GE Consumer & Industrial
Multilin

PQMII

Power Quality Meter™

INSTRUCTION MANUAL

Software Revision: 2.2x

Manual P/N: 1601-0130-A3
Manual Order Code: GEK-106475B

GE Multilin

215 Anderson Avenue, Markham, Ontario

Canada L6E 1B3

Tel: (905) 294-6222   Fax: (905) 201-2098

Internet: http://www.GEmultilin.com

REGISTERED ISO9001:2000 GE MULTILIN

GE Multilin's Quality Management
System is registered to ISO9001:2000

QMI # 005094
UL # A3775

GE Multilin PQMII Power Quality Meter instruction manual for revision 2.2x.

Part numbers contained in this manual are subject to change without notice, and should therefore be verified by GE Multilin before ordering.

Part number: 1601-0130-A3 (April 2007)

Table of Contents

GE Consumer & Industrial
Multilin

PQMII Power Quality Meter

Chapter 1: Overview

1.1 Introduction to the PQMII

1.1.1 Description

The GE Multilin PQMII Power Quality Meter is an ideal choice for continuous monitoring of a single or three-phase system. It provides metering for current, voltage, real power, reactive power, apparent power, energy use, cost of power, power factor, and frequency. Programmable setpoints and four assignable output relays allow control functions to be added for specific applications. This includes basic alarm on over/under current or voltage, unbalance, demand-based load shedding, and capacitor power factor correction control. More complex control is possible using the four switch inputs; these can also be used for status information such as breaker open/closed and flow information.

As a data gathering device for plant automation systems that integrate process, instrument, and electrical requirements, all monitored values are available via one of two RS485 communication ports running the Modbus protocol. If analog values are required for direct interface to a PLC, any of the monitored values can output as a 4 to 20 mA (or 0 to 1 mA) signal to replace up to four (4) separate transducers. A third RS232 communication port connects to a PC from the front panel for simultaneous access of information by other plant personnel.

With increasing use of electronic loads such as computers, ballasts, and variable frequency drives, the quality of the power system is important. With the harmonic analysis option, any phase current or voltage can be displayed and the harmonic content calculated. Knowledge of the harmonic distribution allows action to be taken to prevent overheated transformers, motors, capacitors, neutral wires, and nuisance breaker trips. Redistribution of system loading can also be determined. The PQMII can also provide waveform and data printouts to assist in problem diagnosis.

1.1.2 Feature Highlights

- Monitoring: A, V, VA, W, var, kWh, kvarh, kVAh, PF, Hz
- Demand metering: W, var, A, VA
- Setpoints for alarm or control from most measured values, including: unbalance, frequency, power factor, voltage, and current
- four (4) output relays / four (4) switch inputs for flexible control configuration
- four (4) isolated analog outputs replace transducers for PLC interface
- one 4 to 20 mA analog input
- Modbus communications
- Three COM ports (two rear RS485 ports and one front RS232 port) for access by process, electrical, maintenance, and instrument personnel
- Harmonic analysis for power quality review and problem correction
- 40-character display and keypad for local programming
- No-charge EnerVista PQMII Setup Software
- Simulation mode for testing and training
- Compact design for panel mount
- AC/DC control power

1.1.3 Applications of the PQMII

- Metering of distribution feeders, transformers, generators, capacitor banks, and motors
- Medium and low voltage three-phase systems
- Commercial, industrial, utility
- Flexible control for demand load shedding, power factor, etc.
- Power quality analysis
- System debugging

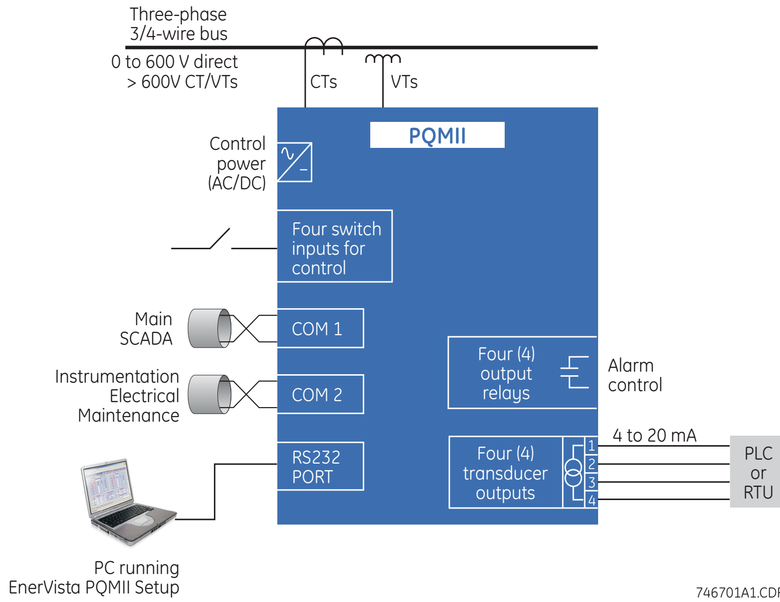


FIGURE 1–1: Single Line Diagram

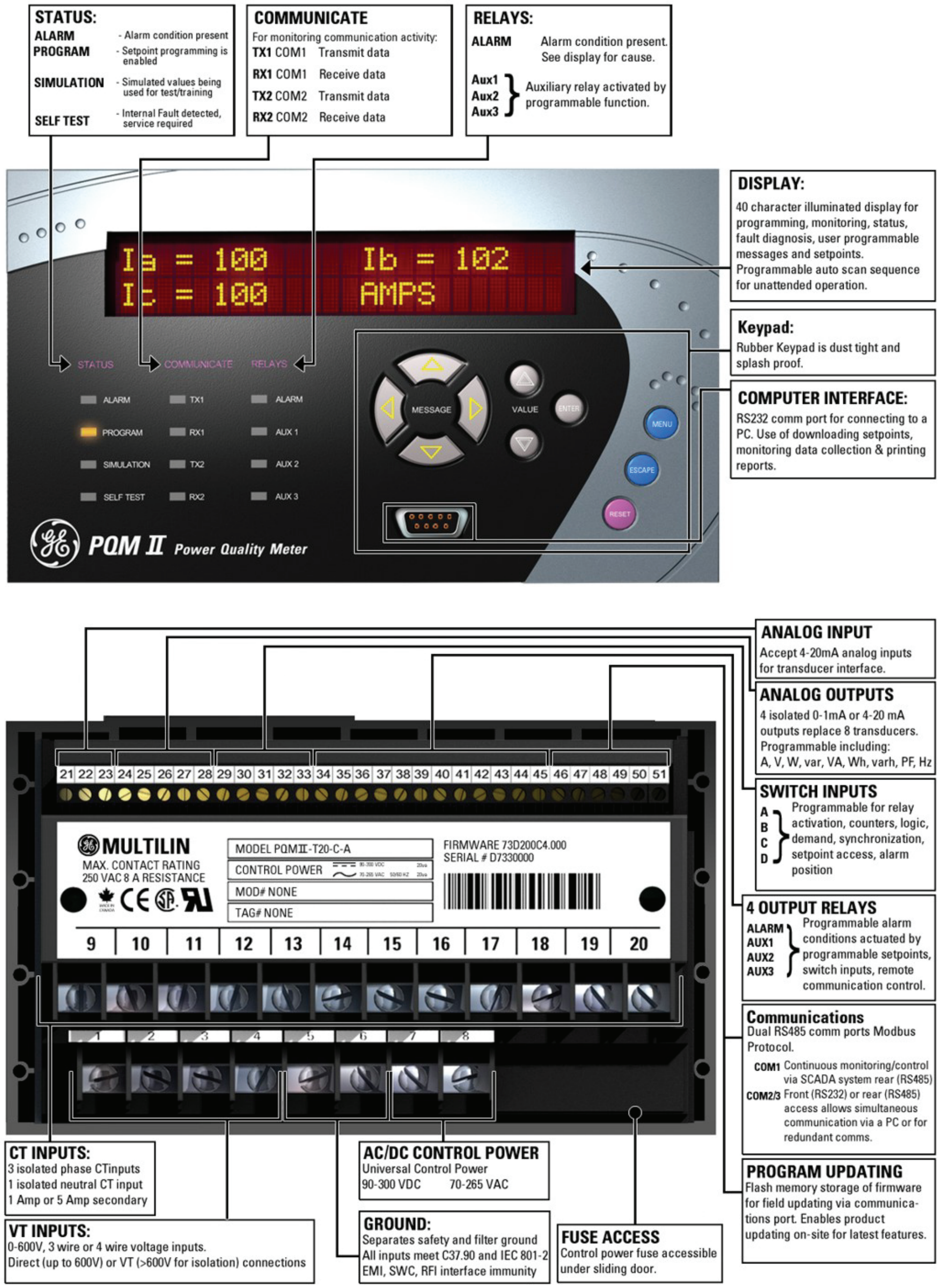


FIGURE 1–2: Feature Highlights

1.2 Standard Features

1.2.1 Metering

True RMS monitoring of Ia, Ib, Ic, In, Van, Vbn, Vcn, Vab, Vbc, Vca, voltage/current unbalance, power factor, line frequency, watts, vars, VA, Wh, varh, VAh, and demand readings for A, W, vars, and VA. Maximum and minimum values of measured quantities are recorded and are date and time stamped.

A 40-character liquid crystal display is used for programming setpoints and monitoring values and status.

1.2.2 Alarms

Alarm conditions can be set up for all measured quantities. These include overcurrent, undercurrent, neutral current, current unbalance, voltage unbalance, phase reversal, overfrequency, underfrequency, power factor, switch inputs, etc. The alarm messages are displayed in a simple and easy to understand English format.

1.2.3 Communications

The PQMII is equipped with one standard RS485 port utilizing the Modbus or DNP protocols. This can be used to integrate process, instrumentation, and electrical requirements in a plant automation system by connecting several PQMII meters together to a DCS or SCADA system. A PC running the EnerVista PQMII Setup Software can change system setpoints and monitor values, status, and alarms. Continuous monitoring minimizes process downtime by immediately identifying potential problems due to faults or changes from growth.

The PQMII also includes a front RS232 port which can be used for the following tasks:

- data monitoring
- problem diagnosis
- viewing event records
- trending
- printing settings and/or actual values
- loading new firmware into the PQMII

1.2.4 Future Expansion

Flash memory is used to store firmware within the PQMII. This allows future product upgrades to be loaded via the serial port.

FIGURE 1–3: Downloading Product Enhancements via the Serial Port

1.2.5 Open Architecture

PQMII units can initially be used as standalone meters. Their open architecture allows connection to other Modbus compatible devices on the same communication link. These can be integrated in a complete plant-wide system for overall process monitoring and control.

1.3 Optional Features

1.3.1 Transducer Input/Outputs

Four isolated 4 to 20 mA (or 0 to 1 mA depending on the installed option) analog outputs are provided that can replace up to eight transducers. The outputs can be assigned to any measured parameters for direct interface to a PLC.

One 4 to 20 mA analog input is provided to accept a transducer output for displaying information such as temperature or water level.

An additional rear RS485 communication port is provided for simultaneous monitoring by process, instrument, electrical, or maintenance personnel.

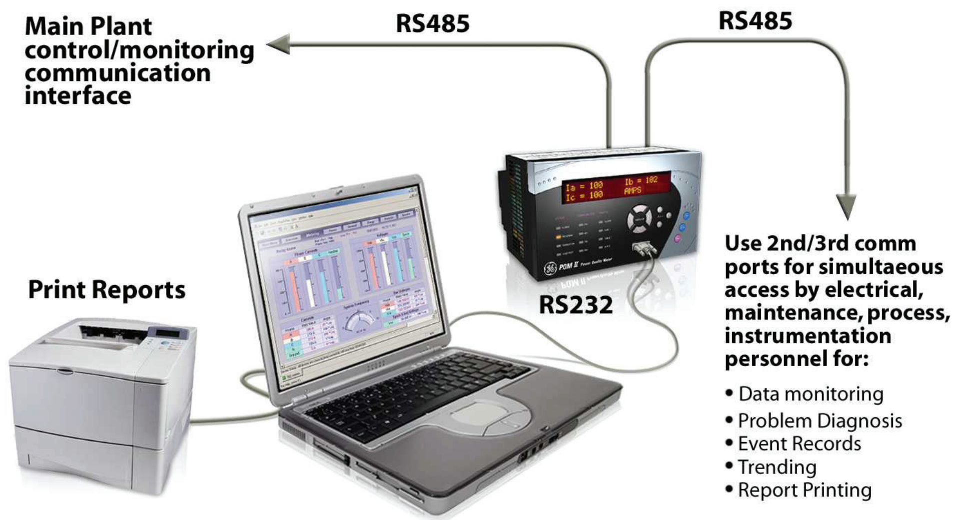


FIGURE 1–4: Additional Communication Port

1.3.2 Control Option

An additional three dry-contact form “C” output relays and four dry-contact switch inputs are provided. These additional relays can be combined with setpoints and inputs/outputs for control applications. Possibilities include:

- undercurrent alarm warnings for pump protection
- overvoltage/undervoltage for generators
- unbalance alarm warnings to protect rotating machines
- dual level power factor for capacitor bank switching
- underfrequency/demand output for load shedding resulting in power cost saving
- kWh, kvarh and kVAh pulse output for PLC interface
- Pulse input for totalizing quantities such as kWh, kvarh, kVAh, etc.

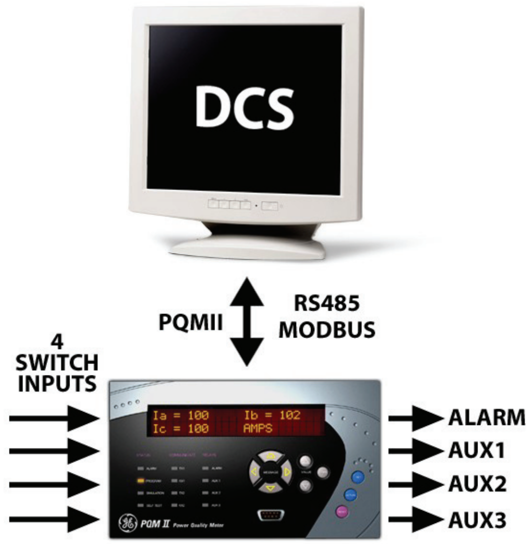


FIGURE 1–5: Switch Inputs and Outputs Relays

1.3.3 Power Analysis Option

Non-linear loads (such as variable speed drives, computers, and electronic ballasts) can cause unwanted harmonics that may lead to nuisance breaker tripping, telephone interference, and transformer, capacitor or motor overheating. For fault diagnostics such as detecting undersized neutral wiring, assessing the need for harmonic rated transformers, or judging the effectiveness of harmonic filters, details of the harmonic spectrum are useful and available with the power analysis option.

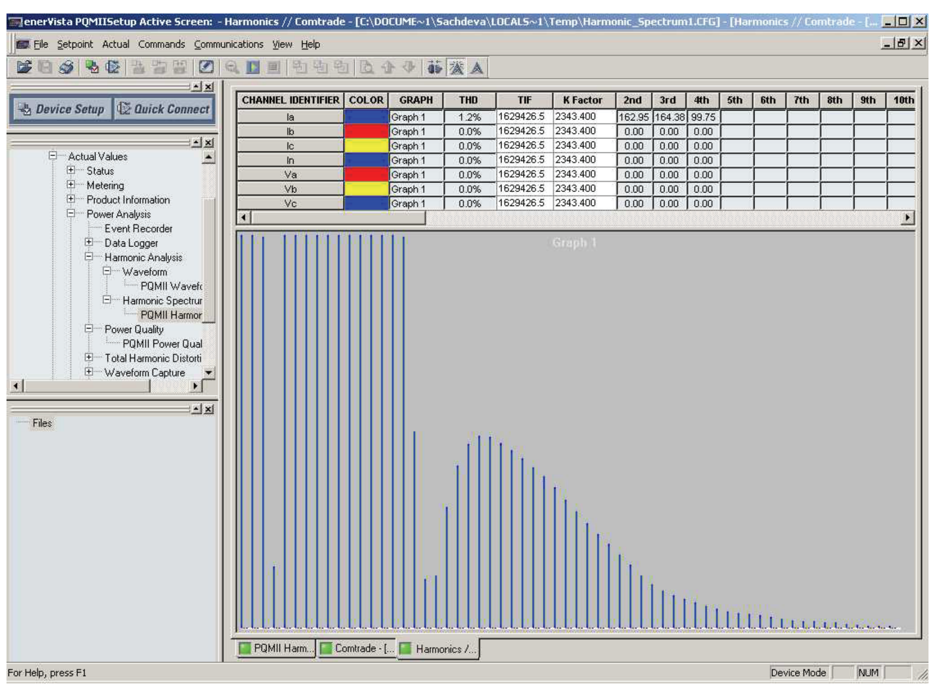


FIGURE 1–6: Harmonic Spectrum

Voltage and current waveforms can be captured and displayed on a PC with the EnerVista PQMII Setup Software or EnerVista Viewpoint. Distorted peaks or notches from SCR switching provide clues for taking corrective action.

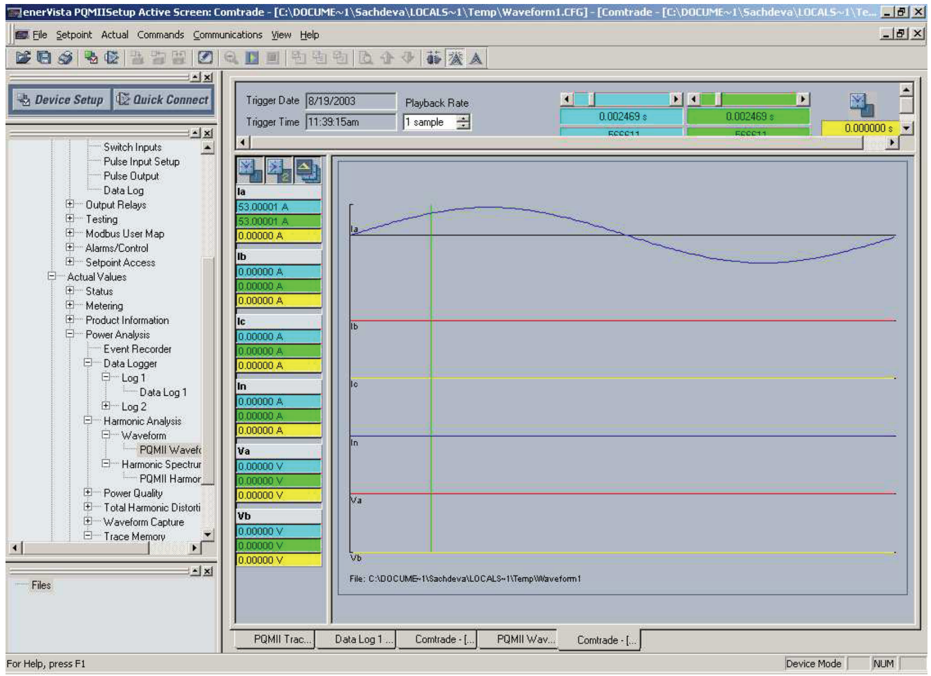


FIGURE 1–7: Captured Waveform

Alarms, triggers, and input/output events can be stored in a 150-event record and time/date stamped by the internal clock. This is useful for diagnosing problems and system activity. The event record is available through serial communication. Minimum and maximum values are also continuously updated and time/date stamped.

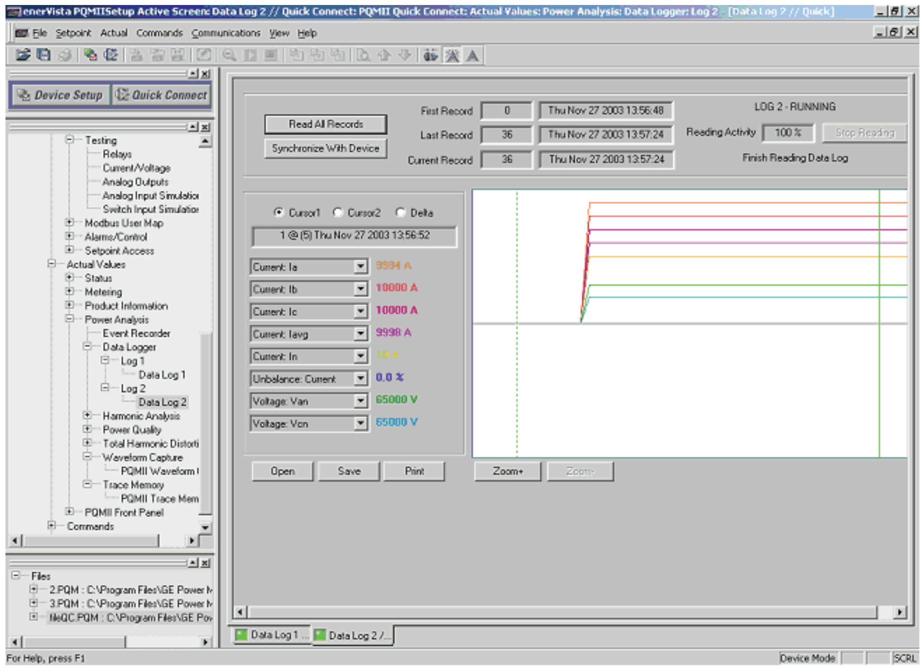


FIGURE 1–8: Data Logger

Routine event logs of all measured quantities can be created, saved to a file, and/or printed.

For additional information on waveform sampling and analysis features, see *Power Analysis* on page 4–13.

The power analysis option also provides a Trace Memory feature. This feature can be used to record specified parameters based on the user defined triggers.

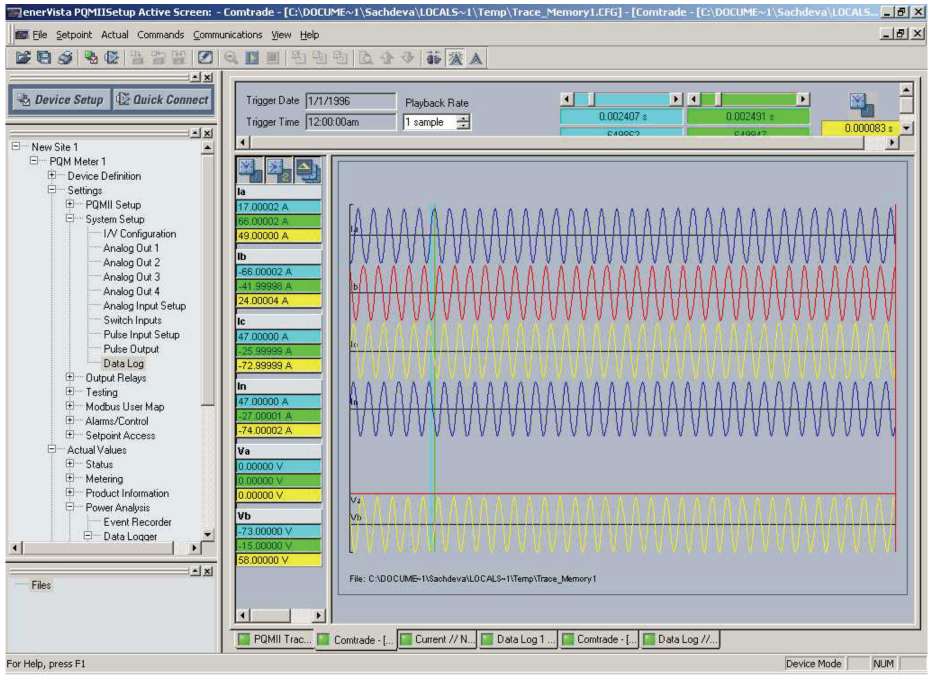


FIGURE 1–9: Trace Memory Capture

1.4 EnerVista PQMII Setup Software

1.4.1 Overview

All data continuously gathered by the PQMII can be transferred to a third party software program for display, control, or analysis through the communications interface. The EnerVista PQMII Setup Software allows the user to view and manipulate this data and assists in programming the PQMII. Some of the tasks that can be executed using the EnerVista PQMII Setup Software package include:

- reading metered data
- monitoring system status
- changing PQMII setpoints on-line
- saving setpoints to a file and downloading into any PQMII
- capturing and displaying voltage and current waveforms for analysis
- recording demand profiles for various measured quantities
- troubleshooting communication problems with a built in debugger
- printing graphs, charts, setpoints, and actual values

The EnerVista PQMII Setup Software is fully described in Chapter *Software*.

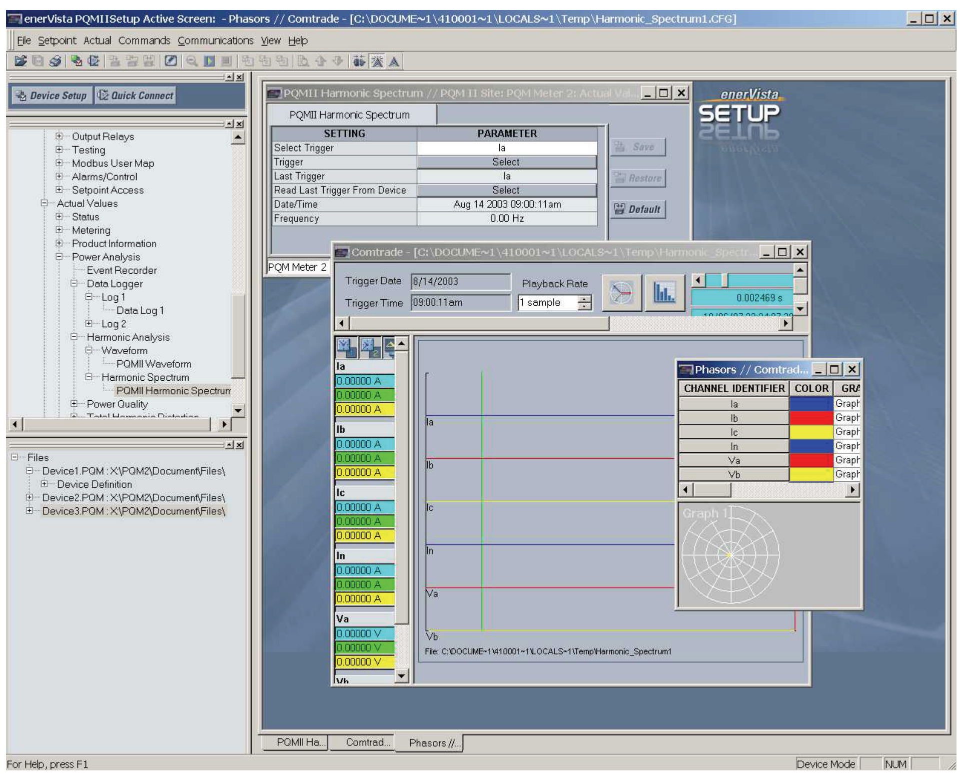


FIGURE 1–10: EnerVista PQMII Setup Software Main Window

1.5 Order Codes

1.5.1 Order Code Table

The order code for all options is: **PQMII-T20-C-A**

Table 1–1: Order Codes

	PQMII				
Basic Unit	PQMII –	–	–		Basic unit with display, all current/voltage/power measurements, one (1) RS485 communication port, one (1) RS232 communication port
Transducer Option		T20 –	–		Four (4) isolated analog outputs, 0-20 mA and 4-20 mA assignable to all measured parameters, 4-20 mA analog input, 2nd RS485 communication port
		T1	–		Four (4) isolated analog outputs, 0-1 mA assignable to all measured parameters, 4-20 mA analog input, 2nd RS485 communication port
Control Option			C –		Three (3) additional programmable output relays (for a total of 4), 4 programmable switch inputs
Power Analysis Option				A	Harmonic analysis, triggered trace memory, waveform capture, event recorder, data logger, voltage disturbance recorder*

* The voltage disturbance recorder is only available with the 25 MHz processor.

1.5.2 Modifications

Consult the factory for any additional modification costs):

- MOD 501: 20 to 60 V DC / 20 to 48 V AC Control Power
- MOD 502: Tropicalization
- MOD 504: Removable Terminal Blocks
- MOD 506: 4-Step Capacitor Bank Switching

1.5.3 Accessories

Consult the factory for any additional accessory costs:

- EnerVista PQMII Setup Software (included with the PQMII; also available at http://www.enerVista.com)
- RS232 to RS485 converter (required to connect a PC to the PQMII RS485 ports)
- GE MultiNET RS485 serial-to-Ethernet converter (required for connection to an Ethernet network)
- RS485 terminating network

1.5.4 Control Power

- 90 to 300 V DC / 70 to 265 V AC standard
- 20 to 60 V DC / 20 to 48 V AC (MOD 501)

1.6 Specifications

NOTE

Specifications are subject to change without notice.

1.6.1 Inputs/Outputs

CURRENT INPUTS

Conversion:	true RMS, 64 samples/cycle
CT Input:	1 A and 5 A secondary
Burden:	0.2 VA
Overload:	20 × CT for 1 sec. 100 × CT for 0.2 sec.
Range:	1 to 150% of CT primary
Full scale:	150% of CT primary
Frequency:	up to 32nd harmonic
Accuracy:	±0.2% of full scale

VOLTAGE INPUTS

Conversion:	true RMS, 64 samples/cycle
VT pri./sec.:	120 to 72000 : 69 to 240, or Direct
VT Ratio:	1:1 to 3500:1
Burden:	2.2 MΩ
Input Range:	40 to 600 V AC
Full scale:	
for VT input ≤150 V AC:	150 V AC
for VT input >150 V AC:	600 V AC
Frequency:	up to 32nd harmonic
Accuracy:	±0.2% of full scale

SWITCH INPUTS

Type:	dry contacts
Resistance:	1000 Ω max ON resistance
Output:	24 V DC at 2 mA (pulsed)
Duration:	100 ms minimum

ANALOG OUTPUT (0–1 MA)

Max. load:	2400 Ω
Max. output:	1.1 mA
Accuracy:	±1% of full-scale reading
Isolation:	±36 V DC isolated, active source

ANALOG OUTPUT (4–20 MA)

Max. load:	600 Ω
Max. output:	21 mA
Accuracy:	±1% of full-scale reading
Isolation:	±36 V DC isolated, active source

PULSE OUTPUT

Parameters:	+kWh, –kWh, +kvarh, –kvarh, kVAh
Interval:	1 to 65000 in steps of 1
Pulse width:	100 to 2000 ms in steps of 10
Minimum pulse interval:	500 ms
Accuracy:	±10 ms

PULSE INPUT
Max. inputs: 4
Min. pulse width: 150 ms
Min. off time: 200 ms

1.6.2 Trace Memory Trigger

TRACE MEMORY TRIGGER
Input: 2 data cycles (current, voltage)
Time delay: 0 to 30 cycles
Current input full scale: 150% of CT primary
Voltage input full scale: 600 V AC

TRIGGER LEVEL PICKUP ACCURACY
Overcurrent: ±2% of full scale
Overvoltage: ±2% of full scale
Undervoltage: ±3% of full scale

1.6.3 Sampling Modes

METERED VALUES
Samples per cycle: 64
Inputs sampled at a time: all
Duration: 2 cycles

TRACE MEMORY
Samples per cycle: 16
Inputs sampled at a time: all
Duration: continuous

HARMONIC SPECTRUM
Samples per cycle: 256
Inputs sampled at a time: 1
Duration: 1 cycle

VOLTAGE DISTURBANCE RECORDER
Samples per half-cycle: 8
Inputs sampled: all measured voltages
Duration: 0.5 cycles to 1 minute

1.6.4 Output Relays

MAKE/CARRY
Continuous: 5 A
0.1 second: 30 A

BREAK
Resistive: 5 A at 30 V DC, 125/250 V AC
0.5 A at 125 V DC
0.3 A at 250 V DC
Inductive (L/R = 7 ms): 5 A at 30 V DC, 125/250 V AC
0.25 A at 125 V DC
0.15 A at 250 V DC

1.6.5 Metering

MEASURED VALUES ACCURACY

Voltage:	±0.2% of full-scale
Current:	±0.2% of full-scale
Voltage unbalance:	±1% of full-scale
Current unbalance:	±1% of full-scale
kW:	per curves ±1 digit on display
kvar:	per curves ±1 digit on display
kVA:	per curves ±1 digit on display
kWh:	per curves ±1 digit on display
kvarh:	per curves ±1 digit on display
kVAh:	per curves ±1 digit on display
Power factor:	±1% of full-scale
Frequency:	±0.02 Hz
kW demand:	±0.4% of full-scale
kvar demand:	±0.4% of full-scale
kVA demand:	±0.4% of full-scale
Current demand:	±0.4% of full-scale
Current THD:	±2.0% of full-scale
Voltage THD:	±2.0% of full-scale
Crest factor:	±0.4% of full-scale

MEASURED VALUES RANGE

Voltage:	20 to 100% of VT
Current:	1 to 150% of CT
Voltage unbalance:	0 to 100%
Current unbalance:	0 to 100%
Real power:	0 to ±999,999.99 kW
Reactive power:	0 to ±999,999.99 kvar
Apparent power:	0 to 999,999.99 kVA
Real energy:	2^{32} kWh
Reactive energy:	2^{32} kvarh
Apparent energy:	2^{32} kVAh
Power factor:	0.00 to ±1.00
Frequency:	20.00 to 70.00 Hz
kw demand:	0 to ±999,999.99 kW
kvar demand:	0 to ±999,999.99 kvar
kVA demand:	0 to 999,999.99 kVA
Current demand:	0 to 7500 A
THD (current and voltage):	0.0 to 100.0%
Crest factor:	1 to 9.99

MEASURED VALUES ACCURACY

kW:	±0.4% of full scale
kvar:	±0.4% of full scale
kVA:	±0.4% of full scale
kWh:	±0.4% of full scale
kvarh:	±0.4% of full scale
kVAh:	±0.4% of full scale

1.6.6 Monitoring

UNDERVOLTAGE MONITORING

Req'd voltage: .... >20 V applied in all phases
Pickup: .... 0.50 to 0.99 × VT in steps of 0.01
Dropout: .... 103% of pickup
Time delay: .... 0.5 to 600.0 s in steps of 0.5
Phases: .... Any 1 / Any 2 / All 3 (programmable) have to be ≤ pickup to operate
Accuracy: .... per voltage input
Timing accuracy: .... –0 / +1 sec.

OVERVOLTAGE MONITORING

Pickup: .... 1.01 to 1.25 × VT in steps of 0.01
Dropout: .... 97% of pickup
Time delay: .... 0.5 to 600.0 s in steps of 0.5
Phases: .... Any 1 / Any 2 / All 3 (programmable) must be ≥ pickup to operate
Accuracy: .... Per voltage input
Timing accuracy: .... –0 / +1 sec.

UNDERFREQUENCY MONITORING

Req'd voltage: .... >30 V applied in phase A
Pickup: .... 20.00 to 70.00 Hz in steps of 0.01
Dropout: .... Pickup + 0.03 Hz
Time delay: .... 0.1 to 10.0 s in steps of 0.1
Accuracy: .... 0.02 Hz
Timing accuracy: ±100 ms

OVERFREQUENCY MONITORING

Req'd voltage: .... >30 V applied in phase A
Pickup: .... 20.00 to 70.00 Hz in steps of 0.01
Dropout: .... Pickup – 0.03 Hz
Time delay: .... 0.0 to 10.0 s in steps of 0.1
Accuracy: .... 0.02 Hz
Timing accuracy: ±100 ms

POWER FACTOR MONITORING

Req'd voltage: .... >20 V applied in phase A
Pickup: .... 0.50 lag to 0.50 lead step 0.01
Dropout: .... 0.50 lag to 0.50 lead step 0.01
Time delay: .... 0.5 to 600.0 s in steps of 0.5
Timing accuracy: .... –0.5/+1 sec.

DEMAND MONITORING

Measured values: .... Phase A/B/C/N Current (A)
3ϕ Real Power (kW)
3ϕ Reactive Power (kvar)
3ϕ Apparent Power (kVA)
Measurement type (programmable):
Thermal Exponential, 90% response time: 5 to 60 min. in steps of 1
Block interval: .... 5 to 60 min. in steps of 1
Rolling Demand Time Interval: .... 5 to 60 min. in steps of 1
Pickup: .... 10 to 7500 A in steps of 1
1 to 65000 kW in steps of 1
1 to 65000 kvar in steps of 1
1 to 65000 kVA in steps of 1

VOLTAGE DISTURBANCE RECORDER

Required voltage:	>20 V or 10% (whichever is greater) applied in each measured phase
Minimum nominal voltage:	60 V
Phases recorded:	all three phases recorded independently
Conversion:	true RMS, 8 samples/half-cycle
Sag:	
Pickup level:	0.20 to 0.90 × VT in steps of 0.01
Dropout level:	pickup + 10% of nominal
Swell:	
Pickup level:	1.01 to 1.50 × VT in steps of 0.01
Dropout level:	pickup – 10% of nominal

1.6.7 System

COMMUNICATIONS

COM1/2:	RS485 2-wire, half duplex, isolated
COM3:	RS232 9-pin
Baud rate:	1200 to 19200
Protocols:	Modbus® RTU; DNP 3.0
Functions:	Read/write setpoints, read actual values, execute commands, read device status loopback test

CLOCK

Accuracy:	±1 min. / 30 days at 25±5°C
Resolution:	1 sec.

CONTROL POWER

Input:	90 to 300 V DC or 70 to 265 V AC at 50/60 Hz
Power:	nominal 10 VA, max. 20 VA
Holdup:	100 ms typical (at 120 V AC / 125 V DC)

WARNING

It is recommended that the PQMII be powered up at least once per year to avoid deterioration of the electrolytic capacitors in the power supply.

FUSE TYPE/RATING

5 × 20mm, 2.5 A, 250V
Slow blow, High breaking capacity

1.6.8 Testing and Approvals

TYPE TESTS

Dielectric strength:	2.0 kV for 1 minute to relays, CTs, VTs, power supply
Insulation resistance:	IEC255-5, 500 V DC
Transients:	ANSI C37.90.1 Oscillatory at 2.5 kV/1 MHz; ANSI C37.90.1 Fast Rise at 5 kV/10 ns; Ontario Hydro A-28M-82; IEC255-4 Impulse/High Frequency Disturbance Class III
Impulse test:	IEC 255-5 0.5 Joule 5kV
RFI:	50 MHz/15 W Transmitter
EMI:	C37.90.2 Electromagnetic Interference at 150 MHz and 450 MHz, 10V/m
Static:	IEC 801-2 Static Discharge

Humidity: .... 95% non-condensing
Temperature: .... –10°C to +60°C ambient
Environment: .... IEC 68-2-38 Temperature/Humidity Cycle

OTHER TESTS

Vibration: .... Sinusoidal vibration 6.0 g for 72 hrs

CERTIFICATION

ISO: .... Manufactured under an ISO9001 registered program
UL: .... E83849 UL listed for the USA and Canada
CE: .... Conforms to EN 55011 / CISPR 11, EN50082-2, IEC 947-1, IEC 1010-1

1.6.9 Physical

PACKAGING

Shipping box: .... 8½” × 6” × 6” (L × H × D)
21.5cm × 15.2cm × 15.2 cm

GE Consumer & Industrial
Multilin

PQMII Power Quality Meter

Chapter 2: Installation

2.1 Physical Configuration

2.1.1 Mounting

Physical dimensions and required cutout dimensions for the PQMII are shown below. Once the cutout and mounting holes are made in the panel, use the eight #6 self-tapping screws provided to secure the PQMII. Mount the unit on a panel or switchgear door to allow operator access to the keypad and indicators.

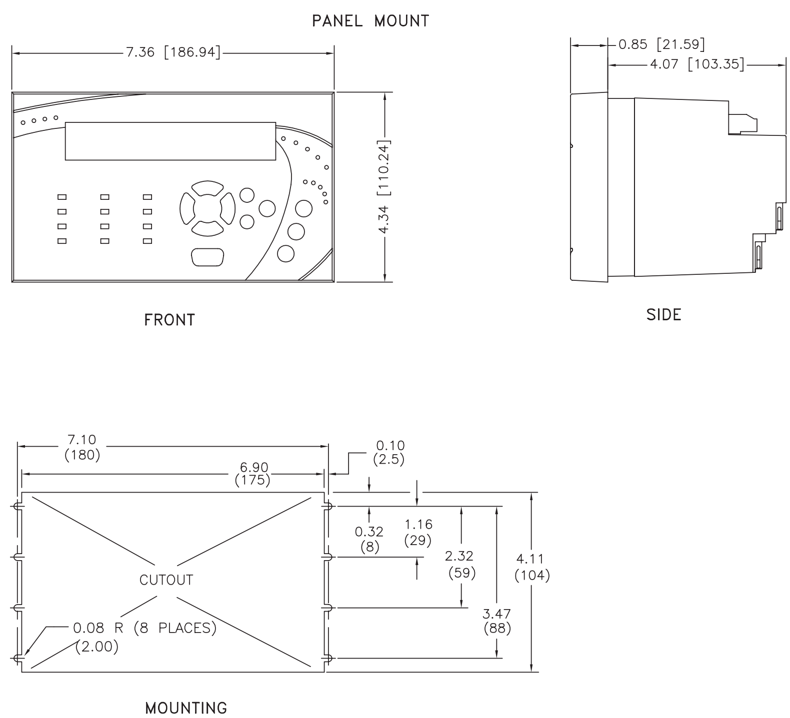


FIGURE 2–1: Physical Dimensions

2.1.2 Product Identification

Product attributes vary according to the configuration and options selected on the customer order. Before applying power to the PQMII, examine the label on the back and ensure the correct options are installed.

The following section explains the information included on the label shown below:

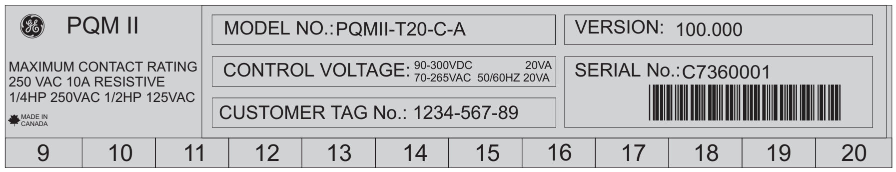


FIGURE 2–2: Product Label

- **Model No**: Shows the PQMII configuration. The model number for a basic panel mount PQMII is "PQMII". T20, C, and A appear in the model number only if the Transducer, Control, or Power Analysis options are installed.
- **Supply Voltage**: Indicates the power supply input configuration installed in the PQMII. The PQMII shown in this example can accept any AC 50/60Hz voltage from 70 to 265 V AC or DC voltage from 90 to 300 V DC.
- **Tag#**: An optional identification number specified by the customer.
- **Mod#**: Indicates if any unique features have been installed for special customer orders. This number should be available when contacting GE Multilin for technical support.
- **Version**: An internal GE Multilin number that should be available when contacting us for technical support.
- **Serial No.**: Indicates the serial number in numeric and barcode formats. Record this number when contacting GE Multilin for technical support.

2.1.3 Revision History

The PQMII revision history is shown below. Each instruction manual revision corresponds to a particular firmware revision. The manual revision is located on the title page as part of the manual part number (the format is 1601-nnnn-*revision*). The firmware revision is loaded in the PQMII and can be viewed by scrolling to the **A4 PRODUCT INFO ⇨⇩ SOFTWARE VERSIONS ⇨⇩ MAIN PROGRAM VERSION** message.

When using the instruction manual to determine PQMII features and settings, ensure that the instruction manual revision corresponds to the firmware revision installed in the PQMII using the table below.

Table 2–1: Manual Revision History

Manual P/N	Firmware Version
1601-0118-A1	1.0x
1601-0118-A2	1.0x

Table 2–1: Manual Revision History

1601-0118-A3	2.0x
1601-0118-A4	2.0x
1601-0118-A5	2.1x
1601-0118-A7	2.2x

2.2 Electrical Configuration

2.2.1 External Connections

Signal wiring is to Terminals 21 to 51. These terminals accommodate wires sizes up to 12 gauge. Please note that the maximum torque that can be applied to terminals 21 to 51 is 0.5 Nm (or 4.4 in ·lb.). CT, VT, and control power connections are made using Terminals 1 to 20. These #8 screw ring terminals accept wire sizes as large as 8 gauge. Consult the wiring diagrams for suggested wiring. A minimal configuration includes connections for control power, phase CTs/VTs, and the alarm relay; other features can be wired as required. Considerations for wiring each feature are given in the sections that follow.

Table 2–2: PQMII External Connections

Terminal	Description	Terminal	Description
VT / Control Power Row (1 to 8)		25	Analog out 4+
1	V1 Voltage input	26	Analog out 3+
2	V2 Voltage input	27	Analog out 2+
3	V3 Voltage input	28	Analog out 1+
4	Vn Voltage input	29	Switch 4 input
5	Filter ground	30	Switch 3 input
6	Safety ground	31	Switch 2 input
7	Control neutral (–)	32	Switch 1 input
8	Control live (+)	33	+24 V DC switch com
CT Row (9 to 20)		34	Aux3 relay NC
9	Phase A CT 5A	35	Aux3 relay COM
10	Phase A CT 1A	36	Aux3 relay NO
11	Phase A CT COM	37	Aux2 relay NC
12	Phase B CT 5A	38	Aux2 relay COM
13	Phase B CT 1A	39	Aux2 relay NO
14	Phase B CT COM	40	Aux1 relay NC
15	Phase C CT 5A	41	Aux1 relay COM
16	Phase C CT 1A	42	Aux1 relay NO
17	Phase C CT COM	43	Alarm relay NC
18	Neutral CT 5A	44	Alarm relay COM
19	Neutral CT 1A	45	Alarm relay NO
20	Neutral CT COM	46	Comm 1 COM

Table 2–2: PQMII External Connections

Terminal	Description
Signal Upper Row (21 to 51)	
21	Analog shield
22	Analog in –
23	Analog in +
24	Analog out com
47	Comm 1 –
48	Comm 1 +
49	Comm 2 COM
50	Comm 2 –
51	Comm 2 +

2.2.2 Wiring Diagrams

This wiring diagram below shows the typical 4-wire wye connection which will cover any voltage range. Select the **S2 SYSTEM SETUP ⇨⇩ CURRENT/VOLTAGE CONFIGURATION ⇨⇩ VT WIRING:** "4 Wire Wye (3 VTs)" setpoint

.

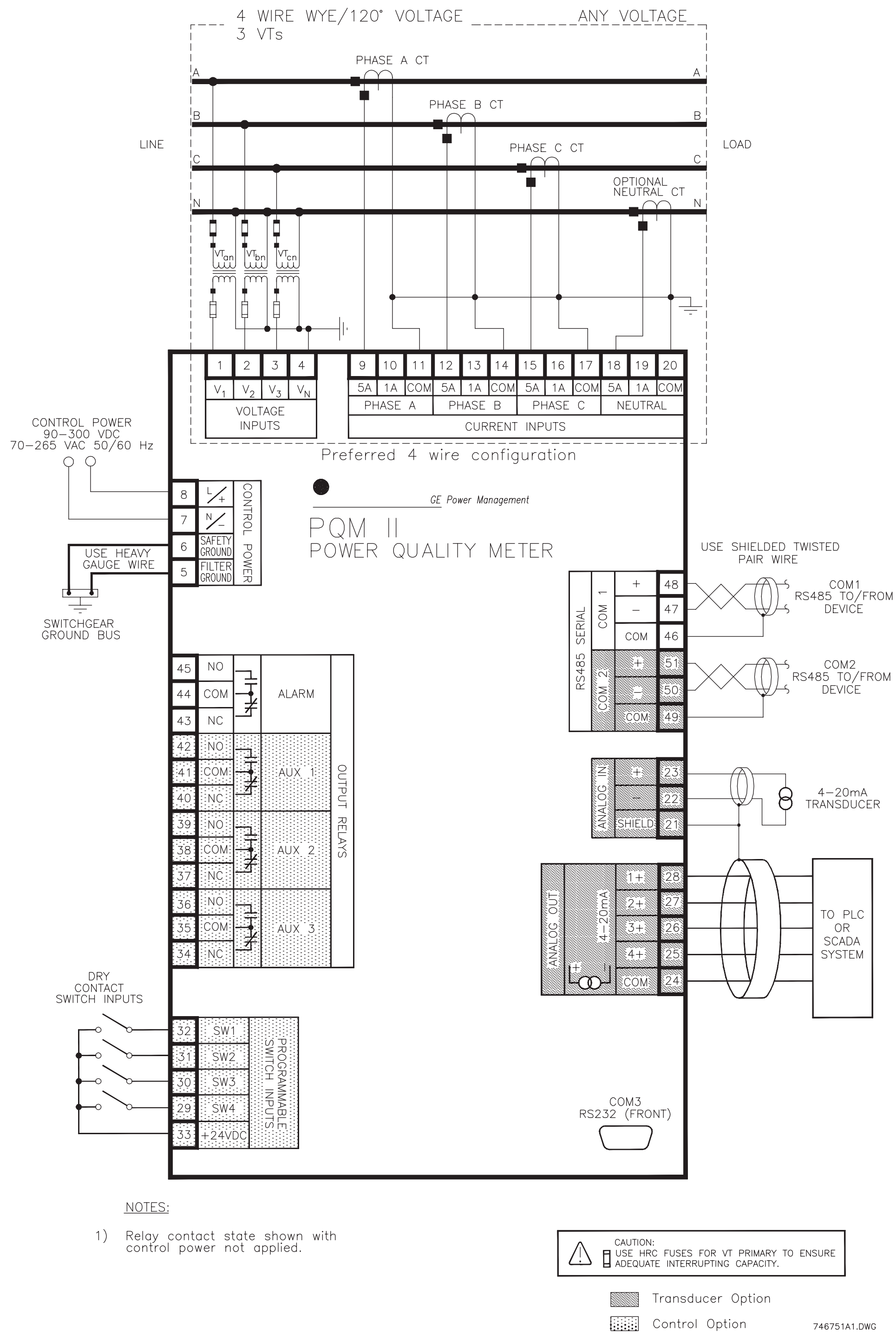


FIGURE 2–3: Wiring Diagram 4-wire Wye (3 VTs)

The 2½ element 4-wire wye connection can be used for situations where cost or size restrictions limit the number of VTs to two. With this connection, Phase Vbn voltage is calculated using the two existing voltages. Select the **S2 SYSTEM SETUP** ⇨⇩ **CURRENT/VOLTAGE CONFIGURATION** ⇨⇩ **VT WIRING:** "4 WIRE WYE (2 VTs)" setpoint.

This wiring configuration will only provide accurate power measurements if the voltages are balanced.

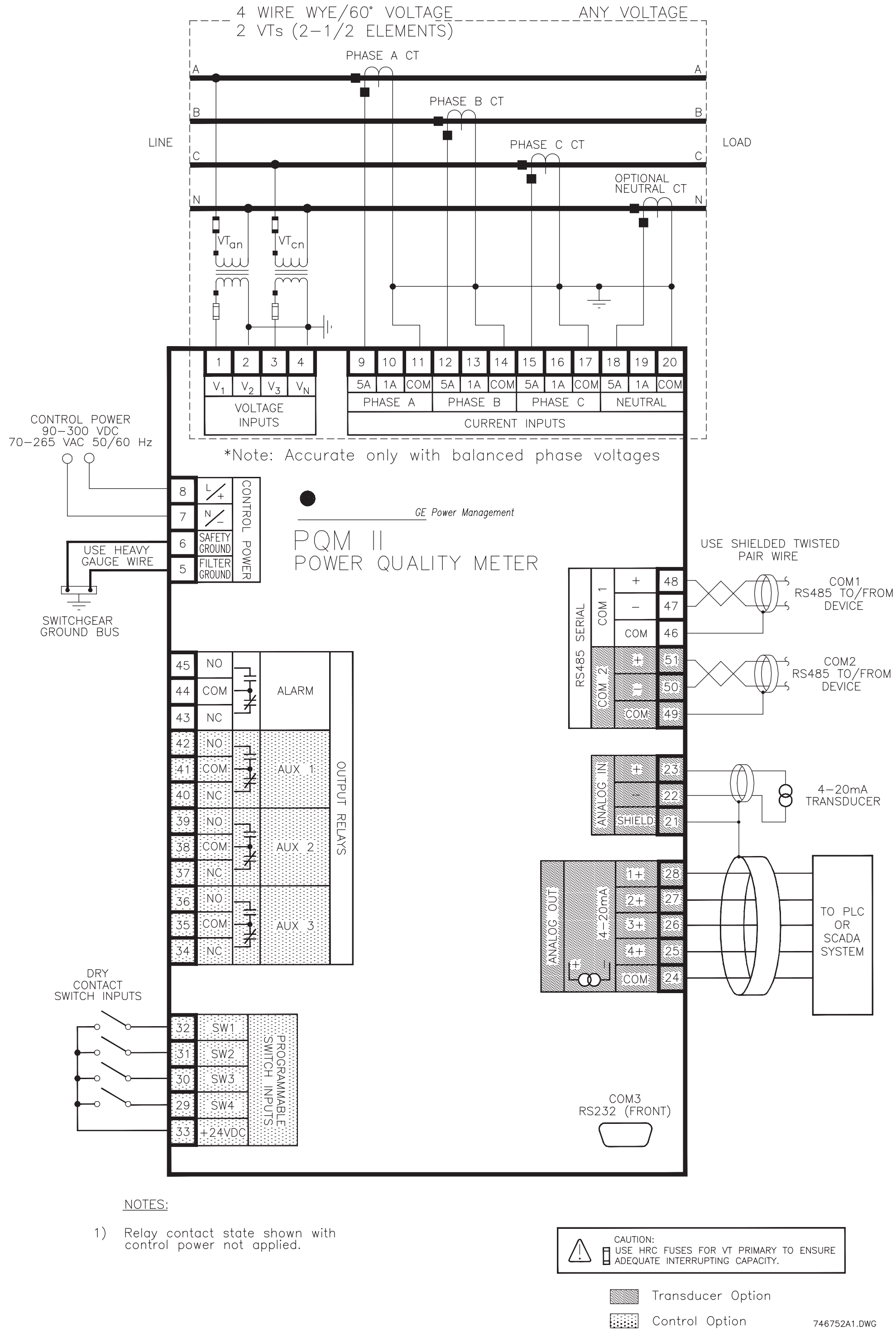


FIGURE 2–4: Wiring Diagram 4-wire Wye (2 VTs)

Four-wire systems with voltages 347 V L-N or less can be directly connected to the PQMII without VTs. Select the **S2 SYSTEM SETUP ⇨⇩ CURRENT/VOLTAGE CONFIGURATION ⇨⇩ VT WIRING: "4 WIRE WYE DIRECT"** setpoint.

The PQMII voltage inputs should be directly connected using HRC fuses rated at 2 A to ensure adequate interrupting capacity.

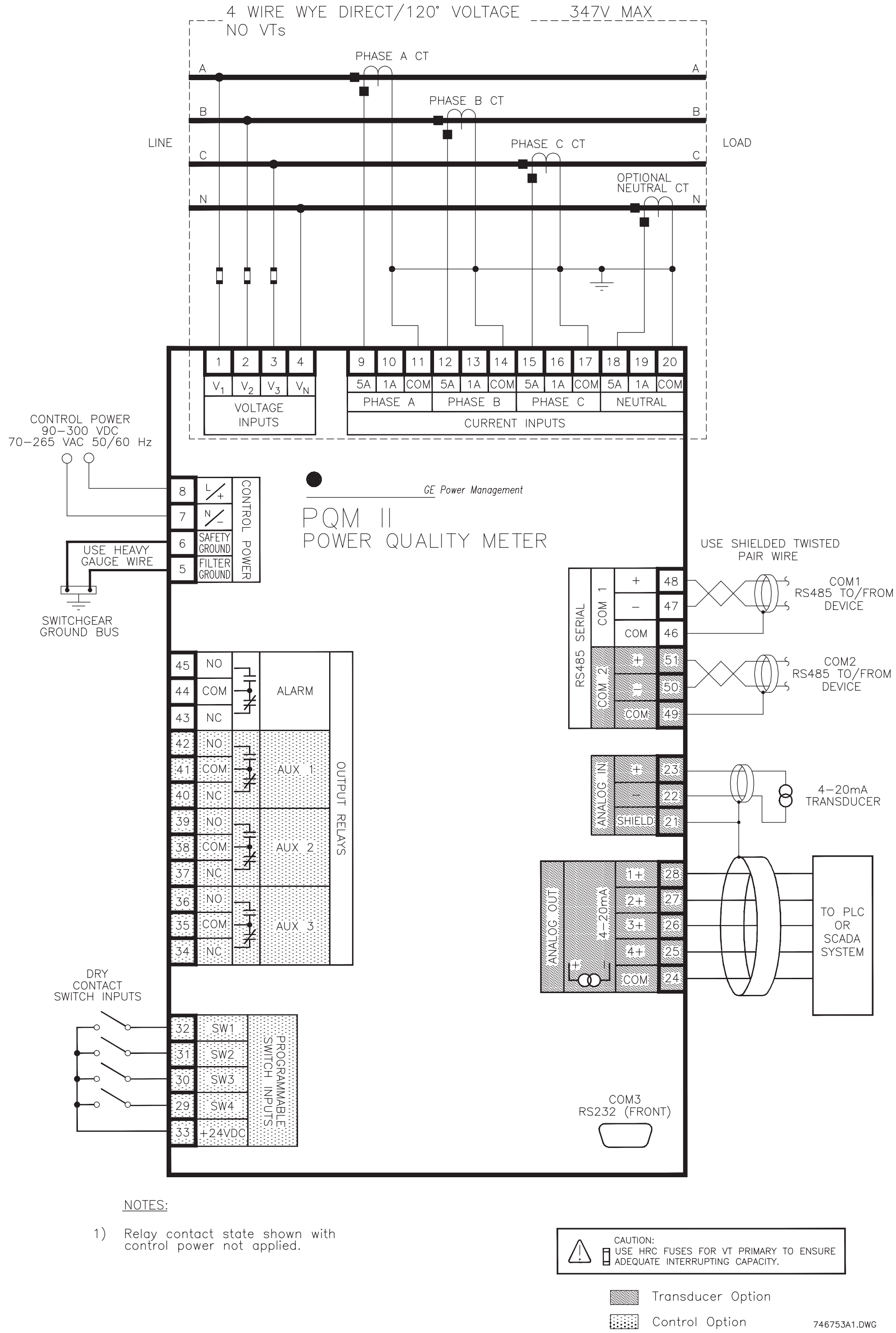


FIGURE 2–5: Wiring Diagram 4-wire Wye Direct (No VTs)

This diagram shows the typical 3-wire delta connection which will cover any voltage range. Select the **S2 SYSTEM SETUP ⇨⇩ CURRENT/VOLTAGE CONFIGURATION ⇨⇩ VT WIRING:** "3 WIRE DELTA (2 VTs)" setpoint.

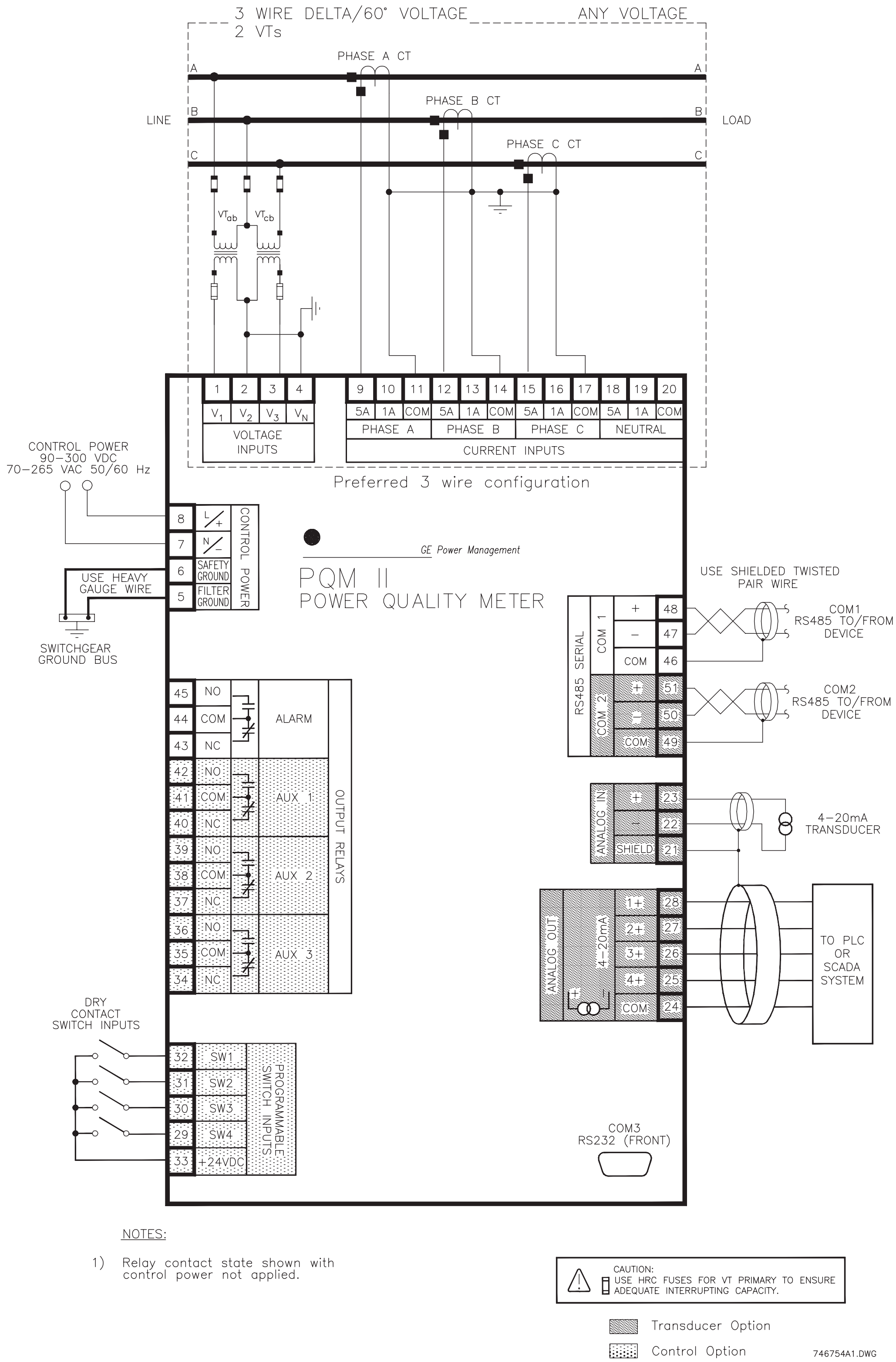


FIGURE 2–6: Wiring Diagram 3-wire Delta (2 VTs)

Three-wire systems with voltages 600 V (L-L) or less can be directly connected to the PQMII without VTs. Select the **S2 SYSTEM SETUP ⇨⇩ CURRENT/VOLTAGE CONFIGURATION ⇨⇩ VT WIRING: "3 WIRE DIRECT"** setpoint.

The PQMII voltage inputs should be directly connected using HRC fuses rated at 2 amps to ensure adequate interrupting capacity.

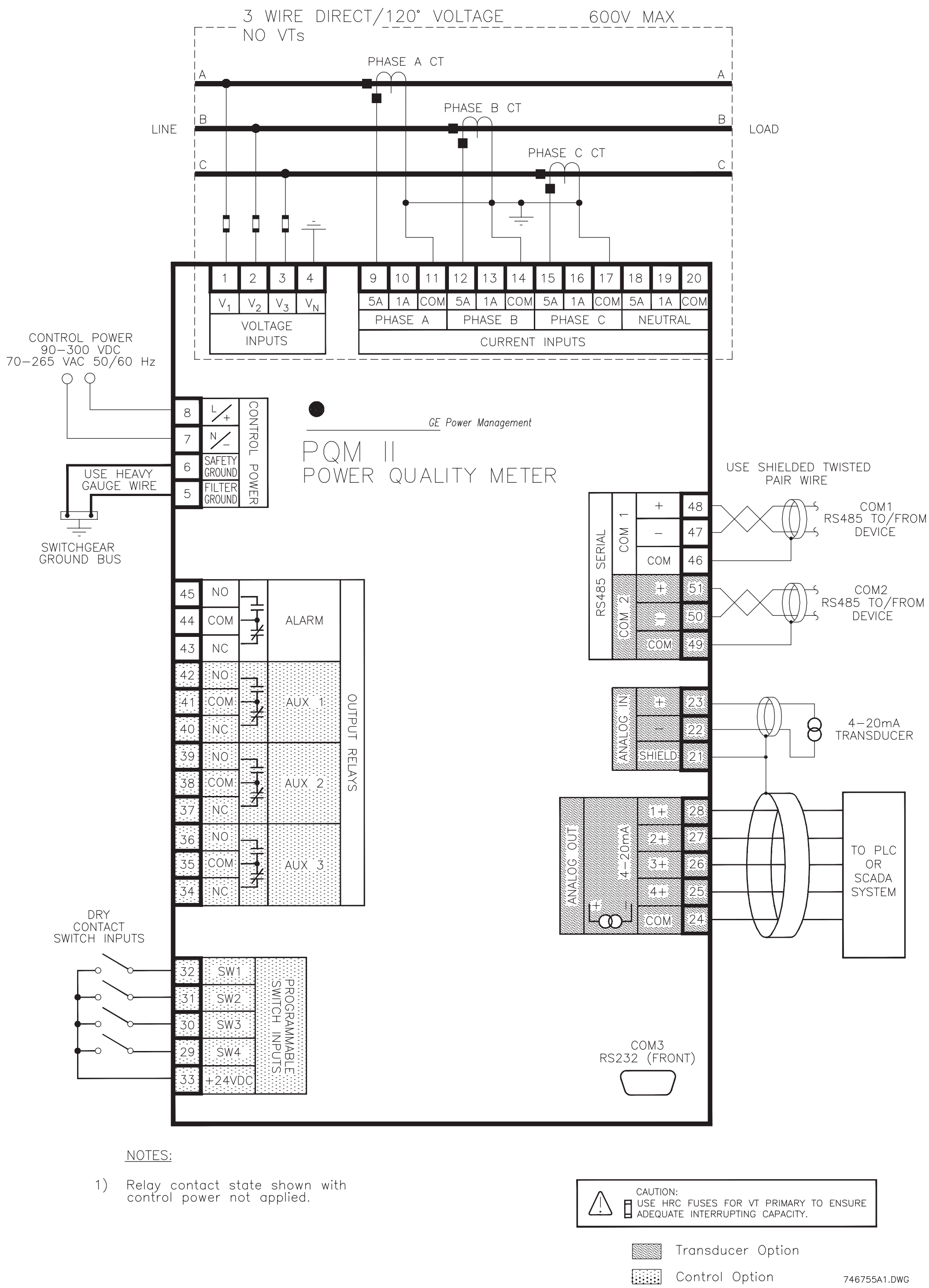


FIGURE 2–7: Wiring Diagram 3-wire Direct (No VTs)

For a single-phase connection, connect current and voltage to the phase A inputs only. All other inputs are ignored. Select the **S2 SYSTEM SETUP ⇨⇩ CURRENT/VOLTAGE CONFIGURATION ⇨⇩ VT WIRING:** "SINGLE PHASE" setpoint.

