



## **User's Guide**

Version 2.0

**CONTENTS**

## Danger

During normal operation of this device, hazardous voltages are present which can cause severe injury or death. These voltages are present on the terminal strips of the device and throughout the connected potential transformer (PT), current transformer (CT), status input, relay, and control power circuits. Installation and servicing should be performed only by qualified, properly trained personnel. See the 7330 ION *Installation & Basic Setup Instructions* for further details.

## Warning

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference in which case the operator will be required to take whatever measures may be required to correct the interference.

For further information or technical assistance, please contact your local Power Measurement representative, or Customer Service at one of the following locations:



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Basic communications settings (baud rate, protocol) and metering settings (volts mode, CT/PT ratios) must be configured before you can use the 7330 ION. If these settings have not been configured, follow the steps in the *7330 ION Installation & Basic Setup Instructions* before consulting this User's Guide.

You may only need to read certain sections of this User's Guide, depending on how you will use the 7330 ION.

## Chapter 1 ♦ Understanding the Basics of the 7330 ION

Chapter 1 introduces the 7330 ION, and shows how it fits into power monitoring systems. The display and analysis software tools that compliment the 7330 ION are discussed, and some of the device's capabilities are presented.

## Chapter 2 ♦ Accessing Data and Interpreting Displays

Chapter 2 shows you how to access the data that the factory-configured 7330 ION provides. Go directly to this chapter if you want to start viewing real-time data without performing any additional configuration. Chapter 2 describes what data you can access using PEGASYS Vista software, PowerView software, and the front panel display.

## Chapter 3 ♦ Making Minor Configuration Changes

Chapter 3 describes how to use PEGASYS ION Designer to make minor changes to the meter's operation. Configuration functions provided by PowerView and the front panel are also described.

## Chapter 4 ♦ Customizing the 7330 ION / Using Advanced Functions

Chapter 4 provides more details about the 7330 ION's operating software so that the advanced user can create custom functions by linking ION modules. Chapter 4 also describes advanced communications and I/O functions available with the 7330 ION. Creating custom front panel displays is also discussed.

## Chapter 5 ♦ Technical Specifications

The Technical Reference in Chapter 5 provides technical specifications, accuracy data, ordering options, and warranty/registration information.

## Appendix A ♦ Revenue Metering

Details specific to the revenue-class 7330 ION -RMANSI and -RMICAN are provided in the Appendix.

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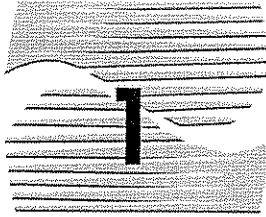
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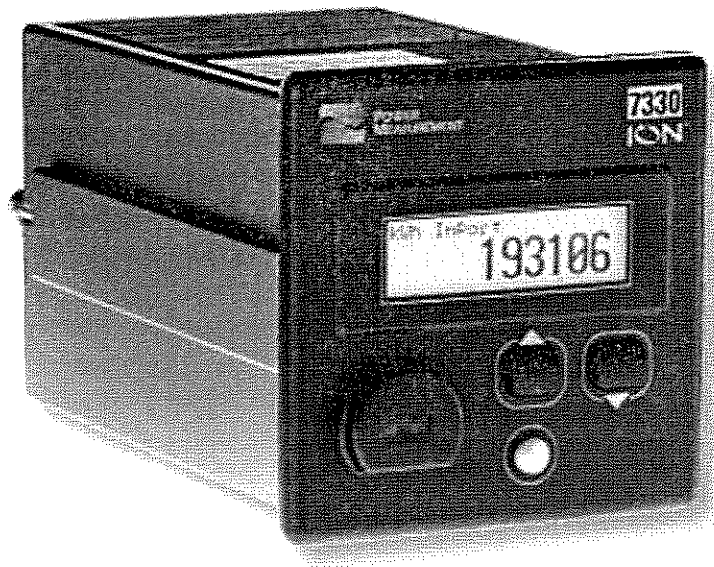
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# Introduction

The 7330 ION is a highly advanced digital power meter, suited to many power monitoring and control applications. This Intelligent Electronic Device (IED) can take the place of numerous transducers, meters and control circuits in your power monitoring system. The 7330 ION provides true RMS measurements of voltage, current, power and energy, complimented by extensive I/O capabilities, comprehensive logging, and advanced power quality functions.



*The 7330 ION Basic Model*

The 7330 ION can be used effectively in numerous supply side and demand side operations. Some common applications of the 7330 ION are:

- ◆ Replacement of Analog Transducers
- ◆ Substation Automation
- ◆ Utility Sub-Metering
- ◆ Universal Metering
- ◆ Commercial/Industrial Metering
- ◆ Demand Monitoring
- ◆ Genset Applications

These are just a few of the many possibilities. Contact Power Measurement Customer Service if you would like assistance with your application.



## The 7330 ION is Factory-Configured and Ready to Operate

Although the 7330 ION is fully customizable, it is shipped from the factory with many functions pre-configured. Once installation and basic setup are performed, all of the basic measurements and energy calculations are ready to operate, right out of the box. Many users will find that the factory configuration will serve their purposes without performing any additional configuration.

## What's New in 7330 Firmware Version 7330V20x

Firmware version 7330V205 and later offers many new and enhanced features, including new power quality functions, new communications and I/O options, and more ION module types for advanced applications. PEGASYS version 2.0 includes several enhancements that make the 7330 ION easier to set up and use.

### Data Display and Device Configuration Improvements

The most significant change to the 7330 ION in the V20x release is found when you display data or perform configuration functions with PEGASYS Vista, ION Designer and the front panel.

The data measured by the 7330 ION is now easier to access and interpret in PEGASYS Vista. A new set of user diagrams, included on the PEGASYS 2.0 release CD, group most of the factory-configured functions onto five main screens for real-time measurements, power quality monitoring, energy and demand calculations, setpoints and digital input status.

### Residual Current Calculation

The 7330 ION provides a residual current calculation for 4-Wire Wye systems. This value is derived from the residual current from an unbalanced load, so it typically represents the current flow in the neutral or ground conductor.

### New Communications and I/O Options

New or improved communications and I/O features include:

- ◆ Support of DNP 3.0 protocol on all communications ports.

### New ION Modules

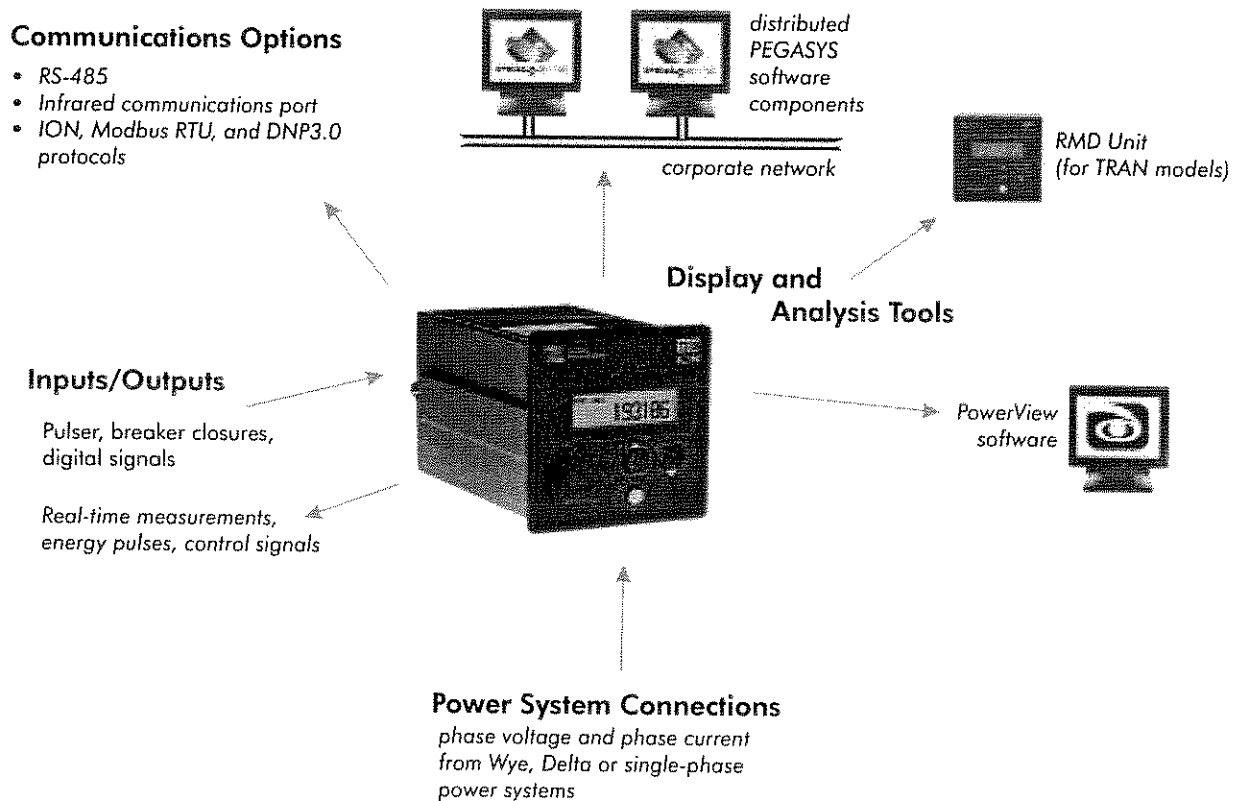
New ION modules are included that provide more options to the advanced user:

- ◆ DNP Import, Export and Options modules for DNP 3.0 communications.
- ◆ Convert modules for converting different types of data.
- ◆ Feedback modules for creating circular linkages in ION frameworks.

## The 7330 ION in a Power Monitoring System

Applications that include the 7330 ION, or any other IED, typically require additional equipment. Display and analysis software tools are almost always used to manage, interpret and distribute the data measured or logged by an IED. Usually there are a variety of tools used, and often these tools are connected using different communications standards and protocols. In many cases, an IED must also provide control capabilities and device-level data sharing.

The 7330 ION can adapt to many situations. Advanced communications allow data to be shared simultaneously across multiple networks, digital outputs provide control capabilities, and a variety of display and analysis tools can be used to monitor your power system. This manual discusses the 7330 ION as it is most commonly used — as a part of a complete power monitoring system.



## Data Display and Analysis Tools

The 7330 ION integrates seamlessly with the display and analysis software available from Power Measurement. The data acquired by the 7330 ION can be used in a variety of systems; however, Power Measurement software is designed to make use of the advanced capabilities the unit provides.

### Power Measurement's PEGASYS Software

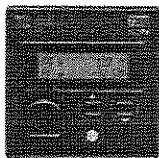


You will get the most out of the 7330 ION using Power Measurement's PEGASYS software suite. When PEGASYS is used, the 7330 ION becomes part of a fully networked information system, together with other Power Measurement IEDs and local and wide-area computer networks. PEGASYS provides tools for power monitoring, analyzing real-time data, generating power system reports, and creating custom functionality at the IED level. PEGASYS is recommended for all power monitoring systems where advanced analysis and control capabilities are required.



### Power Measurement's PowerView Software

The 7330 ION can be installed in power monitoring systems that use Power Measurement's PowerView software. PowerView provides real-time display and analysis features, and complete device configuration capabilities. PowerView provides a low-cost solution for smaller power system where the advanced features of PEGASYS are not required.



### The 7330 ION's Remote Modular Display

The Remote Modular Display can be added to an existing 7330 ION-TRAN model to facilitate local monitoring and standalone applications. The 7330 ION Basic Model provides an integrated front panel display.

Both the front panel and RMD combine real-time display features with limited device configuration functions. When used in combination with a PEGASYS or PowerView system, the display provides an interface for field personnel.

### Third-Party Tools

The 7330 ION can be integrated into various industry-standard networks. Data that is measured by the unit can be made available to other devices using Modbus or DNP 3.0 protocols. Data from devices on these networks can also be imported into the 7330 ION. With these advanced communications functions, the power of the 7330 ION can be utilized in most existing power monitoring systems. Any data display and analysis software that works with Modbus or DNP devices will also work with the 7330 ION.

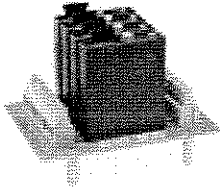
## I/O Options



Four optically isolated digital inputs and four digital outputs are available on the 7330 ION. Up to four digital input or four digital output modules can be added. Refer to the section "Using Onboard I/O and the Extension Board" in Chapter 4 for details.

The standard 7330 ION has two RS-485 communications ports and one infrared port. These ports are capable of data rates up to 19,200 bps. The 7330 ION infrared port on the front panel is compatible with an ANSI C12.13 Type II magnetic optical communications coupler. It can be used to communicate real-time measurements via ION, DNP 3.0, or Modbus protocols.

The RS-485 and infrared ports can communicate simultaneously.



### **REB Option**

Adding the Relay Extension Board (REB) option can enhance the functionality of the onboard digital outputs. The REB option includes a four-position Grayhill module rack and a 100-240VAC to 5VDC power supply. Grayhill modules are ordered separately.

## **Using this Guide**

This User's Guide is directed at three types of user: the typical user or operator, the system administrator, and the advanced user. You might not fit into any of these groups directly, or perhaps you are both an operator and an administrator. These user classifications are intended to make this guide easier to navigate.

### ◆ **Typical User or Operator**

Most users will simply want to display the data provided by the factory-configured 7330 ION. These users want fast access data through the front panel, PEGASYS software, PowerView software or a third-party protocol such as Modbus or DNP.

Chapter 2 addresses the needs of the typical user who wants to get data out of the 7330 ION. This chapter assumes that the reader is not concerned with how the device functions; instead the focus is on accessing and interpreting the data provided.

### ◆ **System Administrator or Manager**

Some users will need to make minor adjustments so that their devices "fit" their power systems: communications settings, demand sub-intervals and other parameters may need to be set before the 7330 ION's setup is complete. These users will use the front panel, PowerView software or PEGASYS software to change settings in the device's operating software. (PEGASYS is highly recommended for device configuration.)

Chapter 3 is directed at the user who wants to get more out of the 7330 ION by making adjustments to its factory-configured functionality. This chapter focuses on the different configuration changes that can be made with minimal effort, and what effects each type of setting will have. Very few details about the device's internal operation are provided.

#### ◆ **Advanced User or Systems Integrator**

Advanced users may want to make use of the flexibility and power provided by the device's ION operating software. These users will need to become familiar with the ION Architecture and the PEGASYS tools used to customize the meter's operation.

Chapter 4 is useful for the advanced user who wants to become familiar with the device's internal operation and its more sophisticated capabilities. This chapter is designed to facilitate different applications by providing background information and detailed functional descriptions — specific applications are only discussed to illustrate a particular function. Configuration instructions for particular applications can be found in Power Measurement Application Notes, available from Power Measurement Customer Service.

### **Before You can Use this Guide**

By the time you are ready to use this Guide, your 7330 ION should be installed, 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 *7330 ION Installation & Basic Setup Instructions* shipped with the meter.

## **Getting More Information**

Additional information is available from Power Measurement. Check our web site at [www.pml.com](http://www.pml.com), contact your local Power Measurement representative, or contact Power Measurement directly. (Contact information is provided on the first page of this document.) Documents related to the installation, operation and application of the 7330 ION:

#### *7330 ION Installation & Basic Setup Instructions*

This brief guide is shipped with each 7330 ION. It details the mounting, wiring and basic setup of the device.

#### *ION Reference*

The reference manual contains detailed descriptions of all of the modules in each ION device.

#### *PEGASYS 2.0 Administrator's Guide*

This guide explains the installation and configuration of the PEGASYS software suite. Advanced PEGASYS tools are described.

#### *PEGASYS ION Designer Online Help*

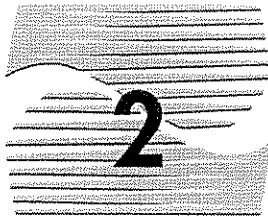
This describes how to use PEGASYS ION Designer.

#### *PEGASYS Vista User's Guide*

This guide describes how to use PEGASYS Vista.

#### *PowerView On-Line Help*

This describes how to use PowerView.



# Displaying Data

The 7330 ION is shipped from the factory with a comprehensive configuration. Most users will find that the factory configuration suits their needs entirely. This chapter describes how to view the data that is measured by the factory-configured 7330 ION using PEGASYS Vista software, PowerView software and the front panel interface.

The 7330 ION's factory configuration also includes some data that does not appear by default in PEGASYS Vista, PowerView or on the front panel. Further, the factory configuration makes several power, energy and demand parameters available through the Modbus RTU protocol. A list of available data that does not appear in PEGASYS Vista, PowerView or on the front panel is presented near the end of this chapter, and how to view it is briefly discussed.

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# Displaying Data with PEGASYS Vista 2.0

PEGASYS Vista version 2.0 is the premiere display and analysis tool for the 7330 ION and other Power Measurement IEDs. A standard set of Vista User Diagrams displays real-time data for various power system parameters. Interactive objects are provided on the diagrams that allow operators with appropriate PEGASYS authority to reset cumulative parameters.

## Summary of Data Provided

The standard set of three Vista diagrams included with PEGASYS 2.0 display a variety of the data measured by the factory-configured 7330 ION. Some of the diagrams include grouping windows that display additional data. The following list summarizes the data available from the standard diagrams; more detail is provided in the next few pages.

### Real-Time Measurements

- ◆ Line-to-neutral voltages, line-to-line voltages, average L-N and L-L voltages and voltage unbalance level
- ◆ Phase currents and average current
- ◆ Phase kW, total kW, kVAR and kVA
- ◆ Frequency and signed power factor
- ◆ Min/max display of each of the above parameters
- ◆ All logged meter events
- ◆ Trend logs of voltage, current, power, frequency and power factor

### Power Quality Data

- ◆ Phase voltage and current total harmonic distortion (THD)
- ◆ Min/max display of phase voltage and current THD
- ◆ Logged average and maximum THD and K factor

### Energy & Demand Data

- ◆ Real-time and peak kW, kVAR and kVA sliding window demand
- ◆ Real-time net kWh, net kVARh and kVAh energy values
- ◆ Trend log of all of the above parameters, plus power factor lead and lag, imported, exported and net energy

### Setpoints

- ◆ Monitoring of kW demand, phase current and voltage unbalance conditions, with annunciation when user-specified upper limit is exceeded
- ◆ Real-time display of kW demand, phase current and voltage unbalance



### NOTE

Many of the diagrams also provide interactive control and parameter reset functions.

## Digital Inputs

- ◆ Monitoring of the 7330 ION's four on-board status inputs
- ◆ Status change counter for each input

## Common Diagram Elements

Each diagram shows the name of the device, the time on the device's clock, and the type of device. The three main diagrams also provide buttons that let you jump to other diagrams. Double-click any of the buttons near the top right-hand corner to jump to the associated diagram (this is illustrated in the Real-Time Measurements section below).

## Displaying Data if PEGASYS is not Fully Configured

The *PEGASYS 2.0 Administrator's Guide*, shipped with PEGASYS 2.0, provides a set of guidelines that should be followed during commissioning. If PEGASYS 2.0 has been installed and configured using the recommended guidelines, the standard Vista user diagrams display real-time data from your 7330 ION automatically.

If commissioning has not been completed (or if commissioning was performed without following the guidelines) some effort may be required to view 7330 ION data in Vista 2.0. If you are not able to run the PEGASYS Communications Server, Log Server or Vista, you will need to complete PEGASYS commissioning before you can display data from your 7330 ION. Contact your PEGASYS Administrator or refer to the *PEGASYS 2.0 Administrator's Guide* before continuing with this User's Guide.

If you can run PEGASYS Vista and log on, you can probably access data from your 7330 ION. Try performing the following steps in Vista:

1. Log on to Vista with Supervisor authority (Level 5).
2. Select Generate Network Diagram from the File menu.
3. In the Network Diagram, double-click the Workstation icon corresponding to the computer that communicates with the 7330 ION. A new diagram with all available IEDs appears.
4. Double-click the icon for the 7330 ION. The Real-Time diagram appears, and live data should appear within moments.

You should now be able to move around through the various diagrams and view real-time and logged data.



### NOTE

Refer to the *PEGASYS Vista User's Guide* if you need help using Vista.



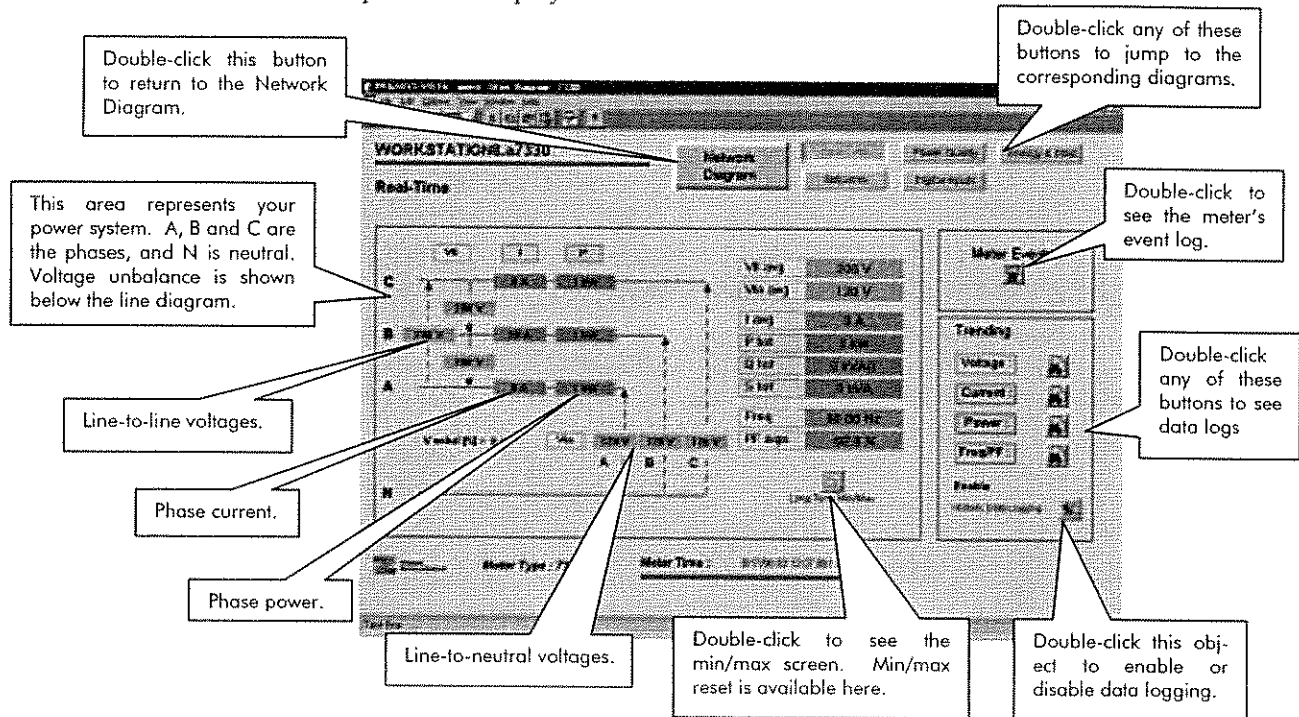
### NOTE

If you can't display data in PEGASYS Vista, and you don't have Level 5 authority, contact your PEGASYS administrator.



## Real-Time Measurements

The Real-Time diagram includes a simple power system illustration that shows various real-time parameters. The diagram also includes links to a min/max parameter display.



### Long-term Min/Max

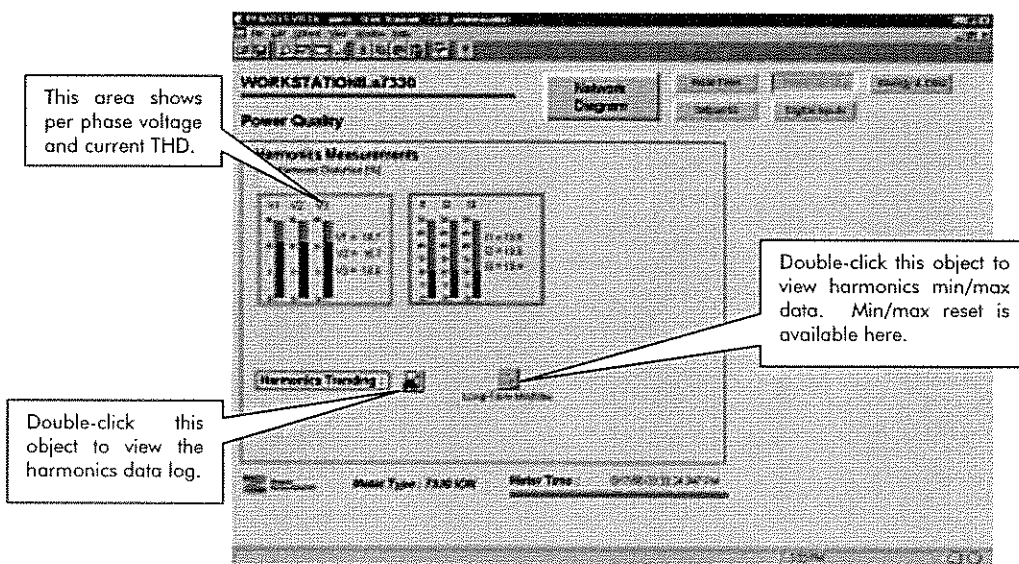
- ◆ Double-click the Long-term Min/Max object to see a Vista grouping window showing min/max values for line-to-line and line-to-neutral voltages, voltage unbalance, phase currents, power values (kVA, kVAR and kW), frequency, and power factor.
- ◆ Level 3 PEGASYS authority is required to reset the min/max values.
- ◆ To return to the real-time diagram, use the Up One Level button on the Vista toolbar; or use the File, Up One Level menu item.
- ◆ Min/max values are valid from the time the meter was powered up, or valid from the time the last reset was performed.

### Historic Data Logging Enable

- ◆ The Log Server must be running to view historical data.
- ◆ Historic data logging is enabled by default.
- ◆ Level 3 PEGASYS authority is required to use the enable control object.
- ◆ The control object indicates the logging enable status: the switch is in the up position (1) when logging is enabled, and down (0) when logging is disabled.

