to configure specific security settings. These include features such as adding users with unique access privileges, and communications lockouts.

Additional features include network port enabling and disabling, Ethernet port number assignment and event log loss preventative measures.

Digital and Analog I/O Options

The meter's digital inputs and outputs connect to the captured-wire terminals near the base of the unit. Additionally, an LED on the front panel is configured for energy pulsing. You can also order an optional analog I/O card with your meter. For more information see the *ION7550/ION7650 I/O Card* product option document.

NOTE: The I/O card is retrofittable – it can be replaced while the meter is in the field.

Onboard I/O

The meter contains eight self-excited digital inputs that can be used for monitoring external contacts or pulse counting applications. The meter contains four Form A outputs and three Form C outputs that can be used for monitoring breaker trips or send KYZ pulsing information to third-party system equipment.

Expansion I/O with analog inputs and analog outputs

The meter offers an optional Analog I/O expansion card. It comes with 8 additional digital inputs combined with one of the options below:

- four 0 to 20 mA analog inputs
- four 0 to 20 mA analog outputs
- four 0 to 20 mA analog inputs & four 0 to 20 mA outputs
- four 0 to 1 analog inputs and four -1 to 1 mA analog outputs

Power Monitoring Expert Software Support

The complete Power Monitoring Expert software package integrates the meter into 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 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.

Vista

Vista presents a graphical view of your power system, allowing you to view and analyze real-time data from power meters and historical data from the ION database. Vista reports on the status of your system components, informing you of alarm conditions and providing you with control capabilities for initiating intelligent device functions or actuating field machinery. Vista includes sophisticated tools for analyzing real-time and logged power data and system events.

For more information, refer to the Vista section in the online *Power Monitoring Expert Help*.

WebReach

The WebReach component of Power Monitoring Expert adds thin-client support functionality to the Power Monitoring Expert software. With the WebReach feature you can use the web browser from any machine on your network to view the Vista diagrams of all the meters on your network, regardless of whether they are located locally or across the country. You can create custom screens in Vista for display in your web browser, including real-time numeric data, background graphics or diagrams, and basic views of event, data and waveform logs.

Web Reporter

The Web Reporter component of Power Monitoring Expert lets you define and create comprehensive database reports. Reports, including Power Quality, Load Profile, Energy and Demand, EN50160, and IEC61000-4-30, are included with Web Reporter.

For more information, refer to the Web Reporter section in the online *Power Monitoring Expert Help*.

Management Console

The Management Console component of Power Monitoring Expert is used to build your Power Monitoring Expert power-monitoring network to reflect the way the physical communications network is wired, so Power Monitoring Expert software can communicate with your devices. The network is created using sites, servers, modems, and intelligent devices that can be added, removed, configured, or duplicated.

You can access the following tools from the Management Console menus:

- **Diagnostics Viewer** is the primary source of troubleshooting information in Power Monitoring Expert.
- **Remote Modem Setup** lets you set up modems for remote sites.
- **Database Manager** lets you manage your Power Monitoring Expert databases with both manual tasks and scheduled tasks.
- **User Manager** lets you configure Power Monitoring Expert software user accounts that define different operations permitted within the ION software, such as viewing meter data, performing control actions, or configuring the meters.
- **License Manager** lets you upgrade the number of devices you can have without re-installing the software.
- **Modbus Device Importer** lets Power Monitoring Expert software recognize and integrate third-party Modbus devices more readily.

For more information, refer to the Management Console section in the online *Power Monitoring Expert Help*.

Designer

The Designer component of Power Monitoring Expert lets you customize the operation of hardware nodes, such as ION meters, and software nodes, such as the Virtual Processor, the Log Inserter, and the Query Server. Designer uses a WYSIWYG graphical user interface to pictorially represent a node's configuration (i.e., how the different ION modules are linked together in a framework). In addition to giving you the ability to change the settings of any ION module, Designer also lets you change existing links between modules, add new links, add new modules or delete modules. Designer helps you visualize the logic when you are programming custom functionality in an ION device.

For more information, refer to the Designer section in the online *Power Monitoring Expert Help*.

ION Setup Software Support

ION Setup is a software tool designed specifically to configure and test meters. ION Setup offers a Setup Assistant for performing basic meter setup, installing templates into meters, resetting accumulated values, verifying meter calibration and measurements, and setting up advanced security. There is a real-time data viewer that allows you to verify your meter operation and measurements, while using ION Setup in advanced mode allows access to the ION modules that comprise the meter's template.

Getting More Information

Additional information is available from Schneider Electric:

- visit our web site at **www.se.com**
- contact your local Schneider Electric representative
- contact Schneider Electric directly

Documents that are related to the installation, operation and application of the meter are as follows:

ION7550/ION7650 installation guide

This brief manual is shipped with each meter. It details the mounting, wiring and basic setup of the device.

ION Reference

The ION Reference describes ION architecture (the common software architecture in all ION devices) and provides an explanation for each of the ION modules.

Online Power Monitoring Expert help & online ION Setup help

In-depth online help systems for Power Monitoring Expert and ION Setup software.

Technical notes

Technical notes provide instructions for using meter features and for creating custom configurations.

Product option documents

These documents include instructions on how to retrofit your current product with your new option, and how to utilize the option.

Protocol documents

Each protocol document contains information explaining how our products interact with a protocol, such as DNP 3.0, Modicon Modbus, IEC 61850 and MV-90.

ION device template reference

This document lists the default ION modules and their default configuration in the shipping template for the most recent firmware releases of ION meters.

Chapter 2 Templates, Frameworks and Firmware

Your meter comes installed with a pre-configured default **template**. This template contains various **frameworks** which provide all the power measuring and analyzing functionality of the meter. Templates and frameworks can be used immediately without any user configuration (“right out of the box”). They can also be customized, reconfigured, and pasted from one meter to another.

NOTE: The ION7550 RTU comes with a very basic template. Contact Technical Support for custom templates.

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

Your meter’s operating system is known as **firmware**. When newer firmware is available for your meter, simply upgrade to the latest version for all the added features and functionality.

NOTE: ION7500/ION7600 firmware is not compatible with ION7550/ION7650 meters, and vice versa.

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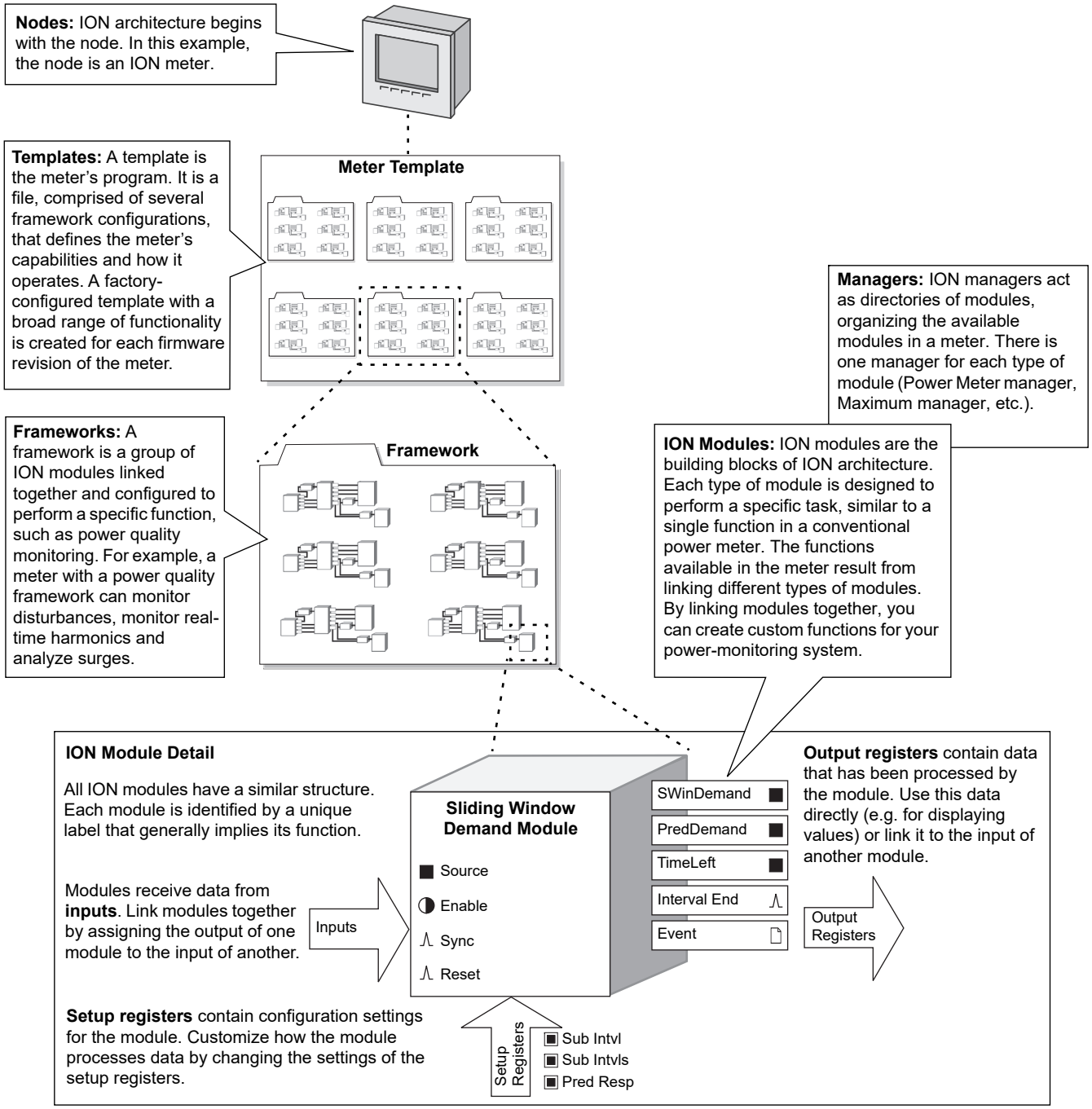
ION Architecture Overview

ION architecture is an object-oriented architecture with a modular structure that is the foundation of every component in an ION system. Although the meter ships with a fully functional, factory-configured template, its modular design enables you to customize the functions of the meter. The graphic below outlines the key components of the architecture in your meter: the node (meter), the template, frameworks, ION modules and module managers. For more detailed information on ION Architecture and individual modules, refer to the *ION Reference.*



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) or configurable information in read/write setup registers.

Factory module settings

The device information provided is as follows:

Setup Register	Description
Device Type	A device type identifier (e.g. “ION7650” for the ION7650)
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
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:

- *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

Updating or restoring the template

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.

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

NOTICE

DATA LOSS

- Ensure all important data from the device has been retrieved before you restore the factory configuration.

Failure to follow these instructions can result in data loss.

Use ION Setup to upgrade or restore the template.

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

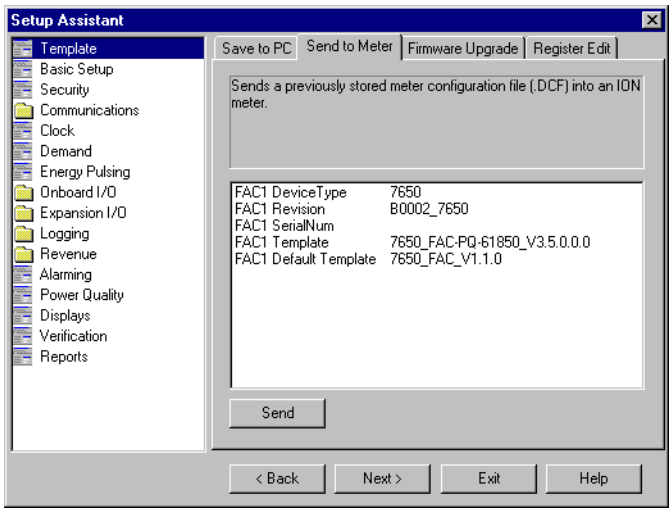
- Do not use the meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.
- Be aware that an unexpected change of state of the digital outputs may result when the supply power to the meter is interrupted or after a meter firmware or template upgrade.

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

Using ION Setup

1. Obtain the meter template that you want to update or restore:
   - Download your meter's factory template or an updated template from the website.
   - Save a template you have configured on another meter. See the ION Setup Help for instructions.
1. Save the .DCF file. The default template file location is .../ION Setup/TEMPLATE.
2. Connect to your meter in ION Setup, using Basic Mode, and open the Setup Assistant.

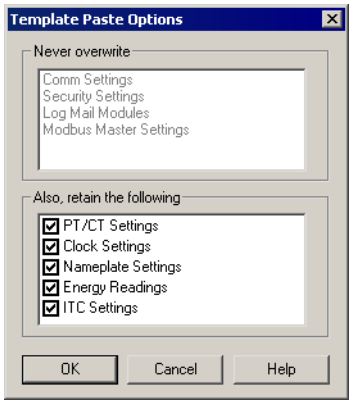
3. Select the **Template** screen. Select the **Send to Meter** tab and click the **Send** button.



4. Select the .DCF file from the TEMPLATE folder and click **OK**.

NOTE: The original template that shipped with your meter is displayed for reference.

5. 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 shows the progress and confirms whether the paste was successful.

Using Designer

See the *Power Monitoring Expert help* for detailed instructions on updating and restoring templates and frameworks.

NOTE: The time required to complete the steps in this procedure can vary depending on your connection and the meter configuration. Some steps may take several minutes to complete.

1. Open your meter in Designer. Ensure that the meter's main Configuration screen is displayed.
2. Click **Edit > Select All** then press DELETE.

   A confirmation dialog box appears explaining that some modules will not be deleted (core modules cannot be deleted — scroll down in the dialog to see which standard modules will be deleted).

3. Click **OK** on the confirmation dialog box.

   The modules are deleted (other than persistent and core modules). You may get a message stating that persistent modules could not be deleted. Click **Continue**.

   The main meter Configuration screen is blank except for a folder that contains the modules which cannot be deleted.

4. Click **Edit > Select All** to select the Frameworks folder. This selects all sub-folders and modules within the folder.

5. Click **Edit > Paste from Framework**, then select the appropriate .fwn file from the folder \Power Monitoring Expert\config\fmwk\nd\. Click **Open**.

NOTE: The Factory module's Default Template register tells you the filename for the default factory framework. For details about framework files, contact Technical Support or visit www.se.com.

   The **Paste Summary** dialog box appears.

6. Click on the first module, scroll down to the last module, hold the SHIFT key and click on the last module. This selects all of the modules.

7. Continue holding the SHIFT key and click on the check box to the left of the module name. A lock icon with a green check mark appears; this performs a lock-paste of the modules.

NOTE: Persistent modules can be overwritten in Designer. When pasting a default framework onto a meter, use lock-paste on the Persistent modules, not free-paste. A list of Persistent modules is available from Technical Support.

8. Select the **Maintain external inputs** check box and click **OK**.

   A message appears indicating that Designer is pasting modules. All modules are selected when the paste is complete. Click anywhere in the background of the node diagram to deselect all of the modules.

9. Click the Power Meter shortcut in the Basic Configuration area to select it. Click the **Reset** icon or select **Edit > Reset**. This reverts the Power Meter to the settings it had before you deleted any modules (retaining your original basic setup).

10. Click **File > Send & Save**. If you receive an message stating that the operation is incomplete, click **Continue** then click **File > Send & Save** again.

Upgrading Your Meter

You can upgrade the firmware (operating software) on your meter using ION Setup.

General Upgrading Considerations

Upgrading to compatible firmware versions

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).

For example, if your meter is an ION7550, you must use ION7550 firmware, not ION7650 firmware. The model is indicated in the firmware filename.

You can download meter firmware from the website.

Recording your device's usernames and passwords

Ensure that you record your device's usernames and passwords prior to upgrading the device firmware.

Lost passwords cannot be recovered. If your device's user access information is lost, you must return the device for factory reconfiguration, which resets your device to its factory defaults and destroys all logged data.

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

See "Security" on page 63 for more information on the device's security settings.

Using a laptop computer to upgrade

Laptop computers generally have different default power properties than desktop computers. Incorrect power options can adversely affect device upgrading because the connection between the laptop and the device must be maintained in order to complete the upgrade successfully. If the laptop's hard disk shuts down or the laptop enters system standby mode, this connection is broken and the upgrade procedure must be restarted.

If you are upgrading a meter 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 hard disks so that they do not shut down after a certain period of time (i.e. set to "never").
- Turn off power suspension (e.g. 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 screen saver; screen savers can burden the CPU.

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 I/O module behavior

The state of your meter's I/O modules may change during an upgrade.

⚠ WARNING

HAZARD OF UNINTENDED OPERATION

- Do not use the ION7550/ION7650 meters for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.
- An unexpected change of state of the digital outputs may result when the supply power to the meter is interrupted or after a meter firmware upgrade.

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

Accumulated energy values and upgrades

The firmware upgrade process clears accumulated energy values in the meter.

If you want to retain these values across a firmware upgrade, you can use the Register Edit feature in ION Setup to manually restore pre-upgrade values back to your meter

Upgrading Firmware Using ION Setup

Performing a device upgrade in ION Setup involves:

- upgrading the device firmware, and
- upgrading the device template.
  You can obtain your device's latest firmware and template by downloading them from the Support section of the website. Save the files in the .../ION Setup/TEMPLATE folder for easy access.

Upgrading the device firmware and template

1. Open ION Setup and select the device you want to upgrade from the left-hand pane.
2. Open the Setup Assistant in the right-hand pane.
3. Select the Template screen from the list of screens in the left-hand pane of Setup Assistant.
4. Select the **Firmware Upgrade** tab, then click the **Upgrade** button. 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 7), click on the **Save to PC** tab and click **Save**. Save your template as a .DCF file. Choose this file in Step 6 instead of the file obtained from the Support section of the website.

5. Browse to the .UPG file (device firmware) that you downloaded from the website and click **Open**. When you are prompted for your ION Setup password, type it and click **OK**.
6. Browse to the .DCF file (device template) that you downloaded from the website (or saved from your meter in Step 4) and click **Open**.
7. Clear any options that you do **not** want to retain then click **OK**.
8. Track the progress of the upgrade.

After the firmware download is complete, ION Setup will attempt to verify the firmware. If the verification fails, contact Technical Support.

When you get a message that the upgrade is complete, click **Exit**.

Chapter 3 Front Panel

The meter's front panel is used for both display and configuration purposes. The ¼ VGA display screen and the numerous selection, navigation, and configuration buttons allow quick access to basic meter configuration provided by special setup screens. The front panel also provides access to many other meter functions, such as meter resets.

This chapter provides information about the meter's front panel display screen and buttons, including instructions for using the setup menus and for displaying meter values, as well as details for configuring the meter's display screens.

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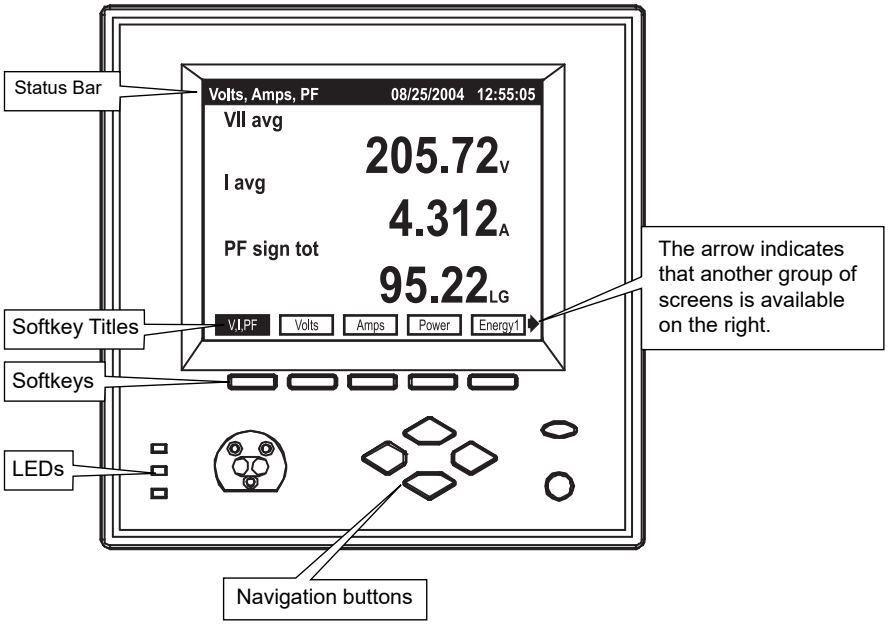
Front panel features

The front panel display provides a detailed graphics and text display that has been factory configured to show many of the parameters measured by the meter.



The meter's display shows numeric data screens, event logs, phasor diagrams, bar graphs, and harmonics histograms.

Front panel buttons

The front panel has numerous buttons: softkeys, navigation buttons, and program buttons. Program buttons are only used when configuring the meter. Use the following buttons to view data on the front panel display screens.

Navigation buttons

The horizontal navigation buttons (Left/Right keys) select a different set of five Softkey titles to access different data screens. The vertical navigation buttons (Up/Down keys) are used to navigate within certain data display screens, such as within a Trend Display's graph and log screens or an Event Log screen, once one has been selected.

Softkeys

Pressing the Softkey button selects the data screen available in the corresponding Softkey title.

Front panel LEDs

The front panel LEDs are as follows:

- The **green operation LED (top)** should always be on when the meter is in service. Contact Technical Support if this is not the case.
- The **red watthour LED (middle)** is factory configured to be a Wh (del+rec) pulser. During the course of normal operation, this LED should blink intermittently as the meter measures power system energy.
- The **red alarm LED (bottom)** on the front panel of the meter is user programmable. Possible applications include sag/swell alarming, setpoint annunciation, and tariff notification. Like all the other outputs on the meter, this port can be controlled by a Digital Output, Pulser, or Calibration Pulser module.

Backlight operation and display contrast

The front panel display is factory set to dim five minutes after the last button press but can also be user-configured. If the front panel is dimmed, press any button to return the display to full brightness. The front panel display is adjusted at the factory to the optimal contrast level. Use the Display Setup menu to adjust the contrast, if necessary (see “Display Setup Menu” on page 41).

Status bar

The Status Bar of the meter is located along the top of all display screens. When in data display mode, the Status Bar shows the date in MM/DD/YYYY format (configurable), the current local time in 24 hour format, and the data display screen title.

Display Screen Types

The meter’s front panel displays measurements, configurable settings, and current configuration data in various forms. These data display screens are described below.

Numeric displays

Numeric displays show multiple parameters at a time: two, three, three with a timestamp, four, eight, ten, or twenty. When displaying numeric values for current and power quantities, the front panel shows resolution to three decimal places by default. All other values are displayed to two decimals of accuracy. For finer resolutions, use Vista software to display the data.

NOTE: If the front panel is unable to read a numeric value, or if the value is not available, it displays a dash (—).

Automatic units

The front panel automatically scales the units for basic measurements, such as voltage, current and power parameters. For example, a measurement of 2,000 Watts is displayed as 2.000 kW. A measurement of 2,000,000 Watts is displayed as 2.000 MW. The meter makes these conversions using your PT and CT ratios.

NOTE: The meter only performs these automatic units if the measurement is derived solely from the Power Meter module’s output.

Phasor diagram displays

Phase information is displayed in phasor diagram format. Phasor diagrams are accompanied by tables that state the angle and magnitude of each phasor. In cases where phasors are too small to be represented graphically, they are only shown as table entries.

Event log displays

Event Log displays alert you to recent events written to the meter's event log. Use the vertical (Up/Down) navigation buttons to move through the list.

For details on altering the meter's Event Log characteristics, such as log depth and logging frequency, see the Logging and Trending chapter.

Nameplate displays

Like Event Log displays, Nameplate displays show information in tabular format. Default nameplates show owner, meter, and power system details.

See the Templates, Frameworks and Firmware chapter for details on configuring the TAG strings.

Histogram displays

Harmonics content is displayed in histogram format. Harmonics are displayed from the 2^{nd} to the 63^{rd} harmonic, with Total Harmonic Distortion (THD) values displayed above the histogram (K Factor and Crest Factor only appear in current harmonic histograms).

On ION7650 meters, use the vertical navigation buttons on the meter front panel to select individual harmonics (from 2^{nd} to 63^{rd}) in the histogram and view data specific to each of them (V_1, V_2, V_3, I_1, I_2, and I_3 only).

An arrow ▲ appears below the harmonic selected. Harmonic magnitude is displayed as an absolute value and as a percentage of the fundamental. The phase angle of each harmonic is also provided. To return to the THD values, position the arrow below the fundamental.

Trend bar graph displays

Bar graph displays can show up to four real-time (numeric) parameters along with their upper and lower extremes.

Each bar graph automatically scales its output based on the magnitude of its extremes. The real-time value of each bar graph is displayed to the right of the graph.

NOTE: Scaling is applied separately to each bar graph in the display. Do not compare the magnitudes of two values based on the size of their bars.

Trend displays

The Trend Display screen graphs the historical data of up to four different parameters simultaneously. A movable cursor, consisting of the intersection of a vertical line and a horizontal line, displays the value and timestamp of any plotted data within a parameter. The cursor displays the values of one parameter at one time only. Use the Up and Down navigation keys to move from one parameter to another.

In addition, a Trend Display log screen displays data logs for any graphed parameter – up to 3360 logs for each parameter. That is equivalent to 35 days worth of 15 minute

data. The graph is updated when a new set of values is recorded. The highest supported update speed is once per second.

The front panel displays three preconfigured trending screens: V-Trend (voltage), I-Trend (current), and P-Trend (power).

Default Front Panel Display Screens

The meter is factory configured to display a number of data screens on its front panel. Additional display screens are provided for ION7650 meters with the EN50160 ordering option

Each screen is accessible with a corresponding Softkey. See “Front panel buttons” on page 32 for instructions on using the softkeys to display data.

NOTE: Each display screen is listed with the corresponding softkey name and the screen title.

Screens shown in display cycle

Ten data display screens are included in the automatic display cycle. By default, the front panel scrolls repeatedly through the following screens in the following order:

Screen Titles	Description
V,I,PF (Volts, Amps, PF)	This numeric display screen contains the average line-to-line voltage, average current, and the total signed power factor.
Volts (Volts)	This numeric display screen shows the line-to-line voltages Vll ab, Vll bc, and Vll ca.
Amps (Amps)	This is a numeric screen containing currents I a, I b, and I c
Power (Total Power)	This numeric display screen contains total kW, kVAR, and kVA values.
Energy1 (Energy Delivered)	This numeric display screen shows delivered (imported) energy values for kWh, kVARh, and kVAh.
Demand1 (Demand Delivered)	This numeric display screen contains delivered values (kW, kVAR, and kVA) in the previous demand period. By default, these values come from a sliding window demand (rolling block) calculation.
Pk Dmd1 (Peak Demand Del)	This is a numeric display screen with timestamps containing maximum delivered demand values for kW, kVAR, and kVA. The timestamps show the date and time at which the values were last updated. By default, these values come from a sliding window demand calculation.
V Bar (Voltage Bar Graph)	These three screens are trend bar graph displays. They show real time values for voltage (Vll ab, Vll bc, Vll ca, Vll avg), current (I a, I b, I c, I avg) and power (kW tot, kVAR tot, kVA tot, PF lag tot). The bar graphs also indicate the maximums and minimums recorded for these values.
I Bar (Current Bar Graph)	
P Bar (Power Bar Graph)	

Additional data display screens

Most of the default data screens are not included in the default scrolling cycle. To view the other display screens, find the Softkey title of the data screen you want and press the corresponding Softkey.

Screen Title	Description
Summary1 (Volts/Amps Summary)	This numeric display provides many important voltage, current, phase, and frequency measurements on a single screen.
Summary2 (Power Summary)	This numeric display provides real, reactive, and apparent power measurements for phase a, b and c (as well as their total). Signed Power Factor measurements are also displayed on this screen.
D Inputs (Digital Inputs)	This numeric display screen shows the status of the eight on-board digital inputs. The present state of all inputs is shown (as OFF or ON) and the number (Cnt) of state changes since the last reset is recorded.
DI - I/O (DI on I/O Card)	This numeric display screen contains the status and counters for the digital inputs on the I/O card.
D - Output (Digital Outputs)	This numeric display screen contains the mode and status for the relay and solid state outputs.
Anlg - I/O (Analog In and Out)	This numeric display screen contains scaled analog inputs (AI*n* scaled) and normalized analog outputs (AO*n* normalized), where *n* ranges from 1 to 4 for both inputs and outputs.
Phasors (Phasors)	This screen is a phasor diagram display that shows the magnitude and the relative angular difference between all phase voltage (Va, Vb, Vc, V4) and current (Ia, Ib, Ic, I4, I5) fundamental components.

Screen Title	Description
Name Plt (Name Plate Info)	The Name Plate Info screen contains the following information: OWNER, TAG 1 and TAG 2 from the Factory module, serial number, firmware revision of the meter, and template version. TAG 1 and TAG 2 typically identify the meter's user and installed location.[1]
Events (Event Log)	The Event Log display alerts you to events written to the meter's event log. DATE, TIME, SOURCE, and EVENT information are provided. Use the Up and Down navigation buttons to move through the list.
Setpoint (Setpoint Status)	This numeric display screen displays the status of the setpoint parameters defined in the Vista Setpoints diagram.
Energy2 (Energy Received)	This numeric display screen shows received (exported) energy values for kWh, kVARh, and kVAh.
Demand2 (Demand Received)	This numeric display screen shows received power quantities (kW, kVAR, and kVA) in the present demand period. By default, these values are from a sliding window demand (rolling block) calculation.
Pk Dmd2 (Peak Demand Rec)	This is a numeric display screen with timestamps. It shows the maximum received demand quantities (kW, kVAR, and kVA) and the time at which they were recorded. By default, these values are from a sliding window demand (rolling block) calculation.
THD (Volts and Amps THD)	This numeric display screen contains the total harmonic distortion on all phase voltage and current inputs.
V1 Harm (Harmonics)	These four histogram display screens show the harmonic content on the phase voltage inputs.
V2 Harm (Harmonics)	
V3 Harm (Harmonics)	
V4 Harm (Harmonics)	
I1 Harm (Harmonics)	These five histogram display screens show the harmonic content on the phase current inputs.
I2 Harm (Harmonics)	
I3 Harm (Harmonics)	
I4 Harm (Harmonics)	
I5 Harm (Harmonics)	
TOU (Active Rate / Season)[2]	This eight parameter display screen shows kWh delivered values for each all four of the possible time of use (TOU) rates (rates A, B, C, and D).
TOU Egy (TOU Energy Del)[2]	This numeric display screen shows the energy (in kWh) delivered for each time of use (TOU) rate (rates A, B, C, and D).
TOU Dmd1[2]	TOU Peak Demand 1 and 2: These two screens are numeric displays with timestamps. Together they show the maximum delivered kilowatts for each time of use (TOU) rate (rates A, B, C, and D). The timestamps show the date and time at which the values were last updated. By default, these values come from a sliding window demand (rolling block) calculation.
TOU Dmd2[2]	
V Trend (Voltage Trend Display)	The voltage trend display graphs the VII avg trend. Each trending display has two views - graph and log - which are accessible via softkeys once you are displaying the trend screen.
I Trend (Current Trend Display)	The current trend display graphs the I avg trend. Each trending display has two views - graph and log - which are accessible via softkeys once you are displaying the trend screen.
P Trend (Power Trend Display)	The power trend display graphs the KW tot trend. Each trending display has two views - graph and log - which are accessible via softkeys once you are displaying the trend screen.

[1] The OWNER and TAG registers are configurable with ION software and the WebMeter Setup page.

[2] The four TOU screens may only be important if you are using the meter in a billing application (i.e., you are a power provider). Typically, most power consumers can ignore the Time-Of-Use front panel displays.

EN50160 data and statistics displays (ION7650 meters with EN50160 ordering option only)

The remaining front panel screens display data to help you determine EN50160 voltage compliance. More details about EN50160 are provided in the *Power Quality: ION Meters and EN50160* technical note,

Screen Title	Description
PQ Freq (PQ Power Frequency)	This numeric display shows the following EN50160 Power Frequency data: Nominal Frequency, period (10 second) Freq mean, minimum, and maximum. It also shows the EN50160 frequency compliance statistics: Freq N (the number of valid evaluation periods), Freq N_1 (a count of non-compliance), and Freq N_2 (the number of invalid evaluation periods).
PQ Vmag1 (PQ Supply Voltage 1)	This bar graph display shows the following EN50160 Voltage Magnitude data for all three voltage phases: period (10 minute) mean, minimum, and maximum.
PQ Vmag2 (PQ Supply Voltage 2)	This numeric display shows the following EN50160 Voltage Magnitude compliance statistics for all three voltage phases: mag N and mag N1.
PQ Flk1 (PQ Flicker 1)	This bar graph display shows the following EN50160 Flicker data for all three voltage phases: present Pst, minimum Pst, and maximum Pst.
PQ Flk2 (PQ Flicker 2)	This numeric display shows the following EN50160 Flicker data for all three voltage phases: present Pst, present Plt, and compliance statistics (Flck N and Flck N_1).
PQ Vdist (PQ Volt Disturbance)	This numeric display shows the following EN50160 Overvoltage and Dip data for all three voltage phases: expected nominal, minimum Dip, and maximum Overvoltage.
PQ Vunb (PQ Volt Unbalance)	This numeric display contains the following EN50160 Voltage Unbalance data: V unbal mean, V unbal mean min, V unbal mean max, and compliance indicators (unbal N and unbal N_1).
PQ Vhrm1 (PQ Volt Harmonics 1)	This bar graph display shows the following EN50160 Harmonics data: THD mean, THD mean mn, THD mean max for all three voltage phases (10-minute mean values, min and max values are updated every new observation period).
PQ Vhrm2 (PQ Volt Harmonics 2)	This numeric display shows EN50160 Harmonics compliance statistics for all three voltage phases: Hrm N, Hrm N_1, Hrm N_2.

Configuring the Meter with the Front Panel

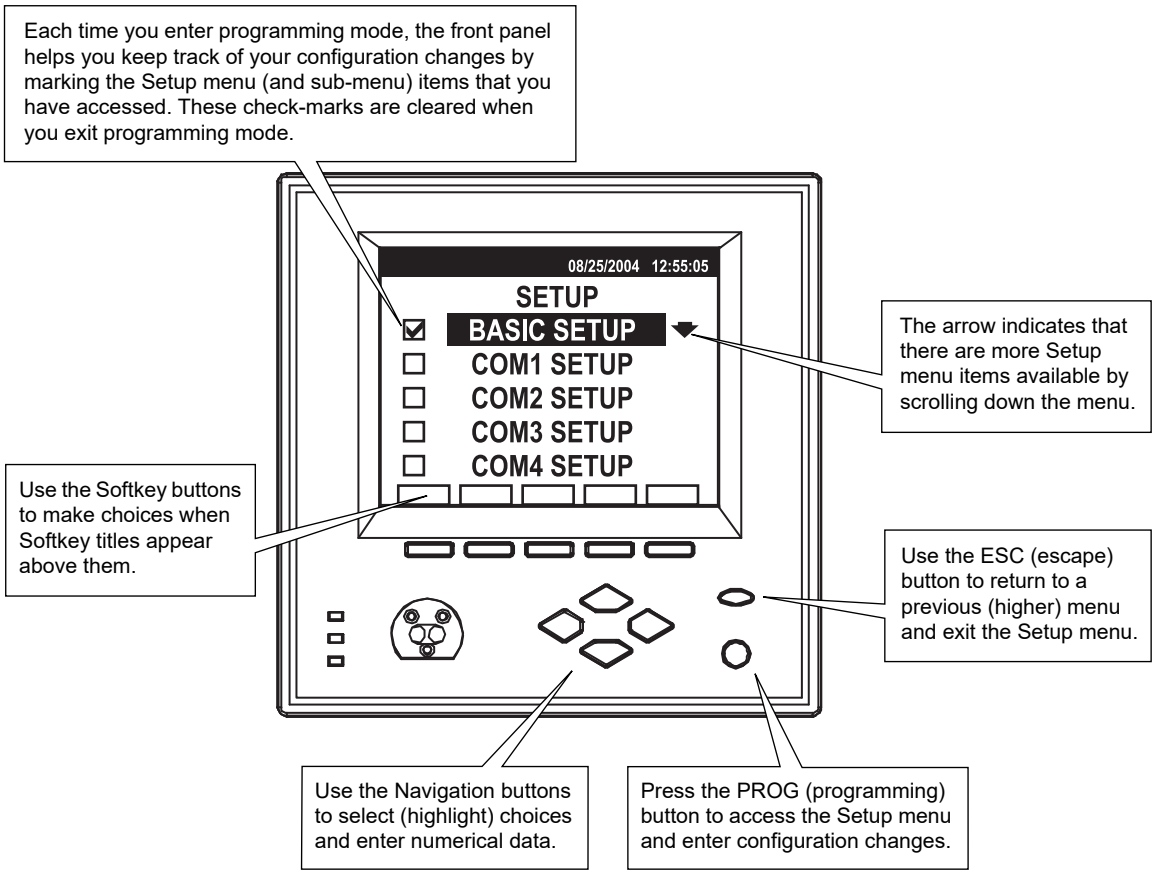
The front panel allows you to setup and configure the meter at its installed location. When you change a setting in the front panel's Setup menu, you are actually altering the setup register value of an ION module.

NOTE: ION module links cannot be added or deleted using the front panel.

You can also use the front panel's Setup menu to quickly reset common cumulative values like kilowatt hours.

The Front Panel's Main Setup Menu

To access the Front Panel's Setup Menu, press that PROG (programming) button. Pressing the ESC (escape) button returns you to the data display screens.



Using the front panel buttons for configuration

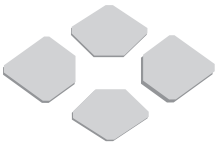
Use the front panel buttons as follows to adjust meter settings:

PROG

Press the PROG (programming) button to access the Setup Menu. Once in programming mode, the PROG button functions just like an Enter key on a computer keyboard. Press the PROG button to select a highlighted item, to accept changes, to enter passwords, and to trigger resets.

ESC

Press the ESC (escape) button to return to a higher menu or abort a configuration change.



Navigation

Highlight menu items with the vertical (Up/Down) buttons.

Entering numbers: when a digit is highlighted, pressing the Up button increments the number by one, and pressing the Down button decreases it. Move the cursor to an adjacent digit with the horizontal (Left/Right) buttons.

Softkeys

Press a Softkey button when Softkey options become available (when titles appear in the Softkey title bar). Use Softkeys to select the parameters that you want to configure from the various sub-menus.

Passwords

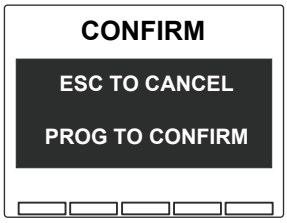
All configuration functions in the front panel are password protected. The password is set to 0 (zero) in the factory. This password allows you to access the Security setup menu and to disable or change the password for a custom value. The front panel prompts you for the meter password before you make your first configuration change. See the Security chapter for more information on passwords.

Language selection

To quickly access the language selection screen, press the right navigation button and the PROG (programming) button simultaneously for 2 seconds then release. For more information on language and other localization options, see "Localization Settings" on page 58.

Setup mode timeout

Once the meter has been configured, the front panel automatically exits the Setup menu five minutes after the last button press is detected. If the front panel returns to data display mode, you must re-enter the Setup menu and provide the valid meter password to resume making configuration changes.



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 both cases, press the PROG button to accept the change and ESC to return to the setup screen.

WRITING ERROR screen

If the CONFIRM screen does not appear for a valid entry, or the display reports a WRITING ERROR, confirm your configuration change is valid and repeat the configuration change. If the problem persists, contact Technical Support.