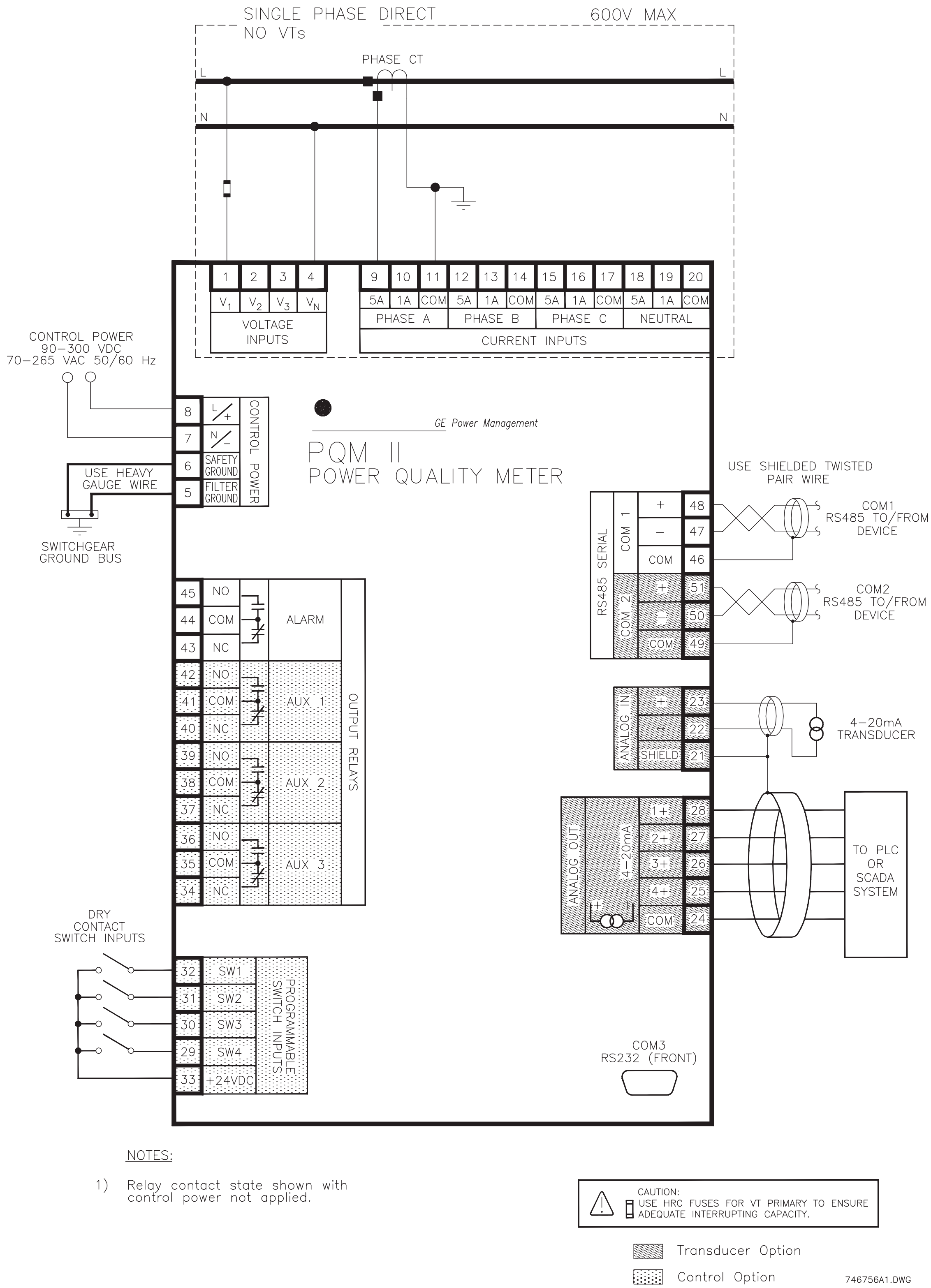


FIGURE 2–8: Single Phase Connection

2.2.3 3-wire System using Two CTs

The figure below shows two methods for connecting CTs to the PQMII for a 3-wire system. The top drawing shows the standard wiring configuration using three CTs. An alternate wiring configuration uses only two CTs. With the two CT method, the third phase is measured by connecting the commons from phase A and C to the phase B input on the PQMII. This causes the phase A and phase C current to flow through the PQMII's phase B CT in the opposite direction, producing a current equal to the actual phase B current.

Ia + Ib + Ic = 0 for a three wire system.
Ib = – (Ia + Ic)

For the CT connections above, the **S2 SYSTEM SETUP** ⇨⇩ **CURRENT/VOLTAGE CONFIGURATION** ⇨⇩ **PHASE CT WIRING** ⇨⇩ **PHASE CT PRIMARY** setpoint must be set to PHASE A, B, AND C.

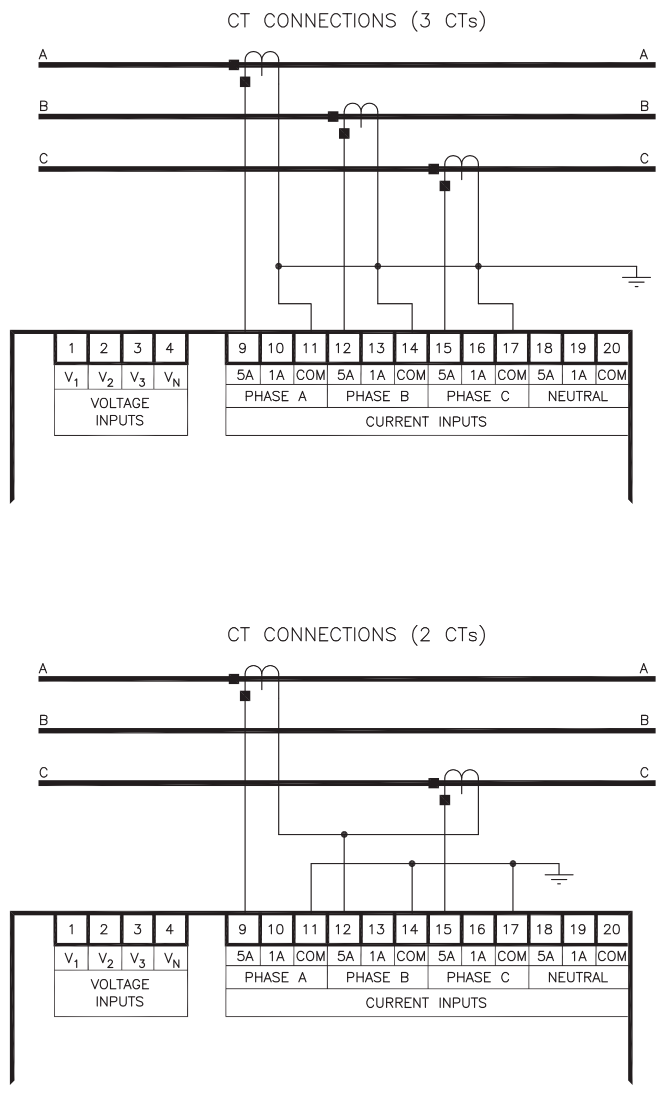


FIGURE 2–9: Alternate CT Connections for 3-wire System

2.2.4 Control Power

CAUTION

The control power supplied to the PQMII must match the installed power supply. If the applied voltage does not match, damage to the unit may occur. Check the product identification to verify the control voltage matches the intended application.

A universal AC/DC power supply is standard on the PQMII. It covers the range 90 to 300 V DC and 70 to 265 V AC at 50/60 Hz. It is not necessary to adjust the PQMII if the control voltage is within this range. A low voltage power supply is available as an option. It covers the range 20 to 60 V DC and 24 to 48 V AC at 50/60 Hz. Verify from the product identification label that the control voltage matches the intended application. Connect the control voltage input to a stable source for reliable operation. A 2.5 A HRC fuse is accessible from the back of the PQMII via the fuse access door. Consult the factory for replacement fuses, if required. Using #12 gauge wire or ground braid, connect Terminals 5 and 6 to a solid system ground, typically a copper bus in the switchgear. The PQMII incorporates extensive filtering and transient protection to ensure reliable operation under harsh industrial operating environments. Transient energy must be conducted back to the source through Filter Ground Terminal (5). The Filter Ground Terminal (5) is separated from the Safety Ground Terminal (6) to allow dielectric testing of switchgear with the PQMII wired up. Filter Ground Terminal connections must be removed during dielectric testing.

When properly installed, the PQMII meets the interference immunity requirements of IEC 801 and ANSI C37.90.1.

2.2.5 VT Inputs

The PQMII accepts input voltages from 0 to 600 V AC between the voltage inputs (V1, V2, V3) and voltage common (Vn). These inputs can be directly connected or supplied through external VTs. If voltages greater than 600 V AC are to be measured, external VTs are required. When measuring line-to-line quantities using inputs V1, V2, and V3, ensure that the voltage common input Vn is grounded. This input is used as a reference for measuring the voltage inputs.

All connections to the PQMII voltage inputs should be connected using HRC fuses rated at 2 Amps to ensure adequate interrupting capacity.

2.2.6 CT Inputs

Current transformer secondaries of 1 A or 5 A can be used with the PQMII for phase and neutral sensing. Each current input has 3 terminals: 5 A input, 1 A input, and common. Select either the 1 A or 5 A terminal and common to match the phase CT secondary. Correct polarity as indicated in the wiring diagrams is essential for correct measurement of all power quantities.

The CTs selected should be capable of supplying the required current to the total secondary load, including the PQMII burden of 0.1 VA at rated secondary current and the connection wiring burden.

All PQMII internal calculations are based on information measured at the CT and VT inputs. The accuracy specified in this manual assumes no error contribution from the external CTs and VTs. To ensure the greatest accuracy, Instrument class CTs and VTs are recommended.

2.2.7 Output Relays

The basic PQMII comes equipped with one output relay; the control option supplies three additional output relays. The PQMII output relays have form C contacts (normally open (NO), normally closed (NC), and common (COM)). The contact rating for each relay is 5 A resistive and 5 A inductive at 250 V AC. Consult *Specifications* on page 1–11 for contact ratings under other conditions. The wiring diagrams show the state of the relay contacts with no control power applied; that is, when the relays are not energized. Relay contact wiring depends on how the relay operation is programmed in the **S3 OUTPUT RELAYS** setpoint group (see *S3 Output Relays* on page 5–24 for details).

- **Alarm Relay (Terminals 43/44/45)**: A selected alarm condition activates the alarm relay. Alarms can be enabled or disabled for each feature to ensure only desired conditions cause an alarm. If an alarm is required when control power is not present, indicating that monitoring is not available, select “Fail-safe” operation for the alarm relay through the **S3 OUTPUT RELAYS** ⇨⇩ **ALARM RELAY** ⇨⇩ **ALARM OPERATION** setpoint. The NC/COM contacts are normally open going to a closed state on an alarm. If “Unlatched” mode is selected with setpoint **S3 OUTPUT RELAYS** ⇨⇩ **ALARM RELAY** ⇨⇩ **ALARM ACTIVATION**, the alarm relay automatically resets when the alarm condition disappears. For “Latched” mode, the key must be pressed (or serial port reset command received) to reset the alarm relay. Refer to *Alarms* on page 6–15 for all the displayed alarm messages.
- **Auxiliary Relays 1,2,3 (Optional; Terminals 34 to 42):** Additional output relays can be configured for most of the alarms listed in *Alarms* on page 6–15. When an alarm feature is assigned to an auxiliary relay, it acts as a control feature. When the setpoint is exceeded for a control feature, the output relay changes state and the appropriate Aux LED lights but no indication is given on the display. The auxiliary relays can also be programmed to function as kWh, kvarh, and kVAh pulse outputs.

2.2.8 Switch Inputs (Optional)

With the control (C) option installed the PQMII has four programmable switch inputs that can be used for numerous functions. The figure below shows the internal circuitry of the switches.

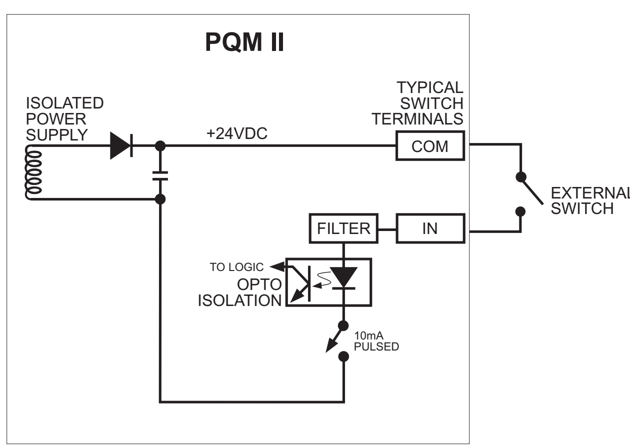


FIGURE 2–10: Switch Input Circuit

Each switch input can be programmed with a 20-character user defined name and can be selected to accept a normally open or normally closed switch. A list of various functions assignable to switches is shown below, followed by a description of each function.

- **Alarm Relay**: When a switch input is assigned to the alarm relay, a change in the switch status produces an alarm condition and the alarm relay activates.
- **Pulse Input 1/2/3/4**: When a switch input is assigned as a pulse input counter, the PQMII counts the number of transitions from open to closed when the input is configured as normally open and closed to open when the input is configured as normally closed. The minimum pulse width required for the PQMII to read the switch is 150 ms. Therefore, for the PQMII to read one pulse, the switch input must be in its inactive state (closed/open) for a minimum of 150 ms then in its active state (open/closed) for another 150 ms. See *Specifications* on page 1–11 for more details.
- **New Demand Period**: The PQMII can be used for load shedding by assigning a switch input to a new demand period. This allows the PQMII demand period to be synchronized with the utility meter. One of the billing parameters used by a utility is peak demand. By synchronizing the PQMII to the utility meter, the PQMII can monitor the demand level read by the utility meter and perform load shedding to prevent the demand from reaching the penalty level. The utility meter provides a dry contact output which can be connected to one of the PQMII switch inputs. When the PQMII senses a contact closure, it starts a new demand period (with Block Interval Demand calculation only).
- **Setpoint Access**: The access terminals must be shorted together in order for the faceplate keypad to have the ability to store new setpoints. Typically the access terminals are connected to a security keyswitch to allow authorized access only. Serial port commands to store new setpoints operate even if the access terminals are not shorted. When the access terminals are open, all actual and setpoint values can still be accessed for viewing; however, if an attempt is made to store a new setpoint value, the message **SETPOINT ACCESS DISABLED** is displayed and the previous setpoint remains intact. In this way, all of the programmed setpoints remain secure and tamper proof.
- **Select Analog Output**: This switch selection allows each analog output to be multiplexed into two outputs. If the switch is active, the parameter assigned in setpoint **S2 SYSTEM SETUP ⇨⇩ ANALOG OUTPUT 1 ⇨⇩ ANALOG OUTPUT 1 ALT** determines the output level. If the switch is not active, the parameter assigned in setpoint **S2 SYSTEM SETUP ⇨⇩ ANALOG OUTPUT 1 ⇨⇩ ANALOG OUTPUT 1 MAIN** is used. See the following section and *Analog Outputs* on page 5–17 for additional details.
- **Select Analog Input**: This switch selection allows the analog input to be multiplexed into two inputs. If the switch is active, the parameter assigned in setpoint **S2 SYSTEM SETUP ⇨⇩ ANALOG INPUT ⇨⇩ ANALOG INPUT ALT** is used to scale the input. If the switch is not active, the parameter assigned in setpoint **S2 SYSTEM SETUP ⇨⇩ ANALOG INPUT ⇨⇩ ANALOG INPUT MAIN** is used. If a relay is assigned in **S2 SYSTEM SETUP ⇨⇩ ANALOG INPUT ⇨⇩ ANALOG IN MAIN/ALT SELECT RELAY**, that relay energizes when the switch is active and de-energizes when the switch is not active, thus providing the ability to feed in analog inputs from two separate sources as shown in the figure below. See the *Analog Input (Optional)* section below for details. Refer to *Analog Input* on page 5–20 for additional details.

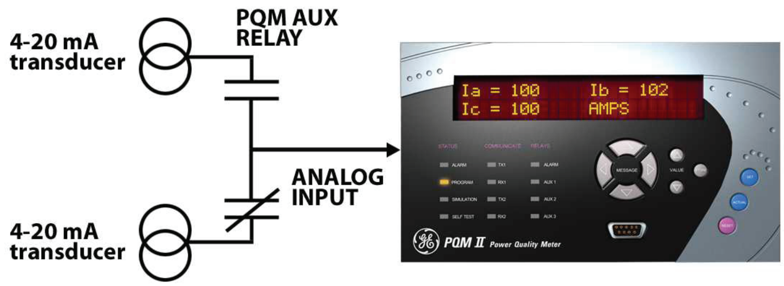


FIGURE 2–11: Analog Input Multiplexing

- **Aux 1/2/3 Relay**: When a switch input is assigned to an Auxiliary relay, a closure on the switch input causes the programmed auxiliary relay to change state. This selection is available only if the Control (C) option is installed.
- **Clear Energy**: When a switch input is assigned to “Clear Energy”, a closure on the switch input will clear all Energy data within the PQMII.
- **Clear Demand**: When a switch input is assigned to “Clear Demand”, a closure on the switch input will clear all Demand data within the PQMII.

2.2.9 Analog Outputs (Optional)

The PQMII has four current outputs when the transducer option is installed (T20 = 4 to 20 mA, T1 = 0 to 1 mA in the order code). These outputs can be multiplexed to produce 8 analog transducers. This output is a current source suitable for connection to a remote meter, chart recorder, programmable controller, or computer load. Use the 4 to 20 mA option with a programmable controller that has a 2 to 40 mA current input. If only a voltage input is available, use a scaling resistor at the PLC terminals to scale the current to the equivalent voltage. For example, install a 500 Ω resistor across the terminals of a 0 to 10 V input to make the 4 to 20 mA output correspond to 2 to 10 V (R = V/I = 10 V / 0.02 A = 500 Ω). Current levels are not affected by the total lead and load resistance which must not exceed 600 Ω for the 4 to 20 mA range and 2400 Ω for the 0 to 1 mA range. For readings greater than full scale the output will saturate at 22 mA (4 to 20 mA) or 1.1 mA (0 to 1 mA). These analog outputs are isolated and since all output terminals are floating, the connection of the analog output to a process input will not introduce a ground loop. Part of the system should be grounded for safety, typically at the programmable controller. For floating loads (such as a meter), ground Terminal 24 externally.

The outputs for these transducers can be selected from any of the measured parameters in the PQMII. The choice of output is selected in the **S2 SYSTEM SETUP ⇨⇩ ANALOG OUTPUT 1(4)** setpoints group. See *Analog Outputs* on page 5–17 for a list of available parameters. Each analog output can be assigned two parameters: a main parameter and an alternate parameter. Under normal operating conditions, the main parameter will appear at the output terminals. To select the alternate parameter, one of the switch inputs must be assigned to “SELECT ANALOG OUT” and the switch input must be closed (assuming normally closed activation). By opening and closing the switch input, two analog output parameters can be multiplexed on one output. This effectively achieves 8 analog outputs for the PQMII.

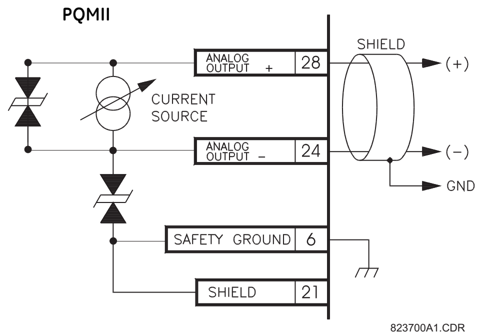


FIGURE 2–12: Analog Output

As shown in wiring diagrams, these outputs are at Terminals 25 to 28 and share Terminal 24 as their common. Shielded cable should be used, with only one end of the shield grounded, to minimize noise effects.

Signals and power supply circuitry are internally isolated, allowing connection to devices (PLCs, computers, etc.) at ground potentials different from the PQMII. Each terminal, however, is clamped to ±36 V to ground.

2.2.10 Analog Input (Optional)

Terminals 22(–) and 23(+) are provided for a current signal input. This current signal can be used to monitor any external quantity, such as transformer winding temperature, battery voltage, station service voltage, transformer tap position, etc. Any transducer output ranges within the range of 0 to 20 mA can be connected to the analog input terminals of the PQMII. See *Analog Input* on page 5–20 for details on programming the analog input.

2.2.11 RS485 Serial Ports

A fully loaded PQMII is equipped with three serial ports. COM1 is a RS485 port available at the rear terminals of the PQMII which is normally used as the main communications interface to the system. COM2, which is also a rear RS485 port, can be used for data collection, printing reports, or problem analysis without disturbing the main communications interface. COM3 is a front panel RS232 port that can be used for setpoint programming or recording using the EnerVista PQMII Setup Software.

A serial port provides communication capabilities between the PQMII and a remote computer, PLC, or distributed control system (DCS). Up to thirty-two PQMIIs can be daisy chained together with 24 AWG stranded, shielded, twisted-pair wire on a single communication channel. Suitable wire should have a characteristic impedance of 120 W (such as Belden #9841). These wires should be routed away from high power AC lines and other sources of electrical noise. The total length of the communications wiring should not exceed 4000 feet for reliable operation. Correct polarity is essential for the communications port to operate. Terminal (485+) of every PQMII in a serial communication link must be connected together. Similarly, the (485–) terminal of every PQMII must also be connected together. These polarities are specified for a 0 logic and should match the polarity of the master device. If the front panel RX1 or RX2 lights are flashing, this indicates that the PQMII is receiving data. If the front panel TX1 or TX2 lights are flashing, this indicates that the PQMII is transmitting data. Each PQMII must be daisy-chained to the next one as shown in the figure below. Avoid star or stub connected configurations. If a large difference in ground potentials exists, communication on the serial communication link will not be possible. Therefore, it is imperative that the serial master and PQMII are both at the same ground potential. This is accomplished by joining the RS485 ground terminal (Terminal 46 for COM1; Terminal 49 for COM2) of every unit together and grounding it at the master only.

The last PQMII in the chain and the master computer require a terminating resistor and terminating capacitor to ensure proper electrical matching of the loads and prevent communication errors. Using terminating resistors on all the PQMIIs would load down the communication network while omitting them at the ends could cause reflections resulting in communication errors. Install the 120 Ω, ¼ watt terminating resistor and 1 nF capacitor externally. Although any standard resistor and capacitor of these values are suitable, these components can also be ordered from GE Multilin as a combined terminating network.

Each communication link must have only one computer (PLC or DCS) issuing commands called the master. The master should be centrally located and can be used to view actual values and setpoints from each PQMII called the slave device. Other GE Multilin relays or devices using the Modbus RTU protocol can be connected to the communication link. Setpoints in each slave can also be changed from the master. Each PQMII in the link must be programmed with a different slave address prior to running communications using the **S1 PQMII SETUP ⇨⇩ COM1 RS485 SERIAL PORT ⇨⇩ MODBUS COMMUNICATION ADDRESS** setpoint. The GE Multilin EnerVista PQMII Setup Software may be used to view status, actual values, and setpoints. See Chapter 4: *Software* for more information on the EnerVista PQMII Setup Software.

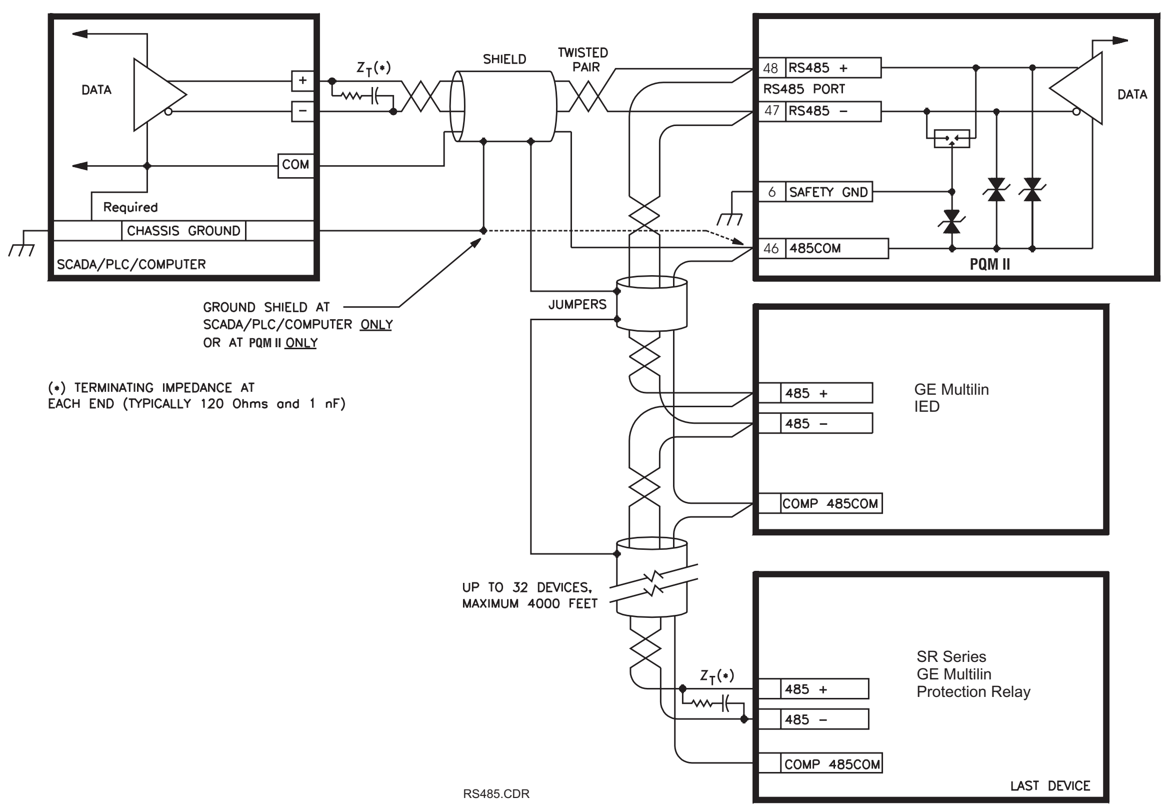


FIGURE 2–13: RS485 Communication Wiring

2.2.12 RS232 Front Panel Port

A 9-pin RS232C serial port provided on the front panel allows the user to program the PQMII with a personal computer. This port uses the same communication protocol as the rear terminal RS485 ports. To use this interface, the personal computer must be running the EnerVista PQMII Setup Software provided with the relay. Cabling to the RS232 port of the computer is shown below for both 9-pin and 25-pin connectors.

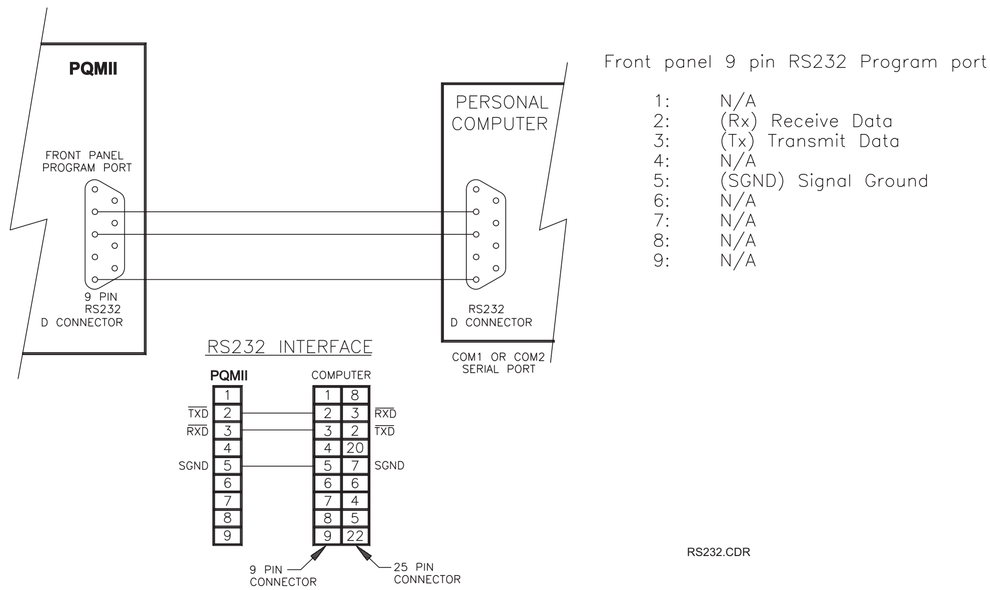


FIGURE 2–14: RS232 Connection

2.2.13 Dielectric Strength Testing

It may be required to test the complete switchgear for dielectric strength with the PQMII installed. This is also known as “flash” or “hipot” testing. The PQMII is rated for 1500 V AC isolation between relay contacts, CT inputs, VT inputs, control power inputs and Safety Ground Terminal 6. Some precautions are necessary to prevent damage to the PQMII during these tests.

Filter networks and transient protection clamps are used between the control power, serial port, switch inputs, analog outputs, analog input, and the filter ground terminal 5 to filter out high voltage transients, radio frequency interference (RFI) and electromagnetic interference (EMI). The filter capacitors and transient absorbers could be damaged by the continuous high voltages relative to ground that are applied during dielectric strength testing. Disconnect the Filter Ground (Terminal 5) during testing of the control power inputs. Relay contact and CT terminals do not require any special precautions. Do not perform dielectric strength testing on the serial ports, switch inputs, analog input or analog output terminals or the PQMII internal circuitry will be damaged.

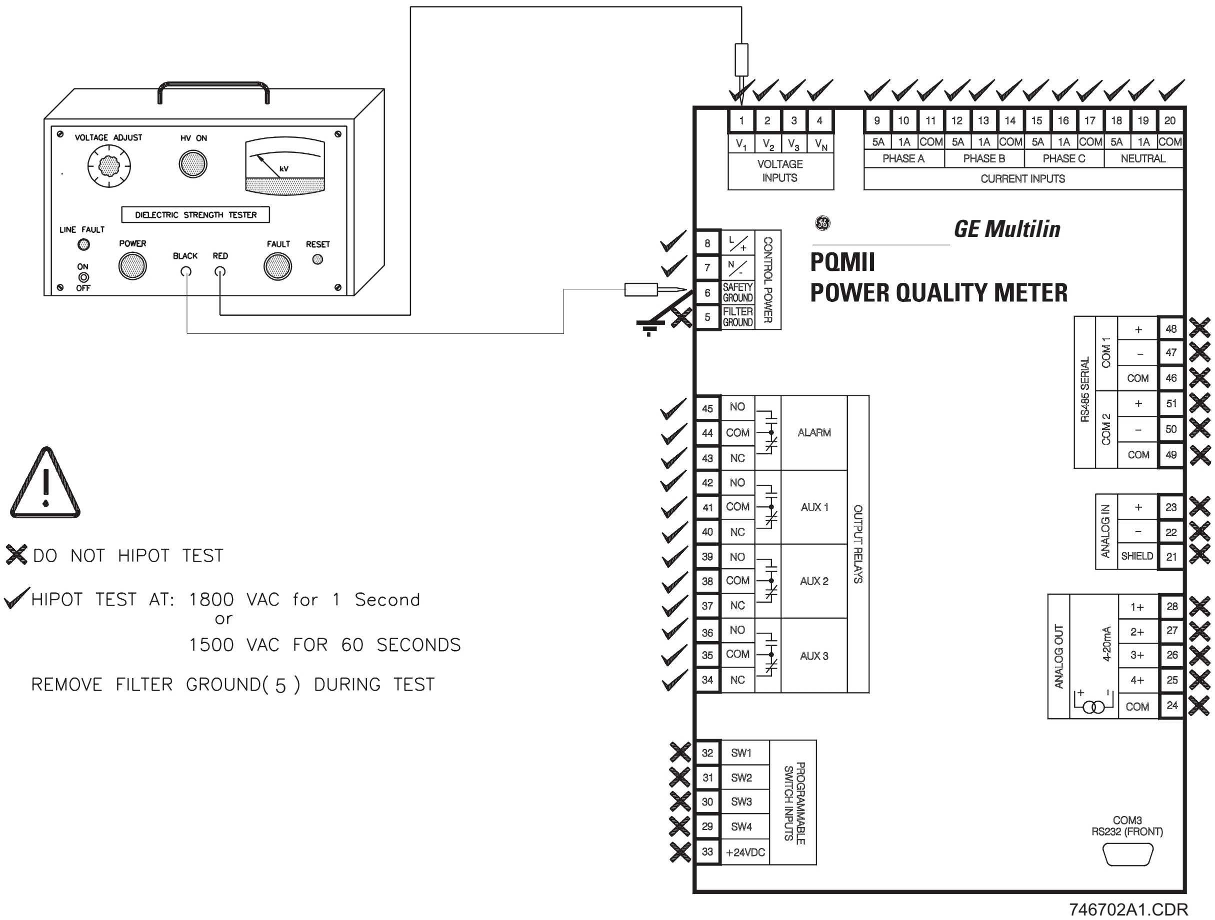


FIGURE 2–15: Hi-Pot Testing

GE Consumer & Industrial
Multilin

PQMII Power Quality Meter

Chapter 3: Operation

3.1 Front Panel and Display

3.1.1 Front Panel

The local operator interface for setpoint entry and monitoring of measured values is through the front panel as shown in the figure below. Control keys are used to select the appropriate message for entering setpoints or displaying measured values. Alarm and status messages are automatically displayed when required. Indicator LEDs provide important status information at all times. An RS232 communications port is also available for uploading or downloading information to the PQMII.

3.1.2 Display

All messages are displayed in English on the 40-character liquid crystal display. This display is visible under varied lighting conditions. When the keypad and display are not actively being used, the screen displays a default status message. This message appears if no key has been pressed for the time programmed in the **S1 PQMII SETUP** ⇨ **PREFERENCES** ⇨ **DEFAULT MESSAGE TIME** setpoint. Note that alarm condition messages automatically override the default messages.

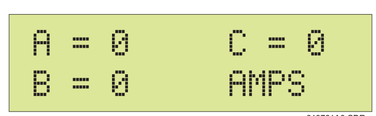


FIGURE 3–1: Display (example)

3.2 LED Indicators

3.2.1 Description

The LED status indicators provide a quick indication of the overall status of the PQMII. These indicators illuminate if an alarm is present, if setpoint access is enabled, if the PQMII is in simulation mode, or if there is a problem with the PQMII itself.

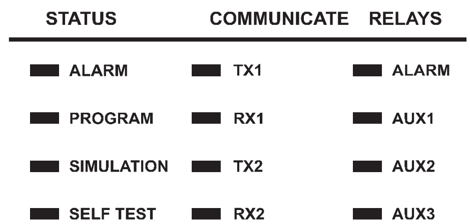


FIGURE 3–2: LED Indicators

3.2.2 Status

- **Alarm**: When an alarm condition exists, the Alarm LED indicator will flash.
- **Program**: The Program LED indicator is on when setpoint access is enabled.
- **Simulation**: The Simulation LED indicator will be on when the PQMII is using simulated values for current, voltage, analog input, switches and analog outputs. While in simulation mode, the PQMII will ignore the measured parameters detected at its inputs and will use the simulated values stored in the **S5 TESTING** ⇨⇩ **SIMULATION** setpoints group.
- **Self-Test**: Any abnormal condition detected during PQMII self-monitoring, such as a hardware failure, causes the Self Test LED indicator to be on. Loss of control power to the PQMII also causes the Self Test LED indicator to turn on, indicating that no metering is present.

3.2.3 Communicate

The Communicate LED indicators monitor the status of the RS485 communication ports. When no serial data is being received through the rear serial ports terminals, the RX1/2 LED indicators are off. This situation occurs if there is no connection, the serial wires become disconnected, or the master computer is inactive. If there is activity on the serial port but the PQMII is not receiving valid messages for its internally programmed address, the TX1/2 LED indicators remain off. This condition can be caused by incorrect message formats (such as baud rate or framing), reversed polarity of the two RS485 twisted-pair connections, or the master not sending the currently programmed PQMII address. If the PQMII is being periodically addressed with a valid message, the RX1/2 LED indicator will turn on followed by the TX1/2 LED indicator.

- **TX1**: The PQMII is transmitting information via the COM1 RS485 communications port when lit.
- **RX1**: The PQMII is receiving information via the COM1 RS485 communications port when lit.

- **TX2**: The PQMII is transmitting information via the COM2 RS485 communications port when lit.
- **RX2**: The PQMII is receiving information via the COM2 RS485 communications port when lit.

3.2.4 Relays

The status of the output relays is displayed with these LED indicators.

- **Alarm**: The Alarm relay is intended for general purpose alarm outputs. This indicator will be on while the Alarm relay is operating. When the condition clears, the Alarm LED indicator turns off. If the alarm relay has been programmed as "Latched", the alarm condition can only be cleared by pressing the **RESET** key or by issuing a computer reset command.
- **Aux1**: The Aux 1 relay is intended for control and customer specific requirements. The Aux1 LED indicator is on while the Auxiliary 1 relay is operating.
- **Aux2**: The Aux 2 relay is intended for control and customer specific requirements. The Aux2 LED indicator is on while the Auxiliary 2 relay is operating.
- **Aux3**: The Aux 3 relay is intended for control and customer specific requirements. The Aux3 LED indicator is on while the Auxiliary 3 relay is operating.

3.3 Keypad

3.3.1 Description

The front panel keypad allows direct access to PQMII functionality. The keys are used to navigate through message pages, allowing the user to modify settings and view actual values from the device location.

3.3.2 Menu Key

Setpoints and actual values are arranged into two distinct groups of messages. The **MENU** key selects the main setpoints or actual values page. Pressing **MENU** while in the middle of a setpoints or actual values page returns the display to the main setpoints or actual values page. The **MESSAGE** keys select messages within a page.

3.3.3 Escape Key

Pressing the **ESCAPE** key during any setpoints or actual values message returns the user to the previous message level. Continually pressing **ESCAPE** will return the user back to the main setpoints or actual values page.

3.3.4 Enter Key

When programming setpoints, enter the new value by using the **VALUE** keys, followed by the **ENTER** key. Setpoint programming must be enabled for the **ENTER** key to store the edited value. An acknowledgment message will flash if the new setpoint is successfully saved in non-volatile memory. The **ENTER** key is also used to add and remove user defined default messages. Refer to *Default Messages* on page 3–5 for details.

3.3.5 Reset Key

The **RESET** key is used to clear the latched alarm and/or auxiliary conditions. Upon pressing the key, the PQMII will perform the appropriate action based on the condition present as shown in the table below.

Table 3–1: Reset Key Actions

Condition Present	Message Displayed	PQMII Action Performed
None	None	No action taken
Alarm	**RESET NOT POSSIBLE ALARM STILL PRESENT**	Alarm LED indicators and alarm relay remain on because condition is still present

Table 3–1: Reset Key Actions

Aux Relay	**RESET NOT POSSIBLE AUX CONDITION EXISTS**	Auxiliary LED indicator(s) and aux relay(s) remain on because condition is still present
Alarm and Aux Relay	**RESET NOT POSSIBLE AUX CONDITION EXISTS**	Auxiliary and Alarm LED indicators and alarm and aux relays remain on because condition is still present
Latched Alarm (condition no longer exists)	None	No message displayed, and Alarm LED indicators and the alarm relay turned off
Latched Aux Relay (condition no longer exists)	None	No message displayed, and appropriate Auxiliary LEDs and auxiliary relay(s) turned off
Alarm and Latched Aux Relay (Aux condition no longer exists)	None	No message displayed, and appropriate Auxiliary LEDs and auxiliary relay(s) turned off
Aux Relay and Latched Alarm (alarm condition no longer exists)	None	No message displayed, and Alarm LEDs and alarm relay turned off

The **RESET** key, along with the **ENTER** key, is also used to remove user defined default messages. Refer to *Default Messages* on page 3–5 further details.

3.3.6 Message Keys

Use the **MESSAGE** keys to move between message groups within a page. The **MESSAGE DOWN** key moves toward the end of the page and the **MESSAGE UP** key moves toward the beginning of the page. A page header message will appear at the beginning of each page and a page footer message will appear at the end of each page. To enter a subgroup, press the **MESSAGE RIGHT** key. To back out of the subgroup, press the **MESSAGE LEFT** key.

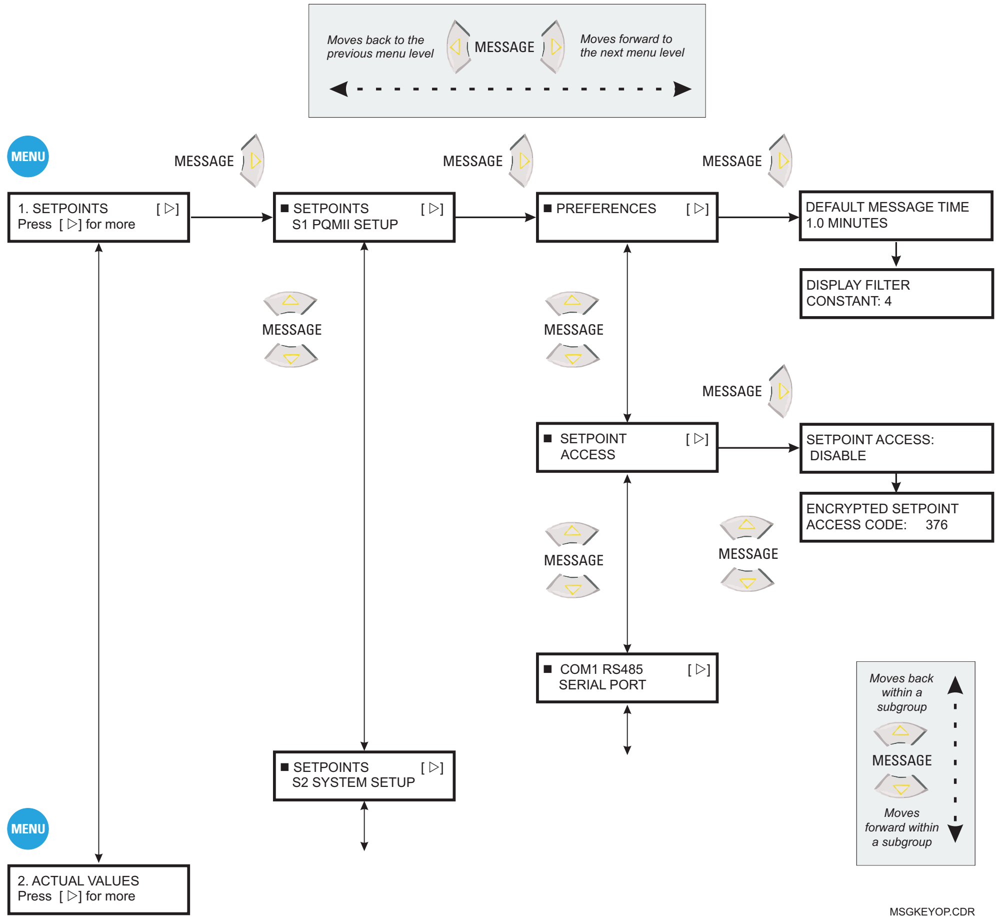


FIGURE 3–3: Message Key Operation

3.3.7 Value Keys

Setpoint values are entered using the **VALUE** keys. When a setpoint is displayed calling for a yes/no response, each time a **VALUE** key is pressed, the "Yes" becomes a "No," or the "No" becomes a "Yes." Similarly, for multiple choice selections, each time a **VALUE** key is pressed, the next choice is displayed. When numeric values are displayed, each time **VALUE UP** is pressed, the value increases by the step increment, up to the maximum. Hold the key down to rapidly change the value.

3.3.8 Data Entry Methods

- **Keypad Entry**: Press the MENU key once to display the first page of setpoints Press the MESSAGE RIGHT key to select successive setpoints pages. The page number and page title appear on the second line. All setpoint page headers are numbered with an 'S' prefix. Actual value page headers are numbered with an 'A' prefix.

  The messages are organized into logical subgroups within each Setpoints and Actual Values page as shown below.

Press the MESSAGE keys when displaying a subgroup to access messages within that subgroup. Otherwise select the MESSAGE keys to display the next subgroup.

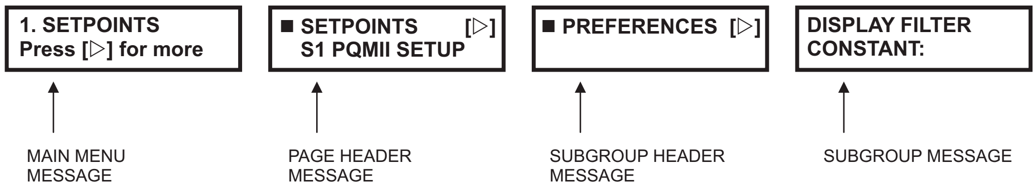


FIGURE 3–4: Message Hierarchy Example

- **Computer Entry**: When running the EnerVista PQMII Setup Software, setpoint values are accessed through the menu bar and displayed in a series of windows. See Chapter 4: *Software* for further details.
- **SCADA Entry**: Details of the complete communication protocol for reading and writing setpoints are given in Chapter 7: *Communications*. A SCADA system connected to the RS485 terminals can be custom programmed to make use of any of the communication commands for remote setpoint programming, monitoring, and control.

3.3.9 Setpoint Access Security

The PQMII incorporates software security to provide protection against unauthorized setpoint changes. A numeric access code must be entered to program new setpoints using the front panel keys. To enable the setpoint access security feature, the user must enter a value in the range of 1 to 999. The factory default access code is 1. If the switch option is installed in the PQMII, a hardware jumper access can be assigned to a switch input. Setpoint access can then only be enabled if the switch input is shorted and the correct software access code entered. Attempts to enter a new setpoint without the electrical connection across the setpoint access terminals or without the correct access code will result in an error message. When setpoint programming is via a computer, no setpoint access jumper is required. If a SCADA system is used for PQMII programming, it is up to the programmer to design in appropriate passcode security.

3.4 Default Messages

3.4.1 Description

Up to 10 default messages can be selected to display sequentially when the PQMII is left unattended. If no keys are pressed for the default message time in the **S1 PQMII SETUP ⇨ PREFERENCES ⇨ DEFAULT MESSAGE TIME** setpoint, then the currently displayed message will automatically be overwritten by the first default message. After three seconds, the next default message in the sequence will display if more than one is selected. Alarm messages will override the default message display. Any setpoint or measured value can be selected as a default message.

Messages are displayed in the order they are selected.

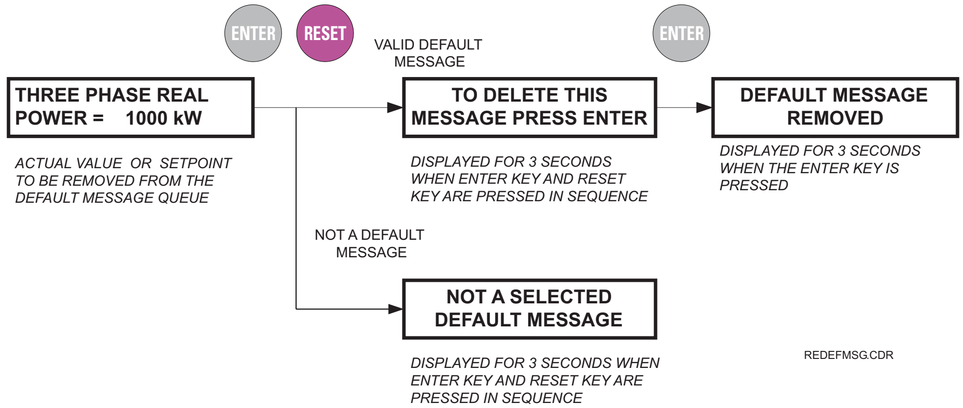
3.4.2 Adding a Default Message

Use the **MESSAGE** keys to display any setpoint or actual value message to be added to the default message queue and follow the steps shown below. When selecting a setpoint message for display as a default, do not modify the value using the **VALUE** keys or the PQMII will recognize the **ENTER** key as storing a setpoint instead of selecting a default message

If 10 default messages are already selected, the first message is erased and the new message is added to the end of the queue.

3.4.3 Deleting a Default Message

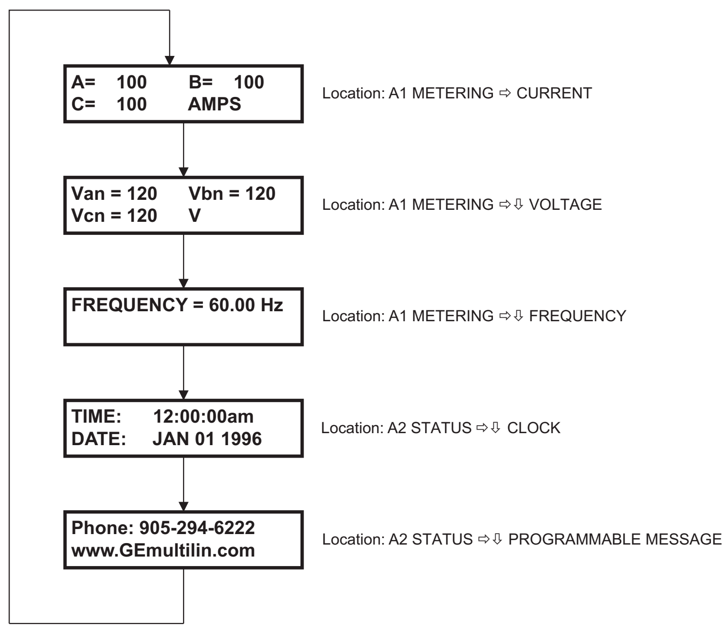
Use the **MESSAGE** keys to display the default message to be erased. If default messages are not known, wait until the PQMII starts to display them and then write them down. Use the **MESSAGE** keys to display the setpoint or actual value message to be deleted from the default message queue and follow the steps below.



3.4.4 Default Message Sequence

Each PQMII is pre-programmed with five default messages as shown below. Note, each time the factory setpoints are reloaded the user programmed default messages are overwritten with these messages.

The PQMII will scroll through the default messages in the sequence shown.



GE Consumer & Industrial
Multilin

PQMII Power Quality Meter

Chapter 4: Software

4.1 Introduction

4.1.1 Overview

Although setpoints can be manually entered using the front panel keys, it is far more efficient and easier to use a computer to download values through the communications port. The no-charge EnerVista PQMII Setup Software included with the PQMII makes this a quick and convenient process. With the EnerVista PQMII Setup Software running on your PC, it is possible to:

- Program and modify setpoints
- Load/save setpoint files from/to disk
- Read actual values and monitor status
- Perform waveform capture and log data
- Perform harmonic analysis
- Trigger trace memory
- Get help on any topic

The EnerVista PQMII Setup Software allows immediate access to all the features of the PQMII through pull-down menus in the familiar Windows environment. The software can also run without a PQMII connected. This allows you to edit and save setpoint files for later use. If a PQMII is connected to a serial port on a computer and communication is enabled, the PQMII can be programmed from the setpoint screens. In addition, measured values, status and alarm messages can be displayed with the actual screens.

4.1.2 Hardware

Communications from the EnerVista PQMII Setup Software to the PQMII can be accomplished three ways: RS232, RS485, and Ethernet (requires the MultiNET adapter) communications. The following figures below illustrate typical connections for RS232 and RS485 communications. For details on Ethernet communications, please see the MultiNET manual.

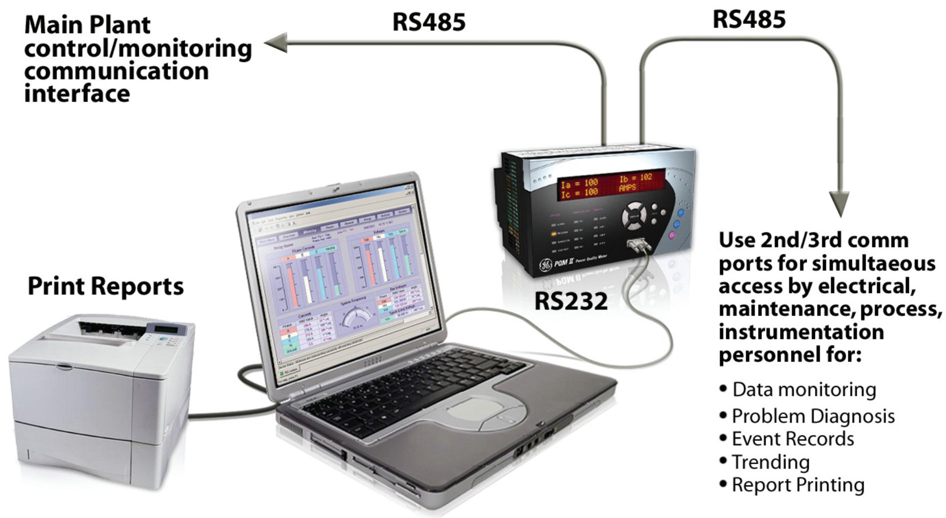


FIGURE 4–1: Communications using The Front RS232 Port

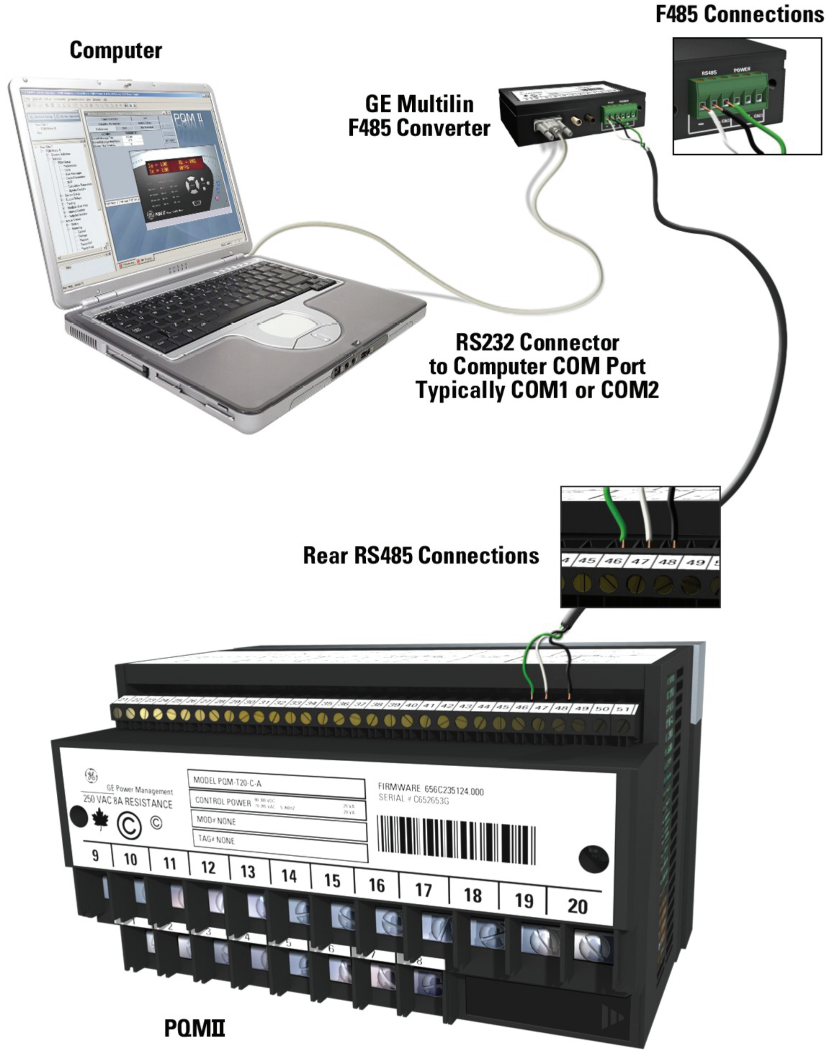


FIGURE 4–2: Communications using Rear RS485 Port

4.1.3 Installing the EnerVista PQMII Setup Software

The following minimum requirements must be met for the EnerVista PQMII Setup Software to operate on your computer.

- Microsoft Windows 95 or higher operating system
- 64 MB of RAM (256 MB recommended)
- Minimum of 50 MB hard disk space (200 MB recommended)

After ensuring these minimum requirements, use the following procedure to install the EnerVista PQMII Setup Software from the enclosed GE EnerVista CD.

▷ Insert the GE EnerVista CD into your CD-ROM drive.

▷ Click the **Install Now** button and follow the installation instructions to install the no-charge EnerVista software on the local PC.

▷ When installation is complete, start the EnerVista Launchpad application.

▷ Click the **IED Setup** section of the **Launch Pad** window.

▷ In the EnerVista Launch Pad window, click the **Install Software** button

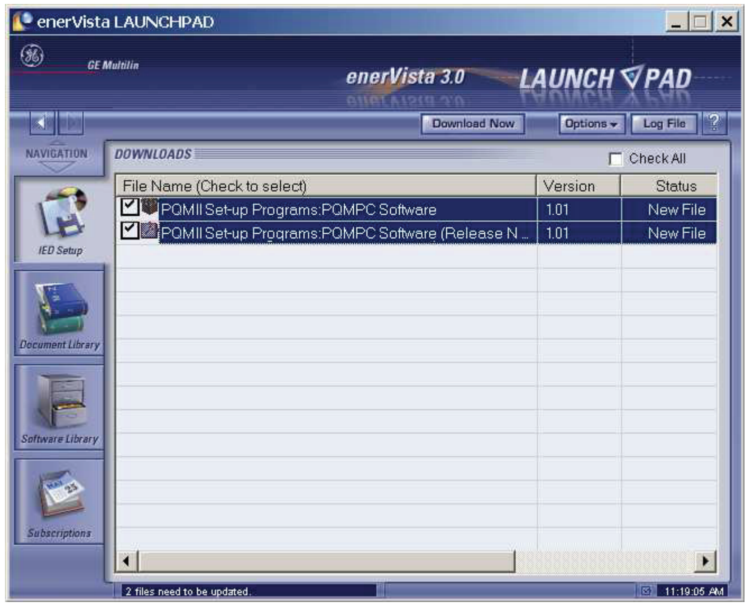
▷ Select the "PQMII Power Quality Meter" from the Install Software window as shown below.

▷ Select the "Web" option to ensure the most recent software release, or select "CD" if you do not have a web connection.

▷ Click the **Check Now** button to list software items for the PQMII.

▷ Select the PQMII software program and release notes (if desired) from the list.

▷ Click the **Download Now** button to obtain the installation program from the Web or CD.
EnerVista Launchpad will obtain the installation program.



▷ Once the download is complete, double-click the installation program to install the EnerVista PQMII Setup Software.
The program will request the user to create a backup 3.5" floppy-disk set. If this is desired, click on the **Start Copying** button; otherwise,

▷ Click on the **CONTINUE WITH PQMII VERSION 1.01 INSTALLATION** button.

▷ Select the complete path, including the new directory name, where the EnerVista PQMII Setup Software will be installed.

▷ Click on **Next** to begin the installation.
The files will be installed in the directory indicated and the installation program will automatically create icons and add EnerVista PQMII Setup Software to the Windows start menu.

▷ Click **Finish** to end the installation.
The PQMII device will be added to the list of installed IEDs in the EnerVista Launchpad window, as shown below.

4.2 Configuring Serial Communications

4.2.1 Description

Before starting, verify that the serial cable is properly connected to either the RS232 port on the front panel of the device (for RS232 communications) or to the RS485 terminals on the back of the device (for RS485 communications). See *Hardware* on page 4–1 for connection details.

- ▷ Install and start the latest version of the EnerVista PQMII Setup Software (available from the GE EnerVista CD). See the previous section for the installation procedure.
- ▷ Click on the **Device Setup** button to open the Device Setup window.
- ▷ Click the **Add Site** button to define a new site.
- ▷ Enter the desired site name in the **Site Name** field. If desired, a short description of site can also be entered along with the display order of devices defined for the site.
- ▷ Click the **OK** button when complete.
  The new site will appear in the upper-left list in the EnerVista PQMII Setup Software window.
- ▷ Click the **Add Device** button to define the new device.
- ▷ Enter the desired name in the **Device Name** field and a description (optional) of the site.
- ▷ Select “Serial” from the Interface drop-down list.
  This will display a number of interface parameters that must be entered for proper RS232 functionality.
- ▷ Enter the relay slave address and COM port values (from the S1 PQMII SETUP ⇨⇩ FRONT PANEL RS232 SERIAL PORT setpoints menu) in the Slave Address and COM Port fields.
- ▷ Enter the physical communications parameters (baud rate and parity settings) in their respective fields.
- ▷ Click the **Read Order Code** button to connect to the PQMII device and upload the order code.
  If a communications error occurs, ensure that the PQMII serial communications values entered in the previous step correspond to the relay setting values.
- ▷ Click **OK** when the relay order code has been received.
  The new device will be added to the Site List window (or Online window) located in the top left corner of the main EnerVista PQMII Setup Software window.

The PQMII Site Device has now been configured for serial communications.

4.3 Upgrading Firmware

4.3.1 Description

To upgrade the PQMII firmware, follow the procedures listed in this section. Upon successful completion of this procedure, the PQMII will have new firmware installed with the original setpoints.

The latest firmware files are available from the GE Multilin website at http://www.GEmultilin.com.

4.3.2 Saving Setpoints to a File

Before upgrading firmware, it is important to save the current PQMII settings to a file on your PC. After the firmware has been upgraded, it will be necessary to load this file back into the PQMII.

▷ To save setpoints to a file, select the **File > Read Device Settings** menu item.
The EnerVista PQMII Setup Software will read the device settings and prompt the user to save the setpoints file.

▷ Select an appropriate name and location for the setpoint file.

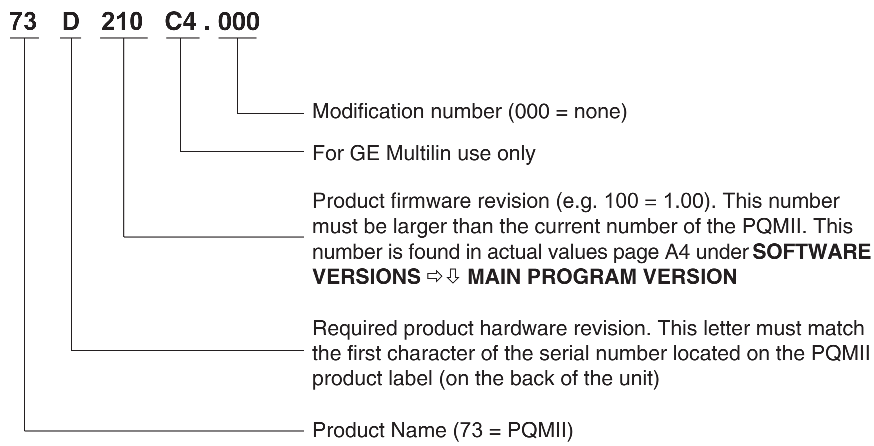
▷ Click **OK**.
The saved file will be added to the “Files” pane of the EnerVista PQMII Setup Software main window.

4.3.3 Loading New Firmware

▷ Select the **Commands > Upgrade Firmware** menu item.
A warning will appear.

