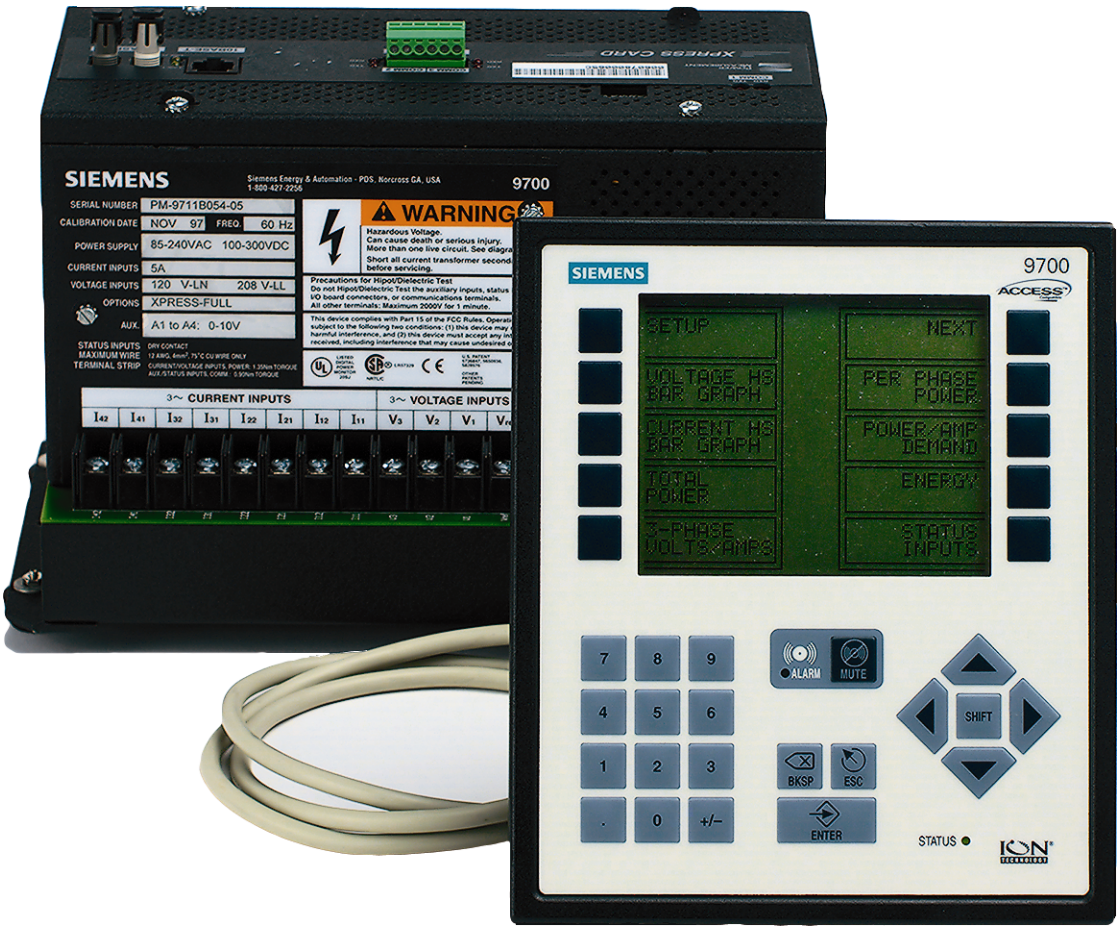
SIEMENS

9700 Power Meter

User's Guide



⚠ DANGER

Electrical equipment contains hazardous Voltages and high speed moving parts.

Can cause death, serious personal injury, or equipment damage.

Always de-energize and ground the equipment before maintenance. Maintenance should be performed only by qualified personnel.

The use of unauthorized parts in the repair of the equipment or tampering by unqualified personnel will result in dangerous conditions which will cause severe personal injury or equipment damage. Follow all safety instructions contained herein.

IMPORTANT

The information contained herein is general in nature and not intended for specific application purposes. It does not relieve the user of responsibility to use sound practices in application, installation, operation, and maintenance of the equipment purchased. Siemens reserves the right to make changes at any time without notice or obligations. Should a conflict arise between the general information contained in this publication and the contents of drawings or supplementary material, or both, the latter shall take precedence.

QUALIFIED PERSONNEL

For the purposes of this manual, a qualified person is one who is familiar with the installation, construction, or operation of the equipment and the hazards involved. In addition, that person has the following qualifications:

(a) **is trained and authorized** to de-energize, clear, ground, and tag circuits and equipment in accordance with established safety practices.

(b) **is trained** in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses, or face shields, flash clothing, etc., in accordance with established safety procedures.

(c) **is trained** in rendering first aid.

SUMMARY

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local sales office.

The contents of the instruction manual shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of Siemens Energy & Automation, Inc. The warranty contained in the contract between parties is the sole warranty of Siemens Energy & Automation, Inc. Any statements contained herein do not create new warranties or modify the existing warranty.

POWER START

Basic communications settings (baud rate, protocol) and metering settings (volts mode, CT/PT ratios) must be configured before you can use the 9700 Power Meter. If these settings have not been configured, follow the steps in the *9700 Power Meter 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 9700 Power Meter.

Chapter 1

♦ Understanding the Basics of the 9700 Power Meter

Chapter 1 introduces the 9700 Power Meter, and shows how it fits into power monitoring systems. The display and analysis software tools that compliment the 9700 Power Meter 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 9700 Power Meter 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 WinPM and the front panel display.

Chapter 3

♦ Making Minor Configuration Changes

Chapter 3 describes how to use the MGT to make minor changes to the meter's operation.

Chapter 4

♦ Using Advanced Features

Chapter 4 provides more details about the 9700 Power Meter's operating software so that the advanced user can create custom functions by linking the modules. Chapter 4 also describes advanced communications and output functions available with the 9700 Power Meter. Creating custom front panel displays is also discussed.

Chapter 5

♦ Technical Specifications

Chapter 5 provides technical specifications, accuracy data, ordering options, and warranty information.

Contents

1 Introduction

The 9700 Power Meter is a highly advanced digital power meter, suited to virtually any power monitoring and control application. This intelligent Electronic Device (IED) can take the place of numerous transducers, meters, and control circuits in your power monitoring system. The 9700 Power Meter provides true RMS measurements of voltage, current, power and energy, complemented by extensive I/O capabilities, comprehensive logging, and advanced power quality functions.

The 9700 Power Meter with the Modular Graphics Terminal

The 9700 Power Meter can be used effectively in numerous supply side and demand side operations. Some common applications of the 9700 Power Meter are:

- Revenue Metering
- Substation Automation
- Commercial/Industrial Metering
- Power Quality Monitoring
- Capacitor Control
- SCADA

These are just a few of the many possibilities. Contact Siemens Energy & Automation Customer Service at 800-427-2256 if you would like assistance with your application.

The 9700 Power Meter is Factory-Configured and Ready to Operate

Although the 9700 Power Meter is fully customizable, it is shipped from the factory with many functions pre-configured. Once installation and basic setup are preformed, all of the basic measurements, energy calculations and recording functions are ready to operate, right out of the box. Many users will find that the factory configuration will serve their purposed without performing any additional configuration.

New Communications and I/O Options

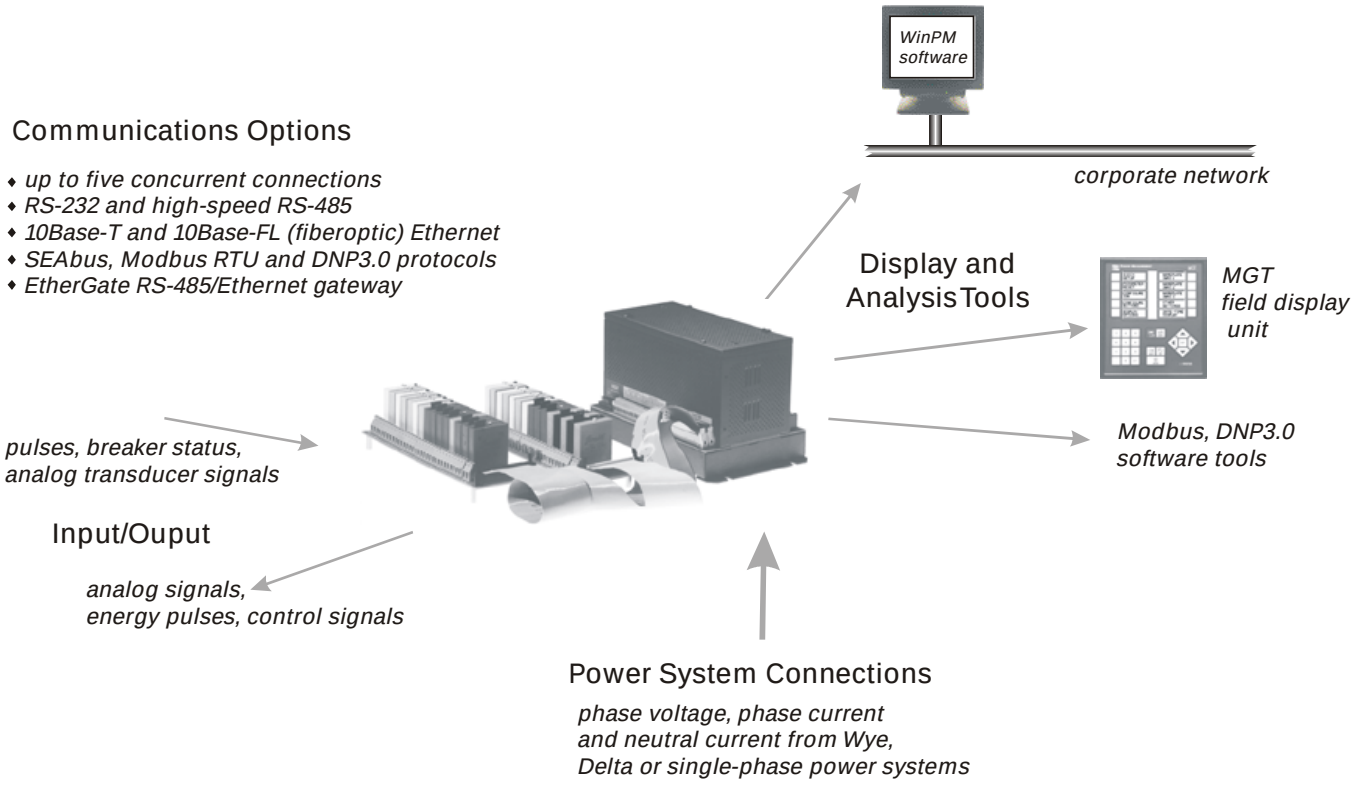
New or improved communications and I/O features include:

- The XPRESS CARD supports the DNP 3.0 protocol on either RS-485 port (only one port can be configured to use DNP 3.0 at any one time.)
- New protocols and functions provide high-accuracy time synchronization using GPS receivers.
- The XPRESS CARD supports two independent EtherGate gateways.
- Support is added for various types of thermocouple inputs.

The 9700 Power Meter in a Power Monitoring System

Applications that include the 9700 Power Meter, 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 9700 Power Meter can adapt to almost any situation. Advanced communications allow data to be shared simultaneously across multiple networks, expandable I/O provides additional monitoring and control capabilities, and a variety of display and analysis tools can be used to monitor your power system. This User's Guide discusses the 9700 Power Meter as it is most commonly used – as part of a complete power monitoring system.



Data Display and Analysis Tools

The 9700 Power Meter integrates seamlessly with the display and analysis software available from Siemens Energy & Automation. The data acquired by the 9700 Power Meter can be used in a variety of systems; however, WinPM is designed to make use of the advanced capabilities the unit provides.

The 9700 Power Meter's Modular Graphics Terminal (MGT)

Local monitoring and standalone applications are facilitated by the 9700 Power Meter's front-panel interface, the Modular Graphics Terminal (MGT). The MGT combines real-time display features with limited device configuration functions.

The MGT is often used in combination with a WinPM system, providing an interface for field personnel.

Communications Options

The standard 9700 Power Meter has a single RS-232/RS-485 communications port capable of data rates up to 19,200 bps. The optional XPRESS CARD provides two additional high-speed RS-485 ports (data rates up to 115,200 bps) and a 10Base-T Ethernet port. A 10 Base-FL fiberoptic Ethernet port is available as an option on the XPRESS CARD .

Depending on the hardware options purchased, separate ports can communicate simultaneously. Siemens Energy & Automation's SEAbus Protocol, Modbus RTU, DNP 3.0 are supported, depending on the communications port used. Refer to the section "Using Onboard and Expansion I/O" in Chapter 4 for details.

Input/Output

The standard 9700 Power Meter has eight status inputs. Four optional analog inputs are available on the meter to monitor AC or DC signals. Additional I/O is available using one or two expansion boards – up to 15 input or output modules can be added (digital or analog inputs or outputs are available.) Some restrictions apply to number of analog modules you can use, due to the power they require. Refer to the section "Using Onboard and Expansion I/O" in Chapter 4 for details.

Using this Guide

This User's Guide is directed at three types of users: 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 9700 Power Meter. These users want fast access to data through the front panel, WinPM, or a third-party protocol.

  Chapter 2 addresses the needs of the typical user who wants to get data out of the 9700 Power Meter. 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 meters "fit" their power systems: data recording intervals, demand sub-intervals and other parameters may need to be set before the 9700 Power meter's setup is complete. These users will use the front panel, or WinPM to change settings in the devices' operating system.

  Chapter 3 is directed at the users who wants to get more out of the 9700 Power Meter 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 devices' internal operation are provided.

- **Advanced User of Systems Integrator**

  Advanced users may want to make use of the flexibility and power provided by the device's operation software. These users will need to become familiar with the device's operation software, the Architecture, and the WinPM tools used to customize the device'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 Siemens Energy & Automation Application Notes, available from Siemens Energy & Automation Customer Service at 800-427-2256.

Before You can Use this Guide

By the time you are ready to use this Guide, your 9700 Power Meter 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 *9700 Power Meter Installation & Basic Setup Instructions* shipped with the meter.

Getting More Information

Additional information is available from Siemens Energy & Automation. Check our web site at www.sea.siemens.com, contact Siemens Energy & Automation directly at 800-427-2256. Documents related to the installation, operation, and application of the 9700 Power Meter.

9700 Power Meter Installation & Basic Setup Instructions
This brief guide is shipped with each 9700 Power Meter. It details the mounting, wiring, and basic setup of the device.

2 Displaying Data

The 9700 Power Meter 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 and logged by the factory-configured 9700 Power Meter using WinPM and the MGT front-panel interface.

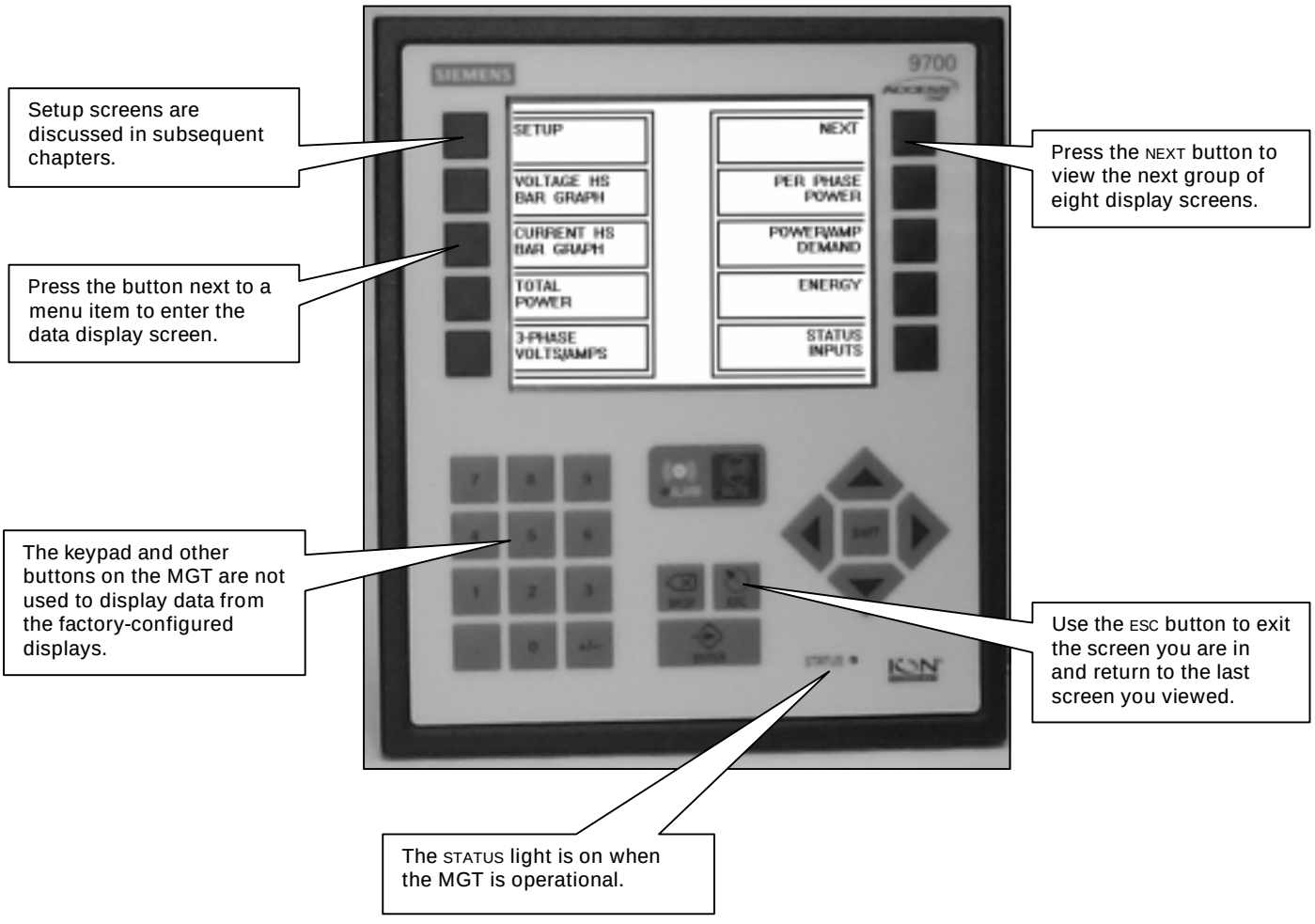
In this Chapter

Displaying Data with the MGT

The MGT, or *Modular Graphics Terminal*, provides a detailed graphics and text display for the 9700 Power Meter. The MGT has been configured at the factory with 24 displays showing most of the parameters measured by the meter. The factory-configured MGT displays numeric data screens, waveforms, trend graphs and harmonics histograms.

Data Display Screens

When the MGT is activated, it displays a menu of eight data display screens. Press the button adjacent to a menu item in the display area to access a particular display screen, or press NEXT move to the next menu of eight displays. The SETUP button provides access to configuration screens (discussed in the next chapter). Pressing the ESC key at any time returns you to the screen that was last displayed. The first screen looks like this:



The 24 screens provided display data in a number of different formats. The following paragraphs detail some of the important aspects of the various display formats.

Interpreting Numbers in Numeric Displays

Eleven of the 24 display screens show up to 15 parameters in a list, with the parameter name on the left, and the corresponding value on the right. One of the screens, Total Power, uses a large character display with four parameters on the screen. Both the 'standard' 15-parameter display and the large character display show numeric values.

When displaying numeric values, the MGT can display up to four digits of resolution. If more than four digits of resolution are required, use WinPM software to display data. If a value is too large or too small to be displayed with four digits, the MGT uses an abbreviated engineering notation that uses standard metric prefixes to indicate the magnitude of the reading. For example,

MGT Display	Value
12m40	0.0124
12K40	12, 400
12M40	12, 400, 000
1G240	1, 240, 000, 000

Numeric values are displayed in base units; voltages are displayed in volts, while current is displayed in amps. The following values, however, are displayed in kilo units rather than base units since kilo is the most frequently used measurement:

- kW
- kVA
- kVAR

When viewing these parameters with the MGT, remember that the values are already multiplied by 1000. For example, the reading below indicates 120, 000 kilowatts, *not* 120, 000 watts.

kW total 120K0

INVLD and N/A Messages

If the MGT is unable to read a numeric or status value from the 9700 Power Meter, it will display either INVLD or N/A in place of the value. INVLD indicates that the value received cannot be displayed because it is either too large or too small (it is below 1m000 or above 9G999). N/A appears if the register is not available.

Bar Graph Displays

Three display screens are provided for phase voltage and current:

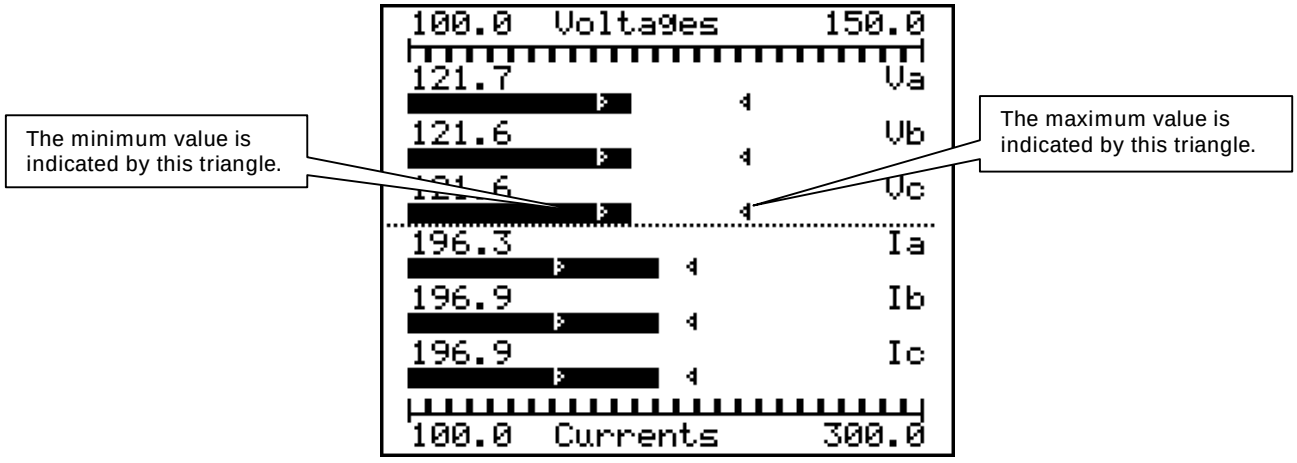
- High-speed line-to-neutral and average voltage (100 ms update rate)
- High-speed phase and average current (100 ms update rate)
- Line-to-neutral voltage and phase current (1 second update) with minimum and maximum indicators.

NOTE
Each of the MGT display screens can be adjusted to match your power system. Refer to "Creating Custom MGT Displays" in Chapter 4.

The two high-speed displays use a four-channel bar graph that shows the low limit, the parameter name (i.e. Vln a, meaning line-to-neutral voltage on phase A), and the upper limit above the bar for each measurement. The high-speed voltage display, called VOLTAGE HS BAR GRAPH, has fixed limits of 0 to 400 volts. The high-speed current display, called CURRENT HS BAR GRAPH, has fixed limits of 0 to 6000 Amps. If your voltage or current values are above the fixed upper limits, the MGT will display OFF SCALE in place of the bar. Similarly, the voltage bar graph displays OFF SCALE if you have a Delta power system, as there are no line-to-neutral voltage values available.

The phase voltage and current bar graph, called VOLTS/AMPS BAR GRAPH, displays line-to-neutral phase voltage and phase current values. As with the high-speed bar graphs, voltage limits of 0 to 400 Volts and current limits of 0 to 6000 Amps are fixed, and line-to-neutral voltages will read OFF SCALE if viewed in a Delta power system.

The VOLTS/AMPS BAR GRAPH also shows the minimum and maximum values measured (since power-up or the last min/max reset). Small triangles located on each parameter's bar indicate the min/max values:



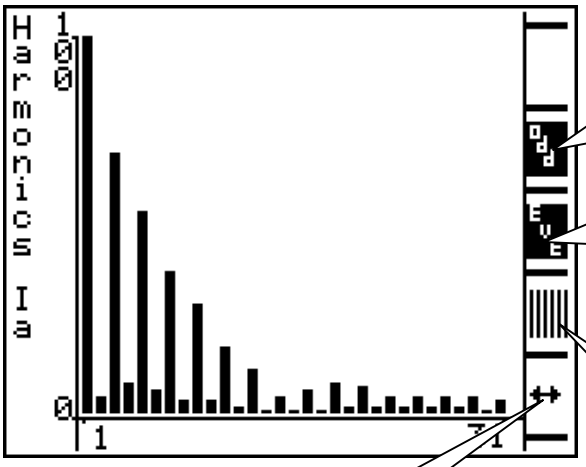
Trend Displays

Trend display screens are provided for total kW and total kVAR. Both screens show the values for each parameter over the last 150 seconds.

The limits set for total kW and total kVAR are 0 to 2400. If the total kW or total kVAR in your system are above this range, no trend graph will be displayed.

Harmonics Displays

Harmonics are displayed for each current phase. All harmonics from the fundamental to the 63rd can be displayed at once, or harmonics can be shown across two screens. The Harmonics display screens can be adjusted to show even harmonics, odd harmonics, or both.