## Power Quality Data

The Power Quality diagram shows harmonics details. The harmonics measurement display shows total harmonic distortion for each phase of voltage and current. Links to harmonics min/max and harmonics trending displays are provided, and a control object is included for enabling/disabling harmonics logging.



### Harmonics Measurements

- ◆ Total Harmonics Distortion (THD) is displayed as a percentage of phase measurements.

### Long-term Min/Max

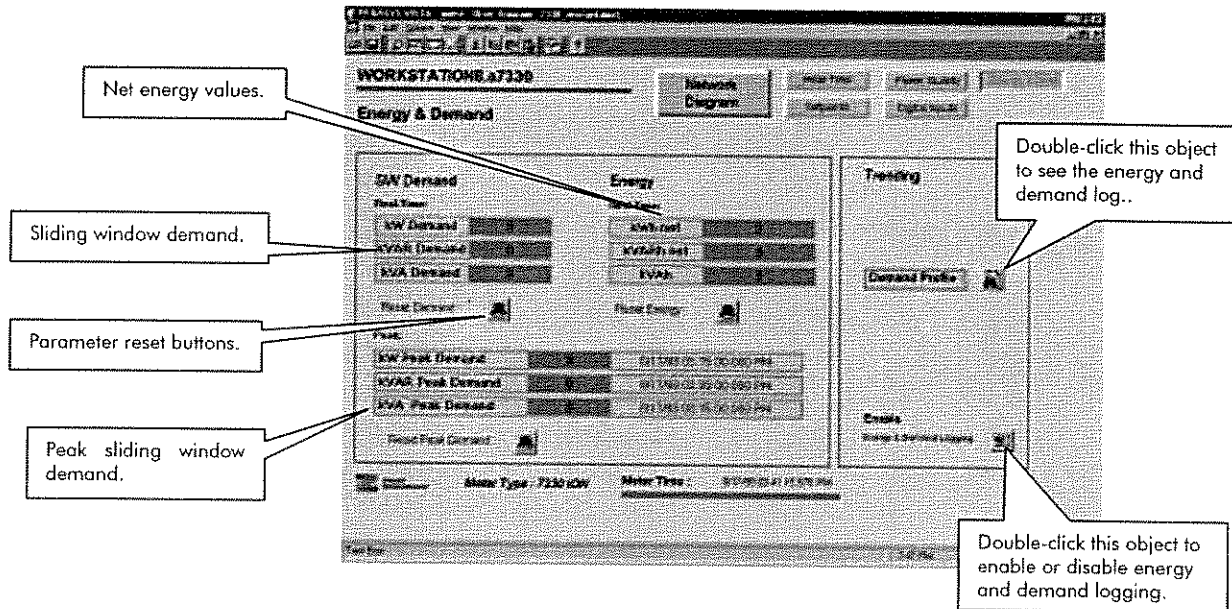
- ◆ Double-click the Long-term Min/Max object to see a Vista grouping window showing min/max values for phase voltage and current THD.
- ◆ Level 3 PEGASYS authority is required to reset the min/max values.

### Harmonics Trending

- ◆ The Log Server must be running to view the logged harmonics data.
- ◆ Harmonics data logging is enabled by default.
- ◆ Level 3 PEGASYS authority is required to use the enable control object.

## Energy & Demand Calculations

The Energy & Demand diagram shows the real-time sliding window demand for kW, kVA and kVAR, and the real-time energy values kWh net, kVARh net and kVAh. Peak demand is displayed for kW, kVAR and kVA, and a link to a demand profile trend is provided. Control objects for enabling/disabling demand logging and resetting energy and demand values are also included.



### Demand, Energy and Peak Demand Reset

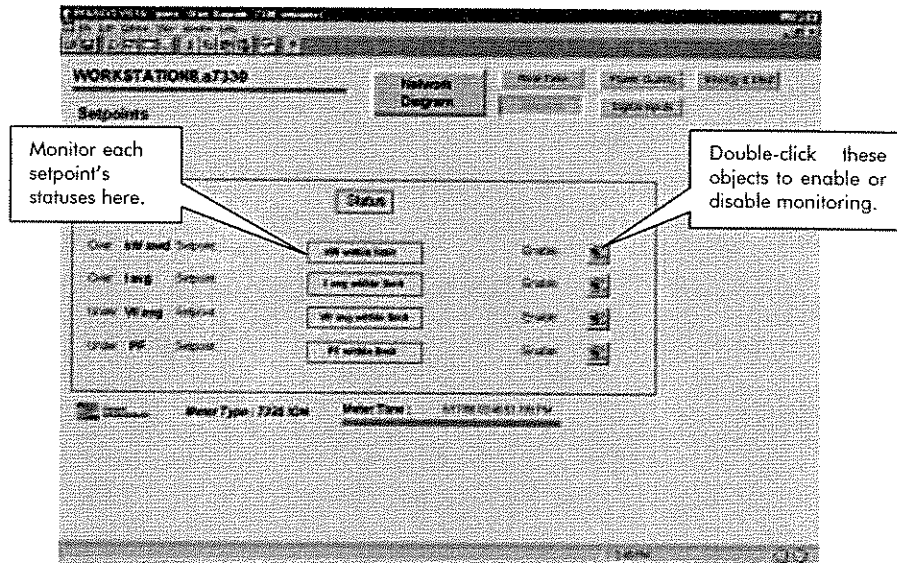
- ◆ Level 3 PEGASYS authority is required to reset these values.

### Demand Profile Trending

- ◆ The Log Server must be running to view the energy and demand log.
- ◆ Energy and demand logging is enabled by default.
- ◆ Level 3 PEGASYS authority is required to use the enable control object.
- ◆ The control object indicates the logging enable status: the switch is in the up position (1) when logging is enabled, and down (0) when logging is disabled.

## Setpoints

The Setpoints diagram uses setpoints to monitor kW demand, over current and under average voltage and power factor levels. Vista announces warnings if any of the values exceed specified limits. Users with Level 3 PEGASYS authority can define the setpoint limits.



### Over kW Sliding Window Demand Monitoring

- ◆ Over kW demand monitoring is disabled by default.
- ◆ Level 3 PEGASYS authority is required to enable this monitoring.
- ◆ The status will read "Not Available" when monitoring is disabled.

### Over Average Current Monitoring

- ◆ Over current monitoring is disabled by default.
- ◆ Level 3 PEGASYS authority is required to enable this monitoring.
- ◆ Each status will read "Not Available" when monitoring is disabled.

### Under Average Voltage Line-to-Line Monitoring

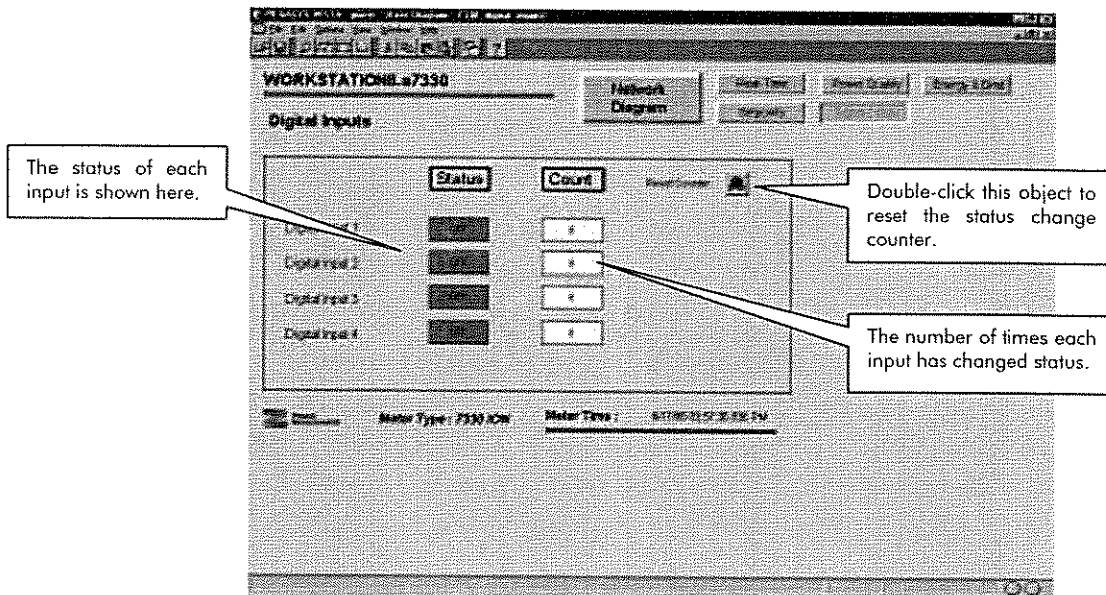
- ◆ Over voltage monitoring is disabled by default.
- ◆ Level 3 PEGASYS authority is required to enable this monitoring.
- ◆ The status will read "Not Available" when monitoring is disabled.

### Under Power Factor Monitoring

- ◆ Under power factor monitoring is disabled by default.
- ◆ Level 3 PEGASYS authority is required to enable this monitoring.
- ◆ The status will read "Not Available" when monitoring is disabled.

## Digital Inputs

The Digital Inputs diagram monitors the four status inputs on the 7330 ION. The status of each input (ON or OFF), and the number of times the status has changed is displayed. The status change counter can be reset.



### Status

- ◆ The 7330 ION's status inputs are de-energized when the meter is powered-up, so each status will initially be OFF.

### Reset

- ◆ Level 3 PEGASYS authority is required to reset the status counter.

## Displaying Additional Data in Vista

The factory-configured 7330 ION measures and calculates additional data that is not presented in the standard Vista diagrams. This data can be added to the standard diagrams, or new diagrams can be created. Any data that the 7330 ION measures can be displayed in Vista.

PEGASYS Supervisor authority (Level 5) is required to create and configure new diagrams. Refer to the *PEGASYS Vista User's Guide* for details on creating Vista User Diagrams. If you don't have Level 5 password authority, contact your PEGASYS administrator for assistance.

Refer to the section "Complete List of Factory Configured Measurements and Functions" near the end of this chapter for a list of the data that is not displayed on the standard Vista diagrams, but is available from the factory-configured 7330 ION.

# Displaying Data with PowerView

PowerView for Windows NT/ 95 displays many of the parameters measured and logged by the 7330 ION. The data displayed in PowerView are considerably different than those in PEGASYS Vista. This section describes how to view data in PowerView, and what data screens are available.

## Summary of Data Provided

PowerView includes a set of tables that display data from the 7330 ION version 7330V2.x. The available data is grouped into 10 data screens for displaying measurements. Many of the data screens have multiple tabs that display additional data. The following list summarizes the data available from the standard data screens; see the "Complete List of Factory Configured Measurements and Functions" near the end of this chapter.

### Data Recorders

- ◆ Any recorded data that is logged by the 7330 ION's 2 data recorders

### Demand

- ◆ Sliding window demand, predicted demand and thermal demand for power and current parameters

### Event

- ◆ The meter's event log (all events logged by the meter)

### Enables

- ◆ The states of the meter's external Booleans.

### Harmonics

- ◆ Phase voltage and current total harmonic distortion; phase voltage and current harmonic distortion values from the 1<sup>st</sup> to the 15<sup>th</sup> harmonic, K-factor

### Maximum

- ◆ Maximum values and timestamps for all voltage, current, power, frequency and harmonic distortion parameters

### Minimum

- ◆ Minimum values and timestamps for all voltage, current, power, frequency and harmonic distortion parameters

### Real-Time

- ◆ Per-phase and total voltage, current, power, frequency and power factor; total, import and export energy

### Status

- ◆ Monitoring of the meter's setpoints; the status of the Digital Inputs.

## PowerView's Data Screens Mode

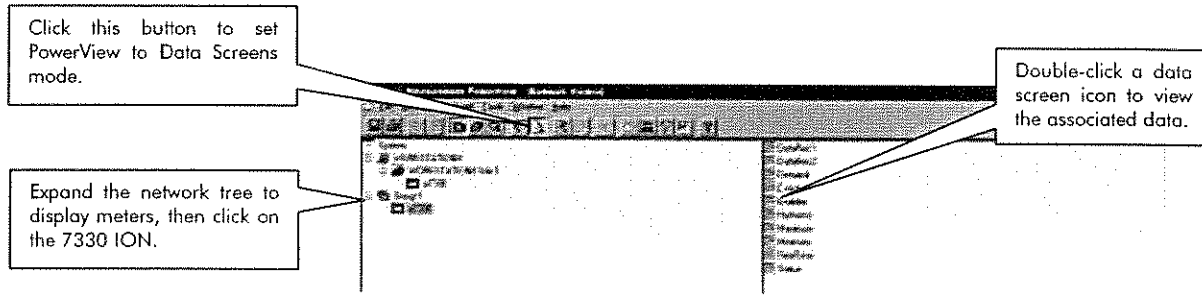


### NOTE

The PowerView network must be properly configured before you can display data. Refer to the *PowerView User's Guide* or on-line help for assistance.

In order to view data in PowerView, you must first set the view mode to Data Screens. This is done by selecting Data Screens from the View menu, or clicking the Data Screens button on the toolbar (see the graphic below).

Once in Data Screens mode, select a meter in the left pane, and the right pane displays the data display groups that are available for viewing.



## Selecting Different Display Screens

PowerView can display different data screens for different versions of the 7330 ION. New data display screens, called tables, can be downloaded from Power Measurement's website at [www.pml.com](http://www.pml.com). Save these tables in PowerView's \Tables\Pml7330\Default folder. Contact Power Measurement Customer Service if you need assistance.

To change to a different set of display screens, expand the workstation tree and right-click the meter's icon. Select Properties from the pop-up menu. Under the Display tab of the Device Properties dialog box, select from the list of tables shown. Although all tables shown will allow you to display data, the Version 2.0 tables match the 7330 ION's factory-configuration, allowing PowerView to display a more comprehensive set of parameters.

## The PowerView Data Filter

In PowerView, each time you double-click a display screen icon that contains logged data the data filter appears. Use the data filter to select the range of data you want to view.

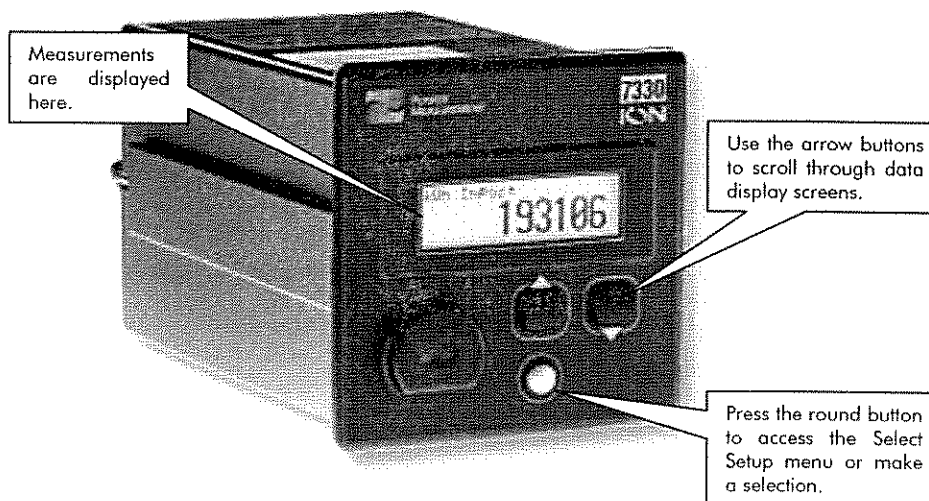


# Displaying Data with the Front Panel

The front panel provides a detailed graphics and text display for the 7330 ION. The front panel is configured at the factory with eight displays showing most of the parameters measured by the device. An RMD, or Remote Modular Display, can be added to an existing 7330 ION TRAN to provide a front panel display.

## Data Display Screens

When the device is activated, the front panel displays net energy. Press the up and down buttons to scroll through the eight preconfigured display screens.



The round button provides access to configuration screens. The three buttons on the front panel are also used to navigate the on-screen menus and enter settings into the setup registers. Many options are available to customize the look and functionality of the front panel's display.

## Display Screen Options

There are eight display screens available in the factory-configuration. While the device is displaying data, press the up or down arrow keys to scroll through the eight display screens. You do not require password authorization to view these screens.

You can also modify the displayed text size by setting the number of measurements displayed, or the contrast of the display. Both the Screen Setup and Display Setup menus are accessed from the Select Setup menu.

## Screen Setup Options

The Screen Setup screen allows you to change the data displayed on the eight display screens, and how the data is displayed (see “Creating Custom Front Panel Displays” in Chapter 4).

## Display Setup Options

There are five Display Setup options that enable you to modify the display. From the Select Setup menu, select Display Setup and you are presented with the following options:

Display Setup Option	Default	Description
AutoScroll	0 s (Disabled)	Time between automatic display screen advance.
Contrast	mid	The display screen's contrast level.
Backlight Time	30 min	Time before display screen backlight automatically turns off.
Update Rate	4 s	Period between data display refreshes.
Display Mode	Programmable	Custom or Factory configured display screen option.

### ◆ Auto Scroll

The Auto Scroll feature shows each of the enabled display screens in sequence. Use the arrow buttons to specify the number of seconds that each screen is displayed before it flips to the next display screen, and press the round button to enter the value. Any screens that have been disabled will not appear when auto scrolled. Set the numeric value to zero to disable Auto Scroll.

### ◆ Contrast

You can change the contrast of the front panel's display; select Contrast in the Display Setup menu. Press an arrow button once, and the display screen's contrast will slowly change. Press an arrow button to stop the process. Press the round button when you are satisfied with the contrast level.

### ◆ Backlight Timeout

This setting allows you to set the amount of time the front panel's back-lighting stays on when the front panel is idle. The backlight has a limited lifespan; to prolong its you should only have back-lighting on when you are actively using the front panel. Select Backlight Timeout, then use the front panel's buttons to change the amount of time in seconds that the backlight should stay on after a button has been pressed.

### ◆ Update Rate

The Update Rate specifies how frequently data on the display screen is updated. You may find the values are being updated too frequently, or that the data shown on screen lags too far behind the actual values. The default update rate is four seconds; use the front panel's buttons to change the update rate to suit your needs.



## NOTE

Contrast can be adjusted from any screen by holding down the round button for more than ten seconds. Release the round button when the contrast is at a suitable level.

◆ **Display Mode**

There are two Display Mode options: Programmable Mode and Fixed Mode. The default is programmable mode, which provides eight data display screens which can be configured to meet your requirements (see “Creating Custom Front Panel Displays” in Chapter 4). Fixed Mode displays four screens, each with large characters in the display, easily visible from a distance. The four fixed mode screens display Average Volts, Average Amps, kW total, and PF total. You cannot customize the fixed mode displays.

**Nameplate Info**

The Nameplate Info menu contains information about the various options of the device. Select Nameplate Info from the Select Setup menu to access the following information:



**NOTE**

Additional information will be displayed in the Nameplate Info screens if the 7330 ION is used as a revenue-class meter.

- ◆ Manufacturer
- ◆ meter type and class
- ◆ service type
- ◆ voltage and current input ratings
- ◆ auxiliary power
- ◆ operating frequency
- ◆ transformer ratios
- ◆ firmware revisions of the 7330 ION
- ◆ Digital output information
- ◆ Approval
- ◆ serial number
- ◆ accuracy rating
- ◆ acceptable operating temperature
- ◆ battery life
- ◆ configured demand settings
- ◆ three custom text lines written into the 7330 ION’s Factory module

# Complete List of Factory-Configured Measurements and Functions



## NOTE

The ION modules and output registers used for each function are listed in this section to assist more advanced users. Typical users can ignore the three right-hand columns in the tables below.

The standard PEGASYS Vista diagrams, the PowerView Data Screens and the front panel display screens show much of the data that the factory-configured 7330 ION measures and calculates. There is additional data, however, that is available from the factory-configured meter but not presented by default in any of these display tools. This section lists all of the data provided by the factory-configured meter, and shows which parameters are displayed or accessible by default.

## Energy & Demand Framework

The energy and demand configuration calculates and logs energy values and both Thermal and Sliding Window demand. External triggers are included for operator reset of all values.

Description of Parameter or Function	Displayed/Accessible by Default			ION Module Name	ION Module Label	Output Register Label
	Vista	PowerView	Front Panel			
Imported kWh		●		Integrator #1	kWh imp	kWh imp
Exported kWh		●		Integrator #2	kWh exp	kWh exp
Total kWh		●		Integrator #3	kWh tot	kWh tot
Net kWh	●		●	Integrator #4	kWh net	kWh net
Imported kVARh		●		Integrator #5	kVARh imp	kVARh imp
Exported kVARh	●	●		Integrator #6	kVARh exp	kVARh exp
Total kVARh		●		Integrator #7	kVARh tot	kVARh tot
Net kVARh	●			Integrator #8	kVARh net	kVARh net
kVAh	●	●		Integrator #9	kVAh	kVAh
kW thermal demand (TD)		●		Thermal Demand #1	kW td	kW td
kVAR TD		●		Thermal Demand #2	kVAR td	kVAR td
kVA TD		●		Thermal Demand #3	kVA td	kVA td
Average current TD		●		Thermal Demand #4	I avg td	I avg td
Energy Calc Enable		●		External Boolean #3	Energy Enble	Energy Enble
kW SW Demand	●	●	●	SW Demand #1*	kW swd	kW swd
kW Predicted Demand		●		SW Demand #1	kW swd	kW pred swd
kVAR SW Demand	●	●		SW Demand #2	kVAR swd	kVAR swd
kVAR Predicted Demand		●		SW Demand #2	kVAR swd	kVAR pred swd
kVA SW Demand	●	●		SW Demand #3	kVA swd	kVA swd
kVA Predicted Demand		●		SW Demand #3	kVA swd	kVA pred swd

\* SW Demand=Sliding Window Demand

### Energy and Demand Framework, Continued

Description of Parameter or Function	Displayed/Accessible by Default			ION Module Name	ION Module Label	Output Register Label
	Vista	PowerView	Front panel			
Avg Current SW Demand		●		SW Demand #4	I avg swd	I avg swd
Avg Current Predicted SW Demand		●		SW Demand #4	I avg swd	I avg pred swd
Energy reset trigger	●	●		External Pulse #7	Energy Rset	Energy Rset
SWD reset trigger	●	●		External Pulse #3	SWDemand Rset	SWDemand Rset
TD reset trigger		●		External Pulse #4	TDemand Rset	TDemand Rset
KWh import pulse				Pulser #1	KWh imp Pulse	
KVARh import pulse				Pulser #2	KVARh imp Pulse	
KVAh pulse				Pulser #3	KVAh Pulse	
KWh import LED pulse				Pulser #4	KWh imp LED	
Energy / Demand Log Enable	●	●		External Boolean #5	EgyDmd Log Enbl	EgyDmd Log Enbl
Energy / Demand Log Trigger				Periodic Timer #1	EgyDmd Log Trg	EgyDmd Log Trg
Energy / Demand Log		●		Data Recorder #1	EgyDmd Log	EgyDmd Log

### Min/Max Framework

This portion of the meter's configuration measures minimum and maximum values for various power, energy, demand and harmonics parameters. Separate reset triggers are provided for demand, harmonics and 'standard' power parameters.