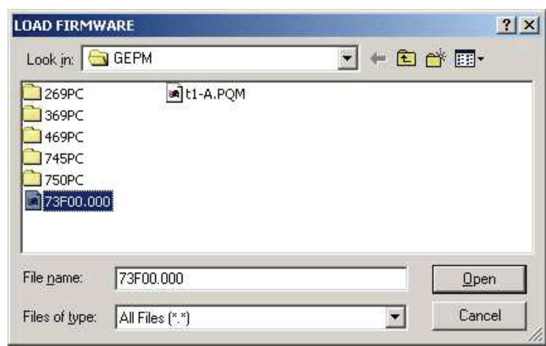
▷ Select **Yes** to proceed or **No** the abort the process.
Do not proceed unless you have saved the current setpoints as shown in the previous section.

▷ Locate the firmware file to load into the PQMII.
The firmware filename has the following format:



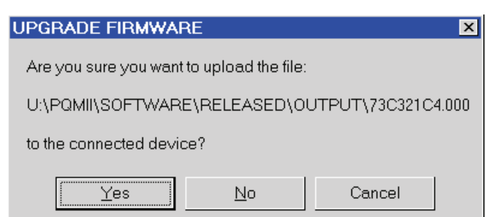
▷ Select the required file.

▷ Click on **OK** to proceed or **Cancel** to abort the firmware upgrade.



One final warning will appear. This will be the last chance to abort the firmware upgrade.

▷ Select **Yes** to proceed, **No** to load a different file, or **Cancel** to abort the process.



The EnerVista PQMII Setup Software now prepares the PQMII to receive the new firmware file. The PQMII will display a message indicating that it is in Upload Mode. While the file is being loaded into the PQMII, a status box appears showing how much of the new firmware file has been transferred and how much is remaining. The entire transfer process takes approximately five minutes.

The EnerVista PQMII Setup Software will notify the user when the PQMII has finished loading the file.

▷ **Carefully read any displayed messages and click OK to return the main screen.**

If the PQMII does not communicate with the EnerVista PQMII Setup Software, ensure that the following PQMII setpoints correspond with the EnerVista PQMII Setup Software settings:

MODBUS COMMUNICATION ADDRESS
BAUD RATE
PARITY (if applicable)

Also, ensure that the correct COM port is being used.

4.3.4 Loading Saved Setpoints

▷ Select the previously saved setpoints file from the File pane of the EnerVista PQMII Setup Software main window.

▷ Select the setpoint file to be loaded into the PQMII.

▷ Click **OK**.

▷ Select the **File > Edit Settings File Properties** menu item and change the file version of the setpoint file to match the firmware version of the PQMII.

▷ With the updated setpoint file selected in the File pane, select the **File > Write Settings to Device** menu item and select the target PQMII to receive the previously saved settings file.
A dialog box will appear to confirm the request to download setpoints.

▷ Click **Yes** to send the setpoints to the PQMII or **No** to end the process.

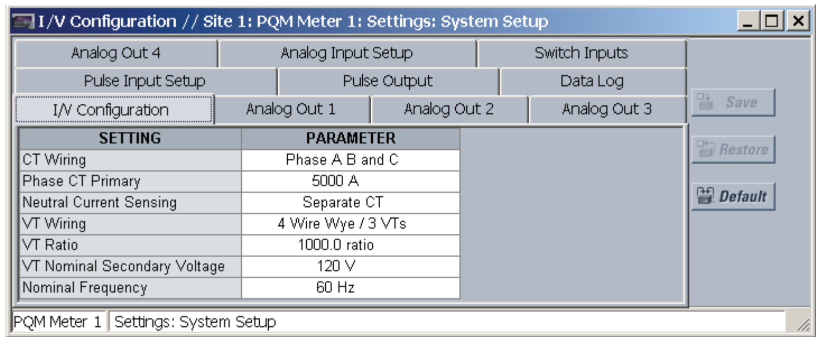
The EnerVista PQMII Setup Software will load the setpoint file into the PQMII. If new setpoints were added in the firmware upgrade, they will be set to factory defaults.

4.4 Using the EnerVista PQMII Setup Software

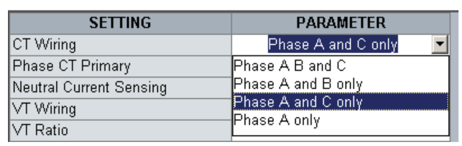
4.4.1 Entering Setpoints

The System Setup page will be used as an example to illustrate the entering of setpoints.

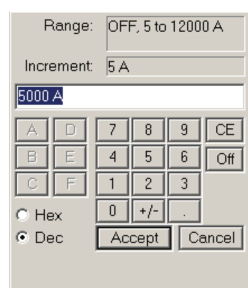
▷ Select the **Setpoint > System Setup** menu item. The following window will appear:



When a non-numeric setpoint such as **CT WIRING** is selected, EnerVista PQMII Setup Software displays a drop-down menu:



When a numeric setpoint such as **PHASE CT PRIMARY** is selected, EnerVista PQMII Setup Software displays a keypad that allows the user to enter a value within the setpoint range displayed near the top of the keypad:



▷ Click **Accept** to exit from the keypad and keep the new value. Click on **Cancel** to exit from the keypad and retain the old value.

▷ In the Setpoint / System Setup dialog box, click on **Store** to save the values into the PQMII.

▷ Click **OK** to accept any changes and exit the window.

▷ Click **Cancel** to retain previous values and exit.

4.4.2 Viewing Actual Values

If a PQMII is connected to a computer via the serial port, any measured value, status and alarm information can be displayed. Use the Actual pull-down menu to select various measured value screens. Monitored values will be displayed and continuously updated.

4.4.3 Setpoint Files

To print and save all the setpoints to a file follow the steps outlined in *Saving Setpoints to a File* on page 4–6.

To load an existing setpoints file to a PQMII and/or send the setpoints to the PQMII follow the steps outlined in *Loading Saved Setpoints* on page 4–7.

4.4.4 Getting Help

A detailed Help file is included with the EnerVista PQMII Setup Software.

Select the **Help > Contents** menu item to obtain an explanation of any feature, specifications, setpoint, actual value, etc. Context-sensitive help can also be activated by clicking on the desired function.

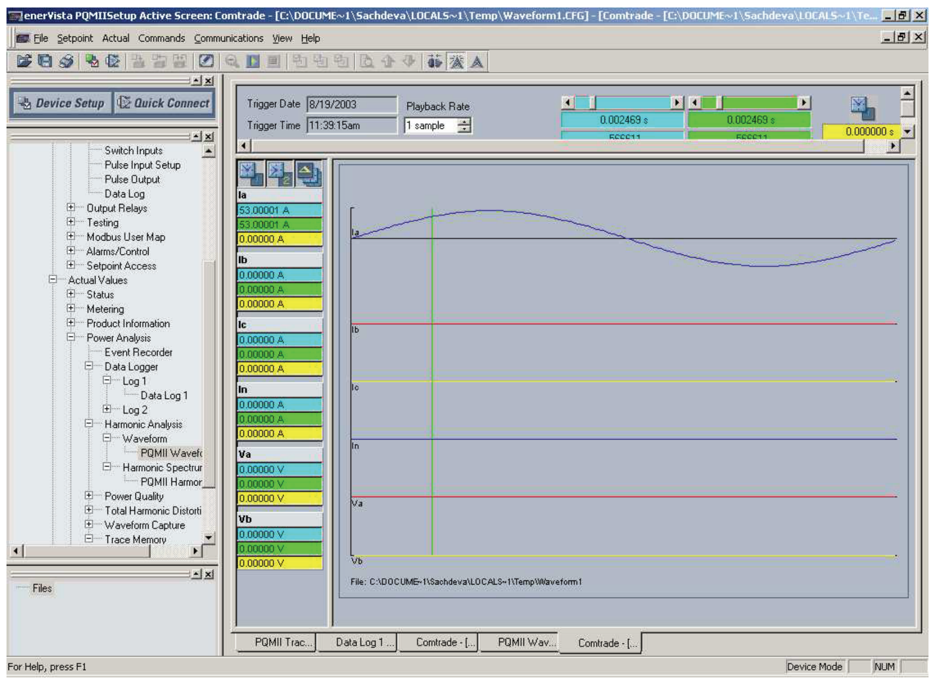
For easy reference, any topic can be printed by selecting **File > Print Topic** item from the Help file menu bar.

4.5 Power Analysis

4.5.1 Waveform Capture

Two cycles (64 samples/cycle) of voltage and current waveforms can be captured and displayed on a PC using the EnerVista PQMII Setup Software or third party software. Distorted peaks or notches from SCR switching provides clues for taking corrective action. Waveform capture is also a useful tool when investigating possible wiring problems due to its ability to display the phase relationship of the various inputs. The waveform capture feature is implemented into EnerVista PQMII Setup Software as shown below.

Select the **Actual > Power Analysis > Waveform Capture** menu item. The EnerVista PQMII Setup Software will open the Waveform Capture dialog box.



Select the buttons on the left to display the desired waveforms. The waveform values for the current cursor line position are displayed to the right of the selected buttons. Numerical values are displayed directly below the button.

4.5.2 Harmonic Analysis

Non-linear loads such as variable speed drives, computers, and electronic ballasts can cause harmonics which may lead to problems such as nuisance breaker tripping, telephone interference, transformer, capacitor or motor overheating. For fault diagnosis such as detecting undersized neutral wiring, need for a harmonic rated transformer or effectiveness of harmonic filters; details of the harmonic spectrum are useful and available with the PQMII and the EnerVista PQMII Setup Software.

The EnerVista PQMII Setup Software can perform a harmonic analysis on any of the four current inputs or any of the three voltage inputs by placing the PQMII in a high speed sampling mode (256 samples/cycle) where it will sample one cycle of the user defined parameter. EnerVista PQMII Setup Software then takes this data and performs a FFT (Fast Fourier Transform) to extract the harmonic information. The harmonic analysis feature is implemented into EnerVista PQMII Setup Software as shown below.

▷ Select the **Actual > Power Analysis > Harmonic Analysis > Harmonic Spectrum** menu item.
The EnerVista PQMII Setup Software can display the Harmonic Analysis Spectrum window including the harmonic spectrum up to and including the 62nd harmonic.

▷ Enter the trigger parameter for the **Select Trigger** setting.

▷ Click the **Select** button for the **Trigger** setting.
The Waveform capture window will appear.

▷ To display the harmonic spectrum, click the Harmonics button () on the top of the screen.

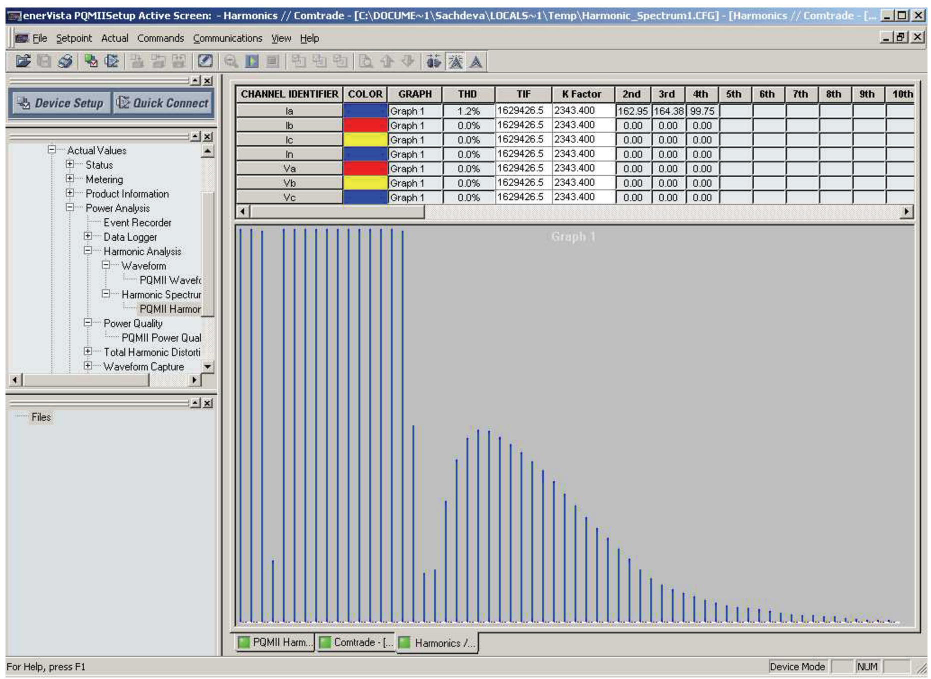


FIGURE 4–3: Harmonic Spectrum Display

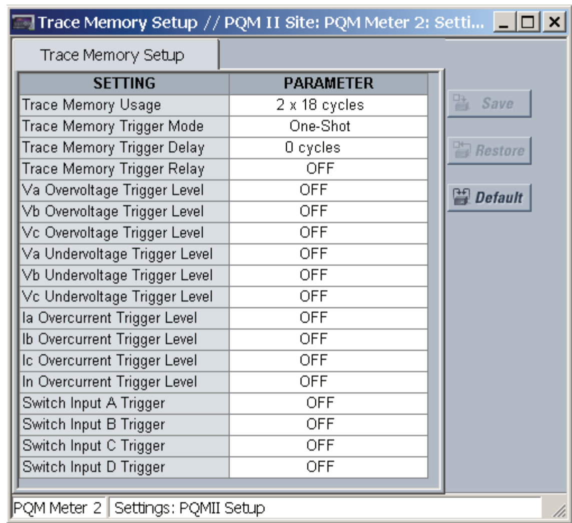
The window includes details of the currently selected harmonic and other harmonic analysis-related data (for example, THD, K Factor, etc.).

▷ Select **Read Last Trigger From Device** to load previous acquired spectra from the PQMII.

4.5.3 Trace Memory

The trace memory feature allows the PQMII to be setup to trigger on various conditions. The trace memory can record maximum of 36 cycles of data (16 samples per cycle) for all voltage and current inputs simultaneously. A Total Trace Triggers Counter has been implemented in the PQMII Memory Map at Register 0x0B83. This register will keep a running total of all valid Trace Memory Triggers from the last time power was applied to the PQMII. The Total Trace Triggers counter will rollover to 0 at 65536. The trace memory feature is implemented into the EnerVista PQMII Setup Software as shown below.

▷ Select the **Setpoint > PQMII Setup > Trace Memory Setup** menu item to setup the trace memory feature.



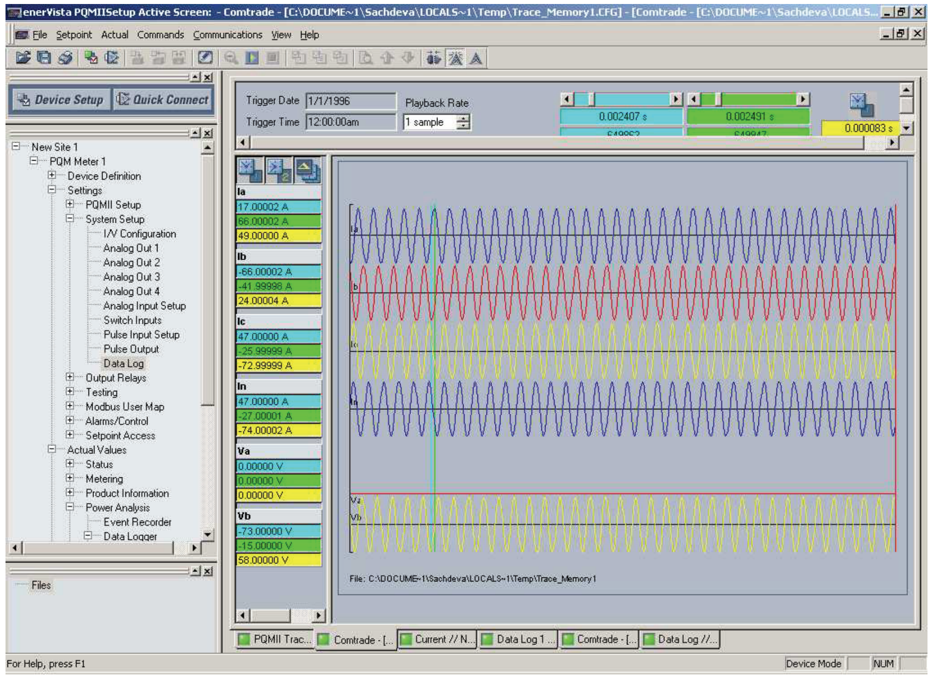
The **Trace Memory Usage** parameter is set as follows:

- 1 x 36 cycles: upon trigger, the entire buffer is filled with 36 cycles of data
- 2 x 18 cycles: 2 separate 18-cycle buffers are created and each is filled upon a trigger
- 3 x 12 cycles: 3 separate 12 cycle buffers are created and each is filled upon a trigger

If the **Trace Memory Trigger Mode** is set to “One-Shot”, then the trace memory is triggered once per buffer; if it is set to “Retrigger”, then it automatically retriggers and overwrites the previous data.

The **Trace Memory Trigger Delay** delays the trigger by the number of cycles specified. The Voltage, Current, and Switch Inputs selections are the parameters and levels that are used to trigger the trace memory. Clicking **Save** sends the current settings to the PQMII.

▷ Select the **Actual > Power Analysis > Trace Memory** menu item to view the trace memory data.
This launches the Trace Memory Waveform window.



4.5.4 Data Logger

The data logger feature allows the PQMII to continuously log various specified parameters at the specified rate. The data logger uses the 64 samples/cycle data. This feature is implemented into EnerVista PQMII Setup Software as shown below.

▷ Select the **Setpoint > System Setup > Data Log** menu item to setup the data logger feature.
This launches the Data Log settings box shown below. The state of each data logger and percent filled is shown.

▷ Use the **Start Log 1(2)** and **Stop Log 1(2)** buttons to start and stop the logs.

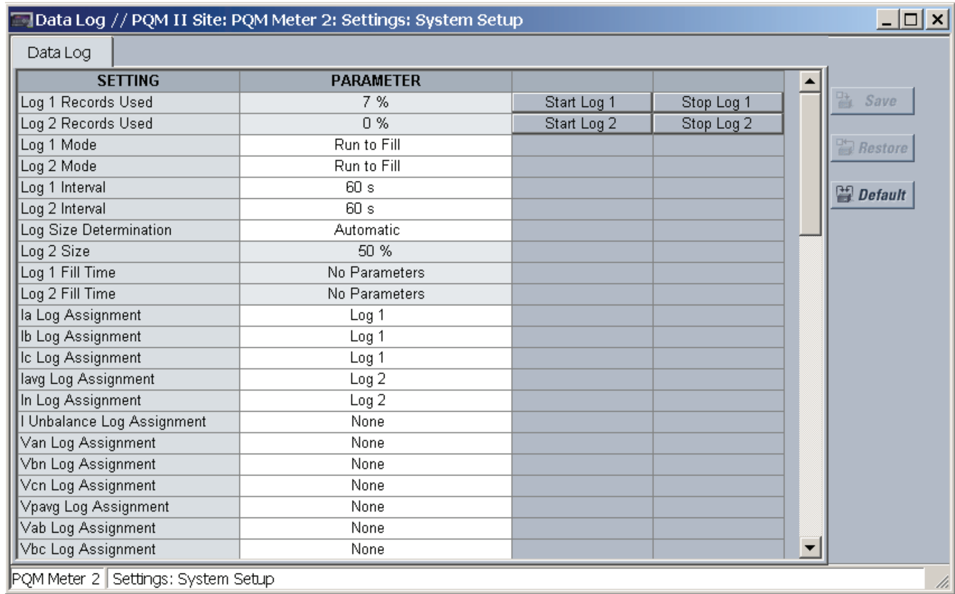


FIGURE 4–4: Data Logger Setup Window

1. The **Log 1(2) Mode** parameters are set as follows:
   - “Run to Fill”: when the data logger is full (100%) it will stop logging
   - “Circulate”: when the data logger is full, it will start from the beginning and overwrite the previous data.
2. The **Log 1(2) Interval** parameters determine how frequently the PQMII logs each piece of data.
3. The total log size is approximately 192KB. The allotment of this memory can be varied between the two logs to maximize the overall log time. Set the **Log Size Determination** to let the PQMII automatically optimize the memory. If desired, the optimization can also be performed manually by the user.
4. The **Log 1(2) Fill Time** parameters represent the amount of time the data logger takes to fill to 100%. This time is dependent on the logging interval and the number of parameters being logged.

▷ Set the parameters to be logged by setting the various **Log Assignment** parameters to the desired log.

▷ Select the **Actual > Power Analysis > Data Logger > Log 1** (or **Log 2**) item to view the respective data logger.

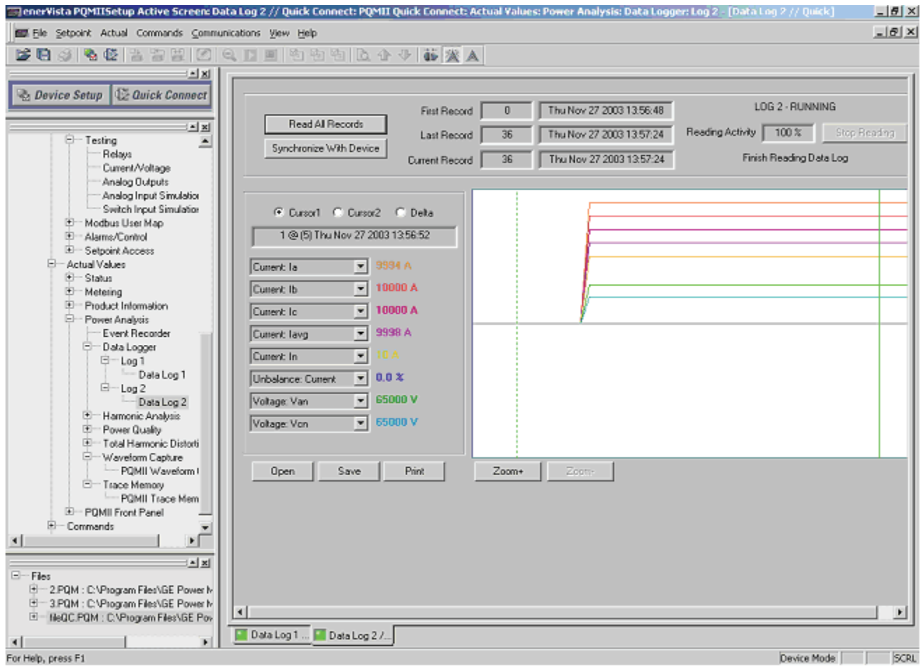


FIGURE 4–5: Data Logger Window

5. The Data Log 1(2) dialog box displays the record numbers, data log start time, the current time, and parameter values for the current cursor line position.

4.5.5 Voltage Disturbance Recorder

The Voltage Disturbance Recorder allows the PQMII to monitor and record sag and swell disturbances. This function can record up to 500 sag/swell events for all voltages simultaneously. The events roll-over and old events are lost when more than 500 events are recorded.

NOTE

PQMII VDR events are stored in volatile memory. Therefore, all voltage disturbance events will be cleared when control power is cycled to the meter.

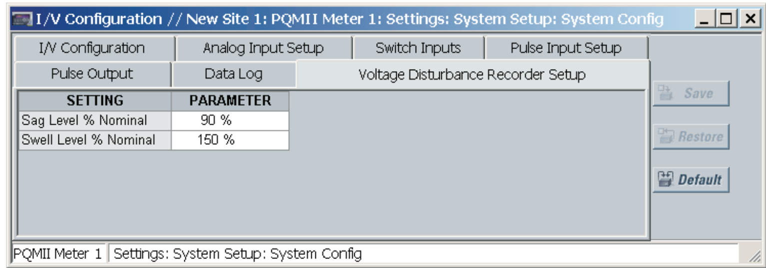
The operation of the voltage disturbance recorder as implemented in the EnerVista PQMII Setup Software is shown below:

▷ Select the **Setpoint > System Setup > System Config** menu item.

▷ Select the **Voltage Disturbance Recorder** Setup tab.

▷ The **Sag Level % Nominal** should be set to the level to which a voltage input must fall before a sag event is to be recorded. The **Swell Level % Nominal** should be set to the level to which a voltage input must rise before a swell event is to be recorded.

▷ Click **Save** to send the current settings to the PQMII.



▷ Select the **Actual > Power Analysis > Voltage Disturbance Recorder** menu item to view the voltage disturbance recorder events.

Within the voltage disturbance recorder window, each event is listed and can be selected. When the event is selected the following values are displayed:

- **Dist. Number**: The event number. The first event recorded (after the event recorder is cleared) will be given the event number of “1”. Each subsequent event will be given an incrementing event number. If the event number reaches 65535, the event number will rollover back to 1.
- **Dist. Type**: The type refers to the classification of the event (i.e. Sag, Swell, Undervoltage or, Overvoltage)
- **Dist. Source**: The source of the disturbance is the line/phase voltage that the disturbance was measured on.
- **Dist. Time/Date**: The time that the disturbance was recorded. Each disturbance is recorded at the end of the disturbance event.
- **Dist. Dur.**: The duration of the event in cycles.
- **Dist. Average Voltage**: The average RMS voltage recorded during the disturbance.

The **Clear Events** button clears the voltage disturbance recorder. Events are overwritten when the event recorder reaches 500 events.

The **Save** button exports the events to a CSV format file. A text file viewer can open and read the file.

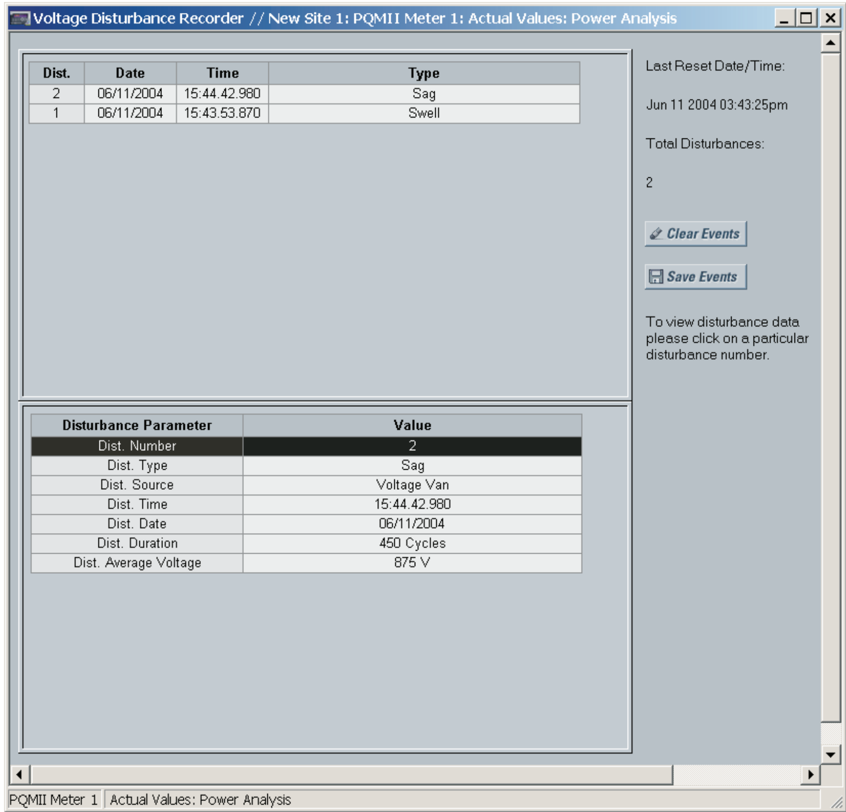


FIGURE 4–6: Voltage Disturbance Recorder

4.6 Using EnerVista Viewpoint with the PQMII

4.6.1 Plug and Play Example

EnerVista Viewpoint is an optional software package that puts critical PQMII information onto any PC with plug-and-play simplicity. EnerVista Viewpoint connects instantly to the PQMII via serial, ethernet or modem and automatically generates detailed overview, metering, power, demand, energy and analysis screens. Installing EnerVista Launchpad (see previous section) allows the user to install a fifteen-day trial version of EnerVista Viewpoint. After the fifteen day trial period you will need to purchase a license to continue using EnerVista Viewpoint. Information on license pricing can be found at http://www.enervista.com.

▷ Install the EnerVista Viewpoint software from the GE EnerVista CD.

▷ Ensure that the PQMII device has been properly configured for either serial or Ethernet communications (see previous sections for details).

▷ Click the **Viewpoint** window in EnerVista to log into EnerVista Viewpoint.
At this point, you will be required to provide a login and password if you have not already done so.

FIGURE 4–7: EnerVista Viewpoint Main Window

▷ Click the **Device Setup** button to open the Device Setup window.

▷ Click the **Add Site** button to define a new site.

▷ Enter the desired site name in the **Site Name** field.
If desired, a short description of site can also be entered along with the display order of devices defined for the site.

▷ Click the **OK** button when complete.
The new site will appear in the upper-left list in the EnerVista PQMII Setup Software window.

▷ Click the **Add Device** button to define the new device.

▷ Enter the desired name in the **Device Name** field and a description (optional) of the site.

▷ Select the appropriate communications interface (Ethernet or Serial) and fill in the required information for the PQMII.

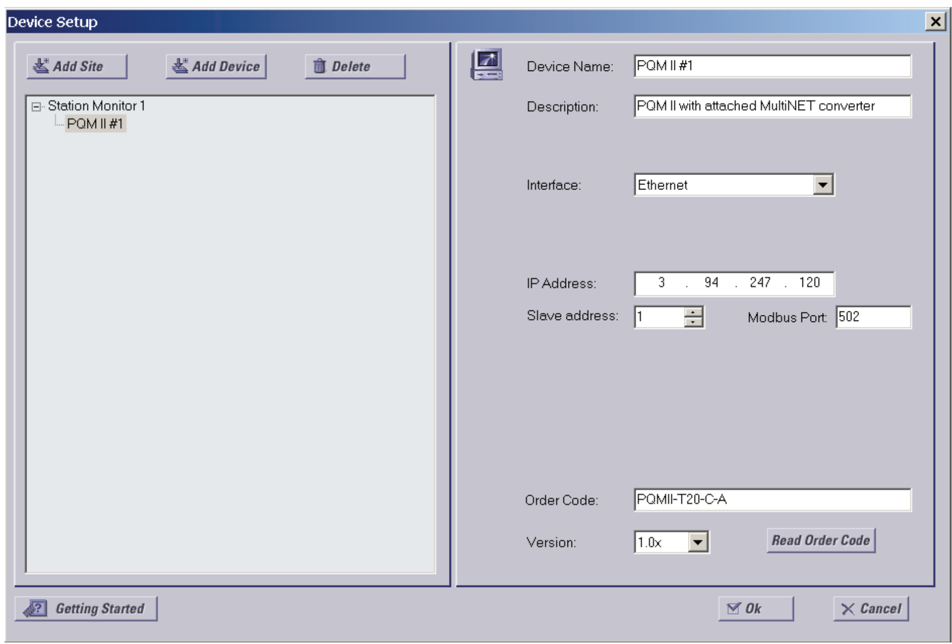


FIGURE 4–8: Device Setup Screen (Example)

▷ Click the **Read Order Code** button to connect to the PQMII device and upload the order code.
If a communications error occurs, ensure that communications values entered in the previous step correspond to the relay setting values.

▷ Click **OK** when complete.

▷ From the EnerVista main window, select the **IED Dashboard** item to open the Plug and Play IED dashboard.
An icon for the PQMII will be shown.

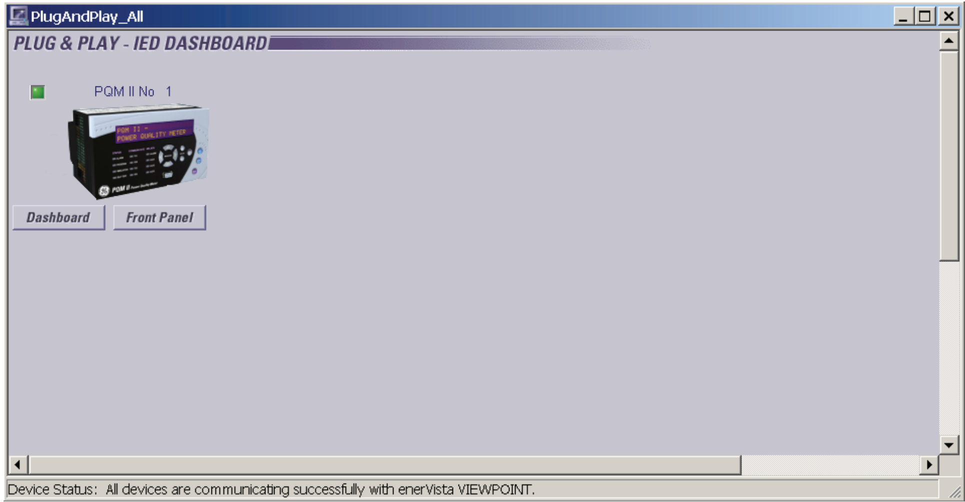


FIGURE 4–9: 'Plug and Play' Dashboard

▷ Click the **Dashboard** button below the PQMII icon to view the device information.
We have now successfully accessed our PQMII through EnerVista Viewpoint.

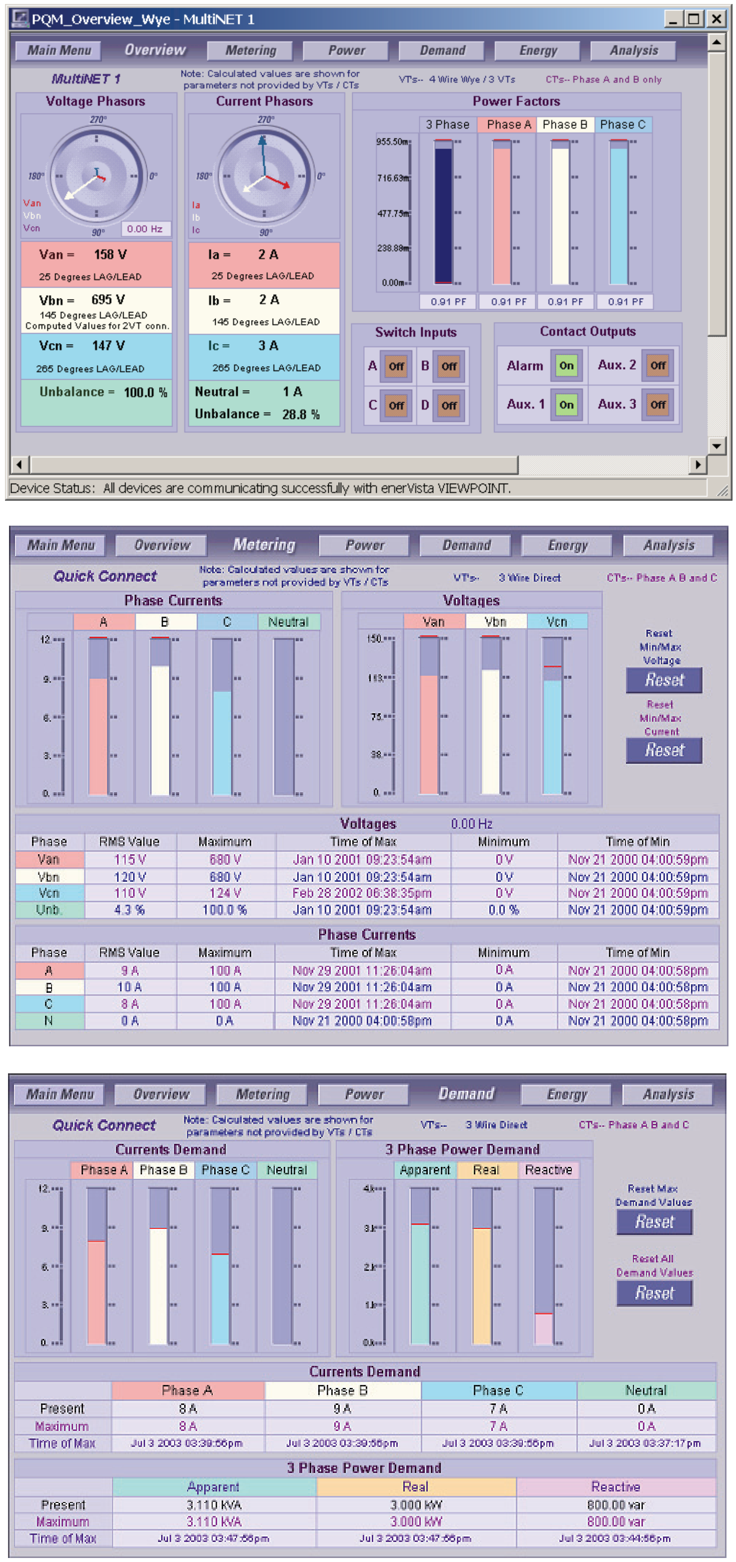


FIGURE 4–10: EnerVista Plug and Play Screens

For additional information on EnerVista viewpoint, please visit the EnerVista website at http://www.enervista.com.

GE Consumer & Industrial
Multilin

PQMII Power Quality Meter

Chapter 5: Setpoints

5.1 Introduction

5.1.1 Setpoint Entry Methods

Prior to operating the PQMII, it is necessary to program setpoints to define system characteristics and alarm settings by one of the following methods:

- Front panel, using the keys and display.
- Rear terminal RS485 port COM1 or COM2, or front RS232 port and a computer running the EnerVista PQMII Setup Software included with the PQMII, or from a SCADA system running user-defined software.

Either of the above methods can be used to enter the same information. However, a computer makes information entry considerably easier. Moreover, a computer allows setpoint files to be stored and downloaded for fast, error-free entry. The EnerVista PQMII Setup Software included with the PQMII facilitates this process. With this software, setpoints can be modified remotely and downloaded at a later time to the PQMII. Refer to Chapter 4: *Software* for additional details.

Setpoint messages are organized into logical groups or pages for easy reference. Messages may vary somewhat from those illustrated because of installed options, and messages associated with disabled features will be hidden. This context sensitive operation eliminates confusing detail. Before accurate monitoring can begin, the setpoints on each page should be worked through, entering values either by local keypad or computer.

The PQMII leaves the factory with setpoints programmed to default values. These values are shown in all setpoint message illustrations. Many of these factory default values can be left unchanged. At a minimum, however, setpoints that are shown shaded in *Current and Voltage Configuration* on page 5–15 must be entered for the system to function correctly. As a safeguard, the PQMII will alarm and lock-out until values have been entered for these setpoints. The **CRITICAL SETPOINTS NOT STORED** alarm message will be displayed until the PQMII is programmed with these critical setpoints.

5.1.2 Setpoints Main Menu

Key	Display	Reference
	■ SETPOINTS [▷] S1 PQMII SETUP	
	■ PREFERENCES [▷]	See page 5-4.
MESSAGE	■ SETPOINT [▷] ACCESS	See page 5-5.
MESSAGE	■ COM1 RS485 [▷] SERIAL PORT	See page 5-6.
MESSAGE	■ COM2 RS485 [▷] SERIAL PORT	See page 5-6.
MESSAGE	■ FRONT PANEL [▷] RS232 SERIAL PORT	See page 5-6.
MESSAGE	■ DNP 3.0 [▷] CONFIGURATION	See page 5-7.
MESSAGE	■ CLOCK [▷]	See page 5-7.
MESSAGE	■ CALCULATION [▷] PARAMETERS	See page 5-8.
MESSAGE	■ CLEAR DATA [▷]	See page 5-10.
MESSAGE	■ EVENT RECORDER [▷]	See page 5-11.
MESSAGE	■ TRACE MEMORY [▷]	See page 5-12.

MESSAGE ■ PROGRAMMABLE [▷] MESSAGE See page 5-14.

MESSAGE ■ PRODUCT [▷] OPTIONS See page 5-14.

MESSAGE ■ END OF PAGE S1 [▷]

MESSAGE

■ SETPOINTS [▷] S2 SYSTEM SETUP

■ CURRENT/ [▷] VOLTAGE CONFIG. See page 5-15.

MESSAGE ■ ANALOG [▷] OUTPUT 1 See page 5-17.

MESSAGE ■ ANALOG [▷] OUTPUT 2 See page 5-17.

MESSAGE ■ ANALOG [▷] OUTPUT 3 See page 5-17.

MESSAGE ■ ANALOG [▷] OUTPUT 4 See page 5-17.

MESSAGE ■ ANALOG INPUT [▷] See page 5-20.

MESSAGE ■ SWITCH INPUT A [▷] See page 5-21.

MESSAGE ■ SWITCH INPUT B [▷] See page 5-21.

MESSAGE ■ SWITCH INPUT C [▷] See page 5-21.

MESSAGE ■ SWITCH INPUT D [▷] See page 5–21.

MESSAGE ■ PULSE OUTPUT [▷] See page 5–22.

MESSAGE ■ PULSE INPUT [▷] See page 5–23.

MESSAGE ■ DATA LOGGER [▷] See page 5–24.

MESSAGE ■ VOLTAGE DIST. [▷] RECORDER See page 5–24.

MESSAGE ■ END OF PAGE S2 [▷]

MESSAGE

■ SETPOINTS [▷] S3 OUTPUT RELAYS

■ ALARM RELAY [▷] See page 5–25.

MESSAGE ■ AUXILIARY [▷] RELAY 1 See page 5–25.

MESSAGE ■ AUXILIARY [▷] RELAY 2 See page 5–25.

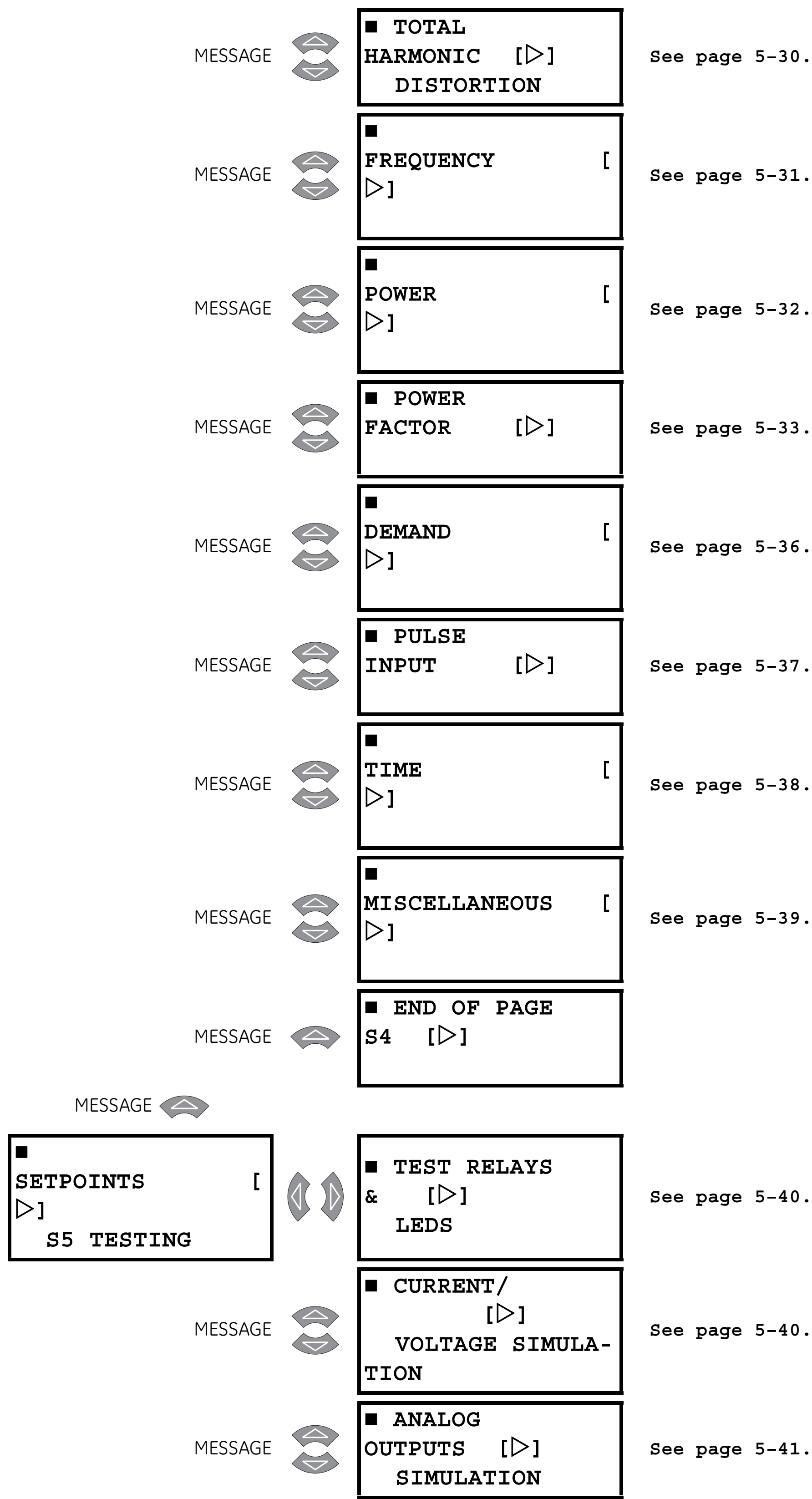
MESSAGE ■ AUXILIARY [▷] RELAY 3 See page 5–25.

MESSAGE ■ END OF PAGE S3 [▷]

MESSAGE

■ SETPOINTS [▷] S4 ALARMS/CONTROL

■ CURRENT/ [▷] VOLTAGE See page 5–26.


MESSAGE
■ TOTAL HARMONIC [▷] DISTORTION
See page 5-30.
MESSAGE
■ FREQUENCY [▷]
See page 5-31.
MESSAGE
■ POWER [▷]
See page 5-32.
MESSAGE
■ POWER FACTOR [▷]
See page 5-33.
MESSAGE
■ DEMAND [▷]
See page 5-36.
MESSAGE
■ PULSE INPUT [▷]
See page 5-37.
MESSAGE
■ TIME [▷]
See page 5-38.
MESSAGE
■ MISCELLANEOUS [▷]
See page 5-39.
MESSAGE
■ END OF PAGE S4 [▷]
MESSAGE
■ SETPOINTS [▷] S5 TESTING
■ TEST RELAYS & [▷] LEDS
See page 5-40.
MESSAGE
■ CURRENT/ [▷] VOLTAGE SIMULA-TION
See page 5-40.
MESSAGE
■ ANALOG OUTPUTS [▷] SIMULATION
See page 5-41.

MESSAGE	■ ANALOG INPUT [▷] SIMULATION	See page 5-41.
MESSAGE	■ SWITCH INPUTS [▷] SIMULATION	See page 5-42.
MESSAGE	■ FACTORY USE [▷] ONLY	See page 5-42.
MESSAGE	■ END OF PAGE S5 [▷]	

5.2 S1 PQMII Setup

5.2.1 Description

General settings to configure the PQMII are entered on this page. This includes user preferences, the RS485 and RS232 communication ports, loading of factory defaults, and user-programmable messages.

5.2.2 Preferences

PATH: SETPOINTS ⇨ S1 PQMII SETUP ⇨ PREFERENCES

```
■
PREFERENCES      [
▷]
```

```
DEFAULT MESSAGE
TIME:
   1.0 MINUTES
```

Range: 0.1 to 120.0 minutes in steps of 0.1 or OFF

MESSAGE

```
DISPLAY FILTER
CONSTANT: 4
```

Range: 1 to 10 in steps of 1

- **DEFAULT MESSAGE TIME**: Up to 10 default messages can be selected to scan sequentially when the PQMII is left unattended. If no keys are pressed for the interval defined by the **DEFAULT MESSAGE TIME** setting, then the currently displayed message is automatically overwritten by the first default message. After 3 seconds, the next default message in the sequence is displayed. Alarm messages will always override the default message display. Note that any setpoint or measured value can be selected as a default message.

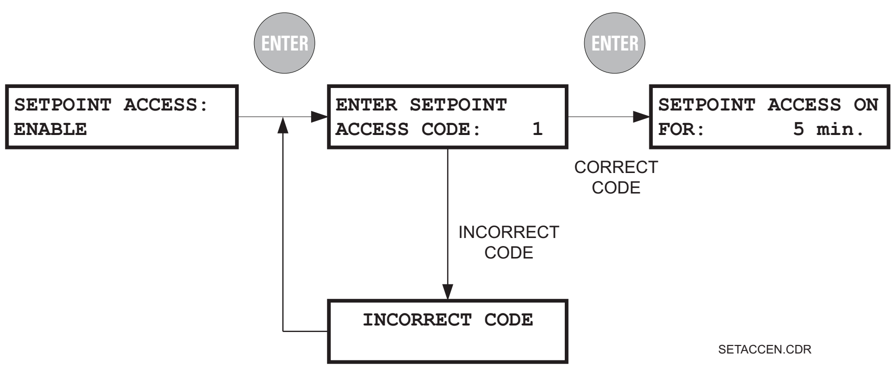
  See *Default Messages* on page 3–5 for details on default message operation and programming.
- **DISPLAY FILTER CONSTANT**: Display filtering may be required in applications where large fluctuations in current and/or voltage are normally present. This setpoint allows the user to enter the PQMII filter constant to average all metered values. If the **DISPLAY FILTER CONSTANT** setpoint is set to 1, the PQMII updates the displayed metered values approximately every 400 ms. Therefore, the display updating equals **DISPLAY FILTER CONSTANT** × 400 ms.

5.2.3 Setpoint Access

PATH: SETPOINTS ⇨ S1 PQMII SETUP ⇨⇩ SETPOINT ACCESS

■ SETPOINT [▷] ACCESS	SETPOINT ACCESS: DISABLE	*Range: Disable, Enable*
MESSAGE	ENTER SETPOINT ACCESS CODE: 1	*Range: 1 to 999 in steps of 1*
MESSAGE	SETPOINT ACCESS ON FOR: 5 min.	*Range: 1 to 300 min. in steps of 1 or Unlimited*
MESSAGE	CHANGE SETPOINT ACCESS CODE: No	*Range: No, Yes*
MESSAGE	ENTER NEW ACCESS CODE: 0	*Range: 1 to 999 in steps of 1*
MESSAGE	RE-ENTER NEW ACCESS CODE: 0	*Range: 1 to 999 in steps of 1*
MESSAGE	ENCRYPTED SET-POINT ACCESS CODE: 376	*Range: N/A*

To enable setpoint access, follow the steps outlined in the following diagram:



The factory default access code for the PQMII is 1.

If three attempts are made to enable setpoint access with an incorrect code, the value of the setpoint access setpoint changes to “Disabled” and the above procedure must be repeated.

Once setpoint access is enabled, the Program LED indicator turns on. Setpoint alterations are allowed as long as the Program LED indicator remains on. Setpoint access is be disabled and the Program LED indicator turns off when:

- The time programmed in **S1 PQMII SETUP ⇨ SETPOINT ACCESS ⇨⇩ SETPOINT ACCESS ON FOR** is reached

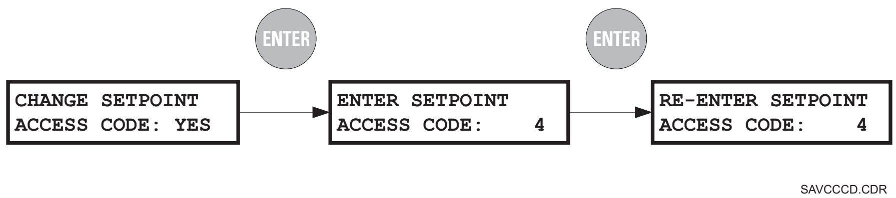
- The control power to the PQMII is removed
- The factory setpoints are reloaded

To permanently enable the setpoint access feature, enable setpoint access and then set **SETPOINT ACCESS ON FOR** to "Unlimited". Setpoint access remains enabled even if the control power is removed from the PQMII.

NOTE

Setpoints can be changed via the serial ports regardless of the state of the setpoint access feature or the state of an input switch assigned to setpoint access.

To change the setpoint access code, enable setpoint access and perform the steps as outlined below:



If an attempt is made to change a setpoint when setpoint access is disabled, the **SETPOINT ACCESS: DISABLED** message is displayed to allow setpoint access to be enabled. Once setpoint access has been enabled, the PQMII display will return to the original setpoint message.

If the control option is installed and one of the switches is assigned to "Setpoint Access", the setpoint access switch and the software setpoint access will act as a logical 'AND'. That is, both conditions must be satisfied before setpoint access will be enabled. Assuming the setpoint access switch activation is set to closed, the following flash messages will appear depending upon the condition present when the **ENTER** key is pressed.

Table 5–1: Setpoint Access Conditions

Condition		Displayed Message
Access Code	Switch Input	
Incorrect	Open	SETPOINT ACCESS OFF ENTER ACCESS CODE
Incorrect	Closed	SETPOINT ACCESS OFF ENTER ACCESS CODE
Correct	Open	CANNOT ALTER SETTING ACCESS SW. DISABLED
Correct	Closed	NEW SETPOINT STORED

5.2.4 Serial Ports

PATH: SETPOINTS ⇨ S1 PQMII SETUP ⇨⇩ COM1 RS485 SERIAL PORT

■ COM1 RS485 [▷] SERIAL PORT		MODBUS COMMUNICATION ADDRESS: 1	*Range: 1 to 255 in steps of 1*
	MESSAGE	COM1 BAUD RATE: 19200 BAUD	*Range: 1200, 2400, 4800, 9600, and 19200 baud*
	MESSAGE	COM1 PARITY: NONE	*Range: None, Even, Odd*
■ COM2 RS485 [▷] SERIAL PORT		COM2 BAUD RATE: 19200 BAUD	*Range: 1200, 2400, 4800, 9600, and 19200 baud*
	MESSAGE	COM2 PARITY: NONE	*Range: None, Even, Odd*
■ FRONT PANEL [▷] RS232 SERIAL PORT		RS232 BAUD RATE: 9600 Baud	*Range: 1200, 2400, 4800, 9600, and 19200 baud*
	MESSAGE	RS232 PARITY: None	*Range: None, Even, Odd*

- **MODBUS COMMUNICATION ADDRESS**: Enter a unique address from 1 to 255. The selected address is used for all serial communication ports. Address 0 represents a broadcast message to which all PQMIIs will listen but not respond. Although addresses do not have to be sequential, no two PQMIIs can have the same address or there will be conflicts resulting in errors. Generally, each PQMII added to the link uses the next higher address, starting from address 1.
- **BAUD RATE**: Enter the baud rate for each port: 1200, 2400, 4800, 9600, or 19200 baud. All PQMIIs and the computer on the RS485 communication link must run at the same baud rate. The fastest response is obtained at 19200 baud. Use slower baud rates if noise becomes a problem. The data frame consists of 1 start bit, 8 data bits, 1 stop bit and a programmable parity bit. The baud rate default setting is 9600.
- **PARITY**: Enter the parity for each communication port: “Even”, “Odd”, or “None”. All PQMIIs on the RS485 communication link and the computer connecting them must have the same parity.

5.2.5 DNP 3.0 Configuration

PATH: SETPOINTS ⇨ S1 PQMII SETUP ⇨⇩ DNP 3.0 CONFIGURATION

```
■ DNP
3.0            [▷]
  CONFIGURATION
```

```
DNP PORT: None
```

Range: None, COM1, COM2

```
DNP SLAVE
ADDRESS:
  0
```

Range: 0 to 255 in steps of 1

```
DNP TURNAROUND
TIME:
   0 ms
```

Range: 0 to 100 ms in steps of 10

- **DNP PORT**: Select the appropriate PQMII port to be used for DNP protocol. The COM2 selection is only available if T1 or T20 option is installed in the PQMII. Each port is configured as shown in *Serial Ports* on page 5–6.
- **DNP SLAVE ADDRESS**: Enter a unique address from 0 to 255 for this particular PQMII. The address selected is applied to the PQMII port currently assigned to communicate using the DNP protocol. Although addresses do not have to be sequential, no two PQMIIs that are daisy chained together can have the same address or there will be conflicts resulting in errors. Generally each PQMII added to the link will use the next higher address.
- **DNP TURNAROUND TIME**: The turnaround time is useful in applications where the RS485 converter without RTS or DTR switching is being employed. A typical value for the delay is 30 ms to allow the transmitter to drop in the RS485 converter.

5.2.6 Clock

PATH: SETPOINTS ⇨ S1 PQMII SETUP ⇨⇩ CLOCK

```
■
CLOCK            [
▷]
```

```
SET TIME hh:mm:ss
12:00:00
am   DATE ▷
```

Range: time format as shown

MESSAGE

```
SET DATE
dd:mm:yyyy
 Nov 21, 2003
```

Range: date format as shown

- **SET TIME/DATE**: These messages are used to set the time and date for the PQMII software clock.

  The PQMII software clock is retained for power interruptions of approximately thirty days. A Clock Not Set alarm can be enabled so that an alarm will occur on the loss of clock data. The time and date are used for all time-stamped data. If the clock has not been set, a “?” will appear on the right-hand side of the displayed time for all time-stamped data. Follow the steps shown below to set the new time and date.

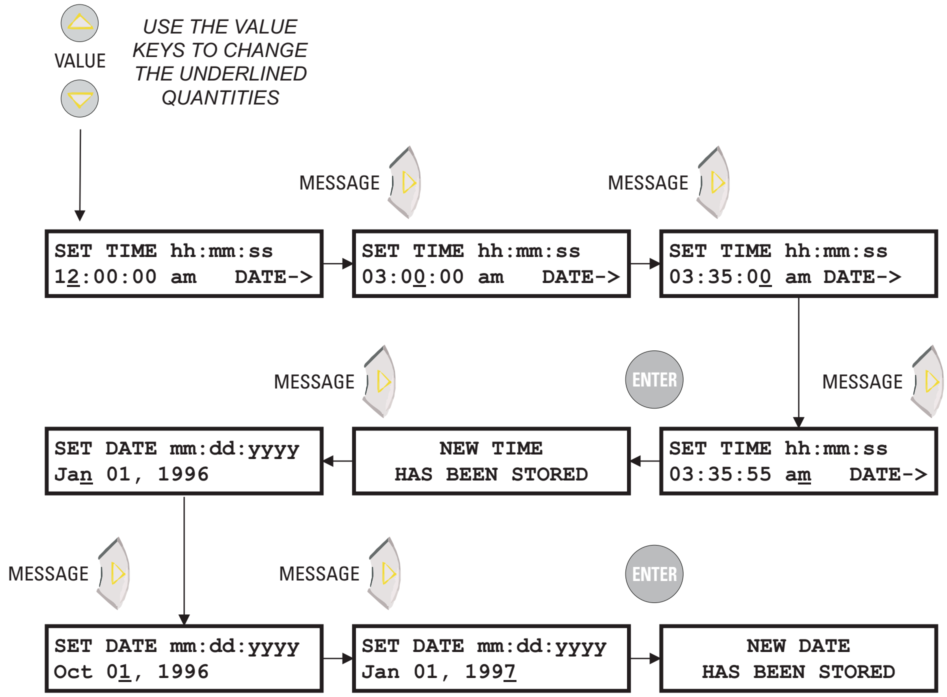


FIGURE 5–1: Setting the Date and Time

The time and date can also be set via Modbus communications. *Refer to Broadcast Command (Function Code 10h) on page 7–10* as an example.

5.2.7 Calculation Parameters

PATH: SETPOINTS ⇨ S1 PQMII SETUP ⇨⇩ CALCULATION PARAMETERS

■ CALCULATION [▷] PARAMETERS	EXTRACT FUNDAMENTAL: DISABLE	*Range: Disable, Enable*
MESSAGE	CURRENT DEMAND TYPE: THERMAL EXPONENTIAL	*Range: Thermal Exponential, Rolling Interval, Block Interval*
MESSAGE	CURRENT DEMAND TIME INTERVAL: 30 min.	*Range: 5 to 180 min. in steps of 1*
MESSAGE	POWER DEMAND TYPE: THERMAL EXPONENTIAL	*Range: Thermal Exponential, Rolling Interval, Block Interval*
MESSAGE	POWER DEMAND TIME INTERVAL: 30 min.	*Range: 5 to 180 min. in steps of 1*
MESSAGE	ENERGY COST PER kWh 10.00 cents	*Range: 0.01 to 500.00 cents in steps of 0.01*
MESSAGE	TARIFF PERIOD 1 START TIME: 0 min.	*Range: 0 to 1439 min. in steps of 1*
MESSAGE	TARIFF PERIOD 1 COST PER kWh: 10.00 cents	*Range: 0.01 to 500.00 cents in steps of 0.01*
MESSAGE	TARIFF PERIOD 2 START TIME: 0 min.	*Range: 0 to 1439 min. in steps of 1*
MESSAGE	TARIFF PERIOD 2 COST PER kWh: 10.00 cents	*Range: 0.01 to 500.00 cents in steps of 0.01*
MESSAGE	TARIFF PERIOD 3 START TIME: 0 min.	*Range: 0 to 1439 min. in steps of 1*
MESSAGE	TARIFF PERIOD 3 COST PER kWh: 10.00 cents	*Range: 0.01 to 500.00 cents in steps of 0.01*

The PQMII can be programmed to calculate metering quantities and demand by various methods.

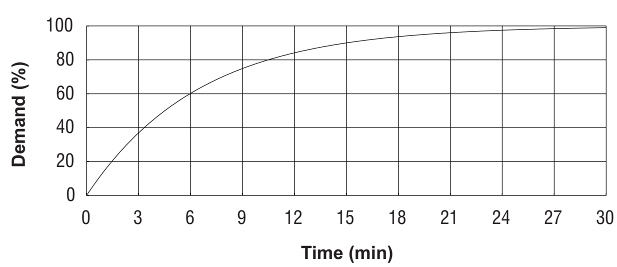
- **EXTRACT FUNDAMENTAL**: The PQMII can be programmed to calculate all metering quantities using true RMS values or the fundamental component of the sampled data. When this setpoint is set to “Disable”, the PQMII will include all harmonic content, up to the 32nd harmonic, when making metering calculations. When this setpoint is set to “Enable”, the PQMII will extract the fundamental contribution of the sampled data only and use this contribution to calculate all metering quantities. Many utilities base their metering upon fundamental, or displacement, values. Using the fundamental contribution allows one to compare the quantities measured by the PQMII with the local utility meter.
- **CURRENT DEMAND TYPE**: Three current demand calculation methods are available: thermal exponential, block interval, and rolling interval (see the *Demand Calculation Methods* table below). The current demand for each phase and neutral is calculated individually.
- **CURRENT DEMAND TIME INTERVAL**: Enter the time period over which the current demand calculation is to be performed.
- **POWER DEMAND TYPE**: Three real/reactive/apparent power demand calculation methods are available: thermal exponential, block interval, and rolling interval (see the *Demand Calculation Methods* table below). The three phase real/reactive/apparent power demand is calculated.
- **POWER DEMAND TIME INTERVAL**: Enter the time period over which the power demand calculation is to be performed.

Table 5–2: Demand Calculation Methods

<table>
<tr><th>Method</th><th>Description</th></tr>
<tr><td>Thermal Exponential</td><td>
This selection emulates the action of an analog peak-recording thermal demand meter. The PQMII measures the average quantity (RMS current, real power, reactive power, or apparent power) on each phase every minute and assumes the circuit quantity remains at this value until updated by the next measurement. It calculates the “thermal demand equivalent” based on the following equation:

$$d(t) = D(1 - e^{-kt}) \quad \textbf{(EQ 5.1)}$$

where: d = demand after applying input quantity for time t (in min.)
D = input quantity (constant)
k = 2.3 / thermal 90% response time



The graph above shows the thermal response characteristic for a thermal 90% response time of 15 minutes. A setpoint establishes the time to reach 90% of a steady-state value, just as the response time of an analog instrument (a steady-state value applied for twice the response time will indicate 99% of the value).
</td></tr>
</table>

Table 5–2: Demand Calculation Methods

Method	Description
Block Interval	This selection calculates a linear average of the quantity (RMS current, real power, reactive power, or apparent power) over the programmed demand **TIME INTERVAL**. Each new value of demand becomes available at the end of each time interval.
Rolling Interval	This selection calculates a linear average of the quantity (RMS current, real power, reactive power, or apparent power) over the programmed demand **TIME INTERVAL** (in the same way as Block Interval). The value is updated every minute and indicates the demand over the time interval just preceding the time of update.

- **ENERGY COST PER kWh**: Enter the cost per kWh that is charged by the local utility.
- **TARIFF PERIOD START TIME**: Enter the start time for each of the three tariff period calculations.
- **TARIFF PERIOD COST PER kWh**: Enter the cost per kWh for each of the three tariff periods.