Press the button next to ODD to display odd harmonics (ODD will be highlighted, as shown, if odd harmonics are being displayed).

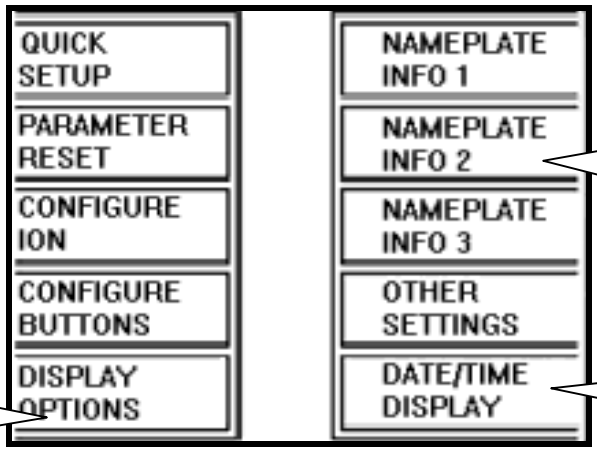
Press the button next to EVE to display even harmonics (EVE will be highlighted, as shown, if even harmonics are being displayed).

Press the button next to this graphic to toggle between one or two screen displays.

This arrow appears if the two-screen display is selected. Press the button next to this arrow to move between the two display screens.

Display Screens Available under SETUP

There are five display screens available under the SETUP menu item. You do not require password authorization to view these screens. The other eight items in the setup menu are used to configure the 9700 Power Meter and the MGT, and require password authority (setup functions are described in the next chapter). Press SETUP on the main MGT screen to display these options:



The three NAMEPLATE INFO screens display information about the 9700 Power Meter and its settings.

Enter DISPLAY OPTIONS to adjust the MGT's contrast, number display format and backlight timeout.

Choose DATE/TIME DISPLAY to have the MGT display date, time and time zone.

Display Options

The DISPLAY OPTIONS menu includes three options: Adjust Contrast, Backlight Timeout and Numbers X.XXX.

Adjust Contrast allows you to change the contrast of the MGT's display. The MGT has a contrast scale of 0 to 15. Select Adjust Contrast, then use the right and left arrow buttons to lighten or darken the display screen.

Backlight Timeout allows you to set the amount of time the MGT's backlighting stays on when the MGT is idle. The bulb that provides the backlighting has a limited lifespan; to prolong the life of the bulb, you should only have backlighting on when you are actively using the MGT. Select Backlight Timeout, then enter the amount of time in seconds that the light should stay on after a button has been pressed.

Numbers X.XXX lets you change the numeric display format to use either a period or a comma character as the decimal delimiter when displaying numbers.

Nameplate Info 1

Nameplate Info 1 displays the 9700 Power Meter's manufactured location, serial number, accuracy rating, and power system details.

NOTE
Additional information will be displayed in the Nameplate Info screens if the MGT is used with revenue-class 9700 Power Meters.

Nameplate Info 2

Nameplate Info 2 displays the MGT's acceptable operating temperature, the amount of battery life left in the 9700 Power Meter, and the configured demand settings.

Nameplate Info 3

Nameplate Info 3 displays the three lines of text that are written into the 9700 Power Meter's Factory module. You can customize the text displayed by configuring the Factory module's Owner, Tag1 and Tag2 setup registers in ION Designer. Nameplate Info 3 also shows the firmware revisions of the 9700 Power Meter, the MGT and the XPRESS CARD (if one exists), as well as the optional auxiliary I/O board's voltage level and the total amount of memory in the 9700 Power Meter.

Date/Time Display

The MGT can be set to display the date, time and timezone. To display the data and time, press SETUP, then press DATE/TIME DISPLAY. You can exit the date/time screen at any time by holding the ESC button down for two seconds.

Complete List of Factory-Configured Measurements and Functions

NOTE
The 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 WinPM and MGT display screens show much of the data that the factory-configured 9700 Power Meter 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 in each of the tools provided by Siemens Energy & Automation.

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		Module Name	Module Label	Output Register Label
	WinPM	MGT			
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

* SW Demand = Sliding Window Demand

Energy and Demand Framework, Continued

Description of Parameter or Function	Displayed/Accessible by Default		Module Name	Module Label	Output Register Label
	WinPM	MGT			
Energy / Demand Logging trigger			Periodic Timer #1	EgyDmd Log Trg	EgyDmd Log Trg
Energy / Demand Recorder Enable	●		External Boolean #5	EgyDmd Log Enbl	EgyDmd Log Enbl
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
Avg Current SW Demand	●	●	SW Demand #4	I avg swd	I avg swd
Avg Current 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
Energy / Demand Recorder	●		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		Module Name	Module Label	Output Register Label
	WinPM	MGT			
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
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

Min / Max Framework, Continued

Description of Parameter or Function	Displayed/Accessible by Default		Module Name	Module Label	Output Register Label
	WinPM	MGT			
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	Vln a mn	Vln a mn
Min Phase B L-N Volts	●	●	Minimum #2	Vln b mn	Vln b mn
Min Phase C L-N Volts	●	●	Minimum #3	Vln c mn	Vln c mn
Min Average L-N Volts	●	●	Minimum #4	Vln avg mn	Vln avg mn
Min kVA total	●		Minimum #16	kVA tot mn	kVA tot mn
Min L-L Volts AB	●	●	Minimum #5	Vll ab mn	Vll ab mn
Min L-L Volts BC	●	●	Minimum #6	Vll bc mn	Vll bc mn
Min L-L Volts CA	●	●	Minimum #7	Vll ca mn	Vll ca mn
Min Average L-L Volts	●	●	Minimum #8	Vll avg mn	Vll 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 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 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 td mn	kVA td mn
Min kW Thermal Demand	●	●	Minimum #30	kW td mn	kW td mn

Min / Max Framework, Continued

Description of Parameter or Function	Displayed/Accessible by Default		Module Name	Module Label	Output Register Label
	WinPM	MGT			
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 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 #5	MnMx Rset	MnMx Rset
Demand Min/Max Reset	●		External Pulse #1	Peak Dmd Rset	Peak Dmd Rset
Harmonics min/max Reset	●		External Pulse #10	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		Module Name	Module Label	Output Register Label
	WinPM	MGT			
Mean L-L Volts, AB	●		SW Demand #5	Vll ab mean	Vll ab mean
Mean L-L Volts, BC	●		SW Demand #6	Vll bc mean	Vll bc mean
Mean L-L Volts, CA	●		SW Demand #7	Vll ca mean	Vll ca mean
Mean L-L Volts, average	●		SW Demand #8	Vll avg mean	Vll avg mean
Mean Voltage Unbalance	●		SW Demand #9	V unbal mean	V unbal mean
Mean Phase A Current	●		SW Demand #10	I a mean	I a mean
Mean Phase B Current	●		SW Demand #11	I b mean	I b mean
Mean Phase C Current	●		SW Demand #12	I c mean	I c mean
Mean Average Current	●		SW Demand #13	I avg mean	I avg mean
Mean Neutral Current	●		SW Demand #14	I4 mean	I4 mean
Mean kW total	●		SW Demand #15	kW tot mean	kW tot mean
Mean kVAR total	●		SW Demand #16	kVAR tot mean	kVAR tot mean
Mean kVA total	●		SW Demand #17	kVA tot mean	kVA tot mean
Mean Power Factor lag	●		SW Demand #18	PF lag mean	PF lag mean
Mean Power Factor lead	●		SW Demand #19	PF lead mean	PF lead mean
Mean Frequency	●		SW Demand #20	Freq mean	Freq mean
High L-L Volts, AB	●		Maximum #20	Vll ab high	Vll ab high
High L-L Volts, BC	●		Maximum #55	Vll bc high	Vll bc high
High L-L Volts, CA	●		Maximum #56	Vll ca high	Vll ca high
High L-L Volts, average	●		Maximum #33	Vll avg high	Vll avg high
High Voltage Unbalance	●		Maximum #34	V unbal high	V unbal high
High Phase A Current	●		Maximum #35	I a high	I a high
High Phase B Current	●		Maximum #36	I b high	I b high
High Phase C Current	●		Maximum #37	I c high	I c high
High Average Current	●		Maximum #38	I avg high	I avg high
High Neutral Current	●		Maximum #39	I4 high	I4 high

Historic Data Logging Framework, Continued

Description of Parameter or Function	Displayed/Accessible by Default		Module Name	Module Label	Output Register Label
	WinPM	MGT			
High kW total	●		Maximum #40	kW tot high	kW tot high
High kVAR total	●		Maximum #41	kVAR tot high	kVAR tot high
High kVA total	●		Maximum #42	kVA tot high	kVA tot high
High Power Factor lag	●		Maximum #43	PF lag high	PF lag high
High Power Factor lead	●		Maximum #44	PF lead high	PF lead high
High Frequency	●		Maximum #45	Freq high	Freq high
Low L-L Volts, AB	●		Minimum #20	Vll ab low	Vll ab low
Low L-L Volts, BC	●		Minimum #46	Vll bc low	Vll bc low
Low L-L Volts, CA	●		Minimum #47	Vll ca low	Vll ca low
Low L-L Volts, average	●		Minimum #33	Vll avg low	Vll avg low
Low Voltage Unbalance	●		Minimum #34	V unbal low	V unbal low
Low Phase A Current	●		Minimum #35	I a low	I a low
Low Phase B Current	●		Minimum #36	I b low	I b low
Low Phase C Current	●		Minimum #37	I c low	I c low
Low Average Current	●		Minimum #38	I avg low	I avg low
Low Neutral Current	●		Minimum #39	I4 low	I4 low
Low kW total	●		Minimum #40	kW tot low	kW tot low
Low kVAR total	●		Minimum #41	kVAR tot low	kVAR tot low
Low kVA total	●		Minimum #42	kVA tot low	kVA tot low
Low Power Factor lag	●		Minimum #43	PF lag low	PF lag low
Low Power Factor lead	●		Minimum #44	PF lead low	PF lead low
Low Frequency	●		Minimum #45	Freq low	Freq low
Historic Logging Trigger	●		Periodic Timer #2	Hist Log Trg	Hist Log Trg
Historic Logging Enable	●		External Boolean #2	Hist Log Enble	Hist Log Enble
High value Reset	●		Feedback #1	Reset Hist high	Reset Hist high
Low value Reset	●		Feedback #2	Reset Hist low	Reset Hist low
Mean value recorder	●		Data Recorder #2	Hist mean Log	Hist mean Log
High value recorder	●		Data Recorder #3	Hist high Log	Hist high Log
Low value recorder	●		Data Recorder #4	Hist low Log	Hist low Log

Harmonics Logging Framework

This portion of the factory configuration records voltage and current harmonics measurements. Mean and average values are calculated, recorded and then reset every 60 minutes.

Description of Parameter or Function	Displayed/Accessible by Default		Module Name	Module Label	Output Register Label
	WinPM	MGT			
Mean Phase A Voltage THD*	●		S W Demand #21	V1 THD* mean	V1 THD* mean
Mean Phase B Voltage THD	●		S W Demand #22	V2 THD mean	V2 THD mean
Mean Phase C Voltage THD	●		S W Demand #23	V3 THD mean	V3 THD mean
Mean Phase A Current THD	●		S W Demand #24	I1 THD mean	I1 THD mean
Mean Phase B Current THD	●		S W Demand #25	I2 THD mean	I2 THD mean
Mean Phase C Current THD	●		S W Demand #26	I3 THD mean	I3 THD mean
Mean Phase A Current K Factor	●		S W Demand #27	I1 K Fac mean	I1 K Fac mean
Mean Phase B Current K Factor	●		S W Demand #28	I2 K Fac mean	I2 K Fac mean
Mean Phase C Current K Factor	●		S W Demand #29	I3 K Fac mean	I3 K Fac mean
High Phase A Voltage THD	●		Maximum #46	V1 THD* high	V1 THD* high
High Phase B Voltage THD	●		Maximum #47	V2 THD high	V2 THD high
High Phase C Voltage THD	●		Maximum #48	V3 THD high	V3 THD high
High Phase A Current THD	●		Maximum #49	I1 THD high	I1 THD high
High Phase B Current THD	●		Maximum #50	I2 THD high	I2 THD high
High Phase C Current THD	●		Maximum #51	I3 THD high	I3 THD high
High Phase A Current K Factor	●	●	Maximum #52	I1 K Fac high	I1 K Fac high
High Phase B Current K Factor	●	●	Maximum #53	I2 K Fac high	I2 K Fac high
High Phase C Current K Factor	●	●	Maximum #54	I3 K Fac high	I3 K Fac high
Harmonics Logging trigger	●		Periodic Timer #3	Harm Log Trg	Harm Log Trg
Harmonics Logging enable	●		External Boolean #6	Harm Log Enble	Harm Log Enble
High Harmonics reset	●		Feedback #3	Rset Harm high	Rset Harm high
Mean Harmonics Recorder	●		Data Recorder #7	Harm mean Log	Harm mean Log
High Harmonics Recorder	●		Data Recorder #8	Harm high Log	Harm high Log

* THD = Total Harmonic Distortion

Power Quality Monitoring Framework

This portion of the factory configuration monitors the phase voltage signals for sag/swell and transient events, and triggers waveform recordings when they occur (statistics are also recorded for each event). A trigger is provided for manual waveform recording, and counters are included to display the number of events that have occurred (an additional trigger provided to reset these counters).

Description of Parameter or Function	Displayed/Accessible by Default		Module Name	Module Label	Output Register Label
	WinPM	MGT			
Sag or Swell Duration	●		Sag/Swell #1	Sag/Swell 1	SS1 DistDur
Phase A min Voltage	●				SS1 DistV1Min
Phase A max Voltage	●				SS1 DistV1Max
Phase A average Voltage	●				SS1 DistV1Avg
Phase A Energy variance	●				SS1 DistV1Engy
Phase B min Voltage	●				SS1 DistV2Min
Phase B max Voltage	●				SS1 DistV2Max
Phase B average Voltage	●				SS1 DistV2Avg
Phase B Energy variance	●				SS1 DistV2Engy
Phase C min Voltage	●				SS1 DistV3Min
Phase C max Voltage	●				SS1 DistV3Max
Phase C average Voltage	●				SS1 DistV3Avg
Phase C Energy variance	●				SS1 DistV3Engy
Nominal Voltage at the beginning of Sag or Swell disturbance	●				SS1 DistNominal
Voltage level considered a Swell	●				SS1 Swell Lim *
Voltage level considered a Sag	●				SS1 Sag Lim *
Phase A Transient duration	●		Transient #1	Transient 1	TR1 TranV1Dur
Phase A Max Peak Transient	●				TR1 TranV1Max
Phase B Transient duration	●				TR1 TranV2Dur
Phase B Max Peak Transient	●				TR1 TranV2Max
Phase C Transient duration	●				TR1 TranV3Dur
Phase C Max Peak Transient	●				TR1 TranV3Max
Nominal Voltage at the beginning of Transient disturbance	●				TR1 TranNominal
Voltage fluctuation amount considered a Transient	●				TR1 Threshold *

* These are setup registers, not output registers.

Power Quality Framework, Continued

Description of Parameter or Function	Displayed/Accessible by Default		Module Name	Module Label	Output Register Label
	WinPM	MGT			
Sag/Swell Data Recorder	●		Data Recorder #5	Sag/Swell Log	Sag/Swell Log
Transient Data Recorder	●		Data Recorder #6	Transient Log	Transient Log
Phase A Voltage Waveform Rec.	●		Waveform Recorder #1	Wfm Rec V1	Wfm Rec V1
Phase B Voltage Waveform Rec.	●		Waveform Recorder #2	Wfm Rec V2	Wfm Rec V2
Phase C Voltage Waveform Rec.	●		Waveform Recorder #3	Wfm Rec V3	Wfm Rec V3
Phase A Current Waveform Rec.	●	●	Waveform Recorder #4	Wfm Rec I1	Wfm Rec I1
Phase B Current Waveform Rec.	●	●	Waveform Recorder #5	Wfm Rec I2	Wfm Rec I2
Phase C Current Waveform Rec.	●	●	Waveform Recorder #6	Wfm Rec I3	Wfm Rec I3
Sag/Swell monitoring Enable	●		External Boolean #4	Sag/Swell Enble	Sag/Swell Enble
Transient monitoring Enable	●		External Boolean #10	Transient Enble	Transient Enble
Waveform Recording Enable	●		External Boolean #11	Wfm Rec Enble	Wfm Rec Enble
Disturbance Counter reset	●		External Pulse #8	Dist Count Rset	Dist Count Rset
Manual Waveform Rec trigger	●		External Pulse #12	Man Wfm Trg	Man Wfm Trg
Sag/Swell Counter	●		Counter #9	Sag/Swell Count	Sag/Swell Count
Transient Counter	●		Counter #10	Transient Count	Transient Count
Disturbance timestamp reset	●		Counter #11	Rset timestamp	Rset timestamp
Waveform trigger merge	●		Pulse Merge #1	Wfm Trg Merge	Wfm Trg Merge

Setpoint Framework

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

Description of Parameter or Function	Displayed/Accessible by Default		Module Name	Module Label	Output Register Label
	WinPM	MGT			
Over kW SW Demand	●		Relative Setpoint #1	Over kW swd	Over kW swd
Over Phase A Current	●		Relative Setpoint #2	Over I a	Over I a
Over Phase B Current	●		Relative Setpoint #3	Over I b	Over I b
Over Phase C Current	●		Relative Setpoint #4	Over I c	Over I c
Over Voltage Unbalance	●		Relative Setpoint #5	Over V unbal	Over V unbal
Nominal kW SW Demand	●		External Numeric #1	kW swd nominal	kW swd nominal
Nominal Phase A Current	●		External Numeric #2	I a nominal	I a nominal
Nominal Phase B Current	●		External Numeric #3	I b nominal	I b nominal
Nominal Phase C Current	●		External Numeric #4	I c nominal	I c nominal
Nominal Voltage unbalance	●		External Numeric #5	V unbal nominal	V unbal nominal
Over-demand monitoring enable	●		External Boolean #7	Over kW Enble	Over kW Enble
Over-current monitoring enable	●		External Boolean #8	Over Amp Enble	Over Amp Enble
Over-voltage unbalance monitoring enable	●		External Boolean #9	Over Vunb Enble	Over Vunb Enble

Digital Inputs Framework

This portion of the meter's configuration monitors the status of the 7900 Power Meter's on-board digital inputs, and counts the number of times each input changes state.

Description of Parameter or Function	Displayed/Accessible by Default		Module Name	Module Label	Output Register Label
	WinPM	MGT			
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
Status of Digital Input 5	●	●	Digital Input #5	Digital In 5	S5
Status of Digital Input 6	●	●	Digital Input #6	Digital In 6	S6
Status of Digital Input 7	●	●	Digital Input #7	Digital In 7	S7
Status of Digital Input 8	●	●	Digital Input #8	Digital In 8	S8
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
Digital Input 5 status changes	●		Counter #5	S5 Counter	S5 Counter
Digital Input 6 status changes	●		Counter #6	S6 Counter	S6 Counter
Digital Input 7 status changes	●		Counter #7	S7 Counter	S7 Counter
Digital Input 8 status changes	●		Counter #8	S8 Counter	S8 Counter
Status change counter reset	●		External Pulse #6	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, harmonics measurements, symmetrical component data, and output from the device's real-time clock.

Description of Parameter or Function	Displayed/Accessible by Default		Module Name	Module Label	Output Register Label
	WinPM	MGT			
Phase A L-N Volts	●	●	Power Meter Module	Power Meter *	Vln a *
Phase B L-N Volts	●	●			Vln b
Phase C L-N Volts	●	●			Vln c
Average L-N Volts	●	●			Vln avg
L-L Volts AB	●	●			Vll ab
L-L Volts BC	●	●			Vll bc
L-L Volts CA	●	●			Vll ca
Average L-L Volts	●	●			Vll 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 9700 Power Meter includes a HS (high-speed) Power Meter and a MU (meter units) Power Meter modules. Module and output register labels from the HS and MU Power Meter modules include an HS or MU prefix.

** Quadrant Boolean values indicate the quadrant where the Power Factor lies. Only one Quadrant Boolean will be on at any given time.

Real-Time Measurements, Continued

Description of Parameter or Function	Displayed/Accessible by Default		Module Name	Module Label	Output Register Label
	WinPM	MGT			
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
Current Line 4		●			I 4
Phase Revolution					Phase Rev
Frequency Phase A	●				Freq
Meter Event					Event
Volts zero sequence magnitude		●			V ZeroSeqMag
Volts zero seq. phase angle		●			V ZeroSeqPhs
Volts positive seq. magnitude		●			V PosSeqMag
Volts positive seq. phase angle		●			V PosSeqPhs
Volts negative seq. Magnitude		●			V NegSeqMag
Volts negative seq. phase angle		●			V NegSeqPhs
Current zero seq. magnitude		●			I ZeroSeqMag
Current zero seq. phase angle		●			I ZeroSeqPhs
Current positive seq. magnitude		●			I PosSeqMag

Real-Time Measurements, Continued

Description of Parameter or Function	Displayed/Accessible by Default		Module Name	Module Label	Output Register Label
	WinPM	MGT			
Current positive seq. phase angle		●	Power Meter Module	Power Meter	I PosSeqPhs
Current negative seq. Magnitude		●			I NegSeqMag
Current negative seq. phase angle		●			I NegSeqPhs
Volts Phase A HDs	● (2^{nd} to 15^{th})		Harmonics Analyzer Module #1	V1 Harmonics	V1 HD 1 *thru* V1 HD 63
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	● (2^{nd} to 15^{th})		Harmonics Analyzer Module #2	V2 Harmonics	V2 HD 1 *thru* V2 HD 63
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
Volts Phase C HDs	● (2^{nd} to 15^{th})		Harmonics Analyzer Module #3	V3 Harmonics	V3 HD 1 *thru* V3 HD 63
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	● (2^{nd} to 15^{th})	●	Harmonics Analyzer Module #4	I1 Harmonics	I1 HD 1 *thru* I1 HD 63
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 A K-Factor	●	●			I1 K Factor
Current Phase B HDs	● (2^{nd} to 15^{th})	●	Harmonics Analyzer Module #5	I2 Harmonics	I2 HD 1 *thru* I2 HD 63
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

Real-Time Measurements, Continued

Description of Parameter or Function	Displayed/Accessible by Default		Module Name	Module Label	Output Register Label
	WinPM	MGT			
Current Phase B K-Factor	●	●			I2 K Factor
Current Phase C HDs	● (2^{nd} to 15^{th})	●	Harmonics Analyzer Module #6	I3 Harmonics	I3 HD 1 *thru* I3 HD 63
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 K-Factor	●	●			I3 K Factor
Current 4 HDs	● (2^{nd} to 15^{th})	●	Harmonics Analyzer Module #7	I4 Harmonics	I4 HD 1 *thru* I4 HD 63
Current 4 total HDs	●	●			I4 Total HD
Current 4 total even HDs	●				I4 Tot EvenHD
Current 4 total odd HDs	●				I4 Tot OddHD
Current 4 K-Factor	●	●			I4 K Factor
Universal Time (UTC)			Clock Module	Clock	UnivTime
Local Time	●				LocalTime
Daylight Savings Time (ON/OFF)					DSTFlag

3 Making Configuration Changes

Once basic setup is performed, most users will find that the 9700 Power Meter's factory configuration provides all of the monitoring, logging 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.

The 9700 Power Meter can be customized to perform virtually any 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 9700 Power Meter, refer to Chapter 4.

In this Chapter

Configuration Tools

Different types of configuration changes can be made using the different tools provided by Siemens Energy & Automation. 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 9700 Power Meter is discussed in the next chapter.

- WinPM 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 WinPM. The different types of device functions are grouped together on the WinPM screen, so you can quickly access the types of settings you want to change.
- The MGT also provides access to the settings of every meter function. Special screens are provided for quick access to basic setup functions. The MGT 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 WinPM for device configuration — this software provides the most comprehensive view of the 9700 Power Meter's internal operation. Once you have become comfortable with the WinPM interface, you will be better prepared to make major changes later.

Basics of the Architecture

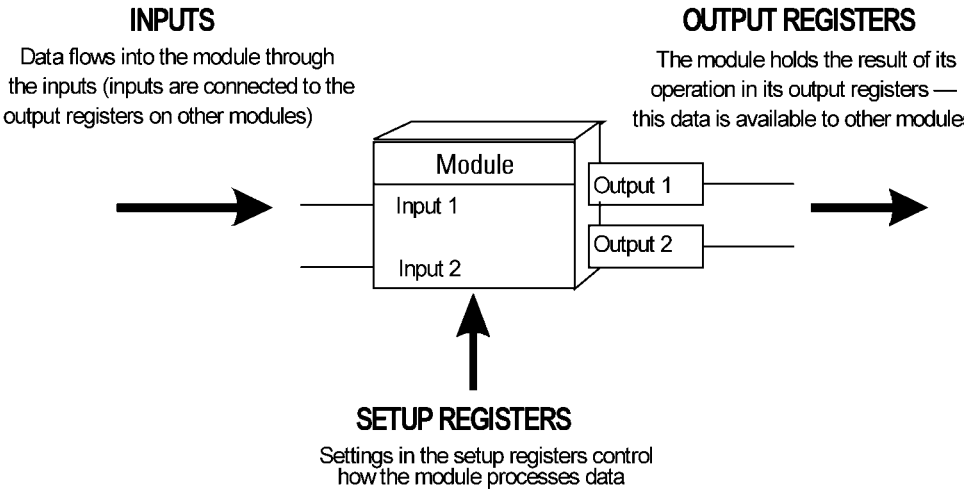
Before you begin altering the 9700 Power Meter's operation, it is advisable to familiarize yourself with the basics of how the device operates. Understanding the basics of the architecture will help you understand how to make different types of configuration changes.