Description of Parameter or Function	Displayed/Accessible by Default			ION Module Name	ION Module Label	Output Register Label
	Vista	PowerView	Front panel			
Max Phase A L-N Volts	●	●		Maximum #1	Vln a mx	Vln a mx
Max Phase B L-N Volts	●	●		Maximum #2	Vln b mx	Vln b mx
Max Phase C L-N Volts	●	●		Maximum #3	Vln c mx	Vln c mx
Max Average L-N Volts		●		Maximum #4	Vln avg mx	Vln avg mx
Max L-L Volts AB	●	●		Maximum #5	Vll ab mx	Vll ab mx
Max L-L Volts BC	●	●		Maximum #6	Vll bc mx	Vll bc mx
Max L-L Volts CA	●	●		Maximum #7	Vll ca mx	Vll ca mx
Max Average L-L Volts		●		Maximum #8	Vll avg mx	Vll avg mx
Max Voltage Unbalance	●	●		Maximum #9	V unbal mx	V unbal mx
Max Phase A Current	●	●		Maximum #10	I a mx	I a mx

Min/ Max Framework, Continued

Description of Parameter or Function	Displayed/Accessible by Default			ION Module Name	ION Module Label	Output Register Label
	Vista	PowerView	Front panel			
Max Phase B Current	●	●		Maximum #11	I b mx	I b mx
Max Phase C Current	●	●		Maximum #12	I c mx	I c mx
Max Average Current		●		Maximum #13	I avg mx	I avg mx
Max kW total	●	●		Maximum #14	kW tot mx	kW tot mx
Max kVAR total	●	●		Maximum #15	kVAR tot mx	kVAR tot mx
Max kVA total	●	●		Maximum #16	kVA tot mx	kVA tot mx
Max Phase A Current THD	●	●	●	Maximum #17	I1 THD mx	I1 THD mx
Max Phase B Current THD	●	●		Maximum #18	I2 THD mx	I2 THD mx
Max Phase C Current THD	●	●		Maximum #19	I3 THD mx	I3 THD mx
Max Frequency	●	●		Maximum #21	Freq mx	Freq mx
Max Power Factor Lead		●		Maximum #22	PF lead mx	PF lead mx
Max Power Factor Lag	●	●		Maximum #23	PF lag mx	PF lag mx
Max Phase A Voltage THD	●	●		Maximum #24	V1 THD mx	V1 THD mx
Max Phase B Voltage THD	●	●		Maximum #25	V2 THD mx	V2 THD mx
Max Phase C Voltage THD	●	●		Maximum #26	V3 THD mx	V3 THD mx
Max kW SW Demand	●	●		Maximum #27	kW swd mx	kW swd mx
Max kVAR SW Demand	●	●		Maximum #28	kVAR swd mx	KVAR swd mx
Max kVA SW Demand	●	●		Maximum #29	kVA swd mx	KVA swd mx
Max kW Thermal Demand		●		Maximum #30	kW td mx	KW td mx
Max kVAR Therm. Demand		●		Maximum #31	kVAR td mx	kVAR td mx
Max kVA Thermal Demand		●		Maximum #32	kVA td mx	kVA td mx
Min Phase A L-N Volts	●	●		Minimum #1	VIn a mn	VIn a mn
Min Phase B L-N Volts	●	●		Minimum #2	VIn b mn	VIn b mn
Min Phase C L-N Volts	●	●		Minimum #3	VIn c mn	VIn c mn
Min Average L-N Volts		●		Minimum #4	VIn avg mn	VIn avg mn
Min L-L Volts AB	●	●		Minimum #5	VII ab mn	VII ab mn
Min L-L Volts BC	●	●		Minimum #6	VII bc mn	VII bc mn
Min L-L Volts CA	●	●		Minimum #7	VII ca mn	VII ca mn
Min Average L-L Volts		●		Minimum #8	VII avg mn	VII avg mn
Min Voltage Unbalance	●	●		Minimum #9	V unbal mn	V unbal mn
Min Phase A Current	●	●		Minimum #10	I a mn	I a mn
Min Phase B Current	●	●		Minimum #11	I b mn	I b mn

Min/ Max Framework, Continued

Description of Parameter or Function	Displayed/Accessible by Default			ION Module Name	ION Module Label	Output Register Label
	Vista	PowerView	Front panel			
Min Phase C Current	●	●		Minimum #12	I c mn	I c mn
Min Average Current		●		Minimum #13	I avg mn	I avg mn
Min kW total	●	●		Minimum #14	KW tot mn	kW tot mn
Min kVAR total	●	●		Minimum #15	KVAR tot mn	kVAR tot mn
Min kVA total	●	●		Minimum #16	KVA tot mn	kVA tot mn
Min Phase A Current THD	●	●		Minimum #17	I1 THD mn	I1 THD mn
Min Phase B Current THD	●	●		Minimum #18	I2 THD mn	I2 THD mn
Min Phase C Current THD	●	●		Minimum #19	I3 THD mn	I3 THD mn
Min Frequency	●	●		Minimum #21	Freq mn	Freq mn
Min Power Factor Lead		●		Minimum #22	PF lead mn	PF lead mn
Min Power Factor Lag	●	●		Minimum #23	PF lag mn	PF lag mn
Min Phase A Voltage THD	●	●		Minimum #24	V1 THD mn	V1 THD mn
Min Phase B Voltage THD	●	●		Minimum #25	V2 THD mn	V2 THD mn
Min Phase C Voltage THD	●	●		Minimum #26	V3 THD mn	V3 THD mn
Min kW SW Demand		●		Minimum #27	KW swd mn	KW swd mn
Min kVAR SW Demand		●		Minimum #28	KVAR swd mn	KVAR swd mn
Min Phase C Current THD		●		Minimum #29	KVA swd mn	KVA swd mn
Min kW Thermal Demand		●		Minimum #30	KW td mn	KW td mn
Min kVAR Therm. Demand		●		Minimum #31	KVAR td mn	kVAR td mn
Min kVA Thermal Demand		●		Minimum #32	KVA td mn	kVA td mn
Min / Max Enable		●		External Boolean #1	MnMx Enble	MnMx Enble
V/A/Power Min/Max Reset	●	●		External Pulse #2	MnMx Rset	MnMx Rset
Demand Min/Max Reset	●	●		External Pulse #1	Peak Dmd Rset	Peak Dmd Rset
Harmonics min/max Reset		●		External Pulse #6	Harm MnMx Rset	Harm MnMx Rset

## Historic Data Logging Framework

This portion of the meter's configuration records 'standard' power system parameters such as voltage, current, power, frequency and power factor. Low, mean and high values are recorded for all parameters. Note that 'low' and 'high' are different from 'min' and 'max': low and high are reset every 15 minutes, whereas min and max are typically long-term measurements that are only reset by the operator. Similarly, 'mean' is reset every 15 minutes, unlike 'average' which is typically an instantaneous averaging of multiple real-time measurements.

Description of Parameter or Function	Displayed/Accessible by Default			ION Module Name	ION Module Label	Output Register Label
	Vista	PowerView	Front panel			
Mean L-L Volts, average		●		SW Demand #5	Vll avg mean	Vll avg mean
Mean L-N Volts, average		●		SW Demand #6	Vln avg mean	Vln avg mean
Mean Average Current		●		SW Demand #7	I avg mean	I avg mean
Mean kW total		●		SW Demand #8	kW tot mean	kW tot mean
Mean kVAR total		●		SW Demand #9	kVAR tot mean	kVAR tot mean
Mean kVA total		●		SW Demand #10	kVA tot mean	kVA tot mean
Mean Power Factor sign		●		SW Demand #11	PF sign mean	PF sign mean
Mean Frequency		●		SW Demand #12	Freq mean	Freq mean
Mean Voltage Unbalance		●		SW Demand #13	V unbal mean	V unbal mean
Mean Current Unbalance		●		SW Demand #14	I unbal mean	I unbal mean
Mean Phase A Voltage THD*	●	●		S W Demand #15	V1 THD* mean	V1 THD* mean
Mean Phase B Voltage THD	●	●		S W Demand #16	V2 THD mean	V2 THD mean
Mean Phase C Voltage THD	●	●		S W Demand #17	V3 THD mean	V3 THD mean
Mean Phase A Current THD	●	●		S W Demand #18	I1 THD mean	I1 THD mean
Mean Phase B Current THD	●	●		S W Demand #19	I2 THD mean	I2 THD mean
Mean Phase C Current THD	●	●		S W Demand #20	I3 THD mean	I3 THD mean
Historic Log Trigger				Periodic Timer #2	Hist Log Trg	Hist Log Trg
Historic Log Enable	●	●		External Boolean #2	Hist Log Enble	Hist Log Enble
Historic Mean Log		●		Data Recorder #2	Hist Mean Log	Hist Mean Log

\* THD = Total Harmonic Distortion



## Setpoint Framework

This portion of the configuration provided setpoints to monitor phase current, voltage unbalance and kW sliding window demand. Using PEGASYS Vista, upper limits are input for each parameter. If the measured value goes above the specified limit for at least 30 seconds, Vista annunciates an alarm.

Description of Parameter or Function	Displayed/Accessible by Default			ION Module Name	ION Module Label	Output Register Label
	Vista	PowerView	Front panel			
Over kW SW Demand	●	●		Setpoint #1	Over kW swd	Over kW swd
Under L-L Voltage average	●	●		Setpoint #2	Under Vll avg	Under Vll avg
Over Current average	●	●		Setpoint #3	Over I avg	Over I avg
Under Power Factor Sign	●	●		Setpoint #4	Under PF sign	Under PF sign
Over-demand monitoring enable	●	●		External Boolean #7	Over kW Enble	Over kW Enble
Under Voltage monitoring enable	●	●		External Boolean #4	Under V Enble	Under V Enble
Over-current monitoring enable	●	●		External Boolean #8	Over Amp Enble	Over Amp Enble
Under Power Factor monitoring enable	●	●		External Boolean #6	Under PF Enble	Under PF Enble

## Digital Inputs Framework

This portion of the meter's configuration monitors the status of the 7700 ION's eight on-board digital inputs, and counts the number of times each input changes state.

Description of Parameter or Function	Displayed/Accessible by Default			ION Module Name	ION Module Label	Output Register Label
	Vista	PowerView	Front panel			
Status of Digital Input 1	●	●		Digital Input #1	Digital In 1	S1
Status of Digital Input 2	●	●		Digital Input #2	Digital In 2	S2
Status of Digital Input 3	●	●		Digital Input #3	Digital In 3	S3
Status of Digital Input 4	●	●		Digital Input #4	Digital In 4	S4
Digital Input 1 status changes	●			Counter #1	S1 Counter	S1 Counter
Digital Input 2 status changes	●			Counter #2	S2 Counter	S2 Counter
Digital Input 3 status changes	●			Counter #3	S3 Counter	S3 Counter
Digital Input 4 status changes	●			Counter #4	S4 Counter	S4 Counter
Status change counter reset	●	●		External Pulse #8	S Count Rset	S Count Rset

## Real Time Measurements (Core Modules)

This portion of the factory configuration contains the real-time phase voltage and current measurements, and harmonics measurements.

Description of Parameter or Function	Displayed/Accessible by Default			ION Module Name	ION Module Label	Output Register Label
	Vista	PowerView	Front panel			
Phase A L-N Volts	●	●		Power Meter Module	Power Meter *	VIn a *
Phase B L-N Volts	●	●				VIn b
Phase C L-N Volts	●	●				VIn c
Average L-N Volts	●	●				VIn avg
L-L Volts AB	●	●	●			VII ab
L-L Volts BC	●	●	●			VII bc
L-L Volts CA	●	●	●			VII ca
Average L-L Volts	●	●	●			VII avg
Phase A Current	●	●	●			I a
Phase B Current	●	●	●			I b
Phase C Current	●	●	●			I c
Average Current	●	●	●			I avg
Phase A kW	●	●				kW a
Phase B kW	●	●				kW b
Phase C kW	●	●				kW c
kW total	●	●	●			kW tot
Phase A kVAR		●				kVAR a
Phase B kVAR		●				kVAR b
Phase C kVAR		●				kVAR c
kVAR total	●	●	●			kVAR tot
Phase A kVA		●				kVA a
Phase B kVA		●				kVA b
Phase C kVA		●				kVA c
kVA total	●	●	●			kVA tot
PF in Quadrant 1 **						Quadrant 1

\* In addition to the standard Power Meter module, the 7330 ION includes a MU (meter units) Power Meter module. Module and output register labels from the MU Power Meter modules include a MU prefix. Refer to the Power Meter module description in the ION reference for details.

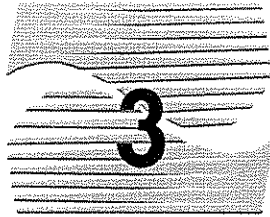
\*\* Quadrant Boolean values indicate the quadrant where the Power Factor lies. Only one Quadrant Boolean will be on at any given time. Refer to the ION Reference for details on the Power Factor's quadrant.

Real-Time Measurements, Continued

Description of Parameter or Function	Displayed/Accessible by Default			ION Module Name	ION Module Label	Output Register Label
	Vista	PowerView	Front panel			
PF in Quadrant 2				Power Meter Module	Power Meter	Quadrant 2
PF in Quadrant 3						Quadrant 3
PF in Quadrant 4						Quadrant 4
Power Factor Phase A		●				PF sign a
Power Factor Phase B		●				PF sign b
Power Factor Phase C		●				PF sign c
Power Factor total		●	●			PF sign tot
Leading Power Factor Phase A						PF lead a
Leading Power Factor Phase B						PF lead b
Leading Power Factor Phase C						PF lead c
Leading Power Factor total						PF lead tot
Lagging Power Factor Phase A						PF lag a
Lagging Power Factor Phase B						PF lag b
Lagging Power Factor Phase C						PF lag c
Lagging Power Factor total						PF lag tot
Voltage Unbalance						V unbal
Current Unbalance						I unbal
Residual Current						I 4
Phase Revolution						Phase Rev
Frequency		●	●			Freq
Meter Event				Event		
Volts Phase A HDs		●		Harmonics Analyzer Module #1	V1 Harmonics	V1 HD 1 thru V1 HD 15
Volts Phase A total HDs		●	●			V1 Total HD
Volts Phase A total even HDs		●				V1 Tot EvenHD
Volts Phase A total odd HDs		●				V1 Tot OddHD
Volts Phase B HDs		●		Harmonics Analyzer Module #2	V2 Harmonics	V2 HD 1 thru V2 HD 15
Volts Phase B total HDs		●	●			V2 Total HD
Volts Phase B total even HDs		●				V2 Tot EvenHD
Volts Phase B total odd HDs		●				V2 Tot OddHD

### Real-Time Measurements, Continued

Description of Parameter or Function	Displayed/Accessible by Default			ION Module Name	ION Module Label	Output Register Label
	Vista	PowerView	Front panel			
Volts Phase C HDs		●		Harmonics Analyzer Module #3	V3 Harmonics	V3 HD 1 thru V3 HD 15
Volts Phase C total HDs		●	●			V3 Total HD
Volts Phase C total even HDs		●				V3 Tot EvenHD
Volts Phase C total odd HDs		●				V3 Tot OddHD
Current Phase A HDs		●		Harmonics Analyzer Module #4	I1 Harmonics	I1 HD 1 thru I1 HD 15
Current Phase A total HDs		●	●			I1 Total HD
Current Phase A total even HDs		●				I1 Tot EvenHD
Current Phase A total odd HDs		●				I1 Tot OddHD
Current Phase B Power Factor		●				I1 K Factor
Current Phase B HDs		●		Harmonics Analyzer Module #5	I2 Harmonics	I2 HD 1 thru I2 HD 15
Current Phase B total HDs		●	●			I2 Total HD
Current Phase B total even HDs		●				I2 Tot EvenHD
Current Phase B total odd HDs		●				I2 Tot OddHD
Current Phase B Power Factor		●				I2 K Factor
Current Phase C HDs		●		Harmonics Analyzer Module #6	I3 Harmonics	I3 HD 1 thru I3 HD 15
Current Phase C total HDs		●	●			I3 Total HD
Current Phase C total even HDs		●				I3 Tot EvenHD
Current Phase C total odd HDs		●				I3 Tot OddHD
Current Phase C Power Factor		●				I3 K Factor
Universal Time (UTC)				Clock Module	Clock	UnivTime
Local Time	●					LocalTime
Daylight Savings Time (ON/OFF)						DSTFlag



# Making Configuration Changes

Once basic setup is performed, most users will find that the 7330 ION's factory configuration provides all of the monitoring and control functionality they require. Depending on your application, you may need to make minor changes to the factory configuration to make the device "fit" your power system. This chapter explains how to make small changes to the factory configuration using PEGASYS software, PowerView software, and the front panel.

The 7330 ION can be customized to perform many power monitoring and control functions. Creating custom functionality involves dismantling the factory configuration and replacing it with your own module links and settings. If you want to make significant changes to the operation of the 7330 ION, refer to Chapter 4.

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# Configuration Tools

Different types of configuration changes can be made using the different tools provided by Power Measurement. Each of the tools available has been designed to make basic configuration changes easy. The configuration tools available and the types of configuration changes you can make with them are as follows:



## NOTE

Creating custom functionality in the 7330 ION is discussed in the next chapter.

- ◆ PEGASYS ION Designer software lets you change the settings for any function performed by the meter. Everything from basic setup to creating custom functionality can be performed using ION Designer. The different types of device functions are grouped together on the ION Designer screen, so you can quickly access the types of settings you want to change.

Refer to the *ION Designer's Online Help* for assistance using the software.

- ◆ PowerView for Windows NT / 95 software provides basic setup and advanced setup modes, allowing you to change the settings for any meter function. Advanced users can create custom functionality with PowerView.

Refer to the PowerView on-line help for assistance using the software.

- ◆ The front panel also provides access to the settings of every meter function. Special screens are provided for quick access to basic setup functions. The front panel cannot be used to create custom functionality.

Any of the tools mentioned above are suitable for making minor changes to the device's configuration. If you plan to do more extensive changes later on, use PEGASYS ION Designer for device configuration — this software provides the most comprehensive view of the 7330 ION's internal operation. Once you have become comfortable with the ION Designer interface you will be better prepared to make major changes later.

# Basics of the ION Architecture

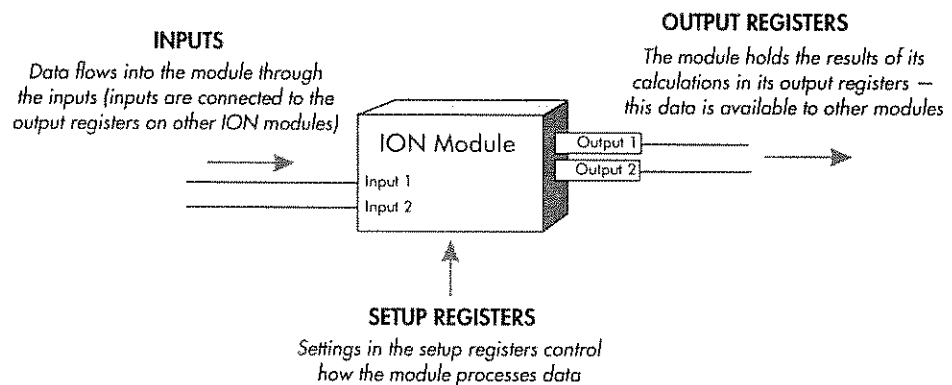
Before you begin altering the 7330 ION's operation, it is advisable to familiarize yourself with the basics of how the device operates. Understanding the basics of the ION architecture will help you understand how to make different types of configuration changes.

The 7330 ION and all other ION devices (including some PEGASYS software nodes, such as the VIP and the Log Server) use the Integrated Object Network, or ION, as their architecture. ION applies the principles of object-oriented software design to the creation of functionality inside your devices. The object-oriented structure of ION allows you to connect different discrete objects (called *ION modules*) in different ways to define how information is accessed, transferred, and manipulated inside the device and across the power monitoring network.

Each ION device contains a number of ION modules that perform specific functions. The ION modules are linked together to create *frameworks*, defining multiple operations and logical pathways for power system information. The basic structure of an ION module is the same for each module type, making it easy to use new features once the basics are understood.

## The ION Module

The ION module is the basic building block of the ION device's architecture. A module can be considered as a "function box": it receives data from its inputs, makes decisions based on the settings in its setup registers, and then makes data available at its output registers. All functionality provided by an ION device can be considered in terms of its modules and the linkages between them.



There are approximately 50 types of modules in the ION architecture; the 7330 ION has 34 different module types. Most ION devices can support several instances of a certain module type (for example, the 7330 ION includes 32 Maximum modules, 30 Sliding Window Demand modules, and eight External Boolean modules).



## NOTE

More detail on ION modules and registers is provided in Chapter 4.

## ION Registers

Each module has one or more output registers, and most modules have setup registers. (A module's inputs can be thought of as a link to the output registers on other modules.)

There are different types of registers, classified by the type of data they accept. When you want to change a module's configuration, you must supply the type of data that is appropriate for the register you are configuring. All of the configuration tools discussed in this chapter prevent you from entering the wrong type of data into a register, but they do not prevent you from entering the wrong value. As any changes to a register's value alters the operation of the device, exercise caution when making configuration changes.

## Making ION Configuration Changes

Regardless of the interface you use, when you make configuration changes to an ION device you are either changing a value in a module's setup register or you are changing the linkage between two or more modules. The types of configuration changes discussed in this chapter are changes to the settings held in ION module setup registers.



The 7330 ION is factory-configured for optimal operation. After basic setup is performed, you do not need to make any modifications to the device's configuration for normal use.

Changing the settings in an ION module's setup registers changes the way the device operates. Carefully consider any change you intend to make before proceeding. Refer to the *ION Reference* for details on each ION module.

Adding or deleting links between ION modules significantly alters the operation of the device, and should only be performed by experienced personnel. Refer to "Customizing the 7330 ION's Operation" in Chapter 4 for instructions on changing module links.

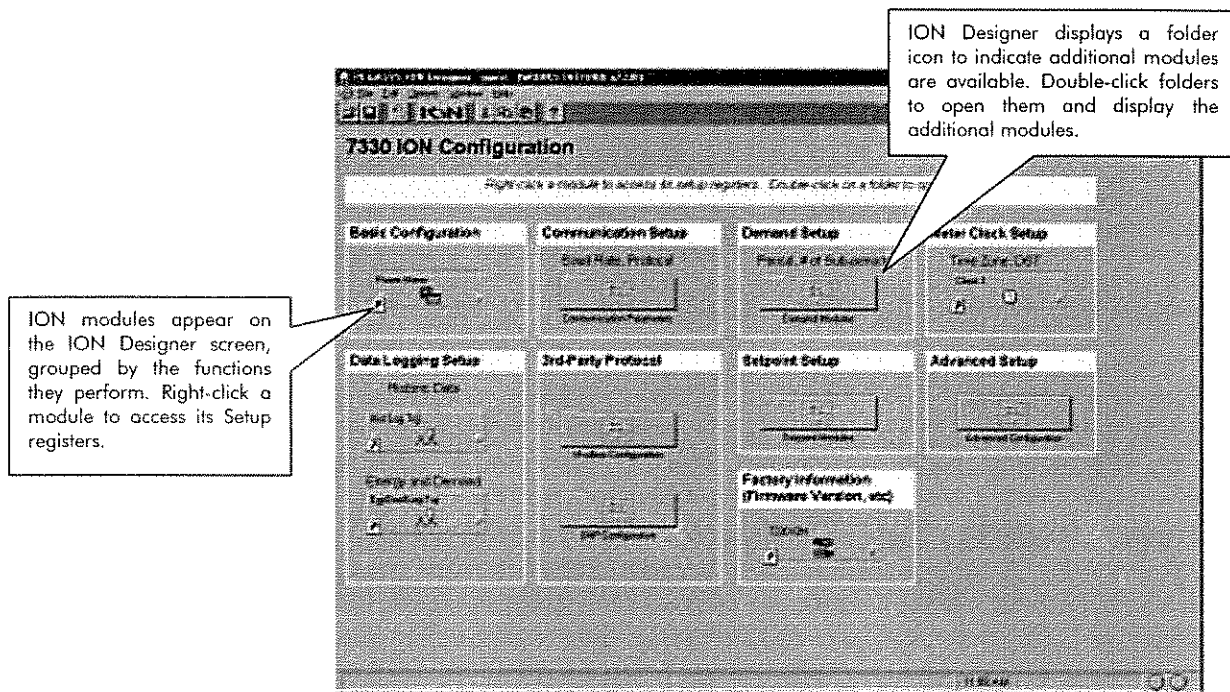


# Configuring the 7330 ION with ION Designer

ION Designer software (part of Power Measurement's PEGASYS suite) provides the most powerful interface to the 7330 ION's operating software. All of the device's ION modules can be accessed and configured using a standard technique and a unified interface.

## The Main 7330 ION Configuration Screen

If PEGASYS 2.0 has been properly configured, the screen below will appear in each time that you open a 7330 ION in ION Designer. If PEGASYS has not yet been configured, refer to the *PEGASYS Administrator's Guide*, or contact your PEGASYS network administrator.



## Using ION Designer to Change Setup Registers

You require PEGASYS password level 5 to modify the settings in a module's setup register. If you do not have sufficient password authority, contact your PEGASYS administrator.

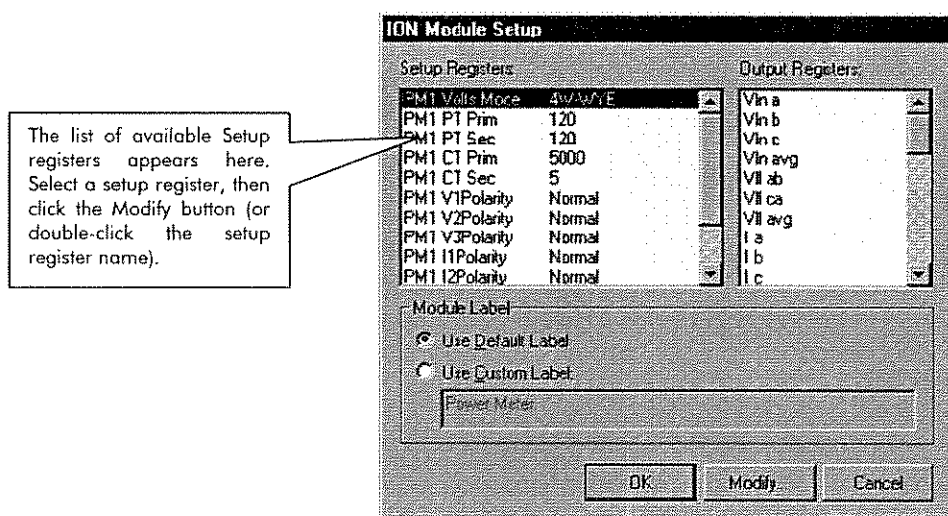
Once you have logged on to ION Designer and you have opened the 7330 ION's node diagram, you can begin configuring ION modules. ION Designer displays two types of objects on the main configuration screen: ION modules and grouping objects (also called folders).

## Grouping Windows (Folders)

The main 7330 ION configuration screen displays a number of folders. A folder in ION Designer indicates that additional modules are available. Double-click on a folder to access the modules that are contained inside it. In some cases a folder will contain additional folders — continue double-clicking on the folders until you reach the ION module you want to configure.

## Accessing ION Module Setup Registers

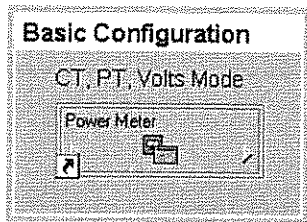
Once you have penetrated the folders to display the ION module you want to configure, right-click near the center of the module's icon. The ION Module Setup dialog box appears, showing a list of setup registers available for configuration:



Highlight the setup register you want to configure, and click the Modify button. The Modify Register dialog box appears — this is where you make the change to the register's setting.

As there are different types of data held in setup registers, there are different Modify Register dialog boxes. The Modify Register dialog box may require that you choose an option from a list or enter a numeric value. The details you need to perform basic configuration changes are provided in the following paragraphs. Complete details of each ION module setup register are provided in the *ION Reference*.

## Basic Configuration



The Basic Configuration area contains the Power Meter module. This module is the main connection between the power system measurements and all other ION modules in the device. The Power Meter reports the values for all of the voltage, current and power measurements. Right-click near the center of the module's icon to configure its setup registers.

The Power Meter module's setup registers describe details of the power system is being monitored. Many of the Power Meter module's setup registers are configured when the 7330 ION is initially put into service (the device will not operate properly until Volts mode and PT and CT ratios are set), but some registers may need to be changed to refine the device's operation.

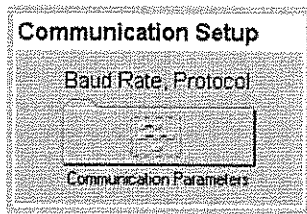
The functions of the setup registers in the Power Meter module are as follows:

Setup Register	Function
Volts Mode *	The power system's configuration – WYE, DELTA, Single, etc
PT Prim *	The Potential Transformer's primary winding rating for V1, V2 and V3
PT Sec *	The Potential Transformer's secondary winding rating for V1, V2 and V3
CT Prim *	The Current Transformer's primary winding rating for I1, I2 and I3
CT Sec *	The Current Transformer's secondary winding rating for I1, I2 and I3
V1 Polarity	The polarity of the Potential Transformer on V1
V2 Polarity	The polarity of the Potential Transformer on V2
V3 Polarity	The polarity of the Potential Transformer on V3
I1 Polarity	The polarity of the Current Transformer on I1
I2 Polarity	The polarity of the Current Transformer on I2
I3 Polarity	The polarity of the Current Transformer on I3
Phase Order	The expected rotation of the voltage phases (ABC or ACB)
Phase Lbls	The phase label format assigned to the outputs (ABC, RST, XYZ, RYB, RWB or 123)

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

Once basic setup is performed (i.e. the PT/CT and Volts Mode settings), the 7330 ION will operate properly. Typically there is no need to make further changes to the Power Meter module's setup registers.