Main Setup Menus

Press the PROG button to enter the Main Setup menu. The following table summarizes the front panel's Setup menu functions:

Setup Menu Item	Description	For more information
Basic Setup	Changes basic settings in the power measurement system configuration	See "Basic Setup" chapter
COM1 Setup	RS-232 or RS-485 port setup	See "Communications" chapter
COM2 Setup	High-speed RS-485 port setup	See "Communications" chapter
COM3 Setup	Optional internal modem setup	See "Communications" chapter
COM4 Setup	Front optical port setup	See "Communications" chapter
Network Setup	Optional Ethernet network addressing	See "Communications" chapter
PQ Setup	Sets the criteria (including nominal voltage) for disturbance detection	See "Power Quality" chapter
Format Setup	Customizes the style and values appearing on the display screens	See "Format Setup Menu" below
Display Setup	Customizes display appearance and update rate	See "Display Setup Menu" below
Time Setup	Clock and meter time settings	See "Time" chapter
Security Setup	Modify and enable/disable password functions	See "Security" chapter
Meter Resets	Reset functions for factory and user determined cumulative parameters	See "Meter Resets" chapter

Highlight the Setup menu item that you want to access, using the vertical navigation buttons. To select the item, press the PROG button.

Format Setup Menu

Use the Format Setup menu to set labeling and formatting preferences for the front panel display.

Numeric format

The Numeric Format sub-menu contains the following settings:

Digit group

This specifies the symbols used to delimit thousands and the decimal place holder (i.e. 1000.0 or 1,000.0 or 1 000,0). The default is 1000.0 (no commas, no spaces).

Volts decimal

Display voltage measurements to one, two, or three decimal places. The default value is two decimal places.

Current decimal

Display current measurements to one, two, or three decimal places. The default value is three decimal places.

Power decimal

Display power measurements to one, two, or three decimal places. The default value is three decimal places.

Date/Time

The Date/Time sub-menu contains the following settings:

Date format

The front panel can express the date in any of these formats: MM/DD/YYYY, DD/MM/YYYY, and YYYY/MM/DD. The default is MM/DD/YYYY.

Time format

The front panel can express the time using either 24 hour or 12 hour (AM/PM) format. The default is 24 hour.

Display DST

Choose whether or not to display Daylight Savings Time (DST) on the front panel. The default is Yes.

IEEE/IEC

The IEEE/IEC sub-menu contains the following settings:

Meas (Measurement) symbols

Set the measurement symbols used on the front panel to IEEE (Vll, Vln, kW, kVAR, kVA) or IEC (U, V, P, Q, S).

Phase label

Apply phase labels in any of the following six variations: ABC, RST, XYZ, RYB, RWB, and 123. The default label is ABC.

PF sign

Select how the meter interprets power factor (per IEEE or IEC convention) and displays it on the front panel when the PF Symbol is set to “+/–”. For more information on PF sign convention, see “Power factor interpretation” on page 59.

PF symbol

Choose Power Factor symbols to be: LD/LG (lead/lag), +/– (positive/negative), or CAP/IND (capacitive/inductive). The default symbols are LD/LG.

Display Setup Menu

Configure the following display preferences within Display Setup.

Update rate

Set the front panel to update its data from every one to every six seconds. The default update time is one second.

Contrast

Set the front panel display contrast level from level zero to level nine where higher numbers represent a sharper level of contrast.

NOTE: Press and hold both the “Up” navigation button and the PROG button at the same time. The contrast level cycles through its range (0 to 9). Release the buttons at the contrast level you desire.

Backlight Timeout

Set the backlight to turn off automatically after one to 7200 seconds (two hours). The default is 300 seconds (5 minutes). If this value is set to zero, the backlight will always be on. Leaving the backlight on will reduce the backlight's life expectancy.

Delta vectors

Set how vector (phasor) diagrams are displayed when the meter is in Delta mode. When set to Instrument, vectors appear 60 degrees apart — showing the actual voltage and current values that the meter is measuring. When set to System, vectors appear 120 degrees apart — showing true system operation even though IB and VCA are calculated values.

Language

Set the language that is used to display default front panel items. The default is English.

NOTE: Press the right navigation button and the PROG button at the same time then release to access the language menu from the display screen.

For more information on language, convention and other localization options, see "Localization Settings" on page 58.

Meter Display Modules

The meter's front panel display is controlled by three types of ION modules: the Display Options module, the Scroll module, and the Display modules.

For more detailed information on these modules, see the *ION Reference*.

Display Options Module Settings

The Display Options module contains setup registers that hold data display settings such as contrast level, backlight timeout, daylight savings time, and update time. Settings in the Display Options modules are global and affect the entire set of front panel display screens.

Setup Register	Function	Default
Contrast	Sets the global contrast setting for the meter display.	5
Backlight Timeout	Set how long until the backlight turns off after inactivity (in seconds).	300
Current Resolution	Sets the number of decimal places of accuracy displayed for current readings.	1.XXX
Date Format	Sets how the date is shown.	mm/dd/yyyy
Display Update Time	Sets the period between data display refreshes (in seconds).	1
Digit Grouping	Sets the numbering format by determining how groups of three digits are separated.	1,000
Demand Lockout Timeout	Sets the minimum time allowed between consecutive demand resets.	2,160,000
Delta Vector Display Type	Sets how vector (phasor) diagrams are displayed when the meter is in Delta mode.	System
DST Options	Determines whether the display time value reflects Daylight Savings Time (DST)	Yes
Front Panel Programming	Determines whether users can change meter configuration settings via the front panel.	Allowed
Language	Sets the language used to display default front panel items.	English
Measurement Symbols	Determines whether IEC or IEEE measurement symbols are used.	IEEE
PF Symbol	Determines how power factor data is labeled.	LD/LG

Power Resolution	Sets the number of decimal places of accuracy displayed for power readings.	1.XXX
Time Format	Sets the format used to display time on the meter.	24 Hour
Volts Resolution	Sets the number of decimal places of accuracy displayed for voltage readings.	1.XX
Remote Display Registers[1]	Various Remote Display screen settings for colors, threshold limits etc.	-

[1] For more information, see the *PowerLogic Remote Display for ION7550, ION7650, and ION7550 RTU Installation and user guide*.

Scroll Module Settings

The Scroll module determines the sequence and rate of scrolling for multiple front panel display screens.

Setup Register	Function	Default
Scroll Delay	Sets the time that will elapse between successive pulses on the *Trigger* outputs when the scroll module is enabled.	6
Wraparound	Designates the last *Trigger* output (*Trigger* n) before returning to the first *Trigger* in the order.	10
Freeze Time	Sets the time (in seconds) that the Scroll module remains “frozen” when pulsed from the *Freeze*, *Up*, or *Down* inputs.	60

The *Trigger* outputs of a Scroll module are linked to the inputs of Display modules. When a pulse is sent from the *Trigger* output of a Scroll module to a linked Display module, the Display module shows its information on the front panel.

Display Module Settings

A Display module controls which values are displayed on a display screen, and how these values are presented. Each Display module corresponds to one meter display screen.

The Display module’s *Source* inputs are linked to the numeric parameters you want to display. These parameters are sent to the front panel when the Display module’s *Show* input is pulsed.

The Display module’s setup registers determine screen type (e.g. numeric, event log, trend bar etc.), softkey name and number, and screen title of each display. Many Display modules available in the meter are used in the factory configuration. You can alter some characteristics of the factory-configured displays by modifying the setup register of the Display modules.

The Display module’s setup registers determine how the *Source* data is presented on the front panel display. Depending on the display screen type, which is specified by the *Screen Type* setup register, you can use up to twenty *Source* links to a single Display module. This means you can show the values of up to twenty different sources on one front panel display screen. In addition, you can display harmonics, trending, and event logs (see the Screen Types table below).

Setup Register	Function	Default
Screen Type	This specifies the way the linked parameters are displayed on the front panel screen.	Defaults vary among display screens.
Softkey Number	This assigns a softkey number to the display screen.	
Softkey Name	This assigns a softkey name to the display screen.	
Screen Title	This assigns a title to the display screen.	
Screen Resolution	This determines the leading zeros and decimal point in a numeric display.	
Last Digit Mode	This specifies whether the last digit of a number is rounded off or truncated.	
Source 1-20 Units	These specify what unit each input (1-20) is displayed in.	

Screen types

Screen Types	Max. # of Source Inputs	Display Description
Two, three, four, eight, ten, and twenty parameter numeric[1]	2, 3, 4, 8, 10, and 20	Displays one to twenty values (the fewer the values, the larger the values appear on the display screen)
4 parameter trend bar graph[2]	12	Displays 4 real time parameters with minimum and maximum values
Three parameter with Timestamp	3	Displays three values with timestamp data for each value.
Harmonics V1-V4	0	Displays phase voltage harmonics histogram
Harmonics I1 – I5	0	Displays phase current harmonics histogram
Vector diagram	0	Data is displayed in phasor format
Event Log	0	Displays Event Log data
Name plate	0	Displays Nameplate Information
All segments	0	Activates all of the display screen's pixels
Data Log Trend - log source 1 to 4	4	Configures a Display module for Trend Display

[1] If you alter the *Screen Type* setting to a display type that accommodates more numeric parameters, you may have to create additional *Source* links.

[2] See "Creating custom trend bar graphs" on page 49.

Screen type register

The number of inputs for the Display module should match the *Screen Type* setup register.

If you select a *Screen Type* with more parameters than are currently linked to the Display module, the display screen shows any unavailable inputs as N/A. If a *Screen* Type is selected which has fewer parameters than are linked to the module, the Display module only displays the *Display Type* number, and breaks any links to parameters that it cannot display.

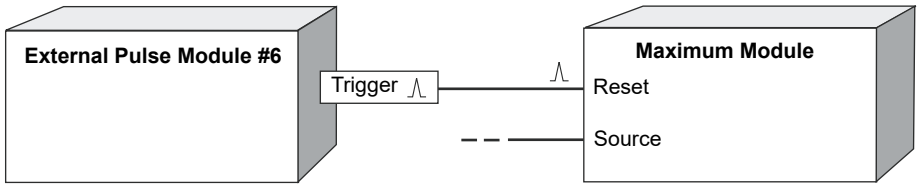
For example, if you have a display screen with four parameters, and you select a *Screen Type* of ONE PARAMETER, the first parameter is displayed and the other three links to the ION Display module are severed.

Changing the parameters that are displayed

The meter's default display configuration shows a comprehensive set of parameters. Changing these parameters requires that you alter the links between various ION modules. Complete details on changing the front panel displays are provided in the section "Configuring Front Panel Displays" on page 45.

Creating a Front Panel Reset

The meter's factory configuration allows External Pulse module 6 to be triggered from the User Resets screen in the meter Setup menu. To define a custom reset, use ION software to link one of these External Pulse modules to the *Reset* input of the module that holds the value that you want to reset.



By default, the *Trigger* output of this module is linked to the User Resets item in the front panel Setup menu.

This ION module holds the value that you can reset from the front panel. You may also have to create and configure it.

See the Resets chapter for more information about User Resets.

Accessing external pulse module 6 in Designer

1. Open your meter in Designer.
2. Navigate to **Advanced Setup > Custom Resets**. Edit External Pulse module 6 as required.

Configuring Front Panel Displays

ION7550/ION7650 meters ship with preconfigured display screens. Most users find that the preconfigured data screens displayed by the front panel LCD (Liquid Crystal Display) suit their needs. However, front panel displays can also be customized if required.

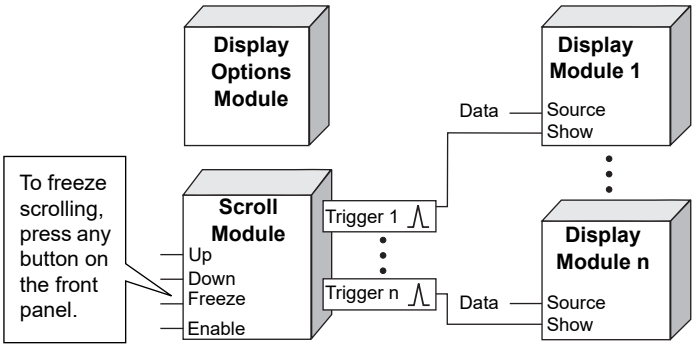
The meter's display screens can be customized to show virtually any measurement or calculation of which the meter is capable. For example, you could do one or all of the following:

- change displayed parameters, such as from *Vll* to *Vln* or *Vllab* to *Vlna*
- aggregate displays from multiple meters, such as using a meter's front panel display to view data collected by one or more TRAN units (see "Displaying Data from Other Meters" on page 52)
- 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

In order to customize your front panel display screens, you must make changes to ION modules that belong to the display framework.

Display Framework Overview

The following diagrams illustrate how the Display Options module, Display module, and Scrolling module work together to provide your meter's front panel with the appropriate display screens.



Note that the first Display module's *Show* input is linked to the Scroll module's first *Trigger* output register: this is your first display screen on the meter. Accordingly, the second Display module's *Show* input is linked to the Scroll module's second *Trigger* output in order to setup the second display screen, and so on.

The order in which data displays depends on the numbering of the Display modules. Therefore, the data linked to Display module 1 is displayed on the first front panel screen and so on. Scrolling between the display screens is done with the Up and Down arrow buttons on the front of the meter.

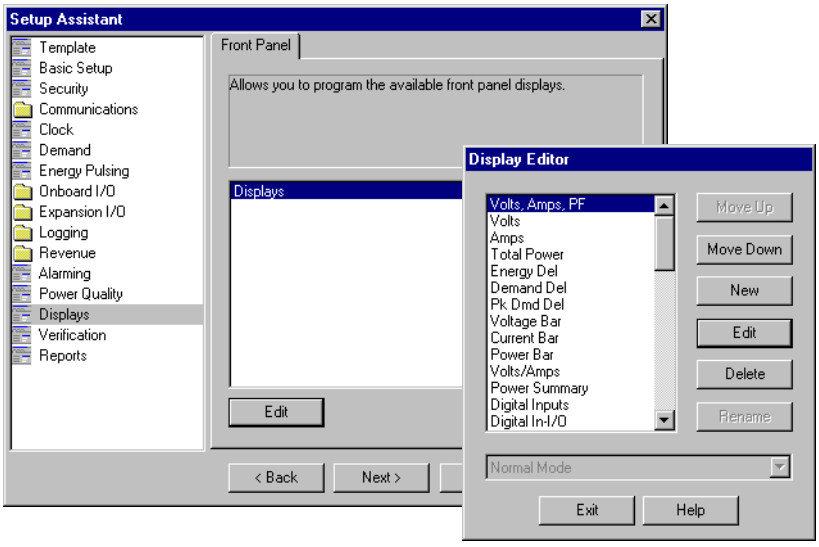
Using the Front Panel

You cannot configure displays from the front panel.

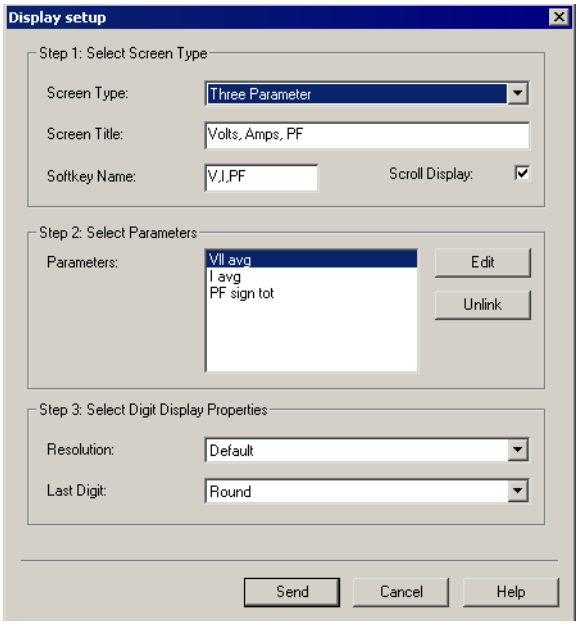
Using ION Setup

1. Open ION Setup and connect, in basic mode, to your meter.
2. In the Setup Assistant, navigate to Displays and click **Edit**.

   ION Setup uploads your meter's display information to the Display Editor.



3. Edit, rename, delete or rearrange displays as desired.
4. 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, edit the screen title and softkey name, and select the Scroll Display check box if you want this screen included in the scroll cycle.
   – Select the parameters available for your chosen screen type.
   – Select your display qualities, including digit resolution and truncated or rounded last digits.
5. Click **Send** to save the changes in the meter.

Using Designer

This section explains how to configure your meter's front panel display screens using Designer software.

Changing default display frameworks

The factory-configured Display framework uses many of the Display modules available in the meter. Only a few of the default screens have room for extra data. To make a significant modification to the existing display framework, you either have to create new display modules and configure them, or change the links and settings of the modules in the existing Display framework (or both).

Four common modifications are discussed in the following sections:

- removing a display screen
- adding a new display screen
- replacing the parameters in an existing display screen
- creating custom trend bar graphs

Removing a display screen

Use caution when deleting modules, as any dependant modules are also affected. Designer informs you of dependant modules if they exist on the same node.

Removing a data display screen in Designer

1. Open your meter in Designer and navigate to **Advanced Setup > Frameworks > Display Framework**.
2. Select the Display module responsible for the screen.
3. Press **Delete**. This also deletes all links to that particular Display module.
4. Select **Send & Save** to save your changes to the meter.

If the display screen you are deleting is part of the automatic scrolling cycle, you should reconfigure the links from the Scroll module's *Trigger* outputs to the remaining Display modules so that the following considerations hold true:

- The first Display module in the scrolling cycle is linked to the *Trigger 1* output of the Scroll module.
- The last Display module in the scrolling cycle (module *n*) is linked to the *Trigger n* output of the Scroll module. For example, if your scrolling cycle consists of 5 screens, then *Trigger 5* should be linked to the fifth module in the cycle.
- The *Wraparound* setup register of the Scroll module designates the last trigger output (*Trigger n*). Expanding on the previous example, since *Trigger 5* is the last trigger, the Scroll module's *Wraparound* setup register would have a value of 5.

Adding a new display screen

You can create a new front panel display without dismantling any of the existing displays.

Adding a new display screen in Designer

1. Open your meter in Designer and navigate to **Advanced Setup > Frameworks > Display Framework**.
2. Drag out a new Display module and right-click on the center of the module icon to access its setup registers.
3. Define the module's characteristics (display format) by adjusting its setup registers.
4. Link any required data to the *Source* inputs of the Display module.
5. Select **Send & Save** to save your changes to the meter.

If you want your new screen to appear in the automatic scrolling cycle, then you must link the *Show* input of the Display module to a *Trigger* output of a Scroll module. See "Removing a display screen" on page 47 for considerations on re-linking Scroll module *Trigger* outputs.

Changing displayed parameters in an existing screen

Use Designer software to change displayed parameters in existing screens on your meter.

To change parameters, link the output register containing the numeric data you want to display to the *Source* inputs of the Display module. If there is not a free *Source* input, you will have to first delete (i.e., unlink) an existing link to a *Source* input.

Creating custom trend bar graphs

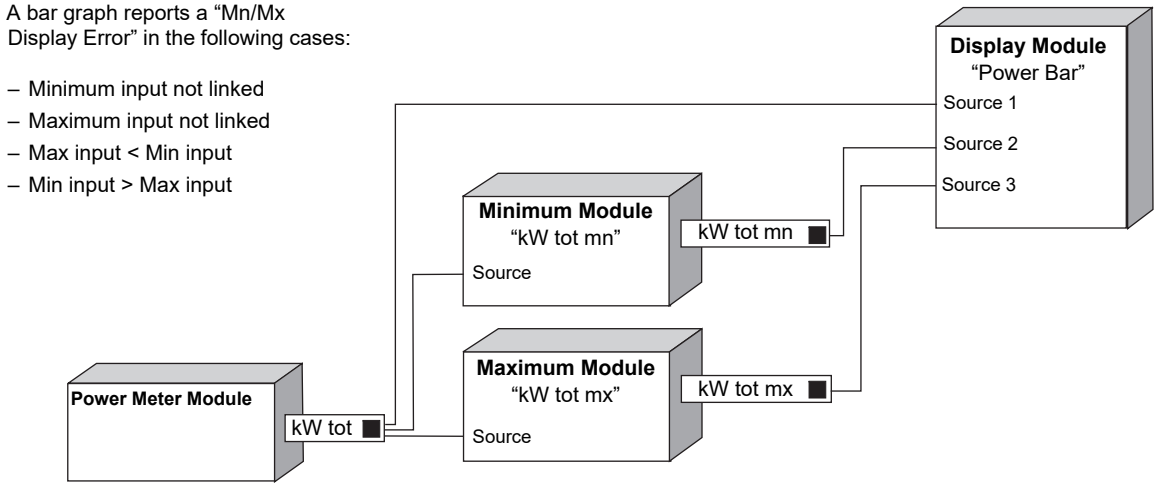
Bar Graph displays are configured differently than other numeric parameter displays. Each bar in the display is associated with three specific *Source* inputs as follows:

Bar Graph	Input	Function	Attributes
First (top)	Source 1	Real-Time value for Bar Graph #1	Bar graph #1 will not appear if you do not link this input
	Source 2	Minimum value for Bar Graph #1	Link to the output of a Minimum module
	Source 3	Maximum for Bar Graph #1	Link to the output of a Maximum module
Second	Source 4	Real-Time value for Bar Graph #2	Bar graph #2 will not appear if this input is not linked
	Source 5	Minimum for Bar Graph #2	Link to the output of a Minimum module
	Source 6	Maximum for Bar Graph #2	Link to the output of a Maximum module
Third	Source 7	Real-Time value for Bar Graph #3	Bar graph #3 will not appear if this input is not linked
	Source 8	Minimum for Bar Graph #3	Link to the output of a Minimum module
	Source 9	Maximum for Bar Graph #3	Link to the output of a Maximum module
Fourth (bottom)	Source 10	Real-Time value for Bar Graph #4	Bar graph #4 will not appear if this input is not linked
	Source 11	Minimum for Bar Graph #4	Link to the output of a Minimum module
	Source 12	Maximum for Bar Graph #4	Link to the output of a Maximum module

Typically, the minimum and maximum values for each bar graph come from links to the outputs of Minimum and Maximum ION modules that are themselves linked to the real-time parameter shown in the bar graph.

NOTE: This feature works only if the meter's Volts Mode is NOT set to Demo. When the meter is in Demo mode, a default trending log showing Vll ab, Ia, PF and KW is displayed rather than the actual log that has been linked to the Display module.

The diagram below shows an example of the links necessary for one bar graph (in the top position).



A bar graph reports a "Mn/Mx Display Error" in the following cases:

- Minimum input not linked
- Maximum input not linked
- Max input < Min input
- Min input > Max input

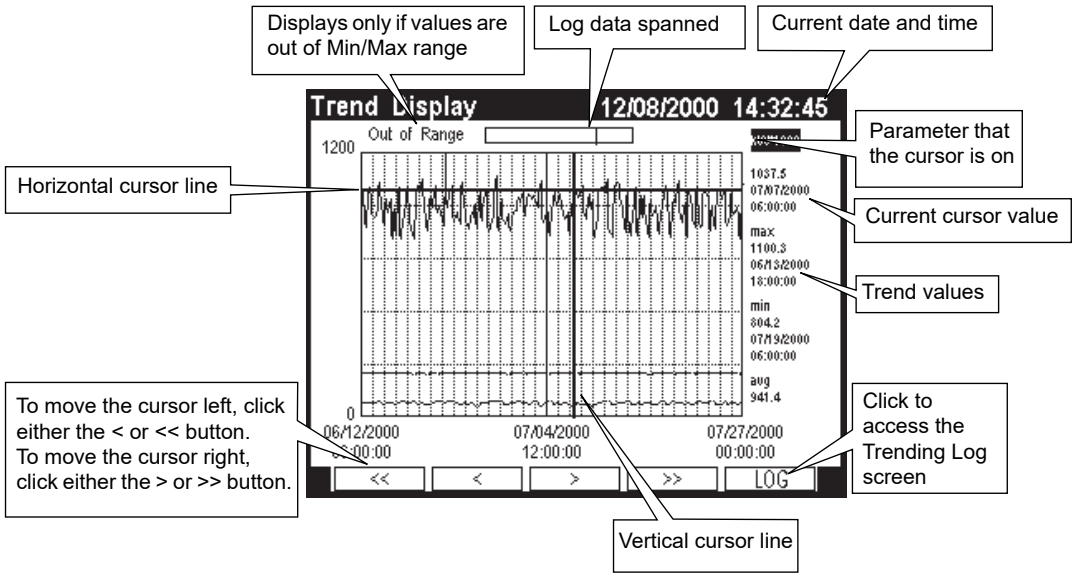
Trend Displays

Your meter's Trend Display screen simultaneously graphs the historical data of up to four different parameters. A Trend Display log screen displays the data logs for any graphed parameter.

The front panel displays three preconfigured trending screens: V-Trend (voltage), I-Trend (current), and P-Trend (power).

NOTE: It is possible to change the Trending parameters with Designer software. Contact Technical Support for information.

Trend display screen



Selecting and navigating the Trend Display screen

- Press the appropriate softkey to view the Trend Display screen from the front panel.
- Once the trend is selected, the softkeys and Up/Down arrow keys only navigate within the Trend Display graph and log screens.
  A moveable cursor, composed from the intersection of a vertical line and a horizontal line, displays the value and timestamp of any plotted data within a parameter. The cursor only displays the values of one parameter at one time. Move the cursor from one parameter to another with the Up and Down navigation keys.
- Use the ESC key to exit the Trend Display.

NOTE: The default Trending parameters displayed are kW sd d-r, Vll, and Iavg. The minimum and maximum values of the graph automatically scale based on the CT primary and PT primary values.

Statistical values for the data (such as Minimum, Maximum, and Average) also display at the cursor location. The Minimum and Maximum values display with timestamps. Statistical values are calculated for all the historical data available in the associate data log, including the data that does not fit into the current screen view.

It is possible to display up to 3360 logs for each parameter; this is 35 days worth of 15 minute data. The graph is updated when a new set of values is recorded. The highest supported update speed is once per second.

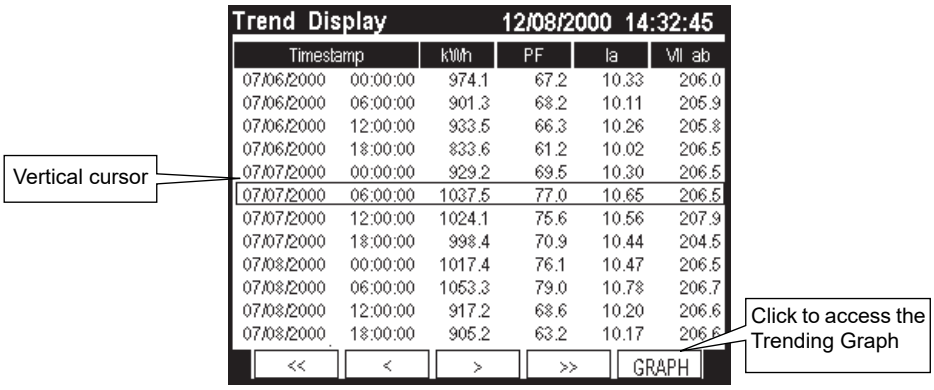
By default, the data is logged for Trend Display every 15 minutes. Change this logging interval by configuring the Periodic Timer module's setup register with Designer software.

Changing the logging interval for Trend Display data

1. Open your meter in Designer.
2. Navigate to **Advanced Setup > Display Framework > Trending Display Support**.
3. Right-click the Dsp Trnd Log Trg module to access the setup registers.
4. Double-click on the PT7 Period and change the value.
5. Select **Send & Save**. The Trend Display screen now logs and plots data at the interval you specified.

NOTE: Currently, the Trending Display screen only accepts synchronous data triggered by a periodic timer. If a setpoint module asynchronously triggers a data recorder which is set for the trending purposes, then it is possible that the records drawn in the screen will be unevenly distributed over time.

Trending data log screen



You can access a data log screen for any value on the graph. Simply press the softkey corresponding to the Log button to view the graphed value in a data log format. The log screen also lists the twelve parameter values that surround the current cursor position, each with a corresponding timestamp.

Screen Messages

Messages that can appear on the Trending Display screen are explained in the following table.

Screen Message	Description
Start of Logged Data	This displays when you have navigated to the extreme left of the Trending Display Graph where the plotted data starts.
End of Logged Data	This displays when you have navigated to the extreme right of the Trending Display Graph where the plotted data ends.
Out of Range	This displays when a logged data value is not within the minimum or maximum range. You can view the "out of range" values on the Data Log screen.

Screen Message	Description
Setup Error	This never displays if you use the default Trending Display screens. This message will display if the default Trending Display framework has been modified so that a minimum value is larger than a maximum value. It also displays when a Display module configured for Trending has not been linked to a Data Recorder module, so there are no values to plot.
Invalid Log	This displays whenever an invalid log value is recorded. In addition, trend graphs cannot be viewed.

Adding New Trend Display Modules

Users who are familiar with the ION architecture, Designer software, and Vista software can link additional Display modules for trending. Here are some guidelines:

- You can configure any Display module as Trend Display by setting the *Screen Type* setup register to *Data Log Trend - Log Source 1 to 4*.
- The maximum number of Trend Display modules permitted is 10.
- Any Data Recorder module output log can be connected to a Trend Display module.
  - The Data Recorder module output log must be connected to the first input of the associated Trend Display module.
  - Even though a Data Recorder module has up to sixteen *Source* inputs, only the first four *Source* inputs can be viewed in Trend Display.
- With External Numeric modules, min/max can be set in Vista.
  - The External Numeric module that sets up the minimum value for the displayed data must be connected to the second input of the associated Trend Display module.
  - The External Numeric module that sets up the maximum value for the displayed data must be connected to the third input of the associated Trend Display module.

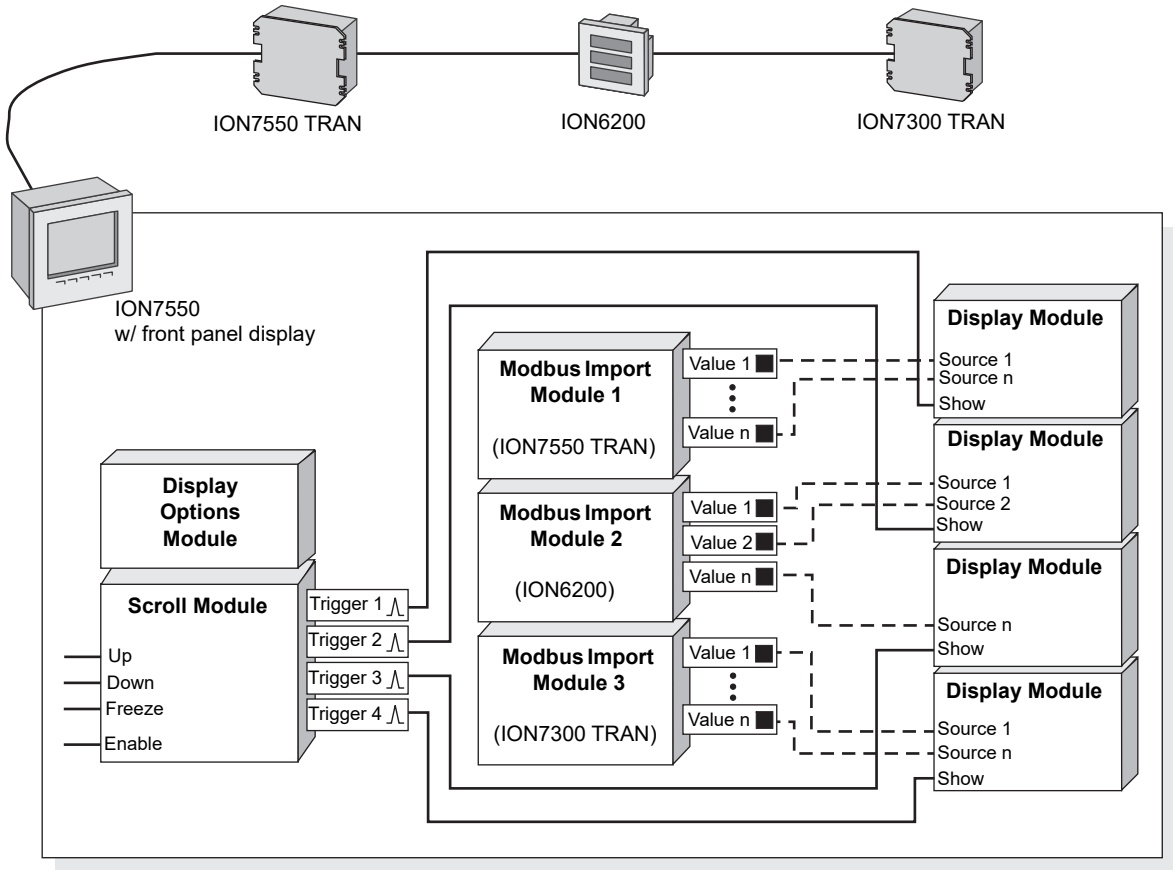
Displaying Data from Other Meters

Data can be read at a workstation using Power Monitoring Expert software, but there may be situations which require the data to be read at the source. With just one ION7550/ION7650 meter, you can view the data collected by numerous TRANs and other devices over a serial network. This is done using the Modicon Modbus™ protocol. The ION7550/ION7650 meter with the front panel display acts as the Modbus Master, while the other meters are the Modbus Slaves. The display meter has its protocol set to MODBUS MASTER, and each TRAN meter is configured to use the MODBUS protocol.

NOTE: A TRAN (transducer) meter is a basic meter model without a front panel display; a TRAN can be used with a remote display.

See the *Modbus and ION Technology* technical note for more information on how to configure your meter as a Modbus Master.

Customized display framework



The ION7550 meter with front panel display is the Modbus Master, showing data from the other meters (the Modbus Slaves) on the serial connection.

If this were the complete display framework, then there would be a total of four screens showing data on the ION7550 with front panel display: one screen from each TRAN (the ION7550 and the ION7300) and two screens from the ION6200. Notice how the ION6200 has had its data displayed on different screens.

Configuring your custom display framework

To aggregate data from multiple devices on a network and display it on an ION7550/ION7650 meter, follow the steps below. The framework changes are made to the meter displaying the data.

1. Connect to your meter in Designer, ensuring that **Options > Show Toolbox** is checked.

   If you want a blank work space, where you can keep your master configuration, simply drag out a new grouping object from the toolbox, name it appropriately and double-click on your new grouping object.

2. Drag out a Modbus Import module and right-click on the Modbus Import module to access the setup registers.

3. Use the *ReadNow* input of the Modbus Import module if you want to setup a trigger source that activates a read (i.e. a pulse). If you do not link *ReadNow* the module polls Modbus devices continuously.

4. Right-click the Modbus Import module to configure setup register settings.

   Configure the following setup registers as needed: *Slave Address, Register Address*, *Number of Registers*, *Format* and *Scaling*. The supported *Slave Address* range (Unit ID on ION meters) for a Modbus device is from 1 to 247.

5. Repeat steps 2 - 4 for every meter or TRAN in the serial network whose data you want to display on the meter with the front panel.

   The meter with the front panel requires a separate Modbus Import module for each meter whose data it displays, because all meters in the network have unique Unit IDs. This is how the Modbus Master distinguishes which meter (*Slave Address*) is providing what data (*Register Address*).

6. Link each Modbus Import module's output registers to the appropriate Display module's *Source* inputs.

7. Define each Display module's characteristics (display format) by adjusting its setup registers. Do the same to the Display Options module if so desired.

8. See "Removing a display screen" on page 47 for considerations on re-linking Scroll module *Trigger* outputs.

   This step is important if you want to have your new screens appear in an automatic scrolling cycle, or if your custom framework has fewer display screens than the factory configuration, and you need to adjust the Scroll module's settings.

9. Select **Send & Save** to save your changes.

Chapter 4 Basic Setup

This chapter explains how to perform basic power meter setup and configure localization settings such as language and convention (IEEE/IEC). Usually, you only need to perform this setup when the meter is commissioned.

In this chapter

Basic Power Meter Setup 56
- Configuring Basic Setup 56
- Power Meter Module Settings 57

Localization Settings 58
- Configuring Language 59
- Configuring IEEE/IEC Convention Settings 60

Basic Power Meter Setup

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.

Basic setup is typically performed 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. Refer to the *ION Reference* for more details on the Power Meter module.

Configuring Basic Setup

Use the front panel or software to perform basic meter setup.

Using the front panel

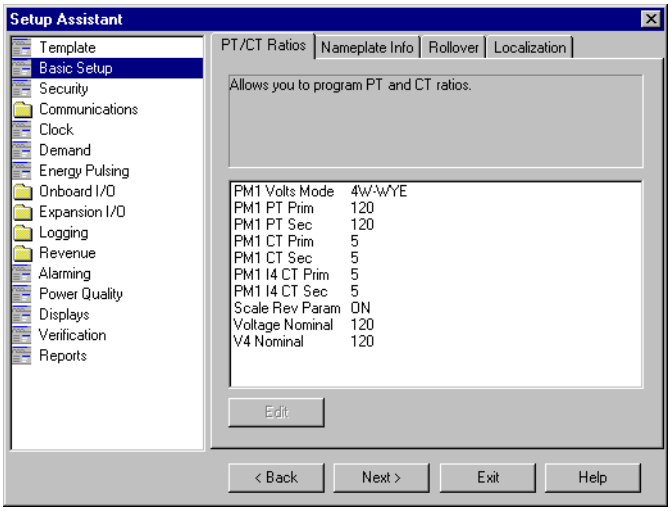
The Basic Setup menu item provides access to the following power system settings:

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 999,999.99	120.00
	PT SECONDARY	The Potential Transformer's secondary winding voltage rating	1 to 999,999.99	120.00
	CT PRIMARY	The Current Transformer's primary winding current rating	1 to 999,999.99	5.00
	CT SECONDARY	The Current Transformer's secondary winding current rating	1 to 999,999.99	5.00
	V4 PRIMARY	The Potential Transformer's primary winding voltage rating on V4	1 to 999,999.99	120.00
	V4 SECONDARY	The Potential Transformer's secondary winding voltage rating on V4	1 to 999,999.99	120.00
	I4 PRIMARY	The Current Transformer's primary winding current rating on I4	1 to 999,999.99	5.00
	I4 SECONDARY	The Current Transformer's secondary winding current rating on I4	1 to 999,999.99	5.00
	I5 PRIMARY	The Current Transformer's primary winding current rating on I5	1 to 999,999.99	5.00
	I5 SECONDARY	The Current Transformer's secondary winding current rating on I5	1 to 999,999.99	5.00
	V NOMINAL	The V1, V2 and V3 nominal voltage used for harmonics calculations	1.000 to 999,999.000	120.00
	V4 NOMINAL	The V4 nominal voltage used for harmonics calculations	1.000 to 999,999.000	120.00
	Va POLARITY	The polarity of the Potential Transformer on Va	Normal or Inverted	Normal
	Vb POLARITY	The polarity of the Potential Transformer on Vb	Normal or Inverted	Normal
	Vc POLARITY	The polarity of the Potential Transformer on Vc	Normal or Inverted	Normal
	V4 POLARITY	The polarity of the Potential Transformer on V4	Normal or Inverted	Normal
	Ia POLARITY	The polarity of the Current Transformer on Ia	Normal or Inverted	Normal
	Ib POLARITY	The polarity of the Current Transformer on Ib	Normal or Inverted	Normal
	Ic POLARITY	The polarity of the Current Transformer on Ic	Normal or Inverted	Normal
	I4 POLARITY	The polarity of the Current Transformer on I4	Normal or Inverted	Normal
	I5 POLARITY	The polarity of the Current Transformer on I5	Normal or Inverted	Normal
	CURRENT PROBE TYPE	The type of current probes being used with the meter	Factory Default, User Defined 1, or User Defined 2	Factory Default

Using ION Setup

The Basic Setup Assistant helps you configure the Power Meter module.

1. Open ION Setup and connect to your meter, using Basic Mode.
2. In the Setup Assistant, navigate to Basic Setup and click on the **PT/CT Ratios** tab.