The 9700 Power Meter and all other devices use the Integrated Object Network as their architecture. This architecture applies the principles of object-oriented software design to the creation of functionality inside your devices. The object-oriented structure allows you to connect different discrete objects, called *modules*, in different ways to define how information is accessed, transferred, and manipulated inside the device and across the power monitoring network.

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

The Module

The module is the basic building block of the 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 a device can be considered in terms of its modules and the linkages between them.



There are approximately 50 types of modules in the architecture; the 9700 Power Meter has 18 different module types. Most devices can support several instances of a certain module type (for example, the 9700 Power Meter includes 32 Maximum modules, 16 Sliding Window Demand modules, and eight External Boolean modules).

NOTE

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

The 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 Configuration Changes

Regardless of the interface you use, when you make configuration changes to a 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 module setup registers.

The 9700 Power Meter 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 a module's setup registers changes the way the device operates. Carefully consider any change you intend to make before proceeding.

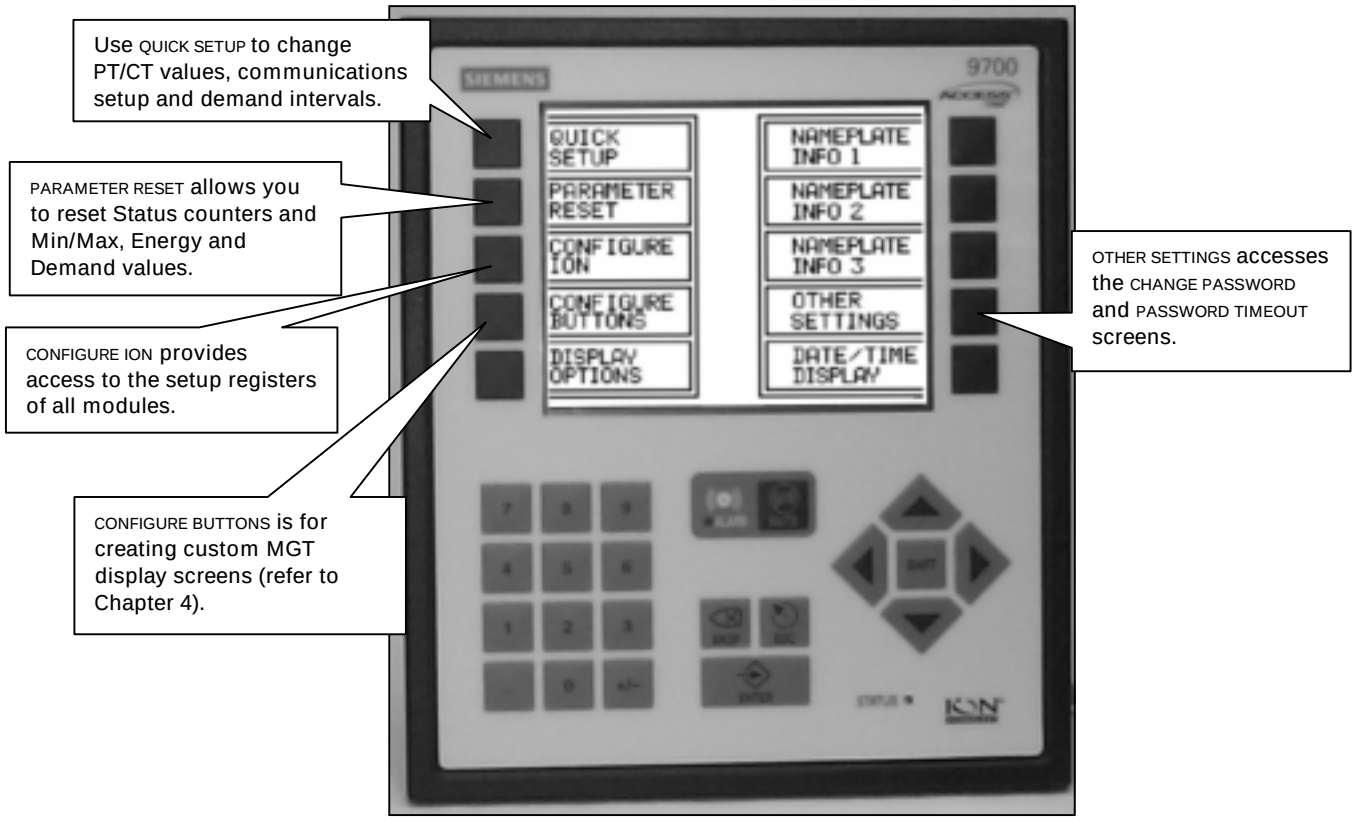
Adding or deleting links between modules significantly alters the operation of the device, and should only be performed by experienced personnel.

Configuring the 9700 Power Meter with the MGT

The MGT provides device setup capability at the 9700 Power Meter's installed location. All of the 9700 Power Meter's setup registers can be configured moving through menus on the MGT's screen. (module links cannot be added or deleted using the MGT). The MGT also provides quick access to parameter reset for common cumulative parameters.

The MGT's Setup Menus

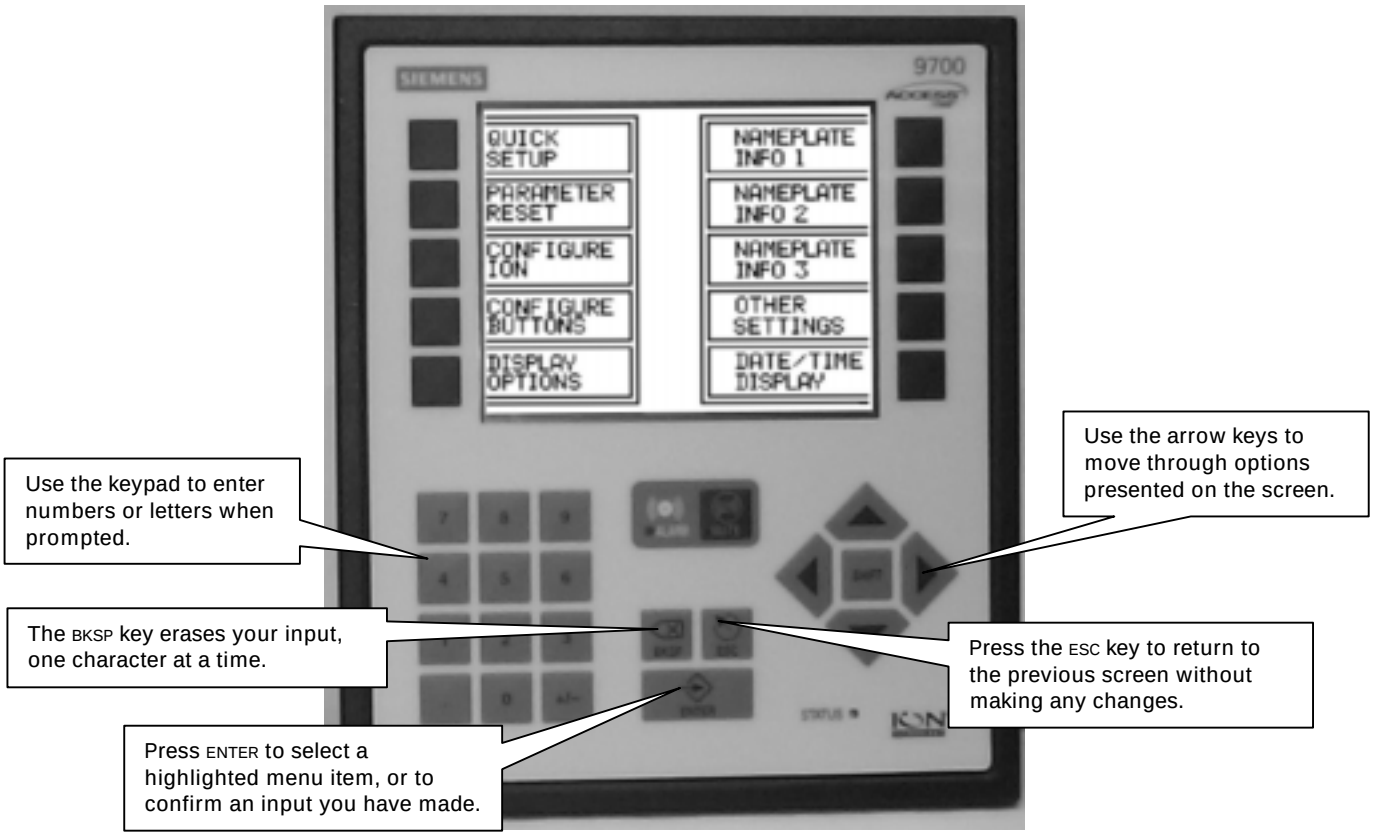
To access the MGT's device configuration functions, press the button next to the SETUP menu item (the top button on the left of the display screen). If the SETUP menu item does not appear on the MGT's display, press the button next to the PREVIOUS menu item until the SETUP option becomes available. Press SETUP to enter the MGT's main Setup Menu:



The DISPLAY OPTIONS, NAMEPLATE INFO and DATE/TIME DISPLAY menu items are described in "Displaying Data with the MGT" in Chapter 2.

Using the MGT's Buttons

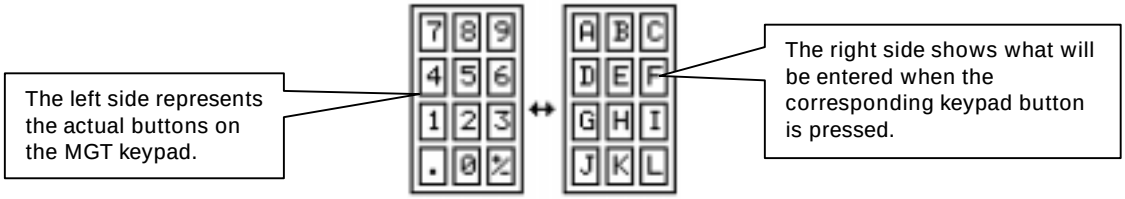
Move through the MGT's menu items by pressing the buttons adjacent to menu items on the screen. To enter data, use the numeric keypad and the arrow keys to make a selection or enter a value (detailed below). Once a selection is made or a value is entered, use the ENTER button to confirm the input and send the data to the 9700 Power Meter. The BKSP button is used to delete the values you have entered, one character at a time. The ESC button moves you back to the previously viewed screen, discarding any changes you have made.



Making Selections and Entering Data

Many configuration changes are made by selecting options from a list. To make a selection, use the arrow keys to highlight the item you want, then press ENTER.

Some procedures require that you enter a number or a word. When the MGT wants input from you, it displays a representation of the keypad on the screen:



The left side of the button assignment screen represents the actual buttons on the MGT keypad. The right side of the display indicates which characters each of the keypad buttons represent. In the display above, to enter the character "G", you would press "1" on the MGT keypad.

Press the right or left arrow buttons to scroll through all of the available keypad button assignments. When the character you want to enter is displayed on the right, press the corresponding keypad button on the left to enter that character. The SHIFT key offers a shortcut for accessing characters on other keypad screens: similar to the SHIFT key on a computer keyboard, pressing SHIFT on the MGT changes the case of the characters.

After you have entered the characters you want, press the ENTER button to send the command to the 9700 Power Meter.

Passwords and Password Timeout

All device configuration functions are password protected. The password is factory set to zero (0). With the factory password you can penetrate the menus and change the password to a custom value.

NOTE
If you forget your password, contact Siemens Energy & Automation with your 9700 Power Meter serial number.

The MGT also features a Password Timeout feature. This feature permits you to make multiple changes without having to repeatedly enter a password to authorize the change. Note that the timeout feature is applicable only within a particular SETUP menu (i.e. within CONFIGURE ION or PARAMETER RESET). You will be prompted for your password again if the timeout elapses or if you attempt to make changes from a different SETUP menu area.

To change the password or adjust the timeout value, choose the OTHER SETTINGS menu. When you are prompted for your password, press 0 (zero) on the keypad, then press the enter button. Choose either PASSWORD TIMEOUT or CHANGE PASSWORD. Follow the instructions on the MGT screen.

Quick Setup

QUICK SETUP

The MGT's Quick Setup menu provides access to four basic setup functions: PT/CT, Serial COM, Ethernet COM and Demand. These settings are all made when the device is initially put into service — typically you will not need to change these settings once the device is operational. To access a Quick Setup menu, press SETUP, QUICK SETUP, and then the menu you want to use.

PT/CT

The PT/CT menu accesses the Power Meter and Sag/Swell module setup registers that are used for basic setup:

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
I4 CT Prim	The Current Transformer's primary winding rating for I4
I4 CT Sec	The Current Transformer's secondary winding rating for I4
Nom Volts	The nominal power system voltage (used for power quality calculations)
Phase Lbls	The phase label format assigned to the outputs (ABC, RST, XYZ, RYB, RWB or 123)

Serial COM

The Serial COM menu accesses the Communications modules that control the 9700 Power Meter's serial ports (Comm 1, and Comm 2/Comm 3 on the optional XPRESS CARD).

Setup Register	Function
Comm Mode	Sets the Comm 1 serial port's communications mode (RS-232 or RS-485)
Baud Rate *	Sets the communications speed, in bits/second) for the serial port
Unit ID *	Sets the 9700 Power Meter's Unit ID — a unique Unit ID is required for each device
Protocol *	Sets the communications protocol for the serial port.

* These setup registers are available for each installed serial port. The MGT displays CM1, CM2 or CM 3 to indicate communications ports 1, 2 or 3.

Ethernet COM

The Ethernet COM menu accesses the Ethernet module's setup registers. The Ethernet module controls the 10Base-T and 10Base-FL ports on the optional XPRESS CARD.

Setup Register	Function
Protocol	Sets the communications protocol for the Ethernet ports.
IP Address	Sets the IP Address for the 9700 Power Meter
Subnet Mask	Used if subnetting applies to your network – see your Network Administrator
Gateway	Used in multiple network configurations – see your Network Administrator

Typically your Network Administrator will provide you with the appropriate IP Address for the 9700 Power Meter. The Subnet Mask and Gateway settings are only required if you have communications between multiple Ethernet networks, and if subnetting is implemented.

Demand

The Demand menu accesses some of the setup registers in the factory-configured Sliding Window Demand and Thermal Demand modules. These setup registers control the timing of demand calculations.

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
Interval (Thermal) *	The time, in seconds, in the thermal demand interval

* These setup registers are available for each demand module. The MGT displays SD1 to SD4 to indicate Sliding Window Demand modules 1 through 4, and TD1 through TD4 to indicate Thermal Demand modules 1 through 4.

Parameter Reset

The Parameter Reset menu allows you to reset various cumulative parameters. To access Parameter Reset, press SETUP, PARAMETER RESET, then use the up and down arrow keys to highlight the parameter you want to reset. When the parameter you want is highlighted, press ENTER.

The first time you reset a parameter, the password screen appears – enter 0 (zero) or the user password you previously configured. The MGT displays "…Done" next to the parameter name once it has been successfully reset. The parameters that are reset by each menu selection are detailed below.

Min/Max Reset

The minimum AND the maximum values for each the following parameters are reset when *Min/Max 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

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

- Average Current SWD
- kVAR SWD
- kW SWD
- kVA SWD

Status Counter Reset

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

Thermal Demand Reset

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

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

Energy Reset

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

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

Configure ION

The Configure ION menu provides access to the setup registers of every ION module in the 9700 Power Meter. To edit a module's setup registers with the MGT, press SETUP then CONFIGURE ION. The Feature Manager appears, listing all of the module types available. Follow this procedure to access a setup register:

1. Use the arrow buttons to highlight the type of module you want to configure. The list of available modules occupies multiple MGT screens — when you get to the bottom of a screen, press ENTER when the word "more..." is highlighted to see the next group of module types. When the type of module you want to configure is highlighted, press ENTER to view the available modules of that type.

2. Use the arrow buttons to highlight the module you want to configure, then press ENTER. The module's setup registers appear, with their current settings displayed on the right.

3. Use the arrow buttons to move through the setup register listing until the register you want to configure is highlighted. Press ENTER, then enter your password to access the register's setting (use '0' if you have not configured a password). Press ENTER again after keying in your password.

4. Use the keypad to enter the new value, or use the arrow buttons to select the desired option from the list. Press ENTER to send the new setup register value to the 9700 Power Meter. (Press ESC if you want to leave the screen without making any changes.)

Refer to Chapter 5 in this guide for a listing of the supported ranges or options for each module in the 9700 Power Meter.

4 Using Advanced Features

The 9700 Power Meter provides many advanced features, including comprehensive I/O, advanced interoperability support, and precision time synchronization. In addition, the 9700 Power Meter's functionality can be customized to perform virtually any 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 I/O and advanced communications protocols, and the creation of custom MGT displays.

In this Chapter

WinPM-Advanced 9000 Series Meter Programming

The factory configuration for 9000 series meters provides all of the monitoring, logging and control functionality you normally require. However, the 9000 series meters can be customized to perform virtually any power monitoring and control function. Minor changes can be made to the factory configuration allowing your device to be better suited to the particular metering needs of your application. This chapter explains how to make small changes to the factory configuration using WinPM.

You should dismantle the factory configuration and replace it with your own module links and settings to create custom functionality. Advanced configuration should be performed by only experienced personnel. If you want to make significant changes to the operation of the 9000 series meters, please contact Siemens Energy & Automation Customer Service in Siemens at 800-427-2256.

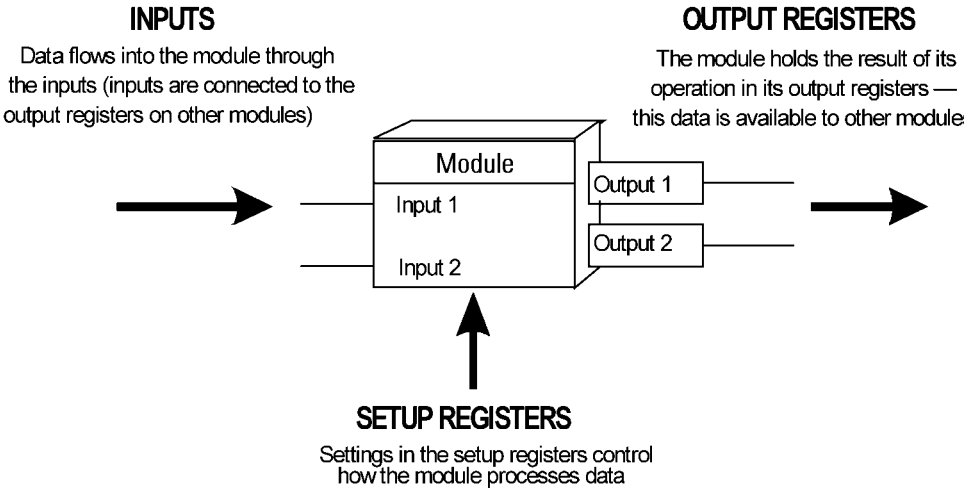
Basic Concepts

Before you begin altering the 9000 series meter's operation, you must learn the basics of how the device operates. Understanding the basics of the architecture will help you understand how to make different types of configuration changes.

Each 9000 series device contains a number of modules that perform specific functions. The modules are linked together to create frameworks. Framework defines multiple operations and logical pathways for power system information. The basic structure of a module is the same for each module type, making it easy to use new features once the basics are understood.

The Module

The 9000 series module is the basic building block of the 9000 device's operating software. 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 a 9000 series device can be considered in terms of its modules and linkages between them.



There are approximately 50 types of modules in the 9000 series meter architecture; the 9000 series meter has 46 different types. Most 9000 series meters can support several instances of a certain module type (for example, the 9000 series meter supports 16 Thermal Demand modules, 20 Periodic Timer modules and one Clock module).

The 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.

Module Linking

Module Linkage is a connection from the output of one module to the inputs of other modules. You can link modules together by assigning the input of one module to the output register of another module. Data received by the module through a module's input is then processed.

Module Linking Restrictions

You can only link each module once; however, you can link one output to one or more different inputs. Circular links are not permitted. You can not link one module's output to its input, or to the input of any module preceding it. The only exception to the circular linkage restriction is the Feedback module. For more details, refer to the *Advanced Meter Configuration Reference Guide*.

An input of one module can be linked to the output registers of another module only if they are of the same register class. For more on module linking, see the section on *Register Classes* later in this chapter.

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, its output register is also set to Not Available. This helps distinguish between cases where a register contains a value like '0' (zero) or Off, and cases where there is actually no value available.

If the inputs of a module are Not Available, its output registers are also Not Available. The setting of Not Available propagates through linked modules.

Online and Offline Modules

The terms online and offline describe whether a module is currently active or not. A module is described as online when it is functioning normally (monitoring its input and updating its output registers). An offline module is inactive.

When you configure a 9000 series meter, the affected modules are temporarily taken offline while they are programmed with your changes. Once they have been programmed, the modules are then placed back online. When a module is created, the module is offline. To make it online, you may link the module to other modules and/or configure setup registers properly.

Normally, this is a routine procedure; however, certain circumstances may prevent a module from returning online. For example, if the node lacks sufficient processing power to operate the module, or if the module has been configured incorrectly, the module will remain offline.

Making Configuration Changes

When you make configuration changes to a 9000 series 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 module setup registers.

Changing the settings in a module's setup registers changes the way the device operates. Carefully consider any change you intend to make before proceeding. Adding or deleting links between modules significantly alters the operation of the device, and should only be performed by experienced personnel.

The 9000 series meter is factory-configured for use in most standard applications. Aside from basic setup, you do not need to make any modifications to the device's configuration for normal use. The following sections address advanced configuration.

Creating New Modules

This procedure describes how to use WinPM to create new modules in your 9000 series meter. Do the following to create a new module:

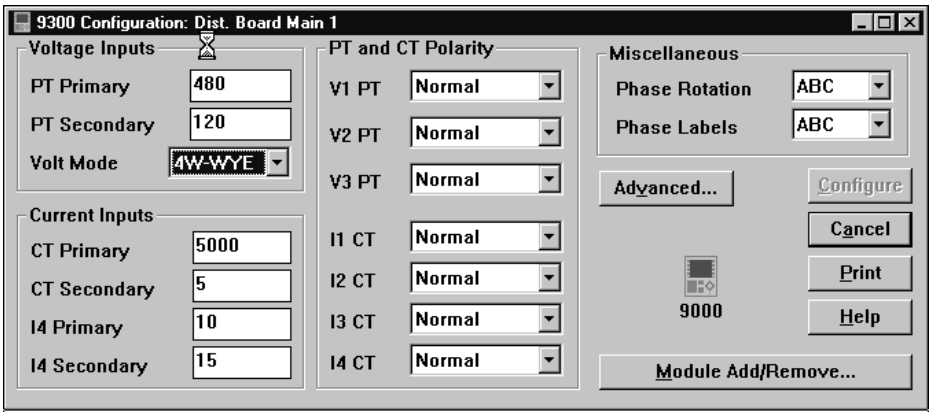
1. From the View Menu, select Device List.

   Result: The Device List window is displayed.

2. On the Device List window, highlight the 9300 Power Meter.

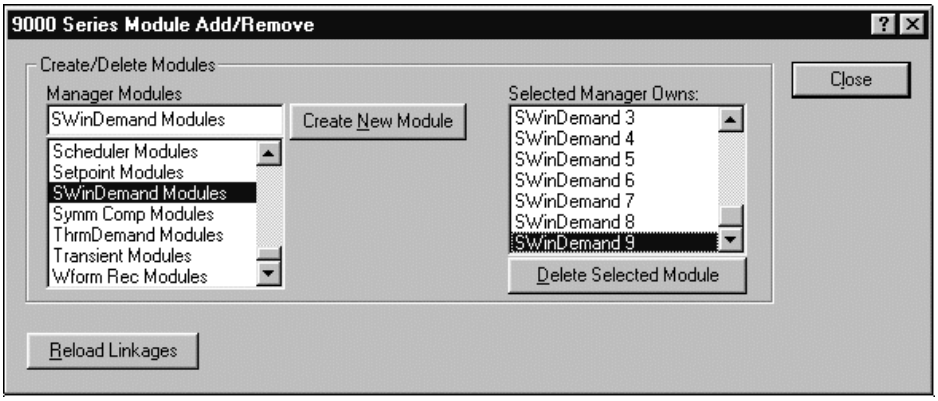
3. Click the right mouse button, and select Device Configuration from the drop-down button menu that is displayed.

   Result: The 9300 Configuration window is displayed.



4. Click the Module Add/Remove button.

   Result: The 9300 Power Meter Add/Remove window is displayed.