5.2.8 Clear Data

PATH: SETPOINTS ⇨ S1 PQMII SETUP ⇨⇩ CLEAR DATA

■ CLEAR DATA [▷]	◁ ▷	CLEAR ENERGY VALUES: NO	*Range: Yes, No*
MESSAGE	△ ▽	CLEAR MAX DEMAND VALUES: NO	*Range: Yes, No*
MESSAGE	△ ▽	CLEAR ALL DEMAND VALUES: NO	*Range: Yes, No*
MESSAGE	△ ▽	CLEAR MIN/MAX CURRENT VALUES: NO	*Range: Yes, No*
MESSAGE	△ ▽	CLEAR MIN/MAX VOLTAGE VALUES: NO	*Range: Yes, No*
MESSAGE	△ ▽	CLEAR MIN/MAX POWER VALUES: NO	*Range: Yes, No*
MESSAGE	△ ▽	CLEAR MIN/MAX FREQUENCY VAL-UES: NO	*Range: Yes, No*
MESSAGE	△ ▽	CLEAR MAX THD VALUES: NO	*Range: Yes, No*
MESSAGE	△ ▽	CLEAR PULSE INPUT VALUES: NO	*Range: Yes, No*
MESSAGE	△ ▽	CLEAR EVENT RECORD: NO	*Range: Yes, No*
MESSAGE	△ ▽	CLEAR VOLTAGE DIST. RECORD: NO	*Range: Yes, No*
MESSAGE	△	LOAD FACTORY DEFAULT SETPOINTS: NO	*Range: Yes, No*

- **CLEAR ENERGY VALUES**: Enter "Yes" to clear all the energy used data in the **A1 METERING ⇨⇩ ENERGY** actual values subgroup. The **TIME OF LAST RESET** date under the same subgroup is updated upon issuing this command.
- **CLEAR MAX DEMAND VALUES**: Enter "Yes" to clear all the maximum power and current demand data under the actual values subgroup **A1 METERING ⇨⇩ DEMAND**. The time and date associated with each message will be updated to the current date upon issuing this command.
- **CLEAR ALL DEMAND VALUES**: Enter "Yes" to clear all the power and current demand data under the actual values subgroup **A1 METERING ⇨⇩ DEMAND**. The time and date associated with each message will be updated to the current date upon issuing this command.

- **CLEAR MIN/MAX CURRENT VALUES**: Enter “Yes” to clear all the minimum/maximum current data under the actual values subgroup **A1 METERING ⇨⇩ CURRENT**. The time and date associated with each message will be updated to the current date upon issuing this command.
- **CLEAR MIN/MAX VOLTAGE VALUES**: Enter “Yes” to clear all the minimum/maximum voltage data under the actual values subgroup **A1 METERING ⇨⇩ VOLTAGE**. The time and date associated with each message will be updated to the current date upon issuing this command.
- **CLEAR MIN/MAX POWER VALUES**: Enter “Yes” to clear all the minimum/maximum power data under the actual values subgroup **A1 METERING ⇨⇩ POWER**. The time and date associated with each message will be updated to the current date upon issuing this command.
- **CLEAR MIN/MAX FREQUENCY VALUES**: Enter “Yes” to clear all the minimum/maximum frequency data under the actual values subgroup **A1 METERING ⇨⇩ FREQUENCY**. The time and date associated with each message will be updated to the current date upon issuing this command.
- **CLEAR MAX THD VALUES**: Enter “Yes” to clear all the max THD data under the actual values subgroup **A3 POWER ANALYSIS ⇨⇩ TOTAL HARMONIC DISTORTION**. The time and date associated with each message will be updated to the current date upon issuing this command.
- **CLEAR PULSE INPUT VALUES**: Enter “Yes” to clear all the pulse input values under the actual values subgroup **A1 METERING ⇨⇩ PULSE INPUT**. The time and date associated with this message will be updated to the current date upon issuing this command.
- **CLEAR EVENT RECORD**: Enter “Yes” to clear all of the events in the Event Record. This will eliminate all previous events from the Event Record and create a Clear Events event as the new event number 1. The Event Recorder can be cleared only if it is enabled in **S1 PQMII SETUP ⇨⇩ EVENT RECORDER ⇨⇩ EVENT RECORDER OPERATION**.

  The **CLEAR EVENT RECORD** command takes six seconds to complete, during which no new events will be logged. Do not cycle power to the unit while the event record is being cleared.
- **CLEAR VOLTAGE DIST. RECORD**: Enter “Yes” to clear all of the events in the Voltage Disturbance Record.
- **LOAD FACTORY DEFAULT SETPOINTS**: When the PQMII is shipped from the factory all setpoints will be set to factory default values. These settings are shown in the setpoint message reference figures. To return a PQMII to these known setpoints select “Yes” and press the key while this message is displayed. The display will then warn that all setpoints will be lost and will ask whether to continue. Select yes again to reload the setpoints. It is a good idea to first load factory defaults when replacing a PQMII to ensure all the settings are defaulted to reasonable values.

5.2.9 Event Recorder

PATH: SETPOINTS ⇨ S1 PQMII SETUP ⇨⇩ EVENT RECORDER

```
■ EVENT
RECORDER   [▷]
```

```
EVENT RECORDER
OPERATION: DIS-
ABLE
```

Range: Enable, Disable

The Event Recorder can be disabled or enabled using the **EVENT RECORDER OPERATION** setpoint. When the Event Recorder is disabled no new events are recorded. When the Event Recorder is enabled new events are recorded with the 150 most recent events displayed in **A3 POWER ANALYSIS** ⇨⇩ **EVENT RECORDER**. Refer to *Event Recorder* on page 6–20 for the list of possible events. All data within the Event Recorder is stored in non-volatile memory.

5.2.10 Trace Memory

PATH: SETPOINTS ⇨ S1 PQMII SETUP ⇨⇩ TRACE MEMORY

■ TRACE MEMORY [▷]	TRACE MEMORY USAGE: 1 x 36 cycles	*Range: 1 x 36, 2 x 18, 3 x 12 cycles*
MESSAGE	TRACE MEMORY TRIGGER MODE: ONE SHOT	*Range: One Shot, Retrigger*
MESSAGE	Ia OVERCURRENT TRIG LEVEL: OFF % CT	*Range: 1 to 150% of CT in steps of 1 or OFF*
MESSAGE	Ib OVERCURRENT TRIG LEVEL: OFF % CT	*Range: 1 to 150% of CT in steps of 1 or OFF*
MESSAGE	Ic OVERCURRENT TRIG LEVEL: OFF % CT	*Range: 1 to 150% of CT in steps of 1 or OFF*
MESSAGE	In OVERCURRENT TRIG LEVEL: OFF % CT	*Range: 1 to 150% of CT in steps of 1 or OFF*
MESSAGE	Va OVERVOLTAGE TRIG LEVEL: OFF % NOM-INAL	*Range: 20 to 150% of Nominal in steps of 1 or OFF*
MESSAGE	Vb OVERVOLTAGE TRIG LEVEL: OFF % NOM-INAL	*Range: 20 to 150% of Nominal in steps of 1 or OFF*
MESSAGE	Vc OVERVOLTAGE TRIG LEVEL: OFF % NOM-INAL	*Range: 20 to 150% of Nominal in steps of 1 or OFF*
MESSAGE	Va UNDERVOLTAGE TRIG LEVEL: OFF % NOM-INAL	*Range: 20 to 150% of Nominal in steps of 1 or OFF*

MESSAGE	Vb UNDERVOLTAGE TRIG LEVEL: OFF % NOMINAL	Range: 20 to 150% of Nominal in steps of 1 or OFF
MESSAGE	Vc UNDERVOLTAGE TRIG LEVEL: OFF % NOMINAL	Range: 20 to 150% of Nominal in steps of 1 or OFF
MESSAGE	SWITCH INPUT A TRIG: OFF	Range: Off, Open-to-Closed, Closed-to-Open
MESSAGE	SWITCH INPUT B TRIG: OFF	Range: Off, Open-to-Closed, Closed-to-Open
MESSAGE	SWITCH INPUT C TRIG: OFF	Range: Off, Open-to-Closed, Closed-to-Open
MESSAGE	SWITCH INPUT D TRIG: OFF	Range: Off, Open-to-Closed, Closed-to-Open
MESSAGE	TRACE MEMORY TRIGGER DELAY: 0 cycles	Range: 0 to 30 cycles in steps of 2
MESSAGE	TRACE MEMORY TRIGGER RELAY: OFF	Range: Off, Aux1, Aux2, Aux3, Alarm

The Trace Memory feature involves a separate sampling data stream. All input channels are sampled continuously at a rate of 16 times per cycle. Using a single-cycle block interval, the input samples are checked for trigger conditions as per the trigger setpoints below. Note that the normal sampling burst (64 samples/cycle, 2 cycles) used for all metering calculations is done on top of the trace memory sampling. The harmonic analysis sampling (256 samples/cycles, 1 cycle) causes the trace memory sampling to stop for one cycle whenever a harmonic analysis is requested. Refer to *Trace Memory* on page 4–10 for details on trace memory implementation in the EnerVista PQMII Setup Software.

- **TRACE MEMORY USAGE**: The trace memory feature allows the user to capture maximum of 36 cycles. The **TRACE MEMORY USAGE** setpoint allows the buffer to be divided into maximum of 3 separate buffers as shown in table below.

Setpoint Value	Result
1 x 36 cycles	Upon a trigger, the entire buffer is filled with 36 cycles of data.
2 x 18 cycles	The buffer is split into 2 separate buffers and upon a trigger, the first buffer is filled with 18 cycles of data and upon a second trigger, the second buffer is filled with 18 cycles of data.
3 x 12 cycles	The buffer is split into 3 separate buffers and upon a trigger, the first buffer is filled with 12 cycles of data, upon a second trigger, the second buffer is filled with 12 cycles of data and upon a third trigger, the third buffer is filled with 12 cycles of data.

- **TRACE MEMORY TRIGGER MODE**: The trace memory can be configured to trigger in two different modes as described in the table below.

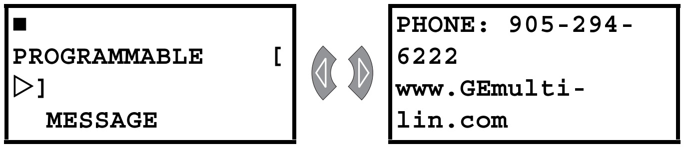
Setpoint Value	Result
One Shot	The trace memory will be triggered once per buffer as defined in the TRACE MEMORY USAGE setpoint above. In order for it to re-trigger, it must be re-armed through the serial port using the EnerVista PQMII Setup Software or other software. Once re-armed the trace memory will default back to the first buffer.
Retrigger	The trace memory will automatically re-trigger upon each condition and overwrite the previous buffer data.

- **Ia/Ib/Ic/In OVERCURRENT TRIG LEVEL**: Once the phase A/B/C/neutral current equals or increases above this setpoint value, the trace memory is triggered and data on all inputs are captured in the buffer. The number of cycles captured depends on the value specified in the TRACE MEMORY USAGE setpoint.
- **Va/Vb/Vc OVERVOLTAGE TRIG LEVEL**: Once the phase A/B/C voltage equals or increases above this setpoint value, the trace memory is triggered and data on all inputs are captured in the buffer. The number of cycles captured depends on the value specified in the TRACE MEMORY USAGE setpoint. Phase to neutral levels are used regardless of the VT wiring.
- **Va/Vb/Vc UNDERVOLTAGE TRIG LEVEL**: Once the phase A/B/C voltage is equal to or less than this setpoint value, the trace memory is triggered and data on all inputs are captured in the buffer. The number of cycles captured depends on the value specified in the TRACE MEMORY USAGE setpoint.
- **SWITCH INPUT A(D) TRIG**: If the setpoint is set to "Open-to-Closed", the trace memory is triggered and data on all inputs are captured in the buffer on a Switch A(D) close transition. If the setpoint is set to "Closed-to-Open", the trace memory is triggered and data on all inputs are captured in the buffer on a Switch A(D) open transition. The number of cycles captured depends on the value specified in the TRACE MEMORY USAGE setpoint.
- **TRACE MEMORY TRIGGER DELAY**: In some applications it may be necessary to delay the trigger point to observe the data before the fault occurred. The PQMII allows the trigger to be delayed by the amount of cycles set in this setpoint. Therefore, buffer will always contain the number cycles specified in this setpoint before the trigger point and the remaining space in the buffer is filled with the cycles after the trigger point.
- **TRACE MEMORY TRIGGER RELAY**: The relay selected here will be activated upon the occurrence of a Trace Memory Trigger. This relay will be cleared once the Trace Memory is re-armed.

See *Triggered Trace Memory* on page 8–7 for additional details on this feature.

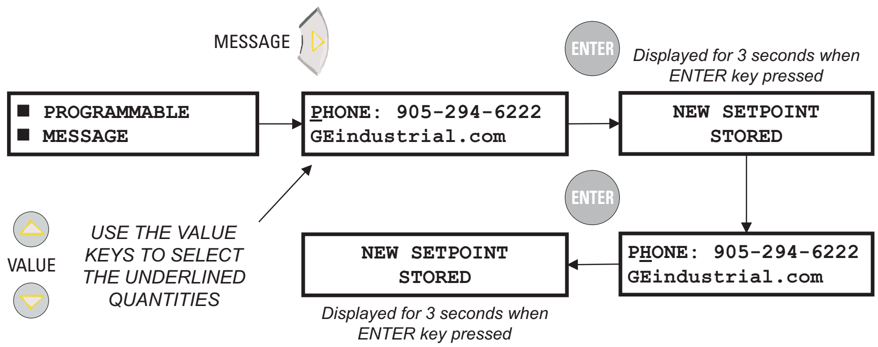
5.2.11 Programmable Message

PATH: SETPOINTS ⇨ S1 PQMII SETUP ⇨⇩ PROGRAMMABLE MESSAGE



Range: 40 alphanumeric characters

A 40-character message can be programmed using the keypad, or via a serial port using the EnerVista PQMII Setup Software. An example of writing a new message over the existing one is shown below:



TIPS:

- The setpoint access must be enabled in order to alter the characters.
- To skip over a character press the **ENTER** key.
- If a character is entered incorrectly, press the **ENTER** key repeatedly until the cursor returns to the position of the error, and re-enter the character.
- See *Default Messages* on page 3–5 for details on selecting this message as a default message

A copy of this message is displayed in actual values page **A2 STATUS** ⇨⇩ **PROGRAMMABLE MESSAGE**.

5.2.12 Product Options

PATH: SETPOINTS ⇨ S1 PQMII SETUP ⇨⇩ PRODUCT OPTIONS

■ PRODUCT [▷] OPTIONS	SELECT ORDER: PQMII-T20-C-A	*Range: see range in PQMII Modbus memory format code F116*
MESSAGE	SELECT MOD1 TO ENABLE: 0	*Range: 0 to 999 in steps of 1*
MESSAGE	SELECT MOD2 TO ENABLE: 0	*Range: 0 to 999 in steps of 1*
MESSAGE	SELECT MOD3 TO ENABLE: 0	*Range: 0 to 999 in steps of 1*
MESSAGE	SELECT MOD4 TO ENABLE: 0	*Range: 0 to 999 in steps of 1*
MESSAGE	SELECT MOD5 TO ENABLE: 0	*Range: 0 to 999 in steps of 1*
MESSAGE	ENTER PASSCODE: _	*Range: consult the factory*

The PQMII can have options and certain modifications upgraded on-site via use of a passcode provided by GE Multilin. Consult the factory for details on the use of this feature.

5.3 S2 System Setup

5.3.1 Current and Voltage Configuration

NOTE

The shaded setpoints below must be set to a value other than “Off” to clear the Critical Setpoints Not Stored alarm.

PATH: SETPOINTS ⇨⇩ S2 SYSTEM SETUP ⇨ CURRENT/VOLTAGE CONFIG.

■ CURRENT/ [▷] VOLTAGE CONFIG.	PHASE CT WIRING: Phases A, B, AND C	*Range: A, B, and C, A and B only, A and C only, A only*
MESSAGE	PHASE CT PRIMARY: OFF A	*Range: 5 to 12000 A in steps of 5 or Off*
MESSAGE	NEUTRAL CURRENT SENSING: OFF	*Range: Off, Separate CT, Calculated*
MESSAGE	NEUTRAL CT PRI-MARY: 100 A	*Range: 5 to 6000 A in steps of 5*
MESSAGE	VT WIRING: OFF	*Range: Off, 4 Wire Wye / 3 VTs, 4 Wire Wye / Direct, 4 Wire Wye / 2 VTs, 3-Wire Delta / 2 VTs, 3 Wire Direct, Single Phase Direct*
MESSAGE	VT RATIO: 1.0 : 1	*Range: 1.0 to 3500.0 in steps of 0.1*
MESSAGE	VT NOMINAL SEC-ONDARY VOLTAGE: 120 V	*Range: 40 to 600 V in steps of 1*
MESSAGE	NOMINAL DIRECT INPUT VOLTAGE: 600 V	*Range: 40 to 600 V in steps of 1*
MESSAGE	NOMINAL SYSTEM FREQUENCY: 60 Hz	*Range: 50 Hz, 60 Hz*

- **PHASE CT WIRING**: The table below indicates the required connection per setpoint setting.

Setpoint Value	Required CT Connection
A,B, and C	CTs are connected to phase A, B and C inputs.
A and B Only	CTs are connected to phase A and B only. Phase C input is left open. The value for phase C is calculated by the PQMII.
A and C Only	CTs are connected to phase A and C only. Phase B input is left open. The value for phase B is calculated by the PQMII.
A Only	CT is connected to phase A only. Phase B and C inputs are left open. The values for phase B and C are calculated by the PQMII.

If the “A and B Only”, “A and C Only”, or “A Only” connection is selected, the neutral sensing must be accomplished with a separate CT.

- **PHASE CT PRIMARY**: Enter the primary current rating of the phase current transformers. All three phase CTs must have the same rating. For example, if 500:5 CTs are used, the **PHASE CT PRIMARY** value is entered as “500”. The **PHASE CT PRIMARY** factory default is “Off”. While set to “Off”, the PQMII is forced to an alarm state as a safety precaution until a valid CT value is entered. Ensure that the CT is connected to the correct 1 or 5 A terminals to match the CT secondary.
- **NEUTRAL CURRENT SENSING**: Neutral current sensing can be accomplished by using a separate external CT connection or by calculations. Select “Separate CT” when using an external CT. If “Calculated” is selected, the PQMII calculates the neutral current using the vector sum of Ia + Ib + Ic = In. If a residual connection is required using the PQMII internal CT, the neutral CT primary must be the same as the phase CT primary to ensure correct readings.
- **NEUTRAL CT PRIMARY**: This message is visible only if the neutral current sensing setpoint is set to “Separate CT”. Enter the CT primary current. For example, if a 50:5 CT is installed for neutral sensing enter 50. One amp CTs can also be used for neutral sensing.
- **VT WIRING**: Enter the VT connection of the system in this setpoint. The three possible wiring configurations are Wye, Delta, and Single Phase.

  If the system to be measured is a Wye connection, the selections are “4 Wire Wye Direct”, “4 Wire Wye / 3 VTs”, and “4 Wire Wye /2 VTs”. The “4 Wire Wye Direct” value is used for systems that are 600 V or less and directly connected to the PQMII. The **VT NOMINAL SECONDARY VOLTAGE** setpoint is replaced by **NOMINAL DIRECT INPUT VOLTAGE**. With external VTs (depending upon how many external VTs are used), the “4 Wire Wye / 3 VTs” or “4 Wire Wye / 2 VTs” value must be selected. Note that when using the “4 Wire Wye / 2 VTs” value, only two voltages are measured; the third voltage is calculated on the assumption that Van + Vbn + Vcn = 0. This assumption is valid only for balanced system voltages.

  If the system to be measured is a Delta connection, the values are “3 Wire Direct” and “3 Wire Delta / 2 VTs”. The “3 Wire Direct” value should be used for systems that are 600 V or less and directly connected to the PQMII. With external VTs, “3 Wire Delta / 2 VTs” must be selected.

  The PQMII accepts input voltages from 0 to 600 V AC between any two of the voltage terminals (V1, V2, V3, and Vn). These inputs can be directly connected or supplied via external VTs. External VTs are required for input voltages greater than 600 V AC (line-to-line). When measuring line-to-line quantities using inputs V1, V2 and V3, ensure that the voltage common input Vn is grounded. This input is used as a reference for measuring the voltage inputs.

  All connections to the PQMII voltage inputs should be connected using HRC fuses rated at 2 amps to ensure adequate interrupting capacity.
- **VT RATIO**: Enter the voltage transformer ratio. All three voltage inputs must be of the same rating. For example, if 4200:120 VTs are used, the **VT RATIO** should be 4200 / 120 = 35.0:1. This setpoint is not visible if **VT WIRING** is set to “3 Wire Direct”, “4 Wire Direct”, or “Single Phase Direct”.
- **VT NOMINAL SECONDARY VOLTAGE**: Enter the nominal secondary of the VTs. If the voltage inputs are directly connected, enter the nominal system voltage that will be applied to the PQMII. This setpoint is not visible if the **VT WIRING** is set to “3 Wire Direct”,

"4 Wire Direct", or "Single Phase Direct". This value is used to scale an analog output that is assigned to display voltage as a percentage of nominal.

- **NOMINAL DIRECT INPUT VOLTAGE**: This setpoint is displayed only if VT WIRING is selected as a direct connection. The nominal direct input voltage must be entered in this message. This value will be used to scale an analog output that is assigned to display voltage as a percentage of nominal.
- **NOMINAL SYSTEM FREQUENCY**: Enter the nominal system frequency. The PQMII measures frequency from the Van voltage and adjusts its internal sampling to best fit the measured frequency. If the Van input is unavailable, the PQMII will assume the frequency entered here.

5.3.2 Analog Outputs

PATH: SETPOINTS ⇨⇩ S2 SYSTEM SETUP ⇨⇩ ANALOG OUTPUT 1(4)

■ ANALOG [▷] OUTPUT 1	ANALOG OUTPUT RANGE: 4-20 mA	*Range: 0-20 mA, 4-20 mA. Seen only in the Analog Output 1 menu.*
MESSAGE	ANALOG OUTPUT 1 MAIN: Not Used	*Range: refer to the Analog Output Parameters table below*
MESSAGE	MAIN 4 mA VALUE: 0	*Range: refer to the Analog Output Parameters table below*
MESSAGE	MAIN 20 mA VALUE: 0	*Range: refer to the Analog Output Parameters table below*
MESSAGE	ANALOG OUTPUT 1 ALT: NOT USED	*Range: refer to the Analog Output Parameters table below*
MESSAGE	ALT 4 mA VALUE: 0	*Range: refer to the Analog Output Parameters table below*
MESSAGE	ALT 20 mA VALUE: 0	*Range: refer to the Analog Output Parameters table below*

The PQMII has four (4) Analog Outputs configured through four setpoints pages. The ANALOG OUTPUT RANGE setpoint appears in the Analog Output 1 setpoints page only and applies to all four outputs.

- **ANALOG OUTPUT RANGE**: If the T20 option is installed, the Analog Outputs can be configured to operate as 4 to 20 mA current sources or 0 to 20 mA current sources. All four Analog Outputs will operate in the range defined by this setpoint.
- **ANALOG OUTPUT 1(4) MAIN / ANALOG OUTPUT 1(4) ALT**: If the PQMII is used in conjunction with programmable controllers, automated equipment, or a chart recorder, the analog outputs can be used for continuous monitoring. Although parameters can be selected for continuous analog output, all values are available digitally through the communications interface. Applications include using a computer to automatically shed loads as the frequency decreases by monitoring frequency or a chart recorder to plot the loading of a system in a particular process.

Each of the analog outputs can be assigned to two of the parameters listed in the Analog Output Parameters table. The analog output main selection is the default selection and a programmable switch input can be programmed to multiplex the **ANALOG OUTPUT 1(4) ALT** selection to the same output depending upon the open or closed state of the switch input. See *Switch Inputs* on page 5–21 for details about configuring a switch input. If no switch input is assigned as an analog output multiplexer, the analog output main selection will be the only parameter which appears at the analog output terminals. The ability to multiplex two different analog output quantities on one analog output effectively gives the PQMII eight analog outputs. The table below shows the criteria used by the PQMII to decide whether the output is based on MAIN or ALT settings.

- **MAIN/ALT 4 mA VALUE**: This message appears for each analog output and allows the user to assign a numeric value which corresponds to the 4 mA end of the 4 to 20 mA signal range (T20 option) or the 0 mA end of the 0 to 1 mA signal range (T1 option). The numeric value range will depend upon which parameter is selected. See the *Analog Output Parameters* table below for details. Note that if the T20 option is installed and the **ANALOG OUTPUT RANGE** setpoint is set to "0-20 mA", this message represents the 0 mA end of the signal range.

Table 5–3: Analog Output Selection Criteria

Condition Present	'Main' Parameter	'Alt' Parameter	Output Based On
Any condition	"Not Used"	"Not Used"	Main
Control option 'C' not installed	any	not available	Main
Switch assigned to **SELECT ANALOG OUTPUT** and is disabled	any	"Not Used"	Main
Switch assigned to **SELECT ANALOG OUTPUT** and is enabled	any	"Not Used"	Main
Any condition	"Not Used"	anything other than "Not Used"	Alt
Switch assigned to **SELECT ANALOG OUTPUT** and is disabled	"Not Used"	anything other than "Not Used"	Alt
Switch assigned to **SELECT ANALOG OUTPUT** and is enabled	any	anything other than "Not Used"	Alt

- **MAIN/ALT 20 mA VALUE**: This message appears for each analog output and allows the user to assign a numeric value which corresponds to the 20 mA end of the 4 to 20 mA signal range (T20 option) or the 1 mA end of the 0 to 1 mA signal range (T1 option). The numeric value range will depend upon which parameter is selected. See the *Analog Output Parameters* table below.

If the 4 mA (or 0 mA) value is programmed to be higher than the 20 mA (or 1 mA) value, the analog output will decrease towards 4 mA (or 0 mA) as the value increases and the analog output will increase towards 20 mA (or 1 mA) as the value decreases. If the 4 mA (or 0 mA) and 20 mA (or 1 mA) values are programmed to an identical value, the output will always be 4 mA (or 0 mA).

Table 5–4: Analog Output Parameters (Sheet 1 of 3)

Parameter	Range	Step
Phase A Current	0 to 150%	1%
Phase B Current	0 to 150%	1%
Phase C Current	0 to 150%	1%
Neutral Current	0 to 150%	1%
Average Phase Current	0 to 150%	1%
Current Unbalance	0 to 100.0%	0.1%
Voltage Van	0 to 200%	1%
Voltage Vbn	0 to 200%	1%
Voltage Vcn	0 to 200%	1%
Voltage Vab	0 to 200%	1%
Voltage Vbc	0 to 200%	1%
Voltage Vca	0 to 200%	1%
Average Phase Voltage	0 to 200%	1%
Average Line Voltage	0 to 200%	1%
Voltage Unbalance	0 to 100.0%	0.1%
Frequency	00.00 to 75.00 Hz	0.01 Hz
3 Phase PF	0.01 lead to 0.01 lag	0.01
3 Phase kW	–32500 to +32500	1 kW
3 Phase kvar	–32500 to +32500	1 kvar
3 Phase kVA	0 to 65400	1 kVA
3 Phase MW	–3250.0 to +3250.0	0.1 MW
3 Phase Mvar	–3250.0 to +3250.0	0.1 Mvar
3 Phase MVA	0 to 6540.0	0.1 MVA
Phase A PF	0.01 lead to 0.01 lag	0.01
Phase A kW	–32500 to +32500	1 kW
Phase A kvar	–32500 to +32500	1 kvar

Table 5–4: Analog Output Parameters (Sheet 2 of 3)

Parameter	Range	Step
Phase A kVA	0 to 65400	1 kVA
Phase B PF	0.01 lead to 0.01 lag	0.01
Phase B kW	–32500 to +32500	1 kW
Phase B kvar	–32500 to +32500	1 kvar
Phase B kVA	0 to 65400	1 kVA
Phase C PF	0.01 lead to 0.01 lag	0.01
Phase C kW	–32500 to +32500	1 kW
Phase C kvar	–32500 to +32500	1 kvar
Phase C kVA	0 to 65400	1 kVA
3 Phase +kWh Used	0 to 65400	1 kWh
3 Phase +kvarh Used	0 to 65400	1 kvarh
3 Phase –kWh Used	0 to 65400	1 kWh
3 Phase –kvarh Used	0 to 65400	1 kvarh
3 Phase kVAh Used	0 to 65400	1 kVAh
Phase A Current Demand	0 to 7500	1 A
Phase B Current Demand	0 to 7500	1 A
Phase C Current Demand	0 to 7500	1 A
Neutral Current Demand	0 to 7500	1 A
3 Phase kW Demand	–32500 to +32500	1 kW
3 Phase kvar Demand	–32500 to +32500	1 kvar
3 Phase kVA Demand	0 to 65400	1 kVA
3 Phase Current THD	0.0 to 100%	0.1%
3 Phase Voltage THD	0.0 to 100%	0.1%
Phase A Current THD	0.0 to 100%	0.1%
Phase B Current THD	0.0 to 100%	0.1%
Phase C Current THD	0.0 to 100%	0.1%
Voltage Van THD	0.0 to 100%	0.1%
Voltage Vbn THD	0.0 to 100%	0.1%
Voltage Vcn THD	0.0 to 100%	0.1%
Voltage Vab THD	0.0 to 100%	0.1%
Voltage Vbc THD	0.0 to 100%	0.1%

Table 5–4: Analog Output Parameters (Sheet 3 of 3)

Parameter	Range	Step
Neutral Current THD	0.0 to 100%	0.1%
Serial Control	–32500 to +32500	1 Unit

When the Analog Output parameter is set to “Serial Control”, the analog output(s) reflect a value in proportion to the serial value written to a specific register within the PQMII memory map. The locations are as described in the table below.

Analog Output	Modbus Register	Register
Analog Output 1	Analog Output 1 Serial Value	1067
Analog Output 2	Analog Output 2 Serial Value	106F
Analog Output 3	Analog Output 3 Serial Value	1077
Analog Output 4	Analog Output 4 Serial Value	107F

5.3.3 Analog Input

PATH: SETPOINTS ⇨⇩ S2 SYSTEM SETUP ⇨⇩ ANALOG INPUT

■ ANALOG INPUT [▷]	ANALOG IN MAIN/ ALT SELECT RELAY: OFF	*Range: Aux1, Aux2, Aux3, Off.*
MESSAGE	ANALOG IN MAIN NAME: MAIN ANALOG INPUT	*Range: 20 alphanumeric characters*
MESSAGE	ANALOG IN MAIN UNITS: Units	*Range: 10 alphanumeric characters*
MESSAGE	MAIN 4 mA VALUE: 0	*Range: 0 to 65000 in steps of 1*
MESSAGE	MAIN 20 mA VALUE: 0	*Range: 0 to 65000 in steps of 1*
MESSAGE	ANALOG IN MAIN: RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE	ANALOG IN MAIN LEVEL: 100 Units	*Range: 0 to 65000 in steps of 1*
MESSAGE	ANALOG IN MAIN DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 1*
MESSAGE	ANALOG IN ALT NAME: ALT ANALOG INPUT	*Range: 20 alphanumeric characters*
MESSAGE	ANALOG IN ALT UNITS: Units	*Range: 10 alphanumeric characters*
MESSAGE	ALT 4 mA VALUE: 0	*Range: 0 to 65000 in steps of 1*
MESSAGE	ALT 20 mA VALUE: 0	*Range: 0 to 65000 in steps of 1*
MESSAGE	ANALOG IN ALT: RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE	ANALOG IN ALT LEVEL: 100	*Range: 0 to 65000 in steps of 1*
MESSAGE	ANALOG IN ALT DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 1*

- **ANALOG IN MAIN/ALT SELECT RELAY**: Select the output relay that is to be used to multiplex two analog input signals to the PQMII. If this setpoint is "Off", the **MAIN** analog input setpoints will be used unless a switch input assigned to **SELECT ANALOG INPUT** is activated. For more information on multiplexing two analog inputs using one of the PQMII output relays, refer to *Switch Inputs (Optional)* on page 2–12.

- **ANALOG IN MAIN/ALT NAME**: This message allows the user to input a user defined 20 character alphanumeric name for the **MAIN** and **ALT** analog inputs. To enter the names, perform the following steps:
  - ▷ **Allow access to setpoints by enabling setpoint access.**
  - ▷ **Select the Analog Input name message display under the S2 SYSTEM SETUP ⇨⇩ ANALOG INPUT setpoints group.**
  - ▷ **Use the VALUE keys to change the blinking character over the cursor. A space is selected like a character.**
  - ▷ **Press the ENTER key to store the character and advance the cursor to the next position. To skip over a character press the ENTER key.**
  - ▷ **Continue entering characters and spaces until the desired message is displayed. If a character is entered incorrectly, press the ENTER key repeatedly until the cursor returns to the incorrect position and re-enter the character.**
- **ANALOG IN MAIN/ALT UNITS**: This message allows the user to input a user defined 10 character alphanumeric name for the **MAIN** and **ALT** units. To enter the units, perform the same steps as shown for analog input name.
- **MAIN/ALT 4 mA VALUE**: This message appears for each analog input and allows the user to assign a numeric value which corresponds to the 4 mA end of the 4 to 20 mA signal range.
- **MAIN/ALT 20 mA VALUE**: This message appears for each analog input and allows the user to assign a numeric value which corresponds to the 20 mA end of the 4 to 20 mA signal range.
- **ANALOG IN MAIN/ALT RELAY**: Analog input **MAIN** and **ALT** detection can either be disabled, used as an alarm or as a process control. Set this setpoint to OFF if the feature is not required. Selecting “Alarm” causes the alarm relay to activate and displays an alarm message whenever a **MAIN** or **ALT** analog input condition exists. Selecting an auxiliary relay causes the selected auxiliary relay to activate with no message displayed. This is intended for process control.
- **ANALOG IN MAIN/ALT LEVEL**: When the measured **MAIN** or **ALT** analog input meets or exceeds the level set by this setpoint, a **MAIN** or **ALT** analog input condition will occur.
- **ANALOG IN MAIN/ALT DELAY**: If the **MAIN** or **ALT** analog input meets or exceeds the **ANALOG IN MAIN/ALT LEVEL** setpoint value and remains this way for the time delay programmed in this setpoint, an analog input condition will occur. If the **ANALOG IN MAIN/ALT RELAY** setpoint is set to “Alarm”, the alarm relay will activate and the **ANALOG IN MAIN/ALT ALARM** message will be displayed. If the setpoint **ANALOG IN MAIN/ALT RELAY** is set to “Aux1”, “Aux2”, or “Aux3”, the respective auxiliary relay will activate and no message will be displayed after the delay expires.

5.3.4 Switch Inputs

PATH: SETPOINTS ⇨⇩ S2 SYSTEM SETUP ⇨⇩ SWITCH INPUT A(D)

```
■ SWITCH INPUT
A   [▷]
```

```
SWITCH A NAME:
Switch Input A
```

Range: 20 alphanumeric characters

MESSAGE

```
SWITCH A FUNC-
TION:
NOT USED
```

Range: see description below

MESSAGE

```
SWITCH A ACTIVA-
TION:
OPEN
```

Range: Open, Closed

MESSAGE

```
SWITCH A TIME
DELAY:
  0.0 s
```

Range: 0.0 to 600.0 s in steps of 1

There are four (4) Switch Inputs, denoted as Switch Input A, B, C, and D.

- **SWITCH A(D) NAME**: This message allows the user to input a user defined 20-character alphanumeric name for each switch input. To enter a switch name, perform the following steps:
  - ▷ **Allow access to setpoints by enabling setpoint access.**
  - ▷ **Select the switch input message display under the subgroup S2 SYSTEM SETUP ⇨⇩ SWITCH INPUT A.**
  - ▷ **Use the VALUE keys to change the blinking character over the cursor. A space is selected like a character.**
  - ▷ **Press the ENTER key to store the character and advance the cursor to the next position. To skip over a character press the ENTER key.**
  - ▷ **Continue entering characters and spaces until the desired message is displayed. If a character is entered incorrectly, press the ENTER key repeatedly to return the cursor to the position of the error, and re-enter the character.**
- **SWITCH A(D) FUNCTION**: Select the required function for each switch input. See *Switch Inputs (Optional)* on page 2–12 for a description of each function. The "New Demand Period", "Setpoint Access", "Select Analog Out", "Select Analog In", "Pulse Input 1", "Pulse Input 2", "Pulse Input 3", "Pulse Input 4", "Clear Energy" and "Clear Demand" functions can be assigned to only one switch input at a time. If an attempt is made to assign one of these functions to more than one input, the **THIS SWITCH FUNCTION ALREADY ASSIGNED** flash message will be displayed. If an attempt is made via the serial port, no flash message will appear but an error code will be returned.

  The range of functions for the **SWITCH A(D) FUNCTION** setpoint is: Not Used, Alarm, Aux1, Aux2, Aux3, New Demand Period, Setpoint Access, Select Analog Out, Select Analog In, Pulse Input 1, Pulse Input 2, Pulse Input 3, Pulse Input 4, Clear Energy, Clear Demand.
- **SWITCH A(D) ACTIVATION**: This setpoint determines the operating sequence of the switch. Select "Open" if a switch activation is required for a switch input transition of closed to open. Select "Closed" if a switch activation is required for a switch input transition of open to closed.

- **SWITCH A(D) TIME DELAY**: If the switch input function is assigned to "Alarm", "Aux1", "Aux2", or "Aux3", this message will be displayed. Enter the required time delay in this message.

5.3.5 Pulse Output

PATH: SETPOINTS ⇨⇩ S2 SYSTEM SETUP ⇨⇩ PULSE OUTPUT

■ PULSE OUTPUT [▷]		POS kWh PULSE OUTPUT RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
	MESSAGE	POS kWh PULSE OUTPUT INTERVAL: 100 kWh	*Range: 1 to 65000 kWh in steps of 1*
	MESSAGE	NEG kWh PULSE OUTPUT RELAY: Off	*Range: Alarm, Aux1, Aux2, Aux3, Off*
	MESSAGE	NEG kWh PULSE OUTPUT INTERVAL: 100 kWh	*Range: 1 to 65000 kWh in steps of 1*
	MESSAGE	POS kvarh PULSE OUTPUT RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
	MESSAGE	POS kvarh PULSE OUTPUT INTERVAL: 100 kvarh	*Range: 1 to 65000 kvarh in steps of 1*
	MESSAGE	NEG kvarh PULSE OUTPUT RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
	MESSAGE	NEG kvarh PULSE OUTPUT INTERVAL: 100 kvarh	*Range: 1 to 65000 kvarh in steps of 1*
	MESSAGE	kVAh PULSE OUTPUT RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
	MESSAGE	kVAh PULSE OUTPUT INTERVAL: 100 kVAh	*Range: 1 to 65000 kVAh in steps of 1*
	MESSAGE	PULSE WIDTH: 100 ms	*Range: 100 to 2000 ms in steps of 10*

- **kWh / kvarh / kVAh PULSE OUTPUT RELAY**: Five pulse output parameters can be assigned to the alarm or auxiliary relays. They are positive kWh, negative kWh, positive kvarh, negative kvarh, and kVAh. Enter the desired relay to which each parameter is assigned. Select "Off" if a particular output parameter is not required.

- **KWh / kvarh / kVAh PULSE OUTPUT INTERVAL**: Enter the interval for the appropriate quantity at which the relay pulse will occur. The pulse width is set by the **PULSE WIDTH** setpoint described below. If the pulse interval is set to “100 kWh”, one pulse will indicate that 100kWh has been accumulated.
- **PULSE WIDTH**: This setpoint determines the duration of each pulse as shown in the figure below.

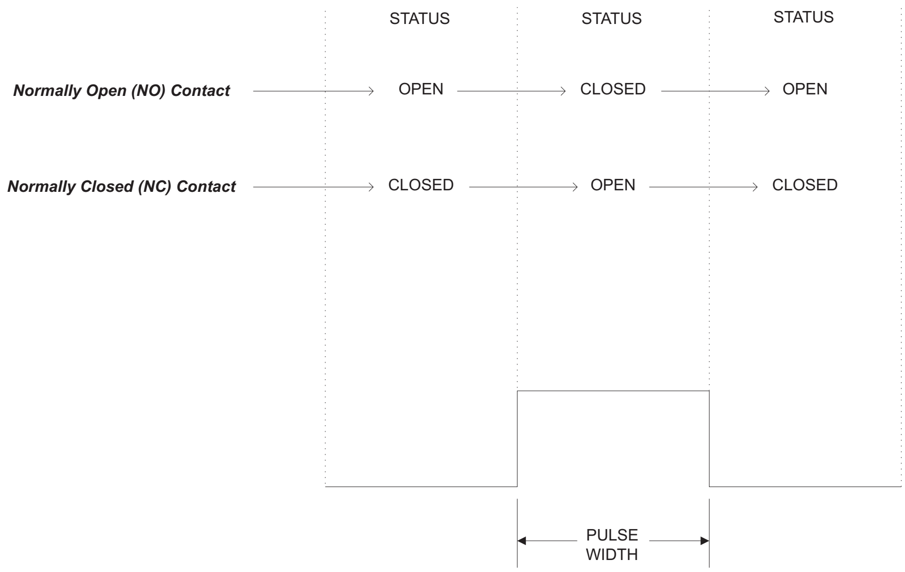
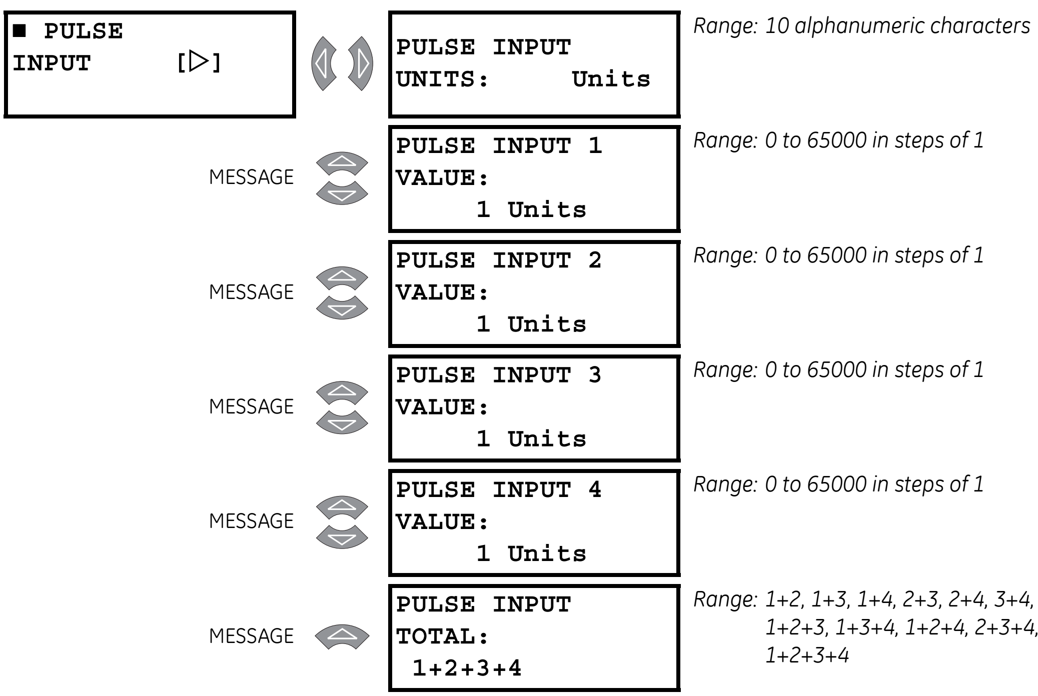


FIGURE 5–2: Pulse Output Timing

5.3.6 Pulse Input

PATH: SETPOINTS ⇨⇩ S2 SYSTEM SETUP ⇨⇩ PULSE INPUT



- **PULSE INPUT UNITS**: This message allows the user to input a user defined 10 character alphanumeric unit for the pulse inputs (i.e. kWh). The unit will be used by all pulse inputs including the totalized value. To enter the unit, perform the following steps:
    - ▷ Allow access to setpoints by enabling setpoint access.
    - ▷ Select the PULSE INPUT UNITS setpoint.
    - ▷ Use the VALUE keys to change the blinking character over the cursor. A space is selected like a character.
    - ▷ Press the ENTER key to store the character and advance the cursor to the next position. To skip over a character press the ENTER key.
    - ▷ Continue entering characters and spaces until the desired message is displayed. If a character is entered incorrectly, press the ENTER key repeatedly until the cursor returns to the incorrect position and re-enter the character.
- **PULSE INPUT 1(4) VALUE**: Enter a value in this setpoint that will be equivalent to 1 pulse input on the switch input assigned to Pulse Input 1(4); i.e., 1 pulse = 100 kWh. The accumulated value is displayed in actual values under **A1 METERING ⇨⇩ PULSE INPUT COUNTERS ⇨⇩ PULSE INPUT 1(4)**.
- **PULSE INPUT TOTAL**: This setpoint defines which pulse inputs to add together. For example, if the selection is this setpoint is "1+2+3", the **PULSE INPUT 1**, **PULSE INPUT 2** and **PULSE INPUT 3** values shown in **A1 METERING ⇨⇩ PULSE INPUT COUNTERS ⇨⇩ PULSE INPUT 1(4)** will be added together and displayed in **A1 METERING ⇨⇩ PULSE INPUT COUNTERS ⇨⇩ PULSE IN 1+2+3**.

5.3.7 Data Logger

PATH: SETPOINTS ⇨⇩ S2 SYSTEM SETUP ⇨⇩ DATA LOGGER

```
■ DATA
LOGGER      [▷]
```

```
STOP DATA LOG 1:
NO       (STOPPED
)
```
Range: No, Yes

MESSAGE

```
STOP DATA LOG 2:
NO       (STOPPED
)
```
Range: No, Yes

The data logger operation is only configurable using the EnerVista PQMII Setup Software. On occasions it may be necessary to stop the data loggers using the PQMII keypad and then a computer to extract the logged information. The **STOP DATA LOG 1(2)** setpoints allow the user to stop the respective data log. These setpoints also display the current status of the respective data logger. Refer to *Data Logger Implementation* on page 8–9 for a detailed implementation description.

5.3.8 Voltage Disturbance

PATH: SETPOINTS ⇨⇩ S2 SYSTEM SETUP ⇨⇩ VOLTAGE DIST. RECORDER

```
■ VOLTAGE
DIST.    [▷]
  RECORDER
```

```
SAG
LEVEL ≤ 80% Nomi-
nal
```

Range: 20 to 90% of Nominal VT in steps of 1

MESSAGE

```
SWELL
LEVEL ≥ 130% Nom-
inal
```

Range: 110 to 150% of Nominal VT in steps of 1

- **SAG LEVEL**: When the voltage on any phase drops below this level a Sag condition occurs. During this condition, the average voltage and duration of the disturbance are calculated. The condition ends when the level increases to at least 10% of nominal plus pickup of the **SAG LEVEL** setting. This hysteresis is implemented to avoid nuisance alarms due to voltage fluctuations. If the duration logged was less then or equal to 1 minute an event with a sag type will be logged. If the duration was greater then 1 minute an event with an undervoltage type will be logged when this feature is configured.
- **SWELL LEVEL**: When the voltage on any phase increases above this level a swell condition occurs. During a swell condition the average voltage and duration of the disturbance are calculated. To end a Swell condition the level must decrease to pickup minus 10% of nominal of the **SWELL LEVEL** setting. This hysteresis is implemented to avoid nuisance alarms due to voltage fluctuations. If the duration logged was less then or equal to 1 minute an event with a swell type will be logged. If the duration was greater then 1 minute an event with an overvoltage type will be logged when this feature is configured.

5.4 S3 Output Relays

5.4.1 Description

Output relay operation in the PQMII occurs in either 'failsafe' or 'non-failsafe' modes, as defined below:

- **Non-failsafe**: The relay coil is not energized in its non-active state. Loss of control power will cause the relay to remain in the non-active state. That is, a non-failsafe alarm relay will not cause an alarm on loss of control power. Contact configuration in the Wiring Diagrams is shown with relays programmed non-failsafe and control power not applied.
- **Failsafe**: The relay coil is energized in its non-active state. Loss of control power will cause the relay to go into its active state. That is, a failsafe alarm relay will cause an alarm on loss of control power. Contact configuration is opposite to that shown in the Wiring Diagrams for relays programmed as failsafe when control power is applied.

5.4.2 Alarm Relay

PATH: SETPOINTS ⇨⇩ S3 OUTPUT RELAYS ⇨ ALARM RELAY

```
■ ALARM
RELAY      [▷]
```

```
ALARM OPERATION:
 NON-FAILSAFE
```

Range: Non-failsafe, Failsafe

MESSAGE

```
ALARM ACTIVATION:
 UNLATCHED
```

Range: Unlatched, Latched

- **ALARM OPERATION**: The terms 'failsafe' and 'non-failsafe' are defined above as implemented in the PQMII. If an alarm is required when the PQMII is not operational due to a loss of control power, select failsafe operation. Otherwise, choose non-failsafe.
- **ALARM ACTIVATION**: If an alarm indication is required only while an alarm is present, select unlatched. Once the alarm condition disappears, the alarm and associated message automatically clear. To ensure all alarms are acknowledged, select latched. Even if an alarm condition is no longer present, the alarm relay and message can only be cleared by pressing the key or by sending the reset command via the computer.

5.4.3 Auxiliary Relays

PATH: SETPOINTS ⇨⇩ S3 OUTPUT RELAYS ⇨ AUXILIARY RELAY 1(3)

```
■
AUXILIARY        [
▷]
  RELAY 1
```

```
AUX1 OPERATION:
 NON-FAILSAFE
```

Range: Non-failsafe, Failsafe

MESSAGE

```
AUX1 ACTIVATION:
 UNLATCHED
```

Range: Unlatched, Latched

The PQMII contains three (3) auxiliary relays, denoted as Aux1 through Aux3. The terms 'failsafe' and 'non-failsafe' are defined in the previous section.

- **AUXILIARY 1(3) OPERATION**: If an output is required when the PQMII is not operational due to a loss of control power, select failsafe auxiliary operation, otherwise, choose non-failsafe.
- **AUXILIARY 1(3) ACTIVATION**: If an auxiliary relay output is only required while the selected conditions are present, select "Unlatched". Once the selected condition disappears, the auxiliary relay returns to the non-active state. To ensure all conditions are acknowledged, select "Latched". If the condition is no longer present, the auxiliary relay can be reset by pressing the key or by sending the reset command via the computer.

NOTE

The PQMII uses a priority system to determine which function will control the relays if they happen to be assigned to more than one function.

The Pulse Output function has the highest activation priority, followed by the Analog Input Main/Alt Select functions. The alarm functions have the lowest priority. For example, if a relay is assigned to an alarm function and also assigned to one of the pulse output parameters, it only responds to the pulse output function.

5.5 S4 Alarms/Control

5.5.1 Current/Voltage Alarms

PATH: SETPOINTS ⇨⇩ S4 ALARMS/CONTROL ⇨ CURRENT/VOLTAGE

Display	Range
■ CURRENT/ [▷] VOLTAGE → DETECT I/V ALARMS USING PERCENTAGE: NO	*Range: No, Yes*
MESSAGE: PHASE UNDERCURRENT RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE: PHASE UNDERCURRENT LEVEL ≤ 100 A	*Range: 1 to 12000 A in steps of 1, or 1 to 100% of CT in steps of 1, set by the* **DETECT I/V ALARMS USING PERCENTAGE** *value.*
MESSAGE: PHASE UNDERCURRENT DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*
MESSAGE: DETECT UNDERCURRENT WHEN 0A: NO	*Range: No, Yes*
MESSAGE: PHASE OVERCURRENT RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE: PHASE OVERCURRENT LEVEL ≥ 100 A	*Range: 1 to 12000 A in steps of 1, or 1 to 150% of CT in steps of 1, set by the* **DETECT I/V ALARMS USING PERCENTAGE** *value.*
MESSAGE: PHASE OVERCURRENT DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*
MESSAGE: PHASE OVERCURRENT ACTIVATION: AVERAGE	*Range: Average, Maximum*
MESSAGE: NEUTRAL OVERCURRENT RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE: NEUTRAL OVERCURRENT LEVEL ≥ 100 A	*Range: 1 to 12000 A in steps of 1, or 1 to 150% of CT in steps of 1, set by the* **DETECT I/V ALARMS USING PERCENTAGE** *value.*
MESSAGE: NEUTRAL OVERCURRENT DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*

MESSAGE	UNDERVOLTAGE RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE	UNDERVOLTAGE LEVEL ≤ 100 V	*Range: 20 to 65000 V in steps of 1, or 20 to 100% of VT in steps of 1, set by the* **DETECT I/V ALARMS USING PERCENTAGE** *value.*
MESSAGE	UNDERVOLTAGE DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*
MESSAGE	PHASES REQ'D FOR U/V OPERATION: ANY ONE	*Range: Any One, Any Two, All Three. Not seen when* **VT WIRING** *is set to "Single Phase Direct"*
MESSAGE	DETECT UNDERVOLT- AGE BELOW 20V: NO	*Range: No, Yes*
MESSAGE	OVERVOLTAGE RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE	OVERVOLTAGE LEVEL ≥ 100 V	*Range: 20 to 65000 V in steps of 1, or 20 to 150% of VT in steps of 1, set by the* **DETECT I/V ALARMS USING PERCENTAGE** *value.*
MESSAGE	OVERVOLTAGE DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*
MESSAGE	PHASES REQ'D FOR O/V OPERATION: ANY ONE	*Range: Any One, Any Two, All Three. Not seen when* **VT WIRING** *is set to "Single Phase Direct"*
MESSAGE	CURRENT UNBALANCE RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE	CURRENT UNBALANCE LEVEL ≥ 100%	*Range: 1 to 100% in steps of 1*
MESSAGE	CURRENT UNBALANCE DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*
MESSAGE	VOLTAGE UNBALANCE RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE	VOLTAGE UNBALANCE LEVEL ≥ 100%	*Range: 1 to 100% in steps of 1*
MESSAGE	VOLTAGE UNBALANCE DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*
MESSAGE	VOLTS PHASE REVERSAL RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE	VOLTS PHASE REVERSAL DELAY: 1.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*

- **DETECT I/V ALARMS USING PERCENTAGE**: When “Yes” is selected, all current and voltage alarms can be set in percentages of CT and VT. When “No” is selected, all current and voltage alarms are actual voltage and current levels.
- **PHASE UNDERCURRENT RELAY**: Undercurrent can be disabled, used as an alarm, or as a process control feature. Set this setpoint to “Off” if the feature is not required. Selecting “Alarm” activates the alarm relay and displays an alarm message whenever an undercurrent condition exists. Selecting an auxiliary relay activates the selected auxiliary relay for an undercurrent condition but no message will be displayed. This is intended for process control.
- **PHASE UNDERCURRENT LEVEL**: When the average three phase current drops to or below the level set by this setpoint, a phase undercurrent condition will occur. Refer to the DETECT UNDERCURRENT WHEN 0A setpoint description below to enable/disable undercurrent detection below 5% of CT.
- **PHASE UNDERCURRENT DELAY**: If the average phase current is less than or equal to the PHASE UNDERCURRENT LEVEL setpoint value for the time delay programmed in this setpoint, a phase undercurrent condition will occur.
- **DETECT UNDERCURRENT WHEN 0A**: If this setpoint is set to “Yes”, undercurrent will be detected if the average phase current drops below 5% of CT. If the setting is “No”, the undercurrent detection is only enabled if the average phase current is equal to or above 5% of CT.
- **PHASE OVERCURRENT RELAY**: Overcurrent can either be disabled, used as an alarm or as a process control. Set this setpoint to “Off” if the feature is not required. Selecting “Alarm” activates the alarm relay and displays an alarm message whenever an overcurrent condition exists. Selecting an auxiliary relay activates the auxiliary relay for an overcurrent condition but no message will be displayed. This is intended for process control.
- **PHASE OVERCURRENT LEVEL**: When the average (or maximum, see below) three phase current equals or exceeds the level set by this setpoint, a phase overcurrent condition will occur.
- **PHASE OVERCURRENT DELAY**: If the average (or maximum, see below) phase current equals or exceeds the PHASE OVERCURRENT LEVEL setpoint value and remains this way for the time delay programmed in this setpoint, a phase overcurrent condition will occur.
- **PHASE OVERCURRENT ACTIVATION**: The Phase Overcurrent function can use either the average phase current or the maximum of the three phase currents. This setpoint determines which is used.
- **NEUTRAL OVERCURRENT RELAY**: Neutral overcurrent can be disabled, used as an alarm, or used as a process control. Set this setpoint to “Off” if the feature is not required. Selecting “Alarm” activates the alarm relay and displays an alarm message whenever a neutral overcurrent condition exists. Selecting an auxiliary relay activates the auxiliary relay for a neutral overcurrent condition but no message will be displayed. This is intended for process control.
- **NEUTRAL OVERCURRENT LEVEL**: When the neutral current equals or exceeds the level set by this setpoint, a neutral overcurrent condition will occur.
- **NEUTRAL OVERCURRENT DELAY**: If the neutral current greater than or equal to the NEUTRAL OVERCURRENT LEVEL setpoint value for the time delay programmed in this setpoint, a neutral overcurrent condition will occur.

- **UNDERVOLTAGE RELAY**: Undervoltage can either be disabled, used as an alarm, or as a process control. Set this setpoint to “Off” if the feature is not required. Selecting “Alarm” activates the alarm relay and displays an alarm message whenever an undervoltage condition exists. Selecting an auxiliary relay activates the auxiliary relay for an undervoltage condition but no message will be displayed. This is intended for process control.
- **UNDERVOLTAGE LEVEL**: When the voltage on one, two, or three phases drops to or below this level, an undervoltage condition occurs. The required number of phases is determined by the **PHASES REQUIRED FOR U/V OPERATION** setpoint. To clear the undervoltage condition, the level must increase to 103% of the **UNDERVOLTAGE LEVEL** setting. For example, if the **UNDERVOLTAGE LEVEL** is “4000 V”, the condition clears when the voltage in the appropriate phase(s) increases above 4120 V (4000 × 1.03). This hysteresis is implemented to avoid nuisance alarms due to voltage fluctuations.
- **UNDERVOLTAGE DELAY**: If the voltage drops to or below the **UNDERVOLTAGE LEVEL** setpoint value and remains this way for the time delay programmed in this setpoint, an undervoltage condition will occur.
- **PHASES REQ’D FOR U/V OPERATION**: Select the minimum number of phases on which the undervoltage condition must be detected before the selected output relay will operate. This setpoint is not visible if **VT WIRING** is set to “Single Phase Direct”.
- **DETECT UNDERVOLTAGE BELOW 20V**: If an indication is required for loss of voltage, select “Yes”. If “No” is selected and any one of the voltage inputs has less than 20 V applied, the undervoltage feature will be disabled.
- **OVERVOLTAGE RELAY**: Overvoltage can either be disabled, used as an alarm, or as a process control. Set this setpoint to “Off” if the feature is not required. Selecting “Alarm” activates the alarm relay and displays an alarm message whenever an overvoltage condition exists. Selecting an auxiliary relay activates the auxiliary relay for an overvoltage condition but no message will be displayed. This is intended for process control.
- **OVERVOLTAGE LEVEL**: When the voltage on one, two, or three phases equals or exceeds the level determined with this setpoint, an overvoltage condition occurs. The required number of phases is determined by the **PHASES REQUIRED FOR O/V OPERATION** setpoint. To clear the overvoltage condition, the level must decrease to 97% of the **OVERVOLTAGE LEVEL** setting. For example, if the **OVERVOLTAGE LEVEL** is set to “4200 V”, the condition clears when the voltage in the appropriate phase(s) goes below 4074 V (4200 × 0.97). This hysteresis is implemented to avoid nuisance alarms due to voltage fluctuations.
- **OVERVOLTAGE DELAY**: If the voltage equals or exceeds the **OVERVOLTAGE LEVEL** setpoint value for the time delay programmed in this setpoint, an overvoltage condition will occur.
- **PHASES REQ’D FOR O/V OPERATION**: Select the minimum number of phases on which the overvoltage condition must be detected before the selected output relay operates. This setpoint is not visible if **VT WIRING** is set to “Single Phase Direct”.
- **CURRENT UNBALANCE RELAY**: Current unbalance is calculated as the maximum deviation from the average divided by the average three phase current. Current unbalance can either be disabled, used as an alarm, or as a process control. Set this setpoint to “Off” if the feature is not required. Selecting “Alarm” activates the alarm relay and displays an alarm message whenever a current unbalance condition exists.

Selecting an auxiliary relay activates the auxiliary relay for a current unbalance condition but no message will be displayed. This is intended for process control.

- **CURRENT UNBALANCE LEVEL**: When the current unbalance equals or exceeds this level, a current unbalance condition will occur. See *Current Metering* on page 6–3 for details on the method of calculation.
- **CURRENT UNBALANCE DELAY**: If the current unbalance equals or exceeds the **CURRENT UNBALANCE LEVEL** value for the time delay programmed in this setpoint, a current unbalance condition occurs.
- **VOLTAGE UNBALANCE RELAY**: Voltage unbalance is calculated as the maximum deviation from the average divided by the average three phase voltage. Voltage unbalance can either be disabled, used as an alarm, or as a process control. Set this setpoint to “Off” if the feature is not required. Selecting “Alarm” activates the alarm relay and displays an alarm message whenever a voltage unbalance condition exists. Selecting an auxiliary relay activates the auxiliary relay for a voltage unbalance condition but no message will be displayed. This is intended for process control.
- **VOLTAGE UNBALANCE LEVEL**: When the voltage unbalance equals or exceeds this level, a voltage unbalance condition occurs. See *Voltage Metering* on page 6–4 for details on the method of calculation.
- **VOLTAGE UNBALANCE DELAY**: If the voltage unbalance equals or exceeds the **VOLTAGE UNBALANCE LEVEL** setpoint value and remains this way for the time delay programmed in this setpoint, a voltage unbalance condition will occur.
- **VOLTAGE PHASE REVERSAL**: Under normal operating conditions, the PQMII expects to see the voltages connected with a 1-2-3 or A-B-C sequence. If the voltages are connected with the wrong sequence (e.g. 2-1-3 or B-A-C), a voltage phase reversal condition will occur. A minimum of 20 V must be applied to the PQMII on all voltage inputs before the phase reversal feature will operate.

  A phase reversal condition is determined by looking at the phase angle at the occurrence of the peak sample of phase B voltage and subtracting it from the phase angle at the peak sample of phase A voltage (phase A angle – phase B angle). This angle is averaged over several cycles before deciding on the condition to avoid any false triggering of the feature. Only two phases are required to detect phase reversal because all phase reversal conditions can be covered without the use of the third phase. The angle to detect phase reversal will vary depending on the connection being used as described below.

For “4-Wire Wye / 3 VTs”, “4 Wire Wye / 2 VTs”, “4 Wire Direct”, and “3 Wire Direct” connections, the phase reversal function operates when the angle between phase A and B becomes ≤ –150° or ≥ –90° as shown below.

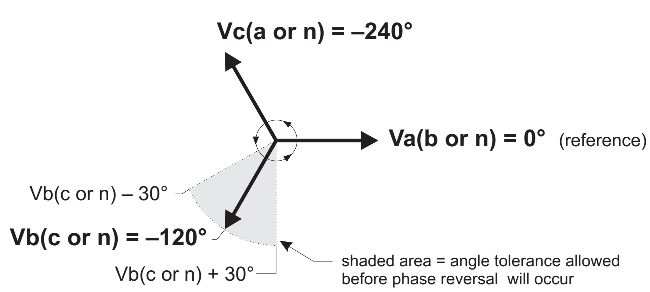


FIGURE 5–3: Phase Reversal for 4-wire and 3-wire Direct Connections

For the “3 Wire Delta / 2 VTs” connection, the phase reversal function operates when the angle between phase A and B is ≤30° or ≥90° as shown below.

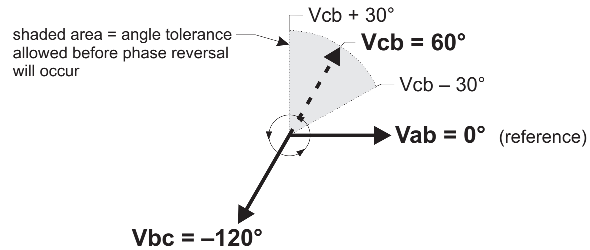


FIGURE 5–4: Phase Reversal for 3-wire Delta (2 VTs Open-Delta) Wiring

When the “Single Phase Direct” connection is used the phase reversal feature will never operate.

- **VOLTAGE PHASE REVERSAL DELAY**: If a voltage phase reversal exists for the time programmed in this setpoint a voltage phase reversal condition will occur.

5.5.2 Harmonic Distortion

PATH: SETPOINTS ⇨⇩ S4 ALARMS/CONTROL ⇨⇩ TOTAL HARMONIC DISTORTION

■ TOTAL HARMONIC [▷] DISTORTION		AVERAGE CURRENT THD RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
	MESSAGE	AVERAGE CURRENT THD LEVEL ≥ 10.0 %	*Range: 0.5 to 100.0% in steps of 0.5*
	MESSAGE	AVERAGE CURRENT THD DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*
	MESSAGE	AVERAGE VOLTAGE THD RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
	MESSAGE	AVERAGE VOLTAGE THD LEVEL ≥ 10.0 %	*Range: 0.5 to 100.0% in steps of 0.5*
	MESSAGE	AVERAGE VOLTAGE THD DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*

- **AVERAGE CURRENT THD RELAY**: Excessive phase current THD detection can either be disabled, used as an alarm, or as a process control. Set this setpoint to “Off” if the feature is not required. Selecting “Alarm” activates the alarm relay and displays an alarm message whenever an excessive average current THD condition exists. Selecting an auxiliary relay activates the auxiliary relay, but no message will be displayed. This is intended for process control.
- **AVERAGE CURRENT THD LEVEL**: When the measured average current THD exceeds this setpoint value, an average current THD condition occurs.