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

Using Designer

Open your meter in Designer and navigate to the Basic Configuration Framework. Right-click on the Power Meter module to 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 V1, V2 and V3	120
PT Sec[1]	The Potential Transformer's secondary winding rating for V1, V2 and V3	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
V4 Prim[1]	The Potential Transformer's primary winding rating for V4	120
V4 Sec[1]	The Potential Transformer's secondary winding rating for V4	120
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
I5 CT Prim[1]	The Current Transformer's primary winding rating for I5	5
I5 CT Sec[1]	The Current Transformer's secondary winding rating for I5	5
Vn Polarity	The polarity of the Potential Transformer on Vn	Normal
In Polarity	The polarity of the Current Transformer on In	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)	ABC
kVA tot Method	The method used to calculate kVA total (Vector Sum or Scalar Sum)	Vector Sum
PF Sign Convention	Determines which sign convention, IEEE or IEC, is used for the Power Meter module's PF sign output registers, and therefore how those values appear on the front panel and in software. For more information on PF sign convention, see "Power factor interpretation" on page 59.	IEEE
Nominal Frequency	The nominal frequency of the power system the meter is used in (50Hz or 60Hz)	60Hz

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

Additional information for current probes

The Current Probe phase calibration registers are setup registers in the Factory module that can be configured in a Telnet or HyperTerminal session. Up to three separate groups of registers (*Factory Default, User Defined 1,* and *User Defined 2*) can be set up for three different Current Probes. In the Basic Setup menu, the *Current Probe* register is used to activate one of those register groups. Only the selected group is used in the meter's calculations.

For more information on configuring your meter's non-intrusive current probes, see the *Current Probe Input Option* product option document for the ION7550/ION7650.

Localization Settings

The localization settings on the meter affect how information is displayed on the front panel as well as how some values are calculated. Options include language, number format and IEEE (Institute of Electrical and Electronics Engineers) or IEC (International Electrotechnical Commission) convention settings. The setup registers involved are listed in the table below. The default setting, without any configuration, is given in the Default column (generally, the default settings follow IEEE standards). The settings used if you use ION Setup to configure the convention are given in "Configuring IEEE/IEC Convention Settings" on page 60.

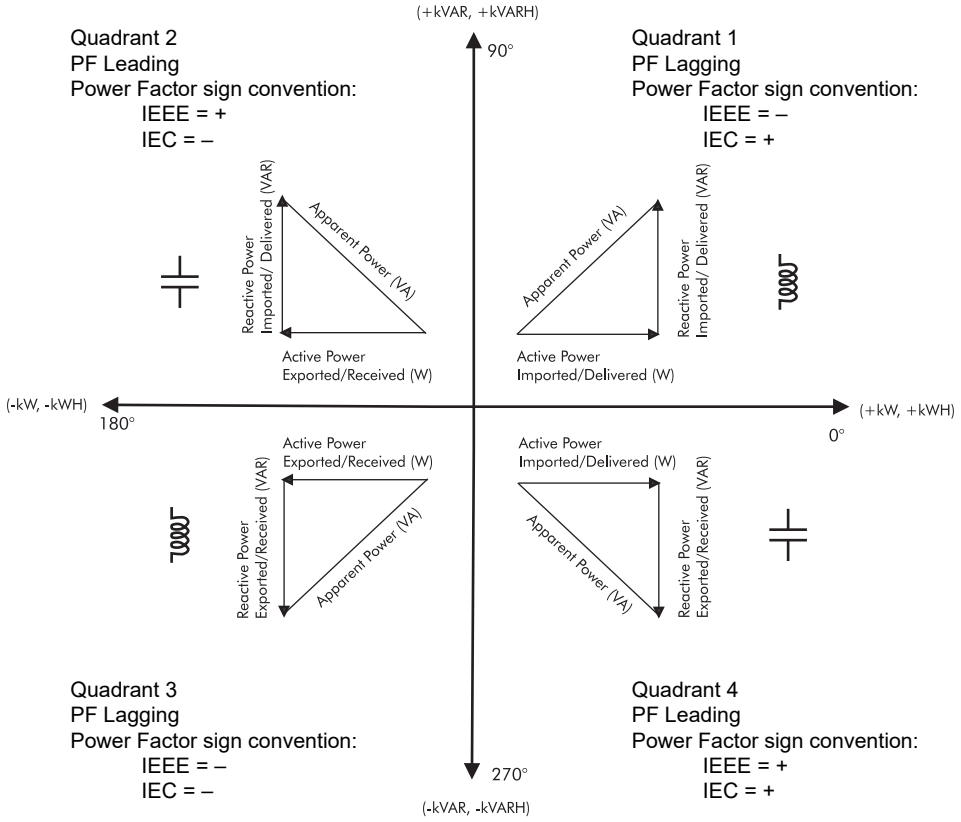
Setup Register (Module)	Function	Default
Language (Display Options)	Sets the language in which parameters are displayed on the front panel: English, Spanish, French, Russian.	English
Time Format (Display Options)	Sets the time format used on the front panel (H=hour, M=minute, S=second): – 24 H (displays time using a 24 hour clock: HH:MM:SS) – 12 H (displays time using a 12 hour clock: HH:MM:SS AM/PM)	24 H
Date Format (Display Options)	Sets the date format used on the front panel (M=month, D=day, Y=year): – MM/DD/YYYY – DD/MM/YYYY – YYYY/MM/DD	MM/DD/YYYY
Digit Grouping (Display Options)	Sets how groups of digits are displayed on the front panel: – 1000.0 – 1,000.0 – 1 000,0	1000.0
PF Sign Convention (Power Meter)	Determines which sign convention, IEEE or IEC, is used for certain power factor related output registers of the Power Meter module, and therefore how it is displayed on the front panel when the PF Symbols register in the Display Options module is set to "+/–". For more information on PF sign convention, see "Power factor interpretation" on page 59.	IEEE
PF Front Panel Symbol (Display Options)	Specifies the set of symbols used for power factor data on the front panel (LD/LG, +/–, CAP/IND).	LD/LG
Measurement Symbols (Display Options)	Sets the measurement symbols used on the front panel to IEEE (Vll, Vln, kW, kVAR, kVA) or IEC (U, V, P, Q, S).	IEEE
Phase Labels (Power Meter)	Sets the phase labels used by the meter (ABC, RST, XYZ, RYB, RWB, 123).	ABC
Harmonics Display Mode (Harmonics Analyzer)	Specifies how the individual harmonic distortion output values are calculated.	Engineering Units[1]
Display Mode (Harmonics Measurement)		Magnitude Outputs Displayed as Engineering Units[1]

Setup Register (Module)	Function	Default
THD Display Mode (Harmonics Analyzer)	Specifies how the total harmonic distortion output values are calculated.	Percent Fundamental[1]
THD Display Mode (Harmonics Measurement)		Percentages[1]

[1] If any of the harmonics Display Mode registers are set to PERCENT NOMINAL, you may need to change the value of the *Vnominal*, *V4nominal*, *Inominal*, *I4nominal* and *I5nominal* registers in the Factory module. For more information, see "Setting the nominals for harmonics calculations" on page 62.

Power factor interpretation

Values for power factor are interpreted according to the conventions shown in the diagram below.



NOTE: In the IEEE sign convention, the power factor sign is **positive** when the power factor is **Leading**, and **negative** when the power factor is **Lagging**.
In the IEC sign convention, the power factor sign is **positive** when active power is **positive**, and **negative** when active power is **negative**.

Configuring Language

Use the front panel or software to set this display option.

Using the front panel

To quickly access the language setup display, press the right navigation button and the PROG button at the same time and hold for a few seconds. Release both buttons and the language setup screen is displayed.

You can also access the language selection screen through the Display Setup menu on the front panel. For more information on programming via the front panel, see the Front Panel chapter.

Menu	Setting	Description	Range (Values)	Default
DISPLAY SETUP	LANGUAGE	Sets the language used for front panel displays	ENGLISH, SPANISH, FRENCH, RUSSIAN	ENGLISH

Using ION Setup

1. Open ION Setup and connect to your meter in Basic mode.
2. Select the Basic Setup screen and click the **Localization** tab.
3. Select Language and click **Edit**.
4. Select the language you want to display on the front panel and click **OK**.

Using Power Monitoring Expert

Open your meter in Designer and navigate to the Display Options module folder. Right-click on the module to edit.

Configuring IEEE/IEC Convention Settings

The convention settings on the meter enable you to set certain parameters to IEEE or IEC standards. You can configure the IEC/IEEE settings via the front panel and ION software.

Using the front panel

The IEEE/IEC and DATE/TIME submenus in the Format Setup menu allow you to change the following settings from the front panel:

Menu	Setting	Description	Range (Values)	Default
IEEE/IEC	MEASUREMENT SYMBOLS	Sets the measurement symbols used on the front panel	IEEE (VII, VIn, kW, kVAR, kVA) or IEC (U, V, P, Q, S)	IEEE
	PHASE LABELS	Sets the phase labels used by the meter	ABC, RST, XYZ, RYB, RWB, 123	ABC
	PF SIGN CONVENTION	Determines which sign convention, IEEE or IEC, is used for certain power factor related output registers of the Power Meter module, and therefore how it is displayed on the front panel when the PF Symbol register is set to "+/–"	IEEE or IEC	IEEE
	PF SYMBOL	Sets the symbols used for power factor data on the front panel	LD/LG, +/–, CAP/IND	LD/LG
DATE/TIME	DATE FORMAT	Sets the date format used on the front panel	MM/DD/YYYY, DD/MM/YYYY, or YYYY/MM/DD[1]	MM/DD/ YYYY
	TIME FORMAT	Sets the time format used on the front panel	24 H or 12 H	24h

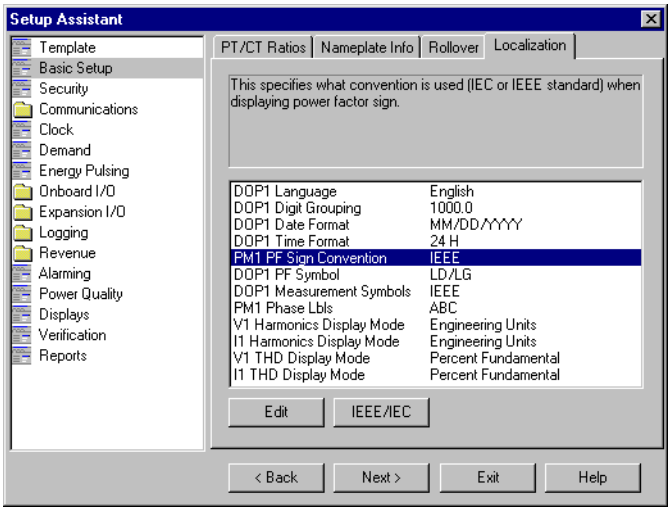
[1] M=month, D=day, Y=year

Using ION Setup

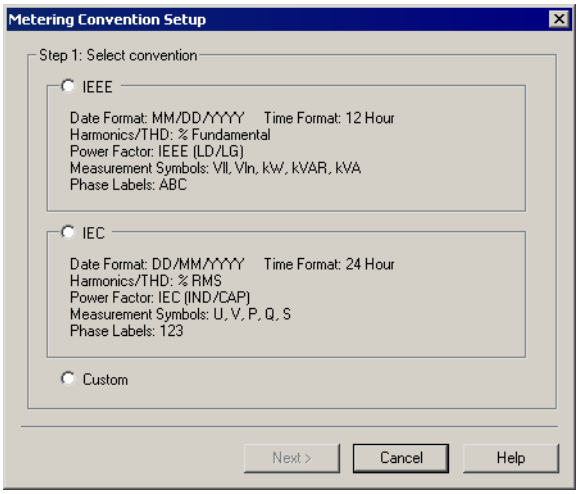
NOTE: To view Power Factor information correctly in ION Setup, you also need to set the convention in the software. Select **Tools > Options** and select the **Conventions** tab. Set the PF Convention to IEEE or IEC, as required.

1. Open ION Setup and connect to your meter in Basic Mode.
2. Navigate to the Basic Setup screen and select the **Localization** tab.

3. The localization settings are displayed. You can click on the **IEEE/IEC** button to access the Metering Convention Setup wizard, where you can toggle between IEEE or IEC settings, or create custom localization settings. You can modify individual values by highlighting them and clicking **Edit**.



4. If you clicked **IEEE/IEC**, the Metering Convention Setup wizard is displayed. Select IEEE or IEC and click **Finish** or select Custom and click **Next**.



If you select IEEE or IEC, the default settings are as follows:

Setup Register	IEEE	IEC
Time Format	12H	24H
Date Format	MM/DD/YYYY	DD/MM/YYYY
PF Sign Convention	IEEE	IEC
PF Front Panel Symbol	LD/LG	IND/CAP
Measurement Symbols	IEEE	IEC
Phase Labels	ABC	123
Harmonics Display Mode	% Fundamental	% RMS
THD Display Mode	% Fundamental	% RMS

Custom convention settings configuration

If you selected Custom in step 4, continue with the steps below.

5. Select the date and time format you want to use on your meter's front panel and click **Next**.
6. Select the PF sign convention and the PF Front Panel Symbol you want to use and click **Next**.
7. Select the Measurement Symbols and the Phase Labels you want to use and click **Next**.
8. Select the harmonic calculation methods you want to use and click **Next**.
9. Select the THD calculation method you want to use and click **Next**.

   Click **Finish** when you are done.

Setting the nominals for harmonics calculations

When the harmonics calculation method is set to Percent Nominal, you may need to adjust the value of the following registers in the factory module:

- Vnominal
- V4nominal
- Inominal
- I4nominal
- I5nominal

The default value of these registers is the same as the value of the corresponding PT or CT Primary.

To change the value of the V or V4 nominal:

1. Open ION Setup and connect to your meter in Basic mode.
2. Navigate to the Basic Setup screen and select Voltage Nominal (Vnominal) or V4 Nominal (V4nominal) and click **Edit**.
3. Type the new nominal and click **OK**.

To change the value of the I, I4 or I5 nominal:

1. Open ION Setup and connect to your meter in Advanced mode.
2. Navigate to the Factory folder and double-click on the module in the right-hand pane.
3. Select the **Setup Registers** tab, then select the register you want to change and click **Edit**.
4. Type the new nominal and click **OK**.
5. When you are finished, click **Send** to save your changes.

Using Power Monitoring Expert

Open your meter in Designer and navigate to the module you want to change. Right-click on the module to edit.

Chapter 5 Security

ION7550/ION7650 meters offer Standard (which is enabled by default from the factory) and Advanced meter security. Standard and Advanced meter security settings can be modified using the front panel and ION software. Additional security features are available for revenue meters.

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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 system security.

See the *Cybersecurity Hardening Best Practices* white paper for suggested best practices.

Security features on your meter

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

Front panel security

You must enter the meter password before you can make configuration changes to your meter. Front panel password protection can be disabled, but this is not recommended. See "Configuring Standard security using the front panel" on page 70.

Standard meter security

Standard security is enabled by default from the factory. Any time you make configuration changes to your meter, you must enter a password. See "Configuring Standard security using ION Setup" on page 72

Advanced meter security

Advanced security settings allow you to:

- Add up to 50 users, each with unique access privileges.
- Configure communications lockouts to limit the number of invalid login attempts permitted for each protocol, and set the priority of associated device events.
- Enable or disable Modbus programming.
- Enable or disable programming through the front panel.

See "Configuring Advanced Security using ION Setup" on page 73

Port number reassignment on Ethernet protocols

You can change the default port number assigned to Ethernet protocols. This feature can assist in preventing port service overlap. Network ports that remain open should be changed from their default values whenever possible. See "Network protocol control" on page 93.

Once your meter is configured, all ports related to unused network protocols should be closed (disabled). When required, you can always temporarily open a port for specific activities such as periodic firmware or software downloads.

Enable/disable communication ports

You can disable your meter's communication ports when they are not in use. This includes serial and Ethernet communication ports. See "Disabling serial communications ports" on page 88 and "Network protocol control" on page 93.

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

Event logging

Your meter records meter functions, events and changes to meter parameters and logs them as entries in the event log. Security-related events such as resets, successful or unsuccessful login attempts, user lockout, and meter configuration changes are also recorded in the event log along with a timestamp and the user associated with the event. The event log can be used to monitor system events, assist in confirming security compliance, or assist in tracking unauthorized intrusion attempts. See "Event Logging" on page 156.

Syslog

They Syslog feature allows you to push event log information to a centralized syslog server.

When the event log of a meter is full, new log entries overwrite the existing entries. By pushing the event log information to a syslog server, older event log information can be preserved and used as part of an information storage and retrieval strategy. See "Syslog" on page 96

Revenue meter security

Your meter can be protected by hardware-lock security and anti-tamper sealing. See "Additional revenue metering security" on page 77.

Software security

Power Monitoring Expert or ION Setup add another layer of access-level security to the meter. With Power Monitoring Expert or ION Setup, you can configure multiple users with different passwords and specify access rights. Power Monitoring Expert or ION Setup security only applies to users who are accessing the meter using the software.

For more information on Power Monitoring Expert or ION Setup security, refer to the software's online help.

Time synchronization security considerations

Depending on the software security settings, a workstation that connects to the meter may send a time synchronization signal to synchronize the meter's internal clock with the workstation's clock. This can cause overlaps in the demand intervals, and timestamps in the data logs may not be accurate.

The *Time Sync Source* setup register, located in the Clock module, identifies the communications port that will accept time synchronization broadcasts. Time

synchronization signals on other communications ports are ignored. You can configure this setup register through ION Setup or the Designer component of Power Monitoring Expert.

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

Security recommendations and best practices

Use recommended security configuration and best practices to help improve security on your meter.

Recommended security configuration

- Enable front panel security on your meter.
- Enable advanced security on your meter.
  - Configure users and passwords to help minimize access to your meter.
  - Disable web server programming to help prevent configuration access to your meter over the web.
  - Disable Modbus programming to help prevent access to your meter using Modbus. This disables write access to all Modbus registers, and only allows read access to the registers in the Modbus Slave modules.
  - Configure the protocol lockouts to help minimize access to your meter.
  - Ensure that the Factory user is disabled.
- Change Ethernet port numbers from their default values wherever possible.
- Disable all unused serial and network communications ports.

Password best practices

The following recommendations help improve security on your meter:

- Change your meter's front panel password from the default factory value of 0 (zero).
- Make your meter's front panel and user-specific passwords as complex as possible. For passwords created in ION Setup, there is a password strength indicator. Password strength ranges from Very weak to Very strong.

NOTE: Make sure that the user password you enter is compatible with the software used to communicate with your meter. For example, some energy management software applications only accept letters, numbers and underscores, and do not accept special characters.

- Schedule regular changes to your meter's front panel and user passwords.
- Record and store your device's user and password information in a secure location.

Lost passwords cannot be recovered. If your device's user access information is lost, you must return the device for factory reconfiguration, which resets your device to its factory defaults and destroys all logged data.

NOTICE

DATA LOSS

Record and store your device's user and password information in a secure location.

Failure to follow these instructions can result in data loss.

Additional security recommendations

- For the highest level of security, use a hardware-locked, sealed meter with advanced security enabled and configured for minimum access.
- Protect all Ethernet devices with a properly configured firewall that prevents Telnet access over port 23.
- Save a copy of your meter's security configuration (.scf) file in a secure location in addition to the password and user information.
- Set meter communication ports to the Factory protocol only when necessary to permit access by Schneider Electric Technical Support, and return the ports to their original settings as soon as possible.
- Set the meter's time synchronization source to a secure communications port (this disables time synchronization on all other ports). See the *Time synchronization & timekeeping* technical note for more information.

Default security settings

The meter ships from the factory with standard security enabled and a default password of 0 (zero). Default security settings for meters shipping from the factory are defined in the following table. If you upgrade your meter to use the latest firmware, your meter's existing security values are not affected; the values will retain their current settings.

Security setting	Value
Allow Web Server programming	Disabled (not allowed)
Allow Modbus programming[1]	Disabled (not allowed)
Protocol lockout attempts	8 (for all protocols)
Session timeout	30 minutes
Lockout duration	1440 minutes (24 hours)
Valid login event priority	0
Invalid login event priority	128
Lockout event priority	255
Protocols selected for security	All protocols (ION, HTTP, FTP, Telnet, Factory, Front panel)
Factory user	Disabled
Factory Access Minutes	0

[1] This setting only applies to advanced security.

Unless otherwise noted, these security settings apply regardless of whether the meter has standard or advanced security enabled; for example, if you change the lockout duration to 720 minutes (12 hours), that is the lockout duration for the meter in standard security or in advanced security.

Standard meter security

Standard meter security lets you configure the meter through the front panel or with communications software using a meter password.

Standard meter security is enabled by default on all ION7550/ION7650 meters; all configuration functions using the front panel and software are password-protected.

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 through ION software or an internet browser, you are prompted by the meter for its password (and sometimes the user name, USER0). After

you enter the correct meter password and confirm the new configuration, the changes are saved to the meter.

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.

Advanced meter security

Advanced meter security allows you to configure up to 50 users, each with unique access rights to the meter. Access rights consist of the following levels where you can:

- **Time sync:** set the time on the meter.
- **Read:** view any parameter except the security configuration.
- **Peak demand reset:** perform a reset of peak demand values (for example, sliding window demand for kW, kVAR, kVA etc.).
- **Full meter configuration:** 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.
- **Test mode:** put the meter into test mode.
- **Advanced security configuration:** configure Advanced security for the meter, full meter configuration must also be set to YES.

Use the Setup Assistant in ION Setup to configure Advanced security. 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 (*Security Config Access* setup register), you must set multiple access options to YES. When you are configuring Advanced security, ION Setup prompts you about improper or incomplete user configurations.

Entering an advanced security user and password in ION software

When you use ION software to view data or make a change to a meter that has advanced security enabled, you are prompted to enter a valid user name and password combination.

User names in advanced security are fixed as USER1 through USER50.

Security configuration process

The security configuration process has four basic steps: review security recommendations, set basic security options, configure communications protocol lockout settings, and configure users.

1. Review security recommendations
2. Set basic security options:
   - Change the meter password
   - Disable broadcasting time synchronization (advanced security only)

– Enable/disable display (front panel) and Webserver programming
– Enable/disable Modbus programming (advanced security only)

3. Configure communications protocol lockout options.

a. Configure protocol-specific settings:

– Set the number of attempts before the protocol is locked out
– Set the session timeout

b. Configure global lockout settings:

– Enter a lockout duration
– Set the priority of meter access events

4. Configure users (advanced security only):

– Determine user access
– Set user password

Communications protocol lockout overview

The communications protocol lockout advanced 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). By default, all protocols are set to eight invalid attempts (*Ftp Lock Attempts*, *Factory Lock Attempts*, *Frontpanel Lock Attempts*, *ION Lock Attempts*, *Http Lock Attempts* setup registers). Setting the value to 0 (zero) disables the lockout feature for that protocol.

Protocols that are not session-based, such as ION or HTTP, send security credentials with each packet transaction. For these protocols, you can configure how often the meter registers invalid login attempts by setting the session timeout (*ION Silence Minutes* and *Http Silence Minutes* setup registers), during which time only the first invalid login attempt is counted towards the invalid login count. Each invalid attempt using a different User/Password combination is counted. Session timeout is specific to the protocol and communications port used, for example, ION over the COM1 serial communications port.

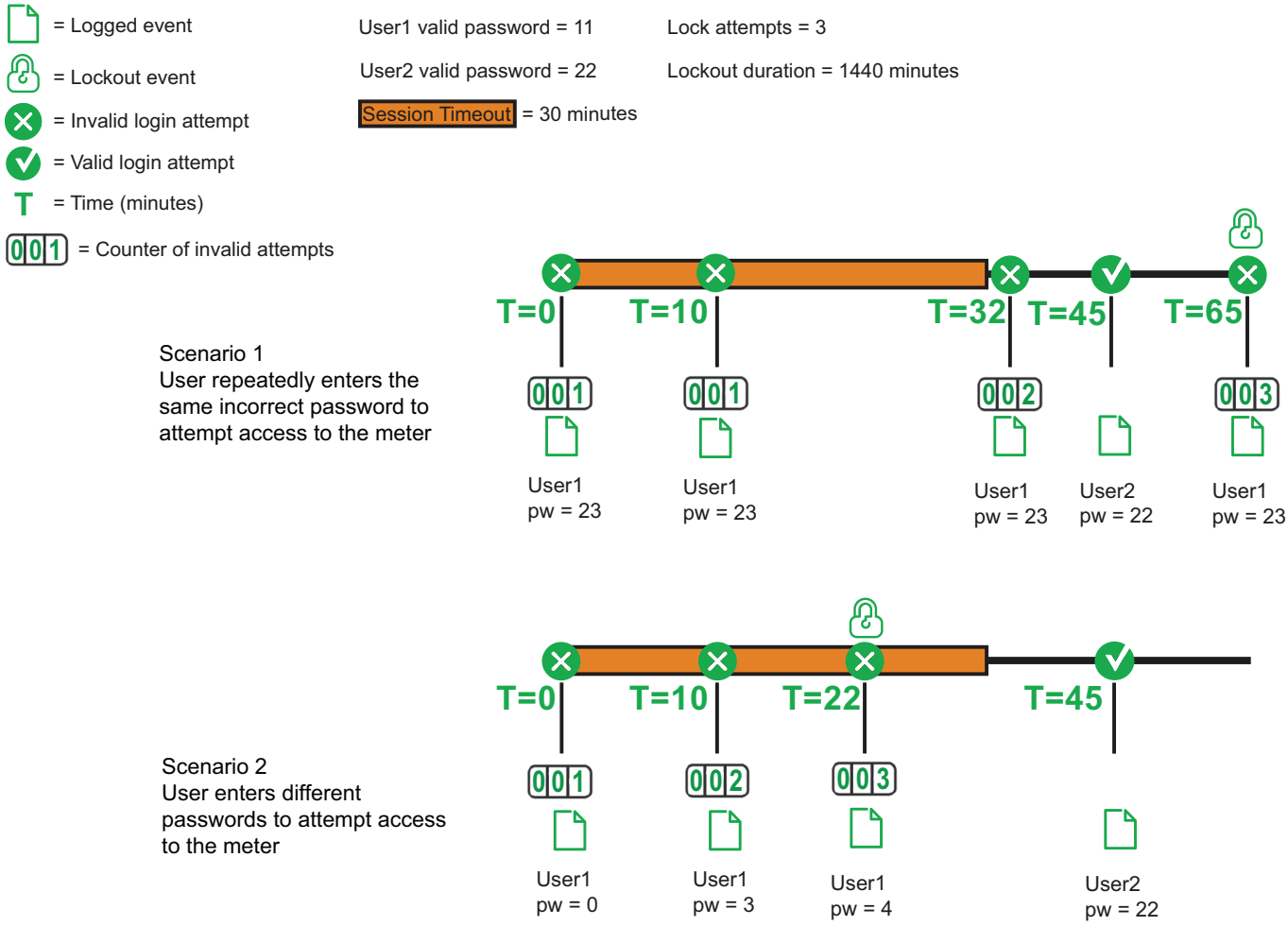
Invalid login attempts accumulate until the user has completed a valid login or is locked out. If the user enters the correct User/Password combination before being locked out, the invalid attempt counter is reset to zero.

The lockout duration (*Lockout Duration Minutes* setup register) applies to all configured protocol lockouts and defines the length of time (in minutes) that a User/Password combination remains locked out. The default lockout duration is 24 hours (1440 minutes). The meter blocks login attempts from that User on that protocol and communication port until the lockout duration has passed.

NOTE: Lockout is protocol-specific. For example, if the user is locked out using ION over Ethernet, the same user can still access the meter by entering the correct User/Password combination over a different protocol and communications port.

For advanced security login events, you can set the event priority for valid login attempts (*Valid Auth Priority*), invalid login attempts (*Invalid Auth Priority*) and protocol

lockout events (*Locked Auth Priority*). These settings apply to all configured lockouts. Setting the value to 0 (zero) disables logging for those events.



Configuring meter security

Configure your meter's Standard security settings through the front panel or with ION software.

Advanced security can only be configured via ION software.

Configuring Standard security using the front panel

Use the meter display's Security menu to:

- modify the existing meter password
- enable/disable the password security check (this enables/disables Standard security)
- enable/disable web browser configuration of the meter
- enable/disable the meter's web server

If you have not yet entered your password, the meter front panel requires that you enter it before you can view the Security Setup menu.

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 enter an incorrect password, the front panel displays an “invalid password” message and you must try again.

PASSWORD

Use this setting to change the current password to any numeric value, up to eight digits in length. The factory default meter password is **0** (zero).

Changing the meter password using the front panel

1. Scroll down the Setup menu and select the Security Setup menu.
2. Press the PROG button to enter the Security Setup menu.
3. Press the MODIFY softkey. The menu selection Password is highlighted, as well as the last zero.
4. Enter your new numeric password.
   - Use the Up/Down arrow buttons to change the value of the highlighted digit.
   - Use the Left/Right arrow buttons to change the position of the cursor one space to the left or right.
5. Record and store your device’s user and password information in a secure location.
6. Press PROG to accept the new password.

ENABLED

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

Disabling (and enabling) password security using the front panel

1. Scroll down the Setup menu and select the Security Setup menu.
2. Press the PROG button to enter the Security Setup menu.
3. Enter the current password and press PROG if you are presented with the Enter Password screen.
4. Press the softkey titled ENABLE, and select **Yes** to enable password security (if it has been disabled) or No to disable it.
5. Press PROG to make your selection. The Confirm screen appears.
6. Press PROG to confirm the change.

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

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

Disabling the Password Security Check is required to write to the meter via the Modbus RTU protocol. See the “Third-party Protocols” chapter for details about configuring your meter for third-party systems.

WEB CONFIG

Use this setting to enable/disable web browser configuration of the meter. The default is Disabled.

WEB ACTIVE

Use this setting to activate the internal webserver (WebMeter) functionality of the meter. The default is Yes.

Configuring Standard security using ION Setup

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Security**.
4. Select **Security Mode** and click **Edit**. The open dialog box appears.
5. Select the Standard.scf file and click **Open**. The standard options screen appears.
6. Select the check boxes of the security options you want enabled. Some options may be grayed out (not editable) due to existing security settings.

   To change the password, enter a new meter password and then confirm it by entering it again. The factory default meter password is **0** (zero).
7. Record and store your device's user and password information in a secure location.
8. Click **Next** to configure protocol access information. The protocol lockout screen is displayed.
9. In the protocol lockout screen, select the protocols that you want to be protected by the protocol lockout function, or clear the check box to disable lockout function for that protocol (all protocols are selected by default). Click to highlight a selected protocol and click **Edit** to modify the lockout attempts and session timeout values (if applicable) for that protocol. Set 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.
10. Click **Events** to configure user access event priorities. The **Event priorities** screen appears. The event priorities apply to all lockout-enabled protocols. Enter 0 (zero) to disable event logging for a particular type of login attempt.
11. Click **Finish** when you are done.
12. When prompted, you can choose to save your security settings in a file.
    - Click **Yes**, enter a new name for your security file and click **Save**. If you want to overwrite your default standard security file, select Standard.scf and click **Save**.
    - Click **No** if you do not want to save the changes.

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.

Configuring Advanced Security using ION Setup

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Security**.
4. Select **Security Mode** and click **Edit**. The open dialog box appears.
5. Select the Advanced.scf file and click **Open**. The advanced options screen appears.
6. Select the check boxes of the security options you want enabled. Some options may be grayed out (not editable) due to existing security settings.
7. Click **Next** to configure protocol access information. The protocol lockout screen is displayed.
8. In the protocol lockout screen, select the protocols that you want to be protected by the protocol lockout function, or clear the check box to disable lockout function for that protocol (all protocols are selected by default). Click to highlight a selected protocol and click **Edit** to modify the lockout attempts and session timeout values (if applicable) for that protocol. Set 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.
9. Click **Events** to configure user access event priorities. The **Event priorities** screen appears. The event priorities apply to all lockout-enabled protocols. Enter 0 (zero) to disable event logging for a particular type of login attempt.
10. Click **Next**. Select the check box for each user you want to configure (USER1 through USER50). Select the check boxes to set permissions for that user:
    - **Time Sync Access**: allows the user to time synchronize the meter clock
    - **Read Access**: allows the user to read most data (except Advanced Security settings)
    - **Peak Demand Reset Access**: allows the user to reset peak demand readings
    - **Comm Config Access**: allows the user to configure communications settings, including communications-related security settings
    - **Test Mode Access**: allows the user to switch the meter into Test mode
    - **Full Meter Config Access**: allows the user to configure most meter settings
    - **Security Config Access**: allows the user to configure Advanced Security settings
11. Click **Password** to set a password for each user. Click **OK**.
12. Record and store your device's user and password information in a secure location.
13. When all users and passwords have been set, click **Finish**.
14. When prompted, you can save your security settings in a file.
    - Click **Yes**, enter a new name for your security file and click **Save**. If you want to overwrite your default advanced security file, select Advanced.scf and click **Save**.
    - Click **No** if you do not want to save the security settings to a file.

15. Click **Send** to send the changes to the meter.

Loading a security configuration file using ION Setup

You can load an existing security configuration file (*.scf) onto your meter using ION Setup.

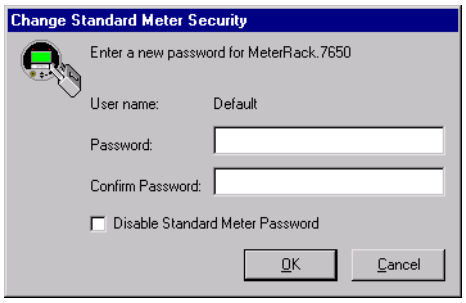
The *.scf file can be a configuration for either standard or advanced security and must be from the same model of meter.

In order to change security settings, you must be logged into ION Setup with an appropriate ION Setup user level. You must also have the appropriate meter-level security access to configure meter security.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to Security. Select **Security Mode** and click **Send**. The Open dialog box appears.
4. Navigate to the location of the *.scf file you want to load onto your meter. Select the *.scf file and click **Open**. The *.scf file is loaded onto your meter.

Configuring Standard Security using Power Monitoring Expert

1. Launch Designer software with Supervisor access.
2. Select **Options > Show Toolbox** if the toolbox is not displayed.
3. Select **Options > Change Standard Meter Security**.
4. Enter the meter password when prompted. You must enter the existing meter password before you can change security settings (the default is 0 [zero]).
5. Type a new numeric password and confirm it by re-typing the password in the appropriate fields. If you are sure you want to disable Standard security, check the Disable Standard Meter Security check box.



NOTE: Do not disable security unless it is absolutely necessary. Disabling Standard security leaves your meter configuration open to tampering (intentional or unintentional) through communications or the front panel.

Configuring Advanced Security using Power Monitoring Expert

1. Connect to your meter in Designer with Supervisor access.
2. If the toolbox is not displayed, select **Options > Show Toolbox**.

3. If you do not want to allow front panel programming using the Standard security meter password, double-click on the Display Options module in **Advanced Setup > Core Modules** and change the Front Panel Programming register to disallow.

NOTE: If you allow front panel programming when you set up Advanced security, the meter password (used in Standard security) is still active through the front panel. You may need to allow front panel programming if someone installs the meter in the field and needs to make setup modifications. Once the meter is installed, you can disable front panel programming so that Advanced security users and passwords must be used to view or change meter information.

4. Double-click on the Meter Security Setup folder.

   For each user you want to configure, drag out a Security User module from the Toolbox and modify the appropriate access level setup registers.

5. Click the **Change Password** button at the bottom left of the module setup screen to configure a password. The default password is 0 (zero).

   Click **OK** when you have configured the users.

6. Record and store your device's user and password information in a secure location.

7. Right-click on the Security Options module.

8. Double-click on any setup register and use the drop-down menu to change the register setting or label.

   Set the *Enable Advanced Security* register to Enabled. Refer to the Security Options module description in the *ION Reference* for more details.

9. Select **File > Send & Save**. Advanced security is now enabled on the meter.

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 meter 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. Setting it to 0 (zero) disables all factory access.

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 be enabled. The meter will only permit factory-level access, with the correct login credentials, for the period specified in the *Factory Access Minutes* setup register.

Configuring the factory access 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. In order to change security settings, you must be logged into ION Setup with a Supervisor level user account with permissions to change these settings.

You can also use the Designer component of Power Monitoring Expert to configure the register. See the Power Monitoring Expert Help for more information.

1. Connect to your meter in advanced mode in ION Setup. See the ION Setup Help for more information.
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. Select Elapsed Interval Format from the dropdown list to enter day, 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:

- *Factory Access Minutes* setup register is not 0 (zero).
- 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 a meter with standard security even if they 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:

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

NOTE: The Factory user can be enabled and disabled on the user configuration screen of the ION Setup advanced security wizard.

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 a meter with advanced security even if they entered appropriate user and password information.

Device security access for ION services

Many ION services need constant access to your meter. These services include the ION Log Inserter Service, the ION Virtual Processor Service and ION Site Service that perform the following type of functions:

Service	Function
ION Log Inserter Service	Reads the ION meter Data Recorder or Waveform Recorder modules and can automatically rearm recorders that are configured as Stop-When-Full
ION Virtual Processor Service	Can be configured to read from a meter or perform control action using Distributed Control.
ION Site Service	Broadcasts time signals to the meter.

NOTE: You may want to configure a separate user for accessing services. If you observe trouble with ION software accessing the meter, it is likely that these services either do not have access rights or the original user and password have changed.

Allowing ION Services access to security enabled meters

1. Launch the Management Console and click **Devices** on the Management Console's System Setup Pane.
2. Highlight your meter, right-click and select Security.
3. Select Standard Security from the drop down menu. Check the check box if you want to allow this user to send time synchronization signals to the meter. Click **OK**.
4. Enter the valid meter password for Standard Security, re-type the password to confirm, and click **OK**.

Additional revenue metering security

To meet government regulations and utility security requirements, the revenue meter supports additional security systems:

- a hardware-locked security system that prevents modification of revenue quantities after the meter is sealed.
- a traditional anti-tamper mechanical seal on the meter base unit.

For more information on ION7550/ION7650 revenue meters see the *ION7550/ION7650 Revenue Meter* product option document.

Revenue lock security option

ION7550/ION7650 meters offer a revenue-locked security feature. To make configuration changes on a revenue-locked meter, you must first unlock the meter.

Revenue lock and protected values

The revenue-related settings on meters with this option are factory configured and cannot be changed, even in test mode.

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.

In certain countries revenue certification is void if the hardware lock is broken.

The revenue lock option combined with Standard or Advanced security offers the highest level of security.

Locked module listings

For a complete list of locked modules specific to your meter and firmware, refer to the *ION Device Template Reference* or contact technical support.

Anti-tamper seals

ION7550/ION7650 revenue meters incorporate sealing tabs through which traditional lead/wire seals are inserted. These seals effectively prevent unauthorized personnel from gaining access to meter internals, and are provided with the meter.

Chapter 6 Communications

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

For specific installation steps and meter specifications, consult your Installation Guide.

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Communications Overview

ION7550 and ION7650 meters have numerous communication possibilities depending on your ordering options. Both models have exactly the same communications options available.

All of the communication ports can be used concurrently.

COM Port	Available Connections	Standard/Option	Description
1	Selectable RS-232/RS-485 port	Standard	COM1 can switch between RS-232 mode for a single direct connection or RS-485 for multi-point serial connections. Both ports support the following protocols: ION, Factory, EtherGate, GPS, ModemGate, Modbus RTU, Modbus Master, DNP V3.00 and None.
2	Dedicated RS-485 port	Standard	COM2 provides an RS-485 serial port that supports the following protocols: ION, GPS, EtherGate, ModemGate, Modbus RTU, DNP V3.00, Modbus Master, Factory and None.
3	Internal modem	Option	COM3 provides an optional internal modem. The meter's internal modem communicates to the server computer over the telephone network.
4	Optical port	Standard	COM4 provides an ANSI Type 2 Optical port (located on the front of the meter) that is used for serial communications, and supports the following protocols: ION, Factory, Modbus RTU, DNP V3.00 and None.
Ethernet	10BASE-T/100BASE-TX and 100BASE-FX Ethernet	Option	The Ethernet port supports 10BASE-T/100BASE-TX and 100BASE-FX (fiber) connections. You can communicate with your meter using SNMP or FTP (for IEC 61850 and COMTRADE) via Ethernet.