NOTE

You should wait until reloading the linkage to the 9000 series meter is complete. If the maximum number of modules in the group is exceeded, WinPM pops up an error message box.

5. Select a group to which you want to add new module by highlighting an item in the Manager Modules list. Then click the Create New Module button.

   Result: The confirmation window for creating a new module is displayed.

6. Click the Yes button.

   Result: WinPM creates a new module for you.

Deleting Modules

This procedure describes how to use WinPM to delete modules in your 9000 series meter. Do the following to delete an existing module:

NOTE

Before you can delete a module, you must remove all links. You cannot delete a module if any other modules depend upon the output of the module.

1. From the View menu, select Device List.

   Result: The Device List window is displayed.

2. On the Device List window, highlight the 9000 series power meter that you want to configure.

3. Click the right mouse button, and then select Device Configuration from the drop-down menu that is displayed.

   Result: The 9000 Series Meter Configuration window of the selected meter is displayed.

4. Click the Module Add/Remove button.

   Result: The 9000 Series Modules Add/Remove window of the selected meter is displayed.

5. Select a group that you want to delete an existing module by highlighting an item in the Manager Modules list box. Then select the module in the Selected Manager Owns list box.

6. Click the Delete Selected Module button.

   Result: The confirmation window is displayed.

7. Click Yes to delete the module.

   Result: WinPM deletes the existing module for you. You should wait until the completion of reloading the linkage to the 9000 series meter

Configuring Existing Modules

This procedure describes how to use WinPM to configure the existing modules by changing the setup registers in your 9000 series meter. Do the following to configure an existing module:

1. From the View menu, select Device List.

   Result: The Device List window is displayed.

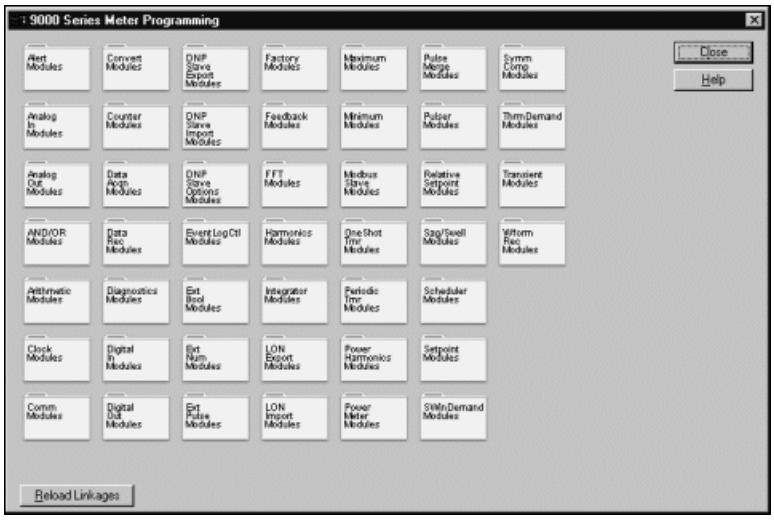
2. On the Device List window, highlight the 9000 series power meter that you want to configure.

3. Click the right mouse button, and then select Device Configuration from the drop-down menu that is displayed.

   Result: The 9000 Series Meter Configuration window of the selected meter is displayed.

4. Click the Advanced button.

   Result: The first level window for 9000 Series meter programming is displayed. The window lists all the groups (types) of modules available in the selected meter. WinPM displays each module type or group in one folder. The folders are sorted in alphabetically order. Each group consists of modules having similar functionality.

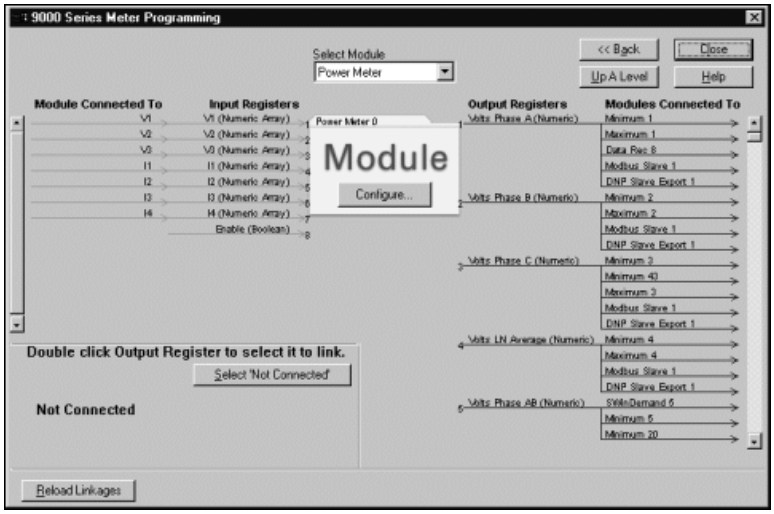


5. Double click a module group folder such as, Power Meter modules.

   Result: The second level window for 9000 Series meter programming is displayed. The window lists all the modules available in the selected group.

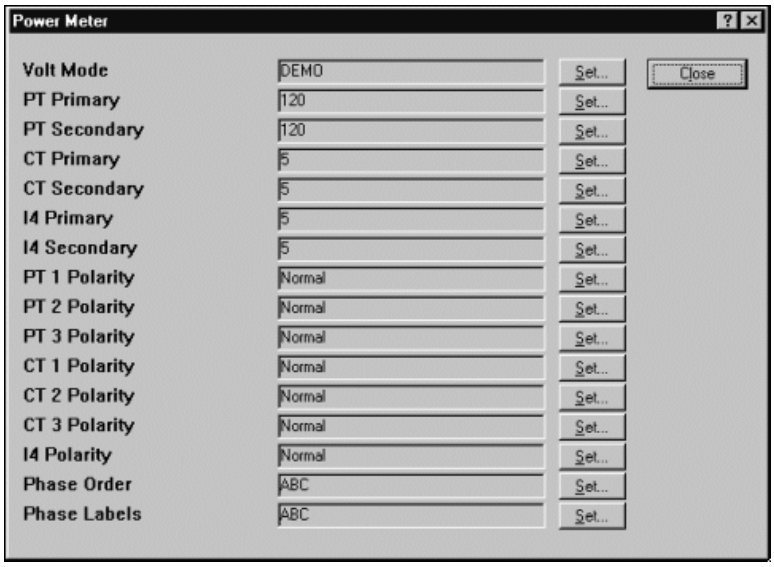
6. Double click a module group folder such as, Power Meter modules.

   Result: The second level window for 9000 Series meter programming is displayed. The window lists all the modules available in the selected group.



7. Click the Configure button.

   Result: The setup register window for the selected module is displayed. The window shows a list of setup registers available for configuration. The current value for each setup register is displayed in the window.



8. Click the Set button for the setup register.

   Result: The Modify setup register window for the selected register is displayed.

9. Click the Ok button to change a setup register setting. Enter the value or select an item in the drop down list.

   Result: A message box displays once the setup register setting is changed in the selected meter.

As there are different types of data held in setup registers, the Modify Register dialog box may be different. You may need to choose an option from a list, enter a numeric value, or enter a string. The details you need to perform the configuration changes are provided in the *Advanced Meter Configuration Reference Guide*.

On the third level module window for 9000 series meter programming, you may also view or change the configuration of another module or go back to the second level window that displays all the modules available in the selected group.

Do the following to change configuration for another module:

1. To view the details of another module, click the Selected Module list box and then select the module in the list.

   Result: The window displays the details of the selected module, such as input registers, output registers, and other modules connected to the module.

2. To go back to the second level window for 9000 series meter programming, click the Up A Level button.

   Result: The second level window is displayed. The window lists all the modules available in the selected group.

Linking Modules

This procedure describes how to use WinPM to link the input of one module to the output of another module in your 9000 series meter. Do the following to link modules:

1. From the View menu, select Device List.

   Result: The Device List window is displayed.

2. On the Device List window, highlight the 9000 series power meter that you want to configure.

3. Click the right mouse button, and then select Device Configuration from the drop-down menu that is displayed.

   Result: The 9000 Series Meter Configuration window of the selected meter is displayed.

4. Click the Advanced button.

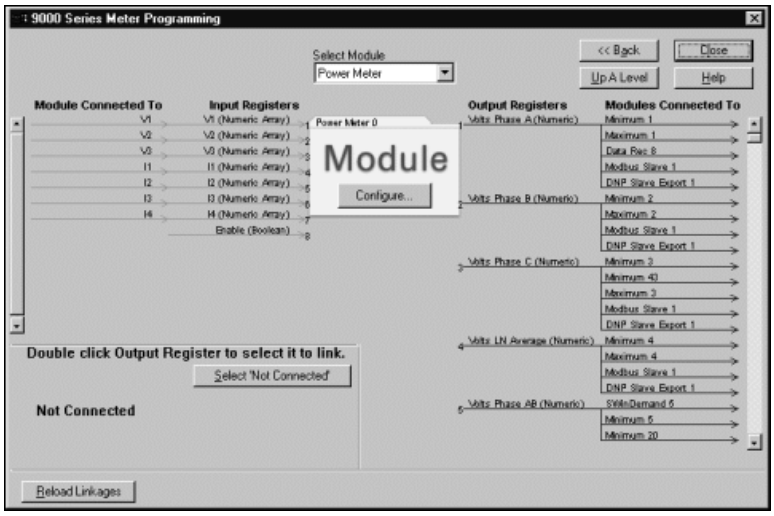
   Result: The first level window for 9000 Series meter programming is displayed. The window lists all the groups (types) of modules available in the selected meter. WinPM displays each module type or group in one folder. The folders are sorted in alphabetically order. Each group consists of modules having similar functionality.

5. Double click a module group folder such as, Power Meter Modules.

   Result: The second level window for 9000 Series meter programming is displayed. The window lists all the modules available in the selected group.

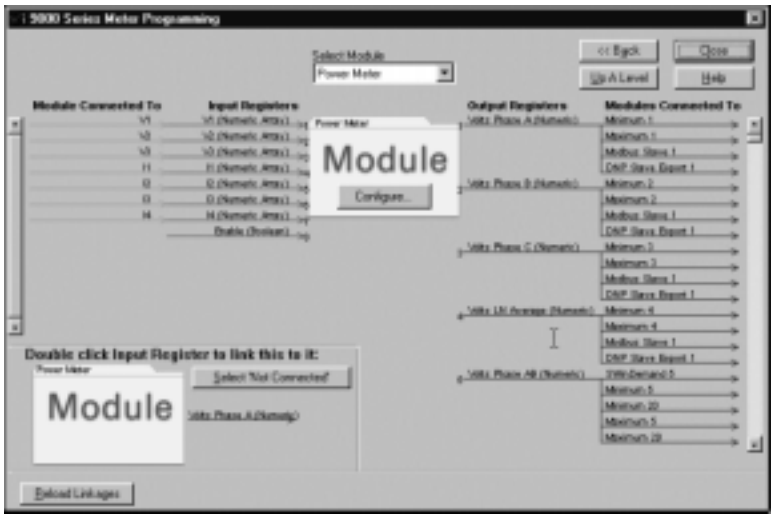
6. Double click a module folder such as, Power Meter module.

   Result: The third level window for 9000 Series meter programming is displayed. The window shows the details of the selected module, such as input registers, output registers, and other modules connected to the module.



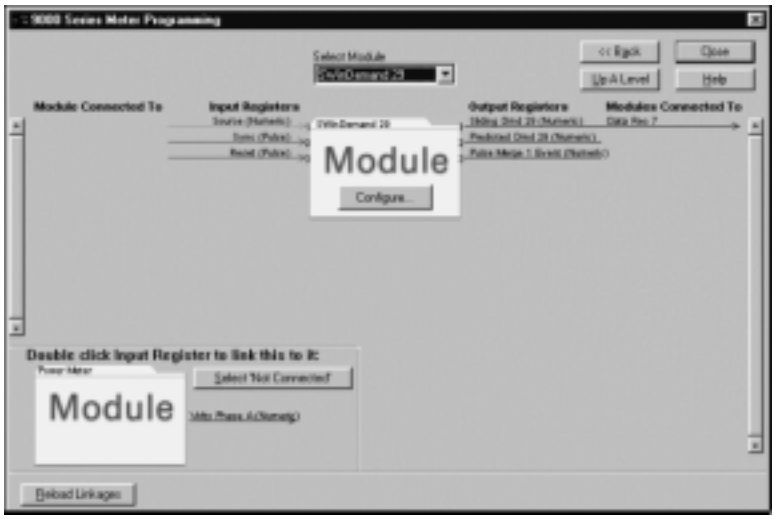
7. Double click an output register that will be the input of another module.

   Result: On the lower left-hand corner of the window, WinPM displays the output register of the selected module.



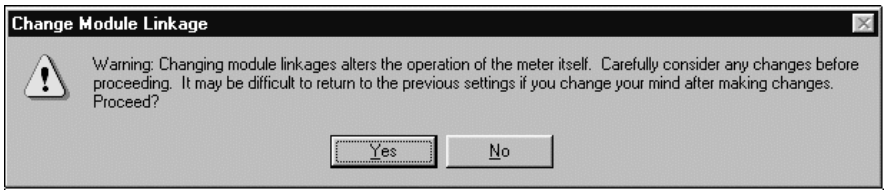
8. Select the module to be connected to in the Select Module drop down list.

   Result: WinPM displays the module to connect to. If the data type of the input registers matches the data type of the selected output register, the color of the lines for the input registers are light green.



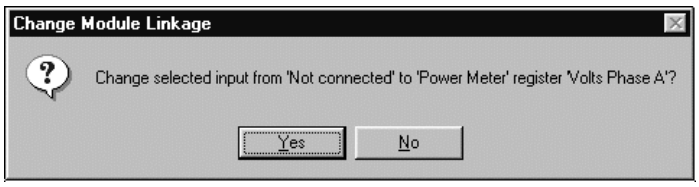
9. Double click the input register to connect to.

   Result: WinPM displays a warning message.



10. Click the Yes button.

    Result: WinPM displays a confirmation message box.



11. Click the Yes button.

    Result: WinPM creates the linkage between the two modules.

Deleting Links

This procedure describes how to use WinPM to delete links between two modules in your 9000 series meter. Do the following to delete links:

1. From the View menu, select Device List.

   Result: The Device List window is displayed.

2. On the Device List window, highlight the 9000 series power meter that you want to configure.

3. Click the right mouse button, and then select Device Configuration from the drop-down menu that is displayed.

   Result: The 9000 Series Meter Configuration window of the selected meter is displayed.

4. Click the Advanced button.

   Result: The first level window for 9000 Series meter programming is displayed. The window lists all the groups (types) of modules available in the selected meter. WinPM displays each module type or group in one folder. The folders are sorted in alphabetically order. Each group consists of modules having similar functionality.

5. Double click a module group folder such as, SWinDemand Modules.

   Result: The second level window for 9000 Series meter programming is displayed. The window lists all the modules available in the selected group.

6. Double click a module folder such as, SWinDemand 29 module.

   Result: The third level window for 9000 Series meter programming is displayed. The window shows the details of the selected module, such as input registers, output registers and other modules connected to the module.

7. Click the Select Not Connected button in the lower left-hand corner of the window, and then double click the input register to be deleted.

   Result: WinPM displays a warning message.

8. Click the Yes button.

   Result: WinPM displays a confirmation message box.

9. Click the Yes button.

   Result: The link is deleted.

Overview of Module Groups

This section lists different groups (types) of modules available in the 9000 series meters and provides a brief description of each group. For a more detailed description of any modules, refer to the *Advanced Meter Configuration Reference Guide*.

Module Group	Description
Arithmetic	Applies mathematical formulas to several Boolean or numeric values. Supports multiple formulas to provide a variety of result outputs. Includes previous-value buffers for rate of change calculations.
Clock	Enables you to specify time zone, daylight savings, and time-synchronization settings.
Communications	Sets up the communications interface on the device. Specifications include communications standard, baud rate, handshake mode, RTS/CTS levels, RTS delay, device ID and protocol.
Convert	Converts numeric or Boolean input to numeric, Boolean, or pulse output. Useful for creating control and status signals for other modules. For example, you can convert the Status output of a setpoint module to two distinct pulses (an ON pulse and an OFF pulse) and then use these pulses to trigger separate events.
Counter	Counts pulses to track the number of times a certain event occurs. Counts upwards or downwards by a specified amount.
Data Acquisition	Converts the power signals received by a 9000 series device to a numeric array format that can be used by other modules
Data Recorder	Logs time-stamped numeric values from multiple sources. Can be activated by external, manual, setpoint, or schedule triggers. Useful for fault analysis, historical trending, and the creation of coincidental Min/Max logs.
Diagnostics	Provides data about the status, load, and errors for various functions. Used in maintenance and troubleshooting.
Digital Input	Converts the state of a digital hardware port to a value that can be used with other modules.
Digital Output	Outputs a continuous or pulse signal to a chosen hardware port. Useful for relay control.
DNP Slave Export	Uses the value of a register to create a DNP (Distributed Network Protocol) object that can be read by a DNP Master device.
DNP Slave Import	Takes the value of a DNP object (written by a DNP Master device) and writes it into a register in a 9000 series device.
DNP Slave Options	Specifies the global options that support the DNP protocol on the device. This module also indicates the remaining event buffer space available.
Ethernet	Sets up communications for the node's 10Base-T or 10Base-FL Ethernet port. Used to integrate the node into energy-management systems and enterprise computer networks.

Module Group	Description
Event Log Controller	Monitors the node, and logs events as they occur. Logged events include setpoints, resets, and communication problems. Can be used to monitor breaker and transfer-switch operations, equipment starts and stops, and more.
External Boolean	Provides a single Boolean register that can be defined as either ON or OFF. Can be manually controlled via communications.
External Numeric	Provides a numeric register that can be set to a specified value. Can be manually controlled via communications. Useful for testing frameworks that have an initial numeric input, or for specifying settings for external equipment.
External Pulse	Provides a pulse register that can be configured to pulse on demand. Can be manually controlled via communications. Useful for resetting counters or timers, or pulsing external equipment.
Factory	Contains system information including device type, revision, serial numbers, and configured options.
Feedback	Outputs a pulse each time it receives a pulse. Can be used to create a circular linkage within a module framework.
FFT	Performs Fast Fourier Transforms (FFT) on waveforms sampled by the Data Acquisition module. This prepares the waveforms for input into the Harmonics Analyzer module.
Harmonics Analyzer	Provides harmonic distortion percentages for individual, total, total even, and total odd harmonics. Operates on voltage, current, or analog source. Calculates K factor for current input.
Infrared Communications	Sets up the infrared (IR) communications interface (optical port) of the device. Defines all settings of the IR port, enabling communications via Modbus protocols.
Integrator	Integrates any numeric value over time. Usually used to calculate energy.
Maximum	Monitors a single numeric variable, and records the maximum value reached.
Minimum	Monitors a single numeric variable, and records the minimum value reached.
Modbus Slave	Converts data that has been measured or calculated by a 9000 series device, and provides it to master devices on the Modbus network.
One-Shot Timer	Implements a time delay to postpone or control the length of an operation.
Periodic Timer	Provides a running timer that pulses at programmable intervals. When used in conjunction with other modules, the Periodic Timer can trigger events on a regular basis; for example, when used with a Recorder module, the Periodic Timer can trigger entries for a snapshot log.
Power Harmonics	Provides an in-depth analysis of power system parameters for a selected harmonic. Measures voltage and current levels for the selected harmonic, and derives kW, kVAR, kVA, Voltage Angle, Current Angle, and Phase Angle values for each phase.

Module Group	Description
Periodic Timer	Provides a running timer that pulses at programmable intervals. When used in conjunction with other modules, the Periodic Timer can trigger events on a regular basis; for example, when used with a Recorder module, the Periodic Timer can trigger entries for a snapshot log.
Power Meter	Performs calculations on sample waveforms of a three-phase or single-phase power system. The Power Meter module is automatically linked to the Data Acquisition module, and together these modules serve as the link between all other modules and the physical world.
Pulser	Sends pulses or state changes (KYZ mode) to the specified hardware port.
Sliding Window Demand	Calculates sliding window and predicted demand. Useful for providing average power consumption over a specified time interval.
Thermal Demand	Calculates thermal demand to provide average power consumption over a specified time period. Provides a contemporary alternative to thermal averaging (the traditional demand indicator in which an element is heated in a watt-hour meter).

Using Onboard and Expansion I/O

The 9700 Power Meter is available with numerous I/O options. The standard configuration includes eight onboard status inputs. Four onboard analog inputs and two expansion boards, each with up to 15 I/O modules, are available as ordering options.

Onboard Status Inputs

The eight onboard status inputs can be used for monitoring external contacts or pulse counting applications. These inputs use a current sensing technique to monitor contact status by providing an internal 30 VDC supply for self-excitation. 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 status input is controlled by the Digital Input modules 1 through 8. These modules are preconfigured at the factory, together with eight Counter modules for counting status changes, and an External Pulse module for resetting the Counter modules.

Once you have connected the status inputs to the field equipment that they monitor, check the 9700 Power Meter's Digital Input modules to ensure they are configured appropriately. The eight Digital Input modules are factory configured as follows:

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	STATUS1 to STATUS8 (specifies which hardware port the module controls)

Auxiliary Analog Inputs

The 9700 Power Meter can be ordered with an optional analog input board that provides four double-ended voltage or current inputs for direct interface with transducers. The configuration and maximum input range depends on the option ordered. The options are as follows:

Option	Input Impedance	Max Common Mode Voltage
0 – 1 mA	49.9 •	8 V
0 – 20 mA	100 •	20 V
0 – 1 V	>=50 k•	12 V
0 – 10 V	>= 50 k•	25 V

Note that each of the four analog inputs can be configured to monitor AC or DC signals; however, all four inputs must be configured with the same input rating. In other words, if you ordered the AUX 20mA option, all four inputs must be configured as 0-20mA but some can be AC and some can be DC.

Analog Input modules control the function of each analog input. As the analog input board is optional, no Analog Input modules are included in the 9700 Power Meter's factory configuration.

Analog Input modules are configured by selecting the port they monitor, and setting the scaling values used to normalize the incoming signal. Once configured, you can link the output of the Analog Input module to any other module that accepts numeric data.

Expansion Boards

Do not use digital output modules on I/O Expansion Board B for control applications.
False triggers may result when supply power to the board is lost.

Contact Siemens Energy & Automation Customer Service at 800-427-2256 for assistance if you want to use digital output modules on I/O Expansion Board B for control purposes.

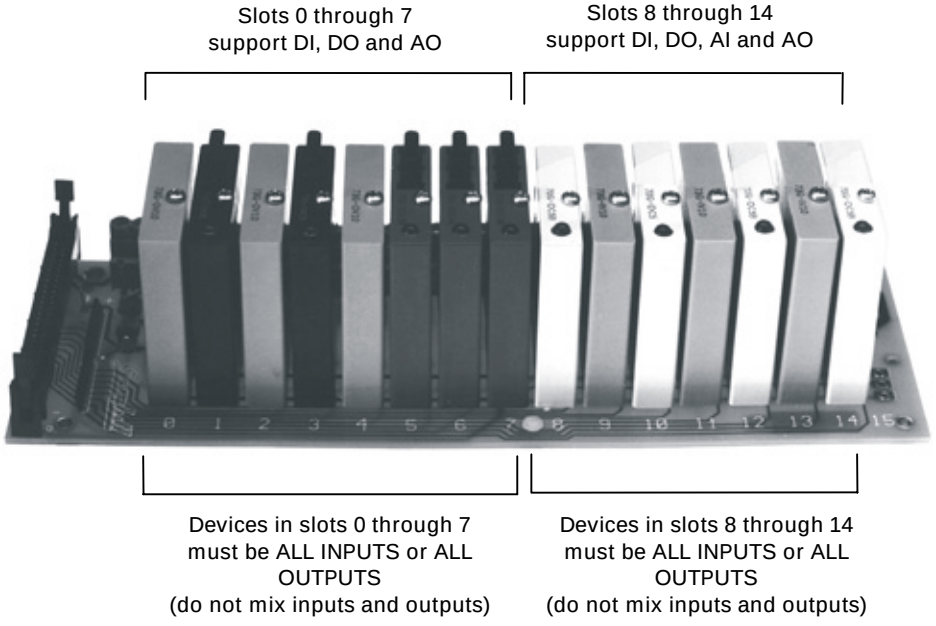
The external input and output capabilities of the 9700 Power Meter can be expanded using up to two plug-in I/O expansion boards. Each expansion board can provide multiple analog inputs, analog outputs, digital inputs, and/or digital outputs. A list of the I/O devices supported by the 9700 Power Meter is available in Appendix A under the section "Ordering Options".

The functions of the I/O devices are controlled by Analog Input, Analog Output, Digital Input, Digital Output, and Pulser modules. Input and Output modules are configured by specifying the port they use to send or receive signals (see page 4–20), and configuring other settings specific to the type of operation they perform.

Each expansion board offers 15 slots you can plug I/O devices into. Slots 0 through 7 support digital input, digital output and analog output devices only (analog input devices are not supported). Slots 8 through 14 support digital input, digital output, analog input and analog output devices. Slot 15 is not supported. Other restrictions apply to the use of analog I/O devices, as discussed below.

NOTE

Slots are numbered on the expansion boards. Note that slots 0–7 do not support analog input devices, and slot 15 is not used.