- **AVERAGE CURRENT THD DELAY**: If the average current THD exceeds the **AVERAGE CURRENT THD LEVEL** for the time delay programmed in this setpoint, an average current THD condition occurs.
- **AVERAGE VOLTAGE THD RELAY**: Average voltage THD detection can either be disabled, used as an alarm or as a process control. Set this setpoint to off if the feature is not required. Selecting alarm relay will cause the alarm relay to activate and display an alarm message whenever an average voltage THD condition exists. Selecting auxiliary relay will cause the auxiliary relay to activate, but no message will be displayed. This is intended for process control.
- **AVERAGE VOLTAGE THD LEVEL**: When the measured average voltage THD equals or exceeds this setpoint value, an Average Voltage THD condition occurs.
- **AVERAGE VOLTAGE THD DELAY**: If the average voltage THD equals or exceeds the **AVERAGE VOLTAGE THD LEVEL** value and remains this way for the time delay programmed in this setpoint, an Average Voltage THD condition will occur.

5.5.3 Frequency

PATH: SETPOINTS ⇨⇩ S4 ALARMS/CONTROL ⇨⇩ FREQUENCY

■ FREQUENCY [▷]	UNDERFREQUENCY RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE	UNDERFREQUENCY LEVEL ≤ 40.00 Hz	*Range: 20.00 to 70.00 Hz in steps of 0.01*
MESSAGE	UNDERFREQUENCY DELAY: 1.0 s	*Range: 0.1 to 10.0 s in steps of 0.1*
MESSAGE	UNDERFREQUENCY WHEN FREQUENCY=0 Hz: NO	*Range: Yes, No*
MESSAGE	OVERFREQUENCY RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE	OVERFREQUENCY LEVEL ≥ 70.00 Hz	*Range: 20.00 to 125.00 Hz in steps of 0.01*
MESSAGE	OVERFREQUENCY DELAY: 1.0 s	*Range: 0.1 to 10.0 s in steps of 0.1*

- **UNDERFREQUENCY RELAY**: Underfrequency detection can either be disabled or used as an alarm, or process control. Set this setpoint to “Off” if the feature is not required. Selecting alarm relay will cause the alarm relay to activate and display an alarm message whenever an underfrequency condition exists. Selecting an auxiliary relay activates the auxiliary relay for an underfrequency condition, but no message will be displayed. This is intended for process control.
- **UNDERFREQUENCY LEVEL**: When the measured frequency drops to or below the level set by this setpoint, an underfrequency condition will occur.

- **UNDERFREQUENCY DELAY**: If the underfrequency drops to or below the UNDERFREQUENCY LEVEL value for the time delay programmed in this setpoint, an underfrequency condition will occur.
- **UNDERFREQUENCY WHEN FREQ=0 Hz**: A voltage greater than 20 V is required on phase AN (AB) voltage input before frequency can be measured. If no voltage is applied or if the voltage applied is less than 20 V, the displayed frequency will be 0 Hz. If “No” is selected in this setpoint, an underfrequency condition will not occur when the displayed frequency is 0 Hz.
- **OVERFREQUENCY RELAY**: Overfrequency detection can either be disabled, used as an alarm or as a process control. Set this setpoint to off if the feature is not required. Selecting alarm relay will cause the alarm relay to activate and display an alarm message whenever an overfrequency condition exists. Selecting auxiliary relay will cause the auxiliary relay to activate for an overfrequency condition, but no message will be displayed. This is intended for process control.
- **OVERFREQUENCY LEVEL**: When the measured frequency equals or exceeds the level set by this setpoint, an overfrequency condition will occur.
- **OVERFREQUENCY DELAY**: If the overfrequency equals or exceeds the OVERFREQUENCY LEVEL setpoint value for the time delay programmed in this setpoint, an overfrequency condition will occur.

5.5.4 Power Alarms

PATH: SETPOINTS ⇨⇩ S4 ALARMS/CONTROL ⇨⇩ POWER

	Display	Range
■ POWER [▷]	POWER ALARMS LEVEL BASE UNIT(s): kW/kvar	*Range: kW/kvar, MW, Mvar*
MESSAGE	POSITIVE REAL POWER RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE	POSITIVE REAL POWER LEVEL ≥ 1000 kW	*Range: 1 to 65000 kW in steps of 1, or 0.01 to 650.00 MW in steps of 0.01*
MESSAGE	POSITIVE REAL POWER DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*
MESSAGE	NEGATIVE REAL POWER RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE	NEGATIVE REAL POWER LEVEL ≥ 1000 kW	*Range: 1 to 65000 kW in steps of 1, or 0.01 to 650.00 MW in steps of 0.01*
MESSAGE	NEGATIVE REAL POWER DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*

MESSAGE	POSITIVE REACT POWER RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE	POSITIVE REACT POWER LEVEL ≥ 1000 kvar	*Range: 1 to 65000 kvar in steps of 1, or 0.01 to 650.00 Mvar in steps of 0.01*
MESSAGE	POSITIVE REACT POWER DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*
MESSAGE	NEGATIVE REACT POWER RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE	NEGATIVE REACT POWER LEVEL ≥ 1000 kvar	*Range: 1 to 65000 kvar in steps of 1, or 0.01 to 650.00 Mvar in steps of 0.01*
MESSAGE	NEGATIVE REACT POWER DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*

- **POWER ALARMS LEVEL BASE UNIT(S)**: This setpoint is used to select the base unit multiplier for all power alarms. When set to kW/kvar, all power alarm levels can be set in terms of kW and kvar with a step value of 1 kW/kvar. When set to MW/Mvar, all power alarm levels can be set in terms of MW and Mvar with a step value of 0.01 MW/Mvar.
- **POSITIVE/NEGATIVE REAL POWER RELAY**: The positive and negative real power level detection can be disabled, used as an alarm, or used as a process control. The "Off" setting disables this feature. Selecting "Alarm" activates the alarm relay and displays an alarm message whenever a positive/negative real power level exceeds the selected level. Selecting an auxiliary relay activates the auxiliary relay for a set level of positive/negative real power but no message will be displayed. This is intended for process control.
- **POSITIVE/NEGATIVE REAL POWER LEVEL**: When the three phase real power equals or exceeds the level defined by this setpoint, an excess positive/negative real power condition will occur.
- **POSITIVE/NEGATIVE REAL POWER DELAY**: If the positive/negative real power equals or exceeds the **POSITIVE/NEGATIVE REAL POWER LEVEL** setpoint value for the time delay programmed in this setpoint, an excessive positive/negative real power condition will occur.
- **POSITIVE/NEGATIVE REACTIVE POWER RELAY**: Positive and negative reactive power level detection can either be disabled, used as an alarm, or as a process control. Set this setpoint to "Off" if the feature is not required. Selecting "Alarm" activates the alarm relay and displays an alarm message whenever a positive/negative reactive power level exceeds the selected level. Selecting an auxiliary relay activates the auxiliary relay for a set level of positive/negative reactive power but no message will be displayed. This is intended for process control.

- **POSITIVE/NEGATIVE REACTIVE POWER LEVEL**: When the three phase reactive power equals or exceeds the level set by this setpoint, an excess positive/negative reactive power condition will occur.
- **POSITIVE/NEGATIVE REACTIVE POWER DELAY**: If the positive reactive power equals or exceeds the **POSITIVE/NEGATIVE REACTIVE POWER LEVEL** setpoint value for the time delay programmed in this setpoint, an excessive positive reactive power condition will occur.

5.5.5 Power Factor

PATH: SETPOINTS ⇨⇩ S4 ALARMS/CONTROL ⇨⇩ POWER FACTOR

■ POWER FACTOR [▷]	◁ ▷	POWER FACTOR LEAD 1 RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
	MESSAGE	POWER FACTOR LEAD 1 PICKUP ≤ 0.99	*Range: 0.50 to 1.00 in steps of 0.01*
	MESSAGE	POWER FACTOR LEAD 1 DROPOUT ≥ 1.00	*Range: 0.50 to 1.00 in steps of 0.01*
	MESSAGE	POWER FACTOR LEAD 1 DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*
	MESSAGE	POWER FACTOR LAG 1 RELAY: Off	*Range: Alarm, Aux1, Aux2, Aux3, Off*
	MESSAGE	POWER FACTOR LAG 1 PICKUP ≤ 0.99	*Range: 0.50 to 1.00 in steps of 0.01*
	MESSAGE	POWER FACTOR LAG 1 DROPOUT ≥ 1.00	*Range: 0.50 to 1.00 in steps of 0.01*
	MESSAGE	POWER FACTOR LAG 1 DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*
	MESSAGE	POWER FACTOR LEAD 2 RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
	MESSAGE	POWER FACTOR LEAD 2 PICKUP ≤ 0.99	*Range: 0.50 to 1.00 in steps of 0.01*
	MESSAGE	POWER FACTOR LEAD 2 DROPOUT ≥ 1.00	*Range: 0.50 to 1.00 in steps of 0.01*
	MESSAGE	POWER FACTOR LEAD 2 DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*
	MESSAGE	POWER FACTOR LAG 2 RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
	MESSAGE	POWER FACTOR LAG 2 PICKUP ≤ 0.99	*Range: 0.50 to 1.00 in steps of 0.01*

MESSAGE	**POWER FACTOR LAG 2 DROPOUT ≥ 1.00**	*Range: 0.50 to 1.00 in steps of 0.01*
MESSAGE	**POWER FACTOR LAG 2 DELAY: 10.0 s**	*Range: 0.5 to 600.0 s in steps of 0.5*

It is generally desirable for a system operator to maintain the power factor as close to unity as possible (that is, to make the real power of the system as close as possible to the apparent power) to minimize both costs and voltage excursions. On dedicated circuits such as some large motors, with a near-fixed load, a capacitor bank may be switched on or off with the motor to supply leading vars to compensate for the lagging vars required by the motor. Since the power factor is variable on common non-dedicated circuits, it is advantageous to compensate for low (lagging) power factor values by connecting a capacitor bank to the circuit when required. The PQMII provides power factor monitoring and allows two stages of capacitance switching for power factor compensation.

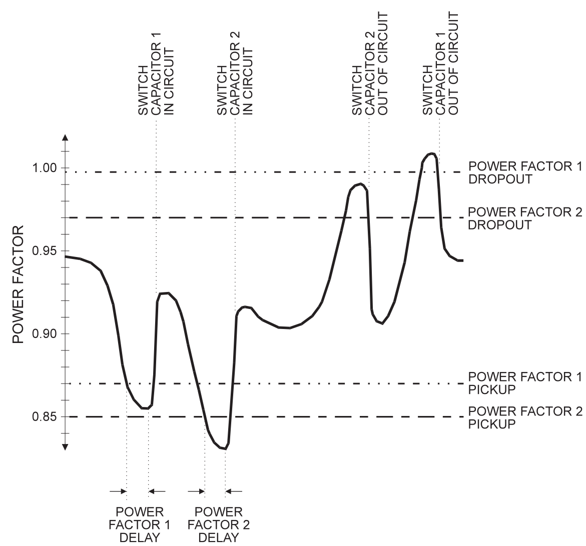


FIGURE 5–5: Capacitor Bank Switching

The PQMII calculates the average power factor in the three phases, according to the following equation:

$$\text{Average Power Factor} = \frac{\text{Total 3-phase Real Power}}{\text{Total 3-phase Apparent Power}} \qquad \textbf{(EQ 5.2)}$$

Two independent ‘elements’ are available for monitoring power factor, Power Factor 1 and Power Factor 2, each having a pickup and a dropout level. For each element, when the measured power factor is equal to or becomes more lagging than the pickup level (i.e. numerically less than), the PQMII will operate a user-selected output relay. This output can be used to control a switching device which connects capacitance to the circuit, or to signal an alarm to the system operator. After entering this state, when the power factor becomes less lagging than the power factor dropout level, the PQMII will reset the output relay to the non-operated state.

Both Power Factor 1 and 2 features are inhibited from operating unless all three voltages are above 20% of nominal and one or more currents is above 0. Power factor 1 and 2 delay timers will be allowed to time only when the 20% threshold is exceeded on all phases (and, of course, only while the power factor remains outside of the programmed pickup and dropout levels). In the same way, when a power factor condition starts the power factor 1 or 2 delay timer, if all three phase voltages fall below the 20% threshold before the timer has timed-out, the element will reset without operating. A loss of voltage during any state will return both Power Factor 1 and 2 to the reset state.

- **POWER FACTOR LEAD 1(2) RELAY**: Power factor detection can either be disabled, used as an alarm or as a process control. Set this setpoint to “Off” if the feature is not required. Selecting “Alarm” activates the alarm relay and displays an alarm message when the power factor is more leading than the level set. Selecting “Aux1”, “Aux2”, or “Aux3” activates the respective auxiliary relay when the power factor is equal to or more leading than the level set, but no message will be displayed. This is intended for process control. A minimum of 20 V applied must exist on all voltage inputs before this feature will operate.
- **POWER FACTOR LEAD 1(2) PICKUP**: When a leading power factor equals or exceeds the level set by this setpoint, a Power Factor Lead 1(2) condition will occur.
- **POWER FACTOR LEAD 1(2) DROPOUT**: When a leading power factor drops below this level, the Power Factor Lead 1(2) condition will drop out.
- **POWER FACTOR LEAD 1(2) DELAY**: If the power factor equals or exceeds the **POWER FACTOR LEAD 1(2) PICKUP** setpoint value and remains this way for the time delay programmed in this setpoint, a Power Factor Lead 1(2) condition will occur.

  If the power factor drops below the **POWER FACTOR LEAD 1(2) DROPOUT** setpoint value, the power factor lead 1(2) condition will drop out. If the **POWER FACTOR LEAD 1(2) RELAY** setpoint is set to “Alarm”, the alarm relay will deactivate and the **POWER FACTOR LEAD 1(2) ALARM** message will be cleared. If the **POWER FACTOR LEAD 1(2) RELAY** setpoint is set to “Aux1”, “Aux2”, or “Aux3,” the respective auxiliary relay deactivates.
- **POWER FACTOR LAG 1(2) RELAY**: Power factor detection can either be disabled, used as an alarm or as a process control. Set this setpoint to “Off” if the feature is not required. Selecting “Alarm” activates the alarm relay and displays an alarm message when the power factor is more lagging than the level set. Selecting “Aux1”, “Aux2”, or “Aux3” activates the respective auxiliary relay when the power factor is equal to or more lagging than the level set, but no message will be displayed. This is intended for process control. A minimum of 20 V applied must exist on all voltage inputs before this feature will operate.
- **POWER FACTOR LAG 1(2) PICKUP**: When a lagging power factor equals or exceeds the level set by this setpoint, a Power Factor Lag 1(2) condition will occur.
- **POWER FACTOR LAG 1(2) DROPOUT**: When a lagging power factor drops below this level, the Power Factor Lag 1(2) condition will drop out.
- **POWER FACTOR LAG 1(2) DELAY**: If the power factor equals or exceeds the **POWER FACTOR LAG 1/2 PICKUP** setpoint value and remains this way for the time delay programmed in this setpoint, a Power Factor Lag 1(2) condition will occur.

If the power factor drops below the **POWER FACTOR LAG 1(2) DROPOUT** setpoint value, the Power Factor 1(2) lag condition will drop out. If the **POWER FACTOR LAG 1(2) RELAY** setpoint is set to “Alarm”, the alarm relay will deactivate and the **POWER FACTOR LAG 1(2) ALARM** message will be cleared. If the **POWER FACTOR LAG 1(2) RELAY** setpoint is set to “Aux1”, “Aux2”. or “Aux3”, the respective auxiliary relay will deactivate.

5.5.6 Demand Alarms

PATH: SETPOINTS ⇨⇩ S4 ALARMS/CONTROL ⇨⇩ DEMAND

■ DEMAND [▷]		PHASE A CURRENT DMD RELAY: OFF	Range: Alarm, Aux1, Aux2, Aux3, Off
MESSAGE		PHASE A CURRENT DMD LEVEL ≥ 100 A	Range: 10 to 7500 A in steps of 1
MESSAGE		PHASE B CURRENT DMD RELAY: OFF	Range: Alarm, Aux1, Aux2, Aux3, Off
MESSAGE		PHASE B CURRENT DMD LEVEL ≥ 100 A	Range: 10 to 7500 A in steps of 1
MESSAGE		PHASE C CURRENT DMD RELAY: OFF	Range: Alarm, Aux1, Aux2, Aux3, Off
MESSAGE		PHASE C CURRENT DMD LEVEL ≥ 100 A	Range: 10 to 7500 A in steps of 1
MESSAGE		NEUTRAL CURRENT DMD RELAY: OFF	Range: Alarm, Aux1, Aux2, Aux3, Off
MESSAGE		NEUTRAL CURRENT DMD LEVEL ≥ 100 A	Range: 10 to 7500 A in steps of 1
MESSAGE		3Φ POS REAL PWR DMD RELAY: OFF	Range: Alarm, Aux1, Aux2, Aux3, Off
MESSAGE		3Φ POS REAL PWR DMD LEVEL ≥ 1000 kW	Range: 1 to 65000 kW in steps of 1
MESSAGE		3Φ POS REACT PWR DMD RELAY: OFF	Range: Alarm, Aux1, Aux2, Aux3, Off

	Display	Range
MESSAGE	3Φ POS REACT PWR DMD LEVEL ≥ 1000 kvar	*Range: 1 to 65000 kvar in steps of 1*
MESSAGE	3Φ NEG REAL PWR DMD RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE	3Φ NEG REAL PWR DMD LEVEL ≥ 1000 kW	*Range: 1 to 65000 kW in steps of 1*
MESSAGE	3Φ NEG REACT PWR DMD RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE	3Φ NEG REACT PWR DMD LEVEL ≥ 1000 kvar	*Range: 1 to 65000 kvar in steps of 1*
MESSAGE	3Φ APPARENT PWR DMD RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE	3Φ APPARENT PWR DMD LEVEL ≥ 1000 kVA	*Range: 1 to 65000 kVA in steps of 1*

- **PHASE A/B/C/NEUTRAL CURRENT DMD RELAY**: Phase/neutral current demand detection can either be disabled or used as an alarm or process control. Set this setpoint to “Off” if the feature is not required. Selecting “Alarm” activates the alarm relay and displays an alarm message whenever a phase/neutral current demand level is equalled or exceeded. Selecting “Aux1”, “Aux2”, or “Aux3” activates the respective auxiliary relay with no message displayed. This is intended for process control.
- **PHASE A/B/C/NEUTRAL CURRENT DMD LEVEL**: When the phase A/B/C/ or neutral current demand equals or exceeds this setpoint, a phase A/B/C or neutral demand alarm or process control indication occurs.
- **3Φ POS/NEG REAL PWR DMD RELAY**: Three-phase positive/negative real power demand detection can either be disabled or used as an alarm or process control. Set this setpoint to “Off” if the feature is not required. Selecting “Alarm” activates the alarm relay and displays an alarm message whenever the positive/negative three-phase real power demand level is equalled or exceeded. Selecting “Aux1”, “Aux2”, or “Aux3” activates the respective auxiliary relay with no message displayed. This is intended for process control.
- **3Φ POS/NEG REAL PWR DMD LEVEL**: When the three-phase real power demand exceeds this setpoint, a three-phase positive/negative real power demand alarm or process control indication will occur.
- **3Φ POS/NEG REACT PWR DMD RELAY**: Three-phase positive/negative reactive power demand detection can either be disabled or used as an alarm or process control. Set to “Off” if this feature is not required. Selecting “Alarm” activates the alarm relay and

displays an alarm message whenever the positive/negative three-phase reactive power demand level is equalled or exceeded. Selecting “Aux1”, “Aux2”, or “Aux3” activates the respective auxiliary relay with no message displayed. This is intended for process control.

- **3Φ POS/NEG REACT PWR DMD LEVEL**: When the three-phase reactive power demand equals or exceeds this setpoint, a three-phase positive/negative reactive power demand alarm or process control indication will occur.
- **3Φ APPARENT POWER DEMAND RELAY**: Three-phase apparent power demand detection can be disabled or used as an alarm or process control. Set to “Off” if this feature is not required. Selecting “Alarm” activates the alarm relay and displays an alarm message if the three-phase apparent power demand level is equalled or exceeded. Selecting “Aux1”, “Aux2”, or “Aux3” activates the respective auxiliary relay with no message displayed. This is intended for process control.
- **3Φ APPARENT POWER DEMAND LEVEL**: When the three-phase apparent power demand equals or exceeds this setpoint, a three-phase apparent power alarm or process control indication will occur.

5.5.7 Pulse Input

PATH: SETPOINTS ⇩ S4 ALARMS/CONTROL ⇨ PULSE INPUT

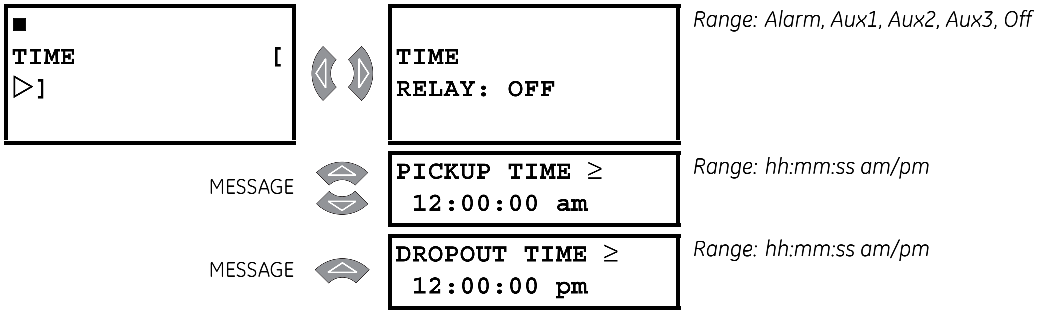
■ PULSE INPUT [▷]		PULSE INPUT 1 RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
	MESSAGE	PULSE INPUT 1 LEVEL ≥ 100 Units	*Range: 1 to 65000 in steps of 1*
	MESSAGE	PULSE INPUT 1 DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*
	MESSAGE	PULSE INPUT 2 RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
	MESSAGE	PULSE INPUT 2 LEVEL ≥ 100 Units	*Range: 1 to 65000 in steps of 1*
	MESSAGE	PULSE INPUT 2 DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*
	MESSAGE	PULSE INPUT 3 RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
	MESSAGE	PULSE INPUT 3 LEVEL ≥ 100 Units	*Range: 1 to 65000 in steps of 1*
	MESSAGE	PULSE INPUT 3 DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*
	MESSAGE	PULSE INPUT 4 RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*

	Display	Range
MESSAGE	PULSE INPUT 4 LEVEL ≥ 100 Units	*Range: 1 to 65000 in steps of 1*
MESSAGE	PULSE INPUT 4 DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*
MESSAGE	TOTALIZED PULSES RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE	TOTAL PULSES LEVEL ≥ 100 Units	*Range: 1 to 65000 in steps of 1*
MESSAGE	TOTALIZED PULSES DELAY: 10.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*

- **PULSE INPUT 1(4) RELAY**: Any of the PQMII switch inputs can be assigned to count pulse inputs as shown in *Switch Inputs* on page 5–21. This setpoint can be used to give an indication (alarm or control) if the programmed level is equaled or exceeded. Set this setpoint to "Off" if the feature is not required. Selecting "Alarm" activates the alarm relay and displays an alarm message whenever a pulse count level equals or exceeds the selected level. Selecting "Aux1", "Aux2", or "Aux3" activates the appropriate auxiliary relay but no message is displayed. The "Aux1", "Aux2", and "Aux3" selections are intended for process control.
- **PULSE INPUT 1(4) LEVEL**: When the pulse input value accumulated in the **A1 METERING ⇨⇩ PULSE COUNTER ⇨⇩ PULSE INPUT 1(4)** actual value equals or exceeds this setpoint value, the relay assigned in the **PULSE INPUT 1(4) RELAY** will energize. If the "Alarm" relay is assigned, a **PULSE INPUT 1(4) ALARM** message will also be displayed. The units in this setpoint are determined by the **S2 SYSTEM SETUP ⇨⇩ PULSE INPUT ⇨⇩ PULSE INPUT UNITS** setpoint.
- **PULSE INPUT 1(4) DELAY**: This setpoint can be used to allow a time delay before the assigned relay will energize after the **PULSE INPUT 1(4) LEVEL** has been equaled or exceeded.
- **TOTALIZED PULSES RELAY**: A relay can be selected to operate based upon a Total Pulse Input Count as configured in the PQMII. Selecting "Alarm" activates the alarm relay and displays an alarm message whenever a pulse count level equals or exceeds the selected level. Selecting "Aux1", "Aux2", or "Aux3" activates the appropriate auxiliary relay but no message will be displayed. The "Aux1", "Aux2", and "Aux3" selections are intended for process control.
- **TOTAL PULSES LEVEL**: When the pulse input value accumulated in the **A1 METERING ⇨⇩ PULSE COUNTER ⇨⇩ PULSE INPUT 1+2+3+4** actual value exceeds this setpoint value, the relay assigned in the **TOTALIZED PULSES RELAY** will energize. If the "Alarm" relay is assigned, a **TOTALIZED PULSES ALARM** message will also be displayed. The units in this setpoint are determined by the **S2 SYSTEM SETUP ⇨⇩ PULSE INPUT ⇨⇩ PULSE INPUT UNITS** setpoint.
- **TOTALIZED PULSES DELAY**: This setpoint can be used to allow a time delay before the assigned relay will energize after the **TOTAL PULSES LEVEL** has been equaled or exceeded.

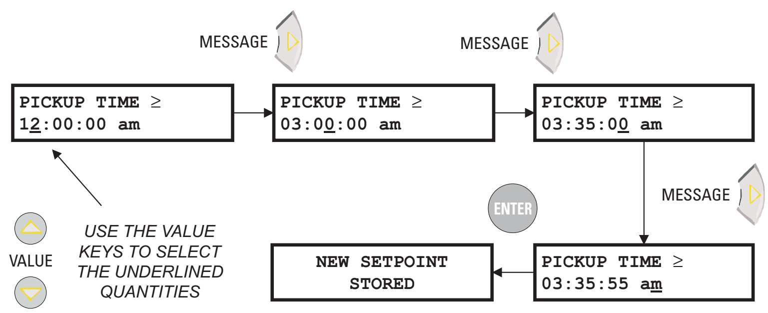
5.5.8 Time

PATH: SETPOINTS ⇨⇩ S4 ALARMS/CONTROL ⇨⇩ TIME



The time function is useful where a general purpose time alarm is required or a process is required to start and stop each day at the specified time.

- **TIME RELAY**: This setpoint can be used to give an indication (alarm or control) if the programmed **PICKUP TIME** is equaled or exceeded. Set to "Off" if the feature is not required. Selecting "Alarm" activates the alarm relay and displays an alarm message whenever the PQMII clock time equals or exceeds the set **PICKUP TIME**. Selecting "Aux1", "Aux2", or "Aux3" activates the appropriate auxiliary relay but no message is displayed. The "Aux1", "Aux2", and "Aux3" selections are intended for process control. The selected relay will de-energize when the PQMII clock time equals or exceeds the **DROPOUT TIME** setting.
- **PICKUP TIME**: The relay assigned in the **TIME RELAY** setpoint energizes when the PQMII clock time equals or exceeds the time specified in this setpoint. Follow the example below to set the **PICKUP TIME**.



- **DROPOUT TIME**: The relay assigned in the **TIME RELAY** setpoint de-energizes when the PQMII clock time equals or exceeds the time specified in this setpoint. Follow the example above to set the **DROPOUT TIME**.

5.5.9 Miscellaneous Alarms

PATH: SETPOINTS ⇨⇩ S4 ALARMS/CONTROL ⇨⇩ MISCELLANEOUS

■ MISCELLANEOUS [▷]	◁▷	SERIAL COM1 FAILURE ALARM DELAY: OFF s	*Range: 5 to 60 s in steps of 1 or OFF*
MESSAGE	△▽	SERIAL COM2 FAILURE ALARM DELAY: OFF s	*Range: 5 to 60 s in steps of 1 or OFF*
MESSAGE	△▽	CLOCK NOT SET ALARM: ON	*Range: Off, On*
MESSAGE	△▽	DATA LOG 1 MEMORY FULL LEVEL: OFF %	*Range: 50 to 100% in steps of 1 or OFF*
MESSAGE	△	DATA LOG 2 MEMORY FULL LEVEL: OFF %	*Range: 50 to 100% in steps of 1 or OFF*

- **SERIAL COM1(2) FAILURE ALARM DELAY**: If loss of communications to the external master is required to activate the alarm relay, select a time delay in the range of 5 to 60 seconds. In this case, an absence of communication polling on the RS485 communication port for the selected time delay will generate the alarm condition. Disable this alarm if communications is not used or is not considered critical. This alarm is not available on the front RS232 port.
- **CLOCK NOT SET ALARM**: The software clock in the PQMII will remain running for a period of approximately thirty days after power has been removed from the PQMII power supply inputs. Selecting "On" for this setpoint causes a Clock Not Set Alarm to occur at power-up for power losses greater than thirty days. Once the alarm occurs, the **S1 PQMII SETUP ⇨⇩ CLOCK ⇨⇩ SET TIME & DATE** setting must be stored to reset the alarm.
- **DATA LOG 1(2) MEMORY FULL LEVEL**: These messages can be used to configure alarms to indicate that the Data Logger memory is almost full. Separate alarms are provided for each log. When the log memory reaches the level programmed in this message a Data Log 1(2) Alarm will occur.

5.6 S5 Testing

5.6.1 Test Relays and LEDs

PATH: SETPOINTS ⇨⇩ S5 TESTING ⇨⇩ TEST RELAYS & LEDS

■ TEST RELAYS & [▷] LEDS	◁ ▷	OPERATION TEST: NORMAL MODE	

To verify correct operation of output relay wiring, each output relay and status indicator can be manually forced on or off via the keypad or serial port.

While the **OPERATION TEST** setpoint is displayed, use the **VALUE** keys to scroll to the desired output relay and/or status indicator to be tested. As long as the test message remains displayed the respective output relay and/or status indicator will be forced to remain energized. As soon as a new message is selected, the respective output relay and/or status indicator return to normal operation.

5.6.2 Current/Voltage

PATH: SETPOINTS ⇨⇩ S5 TESTING ⇨⇩ CURRENT/VOLTAGE SIMULATION

■ CURRENT/ [▷] VOLTAGE SIMULA-TION	◁ ▷	SIMULATION: OFF	*Range: Off, On*
MESSAGE	△ ▽	SIMULATION ENABLED FOR: 15 min	*Range: 5 to 300 min. in steps of 5 or UNLIMITED*
MESSAGE	△ ▽	PHASE A CURRENT: 0 A	*Range: 0 to 10000 A in steps of 1*
MESSAGE	△ ▽	PHASE B CURRENT: 0 A	*Range: 0 to 10000 A in steps of 1*
MESSAGE	△ ▽	PHASE C CURRENT: 0 A	*Range: 0 to 10000 A in steps of 1*
MESSAGE	△ ▽	NEUTRAL CURRENT: 0 A	*Range: 0 to 10000 A in steps of 1*
MESSAGE	△ ▽	Vax VOLTAGE: 0 V	*Range: 0 to 65000 V in steps of 1*
MESSAGE	△ ▽	Vbx VOLTAGE: 0 V	*Range: 0 to 65000 V in steps of 1*
MESSAGE	△ ▽	Vcx VOLTAGE: 0 V	*Range: 0 to 65000 V in steps of 1*
MESSAGE	△	PHASE ANGLE: 0 DEGREES	*Range: 0 to 359 degrees in steps of 1*

Simulated currents and voltages can be forced instead of using actual currents or voltages. This allows for verification of current and voltage related functions.

- **SIMULATION**: Enter "On" to switch from actual currents and voltages to the programmed simulated values. Return to "Off" after simulation is complete.
- **SIMULATION ENABLED FOR**: Select the desired length of time to enable simulation. When the programmed time has elapsed, current and voltage simulation will turn off. If "Unlimited" is selected, simulated currents and voltages will be used until simulation is turned off via the SIMULATION setpoint or via the serial port or until control power is removed from the PQMII.
- **PHASE A/B/C/NEUTRAL CURRENT**: Enter the desired phase and neutral currents for simulation.
- **Vax/Vbx/Vcx VOLTAGE**: Enter the desired voltages for simulation. The voltages entered will be line or phase quantities depending upon the VT wiring type selected with the S2 SYSTEM SETUP ⇨⇩ CURRENT/VOLTAGE CONFIGURATION ⇨⇩ VT WIRING setpoint.
- **PHASE ANGLE**: This setpoint represents the phase shift from a unity power factor. Enter the desired phase angle between the current and voltage. The angle between the individual currents and voltages is fixed at 120°.

5.6.3 Analog Outputs

PATH: SETPOINTS ⇨⇩ S5 TESTING ⇨⇩ ANALOG OUTPUTS SIMULATION

■ ANALOG OUTPUTS [▷] SIMULATION	◁ ▷	SIMULATION: OFF	*Range: Off, On*
	MESSAGE △▽	SIMULATION ENABLED FOR: 15 min	*Range: 5 to 300 min. in steps of 5 or UNLIMITED*
	MESSAGE △▽	ANALOG OUTPUT 1: OFF %	*Range: 0.0 to 120.0% in steps of 0.1*
	MESSAGE △▽	ANALOG OUTPUT 2: OFF %	*Range: 0.0 to 120.0% in steps of 0.1*
	MESSAGE △▽	ANALOG OUTPUT 3: OFF %	*Range: 0.0 to 120.0% in steps of 0.1*
	MESSAGE △	ANALOG OUTPUT 4: OFF %	*Range: 0.0 to 120.0% in steps of 0.1*

- **SIMULATION**: Enter "On" to switch from actual analog outputs to the programmed simulated values. Set this setpoint "Off" after simulation is complete.
- **SIMULATION ENABLED FOR**: Select the desired length of time that simulation will be enabled. When the programmed time has elapsed, analog output simulation will turn off. If unlimited is selected, simulated analog outputs will be used until simulation is turned off via the SIMULATION setpoint or via the serial port or until control power is removed from the PQMII.
- **ANALOG OUTPUT 1(4)**: Enter the percentage of analog output to be simulated. The output is 0 to 1 or 4 to 20 mA, depending upon the installed option.

For example, alter the setpoints below:

S5 TESTING ⇨⇩ **ANALOG OUTPUTS SIMULATION** ⇨⇩ **ANALOG OUTPUT 1**: "50.0%"

S5 TESTING ⇨⇩ **ANALOG OUTPUTS SIMULATION** ⇨ **SIMULATION**: "On"

The output current level on Analog Output 1 will be 12 mA (4 to 20mA) or 0.5 mA (0 to 1mA).

NOTE

Simulated values for Analog outputs may only be entered while SIMULATION mode is set to "On".

5.6.4 Analog Input

PATH: SETPOINTS ⇩ S5 TESTING ⇩ ANALOG INPUTS SIMULATION

```
■ ANALOG
INPUT      [▷]
  SIMULATION
```

```
SIMULATION:
 OFF
```

Range: Off, On

MESSAGE

```
SIMULATION
ENABLED
FOR:          15 min
```

Range: 5 to 300 min. in steps of 5 or UNLIMITED

MESSAGE

```
ANALOG INPUT:
   OFF mA
```

Range: 4.0 to 20.0 mA in steps of 0.1

- **SIMULATION**: Enter "On" to switch from an actual analog input to the programmed simulated value. Set this setpoint "Off" after simulation is complete.
- **SIMULATION ENABLED FOR**: Select the desired length of time to run simulation. When the programmed time has elapsed, analog input simulation will end. If "Unlimited" is selected, the simulated analog input will be used until simulation is turned off via the SIMULATION setpoint or via the serial port or until control power is removed from the PQMII.
- **ANALOG INPUT**: Enter an analog input current in the range of 4 to 20 mA to be simulated.

5.6.5 Switch Inputs

PATH: SETPOINTS ⇨⇩ S5 TESTING ⇨⇩ SWITCH INPUTS SIMULATION

■ SWITCH INPUTS [▷] SIMULATION		SIMULATION: Off	Range: Off, On
	MESSAGE	SIMULATION ENABLED FOR: 15 min.	Range: 5 to 300 min. in steps of 5 or UNLIMITED
	MESSAGE	SWITCH INPUT A: Open	Range: Open, Closed
	MESSAGE	SWITCH INPUT B: Open	Range: Open, Closed
	MESSAGE	SWITCH INPUT C: Open	Range: Open, Closed
	MESSAGE	SWITCH INPUT D: Open	Range: Open, Closed

- **SIMULATION**: Enter “On” to switch from actual switch inputs to the programmed simulated switches. Set this setpoint “Off” after simulation is complete.
- **SIMULATION ENABLED FOR**: Select the desired length of time that simulation will be enabled. When the programmed time has elapsed, switch input simulation will turn off. If “Unlimited” is selected, the simulated switch inputs will be used until simulation is turned off via the SIMULATION setpoint or via the serial port or until control power is removed from the PQMII.
- **SWITCH INPUT A(D)**: Enter the switch input status (open or closed) to be simulated.

5.6.6 Factory Use Only

PATH: SETPOINTS ⇨⇩ S5 TESTING ⇨⇩ FACTORY USE ONLY

■ FACTORY USE [▷] ONLY	SERVICE PASSCODE: 0	Range: N/A

These messages are for access by GE Multilin personnel only for testing and service.

GE Consumer & Industrial
Multilin

PQMII Power Quality Meter

Chapter 6: Monitoring

6.1 Actual Values Viewing

6.1.1 Description

Any measured value can be displayed on demand using the **MENU** and **MESSAGE** keys. Press the **MENU** key to select the actual values, then the **MESSAGE RIGHT** key to select the beginning of a new page of monitored values. These are grouped as follows: A1 Metering, A2 Status, A3 Power Analysis, and A4 Product Info. Use the **MESSAGE** keys to move between actual value messages. A detailed description of each displayed message in these groups is given in the sections that follow.

6.1.2 Actual Values Menu

Page	Key	Display	Reference
■ ACTUAL VALUES [▷] A1 METERING	◁ ▷	■ CURRENT [▷]	See page 6-3.
	MESSAGE △ ▽	■ VOLTAGE [▷]	See page 6-4.
	MESSAGE △ ▽	■ PHASORS [▷]	See page 6-6.
	MESSAGE △ ▽	■ POWER [▷]	See page 6-7.
	MESSAGE △ ▽	■ ENERGY [▷]	See page 6-11.
	MESSAGE △ ▽	■ DEMAND [▷]	See page 6-12.
	MESSAGE △ ▽	■ FREQUENCY [▷]	See page 6-13.
	MESSAGE △ ▽	■ PULSE INPUT [▷] COUNTERS	See page 6-13.
	MESSAGE △ ▽	■ ANALOG INPUT [▷]	See page 6-14.
	MESSAGE △	■ END OF PAGE A1 [▷]	
MESSAGE △ ▽			
■ ACTUAL VALUES [▷] A2 STATUS	◁ ▷	■ ALARMS [▷]	See page 6-15.

MESSAGE ▲▼ ■ SWITCHES [▷] — See page 6–17.

MESSAGE ▲▼ ■ CLOCK [▷] — See page 6–17.

MESSAGE ▲▼ ■ PROGRAMMABLE [▷] MESSAGE — See page 6–17.

MESSAGE ▲ ■ END OF PAGE A2 [▷]

MESSAGE ▲▼

■ ACTUAL VALUES [▷] A3 POWER ANALYSIS ◁▷ ■ POWER QUALITY [▷] VALUES — See page 6–18.

MESSAGE ▲▼ ■ TOTAL HARMONIC [▷] DISTORTION — See page 6–19.

MESSAGE ▲▼ ■ DATA LOGGER [▷] — See page 6–20.

MESSAGE ▲▼ ■ EVENT RECORDER [▷] — See page 6–20.

MESSAGE ▲▼ ■ VOLTAGE DIST. [▷] RECORDER — See page 6–23.

MESSAGE ▲ ■ END OF PAGE A3 [▷]

MESSAGE ▲

■ ACTUAL VALUES [▷] A4 PRODUCT INFO ◁▷ ■ SOFTWARE [▷] VERSIONS — See page 6–24.

▲▼ ■ MODEL [▷] INFORMATION — See page 6–24.

MESSAGE ▲

```
■ END OF PAGE
A4   [▷]
```

6.2 A1 Metering

6.2.1 Current Metering

PATH: ACTUAL VALUES ⇨ A1 METERING ⇨⇩ CURRENT

```
■
CURRENT              [
▷]
```

```
A = 100      B =
100
C = 100      AMPS
```

MESSAGE

```
Iavg =       100
AMPS
Vavg =       120 V
L-N
```

MESSAGE

```
NEUTRAL CURRENT =
   0 AMPS
```

MESSAGE

```
CURRENT UNBAL-
ANCE =
   0.0%
```

MESSAGE

```
Ia MIN =     100
AMPS
12:00:00am  01/
01/95
```

MESSAGE

```
Ib MIN =     100
AMPS
12:00:00am  01/
01/95
```

MESSAGE

```
Ic MIN =     100
AMPS
12:00:00am  01/
01/95
```

MESSAGE

```
In MIN =     100
AMPS
12:00:00am  01/
01/95
```

MESSAGE

```
I U/B MIN =
  0.0%
12:00:00am  01/
01/95
```

MESSAGE

```
Ia MAX =     100
AMPS
12:00:00am  01/
01/95
```

MESSAGE

```
Ib MAX =     100
AMPS
12:00:00am  01/
01/95
```

MESSAGE

```
Ic MAX =    100
AMPS
12:00:00am  01/
01/95
```

MESSAGE

```
In MAX =    100
AMPS
12:00:00am  01/
01/95
```

MESSAGE

```
I U/B MAX =
  0.0%
12:00:00am  01/
01/95
```

- **A, B, C CURRENT**: Displays the current in each phase corresponding to the A, B, and C phase inputs. Current will be measured correctly only if the **CT PRIMARY** is entered to match the installed CT primary and the CT secondary is wired to match the 1 or 5 A input. If the displayed current does not match the actual current, check this setpoint and wiring.
- **Iavg/Vavg**: Displays the average of the three phase currents and three voltages. This line is not visible if the **VT WIRING** setpoint is set to “Single Phase Direct”. L-N is displayed when **VT WIRING** is set to “4 Wire Wye /3 VTs”, “4 Wire Wye Direct”, “4 Wire Wye / 2 VTs”, or “3 Wire Direct”. L-L is displayed when **VT WIRING** is set to “3 Wire Delta / 2 VTs”.
- **NEUTRAL CURRENT**: Neutral current can be determined by two methods. One method measures the current via the neutral CT input. The second calculates the neutral current based on the three phase currents; using the instantaneous samples, $I_a + I_b + I_c = I_n$. If the sum of the phase currents does not equal 0, the result is the neutral current. When using the CT input, the neutral current reading will be correct only if the CT is wired correctly and the correct neutral CT primary value is entered. Verify neutral current by connecting a clamp-on ammeter around all 3 phases. If the neutral current appears incorrect, check the settings in **S2 SYSTEM SETUP ⇨⇩ CURRENT/VOLTAGE CONFIGURATION** and verify the CT wiring.
- **CURRENT UNBALANCE**: Displays the percentage of current unbalance. Current unbalance is calculated as:

$$\text{Current Unbalance} = \frac{|I_m - I_{av}|}{|I_{av}|} \times 100\% \qquad \textbf{(EQ 0.1)}$$

  where: I_{av} = average phase current = $(I_a + I_b + I_c) / 3$
  I_m = current in phase with maximum deviation from I_{av}.

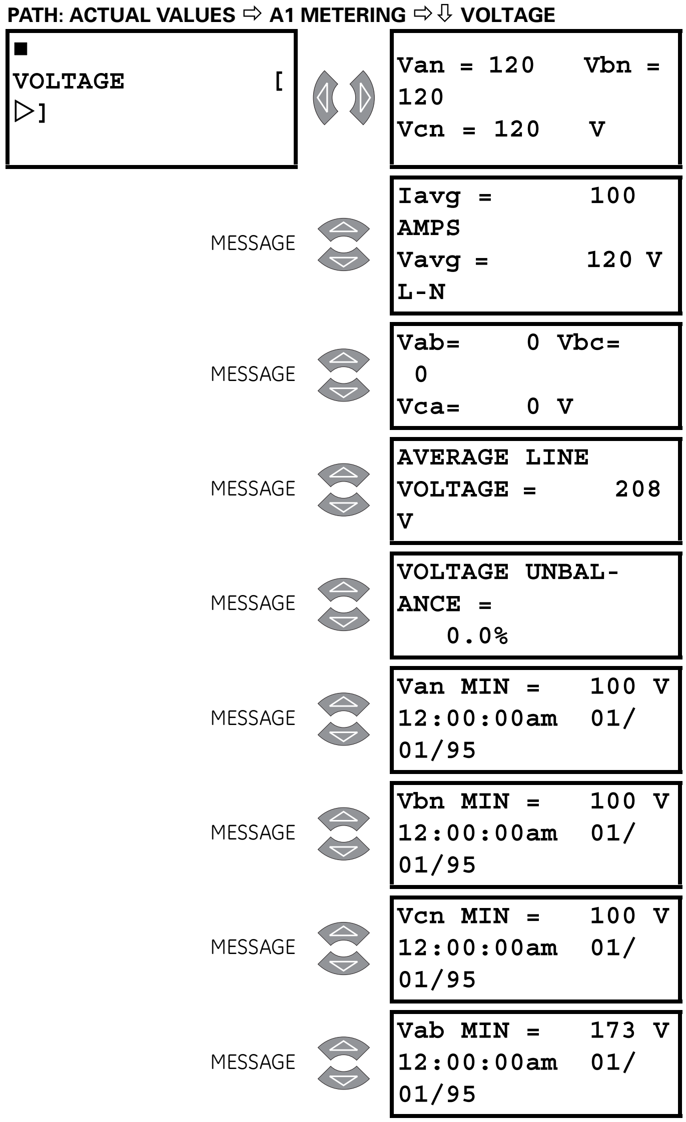
  Even though it is possible to achieve unbalance greater than 100% with the above formula, the PQMII limits unbalance readings to 100%.

  If the average current is below 10% of the **CT PRIMARY** setpoint, the unbalance reading is forced to 0%. This avoids nuisance alarms when the system is lightly loaded. If the simulation currents are being used, the unbalance is never forced to 0%.
- **Ia, Ib, Ic, In MIN**: Displays the minimum current magnitudes and the time and date of their occurrence. This information is stored in non-volatile memory and is retained during loss of control power. The **S1 PQMII SETUP ⇨⇩ CLEAR DATA ⇨⇩ CLEAR MIN/MAX CURRENT VALUES** setpoint clears these values.

- **I U/B MIN**: Displays the minimum current unbalance and the time and date of its measurement. This information is stored in non-volatile memory and is retained during loss of control power. The **S1 PQMII SETUP ⇨⇩ CLEAR DATA ⇨⇩ CLEAR MIN/MAX CURRENT VALUES** setpoint clears this value.
- **Ia, Ib, Ic, In MAX**: Displays the maximum current magnitudes and the time and date of their occurrence. This information is stored in non-volatile memory and is retained during loss of control power. The **S1 PQMII SETUP ⇨⇩ CLEAR DATA ⇨⇩ CLEAR MIN/MAX CURRENT VALUES** setpoint clears these values.
- **I U/B MAX**: Displays the maximum current unbalance and the time and date of its measurement. This information is stored in non-volatile memory and is retained during loss of control power. The **S1 PQMII SETUP ⇨⇩ CLEAR DATA ⇨⇩ CLEAR MIN/MAX CURRENT VALUES** setpoint command clears this value.

6.2.2 Voltage Metering

PATH: ACTUAL VALUES ⇨ A1 METERING ⇨⇩ VOLTAGE



MESSAGE

```
Vbc MIN =   173 V
12:00:00am  01/
01/95
```

MESSAGE

```
Vca MIN =   173 V
12:00:00am  01/
01/95
```

MESSAGE

```
V U/B MIN =
  0.0%
12:00:00am  01/
01/95
```

MESSAGE

```
Van MAX =   140 V
12:00:00am  01/
01/95
```

MESSAGE

```
Vbn MAX =   140 V
12:00:00am  01/
01/95
```

MESSAGE

```
Vcn MAX =   140 V
12:00:00am  01/
01/95
```

MESSAGE

```
Vab MAX =   242 V
12:00:00am  01/
01/95
```

MESSAGE

```
Vbc MAX =   242 V
12:00:00am  01/
01/95
```

MESSAGE

```
Vca MAX =   242 V
12:00:00am  01/
01/95
```

MESSAGE

```
V U/B MAX =
  5.1%
12:00:00am  01/
01/95
```

- **Van, Vbn, Vcn**: Displays phase voltages corresponding to the A, B, and C voltage inputs. This voltage will be measured correctly only if the VT RATIO, VT NOMINAL SECONDARY, and VOLTAGE WIRING setpoints match the installed VTs. If the displayed voltage does not match the actual voltage, check the setpoints and wiring. This message appears only if the VT WIRING is configured for a wye input.
- **Iavg/Vavg**: Displays the average of the three phase currents/voltages. This value is not visible if the VT WIRING setpoint is set to “Single Phase Direct”. L-N is displayed when VT WIRING is set to “4 Wire Wye / 3 VTs”, “4 Wire Wye Direct”, “4 Wire Wye / 2 VTs”, or “3 Wire Direct” and L-L is displayed when VT WIRING is set to “3 Wire Delta / 2 VTs”.
- **Vab, Vbc, Vca**: Displays line voltages corresponding to the A, B, and C voltage inputs. The measured voltage is correct only if the VT RATIO, VT NOMINAL SECONDARY, and VOLTAGE WIRING setpoints match the installed VTs. If the displayed voltage does not match the actual voltage, check the setpoints and wiring.

- **AVERAGE LINE VOLTAGE**: Displays the average of the three line voltages. This value is not visible if the **VT WIRING** setpoint is set to “Single Phase Direct”.
- **VOLTAGE UNBALANCE**: Displays the percentage voltage unbalance. Voltage unbalance is calculated as shown below. If the **VOLTAGE WIRING** is configured for a wye input, voltage unbalance is calculated using phase quantities. If the **VT WIRING** is configured as a delta input, voltage unbalance is calculated using line voltages.

$$\text{Voltage Unbalance} = \frac{|V_m - V_{avg}|}{V_{avg}} \times 100\% \qquad \textbf{(EQ 0.2)}$$

where: V_{avg}= average phase voltage = (V_{an} + V_{bn} + V_{cn}) / 3 for “Wye” and “3 Wire Direct” connections;
= average line voltage = (V_{ab} + V_{bc} + V_{ca}) / 3 for “3 Wire Delta / 2 VTs” connection
V_m = voltage in a phase (or line) with maximum deviation from V_{avg}.

NOTE

Even though it is possible to achieve unbalance greater than 100% with the above formula, the PQMII will limit unbalance readings to 100%.

If the average voltage is below 10% of **VT RATIO** × **VT NOMINAL SECONDARY VOLTAGE** for “3 Wire Delta / 2 VTs”, “4 Wire Wye / 3 VTs”, and “4 Wire Wye / 2 VTs” connections, or below 10% of **VT RATIO** × **NOMINAL DIRECT INPUT VOLTAGE** for “4 Wire Wye/Direct” and “3 Wire Direct” connections, the unbalance reading is forced to 0%. This is implemented to avoid nuisance alarms when the system is lightly loaded. If the simulation voltages are being used, the unbalance is never forced to 0%.

- **Van, Vbn, Vcn MIN/MAX**: Displays the minimum/maximum phase voltage magnitudes and the time and date of their occurrence. This information is stored in non-volatile memory and is retained during loss of control power. The **S1 PQMII SETUP** ⇨⇩ **CLEAR DATA** ⇨⇩ **CLEAR MIN/MAX VOLTAGE VALUES** setpoint clears these values.
- **Vab, Vbc, Vca MIN/MAX**: Displays the minimum/maximum line voltage magnitudes and the time and date of their occurrence. This information is stored in non-volatile memory and is retained during loss of control power. The **S1 PQMII SETUP** ⇨⇩ **CLEAR DATA** ⇨⇩ **CLEAR MIN/MAX VOLTAGE VALUES** setpoint clears these values.
- **V U/B MIN/MAX**: Displays minimum/maximum voltage unbalance and the time and date of its measurement. This information is stored in non-volatile memory and is retained during loss of control power. This value is cleared with the **S1 PQMII SETUP** ⇨⇩ **CLEAR DATA** ⇨⇩ **CLEAR MIN/MAX VOLTAGE VALUES** setpoint.

6.2.3 Phasors

PATH: ACTUAL VALUES ⇨ A1 METERING ⇨⇩ PHASORS

```
■
PHASORS          [
▷]
```

```
Va PHASOR:
      0V at   0°
Lag
```

MESSAGE

```
Vb PHASOR:
      0V at   0°
Lag
```

```
MESSAGE  [▲▼]  Vc PHASOR:
                     0V at    0°
               Lag

MESSAGE  [▲▼]  Ia PHASOR:
                     0A at    0°
               Lag

MESSAGE  [▲▼]  Ib PHASOR:
                     0A at    0°
               Lag

MESSAGE  [▲]   Ic PHASOR:
                     0A at    0°
               Lag
```

- **Va PHASOR**: Displays a phasor representation for the magnitude and angle of Va. Va is used as a reference for all other phasor angles. If there is no voltage present at the PQMII voltage inputs, then Ia will be used as the reference for all other angles. Va is also used as the reference when in Simulation Mode.
- **Vb/Vc PHASOR**: Displays a phasor representation for the magnitude and angle of Vb/Vc. Both **VB** and **VC PHASOR** values use the angle of **VA PHASOR** as a reference point. If there is no voltage at the PQMII voltage inputs, **IA PHASOR** is used as the reference. These setpoints are not displayed when the PQMII is configured for the "3 Wire Delta/2 VTs", "4 Wire Wye/2 VTs", or "Single Phase Direct" connections.
- **Ia PHASOR**: A phasor representation for the magnitude and angle of Ia is displayed here. Ia is used as a reference for all other Phasor angles only when there is no voltage present at the PQMII voltage inputs, otherwise, Va is used as the reference.
- **Ib/Ic PHASOR**: A phasor representation for the magnitude and angle of Ib/Ic is displayed here. The Ib and Ic currents use the angle of Va as a reference point. If there is no voltage at the PQMII voltage inputs, Ia is used as the reference. These setpoints are is not displayed when the PQMII is configured for "Single Phase Direct" connection.

6.2.4 Power Metering

PATH: ACTUAL VALUES ⇨ A1 METERING ⇨⇩ POWER

```
■
POWER              [       [◄►]  THREE PHASE REAL
▷]                               POWER =       1000
                                 kW

                 MESSAGE  [▲▼]   THREE PHASE REAC-
                                 TIVE
                                 POWER =    120
                                 kvar

                 MESSAGE  [▲▼]   THREE PHASE
                                 APPARENT
                                 POWER =     1007
                                 kVA
```

MESSAGE	THREE PHASE POWER FACTOR = 0.99 Lag
MESSAGE	PHASE A REAL POWER = 1000 kW
MESSAGE	PHASE A REACTIVE POWER = 120 kvar
MESSAGE	PHASE A APPARENT POWER = 1007 kVA
MESSAGE	PHASE A POWER FACTOR = 0.99 Lag
MESSAGE	PHASE B REAL POWER = 1000 kW
MESSAGE	PHASE B REACTIVE POWER = 120 kvar
MESSAGE	PHASE B APPARENT POWER = 1007 kVA
MESSAGE	PHASE B POWER FACTOR = 0.99 Lag
MESSAGE	PHASE C REAL POWER = 1000 kW
MESSAGE	PHASE C REACTIVE POWER = 120 kvar
MESSAGE	PHASE C APPARENT POWER = 1007 kVA
MESSAGE	PHASE C POWER FACTOR = 0.99 Lag
MESSAGE	THREE PHASE REAL POWER = 10.00 MW

MESSAGE

```
THREE PHASE REAC-
TIVE
POWER =     1.20
Mvar
```

MESSAGE

```
THREE PHASE
APPARENT
POWER =    10.07
MVA
```

MESSAGE

```
3Φ kW MIN =
    1000
12:00:00am  01/
01/95
```

MESSAGE

```
3Φ kvar MIN =
   120
12:00:00am  01/
01/95
```

MESSAGE

```
3Φ kVA MIN =
   1007
12:00:00am  01/
01/95
```

MESSAGE

```
3Φ PF MIN = 0.99
Lag
12:00:00am  01/
01/95
```

MESSAGE

```
3Φ kW MAX =
    1000
12:00:00am  01/
01/95
```

MESSAGE

```
3Φ kvar MAX =
   120
12:00:00am  01/
01/95
```

MESSAGE

```
3Φ kVA MAX =
   1007
12:00:00am  01/
01/95
```

MESSAGE

```
3Φ PF MAX = 0.99
Lag
12:00:00am  01/
01/95
```

MESSAGE

```
AΦ kW MIN =
    1000
12:00:00am  01/
01/95
```

MESSAGE	AΦ kvar MIN = 120 12:00:00am 01/01/95
MESSAGE	AΦ kVA MIN = 1007 12:00:00am 01/01/95
MESSAGE	AΦ PF MIN = 0.99 Lag 12:00:00am 01/01/95
MESSAGE	AΦ kW MAX = 1000 12:00:00am 01/01/95
MESSAGE	AΦ kvar MAX = 120 12:00:00am 01/01/95
MESSAGE	AΦ kVA MAX = 1007 12:00:00am 01/01/95
MESSAGE	AΦ PF MAX = 0.99 Lag 12:00:00am 01/01/95
MESSAGE	BΦ kW MIN = 1000 12:00:00am 01/01/95
MESSAGE	BΦ kvar MIN = 120 12:00:00am 01/01/95
MESSAGE	BΦ kVA MIN = 1007 12:00:00am 01/01/95
MESSAGE	BΦ PF MIN = 0.99 Lag 12:00:00am 01/01/95

MESSAGE ⇅
```
BΦ kW MAX =
    1000
12:00:00am  01/
01/95
```

MESSAGE ⇅
```
BΦ kvar MAX =
   120
12:00:00am  01/
01/95
```

MESSAGE ⇅
```
BΦ kVA MAX =
   1007
12:00:00am  01/
01/95
```

MESSAGE ⇅
```
BΦ PF MAX = 0.99
Lag
12:00:00am  01/
01/95
```

MESSAGE ⇅
```
CΦ kW MIN =
    1000
12:00:00am  01/
01/95
```

MESSAGE ⇅
```
CΦ kvar MIN =
   120
12:00:00am  01/
01/95
```

MESSAGE ⇅
```
CΦ kVA MIN =
   1007
12:00:00am  01/
01/95
```

MESSAGE ⇅
```
CΦ PF MIN = 0.99
Lag
12:00:00am  01/
01/95
```

MESSAGE ⇅
```
CΦ kW MAX =
    1000
12:00:00am  01/
01/95
```

MESSAGE ⇅
```
CΦ kvar MAX =
   120
12:00:00am  01/
01/95
```

MESSAGE ⇅
```
CΦ kVA MAX =
   1007
12:00:00am  01/
01/95
```

MESSAGE

```
CΦ PF MAX = 0.99
Lag
12:00:00am  01/
01/95
```

Power metering actual values are displayed in this page. The **S1 PQMII SETUP ⇨⇩ CLEAR DATA ⇨⇩ CLEAR MIN/MAX POWER VALUES** setpoint can be used to clear the minimum and maximum values. Refer to FIGURE 6–1: Power Measurement Conventions on page 6–10 for the convention used to describe power direction.

- **THREE PHASE/A/B/C REAL POWER**: The total RMS three phase real power as well as individual phase A/B/C real power is displayed. The phase A/B/C real power messages are displayed only for a “Wye” or “3 Wire Direct” connections. The PQMII shows direction of flow by displaying the signed value of kW.
- **THREE PHASE/A/B/C REACTIVE POWER**: The total RMS three phase reactive power as well as the individual phase A/B/C reactive power is displayed. The phase A/B/C reactive power messages will be displayed only for a “Wye” or “3 Wire Direct” connected system. The PQMII shows direction of flow by displaying the signed value of kvar.
- **THREE PHASE/A/B/C APPARENT POWER**: The total RMS three phase apparent power as well as the individual phase A/B/C apparent power is displayed. The phase A/B/C apparent power messages will be displayed only for a “Wye” or “3 Wire Direct” connected system.
- **THREE PHASE/A/B/C POWER FACTOR**: The three phase true power factor as well as the individual phase A/B/C true power factors is displayed in these messages. The phase A/B/C true power factor messages will be displayed only for a “Wye” or “3 Wire Direct” connected system.
- **3Φ/AΦ/BΦ/CΦ kW MIN/MAX**: The minimum/maximum three phase real power as well as the minimum/maximum individual phase A/B/C real power is displayed, along with the time and date of their measurement. This information is stored in non-volatile memory and will be retained during a loss of control power. The phase A/B/C minimum/maximum real power messages will be displayed only for a “Wye” connected system.
- **3Φ/AΦ/BΦ/CΦ kvar MIN/MAX**: The minimum/maximum three phase reactive power as well as the minimum/maximum individual phase A/B/C reactive power is displayed, along with the time and date of their measurement. This information is stored in non-volatile memory and will be retained during a loss of control power. The phase A/B/C minimum/maximum reactive power messages will be displayed only for a “Wye” connected system.
- **3Φ/AΦ/BΦ/CΦ kVA MIN/MAX**: The minimum/maximum three phase apparent power as well as the minimum/maximum individual phase A/B/C apparent power is displayed, along with the time and date of their measurement. This information is stored in non-volatile memory and will be retained during a loss of control power. The phase A/B/C minimum/maximum apparent power messages will be displayed only for a “Wye” connected system.
- **3Φ/AΦ/BΦ/CΦ PF MIN/MAX**: The minimum/maximum three phase lead or lag power factor as well as the minimum/maximum lead or lag individual phase A/B/C power factor is displayed, along with the time and date of their measurement. This information is stored in non-volatile memory and will be retained during a loss of

control power. The phase A/B/C minimum/maximum lead or lag power factor messages will be displayed only for a “Wye” connected system.

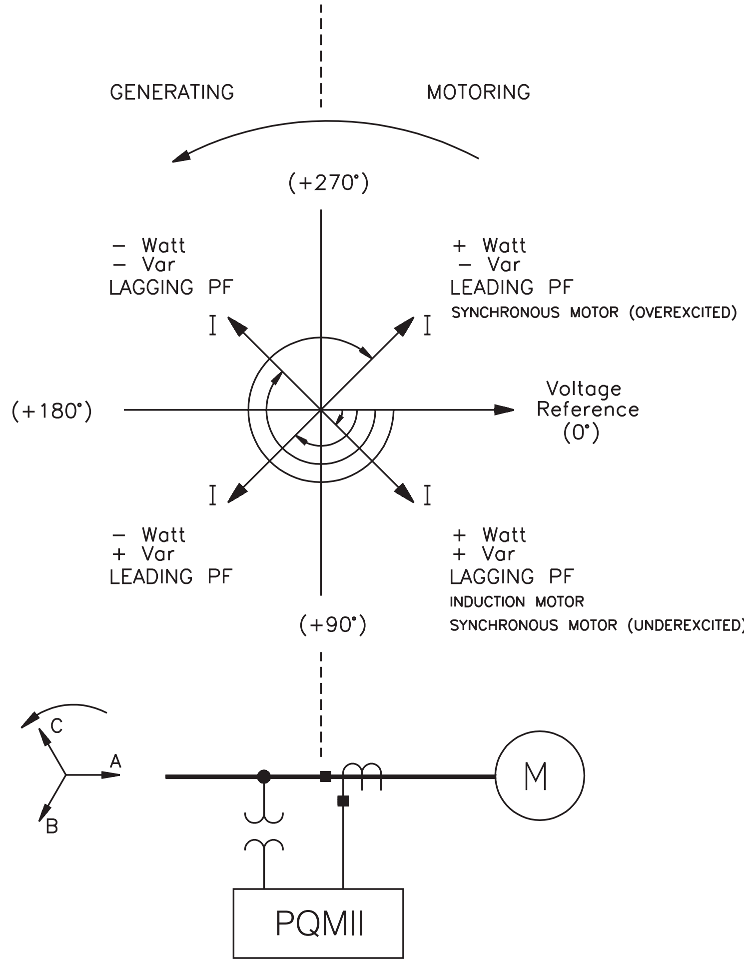


FIGURE 6–1: Power Measurement Conventions

6.2.5 Energy Metering

PATH: ACTUAL VALUES ⇨ A1 METERING ⇨⇩ ENERGY

```
■ ENERGY [▷]
```

```
3Φ POS REAL ENERGY
=        32745 kWh
```

MESSAGE

```
3Φ NEG REAL ENERGY
=        32745 kWh
```

MESSAGE

```
3Φ POS REACT ENERGY
=        32745 kvarh
```

```
MESSAGE   3Φ NEG REACT
          ENERGY
          =       32745
          kvarh

MESSAGE   3Φ APPARENT
          ENERGY
          =       32745
          kVAh

MESSAGE   REAL ENERGY LAST
          24h
          =         1245
          kWh

MESSAGE   REAL ENERGY COST
          =
          $12575.34

MESSAGE   REAL ENERGY COST
          =
          $125.01 / DAY

MESSAGE   TARIFF PERIOD 1
          COST
           $0.00

MESSAGE   TARIFF PERIOD 2
          COST
           $0.00

MESSAGE   TARIFF PERIOD 3
          COST
           $0.00

MESSAGE   TARIFF PERIOD 1
          NET
          ENERGY:    0 kWh

MESSAGE   TARIFF PERIOD 2
          NET
          ENERGY:    0 kWh

MESSAGE   TARIFF PERIOD 3
          NET
          ENERGY:    0 kWh

MESSAGE   TIME OF LAST
          RESET:
          12:00:00am  01/
          01/95
```

Energy metering actual values are displayed here. The **S1 PQMII SETUP ⇨⇩ CLEAR DATA ⇨⇩ CLEAR ENERGY VALUES** setpoint clears these values. The displayed energy values roll over to "0" once the value "4294967295" (FFFFFFFFh) has been reached.