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*.

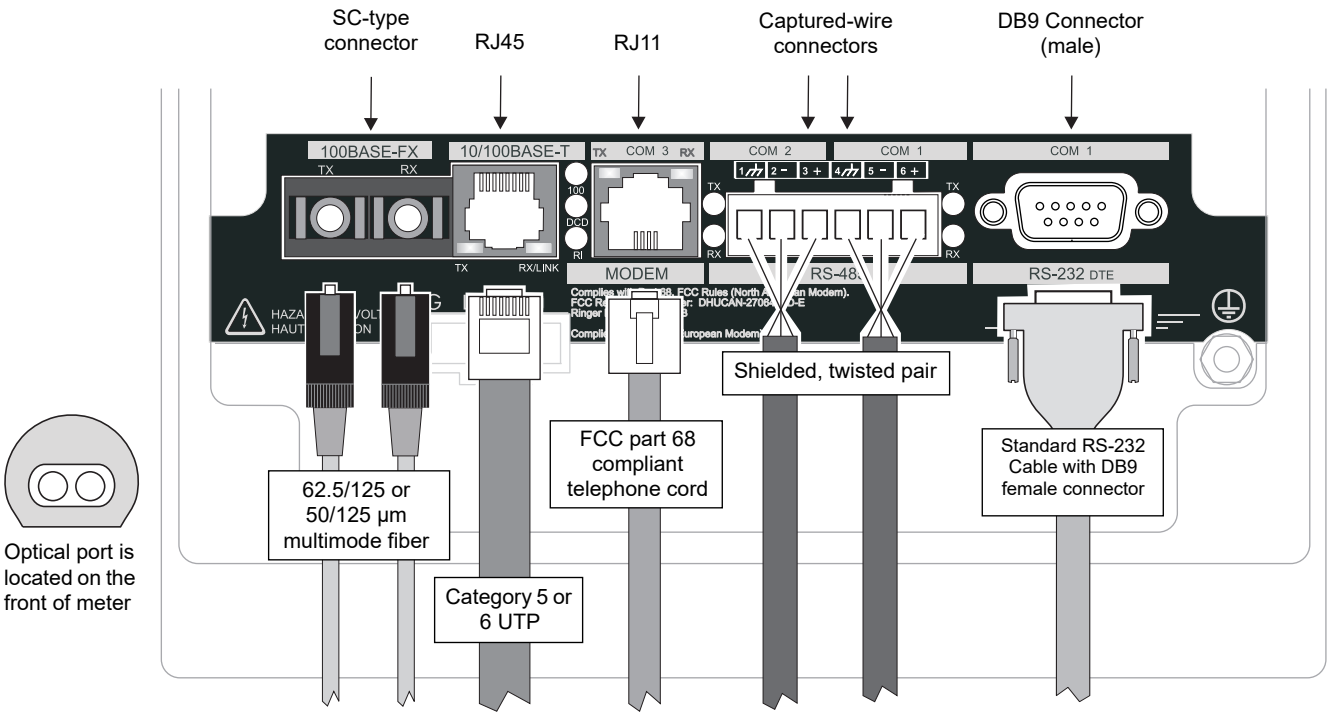
Most communications connections to the meter are made to the Communication Card (Comm Card), found on the **rear** of the meter. Optical connections are made to the port on the **front** of the meter. See the diagram below for details.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

these instructions will result in death or serious injury.



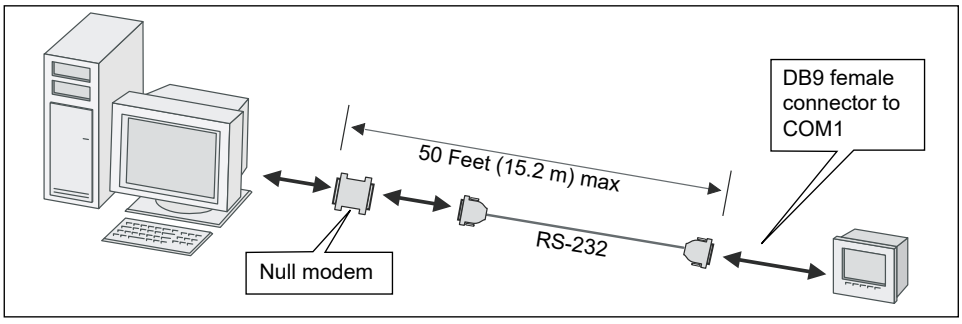
RS-232 Connections (COM1)

RS-232 connections are made to the male DB9 connector (COM1) on the back of the meter. The meter acts as a DTE (data terminal equipment) device in all RS-232 connections. Use a:

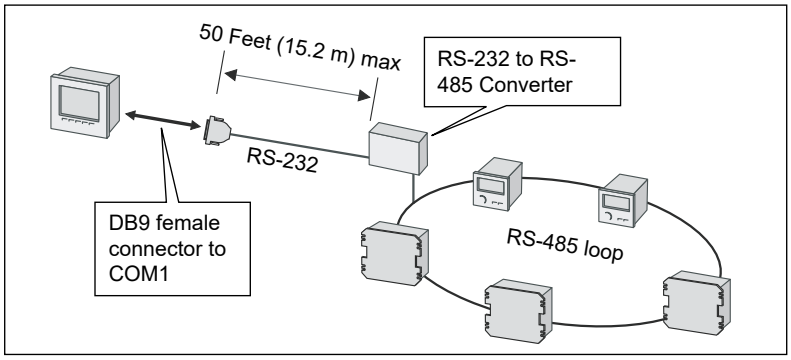
- **null modem cable** for connecting the meter to a computer, or
- standard **straight-through cable** for connecting to an external modem.

In either case, one end of the cable must be equipped with DB9 female connector for mating with the DB9 male connector on the meter. The maximum cable length is 50 feet (15.2 m).

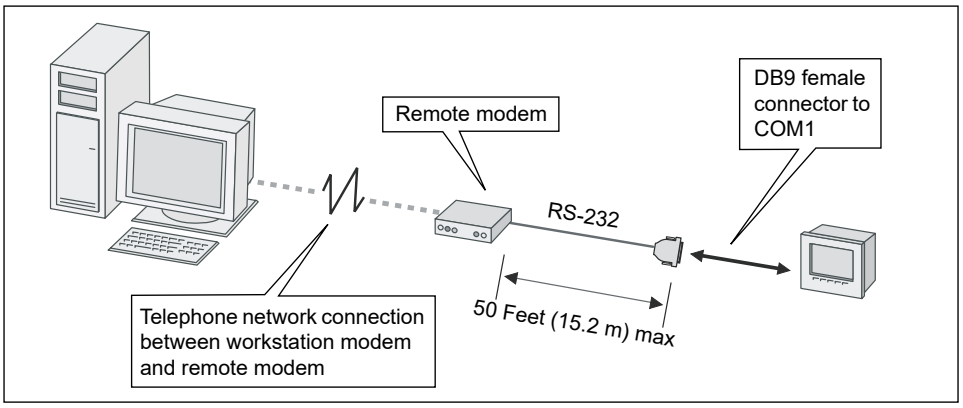
Meter to computer connection



Meter to serial loop connection



Meter to external modem connection

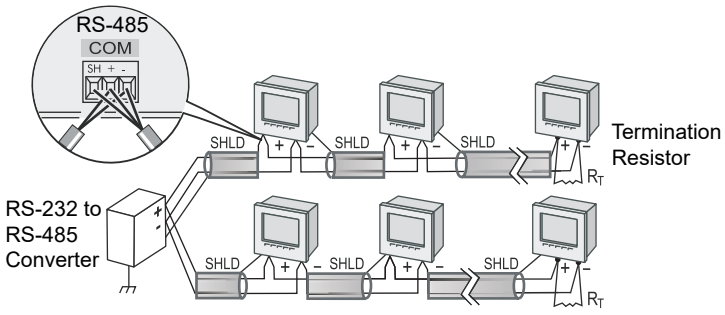


RS-485 Connections (COM1 and COM2)

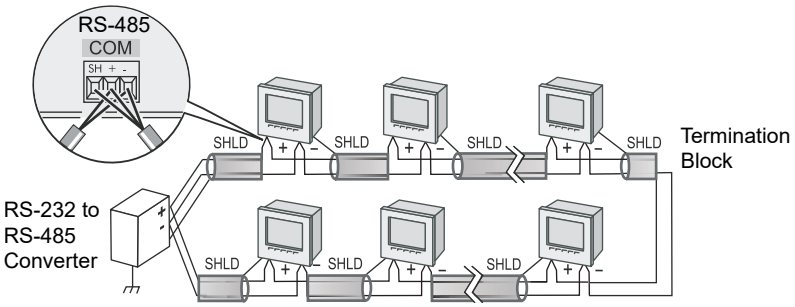
RS-485 connections are made via the captured-wire connectors on the rear of the meter. Up to 32 devices can be connected on a single RS-485 bus.

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 4000 ft. (1219 m). The RS-485 bus can be configured in straight-line or loop topologies.

Straight-line topology



Loop topology



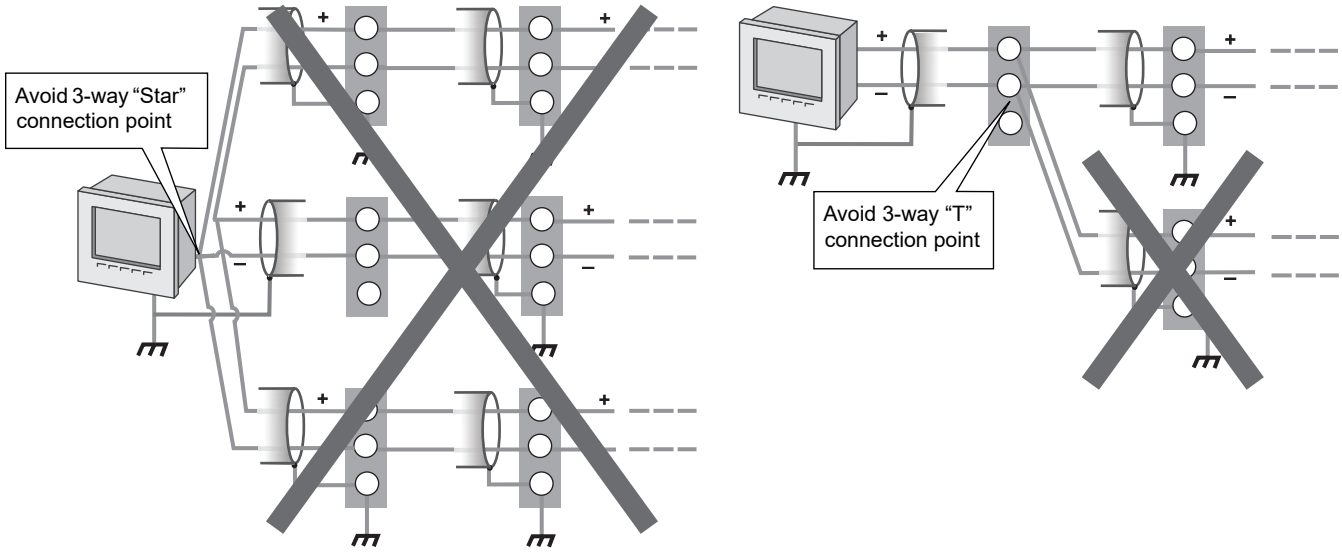
General bus wiring considerations

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, which is typically 120 ohms (consult the cable manufacturer's documentation for the cable's impedance value).

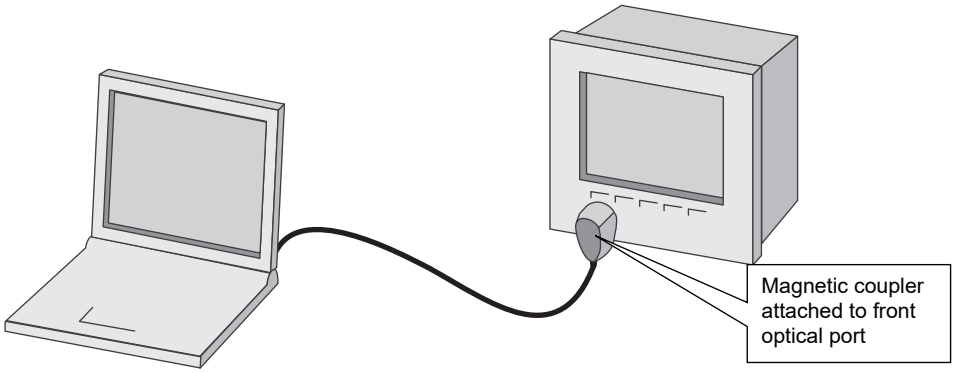
RS-485 connection methods to avoid

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. No more than two cables should be connected at any connection point on the RS-485 bus. This includes connection points on instruments, converters, and terminal strips. Following these guidelines ensures that both star and tee connections are avoided.



Optical Port Connections (COM4)

The front optical port is designed to accept ANSI Type 2 magnetic couplers. It can be used to communicate real-time measurements to a portable computer or for meter configuration via the ION, Factory, Modbus RTU, or DNP 3.00 protocols.

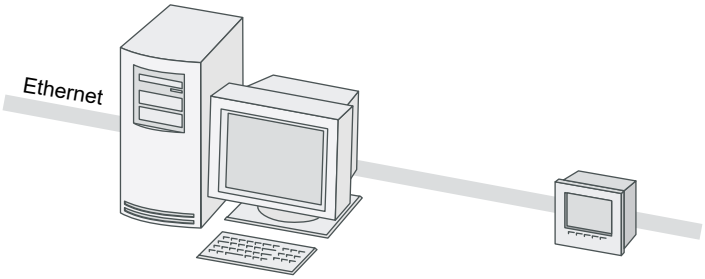


To enable communications from the optical port, configure the Comm 4 Communications module. The *Protocol*, the *Baud Rate* and *Unit ID* setup registers must properly match your system. When creating the site in ION software, ensure that RtsCts and DTR settings are both disabled (set to No/Off) in the COM4 serial site.

Refer to the *Magnetic Optical Couplers* technical note for more information.

Ethernet Connections (optional)

This section only applies if your ION7550/ION7650 meter has an Ethernet option.



There are two Ethernet port ordering options available: a 10BASE-T/100BASE-TX port with an RJ45 modular connector or a 100BASE-FX port with two SC-type fiber connectors. Both types of connector plug into the Comm Card ports on the back of the meter.

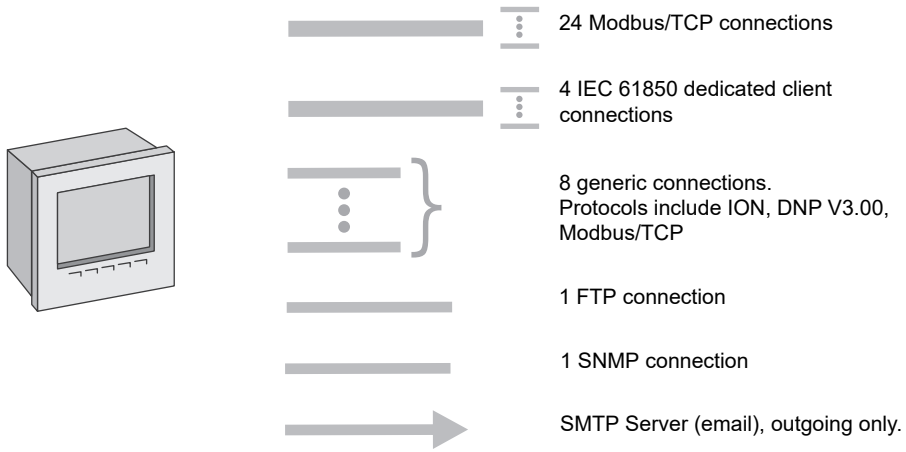
NOTE: IEC 61850 and COMTRADE require that your meter have an Ethernet connection.

The optional Ethernet port:

- is capable of data rates up to 100 Mbps
- supports TCP/IP, ION, Telnet, DNP 3.00, Modbus/TCP, SNMP, FTP and IEC 61850 protocols
- is controlled by the ETH1 Communications module.

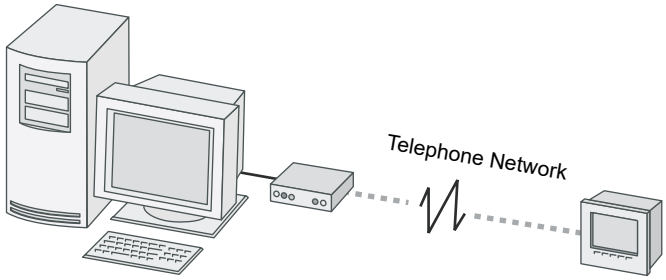
NOTE: If you have multiple simultaneous Ethernet connections to a meter, you may need to adjust your workstation's timeout settings to account for the high volume of traffic.

Ethernet connections



The EtherGate feature provides communications both to an Ethernet connected device and through that device to a connected serial network. Only one EtherGate connection is allowed per meter port at any given time. See “The EtherGate protocol” on page 90 or *The ION Meter as an Ethernet Gateway* technical note for more information.

Internal Modem Connections (optional)



The meter’s optional internal modem can be readily used in most countries, and complies with FCC, Industry Canada and European regulations — refer to the Notices at the beginning of this document for more details.

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

To enable communications through the meter’s internal modem, you must configure the Comm 3 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 91 for details.

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 control the following channels:

Module Name	Settings
Comm 1	Selectable RS-232 or RS-485 port on COM1
Comm 2	High-speed RS-485 port on COM2
Comm 3	Optional internal modem on COM3
Comm 4	Optical port on COM4
Ethernet	Optional 10BASE-T/100BASE-TX or 100BASE-FX Ethernet port

Use the meter's front panel or ION Setup to initially configure the meter's communications. Once communication is established, Vista, Designer or the WebMeter internal web server can also be used to modify meter communications.

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

See the Communications module description in the *ION Reference* for complete details about all 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.

Available protocols

- ION
- Modbus RTU and Modbus Master
- DNP V3.00
- GPS
- EtherGate
- ModemGate
- SNMP (this TCP/IP protocol is not set with the *Protocol* register)
- IEC 61850 (this TCP/IP protocol is not set with the *Protocol* register)
- Factory (reserved for use by Technical Support)

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 software.

Use the *RS485 Bias* setting to fine-tune RS-485 communications. Set bias to ON when the meter is acting as Master on that port, and leave it OFF when the meter is a Slave.

Using the front panel

The current configuration of the meter's serial communication ports are found in the various COM Setup menu items (COM1 through COM4).

Menu	Setting	Description	Range (Values)	Default
COM1 SETUP	PROTOCOL	The communications protocol	ION, Modbus RTU, Modbus Master, DNP V3.00, Ethergate, ModemGate, GPS:Truetime/Datum,GPS: Arbiter, GPS:Arbiter-Vorne, Factory, None[1]	ION
	BAUD RATE	The data rate, in bits per second	300[2], 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	19200
	TRAN DELAY	The transmit delay in seconds	0 to 1	0.010
	UNIT ID	Every meter on an RS-485 network must have a unique Unit ID number	1 to 9999	From serial number[3]
	SERIAL PORT	Parity and stop bits for the port	8N1, 8N2, 8E1, 8E2, 8O1, 8O2	8N1
	MODE	Hardware mode for port	RS232 or RS485	RS232
	FLOW CONTROL	Specifies the handshake mode when COM1 is set to RS232	RTS + DELAY or RTS/CTS	RTS + DELAY
	RS485 BIAS	Controls the biasing option on the RS485 bus	ON or OFF	OFF
COM2 SETUP	PROTOCOL	The communications protocol	See COM1 Protocol	ION
	BAUD RATE	The data rate, in bits per second	300[2], 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	19200
	TRAN DELAY	The transmit delay in seconds	0 to 1	0.010
	UNIT ID	Every meter on an RS-485 network must have a unique Unit ID number	1 to 9999	101
	SERIAL PORT	Parity and stop bits for the port	8N1, 8N2, 8E1, 8E2, 8O1, 8O2	8N1
	RS485 BIAS	Controls the biasing option on the RS485 bus	ON or OFF	OFF
COM3 SETUP	PROTOCOL	The communications protocol	ION, Modbus RTU, Modbus Master, DNP V3.00, GPS:Truetime/Datum,GPS: Arbiter, GPS:Arbiter-Vorne, Factory, None[1]	ION
	BAUD RATE	The data rate, in bits per second	300[2], 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	19200
	TRAN DELAY	The transmit delay in seconds	0 to 1	0.010
	UNIT ID	Every meter on an RS-485 network must have a unique Unit ID number	1 to 9999	102
	ANSWER HR RINGS	The number of rings during defined answer hours	0 to 255	1
	NON-ANSWER HR RINGS	The number of rings during defined non-answer hours	0 to 255	5
COM4 SETUP	PROTOCOL	The communications protocol	ION, Modbus RTU, DNP V3.00, Factory, None[1]	ION
	BAUD RATE	The data rate, in bits per second	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	9600
	TRAN DELAY	The transmit delay in seconds	0 to 1	0.010
	UNIT ID	Every meter on an RS-485 network must have a unique Unit ID number	1 to 9999	103
	SERIAL PORT	Parity and stop bits for the port	8N1, 8N2, 8E1, 8E2, 8O1, 8O2	8N1

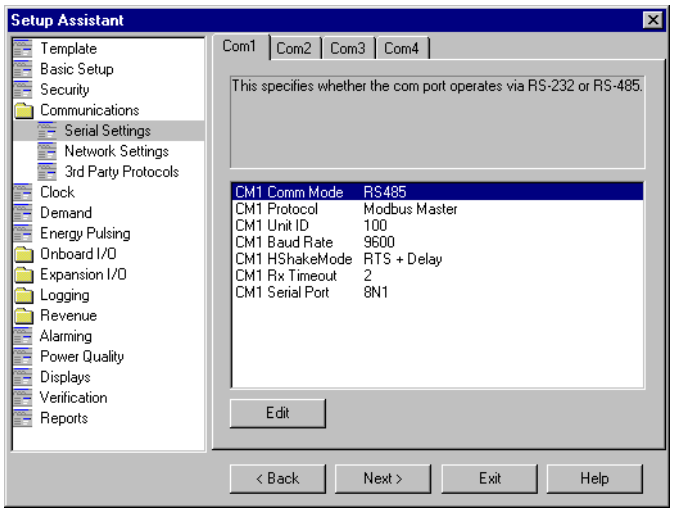
[1] This protocol setting stops communications using this port.

[2] 300 baud rate is only intended for paging applications.

[3] The factory set Unit ID for COM1 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-000**9**B**263**-01, the Unit ID is set in the factory to 9263. After a factory reset, the unit ID number defaults to 100.

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 Serial Settings screen.



4. 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**.

Using Designer

1. Open your meter in Designer. Navigate to the Communications Setup framework.
2. Right-click the Communications module for the serial port you want to congifure. Configure the *Protocol*, *Tran Delay*, *Baud Rate* and *Unit ID* setup registers to match your system.

Disabling serial communications ports

You can disable serial communications ports. Disabling unused ports is considered a cybersecurity best practice to help minimize unauthorized access to your meter.

Using the front panel

Press PROG, navigate to the serial port (**COM1** through **COM4**) you want to disable, then set *Protocol* to **None**.

Using ION Setup

1. Open the Setup Assistant for your meter.
2. Select **Communications > Serial Settings**.
3. Click the **COM1**, **COM2**, **COM3** or **COM4** tab.
4. Select *Protocol* and click **Edit**.
5. Select **None** from the dropdown list and click **OK**.

Using Designer

1. Open your meter in Designer, then navigate to the Communications Setup framework.
2. Right-click the Cmmunications module for the serial port you want to disable.
3. Set *Protocol* to **None**.

Ethernet Communications Setup

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

Using the front panel

Ethernet settings for the meter are located in the Network Setup menu.

Menu		Setting	Description	Range (Values)	Default
NETWORK SETUP	GENERAL	IP ADDRESS	Sets the IP address for the meter	000.000.000.000 to 255.255.255.255	varies[1]
		SUBNET MASK	Used if subnetting applies to your network	000.000.000.000 to 255.255.255.255	255.240.0.0
		GATEWAY	Used in multiple network configurations	000.000.000.000 to 255.255.255.255	0.0.0.0
		MAC ADDRESS	Media Access Control address	Hexadecimal	N/A[2]
	DNS	PRIMARY	Sets the address for the primary DNS Server that is configured to resolve domain names	000.000.000.000 to 255.255.255.255	none
		SECONDARY	Sets the address for the secondary DNS Server that is configured to resolve domain names	000.000.000.000 to 255.255.255.255	none
	SMTP / NTP	SMTP ADDR	Displays the IP address for the SMTP (Simple Mail Transfer Protocol) server used to deliver email	000.000.000.000 to 255.255.255.255	none[3]
		NTP ADDR	Displays the IP address for the NTP (Network Time Protocol) server used for time synchronization	000.000.000.000 to 255.255.255.255	none[3]
	PORT CONFIG	10/100BT CONFIG	Controls the maximum link speed and duplexing of the BASE-T Ethernet connection (RJ45)	Auto, 10BT half, 10BT full, 100BTX half, 100BTX full	Auto
		100BFX CONFIG	Sets the Fiber Ethernet duplexing (SC connectors)	Full Duplex or Half Duplex	Full Duplex
	PORT ENABLE	WEBSERVER	Enable or disable the meter's web server	Enable: Yes or No	Yes
		FTP	Enable or disable the meter's FTP server	Enable: Yes or No	Yes
		DNP	Enable or disable DNP communications over Ethernet	Enable: Yes or No	Yes
		ION	Enable or disable ION communications over Ethernet	Enable: Yes or No	Yes
		MODBUS RTU	Enable or disable Modbus RTU communications over Ethernet	Enable: Yes or No	Yes
		MODBUS	Enable or disable Modbus communications over Ethernet	Enable: Yes or No	Yes
		SNMP	Enable or disable SNMP communications over Ethernet	Enable: Yes or No	No
		TELNET	Enable or disable Telnet communications over Ethernet	Enable: Yes or No	Yes

[1] Default IP Address = 172.16.xxx.xxx, where the last two bytes (decimal) match the last two bytes of the meter's MAC address (hex). MAC address = 0060780**12DC**, Default IP address = 172.16.**18.220**

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

[3] SMTP and NTP address can only be configured using ION software.

Use the four 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 the cursor across the network address.

89.123.40.056

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

Using ION Setup

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Communications > Basic Ethernet**.
4. Click the tabs to configure the meter's IPv4 and TCP/IP settings. To change a setting, select the parameter and click **Edit**.
5. Navigate to **Communications > Advanced Ethernet**.
6. Click the tabs to configure the meter's DNS, SMTP, NTP, SysLog and Protocols settings. To change a setting, select the parameter and click **Edit**.

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

NOTE: The MAC Address is for reference only and cannot be changed.

Using Designer

1. Open your meter in Designer.
2. Navigate to the Communications Setup framework.
3. Right-click the Ethernet Communications module and configure the *IP Address*, *Subnet Mask,* and *Gateway* setup registers to match your system.

Meter network configuration and Power Monitoring Expert

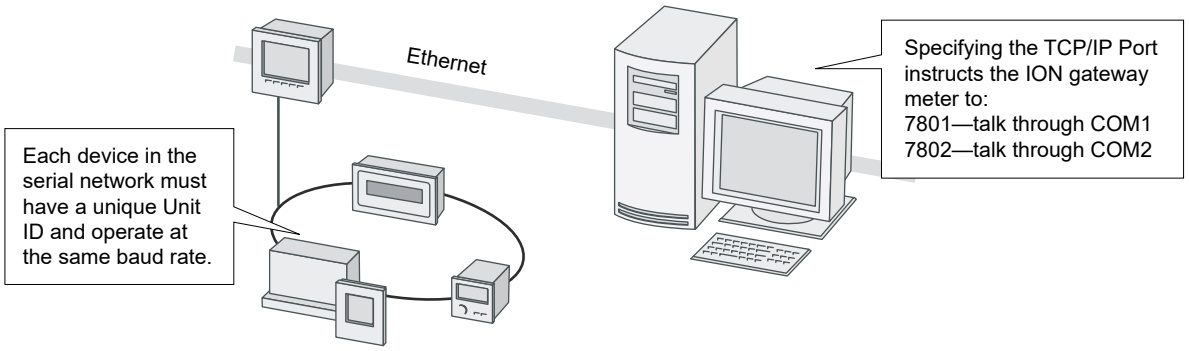
After you have wired your meter to the Ethernet network and performed basic setup, add the meter to your Power Monitoring Expert network using the Management Console.

See the Management Console section in the online *Power Monitoring Expert Help* for details.

The EtherGate protocol

The EtherGate protocol is a communications tool that lets you communicate **to** a meter and **through** a meter simultaneously. When a meter installed on the Ethernet network has EtherGate enabled, a master device (such as a workstation running Power Monitoring Expert software) can communicate to the meter, and through the meter to a serial network of devices wired to the meter's COM port. EtherGate is available on

serial ports COM1 and COM 2. 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 COM1 or COM2 *Protocol* setting to EtherGate. The transfer of data between protocols is then handled automatically.

See the *ION Meter as an Ethernet Gateway* technical note for complete details on configuring your meter for EtherGate.

The meter as a Modbus gateway

The meter can function as a Modbus gateway. For more information, see "The Meter as Modbus Gateway" on page 108.

Communicating via SNMP

The meter can communicate specified parameters via SNMP over the Ethernet. For more information, see "Using SNMP" on page 118.

Modem Communications Setup

See "Serial Communications Setup" on page 86 for configuring COM3. Additional modem configuration requirements are explained in the following sections.

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 COM1 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 1 Communications module is changed. Any changes to the *Modem Init* or *Baud Rate* setup registers while the modem is online causes the modem to disconnect from the phone line.

Modem initialization strings

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

Adjusting the modem initialization string for modems in Europe

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

Behavior	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 Power Monitoring Expert online help. After the meter is installed and the internal modem is connected to the telephone network, the Comm 3 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*.

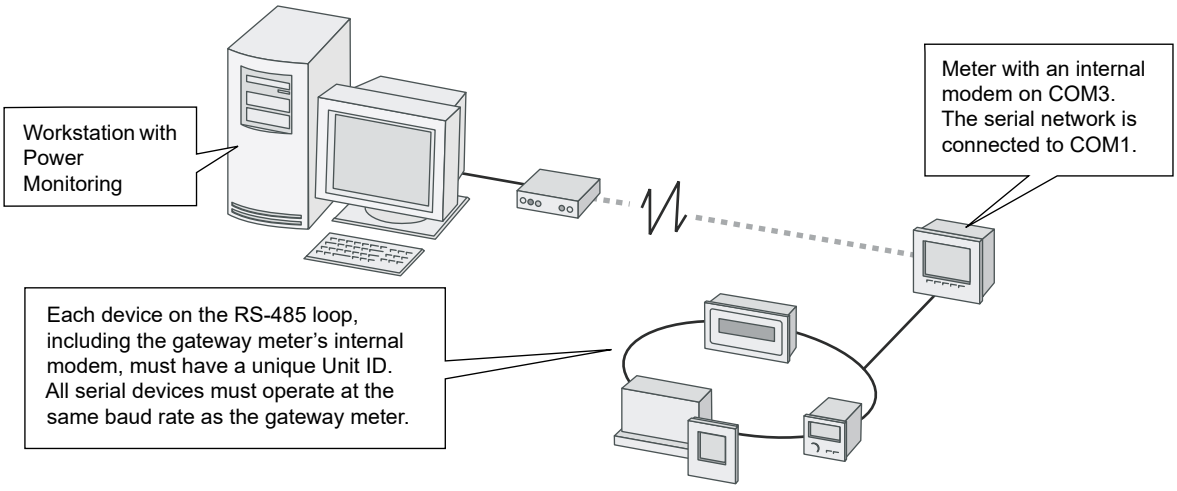
Adding a meter and a modem site to your Power Monitoring Expert network

In the Management Console, add the meter with the internal modem, and then add a modem site to your Power Monitoring Expert network.

Consult the online *Power Monitoring Expert Help* for details on commissioning the ION network, managing modem connections, setting up periodic dial-out, and configuring remote site event notification.

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 COM1 and COM2, but you cannot use the protocol on both ports simultaneously.



ModemGate connections do not connect a workstation with Power Monitoring Expert (or other master device) to the gateway meter's COM1 or COM2 port, but rather the gateway meter's internal modem port (COM3).

Refer to the *ION Meter as a ModemGate* technical note for complete details on configuring your meter for ModemGate.

Network protocol control

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

Disabling unused ports is considered a cybersecurity best practice to help minimize unauthorized access to your meter.

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

Using the front panel

1. Press PROG, navigate to **NETWORK SETUP > PORT ENABLE**.
2. Select the protocol you want to enable or disable.
3. Press ENABLE to change the setting to **Yes** (enabled) or **No** (disabled).

Using ION Setup

1. Open the Setup Assistant for your meter.
2. Select **Communications > Advanced Ethernet**.
3. Click the **Protocols** tab.
4. Select the protocol and click **Edit**.
5. Select **Enabled** to enable the port, or clear the box to disable the port. If editable, you can use the **Port Number** box to change the port number for the protocol.
6. Click **OK**.

Using Designer

1. Open your meter in Designer, then navigate to the Communications Setup framework.
2. Right-click the Communications module to enable or disable the network protocol and change its port number.

Internet Connectivity

Ethernet ION7550/ION7650 meters provide Internet connectivity so you can receive meter emails, view real-time data, provide IEC 61850 client support and configure your system through a web browser from anywhere in the world. Your meter provides the following internet connectivity options:

- WebMeter feature (onboard web server allows you to view real-time data and configure the meter through a web browser)
- Email messaging feature (receive data logs and email alerts from the meter)
- WebReach (view Power Monitoring Expert system information through a web browser)
- Microsoft Terminal Services for Power Monitoring Expert (an Power Monitoring Expert system that is located on a Terminal Server allows multiple users to view or configure an Power Monitoring Expert system through a web browser)
- IEC 61850 protocol (your meter becomes an IEC 61850 server with client reporting and control functionality)
- FTP (acts as an FTP server for IEC 61850 configuration and file support, and COMTRADE format waveform records)

WebMeter Feature

WebMeter-enabled meters have an on-board web server. Built-in web pages display certain energy and basic power quality information, show trending and forecasting values and 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.

See 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

Email Messaging Feature

The email messaging 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.

See the *MeterM@il Internal Email Client Feature* technical note to learn how to:

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

WebReach

WebReach allows you to remotely view Power Monitoring Expert information through a web browser. WebReach requires a simple URL and no client machine configuration so you have the flexibility to view your data from a web browser anywhere in the world. With WebReach, you can view real-time data and select views of historical/waveform data. Currently, no configuration or control functions are available through WebReach. Refer to the online *Power Monitoring Expert Help* for more details on WebReach.

Telnet and HyperTerminal

You can access certain Ethernet settings and statistics through a telnet application such as Microsoft Telnet. Similarly, you can use Windows HyperTerminal to access certain meter module settings. Use the following guidelines to determine which application you should use to access your meter:

- If your meter is connected to an Ethernet network, use a telnet application such as Microsoft Telnet.
- If your meter is connected serially or through a modem to your workstation, use a terminal application such as Windows HyperTerminal.

You can access certain Power Meter module and Factory module settings from both a Telnet session and HyperTerminal session. Both sessions also let you configure Factory module setup registers for Current Probe Input applications. Additionally, a Telnet session lets you view Ethernet statistics and access certain Ethernet communications module settings.

See the *Telnet and HyperTerminal Access* technical note for the appropriate application's menu options and connection instructions.

Meter FTP server

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, with standard meter security (no user configured) and the a front panel password of **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 ports:

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.

FTP folder structure

Your meter has the following FTP folder structure:

- COMTRADE: you can read COMTRADE files from these folders, but you cannot delete or add files.
- IEC61850: you can add an IEC 61850 configuration (CID) file to this folder to activate the IEC 61850 protocol functions of your meter.

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

Syslog

Syslog is a useful feature to help 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 syslog server can receive logs from multiple devices, including meters, then store and filter the log information as needed. You can use ION Setup to modify the syslog network settings for your device. Ethernet is required to use the Syslog feature.

Syslog server

Syslog is an open standard that 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: The Syslog feature cannot be configured through the meter's display.

Configuring Syslog network settings using ION Setup

1. Open the Setup Assistant for your meter.
2. Select **Communications > Advanced Ethernet** 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

Communications LEDs

The communications LEDs on the back of the meter flash to indicate the following:

LED	Color	Function
Ethernet 100 (Speed)	Green	Off = link at 10 Mb or no link On = link at 100 Mb
Ethernet TX	Green	Blinking indicates Ethernet transmission
Ethernet RX/LINK	Green	On = link up, Off = link down Blinking indicates Ethernet reception
Modem DCD	Green	Indicates a carrier signal is detected (active connection to the modem)
Modem RI	Green	Indicates a ring is detected by the modem
COM3 (Modem) TX	Yellow	Indicates serial transmission on COM3
COM3 (Modem) RX	Yellow	Indicates serial reception on COM3
COM2 TX	Yellow	Indicates serial transmission on COM2
COM2 RX	Yellow	Indicates serial reception on COM2
COM1 TX	Yellow	Indicates serial transmission on COM1
COM1 RX	Yellow	Indicates serial reception on COM1

Chapter 7 Third-party Protocols

This chapter explains how third-party protocols Modbus, DNP 3.00, IEC 61850 and SNMP are implemented on the meter.

For more information on using your meter with MV90 software, see the *MV90 and ION Technology* technical note.

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Overview

ION7550/ION7650 meters support DNP 3.00, Modbus RTU and Modbus/TCP, IEC 61850 (via FTP) and SNMP protocols.

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 3.00 data to a DNP Master. IEC 61850 support requires specific configuration, refer to the *IEC 61850 and ION* technology protocol document for more information.

NOTE: Changing the default factory third-party protocol frameworks (or creating new frameworks to enable receive functionality) is an advanced procedure. Refer to the DNP, IEC 61850 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* before proceeding.

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

NOTE: Changing these modules from their factory configuration is an advanced setup procedure that requires an understanding of the protocol, as well as an understanding of the meter's internal operation. For more information on your meter and these protocols see the *Modbus Protocol and Register Map for ION Devices* document and the *ION7550/ION7650 DNP 3.0 Device Profile*.

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. Select the 3rd-party protocol you want from the list of available protocols in the Communications module's Protocol setup register. See the Communications chapter 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 3.00 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

Your meter can act as a Modbus Slave, using both the Modbus RTU and Modbus/TCP (Modbus over 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.

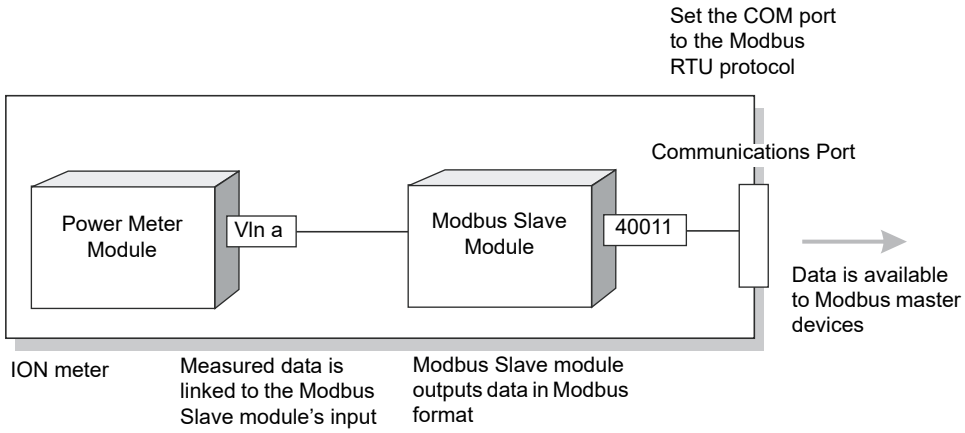
Using the Modbus RTU Protocol

Both the ION7550 and ION7650 meters can act as Modbus Slave devices, making 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 your meter's ION registers, making device configuration changes and initiating control actions.