Analog Device Restrictions — Power Supplies

Power requirements and hardware restrictions limit the number and placement of analog devices on I/O expansion boards.

The allowable number of analog devices the 9700 Power Meter can support increases significantly when two external power supplies are used to power the expansion boards. The default configuration of Expansion Board A does not include a power supply; it has to be purchased separately. If Expansion Board A is powered directly from the 9700 Power Meter, then a maximum of six analog devices can be installed on it. (A separate power supply is required for Expansion Board B in any configuration.)

To use the maximum number of analog I/O devices, two power supplies must be used (one for each expansion board). Note that if a separate power supply is used with Expansion Board A, then the jumper must be removed from the board. Failure to remove the jumper will void the 9700 Power Meter's warranty. (Refer to the *9700 Power Meter Installation & Basic Setup Instructions* for jumper location.)

Analog Device Restrictions — Direction (Input or Output)

The direction of all of the devices in slots 0 through 7 and slots 8 through 14 must be the same. You cannot mix inputs and outputs within these two groups of slots; however, you can have all inputs in slots 0 through 7, and all outputs in slots 8 through 14 (or vice versa).

As noted on the graphic above, only slots 8 through 14 support analog input devices, thereby limiting the maximum number of these devices to seven per board. Analog Output devices can populate both slot groups on the expansion board, so a maximum of 15 of these devices can be used per board.

If Expansion Board A is used without a separate power supply, only six analog devices can be used in total, regardless of direction restrictions.

The following table summarizes the restrictions on analog I/O devices.

	Max # of Analog Inputs	Max # of Analog Outputs	Max # of Analog Devices	Possible Maximum Configurations
Board A WITHOUT Optional Power Supply (default configuration)	6	6	6	Any combination up to 6 total
Board A WITH Optional Power Supply	7	15	15	Board full
Board A WITHOUT Optional Power Supply (default configuration) + Board B	13	21	21	A: 6 AI; B: 7 AI, 8 AO A: 6 AO; B: 7 AI, 8 AO A: 6 AO; B: 15 AO A: 6 AI; B: 15 AO
Board A WITH Optional Power Supply + Board B	14	30	30	Both boards full

Specifying a Port in an Module

The Analog Output, Digital Output and Pulser modules in the 9700 Power Meter allow you to specify which port a signal is sent to. Similarly, the Analog Input and Digital Input modules allow you to specify which port to monitor for incoming signals.

When you access any of these module's Port setup register, all expansion board ports will be available selections, even if there is no expansion board connected to the 9700 Power Meter. The AUX inputs will only appear in Port setup registers if the optional analog input card is installed. The following tables indicate what ports selections are available with the different 9700 Power Meter I/O options.

Expansion Board A	Expansion Board B	Status Inputs	Aux Analog Inputs
Port A-0	Port B-0	STATUS1	AUX1/*optional*DC
Port A-1	Port B-1	STATUS2	AUX1/*optional*AC
Port A-2	Port B-2	STATUS3	AUX2/*optional*DC
Port A-3	Port B-3	STATUS4	AUX2/*optional*AC
Port A-4	Port B-4	STATUS5	AUX3/*optional*DC
Port A-5	Port B-5	STATUS6	AUX3/*optional*AC
Port A-6	Port B-6	STATUS7	AUX4/*optional*DC
Port A-7	Port B-7	STATUS8	AUX4/*optional*AC
Port A-8	Port B-8		
Port A-9	Port B-9		
Port A-10	Port B-10		
Port A-11	Port B-11		
Port A-12	Port B-12		
Port A-13	Port B-13		
Port A-14	Port B-14		

Auxiliary analog input options include 0-20mA, 0-1mA, 0-1V and 0-10V

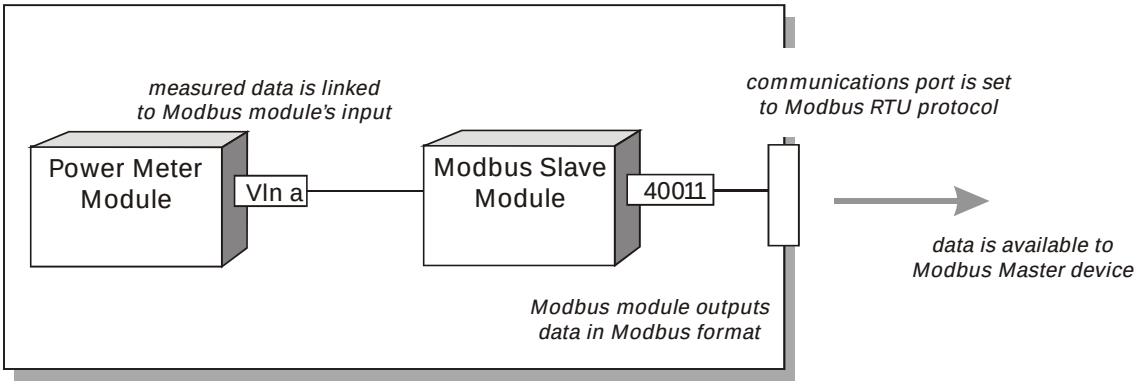
Note that module setup registers will only display the ports that are not yet assigned. As the 9700 Power Meter's factory configuration makes use of all eight status inputs, STATUS1 through STATUS8 will not appear in new Digital Input modules you create. To make a STATUS port available, set the Port setup register to NOT USED in one of the factory-configured Digital Input modules.

Using the Modbus RTU Protocol

The 9700 Power Meter can make any real-time data available through the Modicon Modbus RTU protocol. Modbus Master devices connected to the 9700 Power Meter can access this data. Modbus Master devices can also write data into registers, making device configuration changes or initializing control actions.

The 9700 Power Meter's Factory Modbus Configuration

The 9700 Power Meter makes data available to Modbus Master devices using four Modbus Slave modules. These modules are linked to other modules in the 9700 Power Meter that provide the energy, power and demand data. Once a communications channel is configured to use Modbus RTU protocol (refer to "Communications Setup" in Chapter 2), the data is available to Modbus Master devices.



9700 Power Meter

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 9700 Power Meter are required to interpret the data provided.

Changing the Modbus Configuration

If the factory Modbus configuration does not suit your needs, the existing Modbus Slave modules can be relinked to other parameters that you want to access through Modbus. There are only four Modbus Slave modules available in the 9700 Power Meter, 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.

Modbus Slave Module Settings

The settings in the Modbus Salve module setup registers are shown in the tables below.

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 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 Module	Modbus Module and Input Number	Modbus Register
L-N Voltage Phase A	Vln a	Power Meter	Modbus Slave #1 – Source Input #1	40011
L-N Voltage Phase B	Vln b	Power Meter	Modbus Slave #1 – Source Input #2	40012
L-N Voltage Phase C	Vln c	Power Meter	Modbus Slave #1 – Source Input #3	40013
Average L-N Voltage	Vln 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
Neutral Current	I 4	Power Meter	Modbus Slave #1 – Source Input #16	40026

Modbus Slave Module #2 Links

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

Modbus Slave Module #4 Links

Measurement	Label	Source 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

Importing Data using Modbus RTU

It is possible to bring data into the 9700 Power Meter using Modbus. Various registers can be written by Modbus Master devices by correlating the Modbus register number with the address of the register you want to write. When a Modbus register is written with a value, the corresponding register will be written, provided the Modbus RTU protocol is active on the communications channel that connects the Modbus Master to the 9700 Power Meter.

You can use the Modbus RTU protocol to write values into external numeric, pulse and Boolean registers, allowing you to enable, disable and reset 9700 Power Meter functions. You can also use the Modbus protocol to change setup register values in various modules to configure the 9700 Power Meter's operation.

Using the DNP 3.0 Protocol

The Distributed Network Protocol Version 3.0 (DNP 3.0) is an open protocol used in the electric utility industry for communications and interoperability among substation computers, RTUs, IEDs, and Master Stations. The 9700 Power Meter can be integrated into a DNP network using the DNP Slave Import, Export and Options modules.

NOTE

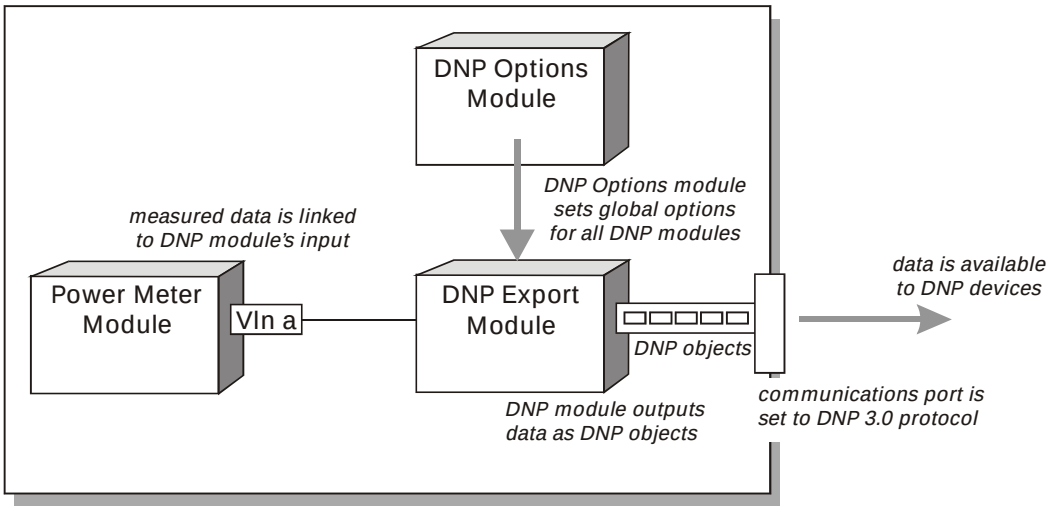
Complete DNP documentation is available through the DNP User's Group (on the web at www.dnp.org).

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

The 9700 Power Meter's Factory DNP 3.0 Configuration

The 9700 Power Meter'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 9700 Power Meter.

Modules are linked to DNP Slave Export modules which convert the data into the appropriate DNP objects. These objects are available through the 9700 Power Meter 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.



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 parameters to them. There are 16 DNP Slave Export modules available on the 9700 Power Meter; 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.

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 guide to describe DNP; consult the DNP User's Group or other resources to learn more about the protocol.

NOTE

DNP 3.0 can only be used on the XPRESS CARD's RS-485 ports (COM 1 and Ethernet ports are not supported).

Only one port per 9700 Power Meter can be used with DNP 3.0

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 *Analog Input*; three are *Binary Counter*
EventObj	Disable Event Objects
Deadband	0
FrozStaObj	Disable Frozen Static Objects
FrozEvtObj	Disable Frozen Event Objects
EventClass	Class 1
Scaling	OFF (excluding *Unbalx10* and *Freqx10* which are ON)
SEAbusZero	0
SEAbusFull	0 (1000 for *Unbalx10* and 100 for *Freqx10*)
DNPZero	0
DNPFull	0 (10000 for *Unbalx10* and 1000 for *Freqx10*)

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 returned from Class 0 poll 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 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 9700 Power Meter from a DNP control relay or analog output device. DNP Slave Import modules are used to take a DNP Analog output or Binary output object and map them into registers.

Using the EtherGate Protocol

The EtherGate protocol can be used on one or more of the XPRESS CARD's RS-485 ports, in place of SEAbus, Modbus RTU or DNP 3.0 protocols. The EtherGate protocol allows the 9700 Power Meter to act as a gateway, transferring data directly between Ethernet and RS-485 networks.

There are three ways EtherGate can be used to transfer data between networks. Using the IP Address of the 9700 Power Meter, one of three IP Service Port numbers (sockets) can be used to direct the flow of data as follows:

- If the IP Service Port is set to 7800, Ethernet data is transferred to both XPRESS CARD RS-485 ports.
- If the IP Service Port is set to 7802, Ethernet data is transferred to the XPRESS CARD'S COM 2 RS-485 port only.
- If the IP Service Port is set to 7803, Ethernet data is transferred to the XPRESS CARD'S COM 3 RS-485 port only.

Communicating *Through* the 9700 Power Meter

In the basic EtherGate configuration, your WinPM workstation connects to the XPRESS CARD's Ethernet port, and an RS-485 loop of devices connects to the XPRESS CARD's COM2 or COM3 RS-485 port (or both, if you have two RS-485 loops). In this configuration you communicate with the RS-485 loop *through* the 9700 Power Meter (the 9700 Power Meter acts as the gateway).

Using the Internal Modem

This section describes the operation of the 9700 Power Meter internal modem. This section only applies if you have ordered the –MDM (or –MDMC) option.

Before installing or using your 9700 Power Meter, make sure that you are familiar with the FCC and Industry Canada warnings located at start of this manual, as well as the *Installation and Basic Setup Instructions* included with the device.

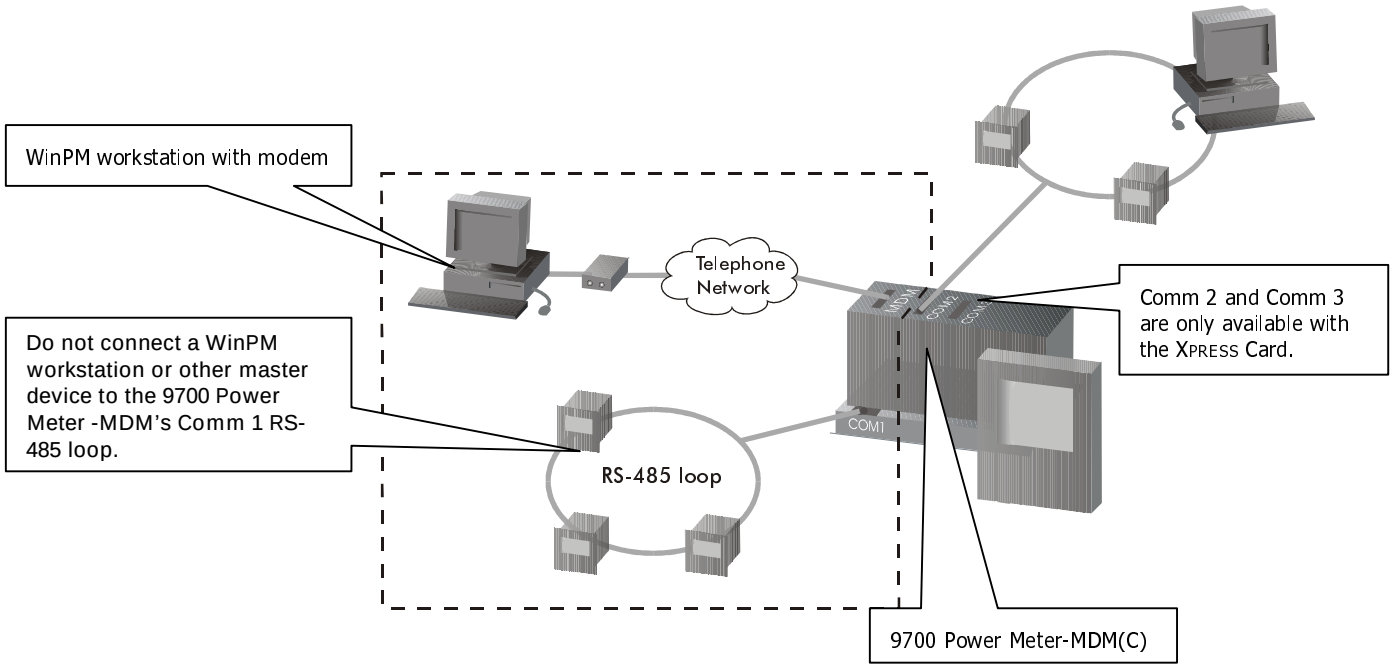
The cable that connects the modem to the telephone network must be disconnected before opening the meter for servicing.

Baud Rates

The internal modem is capable of using all standard modem protocols from 300 bps to 33600 bps. The baud rate used between connected modems is independent of the baud rate used for communication between the modem and the 9700 Power Meter.

ModemGate Functionality

The 9700 Power Meter-MDM's internal modem is multiplexed with the Comm 1 communications port. This provides a connection between your meter, your connected RS-485 loop, and your telephone network. This connection, referred to as ModemGate, transfers all data received by the internal modem to the RS-485 loop connected to Comm 1.



Connecting the Modem

NOTE

If your 9700 Power Meter has the –MDMC option, connect the bare wire cable included with your meter to the captured wire connector.

Connect the 9700 Power Meter-MDM modem via the RJ-11 jack located on the top of the meter. An FCC compliant telephone cord is provided that has two male RJ-11 plugs. Connect the meter to your telephone network using the cable provided (if you use a different cable, ensure that it is FCC Part 68 compliant). Follow these steps to connect the modem to your telephone network:

1. Install the meter into its mounting location and connect the power supply, communications connections, and voltage and current inputs as described in the *Installation and Basic Setup Instructions* shipped with the meter.

2. Plug the telephone cord into the modem's RJ-11 socket, located on the top of the meter (labeled MODEM).

3. Plug the other end of the telephone cable into the telephone jack that connects to the telephone network.

4. Power up the meter.

5. Using WinPM, configure the Comm 1 Communication's module settings (described below).

Communications Module Settings

The Comm 1 Communications module on the 9700 Power Meter has one additional setup register labeled *ModemInit*. This string register defines the initialization string for the internal modem, using a maximum of 47 characters.

Edit the *ModemInit* register and enter the initialization string desired. The string is sent to the modem as soon as you download (Send & Save) the Comm 1 module. Note that the string is also sent to the modem whenever the meter is powered up, or whenever the baud rate in the Comm 1 Communications module is changed.

Any changes to the *Modem Init* or Baud Rate setup registers while the modem is online will cause the modem to disconnect from the phone line.

Verifying Communications

There are four LEDs on the top of the 9700 Power Meter to help you verify that the modem is communicating properly. Beside the RJ-11 (or captured wire) connector marked MODEM, are two LEDs marked TXD and CD.

LED	Function
CD	This LED indicates the presence of a carrier signal. It should stay on as long as there is an active connection to the modem.
TXD	This LED flashes to indicate the presence signals transmitted out on the telephone line.

The two LEDs indicating traffic on COMM 1 are marked RXD and TXD.

LED	Function
RXD	This LED flashes as signals are received on Comm1 from the RS-485 loop.
TXD	This LED flashes as signals are transmitted from Comm1 to the RS-485 loop.

Modem Initialization String Examples

The modem supports various commands in the initialization string. The examples below are for use when the modem is used to receive incoming calls.

1. Enter the following string to force the modem to use the 1200 bps Bell 212A quick-connect (this ensures the modem will answer incoming calls and connect within nine seconds):

   AT&F0 +MS=69,0,1200,1200 \N0 S0=1

2. This string will set the modem back to its default state of connecting with the fastest possible baud rate between modems:

   AT&F0 S0=1

For any initialization string it is recommended that the &F0 be at the beginning of the string. A list of compatible AT commands is provided in Chapter 5: ”Technical Reference”.

Using Time Synchronization

Time synchronization allows you to synchronize the internal clocks of multiple networked Siemens Energy & Automation devices. When your devices' clocks are synchronized, all data logs will have timestamps that are relative to a uniform time base. This allows you to perform accurate sequence-of-events and power quality analyses.

Time synchronization is achieved by broadcasting the time across the network of IEDs. When the source of the time broadcast initially connects to the devices, the time signal is interpreted as the absolute time, and the devices' clocks are reset. During normal operation time signals are sent out periodically, and each 9700 Power Meter will continually assess its ability to remain synchronized with the incoming broadcasts. Over a brief period of time the 9700 Power Meter learns how its internal timing differs from that of the broadcast source, and adjusts its timekeeping to compensate. Very accurate time synchronization can be achieved with this method.

NOTE

If the time on a device is out by one second or more when a time sync signal is received, the device's clock is reset to the broadcast time.

Devices that are not continuously connected to the time source (i.e. modem sites) will be synchronized each time they are connected. The longer the duration between connections, the larger the error in time synchronization can be. In the extreme case this can result in missing or duplicated logs. If this occurs, GPS receivers can be installed at the remote sites, a direct WinPM connection can be implemented, or the time between connections can be reduced. As a remote device's clock is reset upon connection if its clock is out of synchronization by one or more seconds, increasing the frequency of connections will typically ensure records are not duplicated or lost.

Time Synchronization Accuracy

Different time sync methods can be used to provide different levels of accuracy. WinPM can be used for systems where time synchronization is not critical. In this configuration, each device's clock is synchronized to the time broadcast by the WinPM Communications Server workstation. For applications where highly accurate synchronization is required, an additional serial network is installed at the site, and a GPS receiver is used to broadcast the time synchronization signal.

Using a GPS receiver, the 9700 Power Meter can be synchronized to within ± 1ms of Universal Time, or within ± 2ms (typical) of other 9700 Power Meter devices on the network.

Communications Ports and Protocols Used

Time synchronization signals from WinPM or a GPS receiver are received through the communications ports on the 9700 Power Meter base unit and optional XPRESS CARD. Signals can be received on the device's COM 1 RS-232/RS-485 port, the XPRESS CARD'S COM 2 or COM 3 RS-485 ports, or the XPRESS CARD'S 10BaseT and 10BaseFL Ethernet ports.

NOTE

Time synchronization accuracy cannot be guaranteed on Ethernet networks.

An XPRESS CARD is required if time synchronization from a GPS receiver is implemented (two communications ports are required in this configuration), and COM1 should be used to receive time synchronization signals.

Time synchronization can be achieved using SEAbus and DNP3.0 protocols (note that DNP 3.0 can be used on only one XPRESS CARD port per device). GPS time synchronization uses special protocols defined for the type of GPS receiver you are using.

Configuring the 9700 Power Meter to Interpret Time Synchronization Signals

To implement GPS time synchronization, use WinPM or the MGT to configure the Clock module and the Communications or Ethernet module:

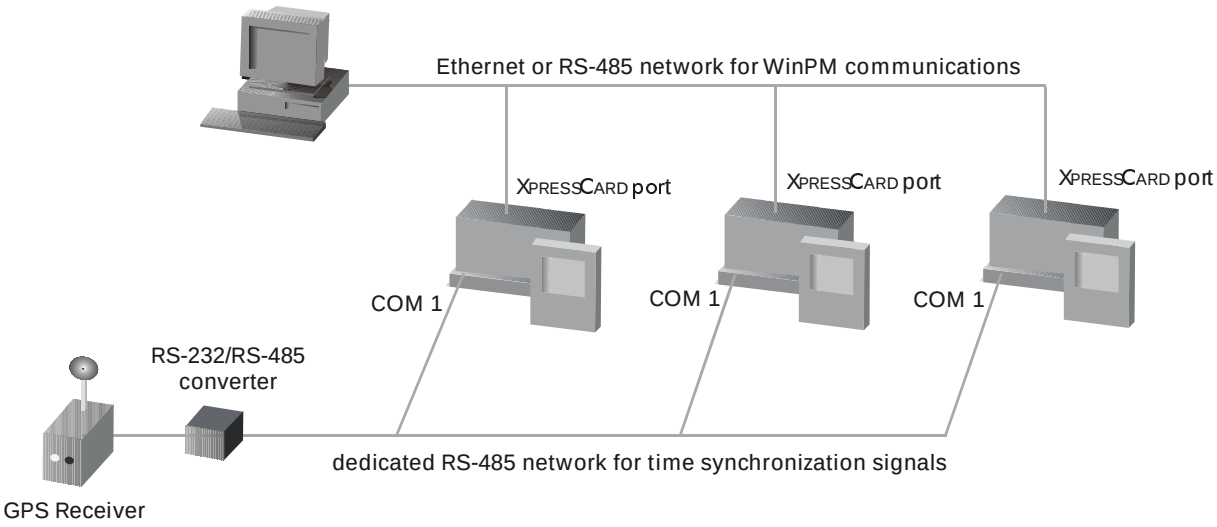
- Specify which port will receive time synchronization signals by setting the Time Sync Source setup register in the 9700 Power Meter's Clock module. Only signals received on the port specified will be used for synchronization.
- Specify the protocol you want to use by setting the Protocol setup register in the 9700 Power Meter's Communications module (or Ethernet module) for the port that receives the signals.

You may need to modify the "Time Sync Type" setup register if a DNP Master is sending time broadcasts in local time.

If you are using WinPM as the source for time synchronization signals, set the Communications or Ethernet module's Protocol setup register to SEAbus. If you are using a GPS receiver as the time source, specify the receiver type in the Protocol setup register that matches your receiver. Various GPS receivers are supported by the 9700 Power Meter.

Time Synchronization using a GPS Receiver

Use GPS receivers at each Site if you require time synchronization of your 9700 Power Meter devices to be within ±1ms of Universal Time. To implement GPS time synchronization, each 9700 Power Meter must be equipped with the optional XPRESS CARD, as two communications links are required at each device. The highest possible accuracy can be achieved using COM 1 to receive time signals; however, COM 2 and COM 3 can be used for time synchronization with slightly less accuracy than COM 1.



Either RS-232 or RS-485 networks can be used for time synchronization, however, RS-485 is recommended if more than two devices are being synchronized. (Ethernet cannot be used for GPS time synchronization.)