- **3Φ POS/NEG REAL ENERGY**: These messages display the positive/negative watthours (in kWh) since the **TIME OF LAST RESET** date. Real power in the positive direction add to the **3Φ POS REAL ENERGY** value, whereas real power in the negative direction adds to the **3Φ NEG REAL ENERGY** value.

- **3Φ POS/NEG REACT ENERGY**: These messages display the positive/negative varhours (in kvarh) since the **TIME OF LAST RESET** date. Reactive power in the positive direction add to the **3Φ POS REACT ENERGY** value, whereas reactive power in the negative direction adds to the **3Φ NEG REACT ENERGY** value.
- **3Φ APPARENT ENERGY:** This message displays the accumulated VAhours (in kVAh) since the **TIME OF LAST RESET** date.
- **REAL ENERGY LAST 24h**: This message displays the accumulated real energy (in kWh) over the last 24-hour period. The 24-hour period used by the PQMII is started when control power is applied. The PQMII updates this value every hour based on the previous 24-hour period. This information will be lost if control power to the PQMII is removed.
- **REAL ENERGY COST**: This message displays the total cost for the real energy accumulated since the **TIME OF LAST RESET** date.
- **REAL ENERGY COST PER DAY**: Displays the average cost of real energy per day from time of last reset to the present. The cost per kWh is entered in the **S1 PQMII SETUP ⇨⇩ CALCULATION PARAMETERS ⇨⇩ ENERGY COST PER KWH** setpoint.
- **TARIFF PERIOD 1(3) COST**: These messages display the cost accrued for the three user-definable tariff periods. The start time and cost per kWh for these tariff periods are entered with the **S1 PQMII SETUP ⇨⇩ CALCULATION PARAMETERS ⇨⇩ TARIFF PERIOD 1(3) START TIME** and the **S1 PQMII SETUP ⇨⇩ CALCULATION PARAMETERS ⇨⇩ TARIFF PERIOD 1(3) COST PER KWH** setpoints, respectively.
- **TARIFF PERIOD 1(3) NET ENERGY**: These messages display the net energy for the three user-definable tariff periods. The start time and cost per kWh for these tariff periods are entered with the **S1 PQMII SETUP ⇨⇩ CALCULATION PARAMETERS ⇨⇩ TARIFF PERIOD 1(3) START TIME** and the **S1 PQMII SETUP ⇨⇩ CALCULATION PARAMETERS ⇨⇩ TARIFF PERIOD 1(3) COST PER KWH** setpoints, respectively.
- **TIME OF LAST RESET**: This message displays the time and date when the energy parameters were last cleared through the **S1 PQMII SETUP ⇨⇩ CLEAR DATA ⇨⇩ CLEAR ENERGY VALUES** setpoint.

6.2.6 Demand Metering

PATH: ACTUAL VALUES ⇨ A1 METERING ⇨⇩ DEMAND

■ DEMAND [▷]	◁ ▷	PHASE A CURRENT DEMAND = 125 A
	MESSAGE ▲▼	PHASE B CURRENT DEMAND = 125 A
	MESSAGE ▲▼	PHASE C CURRENT DEMAND = 125 A
	MESSAGE ▲▼	NEUTRAL CURRENT DEMAND = 125 A
	MESSAGE ▲▼	3Φ REAL POWER DEMAND = 1000 kW
	MESSAGE ▲▼	3Φ REACTIVE POWER DEMAND = 25 kvar
	MESSAGE ▲▼	3Φ APPARENT POWER DEMAND = 1007 kVA
	MESSAGE ▲▼	Ia MAX DMD = 560 A 12:00:00am 01/ 01/95
	MESSAGE ▲▼	Ib MAX DMD = 560 A 12:00:00am 01/ 01/95
	MESSAGE ▲▼	Ic MAX DMD = 560 A 12:00:00am 01/ 01/95
	MESSAGE ▲▼	In MAX DMD = 560 A 12:00:00am 01/ 01/95
	MESSAGE ▲▼	3Φ kW MAX = 1000 12:00:00am 01/ 01/95
	MESSAGE ▲▼	3Φ kvar MAX = 25 12:00:00am 01/ 01/95
	MESSAGE ▲	3Φ kVA MAX = 1200 12:00:00am 01/ 01/95

Demand metering actual values are displayed in this page. The **S1 PQMII SETUP ⇨⇩ CLEAR DATA ⇨⇩ CLEAR MAX DEMAND VALUES** setpoint can be used to clear the maximum demand values shown here.

- **PHASE A/B/C/NEUTRAL DEMAND**: This message displays the phase A/B/C/N current demand (in amps) over the most recent time interval.
- **3Φ REAL POWER DEMAND**: This message displays the 3 phase real power demand (in kW) over the most recent time interval.
- **3Φ REACTIVE POWER DEMAND**: This message displays the 3 phase reactive power demand (in kvar) over the most recent time interval.
- **3Φ APPARENT POWER DEMAND**: This message displays the 3 phase apparent power demand (in kVA) over the most recent time interval.
- **Ia/Ib/Ic/In MAX DMD**: These messages display the maximum phase A/B/C/N current demand (in amps) and the time and date when this occurred.
- **3Φ kW MAX**: This message displays the maximum three-phase real power demand (in kW) and the time and date when this occurred.
- **3Φ kvar MAX**: This message displays the maximum three-phase reactive power demand (in kvar) and the time and date when this occurred.
- **3Φ kVA MAX**: This message displays the maximum three-phase apparent power demand (in kVA) and the time and date when this occurred.

6.2.7 Frequency Metering

PATH: ACTUAL VALUES ⇨ A1 METERING ⇨⇩ FREQUENCY

```
■
FREQUENCY        [
▷]
```

```
FREQUENCY = 60.00
Hz
```

MESSAGE

```
FREQ MIN = 59.98
Hz
12:00:00am  01/
01/95
```

MESSAGE

```
FREQ MAX = 59.98
Hz
12:00:00am  01/
01/95
```

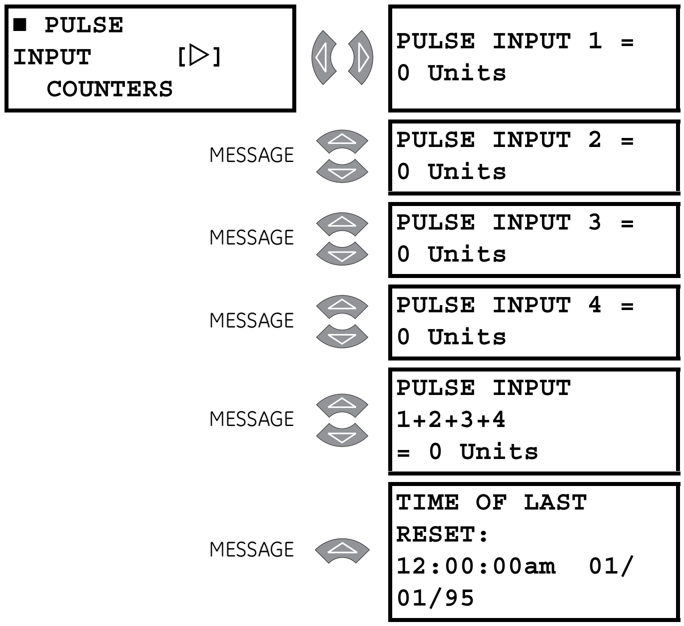
Frequency metering actual values are displayed in this page. The **S1 PQMII SETUP ⇨⇩ CLEAR DATA ⇨⇩ CLEAR MIN/MAX FREQUENCY VALUES** setpoint can be used to clear the minimum and maximum frequency values shown here.

- **FREQUENCY**: This message displays the frequency (in Hz). Frequency is calculated from the phase A-N voltage (when setpoint **S2 SYSTEM SETUP ⇨⇩ CURRENT/VOLTAGE CONFIGURATION ⇨⇩ VT WIRING** is “Wye”) or from phase A-B voltage (when setpoint **VT WIRING** is “Delta”). A value of “0.00” is shown if there is insufficient voltage applied to the PQMII’s terminals (less than 30 V on phase A).
- **FREQ MIN**: This message displays the minimum frequency measured as well as the time and date at which the minimum frequency occurred.

- **FREQ MAX**: This message displays the maximum frequency measured as well as the time and date at which the maximum frequency occurred.

6.2.8 Pulse Input Counters

PATH: ACTUAL VALUES ⇨ A1 METERING ⇨⇩ PULSE INPUT COUNTERS



- **PULSE INPUT 1(4)**: These messages display the accumulated value based on total number of pulses counted since the last reset. One switch input pulse is equal to the value assigned in the **S2 SYSTEM SETUP ⇨⇩ PULSE INPUT ⇨⇩ PULSE INPUT 1(4) VALUE** setpoint. The units shown after the value are as defined in the **PULSE INPUT UNITS** setpoint in the same menu. The displayed value rolls over to “0” once the value “4294967295” (FFFFFFFFh) has been reached. To use this feature, the “C” (control) option must be installed and one of the PQMII switch inputs must be assigned to “Pulse Input 1(4)” function. The switch input will then count the number of closures or openings depending upon how the switch is configured; see *Switch Inputs* on page 5–21 for details. The minimum timing requirements are shown in FIGURE 6–2: Pulse Input Timing on page 6–14.
- **PULSE IN 1+2+3+4**: The totalized pulse input value is displayed here. The pulse inputs totalized is based on the **S2 SYSTEM SETUP ⇨⇩ PULSE INPUT ⇨⇩ PULSE INPUT TOTAL** setpoint.
- **TIME OF LAST RESET**: This message displays the time and date when the pulse input values were last cleared. The **S1 PQMII SETUP ⇨⇩ CLEAR DATA ⇨⇩ CLEAR PULSE INPUT VALUES** setpoint clears the pulse input values.

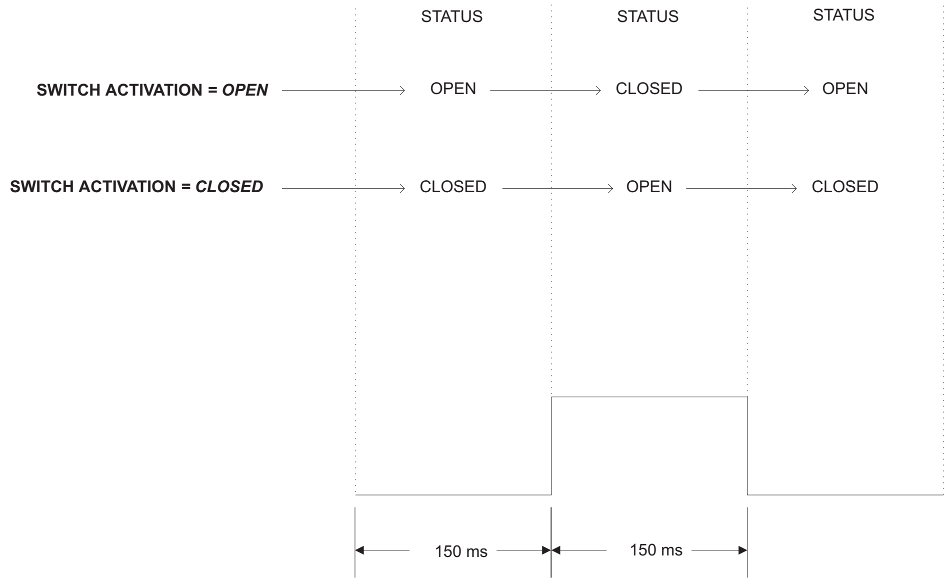


FIGURE 6–2: Pulse Input Timing

6.2.9 Analog Input

PATH: ACTUAL VALUES ⇨ A1 METERING ⇨⇩ ANALOG INPUT

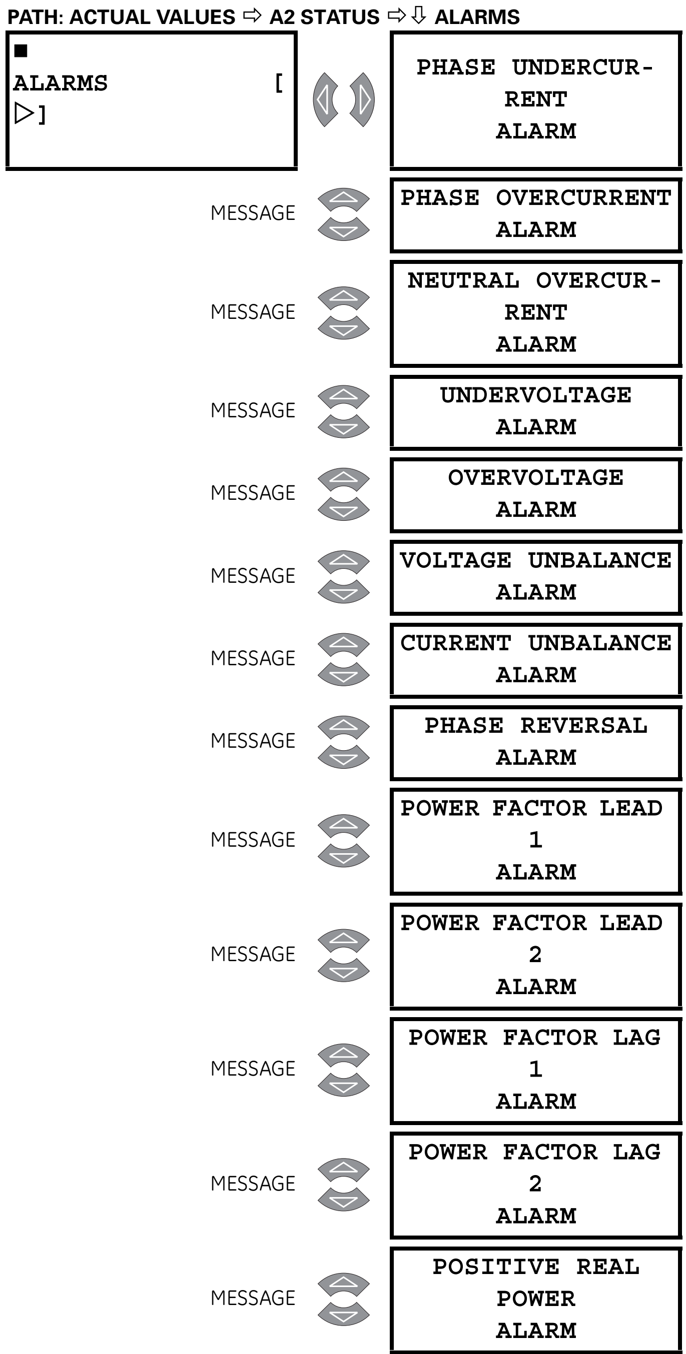
```
■ ANALOG
INPUT     [▷]
```

```
MAIN/ALT ANALOG
INPUT
20.1 mA
```

This message displays the measured 4 to 20 mA analog input scaled to the user defined name and units. The analog input can be configured via a switch input and output relay to multiplex two analog input signals. The displayed user defined name and units will change to the corresponding values depending upon which analog input is connected. Refer to *Analog Input* on page 5–20 for information regarding user defined names and units as well as analog input multiplexing.

6.3 A2 Status

6.3.1 Alarms



MESSAGE | NEGATIVE REAL POWER ALARM
MESSAGE | POSITIVE REACTIVE POWER ALARM
MESSAGE | NEGATIVE REACTIVE POWER ALARM
MESSAGE | UNDERFREQUENCY ALARM
MESSAGE | OVERFREQUENCY ALARM
MESSAGE | PHASE A CURRENT DEMAND ALARM
MESSAGE | PHASE B CURRENT DEMAND ALARM
MESSAGE | PHASE C CURRENT DEMAND ALARM
MESSAGE | DATA LOG 1 ALARM
MESSAGE | DATA LOG 2 ALARM
MESSAGE | NEUTRAL CURRENT DEMAND ALARM
MESSAGE | POSITIVE REAL POWER DEMAND ALARM
MESSAGE | NEGATIVE REAL POWER DEMAND ALARM
MESSAGE | POSITIVE REACTIVE POWER DEMAND ALARM
MESSAGE | NEGATIVE REACTIVE POWER DEMAND ALARM
MESSAGE | APPARENT POWER DEMAND ALARM

MESSAGE	SWITCH INPUT A ALARM
MESSAGE	SWITCH INPUT B ALARM
MESSAGE	SWITCH INPUT C ALARM
MESSAGE	SWITCH INPUT D ALARM
MESSAGE	SELF-TEST FAILURE ALARM
MESSAGE	SERIAL COM1 FAIL- URE ALARM
MESSAGE	SERIAL COM2 FAIL- URE ALARM
MESSAGE	CLOCK NOT SET ALARM
MESSAGE	MAIN ANALOG INPUT ALARM
MESSAGE	ALT ANALOG INPUT ALARM
MESSAGE	CRITICAL SET- POINTS NOT STORED
MESSAGE	CURRENT THD ALARM
MESSAGE	VOLTAGE THD ALARM
MESSAGE	PULSE INPUT 1 ALARM
MESSAGE	PULSE INPUT 2 ALARM
MESSAGE	PULSE INPUT 3 ALARM
MESSAGE	PULSE INPUT 4 ALARM
MESSAGE	TOTALIZED PULSES ALARM
MESSAGE	TIME ALARM

The alarm messages appear only when the alarm threshold has been exceeded for the programmed time. When an alarm is assigned to an output relay, the relay can be set to be unlatched or latched. When the alarm is set as unlatched, it automatically resets when the alarm condition no longer exists. If the alarm is set as latched, a keypad reset or a serial port reset is required.

The **SELF TEST ALARM** occurs if a fault in the PQMII hardware is detected. This alarm is permanently assigned to the alarm output relay and is not user configurable. If this alarm is present, contact the GE Multilin Service Department.

6.3.2 Switch Status

PATH: ACTUAL VALUES ⇨ A2 STATUS ⇨⇩ SWITCHES

```
■
SWITCHES          [
▷]
```

```
SWITCH INPUT A
STATE: Closed
```

MESSAGE

```
SWITCH INPUT B
STATE: Closed
```

MESSAGE

```
SWITCH INPUT C
STATE: Closed
```

MESSAGE

```
SWITCH INPUT D
STATE: Closed
```

To assist in troubleshooting, the state of each switch can be verified using these messages. A separate message displays the status of each input identified by the corresponding name as shown in the wiring diagrams in chapter 2. For a dry contact closure across the corresponding switch terminals the message will read “Closed”.

6.3.3 Clock

PATH: ACTUAL VALUES ⇨ A2 STATUS ⇨⇩ CLOCK

```
■
CLOCK             [
▷]
```

```
TIME: 12:00:00am
DATE: Nov 21 2003
```

The current time and date is displayed in this message. The PQMII uses an internally generated software clock which runs for approximately thirty days after the control power has been removed. For instructions on setting the clock, see *Clock* on page 5–7. The **S4 ALARMS/CONTROL ⇨⇩ MISCELLANEOUS ⇨⇩ CLOCK NOT SET ALARM** alarm occurs if power has been removed for longer than thirty days and the clock value has been lost.

6.3.4 Programmable Message

PATH: ACTUAL VALUES ⇨ A2 STATUS ⇨⇩ PROGRAMMABLE MESSAGE

```
■
PROGRAMMABLE    [
▷]
  MESSAGE
```

```
PHONE: 905-294-
6222
www.GEmulti-
lin.com
```

A 40-character user defined message is displayed. The message is programmed using the keypad or via the serial port using the EnerVista PQMII Setup Software. See *Programmable Message* on page 5–14 for programming details.

6.4 A3 Power Analysis

6.4.1 Power Quality

PATH: ACTUAL VALUES ⇨ A3 POWER ANALYSIS ⇨⇩ POWER QUALITY VALUES

```
■ POWER
QUALITY    [▷]
  VALUES
```

```
Ia CREST FACTOR =
 1.233
```

MESSAGE
```
Ib CREST FACTOR =
 1.008
```

MESSAGE
```
Ic CREST FACTOR =
 1.000
```

MESSAGE
```
Ia THDF = 0.944
```

MESSAGE
```
Ib THDF = 0.999
```

MESSAGE
```
Ic THDF = 0.988
```

- **Ia/Ib/Ic CREST FACTOR**: The crest factor describes how much the load current can vary from a pure sine wave while maintaining the system's full rating. A completely linear load (pure sine wave) has a crest factor of $\sqrt{2}$ (1 /0.707), which is the ratio of the peak value of sine wave to its RMS value. Typically, the crest factor can range from $\sqrt{2}$ to 2.5.
- **Ia/Ib/Ic THDF**: The Transformer Harmonic Derating Factor (THDF), also known as CBEMA factor, is defined as the crest factor of a pure sine wave ($\sqrt{2}$) divided by the measured crest factor. This method is useful in cases where lower order harmonics are dominant. In a case where higher order harmonics are present, it may be necessary to use a more precise method (K-factor) of calculating the derating factor. This method also does not take into consideration the losses associated with rated eddy current in the transformer. The EnerVista PQMII Setup Software provides the K-factor method of calculating the derating factor, which is defined on a per unit basis as follows:

$$K = \sum_{h=1}^{h_{max}} I_h^2 \times h^2 \qquad \textbf{(EQ 6.3)}$$

where: I_h = RMS current at harmonic h, in per unit of rated RMS load current

6.4.2 THD

PATH: ACTUAL VALUES ⇨ A3 POWER ANALYSIS ⇨⇩ TOTAL HARMONIC DISTORTION

```
■ TOTAL
HARMONIC   [▷]
  DISTORTION
```

```
PHASE A CURRENT
THD=
  5.3%
```

MESSAGE	PHASE B CURRENT THD= 7.8%
MESSAGE	PHASE C CURRENT THD= 4.5%
MESSAGE	NEUTRAL CURRENT THD= 15.4%
MESSAGE	VOLTAGE Van THD= 1.2%
MESSAGE	VOLTAGE Vbn THD= 2.0%
MESSAGE	VOLTAGE Vcn THD= 2.0%
MESSAGE	VOLTAGE Vab THD= 2.0%
MESSAGE	VOLTAGE Vbc THD= 1.1%
MESSAGE	Ia MAX THD = 5.9% 12:00:00am 01/01/95
MESSAGE	Ib MAX THD = 7.8% 12:00:00am 01/01/95
MESSAGE	Ic MAX THD = 4.5% 12:00:00am 01/01/95
MESSAGE	In MAX THD = 15.4% 12:00:00am 01/01/95
MESSAGE	Van MAX THD = 1.2% 12:00:00am 01/01/95
MESSAGE	Vbn MAX THD = 2.0% 12:00:00am 01/01/95

MESSAGE

```
Vcn MAX THD =
  2.0%
12:00:00am   01/
01/95
```

MESSAGE

```
Vab MAX THD =
  2.0%
12:00:00am   01/
01/95
```

MESSAGE

```
Vbc MAX THD =
  1.1%
12:00:00am   01/
01/9
```

- **PHASE A/B/C/N CURRENT THD**: These messages display the calculated total harmonic distortion for each current input.
- **VOLTAGE Van/Vbn/Vcn/Vab/Vbc THD**: These messages display the calculated total harmonic distortion for each voltage input. Phase-to-neutral voltages will appear when the setpoint **S2 SYSTEM SETUP ⇨⇩ CURRENT/VOLTAGE CONFIGURATION ⇨⇩ VT WIRING** is set as "Wye". Line-to-line voltages will appear when **VT WIRING** is set as "Delta".
- **Ia/Ib/Ic/In MAX THD**: The maximum total harmonic value for each current input and the time and date which the maximum value occurred are displayed. The **S1 PQMII SETUP \ CLEAR DATA \ CLEAR MAX THD VALUES** setpoint clears this value.
- **Van/Vbn/Vcn/Vab/Vbc MAX THD**: These messages display the maximum total harmonic value for each voltage input and the time and date of its occurrence. The setpoint **S1 PQMII SETUP ⇨⇩ CLEAR DATA \⇨⇩CLEAR MAX THD VALUES** is used to clear this value. Phase to neutral voltages will appear when the setpoint **S2 SYSTEM SETUP ⇨⇩ CURRENT/ VOLTAGE CONFIGURATION ⇨⇩ VT WIRING** is set to "Wye". Line to line voltages will appear when **VT WIRING** is set to "Delta".

6.4.3 Data Logger

PATH: ACTUAL VALUES ⇨ A3 POWER ANALYSIS ⇨⇩ DATA LOGGER

```
■ DATA
LOGGER      [▷]
```

```
DATA LOG 1:
STOPPED:
  0% FULL
```

MESSAGE

```
DATA LOG 2:
STOPPED:
  0% FULL
```

These message display the current status of Data Loggers 1 and 2. The Data Logger can be set up and run only from the EnerVista PQMII Setup Software. See *Data Logger* on page 4–12 and *Data Logger Implementation* on page 8–9 for additional details on the Data Logger feature.

It is possible to stop the data loggers from the PQMII front panel using the **S2 SYSTEM SETUP ⇨⇩ DATA LOGGER ⇨⇩ STOP DATA LOGGER 1(2)** setpoint.

6.4.4 Event Recorder

PATH: ACTUAL VALUES ⇨ A3 POWER ANALYSIS ⇨⇩ EVENT RECORDER

■ EVENT
RECORDER [▷]

3: POWER ON
12:00:00am 01/
01/03

MESSAGE

2: POWER OFF
12:00:00am 01/
01/03

MESSAGE

1: CLEAR RECORDS
12:00:00am 01/
01/03

The PQMII Event Recorder runs continuously and records the number, cause, time, date, and metering quantities present at the occurrence of each event. This data is stored in non-volatile memory and is not lost when power to the PQMII is removed. The Event Recorder must be enabled in **S1 PQMII SETUP ⇨⇩ EVENT RECORDER ⇨⇩ EVENT RECORDER OPERATION**. The Event Recorder can be cleared in **S1 PQMII SETUP ⇨⇩ CLEAR DATA ⇨⇩ CLEAR EVENT RECORD**. Data for the 150 most recent events is stored. Event data for older events is lost. Note that the event number, cause, time, and date is available in the messages as shown in the following table, but the associated metering data is available only via serial communications.

NOTE

The event data stored for POWER OFF events does not reflect values at the time of power-off.

These messages display the 150 most recent events recorded by the event recorder. The list of possible events and their display on the PQMII is shown below.

Table 6–1: List of Possible Events (Sheet 1 of 4)

Displayed Event Name	Event Description
3Φ +kvar DMD ↑	Positive Reactive Power Demand Alarm/Control Pickup
3Φ +kvar DMD ↓	Positive Reactive Power Demand Alarm/Control Dropout
3Φ +kW DMD ↑	Positive Real Power Demand Alarm/Control Pickup
3Φ +kW DMD ↓	Positive Real Power Demand Alarm/Control Dropout
3Φ kVA DEMAND ↑	Apparent Power Demand Alarm/Control Pickup
3Φ kVA DEMAND ↓	Apparent Power Demand Alarm/Control Dropout
3Φ –kvar DMD ↑	Negative Reactive Power Demand Alarm/Control Pickup
3Φ –kvar DMD ↓	Negative Reactive Power Demand Alarm/Control Dropout
3Φ –kW DMD ↑	Negative Real Power Demand Alarm/Control Pickup
3Φ –kW DMD ↓	Negative Real Power Demand Alarm/Control Dropout
ALARM RESET	Latched Alarm/Auxiliary Reset

Table 6–1: List of Possible Events (Sheet 2 of 4)

Displayed Event Name	Event Description
AN INPUT ALT ↑	Alternate Analog Input Alarm/Control Pickup
AN INPUT ALT ↓	Alternate Analog Input Alarm/Control Dropout
AN INPUT MAIN ↑	Main Analog Input Alarm/Control Pickup
AN INPUT MAIN ↓	Main Analog Input Alarm/Control Dropout
CLOCK NOT SET ↑	Clock Not Set Alarm Pickup
CLOCK NOT SET ↓	Clock Not Set Alarm Dropout
COM1 FAILURE ↑	COM1 Failure Alarm Pickup
COM1 FAILURE ↓	COM1 Failure Alarm Dropout
COM2 FAILURE ↑	COM2 Failure Alarm Pickup
COM2 FAILURE ↓	COM2 Failure Alarm Dropout
CURRENT THD ↑	Current THD Alarm/Control Pickup
CURRENT THD ↓	Current THD Alarm/Control Dropout
CURRENT U/B ↑	Current Unbalance Alarm/Control Pickup
CURRENT U/B ↓	Current Unbalance Alarm/Control Dropout
DATA LOG 1 ↑	Data Log 1 Alarm Pickup
DATA LOG 1 ↓	Data Log 1 Alarm Dropout
DATA LOG 2 ↑	Data Log 2 Alarm Pickup
DATA LOG 2 ↓	Data Log 2 Alarm Dropout
Ia DEMAND ↑	Phase A Current Demand Alarm/Control Pickup
Ia DEMAND ↓	Phase A Current Demand Alarm/Control Dropout
Ib DEMAND ↑	Phase B Current Demand Alarm/Control Pickup
Ib DEMAND ↓	Phase B Current Demand Alarm/Control Dropout
Ic DEMAND ↑	Phase C Current Demand Alarm/Control Pickup
Ic DEMAND ↓	Phase C Current Demand Alarm/Control Dropout
In DEMAND ↑	Neutral Current Demand Alarm/Control Pickup
In DEMAND ↓	Neutral Current Demand Alarm/Control Dropout
NEG kvar ↑	Negative Reactive Power Alarm/Control Pickup
NEG kvar ↓	Negative Reactive Power Alarm/Control Dropout
NEG kW ↑	Negative Real Power Alarm/Control Pickup
NEG kW ↓	Negative Real Power Alarm/Control Dropout
NEUTRAL ↑	Neutral Overcurrent Alarm/Control Pickup

Table 6–1: List of Possible Events (Sheet 3 of 4)

Displayed Event Name	Event Description
NEUTRAL ↓	Neutral Overcurrent Alarm/Control Dropout
OVERCURRENT ↑	Overcurrent Alarm/Control Pickup
OVERCURRENT ↓	Overcurrent Alarm/Control Dropout
OVERFREQUENCY ↑	Overfrequency Alarm/Control Pickup
OVERFREQUENCY ↓	Overfrequency Alarm/Control Dropout
OVERVOLTAGE ↑	Overvoltage Alarm/Control Pickup
OVERVOLTAGE ↓	Overvoltage Alarm/Control Dropout
PARAM NOT SET ↑	Critical Setpoints Not Stored Alarm Pickup
PARAM NOT SET ↓	Critical Setpoints Not Stored Alarm Dropout
PF LAG 1 ↑	Power Factor Lag 1 Alarm/Control Pickup
PF LAG 1 ↓	Power Factor Lag 1 Alarm/Control Dropout
PF LAG 2 ↑	Power Factor Lag 2 Alarm/Control Pickup
PF LAG 2 ↓	Power Factor Lag 2 Alarm/Control Dropout
PF LEAD 1 ↑	Power Factor Lead 1 Alarm/Control Pickup
PF LEAD 1 ↓	Power Factor Lead 1 Alarm/Control Dropout
PF LEAD 2 ↑	Power Factor Lead 2 Alarm/Control Pickup
PF LEAD 2 ↓	Power Factor Lead 2 Alarm/Control Dropout
PHASE REVERSAL↑	Phase Reversal Alarm/Control Pickup
PHASE REVERSAL↓	Phase Reversal Alarm/Control Dropout
POS kvar ↑	Positive Reactive Power Alarm/Control Pickup
POS kvar ↓	Positive Reactive Power Alarm/Control Dropout
POS kW ↑	Positive Real Power Alarm/Control Pickup
POS kW ↓	Positive Real Power Alarm/Control Dropout
POWER OFF	Power Off
POWER ON	Power On
PROGRAM ENABLE	Setpoint Access On
PULSE IN 1 ↑	Pulse Input 1 Alarm/Control Pickup
PULSE IN 1 ↓	Pulse Input 1 Alarm/Control Dropout
PULSE IN 2 ↑	Pulse Input 2 Alarm/Control Pickup
PULSE IN 2 ↓	Pulse Input 2 Alarm/Control Dropout
PULSE IN 3 ↑	Pulse Input 3 Alarm/Control Pickup

Table 6–1: List of Possible Events (Sheet 4 of 4)

Displayed Event Name	Event Description
PULSE IN 3 ↓	Pulse Input 3 Alarm/Control Dropout
PULSE IN 4 ↑	Pulse Input 4 Alarm/Control Pickup
PULSE IN 4 ↓	Pulse Input 4 Alarm/Control Dropout
PULSE TOTAL ↑	Totalized Pulses Alarm/Control Pickup
PULSE TOTAL ↓	Totalized Pulses Alarm/Control Dropout
SELF TEST ↑	Self Test Failure Alarm Pickup
SELF TEST ↓	Self Test Failure Alarm Dropout
SW A ACTIVE ↑	Switch Input A Alarm/Control Pickup
SW A ACTIVE ↓	Switch Input A Alarm/Control Dropout
SW B ACTIVE ↑	Switch Input B Alarm/Control Pickup
SW B ACTIVE ↓	Switch Input B Alarm/Control Dropout
SW C ACTIVE ↑	Switch Input C Alarm/Control Pickup
SW C ACTIVE ↓	Switch Input C Alarm/Control Dropout
SW D ACTIVE ↑	Switch Input D Alarm/Control Pickup
SW D ACTIVE ↓	Switch Input D Alarm/Control Dropout
TIME ↑	Time Alarm/Control Pickup
TIME ↓	Time Alarm/Control Dropout
TRACE TRIG ↑	Trace Memory Triggered
UNDERCURRENT ↑	Undercurrent Alarm/Control Pickup
UNDERCURRENT ↓	Undercurrent Alarm/Control Dropout
UNDERVOLTAGE ↑	Undervoltage Alarm/Control Pickup
UNDERVOLTAGE ↓	Undervoltage Alarm/Control Dropout
UNDRFREQUENCY ↑	Underfrequency Alarm/Control Pickup
UNDRFREQUENCY ↓	Underfrequency Alarm/Control Dropout
VOLTAGE THD ↑	Voltage THD Alarm/Control Pickup
VOLTAGE THD ↓	Voltage THD Alarm/Control Dropout
VOLTAGE U/B ↑	Voltage Unbalance Alarm/Control Pickup
VOLTAGE U/B ↓	Voltage Unbalance Alarm/Control Dropout

6.4.5 Voltage Disturbance

Main Menu

PATH: ACTUAL VALUES ⇨ A3 POWER ANALYSIS ⇨⇩ VOLTAGE DIST. RECORDER

```
■ VOLTAGE
DIST.    [▷]
  RECORDER
```

```
3: Van SWELL
12:00:05am   01/
01/03
```

MESSAGE

```
2: Vbn SAG
12:00:02am   01/
01/03
```

MESSAGE

```
1: Vcn UNDERVOLT-
AGE
12:00:00am   01/
01/03
```

The Voltage Disturbance Recorder runs continuously and records the source, level and duration of each voltage disturbance. Up to 500 disturbances are recorded in a circular buffer. When over 500 disturbances are recorded, data for older disturbances are lost as new disturbances are recorded. Additionally, since the events are stored within volatile memory, the voltage disturbance recorder will lose all events upon a power loss. The time and date of when the disturbance *ended* is recorded with the disturbance event. The following available is available for each disturbance:

- **Type**: Each disturbance is classified as a **SWELL** or **SAG**. The disturbance will be distinguished as a swell if the voltage increases above the swell level, for up to 1 minute. A sag disturbance is distinguished in the same manner except that it involves a voltage decrease below the sag level.
- **Source**: The source of the disturbance is the phase voltage that recorded the disturbance; either Van, Vbn, Vcn, Vab, or Vca. If the disturbance is found on two or more phases, multiple disturbances will be recorded.

NOTE

The voltage disturbance recorder monitors only measured values. Therefore, when the Vbc (delta connection only) and Vbn (2 VT 4-Wire Wye only) phases are calculated quantities, they are not considered a source.

The duration and average level are recorded in sub-menus as shown below.

Sub-Menus

PATH: ACTUAL VALUES ⇨ A3 POWER ANALYSIS ⇨⇩ VOLTAGE DIST... ⇨ 1(500): <DIST_TYPE>

```
1: Vcn UNDERVOLT-
AGE
12:00:00am   01/
01/03
```

```
1
          DURATIO
N:
             65
cycles
```

MESSAGE

```
1      VOLTAGE
LEVEL:
                41
25 V
```

The **DURATION** is the length of time of the disturbance. If the disturbance is either a sag or a swell the duration will be recorded in cycles with a maximum possible value of 1 minute (3600 cycles at 60Hz).

The **VOLTAGE LEVEL** represents the average level in volts for the disturbance.

NOTE

The voltage disturbance recorder is independent from the event recorder. The alarm events will record normally as per the conditions set within the S4 ALARMS ⇨⇩ CONTROL settings menu, regardless whether the voltage disturbance recorder is enabled or of the sag/swell level.

If an undervoltage/overvoltage alarm occurs, it is immediately recorded as an event (if enabled). On the other hand, the voltage disturbance is recorded, if enabled, once the voltage level returns to nominal and the condition is complete. As a result, the time recorded in the event recorder is the start time of the alarm condition, while the time recorded in the disturbance recorder is the end time of the condition.

6.5 A4 Product Info

6.5.1 Software Versions

PATH: ACTUAL VALUES ⇨ A4 PRODUCT INFO ⇨⇩ SOFTWARE VERSIONS

```
■
SOFTWARE          [▷]
  VERSIONS
```

```
MAIN PROGRAM VER:
2.22     MAY 09, 2006
```

MESSAGE

```
BOOT PROGRAM VER:
3.00
```

Product software revision information is contained in these messages.

- **MAIN PROGRAM VERSION**: When referring to documentation or requesting technical assistance from the factory, record the **MAIN PROGRAM VERSION**. This value identifies the firmware installed internally in the flash memory. The title page of this instruction manual states the main program revision code for which the manual is written. There may be differences in the product and manual if the revision codes do not match.
- **BOOT PROGRAM VERSION**: This identifies the firmware installed internally in the memory of the PQMII. This does not affect the functionality of the PQMII.

6.5.2 Model Information

PATH: ACTUAL VALUES ⇨ A4 PRODUCT INFO ⇨⇩ MODEL INFORMATION

```
■
MODEL             [▷]
  INFORMATION
```

```
ORDER CODE:
PQMII-T20-C-A
```

MESSAGE

```
CPU SPEED:
25 MHz
```

MESSAGE

```
MOD NUMBER(S):
000
```

MESSAGE

```
SERIAL NUMBER:
C7387777
```

MESSAGE

```
DATE OF MANUFAC-
TURE:
Aug 29 2003
```

MESSAGE

```
DATE OF CALIBRA-
TION:
Aug 29 2003
```

Product identification information is contained in these messages.

- **ORDER CODE**: This indicates which features were ordered with this PQMII. T = Transducer option (T20 = 4-20 mA, T1 = 0-1 mA Analog Outputs), C = Control option, A = Power Analysis option.

- **CPU SPEED**: Newer hardware revisions support the 25 MHz CPU speed, while older revisions only support 16 MHz. Certain features are only available on the 25 MHz platform (such as the Voltage Disturbance Recorder).
- **MOD NUMBER(S)**: If unique features have been installed for special customer orders, the **MOD NUMBER** will be used by factory personnel to identify the matching product records. If an exact replacement model is required, the **MAIN PROGRAM VERSION**, **MOD NUMBER(S)**, **ORDER CODE**, and **SERIAL NUNBER** should be specified with the order.
- **SERIAL NUMBER**: This is the serial number of the PQMII. This should match the number on the label located on the back of the PQMII.
- **DATE OF MANUFACTURE**: This is the date the PQMII was final tested at GE Multilin.
- **DATE OF CALIBRATION**: This is the date the PQMII was last calibrated.

GE Consumer & Industrial
Multilin

PQMII Power Quality Meter

Chapter 7: Communications

7.1 Modbus Overview

7.1.1 Modbus Protocol

The GE Multilin PQMII implements a subset of the AEG Modicon Modbus RTU serial communication standard. Many popular programmable controllers support this protocol directly with a suitable interface card allowing direct connection of the PQMII. Although the Modbus protocol is hardware independent, the PQMII interface uses 2-wire RS485 and 9-pin RS232 interfaces. Modbus is a single-master multiple-slave protocol suitable for a multi-drop configuration provided by RS485 hardware. In this configuration, up to 32 slaves can be daisy-chained together on a single communication channel.

The PQMII is always a Modbus slave; it cannot be programmed as a Modbus master. Computers or PLCs are commonly programmed as masters. The Modbus protocol exists in two versions: Remote Terminal Unit (RTU, binary) and ASCII. Only the RTU version is supported by the PQMII. Monitoring, programming and control functions are possible using read and write register commands.

7.1.2 Electrical Interface

The electrical interface is 2-wire RS485 and 9-pin RS232. In a 2-wire RS485 link, data flow is bi-directional and half duplex. That is, data is never transmitted and received at the same time. RS485 lines should be connected in a daisy-chain configuration (avoid star connections) with a terminating network installed at each end of the link, i.e. at the master end and the slave farthest from the master. The terminating network should consist of a 120 Ω resistor in series with a 1 nF ceramic capacitor when used with Belden 9841 RS485 wire. The value of the terminating resistors should be equal to the characteristic impedance of the line. This is approximately 120 Ω for standard #22 AWG twisted-pair wire. Shielded wire should always be used to minimize noise. Polarity is important in RS485 communications: each '+' terminal of every device must be connected together for the system to operate. See *RS485 Serial Ports* on page 2–14 for details on serial port wiring.

7.1.3 Data Frame Format and Data Rate

One data frame of an asynchronous transmission to or from a PQMII consists of 1 start bit, 8 data bits, and 1 stop bit, resulting in a 10-bit data frame. This is important for high-speed modem transmission, since 11-bit data frames are not supported by Hayes modems at bit rates greater than 300 bps. The Modbus protocol can be implemented at any standard communication speed. The PQMII supports operation at 1200, 2400, 4800, 9600, and 19200 baud.

7.1.4 Data Packet Format

A complete request/response sequence consists of the following bytes (transmitted as separate data frames):

Master Request Transmission:

SLAVE ADDRESS: 1 byte
FUNCTION CODE: 1 byte
DATA: variable number of bytes depending on the Function Code
CRC: 2 bytes

Slave Response Transmission:

SLAVE ADDRESS: 1 byte
FUNCTION CODE: 1 byte
DATA: variable number of bytes depending on FUNCTION CODE
CRC: 2 bytes

The **Slave Address** is the first byte of every transmission. It represents the user-assigned address of the slave device assigned to receive the message sent by the master. Each slave device must be assigned a unique address so only it responds to a transmission that starts with its address. In a master request transmission, the Slave Address represents the address to which the request is being sent. In a slave response transmission the Slave Address represents the address sending the response.

NOTE

A master transmission with a Slave Address of 0 indicates a broadcast command. Broadcast commands can be used only to store setpoints or perform commands.

The **Function Code** is the second byte of every transmission. Modbus defines function codes of 1 to 127. The PQMII implements some of these functions. See *Supported Modbus Functions* on page 7–3 for details of the supported function codes. In a master request transmission the Function Code tells the slave what action to perform. In a slave response transmission if the Function Code sent from the slave is the same as the Function Code sent from the master then the slave performed the function as requested. If the high order bit of the Function Code sent from the slave is a 1 (i.e. if the Function Code is > 127) then the slave did not perform the function as requested and is sending an error or exception response.

The **Data** is a variable number of bytes depending on the Function Code. This may be Actual Values, Setpoints, or addresses sent by the master to the slave or by the slave to the master. See *Supported Modbus Functions* on page 7–3 for a description of the supported functions and the data required for each.

The **CRC** is a a two byte error checking code. See the following section for details.

7.1.5 Error Checking

The RTU version of Modbus includes a 2-byte CRC-16 (16-bit cyclic redundancy check) with every transmission. The CRC-16 algorithm essentially treats the entire data stream (data bits only; start, stop and parity are ignored) as one continuous binary number. This number is first shifted left 16 bits and then divided by a characteristic polynomial (11000000000000101B). The 16-bit remainder is appended to the end of the transmission, MSByte first. The resulting message including CRC, when divided by the same polynomial at the receiver, results in a zero remainder if no transmission errors have occurred.

If a PQMII Modbus slave device receives a transmission in which an error is indicated by the CRC-16 calculation, the slave device will not respond to the transmission. A CRC-16 error indicates that one or more bytes of the transmission were received incorrectly and thus the entire transmission should be ignored in order to avoid the PQMII performing any incorrect operation.

The CRC-16 calculation is an industry standard method used for error detection. An algorithm is included here to assist programmers in situations where no standard CRC-16 calculation routines are available.

7.1.6 CRC-16 Algorithm

Once the following algorithm is complete, the working register "A" will contain the CRC value to be transmitted. Note that this algorithm requires the characteristic polynomial to be reverse bit ordered. The MSbit of the characteristic polynomial is dropped since it does not affect the value of the remainder. The following symbols are used in the algorithm:

-->: data transfer;
A: 16-bit working register;
AL: low order byte of A;
AH: high order byte of A;
CRC: 16-bit CRC-16 value;
i and j: loop counters;
(+): logical exclusive-OR operator;
Di: i-th data byte (i = 0 to N – 1);
G: 16-bit characteristic polynomial = 1010000000000001 with MSbit dropped and bit order reversed;
shr(x): shift right (the LSbit of the low order byte of x shifts into a carry flag, a '0' is shifted into the MSbit of the high order byte of x, all other bits shift right one location

The algorithm is shown below:

```
1. FFFF hex --> A
2. 0 --> i
3. 0 --> j
4. Di (+) AL --> AL
5. j + 1 --> j
6. shr(A)
7. is there a carry?  No: go to 8; Yes: G (+) A --> A
8. is j = 8?  No: go to 5; Yes: go to 9.
9. i + 1 --> i
10. is i = N?  No: go to 3; Yes: go to 11.
11. A --> CRC
```

7.1.7 Timing

Data packet synchronization is maintained by timing constraints. The receiving device must measure the time between the reception of characters. If three and one half character times elapse without a new character or completion of the packet, then the communication link must be reset (i.e. all slaves start listening for a new transmission from the master). Thus at 9600 baud a delay of greater than $3.5 \times 1/9600 \times 10 = 3.65$ ms will cause the communication link to be reset.

7.2 Modbus Functions

7.2.1 Supported Modbus Functions

The following functions are supported by the PQMII:

03h: Read Setpoints and Actual Values

04h: Read Setpoints and Actual Values

05h: Execute Operation

06h: Store Single Setpoint

07h: Read Device Status

08h: Loopback Test

10h: Store Multiple Setpoints

7.2.2 Read Setpoints/Actual Values (Function Codes 03/04h)

Modbus implementation: Read Input and Holding Registers
PQMII Implementation: Read Setpoints and Actual Values

For the PQMII Modbus implementation, these commands are used to read any setpoint ('holding registers') or actual value ('input registers'). Holding and input registers are 16-bit (two byte) values with the high-order byte transmitted first. Thus, all setpoints and actual values are sent as two bytes. A maximum of 125 registers can be read in one transmission. Function codes 03 and 04 are configured to read setpoints or actual values interchangeably since some PLCs do not support both of them.

The slave response to function codes 03/04 is the slave address, function code, number of data bytes to follow, the data, and the CRC. Each data item is sent as a 2 byte number with the high order byte first.

Message Format and Example for Modbus Function Code 03/04h:

Request slave 17 to respond with 3 registers starting at address 006B. For this example the register data in these addresses is:

Address:	006B	006C	006D
Data:	022B	0000	0064

The master/slave packet format is shown below:

Master Transmission	Bytes	Example	Description
Slave Address	1	11	message for slave 17
Function Code	1	03	read registers
Data Starting Address	2	00 6B	data starting at 006B
Number Of Setpoints	2	00 03	3 registers = 6 bytes total
CRC	2	9D 8D	CRC error code

Slave Response	Bytes	Example	Description
Slave Address	1	11	message from slave 17

Slave Response	Bytes	Example	Description
Function Code	1	03	read registers
Byte Count	1	06	3 registers = 6 bytes
Data 1 (see definition above)	2	02 2B	value in address 006B
Data 2 (see definition above)	2	00 00	value in address 006C
Data 3 (see definition above)	2	00 64	value in address 006D
CRC	2	C8 B8	CRC error code

7.2.3 Execute Operation (Function Code 05h)

Modbus Implementation: Force Single Coil
PQMII Implementation: Execute Operation

This function code allows the master to request a PQMII to perform specific command operations. The command numbers listed in the Commands area of the memory map correspond to operation codes for function code 05.

The operation commands can also be initiated by writing to the Commands area of the memory map using function code 16. Refer to *Performing Commands (Function Code 10h)* on page 7–8 for complete details.

Message Format and Example for Modbus Function Code 05h:

Reset PQMII (operation code 1).

Master Transmission	Bytes	Example	Description
Slave Address	1	11	message for slave 17
Function Code	1	05	execute operation
Operation Code	2	00 01	Reset command (operation code 1)
Code Value	2	FF 00	perform function
CRC	2	DF 6A	CRC error code

Slave Response	Bytes	Example	Description
Slave Address	1	11	message from slave 17
Function Code	1	05	execute operation
Operation Code	2	00 01	operation code 1
Code Value	2	FF 00	perform function
CRC	2	DF 6A	CRC error code

7.2.4 Broadcast Command (Function Code 05h)

Modbus Implementation: Force Single Coil
PQMII Implementation: Execute Operation

This function code allows the master to request all PQMIIs on a particular communications link to Clear All Demand Data. The PQMII will recognize a packet as being a broadcast command if the Slave Address is transmitted as 0. Below is an example of the Broadcast Command to Clear All Demand Data.

Message Format and Example for Modbus Function Code 05h:

Clear All Demand Data on all PQMIIs (operation code 34).

Master Transmission	Bytes	Example	Description
Slave Address	1	00	broadcast command (address = 0)
Function Code	1	05	execute operation
Operation Code	2	00 22	clear all demand data (op. code 34)
Code Value	2	FF 00	perform function
CRC	2	2D E1	CRC error code

Slave Response	Bytes	Example	Description
Slave does not respond back to the master.			

7.2.5 Store Single Setpoint (Function Code 06h)

Modbus Implementation: Preset Single Register
PQMII Implementation: Store Single Setpoint

This command allows the master to store a single setpoint into the memory of a PQMII. The slave response to this function code is to echo the entire master transmission.

Message Format and Example for Modbus Function Code 06h:

Request slave 17 to store the value 01E4 in setpoint address 1020. After the transmission in this example is complete, setpoint address 1020 will contain the value 01E4.

Master Transmission	Bytes	Example	Description
Slave Address	1	11	message for slave 17
Function Code	1	06	store single setpoint
Data Starting Address	2	10 20	setpoint address 1020
Data	2	01 E4	data for setpoint address 1020
CRC	2	8E 47	CRC error code

Slave Response	Bytes	Example	Description
Slave Address	1	11	message from slave 17
Function Code	1	06	store single setpoint
Data Starting Address	2	10 20	setpoint address 1020
Data	2	01 E4	data stored in setpoint address 1020
CRC	2	8E 47	CRC error code

7.2.6 Read Device Status (Function Code 07h)

Modbus Implementation: Read Exception Status
PQMII Implementation: Read Device Status

This is a function used to quickly read the status of a selected device. A short message length allows for rapid reading of status. The status byte returned will have individual bits set to 1 or 0 depending on the status of the slave device.

PQMII General Device Status Byte:

Bit Position	Description
B0 (LSBit)	Alarm Condition = 1
B1	Self test failure = 1
B2	Alarm relay energized = 1
B3	Aux 1 relay energized = 1
B4	Aux 2 relay energized = 1
B5	Aux 3 relay energized = 1
B6	Not used
B7 (MSBit)	Not used

Message Format and Example for Modbus Function Code 07h:

Request status from slave 17.

Master Transmission	Bytes	Example	Description
Slave Address	1	11	message for slave 17
Function Code	1	07	read device status
CRC	2	4C 22	CRC error code

Slave Response	Bytes	Example	Description
Slave Address	1	11	message from slave 17
Function Code	1	07	read device status
Device Status (see above)	2	2C	status = 00101100 (in binary)
CRC	2	22 28	CRC error code

7.2.7 Loopback Test (Function Code 08h)

Modbus Implementation: Loopback Test
PQMII Implementation: Loopback Test

This function is used to test the integrity of the communication link. The PQMII will echo the request.

Message Format and Example for Modbus Function 08h:

Loopback test from slave 17.

Master Transmission	Bytes	Example	Description
Slave Address	1	11	message for slave 17
Function Code	1	08	loopback test
Diagnostic code	2	00 00	must be 00 00
Data	2	00 00	must be 00 00

Master Transmission	Bytes	Example	Description
CRC	2	E0 0B	CRC error code

Slave Response	Bytes	Example	Description
Slave Address	1	11	message from slave 17
Function Code	1	08	loopback test
Diagnostic Code	2	00 00	must be 00 00
Data	2	00 00	must be 00 00
CRC	2	E0 0B	CRC error code

7.2.8 Store Multiple Setpoints (Function Code 10h)

Modbus Implementation: Preset Multiple Registers
PQMII Implementation: Store Multiple Setpoints

This function code allows multiple setpoints to be stored into the PQMII memory. Modbus 'registers' are 16-bit (2-byte) values transmitted high order byte first. Thus all PQMII setpoints are sent as two bytes. The maximum number of setpoints that can be stored in one transmission is dependent on the slave device. Modbus allows up to a maximum of 60 holding registers to be stored. The PQMII allows 60 registers to be stored in one transmission. The PQMII response to this function is to echo the slave address, function code, starting address, the number of setpoints stored, and the CRC.

Message Format and Example for function code 10h:

Request slave 17 to store the value 01F4 to setpoint address 1028 and the value 2710 to setpoint address 1029.

Master Transmission	Bytes	Example	Description
Slave Address	1	11	message for slave 17
Function Code	1	10	store multiple setpoints
Data Starting Address	2	10 28	setpoint address 1028
Number of Setpoints	2	00 02	2 setpoints = 4 bytes total
Byte Count	1	04	4 bytes of data
Data 1	2	01 F4	data for setpoint address 1028
Data 2	2	27 10	data for setpoint address 1029
CRC	2	33 23	CRC error code

Slave Response	Bytes	Example	Description
Slave Address	1	11	message from slave 17
Function Code	1	10	store multiple setpoints
Data Starting Address	2	10 28	setpoint address 1028
Number of Setpoints	2	00 02	2 setpoints
CRC	2	C7 90	CRC error code

7.2.9 Performing Commands (Function Code 10h)

Some PLCs may not support command execution using function code 05 but do support storing multiple setpoints with function code 10h. To perform this operation using function code 10h, a certain sequence of commands must be written to the PQMII. The sequence consists of: command function register, command operation register and command data (if required). The command function register must be written with the value of 05, indicating an execute operation. The command operation register must then be written with a valid command operation number from the list of commands shown in the memory map. The command data registers must be written with valid data if the command operation requires data. The selected command will be executed immediately upon receipt of a valid transmission.

Message Format and Example for Function Code 10h:

Perform a reset on PQMII (operation code 1).

Master Transmission	Bytes	Example	Description
Slave Address	1	11	message for slave 17
Function Code	1	10	store multiple setpoints
Data Starting Address	2	00 80	setpoint address 0080
Number of Setpoints	2	00 02	2 setpoints = 4 bytes total
Byte Count	1	04	4 bytes of data
Data 1	2	00 05	data for setpoint address 0080
Data 2	2	00 01	data for setpoint address 0081
CRC	2	B0 D6	CRC error code

Slave Response	Bytes	Example	Description
Slave Address	1	11	message from slave 17
Function Code	1	10	store multiple setpoints
Data Starting Address	2	00 80	setpoint address 0080
Number of Setpoints	2	00 02	2 setpoints
CRC	2	46 7A	CRC error code

7.2.10 Broadcast Command (Function Code 10h)

In applications where multiple devices are daisy-chained, it may be necessary to synchronize device clocks (date and/or time) through one command. The broadcast command allows such synchronization. The PQMII recognizes a packet as being a broadcast command if the Slave Address is transmitted as 0.

Message Format and Example for Function Code 10h:

Send broadcast command to store 1:27:10.015 pm, October 29, 1997.

Master Transmission	Bytes	Example	Description
Slave Address	1	00	broadcast command (address = 0)
Function Code	1	10	store multiple setpoints
Data Starting Address	2	00 F0	setpoint address 00F0
Number of Setpoints	2	00 04	4 setpoints = 8 bytes total
Byte Count	1	08	8 bytes of data

Master Transmission	Bytes	Example	Description
Data 1	2	0D 1B	hours (24-hour format), minutes
Data 2	2	27 1F	milliseconds
Data 3	2	0A 1D	month, day
Data 4	2	07 CD	year (four digits, i.e. 1997)
CRC	2	9D 8D	CRC error code

Slave Response	Bytes	Example	Description
Slave does not respond back to the master.			

The PQMII allows the date and time to be stored separately. In other word, a broadcast command can be sent to store just date or time.

7.2.11 Error Responses

When a PQMII detects an error other than a CRC error, a response will be sent to the master. The MSbit of the Function Code byte will be set to 1 (i.e. the function code sent from the slave will be equal to the function code sent from the master plus 128). The following byte will be an exception code indicating the type of error that occurred.

Transmissions received from the master with CRC errors are ignored by the PQMII.

The slave response to an error (other than CRC error) will be:

Slave Address: 1 byte
Function Code: 1 byte (with MSbit set to 1)
Exception Code: 1 byte
CRC: 2 bytes

The PQMII implements the following exception response codes.

- **01 - Illegal Function**: The function code transmitted is not one of the functions supported by the PQMII.
- **02 - Illegal Data Address**: The address referenced in the data field transmitted by the master is not an allowable address for the PQMII.
- **03 - Illegal Data Value**: The value referenced in the data field transmitted by the master is not within range for the selected data address.

7.3 Modbus Memory Map

7.3.1 Memory Map Information

The data stored in the PQMII are grouped by setpoints and actual values. Setpoints can be read and written by a master computer; actual values are read-only. All setpoints and actual values are stored as two-byte values; that is, each register address is the address of a two-byte value. In the Modbus memory map, addresses are shown in hexadecimal notation; data values (setpoint ranges, increments, factory values) are in decimal notation.

7.3.2 User-definable Memory Map

The PQMII contains a user-definable area in the memory map. This area allows remapping of the addresses of all actual values and setpoints registers. The user-definable area has two sections:

- A **Register Index** area (memory map addresses 0180h to 01F7h) that contains 120 actual values or setpoints register addresses.
- A **Register** area (memory map addresses 0100h to 017Fh) that contains the data at the addresses in the Register Index.

Register data that is separated in the rest of the memory map may be remapped to adjacent register addresses in the user-definable registers area. This is accomplished by writing to register addresses in the user-definable register index area. This allows for improved throughput of data and can eliminate the need for multiple read command sequences.

For example, if the values of Phase A Current (register address 0240h) and Phase A Power Factor (register address 02FDh) are required to be read from a PQMII, their addresses may be remapped as follows:

1. Write 0240h to address 0180h (User-Definable Register Index 0000) using Modbus function code 06h or 10h.
2. Write 02FDh to address 0181h (User-Definable Register Index 0001) using Modbus function code 06h or 10h.

A read (function code 03h or 04h) of registers 0100h (User-Definable Register 0000) and 0101h (User-Definable Register 0001) will return the Phase A Current and Phase A Power Factor.

7.3.3 PQMII Memory Map

The PQMII memory map is shown in the following table.

Table 7–1: PQMII Memory Map (Sheet 1 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
Product Information (Input Registers) Addresses: 0000 to 007F							
PRODUCT ID	0000	Product Device Code	---	---	---	F1	73
	0001	Hardware Version Code	---	---	---	F5	current version
	0002	Main Software Version Code	---	---	---	F1	current version
	0003	Modification File Number 1	---	---	---	F1	mod. file number 1
	0004	Boot Software Version Code	---	---	---	F1	current version
	0005	Reserved					
	0006	Product options	---	---	---	F100	from order code
	0007	Modification File Number 2	---	---	---	F1	mod. file number 2
	0008	Modification File Number 3	---	---	---	F1	mod. file number 3
	0009	Modification File Number 4	---	---	---	F1	mod. file number 4
	000A	Modification File Number 5	---	---	---	F1	mod. file number 5
	000B	CPU Speed	0 to 1	1	---	F45	16 MHz
	to	↓					
	001F	Reserved					
	0020	Serial Number Character 1 and 2	---	---	ASCII	F10	1st, 2nd char.
	0021	Serial Number Character 3 and 4	---	---	ASCII	F10	3rd, 4th char.
	0022	Serial Number Character 5 and 6	---	---	ASCII	F10	5th, 6th char
	0023	Serial Number Character 7 and 8	---	---	ASCII	F10	7th, 8th char.
	0024	Reserved					
	to	↓					
	002F	Reserved					
	0030	Manufacture Month/Day	---	---	---	F24	manf. month/day
	0031	Manufacture Year	---	---	---	F25	manufacture year
	0032	Calibration Month/Day	---	---	---	F24	cal. month/day
	0033	Calibration Year	---	---	---	F25	calibration year
	0034	Reserved					
	0035	Reserved					
	to	↓					
	007F	Reserved					
Commands (Holding Registers) Addresses: 0080 to 00EF							
COMMANDS	0080	Command Function Code	5	---	---	F1	5
	0081	Command Operation Code	1 to 35	1	---	F7	0
	0082	Command Data 1	0 to 65535	1	---	*	0
	0083	Command Data 2	0 to 65535	1	---	F31	0
	0084	Command Data 3	0 to 65535	1	---	F8	0
	0085	Command Data 4	0 to 65535	1	---	F8	0
	0086	Command Data 5	0 to 65535	1	---	F8	0
	0087	Command Data 6	0 to 65535	1	---	F8	0
	0088	Command Data 7	0 to 65535	1	---	F8	0
	0089	Command Data 8	0 to 65535	1	---	F8	0
	008A	Command Data 9	0 to 65535	1	---	F8	0

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents "OFF".
**** Minimum Setpoint value represents "OFF".
***** Maximum Setpoint value represents "UNLIMITED".