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 Service Port 7701 for Modbus RTU communications over Ethernet.
On ION7550/ION7650 meters with firmware version v310, the required Modbus Unit ID of the meter over Ethernet is 100. Later versions allow any Unit ID.



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. See the *ION Reference* for complete details on the Modbus Slave module.

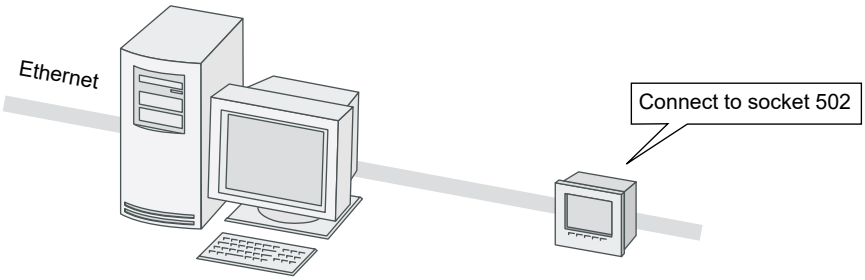
Using the Modbus/TCP Protocol

Modbus/TCP is a Modbus protocol variant that defines the packet structure and connection port (port 502) for the industry standard TCP/IP protocol. The Modbus ID for Modbus/TCP communication is 255. The structure of Modbus/TCP is very similar to the Modbus RTU packet except that it has an extra six-byte header and does not use the cyclic redundancy check (CRC). Modbus/TCP retains the Modbus RTU limit of 256 bytes to a packet.

Modbus/TCP can be used to communicate with the meter as a master or as a slave. It can also be used with the meter as a Modbus Gateway. See “The Meter as Modbus Gateway” on page 108 for more information.

Modbus TCP communications

You can communicate to the meter using Modbus TCP (formerly called MBAP). Your meter must have the optional Ethernet port. Connect to socket **502**.



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

Configuring the Meter as a Modbus Slave

Using the front panel

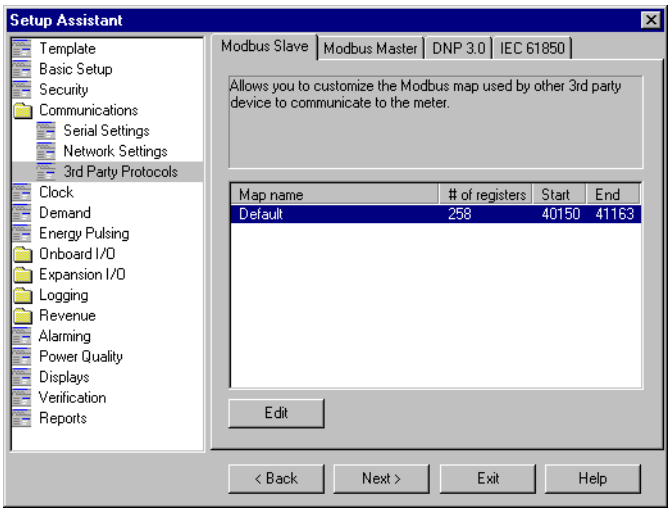
You cannot fully configure Modbus through the meter’s front panel; you can only assign the Modbus protocol to communication ports (see the Communications chapter for details).

Use ION software to perform full Modbus configuration. For more information about the default Modbus register map, please refer to the *Modbus Protocol and Register Map for ION Devices*, available from the website.

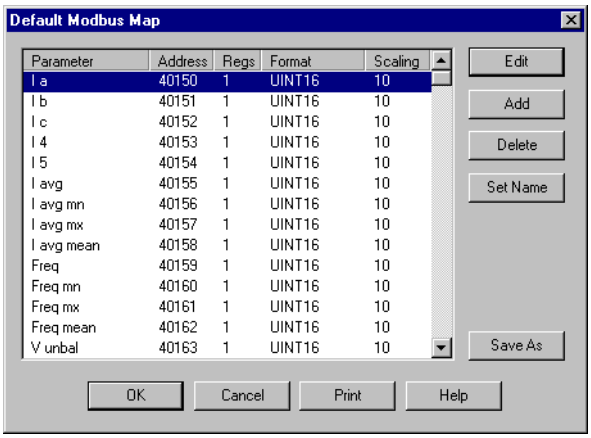
Using ION Setup

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

1. Open ION Setup and connect to your meter, using Basic Mode.
2. In the Setup Assistant, navigate to **Communications > 3rd Party Protocols**.
3. Click on the Modbus Slave tab to edit the Modbus Slave modules.
4. Select the map name (in this example, the default map) and click **Edit**. Enter the meter password, if prompted.



5. The default Modbus map editor appears, allowing you to edit, add, delete or set the name of Modbus Slave module registers.



Using Power Monitoring Expert

Use Designer to configure Modbus slave functionality on your meter.

1. Open your meter in Designer.
2. Open the Modbus folder in the Third-Party Protocols section of your framework. Right-click on the Modbus Slave module you want to configure to access the ION Module Setup dialog. Select the setup register you want to change and click **Modify**, or double-click on the register.
3. Link the module inputs and outputs as required.
4. Click **OK** and select **File > Send & Save** when you are finished.

See the online *Power Monitoring Expert Help* for more information on modifying and linking modules in Designer.

Modbus Slave Modules

Your meter is pre-configured with five modules. (ION7650 meters with the EN50160 ordering option have six additional modules). The Modbus registers and their parameters are described in the *Modbus Protocol and Register Map for ION Devices* protocol document, available from the website.

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.

The Meter as Modbus Master

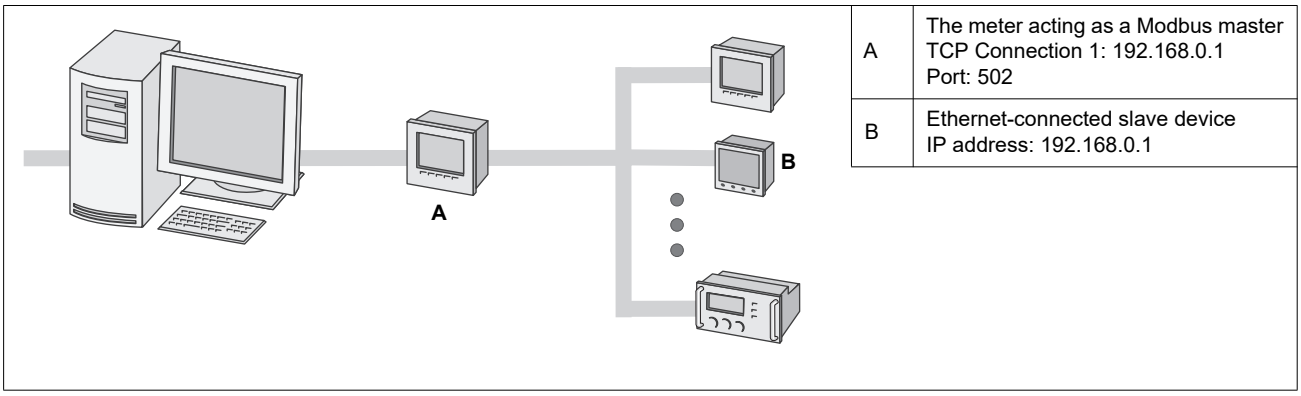
Your meter can act as a Modbus Master using the Modbus RTU and Modbus/TCP protocols. Ethernet and serial connections (on COM1 and COM2) are supported between the ION7550/ION7650 meter and the Modbus Slave devices.

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 software, etc.). The meter can also send control commands or data directly to other devices on a Modbus network.

NOTE: The ION7550 RTU does not support multiport Modbus mastering. The device cannot master on serial communication ports 1 and 2 at the same time.

Modbus mastering over TCP/IP

With the Modbus master over TCP/IP feature, you can use the meter to master up to twenty (20) Ethernet-connected Modbus slave devices. The Modbus master over TCP/IP feature uses a dedicated connection that is independent of the existing available maximum eight (8) Ethernet connections.



A	The meter acting as a Modbus master TCP Connection 1: 192.168.0.1 Port: 502
B	Ethernet-connected slave device IP address: 192.168.0.1

NOTE: In order to use the Modbus master over TCP/IP feature, you need a device with the Ethernet order option that has firmware v366 (or v365 for the ION7550 RTU) or later installed.

The Factory Modbus Master Configuration

There is no pre-configured framework for Modbus mastering on your meter. This functionality must be “turned on” 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 will have 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:** provides read functionality when used in conjunction with the Modbus Master Map module. This imported data can be used by other ION modules.

- **Modbus Master Map module:** provides a common place to hold mapping 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 from the Modbus Import and Modbus Export modules to any serial communications port.
- **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.

Upgrading meters with Modbus mastering enabled

After upgrading your meter to firmware version 320 (and later), you will need to perform specific configuration steps in order to re-enable Modbus mastering.

Contact Technical Support for detailed instructions.

Configuring the Meter as Modbus Master

Using the front panel

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

Use ION software to perform full Modbus configuration.

Using ION Setup

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

1. Open ION Setup and connect to your meter, using Basic Mode.
2. In the Setup Assistant, navigate to **Communications > 3rd Party Protocols**.
3. Click on the Modbus Master tab.
4. Click **Add** to add a Modbus Slave device.
5. The Modbus Device screen appears. Enter the Slave device's name, a label suffix and select a device type.
6. Select a connection point from the **Connected via** list then click **Connections** to configure that connection to be used by the Modbus master device to connect to this slave device. The Modbus Master Connections dialog box appears.
7. Select the tab that corresponds to the connection you are configuring (for example, if you selected TCP Connection 1 from the Connected via list, select the TCP 1 tab), and configure it based on the connection type.

Connection type	Configuration
Serial connection	Select the serial communications port that is connected to the Modbus slave devices from the Assigned Port list.
TCP connection	Enter the IP address of the Modbus slave device, making sure that the IP port is set to 502. Make sure that the Modbus RTU and Modbus TCP/IP protocols are enabled.

8. Click **OK** to return to the Modbus Device dialog box.
9. Click **OK** to add the Slave device. The device now appears in the list. Continue adding devices and click **Exit** when you are finished. Repeat steps 4 to 8 to continue adding slave devices.

NOTE: You can configure all of the Serial and TCP tabs at once in the Modbus Master Connections dialog box. However, you need to add each slave device separately by clicking **Add** and entering the slave device information in the Modbus Device dialog box.

Using Power Monitoring Expert

Use Designer to configure Modbus slave functionality on your meter.

1. Open your meter in Designer.
2. Create a new Modbus Master Device module. Right-click on the module to access the ION Module Setup dialog. Configure the setup registers by selecting the setup register you want to change and clicking **Modify**, or double-clicking on the register.
3. Link the module inputs and outputs as required.
4. Click **OK** and select **File > Send & Save** when you are finished.

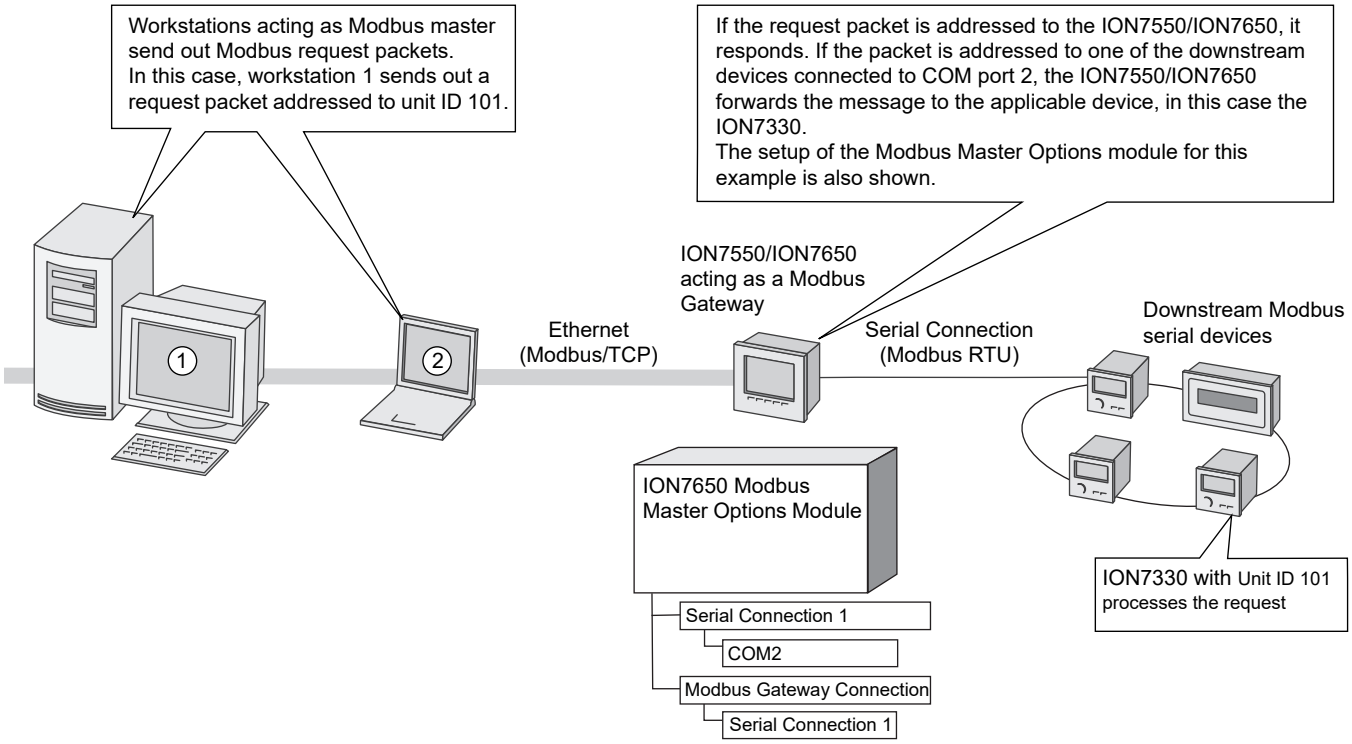
See the online *Power Monitoring Expert Help* for more information on creating, modifying and linking modules in Designer.

The Meter as Modbus Gateway

You can use both the ION7550 and ION7650 as a Modbus gateway. In a Modbus Gateway configuration, a Modbus Master device can communicate using Ethernet through the gateway meter to downstream serial devices.

A Modbus request is sent through Ethernet using Modbus TCP to the gateway meter. If this request is addressed with the slave ID of one of the downstream serial devices, the meter forwards the message to that device using Modbus RTU. When the downstream device responds, the gateway meter forwards the response back to the master. Modbus gateway supports an additional slave address of 255 (in addition to 0-247), which sends a packet to the gateway meter only.

In the example below, the workstations are functioning as the Modbus master, the ION7650 is set up as a Modbus gateway, and the ION7330, which has a unit ID of 101, is the slave device to which the request is addressed.



The number of Modbus gateway Ethernet connections available is equal to the number of TCP connections the gateway meter can handle. Only one request is allowed at a time for each TCP connection. For example, in the image above, if workstation 1 sends a request, workstation 2 is also allowed to send a request. However, if workstation 1 sends a second request before it receives a response to its first request, the gateway meter will send back an exception response, stating that the gateway is currently busy.

Configuring the Meter as a Modbus Gateway

Modbus gateway functionality is disabled by default. To configure the gateway, follow the instructions below.

Configuring communications

To configure the meter to act as a Modbus gateway, you first need to up your meter's Ethernet communications. See "Ethernet Communications Setup" on page 89 for more information.

Configuring the Modbus gateway

After you have configured the Ethernet communications on your gateway meter, you can set up the meter as a Modbus gateway by configuring the setup registers listed in the tables below.

Modbus Master Options Module			
Setup Register	**Function**	**Default**	**Modbus Gateway Setting**
Serial Connection 1-4	Maps a serial connection to a serial communications port	None	Select a Serial Connection and set it to the COM port where the serial Modbus devices are connected.
Modbus Gateway Connection	Informs the meter that the selected Serial Connection is being used as a Modbus gateway	Gateway Disabled[1]	Set this to the Serial Connection you have just configured (above) to enable Modbus Gateway functions on the serial COM port.
Modbus Gateway Exception Val	Determines the exception code that is returned if a downstream device fails to respond to a request	0x0B	This register is specific to Modbus gateway but no specific setting is required
Modgate Process Broadcast	Determines how broadcast messages (with the unit ID of 0) are processed by the gateway meter - No (forward to downstream devices only) or Yes (process and forward to downstream devices)	No	This register is specific to Modbus gateway but no specific setting is required

[1] The default "Gateway Disabled" setting disables the gateway functionality and allows the meter to respond to any Unit ID. This is different from the "no connection" setting which enables the gateway functionality and sets the meter to respond only to Unit ID 255; any request with a different Unit ID gives a 0x0B response.

Ethernet Communications Module			
Setup Register	**Function**	**Default**	**Modbus Gateway Setting**
Modbus TCP Idle Timeout	Determines the number of seconds the device maintains a Modbus TCP/IP connection after that connection becomes idle	0	This can be set as required; no specific setting is required for Modbus gateway. 0 (zero) disables the timeout function.

Serial Communications Module			
Setup Register	**Function**	**Default**	**Modbus Gateway Setting**
Protocol	Specifies the communications protocol for the communications port	ION	You must set this to Modbus Master to enable Modbus Gateway functionality.

Configuration can be done via ION software.

Using the front panel

You can configure only the Ethernet and serial communications through the front panel. Use ION software to configure the Modbus Master Options module.

Using ION Setup

1. To configure Modbus gateway parameters, open ION Setup and connect to your meter in Basic Mode.

2. Navigate to **Communications > Serial Settings**, select the tab of the serial communications port being used to communicate with the downstream devices and change the *Protocol* to MODBUS MASTER.
3. Navigate to the **Communications > Basic Ethernet** and select the TCP/IP tab. Select Modbus Gateway and click **Edit**.
4. In the Select Modbus Gateway dialog box, select the COM port you set up in step 2 and click **OK**.
5. To configure other parameters in the Modbus Master Options module, such as the exception error and whether or not the gateway meter processes broadcast messages, connect to your meter in Advanced Mode. Navigate to the Modbus Master Options module folder and double-click the Modbus Master Options module in the right-hand pane. On the Setup Registers tab, select the register you want to change and click **Edit**. Select the desired setting from the list and click **OK**. When you are finished, click **Send** to save the changes to the meter.

Using Power Monitoring Expert

1. Open your meter in Designer.
2. Navigate to the Modbus Master Options module in the Core Modules folder.
3. Right-click on the center of the module icon to access the setup registers. Select a register you want to change and click **Modify**, or double-click on the register.

   Configure the setup registers as outlined above in “The Meter as Modbus Gateway”.
4. Click **OK** when you are finished configuring the module. When you are finished meter configuration, select **File > Send & Save** to save your changes to the meter.

NOTE: Custom communications frameworks such as Modbus Gateway will be deleted during a Paste from Framework in Designer. If you request Modbus information from downstream devices, the gateway (host) meter data will be provided, not the downstream device’s data.

Using the DNP 3.00 Protocol

The Distributed Network Protocol Version 3.0 (DNP 3.00) 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.

Your 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 3.00 protocol; one for each serial port, up to three using Ethernet, or a combination of both. Combinations available 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. For more details, refer to the *Multiport DNP 3.0 and ION Technology* technical note.

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

The factory DNP 3.00 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 *ION7550/ION7650 DNP 3.0 Device Profile*.

Importing data using DNP 3.00

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. See the DNP Slave Import module description in the *ION Reference* for details.

Configuring DNP 3.00

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.

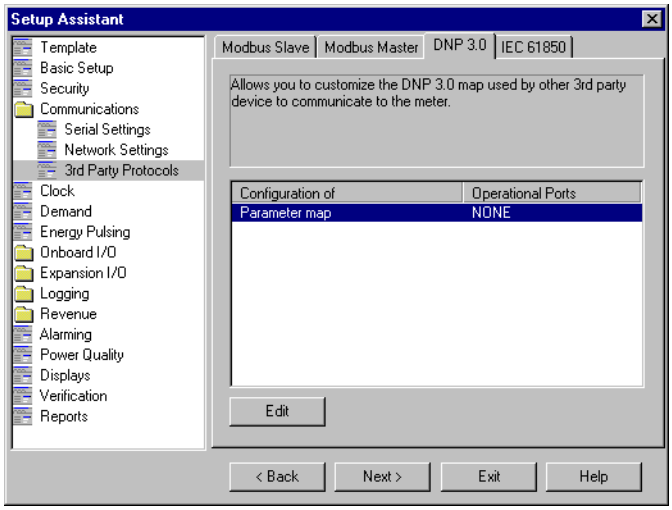
Using the front panel

You cannot configure DNP through the meter's front panel. You can only assign the DNP 3.00 protocol to communication ports. See the Communications chapter.

Using ION Setup

The DNP 3.0 Setup Assistant helps you configure the DNP Slave Export and DNP Slave Options modules.

1. Open ION Setup and connect to your meter, using Basic Mode.
2. In the Setup Assistant, navigate to **Communications > 3rd Party Protocols** and click on the **DNP 3.0** tab.
3. Select the DNP feature you want to configure (Parameter Map in this example) and click **Edit**.



4. 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 Device) that are networked together to perform monitoring, metering, and real-time, non-critical protection and control.

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

Your meter can be integrated into a 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 I/O ports and to map additional meter values into IEC 61850. 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 Commision) 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.

NOTE: Not all meter variants or firmware versions support IEC 61850.

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

IEC 61850 and logging memory

The ION7550/ION7650 meter comes with either 5MB or 10MB of logging memory. However, meters with IEC 61850 are only capable of 5MB of logging memory. If you upgrade a 10MB meter with IEC 61850 firmware, you will automatically reduce your meter's logging memory to 5MB. If you subsequently upload a non-IEC 61850 firmware to your meter, its original logging memory capacity will be restored.

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

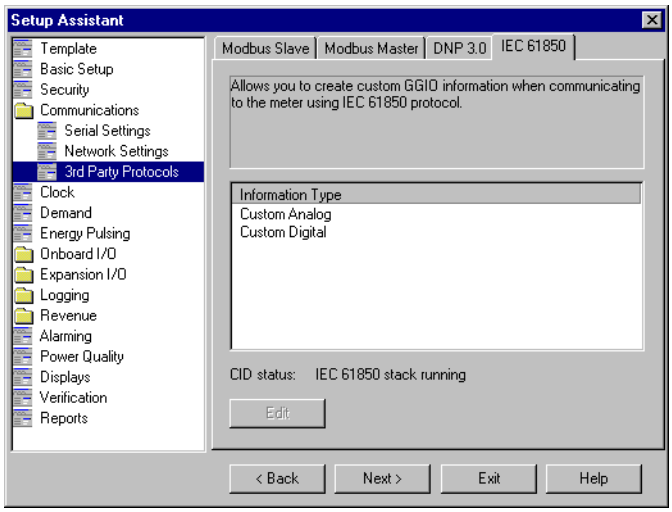
1. Open ION Setup and connect to your meter, using Basic Mode.
2. In the Setup Assistant, navigate to **Communications > 3rd Party Protocols** and select the IEC 61850 tab.

   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.

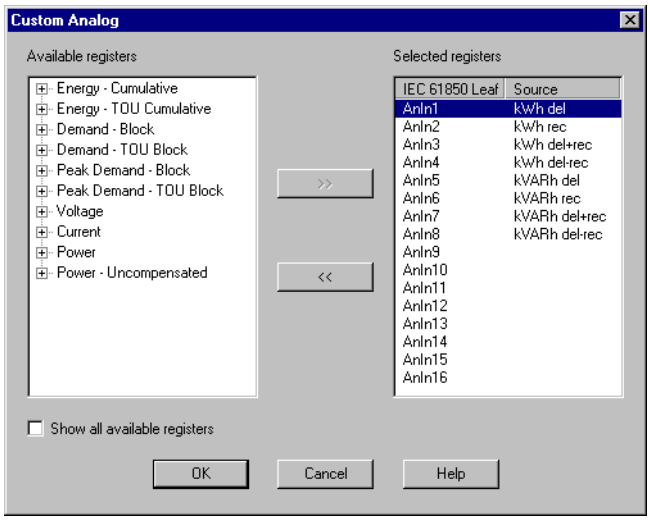


3. Custom Analog and Custom Digital allow you to map additional numeric (analog) or Boolean/binary (digital) values into IEC 61850. Select the custom option that matches the data you want to map, and click **Edit**.

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

4. For mapping custom analog or digital values into IEC 61850, expand the Available registers list and select the value you want to map. Highlight the IEC 61850 leaf you want to map onto, and click the **>>** button to map the value. 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 digital output hardware ports by configuring the GGIO Onboard ION module and the Digital Output module.

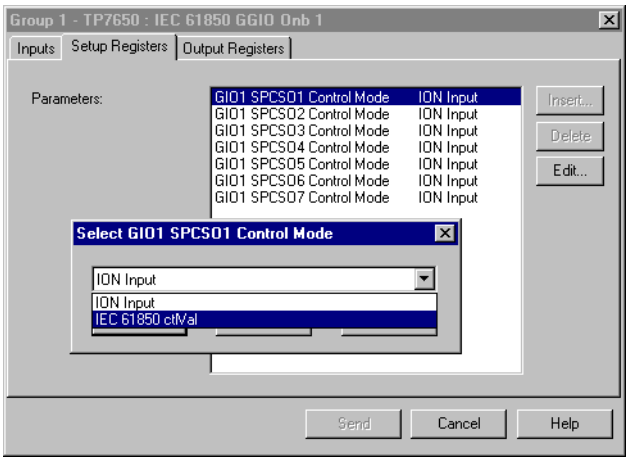
NOTE: Refer to "Inputs / Outputs" on page 133 for details on how to configure your meter's digital inputs and outputs.

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.

Using ION Setup

1. Open ION Setup and connect to your meter, using Advanced Mode.
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**.

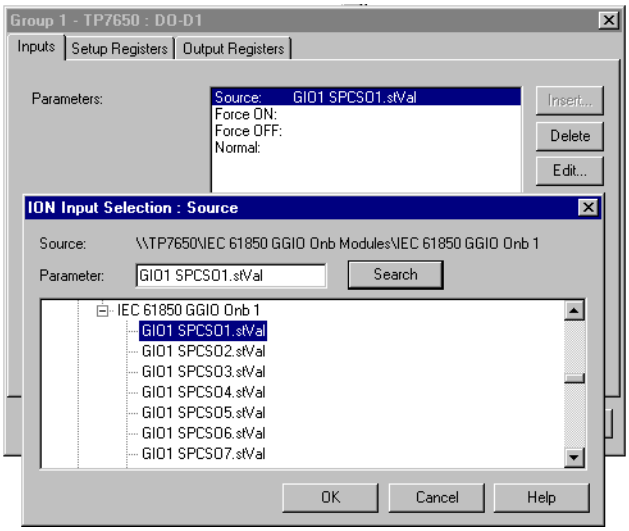
5. In the dialog box, select IEC 61850 CTLVAL and click **OK**.



6. Select the Inputs tab.
7. Select the digital output *Status* register for the digital output you want to control through IEC 61850.
8. 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.

9. Click **Send** to send your changes to the meter.
10. Navigate to the Digital Output folder.
11. Double-click on the Digital Output module that you wish to control through IEC 61850.
12. Select the Setup Registers tab and confirm that the Digital Output module's setup registers are appropriately configured.
13. Select the Inputs tab.
14. Select the *Source* register and click **Edit**.
15. Navigate to the IEC 61850 GGIO Onboard module, and select the *SPCS.stVal* output register that corresponds to the digital output.



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

Configuring meter analog I/O control to IEC 61850

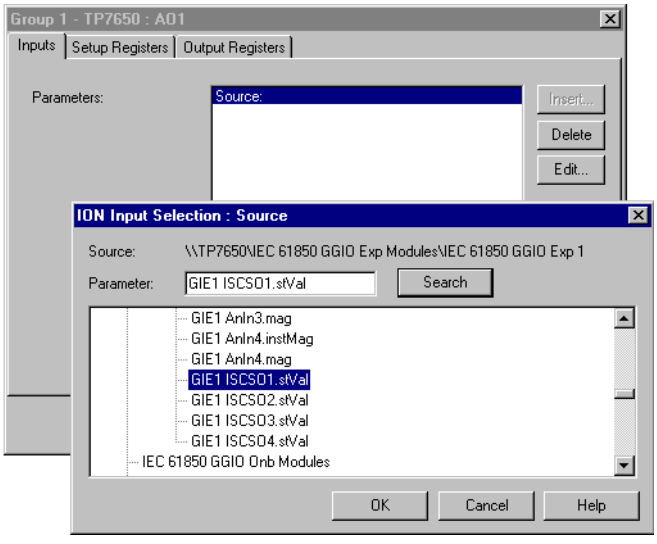
By default, your meter's I/O status values are available via IEC 61850. You must configure the meter in order to provide IEC 61850 control of the meter's analog output hardware ports.

NOTE: Refer to "Inputs / Outputs" on page 133 for details on how to configure your meter's optional analog inputs and outputs.

To control your meter's analog outputs via IEC 61850, you must configure the Analog Output module's *Source* register to be the IEC 61850 analog status value (*ISCS.stVal*) output register. This output register is written by the IEC 61850 system into the IEC 61850 GGIO Expansion module. Refer to the *ION Reference* for details of the IEC 61850 GGIO Expansion module.

Using ION Setup

1. Open ION Setup and connect to your meter, using Advanced Mode.
2. Navigate to the Analog Out folder and double-click on the module in the right-hand pane that corresponds to the analog output port you want to control via IEC 61850.
3. Select the Setup Registers tab and confirm that the analog output module's setup registers are appropriately configured.
4. Select the Inputs tab.
5. Select *Source* and click **Edit**.
6. In the selection dialog box, navigate to the IEC 61850 GGIO Exp module. Select the *ISCS.stVal* output register that corresponds to the analog output you want to control and click **OK**.



7. Click **Send** to save your changes to the meter.

Using SNMP

This section provides setup and configuration instructions for using your meter with the Simple Network Management Protocol (SNMP) and assumes that you have some familiarity with the protocol.

NOTE: Before communicating with your meter via SNMP, you need to install the custom MIB file on your SNMP network management system. The file can be obtained by download from www.se.com or by contacting Technical Support.

The Simple Network Management Protocol (SNMP) is an application layer protocol that enables the exchange of network management information between devices, allowing network administrators to manage network performance and to identify and solve problems on networks of diverse devices. It is part of the Transmission Control Protocol/Internet Protocol (TCP/IP) protocol suite.

Terminology

There are three main components in an SNMP-managed network: managed devices, agents, and network management systems (NMSs). Other important terms include managed objects, object identifiers (OIDs) and management information bases (MIBs).

A **network management system (NMS)**, **manager** or **client** is software or hardware that executes applications to monitor and control devices. It serves as the human-machine interface in an SNMP-managed network. NMSs provide most of the processing power and memory required for network management. One or more NMSs must exist on any managed network.

An **agent** is a software module that resides in a managed device and serves as an interface between the NMS and the physical device. An agent has device-specific knowledge of management information and translates that information into a form compatible with SNMP.

A **managed device** (sometimes called a network element) is a network node that resides on a managed network and contains an SNMP agent. Managed devices collect and store information that is then available to NMSs via SNMP. In this case, the managed device is your meter.

A **managed object** is any one of a number of specific characteristics of a managed device. Each managed object is identified by a unique object identifier in the management information base. Each managed object consists of one or more object instances (or variables).

An **object identifier (OID)** is a number that uniquely identifies a managed object in the MIB and associates it with a human readable label.

A **management information base (MIB)** is a collection of information that is organized in a hierarchical tree. It associates the OID of each managed object with a human readable label, and contains other related metadata. The custom ION MIB file contains custom OIDs along with a description field that you can modify to make the values from the meter more readable. The standard MIB file #1213 is also part of this implementation. It lets you read basic network information for the meter, for example, TCP/IP traffic, number of packets received, etc.

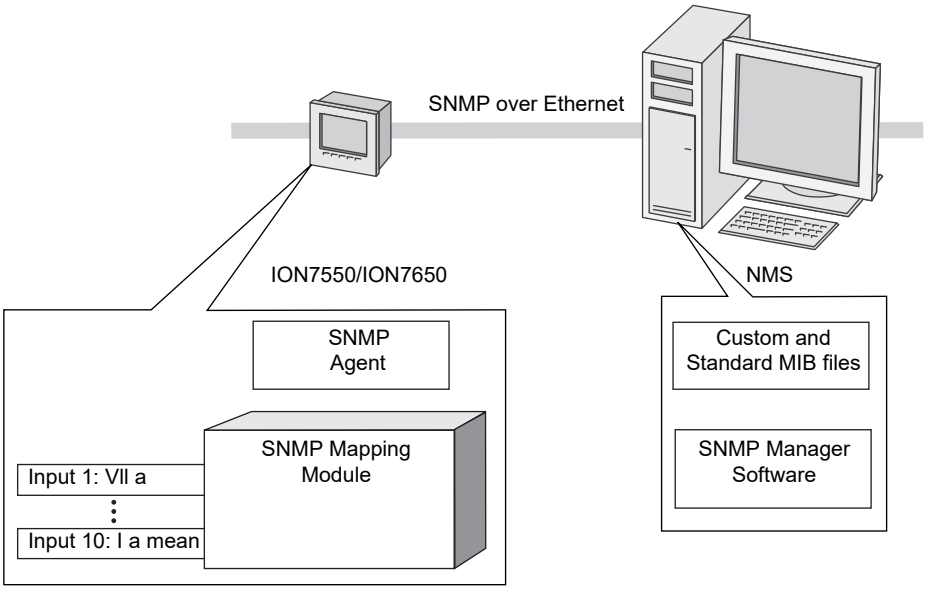
For information on customizing the variable labels, see “Customizing the MIB File” on page 121.

The custom MIB file needed for use with your meter can be obtained by contacting Technical Support or downloading it from www.se.com.

Using ION Meters with SNMP

This implementation only supports read-only mode. Only the following SNMP-related identification text strings can be written to the meter: System Contact, System Name, System Location.

The illustration below demonstrates how SNMP functions with ION meters. Within the ION meter is the SNMP agent and the SNMP Mapping module (to which you link the values you want to read from the meter). In this case, the NMS is a workstation with SNMP manager software. The NMS also contains the custom and standard MIB files needed to organize the managed objects and to map them to a custom label.



The default parameters linked to the SNMP Mapping modules are:

Vln a	Vll b	I b	PF sign a	kVAR tot	kWh del
Vln b	Vll c	I c	PF sign b	kVA tot	kWh rec
Vln c	Vll avg	I a mean	PF sign c	kW sd del-rec	kVARh del
Vln avg	Vunbal	I b mean	PF sign tot	kVAR sd del-rec	kVARh rec
Vll a	I a	I c mean	kW tot	kVA sd del+rec	kVAh del+rec

Configuring SNMP on ION Meters

To use SNMP with your ION meter, you need to:

- Obtain the MIB file from www.se.com or by contacting Technical Support and download it onto your NMS.
- Enable SNMP in the Ethernet module.
- Select the parameters you want to read via SNMP, if different from the defaults, and link those parameters to an SNMP Mapping module.

Using the front panel

The only configuration you can perform via the front panel is to set the Enable SNMP register in the Ethernet module to Enabled or Disabled.

Using ION Setup

Configuring the SNMP Mapping module

1. Open ION Setup and connect to your meter in Advanced Mode.
2. Navigate to the SNMP Mapping module folder.
3. Double-click on the module icon in the right-hand pane to open the module configuration dialog. To insert a new module, select the module folder and click **Insert > Module**.
4. To link inputs to the module, double-click on the source in the **Input** tab then navigate to the parameter you want to link in the Input Selection dialog.
5. Click **Send** to save your changes to the meter.

Configuring the Ethernet module

1. Open ION Setup and connect to your meter in Basic Mode.
2. Open the Setup Assistant and navigate to the Network Settings screen.
3. Select Enable SNMP from the **TCP/IP** tab and click **Edit**.
4. Select Enabled or Disabled from the list then click **OK**.

Using Power Monitoring Expert

Configuring the SNMP Mapping module

1. Open your meter in Designer. To add a new SNMP module, drag a new module from the toolbox.
2. Select the numeric outputs of other modules that you want to read via SNMP and link them to the inputs of an SNMP Mapping module.
3. Click **Send & Save** to save your changes to the meter.

Configuring the Ethernet module

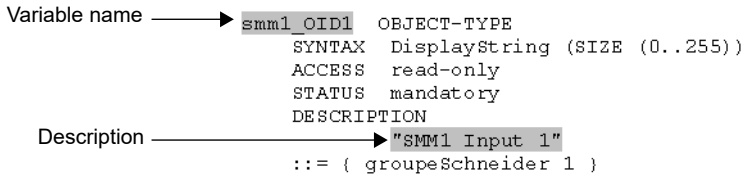
1. Open your meter in Designer and navigate to the Ethernet module in the Core Modules folder.
2. Click on the center of the module icon to open the module configuration dialog. Select the SNMP Enable setup register and click **Modify**.
3. Select Enabled or Disabled and click **OK**.

4. Click **Send & Save** to save your changes to the meter.

Customizing the MIB File

The ASN (Abstract Syntax Notation) MIB file contains MIB variable definitions for an MIB module, in this case the ION7550/ION7650 Schneider Electric MIB. The name of this custom MIB file is ion7x50schneiderMIB.asn.

Below is an example of an OID entry in the MIB:



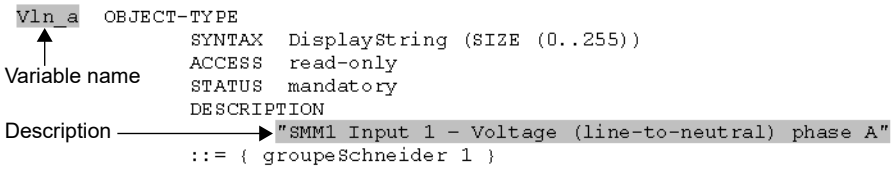
The highlighted sections show the fields that you can edit to make the variables linked to the SNMP Mapping module (SMM) more readable and the labels more meaningful. The description field, in quotation marks, can be changed to any text, including spaces and special symbols. However, the variable name must follow these rules:

- The first character must be a letter.
- The first character must be lower case.
- The name must not have any special characters (i.e., * ? & , .).
- The name must not contain spaces.

For example, if you had SMM1's OID1 input linked to Vln a, using the default MIB, the client software would read:

```
Variable name: Smm1_OID1
Description: "SMM1 Input 1"
```

However, you can edit the MIB file to use more meaningful labels:



In this case, the client software reads:

```
Variable name: Vln_a
Description: "SMM1 Input 1 - Voltage (line-to-neutral) phase A"
```

NOTE: Any fields other than those mentioned above (variable name and description) should not be changed. Doing so can cause the client software to report problems or return errors when trying to retrieve or view the parameters.

Chapter 8 Time

This chapter covers the meter's clock and time synchronization.

For more information, refer to the *Time Synchronization & Timekeeping* technical note.

In this chapter

Meter Clock 124
Configuring the Meter Clock 124
Clock Module Settings 126
Time Synchronization 127

Meter Clock

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 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, an NTP server or a DNP Master) can be used to synchronize the clock through a communications channel.

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

See the *ION Reference* for more information on the Clock module.