Supported GPS Receivers

As of 9700 Power Meter V200, the following GPS receivers are supported:

GPS Receiver	Comm Module Protocol Register Setting
True Time XL-DC series	GPS:TRUETIME/DATUM
Datum ExacTime Series	GPS:TRUETIME/DATUM
Arbiter 1092	GPS:ARBITER
Clark and Associates GPS-200-ASCII	GPS:TRUETIME/DATUM

Time Synchronization Diagnostics and Event Logging

The 9700 Power Meter's Diagnostics module includes five output registers that provide time synchronization diagnostics. Refer to the 9700 Power Meter.

Events are logged by the 9700 Power Meter's Clock module, Communications modules and Diagnostics module in response to time synchronization events. The following events will appear in the WinPM Event Log:

- Time sync acquired — generated when the first time sync signal is received (Diagnostics module's Time Sync Status register goes ON).
- Time sync lost — generated if no time sync signals are received in two times the average interval of the last five signals (Diagnostics module's Time Sync Status register goes OFF).
- GPS locked — generated when the GPS receiver locks onto a time source (Diagnostics module's GPS Status register goes ON).
- GPS unlocked — generated when the GPS receiver loses its lock on a time source (Diagnostics module's GPS Status register goes OFF).
- Time set — generated when a time synchronization signal is interpreted as a time set, and the device's clock is reset. Two events are recorded; one with the timestamp before the clock was set, and one with the timestamp after the clock was set.

Creating Custom MGT Displays

Custom MGT displays can be created showing any data the 9700 Power Meter measures or calculates. To create a custom display, configure one of the buttons adjacent to the MGT's screen and specify the display format and parameters to show on the screen. As the MGT's buttons are factory-configured, an existing display is sacrificed when a custom display is created.

The MGT displays data in 11 different formats: standard character screens, large character screens, four and six-channel bar graphs, harmonics screens, trending screens, integrator screens, and three types of status screens. This section details the 11 different MGT display formats, and shows how each is set up to display specific parameters.

Overview of MGT Button Configuration

To create a custom display, one of the user-configurable buttons is reconfigured. All the user-configurable MGT buttons are set up as follows:

1. Press the SETUP button on the main menu, then press the button labeled CONFIGURE BUTTONS.

2. Using the keypad, enter your password.

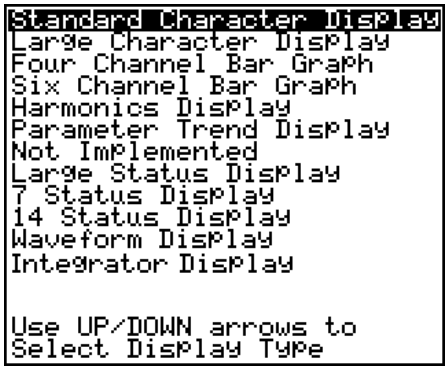
NOTE

If the button you want to configure resides on a different screen, use the buttons labeled NEXT and PREVIOUS to scroll back and forth between the screens of configurable buttons. Press the ESC button to return to the main menu.

3. Press the button that you want to configure.

4. You will be prompted to enter the first line of the new button label you want to define. Use the keypad to enter the first line of your new button label, then press ENTER. (The first line of the label can be up to 10 characters long.) Pressing ENTER will keep the current button label.

5. Use the keypad to enter the second line of your new button label (again, up to 10 characters) then press ENTER. The following screen appears:



6. Select the type of display screen you want to use, then press ENTER. Depending on the screen type you have chosen, you will be prompted for different information. Setting up each of the display screens is described in detail in the sections that follow. Refer to these sections for instructions about setting them up.

7. When you have specified all the necessary information for the display screen you selected, press ENTER. You will return to the main menu screens and the new button you have specified will appear in the main menu.

Any time you want to view the data in the screen you have setup, press its button in the main menu. To leave the screen and return to the main menu, press the ESC button.

Using the MGT Display Formats

The following paragraphs describe the various display formats that the MGT offers, and how each is configured. Refer to the register class symbol at the start of each format description to determine what register classes can be displayed in each screen (register classes are introduced on page 4-4).

Specifying Parameter Handles

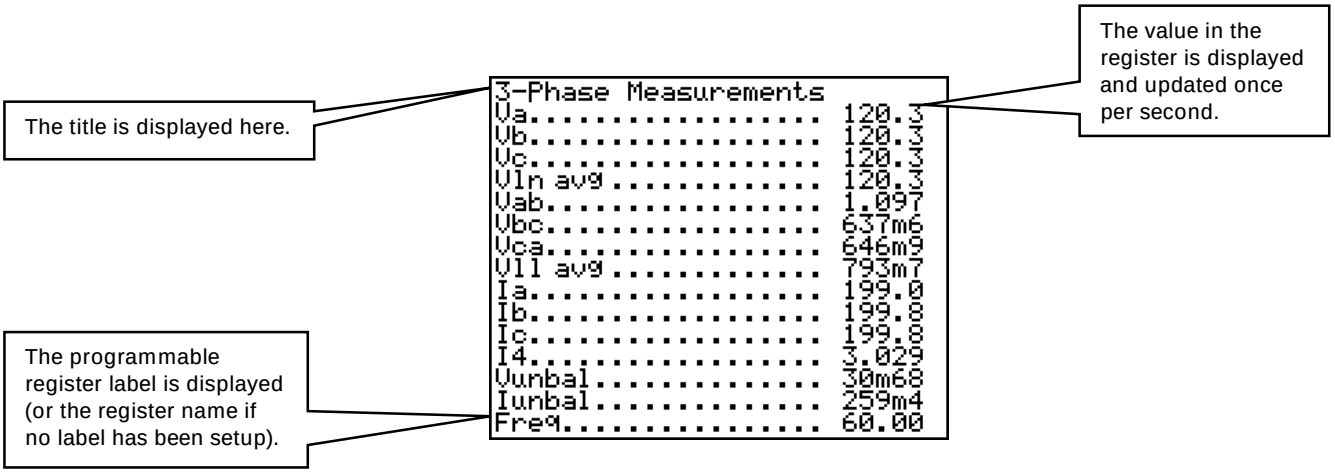
When you create a custom screen, the MGT requests a *parameter handle.* Parameter handles specify the memory location inside the 9700 Power Meter where data is stored. Each register has a unique parameter handle.

Parameter handles are four-digit hexadecimal numbers, such as 71E4. To determine a particular parameter handle, refer to the help file handles.pdf, provided on all WinPM release CDs. If you do not have a release CD from

Siemens Energy & Automation, contact Customer Service at 800-427-2256 and request the parameter handles for the 9700 Power Meter.

Standard Character Screens

Standard character screens are used for displaying numeric register values. They present data in small enough characters to include 15 different numeric registers on one screen. These screens are best suited for viewing close-up. Data in standard character screens are updated once per second, regardless of the update rate of the register on the connected device.



To set up a standard character screen:

1. Enter the parameter handle of the first register you want to display on the screen, then press ENTER. If you want to keep the register that is currently in use, press the button labeled KEEP PREVIOUS.

2. Repeat step 1 for the remaining 14 registers that you want to display. If at any point you want to return to the main menu and cancel your changes, press the ESC button. You do not have to specify a handle for every register if you do not want to use all 15 lines. Pressing ENTER will skip a line; in the display screen, that line will be left blank.

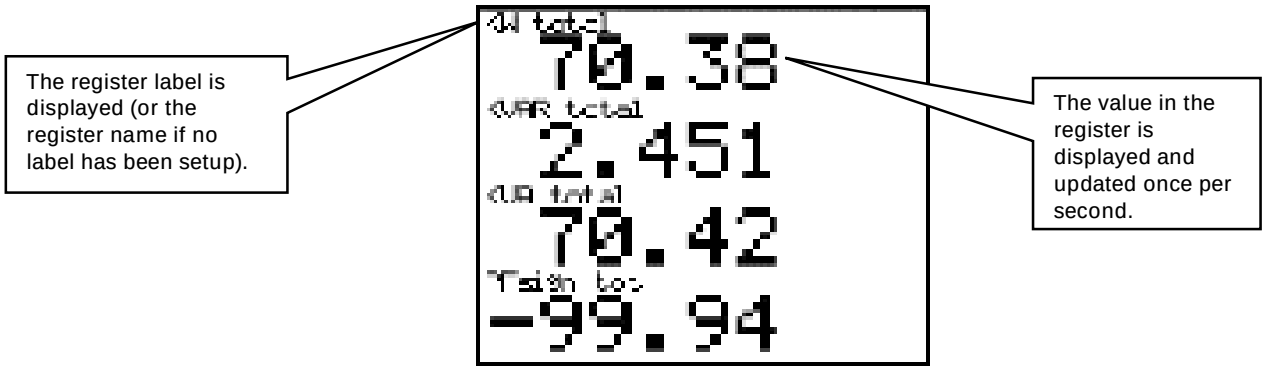
3. Once you have entered the parameter handles, you are prompted for a title for the display screen. Enter a title of up to 26 characters, then press the ENTER button. If you want to keep the title that is currently in use, press the button labeled KEEP PREVIOUS.

NOTE

If you have already set up a standard character screen and you want to change only some of the registers you are displaying, use the KEEP PREVIOUS button to keep the old registers.

Large Character Screens

Large character screens are also used for displaying numeric register values. They display up to four registers on one screen. The large character format is well suited for viewing from a distance. Data in large character screens are updated once per second, regardless of the update rate of the register on the connected device.



To set up a large character screen:

1. Enter the parameter handle of the first register you want to display on the screen, then press ENTER. If you want to keep the register that is currently in use, press the button labeled KEEP PREVIOUS.

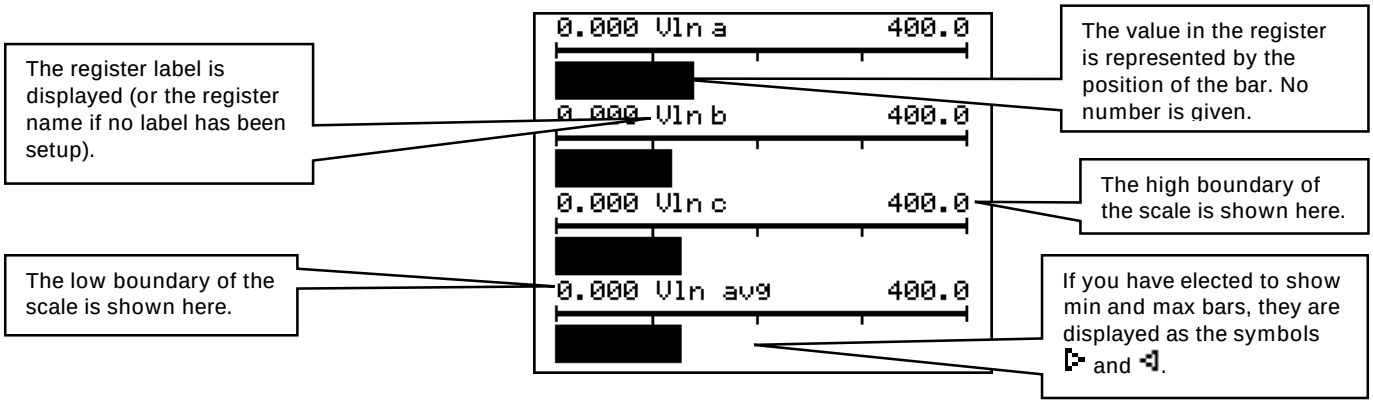
2. Repeat step 1 for the remaining 3 registers that you want to display. If at any point you want to return to the main menu, press the ESC button. You do not have to specify a handle for every register if you do not want to use all 4 lines. Pressing ENTER will skip a line; in the display screen, that line will be left blank.

Bar Graph Screens

The MGT offers two different kinds of bar graph screens to display numeric registers on the connected device (a 4-channel and a 6-channel display). These displays offer a graphical representation of fluctuations in the register values and they are suitable for viewing from a distance. For both the 4- and 6-channel displays, you can define a minimum and a maximum boundary of the bar graph and hence control the scale of the graph. If you have linked any of the registers you are displaying to a Minimum or Maximum module, you can also display the minimum and maximum values attained by the register.

4-Channel Bar Graph

The 4-channel bar graph displays four numeric register values in bar graph form. If you are displaying high-accuracy registers, the graph is updated every second. If you are displaying high-speed registers without minimum and maximum values indicated, the graph is updated every 100 msec (with the minimum and maximum values displayed, the update rate is 1 second).



To set up a 4-channel bar graph screen:

1. Enter the parameter handle of the first register you want to display on the screen, then press ENTER. If you want to keep the register that is currently in use, press the button labeled KEEP PREVIOUS.

1. Enter the minimum boundary for the bar graph scale, then press ENTER. Note that this value should be the lowest value you expect the register to attain. For example, if your bar graph is to display the voltage on phase a, and you expect the voltage to be around 1200 V, you may want to enter 1000 as your minimum boundary. If you want to keep the value that is currently in use, press the button labeled KEEP PREVIOUS.

2. Enter the maximum boundary for the bar graph scale, then press ENTER. Note that this value should be the highest value you expect the register to attain. For example, if your bar graph is to display the voltage on phase a, and you expect the voltage to be around 1200 V, you may want to enter 1400 as your maximum boundary. If you want to keep the value that is currently in use, press the button labeled KEEP PREVIOUS.

3. Repeat steps 1 to 3 for the remaining 3 registers that you want to display. If at any point you want to return to the main menu, press the ESC button.

Parameter		Function
5	=	*min for parameter 1*
6	=	*max for parameter 1*
7	=	*min for parameter 2*
8	=	*min for parameter 2*
9	=	*min for parameter 3*
10	=	*max for parameter 3*
11	=	*min for parameter 4*
12	=	*max for parameter 4*

4. The next value you are prompted for is the minimum value attained by the first register in the display. If you have linked the first register you are displaying to a Minimum module, you can display that minimum value on your bar graph. To do so, enter the handle of the appropriate Minimum module output register, then press ENTER. If you have not linked to a Minimum module, just press ENTER to continue.

5. Next, you are prompted for the maximum value attained by the first register in the display. If you have linked the first register you are displaying to a Maximum module, you can display that maximum value on your bar graph. To do so, enter the handle of the appropriate Maximum module output register, then press ENTER. If you have not linked to a Maximum module, just press ENTER to continue.

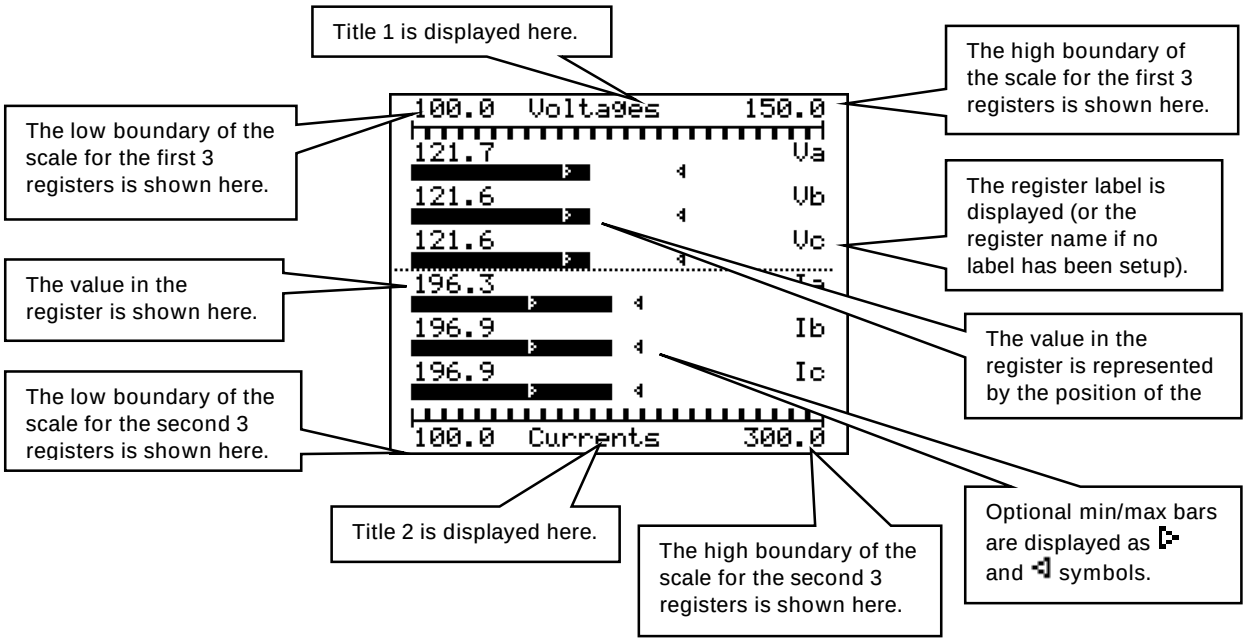
6. Steps 5 and 6 are repeated for the remaining three registers to be displayed in the bar graph.

7. You are prompted to specify if you want to display min and max bars on the bar graph. If you specified parameter handles in steps 5 or 6 and you want to display these values, select 1, then press ENTER. If you have not linked to any Minimum or Maximum modules, or you do not want to display these values, select 0 and press ENTER.

NOTE
The minimum and maximum values attained by the register are not the same as the minimum and maximum boundaries of the scale.

6-Channel Bar Graph

The 6-channel bar graph displays six numeric register values in bar graph form, and in number form. If you are displaying high-accuracy registers, the graph is updated every second. If you are displaying high-speed registers without minimum and maximum values indicated, the graph is updated every 100 ms (with the minimum and maximum values displayed, the update rate is 1 second).



To set up a 6-channel bar graph screen:

1. Enter the parameter handle of the first register you want to display on the screen, then press ENTER. If you want to keep the register that is currently in use, press the button labeled KEEP PREVIOUS. Repeat this step for the remaining 5 registers.

Parameter		Function
7	=	*min for parameter 1*
8	=	*max for parameter 1*
9	=	*min for parameter 2*
10	=	*min for parameter 2*
11	=	*min for parameter 3*
12	=	*max for parameter 3*
13	=	*min for parameter 4*
14	=	*max for parameter 4*
15	=	*min for parameter 5*
16	=	*max for parameter 5*
17	=	*min for parameter 6*
18	=	*max for parameter 6*

2. The next value you are prompted for is the minimum value attained by the first register in the display. If you have linked the first register you are displaying to a Minimum module, you can display that minimum value on your bar graph. To do so, enter the handle of the appropriate Minimum module output register, then press ENTER. If you have not linked to a Minimum module, just press ENTER to continue.

3. Next, you are prompted for the maximum value attained by the first register in the display. If you have linked the first register you are displaying to a Maximum module, you can display that maximum value on your bar graph. To do so, enter the handle of the appropriate Maximum module output register, then press ENTER. If you have not linked to a Maximum module, just press ENTER to continue.

4. Repeat steps 3 and 4 for the remaining 5 registers that you want to display. If at any point you want to return to the main menu, press the ESC button.

NOTE

The closer together your min and max values are, the more pronounced your graph's response will be to changes in the register value.

6. Enter the minimum boundary for the bar graph scale for the first three registers, then press ENTER. Note that this value should be the lowest value you expect any of these registers to attain.

7. Enter the maximum boundary for the bar graph scale for the first three registers, then press ENTER. Note that this value should be the highest value you expect any of these registers to attain. Enter the minimum boundary for the bar graph scale for the second three registers, then press ENTER

8. Enter the maximum boundary for the bar graph scale for the second three registers, then press ENTER.

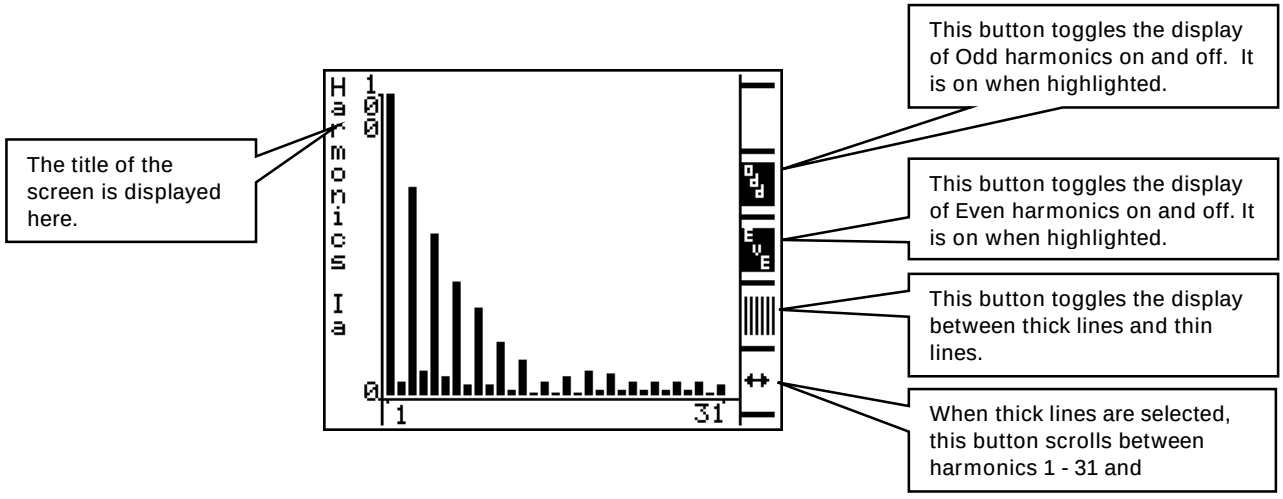
9. You are prompted to specify if you want to display min and max bars on the bar graph. If you specified parameter handles in steps 2 or 3 and you want to display these values, select 1, then press ENTER. If you have not linked to any Minimum or Maximum modules, or you do not want to display these values, select 0 and press ENTER.

10. Next, you are prompted for a title for the top three bar graphs (Title 1). Enter a title of up to 9 characters, then press the ENTER button.

11. Next, you are prompted for a title for the bottom three bar graphs (Title 2). Enter a title of up to 9 characters, then press the ENTER button.

Harmonics Screens

The harmonics screens allow you to display the values calculated by the Harmonics Analyzer module. They appear in a histogram form to show the harmonic spectrum of the input for which harmonics are being calculated. To maximize the resolution of the display, the harmonic with the highest amplitude is scaled to the top of the screen. The display is updated every second.



To set up a harmonics screen:

1. Enter the handle of the first output register of the Harmonics Analyzer module you want to view, then press ENTER. If you want to keep the register that is currently in use, press the button labeled KEEP PREVIOUS.

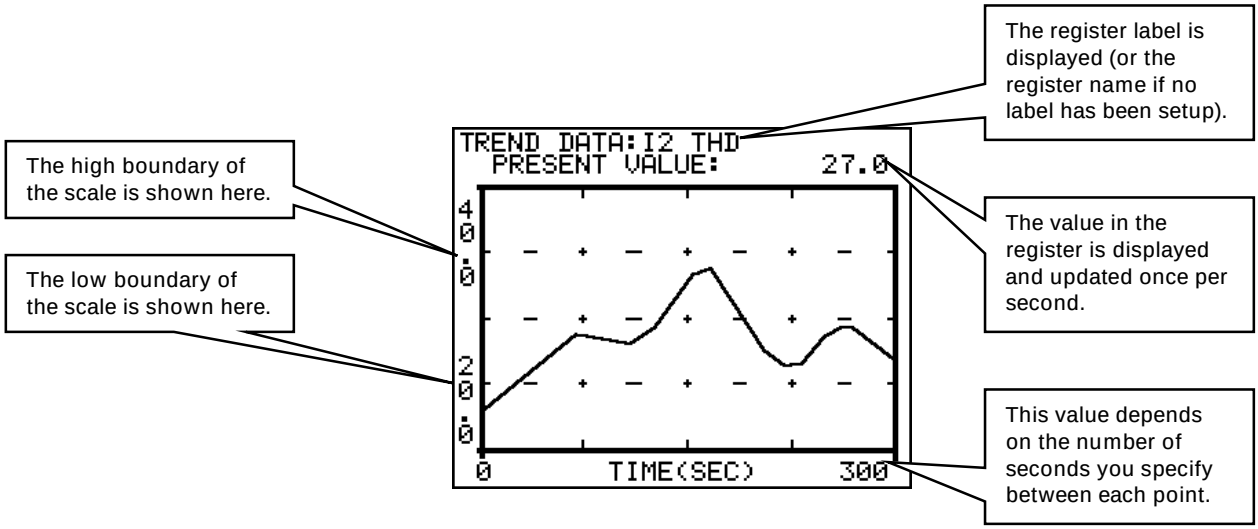
2. Enter a title of up to 15 characters, then press the ENTER button. If you want to keep the title that is currently in use, press the button labeled KEEP PREVIOUS.

IMPORTANT

You only need to enter the parameter handle for the first harmonic; the MGT automatically reads the remaining harmonic registers. If you enter an incorrect handle for the first output register, the rest of the readings will be unpredictable

Parameter Trending Screens

The parameter trending screens plot the value of a register over time. These real-time displays allow you to view a register value graphically. You can specify the scale for the Y-axis of the graph (the register value) and the X-axis (time). The maximum update rate for a parameter trending screen is 1 second.



To set up a parameter trending screen:

1. Enter the handle of the register you want to plot on the screen, then press ENTER. If you want to keep the register that is currently in use, press the button labeled KEEP PREVIOUS.