Table 7–1: PQMII Memory Map (Sheet 2 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
	008B	Command Data 10	0 to 65535	1	---	F8	0
COMMANDS continued	008C	Command Data 11	0 to 65535	1	---	F8	0
	008D	Reserved					
	to	↓					
	00EF	Reserved					
Broadcast Command (Holding Registers) Addresses: 00F0 to 00FF							
BROADCAST COMMAND	00F0	Time Hours/Minutes	0 to 65535	1	hr/min	F22	N/A
	00F1	Time Seconds	0 to 59999	1	ms	F23	N/A
	00F2	Date Month/Day	0 to 65535	1	---	F24	N/A
	00F3	Date Year	0 to 2037	1	---	F25	N/A
	00F4	Reserved					
	to	↓					
	00FF	Reserved					
User Definable Register (Input Registers) Addresses: 0100 to 017F							
USER DEFINABLE REGISTERS	0100	User Definable Data 0000	---	---	---	---	---
	0101	User Definable Data 0001	---	---	---	---	---
	0102	User Definable Data 0002	---	---	---	---	---
	0103	User Definable Data 0003	---	---	---	---	---
	0104	User Definable Data 0004	---	---	---	---	---
	0105	User Definable Data 0005	---	---	---	---	---
	0106	User Definable Data 0006	---	---	---	---	---
	0107	User Definable Data 0007	---	---	---	---	---
	0108	User Definable Data 0008	---	---	---	---	---
	0109	User Definable Data 0009	---	---	---	---	---
	010A	User Definable Data 000A	---	---	---	---	---
	010B	User Definable Data 000B	---	---	---	---	---
	to	↓	↓	↓	↓	↓	↓
	0177	User Definable Data 0077	---	---	---	---	---
	0178	Reserved					
	to	↓					
	017F	Reserved					
User Definable Register Index (Holding Registers) Addresses: 0180 to 01FF							
USER DEFINABLE REGISTER INDEX	0180	Register address for User Data 0000	**	1	---	F1	0
	0181	Register address for User Data 0001	**	1	---	F1	0
	0182	Register address for User Data 0002	**	1	---	F1	0
	0183	Register address for User Data 0003	**	1	---	F1	0
	0184	Register address for User Data 0004	**	1	---	F1	0
	0185	Register address for User Data 0005	**	1	---	F1	0
	0186	Register address for User Data 0006	**	1	---	F1	0
	0187	Register address for User Data 0007	**	1	---	F1	0
	0188	Register address for User Data 0008	**	1	---	F1	0
	0189	Register address for User Data 0009	**	1	---	F1	0
	018A	Register address for User Data 000A	**	1	---	F1	0
	018B	Register address for User Data 000B	**	1	---	F1	0
	018C	Register address for User Data 000C	**	1	---	F1	0
	018D	Register address for User Data 000D	**	1	---	F1	0
	to	↓	↓	↓	↓	↓	↓

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 3 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
	01F7	Register address for User Data 0077	**	1	---	F1	0
USER DEFINABLE REGISTER INDEX continued	01F8	Reserved					
	to	↓					
	01FF	Reserved					
Actual Values (Input Registers) Addresses: 0200-0E1F							
STATUS	0200	Switch Input Status	---	---	---	F101	N/A
	0201	LED Status Flags	---	---	---	F102	N/A
	0202	LED Attribute Flags	---	---	---	F103	N/A
	0203	Output Relay Status Flags	---	---	---	F104	N/A
	0204	Alarm Active Status Flags 1	---	---	---	F105	N/A
	0205	Alarm Pickup Status Flags 1	---	---	---	F105	N/A
	0206	Alarm Active Status Flags 2	---	---	---	F106	N/A
	0207	Alarm Pickup Status Flags 2	---	---	---	F106	N/A
	0208	Alarm Active Status Flags 3	---	---	---	F107	N/A
	0209	Alarm Pickup Status Flags 3	---	---	---	F107	N/A
	020A	Aux. 1 Active Status Flags 1	---	---	---	F105	N/A
	020B	Aux. 1 Pickup Status Flags 1	---	---	---	F105	N/A
	020C	Aux. 1 Active Status Flags 2	---	---	---	F106	N/A
	020D	Aux. 1 Pickup Status Flags 2	---	---	---	F106	N/A
	020E	Aux. 1 Active Status Flags 3	---	---	---	F107	N/A
	020F	Aux. 1 Pickup Status Flags 3	---	---	---	F107	N/A
	0210	Aux. 2 Active Status Flags 1	---	---	---	F105	N/A
	0211	Aux. 2 Pickup Status Flags 1	---	---	---	F105	N/A
	0212	Aux. 2 Active Status Flags 2	---	---	---	F106	N/A
	0213	Aux. 2 Pickup Status Flags 2	---	---	---	F106	N/A
	0214	Aux. 2 Active Status Flags 3	---	---	---	F107	N/A
	0215	Aux. 2 Pickup Status Flags 3	---	---	---	F107	N/A
	0216	Aux. 3 Active Status Flags 1	---	---	---	F105	N/A
	0217	Aux. 3 Pickup Status Flags 1	---	---	---	F105	N/A
	0218	Aux. 3 Active Status Flags 2	---	---	---	F106	N/A
	0219	Aux. 3 Pickup Status Flags 2	---	---	---	F106	N/A
	021A	Aux. 3 Active Status Flags 3	---	---	---	F107	N/A
	021B	Aux. 3 Pickup Status Flags 3	---	---	---	F107	N/A
	021C	General Status	---	---	---	F109	N/A
	021D	Encrypted Passcode	---	---	---	F1	N/A
	021E	Reserved					
	to	↓	↓	↓	↓	↓	↓
	022F	Reserved					
CLOCK	0230	Time - Hours/Minutes	---	---	---	F22	N/A
	0231	Time - Seconds	---	---	---	F23	N/A
	0232	Time - Month/Day	---	---	---	F24	N/A
	0233	Time Year	---	---	---	F25	N/A
	0234	Reserved					
	to	↓	↓	↓	↓	↓	↓
	023F	Reserved					
CURRENT	0240	Phase A Current	---	---	A	F1	N/A

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 4 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
	0241	Phase B Current	---	---	A	F1	N/A
CURRENT continued	0242	Phase C Current	---	---	A	F1	N/A
	0243	Average Current	---	---	A	F1	N/A
	0244	Neutral Current	---	---	A	F1	N/A
	0245	Current Unbalance	---	---	0.1 ×%	F1	N/A
	0246	Phase A Current - Minimum			A	F1	N/A
	0247	Phase B Current - Minimum			A	F1	N/A
	0248	Phase C Current - Minimum			A	F1	N/A
	0249	Neutral Current - Minimum			A	F1	N/A
	024A	Current Unbalance - Minimum			0.1 ×%	F1	N/A
	024B	Phase A Current - Maximum			A	F1	N/A
	024C	Phase B Current - Maximum			A	F1	N/A
	024D	Phase C Current - Maximum			A	F1	N/A
	024E	Neutral Current - Maximum			A	F1	N/A
	024F	Current Unbalance - Maximum			0.1 ×%	F1	N/A
	0250	Time - Hour/Minutes of Phase A Curr. Min	---	---	---	F22	N/A
	0251	Time - Seconds of Phase A Current Min	---	---	---	F23	N/A
	0252	Date - Month/Day of Phase A Current Min	---	---	---	F24	N/A
	0253	Date - Year of Phase A Current Min	---	---	---	F25	N/A
	0254	Time - Hour/Minutes of Phase B Curr. Min	---	---	---	F22	N/A
	0255	Time - Seconds of Phase B Current Min	---	---	---	F23	N/A
	0256	Date - Month/Day of Phase B Current Min	---	---	---	F24	N/A
	0257	Date - Year of Phase B Current Min	---	---	---	F25	N/A
	0258	Time - Hour/Minutes of Phase C Curr. Min	---	---	---	F22	N/A
	0259	Time - Seconds of Phase C Current Min	---	---	---	F23	N/A
	025A	Date - Month/Day of Phase C Current Min	---	---	---	F24	N/A
	025B	Date - Year of Phase C Current Min	---	---	---	F25	N/A
	025C	Time - Hour/Minutes of Neutral Current Min	---	---	---	F22	N/A
	025D	Time - Seconds of Neutral Current Min	---	---	---	F23	N/A
	025E	Date - Month/Day of Neutral Current Min	---	---	---	F24	N/A
	025F	Date - Year of Neutral Current Min	---	---	---	F25	N/A
	0260	Time - Hour/Minutes of Current Unbal. Min	---	---	---	F22	N/A
	0261	Time - Seconds of Current Unbalance Min	---	---	---	F23	N/A
	0262	Date - Month/Day of Current Unbal. Min	---	---	---	F24	N/A
	0263	Date - Year of Current Unbalance Min	---	---	---	F25	N/A
	0264	Time - Hour/Minutes of Phase A Curr. Max	---	---	---	F22	N/A
	0265	Time - Seconds of Phase A Current Max	---	---	---	F23	N/A
	0266	Date - Month/Day of Phase A Current Max	---	---	---	F24	N/A
	0267	Date - Year of Phase A Current Max	---	---	---	F25	N/A

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 5 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
	0268	Time - Hour/Minutes of Phase B Curr. Max	---	---	---	F22	N/A
CURRENT continued	0269	Time - Seconds of Phase B Current Max	---	---	---	F23	N/A
	026A	Date - Month/Day of Phase B Current Max	---	---	---	F24	N/A
	026B	Date - Year of Phase B Current Max	---	---	---	F25	N/A
	026C	Time - Hour/Minutes of Phase C Curr. Max	---	---	---	F22	N/A
	026D	Time - Seconds of Phase C Current Max	---	---	---	F23	N/A
	026E	Date - Month/Day of Phase C Current Max	---	---	---	F24	N/A
	026F	Date - Year of Phase C Current Max	---	---	---	F25	N/A
	0270	Time - Hour/Minutes of Neutral Current Max	---	---	---	F22	N/A
	0271	Time - Seconds of Neutral Current Max	---	---	---	F23	N/A
	0272	Date - Month/Day of Neutral Current Max	---	---	---	F24	N/A
	0273	Date - Year of Neutral Current Max	---	---	---	F25	N/A
	0274	Time - Hour/Minutes of Current Unbal. Max	---	---	---	F22	N/A
	0275	Time - Seconds of Current Unbal. Max	---	---	---	F23	N/A
	0276	Date - Month/Day of Current Unbal. Max	---	---	---	F24	N/A
	0277	Date - Year of Current Unbalance Max	---	---	---	F25	N/A
	0278	Reserved					
	to	↓	↓	↓	↓	↓	↓
	027F	Reserved					
VOLTAGE	0280	Voltage Van (High)	---	---	V	F3	N/A
	0281	Voltage Van (Low)					
	0282	Voltage Vbn (High)	---	---	V	F3	N/A
	0283	Voltage Vbn (Low)					
	0284	Voltage Vcn (High)	---	---	V	F3	N/A
	0285	Voltage Vcn (Low)					
	0286	Average Phase Voltage (High)	---	---	V	F3	N/A
	0287	Average Phase Voltage (Low)					
	0288	Voltage Vab (High)	---	---	V	F3	N/A
	0289	Voltage Vab (Low)					
	028A	Voltage Vbc (High)	---	---	V	F3	N/A
	028B	Voltage Vbc (Low)					
	028C	Voltage Vca (High)	---	---	V	F3	N/A
	028D	Voltage Vca (Low)					
	028E	Average Line Voltage (High)	---	---	V	F3	N/A
	028F	Average Line Voltage (Low)					
	0290	Voltage Unbalance	---	---	0.1 × %	F1	N/A
	0291	Voltage Van - Minimum (high)	---	---	V	F3	N/A
	0292	Voltage Van - Minimum (Low)					
	0293	Voltage Vbn - Minimum (high)	---	---	V	F3	N/A
	0294	Voltage Vbn - Minimum (Low)					

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents "OFF".
**** Minimum Setpoint value represents "OFF".
***** Maximum Setpoint value represents "UNLIMITED".

Table 7–1: PQMII Memory Map (Sheet 6 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
VOLTAGE continued	0295	Voltage Vcn - Minimum (high)	---	---	V	F3	N/A
	0296	Voltage Vcn - Minimum (Low)					
	0297	Voltage Vab - Minimum (high)	---	---	V	F3	N/A
	0298	Voltage Vab - Minimum (Low)					
	0299	Voltage Vbc - Minimum (high)	---	---	V	F3	N/A
	029A	Voltage Vbc - Minimum (Low)					
	029B	Voltage Vca - Minimum (high)	---	---	V	F3	N/A
	029C	Voltage Vca - Minimum (Low)					
	029D	Voltage Unbalance - Minimum	---	---	0.1 ×%	F1	N/A
	029E	Voltage Van - Maximum (high)	---	---	V	F3	N/A
	029F	Voltage Van - Maximum (Low)					
	02A0	Voltage Vbn - Maximum (high)	---	---	V	F3	N/A
	02A1	Voltage Vbn - Maximum (Low)					
	02A2	Voltage Vcn - Maximum (high)	---	---	V	F3	N/A
	02A3	Voltage Vcn - Maximum (Low)					
	02A4	Voltage Vab - Maximum (high)	---	---	V	F3	N/A
	02A5	Voltage Vab - Maximum (Low)					
	02A6	Voltage Vbc - Maximum (high)	---	---	V	F3	N/A
	02A7	Voltage Vbc - Maximum (Low)					
	02A8	Voltage Vca - Maximum (high)	---	---	V	F3	N/A
	02A9	Voltage Vca - Maximum (Low)					
	02AA	Voltage Unbalance - Maximum	---	---	0.1 ×%	F1	N/A
	02AB	Time - Hour/Minutes of Voltage Van Min	---	---	---	F22	N/A
	02AC	Time - Seconds of Voltage Van Min	---	---	---	F23	N/A
	02AD	Date - Month/Day of Voltage Van Min	---	---	---	F24	N/A
	02AE	Date - Year of Voltage Van Min	---	---	---	F25	N/A
	02AF	Time - Hour/Minutes of Voltage Vbn Min	---	---	---	F22	N/A
	02B0	Time - Seconds of Voltage Vbn Min	---	---	---	F23	N/A
	02B1	Date - Month/Day of Voltage Vbn Min	---	---	---	F24	N/A
	02B2	Date - Year of Voltage Vbn Min	---	---	---	F25	N/A
	02B3	Time - Hour/Minutes of Voltage Vcn Min	---	---	---	F22	N/A
	02B4	Time - Seconds of Voltage Vcn Min	---	---	---	F23	N/A
	02B5	Date - Month/Day of Voltage Vcn Min	---	---	---	F24	N/A
	02B6	Date - Year of Voltage Vcn Min	---	---	---	F25	N/A
	02B7	Time - Hour/Minutes of Voltage Vab Min	---	---	---	F22	N/A
	02B8	Time - Seconds of Voltage Vab Min	---	---	---	F23	N/A
	02B9	Date - Month/Day of Voltage Vab Min	---	---	---	F24	N/A
	02BA	Date - Year of Voltage Vab Min	---	---	---	F25	N/A
	02BB	Time - Hour/Minutes of Voltage Vbc Min	---	---	---	F22	N/A
	02BC	Time - Seconds of Voltage Vbc Min	---	---	---	F23	N/A
	02BD	Date - Month/Day of Voltage Vbc Min	---	---	---	F24	N/A
	02BE	Date - Year of Voltage Vbc Min	---	---	---	F25	N/A
	02BF	Time - Hour/Minutes of Voltage Vca Min	---	---	---	F22	N/A

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 7 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
VOLTAGE continued	02C0	Time - Seconds of Voltage Vca Min	---	---	---	F23	N/A
	02C1	Date - Month/Day of Voltage Vca Min	---	---	---	F24	N/A
	02C2	Date - Year of Voltage Vca Min	---	---	---	F25	N/A
	02C3	Time - Hour/Minutes of Voltage Unbal. Min	---	---	---	F22	N/A
	02C4	Time - Seconds of Voltage Unbalance Min	---	---	---	F23	N/A
	02C5	Date - Month/Day of Voltage Unbal. Min	---	---	---	F24	N/A
	02C6	Date - Year of Voltage Unbalance Min	---	---	---	F25	N/A
	02C7	Time - Hour/Minutes of Voltage Van Max	---	---	---	F22	N/A
	02C8	Time - Seconds of Voltage Van Max	---	---	---	F23	N/A
	02C9	Date - Month/Day of Voltage Van Max	---	---	---	F24	N/A
	02CA	Date - Year of Voltage Van Max	---	---	---	F25	N/A
	02CB	Time - Hour/Minutes of Voltage Vbn Max	---	---	---	F22	N/A
	02CC	Time - Seconds of Voltage Vbn Max	---	---	---	F23	N/A
	02CD	Date - Month/Day of Voltage Vbn Max	---	---	---	F24	N/A
	02CE	Date - Year of Voltage Vbn Max	---	---	---	F25	N/A
	02CF	Time - Hour/Minutes of Voltage Vcn Max	---	---	---	F22	N/A
	02D0	Time - Seconds of Voltage Vcn Max	---	---	---	F23	N/A
	02D1	Date - Month/Day of Voltage Vcn Max	---	---	---	F24	N/A
	02D2	Date - Year of Voltage Vcn Max	---	---	---	F25	N/A
	02D3	Time - Hour/Minutes of Voltage Vab Max	---	---	---	F22	N/A
	02D4	Time - Seconds of Voltage Vab Max	---	---	---	F23	N/A
	02D5	Date - Month/Day of Voltage Vab Max	---	---	---	F24	N/A
	02D6	Date - Year of Voltage Vab Max	---	---	---	F25	N/A
	02D7	Time - Hour/Minutes of Voltage Vbc Max	---	---	---	F22	N/A
	02D8	Time - Seconds of Voltage Vbc Max	---	---	---	F23	N/A
	02D9	Date - Month/Day of Voltage Vbc Max	---	---	---	F24	N/A
	02DA	Date - Year of Voltage Vbc Max	---	---	---	F25	N/A
	02DB	Time - Hour/Minutes of Voltage Vca Max	---	---	---	F22	N/A
	02DC	Time - Seconds of Voltage Vca Max	---	---	---	F23	N/A
	02DD	Date - Month/Day of Voltage Vca Max	---	---	---	F24	N/A
	02DE	Date - Year of Voltage Vca Max	---	---	---	F25	N/A
	02DF	Time - Hour/Minutes of Voltage Unbal. Max	---	---	---	F22	N/A
	02E0	Time - Seconds of Voltage Unbalance Max	---	---	---	F23	N/A
	02E1	Date - Month/Day of Voltage Unbalance Max	---	---	---	F24	N/A
	02E2	Date - Year of Voltage Unbalance Max	---	---	---	F25	N/A
	02E3	Reserved					
	02E4	Reserved					
	02E5	Reserved					
	02D6	Reserved					
	02E7	Va Phasor Angle	---	---	° lag	F1	

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 8 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
VOLTAGE continued	02E8	Vb Phasor Angle	---	---	° lag	F1	
	02E9	Vc Phasor Angle	---	---	° lag	F1	
	02EA	Ia Phasor Angle	---	---	° lag	F1	
	02EB	Ib Phasor Angle	---	---	° lag	F1	
	02EC	Ic Phasor Angle	---	---	° lag	F1	
	02ED	Reserved					
	02EE	Reserved					
	02EF	Reserved					
POWER	02F0	3 Phase Real Power (high)	---	---	0.01 x kW	F4	N/A
	02F1	3 Phase Real Power (low)					
	02F2	3 Phase Reactive Power (high)	---	---	0.01 x kvar	F4	N/A
	02F3	3 Phase Reactive Power (low)					
	02F4	3 Phase Apparent Power (high)	---	---	0.01 x kVA	F3	N/A
	02F5	3 Phase Apparent Power (low)					
	02F6	3 Phase Power Factor	---	---	0.01 x PF	F2	N/A
	02F7	Phase A Real Power (high)	---	---	0.01 x kW	F4	N/A
	02F8	Phase A Real Power (low)					
	02F9	Phase A Reactive Power (high)	---	---	0.01 x kvar	F4	N/A
	02FA	Phase A Reactive Power (low)					
	02FB	Phase A Apparent Power (high)	---	---	0.01 x kVA	F3	N/A
	02FC	Phase A Apparent Power (low)					
	02FD	Phase A Power Factor	---	---	0.01 x PF	F2	N/A
	02FE	Phase B Real Power (high)	---	---	0.01 x kW	F4	N/A
	02FF	Phase B Real Power (low)					
	0300	Phase B Reactive Power (high)	---	---	0.01 x kvar	F4	N/A
	0301	Phase B Reactive Power (low)					
	0302	Phase B Apparent Power (high)	---	---	0.01 x kVA	F3	N/A
	0303	Phase B Apparent Power (low)					
	0304	Phase B Power Factor	---	---	0.01 x PF	F2	N/A
	0305	Phase C Real Power (high)	---	---	0.01 x kW	F4	N/A
	0306	Phase C Real Power (low)					
	0307	Phase C Reactive Power (high)	---	---	0.01 x kvar	F4	N/A
	0308	Phase C Reactive Power (low)					
	0309	Phase C Apparent Power (high)	---	---	0.01 x kVA	F3	N/A
	030A	Phase C Apparent Power (low)					
	030B	Phase C Power Factor	---	---	0.01 x PF	F2	N/A
	030C	3 Phase Real Power - Minimum (high)	---	---	0.01 x kW	F4	N/A
	030D	3 Phase Real Power - Minimum (low)					
	030E	3 Phase Reactive Power - Minimum (high)	---	---	0.01 x kvar	F4	N/A
	030F	3 Phase Reactive Power - Minimum (low)					
	0310	3 Phase Apparent Power - Minimum (high)	---	---	0.01 x kVA	F3	N/A
	0311	3 Phase Apparent Power - Minimum (low)					
	0312	3 Phase Power Factor - Minimum	---	---	0.01 x PF	F2	N/A

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 9 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
POWER continued	0313	3 Phase Real Power - Maximum (high)	---	---	0.01 x kW	F4	N/A
	0314	3 Phase Real Power - Maximum (low)					
	0315	3 Phase Reactive Power - Maximum (high)	---	---	0.01 x kvar	F4	N/A
	0316	3 Phase Reactive Power - Maximum (low)					
	0317	3 Phase Apparent Power - Maximum (high)	---	---	0.01 x kVA	F3	N/A
	0318	3 Phase Apparent Power - Maximum (low)					
	0319	3 Phase Power Factor - Maximum	---	---	0.01 x PF	F2	N/A
	031A	Phase A Real Power - Minimum (high)	---	---	0.01 x kW	F4	N/A
	031B	Phase A Real Power - Minimum (low)					
	031C	Phase A Reactive Power - Minimum (high)	---	---	0.01 x kvar	F4	N/A
	031D	Phase A Reactive Power - Minimum (low)					
	031E	Phase A Apparent Power - Minimum (high)	---	---	0.01 x kVA	F3	N/A
	031F	Phase A Apparent Power - Minimum (low)					
	0320	Phase A Power Factor - Minimum	---	---	0.01 xPF	F2	N/A
	0321	Phase A Real Power - Maximum (high)	---	---	0.01 x kW	F4	N/A
	0322	Phase A Real Power - Maximum (low)					
	0323	Phase A Reactive Power - Maximum (high)	---	---	0.01 x kvar	F4	N/A
	0324	Phase A Reactive Power - Maximum (low)					
	0325	Phase A Apparent Power - Maximum (high)	---	---	0.01 x kVA	F3	N/A
	0326	Phase A Apparent Power - Maximum (low)					
	0327	Phase A Power Factor - Maximum	---	---	0.01 x PF	F2	N/A
	0328	Phase B Real Power - Minimum (high)	---	---	0.01 x kW	F4	N/A
	0329	Phase B Real Power - Minimum (low)					
	032A	Phase B Reactive Power - Minimum (high)	---	---	0.01 x kvar	F4	N/A
	032B	Phase B Reactive Power - Minimum (low)					
	032C	Phase B Apparent Power - Minimum (high)	---	---	0.01 x kVA	F3	N/A
	032D	Phase B Apparent Power - Minimum (low)					
	032E	Phase B Power Factor - Minimum	---	---	0.01 x PF	F2	N/A
	032F	Phase B Real Power - Maximum (high)	---	---	0.01 x kW	F4	N/A
	0330	Phase B Real Power - Maximum (low)					
	0331	Phase B Reactive Power - Maximum (high)	---	---	0.01 x kvar	F4	N/A
	0332	Phase B Reactive Power - Maximum (low)					
	0333	Phase B Apparent Power - Maximum (high)	---	---	0.01 x kVA	F3	N/A
	0334	Phase B Apparent Power - Maximum (low)					
	0335	Phase B Power Factor - Maximum	---	---	0.01 x PF	F2	N/A

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents "OFF".
**** Minimum Setpoint value represents "OFF".
***** Maximum Setpoint value represents "UNLIMITED".

Table 7–1: PQMII Memory Map (Sheet 10 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
POWER continued	0336	Phase C Real Power - Minimum (high)	---	---	0.01 x kW	F4	N/A
	0337	Phase C Real Power - Minimum (low)					
	0338	Phase C Reactive Power - Minimum (high)	---	---	0.01 x kvar	F4	N/A
	0339	Phase C Reactive Power - Minimum (low)					
	033A	Phase C Apparent Power - Minimum (high)	---	---	0.01 x kVA	F3	N/A
	033B	Phase C Apparent Power - Minimum (low)					
	033C	Phase C Power Factor - Minimum	---	---	0.01 x PF	F2	N/A
	033D	Phase C Real Power - Maximum (high)	---	---	0.01 x kW	F4	N/A
	033E	Phase C Real Power - Maximum (low)					
	033F	Phase C Reactive Power - Maximum (high)	---	---	0.01 x kvar	F4	N/A
	0340	Phase C Reactive Power - Maximum (low)					
	0341	Phase C Apparent Power - Maximum (high)	---	---	0.01 x kVA	F3	N/A
	0342	Phase C Apparent Power - Maximum (low)					
	0343	Phase C Power Factor - Maximum	---	---	0.01 x PF	F2	N/A
	0344	Time - Hour/Minutes of Real Power Min	---	---	---	F22	N/A
	0345	Time - Seconds of Real Power Min	---	---	---	F23	N/A
	0346	Date - Month/Day of Real Power Min	---	---	---	F24	N/A
	0347	Date - Year of Real Power Min	---	---	---	F25	N/A
	0348	Time - Hour/Minutes of Reactive Pwr Min	---	---	---	F22	N/A
	0349	Time - Seconds of Reactive Power Min	---	---	---	F23	N/A
	034A	Date - Month/Day of Reactive Power Min	---	---	---	F24	N/A
	034B	Date - Year of Reactive Power Min	---	---	---	F25	N/A
	034C	Time - Hour/Minutes of Apparent Pwr Min	---	---	---	F22	N/A
	034D	Time - Seconds of Apparent Power Min	---	---	---	F23	N/A
	034E	Date - Month/Day of Apparent Power Min	---	---	---	F24	N/A
	034F	Date - Year of Apparent Power Min	---	---	---	F25	N/A
	0350	Time - Hour/Minutes of Power Factor Min	---	---	---	F22	N/A
	0351	Time - Seconds of Power Factor Min	---	---	---	F23	N/A
	0352	Date - Month/Day of Power Factor Min	---	---	---	F24	N/A
	0353	Date - Year of Power Factor Min	---	---	---	F25	N/A
	0354	Time - Hour/Minutes of Real Power Max	---	---	---	F22	N/A
	0355	Time - Seconds of Real Power Max	---	---	---	F23	N/A
	0356	Date - Month/Day of Real Power Max	---	---	---	F24	N/A
	0357	Date - Year of Real Power Max	---	---	---	F25	N/A
	0358	Time - Hour/Minutes of Reactive Pwr Max	---	---	---	F22	N/A

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents "OFF".
**** Minimum Setpoint value represents "OFF".
***** Maximum Setpoint value represents "UNLIMITED".

Table 7–1: PQMII Memory Map (Sheet 11 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
POWER continued	0359	Time - Seconds of Reactive Power Max	---	---	---	F23	N/A
	035A	Date - Month/Day of Reactive Pwr Max	---	---	---	F24	N/A
	035B	Date - Year of Reactive Power Max	---	---	---	F25	N/A
	035C	Time - Hour/Minutes of Apparent Pwr Max	---	---	---	F22	N/A
	035D	Time - Seconds of Apparent Pwr Max	---	---	---	F23	N/A
	035E	Date - Month/Day of Apparent Pwr Max	---	---	---	F24	N/A
	035F	Date - Year of Apparent Power Max	---	---	---	F25	N/A
	0360	Time - Hour/Minutes of Power Factor Max	---	---	---	F22	N/A
	0361	Time - Seconds of Power Factor Max	---	---	---	F23	N/A
	0362	Date - Month/Day of Power Factor Max	---	---	---	F24	N/A
	0363	Date - Year of Power Factor Max	---	---	---	F25	N/A
	0364	Time - Hour/Min of Phase A Real Pwr Min	---	---	---	F22	N/A
	0365	Time - Seconds of Phase A Real Pwr Min	---	---	---	F23	N/A
	0366	Date - Month/Day of Phase A Real Pwr Min	---	---	---	F24	N/A
	0367	Date - Year of Phase A Real Pwr Min	---	---	---	F25	N/A
	0368	Time - Hour/Min of Phase A React Pwr Min	---	---	---	F22	N/A
	0369	Time - Seconds of Phase A React Pwr Min	---	---	---	F23	N/A
	036A	Date - Month/Day of Phase A React Pwr Min	---	---	---	F24	N/A
	036B	Date - Year of Phase A Reactive Pwr Min	---	---	---	F25	N/A
	036C	Time - Hour/Min of Phase A App Pwr Min	---	---	---	F22	N/A
	036D	Time - Seconds of Phase A App Pwr Min	---	---	---	F23	N/A
	036E	Date - Month/Day of Phase A App Pwr Min	---	---	---	F24	N/A
	036F	Date - Year of Phase A Apparent Pwr Min	---	---	---	F25	N/A
	0370	Time - Hour/Minutes of Phase A PF Min	---	---	---	F22	N/A
	0371	Time - Seconds of Phase A PF Min	---	---	---	F23	N/A
	0372	Date - Month/Day of Phase A PF Min	---	---	---	F24	N/A
	0373	Date - Year of Phase A Power Factor Min	---	---	---	F25	N/A
	0374	Time - Hour/Min of Phase A Real Pwr Max	---	---	---	F22	N/A
	0375	Time - Seconds of Phase A Real Pwr Max	---	---	---	F23	N/A
	0376	Date - Month/Day of Phase A Real Pwr Max	---	---	---	F24	N/A
	0377	Date - Year of Phase A Real Power Max	---	---	---	F25	N/A
	0378	Time - Hour/Min of Phase A React Pwr Max	---	---	---	F22	N/A
	0379	Time - Seconds of Phase A React Pwr Max	---	---	---	F23	N/A
	037A	Date - Mnth/Day of Phase A React Pwr Max	---	---	---	F24	N/A

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 12 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
POWER continued	037B	Date - Year of Phase A Reactive Pwr Max	---	---	---	F25	N/A
	037C	Time - Hour/Min of Phase A App Pwr Max	---	---	---	F22	N/A
	037D	Time - Seconds of Phase A App Pwr Max	---	---	---	F23	N/A
	037E	Date - Month/Day of Phase A App Pwr Max	---	---	---	F24	N/A
	037F	Date - Year of Phase A Apparent Pwr Max	---	---	---	F25	N/A
	0380	Time - Hour/Minutes of Phase A PF Max	---	---	---	F22	N/A
	0381	Time - Seconds of Phase A PF Max	---	---	---	F23	N/A
	0382	Date - Month/Day of Phase A PF Max	---	---	---	F24	N/A
	0383	Date - Year of Phase A Power Factor Max	---	---	---	F25	N/A
	0384	Time - Hour/Min of Phase B Real Pwr Min	---	---	---	F22	N/A
	0385	Time - Seconds of Phase B Real Pwr Min	---	---	---	F23	N/A
	0386	Date - Month/Day of Phase B Real Pwr Min	---	---	---	F24	N/A
	0387	Date - Year of Phase B Real Power Min	---	---	---	F25	N/A
	0388	Time - Hour/Min of Phase B React Pwr Min	---	---	---	F22	N/A
	0389	Time - Seconds of Phase B React Pwr Min	---	---	---	F23	N/A
	038A	Date - Month/Day of Phase B React Pwr Min	---	---	---	F24	N/A
	038B	Date - Year of Phase B Reactive Pwr Min	---	---	---	F25	N/A
	038C	Time - Hour/Min of Phase B App Pwr Min	---	---	---	F22	N/A
	038D	Time - Seconds of Phase B App Pwr Min	---	---	---	F23	N/A
	038E	Date - Month/Day of Phase B App Pwr Min	---	---	---	F24	N/A
	038F	Date - Year of Phase B Apparent Pwr Min	---	---	---	F25	N/A
	0390	Time - Hour/Minutes of Phase B PF Min	---	---	---	F22	N/A
	0391	Time - Seconds of Phase B PF Min	---	---	---	F23	N/A
	0392	Date - Month/Day of Phase B PF Min	---	---	---	F24	N/A
	0393	Date - Year of Phase B PF Min	---	---	---	F25	N/A
	0394	Time - Hour/Min of Phase B Real Pwr Max	---	---	---	F22	N/A
	0395	Time - Seconds of Phase B Real Pwr Max	---	---	---	F23	N/A
	0396	Date - Month/Day of Phase B Real Pwr Max	---	---	---	F24	N/A
	0397	Date - Year of Phase B Real Power Max	---	---	---	F25	N/A
	0398	Time - Hour/Min of Phase B React Pwr Max	---	---	---	F22	N/A
	0399	Time - Seconds of Phase B React Pwr Max	---	---	---	F23	N/A
	039A	Date - Mnth/Day of Phase B React Pwr Max	---	---	---	F24	N/A
	039B	Date - Year of Phase B Reactive Pwr Max	---	---	---	F25	N/A

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 13 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
POWER continued	039C	Time - Hour/Min of Phase B App Pwr Max	---	---	---	F22	N/A
	039D	Time - Seconds of Phase B App Pwr Max	---	---	---	F23	N/A
	039E	Date - Month/Day of Phase B App Pwr Max	---	---	---	F24	N/A
	039F	Date - Year of Phase B Apparent Pwr Max	---	---	---	F25	N/A
	03A0	Time - Hour/Minutes of Phase B PF Max	---	---	---	F22	N/A
	03A1	Time - Seconds of Phase B PF Max	---	---	---	F23	N/A
	03A2	Date - Month/Day of Phase B PF Max	---	---	---	F24	N/A
	03A3	Date - Year of Phase B Power Factor Max	---	---	---	F25	N/A
	03A4	Time - Hour/Min of Phase C Real Pwr Min	---	---	---	F22	N/A
	03A5	Time - Seconds of Phase C Real Pwr Min	---	---	---	F23	N/A
	03A6	Date - Month/Day of Phase C Real Pwr Min	---	---	---	F24	N/A
	03A7	Date - Year of Phase C Real Power Min	---	---	---	F25	N/A
	03A8	Time - Hour/Min of Phase C React Pwr Min	---	---	---	F22	N/A
	03A9	Time - Seconds of Phase C React Pwr Min	---	---	---	F23	N/A
	03AA	Date - Mnth/Day of Phase C React Pwr Min	---	---	---	F24	N/A
	03AB	Date - Year of Phase C Reactive Pwr Min	---	---	---	F25	N/A
	03AC	Time - Hour/Min of Phase C App Pwr Min	---	---	---	F22	N/A
	03AD	Time - Seconds of Phase C App Pwr Min	---	---	---	F23	N/A
	03AE	Date - Month/Day of Phase C App Pwr Min	---	---	---	F24	N/A
	03AF	Date - Year of Phase C Apparent Pwr Min	---	---	---	F25	N/A
	03B0	Time - Hour/Minutes of Phase C PF Min	---	---	---	F22	N/A
	03B1	Time - Seconds of Phase C PF Min	---	---	---	F23	N/A
	03B2	Date - Month/Day of Phase C PF Min	---	---	---	F24	N/A
	03B3	Date - Year of Phase C Power Factor Min	---	---	---	F25	N/A
	03B4	Time - Hour/Min of Phase C Real Pwr Max	---	---	---	F22	N/A
	03B5	Time - Seconds of Phase C Real Pwr Max	---	---	---	F23	N/A
	03B6	Date - Month/Day of Phase C Real Pwr Max	---	---	---	F24	N/A
	03B7	Date - Year of Phase C Real Power Max	---	---	---	F25	N/A
	03B8	Time - Hour/Min of Phase C React Pwr Max	---	---	---	F22	N/A
	03B9	Time - Seconds of Phase C React Pwr Max	---	---	---	F23	N/A
	03BA	Date - Mnth/Day of Phase C React Pwr Max	---	---	---	F24	N/A
	03BB	Date - Year of Phase C Reactive Pwr Max	---	---	---	F25	N/A
	03BC	Time - Hour/Min of Phase C App Pwr Max	---	---	---	F22	N/A

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 14 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
POWER continued	03BD	Time - Seconds of Phase C App Pwr Max	---	---	---	F23	N/A
	03BE	Date - Month/Day of Phase C App Pwr Max	---	---	---	F24	N/A
	03BF	Date - Year of Phase C Apparent Pwr Max	---	---	---	F25	N/A
	03C0	Time - Hour/Minutes of Phase C PF Max	---	---	---	F22	N/A
	03C1	Time - Seconds of Phase C PF Max	---	---	---	F23	N/A
	03C2	Date - Month/Day of Phase C PF Max	---	---	---	F24	N/A
	03C3	Date - Year of Phase C Power Factor Max	---	---	---	F25	N/A
	03C4	Reserved					
	to	↓	↓	↓	↓	↓	↓
	03CF	Reserved					
ENERGY	03D0	3 Phase Positive Real Energy Used (high)	---	---	kWh	F3	N/A
	03D1	3 Phase Positive Real Energy Used (low)					
	03D2	3 Phase Negative Real Energy Used (high)	---	---	kWh	F3	N/A
	03D3	3 Phase Negative Real Energy Used (low)					
	03D4	3 Phase Positive React. Energy Used (high)	---	---	kvarh	F3	N/A
	03D5	3 Phase Positive React. Energy Used (low)					
	03D6	3 Phase Neg Reactive Energy Used (high)	---	---	kvarh	F3	N/A
	03D7	3 Phase Neg Reactive Energy Used (low)					
	03D8	3 Phase Apparent Energy Used (high)	---	---	kVAh	F3	N/A
	03D9	3 Phase Apparent Energy Used (low)					
	03DA	3 Phase Energy Used in Last 24 h (high)	---	---	kWh	F3	N/A
	03DB	3 Phase Energy Used in Last 24 h (low)					
	03DC	3 Phase Energy Cost Since Reset (high)	---	---	$ × 0.01	F3	N/A
	03DD	3 Phase Energy Cost Since Reset (low)					
	03DE	3 Phase Energy Cost Per Day (high)	---	---	$ × 0.01	F3	N/A
	03DF	3 Phase Energy Cost Per Day (low)					
	03E0	Time - Hours/Minutes of Last Reset	---	---	---	F22	N/A
	03E1	Time - Seconds of Last Reset	---	---	---	F23	N/A
	03E2	Date - Month/Day of Last Reset	---	---	---	F24	N/A
	03E3	Date - Year of Last Reset	---	---	---	F25	N/A
	03E4	Tariff Period 1 Positive Real Energy (high)	---	---	kWh	F3	N/A
	03E5	Tariff Period 1 Positive Real Energy (low)					
	03E6	Tariff Period 1 Negative Real Energy (high)	---	---	kWh	F3	N/A
	03E7	Tariff Period 1 Negative Real Energy (low)					
	03E8	Tariff Period 2 Positive Real Energy (high)	---	---	kWh	F3	N/A
	03E9	Tariff Period 2 Positive Real Energy (low)					

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents "OFF".
**** Minimum Setpoint value represents "OFF".
***** Maximum Setpoint value represents "UNLIMITED".

Table 7–1: PQMII Memory Map (Sheet 15 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
ENERGY continued	03EA	Tariff Period 2 Negative Real Energy (high)	---	---	kWh	F3	N/A
	03EB	Tariff Period 2 Negative Real Energy (low)					
	03EC	Tariff Period 3 Positive Real Energy (high)	---	---	kWh	F3	N/A
	03ED	Tariff Period 3 Positive Real Energy (low)					
	03EE	Tariff Period 3 Negative Real Energy (high)	---	---	kWh	F3	N/A
	03EF	Tariff Period 3 Negative Real Energy (low)					
	03F0	Tariff Period 1 Cost (high)	---	---	$ x 0.01	F3	N/A
	03F1	Tariff Period 1 Cost (low)					
	03F2	Tariff Period 2 Cost (high)	---	---	$ x 0.01	F3	N/A
	03F3	Tariff Period 2 Cost (low)					
	03F4	Tariff Period 3 Cost (high)	---	---	$ x 0.01	F3	N/A
	03F5	Tariff Period 3 Cost (low)					
	03F6	Tariff Period 1 Net Energy Used (high)	---	---	kWh	F3	N/A
	03F7	Tariff Period 1 Net Energy Used (low)					
	03F8	Tariff Period 2 Net Energy Used (high)	---	---	kWh	F3	N/A
	03F9	Tariff Period 2 Net Energy Used (low)					
	03FA	Tariff Period 3 Net Energy Used (high)	---	---	kWh	F3	N/A
	03FB	Tariff Period 3 Net Energy Used (low)					
	03FC	Reserved					
	to	↓	↓	↓	↓	↓	↓
	03FF	Reserved					
DEMAND	0400	Phase A Current Demand	---	---	A	F1	N/A
	0401	Phase B Current Demand	---	---	A	F1	N/A
	0402	Phase C Current Demand	---	---	A	F1	N/A
	0403	Neutral Current Demand	---	---	A	F1	N/A
	0404	3 Phase Real Power Demand (high)	---	---	0.01 x kW	F4	N/A
	0405	3 Phase Real Power Demand (low)					
	0406	3 Phase React Power Demand (high)	---	---	0.01 x kvar	F4	N/A
	0407	3 Phase React Power Demand (low)					
	0408	3 Phase Apparent Power Demand (high)	---	---	0.01 x kVA	F3	N/A
	0409	3 Phase Apparent Power Demand (low)					
	040A	Phase A Current Demand - Maximum	---	---	A	F1	N/A
	040B	Phase B Current Demand - Maximum	---	---	A	F1	N/A
	040C	Phase C Current Demand - Maximum	---	---	A	F1	N/A
	040D	Neutral Current Demand - Maximum	---	---	A	F1	N/A
	040E	3 Phase Real Power Dmd (high) - Max	---	---	0.01 x kW	F4	N/A
	040F	3 Phase Real Power Dmd (low) - Max					
	0410	3 Phase React Power Dmd (high) - Max	---	---	0.01 x kvar	F4	N/A
	0411	3 Phase React Power Dmd (low) - Max					
	0412	3 Phase Apparent Power Dmd (high) - Max	---	---	0.01 x kVA	F3	N/A
	0413	3 Phase Apparent Power Dmd (low) - Max					
	0414	Time - Hours/Min of Phase A Cur. Dmd Max	---	---	---	F22	N/A

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 16 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
DEMAND continued	0415	Time - Seconds of Phase A Cur. Dmd Max	---	---	---	F23	N/A
	0416	Date - Mnth/Day of Phase A Cur. Dmd Max	---	---	---	F24	N/A
	0417	Date - Year of Phase A Cur. Dmd Max	---	---	---	F25	N/A
	0418	Time - Hours/Min of Phase B Cur. Dmd Max	---	---	---	F22	N/A
	0419	Time - Seconds of Phase B Cur. Dmd Max	---	---	---	F23	N/A
	041A	Date - Mnth/Day of Phase B Cur. Dmd Max	---	---	---	F24	N/A
	041B	Date - Year of Phase B Cur. Dmd Max	---	---	---	F25	N/A
	041C	Time - Hours/Min of Phase C Cur. Dmd Max	---	---	---	F22	N/A
	041D	Time - Seconds of Phase C Cur. Dmd Max	---	---	---	F23	N/A
	041E	Date - Mnth/Day of Phase C Cur. Dmd Max	---	---	---	F24	N/A
	041F	Date - Year of Phase C Cur. Dmd Max	---	---	---	F25	N/A
	0420	Time - Hours/Min of Neutral Cur. Dmd Max	---	---	---	F22	N/A
	0421	Time - Seconds of Neutral Cur. Dmd Max	---	---	---	F23	N/A
	0422	Date - Month/Day of Neutral Cur. Dmd Max	---	---	---	F24	N/A
	0423	Date - Year of Neutral Cur. Dmd Max	---	---	---	F25	N/A
	0424	Time - Hours/Min of Real Pwr Dmd Max	---	---	---	F22	N/A
	0425	Time - Seconds of Real Pwr Dmd Max	---	---	---	F23	N/A
	0426	Date - Month/Day of Real Pwr Dmd Max	---	---	---	F24	N/A
	0427	Date - Year of Real Pwr Dmd Max	---	---	---	F25	N/A
	0428	Time - Hours/Min of React Pwr Dmd Max	---	---	---	F22	N/A
	0429	Time - Seconds of React Pwr Dmd Max	---	---	---	F23	N/A
	042A	Date - Month/Day of React Pwr Dmd Max	---	---	---	F24	N/A
	042B	Date - Year of React Pwr Dmd Max	---	---	---	F25	N/A
	042C	Time - Hour/Min of App. Pwr Dmd Max	---	---	---	F22	N/A
	042D	Time - Seconds of Apparent Pwr Dmd Max	---	---	---	F23	N/A
	042E	Date - Month/Day of App. Pwr Dmd Max	---	---	---	F24	N/A
	042F	Date - Year of Apparent Pwr Dmd Max	---	---	---	F25	N/A
	0430	Reserved					
	to	↓	↓	↓	↓	↓	↓
	043F	Reserved					
FREQUENCY	0440	Frequency	---	---	0.01 x Hz	F1	N/A
	0441	Frequency Minimum	---	---	0.01 x Hz	F1	N/A
	0442	Frequency Maximum	---	---	0.01 x Hz	F1	N/A
	0443	Time - Hours/Min of Frequency Max	---	---	---	F22	N/A
	0444	Time - Seconds of Frequency Max	---	---	---	F23	N/A
	0445	Date - Month/Day of Frequency Max	---	---	---	F24	N/A
	0446	Date - Year of Frequency Max	---	---	---	F25	N/A
	0447	Time - Hours/Min of Frequency Min	---	---	---	F22	N/A

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 17 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
FREQUENCY continued	0448	Time - Seconds of Frequency Min	---	---	---	F23	N/A
	0449	Date - Month/Day of Frequency Min	---	---	---	F24	N/A
	044A	Date - Year of Frequency Min	---	---	---	F25	N/A
	044B	Reserved					
	to	↓	↓	↓	↓	↓	↓
	044F	Reserved					
PULSE INPUT COUNTERS	0450	Pulse Input 1 (high)	---	---	---	F3	N/A
	0451	Pulse Input 1 (low)					
	0452	Pulse Input 2 (high)	---	---	---	F3	N/A
	0453	Pulse Input 2 (low)					
	0454	Pulse Input 3 (high)	---	---	---	F3	N/A
	0455	Pulse Input 3 (low)					
	0456	Pulse Input 4 (high)	---	---	---	F3	N/A
	0457	Pulse Input 4 (low)					
ANALOG INPUT	0458	Main/Alternate Analog Input (High)	---	---	---	F3	N/A
	0459	Main/Alternate Analog Input (low)					
	045A	Reserved					
	to	↓	↓	↓	↓	↓	↓
	045F	Reserved					
PULSE INPUT COUNTERS	0460	Totalized Pulse Input (high)	---	---	---	F3	N/A
	0461	Totalized Pulse Input (low)					
	0462	Pulse Count Cleared Time – Hours/Min	---	---	---	F22	N/A
	0463	Pulse Count Cleared Time – Seconds	---	---	---	F23	N/A
	0464	Pulse Count Cleared Date – Month/Day	---	---	---	F24	N/A
	0465	Pulse Count Cleared Date – Year	---	---	---	F25	N/A
	0466	Reserved					
	to	↓	↓	↓	↓	↓	↓
	046F	Reserved					
POWER QUALITY	0470	Ia Crest Factor	---	---	0.001 xCF	F1	N/A
	0471	Ib Crest Factor	---	---	0.001 xCF	F1	N/A
	0472	Ic Crest Factor	---	---	0.001 xCF	F1	N/A
	0473	Ia Transformer Harmonic Derating Factor	---	---	0.01xTHDF	F1	N/A
	0474	Ib Transformer Harmonic Derating Factor	---	---	0.01xTHDF	F1	N/A
	0475	Ic Transformer Harmonic Derating Factor	---	---	0.01xTHDF	F1	N/A
	0476	Reserved					
	0477	Reserved					
TOTAL HARMONIC DISTORTION	0478	Phase A Current THD	---	---	0.1 x %	F1	N/A
	0479	Phase B Current THD	---	---	0.1 x %	F1	N/A
	047A	Phase C Current THD	---	---	0.1 x %	F1	N/A
	047B	Neutral Current THD	---	---	0.1 x %	F1	N/A
	047C	Voltage Van THD	---	---	0.1 x %	F1	N/A
	047D	Voltage Vbn THD	---	---	0.1 x %	F1	N/A
	047E	Voltage Vcn THD	---	---	0.1 x %	F1	N/A
	047F	Voltage Vab THD	---	---	0.1 x %	F1	N/A
	0480	Voltage Vbc THD	---	---	0.1 x %	F1	N/A

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents "OFF".
**** Minimum Setpoint value represents "OFF".
***** Maximum Setpoint value represents "UNLIMITED".

Table 7–1: PQMII Memory Map (Sheet 18 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
TOTAL HARMONIC DISTORTION continued	0481	Reserved					
	0482	Phase A Current THD - Maximum	---	---	0.1 x %	F1	N/A
	0483	Phase B Current THD - Maximum	---	---	0.1 x %	F1	N/A
	0484	Phase C Current THD - Maximum	---	---	0.1 x %	F1	N/A
	0485	Neutral Current THD - Maximum	---	---	0.1 x %	F1	N/A
	0486	Voltage Van THD - Maximum	---	---	0.1 x %	F1	N/A
	0487	Voltage Vbn THD - Maximum	---	---	0.1 x %	F1	N/A
	0488	Voltage Vcn THD - Maximum	---	---	0.1 x %	F1	N/A
	0489	Voltage Vab THD - Maximum	---	---	0.1 x %	F1	N/A
	048A	Voltage Vbc THD - Maximum	---	---	0.1 x %	F1	N/A
	048B	Reserved					
	048C	Time - Hour/Min of Phase A Cur. THD Max	---	---	---	F22	N/A
	048D	Time - Seconds of Phase A Cur. THD Max	---	---	---	F23	N/A
	048E	Date - Mnth/Day of Phase A Cur. THD Max	---	---	---	F24	N/A
	048F	Date - Year of Phase A Cur. THD Max	---	---	---	F25	N/A
	0490	Time - Hour/Min of Phase B Cur. THD Max	---	---	---	F22	N/A
	0491	Time - Seconds of Phase B Cur. THD Max	---	---	---	F23	N/A
	0492	Date - Mnth/Day of Phase B Cur. THD Max	---	---	---	F24	N/A
	0493	Date - Year of Phase B Cur. THD Max	---	---	---	F25	N/A
	0494	Time - Hour/Min of Phase C Cur. THD Max	---	---	---	F22	N/A
	0495	Time - Seconds of Phase C Cur. THD Max	---	---	---	F23	N/A
	0496	Date - Mnth/Day of Phase C Cur. THD Max	---	---	---	F24	N/A
POWER QUALITY continued	0497	Date - Year of Phase C Cur. THD Max	---	---	---	F25	N/A
	0498	Time - Hour/Min of Neutral Cur. THD Max	---	---	---	F22	N/A
	0499	Time - Seconds of Neutral Cur. THD Max	---	---	---	F23	N/A
	049A	Date - Mnth/Day of Neutral Cur. THD Max	---	---	---	F24	N/A
	049B	Date - Year of Neutral Cur. THD Max	---	---	---	F25	N/A
	049C	Time - Hours/Min of Van THD Max	---	---	---	F22	N/A
	049D	Time - Seconds of Van THD Max	---	---	---	F23	N/A
	049E	Date - Month/Day of Van THD Max	---	---	---	F24	N/A
	049F	Date - Year of Van THD Max	---	---	---	F25	N/A
	04A0	Time - Hours/Min of Vbn THD Max	---	---	---	F22	N/A
	04A1	Time - Seconds of Vbn THD Max	---	---	---	F23	N/A
	04A2	Date - Month/Day of Vbn THD Max	---	---	---	F24	N/A
	04A3	Date - Year of Vbn THD Max	---	---	---	F25	N/A
	04A4	Time - Hours/Min of Vcn THD Max	---	---	---	F22	N/A
	04A5	Time - Seconds of Vcn THD Max	---	---	---	F23	N/A
	04A6	Date - Month/Day of Vcn THD Max	---	---	---	F24	N/A
	04A7	Date - Year of Vcn THD Max	---	---	---	F25	N/A

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 19 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
TOTAL HARMONIC DISTORTION continued	04A8	Time - Hours/Min of Vab THD Max	---	---	---	F22	N/A
	04A9	Time - Seconds of Vab THD Max	---	---	---	F23	N/A
	04AA	Date - Month/Day of Vab THD Max	---	---	---	F24	N/A
	04AB	Date - Year of Vab THD Max	---	---	---	F25	N/A
	04AC	Time - Hours/Min of Vbc THD Max	---	---	---	F22	N/A
	04AD	Time - Seconds of Vbc THD Max	---	---	---	F23	N/A
	04AE	Date - Month/Day of Vbc THD Max	---	---	---	F24	N/A
	04AF	Date - Year of Vbc THD Max	---	---	---	F25	N/A
	04B0	Reserved					
	04B1	Reserved					
	04B2	Reserved					
	04B3	Reserved					
	04B4	Average Current THD	---	---	0.1 x%	F1	N/A
	04B5	Average Voltage THD	---	---	0.1 x%	F1	N/A
	04B6	Reserved					
	to	↓	↓	↓	↓	↓	↓
	04C7	Reserved					
DEBUG DATA	04C8	ADC Reference	---	---	---	F1	N/A
	04C9	Power Loss Fine Time	---	---	10 ms	F1	N/A
	04CA	Power Loss Coarse Time	---	---	0.1 min	F1	N/A
	04CB	Current Key Press	---	---	---	F6	N/A
	04CC	Internal Fault Error Code	---	---	---	F108	N/A
	04CD	Reserved					
	to	↓	↓	↓	↓	↓	↓
	04D7	Reserved					
MESSAGE BUFFER	04D8	Message Buffer characters 1 and 2	---	---	ASCII	F10	N/A
	04D9	Message Buffer characters 3 and 4	---	---	ASCII	F10	N/A
	04DA	Message Buffer characters 5 and 6	---	---	ASCII	F10	N/A
	04DB	Message Buffer characters 7 and 8	---	---	ASCII	F10	N/A
	04DC	Message Buffer characters 9 and 10	---	---	ASCII	F10	N/A
	04DD	Message Buffer characters 11 and 12	---	---	ASCII	F10	N/A
	04DE	Message Buffer characters 13 and 14	---	---	ASCII	F10	N/A
	04DF	Message Buffer characters 15 and 16	---	---	ASCII	F10	N/A
	04E0	Message Buffer characters 17 and 18	---	---	ASCII	F10	N/A
	04E1	Message Buffer characters 19 and 20	---	---	ASCII	F10	N/A
	04E2	Message Buffer characters 21 and 22	---	---	ASCII	F10	N/A
	04E3	Message Buffer characters 23 and 24	---	---	ASCII	F10	N/A
	04E4	Message Buffer characters 25 and 26	---	---	ASCII	F10	N/A
	04E5	Message Buffer characters 27 and 28	---	---	ASCII	F10	N/A
	04E6	Message Buffer characters 29 and 30	---	---	ASCII	F10	N/A
	04E7	Message Buffer characters 31 and 32	---	---	ASCII	F10	N/A
	04E8	Message Buffer characters 33 and 34	---	---	ASCII	F10	N/A
	04E9	Message Buffer characters 35 and 36	---	---	ASCII	F10	N/A

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 20 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
MESSAGE BUFFER continued	04EA	Message Buffer characters 37 and 38	---	---	ASCII	F10	N/A
	04EB	Message Buffer characters 39 and 40	---	---	ASCII	F10	N/A
	04EC	Reserved					
	to	↓	↓	↓	↓	↓	↓
	04F7	Reserved					
HIGH SPEED SAMPLES FOR HARMONIC SPECTRUM	04F8	High Speed Sampling Parameter	---	---	---	F26	N/A
	04F9	High Speed Sampling Scale Factor (high)	---	---	A or V x 10000	F3	N/A
	04FA	High Speed Sampling Scale Factor (low)					
	04FB	Freq. of High Speed Sampling Waveform	---	---	0.01 xHz	F1	N/A
	04FC	Time - Hours/Minutes of Last Sampling	---	---	---	F22	N/A
	04FD	Time - Seconds of Last Sampling	---	---	---	F23	N/A
	04FE	Date - Month/Day of Last Sampling	---	---	---	F24	N/A
	04FF	Date - Year of Last Sampling	---	---	---	F25	N/A
	0500	High Speed Sample Buffer 1	---	---	ADC counts	F2	N/A
	0501	High Speed Sample Buffer 2	---	---	ADC counts	F2	N/A
	0502	High Speed Sample Buffer 3	---	---	ADC counts	F2	N/A
	0503	High Speed Sample Buffer 4	---	---	ADC counts	F2	N/A
	to	↓	↓	↓	↓	↓	↓
	05FD	High Speed Sample Buffer 254	---	---	ADC counts	F2	N/A
	05FE	High Speed Sample Buffer 255	---	---	ADC counts	F2	N/A
	05FF	High Speed Sample Buffer 256	---	---	ADC counts	F2	N/A
	0600	Reserved					
	to	↓	↓	↓	↓	↓	↓
	061F	Reserved					
WAVEFORM CAPTURE HEADER	0620	Time - Hours/Minutes of Last Capture	---	---	---	F22	N/A
	0621	Time - Seconds of Last Capture	---	---	---	F23	N/A
	0622	Date - Month/Day of Last Capture	---	---	---	F24	N/A
	0623	Date - Year of Last Capture	---	---	---	F25	N/A
	0624	Frequency of Last Capture	---	---	0.01 x Hz	F1	N/A
	0625	Reserved					
	0626	Reserved					
	0627	Reserved					
WAVEFORM CAPTURE Ia	0628	Ia Waveform Capture Scale Factor (high)	---	---	A x 10000	F3	N/A
	0629	Ia Waveform Capture Scale Factor (low)					
	062A	Ia Sample Buffer 1	---	---	ADC counts	F2	N/A
	062B	Ia Sample Buffer 2	---	---	ADC counts	F2	N/A
	062C	Ia Sample Buffer 3	---	---	ADC counts	F2	N/A
	062D	Ia Sample Buffer 4	---	---	ADC counts	F2	N/A
	to	↓	↓	↓	↓	↓	↓
	06A6	Ia Sample Buffer 125	---	---	ADC counts	F2	N/A
	06A7	Ia Sample Buffer 126	---	---	ADC counts	F2	N/A
	06A8	Ia Sample Buffer 127	---	---	ADC counts	F2	N/A
	06A9	Ia Sample Buffer 128	---	---	ADC counts	F2	N/A

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents "OFF".
**** Minimum Setpoint value represents "OFF".
***** Maximum Setpoint value represents "UNLIMITED".