Configuring the Meter Clock

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

Using the front panel

The Time Setup menu provides access to various time-related parameters in the meter, such as the synchronization sources and channels used, and the time offsets applicable to your location.

The Clock Setup sub-menu contains settings for the meter's time keeping and time synchronization methods. Changing the settings under Clock Setup alters the setup register values of the Clock module — the module that provides timestamps for the data logged by the meter.

TZ offset (hh:mm)

Set this value to the time zone of the meter's location, relative to Coordinated Universal Time (UTC). For example, an entry of -08:00 is the correct offset for Pacific Time in the USA, Canada, and Tijuana. Specify a positive (+) or negative (–) offset with the Navigation buttons. The value must be non-zero before you can change its sign.

DST offset (hh:mm)

This setting determines the daylight savings time offset applicable to your location. The DST offset is the amount of time that the clock is moved when Daylight Savings time begins or ends. For example, an entry of +01:00 sets a daylight savings time offset of one hour. Setting DST offset to 0 (zero) disables daylight savings entirely. Specify a positive (+) or negative (–) offset with the Navigation buttons. The value must be non-zero before you can change its sign.

NOTE: The Clock Module's *DST Start* and *DST Stop* setup registers control the start and end times for Daylight Savings for up to twenty consecutive years. These registers are already configured in the factory for North American users but can be changed using ION software.

Sync source

This setting determines the port responsible for receiving the time synchronization signals. Only signals received on the selected port are used to synchronize the meter's internal clock; time synchronization signals on all other ports are ignored. The choices are ETHERNET, ETHERNET - ION, ETHERNET - DNP, COM1, COM2, COM3 and COM4.

See the *Time Synchronization & Timekeeping* technical note for more details on synchronization sources.

Sync type

This setting specifies whether time synchronization signals are received in UTC (Coordinated Universal Time) or Local Time. The default is set to UTC for Power Monitoring Expert. Some DNP masters use Local Time.

Clock source

This item determines the time synchronization source. The meter clock can be synchronized from an internal crystal (Internal), via line frequency (Line Freq) or through a communications port (COMM). If you are using GPS time synchronization, change this setting to COMM.

The Set Meter Time sub-menu contains settings for the date and time displayed on the front panel. The Meter Time settings are dependent upon the configuration of the Clock Setup menu–-you must set the time zone offset (TZ Offset) prior to setting the Local Date and Time.

Local date

Use this item to set the meter's display to the current date. The format of the date is defined in the General Format Setup menu.

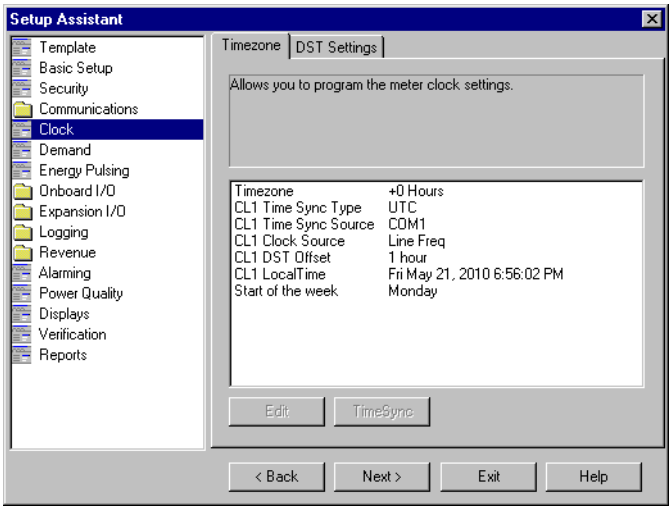
Local time

Use this item to set the meter's display to local time.

Using ION Setup

The Clock Setup Assistant helps you configure the Clock module.

1. Open ION Setup and connect to your meter, using Basic Mode.
2. In the Setup Assistant, navigate to the Clock folder.



3. Click on the Timezone tab to configure your meter's clock settings. Select a parameter and click **Edit** to change.
4. Click on 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.

Using Designer

Open your meter in Designer and navigate to the Meter Clock Setup framework. Right-click on the Clock module to edit.

Clock Module Settings

The setup registers in the Clock module specify time zone, Daylight Savings Time (DST) parameters and time synchronization functions.

Setup Register	Function	Default
TimeZone	The timezone the device is in, relative to Greenwich Mean Time	0
DST Start	Date and time when DST begins	varies[1]
DST End	Date and time when DST ends	varies[1]
DST Offset	The amount of time the clock is changed when DST begins or ends	0
Time Sync Source	The communications port that receives time sync signals	COM1
Time Sync Type	The type of time sync signal (Local or Universal time)	UTC
Clock Source	Specifies the clock's time synchronization signal source (line frequency, communications signals, or internal crystal)	Line Freq
Use Clock Source Quality Flag	Determines if the meter will accept time syncs only if the GPS has locked onto a satellite source (USE FLAG) or if the meter always accepts time sync from GPS (IGNORE FLAG).	USE FLAG
Enable NTP Time Sync	Enables or disable time synchronization via NTP	NO
NTP Time Sync Interval	Specifies the frequency at which the meter attempts time synchronization via NTP, if enabled	86400

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

When modifying setup registers of the Clock module in Designer, use the Format option to convert between UNIX and conventional time.

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 allows you to achieve 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.

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

Chapter 9 Demand

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

In this chapter

Introduction 130
Configuring Demand 130
Sliding Window Demand Module Settings 131
Displaying Demand 131

Introduction

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. The method of measuring demand uses Sliding Window Demand modules. These 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 ION software to change your meter's demand settings.

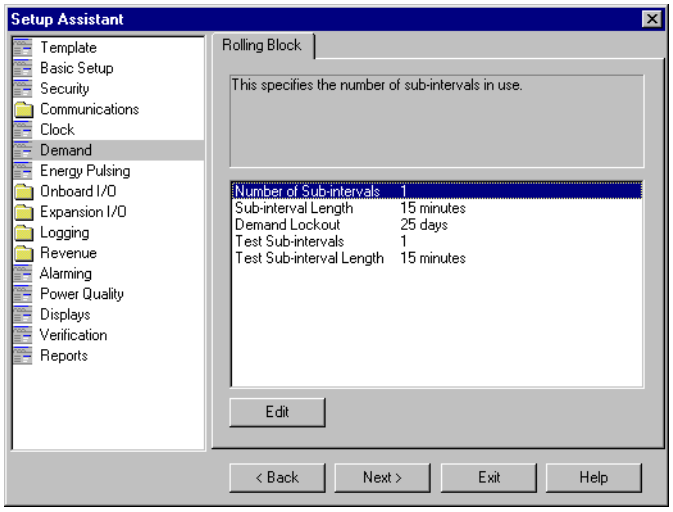
Using the front panel

You cannot configure Demand using the front panel.

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 ION Setup and connect to your meter, using Basic Mode.
2. In the Setup Assistant, navigate to the Demand folder.



3. Configure Rolling Block demand by selecting a register and clicking **Edit**.

You can also configure the Sliding Window Demand modules using Advanced Mode.

1. Connect to your meter, using Advanced Mode.
2. Click on the module you want to configure.

Using Designer

Open your meter in Designer and navigate to **Demand Setup > Sliding Window Demand**. Right-click on a module 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. 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.	900
#SubIntvls	The number of sub-intervals in the sliding window.	1
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

Displaying Demand

View Demand values in the following locations:

Application	Menu	Navigation
Front Panel	Demand1, Demand2 screens	Press Demand1 and Demand2 softkeys
ION Setup	Demand Display Screen	Display Mode > Demand
Vista	Energy & Demand Screen	Energy & Dmd tab
WebMeter	Consumption Screen	Consumption link

Chapter 10 Inputs / Outputs

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

Refer to your *Installation Guide* for instructions on wiring inputs and outputs and for the general meter I/O specifications.

In This Chapter

Digital I/O 134
- Specifying a Port in an ION Module 134
- Using the Onboard Digital Outputs 135
- Using the Onboard Digital Inputs 138

Analog I/O (optional) 139
- Specifying a Port in an ION Module 139
- Using the Analog Inputs 139
- Using the Analog Outputs 140

Configuring Inputs and Outputs 141

Digital I/O

ION7550 and ION7650 meters offer a variety of I/O combinations. The following are standard for all meters:

- 8 digital (status) inputs
- 4 form A digital (solid-state) outputs
- 3 form C relay outputs (electromechanical)
- 2 front panel LED outputs

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 relays for load switching applications. The LED outputs are suitable for energy pulsing and alarming.

The meter is also available with an optional I/O card that can include additional digital inputs. Refer to the meter's datasheet for the ordering options available on the optional I/O card. This card does not need to be ordered with your meter; it can be retrofitted to meters already operating in the field.

Digital Input modules control the meter's digital inputs. The 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.

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

Specifying a Port in an ION Module

Configure the Digital Output, Digital Input, Pulser, 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 both Designer and ION Setup.

Be aware that the enumerated list only displays those ports that are not yet assigned to another module. For example, the meter's factory configuration makes use of Digital Output port DO4 (it is already assigned to Calibration Pulser module "Wh Pulser –D4"). If you create a new Digital Output module and go to set its *Port* setup register, the port DO4 will not appear in the list of available ports.

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, Pulser, Digital Input, and Calibration Pulser modules) to handle digital outgoing or incoming signals.

Standard Output Port Names	Description
Port R1	Digital Output port 1 (Form C Relay)
Port R2	Digital Output port 2 (Form C Relay)
Port R3	Digital Output port 3 (Form C Relay)

Standard Output Port Names	Description
Port D1	Digital Output port 4 (Form A Solid-State)
Port D2	Digital Output port 5 (Form A Solid-State)
Port D3	Digital Output port 6 (Form A Solid-State)
Port D4	Digital Output port 7 (Form A Solid-State)
kWh Pulse –LED	LED Output
Alarm LED	LED Output
Standard Input Port Names	**Description**
Port S1	Digital Input port 1 (Status Input)
Port S2	Digital Input port 2 (Status Input)
Port S3	Digital Input port 3 (Status Input)
Port S4	Digital Input port 4 (Status Input)
Port S5	Digital Input port 5 (Status Input)
Port S6	Digital Input port 6 (Status Input)
Port S7	Digital Input port 7 (Status Input)
Port S8	Digital Input port 8 (Status Input)
Optional Input Port Names	**Description**
Port DI1	Digital Input port 9 (Status Input)
Port DI2	Digital Input port 10 (Status Input)
Port DI3	Digital Input port 11 (Status Input)
Port DI4	Digital Input port 12 (Status Input)
Port DI5	Digital Input port 13 (Status Input)
Port DI6	Digital Input port 14 (Status Input)
Port DI7	Digital Input port 15 (Status Input)
Port DI8	Digital Input port 16 (Status Input)

Using the Onboard 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 kWh pulses, if the receiving device determines energy usage by counting pulses.

The meter provides three Form C mechanical relays and four Form A digital (solid-state) relays. All digital outputs can deliver a continuous signal or a pulse.

Contact Schneider Electric for complete information regarding relay applications.

⚠ WARNING

HAZARD OF UNINTENDED OPERATION

- Do not use the ION7550/ION7650 meters for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.
- An unexpected change of state of the digital outputs may result when the supply power to the meter is interrupted or after a meter firmware upgrade.

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

These outputs can be controlled by Digital Output modules, Pulser modules, or Calibration Pulser modules, depending on the application. For relay and non-critical control, use the Digital Output module. For pulsing applications, the Pulser and Calibration 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, consider using a Form A output in KYZ mode.

Failure to follow this instruction can result in equipment damage.

Digital Output modules

Both the Form A and Form C relays can be controlled with Digital Output modules, Pulser modules, or Calibration Pulser modules. By default, six Digital Output modules (labeled DO-D1 to DO-D3 and DO-R1 to DO-R3) are already created for this purpose. You can use these 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:

ION Module	Setup Registers	Available Settings	Creation Default	Description
Digital Output	Port	Not Used Port DO1 Port DO2 Port DO3 Port DO4 Port R1 Port R2 Port R3 kWh Pulse –LED Alarm LED	Not Used	The output hardware channel
	Pulse Width	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
Pulser	Port	As per Digital Output, above	Not Used	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
Calibration Pulser	Port	As per Digital Output, above	Not Used	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	Absolute	Integration modes that may be selected
	OutputMode	Pulse or KYZ	Pulse	Full pulse or KYZ (transition pulse)

Ensure that the module's *Port* setup register matches the meter's output that 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.

Calibration pulsing relay DO4

Solid-state relay DO4 is factory configured for calibration pulsing and requires no further setup. The Calibration Pulser module labeled *Wh Pulser –D4* controls this port. 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 will output a pulse for every 1.8 Wh accumulated (in NORMAL or TEST mode); this is the same pulsing rate as the middle LED on the front panel of the meter. See the Energy Pulsing chapter for more information.

Alarm LED

Use the red (bottom) LED on the front panel of the meter for custom alarming 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 Onboard Digital Inputs

Use the meter's digital inputs for status monitoring or pulse counting applications. Status monitoring can help 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 eight default Digital Input modules (labeled DI-S1 to DI-S8) for the onboard status inputs. Configure the settings of the controlling module to match your requirements.

NOTE: The Digital Inputs on the Optional I/O card are controlled by the Digital Input modules I/O-S1 to I/O-S8. However, on the Optional I/O card itself, the inputs are labelled DI1 to DI8

The settings in the Digital Input modules are as follows:

Setup Register	Available Settings	Creation Default	Description
Input Mode	Pulse or KYZ	Pulse	Complete pulse or KYZ transition pulse
EvLog Mode	Log Off or Log On	Log Off	Whether or not to log status changes in the Event Log
Debounce	0 to 65.25	0.010	Mechanical contact bounce, in seconds
Polarity	Non-Inverting or Inverting	Non-Inverting	Non-inverted (or level) pulse
Port	Not Used Port DI1 Port DI2 Port DI3 Port DI4 Port DI5 Port DI6 Port DI7 Port DI8	Not Used	The input hardware channel controlled

Analog I/O (optional)

Analog I/O ports are found on the optional I/O card, which can include analog inputs and/or analog outputs or additional digital inputs. Use analog inputs to monitor a wide range of conditions, such as flow rates, RPM, fluid levels, oil pressures and transformer temperatures. Analog outputs let you output real-time power to an RTU or perform equipment control operations.

See the meter's datasheet for the ordering options available on the optional I/O card.

NOTE: The optional I/O card does not need to be ordered with your meter; it can be field retrofitted.

See the *Digital and Analog I/O* technical note for more information on analog inputs and outputs.

Your meter uses Analog Input and Analog Output modules for analog I/O. See the *ION Reference* for more information on these modules.

Specifying a Port in an ION Module

Configure the Analog Output and Analog Input 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 both Designer and ION Setup.

The following table describes the ports that can be configured in the Analog Input and Analog Output modules to handle outgoing or incoming analog signals.

Optional Output Port Names	Description
Port AO1	Analog Output port 1
Port AO2	Analog Output port 2
Port AO3	Analog Output port 3
Port AO4	Analog Output port 4
Optional Input Port Names	**Description**
Port AI1	Analog Input port 1
Port AI2	Analog Input port 2
Port AI3	Analog Input port 3
Port AI4	Analog Input port 4

Using the Analog Inputs

Use the analog inputs to measure and store analog information such as electrical signals from transducers (from flow rates, temperatures, pressures, rotations, and fluid levels). Analog Input modules control the analog inputs.

Analog Input modules

The optional I/O card provides four analog inputs. By default, four Analog Input modules (labeled AI1 to AI4) are already created for this purpose. Configure the settings of the controlling module to match your requirements. The settings in these modules are as follows:

Setup Registers	Available Settings	Creation Default	Description
Port	Not Used or AI1 to AI4 inclusive	Not Used	The input hardware channel
Full Scale	-1×10^9 to 1×10^9	1	Defines what value appears in the ScaledValu output register when the highest possible value from the hardware is applied
Zero Scale [1]	-1×10^9 to 1×10^9	0	Defines what value appears in the ScaledValu output register when the lowest possible value from the hardware is applied

[1] An arbitrary input value can be treated as the Zero Scale (i.e., a 4-20mA input is capable of generating a 0 to X output).

Using the Analog Outputs

Your meter's analog outputs act as transducers. The meter measures power and energy, and then sends that information via the analog outputs to a remote terminal unit (RTU). The analog outputs issue industry standard 0 to 20 mA current signals. They are controlled by the Analog Output modules.

⚠ WARNING

HAZARD OF UNINTENDED OPERATION

- Do not use the ION7550/ION7650 meters for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.
- The electrical signal on the output is DC. Make sure proper polarity is observed when wiring external devices to the analog output ports.

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

Analog Output modules

The optional I/O Card provides four analog outputs. By default, four Analog Output modules (labeled AO1 to AO4) are already created for this purpose. Configure the settings of the controlling module to match your requirements. The settings in these modules are as follows:

Setup Registers	Available Settings	Creation Default	Description
Port	Not Used AO1 to AO4 inclusive	Not Used	The output hardware channel
Full Scale	-1×10^9 to 1×10^9	1	Defines what value appears in the ScaledValu output register when the highest possible value from the hardware is applied
Zero Scale	-1×10^9 to 1×10^9	0	Defines what value appears in the ScaledValu output register when the lowest possible value from the hardware is applied

Configuring Inputs and Outputs

Use ION software to configure the meter's I/O framework.

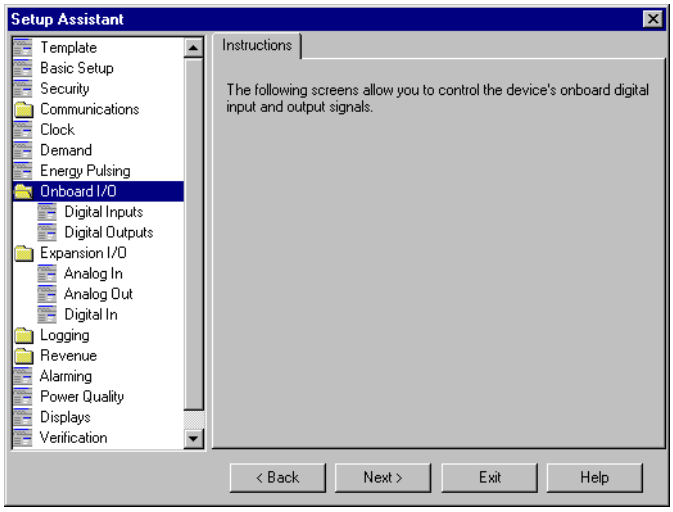
Using the front panel

You cannot configure I/O using the Front Panel.

Using ION Setup

The Inputs/Outputs Setup Assistant helps you configure your meter's onboard and optional expansion I/O card's analog and digital inputs and outputs. See the Energy Pulsing chapter for information on configuring the Calibration Pulser modules in ION Setup.

1. Open ION Setup and connect to your meter, using Basic Mode.
2. In the Setup Assistant, navigate to either the **Onboard I/O** or the **Expansion I/O** folder, and select the I/O type you want to configure.



   The tabs on the I/O screens correspond to the associated modules (for example, **Onboard I/O > Digital Outputs > R1** allows you to configure Digital Output module R1). Click on the tab you want to edit.

3. To edit a value, select the parameter and click **Edit**.
4. To link a Digital Input or Analog Input module to a source (by default, none are linked), select Source and click **Edit**. Navigate to the source register you require and click **OK**

NOTE: To view all possible ION parameters, click the Show all available registers checkbox.

Using Designer

Open your meter in Designer and navigate to the Advanced Setup framework. Click on the appropriate grouping object (Digital Inputs, Digital Outputs or Analog I/O) and right-click the module you want to edit.

Chapter 11 Energy Pulsing

This chapter provides instructions for configuring energy pulsing on your meter.

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Configuring Energy Pulsing 144
- Pulser Module Settings 145
- Calibration Pulser Module Settings 145

Energy Pulsing with LEDs 146

Introduction

Your meter uses Calibration Pulser modules and Pulser modules for energy pulsing.

The Pulser module serves as an intermediary between other modules' pulse output registers (accepting them as pulse inputs) and a hardware output channel on the device. These modules are capable of sending pulses or pulse transitions to any hardware output channel.

> **⚠ 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, consider using a Form A output in KYZ mode.
>
> **this instruction can result in equipment damage.**

The Calibration Pulser module is a highly accurate energy pulser used for verifying calibration 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.

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

Configuring Energy Pulsing

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

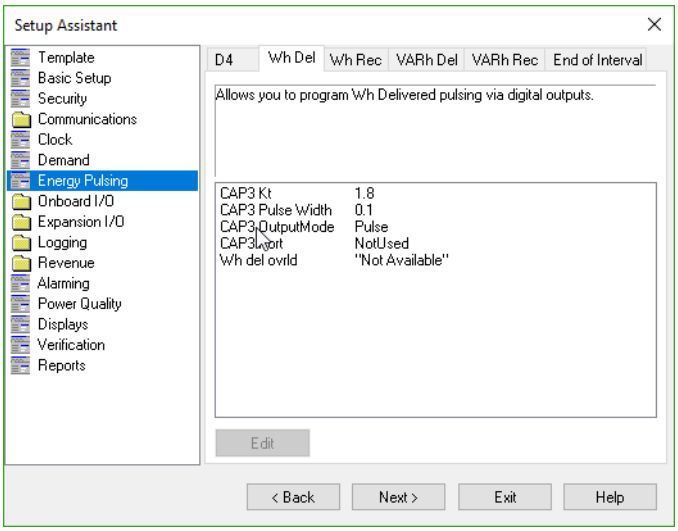
Using the front panel

You cannot configure Energy Pulsing using the front panel.

Using ION Setup

The Energy Pulsing Setup Assistant helps you configure the Calibration Pulser modules.

1. Open ION Setup and connect to your meter, using Basic Mode.
2. In the Setup Assistant, navigate to **Energy Pulsing**.



3. Click the Wh Del, Wh Rec, VARh Del or VARh Rec tab. Each tab corresponds to a Calibration Pulser module. Configure each module as necessary.
4. Click the **End of Interval** tab to configure the end of energy pulsing.

You can configure ***both*** the Calibration Pulser and Pulser modules using Advanced Mode.

1. Connect to your meter, using Advanced Mode.
2. Click the module you want to configure.

Using Designer

Open your meter in Designer and navigate to the Energy Pulsing Setup Framework. Right-click a module to edit.

Pulser Module Settings

The Pulser module contains the following setup registers:

Setup Register	Function	Default
Pulse Width	This register specifies the width of the output pulses (in seconds).	1
OutputMode	This register defines whether the output is a complete pulse or a transition pulse (KYZ).	Pulse
Polarity	This register specifies the polarity of a pulse output. It has no effect if *OutputMode* is KYZ.	Non-inverting
Port	This register specifies which hardware port the output appears on. Only those hardware channels that are still available appear in this list.	Not Used

Five common parameters (Wh del, Wh rec, VARh del, VARh rec, and kW sd del) are already linked to the Pulser modules for you.

NOTE: No hardware channel is pre-selected in order to prevent unintended operation. To make use of these links, you must configure the Pulser modules' *Port* setup registers to the appropriate hardware port that receives the output.

Calibration Pulser Module Settings

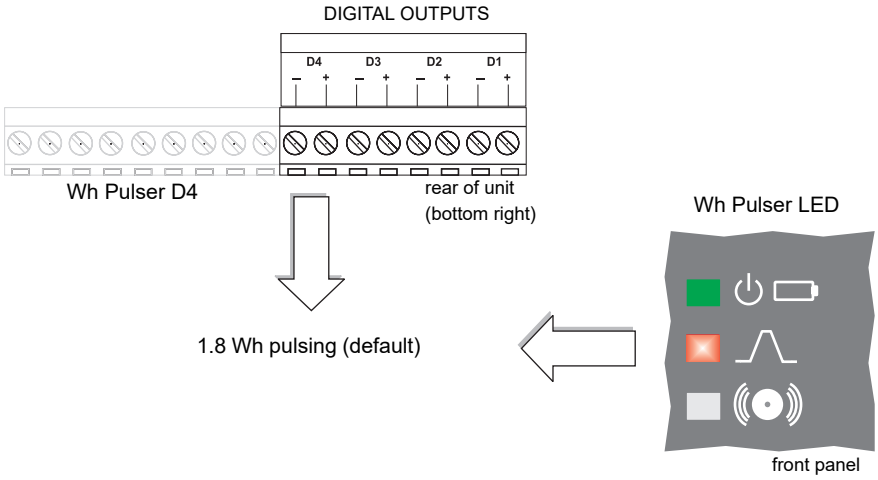
Configure the solid-state output D4 for calibration pulsing by editing the setup registers of the Calibration Pulser module labeled "kWh Pulser –D4". By default, the output on a standard meter generates a pulse for every 1.8 Wh accumulated. This is the same pulsing rate as the middle front panel LED (controlled by a Calibration Pulser module labeled "kWh Pulser –LED"). Modify the pulsing rate of either channel by changing the value of the *Kt* setup register of the Calibration Pulser module controlling them (see below).

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

Setup Register	Function	Default
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.	0.05
Kt	The numeric bounded register defines how much energy the module accumulates before a pulse is sent to the hardware channel. An industry standard for energy pulsing is 1.8, or one pulse per 1.8 energy-hours.	1.80
Int Mode	Specifies the modes of integration that may be selected.	Absolute
OutputMode	This register specifies whether the output is a complete pulse (Pulse) or a change of state transition (KYZ).	Pulse
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.	Not Used

Energy Pulsing with LEDs

The middle red LED on the meter's front panel is factory configured to be an energy pulser. Like solid-state relay output DO4, the Wh Pulser –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". This Arithmetic module is linked to the MU Power Meter module's *MU kW tot* output. The LED port outputs a pulse for every 1.8 Wh accumulated (in both NORMAL and TEST mode).



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 in the Demand Framework. Ensure that the quantity you choose originates from the MU (meter units) Power Meter module.

Chapter 12 Logging and Trending

This chapter provides information regarding the data logging, event recording and trending and forecasting capabilities of the meter.

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Logging and Recording Capacity 157
Trending and Forecasting 158
- Configuring Trending and Forecasting 158
- Viewing Trending and Forecasting Data 159

Introduction

Your meter includes data logging and event recording capabilities. Data and event logs recorded by the meter are prioritized and stored onboard. This data is then retrieved periodically by the ION Log Inserter Service or another third party application.

If you use Power Monitoring Expert software, all retrieved data from your system is stored in an ODBC-compliant database. The information in the database can be viewed and analyzed using Power Monitoring Expert software applications such as Vista (for viewing) or Web Reporter (for organizing and presenting data). For more information on Vista and Web Reporter, see the online *Power Monitoring Expert Help*.

Your meter also has trending and forecasting capabilities to track specified quantities over time and forecast what the value of those quantities will be in the future. Trending and forecasting data can be viewed through the meter's web pages.

Data Logging

Your meter ships with a comprehensive data-logging configuration. The data recording frameworks contain Data Recorder modules, Waveform Recorder modules, and Periodic Timer modules. Data Recorder and Waveform Recorder modules are responsible for logging the power system data. The Periodic Timer modules control 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 will reset logged values. Ensure that all important data has been recorded before you make changes.

See "Default Logging Configuration" on page 152 for detailed information about your meter's pre-configured Data Recorder modules.

Configuring Data Logging

Use ION software to change your meter's logging settings.

Using the front panel

You cannot configure Logging using the front panel.

Using ION Setup

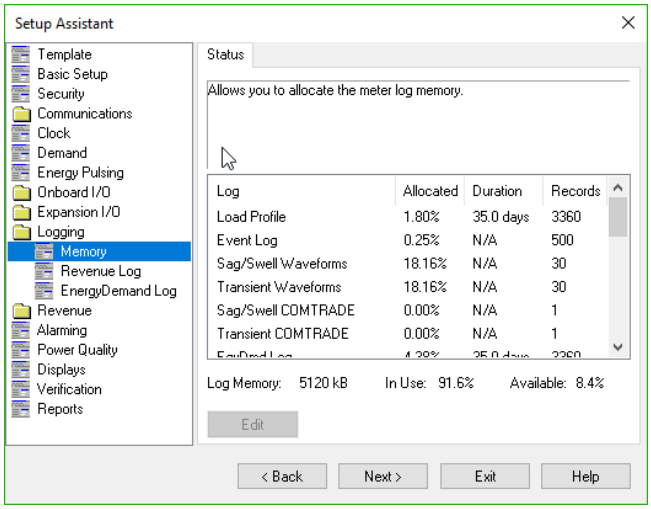
The Logging Setup Assistant helps you configure meter data logging.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to the **Logging**.

   Use the three screens (Memory, Revenue Log and EnergyDemand Log) to configure various logging settings.

Memory screen

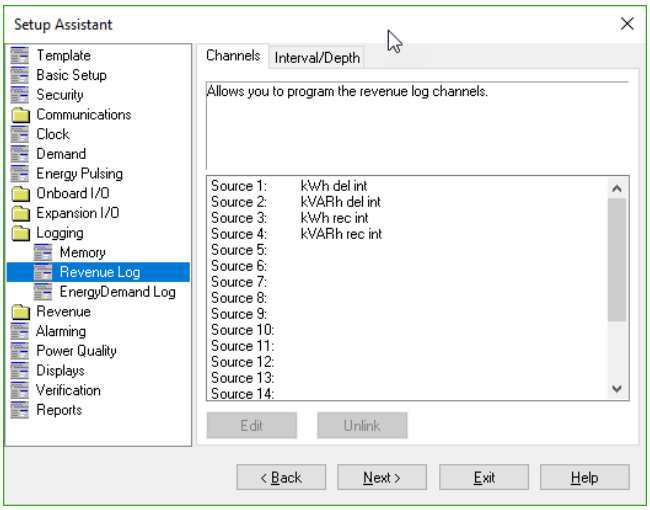
4. Select the Memory screen to re-allocate meter memory.



5. Select the Log you want to configure and click **Edit**. You can change both the Duration (days) and Records for most logs. Notice how changing these parameters affects the meter memory allocated to that log.

Revenue Log screen

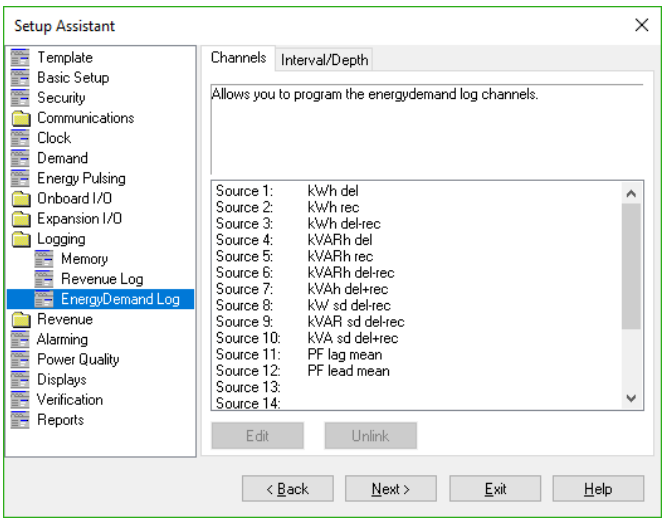
6. Select the Revenue Log screen to configure Data Recorder #1 (the Revenue Log).



7. Click the **Channels** tab to edit, link or unlink revenue parameters.
8. Click the **Interval/Depth** tab to edit the interval and duration of the revenue log.

EnergyDemand Log screen

9. Select the EnergyDemand Log screen to configure Data Recorder #10 (EnergyDemand Log).



10. Click the **Channels** tab to edit, link or unlink EnergyDemand log parameters.
11. Click the **Interval/Depth** tab to edit the interval and duration of the EnergyDemand log

Changing the parameters that are logged

The meter's factory configuration logs a comprehensive set of energy, power and harmonics parameters. 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 a Data Recorder module.

NOTE: Adding or deleting a log's parameters is an advanced procedure, as it requires changes to links between modules; use the Designer component of Power Monitoring Expert (refer to the Designer section of the online *Power Monitoring Expert Help)* or ION Setup.

Changing waveform recording

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.

Default logging capacity

The following table summarizes the default recording depths and recording intervals of the various Data Recorders and Waveform Recorders in the meter.

NOTE: Default logging depth is set differently for 5 MB on-board memory ("one-month") and 10 MB ("three-month") option meters. See the table below for more information.

Log Name	Depth		Interval
	5 MB	10 MB	
Revenue Log	3360 (35 days)	9120 (95 days)	900 seconds (15 minutes)
Loss Log	3360 (35 days)	9120 (95 days)	900 seconds (15 minutes)
Historic Logs (3 data recorders)	3360 (35 days)	9120 (95 days)	900 seconds (15 minutes)
Harmonics Logs (2 data recorders)	840 (35 days)	2280 (95 days)	3600 seconds (1 hour)
Waveform recording (waveform recorders: 6 for ION7550, 12 for ION7650)	30	30	Triggered on demand
COMTRADE records[1]	1	1	Triggered by Waveform recording
Report Generator Log (EgyDmd Log)	3360 (35 days)	9120 (95 days)	900 seconds (15 minutes)
Sag/Swell Log	100	100	Triggered on demand
Transient Log (ION7650)	100	100	Triggered on demand
RVC Log (ION7650)	100	100	Triggered on demand
Event Log (Event Log Controller module)	500	500	Triggered on demand
Trend Display Logs (3 data recorders)[2]	1345	1345	900 seconds (15 minutes)
EN50160 Logs (14 data recorders) (ION7650 with EN50160 ordering option only)	Varies[3]	Varies	Daily, weekly, 10 minutes, ...
4-30 Logs (8 data recorders for ION7650)	Varies[4]	Varies	3 second, 10 minute, 2 hour
DailyNom Log	450	450	Daily

1 See the *COMTRADE and ION Technology* technical note for more details.

2 These logs only gather data for the trend displays on the front panel and are not related to the trending and forecasting feature, which is displayed through the meter's web pages.

3 See the *Power Quality: ION Meters and EN50160* technical note for more details.

4 See the *IEC 61000-4-30 Compliance and ION Meters* technical note for more details.

Changing the log depths

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.

Changing the frequency of logging

The six 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.
- "Dsp Trnd Lg Trg" controls the frequency of Trend Display logging.

NOTE: Programming your meter to write any data recorder at continuous intervals shorter than 60 seconds (heavy logging configuration) may cause loss of data in the event of power loss. Use an uninterruptible power supply (UPS) for heavy logging configurations if data needs to be available after a power cycle.

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

Default Logging Configuration

The following sections describe each Data Recorder and the parameters it logs.

Revenue Log

The *Revenue Log* is configured for use with UTS 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	
Vll ab mean	I avg mean
Vll bc mean	I 4 mean
Vll ca mean	kW tot mean
Vll avg mean	kVAR tot mean
V unbal mean	kVA tot mean
Ia mean	PF lag mean
Ib mean	PF lead mean
Ic mean	Freq mean

Hist High Log	
Vll ab high	I avg high
Vll bc high	I 4 high
Vll ca high	kW tot high
Vll avg high	kVAR tot high
V unbal high	kVA tot high
Ia high	PF lag high
Ib high	PF lead high
Ic high	Freq high

Hist Low Log	
Vll ab low	I avg low
Vll bc low	I 4 low
Vll ca low	kW tot low
Vll avg low	kVAR tot low
V unbal low	kVA tot low
Ia low	PF lag low
Ib low	PF lead low
Ic low	Freq low

Loss log

The *Loss Log* recorder is configured to record loss values. By default, it logs the following ION parameters:

Parameter	Description
MU Ia^2h int	Phase A interval current squared hours
MU Ib^2h int	Phase B interval current squared hours
MU Ic^2h int	Phase C interval current squared hours
MU Vll ab^2h int	Phase A interval voltage Line-to-Line squared hours
MU Vll bc^2h int	Phase B interval voltage Line-to-Line squared hours
MU Vll ca^2h int	Phase C interval voltage Line-to-Line squared hours
MU Vlna^2h int	Phase A interval voltage Line-to-Neutral squared hours
MU Vlnb^2h int	Phase B interval voltage Line-to-Neutral squared hours
MU Vlnc^2h int	Phase C interval voltage Line-to-Neutral squared hours

Harmonics logging

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	
V1 THD mean	I1 K Fac mean
V2 THD mean	I2 K Fac mean
V3 THD mean	I3 K Fac mean
I1 THD mean	
I2 THD mean	
I3 THD mean	

Harm High Log	
V1 THD high	I1 K Fac high
V2 THD high	I2 K Fac high
V3 THD high	I3 K Fac high
I1 THD high	
I2 THD high	
I3 THD high	

Power Monitoring Expert reporting

The *EgyDmd Log* data recorder is configured to provide power system data for the Reporter component of Power Monitoring Expert software. If any input links to this module are changed, Reporter will not be able to create reports from the device's logs. If you use Reporter, do not change the parameters that are logged in the *EgyDmd Log*.

Sag/Swell and Transient logging

The meter logs the following ION output register values:

Sag/Swell Log			
DistDur	DistV1Engy	DistV2Engy	DistV3Engy
DistV1Min	DistV2Min	DistV3Min	DistNominal
DistV1Max	DistV2Max	DistV3Max	SwellLim
DistV1Avg	DistV2Avg	DistV3Avg	SagLim

Transient Log (ION7650 only)			
TranV1Dur	TranV2Max	TranNominal	PT Sec
TranV1Max	TranV3Dur	Threshold	CT Prim
TranV2Dur	TranV3Max	PT Prim	CT Sec

Refer to the *COMTRADE and ION Technology* technical note for information about COMTRADE records.

Trend display logging

Three data recorders are used to provide trend display logging. The data recorders and the ION output registers they log are as follows:

- **V-Trend Log:** Vll avg trend
- **I-Trend Log:** Iavg trend
- **P-Trend Log:** kW tot trend

These logs gather data for the front panel trend displays. They are not related to the trending and forecasting feature, which is displayed through the meter's web pages.

EN50160 compliance logging (ION7650 with EN50160 ordering option only)

By default, 14 Data Recorders are used for logging EN50160 compliance parameters.

Data Recorder	EN50160 Component Logged
EN50160 Frq/Mg	Power Frequency and Supply Magnitude
EN50160 Flicker	Flicker
EN50160 Vlt Dp1	Supply Voltage Dips
EN50160 Vlt Dp2	
EN50160 Intrp	Short/Long Interruptions
EN50160 Swell	Temporary Overvoltages
EN50160 Vunbal	Voltage Unbalance

Data Recorder	EN50160 Component Logged
EN50160 Hrm Vlt	Voltage 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 PrmHrm1	
EN50160 PrmHrm2	

The ION7650 logs EN50160 counter data for present and previous observation periods as well as EN50160 events. EN50160 parameter data logging (from four "Prm" data recorders) is disabled by default. Enable or disable EN50160 Parameter Logging via Vista or by using ION Setup.

For more information about EN50160 data logging, see the *Power Quality: ION Meters and EN50160* technical note.

IEC 61000-4-30 logging (ION7650 only)

Eight data recorders are used to log parameters related to 4-30 compliance and to create reports.

Data Recorder	4-30 parameters logged
4-30 3s THD Log 4-30 3s RMS Log 4-30 10mRMS Log 4-30 10mTHD Log 4-30 2hTHD Log 4-30 2hRMS Log 4-30 10s Freq 4-30 Intrp Log (disabled by default)	– Voltage Disturbances – V1-RMS (Root-Mean-Square) – V2-RMS – V3-RMS – THD (Total Harmonic Distortion) – Vneg/Vpos – Vzero/Vpos – V-Overdeviation – V-Underdeviation – Frequency – Flicker[1] – Unbalance

[1] Deviation expressed as a percentage of nominal voltage; available in 10-minute and 2-hour reports only).

For more information on 4-30 compliance, see the *IEC 61000-4-30 Compliance and ION Meters* technical note.

Viewing Data Logs

See the Web Reporter chapter for more information on viewing data logs and creating reports using Power Monitoring Expert. To view data logs using ION Setup, follow the instructions below.