2. Enter the minimum boundary value you expect the register to attain, then press ENTER. This value becomes the minimum boundary of the Y-axis of the trending graph. If you want to keep the value that is currently in use, press the button labeled KEEP PREVIOUS.

3. Enter the maximum boundary value you expect the register to attain, then press ENTER. This value becomes the maximum boundary of the Y-axis of the trending graph. If you want to keep the value that is currently in use, press the button labeled KEEP PREVIOUS.

4. Enter the number of seconds you want to elapse between each point on the graph. This determines the scale of the X-axis of the graph. For example, if you specify 1 second between each point, the X-axis will span 150 seconds. If you specify 2 seconds between each point, the X-axis will span 300 seconds. If you want to keep the value that is currently in use, press the button labeled KEEP PREVIOUS.

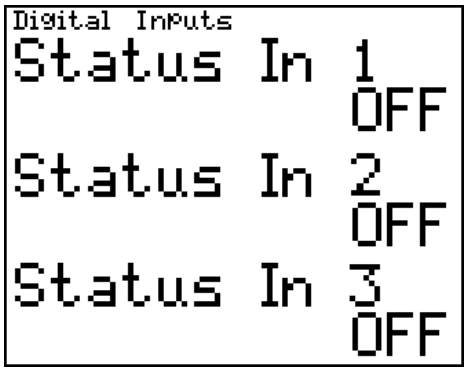
You do not need to specify a title for a parameter trending screen. It is preset to display the label of the selected register (or the register name if no label has been defined). The present value of the selected register is also displayed in numeric format at the top of the graph.

Status Display Screens

Status display screens are used for displaying Boolean register values. The data is presented using small enough characters to include 3, 7, or 14 different Boolean registers on one screen. Data in status display screens are updated once per second, regardless of the updated rate of the register on the connected device.

Large Status Display

The status display screens with three values use large characters and are suitable for viewing from a distance.



To set up a large status display screen:

1. Enter the parameter handle of the first register whose status you want to display on the screen, then press ENTER. If you want to keep the register that is currently in use, press the button labeled KEEP PREVIOUS.

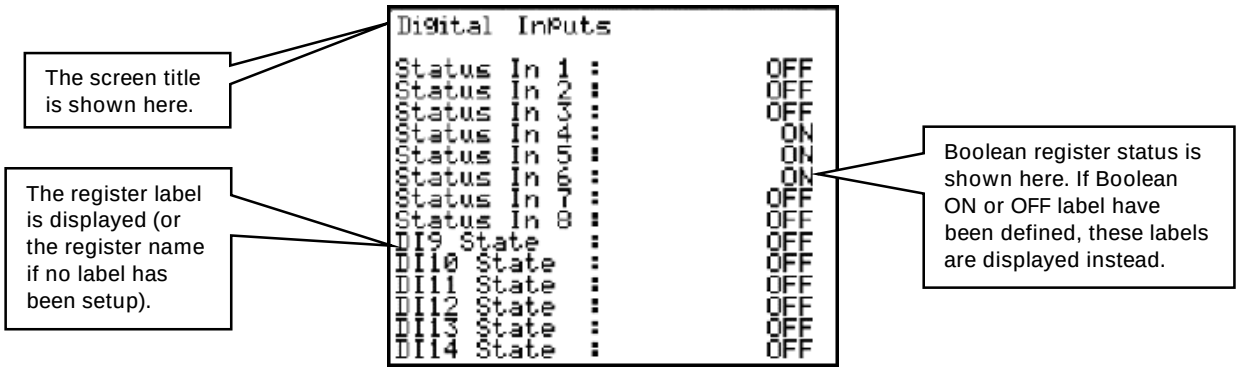
2. Repeat step 1 for the remaining 2 registers whose status you want to display.

3. Once you have entered the parameter handles, you are prompted for a title for the display screen. Enter a title of up to 26 characters, then press the ENTER button. If you want to keep the title that is currently in use, press the button labeled KEEP PREVIOUS.

When you view your status display screen, the labels of the selected registers are displayed; if no labels have been defined, the default register names appear. To the right of each label, the state of the register is displayed. This can be either the associated Boolean ON or OFF label, or, if no Boolean ON/OFF labels have been defined, simply ON or OFF.

7 and 14 Status Display Screens

The screens displaying 7 and 14 values are best suited for viewing close-up.



To set up a 7 or 14 status display screen:

1. Enter the parameter handle of the first register whose status you want to display on the screen, then press ENTER. If you want to keep the register that is currently in use, press the button labeled KEEP PREVIOUS.

2. Repeat step 1 for the remaining 6 or 13 registers (depending on which display you selected) whose status you want to display.

3. Once you have entered the parameter handles, you are prompted for a title for the display screen. Enter a title of up to 26 characters, then press the ENTER button. If you want to keep the title that is currently in use, press the button labeled KEEP PREVIOUS.

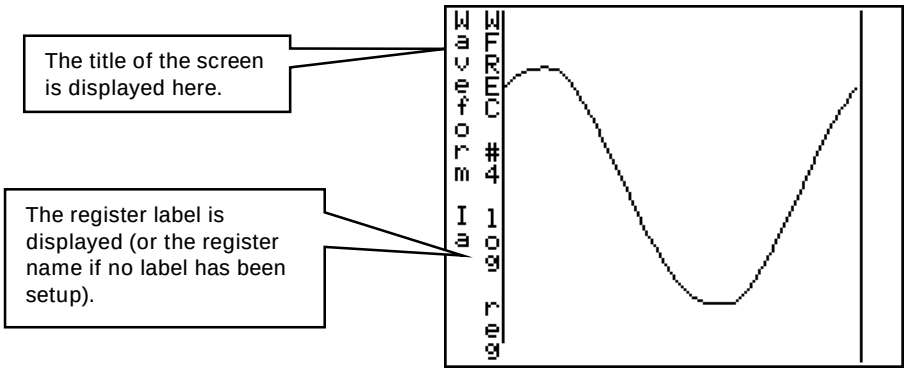
When you view your status display screen, the labels of the selected registers are displayed; if no labels have been defined, the default register names appear. To the right of each label, the state of the register is displayed. This can be either the associated Boolean ON or OFF label, or, if no Boolean ON/OFF labels have been defined, simply ON or OFF.

Waveform Display Screens

Waveform display screens allow you to display the output of a Waveform Recorder module. They read the data from this module's Wform Log output register and display it graphically based on the scale you define. Depending on how the waveform is formatted, your display may contain from 1 to 8 cycles of waveform data:

Waveform Format	Cycles Appearing on MGT	Resolution (samples/cycle)
128 x 14	1	128
64 x 14, 64 x 28	2	64
32 x 12, 32 x 26, 32 x 40, 32 x 54	4	32
16 x 22, 16 x 48, 16 x 72, 16 x 96	8	16

As the MGT can only display 128 points at a time, it takes the most recent set of waveforms in the Wform Log output register.



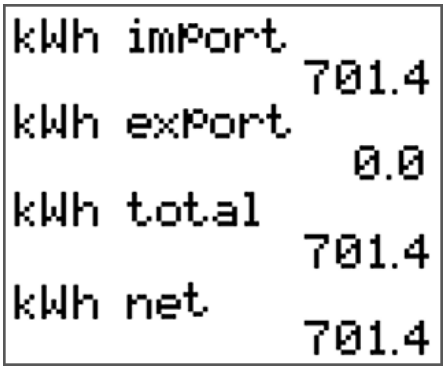
To set up a waveform display screen:

1. Enter the handle of a Waveform Recorder's Wform Log output register, then press ENTER. If you want to keep the register that is currently in use, press the button labeled KEEP PREVIOUS.

2. Enter a title of up to 15 characters, then press the ENTER button. To keep the title that is currently in use, press the button labeled KEEP PREVIOUS.

Integrator Screens

Integrator screens allow you to display numeric outputs with greater resolution than other displays. They can display up to 4 output values on the MGT at one time, with up to 11 digits of resolution. By default, the MGT includes the ENERGY display and the outputs of Integrator modules #1 through #4.



To set up an integrator display screen:

NOTE
Any numeric register can be displayed on an Integrator screen.

1. Enter the handle of an Integrator's Result output register (or other numeric register if desired), then press ENTER. If you want to keep the register that is currently in use, press the button labeled KEEP PREVIOUS.

2. Repeat step 1 for the remaining 3 registers whose Results you want to display. If you want to keep the register that is currently in use, press the button labeled KEEP PREVIOUS.

When you view your Integrator display screen, the labels of the selected registers are displayed; if no labels have been defined, the default register names appear. To the right of each label, the value of the register is displayed.

5 Technical Reference

The specifications that follow are subject to change without notice.

In this Chapter

Module Summary

The following table (pages 5–2 through 5–11) lists all of the modules available in the current version of the 9700 Power Meter. The table shows how many of each module are available, how many of each are used in the factory configuration, and how many are high-speed capable (high-speed capable modules update every cycle; standard modules update every second).

The Module Summary table also shows the ranges or options available for each module's setup registers and the setting each register holds when a new module is created.

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.

Module Summary Table

Module Name	Total Available in 9700	Used in Factory Config.	High-Speed Capable	Setup Registers	Range or Options	Creation Default
Alert	10	none	10	Message	Up to 120 characters	*default message*
				Priority	0 to 255	128
				Destination	Up to 50 characters	9,999-999-9999
				Type	WinPM, alphanumeric Pager, Numeric Pager or ASCII	WinPM
				Pager Num	Up to 16 characters	*empty*
				Com Port	Com 1, Com 2, Com 3 or Not a port	Not a port
				Attempts	1 to 20	3
				Retry Time	5 to 86400	15
				Lockout Time	0 to 86400	0
				Location	Up to 50 characters	*meter's network name*
				Modem Init	Up to 50 characters	AT Q0V1E0

Module Summary Table, Continued

Module Name	Total Available in 9700	Used in Factory Config.	High-Speed Capable	Setup Registers	Range or Options	Creation Default
Analog Input	up to 18	none	none	Zero Scale	-1 x 10^9 to 1 x 10^9	0
				Full Scale	-1 x 10^9 to 1 x 10^9	1
				Port	*depends on I/O options*	NOT USED
Analog Output	up to 30	none	none	Zero Scale	-1 x 10^9 to 1 x 10^9	0
				Full Scale	-1 x 10^9 to 1 x 10^9	1
				Port	*depends on I/O options*	NOT USED
AND/OR	20	none	20	Mode	AND, OR, NAND or NOR	AND
				EvLogMode	LOG ON or LOG OFF	LOG OFF
Arithmetic	4	none	N/A	Formula 1...8	Max 49 characters	*empty*
Clock *	1	1	N/A	TZ Offset	-43,200 to 46,800	0
				DST Start	0 to 4.3 x 10^9	0
				DST End	86400 to 4.3 x 10^9	86400
				DST Offset	-10,800 to 10,800	0
				Time Sync Source*	COM1, COM2, COM3, ETHERNET	COM1
				Time Sync Type	UTC, Local	UTC
Comm *	4 *Comm 1, Comm 2, Comm 3, and MGT* *see also: Ethernet module*	4	*none*	Comm Mode	RS485 or RS232	RS485
				Baud Rate	1200, 2400, 4800, 9600 and 19200 (38400, 57600, 115200 for Comm2 and Comm3)	9600
				HshakeMode	RTS/CTS or RTS WITH DELAY	RTS WITH DELAY
				RTS Level	NORMAL or INVERTED	NORMAL
				CTS Level	NORMAL or INVERTED	NORMAL
				RTS Delay	0 to 1.00 second	0.01 seconds
				Unit ID	1 to 9999	*Factory set*
				Protocol	SEAbus, MODBUS, DNP 3.0 GPS:TRUETIME/DATUM, GPS:ARBITER	SEAbus
Convert	20	none	20	*no setup registers*		

* denotes Core module (refer to Chapter 4)

Module Summary Table, Continued

Module Name	Total Available in 9700	Used in Factory Config.	High-Speed Capable	Setup Registers	Range or Options	Creation Default
Counter	30	11	none	Multiplier	-1×10^9 to 1×10^9	1
				Count Mode	UP or DOWN	UP
				Preset	-1×10^9 to 1×10^9	0
				RollValue	-1×10^9 to 1×10^9	0
Data Acquisition*	1	1	1	*no setup registers*		
Data Recorder	20	8	20	Depth	0 to 2×10^9	0
				Record Mode	CIRCULAR or STOP-WHEN-FULL	CIRCULAR
Diagnostics *	1	1	N/A	*no setup registers*		
Digital Input	up to 38	8	38	Input Mode	PULSE, KYZ	PULSE
				EvLog Mode	LOG ON or LOG OFF	LOG OFF
				Polarity	INVERTING or NON-INVERTING	INVERTING
				Debounce	0 to 65.525 seconds	0
				Port	*depends on I/O options*	NOT USED
Digital Output	30	none	30	EvLog Mode	LOG ON or LOG OFF	LOG OFF
				Polarity	INVERTING or NON-INVERTING	INVERTING
				Debounce	0 to 65.525 seconds	0
				Port	*depends on I/O options*	NOT USED
DNP Slave Export	16	14	16	DNPPoint	0 to 15	0
				DNPObjGrp	Analog Output or Binary Output	Binary Output

* denotes Core module (refer to Chapter 4)

Module Summary Table, Continued

Module Name	Total Available in 7700	Used in Factory Config.	High-Speed Capable	Setup Registers	Range or Options	Creation Default
DNP Slave Import *Note: DNP is only available on Com 2 or Com 3*	16	none	16	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 x 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 x 10^{38} to 1 x 10^{38}	0
				IONFull	-1 x 10^{38} to 1 x 10^{38}	0
				DNPZero	-1 x 10^{38} to 1 x 10^{38}	0
				DNPFull	-1 x 10^{38} to 1 x 10^{38}	0
DNP Slave Options * *Note: DNP is only available on Com 2 or Com 3*	1	1	1	BinInStatic	Single-Bit Binary Input or Binary input with status	Single-Bit Binary Input
				BinInEvents	• Binary Input Change Without Time • Binary Input Change With Time	Binary Input Change Without Time
				BinInEvDepth	Fixed at 100	100
				BinCntStatic	• 32-Bit Binary Counter • 32-Bit Binary Counter Without Flag • 16-Bit Binary Counter • 16-Bit Binary Counter Without Flag	16-Bit Binary Counter Without Flag
				FrzCntStatic	• 32-Bit Frozen Counter • 32-Bit Frozen Counter Without Flag • 32-Bit Frozen Counter With Time of Freeze • 16-Bit Frozen Counter • 16-Bit Frozen Counter Without Flag • 16-Bit Frozen Counter With Time of Freeze	16-Bit Frozen Counter Without Flag

* denotes Core module (refer to Chapter 4)

Module Summary Table, Continued

Module Name	Total Available in 7700	Used in Factory Config.	High-Speed Capable	Setup Registers	Range or Options	Creation Default
DNP Slave Options * *continued* *Note: DNP is only available on Com 2 or Com 3*	1	1	1	FrzCntEvents	• 32-Bit Frozen Counter Event Without Time • 32-Bit Frozen Counter Event With Time • 16-Bit Frozen Counter Event Without Time • 16-Bit Frozen Counter Event With Time	16-Bit Frozen Counter Event Without Time
				FrzCntEvDepth	Fixed at 100	100
				CntChangeEvents	• 32-Bit Counter Change Event Without Time • 32-Bit Counter Change Event With Time • 16-Bit Counter Change Event Without Time • 16-Bit Counter Change Event With Time	16-Bit Counter Change Event Without Time
				CntChangeEvDepth	Fixed at 100	100
				AIStatic	• 32-Bit Analog Input • 32-Bit Analog Input Without Flag • 16-Bit Analog Input • 16-Bit Analog Input Without Flag	16-Bit Analog Input Without Flag
				FrzAIStatic	• 32-Bit Frozen Analog Input Without Flag • 32-Bit Frozen Analog Input With Time of Freeze • 16-Bit Frozen Analog Input Without Flag • 16-Bit Frozen Analog Input With Time of Freeze	16-Bit Frozen Analog Input Without Flag
				FrzAIEvents	• 32-Bit Frozen Analog Event Without Time • 32-Bit Frozen Analog Event With Time • 16-Bit Frozen Analog Event Without Time • 16-Bit Frozen Analog Event With Time	16-Bit Frozen Analog Event Without Time
				FrzAIEvDepth	Fixed at 100	100

* denotes Core module (refer to chapter 4)

Module Summary Table, Continued

Module Name	Total Available in 7700	Used in Factory Config.	High-Speed Capable	Setup Registers	Range or Options	Creation Default
DNP Slave Options * *continued* *Note: DNP is only available on Com 2 or Com 3*	1	1	1	AIChangeEvents	• 32-Bit Analog Change Event Without Time • 32-Bit Analog Change Event With Time • 16-Bit Analog Change Event Without Time • 16-Bit Analog Change Event With Time	16-Bit Analog Change Event Without Time
				AIChangeEvDepth	100 to 200	200
				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
Ethernet *	1	1	none	Gateway	*valid IP address*	None
				SubnetMask	*valid IP address*	None
				IP Address	*valid IP address*	None
				Protocol	SEAbus or MODBUS RTU	SEAbus
Event Log Controller *	1	1	N/A	Depth	0 to 20 000	500
				Protection	The Protection register is factory-set to 128.	
				Cutoff	0 to 255	5
External Boolean	32	11	0	EvPriority	0 to 127	0
External Numeric	20	5	0	EvPriority	0 to 127	0
External Pulse	128	17	0	EvPriority	0 to 127	0
Factory *	1	1	N/A	Device Type *(read-only)*	N/A	9700 Power Meter
				Compliance *(read-only)*	N/A	SEAbus-Compliant

* denotes Core module (refer to chapter 4)

Module Summary Table, Continued

Module Name	Total Available in 7700	Used in Factory Config.	High-Speed Capable	Setup Registers	Range or Options	Creation Default
Factory * *continued*	1	1	N/A	Options *(read-only)*	N/A	*options purchased*
				Revision *(read-only)*	N/A	*firmware revision number*
				SerialNum *(read-only)*	N/A	*unit serial number*
				Owner	up to 255 characters	*empty*
				Tag 1	up to 255 characters	*empty*
				Tag 2	up to 255 characters	*empty*
				Nom Freq *(read-only)*	N/A	*factory set frequency*
				Calibration Values: 39 additional read-only registers hold factory calibration values		
Feedback	10	3	10	*no setup registers*		
FFT *	7	7	7	*no setup registers*		
Harmonics Analyzer *	7	7	none	*no setup registers*		
Integrator	30	9	none	Divisor	0 to 1 x 10^9 seconds	3600
				Int Mode	FORWARD, REVERSE, ABSOLUTE or NET	FORWARD
				Valu/Pulse	0 to 1 x 10^9	0
				RollValue	0 to 1 x 10^9	0 (no rollover)
Maximum	60	56	60	*no setup registers*		
Minimum	60	47	60	*no setup registers*		

* denotes Core module (refer to chapter 4)

Module Summary Table, Continued

Module Name	Total Available in 7700	Used in Factory Config.	High-Speed Capable	Setup Registers	Range or Options	Creation Default
Modbus Slave	4	4	none	Format	• Unsigned 16B • Signed 16B • Unsigned 32B • Signed 32B • Unsigned 32B-M10K • Signed 32-M10K • Packed Boolean	#1: Unsigned 16B #2 & #3: Signed 32 #4: Signed 32B-M10K
				Base Addr	400001 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	-1×10^{38} to 1×10^{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	12	none	12	Duration	0.010 to 2×10^{6} seconds	1
Periodic Timer	90	3	none	Period	0.010 to 2×10^{6} seconds	900
				Sync Mode	NO TRIG ON SYNC or TRIGGER ON SYNC	NO TRIG ON SYNC
Power Harmonics	1	none	none	Harmonic Number	1 to 63	1

* denotes Core module (refer to chapter 4)

Module Summary Table, Continued

Module Name	Total Available in 7700	Used in Factory Config.	High-Speed Capable	Setup Registers	Range or Options	Creation Default
Power Meter *	3	3	1	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
				I4 CT Prim	1 to 999999	5
				I4 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
				I4Polarity	NORMAL or INVERTED	NORMAL
				PhaseOrder	ABC or ACB	ABC
				Nom Freq	*not configurable - factory ordering option*	
				Phase Lbls	ABC, RST, XYZ, RYB or 123	ABC
Pulse Merge	8	1	8	EvLog Mode	LOG ON or LOG OFF	LOG OFF
Pulser	10	none	none	PulseWidth	0 to 2 x 10^6 seconds	1
				OutputMode	PULSE or KYZ	PULSE
				Polarity	INVERTING or NON-INVERTING	INVERTING
				Port	The Port option is variable, and depends on the options ordered with the 9700 Power Meter. There is no default port; the available ports will be presented when you enter this setup register.	
Relative Setpoint	10	5	none	Eval Mode	Value, Percentage	Value
				Over Pickup	0 to 1x10^9%	0
				Over Dropout	0 to 1x10^9%	0
				Under Pickup	0 to 1x10^9%	0

* denotes Core module (refer to chapter 4)

Module Summary Table, Continued

Module Name	Total Available in 7700	Used in Factory Config.	High-Speed Capable	Setup Registers	Range or Options	Creation Default
Relative Setpoint *continued*	10	5	1	Under Dropout	0 to 1x10^9 %	0
				SusUntlON	0 to 3600 seconds	0
				SusUntlOFF	0 to 3600 seconds	0
				EvPriority	0 to 255	128
Sag/Swell	1	1	1	Swell Limit	100 to 1000 %	106
				Sag Limit	0 to 100 %	88
				ChangeCrit	0 to 100 %	10
				NomVoltage	1 to 1x10^6 Volts	1200
				EvPriority	0 to 255	127
Scheduler	1	none	none	Calendar	refer to *ION Reference*	
Setpoint	24	none	24	High Limit	-1 x 10^9 to 1 x 10^9	0
				Low Limit	-1 x 10^9 to 1 x 10^9	0
				SusUntlON	0 to 3600	0
				SusUntlOFF	0 to 3600	0
				Input Mode	Signed or Absolute	Signed
				Eval Mode	GreaterThan or LessThan	GreaterThan
				EvPriority	0 to 255	128
Sliding Window Demand	40	29	none	Sub Intvl	60 to 5940 seconds	1800
				#SubIntvls	1 to 15	1
				Pred Resp	0 to 99	70
Symmetrical Components *	2	2	none	Harmonic	*fixed at the fundamental harmonic*	
Thermal Demand	16	4	16	Interval	60 to 5940 seconds	1800
				Time Const	1 to 99%.	90%
Transient	1	1	1	Threshold	100 to 1000 %	125
				EvPriority	0 to 255	128
Waveform Recorder	14	6	14	Depth	0 to 2 x 10^9	0
				RecordMode	CIRCULAR or STOP-WHEN-FULL	CIRCULAR
				Format	128x14, 64x14, 64x28, 32x12, 2x26, 32x40, 32x54, 16x22, 16x48, 16x72, 6x96	16x22
				Record Delay Cycles	0 to 2000	0

* denotes Core module (refer to chapter 4)

Measurements (@50 Hz/60 Hz @ 25°C) @1% to 125% Full Scale (FS) of input rating (50 mA to 6.25 A)

Parameter	Accuracy ±(%reading + %FS)		MGT Resolution (%FS)*		Register Bounds	
	1 second	*1 cycle*	*1 second*	*1 cycle*	*1 second*	*1 cycle*
Voltage (L-N) in Wye; Vab, Vbc in Delta	0.1% + 0.01%	0.5%+0.05%	0.1%	0.1% + 1 LSD†	0 to $1x10^6$	0 to $1x10^6$
Voltage (L-N) in Wye; Vca in Delta	0.5% + 0.01%	1.0%+0.1%	0.1%	0.1% + 1 LSD	0 to $2x10^6$	0 to $2x10^6$
Frequency	0.01%	0.1%	0.01 Hz	0.01 Hz	20 Hz to 70 Hz	20 Hz to 70 Hz
Current (<5% FS)	1.0%	2.0%	0.1%	0.1% + 1 LSD	0 to $1x10^6$	0 to $1x10^6$
Current (5% to 125% FS)	0.1%+0.01%	0.5%+0.05%	0.1%	0.1% + 1 LSD	0 to $1x10^6$	0 to $1x10^6$
kVA (<5% FS)	1.0%	2.0%	0.1%	0.1% + 1 LSD	0 to $3.3x10^7$	0 to $3.3x10^7$
kVA (5% to 125% FS)	0.2%+0.02%	1.0%	0.1%	0.1% + 1 LSD	0 to $3.3x10^7$	0 to $3.3x10^7$
kVAh	0.2% reading	–	0.1% of reading	–	0 to 10^{38}	–
kW (<5% FS)	1.0%	2.5%+0.25%	0.1%	0.1% + 1 LSD	0 to ± $3.3x10^7$	0 to ±$3.3x10^7$
kW @ Unity PF (5% to 25% FS)	0.5%	2.5%+0.25%	0.1%	0.1% + 1 LSD	0 to ± $3.3x10^7$	0 to ±$3.3x10^7$
kW @ Unity PF (25% to 125% FS)	0.3%	2.5%+0.25%	0.1%	0.1% + 1 LSD	0 to ± $3.3x10^7$	0 to ±$3.3x10^7$
kW @ ±0.5 PF (5% to 25% FS)	0.6%	5.0%+0.5%	0.1%	0.1% + 1 LSD	0 to ± $3.3x10^7$	0 to ±$3.3x10^7$
kW @ ±0.5 PF (25% to 125% FS)	0.4%	5.0%+0.5%	0.1%	0.1% + 1 LSD	0 to ± $3.3x10^7$	0 to ±$3.3x10^7$
kVAR (<5% FS)	1.0%	2.5%+0.25%	0.1%	0.1% + 1 LSD	0 to ± $3.3x10^7$	0 to ±$3.3x10^7$
kVAR (5% to 125% FS)	0.55%+0.005%	2.5%+0.25%	0.1%	0.1% + 1 LSD	0 to ± $3.3x10^7$	0 to ±$3.3x10^7$
kWh, kVARh @ Unity PF ‡	IEC 0.5 Class @ 25°C	–	0.1% of reading	–	0 to ± 10^{38}	–
kWh, kVARh @ ±0.5 PF ‡	IEC 0.5 Class @ 25°C	–	0.1% of reading	–	0 to ± 10^{38}	–
Harmonics (to 63rd)	1% Full Scale	–	0.1%	–	0.0001 to 100.00	–
K Factor	5% Full Scale	–	0.1%	–	0 to $1x10^6$	–
Power Factor @ Unity PF	0.55%+0.025%	3.5%+0.35%	0.01%	1%	-0.01 to –100.00, 100.00 to 0.01	-0 to 100 to 0
Power Factor @ .5 Lag & .5 Lead	0.75%+0.025%	6.0%+0.6%	0.01%	1%	-0.01 to –100.00, 100.00 to 0.01	-0 to 100 to 0
Symmetrical Components	1% Full Scale	–	0.1%	–	Magnitude: 0 to $1x10^6$ Phase: -180° to 180°	–

* Resolutions given are from the MGT. Higher resolution can be obtained via communications.