## Communications Setup



The Communication Setup area contains a single folder called "Communications Parameters." Double-click this folder to view the three Communications modules. The Communications modules control the links between the 7330 ION and the networks or workstations it communicates with. The Communications modules have the following functions:

Module Name	Function
Comm 1	Settings for the Comm 1 RS-485 port
Comm 2	Settings for the Comm 2 RS-485 port
Infrared Comm	Settings for the Infrared port

Communication settings are typically configured when the device is initially put into service. A communications channel must be configured before you can use PEGASYS; if you alter the settings for the channel that is in use you will lose your communications connection with the device.

The setup registers in the Communications and Infrared modules define the parameters used for each communications port. The following parameters can be configured (different parameters are presented on different modules):

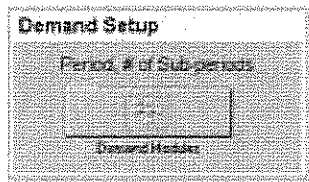
- ◆ communications protocol (for example, ION or Modbus)
- ◆ communications link speed (for example, 19, 200 bps)
- ◆ device unit ID

### Communications Protocols

By default each communications port on the 7330 ION is configured to use the ION protocol. If you want to make use of the Modbus or DNP 3.0 configurations, you need to configure the Communications module that controls the port you want to use.

Use the table above to determine which module controls the port you intend to use, and choose the appropriate protocol from the module's Protocol setup register. Note that only one port can communicate using DNP 3.0 at a time.

## Demand Setup

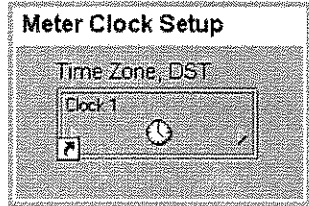


The Demand Setup area contains a single folder called “Demand Modules.” Double-click this folder to view the eight demand modules that have been configured (four Thermal Demand modules and four Sliding Window Demand modules). The demand modules are configured to calculate the average current demand and kW, kVAR and kVA demand.

The setup registers in the demand modules define time intervals for demand calculations, setting the sensitivity of the module’s operation.

Setup Register (module)	Function
Sub Intvl (Sliding Window)	The time, in seconds, in the sliding window demand sub-interval
# SubIntvls (Sliding Window)	The number of sub-intervals in the sliding window
Pred Resp (Sliding Window)	The speed of Predicted Demand calculations; use higher values for faster prediction (values between 70 and 99 recommended)
Interval (Thermal)	The time, in seconds, in the thermal demand interval
Time Const (Thermal)	The sensitivity to changes in the source signal; higher values provide faster response time (common values are 63 and 90)

## Meter Clock Setup



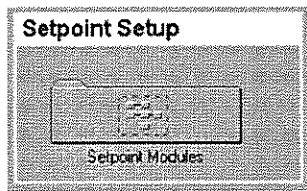
The Meter Clock Setup area contains the Clock module. Right-click near the center of the module’s icon to configure its setup registers. This module controls the 7330 ION’s internal clock, which provides timestamps for data logged by the device. The clock needs to be configured properly to ensure that logged data has accurate timestamp information. The Clock module also receives the time synchronization signals sent to it by PEGASYS workstation, and updates the device’s clock when required.

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

Setup Register	Function
TZ Offset	The timezone the device is in, relative to Greenwich Mean Time
DST Start	Date and time when DST begins
DST End	Date and time when DST ends
DST Offset	The amount of time the clock is changed when DST begins or ends
Time Sync Source	The communications port that provides time sync signals
Time Sync Type	The type of time sync signal (Local or Universal time)

Refer to “Time Synchronization” in Chapter 4 for further details on using the 7330 ION’s time synchronization functions.

## Setpoint Setup



The Setpoint Setup area contains four Setpoint modules that monitor some “over” and “under” conditions for sliding window demand, current, voltage and power factor.

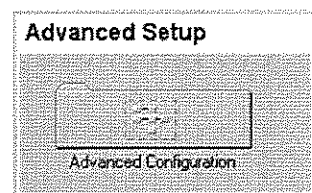
The Setpoint modules have the following setup registers:

Setup Register	Function
High Limit	The limit that a source input must exceed for an over condition to start
Low Limit	The limit that a source input must exceed for an under condition to start
SusUntION	Amount of time an input must be out of range for an over/under condition to start
SusUntIOFF	Amount of time an input must be back in range for an over/under condition to end
Input Mode	This register specifies how the value of the source input is interpreted.
Eval Mode	Determines how the High Limit and Low Limit setup registers are interpreted
EvPriority	The priority assigned to a Relative Setpoint event (0 to 255, 255 is highest)

There is no need to change any of the Setpoint module’s setup registers for normal operation of the 7330 ION. If you want to fine-tune over/ under condition monitoring, the only setup registers you should change are SusUntION and SUSUntIOFF.

SusUntION determines how long the modules will wait after an over/under 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, allowing very brief over/under conditions to be ignored. Similarly, SusUntIOFF is the amount of time a normal value must be present before the module considers normal operation to be restored. Both SusUntION and SusUntIOFF values are entered in seconds (the default value for both is 30 seconds).

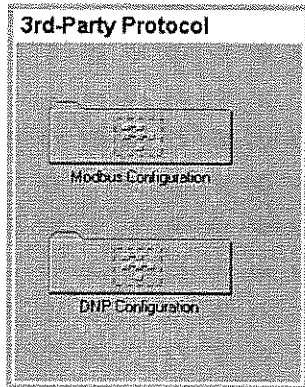
## Advanced Setup



The Advanced Setup area contains a single folder called “Advanced Configuration.” Double-click this folder to view additional folders that contain device configuration information. The six folders inside the Advanced Configuration folder provide access to the module frameworks that perform the various functions on the device.

As the name implies, “Advanced Configuration” should only be performed by experienced personnel who understand the internal operation of the 7330 ION — any changes you make in this area will affect the device’s operation. There are no adjustments required to any of the modules in the Advanced Setup area.

## Third-Party Protocols



### NOTE

The 7330 ION can also be configured to receive data through Modbus. There is no factory-configured framework for receiving data through Modbus — refer to Chapter 4 for details on setting this up.

The third-party Protocols area contains “Modbus Configuration” and “DNP Configuration”. Double-click these folders to view the factory-configured modules.

### Modicon Modbus Protocol

The 7330 ION supports the Modicon Modbus RTU protocol, making a comprehensive set of power, energy, demand and harmonics parameters available to Modbus Master devices. Refer to the section “Using the Modbus RTU Protocol” in Chapter 4 for a list of parameters available through Modbus.

Perform Advanced configuration to make any measured or calculated parameter available to connected Modbus Master devices. This requires modifying existing Modbus Slave Read modules and linking them to the parameters you want to export via Modbus. Refer to Chapter 4 for details.

There are no basic configuration adjustments to make in the Modbus Configuration folder. Changing the factory Modbus configuration is an advanced setup procedure that requires an understanding of the Modbus protocol and an understanding of the 7330 ION’s internal operation.

### DNP 3.0 Configuration

The 7330 ION uses the DNP 3.0 protocol to make various energy, power and demand parameters available to DNP 3.0 master devices. Refer to the section “Using the DNP 3.0 Protocol” for a list of the parameters available through DNP. DNP 3.0 is available on each of the 7330 ION’s communications ports; however, two ports cannot use DNP 3.0 protocol simultaneously.

As with Modbus, any measured or calculated parameter can be made available through DNP 3.0. This requires creating new (or modifying existing) DNP Slave Export modules and linking them to the parameters you want to export via DNP.

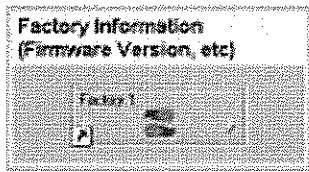
There are no basic configuration adjustments to make in the DNP Configuration folder. Changing the factory DNP configuration is an advanced setup procedure that requires an understanding of the DNP 3.0 protocol and an understanding of the 7330 ION’s internal operation.

## Configuring a Communications Protocol

In order to use the factory Modbus or DNP configuration you must first configure the communications channel you want to use. By default all communications ports are configured to use the ION protocol. Choose either MODBUS or DNP 3.0 from the list of available protocols in the Communications module’s Protocol setup register. Refer to “Communications Setup” on page 3–8 for details on the available communications ports.

Modbus RTU is available on each of the 7330 ION’s communications ports, and can operate on any number of communication ports simultaneously. DNP 3.0 is available on each port, but only one port can use the protocol at any one time.

## Factory Information



The Factory Information area has a single module called “Factory 1”. The Factory module contains information about the 7330 ION. Right-click near the center of the module’s icon to view its setup registers. 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). The device information provided is as follows:

Setup Register	Description
Device Type	A device type identifier (“7330” for the 7330 ION)
Compliance	A statement of whether the device is ION compliant or not
Revision	The 7330 ION’s firmware version
Serial Number	The 7330 ION’s serial number
Nom Freq	The expected frequency of the power system being monitored

Three setup registers are provided for you to enter your company name and other text information you want stored in the device. These registers are as follows:

Setup Register	Description
Owner	Text register for storing user information (for example, your company name)
Tag 1	Text register for storing user information (for example, device location)
Tag 2	Text register for storing user information (for example, device number)

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

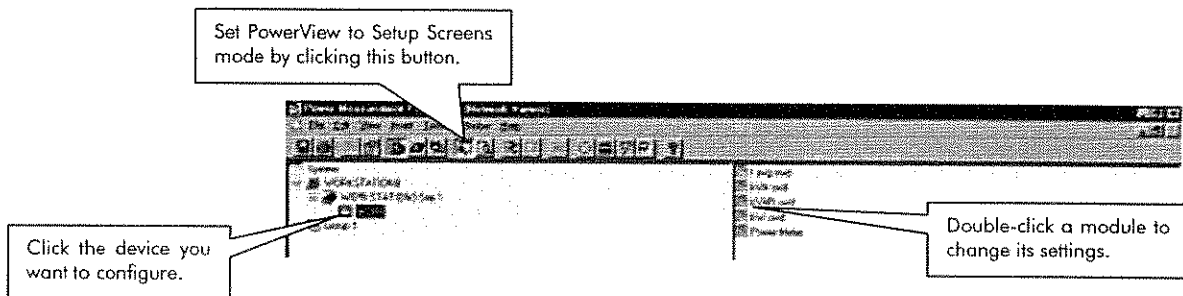


# Configuring the 7330 ION with PowerView

PowerView for Windows NT / 95 provides complete device configuration capabilities. PowerView lets you configure setup registers and modify module links. The device setup functions discussed in this chapter are limited to setup register changes (module linking is an advanced operation - refer to Chapter 4).

## Using the PowerView Interface

When you start PowerView and logon, a split screen appears showing your power monitoring network on the left and setup screens or data screens on the right. To configure an ION device in PowerView, set the display to Setup Screens mode, select the device in the left pane, then double-click the module you want to configure in the right pane.



## PowerView's Setup Screens Mode

PowerView uses the same interface to provide device setup functions and to display measured data. To perform device configuration, make sure PowerView is set in Setup Screens mode.

Set PowerView to Setup Screens mode by selecting Setup Screens in the View menu or by clicking the Setup Screens button on the toolbar.

When PowerView is in Setup Screens mode, the right pane displays the ION modules in the selected device. To edit a module's setup registers or links, double-click the module's icon. Note that the number of ION modules that appear in the right pane depends on PowerView's setup mode (described on the next page).

## PowerView's Basic and Advanced ION Setup Modes

PowerView has two setup modes: Basic ION Setup and Advanced ION Setup. By default PowerView is set to Basic ION Setup mode and only the ION modules that commonly require user configuration are displayed. In Advanced ION Setup mode PowerView displays all of the ION modules available in the device.

### Using Basic ION Setup Mode

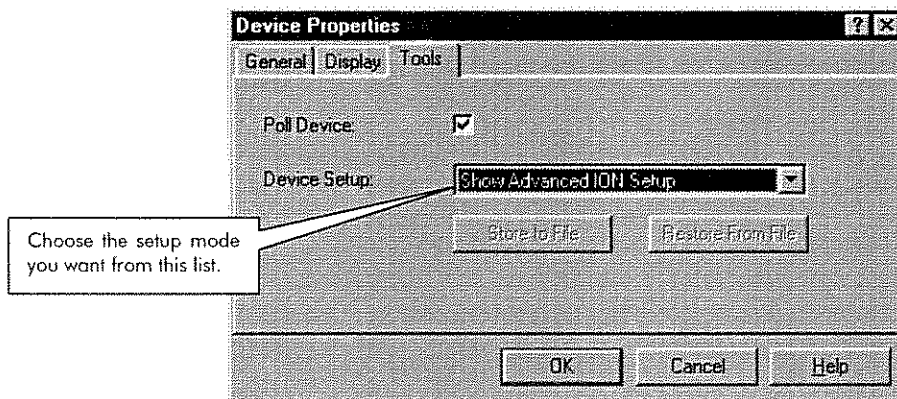
When you initially select Setup Screens mode in PowerView the current and power (I avg, kW, kVA, kVAR) Sliding Window Demand modules and the Power Meter module are displayed in the right pane.

- ◆ Double-click each of the Sliding Window Demand module to set the *Sub Intvl*, *#SubIntvls* and *Pred Resp* setup registers. Refer to page 3-9 for a description of each of these setup registers.
- ◆ Double-click the Power Meter module to configure various basic setup settings, such as PT/CT ratios and power system configuration. Refer to page 3-7 for a description of each of the Power Meter module's setup registers.

### Changing to Advanced Setup Mode

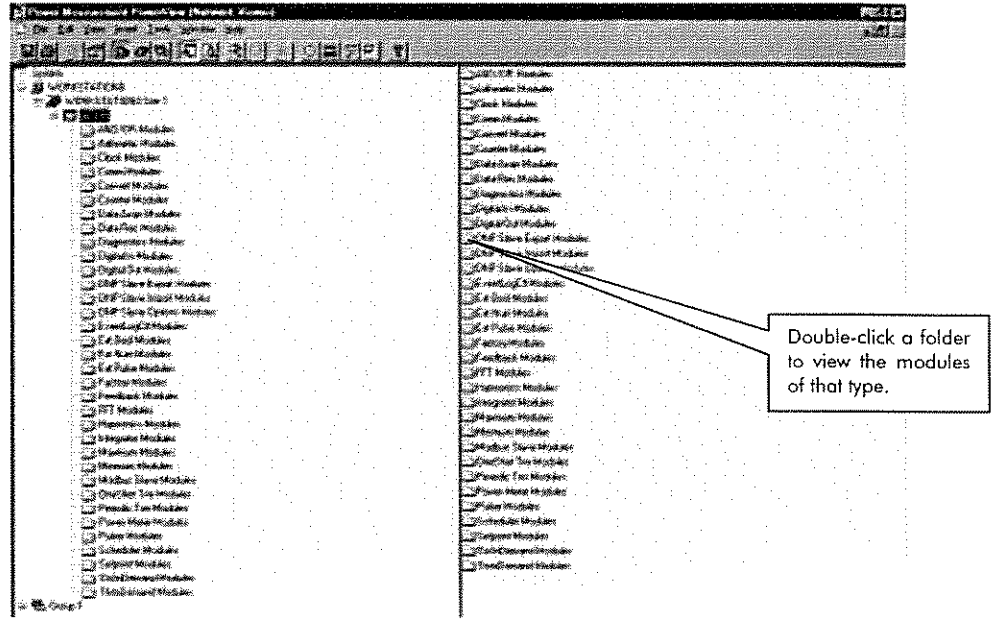
For a comprehensive view of all ION modules in the 7330 ION, set PowerView to Advanced ION Setup mode. Advanced ION Setup can be set for individual devices in the network.

Right-click on the device you want to configure and select Properties... from the pop-up menu. The Device Properties dialog box appears. Click the Tools tab, and choose the setup mode you want to use.



## Using Advanced Setup Mode

Once you choose Show Advanced ION Setup and click OK, PowerView uploads all ION modules from the device. Modules are grouped together by type in folders in the PowerView display. Double-click a folder to view the modules inside it.



If you double-click a folder and no modules appear in the right pane, there are no modules of that type created in the 7330 ION's factory configuration. If a module appears, double-click it to configure its setup registers.

## Determining Which Modules to Configure

The 7330 ION is factory configured to be fully operational. Unless you have a specific setting you want to change, you should not edit any of the device's modules. If you need to make a change to the device's operation, you have to determine which module you need to configure. This is usually a simple task, as all of the ION modules use names that indicate their function.

### NOTE

If you are unable to determine which module you need to configure to achieve a specific type of operation, contact Power Measurement Customer Service.

If you have a specific task you need to perform, but you don't know which module controls that task, first refer to "Configuring the 7330 ION with ION Designer" earlier in this chapter. ION Designer software organizes the modules into the types of functions they perform, such as Communications Setup and Demand Setup. If you can find the type of operation you need to perform in the headings under "Configuring the 7330 ION with ION Designer" you can see which modules are used for that operation. Also refer to the "Complete List of Factory-Configured Measurements and Functions" in Chapter 2.

# Configuring the 7330 ION with the Front Panel

The front panel provides device setup capability at the 7330 ION's installed location. All of the 7330 ION's setup registers can be configured moving through menus on the front panel's screen (ION module links cannot be modified using the front panel). The front panel also provides quick access to parameter reset for common cumulative parameters.

## The Front Panel's Setup Menus

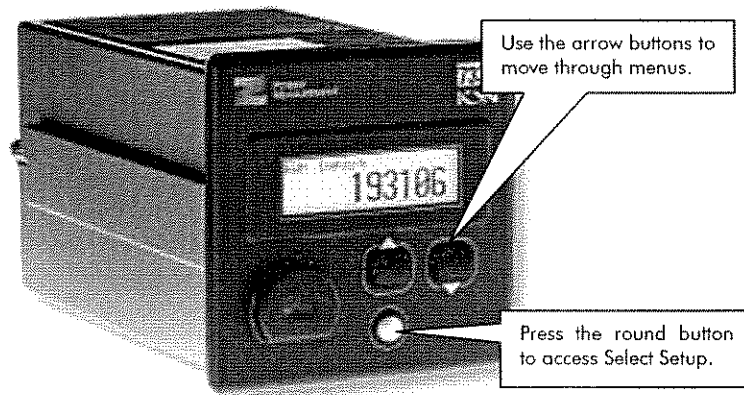
To access the front panel's device configuration functions, press the round button. The Select Setup screen appears listing the 7330 ION's front panel setup options:

Setup Option	Description
Clear Functions	Resets Min/Max, Sliding Window Demand, Energy, Thermal Demand, Peak Demand registers, Harmonics Min/Max, and Status counters.
Quick Setup	Changes settings in the Communications and Power Meter modules.
Adv Meter Setup	Provides access to all the modules in the 7330 ION.
Display Setup	Customizes the appearance of the display screen*.
Screen Setup	Customizes the style and values appearing on the display screens*.
Nameplate Info	Displays information about the device*.
Security	Allows you to modify your password. See "Password Security"

\* See Chapter 2 – Displaying Data for details

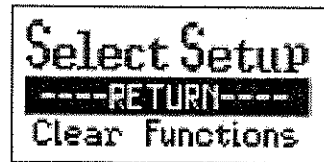
## Accessing the Setup Menus

The three buttons are used to navigate the on-screen menus and edit setup registers. While the device is displaying data, the up and down buttons scroll through the different display screens. Pressing the round button at this time will access the Select Setup menu.



## Navigating Menus

Each menu has a title displayed at the top of the display screen and menu items displayed below the title. Use the arrow buttons to scroll through the menu items. To select an item that is highlighted, press the round key.



To return to the previous screen, select RETURN. Return to the data display screens by repeatedly selecting RETURN.

## Editing Registers

To edit a value of a register, navigate the registers using the arrow keys until the register you want is highlighted, then press the round button. The register will appear in one of two ways: as a number, or as an option selected from a menu. Once you have entered the Password (if required), a Yes or No verification screen appears showing the new value of the register. Select Yes to change the value of the setup register; select No to return to the previous screen without changing the value.

### Numeric Registers

Use the arrow buttons to change the value of the digit above the ▲ cursor.



Change the position of the cursor by holding down an arrow key for about one second. Holding the up arrow button moves the cursor left one position, and holding the right arrow button moves the cursor right one position. Once you have the value you want, press the round button.

### Enumerated Registers

Some registers are displayed as a menu of options. The current value of the register will be displayed in the list with an asterisk (\*) on either side of it. Use the arrow buttons to highlight the setting you want, and press the round button.

## Password Security

The password is required when you make a change to a register. Once you have entered a valid password, you can make multiple register changes. The password is factory set at '00000' (5 zeros). Once you are in Select Setup and you make the first change to any setting, you will be presented with a screen where you enter the password. In the password screen, there are five places to enter numbers (see "Numeric Registers" above). Press the round button when you have entered the correct password.



### NOTE

The 7330 ION user password is factory set at 00000.

# Clear Functions

The Clear Functions menu allows you to reset cumulative parameters. To access the Clear Functions screen, press the round button while the 7330 ION is displaying data; scroll down the Select Setup menu and select Clear Functions.

## Peak Demand Reset

The following Demand parameters are reset when *Peak Dmd Rset* is used:

- ◆ Maximum and Minimum Sliding Window Demand (kW, kVAR, kVA)
- ◆ Maximum and Minimum Thermal Demand (kW, kVAR, kVA)

## Min/Max Reset

The minimum AND the maximum values for each the following parameters are reset when *MnMx Rset* is used:

- ◆ Phase and average Current (I a, I b, I c, and I avg)
- ◆ Line-to-line voltages (Vll ab, bc and ca, and Vll avg)
- ◆ Line-to-neutral voltages (Vln a, b and c, and Vln avg)
- ◆ Frequency
- ◆ PF lead and PF lag
- ◆ Total kW, kVAR and KVA

## Sliding Window Demand Reset

These Sliding Window Demand parameters are reset when *SWDemand Rset* is used:

- ◆ Average Current (I avg) SWD
- ◆ kW SWD
- ◆ kVAR SWD
- ◆ kVA SWD

## Thermal Demand Reset

The following Thermal Demand parameters are reset when *TDemand Rset* is used:

- ◆ Average Current TD
- ◆ kW TD
- ◆ kVAR TD
- ◆ kVA TD

## Harmonics Min/Max Reset

The following Harmonics Parameters are reset when *Harm MnMx Rset* is used:

- ◆ Current Total HD (Ia, Ib, Ic)
- ◆ Voltage Total HD (Va, Vb, Vc)

## Status Counters

Each of the four Status Counters that monitor the number of times each Status input changes are reset when *S Count Rset* is used.

## Energy Reset

The following energy parameters are reset when *Energy Rset* is used:

- ◆ kWh import, export, total and net
- ◆ kVAh
- ◆ kVARh import, export, total and net

## Quick Setup

The front panel's Quick Setup menu provides access to the Power Meter module and the Communications modules. These settings are all configured when the device is initially put into service — typically you will not need to change these settings once the device is operational.

To access the Quick Setup screen, press the round button while the 7330 ION is displaying power system data. Scroll down the Select Setup menu and select Quick Setup.

### Power Meter Module Settings

The Power Meter module setup registers accessed from Quick Setup are as follows:

Register	Default Value	Description
PM1 Volts Mode	4W-WYE	The power system's configuration – WYE, DELTA, etc.
PM1 PT Prim	*	The Potential Transformer's primary winding voltage rating.
PM1 PT Sec	*	The Potential Transformer's secondary winding voltage rating.
PM1 CT Prim	5	The Potential Transformer's primary winding current rating.
PM1 CT Sec	5	The Potential Transformer's secondary winding current rating.
PM1 V1 Polarity	NORMAL	The polarity of the Potential Transformer on V1.
PM1 V2 Polarity	NORMAL	The polarity of the Potential Transformer on V2.
PM1 V3 Polarity	NORMAL	The polarity of the Potential Transformer on V3.
PM1 I1 Polarity	NORMAL	The polarity of the Potential Transformer on I1.
PM1 I2 Polarity	NORMAL	The polarity of the Potential Transformer on I2.
PM1 I3 Polarity	NORMAL	The polarity of the Potential Transformer on I3.

\* PT Prim/Sec will be 120, 277 or 347 depending on the voltage input option you purchased.

The remaining Power Meter module setup options and their default values are given in the *ION Reference* manual. In most cases you can leave them at their default settings and the 7330 ION will function properly.

## Communications Module Settings

The Communication module setup registers accessed from Quick Setup are as follows:



### NOTE

The factory set Unit ID is based on the serial number of the meter. For example, Serial number: PB-9709A263-06; Unit ID: 9263

Register	Default Value	Description
CM1 Unit ID	<i>Factory Set</i>	The communications ID for COM1
CM1 Baud Rate	9600	The baud rate of the COM1 port
CM1 Protocol	ION	The communications protocol for COM1
CM2 Unit ID	<i>Factory Set</i>	The communications ID for COM2
CM2 Baud Rate	9600	The baud rate of the COM2 port
CM2 Protocol	ION	The communications protocol for COM2
IR1 Unit ID	<i>Factory Set</i>	The communications ID for the Infrared port
IR1 Baud Rate	9600	The baud rate of the Infrared port
IR1 Protocol	ION	The communications protocol for the Infrared port

The remaining settings of the communications modules and their default settings are given in the *ION Reference*.