1. Open your meter in ION Setup, using Basic Mode.
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
   - RVC Log
   - Sags & Swells
   - Transformer Losses
   - Transients (ION7650 only)
   - 4-30 10min RMS, 4-30 10min THD, 4-30 2hr RMS, 4-30 2hr THD, 4-30 3s RMS, 4-30 3s THD, 4-30 FlickerLog (ION7650 only)

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; for example, to display messages or perform *netsend* messages.

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	A warning is produced	30
EN50160 Event (ION7650 with EN50160 ordering option only)	An EN50160 Counter (N_1 or N_2) increases	50
Failure	A failure has occurred	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.

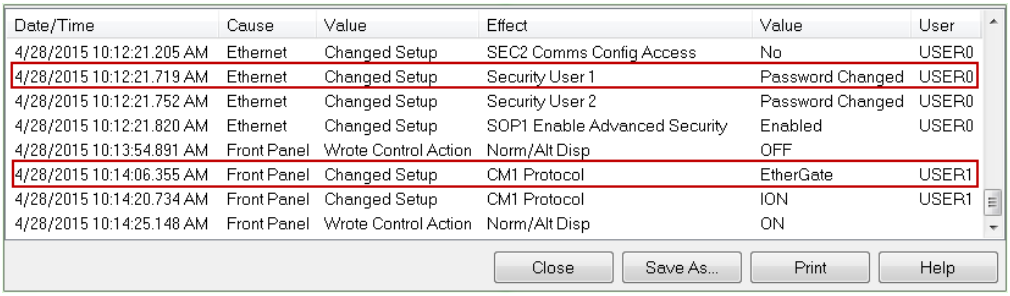
External ION events

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 following table.

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 fail 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 front panel have the username USER0. Events created in advanced security through the front panel or ION Setup are associated with the username that was logged into the meter (USER1 - USER50).



Displaying Events

View Events in the following locations:

Application	Menu / Screen	Navigation
Front Panel	Event Log	Press Events softkey
ION Setup	Event	Display Mode > Event
Vista	Meter Events Log	Volts/Amps tab > Logs > Meter Event Logs 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.

The Memory tab in the Logging folder of the ION Setup Assistant displays the memory allocated to each log and the meter's total in-use and available logging memory.

Trending and Forecasting

The Trending and Forecasting feature of the ION7550/ION7650 enables you to monitor changes in specified quantities over a period of time and view forecasted values for those quantities. Trending and forecasting data can be useful for analyzing changes in load and power quality and forecasting values such as demand.

The data used for trending and forecasting is logged for the following intervals:

- Every hour for the last 24 hours
- Every day for the last month
- Every week for the last 8 weeks
- Every month for the last 12 months

NOTE: Forecasted values are not calculated for the weekly and hourly intervals. Only trend data can be viewed for these intervals.

The default parameters that are logged for trending and forecasting are:

kW sd del-rec (demand)	Freq (frequency)
Vll ab	I a mean
Vll bc	I b mean
Vll ca	I c mean
Vll avg	I avg mean

View the trending and forecasting data via the meter's web pages. See "Viewing Trending and Forecasting Data" on page 159 for more information.

For more information on the Trending and Forecasting module, refer to the *ION Reference*.

Configuring Trending and Forecasting

The trending and forecasting feature does not need to be configured if you want to use the default settings. You only need to give the meter time to accumulate data. Using ION software, you can configure the meter to monitor different values than the default values or use a different start day of the week than the default day (Monday).

NOTE: Changing the start day of the week or the input resets the module. All currently accumulated data is lost.

Using the front panel

You cannot configure trending and forecasting via the front panel.

Using ION Setup

Use ION Setup in Basic mode to set a different start day of the week from the default and in Advanced mode to link and re-link inputs to monitor.

Setting a new day for Start of the Week

1. Open ION Setup and connect to your meter in Basic mode.
2. Open the Setup Assistant and navigate to the Clock screen.
3. Select the Start of the Week entry and click **Edit**.

4. Select the new Start of the Week day from the drop-down list and click **OK**.

Linking a different Source input

1. Open ION Setup and connect to your meter in Advanced mode.
2. Navigate to the Trending and Forecasting module folder. Select the module you want to configure from the right hand pane.
3. Select Source on the **Inputs** tab and click **Edit** to link or re-link a module to a source.
4. Click **Send** to save your changes to the meter.

Using Power Monitoring Expert

Open your meter in Designer and navigate to the Trending and Forecasting module you want to configure. Right-click on the module to edit its setup register.

Viewing Trending and Forecasting Data

Use the meter's web pages to view the trending and forecasting graphs. The data used on the trending and forecasting web page is updated once an hour.

Before you can view the graph on the web page, you need to install the ActiveX control. You can get the necessary "ProEssentials Graph Install.exe" file in the following locations:

- If you have the latest version of ION Setup on your workstation, navigate to /.../ION Setup/ProEssentials Graph Install.exe.
- Download "ProEssentials Graph Install.exe" from the ION7550/ION7650 Support page on www.se.com.

Double-click on the .exe file and follow the installation wizard to install the ActiveX control on your workstation. Once you have the ActiveX control, you can follow the instructions below to view the trending and forecasting graphs on the meter's web pages.

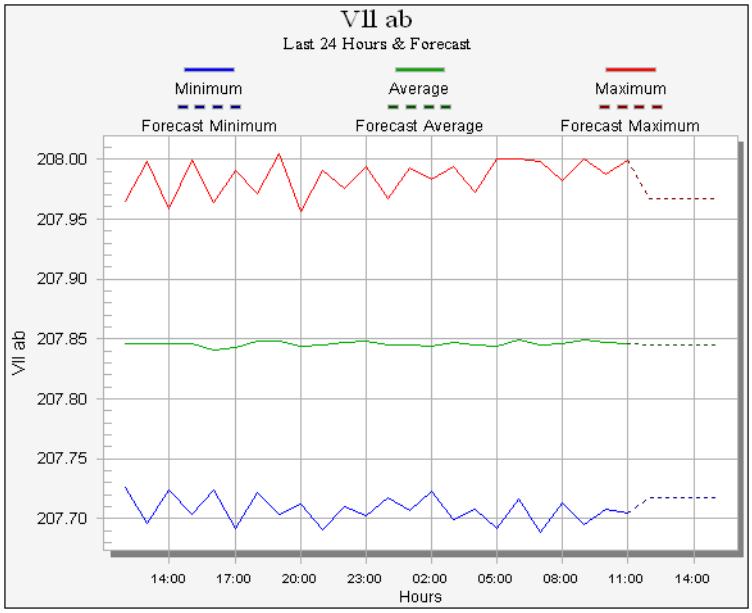
To view the meter's trending and forecasting web pages

1. Enter the meter's IP address into your browser's address field.
2. Select **Trending & Forecasting** from the menu on the Monitoring screen. The Trending and Forecasting screen appears.

NOTE: If you have not installed the ActiveX control, a message appears on the Trending and Forecasting screen informing you that you are missing the ActiveX control and instructing you on where to find it.

3. Select the quantity and the time interval (range) you want to view from the drop-down menus.

4. The graph for the selected quantity and interval appears on the screen.



The meter must accumulate sufficient data in order to calculate trends and forecasts. The time needed to accumulate data varies depending on the interval you want to view. The meter must accumulate data for at least two of the specified intervals; for example, if you want to view the daily graph, the meter must have accumulated data for at least two previous days before the current day. Since the data needs to be accumulated over time in order to build a useful profile, it is important that it persists through power cycles. For this reason, the data accumulated by the module is backed up to the meter's non-volatile memory every hour.

For more information on the meter's other web pages, refer to the *WebMeter Internal Web Server* technical note.

Chapter 13 Revenue

This chapter provides instructions for configuring instrument transformer correction, transformer line loss compensation and time of use.

For more information on revenue metering with the ION7550/ION7650, see the *Revenue Meter* product option document.

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Instrument Transformer Correction (ITC)

Instrument Transformer Correction (ITC) allows you to correct for inaccuracies in the current transformers (CTs) and potential transformers (PTs). The primary application for instrument transformer correction is to apply correction factors for the CT and PT ratios and phase angle errors to instrument transformers. Instrument transformer correction reduces or eliminates the need to replace transformers in installations where high-accuracy is required.

While ION7550/ION7650 meters are shipped with ITC-capable firmware, its ITC modules (Instr Xformer in the firmware) must be configured using accurate measurements to 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 (Instr Xformer) modules according to your meter's power supply and operating ranges.

For detailed explanations of this module's inputs, setup registers and output registers, see the ITC module description in the online *ION Reference*.

Configuring ITC

Use ION software to change your meter's ITC settings.

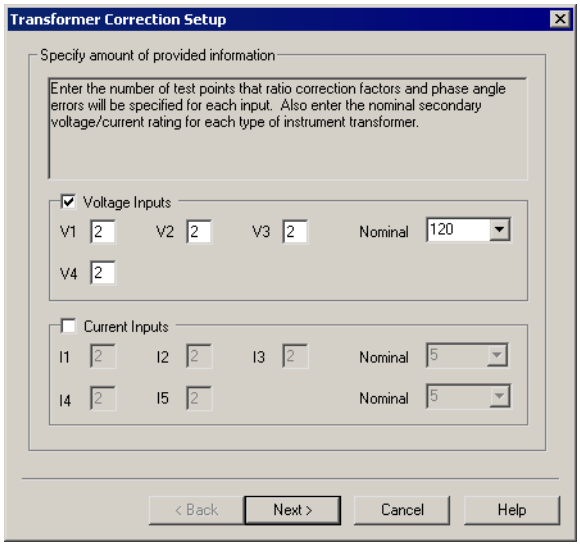
Using the front panel

You cannot configure Instrument Transformer Correction using the front panel.

Using ION Setup

The Revenue Setup Assistant helps you configure ITC. The PT/CT Correction screen allows you to correct on all voltage and current inputs.

1. Open ION Setup and connect to your meter, using Basic Mode.
2. In the Setup Assistant, navigate to **Revenue > PT/CT Correction**. Select **Active Correction** on the **ITC Correction** tab and click **Edit**. The Transformer Correction Setup assistant appears.



3. Enter the number of test points for which ratio correction factors and phase angle errors will be specified. Enter the secondary nominal rating. Click **Next.**

NOTE: You can select a maximum of eight (8) test points.

4. Select each test point and click **Edit** to set the percentage of nominal, ratio correction factor and phase error values for each test point.

5. Click **Finish** when you are done.

Using Designer

Open your meter in Designer and navigate to **Advanced Setup > Core Modules** folder. Right-click an ITC module to edit.

Transformer Line Loss Compensation (TLC)

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.

For more information, see the *Transformer / Line Loss Calculations* technical note.

Configuring TLC

Use ION software to change your meter's TLC settings.

Using the front panel

You cannot configure Transformer Line Loss Compensation using the front panel.

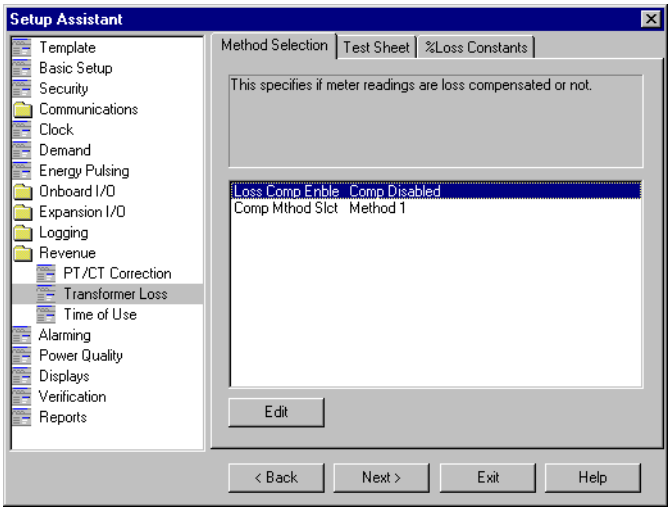
Using ION Setup

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 ION Setup and connect to your meter, using Basic Mode.

2. In the Setup Assistant, navigate to **Revenue > Transformer Loss**.

3. First, enable TLC by selecting Loss Comp Enble and clicking the **Edit** button.



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. Finally, click the tab of the TLC method you chose in the previous step and configure the settings for that method.

Using Vista

Open your meter in Vista and click on the **Energy & Dmd** tab. Click on the Loss Compensation object and configure TLC as required using the Loss Compensation screen. You can also enable/disable TLC and select your method on this screen.

Time of Use

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 require Time Of Use configuration.

See the *ION Reference* for more information on the Time of Use module.

Configuring Time of Use

Use ION software to change your meter's Time of Use settings.

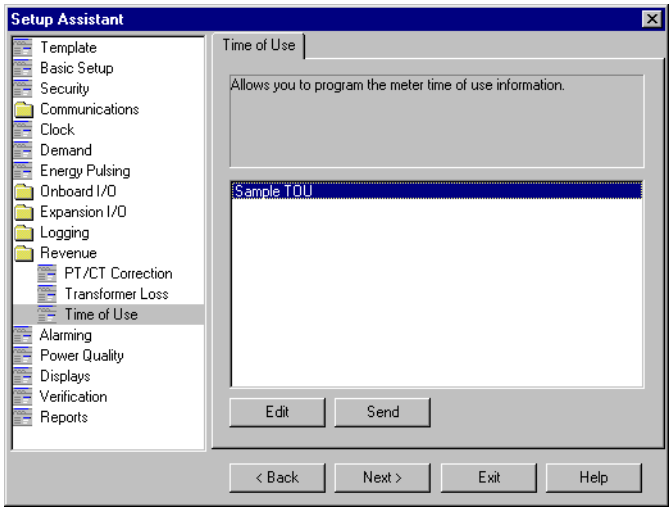
Using the front panel

You cannot configure Time of Use using the front panel.

Using ION Setup

The Time of Use Setup Assistant helps you configure the Time of Use module.

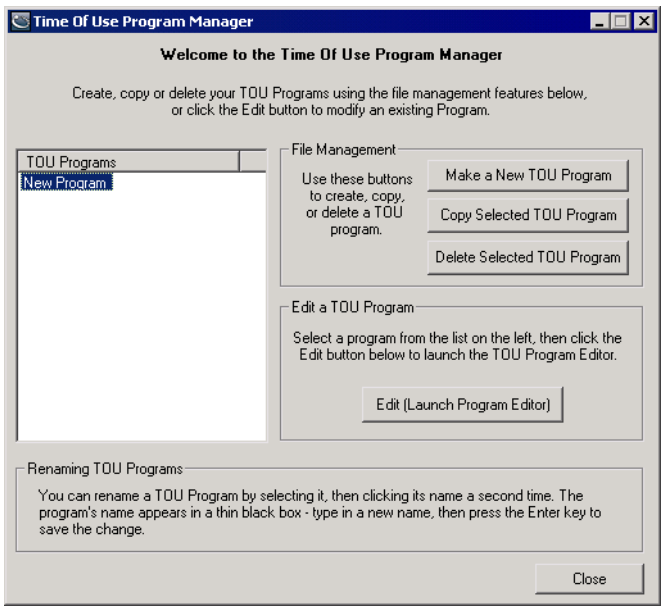
1. Open ION Setup and connect to your meter, using Basic Mode.
2. In the Setup Assistant, navigate to **Revenue > Time of Use**.



3. Select a Time of Use program from the list (in this example, Sample TOU) and click **Edit**.
4. Follow the Time of Use Wizard to configure your program. Click **Send** to save the TOU program on your meter.

Using Designer

Open your meter in Designer and select **Options > Edit TOU Programs**. Follow the steps in the wizard. For more information on using the wizard, see the *Power Monitoring Expert Online Help*.



Time Of Use Module Settings

The Time of Use module's setup registers define your seasons' start and end dates, the day types where your rates may differ, and the rate schedules for each season's day types. The module compares the meter's internal clock with the season, day, and time of day settings in these registers, and changes its output registers to reflect the current state of these settings.

Seasonal settings

The Time of Use module supports up to four separate seasons. Each season's start and end dates are set into the appropriate *Season* setup register.

NOTE: Ensure that there is no date overlapping when defining seasons and that every day of the year is covered by your seasons. If there are gaps between seasons, the module returns an error message and will not function.

If your rates do not change between seasons, you do not need to configure the *Season* setup registers — Season 1 is the default, and all Season 1 rates are in effect all year.

If you have different seasons, enter their start and end dates into the appropriate setup registers. If your season is active on the same dates every year, you only need to enter a single range of dates in the appropriate *Season* setup register. If the active dates are different each year (for example, Season 3 becomes active every first Monday in August), the start dates must be individually specified for each year.

The Time of Use module is partially configured at the factory. Check the setup registers to ensure that the settings match your Time of Use schedules.

Setup Register	Function
Season 1- 4	These setup registers define the dates for each active season. When a season is active, the Time of Use module will use the applicable rate schedules.
Season 1 - 4 Weekday Rates	These setup registers specify seasonal weekday rates.
Season 1 - 4 Weekend Rates	These setup registers specify seasonal weekend rates.
Season 1 - 4 Alt 1 Rates	These setup registers specify a season's daily rates during the days specified in the Alt 1 Days setup register.

Setup Register	Function
Season 1 - 4 Alt 2 Rates	These setup registers specify a season's daily rates during the days specified in the Alt 2 Days setup register.
Season 1 - 4 Holiday Rates	These setup registers specify a season's daily rates during the days specified in the Holidays setup register.
Weekdays	This register defines the days of the week for all seasons. The rates in the Season (1, 2, 3, or 4) Weekday Rates setup registers are used on these days.
Weekends	This register defines the weekend days for all seasons. The rates in the Season (1, 2, 3, or 4) Weekend Rates setup registers are used on these days.
Alt 1 Days	This register defines a set of alternative dates for all seasons. These dates generally have different rates from weekdays, weekends, or holidays.
Alt 2 Days	This register is similar in function to Alt 1 Days, but contains a different set of dates.
Holidays	This register defines the holidays for all seasons. The rates defined in the Season (1, 2, 3, or 4) Holiday Rates setup registers are used on these days.
Self Read Days	This setup register defines the dates and times that the Self Read output register will pulse. If no time is entered in this register, the Self Read output register will pulse on the date specified at 12:00 AM.

Displaying Time of Use

View Time of Use values in the following locations:

Application	Menu	Navigation
Front Panel	TOU, TOU Egy, TOU Dmd1 and TOU Dmd2 screens	Press the applicable softkey
ION Setup	N/A	N/A
Vista	Time of Use Screen	Energy & Dmd > Time of Use object
WebMeter	N/A	N/A

Chapter 14 Power Quality

This chapter explains how to configure your meter's power quality functionality.

NOTE: For complete power quality functionality, ensure your meter has the PQ version of the meter template installed (for example, 7650_FAC-**PQ**_V4.1.5.0.0).

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Introduction

Power quality configuration is provided by a number of modules and frameworks, depending on your meter type and ordering options:

- the Sag/Swell module (all meters)
- the Transient module (ION7650 only)
- EN50160 frameworks (ION7650 with EN50160 ordering option only), including the Mains Signalling Evaluation modules
- IEC 61000-4-30 (“4-30”) frameworks, which include the Power Quality Aggregator and Disturbance Analyzer modules (ION7650 only)
- the Disturbance Direction Detection module (all meters)
- the COMTRADE module (all meters)

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

Sag/Swell and Transient Modules

The sections below describe the default settings for the Sag/Swell and Transient modules, and give basic configuration instructions.

Sag/Swell module settings

The Sag/Swell module monitors voltage waveforms for sags and swells (i.e. INCITS (CBEMA) Type 2 and Type 3 disturbances); it then reports each disturbance’s magnitude and duration. The Sag/Swell module can also detect sub-disturbances during a Sag/Swell event. Settings are as follows:

Setup Register	Function	Default
Swell Lim	This is the magnitude above which a voltage deviation is considered a swell.	110
Sag Lim	This is the magnitude below which a voltage deviation is considered a sag.	90
Change Crit	This is the amount a voltage signal must change during a disturbance to be considered a new sub-disturbance.	10
Nom Volts	This is the nominal power system voltage (used for all Power Quality functions).	0 [1]
Hysteresis	This is the difference in magnitude between the start and end thresholds for a sag or swell	2
Learn Install Mode[2]	This determines the installation mode for learned values after learning is complete: MANUAL or AUTOMATIC	MANUAL
Learn Duration[2]	This specifies the learning duration in days (1 to 365).	30
EvPriority	The priority assigned to Sag/Swell and Transient module events (0 to 255, 255 is highest).	200
Use Vll Always	Determines if the module always evaluates the line-to-line voltage, even if there are line-to-neutral voltages available.	No
Enable RVC	Determines if the Rapid Voltage Change feature is enabled, and the module detects both sag swell and RVC events.	No
RVC Threshold	This specifies the limits the RMS voltage must exceed from the mean of the previous 100/120 half cycles for the *RVC Steady State* register to change to FALSE.	5.0
RVC Hysteresis	This is the difference in magnitude between the start and end thresholds for an RVC event.	2.5

[1] The primary power system voltage is sometimes different than the PT Primary setup register value (i.e. when the PT Primary is used to indicate winding ratio rather than primary voltage).

[2] For more information on these registers, see “Setpoint Learning” on page 197 and refer to the Sag/Swell module description in the *ION Reference*.

Swell limit

This value must be expressed as a percentage of the nominal voltage (entered in the NOMINAL VOLTAGE register, below). Setting the SWELL LIMIT value changes the *Swell Lim* setup register in the factory-configured Sag/Swell module.

Sag limit

This value must be expressed as a percentage of the nominal voltage (entered in the NOMINAL VOLTAGE register, below). Setting the SAG LIMIT value changes the *Sag Lim* setup register in the factory-configured Sag/Swell module.

Change criteria

You do not need to change this value for normal operation. This value must be expressed as a percentage of the nominal voltage (entered in the NOMINAL VOLTAGE register, below).

For example, if your Nominal Voltage is 120 V and your Change Criteria is 10%, any voltage change of 12 V or more during a disturbance causes a new sub-disturbance to be recorded. Setting the CHANGE CRITERIA value changes the *ChangeCrit* setup register in the factory-configured Sag/Swell module.

Nominal voltage (Nom Volts)

By default, this value is set to 0 V. All Sag/Swell functions are disabled when the nominal voltage setting is 0 (zero). Ensure that this item matches your power system's nominal voltage (i.e. 120, 277, or 347). Setting the NOMINAL VOLTAGE value changes the *Nom Volts* setup register in the factory-configured Sag/Swell module.

NOTE: For the ION7650 only, the value you enter is also used by the Transient module and in all EN50160 and 4-30 compliance calculations (if applicable). All power quality functions are disabled when the NOMINAL VOLTAGE setting is 0 (zero).

Event priority (EvPriority)

You do not need to change this value for normal operation. Setting the EVENT PRIORITY value changes the *EvPriority* setup register in the factory-configured Sag/Swell module.

Besides *NomVolts*, the only setup registers that you may need to change in the Sag/Swell module are *Swell Lim* and *Sag Lim*. Most applications are served by the default values entered into these registers. The *Change Crit* and *EvPriority* setup registers do not need to be changed for normal operation.

Transient Module Settings (ION7650 only)

The Transient module monitors voltage waveforms for transient activity (i.e., ITI CBEMA Type 1 disturbances). The *Threshold* setup register defines what voltage disturbance magnitude should be considered as transient activity. *Threshold* is interpreted as a percentage of the nominal system voltage, plus 100. For example, if you want transients recorded when voltage deviates from nominal by 20%, enter 120 into the *Threshold* setup register.

Setup Register	Function	Default
Threshold	This is the magnitude at which a voltage deviation is considered a transient.	125
EvPriority	The priority assigned to Sag/Swell and Transient module events (0 to 255, 255 is highest).	200
Learn Install Mode[1]	This determines the installation mode for learned values after learning is complete: MANUAL or AUTOMATIC	MANUAL
Learn Duration[1]	This specifies the learning duration in minutes (1 to 365).	30

[1] For more information on these registers, see “Setpoint Learning” on page 197 and refer to the Transient module description in the *ION Reference*.

NOTE: You must set the Nominal Voltage register in the Sag/Swell module to monitor transients.

Configuring Sag/Swell and Transient Modules

Use the front panel or ION software to change some of your meter’s power quality settings. You can only configure certain Sag/Swell module settings via the front panel, though the nominal voltage setting is read by other modules, such as the Transient module.

Using the front panel

The PQ Setup screen contains the following settings for the detection of voltage sags and swells. To configure other sag/swell parameters, use ION Setup.

Menu	Setting	Description	Range (Values)	Default
PQ SETUP	SWELL LIMIT[1]	Specifies the magnitude above which a power system input must rise for a swell to be recorded	100 to 1000	110
	SAG LIMIT[1]	Specifies the magnitude below which a power system input must fall for a sag to be recorded	0 to 100	90
	CHANGE CRITERIA	Specifies the amount by which an input must change during a disturbance to be considered a new sub-disturbance	0 to 100	10
	NOMINAL VOLTAGE	Specifies the nominal voltage of the power system for power quality features	0 to 1,000,000	0
	EVENT PRIORITY	Assigns a priority level to sag/swell events	0 to 255 (255 is highest priority)	200

[1] If you have configured your meter to learn the values for the *Swell Lim* and the *Sag Lim* registers, these values are affected by that learning process.

Using ION Setup

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Power Quality > Sag/Swell.**
4. Set all sag/swell parameters, limits and waveform recorder settings:

- Nominal voltage
- Swell limit %
- Sag limit %
- Hysteresis %
- Sag/Swell depth
- Waveform depth
- Waveform format
- Post Event Cycles

5. Click on the **Transient** tab to set the voltage deviation threshold and configure transient waveform recorder settings:
   - Threshold
   - Waveform depth
   - Waveform format
   - Post Event Cycles

Using Designer

Open your meter in Designer and navigate to the Power Quality Setup Framework. Right-click a module to edit.

Configuring COMTRADE using ION Setup

Use ION Setup to configure your meter's COMTRADE settings.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Power Quality > COMTRADE.**
4. To generate COMTRADE files when a sag/swell or transient occurs, set *COMTRADE Sag/Swell* or *COMTRADE Transient* to ENABLED, then click **OK**.
5. Click **Save**, then select and specify how many records are uploaded to the meter's ftp server:
   - All records,
   - A specific number of records, hours or days from the present time, or
   - A specific time range (for parameters, you can specify cumulative, instantaneous only, or a mix of both).
6. Click **OK**.

NOTE: If you want to modify the Waveform Recorders' setup registers, the COMTRADE modules must first be DISABLED. Refer to the *COMTRADE and ION Technology* technical note for more information about COMTRADE format waveform records.

Configuring Advanced PQ using ION Setup

Use ION Setup to configure your meter's power quality (PQ) monitoring and logging settings for EN 50160 and Rapid Voltage Change (RVC).

1. Start ION Setup.

2. Open the Setup Assistant for your meter.
3. Navigate to **Power Quality > Advanced PQ.**
4. Set *EN52160 Enable* to ON to enable the meter's EN50160 feature, or OFF to disable it and clear the logs.
5. To activate the rapid voltage change (RVC) feature for the Sag/Swell module, set *RVC Enable* to YES, then in the next screen select ENABLED and set the *Threshold* and *Hysteresis* for RVC. Click **Send**. See *ION Reference* for more information on RVC.

Learning in the Sag/Swell and Transient Modules

You can set up the Sag/Swell and Transient modules to learn what constitutes a sag, a swell or a transient in your system. For more information on learning in the Sag/Swell and Transient modules, see "Setpoint Learning" on page 197.

Power quality standards compliance

The ION7650 has additional frameworks and settings related to the power quality standards below.

EN50160 settings (ION7650 with EN50160 only)

The EN50160 framework is composed of numerous ION module types including: Mains Signaling Evaluation, Harmonics Evaluation, Voltage Harmonics, Flicker, and more.

NOTE: The ION7650 meter's control power should be supplied with a UPS (Uninterruptible Power Supply) in order to ensure proper operation of the EN50160 framework during power outage situations. Failure to follow this guideline may result in missing data for the EN50160 report.

See "EN50160 compliance logging (ION7650 with EN50160 ordering option only)" on page 154 for information on EN50160 parameter logging.

See the *Power Quality: ION Meters and EN50160* technical note for details.

4-30 settings (ION7650 only)

IEC 61000-4-30 power quality standard compliance is provided by a variety of ION modules including: Power Quality Aggregator, Harmonics Measurement, Disturbance Analyzer, Symmetrical Components, Mains Signaling Evaluation, Sag/Swell and more.

See the *IEC 61000-4-30 Compliance and ION Meters* technical note for details.

COMTRADE settings

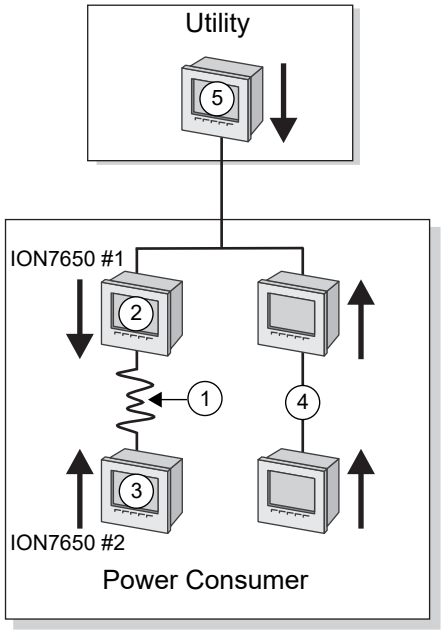
The meter can provide waveforms in COMmon format for TRAnsient Data Exchange (COMTRADE) format. COMTRADE records are created from the existing Waveform Recorder modules, which are connected to the COMTRADE module.

See the *COMTRADE and ION Technology* technical note for details.

Disturbance Direction Detection

Both the ION7550 and the ION7650 have disturbance direction detection capabilities to enable you to determine the location of a disturbance more quickly and accurately. When a disturbance occurs, it triggers the Disturbance Direction Detection module. The module analyzes the disturbance information to determine the direction of the disturbance relative to the meter. The results of this analysis are provided in the event log, along with a timestamp and confidence level indicating the meter's level of certainty that the disturbance is in the determined direction.

The example below illustrates how Disturbance Direction Detection can help locate the source of a disturbance when used in a system of devices with this capability. The arrows show the direction the meters have determined for the disturbance. In this example, ION7650 #1 indicates that the disturbance is downstream from it while ION7650 #2 indicates that it is upstream from it. The meter at the utility indicates that the disturbance is downstream from it. With this information, you can determine that the disturbance occurred between ION7650 #1 and ION7650 #2, and can focus on that section of your system to find the cause of the disturbance.



1. The location of the disturbance
2. ION7650 #1 reports that the disturbance is downstream from it
3. ION7650 #2 reports that the disturbance is upstream from it
4. Meters on this branch report that the disturbance is upstream from them
5. Meter at the utility reports that the disturbance is downstream from it

For more information on the Disturbance Direction Detection module, see the *ION Reference*.

Disturbance Direction Detection Module Settings

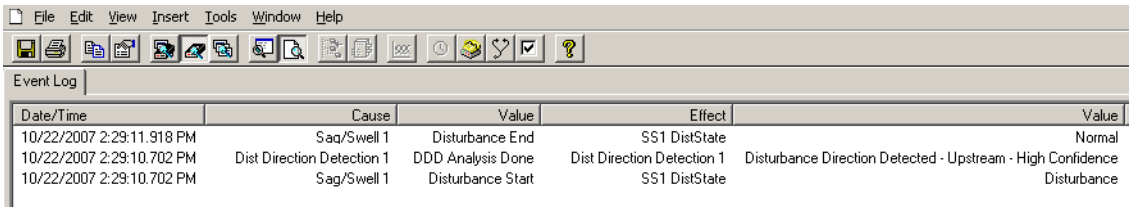
The Disturbance Direction Detection module does not need to be configured in order to function. However, you can customize the priority level given to events generated by this module.

Setup Register	Function	Default
EvPriority	The priority assigned to Disturbance Direction Detection module events (0 to 255, 255 is highest).	127

NOTE: You must set the Nominal Voltage register in the Sag/Swell module for the Disturbance Direction Detection module to function.

Viewing disturbance direction detection events

The results of the disturbance direction detection algorithm appear in the meter's event log. The image below shows how the Disturbance Direction Detection event appears in the Event Log.



Configuring disturbance direction detection

Use ION software to change the module's settings.

Using the front panel

You cannot change Disturbance Direction Detection module settings using the front panel.

Using ION Setup

1. Open ION Setup and connect to your meter in Advanced Mode.
2. Navigate to the Disturbance Direction Detection folder. Double-click the module icon in the right pane to access the configuration dialog.

NOTE: The Disturbance Direction Detection module is enabled by default. You can control the ON/OFF behavior of the Disturbance Direction Detection module by linking its *Enable* input to the Boolean output of a controlling ION module. If this is left unlinked, the module is enabled.

3. Select the Setup Registers tab to edit the EvPriority register and create custom event priority levels for the Disturbance Direction Detection events, if required.
4. Click **Send** to save the changes to your meter.

Using Power Monitoring Expert

1. Open your meter in Designer and navigate to the Disturbance Direction Detection module.
2. Configure the module as required.
3. Select **File > Send & Save** to save the changes to your meter.

Chapter 15 Test Mode

This chapter describes your meter's Test Mode and explains how to switch from Normal Mode to Test Mode.

In this chapter

Introduction 180
Switching to Test Mode 180
- Revenue Meters and Test Mode 181
- Test Mode Default Display Screens 181
- Test Mode Energy Pulsing 182

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.

Switching to Test Mode

Place the meter into Test Mode using Vista or ION Setup. The meter's front panel informs you when the meter is in Test Mode with a special Test Mode display screen.

Using the front panel

You cannot enter Test Mode using the front panel.

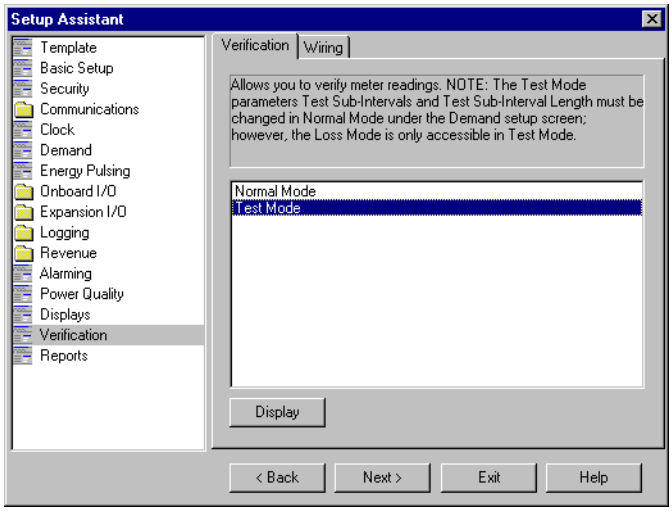
Using Vista

1. Open the meter in Vista.
2. Navigate to Setup/Diagnostic > General and click the Normal/Test Mode Switch control object.
3. You are prompted for the Power Monitoring Expert user password. If meter security is enabled, you are also prompted for the meter password.

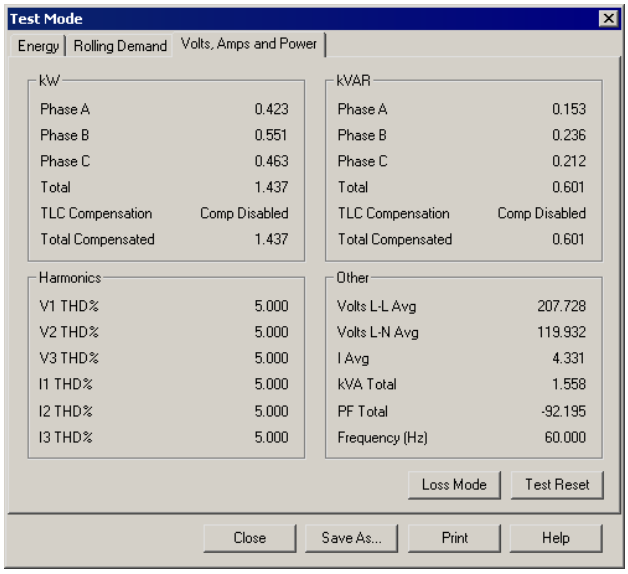
To view the registers that accumulate real-time data, navigate to Energy & Dmd, and click the Test Mode Values control object. For more information, see the Vista section of the online *Power Monitoring Expert Help*.

Using ION Setup

1. Open ION Setup and connect to your meter, using Basic Mode.
2. In the Setup Assistant, navigate to the Verification folder and select the **Verification** tab.



3. Select Test Mode 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.



Click on the tabs to perform various test-related tasks. See the ION Setup online help for more information.

5. Click **Close**. A dialog box informs you the meter is back in Normal Mode.

Revenue Meters and Test Mode

Revenue meters must be in Test Mode before they can be configured. To put a revenue meter into Test Mode, you must unlock the meter first. For instructions on locking and unlocking your meter, see the *Revenue Meter* product option document for this meter.

Test Mode Default Display Screens

Recall that the values shown in the Test Mode display screens represent different accumulators than those shown in normal 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.

Test Mode Energy Pulsing

One digital output (DO4) is factory-configured to pulse while the meter is in Test Mode. The energy pulsing digital output provides an interface for calibration checking instruments.

Chapter 16 Meter Resets

This chapter provides instructions for performing various meter resets.

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Performing a Reset 184
- Using the Front Panel 184
- Using ION Setup 185
- Using Vista 186

Performing a Reset

Resets allow you to clear various accumulated parameters stored by the meter.

NOTE: Be sure to record any important data before performing a meter reset. Refer to the reset descriptions for affected data.

Using the Front Panel

Use the Meter Resets setup menu to perform all available resets. You must enter a valid meter password before executing any meter resets.

Factory resets menu

The Factory Resets sub-menu contains the following default resets:

Peak Dmd Rset

The Peak Demand Reset clears the peak demand values logged in the meter. When the meter is in test mode, the Demand Reset object clears the Revenue Test Mode demand parameters. See the Test Mode chapter for more information.

NOTE: The setup register labeled *Demand Lockout Timeout* (in the 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, see “Display Setup Menu” on page 41. For more details on the Display Options module, see the *ION Reference*.

MnMx Rset

The Minimum/Maximum Reset clears all accumulated minimum and maximum values stored in the meter.

Harm MnMx Rset

The Harmonics Minimum/Maximum Reset clears all accumulated minimum and maximum harmonics values stored in the meter.

Master Reset

The Master Reset control clears all the cumulative and derived quantities from the meter (including demand, peak demand, energy, revenue, and test mode parameters), clears the meter’s event and waveform logs, clears COMTRADE waveform records from the meter’s internal FTP server, and resets the meter’s Data Recorder modules. A display screen appears, indicating the reset is in progress. Another screen informs you when the reset is complete.

DI Count Reset

The DI Count Reset clears the Digital Input Status Change counter. By default, the number of status changes of each digital input is shown in the *D Inputs* front panel display as well as in the Vista Digital Inputs/Outputs diagram.

User Resets menu

The User Resets sub-menu contains secondary and user-configurable controls:

Dist Count Rset

The meter contains a voltage disturbance display in its Power Quality Vista diagram, which counts the number of sag/swell events that have occurred since power-up or last reset. The Disturbance Count Reset clears this counter.

Man Wfm Trg

The Manual Waveform Trigger forces the meter to perform a waveform capture. Waveform data is accessible in the Vista Power Quality diagram.

EN50160 Reset (ION7650 with EN50160 ordering option only)

This item resets all EN50160 parameters and statistics accumulated in the meter. See the *Power Quality: ION Meters and EN50160* technical note for more information about EN50160.