‡ kWh Accuracy Specification meets or exceeds IEC 687 Class 0.5

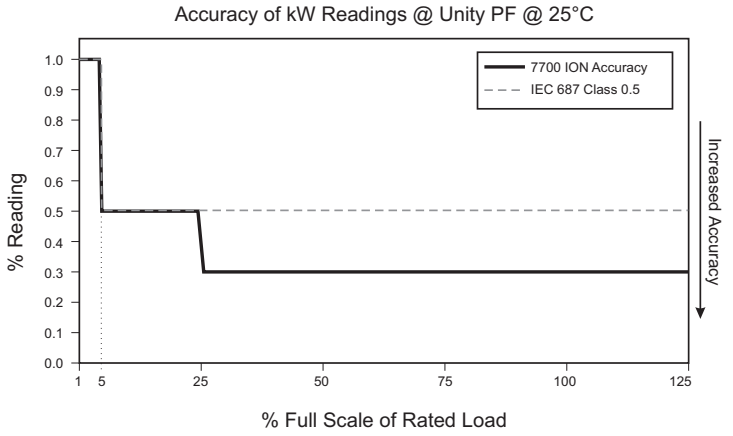
† LSD = least significant digit

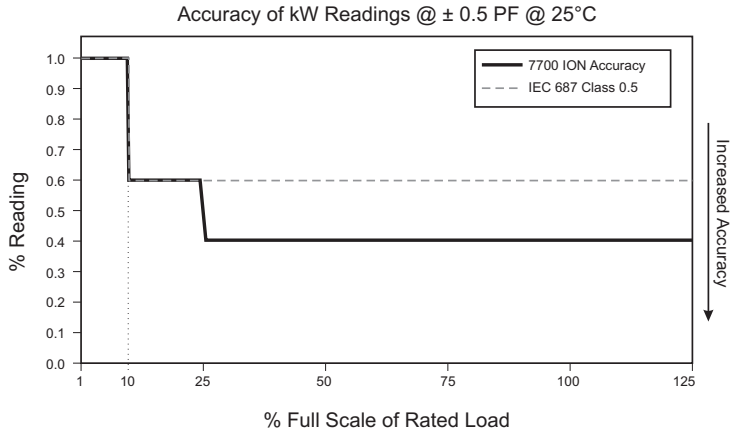
kW Measurement Accuracy

The graphs below indicate the accuracy of the 9700 Power Meter's kW measurements at 25°C at Power Factor values of 1.0, 0.5 lead and 0.5 lag. The graphs also compare 9700 Power Meter accuracy with the IEC 687 Class 0.5 specification.

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.





High-Speed Measurements During Fault

(@125% to 2000% of Rated Input, 6.25 A to 100 A)

Parameter	Accuracy ±(%reading)	MGT Resolution (%FS)	Range
Current (I1, I2 and I3 only)	5%	0.1%	0 to 10^6
kVA	5%	0.1%	0 to $3.3x10^7$
kW, kVAR @ Unity PF	5%	0.1%	0 to ± $3.3x10^7$
kW, kVAR @ 50 Lag and 50 Lead	5%	0.1%	0 to ± $3.3x10^7$
Power Factor @ Unity PF	10%	0.01%	-0.01 to -100.00, 100.00 to 0.01
Power Factor @ 0.5 Lag and 0.5 Lead	10%	0.01%	-0.01 to -100.00, 100.00 to 0.01

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.
		Overload withstand for all options: 1500 VAC continuous, 2500 VAC for 1 second, non-recurring
		Input impedance for all options: 2 MΩ
Current Inputs	Standard	5 Amp nominal F.S. input, 25% overrange
		20x fault capture capability
		Worst Case Burden (@ 6.25 Amps): 0.0625 VA
		Overload withstand for all options: 15 Amps continuous, 300 Amps for 1 second non-recurring
		Input Impedance: 2 mΩ
	1 Amp Option	1 Amp AC Nominal F.S. input, 25% overrange
Onboard Digital Inputs		Standard self-excited, dry contact sensing, no external voltage source required.
		+30 VDC differential SCOM output to S1 through S8 inputs.
		Minimum Pulse Width: 1 msec, Maximum Pulse Rate: 20 pulses / sec.
Optional Onboard Analog Inputs	0-1mA Option	1 mA AC/DC nominal full scale input (1.25 mA AC/DC max.)
		Overload withstand: 50mA continuous, 100mA for 1 second non-recurring
		Input Impedance 49.9kΩ
		Accuracy: AC: ±0.25% F.S.; DC: ±(0.25% F.S. + 0.1% per Vcm*) total error
		Maximum Common Mode: 8 V

* Vcm = Common mode voltage

Input Ratings, continued

Optional Onboard Analog Inputs *continued*	0-20 mA Option	20 mA AC/DC nominal full scale input (25 mA AC/DC max.)
		Overload withstand: 35mA continuous, 70mA for 1 second non-recurring
		Input Impedance 100Ω
		Accuracy: AC: ±0.25% F.S.; DC: ±(0.25% F.S. + 0.1% per Vcm*) total error
		Maximum Common Mode: 20 V
	0-1 V Option	1.0 VAC/VDC nominal full scale input (1.25 VAC/VDC max.)
		Overload withstand: 20 VAC/VDC continuous, 40 VAC/VDC for 1 second non-recurring
		Input Impedance 49.9 kΩ
		Accuracy: AC: 60.25% F.S. DC:6(0.25% F.S. + 0.13% per Vcm*) total error
		Maximum Common Mode: 12 V
	0-10 V Option	10.0 VAC/VDC nominal full scale input (12.5 VAC/VDC max.)
		Overload withstand: 20 VAC/VDC continuous, 40 VAC/VDC for 1 second non-recurring
		Input Impedance 49.9 kΩ
		Accuracy: AC: ±0.25% F.S.; DC: ±(0.25% F.S. + 0.025% per Vcm) total error
		Maximum Common Mode: 25 V
Power Supply*	Standard	85-264VAC (47-440 Hz) or 110-300VDC, 1 Amp worst case loading (56 W) @ 100 VAC @ 25°C
	-P24/ 48 option	20-60VDC @ 30 W worst case
		Power supply fuse current rating, type and rupturing speed: 3 A slow blow

* Power supply ratings apply to both 9700 Power Meter and the external output boards.

Optional Input/Output Modules

Analog Input Modules

	Voltage Inputs					Current Inputs
Part Number	**GAIVDC1**	**GAIVDC5**	**GAIVDC5B**	**GAIVDC10**	**GAIVDC10B**	**GAIIDC420**
Range	0 to 1 VDC	0 to 5 VDC	-5 to 5 VDC	0 to 10 VDC	-10 to 10 VDC	4 to 20 mA
Resolution	244.1 μV	1.22 mV	2.44 mV	2.44 mV	4.88 mV	3.91 μA
Input Impedance	1 MΩ	1 MΩ	1 MΩ	1 MΩ	1 MΩ	133 Ω
Isolation (Input to Output):	2500 Vrms					
Accuracy @ 25°C:	± 0.2%					
Offset Drift:	± 50 ppm/°C					
Gain Drift:	± 55 ppm/°C					
Operating Temperature Range:	0°C to 60°C					
Storage Temperature Range:	-25°C to 85°C					

Analog Output Modules

	Voltage Outputs				Current Outputs
Part Number	**GAOVDC5**	**GAOVDC5B**	**GAOVDC10**	**GAOVDC10B**	**GAOIDC420**
Range	0 to 5 VDC	-5 to 5 VDC	0 to 10 VDC	-10 to 10 VDC	4 to 20 mA
Resolution	1.22 mV	2.44 mV	2.44 mV	4.88 mV	3.9 μA
Sourcing Capability	20 mA max.@ 5 VDC	10 mA max.@ 5 VDC	10 mA max.@ 10 VDC	10 mA max.@ 10 VDC	20 mA max.@ 330 Ω max. loop resistance
Isolation (Input to Output):	2500 Vrms				
Accuracy @ 25°C:	±0.6% range				
Offset Drift:	±45 ppm/°C				
Gain Drift:	±150 ppm/°C				
Short Circuit Protection:	Output signal can be shorted to ground without damaging the module				
Operating Temperature Range:	0°C to 60°C				
Storage Temperature Range:	-25°C to 85°C				

Digital Input Modules

	AC Inputs		DC Inputs	
Part Number	**GDIAC120**	**GDIAC240**	**GDIDC32**	**GDIDC32H** *(High Speed)*
Nominal Input Voltage:	120 VAC	240 VAC	32 VDC	32 VDC
Input Voltage Range:	90 to 140 VAC/VDC	180 to 280 VAC/VDC	3 to 32 VDC	3 to 32 VDC
Input Current @ Max Input Voltage:	8 mA rms	6 mA rms	18 mA	18 mA
Nominal Input Resistance:	22 kΩ	60 kΩ	1.8 kΩ	1.8 kΩ
Pick Up Voltage:	> 90 VAC	> 180 VAC	> 3 VDC	> 3 VDC
Drop Out Voltage:	< 25 VAC	< 50 VAC	< 1 VDC	< 1 VDC
Turn-on Time	20 msec max.	20 msec max.	0.20 msec max.	0.050 msec max.
Turn-off Time	20 msec max.	20 msec max.	0.40 msec max.	0.075 msec max.
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 & Certification:	UL File # E58632, CSA File # LR38763, TUV Certificate #R9474066			
Transient Protection:	Meets ANSI/IEEE C37.90-1989 Surge Withstand Capability Test			
7700 Scan Time:	1 msec maximum, 5 msec minimum, max pulse rate = 20 pps			

Digital Input Dry Contact Modules

Part Number	GDICC
Isolation, Input to Output	2500 VAC rms
Storage Temperature Range	-40°C to 125 °C
Operating Temperature Range	0°C to 60°C
Maximum Dry Contact Voltage Rating	25 VDC
Minimum Dry Contact Current Rating	5 mA
Maximum Turn-on Time	3.0 msec
Minimum Turn-off Time	3.0 msec
Standards and Certification:	UL File # E58632, CSA File # LR38763
Transient Protection:	Meets ANSI 37.90-1989 Surge Withstand Capability Test

Thermocouple Input Modules

Thermocouple Type	Type J	Type K	Type R	Type T
Part Number	**GAITCJ**	**GAITCK**	**GAITCR**	**GAITCT**
Input Range	0 to 700°C	-100 to 924°C	0 to 960°C	-200 to 224°C
Resolution	0.18°C	0.25°C	0.23°C	0.10°C
Isolation (Input to Output):	2500 Vrms			
Accuracy @ 25°C:	± 3°C			
Offset Drift:	± 100 ppm/°C			
Gain Drift:	± 55 ppm/°C			
Operating Temperature Range:	0°C to 60°C			
Storage Temperature Range:	-25°C to 85°C			

RTD Input Modules

Part Number	GAIRTD
Input Range:	-50°C to 350°C
Resolution:	0.10°C
Accuracy, Across Range @ 25°C:	± 0.8°C
Isolation:	2500 VRMS
Operating Temperature Range:	0°C to 60°C
Storage Temperature Range:	-25°C to 85°C

Digital Output Modules

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

	AC Outputs		DC Outputs
Part Number	**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

	AC Outputs (Zero Voltage Turn On)		DC Outputs		
Part Number	**GDOAC120**	**GDOAC240**	**GDODC60**	**GDODC200**	**GDODC60L** *(Low Leakage)*
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:	*N/A*	*N/A*	400 Watts @ 1 msec non-recurring		
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 Relays

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

Compatible AT Commands

The following AT commands are supported by the 9700 Power Meter – MDM.

ATBn Select CCITT or BELL Mode

ATB0	CCITT Mode
ATB1	BELL Mode (default)

ATSn Read/Write S-Register

ATSn=v	Sets S-Register n to the value v

AT&Fn Restore Factory Configuration (Profile)

AT&F0	Restore factory configuration 0
AT&F1	Restore factory configuration 1

AT&Gn Select Guard Tone

AT&G0	Disables guard tone (default)
AT&G1	Disables guard tone
AT&G2	Selects 1800 Hz guard tone

AT%Cn Enable/Disable Data Compression

AT%C0	Disables data decompression
AT%C1	Enables MNP 5 data compression negotiation
AT%C2	Enables V.42 bis data compression
AT%C3	Enables both V.42 bis and MNp 5 data compression

AT%En En/Disable Line Quality Monitor & Auto-Retrain Or Fallback/Fall Fwd

AT%E0	Disable line quality monitor and auto-retrain
AT%E1	Enable line quality monitor and auto-retrain
AT%E2	Enable line quality monitor and fallback/fall forward

AT\Nn Operating Mode

AT\N0	Normal speed buffered mode
AT\N1	Serial interface
AT\N2	Reliable (error-correction) mode
AT\N3	Auto reliable mode
AT\N4	LAPM error-correction mode
AT\N5	MNP error-correction mode

AT+MSCommands Select Modulation

Selects the modulation; enables or disables auto-mode; specifies the lowest and highest connection rates; selects m-Law or A-Law codec type, and enables or disables robbed bit signaling generation (server modem) or detection (client modem)

+MS= <Mod> [,[<Automode>] [,[<Min_Rate>] [,[<Max_Rate>] [,[<X_Law>] [,[< Rb_Signaling>]]]]]] <CR>

AT+MS=? Send a string of info. to the DTE consisting of supported options

<mod>	Modulation	Possible Rates (bps)
0	V.21	300
1	V.22	1200
2	V.22 bis	2400, 1200
3	V.23	1200
9	V.32	9600, 4800
10	V.32 bis	14400, 12000, 9600, 7200, 4800
11	V.34	33600, 31200, 28800, 26400, 24000, 21600, 19200 16800, 14400, 12000, 9600, 7200, 4800, 2400
64	Bell103	300
69	Bell212	1200

AT\An Select Maximum MNP Block Size

AT String	Block Size
AT\A0	64 characters
AT\A1	128 characters (Default)
AT\A2	192 characters
AT\A3	256 characters

Standards Compliance

UL:	Certified to UL 3111
CSA:	Certified to CAN/CSA C22.2 No.1010-1
International:	IEC 1010-1 Registered under CB Scheme to EN61010-1 Measuring inputs comply with Installation Category III Power supply inputs comply with Installation Category 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

Basic Model

9700 Power Meter	With 85 - 240 VAC / 110 - 300 VDC power supply, MGT with 10 ft. (3.0 m) cable, a single optically isolated RS232C/RS485 communications port and 512kB of on-board memory.

Revenue Metering Models

9700 Power Meter -RMICAN	Meets Canadian revenue-metering standards (unsealed). Rated for 0.1 to 10 Amp AC. With universal power supply, MGT with 10 ft. (3.0 m) cable, 1024kB on-board memory, and single optically isolated RS232/RS485 communications card. Approval #AE-0688.
9700 Power Meter -RMANSI	Accuracy meets ANSI C12.16 revenue-metering standard (unsealed). Rated for 0.1 to 10 Amp AC. With universal power supply, 1024kB on-board memory, MGT with 10 ft. (3.0 m) cable, and optically isolated RS232/RS485 communications card.

Meter Options (must be specified with 9700 Power Meter **when ordering)**

-RM	Revenue security enabled, 5 Amp current inputs.
-120	For 69/120, 120/208, or 120/240 (single phase) Volts - systems
-277	For 240/416, or 277/480 Volts systems
-347	For 347/600 Volts systems
-50Hz	For 50 Hz systems
-60Hz	For 60 Hz systems
-1Amp	1.0 Amp nominal full scale current inputs
-P24/48	20 to 60 VDC power supply (instead of 85 to 240 VAC / 110 to 300 VDC)
-TROP	Tropicalization (conformal coating) treatment
-TRAN	No Modular Graphics Terminal (MGT)
-XMEM	Additional 512kB of NVRAM
-XPRESS	Basic XPRESS card with two RS-485 ports and one 10BaseT Ethernet port
-RMSEAL	Factory-sealed meter (for RMICAN meters only). Contact factory for RMSEAL checklist.
-RMKEY	Hardware key for programming unsealed revenue metering units.

Xpress Card Options

-FIBER	10BaseFL Ethernet port
-1MEG	Extra 1 MB of memory
-2MEG	Extra 2 MB of memory
-3MEG	Extra 3 MB of memory

Display

MGT	Modular Graphics Terminal with 10 ft. cable (for ordering MGT separately)
-50ft	50 ft. cable instead of 10 ft. cable
-200ft	200 ft. cable instead of 10 ft. cable

Internal Analog Input Options

(Use separate line item on Purchase Order)

Auxiliary Analog Inputs Board

AUX 1mA	0 to 1mA Auxiliary Analog Input
AUX 20mA	0 to 20mA Auxiliary Analog Input
AUX 1V	0 to 1VAC/VDC Auxiliary Analog Input
AUX 10V	0 to 10VAC/VDC Auxiliary Analog Input

Note: All four on-board Analog Inputs must have the same range.

External Input/Output Expansion Options

(Use separate line item on Purchase Order)

IOCA	I/O card for I/O Port A with ribbon cable (3 feet)
IOCB	I/O card for I/O Port B with ribbon cable (3 feet), and universal power supply (see power supply specifications) . This option should be used for specifying a second I/O board or a board that will be populated with more than 6 analog devices.
-P24/48	Power Supply Option for IOCA or IOCB

Analog Input Devices

GAIVDC1	0 to 1 VDC Analog Input Device
GAIVDC5	0 to 5 VDC Analog Input Device
GAIVDC5B	-5 to 5 VDC Analog Input Device
GAIVDC10	0 to 10 VDC Analog Input Device
GAIVDC10B	-10 to 10 VDC Analog Input Device
GAIIDC420	4 to 20 mA Analog Input Device

Thermocouple Devices

GAITCR	Type R
GAITCT	Type T
GAITCJ	Type J
GAITCK	Type K
GAIRTD	RTD

Analog Output Devices

GAOVDC5	0 to 5 VDC Analog Output Device
GAOVDC5B	-5 to 5 VDC Analog Output Device
GAOVDC10	0 to 10 VDC Analog Output Device
GAOVDC10B	-10 to 10 VDC Analog Output Device
GAOIDC420	4 to 20 mA Analog Output Device

Digital Input Devices

GDIAC120	120 VAC Digital Input Device
GDIAC240	240 VAC Digital Input Device
GDIDC32	32 VDC Digital Input Device
GDIDC32H	32 VDC High Speed Digital Input Device
GDICC	Dry Contact Module

Digital Output Devices

GDOAC120	120 VAC, 3.5A, N.O. Solid State Relay
GDOAC120MO	120 VAC, 3.5A, Zero Voltage Turn On With Manual Override
GDOAC240	240 VAC, 3.5A, N.O. Solid State Relay
GDOAC240MO	240 VAC, 3.5A, Zero Voltage Turn On With Manual Override
GDODC60	60 VDC, 3.5A, N.O. Solid State Relay
GDODC60MO	60 VDC, 3.5A, 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
GDODC100M	100 VDC, 0.5A, N.O. Mechanical Relay

Ordering Example

This example specifies a 9700 Power Meter for a 347/600 Volts, 60 Hz system. It includes an I/O card A with 60 VDC power supply, an I/O card B with 60 VDC power supply, six 0 to 1 VDC Analog Input Devices, six 4 to 20 mA Analog Output Devices, eight 120VAC Digital Input Devices, and four 120VAC Digital Output Devices:

1 9700 Power Meter -347 -60Hz

1 IOCA -P24/48

1 IOCB -P24/48

6 GAIVDC1

6 GAOIDC420

8 GDIAC120

4 GDOAC120

External Output Device Part Number Summary

The following table summarizes the manufacturer's part numbers for external devices used with the 9700 Power Meter.

ORDERING OPTION	DESCRIPTION	MANF. PART #
Digital AC Outputs		
GDOAC120	120 VAC, 3.5A, N.O. Solid State Relay	70G-OAC5
GDOAC120MO	120 VAC, 3.5A, N.O. Zero Voltage Turn-on, Manual	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	70G-OAC5AMA
Digital DC Outputs		
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, 3.5 mA, Manual Override	70G-ODC5MA
GDODC200	200 VDC, 1.0A, N.O. Solid State Relay	70G-ODC5A
GDODC100M	100 VDC, 0.5A, N.O. Mechanical Relay	70G-ODC5R
Digital AC Inputs		
GDIAC120	120 VAC Digital Input Device	70G-IAC5
GDIAC240	240 VAC Digital Input Device	70G-IAC5A
Digital DC Inputs		
GDIDC32	32 VDC Digital Input Device	70G-IDC5
GDIDC32H	32 VDC High Speed Digital Input Device	70G-IDC5B
Dry Contact Inputs		
GDICC	Dry Contact Digital Input Device	70G-IDC5S
Analog Outputs		
GAOVDC5	0 to 5 VDC Analog Output Device	73G-OV5
GAOVDC5B	-5 to 5 VDC Analog Output Device	73G-OV5B
GAOVDC10	0 to 10 VDC Analog Output Device	73G-OV10
GAOVDC10B	-10 to 10 VDC Analog Output Device	73G-OV10B
GAOIDC420	4 to 20 mA Analog Output Device	73G-OI420
Analog Inputs		
GAIVDC1	0 to 1 VDC Analog Input Device	73G-IV1
GAIVDC5	0 to 5 VDC Analog Input Device	73G-IV5
GAIVDC5B	-5 to 5 VDC Analog Input Device	73G-IV5B
GAIVDC10	0 to 10 VDC Analog Input Device	73G-IV10
GAIVDC10B	-10 to 10 VDC Analog Input Device	73G-IV10B
GAIIDC420	4 to 20 mA Analog Input Device	73G-II420
Thermocouple Units		
GAITCJ	Type J Thermocouple Input Device	73G-ITCJ
GAITCK	Type K Thermocouple Input Device	73G-ITCK
GAITCR	Type R Thermocouple Input Device	73G-ITCR
GAITCT	Type T Thermocouple Input Device	73G-ITCT
GAIRTD	100 Ohm Platinum RTD Input Device	73G-ITR100

Warranty

Siemens Energy & Automation, Inc. warrants that all equipment purchased hereunder is warranted on a “RETURN TO FACTORY” basis against all defects in workmanship and materials under normal and proper use and service in its unmodified condition for a period of one (1) year from the data of initial shipment. Siemens Energy & Automation, Inc.’s sole obligation under this warranty shall be limited to furnishing parts and labor to remedy such defects; either, at the option of Siemens Energy & Automation, Inc., by replacing or repairing any defective parts which are returned to Siemens Energy & Automation, Inc. factory or by making available at a Purchaser designated facility a repaired or replaced part. All replaced equipment shall become the property of Siemens Energy & Automation, Inc. The cost of freight to and from Siemens Energy & Automation, Inc. Siemens Energy & Automation, Inc. will be borne by the Purchaser. If Siemens Energy & Automation, Inc. determines that the equipment returned to it for warranty correction is not defective, as herein defined, Purchaser shall pay Siemens Energy & Automation, Inc., all costs of service, parts, handling and transportation.

Product Return Procedure

Contact Siemens Energy & Automation Customer Service at 800-427-2256 for information on the product return procedure.

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Siemens Energy & Automation, Inc.
Power Management Technologies
3333 Old Milton Parkway
Alpharetta, GA 30005

For Nearest Sales Office
1.800.964.4114
www.sea.siemens.com
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