## Advanced Meter Setup

The Advanced Meter Setup provides access to the setup registers of every ION module in the 7330 ION. To access this menu screen, select Adv Meter Setup from the Select Setup menu. Follow this procedure to access a setup register:

1. From the Feature Manager screen, select the module's type.
2. Select the module you want to configure from the list of available modules.
3. From the list of the module's setup registers, select the one you want to configure.
4. Edit the value of the register (see "Editing Registers" on page 3-17).
5. You may be prompted to enter your password setting (see "Password Security" on page 3-17)
6. Select Yes to the next prompt to change the value of the register. Select No if you want to leave the screen without making any changes.

Refer to the *ION Reference* for complete details on each setup register's function. Refer to Chapter 5 in this guide for a listing of the supported ranges or options for each module in the 7330 ION.



## Display Setup, Screen Setup, and Nameplate Info

The Display Setup and Screen setup menus allow you to change the display attributes of the front panel display screen. The Nameplate Info menu displays information about the 7330 ION's manufacturer, serial number, accuracy rating, and options purchased. See Chapter 2 for details on these menus.

## Changing the 7330 ION's Password

### NOTE

Once the correct password is entered, you will not have to re-enter the password for any other changes unless you exit Setup.

When any changes are made to the 7330 ION via the front panel, the 7330 ION prompts for a user password. The password prevents unauthorized tampering with your 7330 ION's configuration. Depending on site security, you may want to modify the user password from the default to protect your configuration. The default password is "00000" and can be set to a maximum numeric value of 60000.

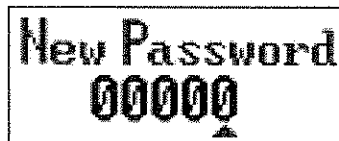
The 7330 ION also has a backdoor password which provides access to all of the configurable options of the 7330 ION. The backdoor password allows Power Measurement personnel access to your 7330 ION in the event that you lose your user password. If you wish to change the backdoor password, contact Power Measurement with the 7330 ION's serial number. Note that once the backdoor password is changed, Power Measurement personnel will no longer be able to access the 7330 ION.

### Changing the User Password

1. Select Security from the Select Setup menu.
2. You will see that the screen displays 00000. Enter the current password. If you have not previously changed your password, the default is 00000.
3. Choose Modify Password to alter your password (the Factory Use Only option is for factory purposes and is not accessible).
4. You can now enter your new numeric password (see "Editing Registers" earlier in this chapter).

### CAUTION

Keep your new user password in a safe place so it will not be lost. If you forget your new password, contact Power Measurement for assistance.



5. Select Yes to accept your new password. You will be returned to the Select Setup screen.

## Diagnostics

The 7330 ION comes with a diagnostic tool to verify digital output and com port communications. The Diagnostic screen is accessed from the Select Setup menu; this screen allows you to verify both Communications and Digital I/O.

Each diagnostics screen shows labeled boxes depicting active communications through a particular port; a filled box indicates active communications; an empty box indicates no communications activity.

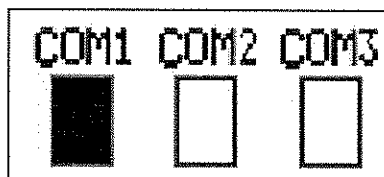


### NOTE

The diagnostic is most effective when the update rate is set to one second (See Chapter 2 for details).

### Communications Diagnostic

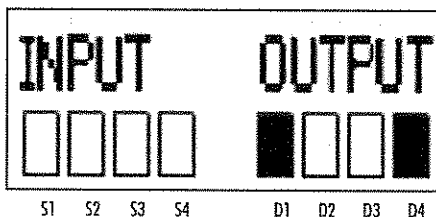
The Communications diagnostic screen shows three boxes labeled COM1, COM2 and COM3. The following screen is an example of COM1 communication:



COM 1 and COM 2 refer to the communications ports on the back panel of the 7330 ION. The COM 3 box verifies communication through the Infrared port on the front panel (IR1).

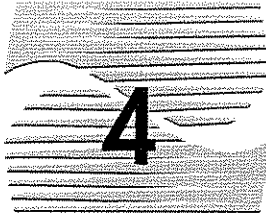
### Digital I/O Diagnostic

The Digital I/O diagnostics mode verifies the operation of the digital inputs and outputs you may have connected to the device. The Digital I/O screen shows four boxes representing the S1 to S4 digital inputs, and D1 to D4 digital outputs. The following screen shows digital output ports D1 and D4 in operation:



### Local Data / Time

This function displays the time and date from the device's internal clock.



# Using Advanced Features

The 7330 ION's functionality can be customized to perform many power monitoring and control functions. Using advanced features often requires considerable background knowledge — please be prepared to spend some time familiarizing yourself with the information in this chapter and the Technical Reference in Chapter 5.

This chapter discusses the creation of custom functionality, the use of digital outputs and advanced communications protocols, and the creation of custom front panel displays.

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  - ION Event Priority Groups ..... 4-8
  - Dismantling the Factory Configuration..... 4-8
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# Customizing the 7330 ION's Operation

The 7330 ION, and all other ION devices, can be completely customized to perform any functions you need. PEGASYS and PowerView software provide the tools to create specific functionality by altering the operating software inside the 7330 ION.



The 7330 ION is a sophisticated device. You should not make any changes to its operating software unless you are familiar with the ION architecture, you know specifically what you want to accomplish, and you understand the effects of the changes you intend to make.

## How Custom Functions are Created

To create custom functions, ION modules are linked together and then configured. Linking ION modules is a simple task: output registers on one module are linked to the inputs of subsequent modules. The data flows from the output register on the first module to the input on the second. Each module that receives data makes decisions and processes the data based on the settings in its setup registers. Once a module has processed the data it has received, it makes the data available at its output registers. These output registers can then be linked to the inputs of other modules, and so on.



## NOTE

Refer to the *ION Reference* for complete details on each ION module.

Adding modules using ION Designer software is discussed on page 4–10.

Most ION modules perform simple, discrete functions. It is the combination of modules linked together that creates powerful functionality. As the operation of the device can be separated into the specific, smaller functions performed by the modules, creating functionality is simple if you understand the functions of the component pieces.

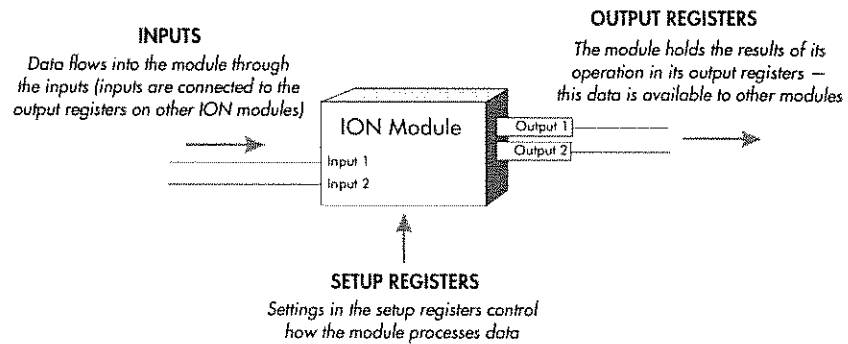
## Recommended Configuration Tools

Both PEGASYS and PowerView software provide the tools necessary to customize the 7330 ION's operation. Whenever possible, PEGASYS ION Designer should be used to create custom functionality as it provides a more powerful interface to the device's internal operation. ION Designer presents ION modules and module links graphically — you are able to view the flow of data on the screen. Many of the discussions in the chapter assume you are using ION Designer.

PowerView provides the functions required to link ION modules, but there is no graphic representation of how the data flows through the linked modules. Using PowerView to create custom functionality requires the ability to conceptualize module linkages without being able to view them on screen.

## ION Details

In order to create custom functions in the 7330 ION it is necessary to understand some of the “rules” of ION. Read the following paragraphs for information on the component parts of an ION module and what restrictions apply to their use. To recall what was stated in Chapter 3, an ION module consists of inputs, setup registers and output registers.



Modules are linked together to create powerful functions. In this example, a combination of modules (also referred to as a *framework*) measures kW, calculates the kW Thermal demand and then monitors kW Thermal demand to determine the maximum value reached..



### Module Linking Restrictions

The maximum number of modules that can be linked in a row is eight. This is referred to as the framework’s *depth*. Modules that branch off or branch into the chain do not affect the depth, and there is no restriction on the number of branches you can have in a framework.

Another restriction concerns “circular” linking of modules. You cannot link a module’s output register to its own input or to the input of any module that precedes it in the chain. This protects you from creating infinite loops that can waste system resources.

## The Not Available Value

If a module is not linked to anything, its output registers will not contain any values and are set to Not Available. In addition, if a module has an input that is invalid (for example, a line-to-neutral measurement for a 3-wire Delta system) its output register is also set to Not Available. This helps distinguish between cases where a register contains a value like 0 or 0xFF, and cases where there is actually no value stored.

If the inputs of a module are Not Available, its output registers are also Not Available. The Not Available value propagates through all linked modules. (The Not Available value propagates through linked Arithmetic modules differently – refer to the Arithmetic module description in the *ION Reference*.)

## Core Modules and Fixed Module Links

The 7330 ION includes several core modules. Core modules are integral to the basic operation of the device; they cannot be created or deleted. Core modules in the 7330 ION version 7330V20x include Communications, Data Acquisition, Diagnostics, Factory, FFT, and Power Meter Components.

Several of the linkages between core modules are fixed; they are required for the basic operation of the device. A fixed link cannot be removed. A core module with fixed links can still be linked to other modules if desired.

## ION Register Details

Not all output registers can serve as input registers for all modules. There are different *classes* of registers and each is capable of holding different types of information. To combine two ION modules together, the output registers of the first module must contain the kind of information that the next module can use.

To see if you can link ION modules, check the class of the module's inputs and output registers to ensure they are the same. The following list describes the various register classes available.

- *Numeric*  
These registers contain a single numeric value. It can be any value within the range capabilities of the device.
- ■ *Numeric Array*  
These registers contain an array of numeric values.
- *Boolean*  
These registers contain a logical ON or OFF (1 or 0).
- ∧ *Pulse*  
These registers “contain” a pulse, or instantaneous signal. They are normally used for resetting, pulsing or triggering functions.



### NOTE

ION Designer uses a double outline to indicate a core module.

### *Enumerated*

These registers are used for storing one value from a list of several options. For example, the Setpoint module has an Evaluate Mode setup register that can be set to either LESSTHAN or GREATERTHAN. Typically only setup registers are of the enumerated class.

### ■ *Numeric Bounded*

These registers contain a number bounded by a high and low limit. For example, in the Thermal Demand (TD) module, the setup register that specifies the period length is numeric bounded because the value must be a number higher than 1 but less than 100. Typically only setup registers are of the numeric bounded class.



### *Calendar*

The Calendar register holds the setup information in the Scheduler module.

### **T** *String*

These registers contain text strings. Text strings can consist of any combination of numbers, letters and spaces, excluding double-quote characters ( "). In addition, the text must not end with a backslash character ( \ ). (Backslashes elsewhere in the text are permissible, as is a backslash at the end of the string if it is followed by a space character.)

String register applications include formulas (Arithmetic module) and device information (Factory module).

### *Event*

Almost every ION module has an output called an event register that records all the *events* produced by the module. An event is simply any occurrence in the system that warrants logging (for example, changing a setup register or a Setpoint module going active). The contents of an event register include:

- ◆ A timestamp of when the event occurred
- ◆ The priority of the event
- ◆ The cause of the event
- ◆ Any values or conditions associated with the cause
- ◆ The effect of the event
- ◆ Any values or conditions associated with the effect

The Event Log Controller module takes all the event registers from all the modules in the device and assembles them to provide an Event Log.



### *Event Log*

These registers contains the assembled contents of all the event registers of other modules. The Event Log Controller module uses this class of register to provide a log of all the events occurring on the device.



### Log

These registers can contain a timestamped list of numeric, Boolean or waveform data. Typically, modules that record data (e.g. Data Recorder, Waveform Recorder) have Log output registers.

### ION Register Names and Labels

Every register in the ION architecture has a name and a programmable label that identify what information the register contains. The default label for each register is typically the same as its name.

You can change the label via communications to be more descriptive for your application. For example, the name (and thus the default label) of the Maximum module's output register is *Maximum*. If you are using that particular module to record maximum values on Vunbal, you may want to change the "Maximum" label to "Max Vunbal" to make it more apparent what the contents of the register represent. The length of the label is limited to 15 characters.

## Timing Considerations in the 7330 ION

The standard, high-accuracy update rate of the modules in the 7330 ION is once per second.



### NOTE

The modules that have time-sensitive setup registers include:

- Setpoint
- Periodic Timer
- One-shot Timer
- Digital Input
- Digital Output
- Pulser
- Communications

In addition, both the Sliding Window Demand module and the Thermal Demand module have definable time intervals.

### Time-Sensitive Modules

Many modules in the 7330 ION have setup registers requiring you to specify a time interval. Typically, these registers are specified in seconds and you can enter any value that is within the allowable range. Due to the update rate of the module, however, the time that you specify cannot always be supported. If you specify a time that is shorter than the update rate of the module (or falls in-between update cycles), the module will round up to the shortest time possible.

Since the frequency of the system defines how many milliseconds there are in a cycle, and the frequency of the system can drift slightly, specifying an exact number of milliseconds may not always correspond with the number of cycles you expect. For example, if you specify a value in milliseconds that exactly corresponds to three cycles, your event may sometimes occur every three cycles and sometime every four if there has been any drift.

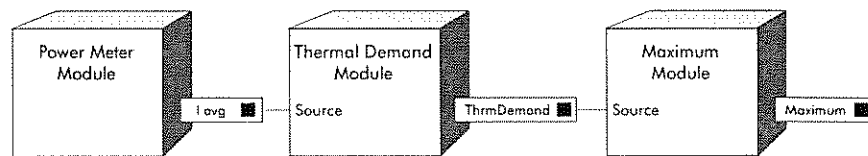
You can take advantage of the fact that some modules always round time values up to the closest update rate they can support to ensure that your time value results in the number of cycles you want. For example, in a 60 Hz system, if you specify 13 instead of 16.67 milliseconds, the module will automatically update every cycle, even if the frequency has drifted and the number of milliseconds in a cycle has changed to 15.



## Sequence of Module Execution

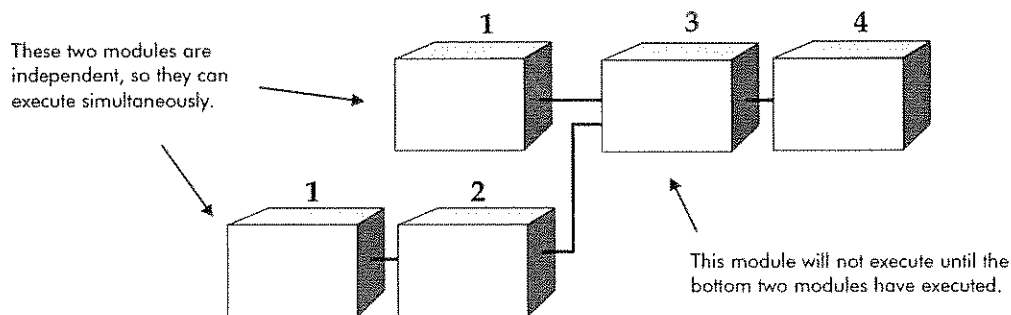
ION modules are executed in the order in which they are logically linked, rather than the order in which you actually linked them. In other words, modules are executed in the same order in which the data flows from one module to the next.

This allows you to create a framework by linking modules in any order you want and maintain a logical execution order. For example, you can create a group of modules, or framework, that determines the maximum thermal demand value reached by I avg. The modules would be executed in the following order:



This allows you to link a framework in any order you wish and maintain a logical execution order. For example, you can link the Maximum and the Thermal Demand modules together first, and then later link them to the Power Meter module. It does not affect the execution order; the Power Meter module will still execute first.

In more complex frameworks, the relationship between modules may not be as linear as in the previous examples. In these cases, modules are still executed in the order of information flow but some modules may be executed simultaneously if they do not depend on each other for data. For example:



Note that execution order and update rate are not the same thing. Update rate refers to how frequently a module performs its operation and updates its output registers. Execution order refers to the order in which modules execute *within* the update period.

## ION Event Priority Groups

Each event has a priority group number assigned to it, based on its type and severity. There are 8 event priority groups in total, as shown in the table below.

Event Group	Description	Priority Number
Reset	Module reset or resynchronized	5
Setup Change	Module setup changes (setup register changes, label changes, input handle changes)	10
Input Register Change	Inputs of certain modules change value (i.e. input to And/Or module changes)	15
I/O State Change	I/O state changes (i.e. relay closes)	20
Information	Module produces important user information	25
Warning	Module produces a warning	30
Failure	A failure has occurred	255

## External ION Events

Some events are not produced by a specific module; they are generated internally by the 7330 ION. These events and their associated priority levels are shown in the table below.

Event Group	Description	Priority Number
Warning	Factory initialize performed	30
	Firmware upgrade performed	
	Memory upgrade performed	
	Device power-up	
	Device power-down	
Failure	Communications fail to allocate required memory	255

## Dismantling the Factory Configuration

The 7330 ION's factory configuration uses approximately 64% of the available processing power. Any additions you make to the device's configuration will increase this number. (The processor power used cannot exceed 100%.)

You can add some functionality to the factory configuration without exceeding 100% processor power. By monitoring the impact each change has on the processor's capacity you can determine whether or not the change can be implemented without removing some existing functionality. If frameworks you are adding exceed 100% of available processor power, you will be prevented from saving them in the device (ION Designer or PowerView will report an error and you will not be able to download the framework).

If you want to make large changes to the factory configuration, you may need to dismantle some of the factory configuration to free up processing power first.

 **NOTE**

You can also view the value of an output in ION Designer. Hold down the Shift key and left-click a module's output register to view the list of outputs and their current values.

## Checking the Processor Power Level

The 7330 ION's Diagnostics module contains an output labeled Prc Pwr Used. This output reports the amount of processor power being used by the device's configuration.

To monitor processor power, add a numeric object to a Vista diagram, and link it to the Prc Pwr Used output register of the Diagnostics module. Each time you download a change you make in ION Designer, check the value of the Prc Pwr Used register in Vista. (Refer to the *Vista User's Guide* for instructions on adding objects to Vista diagrams.)

## Deleting Factory-Configured Functions

If the additions you want to make exceed 100% processor power, you must delete some existing functionality before you can implement your custom framework. The simplest way to free processor resources is to delete the sections of the factory configuration that you are not using. The frameworks in the factory configuration and the amount of processing power each uses is shown in the following table.

Framework or Function	<i>Approximate</i> Processor Load
7330 ION Base Operating Load and Real-time Measurements (Core Modules)	40%
Energy & Demand	8%
Minimum/Maximum	5%
Historic Data Logging	3%
Setpoints	1%
Digital Inputs	1%
Modbus Configuration	7%
DNP 3.0 Configuration	0%
<b>Total</b>	<b>66.8%</b>

The table above shows that most of the frameworks in the factory configuration have a relatively small impact on the overall processor load. If you do not make use of one of the factory-configured frameworks, consider deleting it to free up processor resource.

 **NOTE**

Before deleting a framework, select it and choose Copy to Framework in ION Designer. Give it a unique name, and click OK to save it. This way you can restore the framework without having to reinitialize the factory configuration.

To delete a specific framework (other than the Modbus Configuration), double-click the Advanced Configuration folder on the main 7330 ION Configuration screen. Three folders appear on the screen, showing three of the frameworks shown in the table above. Select the folder containing the framework and press the Delete key on your keyboard. A dialog box appears showing you which modules will be deleted — click OK to remove the modules in the selected framework.

To delete the Modbus Configuration, select its folder on the main 7330 ION Configuration screen and press Delete on your keyboard. Press OK on the confirmation dialog box to remove the Configuration.

### **Restoring the Factory Configuration**

The factory configuration can be reinitialized in the 7330 ION through ION Designer. The basic setup of the device can be retained, so the 7330 ION does not need to be taken out of service for a long period of time. Follow this procedure to restore the factory configuration (any custom features you created will be destroyed):

1. Display the main 7330 ION Configuration screen in ION Designer.
2. Choose Select All from the Edit menu, then press Delete on your keyboard. The confirmation dialog box appears explaining that some modules will not be deleted (core modules cannot be deleted). Press OK on the confirmation dialog box.

After a brief wait the modules are deleted, and the main 7330 ION Configuration screen is blank except for the Advanced Configuration folder (the Advanced folder contains the core modules which cannot be deleted).

3. Choose Select All from the Edit menu to select the Advanced Configuration folder (this also selects all folders and modules within the folder).
4. Choose Paste from Framework in the Edit menu, and select the file 7330\_v2x\_default.fwn from the \PEGASYS\2.0\Config\fmwk\nd\ folder. Click OK on the confirmation dialog box. A message appears indicating that ION Designer is pasting modules.
5. All modules are selected when the paste is complete. Click anywhere in the background of the node diagram to deselect all of the modules. Click the Power Meter shortcut in the Basic Configuration box to select it.
6. With the Power Meter module shortcut selected, click the Reset button in the ION Designer toolbar, or select Reset from the Edit menu. This reverts the Power Meter to the settings it had before you deleted any modules (retaining the basic setup you previously had).
7. Choose Send & Save from the File menu The factory configuration is now restored (any custom functionality you created is removed).

## **Adding and Linking Modules in ION Designer**

In most cases you will only need to change the settings in an existing module's setup registers to achieve the functionality you want. Refer to "Configuring the 7330 ION with ION Designer" in Chapter 3 for information on this type of configuration change.

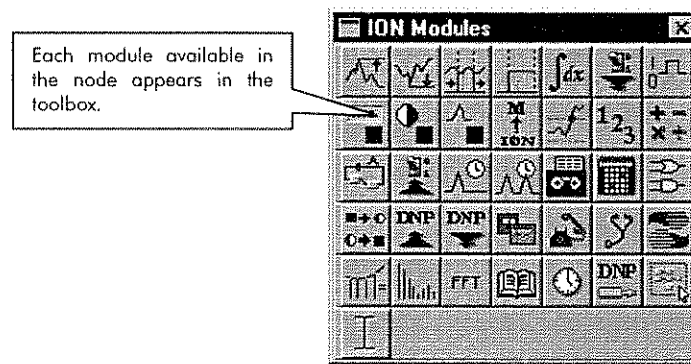
If you need to customize your meter's operation, you will need to create new ION modules, configure their settings, and in some cases link them to other modules. ION Designer provides a graphical view of your meter's internal operation, making these tasks simple. The basic functions of ION Designer are described in the next few paragraphs. Refer to the *ION Reference* for more information on ION Designer, or refer to the *ION Designer On-Line Help* for complete usage details.

## Creating New Modules

To add a module, locate its icon in the ION Designer toolbox, press and hold the left mouse button over the icon, and drag it onto the node diagram. Once you release the mouse button, the module is added to the diagram and can be configured and linked.

### Choosing the Module

The ION Designer toolbox displays icons for all of the modules available in the 7330 ION. If the toolbox is not displayed, choose Show Toolbox from the Options menu, and the toolbox appears:



As you drag the mouse over the icons in the toolbox, the status bar at the bottom of the ION Designer window displays the module type.

### NOTE

Once you have created a module you may have to adjust its setup registers. Chapter 5 shows the setup register defaults a module will contain when it is initially created, as well as the ranges or options each setup register supports. If you have to change a setting, refer to "Configuring the 7330 ION with ION Designer" in Chapter 3 for instructions.

### Creating the Module

Follow these steps to create an ION module in the 7330 ION:

1. On the ION Modules toolbox, press the mouse button down on top of the icon of the module you want to create, and drag it onto the node diagram. As you drag the icon, the cursor changes shape to indicate you are placing an object.
2. Release the mouse button to place the module in the diagram. When you release the mouse button, ION Designer places a *pending* module icon into the diagram (pending modules appear with a dashed outline).
3. Once you have configured the node as appropriate, choose Send & Save from the File menu to download the configuration to the node. Once the module has been saved in the node, the dashed outline is replaced with a solid outline, indicating that your changes have been saved.

## Deleting Modules

To delete a module, select it by clicking its icon, then press the Delete key. Use caution when deleting modules – any dependant modules will be affected. ION Designer will inform you of dependant modules if they exist on the same node.



## Linking Modules

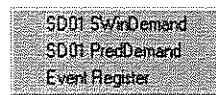
Module linking involves clicking on one module's output register symbol, choosing the output register you want to link, then clicking the input of a second module and selecting the input to link to. This operation can be performed in reverse – you can start with one module's input and link to another module's output register if desired.

You can link modules that reside on different nodes, provided you are linking between software nodes, or from a meter to a software node. You cannot link modules between meters. The paragraphs below describe how to link modules that reside on the same node. Refer to the *ION Reference* or the *ION Designer On-Line Help* for instructions if you want to link modules that reside on different nodes.

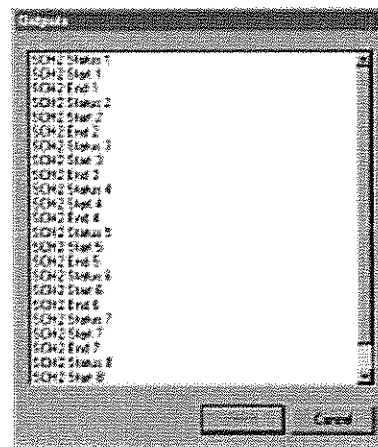
Follow the steps below to link modules on the 7330 ION:



1. To list a module's output registers, click on the  symbol on the right side of the module icon. (To list the module's setup registers, hold the CTRL key while clicking on the  symbol.) In most cases, a pop-up menu will appear listing the available registers. If the module has many registers, a dialog box will appear instead.



OR

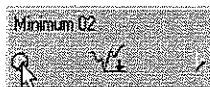



2. Click on the register you want to select. In the case of the dialog box, double-click on an output register, or choose the register and click Select.

The cursor looks like this when a linking operation is in progress:



Drag the cursor towards the module you want to link to; the cursor will change and a dotted line will follow it across the node diagram. This indicates you are in the process of creating a link. (The dotted line will disappear if you link to a module that is in a different window.)



3. Click on the  symbol on the left side of the module icon to display the module's inputs. A pop-up menu or a dialog box will appear listing the module's inputs. Inputs that are of a different class than the selected output register are grayed out to indicate that you cannot select them.