Rst Avlty Stats

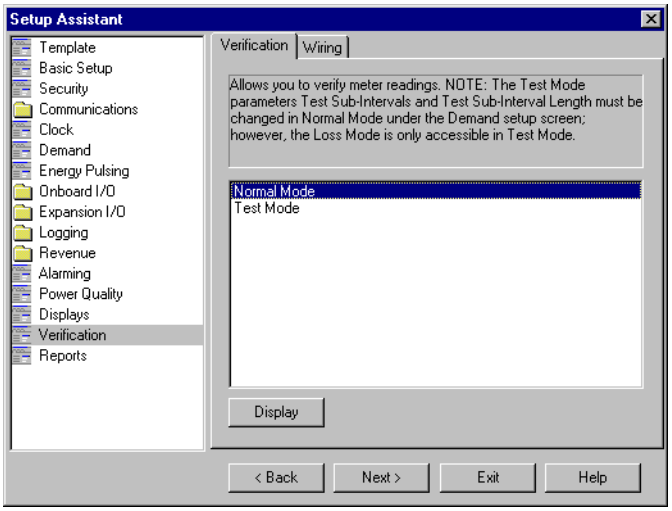
This item is not available on the current shipping framework.

Custom Trigger

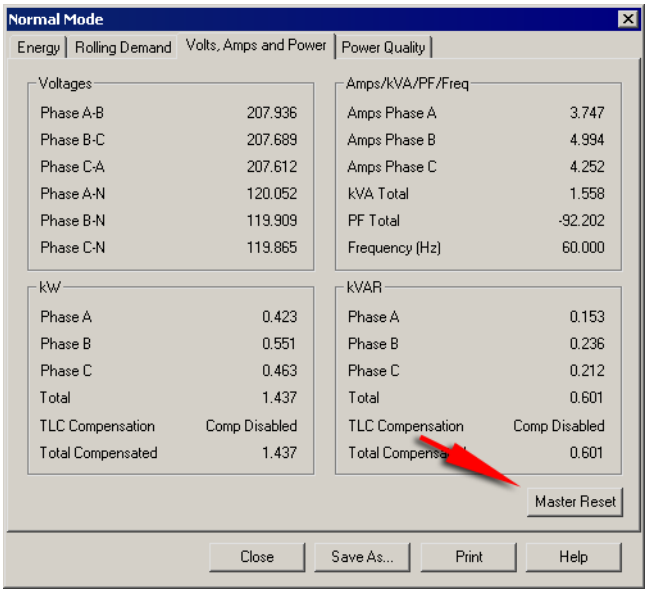
Program this reset with Designer. See “Creating a Front Panel Reset” on page 45 for more details.

Using ION Setup

1. Open ION Setup and connect to your meter, using Basic Mode.
2. In the Setup Assistant, navigate to the Verification folder.
3. Select Normal Mode and click **Display**.



4. Click on various tabs in the Normal Mode dialog box. Two resets are available: Peak Reset and Master Reset. Click the appropriate button to perform the reset (Master Reset in the example below).



A dialog box informs you when the reset is complete.

Using Vista

Open your meter in Vista. You can perform several resets from within Vista:

Performing a Peak Demand reset or Master reset

1. Navigate to **Energy & Dmd > Demand Max**.
2. Click the Peak Demand Reset control object to perform the reset.

Performing a Min/Max reset

1. Navigate to **Volts/Amps > Long-term min/max**.
2. Click the Reset Min/Max control object to perform the reset.

Performing a Harmonics Min/Max Reset

1. Navigate to **Power Quality > Harmonics Details**.
2. Click the Reset Min/Max control object to perform the reset.

Performing a Voltage Disturbance Counter Reset

1. Navigate to **Power Quality**.
2. Click the Reset control object to perform the reset.

Chapter 17 Alerting

Meter alerts can send an email or contact a modem, fax, pager, or software in the event of a user-specified condition. These conditions can be changes in relays or power quality events including surges, sags, swells and outages.

This chapter explains how to configure your meter network for alerting.

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- Alerting ION Software via the Alarm Server 188
- Alerting via an Alphanumeric Pager 189
- Alerting via a Numeric Pager 190
- Alerting via Email 190

Introduction

The meter's Alert module sends an alert whenever its *Trigger* input is pulsed. You can connect this input to any module that produces a pulse output. You can use modules that monitor alarm conditions such as changes in relay status and power quality events. For example, you can connect the *Trigger* input to the output of a Setpoint module, thereby allowing the Alert module to send an alert when the setpoint condition is reached.

The Alert module delivers these types of alerts:

- Numeric Pager
- Alphanumeric Pager
- PEGASYS (for alerts to PEGASYS software)
- ION Alert (for alerts to Power Monitoring Expert software)
- ASCII
- Email

Selection between modes is made with the Alert module *Alert Type* setup register.

The Alert module requires access to either a modem (a dedicated modem or a modem handling a loop of meters) or Ethernet (for the Alert module email capabilities).

Your meter has no pre-configured Alert framework. For detailed information about alerting, including how to build a framework to send alerts, refer to the *ION Meter Alerts* technical note and the Alert module description in the *ION Reference.*

NOTE: For information on configuring alerting using the Alert Monitor Service, refer to the Power Monitoring Expert online help.

Configuring the Meter for Alerting

Use ION software to change your meter's alert settings.

Using the Front Panel

You cannot configure Alerting from the front panel.

Using ION Setup

1. Connect to your meter in ION Setup, using Advanced Mode.
2. Click on an Alert module to edit.

Using Designer

1. Create a new Alert module by dragging one from the Toolbox.
2. Right-click on the module to configure.

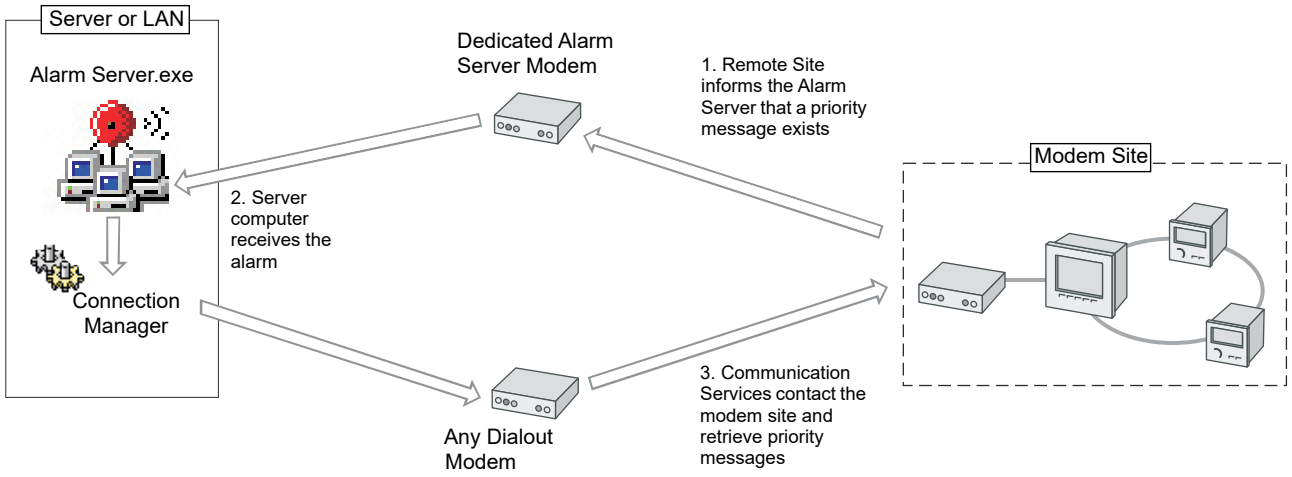
Alerting ION Software via the Alarm Server

NOTE: For detailed information about sending alerts to Power Monitoring Expert software via the Alarm Server, refer to the Power Monitoring Expert online help.

The Alarm Server can run on any ION software Primary or Secondary server. The server computer should have a dedicated phone line and modem. Modems at remote sites are programmed to dial the server's phone number when a priority event occurs. The Alarm Server monitors the phone line and waits for the remote sites to annunciate

events. The most common use of the Alarm Server is to handle Remote Site Event Notification.

Remote Site Event Notification



The Alarm Server uses a series of command line arguments to specify the actions it takes when a priority event is reported. These commands must be entered on the computer that is running the Alarm Server utility. Typically the Alarm Server is configured to launch the Connection Manager, which dials up the remote site and retrieves the logs from the devices. The Alarm Server can also be configured to launch other applications. A series of parameter switches are added to the command line to pass information about the event to the application that is launched.

Alerting via an Alphanumeric Pager

NOTE: For detailed information about building a framework for alerting via an alphanumeric pager, refer to the Alert module description in the *ION Reference.*

If an alphanumeric pager is specified as the destination address in the Alert module, then an alphanumeric paging service receives a message from the ION meter.

Once the modem at the paging service is contacted, the ION meter transmits the following information:

- Pager identification number
- Local time (year, month, date, hours, minutes, seconds)
- Remote site identification
- Priority of the alarm
- Alert message, with text strings and realtime measured values

To include a module's *Source* input in the message, reference the message string by using the form %Vn, where n is the *Source* input number. In the following *Message* register setting, the kWtot value is %V1. The string includes *Source* input 1 which would be the *kWtot* register from the Power Meter module.

The destination register contains your modem access number for the paging service provider and is what is dialed out first. The *Pager Num* register is the pager access number that is provided by your paging company.

Alerting via a Numeric Pager

NOTE: For detailed information about building a framework for alerting via a numeric pager, refer to the Alert module description in the *ION Reference.*

If a numeric pager is specified as the destination address in the Alert module, then a numeric paging service receives a message from the ION meter. Due to the inherent limitations in numeric paging, the ION meter can only send a string of digits to the paging service. The Alert module then waits a specified time, determined by the number of commas inserted after the phone number in the *Pager Num* setup register. Finally, the Alert module dials the message digital string.

There are two important factors to consider when setting up the Alert module for numeric paging. First, be sure to specify a string of digits that is meaningful to you, such as a coded message. Second, be aware that there is no way to ensure that a message has been successfully transmitted. Instead, there may be a busy signal or an answering machine may take the call. The number of commas you add to your dial string is an estimate of how long the modem at the remote site waits before it transmits numbers.

NOTE: In the following destination-setting example: 1-250-123-4567,,,,,999#, the pager number is 1-250-123-4567 and the message string that displays on the pager is 999. You may need to insert 9,,, before the destination number if the line you are using is not a direct line. In this case the destination number is 9,,1-250-123-4567,,999#

Alerting via Email

NOTE: For detailed information about setting up your network and building a framework for meter email alerts, refer to the technical note *MeterM@il Internal Email Client Feature.*

If email is specified as the destination address in the Alert module then an email message is sent to any address you specify. You can only set one email address per Alert module. If you want to send an alert to more than one email address you need to create a group — be sure your email server is configured to send email to groups via SMTP (Simple Message Transport Protocol).

Configuring Alerting using Designer

Follow the steps below to send email alerts from your meter. Note that your meter must support emailing (with a correctly configured SMTP server):

1. Connect to your meter in Designer.
2. Create an Alert module.
3. Configure these Alert module setup registers as indicated:
   - *Message* – type in the text of the alert to be emailed.
   - *Destination* – type in the destination email address.
   - *Type* – select Email.
   - *Com Port* – select Ethernet.
   - *Location* – type in a custom string; this is optional, and appears in the email.
   - *Email From* – type in an address that you want the email to appear from. This may be required as some SMTP servers only accept emails from valid addresses.

4. Create an ION module that will produce a pulse on its *Trigger* output when the exceptional event occurs (for example, a Setpoint module pulses its *Trigger* output when the setpoint condition is reached).
5. Link the Alert module's *Trigger* input to the *Trigger* output of the module created in step 3.
6. Select **File > Send & Save**. When the *Trigger* input is pulsed, the Alert module establishes communications with the SMTP mail server, and emails the alert message.

Chapter 18 Setpoints

This chapter provides instructions for configuring meter setpoints.

In this chapter

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Relative Setpoint Module 194
Configuring Relative Setpoints 194
Setpoint Module 195
Configuring Setpoint modules 195
Setpoint Learning 197
Learned Values 197
Learning Installation Mode and Learning Duration 197
Configuring Setpoint Learning 201

Introduction

ION Setpoint and Relative Setpoint modules provide extensive non-critical control, secondary protection, and analysis capabilities by allowing you to initiate an action in response to a specific condition.

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

Relative Setpoint Module

The Relative Setpoint module is useful for performing actions based on differences between a value (e.g. volts on phase A) relative to a reference value (e.g. nominal voltage). Use this module's outputs for demand control of equipment or any other applications requiring setpoint activity relative to a parameter.

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).

Configuring Relative Setpoints

Use ION software to change your meter's relative setpoints.

NOTE: There is usually no need to change any of the Relative Setpoint modules' setup registers for normal operation of the meter.

Using the front panel

You cannot configure setpoints using the front panel.

Using ION Setup

1. Open ION Setup and connect to your meter in Advanced Mode.
2. Navigate to the Relative Setpoint folder and, in the right-hand pane, double-click on the module you want to configure. The configuration dialog appears.
3. Select the register you want to configure and click **Edit**.
4. When you are finished configuring the inputs and setup registers as required, click **Send** to save the changes to your meter.

Using Power Monitoring Expert

1. Open your meter in Designer and navigate to the Relative Setpoint module you want to configure.
2. Configure the inputs and setup registers as required.
3. When you are finished, select **File > Send & Save** to save the changes to your meter.

Setpoint Module

The Setpoint module monitors a numeric or Boolean input for a specified over or under condition. When that condition is met, the *Status* output changes to ON and a pulse is generated. Use this module's outputs for demand control of equipment, power quality monitoring, activating alarms or other applications requiring setpoint activity dependent on a fixed condition.

Setup Register	Function	Default
High Limit	This determines the limit the source input must exceed to set the status to ON when the *EvalMode* is GREATERTHAN or to OFF when the *EvalMode* is LESSTHAN	0
Low Limit	This determines the limit the source input must fall below to set the status to ON when the *EvalMode* is LESSTHAN or to OFF when the *EvalMode* is GREATERTHAN	0
SusUntlON	This determines how long the module waits before reporting an over or under condition	0.000
SusUntlOFF	This determines how long a normal value must be present before the status is set to OFF	0.000
Input Mode	This determines how the source input is interpreted, as an absolute value or signed value	SIGNED
EvalMode	This determines how the source input is evaluated (GREATERTHAN or LESSTHAN)	GREATERTHAN
EvPriority	This determines the priority level given to Setpoint events	128
Learn Install Mode	This determines the installation of learned values when learning is complete: MANUAL or AUTOMATIC	Varies by module
Learn Duration	This specifies the learning duration in days (1 to 365).	30

See the *ION Reference* for more information on the Setpoint module. See "Setpoint Learning" on page 197 for more information on setting this module to learn the values for the *High Limit*, *Low Limit*, *SusUntlOn* and *SusUntlOFF* registers.

Fine tuning setpoint monitoring

If you want to fine-tune setpoint monitoring, the setup registers you should change are *SusUntlON* and *SusUntlOFF*.

SusUntlON determines how long the modules wait after a high or low limit is detected before reporting it. This gives the monitored value a short period to correct itself before the event is registered with the module. 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).

Configuring Setpoint modules

Use ION software to configure Setpoint modules.

Using the front panel

You cannot use the front panel to configure Setpoint modules.

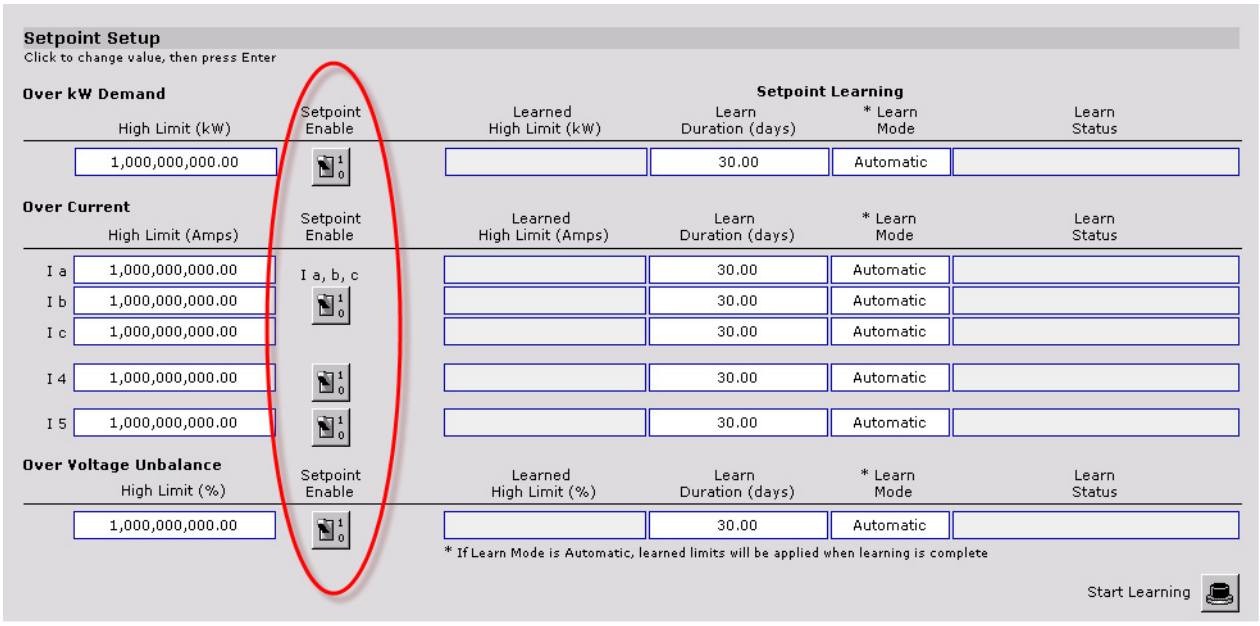
Using ION Setup

1. Open ION Setup and connect to your meter in Advanced Mode.
2. Navigate to the Setpoint folder and, in the right-hand pane, double-click on the module you want to configure. The configuration dialog appears.

3. Select the register you want to configure and click **Edit**.
4. When you are finished configuring the inputs and setup registers as required, click **Send** to save the changes to your meter.

Using Power Monitoring Expert

1. Open your meter in Vista and click on the Setpoints tab.
2. Click the Setup object. Use the switches to turn various monitoring functions on and off (see circled area in the following image). Click the numeric boxes to edit condition settings.



To create new Setpoint modules and perform more advanced configuration, use the Designer component of Power Monitoring Expert.

Setpoint Learning

Your meter can detect disturbances or values that are outside of a set acceptable range. If you do not know what that acceptable range is or what threshold constitutes a disturbance, your meter can learn these values. Both the ION7550 and the ION7650 can monitor normal operating parameters and learn what constitutes a sag, swell, transient or high and low setpoints.

NOTE: To learn accurate values, it is important that learning occur during a period of normal operation. Do not schedule learning during a period of unusual operations in your system. As well, any changes to the setup of the affected modules while learning is in progress stops the learning process.

Learned Values

The table below lists the modules for which learning is available and the registers for which values are learned for each module. For more information on these modules and their registers, see the *ION Reference*.

Module	Learned Setup Registers[1]
Setpoint Module	High Limit
	Low Limit
	SusUntlON
	SusUntlOFF
Sag/Swell Module	Swell Lim
	Sag Lim
Transient Module	Threshold

[1] These setup registers are overwritten by the learned values, either automatically if Learn Install Mode is set to AUTOMATIC or once you approve them if Learn Install Mode is set to MANUAL.

Occasionally, a module can learn a value that is invalid for a particular register if a setting on the meter is incorrect (usually the nominal voltage setting). For example, if the nominal voltage for a Sag/Swell module is set to 120 V but the true system nominal is actually 115 V, the module could learn a swell limit of 116 V, or 97 (97% of the set nominal). However, 97 is not a valid value for the *Swell Lim* register, since this must be 100 or over.

In Automatic installation mode, if a learned value is invalid the installation does not occur and invalid learned values are logged in the event log. In Manual installation mode, if a learned value is invalid you can adjust the invalid value and then install it.

Learning Installation Mode and Learning Duration

Depending on the learning mode you select, the module either learns values and places them in output registers for review or learns values and starts using the learned values automatically. The learning modes are:

- **Manual**: The module learns the applicable values but does not begin using the learned values. The learned values are placed in the learned output registers for review. You can then decide to use the learned values or adjust them, if needed, before installing the values manually.
- **Automatic**: The module learns the applicable values and begins using those learned values automatically once learning is complete.

You can also set the learning duration. The ranges and defaults for each module are listed in the table below.

	Learn Duration Range	Default
Sag/Swell Module	1 to 365 days	30 days
Setpoint Module		
Transient Module	1 to 300 minutes	30 minutes

Remaining Learning Time vs. Stable Learning Time

Each of these modules has two output registers that together indicate the learning status: *Remaining Learning Time* and *Stable Learning Time*. Learning is complete once the value of the *Remaining Learning Time* register is 0 (zero). This happens in one of two ways:

- The Learn Duration has elapsed so the *Remaining Learning Time* register has finished counting down to zero, or
- The *Stable Learning Time* equals 1/4 of the Learn Duration (in seconds), in which case the *Remaining Learning Time* drops to zero.

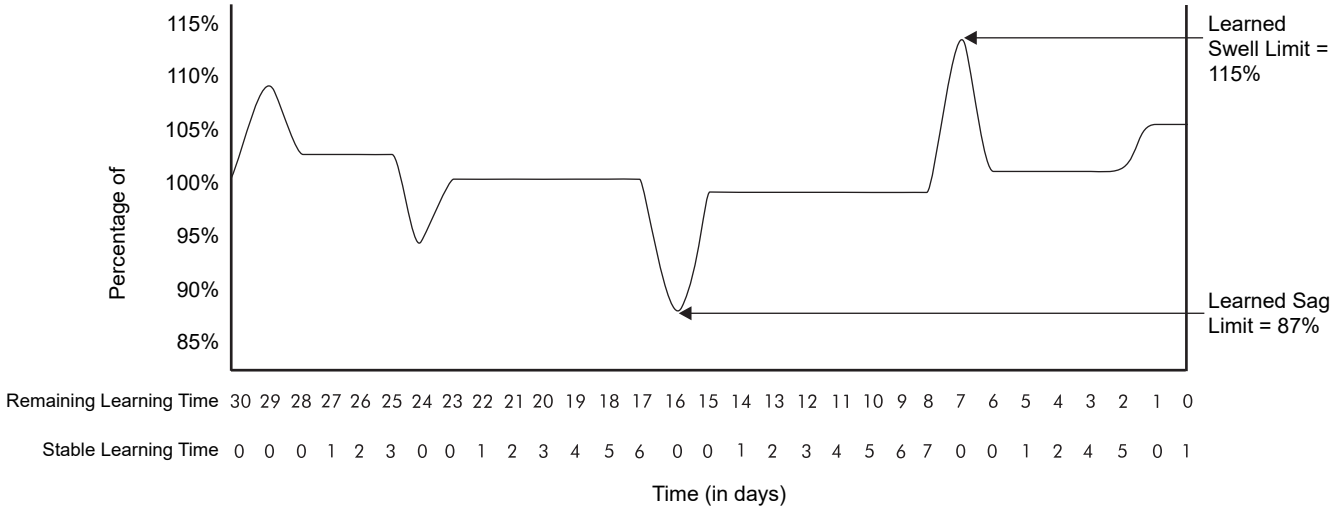
Learning is in progress if the *Remaining Learning Time* register is counting down or the *Stable Learning Time* is less than 1/4 of the learning duration.

The diagrams that follow illustrate how the Stable Learning Time and Remaining Learning Time interact, using the Sag/Swell module as an example. The Learn Duration for both diagrams in this example is 30 days.

In the first diagram, the full Learn Duration of 30 days elapses because the stable learning time never reaches 1/4 of the learn duration (7.5 days or 648000 seconds). In this case, the Remaining Learning Time continues to count down to zero and learning is complete after 30 days. The Sag/Swell module learns a *Swell Lim* of 115 and a *Sag Lim* of 87.

Learning occurs for the full Learn Duration

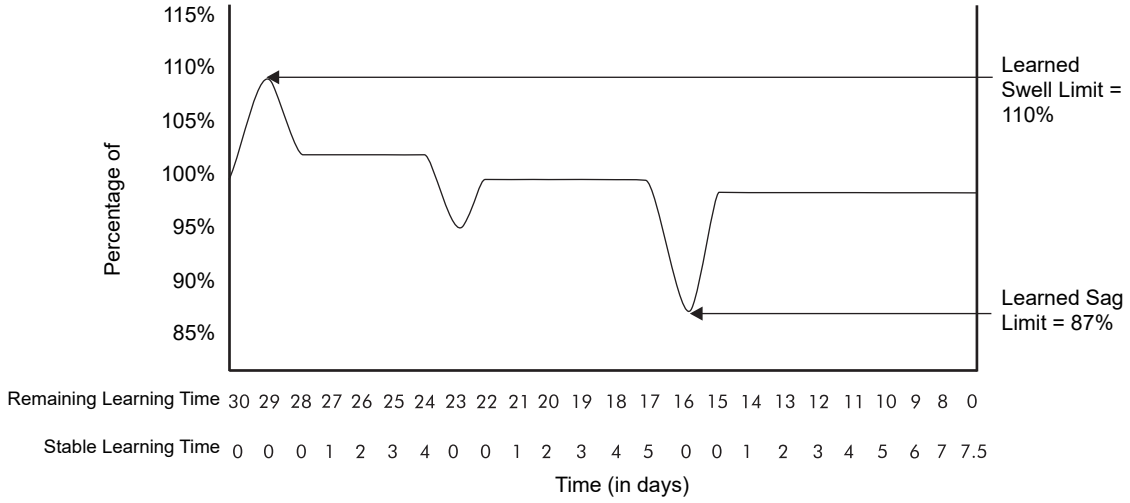
Learn Duration = 30 days



In the second diagram, the stable learning time reaches 1/4 of the 30 day Learn Duration (7.5 days or 648000 seconds). At that point the Remaining Learning Time drops from 8 days to zero days because learning is complete (even though the full 30 days has not elapsed). The module learns a *Swell Lim* of 110 and a *Sag Lim* of 87.

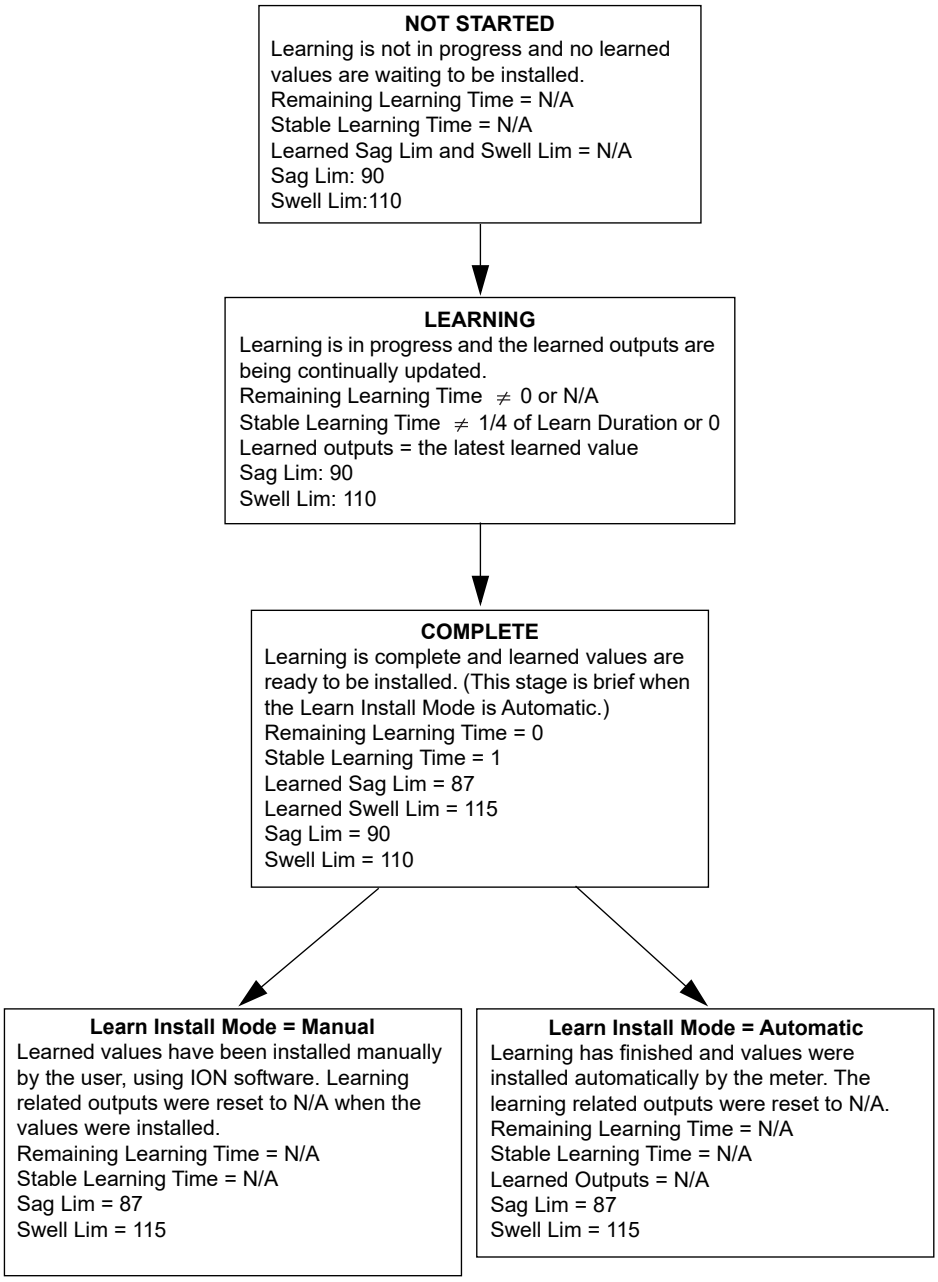
Learning occurs until the Stable Learning Time reaches 1/4 of the Learn Duration

Learn Duration = 30 days



Learning stages

The flow chart shows the different learning stages, and how the installation mode affects the output and setup registers (reflecting the values in the first of the diagrams on the previous page). It shows the values of the module's affected registers at each stage, where the values learned are a swell limit of 115% and a sag limit of 87%. In this example, the module had existing values: a sag limit of 90% and a swell limit of 110%.


NOT STARTED
Learning is not in progress and no learned values are waiting to be installed.
Remaining Learning Time = N/A
Stable Learning Time = N/A
Learned Sag Lim and Swell Lim = N/A
Sag Lim: 90
Swell Lim:110
LEARNING
Learning is in progress and the learned outputs are being continually updated.
Remaining Learning Time ≠ 0 or N/A
Stable Learning Time ≠ 1/4 of Learn Duration or 0
Learned outputs = the latest learned value
Sag Lim: 90
Swell Lim: 110
COMPLETE
Learning is complete and learned values are ready to be installed. (This stage is brief when the Learn Install Mode is Automatic.)
Remaining Learning Time = 0
Stable Learning Time = 1
Learned Sag Lim = 87
Learned Swell Lim = 115
Sag Lim = 90
Swell Lim = 110
Learn Install Mode = Manual
Learned values have been installed manually by the user, using ION software. Learning related outputs were reset to N/A when the values were installed.
Remaining Learning Time = N/A
Stable Learning Time = N/A
Sag Lim = 87
Swell Lim = 115
Learn Install Mode = Automatic
Learning has finished and values were installed automatically by the meter. The learning related outputs were reset to N/A.
Remaining Learning Time = N/A
Stable Learning Time = N/A
Learned Outputs = N/A
Sag Lim = 87
Swell Lim = 115

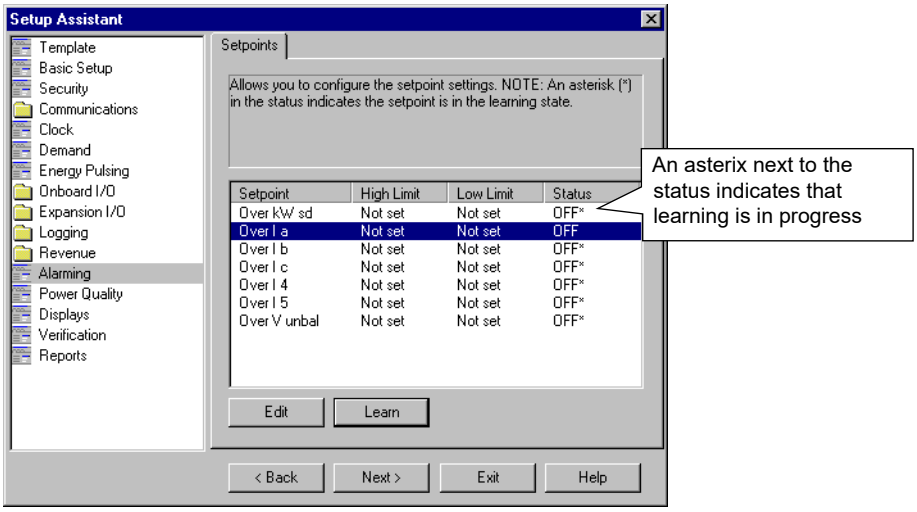
Configuring Setpoint Learning

Use ION software to configure learning.

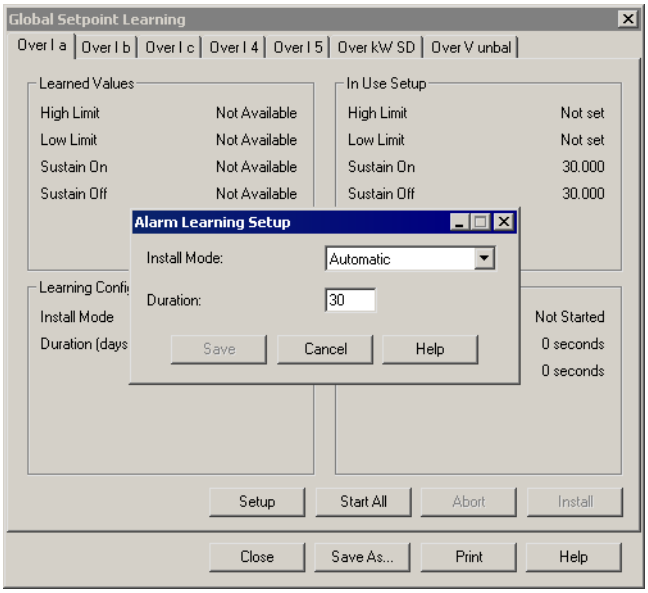
Configuring learning using ION Setup

Use ION Setup to configure learning in the following setpoint modules: Over kW sd, Over I a, Over I b, Over I c, Over V unbal, Over I 4 and Over I 5.

1. Open ION Setup and connect to your meter in Basic mode.
2. Select the **Alarming** screen.



3. Select any setpoint and click **Learn** to bring up the Global Setpoint Learning Assistant.
4. Select a tab and click **Setup**. The Alarm Learning Setup dialog appears.



   – Set the Learning Install Mode to Automatic or Manual (the default for these modules is automatic).
   – Set the Duration over which learning occurs, in days.

Repeat for each of the remaining tabs.

5. When you have set up the Install Mode and Learning Duration for each setpoint, click **Start All** to start learning for all of the setpoints.

Stopping learning

To stop learning for a specific setpoint, click **Abort**. This only stops learning for that setpoint. To stop learning for all the setpoints, repeat on each tab.

Installing learned values in Manual Install Mode

To install learned values for a specific setpoint in Manual Install Mode, click **Install**. This installs the values for that setpoint only. To install values for other setpoints, repeat on each tab.

NOTE: If you click Install while learning is in progress (for setpoints set to both Manual and Automatic install modes), it stops the learning process. A warning appears asking you if you want to stop learning and install the learned values. Click **Yes** to continue or **No** to return to the Global Setpoint Learning Assistant.

Configuring learning in other modules

Configuring learning in other Setpoint modules and in the Sag/Swell and Transient modules is an advanced procedure in ION Setup. To configure learning in these modules, use ION Setup in Advanced Mode or use Power Monitoring Expert (see below).

Configuring learning using Power Monitoring Expert

1. Open your meter in Vista.
2. Navigate to **Setpoints > Setup** (Setpoint modules) or **Power Quality > Setup** (Sag/Swell and Transient modules).
3. Set the Learning Install Mode to Automatic or Manual and set the Learn Duration.
4. Click the Start Learning object to begin learning (for the Setpoint modules, this starts learning for all the setpoints given onscreen).

Stopping learning

Use ION Setup to stop learning that is in progress. See “Configuring learning using ION Setup” for instructions.

Installing learned values in Manual Install Mode

To install learned values for a specific setpoint in Manual Install Mode, open your meter in Vista and navigate to the applicable setup page. Enter the learned value given into the applicable setpoint, limit or threshold field.

Configuring learning in other modules

Configuring learning in other Setpoint modules is an advanced procedure. To configure learning in these modules, use the Designer component of Power Monitoring Expert.

Chapter 19 Reporting

This chapter provides instructions for viewing various meter logs.

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Introduction

Accumulated meter values are saved in logs. These **logs** are acquired by your energy management software (Power Monitoring Expert or third-party) and saved in its database for analysis and reporting.

The Web Reporter component of Power Monitoring Expert is a database reporting application that lets you define, generate, and manage comprehensive **reports** based on the information in your system database.

For more information on reports, see the Web Reporter section of the online *Power Monitoring Expert Help*.

Viewing Meter Logs

View meter logs using ION software or the front panel.

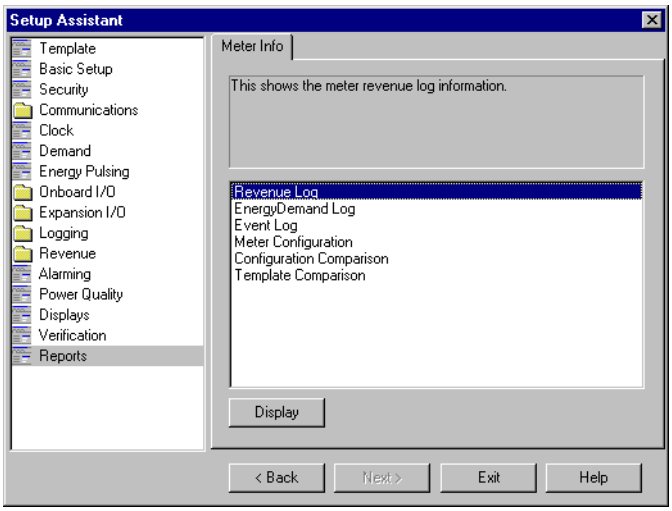
Using the front panel

The only log you can display using the front panel is the Event Log. Press the Events softkey to view.

Using ION Setup

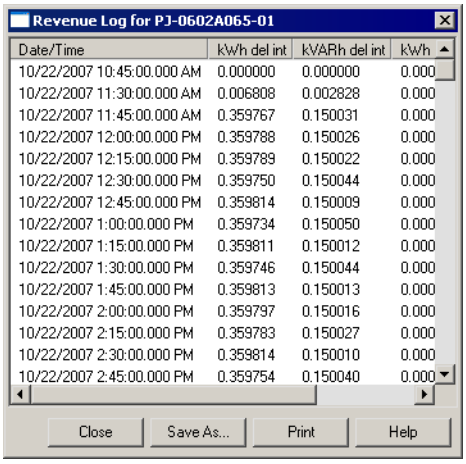
Display various meter logs using the Report Assistant.

1. Open ION Setup and connect to your meter, using Basic Mode.
2. In the Setup Assistant, navigate to the Reports folder.



3. Select one of the logs or comparisons in the list and click **Display** to view the associated log. Select the amount of records to upload, if requested.

   Below is an example of a Revenue Log:



4. You can view, save or print the log. Click **Close** to exit.

Using Vista

Open your meter in Vista and click on the **Volts/Amps** tab. Click an object to view the associated logs. The following logs are available:

- Voltage
- Current
- Power
- Power Factor / Frequency
- Historic data
- Meter events

ION7550/ION7650
User Guide

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