If the input is already linked, the label of the register it is linked to is displayed beside the input. If you select this input, the existing link will be overwritten.

4. Choose the input you want from the pop-up or dialog box.
5. If the two modules are in the same window, the dotted line remains on the screen to show the link between the modules. When you save this change to the node, the line will change from a dotted line to a thin black line to indicate that the link is now programmed on the node.

The procedure described above can also be performed in reverse order. You can select a module's input first and then link it to another module's output register.

## Editing Existing Frameworks

If you are comfortable with ION and the 7330 ION's configuration, you can make changes to the existing frameworks to customize operation. Any edits you make to the existing frameworks will alter the device's operation — be sure you understand what effect your changes will have before proceeding.

Chapter 2 includes a table that lists all of the parameters and functions provided in the 7330 ION factory configuration. This table shows the module and output register that holds each parameter. If you want to delete or change a parameter, use this table to determine which module and which output register provides the data, then check which other modules the output register is linked to (described below).

### CAUTION

Viewing owners by right-clicking a module's output register will only show you module linkages on the same node. Any links to modules on different nodes will not be shown.

If links to modules on other nodes may exist, always check the links at a module's inputs.

### Checking an Output Register's "Owner"

Using ION Designer, right-click a module's output register to view its linkages, referred to as "owners". A dialog box appears showing the inputs that are linked to that output register. With this information you can determine what changes will result to the framework by deleting the links to the parameter. Note that links to inputs on other nodes are not shown in this dialog box.

### Deleting the Link at a Module's Input

You can also check the links at a module's input. Using ION Designer, right-click on the input symbol on a module to view a dialog box listing each of the inputs and the output registers they are linked to. You can unlink inputs from within this dialog box as well.

### Replacing a Link

You do not need to unlink a module's input before linking a different output register to it. If you link an output register to an input that is already linked, the existing link will be overwritten.

# Using Onboard I/O and the Extension Board

The 7330 ION provides four onboard digital output ports, four status inputs, one infrared port, and one configurable LED output. The digital outputs, D1 through D4, can be used as status outputs or for relay control. The four status inputs can be used for monitoring external contacts or pulse counting applications. The infrared port can be used as communications port, or configured as a digital output for energy pulsing applications. The LED (L1) is used for energy pulsing; it is preconfigured for kWh pulsing, but it can be easily reconfigured to perform kVAh pulsing, kVARh pulsing or any other digital output function.

An optional external relay board (the REB option) is available with four external relays that connect to the onboard digital outputs. Eight different types of relay modules are available for use with the external relay board.

## Using the Onboard Digital Inputs

The four onboard digital inputs can be used for monitoring external contacts or pulse counting applications. These inputs can be used for dry contact sensing, but not for voltage sensing.



### NOTE

The onboard status inputs cannot be used for voltage sensing applications.

The function of each digital input is controlled by the Digital Input modules S1 through S4. These modules are preconfigured at the factory, together with four Counter modules for counting status changes, and an External Pulse module for resetting the Counter modules.

The four Digital Input modules are factory configured as follows (refer to the *ION Reference* for complete details on module function):

Setup Register	Factory Setting
Input Mode	Pulse (complete pulse as opposed to KYZ transition pulse)
Event Log Mode	Log Off (status changes are not logged)
Polarity	Inverting (hardware signal is inverted)
Debounce	0.010 (mechanical contact bounce, in seconds)
Port	S1 to S4 (specifies which hardware port the module controls)

Once you have connected the status inputs to the field equipment they will monitor, check the 7330 ION's Digital Input modules to ensure they are configured appropriately.



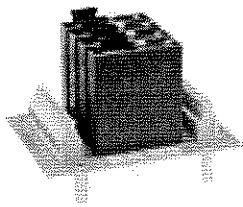
## Using the Onboard Digital Outputs

The four digital output ports are located on the rear panel of the 7330 ION. ION Digital Output or Pulser modules control the function of the digital output ports. These ports can be used to control relays or send status signals.

ION Digital Output modules need to be created in the 7330 ION before you can access them from the front panel. Refer to page 4–10 for instructions on adding an ION module to the 7330 ION using ION Designer software.

Digital Output and Pulser modules are configured by specifying which hardware port they send signals to (see page 4–17), as well as other settings that define the type of pulses they send. Once configured, these modules can be controlled by other ION modules that provide trigger outputs.

Four Pulser modules are preconfigured at the factory for energy pulsing applications. One of these modules is programmed to send kWh pulses to the LED on the back of the 7330 ION. The remaining three (configured for kWh, kVARh and kVAh pulsing) can be configured to send energy pulses to any digital output port. Edit the appropriate Pulser module's Port setup register and set it to the port you want to send the signal through (D1, D2, D3 or D4, or IR1). If the port you want to use does not appear in the Port setup register's list, that port is in use by another module. Edit the Port setup register of the module that is using the port and set it to NOT USED – the port will now be available to other modules.



## Using the Relay Extension Boards (REB Option)

The REB option (Relay Extension Board) allows for custom digital output applications using specific Grayhill relay modules. The REB option includes a 4-position Grayhill module rack; there are nine different relay options available, varying in functionality. The relays are purchased separately; see Chapter 5 – Technical Reference for ordering options.

Both Pulser modules and Digital Output modules can be used to control the functions of the external relays. Set the Digital Output or Pulser module's Port setup register to the digital output port (D1 to D4) that the relay is connected to.



## Using the Infrared Port

The 7330 ION infrared port on the front panel is compatible with an ANSI C12.13 Type II magnetic optical communications coupler. It can be used to communicate real-time measurements via ION, DNP 3.0, or Modbus RTU protocols. This port can also be used to perform infrared energy pulsing.

The 7330 ION is equipped with an additional ION Communications module, *Infrared Comm* (IR1), for configuring this port. The Protocol setup register in the IR Comm module must be set to Infrared I/O to enable infrared energy pulsing.



## CAUTION

If you are using PEGASYS, ensure that RtsCts is disabled for the infrared port's site in Network Builder.

## Infrared Communications

To enable communications through the infrared port, you must configure the IR1 Communications module. The Protocol, the Baud Rate and Unit ID registers must properly match your system. Once you have completed the device's configuration, connect the Type II compatible optical magnetic coupler to the front panel, and start the PEGASYS Communications Server. The device is now ready to communicate with PEGASYS or PowerView software. The optical magnetic coupler is purchased separately.

## Infrared Energy Pulsing

In order to configure the infrared port for energy pulsing, you must set the IR1 Protocol register to Infrared I/O. Use the front panel to set the IR1 Register as follows:

1. From the Select Setup menu, choose Quick Setup, IR1 Protocol, Infrared I/O.
2. Choose Select Setup, Adv Meter Setup, Pulser Modules. Select the module you wish to use for pulsing (kWh Pulse, for example). Choose the Port setup register from the menu provided then select IR LED.



## NOTE

To enable energy pulsing through the infrared port, you must set the IR1 Protocol register to Infrared I/O.

You can also set the infrared port for energy pulsing using ION Designer. Set the IR Communications module's Protocol setup register to Infrared I/O. Once you Send and Save the configuration change to the device, you can now set the port setting of any Pulser module to IR LED.

## LED Energy Pulsing

The LED port (L1) accesses the LED on the back of the 7330 ION. This port is used for kWh pulsing by default; LED 1 on the back of the 7330 ION pulses every 10 kWh. If you wish to configure the LED for other energy pulsing applications (i.e. kVAh, kVARh), you must first disable the default kWh pulsing. Use the front panel to disable kWh pulsing as follows:

1. From the Select Setup menu, choose Adv Meter Setup, Pulser Modules, kWh imp LED, and select the PU4 Port.
2. Select Not Used.

You can also disable the kWh pulsing using ION Designer. Select the kWh imp LED Pulser module and disable the L1 output by setting the Port setup register to NOT USED.

### Configuring Other Energy Pulsing Applications

Now that you have the L1 port free to assign a pulse to, you can assign other Pulser modules to it. Using the front panel, assign a Pulser module as follows:

1. From Select Setup choose Adv Meter Setup, then select Pulser Modules.
2. Choose the module you wish to use for pulsing the LED.
3. Scroll down and select the Port (e.g., PU2) setup register, then choose L1.

You can also configure LED energy pulsing from ION Designer. Select the Pulser module you wish to use and set its Port setup register to L1.

### Specifying a Port In an ION Module

The Digital Output and Pulser modules in the 7330 ION allow you to specify which port a signal is sent to. Similarly, Digital Input modules allow you to specify which port to monitor for incoming signals. The following table indicates what port selections are available in the 7330 ION's modules.

Port	Description
Port S1	Status input port 1
Port S2	Status input port 2
Port S3	Status input port 3
Port S4	Status input port 4
Port D1	Digital output port 1
Port D2	Digital output port 2
Port D3	Digital output port 3
Port D4	Digital output port 4
L1	LED output
IR LED	Infrared LED output

Any port currently in use by a module will not be available for selection. The IR LED capability will not be available until you set the IR1 Protocol register in the IR Comm module to Infrared I/O.

## Residual Current Calculation

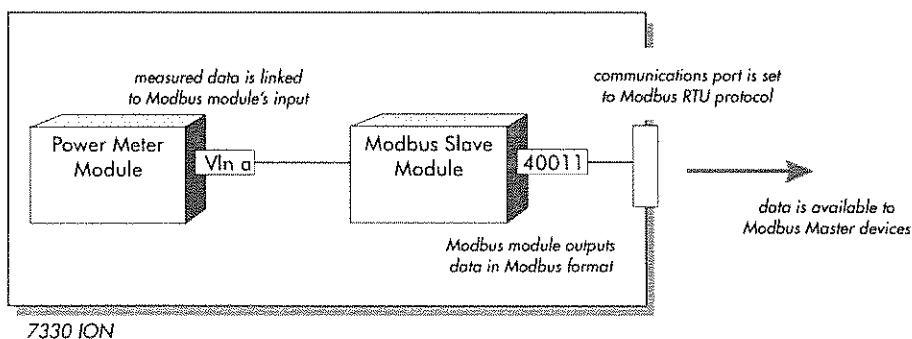
The Power Meter module provides an output register called I4. The I4 value is derived from the residual current from an unbalanced load; it typically represents the current flow in the neutral or ground conductor. The I4 value is updated every seven seconds, and is only available in 4-Wire Wye systems.

# Using the Modbus RTU Protocol

The 7330 ION can make any real-time data available through the Modicon Modbus RTU protocol. Modbus Master devices connected to the 7330 ION can access this data. Modbus Master devices can also write data into ION module registers, making device configuration changes or initializing control actions.

## The 7330 ION's Factory Modbus Configuration

The 7330 ION makes data available to Modbus devices using four Modbus Slave modules. These modules are linked to other modules in the 7330 ION that provide energy, power and demand data. Once a communications channel is configured to use Modbus RTU protocol (refer to "Communications Setup" in Chapter 3), the data is available to Modbus Master devices.



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 7330 ION are required to interpret the data provided.



### NOTE

Refer to the document:

*7300 ION & 7330 ION Modicon Modbus Protocol*

for complete details on the Modbus implementation in the 7330 ION.

## 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. There are only four Modbus Slave modules available in the 7330 ION, so you will have to delete some of the preconfigured links if you want to make other parameters available to Modbus Master devices.

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

## Modbus Slave Module Settings

The settings in the Modbus Slave module setup registers are shown in the tables below. Refer to the Modbus Slave module description in the ION Reference for complete details of each setup register's function and options.

Refer to *7300 ION & 7330 ION Modicon Modbus Protocol* document for additional details on the Modbus implementation in the 7330 ION.

### Modbus Slave Module #1

Setup Register	Setting
Format	unsigned 16-bit
Base Address	40011
Scaling	YES
In Zero	0
In Full	6553
Out Zero	0
Out Full	65530

### Modbus Slave Module #2

Setup Register	Setting
Format	signed 32-bit
Base Address	40027
Scaling	YES
In Zero	-214748364
In Full	214748364
Out Zero	-2147483640
Out Full	2147483640

### Modbus Slave Module #3

Setup Register	Setting
Format	signed 32-bit
Base Address	40059
Scaling	YES
In Zero	-214748364
In Full	214748364
Out Zero	-2147483640
Out Full	2147483640

### Modbus Slave Module #4

Setup Register	Setting
Format	signed 32-bit MFP
Base Address	40089
Scaling	NO

## Modbus Slave Module Parameter Mapping

The following tables show which measurements are provided by each of the four Modbus Slave modules. The source for each measurement is shown ("Source ION Module") so that you can easily delete parameters if you want to access different data. Note that the Modbus Register remains the same if you link a different parameter into one of the Modbus Slave module inputs (i.e. any value you link to Modbus Slave module #1, Source Input #1 will use Modbus Register 40011).

### Modbus Slave Module #1 Links

Measurement	Label	Source ION Module	Modbus Module and Input Number	Modbus Register
L-N Voltage Phase A	VIn a	Power Meter	Modbus Slave #1 – Source Input #1	40011
L-N Voltage Phase B	VIn b	Power Meter	Modbus Slave #1 – Source Input #2	40012
L-N Voltage Phase C	VIn c	Power Meter	Modbus Slave #1 – Source Input #3	40013
Average L-N Voltage	VIn avg	Power Meter	Modbus Slave #1 – Source Input #4	40014
L-L Voltage AB	Vll ab	Power Meter	Modbus Slave #1 – Source Input #5	40015
L-L Voltage BC	Vll bc	Power Meter	Modbus Slave #1 – Source Input #6	40016
L-L Voltage CA	Vll ca	Power Meter	Modbus Slave #1 – Source Input #7	40017
Average L-L Voltage	Vll avg	Power Meter	Modbus Slave #1 – Source Input #8	40018
Phase A Current	I a	Power Meter	Modbus Slave #1 – Source Input #9	40019
Phase B Current	I b	Power Meter	Modbus Slave #1 – Source Input #10	40020
Phase C Current	I c	Power Meter	Modbus Slave #1 – Source Input #11	40021
Average Current	I avg	Power Meter	Modbus Slave #1 – Source Input #12	40022
Voltage Unbalance	V unbal	Power Meter	Modbus Slave #1 – Source Input #13	40023
Current Unbalance	I unbal	Power Meter	Modbus Slave #1 – Source Input #14	40024
Line Frequency	Freq	Power Meter	Modbus Slave #1 – Source Input #15	40025
Phase Revolution	Phase Rev	Power Meter	Modbus Slave #1 – Source Input #16	40026

### Modbus Slave Module #2 Links

Measurement	Label	Source ION Module	Modbus Module and Input Number	Modbus Register
Phase A kW	kW a	Power Meter	Modbus Slave #2 – Source Input #1	40027-40028
Phase B kW	kW b	Power Meter	Modbus Slave #2 – Source Input #2	40029-40030
Phase C kW	kW c	Power Meter	Modbus Slave #2 – Source Input #3	40031-40032
Total kW	kW tot	Power Meter	Modbus Slave #2 – Source Input #4	40033-40034
Phase A kVAR	kVAR a	Power Meter	Modbus Slave #2 – Source Input #5	40035-40036
Phase B kVAR	kVAR b	Power Meter	Modbus Slave #2 – Source Input #6	40037-40038
Phase C kVAR	kVAR c	Power Meter	Modbus Slave #2 – Source Input #7	40039-40040
Total kVAR	kVAR tot	Power Meter	Modbus Slave #2 – Source Input #8	40041-40042
Phase A kVA	kVA a	Power Meter	Modbus Slave #2 – Source Input #9	40043-40044
Phase B kVA	kVA b	Power Meter	Modbus Slave #2 – Source Input #10	40045-40046
Phase V kVA	kVA c	Power Meter	Modbus Slave #2 – Source Input #11	40047-40048
Total kVA	kVA tot	Power Meter	Modbus Slave #2 – Source Input #12	40049-40050
Phase A signed PF	PF sign a	Power Meter	Modbus Slave #2 – Source Input #13	40051-40052
Phase B signed PF	PF sign b	Power Meter	Modbus Slave #2 – Source Input #14	40053-40054
Phase C signed PF	PF sign c	Power Meter	Modbus Slave #2 – Source Input #15	40055-40056
Average signed PF	PF signed tot	Power Meter	Modbus Slave #2 – Source Input #16	40057-40058

### Modbus Slave Module #3 Links

Measurement	Label	Source ION Module	Modbus Module and Input Number	Modbus Register
kW Thermal Demand	kW td	Thermal Demand	Modbus Slave #3 – Source Input #1	40059-40060
kVAR Thermal Demand	kVAR td	Thermal Demand	Modbus Slave #3 – Source Input #2	40061-40062
kVA Thermal Demand	kVA td	Thermal Demand	Modbus Slave #3 – Source Input #3	40063-40064
Maximum kW Thermal Demand	kW td mx	Maximum	Modbus Slave #3 – Source Input #4	40065-40066
Maximum kVAR Thermal Demand	kVAR td mx	Maximum	Modbus Slave #3 – Source Input #5	40067-40068
Maximum kVA Thermal Demand	kVA td mx	Maximum	Modbus Slave #3 – Source Input #6	40069-40070
Maximum Avg L-N Voltage	Vln avg mx	Maximum	Modbus Slave #3 – Source Input #7	40071-40072
Maximum Average Current	I avg mx	Maximum	Modbus Slave #3 – Source Input #8	40073-40074
Maximum Total kW	kW tot mx	Maximum	Modbus Slave #3 – Source Input #9	40075-40076
Maximum Total kVAR	kVAR tot mx	Maximum	Modbus Slave #3 – Source Input #10	40077-40078
Maximum Total kVA	kVA tot mx	Maximum	Modbus Slave #3 – Source Input #11	40079-40080
Maximum Frequency	Freq mx	Maximum	Modbus Slave #3 – Source Input #12	40081-40082
Minimum Avg L-N Voltage	Vln avg mn	Minimum	Modbus Slave #3 – Source Input #13	40083-40084
Minimum Average Current	I avg mn	Minimum	Modbus Slave #3 – Source Input #14	40085-40086
Minimum Frequency	Freq mn	Minimum	Modbus Slave #3 – Source Input #15	40087-40088

## Modbus Slave Module #4 Links

Measurement	Label	Source ION Module	Modbus Module and Input Number	Modbus Register
Imported kWh	kWh imp	Integrator	Modbus Slave #4 – Source Input #1	40089-40090
Exported kWh	kWh exp	Integrator	Modbus Slave #4 – Source Input #2	40091-40092
Total kWh	kWh tot	Integrator	Modbus Slave #4 – Source Input #3	40093-40094
Net kWh	kWh net	Integrator	Modbus Slave #4 – Source Input #4	40095-40096
Imported kVARh	kVARh imp	Integrator	Modbus Slave #4 – Source Input #5	40097-40098
Exported kVARh	kVARh exp	Integrator	Modbus Slave #4 – Source Input #6	40099-40100
Total kVARh	kVARh tot	Integrator	Modbus Slave #4 – Source Input #7	40101-40102
Net kVARh	kVARh net	Integrator	Modbus Slave #4 – Source Input #8	40103-40104
Total kVAh	kVAh	Integrator	Modbus Slave #4 – Source Input #9	40105-40106
Max Phase A Voltage THD	V1 THD max	Maximum	Modbus Slave #4 – Source Input #10	40107-40108
Max Phase B Voltage THD	V2 THD max	Maximum	Modbus Slave #4 – Source Input #11	40109-40110
Max Phase C Voltage THD	V3 THD max	Maximum	Modbus Slave #4 – Source Input #12	40111-40112
Max Phase A Current THD	I1 THD max	Maximum	Modbus Slave #4 – Source Input #13	40113-40114
Max Phase B Current THD	I2 THD max	Maximum	Modbus Slave #4 – Source Input #14	40115-40116
Max Phase C Current THD	I3 THD max	Maximum	Modbus Slave #4 – Source Input #15	40117-40118
Exported kVAh	kVAh exp	Integrator	Modbus Slave #4 – Source Input #16	40119-40120

## Importing Data using Modbus RTU

It is possible to bring data into the 7330 ION 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 7330 ION.

You can use the Modbus RTU protocol to write values into ION external numeric, pulse and Boolean modules, allowing you to enable, disable and reset 7330 ION functions. You can also use Modbus to change setup register values in various ION modules to configure the 7330 ION's operation.

All of the information required to write to ION registers through Modbus is available in *7300 ION & 7330 ION Modicon Modbus Protocol*, available on the PEGASYS distribution CD, or by request from Power Measurement.



# Using the DNP 3.0 Protocol

## NOTE

Complete DNP documentation is available through the DNP User's Group (on the web at [www.dnp.org](http://www.dnp.org)).

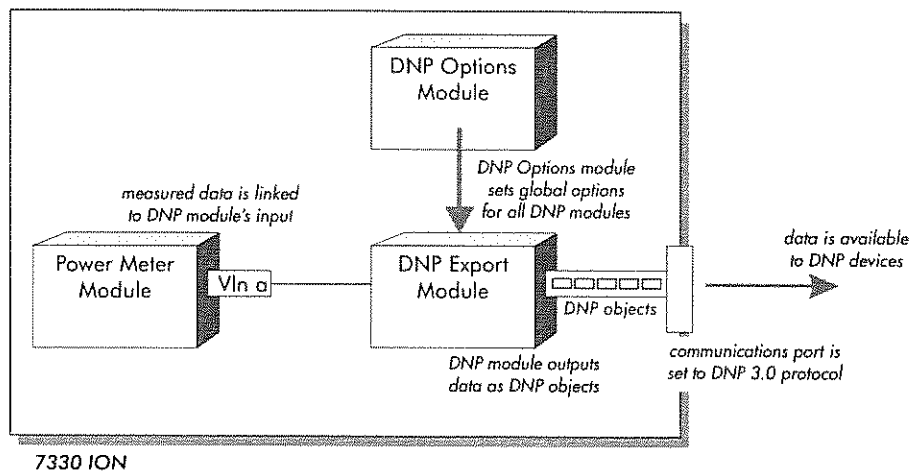
This documentation describes DNP 3.0 Transport Functions, the Application Layer Protocol, the Data Object Library, Data Link Layer Protocol Description, and the Subset Definitions.

The Distributed Network Protocol Version 3.0 (DNP 3.0) is an open protocol used in the electric utility industry for communications and interoperability among substation computers, RTUs, IEDs, and Master Stations. The 7330 ION can be integrated into a DNP network using the DNP Slave Import, Export and Options modules.

## The 7330 ION's Factory DNP 3.0 Configuration

The 7330 ION's factory configuration makes various parameters available through DNP 3.0. There is no factory-configured functionality for importing DNP 3.0 data into the 7330 ION.

ION modules are linked to DNP Slave Export modules which convert the ION data into the appropriate DNP objects. These objects are available through the 7330 ION communications port that is configured to use the DNP 3.0 protocol. The DNP Options module sets global options for all of the DNP Slave Export modules.



## NOTE

Only one port per 7330 ION can be used with DNP 3.0.

## Changing the DNP Configuration

If the factory DNP configuration does not suit your needs, the existing DNP Slave Export modules can be relinked to other parameters that you want to access through DNP. Alternately you can add additional DNP Slave Export modules and link the desired ION parameters to them. There are 16 DNP Slave Export modules available on the 7330 ION; of these, 14 are used by the factory configuration.

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 Options module. Do not make any changes to the DNP Options module's 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 Options module function.

As DNP 3.0 is a very complex protocol, an in-depth understanding of DNP 3.0 is required to interpret the settings in the DNP Options module and the DNP Slave Export modules. It is beyond the scope of this 7330 ION's User's Guide to describe DNP; consult the DNP User's Group or other resources to learn more about the protocol.

## DNP Slave Export Module Settings

The 14 factory-configured DNP Slave Export modules are configured as shown in the following table.

Setup Register	Setting
BasePoint	Varies – each analog input or binary counter has a different BasePoint
StaticObj	11 modules are <i>Analog Input</i> ; three are <i>Binary Counter</i>
EventObj	Disable Event Objects
Deadband	0
FrozStaObj	Disable Frozen Static Objects
FrozEvtObj	Disable Frozen Event Objects
EventClass	Class 1
Scaling	OFF (excluding <i>Unbalx10</i> and <i>Freqx10</i> which are ON)
IONZero	0
IONFull	0 (1000 for <i>Unbalx10</i> and 100 for <i>Freqx10</i> )
DNPZero	0
DNPFull	0 (10000 for <i>Unbalx10</i> and 1000 for <i>Freqx10</i> )

As the table indicates, some of the setup register settings vary for different modules. Specifically, BasePoint will be different for each module within a group (Analog Input and Binary Counter are groups), and StaticObj is set to Analog Input for the 11 analog input points and Binary Counter for the three binary counter points. (StatObj defines the type of DNP object the module provides when the Master polls it.)

In addition, Scaling is OFF for all but two modules. The only modules that apply scaling are the Analog Input points that provide Voltage and Current Unbalance data (labeled *Unbalx10*) and Frequency data (Labeled *Freqx10*). These modules apply x10 scaling.

## DNP Options Module Settings

The DNP Options module provides global settings that affect all DNP Slave Export and DNP Slave Import modules. The default settings in this module are shown in the following table.

Setup Register	Setting	Function
BinInStatic	Single-bit Binary Input	variant for Binary Input Static objects
BinInEvents	Binary Input Change w/o time	variant for Binary Input Event objects
BinInEvDepth	100	maximum number of Binary Input Events that can be stored
BinCntStatic	16-bit Binary Counter w/o flag	variant for Binary Counter Static objects
FrzCntStatic	16-bit Frozen Counter w/o flag	variant for Frozen Counter Static objects
FrzCntEvents	16-bit Frozen Counter Event w/o time	variant for Frozen Counter Event objects
FrzCntEvDepth	100	maximum number of Frozen Counter Events that can be stored
CntChangeEvents	16-bit Counter Change Event w/o time	variant for Counter Change Event objects
CntChangeEvDepth	100	maximum number of Counter Change Events that can be stored
AIStatic	16-bit Analog Input w/o flag	variant for Analog Input Static objects
FrzAIStatic	16-bit Frozen Analog Input w/o flag	variant for Frozen Analog Input Static objects
FrzAIEvents	16-bit Frozen Analog Event w/o time	variant for Frozen Analog Input Event objects
FrzAIEvDepth	100	maximum number of Frozen Analog Input Events that can be stored
AIChangeEvents	16-bit Analog Input Change Event w/o time	variant for Analog Input Change Event objects
AIChangeEvDepth	200	maximum number of Analog Input Change Events that can be stored
AOStatic	16-bit Analog Output Status	variant for Analog Output Block objects
SelectTimeout	10	Select Before Operate timeout period (in seconds)
TimeSynchPeriod	86400	time (in seconds) between IED requests for time syncs
ALFragSize	2048	maximum application layer message size (in octets) that IED can send
DLAck	Never	when device will request data link layer acknowledgements
DLTimeout	2	how long the data link layer waits for acknowledgement from Master
DLNumRetries	0	how many times a data link layer packet is re-sent after failing

## Importing Data using DNP 3.0

Data can be imported into the 7330 ION from a DNP Master device. DNP Slave Import modules are used to take a DNP analog or binary output object and map it into an ION numeric or Boolean register. Refer to the *ION Reference* for detailed module descriptions.

# Creating Custom Front Panel Displays

Custom front panel displays can be created showing any data the 7330 ION measures or calculates. There are eight display screens available for configuration; as the front panel's screen displays are factory-configured, an existing display is sacrificed when a custom display is created.

## Customizing Displays

Each display screen can be configured to display any real-time measurements you require. You can also adjust the size of the characters in each screen so you can easily read the device's display from farther away.



### NOTE

In order for the customized screens to be displayed in the front panel's display, the Display Mode must be set to Programmable Mode (see "Display Setup Options in Chapter 2).

The Screen Setup screen allows you to change the data displayed on the eight display screens. From the Select Setup menu, scroll down until Screen Setup is highlighted, and press the round button. A list of screen numbers will appear ("Screen1, Screen 2") that correspond to each of the eight display screens. The screen number with an asterisk (\*) beside it indicates the active display (the screen displayed before you entered Select Setup mode). Select the screen you want to change, and press the round button. Both the Values and Style can be changed for each screen.

### Values

The Values setting refers to which of the device's measurements are displayed on each display screen. When you change the value displayed on a screen, you are presented with a complete list of the 7330 ION's measurements. Using the lists of modules provided, select the values you want to have displayed on the display screen.

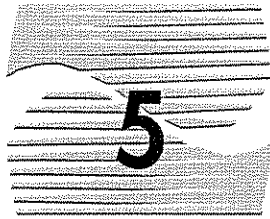
### Style

The Style setting has four options for each display screen: three options for the number of measurements displayed, and one option to disable the display screen. You can display up to four measurements on a single display screen:

One Value	Two Values	Four Values

Select the number of values you want to display (either one, two or four values) using the front panel's buttons. The fewer the values you select for display, the larger the measurement will appear on the display screen.

If you select a large style (for example, one value) for a display screen that is set to display more than one value, only the first value will be displayed. Using the example above, if the style for the Four Values screen was set to one value, only kW tot would appear on the display screen.



# Technical Reference

The specifications that follow are subject to change without notice.

## In this Chapter

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# ION Module Summary

The following table lists all of the ION modules available in the current version of the 7330 ION. The table shows how many of each ION module are available. The ION Module Summary table also shows the ranges or options available for each module's setup registers and the default setting each register holds when a new module is created.



## NOTE

Refer to the *ION Reference* for complete ION module details.





## Setup Register Creation Defaults

It is important to note that the creation defaults shown in the table apply only to new modules when they are created in the device. The setup register settings shown do not apply to modules that are included in the factory configuration. Many of the modules in the factory configuration have been configured with custom settings.

## Input and Output Register Descriptions









Complete descriptions of each module's inputs and output registers can be found in the *ION Reference*. This document also includes operational descriptions for each module type. The *ION Reference* is shipped with PEGASYS software, and provided in a digital format on Power Measurement distribution CD-ROMs.

ION Module Summary Table

ION Module Name	Total Available in 7330	Used in Factory Config.	Setup Registers	Range or Options	Creation Default
AND/OR 	4	0	Mode	AND, OR, NAND or NOR	AND
			EvLogMode	LOG ON or LOG OFF	LOG OFF
Arithmetic 	2	0	Formula 1...8	Max 49 characters	empty
Clock * 	1	1	TZ Offset	-43,200 to 46,800	0
			DST Start	0 to 4.3 x 10 <sup>9</sup>	0
			DST End	86400 to 4.3 x 10 <sup>9</sup>	86400
			DST Offset	-10,800 to 10,800	0
			Time Sync Source	COM1, COM2, IR1	COM1
			Time Sync Type	UTC, Local	UTC
Comm * 	4 <i>Comm 1, Comm 2, IR1, and Front panel</i>	4	Comm Mode	RS485	RS485
			Baud Rate	1200, 2400, 4800, 9600 and 19200	9600
			HshakeMode	RTS/CTS or RTS WITH DELAY	RTS WITH DELAY
			RTS Level	NORMAL or INVERTED	NORMAL

\* denotes Core module (refer to Chapter 4)




ION Module Summary Table, Continued

ION Module Name	Total Available in 7330	Used in Factory Config.	Setup Registers	Range or Options	Creation Default
Comm * <i>continued</i> 			CTS Level	NORMAL or INVERTED	NORMAL
			RTS Delay	0 to 1.00 second	0.01 seconds
			Unit ID	1 to 9999 †	see below
			Protocol	ION, MODBUS, DNP 3.0, (Infrared I/O, Factory)	ION
Convert 	4	0	no setup registers		
Counter 	30	4	Multiplier	$-1 \times 10^9$ to $1 \times 10^9$	1
			Count Mode	UP or DOWN	UP
			Preset	$-1 \times 10^9$ to $1 \times 10^9$	0
			RollValue	$-1 \times 10^9$ to $1 \times 10^9$	0
Data Acquisition * 	1	1	no setup registers		
Data Recorder 	2	2	Depth	0 to $2 \times 10^9$	0
			Record Mode	CIRCULAR or STOP-WHEN-FULL	CIRCULAR
Diagnostics * 	1	1	no setup registers		
Digital Input 	4	4	Polarity	INVERTING or NON-INVERTING	INVERTING
			PulseWidth	0 to $2 \times 10^6$ seconds	0
			Port	<i>depends on I/O options</i>	NOT USED
			Input Mode	Pulse or KYZ	Pulse
Digital Output 	5	0	EvLog Mode	LOG ON or LOG OFF	LOG OFF

\* denotes Core module (refer to Chapter 4)

† The factory set Unit ID is based on the serial number of the meter. For example: Serial number: PB-9809A263-01; Unit ID: 9263. The default Unit ID of IR1 is 100.


### ION Module Summary Table, Continued

ION Module Name	Total Available in 7330	Used in Factory Config.	Setup Registers	Range or Options	Creation Default
DNP Slave Export 	16	14	BasePoint	0 to 60	0
			StaticObj	Binary Input, Binary Counter or Analog Input	Binary Input
			EventObj	Enable or Disable Event Objects	Disable Event Objects
			Deadband	0 to $4.3 \times 10^9$	0
			FrozStaObj	Enable or Disable Frozen Static Objects	Disable Frozen Static Object
			FrozEvtObj	Enable or Disable Frozen Event Objects	Disable Frozen Event Object
			EventClass	Class 1, 2 or 3	Class 1
			Scaling	ON or OFF	OFF
			IONZero	$-1 \times 10^{38}$ to $1 \times 10^{38}$	0
			IONFull	$-1 \times 10^{38}$ to $1 \times 10^{38}$	0
			DNPZero	$-1 \times 10^{38}$ to $1 \times 10^{38}$	0
			DNPFull	$-1 \times 10^{38}$ to $1 \times 10^{38}$	0
DNP Slave Import 	4	0	DNPPoint	0 to 15	0
			DNPObjGrp	Analog Output or Binary Output	Binary Output
			Relay Mode	1 point per address 2 point per address	1 point per address
DNP Slave Options *   Note: DNP is only available on Com 1 or Com 2 or IR1	1	1	BinInStatic	Single-Bit Binary Input or Binary input with status	Single-Bit Binary Input
			BinInEvents	<ul style="list-style-type: none"> <li>• Binary Input Change Without Time</li> <li>• Binary Input Change With Time</li> </ul>	Binary Input Change Without Time
			BinInEvDepth	Fixed at 50	50
			BinCntStatic	<ul style="list-style-type: none"> <li>• 32-Bit Binary Counter</li> <li>• 32-Bit Binary Counter Without Flag</li> <li>• 16-Bit Binary Counter</li> <li>• 16-Bit Binary Counter Without Flag</li> </ul>	16-Bit Binary Counter Without Flag
			FrzCntStatic	<ul style="list-style-type: none"> <li>• 32-Bit Frozen Counter</li> <li>• 32-Bit Frozen Counter Without Flag</li> <li>• 32-Bit Frozen Counter With Time of Freeze</li> <li>• 16-Bit Frozen Counter</li> <li>• 16-Bit Frozen Counter Without Flag</li> <li>• 16-Bit Frozen Counter With Time of Freeze</li> </ul>	16-Bit Frozen Counter Without Flag

\* denotes Core module (refer to Chapter 4)











ION Module Summary Table, Continued

ION Module Name	Total Available in 7330	Used in Factory Config.	Setup Registers	Range or Options	Creation Default
DNP Slave Options * <i>continued</i>  Note: DNP is only available on Com 1 or Com 2 or IR1			FrzCntEvents	<ul style="list-style-type: none"> <li>• 32-Bit Frozen Counter Event Without Time</li> <li>• 32-Bit Frozen Counter Event With Time</li> <li>• 16-Bit Frozen Counter Event Without Time</li> <li>• 16-Bit Frozen Counter Event With Time</li> </ul>	16-Bit Frozen Counter Event Without Time
			FrzCntEvDepth	Fixed at 0	0
			CntChangeEvents	<ul style="list-style-type: none"> <li>• 32-Bit Counter Change Event Without Time</li> <li>• 32-Bit Counter Change Event With Time</li> <li>• 16-Bit Counter Change Event Without Time</li> <li>• 16-Bit Counter Change Event With Time</li> </ul>	16-Bit Counter Change Event Without Time
			CntChangeEvDepth	Fixed at 50	50
			AIStatic	<ul style="list-style-type: none"> <li>• 32-Bit Analog Input</li> <li>• 32-Bit Analog Input Without Flag</li> <li>• 16-Bit Analog Input</li> <li>• 16-Bit Analog Input Without Flag</li> </ul>	16-Bit Analog Input Without Flag
			FrzAIStatic	<ul style="list-style-type: none"> <li>• 32-Bit Frozen Analog Input Without Flag</li> <li>• 32-Bit Frozen Analog Input With Time of Freeze</li> <li>• 16-Bit Frozen Analog Input Without Flag</li> <li>• 16-Bit Frozen Analog Input With Time of Freeze</li> </ul>	16-Bit Frozen Analog Input Without Flag
			FrzAIEvents	<ul style="list-style-type: none"> <li>• 32-Bit Frozen Analog Event Without Time</li> <li>• 32-Bit Frozen Analog Event With Time</li> <li>• 16-Bit Frozen Analog Event Without Time</li> <li>• 16-Bit Frozen Analog Event With Time</li> </ul>	16-Bit Frozen Analog Event Without Time
			FrzAIEvDepth	Fixed at 0	0
			AIChangeEvents	<ul style="list-style-type: none"> <li>• 32-Bit Analog Change Event Without Time</li> <li>• 32-Bit Analog Change Event With Time</li> <li>• 16-Bit Analog Change Event Without Time</li> <li>• 16-Bit Analog Change Event With Time</li> </ul>	16-Bit Analog Change Event Without Time
			AIChangeEvDepth	Fixed at 50	50
			AOStatic	32-bit Analog Output Status/ 16-bit Analog Output Status	16-bit Analog Output Status
			SelectTimeout	0-10 seconds	10 seconds
			TimeSynchPeriod	1- 86400 seconds (1 day)	86400
			ALFragSize	15 – 2048 bytes	2048
			DLAck	ALWAYS, MULTI-PACKET ONLY, NEVER	NEVER
			DLTimeout	100 msecs to 10 seconds	2 seconds
DLNumRetries	0-10	0			







\* denotes Core module (refer to Chapter 4)

ION Module Summary Table, Continued

ION Module Name	Total Available in 7330	Used in Factory Config.	Setup Registers	Range or Options	Creation Default
Event Log Controller * 	1	1	Depth	0 to 20 000	50
			Protection	The Protection register is factory-set to 128.	
			Cutoff	0 to 255	5
External Boolean 	8	8	EvPriority	0	0
External Numeric 	4	0	EvPriority	0 to 127	0
External Pulse 	32	7	EvPriority	0 to 127	0
Factory * 	1	1	Device Type ( <i>read-only</i> )	N/A	7330 ION
			Compliance ( <i>read-only</i> )	N/A	ION-Compliant
			Options ( <i>read-only</i> )	N/A	<i>options purchased</i>
			Revision ( <i>read-only</i> )	N/A	<i>firmware revision number</i>
			SerialNum ( <i>read-only</i> )	N/A	<i>unit serial number</i>
			Owner	up to 255 characters	<i>empty</i>
			Tag 1	up to 255 characters	<i>empty</i>
			Tag 2	up to 255 characters	<i>empty</i>
			Nom Freq ( <i>read-only</i> )	N/A	<i>factory set frequency</i>
			Calibration Values: 22 additional read-only registers hold factory calibration values		
Feedback 	10	0	<i>no setup registers</i>		
FFT * 	6	6	<i>no setup registers</i>		
Harmonics Analyzer * 	6	6	<i>no setup registers</i>		





\* denotes Core module (refer to Chapter 4)

ION Module Summary Table, Continued

ION Module Name	Total Available in 7330	Used in Factory Config.	Setup Registers	Range or Options	Creation Default
Integrator 	30	9	Divisor	0 to $1 \times 10^9$ seconds	3600
			Int Mode	FORWARD, REVERSE, ABSOLUTE or NET	FORWARD
			Valu/Pulse	0 to $1 \times 10^9$	0
			RollValue	0 to $1 \times 10^9$	0 (no rollover)
Maximum 	32	31	no setup registers		
Minimum 	32	31	no setup registers		
Modbus Slave 	4	4	Format	Unsigned 16B; Signed 16B; Unsigned 32B; Signed 32B; Unsigned 32B-M10K; Signed 32-M10K; Packed Boolean	#1: Unsigned 16B #2 & #3: Signed 32B #4: Signed 32B-M10K
			Base Addr	40001 to 41800	#1: 40011 #2: 40027 #3: 40059 #4: 40089
			Scaling	Yes or No	#1, #2 and #3: Yes #4: No
			In Zero, In Full	$-1 \times 10^{38}$ to $1 \times 10^{38}$ *	#1: 0, 6553 #2: -214748364, 214748364 #3: -214748364, 214748364 #4: No Scaling
			Out Zero, Out Full	-2147483647 to 2147483647*	#1: 0, 65530 #2: -2147483640, 2147483640 #3: -2147483640, 2147483640 #4: No Scaling
One-Shot Timer 	4	0	Duration	0.010 to $2 \times 10^6$ seconds	1
Periodic Timer 	2	2	Period	0.010 to $2 \times 10^6$ seconds	900
			Sync Mode	NO TRIG ON SYNC or TRIGGER ON SYNC	NO TRIG ON SYNC



\* denotes Core module (refer to Chapter 4)

ION Module Summary Table, Continued

ION Module Name	Total Available in 7330	Used in Factory Config.	Setup Registers	Range or Options	Creation Default
Power Meter * 	2	2	Volts Mode	4W-WYE, 3W-WYE, DELTA, SINGLE or DEMO	4W-WYE
			PT Prim	1 to 999999	120/277/347 (depends on ordering option)
			PT Sec	1 to 999999	120/277/347 (depends on ordering option)
			CT Prim	1 to 999999	5
			CT Sec	1 to 999999	5
			V1Polarity	NORMAL or INVERTED	NORMAL
			V2Polarity	NORMAL or INVERTED	NORMAL
			V3Polarity	NORMAL or INVERTED	NORMAL
			I1Polarity	NORMAL or INVERTED	NORMAL
			I2Polarity	NORMAL or INVERTED	NORMAL
			I3Polarity	NORMAL or INVERTED	NORMAL
			PhaseOrder	ABC or ACB	ABC
			Nom Freq	not configurable - factory ordering option	
			Phase Lbls	ABC, RST, XYZ, RYB, RWB or 123	ABC
Pulsar 	5	4	PulseWidth	0.2 to 2 x 10 <sup>6</sup> seconds	1
			OutputMode	PULSE or KYZ	PULSE
			Polarity	INVERTING or NON-INVERTING	INVERTING
			Port	Lists all available ports on the 7330 ION	
Scheduler 	1	0	Calendar		
Setpoint 	12	4	High Limit	-1 x 10 <sup>9</sup> to 1 x 10 <sup>9</sup>	0
			Low Limit	-1 x 10 <sup>9</sup> to 1 x 10 <sup>9</sup>	0
			SusUnlON	0 to 3600	0
			SusUnlOFF	0 to 3600	0
			Input Mode	Signed or Absolute	Signed
			Eval Mode	GreaterThan or LessThan	GreaterThan
			EvPriority	0 to 255	128

\* denotes Core module (refer to Chapter 4)

### ION Module Summary Table, Continued

ION Module Name	Total Available in 7330	Used in Factory Config.	Setup Registers	Range or Options	Creation Default
Sliding Window Demand 	30	20	Sub Intvl	1 to 5940 seconds	1800
			#SubIntvls	1 to 15	1
			Pred Resp	0 to 99	70
Thermal Demand 	16	4	Interval	60 to 5940 seconds	1800
			Time Const	1 to 99%	90%

## Measurements (@ 50.0 Hz or @ 60.0 Hz @ 25°C/77°F)

Parameter	Accuracy $\pm$ (%rdg + %F.S.*)	Display Resolution (%F.S.) †	Register Bounds
Voltage(l-n) in Wye, Vab, Vbc in Delta	0.25% + 0.05%	0.1%	0 to $1 \times 10^6$
Voltage(l-l) in Wye, Vca in Delta	0.75% + 0.1%	0.1%	0 to $2 \times 10^6$
Frequency	0.01%	0.01 Hz	40 Hz to 70 Hz
Current	0.25% + 0.05%	0.1%	0 to $1 \times 10^6$
KVA	0.5% + 0.1%	0.1%	0 to $3.3 \times 10^7$
KVAR (>5% F.S.)	1.5% reading	0.1%	0 to $\pm 3.3 \times 10^7$
KVAh	1.0% reading	0.1% of reading	0 to $10^{38}$
KVARh	1.5% reading	0.1% of reading	0 to $\pm 10^{38}$
Power Factor	1.5% reading	0.01	-0.01 to -100.00, 100.00 to 0.01
Total Harmonic Distortion (THD)	1.0% Full Scale	0.1%	0.01 to 100.00
I4 Derivation	1.0% reading + 0.2% unbalanced	0.1%	0 to $1 \times 10^6$
K Factor	5.0% Full Scale	0.1%	0 to $1 \times 10^6$

\* %F.S. is defined as a percentage of nominal full scale voltage & current (e.g. 120 VAC / 10 Amp for a 7330 ION -120).

† Resolutions given are from the front panel display. Higher resolution can be obtained via communications.

## kW and kWh Measurements

% Rated Current (Ir) & Power Factor (PF)	Accuracy *	Display Resolution†		Register Bounds	
		kW (%F.S.)	kWh (% reading)	kW	kWh
@ PF between ±0.8 and 1.0 @ 2% ≤ Ir ≤ 100%	1.0% reading	0.1%	0.1%	0 to ± 3.3x10 <sup>7</sup>	0 to ± 10 <sup>38</sup>
@ PF between ±0.8 and 1.0 @ 1% ≤ Ir < 2%	1.5% reading	0.1%	0.1%	0 to ± 3.3x10 <sup>7</sup>	0 to ± 10 <sup>38</sup>
@ PF between ±0.8 and 0.5 @ 20% ≤ Ir ≤ 100%	1.0% reading	0.1%	0.1%	0 to ± 3.3x10 <sup>7</sup>	0 to ± 10 <sup>38</sup>
@ PF between ±0.8 and 0.5 @ 2% ≤ Ir < 20%	1.5% reading	0.1%	0.1%	0 to ± 3.3x10 <sup>7</sup>	0 to ± 10 <sup>38</sup>

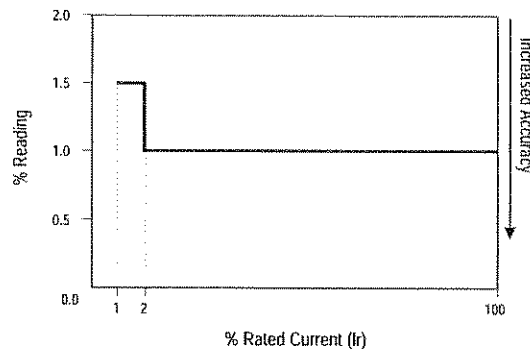
\* All accuracy specifications in this table comply with IEC 1036 Class 1 specification and ANSI C12.16 Class 10 at 25°C (77°F)

† Resolutions given are from the front panel display. Higher resolution can be obtained via communications.

## kW and kWh Accuracy Specifications

The following graphs show the accuracy specifications for kW and kWh (at 25°C/77°F):

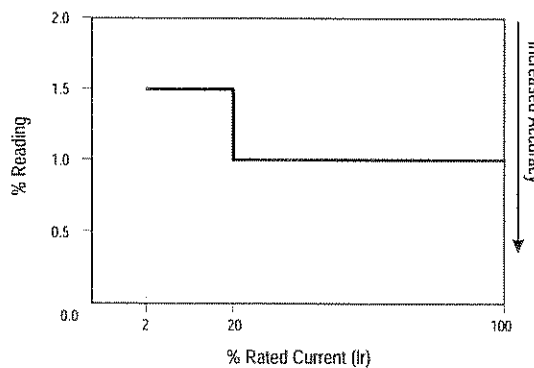
@ PF between 1.0 and 0.8 Lead or Lag



### CAUTION

If the voltage on Phase A drops to 20% or lower of the rated nominal value, frequency detection will not function and measurement accuracy will be impaired.

@ PF between 0.8 and 0.5 Lead or Lag



# Input Ratings

Input	Options	Specifications
Voltage Inputs	-120 option:	120 VAC nominal F.S. input, 25% overrange. Barrier strip connector rated to 600 Volts line-to-line
	-277 option	277 VAC nominal F.S. input, 25% overrange. Barrier strip connector rated to 600 Volts line-to-line
	-347 option	347 VAC nominal F.S. input, 25% overrange. Barrier strip connector rated to 600 Volts line-to-line
	CWC option	(available with -120 & -277 options only). Captured-wire connectors rated to 500 Volts line-to-line
		Overload withstand for all options: 1500 VAC continuous, 2500 VAC for 1 second non-recurring
		Input Impedance for all options: 2 M $\Omega$
Current Inputs	5 Amp nominal/10 Amps full scale	
	Overload withstand for all options: 15 Amps continuous, 300 Amps for 1 second non-recurring	
	Input Impedance: 2 m $\Omega$	
	Worst Case Burden (@ 10 Amps): 0.0625 VA	
Digital Inputs	Standard self-excited, dry contact sensing, no external voltage source required	
	+30 VDC differential COM output to S1 through S4 inputs	
	Minimum Pulse Width: 25 msec, Maximum Pulse Rate: 20 pulses / sec	
Power Supply	Standard	85-240VAC (20-440 Hz) or 85-240VDC ( $\pm 10\%$ ), 0.5 Amp worst case loading (20 W) @ 100 VAC @ 25°C
	-P24 option	20-60VDC ( $\pm 10\%$ ), 1 Amp worst case loading (10 W)
	Power supply fuse current rating, type and rupturing speed: 2 A slow blow	

# Onboard Digital Outputs

Maximum Forward Current: 80 mA  
 Maximum Voltage: 30 V

# Optional Relay Modules

Only use Power Measurement-approved external relays with the digital outputs of the 7330 ION. Contact Power Measurement for complete information regarding relay applications

## Zero Voltage Turn-On, Normally Open, Manual Override Output Modules

Part Number	AC Outputs		DC Outputs
	GDOAC120MO	GDOAC240MO	GDODC60MO
Nominal Line Voltage:	120 VAC	240 VAC	N/A
Frequency Range:	25 Hz to 70 Hz	25 Hz to 70 Hz	N/A
Maximum Line Voltage:	N/A	N/A	60 VDC
Clamping Voltage:	N/A	N/A	80 VDC max.
Maximum Off-state Leakage	2 mA rms @ 60Hz	4 mA rms @ 60Hz	1.5 mA @ 60 VDC
Load Voltage Range:	24 to 140 VAC	24 to 280 VAC	3 to 60 VDC
Turn-on Time (60 Hz):	8.3 msec max.	8.3 msec max.	20 µsec max.
Turn-off Time (60 Hz):	8.3 msec max.	8.3 msec max.	50 µsec max.
Maximum Surge Current (peak):	80 Amps @ 60 Hz, 1 cycle; 25 Amps @ 60 Hz, 60 cycles	80 Amps @ 60 Hz, 1 cycle; 25 Amps @ 60 Hz, 60 cycles	5 Amp for 1 second
Load Current Range (rms):	0.03 to 3.5 Amps		
On-state Voltage Drop (peak):	1.5 Volts max.		
Power Dissipation:	1.0 Watt/Amp typical		
Optical Isolation(Input to Output):	4000 VAC rms		
Operating Temperature Range:	-40°C to +100°C		
Storage Temperature Range:	-40°C to +125°C		
Standards and Certification:	UL File # E58632, CSA File # LR38763		
Transient Protection:	Meets ANSI 37.90-1989 Surge Withstand Capability Test		



### Normally Open, Solid State Relays

Part Number	AC Outputs (Zero Voltage Turn On)		DC Outputs		
	GDOAC120	GDOAC240	GDODC60	GDODC200	GDODC60L <i>(Low Leakage)</i>
Nominal Line Voltage:	120 VAC	240 VAC	N/A	N/A	N/A
Load Power Factor:	0.4 min.	0.4 min.	N/A	N/A	N/A
Frequency Range:	25 Hz to 70 Hz	25 Hz to 70 Hz	N/A	N/A	N/A
Maximum Line Voltage:	N/A	N/A	60 VDC	200 VDC	60 VDC
Maximum Off-state Leakage @ 60Hz (AC) or @ 60 VDC (DC):	2 mA rms	4 mA rms	1.5 mA	0.01 mA	0.01 mA
Load Voltage Range:	24 to 140 VAC	24 to 280 VAC	3 to 60 VDC	4 to 200 VDC	3 to 60 VDC
On-state Voltage Drop:	1.5 Volts max.	1.5 Volts max.	1.2 Volts max.	1.75 Volts max.	1.2 Volts max.
Clamping Voltage:	N/A	N/A	80 VDC max.	360 VDC max.	80 VDC max.
Power Dissipation:	1.0 Watt/Amp typ.	1.0 Watt/Amp typ.	1.0 Watt/Amp typ.	1.5 Watt/Amp typ.	1.0 Watt/Amp typ.
Load Current Range (RMS):	0.03 to 3.5 A	0.03 to 3.5 A	0.02 to 3.5 A	0.02 to 1.0 A	0.02 to 3.5 A
Turn-on Time:	8.3 msec max. @ 60Hz	8.3 msec max. @ 60Hz	20 µsec max.	75 µsec max.	75 µsec max.
Turn-off Time:	8.3 msec max. @ 60Hz	8.3 msec max. @ 60Hz	50 µsec max.	750 µsec max.	500 µsec max.
Surge Current (peak):	80 Amps @ 60 Hz, 1 cycle; 25 Amps @ 60 Hz, 60 cycles	80 Amps @ 60 Hz, 1 cycle; 25 Amps @ 60 Hz, 60 cycles	5 Amps maximum for 1 second	5 Amps maximum for 1 second	5 Amps maximum for 1 second
Transient Power Dissipation:	400 Watts @ 1 msec non-recurring	400 Watts @ 1 msec non-recurring	400 Watts @ 1 msec non-recurring	N/A	N/A
Optical Isolation (Input to Output):	4000 VAC rms				
Operating Temperature Range:	-40°C to +100°C				
Storage Temperature Range:	-40°C to +125°C				
Standards and Certification:	UL File # E58632, CSA File # LR38763				
Transient Protection:	Meets ANSI 37.90-1989 Surge Withstand Capability Test				

## Mechanical Relay

Part Number	GDODC100M
Maximum Line Voltage:	100 VDC/120 VAC maximum
Contact Rating:	10 Watts maximum
Switching Current:	0.5 A dc maximum. Inductive loads require diode suppression.
Carrying Current:	1.0 A maximum. Inductive loads require diode suppression.
Contact Resistance:	250 mΩ maximum
Turn-on Time:	1.0 msec maximum
Turn-off Time:	1.0 msec maximum
Off-state Leakage Current:	2 μA maximum @ 60Hz
Dielectric Isolation (Input to Output):	1500 VAC rms
Operating Temperature Range:	-20°C to +85°C
Storage Temperature Range:	-40°C to +125°C
Transient Protection:	Meets ANSI 37.90-1989 Surge Withstand Capability Test

## Additional Specifications

Operating Temp:	0°C to +50°C (+32°F to +122°F) ambient air. (for TRAN model: -20°C to +50°C (-4°F to +122°F))
Storage Temp:	-30°C to +70°C (-22°F to +158°F)
Humidity:	5% to 95% non-condensing

## Standards Compliance



UL: Certified to UL 3111

CSA: Certified to CAN/CSA C22.2 No.1010-1

International: IEC 1010-1



Measuring inputs comply with Installation Category III  
Power supply inputs comply with Installation Category II  
Device operable under Pollution Degree II

Surge Withstand: All inputs pass ANSI/IEEE C37.90-1989 surge withstand and fast transient tests

FCC: Part 15 of FCC Rules for a Class A Digital Device



CE: approved

Quality Assurance: ISO 9002 certified by QMI

# Ordering Information

To order the 7330 ION you must first specify a model and then indicate the options with which you wish the unit equipped.

## Basic Model

7330 ION With an integrated display, infrared optical port, two optically isolated RS-485 communications ports, four digital inputs, and four digital outputs.

## TRAN Model

7330 ION -TRAN With two optically isolated RS-485 communications ports, four digital inputs, and four digital outputs. This model has no front panel display or infrared optical port.

## TRAN-RMD Model

7330 ION -TRAN-RMD With two optically isolated RS-485 communications ports, four digital inputs, four digital outputs, remote display with an infrared optical port, and supplied cable.

## Meter Options

-120	To monitor 69/120, 120/208, or 120/240 (single phase) Volt systems
-277	To monitor 240/415, or 277/480 Volt systems
-347	To monitor 347/600 Volt systems
-50Hz	Optimized for use on 50 Hz systems
-60Hz	Optimized for use on 60 Hz systems
-CWC	Captured-wire type connectors for Voltage and Current inputs. (Available with -120 or -277 options only.)
-TROP	Tropicalization (conformal coating) treatment
-DRM	DIN rail mount. (Available with the TRAN model only.)
-RMD	Remote Modular Display (for ordering display module separately to add to an existing TRAN unit).
-P24	24 VDC power supply.
-RAP	Round Adapter Plate



### NOTE

The -347 option is not available with the -CWC option.



### NOTE

A 7330 ION -TRAN can be retrofit with a remote modular display.

## Digital Output Devices

-REB	Relay Extension Board option; includes rack for four modules and 100-240 VAC to 5 VDC power supply.
GDOAC120	120 VAC, 3.5A, N.O. Solid State Relay
GDOAC120MO	Zero Voltage Turn On With Manual Override
GDOAC240	240 VAC, 3.5A, N.O. Solid State Relay
GDOAC240MO	Zero Voltage Turn On With Manual Override
GDODC60	60 VDC, 3.5A, N.O. Solid State Relay
GDODC60MO	Zero Voltage Turn On With Manual Override
GDODC200	200 VDC, 1.0A, N.O. Solid State Relay
GDODC60L	60 VDC, 3.5A, Low Leakage, N.O. Solid Relay

## Ordering Example

This example specifies a 7330 ION -TRAN model for use with 347/600 Volts @ 60 Hz systems:

7330ION -TRAN -347 -60Hz

## External Output Device Part Number Summary

The following table summarizes the manufacturer's part numbers for external output devices used with the 7330 ION.

ORDERING OPTION	DESCRIPTION	MANF. PART #
<b>Digital AC Outputs</b>		
GDOAC120	120 VAC, 3.5A, N.O. Solid State Relay	70G-OAC5
GDOAC120MO	120 VAC, 3.5A, N.O. Zero Voltage Turn-on, Manual Override	70G-OAC5MA
GDOAC240	240 VAC, 3.5A, N.O. Solid State Relay	70G-OAC5A
GDOAC240MO	240 VAC, 3.5A, N.O. Zero Voltage Turn-on, Manual Override	70G-OAC5AMA
<b>Digital DC Outputs</b>		
GDODC60	60 VDC, 3.5 A, N.O. Solid State Relay	70G-ODC5
GDODC60L	60 VDC, 1.0 A, Low Leakage, N.O. Solid Relay	70G-ODC5B
GDODC60MO	60 VDC, 1.5 mA, Manual Override	70G-ODC5MA
GDODC200	200 VDC, 1.0A, N.O. Solid State Relay	70G-ODC5A

## Warranty and Registration

This product is warranted against defects in materials and workmanship for three years. The Warranty is effective from date of purchase. Power Measurement Limited will repair or replace, at its option, any product found to be defective (F.O.B. point of manufacture) during the Warranty period, provided the equipment has been installed, wired, programmed, and operated in accordance with the manufacturer's instruction manual included with each unit, and the applicable sections of the Electrical Code.

The Warranty will be invalid if any unauthorized alterations are made to the product, or if the product has been abused or mishandled. Damage due to static discharges will void the Warranty, as will application of voltages or currents outside the specified ratings of the device inputs.

EXCEPT TO THE EXTENT PROHIBITED BY APPLICABLE LAW, NO OTHER WARRANTIES, WHETHER EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, SHALL APPLY TO THIS PRODUCT; UNDER NO CIRCUMSTANCES SHALL POWER MEASUREMENT LIMITED BE LIABLE FOR CONSEQUENTIAL DAMAGES SUSTAINED IN CONNECTION WITH SAID PRODUCT AND POWER MEASUREMENT LIMITED NEITHER ASSUMES NOR AUTHORIZES ANY REPRESENTATIVE OR OTHER

PERSON TO ASSUME FOR IT ANY OBLIGATION OR LIABILITY OTHER THAN SUCH AS IS EXPRESSLY SET FORTH HEREIN.

## Product Return Procedure

The following procedure must be strictly adhered to when returning any Power Measurement product to the factory for the purpose of repair, replacement, credit, upgrade, recalibration, or for any other reason.



### NOTE

Units received without prior authorization will not be accepted under any circumstances.

1. Contact Power Measurement or your local Power Measurement Sales Representative and obtain a *Return Merchandise Authorization* (RMA) number prior to shipment of any unit back to the manufacturer. Be prepared to provide the product's model number, serial number, and the reason for returning the unit.
2. If the unit is being returned for repair, replacement, or upgrade a *product return report* should be completed and included with the unit. The information provided should include:
  - ◆ A functional description of the unit defect or failure and the electrical/environmental conditions at the time of failure. This will significantly reduce repair/upgrade time (and cost, if warranty has expired). If the unit is being returned for an upgrade, recalibration or other modification, list the requirements.
  - ◆ The RMA number issued by Power Measurement, the serial number of the unit, the company name and address, the name of the person filling out the report, and the date.
  - ◆ **IMPORTANT:** The return address to which the unit is to be shipped following servicing.
3. Pack the unit safely, preferably in the original shipping carton, and include the detailed report described above. **The RMA number must be clearly marked on the outside of the box.**
4. A packing slip must be attached to the outside of the box which includes the points of origin and destination, a description of contents, and the reason for return. Examples: *For Repair and Return*, or *Returned for Credit*. There should be no need to declare a value.
5. Ship **PREPAID** to the appropriate address below. Power Measurement will not accept C.O.D. shipments. If the unit is still under warranty, Power Measurement will pay the return shipping charges.

### For Shipments Originating in the U.S.A.:

Power Measurement Ltd.  
c/o VICTORIA CUSTOMS BROKERS  
4131A Mitchell Way  
Bellingham, WA 98226

**For Shipments Originating Overseas:**

Power Measurement Ltd.  
2195 Keating Cross Road,  
Saanichton, BC V8M 2A5

CUSTOMS CLEARANCE  
Livingston International Inc. Ph(250)388-4435

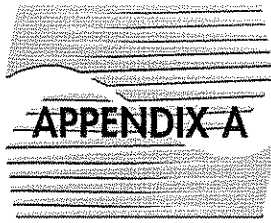
**For Shipments Originating in Canada:**

Power Measurement Ltd.  
2195 Keating Cross Road,  
Saanichton, BC V8M 2A5

## Registration

Please complete and mail the enclosed *Warranty Registration* card immediately. This will allow us to add you to our mailing list, to keep you up to date on the latest product firmware releases and new feature offerings.

Your comments and suggestions for product improvement and feature additions are welcome.



# 7330 ION Revenue Meters

This appendix provides an overview of the 7330 ION-RMxxxx Revenue Meters.

The fundamental functions of a revenue meter are to provide measurements that are within industry-accepted limits for accuracy over a defined range of operating conditions, and to provide adequate protection against unauthorized alteration of these measured quantities. International and national standards define industry-accepted accuracy limits. National and utility-based standards regulate protection against unauthorized alteration of measured quantities.

## 7330 ION-RM Models

Two models of the 7330 ION-RM revenue meter are available; each model is designated by the certification it holds.

Model	Certification Achievement	Current Inputs	Revenue Metering Security Systems
RMICAN (unsealed)	Canadian Revenue Metering Standards	Rated for 0.1 Amps to 10 Amps AC	Enabled
RMANSI (unsealed)	Complies with the accuracy requirements of the ANSI C12.16 Revenue Metering Standard	Rated for 0.1 Amps to 10 Amps AC	Enabled

## 7330 ION-RM Options

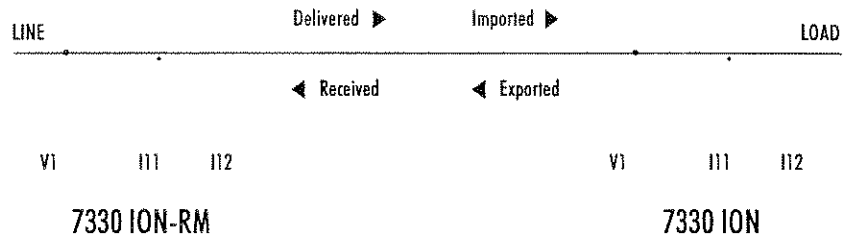
The RMSEAL option provides a factory installed anti-tamper mechanical seal on the base unit. This option is only available with the 7330 ION-RMICAN model.

## Differences between Standard and RM Models

The 7330 ION-RM differs from the standard (non-revenue) 7330 ION meter: additional modules for revenue calculations and new energy output register labels have been added to the 7330 ION-RM firmware.

### Revenue Meter Energy Register Labels

The revenue and non-revenue meters differ in how they label energy flow: standard 7330 ION (non-revenue) meters use the terms "imported" and "exported" energy, 7300 ION-RM (revenue) meters use the terms "delivered" and "received" energy.



The energy output register labels of the 7330 ION-RM follow the revenue metering terminology; the energy labels for kVAh, kVARh and kWh are different from the non-revenue devices as follows:

- ◆ "imp" is "del"
- ◆ "tot" is "del+rec"
- ◆ "exp" is "rec"
- ◆ "net" is "del-rec"

For example, the 7330 ION's output register "kVARh tot" will be "kVARh del+rec" in the 7330 ION-RM. A complete list of output registers is given in Chapter 2 for the non-revenue version of the 7330 ION.

### Additional Revenue Metering Modules

There are 13 additional modules incorporated into the frameworks of the 7330 ION-RM. Some of these modules are used in the calculation and logging of both  $V^2h$  and  $I^2h$  (used for transformer and line loss compensation). The new modules are as follows:

- ◆ 7 Integrator modules
- ◆ 4 AND/OR modules
- ◆ 1 External Pulse module
- ◆ 1 Arithmetic module

With the addition of these revenue-based modules, the overall processor power used by the device (*Prc Pwr Used* output register) is now approximately 72%.

## Security Mechanisms

To meet Government regulations and Utility security requirements, the 7330 ION-RM revenue meter incorporates three types of security systems:

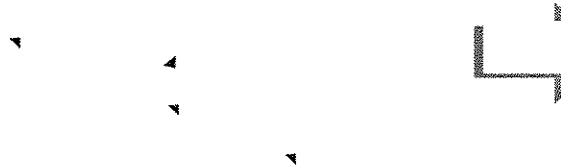
- ◆ a traditional "anti-tamper" mechanical seal on the 7330 ION base unit.
- ◆ a password-based security system that permits password protected minimum/maximum resets (for example, Sliding Window Demand reset).
- ◆ a hardware-based security system that prevents modification of revenue quantities after the meter is sealed.



## Traditional “Anti-Tamper” Seals

The 7330 ION-RM incorporates one or two sealing cans through which traditional lead/wire seals can be inserted. When utilized, these lead/wire seals effectively prevent unauthorized personnel from gaining access to meter internals. These seals are provided with the meter, and are installed as follows:

1. Place the sealing can over one of the rear panel corner holes and insert the screw into the hole through the sealing can.
2. Insert the ball bearing into the sealing can over the head of the screw. Install the wire through the two holes in the sealing can.
3. Twist the wire and crimp the lead-sealing tab onto the wire.



## Password Protected Min/Max Register Resets

The 7330 ION meter front panel incorporates a password that must be entered in order to reset any of the minimum/maximum register values. The password must therefore be used to reset peak demand register values.

## Hardware-based Security

The 7330 ION-RM revenue meter is equipped with a comprehensive security system that provides protection against unauthorized alteration or tampering of “revenue-related” quantities. This security system “locks” all revenue-related ION modules, ION links and ION setup-registers. Of particular importance is the fact that basic meter configuration parameters including volts mode (service-type), PT ratio, and CT ratio are locked. These locks are automatically enabled (at the factory) for all sealed 7330 ION-RM meters.

A two-pin jumper block is used to enable and disable the hardware security. To disable or enable the hardware-based security, follow the steps outlined in “Configuring the 7330 ION-RM” below.

## Protected Quantities and Modules

The following table lists protected quantities and modules that are locked when the hardware security system is enabled.



### NOTE

Locked modules cannot be deleted.

#### Protected Quantities

- ◆ kWh (delivered, received, delivered + received, delivered – received)
- ◆ kVARh (delivered, received, delivered + received, delivered – received)
- ◆ kVAh (delivered + received)
- ◆ kW demand ( TD and SD min , max )
- ◆ kVAR demand ( TD and SD min , max )
- ◆ kVA demand ( TD and SD min , max )
- ◆ Digital Output #1 (kWh del pulse)
- ◆ Digital Output #2 (kWh rec pulse)
- ◆ Digital Output #3 (kVAh del pulse)
- ◆ Digital Output #4 (kVAh rec pulse)
- ◆ V<sup>2</sup>h and I<sup>2</sup>h

#### Protected or “Locked” Modules

- ◆ Power Meter Module.
- ◆ Integrator Modules #1 to #16 inclusive.
- ◆ Sliding Window Demand Module #1 to #3 inclusive.
- ◆ Thermal Demand Module #1 to #3 inclusive.
- ◆ Minimum Module #27 to #32 inclusive.
- ◆ Maximum Module #27 to #32 inclusive.
- ◆ External Pulse Modules #1, #2, 3, 4, 6, 7, 9
- ◆ External Boolean Modules #1, #3, and #5.
- ◆ Arithmetic Module #1.
- ◆ AND/ OR Modules #1 to #4 inclusive.
- ◆ Periodic Timer #1
- ◆ Pulser Modules #1 to #4 inclusive.
- ◆ Data Recorder Module #1

# Configuring the 7330 ION-RM

When enabled, the 7330 ION-RM security system prevents unauthorized alteration of revenue-related quantities. Refer to the previous section, “Security Mechanisms” for details. By default, all 7330 ION-RM meters are shipped from the factory with the security system enabled. The following sections describe the steps required to configure a 7330 ION-RM meter.

## Safety Precautions

Before attempting to remove the back plate of the 7330 ION-RM, ensure that the device is protected against static-electric discharge. To prevent damage to the unit, wear an anti-static wrist strap at all times.



During normal operation of the 7330 ION, hazardous voltages are present which can cause severe injury or death. These voltages are present on the terminal strips of the device and throughout the connected potential transformer (PT), current transformer (CT), status input, relay, and control power circuits. Installation and servicing should be performed only by qualified, properly trained personnel.

1. Open all PT fuses (or direct voltage input fuses) and close all CT shorting blocks.
2. Turn off all power to the 7330 ION-RM and disconnect the Line and Neutral (or DC power) wires from the Supply Power inputs to the unit.
3. Disconnect all other wiring (or power off all other circuits) which may present potentially hazardous voltage levels to the unit, such as connections to the relay outputs.
4. Ensure that all cables still connected to the 7330 ION-RM are **NOT** live.

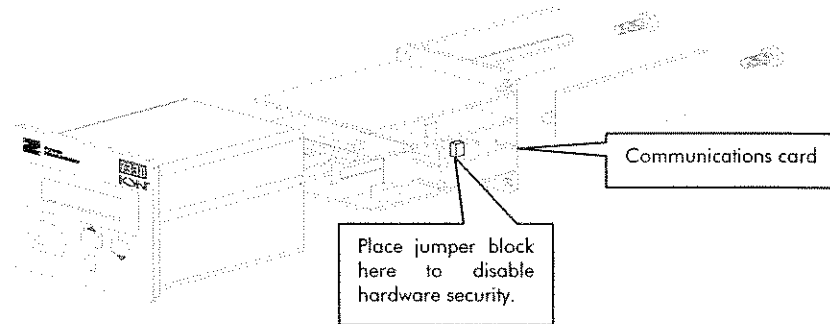
## CAUTION

The components inside the 7330 ION-RM are extremely sensitive to electro-static discharge. To prevent damage to the unit, wear an anti-static wrist strap at all times when working inside the unit. Failure to use proper equipment during servicing will void the 7330ION-RM warranty..

## Configuration Procedure

In order to configure the 7330 ION-RM, ensure that adequate safety precautions have been exercised (see above).

1. Remove the thumbscrews and retainer bars from the unit. Remove the anti-tamper wire seal and four screws on the rear panel.
2. Slide out the rear plate of the device to reveal the unit's circuit board panels. Locate the two-pin jumper header labeled "J1" on the communications card.
3. Place the jumper block onto the J1 two-pin header (this disables the hardware based security).



4. Slide the rear plate back into the device and replace the four screws onto the rear panel. Apply Control power to the 7330 ION-RM.
5. Configure the meter (Volts mode, PT and CT ratios, Pulse outputs, etc.).
6. Remove control power from the 7330 ION-RM.
7. Slide the rear plate out and remove the jumper block from the two-pin header to re-enable the hardware-based security.
8. Replace the rear plate and re-apply the anti-tamper seals.

## CT & PT Selection

Consult your local Revenue Metering authorities to obtain standards for CT and PT selection for revenue metering applications in your region.

# Checklist for Factory-Sealed 7330 ION-RMICAN

COMPANY:	CONTACT NAME:
STREET:	PHONE:
CITY:	FAX:
PROVINCE:	P.O. NUMBER:
POSTAL CODE:	INDUSTRY CANADA REGISTRATION # * :

The following information **MUST** be supplied at time of order:

Service Type (select one)	<input type="checkbox"/> 2-Element 3-Wire DELTA (Volts Mode = DELTA)
	<input type="checkbox"/> 3-Element 4-Wire WYE (Volts Mode = 4W-WYE)
Voltage Transformer Ratio	<input type="text"/> : <input type="text"/> Primary/Secondary Rating (ex. 12000:120)
Current Transformer Ratio	<input type="text"/> : <input type="text"/> Primary/Secondary Rating (ex. 5000:5)
Voltage Input Rating (select one)	<input type="checkbox"/> 120 <input type="checkbox"/> 277 <input type="checkbox"/> 347
Current Input Rating	Industry Canada Class 10
Frequency	60 Hz
Auxiliary Power Input	<input type="checkbox"/> 85-240 VAC /110-300 VDC <input type="checkbox"/> 20-60 VDC
Demand Parameter (select multiple)	<input type="checkbox"/> kW DEMAND <input type="checkbox"/> kVAR DEMAND <input type="checkbox"/> kVA DEMAND
Demand Method (select one)	<input type="checkbox"/> THERMAL DEMAND <input type="checkbox"/> SLIDING WINDOW DEMAND
Demand Period (select both)	<input type="text"/> MINUTES Length of Period TIMES (x) <input type="text"/> NUMBER of Sub-Periods (UPDATE)
Demand Synchronization Method	SYNC to Internal Clock
Mounting Type	Panel Mount
Energy Pulse Outputs	Output D1 = <input type="text"/> kWh/PULSE <input type="text"/> Specify Del, Rec, Del+Rec
	Output D2 = <input type="text"/> kVARh/PULSE <input type="text"/> Specify Del, Rec, Del+Rec
	Output D3 = <input type="text"/> kVAh/PULSE <input type="text"/> Specify Del, Rec, Del+Rec
	Output D4 = <input type="text"/> kVAh/PULSE <input type="text"/> Specify Del, Rec, Del+Rec
	Rollover <input type="text"/> Default = 1,000,000 <input type="text"/> Pulse Width (ms); Default = 20ms
Nameplate Information	OWNER INFO: <input type="text"/>
PLEASE PRINT CLEARLY	INFO 2: <input type="text"/>
	METER TAG #: <input type="text"/>

\* Revenue Meters are factory-sealed for use in Canada only. All Revenue Meters must be registered with the regional *Industry Canada Legal Metrology Branch* office. This registration process is the responsibility of the end customer or main contractor, and results in an *Industry Canada "E"* number being issued for each energy/demand meter. Utility customers can use a meter tag number in place of an "E" number.

## Data Recorder #1 (-RMSEAL only)



### NOTE

For compatibility with the UTS MV-90 billing software, Data Recorder #1 must be configured as a 16-channel recorder.

Data Recorder #1 is locked in the 7330 ION-RMICAN-RMSEAL; channel assignments must therefore be specified prior to sealing.

When ordering the -RMSEAL option, specify the following parameters to be recorded by Data Recorder module #1:

Channel 1 Parameter =	(DEFAULT = kWh DEL)
Channel 2 Parameter =	(DEFAULT = kWh REC)
Channel 3 Parameter =	(DEFAULT = kVARh DEL)
Channel 4 Parameter =	(DEFAULT = kVARh REC)
Channel 5 Parameter =	(DEFAULT = kVAh DEL + REC)
Channel 6 Parameter =	(DEFAULT = kW SWD)
Channel 7 Parameter =	(DEFAULT = kVAR SWD)
Channel 8 Parameter =	(DEFAULT = kVA SWD)
Channel 9 Parameter =	(DEFAULT = V1**2 hours)
Channel 10 Parameter =	(DEFAULT = V2**2 hours)
Channel 11 Parameter =	(DEFAULT = V3**2 hours)
Channel 12 Parameter =	(DEFAULT = I1**2 hours)
Channel 13 Parameter =	(DEFAULT = I2**2 hours)
Channel 14 Parameter =	(DEFAULT = I3**2 hours)
Channel 15 Parameter =	(DEFAULT = CNT #1)
Channel 16 Parameter =	(DEFAULT = CNT #2)

**Recorder Depth** (Default = 100 records = 1 day)

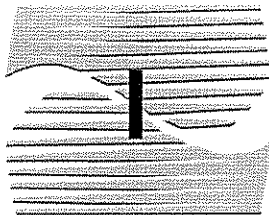
Suggested Alternatives:

960 records = 10 days @ 15 minute recording intervals

1920 records = 20 days @ 15 minute recording intervals

2880 records = 30 days @ 15 minute recording intervals

**Recording Interval** (Default = 15 minutes)



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