Table 7–1: PQMII Memory Map (Sheet 21 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
WAVEFORM CAPTURE Ia continued	06AA	Reserved					
	to	↓	↓	↓	↓	↓	↓
	06AF	Reserved					
WAVEFORM CAPTURE Ib	06B0	Ib Waveform Capture Scale Factor (high)	---	---	A x 10000	F3	N/A
	06B1	Ib Waveform Capture Scale Factor (low)					
	06B2	Ib Sample Buffer 1	---	---	ADC counts	F2	N/A
	06B3	Ib Sample Buffer 2	---	---	ADC counts	F2	N/A
	06B4	Ib Sample Buffer 3	---	---	ADC counts	F2	N/A
	06B5	Ib Sample Buffer 4	---	---	ADC counts	F2	N/A
	to	↓	↓	↓	↓	↓	↓
	072E	Ib Sample Buffer 125	---	---	ADC counts	F2	N/A
	072F	Ib Sample Buffer 126	---	---	ADC counts	F2	N/A
	0730	Ib Sample Buffer 127	---	---	ADC counts	F2	N/A
	0731	Ib Sample Buffer 128	---	---	ADC counts	F2	N/A
	0732	Reserved					
	to	↓	↓	↓	↓	↓	↓
	0737	Reserved					
WAVEFORM CAPTURE Ic	0738	Ic Waveform Capture Scale Factor (high)	---	---	A x 10000	F3	N/A
	0739	Ic Waveform Capture Scale Factor (low)					
	073A	Ic Sample Buffer 1	---	---	ADC counts	F2	N/A
	073B	Ic Sample Buffer 2	---	---	ADC counts	F2	N/A
	073C	Ic Sample Buffer 3	---	---	ADC counts	F2	N/A
	073D	Ic Sample Buffer 4	---	---	ADC counts	F2	N/A
	to	↓	↓	↓	↓	↓	↓
	07B6	Ic Sample Buffer 125	---	---	ADC counts	F2	N/A
	07B7	Ic Sample Buffer 126	---	---	ADC counts	F2	N/A
	07B8	Ic Sample Buffer 127	---	---	ADC counts	F2	N/A
	07B9	Ic Sample Buffer 128	---	---	ADC counts	F2	N/A
	07BA	Reserved					
	to	↓	↓	↓	↓	↓	↓
	07BF	Reserved					
WAVEFORM CAPTURE In	07C0	In Waveform Capture Scale Factor (high)	---	---	A x 10000	F3	N/A
	07C1	In Waveform Capture Scale Factor (low)					
	07C2	In Sample Buffer 1	---	---	ADC counts	F2	N/A
	07C3	In Sample Buffer 2	---	---	ADC counts	F2	N/A
	07C4	In Sample Buffer 3	---	---	ADC counts	F2	N/A
	07C5	In Sample Buffer 4	---	---	ADC counts	F2	N/A
	to	↓	↓	↓	↓	↓	↓
	083E	In Sample Buffer 125	---	---	ADC counts	F2	N/A
	083F	In Sample Buffer 126	---	---	ADC counts	F2	N/A
	0840	In Sample Buffer 127	---	---	ADC counts	F2	N/A
	0841	In Sample Buffer 128	---	---	ADC counts	F2	N/A
	0842	Reserved					

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 22 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
	to	↓	↓	↓	↓	↓	↓
	0847	Reserved					
WAVEFORM CAPTURE Van	0848	Van Waveform Capture Scale Factor (high)	---	---	V x 10000	F3	N/A
	0849	Van Waveform Capture Scale Factor (low)					
	084A	Van Sample Buffer 1	---	---	ADC counts	F2	N/A
	084B	Van Sample Buffer 2	---	---	ADC counts	F2	N/A
	084C	Van Sample Buffer 3	---	---	ADC counts	F2	N/A
	084D	Van Sample Buffer 4	---	---	ADC counts	F2	N/A
	to	↓	↓	↓	↓	↓	↓
	08C6	Van Sample Buffer 125	---	---	ADC counts	F2	N/A
	08C7	Van Sample Buffer 126	---	---	ADC counts	F2	N/A
	08C8	Van Sample Buffer 127	---	---	ADC counts	F2	N/A
	08C9	Van Sample Buffer 128	---	---	ADC counts	F2	N/A
	08CA	Reserved					
	to	↓	↓	↓	↓	↓	↓
	08CF	Reserved					
WAVEFORM CAPTURE Vbn	08D0	Vbn Waveform Capture Scale Factor (high)	---	---	V x 10000	F3	N/A
	08D1	Vbn Waveform Capture Scale Factor (low)					
	08D2	Vbn Sample Buffer 1	---	---	ADC counts	F2	N/A
	08D3	Vbn Sample Buffer 2	---	---	ADC counts	F2	N/A
	08D4	Vbn Sample Buffer 3	---	---	ADC counts	F2	N/A
	08D5	Vbn Sample Buffer 4	---	---	ADC counts	F2	N/A
	to	↓	↓	↓	↓	↓	↓
	094E	Vbn Sample Buffer 125	---	---	ADC counts	F2	N/A
	094F	Vbn Sample Buffer 126	---	---	ADC counts	F2	N/A
	0950	Vbn Sample Buffer 127	---	---	ADC counts	F2	N/A
	0951	Vbn Sample Buffer 128	---	---	ADC counts	F2	N/A
	0952	Reserved					
	to	↓	↓	↓	↓	↓	↓
	0957	Reserved					
WAVEFORM CAPTURE Vcn	0958	Vcn Waveform Capture Scale Factor (high)	---	---	V x 10000	F3	N/A
	0959	Vcn Waveform Capture Scale Factor (low)					
	095A	Vcn Sample Buffer 1	---	---	ADC counts	F2	N/A
	095B	Vcn Sample Buffer 2	---	---	ADC counts	F2	N/A
	095C	Vcn Sample Buffer 3	---	---	ADC counts	F2	N/A
	095D	Vcn Sample Buffer 4	---	---	ADC counts	F2	N/A
	to	↓	↓	↓	↓	↓	↓
	09D6	Vcn Sample Buffer 125	---	---	ADC counts	F2	N/A
	09D7	Vcn Sample Buffer 126	---	---	ADC counts	F2	N/A
	09D8	Vcn Sample Buffer 127	---	---	ADC counts	F2	N/A
	09D9	Vcn Sample Buffer 128	---	---	ADC counts	F2	N/A

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 23 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
WAVEFORM CAPTURE Vcn continued	09DA	Reserved					
	to	↓	↓	↓	↓	↓	↓
	09FF	Reserved					
DATA LOGGER DATA	0A00	Data Log Memory Access Block Number	---	---	---	F1	0
	0A01	Data Log Register 0	---	---	---	F1	---
	0A02	Data Log Register 1	---	---	---	F1	---
	0A03	Data Log Register 2	---	---	---	F1	---
	0A04	Data Log Register 3	---	---	---	F1	---
	to	↓	↓	↓	↓	↓	↓
	0A3D	Data Log Register 60	---	---	---	F1	---
	0A3E	Data Log Register 61	---	---	---	F1	---
	0A3F	Data Log Register 62	---	---	---	F1	---
	0A40	Data Log Register 63	---	---	---	F1	---
	0A41	Reserved					
	to	↓	↓	↓	↓	↓	↓
	0A4F	Reserved					
DATA LOGGER LOG NUMBERS	0A50	Ia Log Number	---	---	---	F110	0 = not selected
	0A51	Ib Log Number	---	---	---	F110	0 = not selected
	0A52	Ic Log Number	---	---	---	F110	0 = not selected
	0A53	Iavg Log Number	---	---	---	F110	0 = not selected
	0A54	In Log Number	---	---	---	F110	0 = not selected
	0A55	I Unbalance Log Number	---	---	---	F110	0 = not selected
	0A56	Van Log Number	---	---	---	F110	0 = not selected
	0A57	Vbn Log Number	---	---	---	F110	0 = not selected
	0A58	Vcn Log Number	---	---	---	F110	0 = not selected
	0A59	Vpavg Log Number	---	---	---	F110	0 = not selected
	0A5A	Vab Log Number	---	---	---	F110	0 = not selected
	0A5B	Vbc Log Number	---	---	---	F110	0 = not selected
	0A5C	Vca Log Number	---	---	---	F110	0 = not selected
	0A5D	Vlavg Log Number	---	---	---	F110	0 = not selected
	0A5E	V Unbalance Log Number	---	---	---	F110	0 = not selected
	0A5F	Pa Log Number	---	---	---	F110	0 = not selected
	0A60	Qa Log Number	---	---	---	F110	0 = not selected
	0A61	Sa Log Number	---	---	---	F110	0 = not selected
	0A62	PFa Log Number	---	---	---	F110	0 = not selected
	0A63	Pb Log Number	---	---	---	F110	0 = not selected
	0A64	Qb Log Number	---	---	---	F110	0 = not selected
	0A65	Sb Log Number	---	---	---	F110	0 = not selected
	0A66	PFb Log Number	---	---	---	F110	0 = not selected
	0A67	Pc Log Number	---	---	---	F110	0 = not selected
	0A68	Qc Log Number	---	---	---	F110	0 = not selected
	0A69	Sc Log Number	---	---	---	F110	0 = not selected
	0A6A	PFc Log Number	---	---	---	F110	0 = not selected
	0A6B	P3 Log Number	---	---	---	F110	0 = not selected
	0A6C	Q3 Log Number	---	---	---	F110	0 = not selected
	0A6D	S3 Log Number	---	---	---	F110	0 = not selected

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 24 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
DATA LOGGER LOG NUMBERS continued	0A6E	PF3 Log Number	---	---	---	F110	0 = not selected
	0A6F	Frequency Log Number	---	---	---	F110	0 = not selected
	0A70	Positive kWh Log Number	---	---	---	F110	0 = not selected
	0A71	Negative kWh Log Number	---	---	---	F110	0 = not selected
	0A72	Positive kvarh Log Number	---	---	---	F110	0 = not selected
	0A73	Negative kvarh Log Number	---	---	---	F110	0 = not selected
	0A74	kVAh Log Number	---	---	---	F110	0 = not selected
	0A75	Ia Demand Log Number	---	---	---	F110	0 = not selected
	0A76	Ib Demand Log Number	---	---	---	F110	0 = not selected
	0A77	Ic Demand Log Number	---	---	---	F110	0 = not selected
	0A78	In Demand Log Number	---	---	---	F110	0 = not selected
	0A79	P3 Demand Log Number	---	---	---	F110	0 = not selected
	0A7A	Q3 Demand Log Number	---	---	---	F110	0 = not selected
	0A7B	S3 Demand Log Number	---	---	---	F110	0 = not selected
	0A7C	Ia THD Log Number	---	---	---	F110	0 = not selected
	0A7D	Ib THD Log Number	---	---	---	F110	0 = not selected
	0A7E	Ic THD Log Number	---	---	---	F110	0 = not selected
	0A7F	In THD Log Number	---	---	---	F110	0 = not selected
	0A80	Van THD Log Number	---	---	---	F110	0 = not selected
	0A81	Vbn THD Log Number	---	---	---	F110	0 = not selected
	0A82	Vcn THD Log Number	---	---	---	F110	0 = not selected
	0A83	Vab THD Log Number	---	---	---	F110	0 = not selected
	0A84	Vbc THD Log Number	---	---	---	F110	0 = not selected
	0A85	Analog Input Log Number	---	---	---	F110	0 = not selected
	0A86	Reserved					
	to	↓	↓	↓	↓	↓	↓
	0A8F	Reserved					
DATA LOGGER LOG 1 HEADER	0A90	Log 1 Time Interval (high)	---	---	s	F3	N/A
	0A91	Log 1 Time Interval (low)					
	0A92	Log 1 Time - Hours/Minutes	---	---	---	F22	N/A
	0A93	Log 1 Time - Seconds	---	---	---	F23	N/A
	0A94	Log 1 Date - Month/Day	---	---	---	F24	N/A
	0A95	Log 1 Date - Year	---	---	---	F25	N/A
	0A96	Log 1 Start Block Number	---	---	---	F1	0
	0A97	Log 1 Start Register Number	---	---	---	F1	0
	0A98	Log 1 Record Size	---	---	bytes	F1	0
	0A99	Log 1 Total Records (high)				F3	
	0A9A	Log 1 Total Records (low)					
	0A9B	Log 1 Block Number of First Record				F1	
	0A9C	Log 1 Register Number of First Record				F1	
	0A9D	Log 1 Pointer to 1st Item of 1st Rec. (high)	---	---	---	F1	0
	0A9E	Log 1 Pointer to 1st Item of 1st Record (low)	---	---	---	F1	0
	0A9F	Log 1 Block Number of Next Record to Write				F1	
	0AA0	Log 1 Register No. of Next Record to Write				F1	

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 25 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
DATA LOGGER LOG 1 HEADER continued	0AA1	Log 1 Pointer of 1st Item of Record after Last (high)				F3	
	0AA2	Log 1 Pointer of 1st Item of Record after Last (low)					
	0AA3	Log 1 Status	---	---	---	F35	0 = STOPPED
	0AA4	Log 1 Records Used (high)				F3	
	0AA5	Log 1 Records Used (low)					
	0AA6	Log 1 Time Until next Reading (high)	---	---	s	F3	N/A
	0AA7	Log 1 Time Until next Reading (low)					
	0AA8	Reserved					
	to	↓	↓	↓	↓	↓	↓
	0AAB	Reserved					
DATA LOGGER LOG 2 HEADER	0AAC	Log 2 Time Interval (high)	---	---	s	F3	N/A
	0AAD	Log 2 Time Interval (low)					
	0AAE	Log 2 Time - Hours/Minutes	---	---	---	F22	N/A
	0AAF	Log 2 Time - Seconds	---	---	---	F23	N/A
	0AB0	Log 2 Date - Month/Day	---	---	---	F24	N/A
	0AB1	Log 2 Date - Year	---	---	---	F25	N/A
	0AB2	Log 2 Start Block Number	---	---	---	F1	0
	0AB3	Log 2 Start Register Number	---	---	---	F1	0
	0AB4	Log 2 Record Size	---	---	bytes	F1	0
	0AB5	Log 2 Total Records (high)				F3	
	0AB6	Log 2 Total Records (low)					
	0AB7	Log 2 Block Number of First Record				F1	
	0AB8	Log 2 Register Number of First Record				F1	
	0AB9	Log 2 Pointer to 1st Item of 1st Rec. (high)	---	---	---	F1	0
	0ABA	Log 2 Pointer to 1st Item of 1st Record (low)	---	---	---	F1	0
	0ABB	Log 2 Block Number of Next Record to Write				F1	
	0ABC	Log 2 Register No. of Next Record to Write				F1	
	0ABD	Log 2 Pointer of 1st Item of Record after Last (high)				F3	
	0ABE	Log 2 Pointer of 1st Item of Record after Last (low)					
	0ABF	Log 2 Status	---	---	---	F35	0 = STOPPED
	0AC0	Log 2 Records Used (high)				F3	
	0AC1	Log 2 Records Used (low)					
	0AC2	Log 2 Time Until next Reading (high)	---	---	s	F3	N/A
	0AC3	Log 2 Time Until next Reading (low)					
	0AC4	Reserved					
	to	↓	↓	↓	↓	↓	↓
	0ACF	Reserved					
EVENT RECORD	0AD0	Total Number of Events Since Last Clear	---	---	---	F1	0
	0AD1	Event Record Last Cleared Time - Hrs./Min.	---	---	---	F22	N/A
	0AD2	Event Record Last Cleared Time - Seconds	---	---	---	F23	N/A
	0AD3	Event Record Last Cleared Date - Month/Day	---	---	---	F24	N/A

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents "OFF".
**** Minimum Setpoint value represents "OFF".
***** Maximum Setpoint value represents "UNLIMITED".

Table 7–1: PQMII Memory Map (Sheet 26 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
EVENT RECORD continued	0AD4	Event Record Last Cleared Date - Year	---	---	---	F25	N/A
	0AD5	Reserved					
	to	↓	↓	↓	↓	↓	↓
	0ADF	Reserved					
	0AE0	Record #N Event Number	---	---	---	F1	N/A
	0AE1	Record #N Event Cause	---	---	---	F36	0 = NO EVENT
	0AE2	Record #N Time - Hours/Minutes	---	---	---	F22	N/A
	0AE3	Record #N Time - Seconds	---	---	---	F23	N/A
	0AE4	Record #N Date - Month/Day	---	---	---	F24	N/A
	0AE5	Record #N Date - Year	---	---	---	F25	N/A
	0AE6	Record #N Switches and Relays States	---	---	---	F111	N/A
	0AE7	Record #N Ia	---	---	A	F1	N/A
	0AE8	Record #N Ib	---	---	A	F1	N/A
	0AE9	Record #N Ic	---	---	A	F1	N/A
	0AEA	Record #N In	---	---	A	F1	N/A
	0AEB	Record #N I Unbalance	---	---	0.1 ×%	F1	N/A
	0AEC	Record #N Van (high)	---	---	V	F3	N/A
	0AED	Record #N Van (low)					
	0AEE	Record #N Vbn (high)	---	---	V	F3	N/A
	0AEF	Record #N Vbn (low)					
	0AF0	Record #N Vcn (high)	---	---	V	F3	N/A
	0AF1	Record #N Vcn (low)					
	0AF2	Record #N Vab (high)	---	---	V	F3	N/A
	0AF3	Record #N Vab (low)					
	0AF4	Record #N Vbc (high)	---	---	V	F3	N/A
	0AF5	Record #N Vbc (low)					
	0AF6	Record #N Vca (high)	---	---	V	F3	N/A
	0AF7	Record #N Vca (low)					
	0AF8	Record #N V Unbalance	---	---	0.1 ×%	F1	N/A
	0AF9	Record #N Pa (high)	---	---	0.01 × kW	F4	N/A
	0AFA	Record #N Pa (low)					
	0AFB	Record #N Qa (high)	---	---	0.01 × kvar	F4	N/A
	0AFC	Record #N Qa (low)					
	0AFD	Record #N Sa (high)	---	---	0.01 × kVA	F3	N/A
	0AFE	Record #N Sa (low)					
	0AFF	Record #N PFa	---	---	0.01 × PF	F2	N/A
	0B00	Record #N Pb (high)	---	---	0.01 × kW	F4	N/A
	0B01	Record #N Pb (low)					
	0B02	Record #N Qb (high)	---	---	0.01 × kvar	F4	N/A
	0B03	Record #N Qb (low)					
	0B04	Record #N Sb (high)	---	---	0.01 × kVA	F3	N/A
	0B05	Record #N Sb (low)					
	0B06	Record #N PFb	---	---	0.01 × PF	F2	N/A
	0B07	Record #N Pc (high)	---	---	0.01 × kW	F4	N/A
	0B08	Record #N Pc (low)					

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 27 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
EVENT RECORD continued	0B09	Record #N Qc (high)	---	---	0.01 × kvar	F4	N/A
	0B0A	Record #N Qc (low)					
	0B0B	Record #N Sc (high)	---	---	0.01 × kVA	F3	N/A
	0B0C	Record #N Sc (low)					
	0B0D	Record #N PFc	---	---	0.01 × PF	F2	N/A
	0B0E	Record #N P3 (high)	---	---	0.01 × kW	F4	N/A
	0B0F	Record #N P3 (low)					
	0B10	Record #N Q3 (high)	---	---	0.01 × kvar	F4	N/A
	0B11	Record #N Q3 (low)					
	0B12	Record #N S3 (high)	---	---	0.01 × kVA	F3	N/A
	0B13	Record #N S3 (low)					
	0B14	Record #N PF3	---	---	0.01 × PF	F2	N/A
	0B15	Record #N Frequency	---	---	0.01 × Hz	F1	N/A
	0B16	Record #N Positive kWh (high)	---	---	kWh	F3	N/A
	0B17	Record #N Positive kWh (low)					
	0B18	Record #N Negative kWh (high)	---	---	kWh	F3	N/A
	0B19	Record #N Negative kWh (low)					
	0B1A	Record #N Positive kvarh (high)	---	---	kvarh	F3	N/A
	0B1B	Record #N Positive kvarh (low)					
	0B1C	Record #N Negative kvarh (high)	---	---	kvarh	F3	N/A
	0B1D	Record #N Negative kvarh (low)					
	0B1E	Record #N kVAh (high)	---	---	kVAh	F3	N/A
	0B1F	Record #N kVAh (low)					
	0B20	Record #N Ia Demand	---	---	A	F1	N/A
	0B21	Record #N Ib Demand	---	---	A	F1	N/A
	0B22	Record #N Ic Demand	---	---	A	F1	N/A
	0B23	Record #N In Demand	---	---	A	F1	N/A
	0B24	Record #N P3 Demand (high)	---	---	0.01 × kW	F4	N/A
	0B25	Record #N P3 Demand (low)					
	0B26	Record #N Q3 Demand (high)	---	---	0.01 × kvar	F4	N/A
	0B27	Record #N Q3 Demand (low)					
	0B28	Record #N S3 Demand (high)	---	---	0.01 × kVA	F3	N/A
	0B29	Record #N S3 Demand (low)					
	0B2A	Record #N Ia THD	---	---	0.1 × %	F1	N/A
	0B2B	Record #N Ib THD	---	---	0.1 × %	F1	N/A
	0B2C	Record #N Ic THD	---	---	0.1 × %	F1	N/A
	0B2D	Record #N In THD	---	---	0.1 × %	F1	N/A
	0B2E	Record #N Van THD	---	---	0.1 × %	F1	N/A
	0B2F	Record #N Vbn THD	---	---	0.1 × %	F1	N/A
	0B30	Record #N Vcn THD	---	---	0.1 × %	F1	N/A
	0B31	Record #N Vab THD	---	---	0.1 × %	F1	N/A
	0B32	Record #N Vbc THD	---	---	0.1 × %	F1	N/A
	0B33	Record #N Analog Input (high)	---	---	---	F3	N/A
	0B34	Record #N Analog Input (low)					
	0B35	Record #N Trace Memory Trigger Cause	---	---	---	F41	N/A

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents "OFF".
**** Minimum Setpoint value represents "OFF".
***** Maximum Setpoint value represents "UNLIMITED".

Table 7–1: PQMII Memory Map (Sheet 28 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
	0B36	Record #N Internal Fault Error Code	---	---	---	F108	N/A
EVENT RECORD continued	0B37	Reserved					
	to	↓	↓	↓	↓	↓	↓
	0B7F	Reserved					
TRACE MEMORY	0B80	Trace Memory Usage	---	---	---	F37	N/A
	0B81	Trace Memory Trigger Flag	---	---	---	F113	N/A
	0B82	Trace Memory Trigger Counter	---	---	---	F1	N/A
	0B83	Total Trace Memory Triggers	---	---	---	F1	N/A
	0B88	Trigger Cause - Trace 1	---	---	---	F41	N/A
	0B89	Time - Hours/Minutes - Trace 1	---	---	---	F22	N/A
	0B8A	Time - Seconds - Trace 1	---	---	---	F23	N/A
	0B8B	Date - Month/Day - Trace 1	---	---	---	F24	N/A
	0B8C	Date - Year - Trace 1	---	---	---	F25	N/A
	0B8D	Trigger Sample Number 1	---	---	---	F1	N/A
	0B8E	Frequency 1	---	---	0.01 x Hz	F1	N/A
	0B98	Trigger Cause - Trace 2	---	---	---	F41	N/A
	0B99	Time - Hours/Minutes - Trace 2	---	---	---	F22	N/A
	0B9A	Time - Seconds - Trace 2	---	---	---	F23	N/A
	0B9B	Date - Month/Day - Trace 2	---	---	---	F24	N/A
	0B9C	Date - Year - Trace 2	---	---	---	F25	N/A
	0B9D	Trigger Sample Number 2	---	---	---	F1	N/A
	0B9E	Frequency 2	---	---	0.01 x Hz	F1	N/A
	0BA8	Trigger Cause - Trace 3	---	---	---	F41	N/A
	0BA9	Time - Hours/Minutes - Trace 3	---	---	---	F22	N/A
	0BAA	Time - Seconds - Trace 3	---	---	---	F23	N/A
	0BAB	Date - Month/Day - Trace 3	---	---	---	F24	N/A
	0BAC	Date - Year - Trace 3	---	---	---	F25	N/A
	0BAD	Trigger Sample Number 3	---	---	---	F1	N/A
	0BAE	Frequency 3	---	---	0.01xHz	F1	N/A
	0BB8	Trace Memory Waveform Selection	---	---	---	F40	N/A
	0BB9	Waveform Scale Factor (high)	---	---	A/Vx10000	F3	N/A
	0BBA	Waveform Scale Factor (low)					
	0BBB	Data Buffer 1	---	---	ADCcounts/2	F2	N/A
	0BBC	Data Buffer 2	---	---	ADCcounts/2	F2	N/A
	to	↓	↓	↓	↓	↓	↓
	0DF9	Data Buffer 575	---	---	ADCcounts/2	F2	N/A
	0DFA	Data Buffer 576	---	---	ADCcounts/2	F2	N/A
	0DFB	Reserved					
	to	↓	↓	↓	↓	↓	↓
	0DFF	Reserved					
	0E00	Invalid Serial Number Flag	---	---	---	F117	N/A
	0E01	Reserved					
	to	↓	↓	↓	↓	↓	↓
	0E1F	Reserved					

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 29 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
VOLTAGE DISTUR-BANCE RECORDER	0E20	Disturbances since Last Clear	---	---	---	F1	0
	0E21	Swell/Sag Last Cleared Time (Hrs./Min.)	---	---	---	F22	N/A
	0E22	Swell/Sag Last Cleared Time (Sec.)	---	---	---	F23	N/A
	0E23	Swell/Sag Last Cleared Date (Month/ Day.)	---	---	---	F24	N/A
	0E24	Swell/Sag Last Cleared Date (Year.)	---	---	---	F25	N/A
	0E25	Reserved					
	to	↓	↓	↓	↓	↓	↓
	0E2F	Reserved					
	0E30	Record *N* Disturbance Number				F1	N/A
	0E31	Record *N* Disturbance Type				F118	N/A
	0E32	Record *N* Disturbance Source				F119	N/A
	0E33	Record *N* Time (hours/minutes)				F22	N/A
	0E34	Record *N* Time (seconds)				F23	N/A
	0E35	Record *N* Date (month/day)				F24	N/A
	0E36	Record *N* Date (seconds)				F25	N/A
	0E37	Record *N* Over/Undervoltage Duration (high)			cycles	F3	N/A
	0E38	Record *N* Over/Undervoltage Duration (low)					
	0E39	Record *N* Average Voltage (high)			0.1 × V	F3	N/A
	0E3A	Record *N* Average Voltage (low)					
	0E3B	Reserved					
	to	↓	↓	↓	↓	↓	↓
	0FFF	Reserved					
Setpoint Values (Holding Registers) Addresses: 1000 to 131F							
METER ID	1000	Meter ID characters 1 and 2	---	---	ASCII	F10	N/A
	1001	Meter ID characters 3 and 4	---	---	ASCII	F10	N/A
	1002	Meter ID characters 5 and 6	---	---	ASCII	F10	N/A
	1003	Meter ID characters 7 and 8	---	---	ASCII	F10	N/A
	1004	Meter ID characters 9 and 10	---	---	ASCII	F10	N/A
	1005	Meter ID characters 11 and 12	---	---	ASCII	F10	N/A
	1006	Meter ID characters 13 and 14	---	---	ASCII	F10	N/A
	1007	Meter ID characters 15 and 16	---	---	ASCII	F10	N/A
	1008	Meter ID characters 17 and 18	---	---	ASCII	F10	N/A
	1009	Meter ID characters 19 and 20	---	---	ASCII	F10	N/A
	100A	Reserved					
	to	↓	↓	↓	↓	↓	↓
	100F	Reserved					
PREFERENCES	1010	Default Message Time	1 to 1201***	1	min ×0.1	F1	10 = 1.0 min
	1011	Reserved					
	1012	Display Filter Constant	1 to 10	1	---	F1	4
	1013	Reserved					
	to	↓	↓	↓	↓	↓	↓
	1017	Reserved					

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 30 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
RS485 COM1 SERIAL PORT	1018	Serial Communication Address	1 to 255	1	---	F1	1
	1019	Modbus Baud Rate for RS485 COM1	0 to 4	1	---	F12	3 = 9600
	101A	Parity for RS485 COM1	0 to 2	1	---	F13	0 = NONE
	101B	Reserved					
	to	↓	↓	↓	↓	↓	↓
	101F	Reserved					
RS485 COM2 SERIAL PORT	1020	Modbus Baud Rate for RS485 COM2	0 to 4	1	---	F12	3 = 9600
	1021	Parity for RS485 COM2	0 to 2	1	---	F13	0 = NONE
	1022	Reserved					
	to	↓	↓	↓	↓	↓	↓
	1027	Reserved					
RS232 SERIAL PORT	1028	Modbus Baud Rate for RS232	0 to 4	1	---	F12	3 = 9600
	1029	Parity for RS232	0 to 2	1	---	F13	0 = NONE
	102A	Reserved					
	to	↓	↓	↓	↓	↓	↓
	102F	Reserved					
CALCU-LATION PARAMETERS	1030	Current Demand Calculation Type	0 to 2	1	---	F28	0 = Thermal Exponential
	1031	Current Demand Time Interval	5 to 180	1	minutes	F1	30 min
	1032	Power Demand Calculation Type	0 to 2	1	---	F28	0 = Thermal Exponential
	1033	Power Demand Time Interval	5 to 180	1	minutes	F1	30 min
	1034	Energy Cost Per kWh	1 to 50000	1	¢ × 0.01	F1	10.00 ¢
	1035	Extract Fundamental	0 to 1	1	---	F11	0=DISABLE
	1036	Reserved					
	1037	Reserved					
CLEAR DATA	1038	Clear Energy Values	0 to 1	1	---	F31	0 = NO
	1039	Clear Max Demand Values	0 to 1	1	---	F31	0 = NO
	103A	Clear Min/Max Current Values	0 to 1	1	---	F31	0 = NO
	103B	Clear Min/Max Voltage Values	0 to 1	1	---	F31	0 = NO
	103C	Clear Min/Max Power Values	0 to 1	1	---	F31	0 = NO
	103D	Clear Max THD Values	0 to 1	1	---	F31	0 = NO
	103E	Clear Pulse Input Values	0 to 1	1	---	F31	0 = NO
	103F	Clear Event Record	0 to 1	1	---	F31	0 = NO
	1040	Clear All Demand Values	0 to 1	1	---	F31	0 = NO
	1041	Clear Frequency Values	0 to 1	1	---	F31	0 = NO
	1042	Reserved					
	1043	Reserved					
DNP	1044	DNP Port	0 to 3	1	---	F47	0 = NONE
	1045	DNP Slave Address	0 to 255	1	---	F1	0
	1046	DNP Turnaround Time	0 to 100	10	ms	F1	10 ms
TARIFF	1047	Tariff Period 1 Start Time	0 to 1439	1	minutes	F1	0 min.
	1048	Tariff Period 1 Cost per kWh	1 to 50000	1	¢ × 0.01	F1	10.00 ¢
	1049	Tariff Period 2 Start Time	0 to 1439	1	minutes	F1	0 min.
	104A	Tariff Period 2 Cost per kWh	1 to 50000	1	¢ × 0.01	F1	10.00 ¢
	104B	Tariff Period 3 Start Time	0 to 1439	1	minutes	F1	0 min.
	104C	Tariff Period 3 Cost per kWh	1 to 50000	1	¢ × 0.01	F1	10.00 ¢

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 31 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
TARIFF continued	104D	Reserved					
	104E	Reserved					
	104F	Reserved					
CURRENT /VOLTAGE CONFIG.	1050	Phase CT Primary	0 to 12000****	5	A	F1	0 = OFF
	1051	Neutral Current Sensing	0 to 2	1	---	F16	0 = OFF
	1052	Neutral CT Primary	5 to 6000	5	A	F1	100 A
	1053	VT Wiring	0 to 6	1	---	F15	0 = OFF
	1054	VT Ratio	10 to 35000	1	0.1 × ratio	F1	1.0:1
	1055	VT Nominal Secondary Voltage	40 to 600	1	V	F1	120 V
	1056	Nominal Direct Input Voltage	40 to 600	1	V	F1	600 V
	1057	Nominal Frequency	50 to 60	10	Hz	F1	60 Hz
	1058	CT Wiring	0 to 3	1	---	F44	0=A,B AND C
	1059	Reserved					
	to	↓	↓	↓	↓	↓	↓
	105F	Reserved					
ANALOG OUTPUT 1	1060	Analog Output 1 Main Type	0 to 59	1	---	F14	5=Avg Ph Current
	1061	Analog Output 1 Main Min Value	See Analog Output Range Table on page 7–53				0
	1062	Analog Output 1 Main Max Value	See Analog Output Range Table on page 7–53				0
	1063	Analog Output 1 Alternate Type	0 to 59	1	---	F14	0=NOT USED
	1064	Analog Output 1 Alternate Min Value	See Analog Output Range Table on page 7–53				0
	1065	Analog Output 1 Alternate Max Value	See Analog Output Range Table on page 7–53				0
	1066	Reserved					
	1067	Analog Output 1 Serial Value		1	---	F2	0
ANALOG OUTPUT 2	1068	Analog Output 2 Main Type	0 to 59	1	---	F14	18=3Ph Real Pwr
	1069	Analog Output 2 Main Min Value	See Analog Output Range Table on page 7–53				0
	106A	Analog Output 2 Main Max Value	See Analog Output Range Table on page 7–53				0
	106B	Analog Output 2 Alternate Type	0 to 59	1	---	F14	0=NOT USED
	106C	Analog Output 2 Alternate Min Value	See Analog Output Range Table on page 7–53				0
	106D	Analog Output 2 Alternate Max Value	See Analog Output Range Table on page 7–53				0
	106E	Reserved					
	106F	Analog Output 2 Serial Value		1	---	F2	0
ANALOG OUTPUT 3	1070	Analog Output 3 Main Type	0 to 59	1	---	F14	19=3Ph React Pwr
	1071	Analog Output 3 Main Min Value	See Analog Output Range Table on page 7–53				
	1072	Analog Output 3 Main Max Value	See Analog Output Range Table on page 7–53				
	1073	Analog Output 3 Alternate Type	0 to 59	1	---	F14	0=NOT USED
	1074	Analog Output 3 Alternate Min Value	See Analog Output Range Table on page 7–53				
	1075	Analog Output 3 Alternate Max Value	See Analog Output Range Table on page 7–53				
	1076	Reserved					
	1077	Analog Output 3 Serial Value		1	---	F2	0

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents "OFF".
**** Minimum Setpoint value represents "OFF".
***** Maximum Setpoint value represents "UNLIMITED".

Table 7–1: PQMII Memory Map (Sheet 32 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
ANALOG OUTPUT 4	1078	Analog Output 4 Main Type	0 to 59	1	---	F14	17=3Ph Pwr Factor
	1079	Analog Output 4 Main Min Value	See Analog Output Range Table on page 7–53				
	107A	Analog Output 4 Main Max Value	See Analog Output Range Table on page 7–53				
	107B	Analog Output 4 Alternate Type	0 to 59	1	---	F14	0=NOT USED
	107C	Analog Output 4 Alternate Min Value	See Analog Output Range Table on page 7–53				
	107D	Analog Output 4 Alternate Max Value	See Analog Output Range Table on page 7–53				
	107E	Reserved					
	107F	Analog Output 4 Serial Value		1	---	F2	0
ANALOG INPUT	1080	Analog Input Main/Alt Select Relay	0 to 3	1	---	F19	0=OFF
	1081	Analog In Main Name 1st and 2nd char.	---	---	ASCII	F10	“”
	1082	Analog In Main Name 3rd and 4th char.	---	---	ASCII	F10	“MA”
	1083	Analog In Main Name 5th and 6th char.	---	---	ASCII	F10	“IN”
	1084	Analog In Main Name 7th and 8th char.	---	---	ASCII	F10	“ A”
	1085	Analog In Main Name 9th and 10th char.	--	--	ASCII	F10	“NA”
	1086	Analog In Main Name 11th and 12th char.	--	--	ASCII	F10	“LO”
	1087	Analog In Main Name 13th and 14th char.	---	---	ASCII	F10	“G “
	1088	Analog In Main Name 15h and 16th char.	----	----	ASCII	F10	“IN”
	1089	Analog In Main Name 17th and 18th char.	---	---	ASCII	F10	“PU”
	108A	Analog In Main Name 19th and 20th char.	---	---	ASCII	F10	“T “
	108B	Analog In Main Units 1st and 2nd char.	---	---	ASCII	F10	“ U”
	108C	Analog In Main Units 3rd and 4th char.	---	---	ASCII	F10	“ni”
	108D	Analog In Main Units 5th and 6th char.	---	---	ASCII	F10	“ts”
	108E	Analog In Main Units 7th and 8th char.	---	---	ASCII	F10	“”
	108F	Analog In Main Units 9th and 10th char.	---	---	ASCII	F10	“”
	1090	Analog Input Main 4 mA Value	0 to 65000	1	---	F1	0
	1091	Analog Input Main 20 mA Value	0 to 65000	1	---	F1	0
	1092	Analog Input Main Relay	0 to 4	1	---	F29	0=OFF
	1093	Analog Input Main Level	0 to 65000	1	---	F1	0
	1094	Analog Input Main Delay	5 to 6000	5	0.1 × s	F1	100=10.0 s
	1095	Reserved					
	1096	Reserved					
	1097	Reserved					
	1098	Analog In Alt Name 1st and 2nd char.	---	---	ASCII	F10	“”
	1099	Analog In Alt Name 3rd and 4th char.	---	---	ASCII	F10	“AL”
	109A	Analog In Alt Name 5th and 6th char.	---	---	ASCII	F10	“T ”
	109B	Analog In Alt Name 7th and 8th char.	---	---	ASCII	F10	“ A”
	109C	Analog In Alt Name 9th and 10th char.	--	--	ASCII	F10	“NA”
	109D	Analog In Alt Name 11th and 12th char.	--	--	ASCII	F10	“LO”
	109E	Analog In Alt Name 13th and 14th char.	---	---	ASCII	F10	“G ”
	109F	Analog In Alt Name 15h and 16th char.	----	----	ASCII	F10	“IN”
	10A0	Analog In Alt Name 17th and 18th char.	---	---	ASCII	F10	“PU”

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 33 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
ANALOG INPUT continued	10A1	Analog In Alt Name 19th and 20th char.	---	---	ASCII	F10	"T "
	10A2	Analog In Alt Units 1st and 2nd char.	---	---	ASCII	F10	" U"
	10A3	Analog In Alt Units 3rd and 4th char.	---	---	ASCII	F10	"ni"
	10A4	Analog In Alt Units 5th and 6th char.	---	---	ASCII	F10	"ts"
	10A5	Analog In Alt Units 7th and 8th char.	---	---	ASCII	F10	" "
	10A6	Analog In Alt Units 9th and 10th char.	---	---	ASCII	F10	" "
	10A7	Analog Input Alt 4 mA Value	0 to 65000	1	---	F1	0
	10A8	Analog Input Alt 20 mA Value	0 to 65000	1	---	F1	0
	10A9	Analog Input Alt Relay	0-4	1	---	F29	0=OFF
	10AA	Analog Input Alt Level	0 to 65000	1	---	F1	0
	10AB	Analog Input Alt Delay	5 to 6000	5	0.1 x s	F1	100=10.0 s
	10AC	Reserved					
	to	↓	↓	↓	↓	↓	↓
	10AF	Reserved					
SWITCH A	10B0	Switch A Name characters 1 and 2	---	---	ASCII	F10	" "
	10B1	Switch A Name characters 3 and 4	---	---	ASCII	F10	" S"
	10B2	Switch A Name characters 5 and 6	---	---	ASCII	F10	"WI"
	10B3	Switch A Name characters 7 and 8	---	---	ASCII	F10	"TC"
	10B4	Switch A Name characters 9 and 10	---	---	ASCII	F10	"H "
	10B5	Switch A Name characters 11 and 12	---	---	ASCII	F10	"IN"
	10B6	Switch A Name characters 13 and 14	---	---	ASCII	F10	"PU"
	10B7	Switch A Name characters 15 and 16	---	---	ASCII	F10	"T "
	10B8	Switch A Name characters 17 and 18	---	---	ASCII	F10	"A "
	10B9	Switch A Name characters 19 and 20	---	---	ASCII	F10	" "
	10BA	Switch A Function	0 to 14	1	---	F20	0 = Not Used
	10BB	Switch A Activation	0 to 1	1	---	F27	1 = Closed
	10BC	Switch A Time Delay	0 to 6000	1	0.1 x s	F1	0.0 s
	10BD	Reserved					
	10BE	Reserved					
	10BF	Reserved					
SWITCH B	10C0	Switch B Name characters 1 and 2	---	---	ASCII	F10	" "
	10C1	Switch B Name characters 3 and 4	---	---	ASCII	F10	" S"
	10C2	Switch B Name characters 5 and 6	---	---	ASCII	F10	"WI"
	10C3	Switch B Name characters 7 and 8	---	---	ASCII	F10	"TC"
	10C4	Switch B Name characters 9 and 10	---	---	ASCII	F10	"H "
	10C5	Switch B Name characters 11 and 12	---	---	ASCII	F10	"IN"
	10C6	Switch B Name characters 13 and 14	---	---	ASCII	F10	"PU"
	10C7	Switch B Name characters 15 and 16	---	---	ASCII	F10	"T "
	10C8	Switch B Name characters 17 and 18	---	---	ASCII	F10	"B "
	10C9	Switch B Name characters 19 and 20	---	---	ASCII	F10	" "
	10CA	Switch B Function	0 to 14	1	---	F20	0=NOT USED
	10CB	Switch B Activation	0 to 1	1	---	F27	1=CLOSED
	10CC	Switch B Time Delay	0 to 6000	1	0.1 x s	F1	0.0 s
	10CD	Reserved					
	10CE	Reserved					
	10CF	Reserved					

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents "OFF".
**** Minimum Setpoint value represents "OFF".
***** Maximum Setpoint value represents "UNLIMITED".

Table 7–1: PQMII Memory Map (Sheet 34 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
SWITCH C	10D0	Switch C Name characters 1 and 2	---	---	ASCII	F10	“ ”
	10D1	Switch C Name characters 3 and 4	---	---	ASCII	F10	“ S”
	10D2	Switch C Name characters 5 and 6	---	---	ASCII	F10	“WI”
	10D3	Switch C Name characters 7 and 8	---	---	ASCII	F10	“TC”
	10D4	Switch C Name characters 9 and 10	---	---	ASCII	F10	“H ”
	10D5	Switch C Name characters 11 and 12	---	---	ASCII	F10	“IN”
	10D6	Switch C Name characters 13 and 14	---	---	ASCII	F10	“PU”
	10D7	Switch C Name characters 15 and 16	---	---	ASCII	F10	“T ”
	10D8	Switch C Name characters 17 and 18	---	---	ASCII	F10	“C ”
	10D9	Switch C Name characters 19 and 20	---	---	ASCII	F10	“ ”
	10DA	Switch C Function	0 to 14	1	---	F20	0=NOT USED
	10DB	Switch C Activation	0 to 1	1	---	F27	1=CLOSED
	10DC	Switch C Time Delay	0 to 6000	1	0.1 × s	F1	0.0 s
	10DD	Reserved					
	10DE	Reserved					
	10DF	Reserved					
SWITCH D	10E0	Switch D Name characters 1 and 2	---	---	ASCII	F10	“ ”
	10E1	Switch D Name characters 3 and 4	---	---	ASCII	F10	“ S”
	10E2	Switch D Name characters 5 and 6	---	---	ASCII	F10	“WI”
	10E3	Switch D Name characters 7 and 8	---	---	ASCII	F10	“TC”
	10E4	Switch D Name characters 9 and 10	---	---	ASCII	F10	“H ”
	10E5	Switch D Name characters 11 and 12	---	---	ASCII	F10	“IN”
	10E6	Switch D Name characters 13 and 14	---	---	ASCII	F10	“PU”
	10E7	Switch D Name characters 15 and 16	---	---	ASCII	F10	“T ”
	10E8	Switch D Name characters 17 and 18	---	---	ASCII	F10	“D ”
	10E9	Switch D Name characters 19 and 20	---	---	ASCII	F10	“ ”
	10EA	Switch D Function	0 to 14	1	---	F20	0=NOT USED
	10EB	Switch D Activation	0 to 1	1	---	F27	1=CLOSED
	10EC	Switch D Time Delay	0 to 6000	1	0.1 × s	F1	0.0 s
	10ED	Reserved					
	10EE	Reserved					
	10EF	Reserved					
PULSE OUTPUT	10F0	Positive kWh Pulse Output Relay	0 to 4	1	---	F29	0=OFF
	10F1	Positive kWh Pulse Output Interval	1 to 65000	1	kWh	F1	100 kWh
	10F2	Negative kWh Pulse Output Relay	0 to 4	1	---	F29	0=OFF
	10F3	Negative kWh Pulse Output Interval	1 to 65000	1	kWh	F1	100 kWh
	10F4	Positive kvarh Pulse Output Relay	0 to 4	1	---	F29	0=OFF
	10F5	Positive kvarh Pulse Output Interval	1 to 65000	1	kvarh	F1	100 kvarh
	10F6	Negative kvarh Pulse Output Relay	0 to 4	1	---	F29	0=OFF
	10F7	Negative kvarh Pulse Output Interval	1 to 65000	1	kvarh	F1	100 kvarh
	10F8	kVAh Pulse Output Relay	0 to 4	1	---	F29	0=OFF
	10F9	kVAh Pulse Output Interval	1 to 65000	1	kVAh	F1	100 kVAh
	10FA	Pulse Output Width	100 to 2000	10	ms	F1	100 ms
	10FB	Serial Pulse Relay Interval	100 to 10000	100	ms	F1	100 ms
	10FC	Reserved					

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 35 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
PULSE INPUT	10FD	Pulse Input Units 1st and 2nd char.	---	---	ASCII	F10	" U"
	10FE	Pulse Input Units 3rd and 4th char.	---	---	ASCII	F10	"ni"
	10FF	Pulse Input Units 5th and 6th char.	---	---	ASCII	F10	"ts"
	1100	Pulse Input Units 7th and 8th char.	---	---	ASCII	F10	" "
	1101	Pulse Input Units 9th and 10th char.	---	---	ASCII	F10	" "
	1102	Pulse Input 1 Value	0 to 65000	1	Units	F1	1
	1103	Pulse Input 2 Value	0 to 65000	1	Units	F1	1
	1104	Pulse Input 3 Value	0 to 65000	1	Units	F1	1
	1105	Pulse Input 4 Value	0 to 65000	1	Units	F1	1
	1106	Pulse Input Total	0 to 10	1	---	F43	9 = 1+2+3+4
	1107	Reserved					
ALARM RELAY	1108	Alarm Relay Operation	0 to 1	1	---	F17	0 = NON-FAILSAFE
	1109	Alarm Relay Activation	0 to 1	1	---	F18	0 = UNLATCHED
	110A	Reserved					
	to	↓	↓	↓	↓	↓	↓
	110F	Reserved					
AUXILIARY RELAY 1	1110	Auxiliary Relay 1 Operation	0 to 1	1	---	F17	0 = NON-FAILSAFE
	1111	Auxiliary Relay 1 Activation	0 to 1	1	---	F18	0 = UNLATCHED
	1112	Reserved					
	to	↓	↓	↓	↓	↓	↓
	1117	Reserved					
AUXILIARY RELAY 2	1118	Auxiliary Relay 2 Operation	0 to 1	1	---	F17	0 = NON-FAILSAFE
	1119	Auxiliary Relay 2 Activation	0 to 1	1	---	F18	0 = UNLATCHED
	111A	Reserved					
	to	↓	↓	↓	↓	↓	↓
	111F	Reserved					
AUXILIARY RELAY 3	1120	Auxiliary Relay 3 Operation	0 to 1	1	---	F17	0 = NON-FAILSAFE
	1121	Auxiliary Relay 3 Activation	0 to 1	1	---	F18	0 = UNLATCHED
	1122	Reserved					
	1123	Reserved					
	1124	Reserved					
	1125	Reserved					
CURRENT/ VOLTAGE ALARMS	1126	Phase Overcurrent Activation	0 to 1	1	---	F115	0=AVERAGE
	1127	Detect I/V Alarms Using Percentage	0 to 1	1	---	F31	0=NO
	1128	Phase Undercurrent Relay	0 to 4	1	---	F29	0=OFF
	1129	Phase Undercurrent Level in Amps	1 to 12000	1	A	F1	100 A
	112A	Phase Undercurrent Delay	5 to 6000	5	0.1 x s	F1	100=10.0 s
	112B	Phase Overcurrent Relay	0 to 4	1	---	F29	0=OFF
	112C	Phase Overcurrent Level in Amps	1 to 12000	1	A	F1	100 A
	112D	Phase Overcurrent Delay	5 to 6000	5	0.1 x s	F1	100=10.0 s
	112E	Neutral Overcurrent Relay	0 to 4	1	---	F29	0=OFF
	112F	Neutral Overcurrent Level in Amps	1 to 12000	1	A	F1	100 A
	1130	Neutral Overcurrent Delay	5 to 6000	5	0.1 x s	F1	100=10.0 s
	1131	Undervoltage Relay	0 to 4	1	---	F29	0=OFF
	1132	Undervoltage Level in Volts	20 to 65000	1	V	F1	100 V
	1133	Undervoltage Delay	5 to 6000	5	0.1 x s	F1	100=10.0 s

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents "OFF".
**** Minimum Setpoint value represents "OFF".
***** Maximum Setpoint value represents "UNLIMITED".

Table 7–1: PQMII Memory Map (Sheet 36 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
CURRENT/ VOLTAGE ALARMS continued	1134	Phases Req'd for Operation of Undervoltage	0 to 2	1	---	F30	0=ANY ONE
	1135	Detect Undervoltage Below 20 V	0 to 1	1	---	F11	0=DISABLE
	1136	Overvoltage Relay	0 to 4	1	---	F29	0=OFF
	1137	Overvoltage Level in Volts	1 to 65000	1	V	F1	100 V
	1138	Overvoltage Delay	5 to 6000	5	0.1 x s	F1	100=10.0 s
	1139	Phases Req'd for Operation of Overvoltage	0 to 2	1	---	F30	0=ANY ONE
	113A	Phase Current Unbalance Relay	0 to 4	1	---	F29	0=OFF
	113B	Phase Current Unbalance Level	1 to 100	1	%	F1	10%
	113C	Phase Current Unbalance Delay	5 to 6000	5	0.1 x s	F1	100=10.0 s
	113D	Voltage Unbalance Relay	0 to 4	1	---	F29	0=OFF
	113E	Voltage Unbalance Level	1 to 100	1	%	F1	10%
	113F	Voltage Unbalance Delay	5 to 6000	5	0.1 x s	F1	100=10.0 s
	1140	Voltage Phase Reversal Relay	0 to 4	1	---	F29	0=OFF
	1141	Voltage Phase Reversal Delay	5 to 6000	5	0.1 x s	F1	100=10.0 s
	1142	Detect Undercurrent When 0A	0 to 1	1	---	F31	0=NO
	1143	Phase Undercurrent Level in % of CT	1 to 100	1	%	F1	100%
	1144	Phase Overcurrent Level in % of CT	1 to 150	1	%	F1	100%
	1145	Neutral Overcurrent Level in % of CT	1 to 150	1	%	F1	100%
	1146	Undervoltage Level in % of VT	20 to 100	1	%	F1	100%
	1147	Overvoltage Level in % of VT	20 to 150	1	%	F1	100%
TOTAL HARMONIC DISTORTION ALARMS	1148	Average Current THD Relay	0 to 4	1	---	F29	0=OFF
	1149	Average Current THD Level	5 to 1000	5	0.1 x %	F1	100=10.0%
	114A	Average Current THD Delay	5 to 6000	5	0.1 x s	F1	100=10.0 s
	114B	Average Voltage THD Relay	0 to 4	1	---	F29	0=OFF
	114C	Average Voltage THD Level	5 to 1000	5	0.1 x %	F1	100=10.0%
	114D	Average Voltage THD Delay	5 to 6000	5	0.1 x s	F1	100=10.0 s
	114E	Reserved					
	to	↓	↓	↓	↓	↓	↓
	1157	Reserved					
FREQUENCY ALARMS	1158	Underfrequency Relay	0 to 4	1	---	F29	0=OFF
	1159	Underfrequency Level	2000 to 7000	1	0.01 x Hz	F1	40.00 Hz
	115A	Underfrequency Delay	1 to 100	1	0.1 x s	F1	100=10.0 s
	115B	Zero Frequency Detect	0 to 1	1	---	F11	0=DISABLE
	115C	Overfrequency Relay	0 to 4	1	---	F29	0=OFF
	115D	Overfrequency Level	2000 to 12500	1	0.01 x Hz	F1	70.00 Hz
	115E	Overfrequency Delay	1 to 100	1	0.1 x s	F1	100=10.0 s
	115F	Reserved					
	to	↓	↓	↓	↓	↓	↓
	1166	Reserved					
POWER ALARMS	1167	Power Alarms Level Base Units	0 to 1	1	---	F114	0=kW/kVAR
	1168	Positive Real Power Relay	0 to 4	1	---	F29	0=OFF
	1169	Positive Real Power Level in kW	1 to 65000	1	kW	F1	1000 kW
	116A	Positive Real Power Delay	5 to 6000	5	0.1 x s	F1	100=10.0 s
	116B	Negative Real Power Relay	0 to 4	1	---	F29	0=OFF
	116C	Negative Real Power Level in kW	1 to 65000	1	kW	F1	1000 kW

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents "OFF".
**** Minimum Setpoint value represents "OFF".
***** Maximum Setpoint value represents "UNLIMITED".

Table 7–1: PQMII Memory Map (Sheet 37 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
POWER ALARMS continued	116D	Negative Real Power Delay	5 to 6000	5	0.1 × s	F1	100=10.0 s
	116E	Positive Reactive Power Relay	0 to 4	1	---	F29	0=OFF
	116F	Positive Reactive Power Level in kVAR	1 to 65000	1	kVAR	F1	1000 kVAR
	1170	Positive Reactive Power Delay	5 to 6000	5	0.1 × s	F1	100=10.0 s
	1171	Negative Reactive Power Relay	0 to 4	1	---	F29	0=OFF
	1172	Negative Reactive Power Level in kVAR	1 to 65000	1	kVAR	F1	1000 kVAR
	1173	Negative Reactive Power Delay	5 to 6000	5	0.1 × s	F1	100=10.0 s
	1174	Positive Real Power Level in MW	1 to 65000	1	0.01 MW	F1	10.00MW
	1175	Negative Real Power Level in MW	1 to 65000	1	0.01 MW	F1	10.00MW
	1176	Positive Reactive Power Level in MVAR	1 to 65000	1	0.01 MVAR	F1	10.00MVAR
	1177	Negative Reactive Power Level in MVAR	1 to 65000	1	0.01 MVAR	F1	10.00MVAR
POWER FACTOR ALARMS	1178	Power Factor Lead 1 Relay	0 to 4	1	---	F29	0=OFF
	1179	Power Factor Lead 1 Pickup Level	0 to 100	1	0.01 × PF	F1	0.99
	117A	Power Factor Lead 1 Dropout Level	0 to 100	1	0.01 × PF	F1	1.00
	117B	Power Factor Lead 1 Delay	5 to 6000	5	0.1 × s	F1	100=10.0 s
	117C	Power Factor Lag 1 Relay	0 to 4	1	---	F29	0=OFF
	117D	Power Factor Lag 1 Pickup Level	0 to 100	1	0.01 × PF	F1	0.99
	117E	Power Factor Lag 1 Dropout Level	0 to 100	1	0.01 × PF	F1	1.00
	117F	Power Factor Lag 1 Delay	5 to 6000	5	0.1 × s	F1	100=10.0 s
	1180	Power Factor Lead 2 Relay	0 to 4	1	---	F29	0=OFF
	1181	Power Factor Lead 2 Pickup Level	0 to 100	1	0.01 × PF	F1	0.99
	1182	Power Factor Lead 2 Dropout Level	0 to 100	1	0.01 × PF	F1	1.00
	1183	Power Factor Lead 2 Delay	5 to 6000	5	0.1 × s	F1	100=10.0 s
	1184	Power Factor Lag 2 Relay	0 to 4	1	---	F29	0=OFF
	1185	Power Factor Lag 2 Pickup Level	0 to 100	1	0.01 × PF	F1	0.99
	1186	Power Factor Lag 2 Dropout Level	0 to 100	1	0.01 × PF	F1	1.00
	1187	Power Factor Lag 2 Delay	5 to 6000	5	0.1 × s	F1	100=10.0 s
	1188	Reserved					
	to	↓	↓	↓	↓	↓	↓
	118F	Reserved					
DEMAND ALARMS	1190	Phase A Current Demand Relay	0 to 4	1	---	F29	0=OFF
	1191	Phase A Current Demand Level	10 to 7500	1	A	F1	100 A
	1192	Phase B Current Demand Relay	0 to 4	1	---	F29	0=OFF
	1193	Phase B Current Demand Level	10 to 7500	1	A	F1	100 A
	1194	Phase C Current Demand Relay	0 to 4	1	---	F29	0=OFF
	1195	Phase C Current Demand Level	10 to 7500	1	A	F1	100 A
	1196	Neutral Current Demand Relay	0 to 4	1	---	F29	0=OFF
	1197	Neutral Current Demand Level	10 to 7500	1	A	F1	100 A
	1198	Positive Real Power Demand Relay	0 to 4	1	---	F29	0=OFF
	1199	Positive Real Power Demand Level	1 to 65000	1	kW	F1	1000 kW
	119A	Positive Reactive Power Demand Relay	0 to 4	1	---	F29	0=OFF
	119B	Positive Reactive Power Demand Level	1 to 65000	1	kvar	F1	1000 kvar
	119C	Apparent Power Demand Relay	0 to 4	1	---	F29	0=OFF
	119D	Apparent Power Demand Level	1 to 65000	1	kVA	F1	1000 kVA
	119E	Negative Real Power Demand Relay	0 to 4	1	---	F29	0=OFF
	119F	Negative Real Power Demand Level	1 to 65000	1	kW	F1	1000 kW

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents "OFF".
**** Minimum Setpoint value represents "OFF".
***** Maximum Setpoint value represents "UNLIMITED".

Table 7–1: PQMII Memory Map (Sheet 38 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
DEMAND ALARMS continued	11A0	Negative Reactive Power Demand Relay	0 to 4	1	---	F29	0=OFF
	11A1	Negative Reactive Power Demand Level	1 to 65000	1	kvar	F1	1000 kvar
	11A2	Reserved					
	to	↓	↓	↓	↓	↓	↓
	11A7	Reserved					
PULSE INPUT ALARMS	11A8	Pulse Input 1 Relay	0 to 4	1	---	F29	0=OFF
	11A9	Pulse Input 1 Level	1 to 65000	1	---	F1	100
	11AA	Pulse Input 1 Delay	5 to 6000	5	0.1 × s	F1	100=10.0 s
	11AB	Reserved					
	to	↓	↓	↓	↓	↓	↓
	11AF	Reserved					
MISC. ALARMS	11B0	Serial COM1 Failure Alarm Delay	5 to 61***	1	s	F1	61=OFF
	11B1	Serial COM2 Failure Alarm Delay	5 to 61***	1	s	F1	61=OFF
	11B2	Clock Not Set Alarm	0 to 1	1	---	F11	0 = DISABLED
	11B3	Data Log 1 Percentage Full Alarm Level	50 to 101***	1	%	F1	101=OFF
	11B4	Data Log 2 Percentage Full Alarm Level	50 to 101***	1	%	F1	101=OFF
	11B5	Reserved					
	11B6	Reserved					
	11B7	Reserved					
PULSE INPUT ALARMS	11B8	Pulse Input 2 Relay	0 to 4	1	---	F29	0=OFF
	11B9	Pulse Input 2 Level	1 to 65000	1	---	F1	100
	11BA	Pulse Input 2 Delay	5 to 6000	5	0.1 × s	F1	100=10.0 s
	11BB	Pulse Input 3 Relay	0 to 4	1	---	F29	0=OFF
	11BC	Pulse Input 3 Level	1 to 65000	1	---	F1	100
	11BD	Pulse Input 3 Delay	5 to 6000	5	0.1 × s	F1	100=10.0 s
	11BE	Pulse Input 4 Relay	0 to 4	1	---	F29	0=OFF
	11BF	Pulse Input 4 Level	1 to 65000	1	---	F1	100
	11C0	Pulse Input 4 Delay	5 to 6000	5	0.1 × s	F1	100=10.0 s
	11C1	Totalized Pulse Input Relay	0 to 4	1	---	F29	0=OFF
	11C2	Totalized Pulse Input Level	1 to 65000	1	---	F1	100
	11C3	Totalized Pulse Input Delay	5 to 6000	5	0.1 × s	F1	100=10.0 s
	11C4	Reserved					
	to	↓	↓	↓	↓	↓	↓
	11C7	Reserved					
SIMULATION	11C8	Current/Voltage Simulation	0 to 1	1	---	F11	0=OFF
	11C9	Current/Voltage Simulation Time	5 to 305	5	min	F1*****	15 min
	11CA	Phase A Current	0 to 10000	1	A	F1	0 A
	11CB	Phase B Current	0 to 10000	1	A	F1	0 A
	11CC	Phase C Current	0 to 10000	1	A	F1	0 A
	11CD	Neutral Current	0 to 10000	1	A	F1	0 A
	11CE	Vax Voltage	0 to 65000	1	V	F1	0 V
	11CF	Vbx Voltage	0 to 65000	1	V	F1	0 V
	11D0	Vcx Voltage	0 to 65000	1	V	F1	0 V
	11D1	Phase Angle	0 to 359	1	degrees	F1	0 degrees

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 39 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
SIMULATION continued	11D2	Analog Output Simulation	0 to 1	1	---	F11	0=OFF
	11D3	Analog Output Simulation Time	5 to 305	5	min	F1*****	15 min
	11D4	Analog Output 1	0 to 1201***	1	0.1 x %	F1	1201=OFF
	11D5	Analog Output 2	0 to 1201***	1	0.1 x %	F1	1201=OFF
	11D6	Analog Output 3	0 to 1201***	1	0.1 x %	F1	1201=OFF
	11D7	Analog Output 4	0 to 1201***	1	0.1 x %	F1	1201=OFF
	11D8	Analog Input Simulation	0 to 1	1	---	F11	0=OFF
	11D9	Analog Input Simulation Time	5 to 305	5	min	F1*****	15 min
	11DA	Analog Input	40 to 201	1	0.1 x mA	F1	201=OFF
	11DB	Switch Input Simulation	0 to 1	1	---	F11	0=OFF
	11DC	Switch Input Simulation Time	5 to 305	5	min	F1*****	15 min
	11DD	Switch Input A	0 to 1	1	---	F27	0=OPEN
	11DE	Switch Input B	0 to 1	1	---	F27	0=OPEN
	11DF	Switch Input C	0 to 1	1	---	F27	0=OPEN
	11E0	Switch Input D	0 to 1	1	---	F27	0=OPEN
	11E1	Reserved					
	11E2	Reserved					
	11E3	Reserved					
TIME ALARM	11E4	Time Relay	0 to 4	1	---	F29	0=OFF
	11E5	Pickup Time Hours/Minutes	0 to 65535	1	hr./min	F22	12:00
	11E6	Pickup Time Seconds	0 to 59000	1000	ms	F1	0
	11E7	Dropout Time Hours/Minutes	0 to 65535	1	hr./min	F22	12:00
	11E8	Dropout Time Seconds	0 to 59000	1000	ms	F1	0
	11E9	Reserved					
	to	↓	↓	↓	↓	↓	↓
	11EF	Reserved					
PROGRAM-MABLE MESSAGE	11F0	Programmable message chars 1 & 2	32 to 127	1	ASCII	F10	"Ph"
	11F1	Programmable message chars 3 & 4	32 to 127	1	ASCII	F10	"on"
	11F2	Programmable message chars 5 & 6	32 to 127	1	ASCII	F10	"e:"
	11F3	Programmable message chars 7 & 8	32 to 127	1	ASCII	F10	" 9"
	11F4	Programmable message chars 9 & 10	32 to 127	1	ASCII	F10	"05"
	11F5	Programmable message chars 11 & 12	32 to 127	1	ASCII	F10	"-2"
	11F6	Programmable message chars 13 & 14	32 to 127	1	ASCII	F10	"94"
	11F7	Programmable message chars 15 & 16	32 to 127	1	ASCII	F10	"-6"
	11F8	Programmable message chars 17 & 18	32 to 127	1	ASCII	F10	"22"
	11F9	Programmable message chars 19 & 20	32 to 127	1	ASCII	F10	"2 "
	11FA	Programmable message chars 21 & 22	32 to 127	1	ASCII	F10	"GE"
	11FB	Programmable message chars 23 & 24	32 to 127	1	ASCII	F10	"in"
	11FC	Programmable message chars 25 & 26	32 to 127	1	ASCII	F10	"du"
	11FD	Programmable message chars 27 & 28	32 to 127	1	ASCII	F10	"st"
	11FE	Programmable message chars 29 & 30	32 to 127	1	ASCII	F10	"ri"
	11FF	Programmable message chars 31 & 32	32 to 127	1	ASCII	F10	"al"
	1200	Programmable message chars 33 & 34	32 to 127	1	ASCII	F10	".c"
	1201	Programmable message chars 35 & 36	32 to 127	1	ASCII	F10	"om"
	1202	Programmable message chars 37 & 38	32 to 127	1	ASCII	F10	"/p"
	1203	Programmable message chars 39 & 40	32 to 127	1	ASCII	F10	"m "

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents "OFF".
**** Minimum Setpoint value represents "OFF".
***** Maximum Setpoint value represents "UNLIMITED".

Table 7–1: PQMII Memory Map (Sheet 40 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
PROGRAM-MABLE MESSAGE continued	1204	Reserved					
	to	↓	↓	↓	↓	↓	↓
	120F	Reserved					
FLASH MESSAGE	1210	Flash message characters 1 and 2	32 to 127	1	ASCII	F10	“”
	1211	Flash message characters 3 and 4	32 to 127	1	ASCII	F10	“”
	1212	Flash message characters 5 and 6	32 to 127	1	ASCII	F10	“”
	1213	Flash message characters 7 and 8	32 to 127	1	ASCII	F10	“”
	1214	Flash message characters 9 and 10	32 to 127	1	ASCII	F10	“”
	1215	Flash message characters 11 and 12	32 to 127	1	ASCII	F10	“”
	1216	Flash message characters 13 and 14	32 to 127	1	ASCII	F10	“”
	1217	Flash message characters 15 and 16	32 to 127	1	ASCII	F10	“”
	1218	Flash message characters 17 and 18	32 to 127	1	ASCII	F10	“”
	1219	Flash message characters 19 and 20	32 to 127	1	ASCII	F10	“”
	121A	Flash message characters 21 and 22	32 to 127	1	ASCII	F10	“”
	121B	Flash message characters 23 and 24	32 to 127	1	ASCII	F10	“”
	121C	Flash message characters 25 and 26	32 to 127	1	ASCII	F10	“”
	121D	Flash message characters 27 and 28	32 to 127	1	ASCII	F10	“”
	121E	Flash message characters 29 and 30	32 to 127	1	ASCII	F10	“”
	121F	Flash message characters 31 and 32	32 to 127	1	ASCII	F10	“”
	1220	Flash message characters 33 and 34	32 to 127	1	ASCII	F10	“”
	1221	Flash message characters 35 and 36	32 to 127	1	ASCII	F10	“”
	1222	Flash message characters 37 and 38	32 to 127	1	ASCII	F10	“”
	1223	Flash message characters 39 and 40	32 to 127	1	ASCII	F10	“”
	1224	Reserved					
	to	↓	↓	↓	↓	↓	↓
	125F	Reserved					
DATA LOGGER	1260	Log 1 Interval (high)	1 to 86400	1	s	F3	3600
	1261	Log 1 Interval (low)					
	1262	Log 2 Interval (high)	1 to 86400	1	s	F3	3600
	1263	Log 2 Interval (low)					
	1264	Log 1 Mode	0 to 1	1	---	F32	0 = RUN TO FILL
	1265	Log 2 Mode	0 to 1	1	---	F32	0 = RUN TO FILL
	1266	Log Size Determination	0 to 1	1	---	F33	0 = AUTOMATIC
	1267	Log 1 Size	0 to 100	1	%	F1	50%
	1268	Data Log Memory Access Block Number	0 to 511	1	---	F1	0
	1269	Stop Data Log 1	0 to 1	1	---	F31	0=NO
	126A	Stop Data Log 2	0 to 1	1	---	F31	0=NO
	126B	Reserved					
	to	↓	↓	↓	↓	↓	↓
	126F	Reserved					
	1270	Ia Log Assignment	0 to 3	1	---	F34	0 = NONE
	1271	Ib Log Assignment	0 to 3	1	---	F34	0 = NONE
	1272	Ic Log Assignment	0 to 3	1	---	F34	0 = NONE
	1273	Iavg Log Assignment	0 to 3	1	---	F34	0 = NONE
	1274	In Log Assignment	0 to 3	1	---	F34	0 = NONE
	1275	I Unbalance Log Assignment	0 to 3	1	---	F34	0 = NONE

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

Table 7–1: PQMII Memory Map (Sheet 41 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
DATA LOGGER continued	1276	Van Log Assignment	0 to 3	1	---	F34	0 = NONE
	1277	Vbn Log Assignment	0 to 3	1	---	F34	0 = NONE
	1278	Vcn Log Assignment	0 to 3	1	---	F34	0 = NONE
	1279	Vp avg Log Assignment	0 to 3	1	---	F34	0 = NONE
	127A	Vab Log Assignment	0 to 3	1	---	F34	0 = NONE
	127B	Vbc Log Assignment	0 to 3	1	---	F34	0 = NONE
	127C	Vca Log Assignment	0 to 3	1	---	F34	0 = NONE
	127D	Vl avg Log Assignment	0 to 3	1	---	F34	0 = NONE
	127E	V Unbalance Log Assignment	0 to 3	1	---	F34	0 = NONE
	127F	Pa Log Assignment	0 to 3	1	---	F34	0 = NONE
	1280	Qa Log Assignment	0 to 3	1	---	F34	0 = NONE
	1281	Sa Log Assignment	0 to 3	1	---	F34	0 = NONE
	1282	PFa Log Assignment	0 to 3	1	---	F34	0 = NONE
	1283	Pb Log Assignment	0 to 3	1	---	F34	0 = NONE
	1284	Qb Log Assignment	0 to 3	1	---	F34	0 = NONE
	1285	Sb Log Assignment	0 to 3	1	---	F34	0 = NONE
	1286	PFb Log Assignment	0 to 3	1	---	F34	0 = NONE
	1287	Pc Log Assignment	0 to 3	1	---	F34	0 = NONE
	1288	Qc Log Assignment	0 to 3	1	---	F34	0 = NONE
	1289	Sc Log Assignment	0 to 3	1	---	F34	0 = NONE
	128A	PFc Log Assignment	0 to 3	1	---	F34	0 = NONE
	128B	P3 Log Assignment	0 to 3	1	---	F34	0 = NONE
	128C	Q3 Log Assignment	0 to 3	1	---	F34	0 = NONE
	128D	S3 Log Assignment	0 to 3	1	---	F34	0 = NONE
	128E	PF3 Log Assignment	0 to 3	1	---	F34	0 = NONE
	128F	Frequency Log Assignment	0 to 3	1	---	F34	0 = NONE
	1290	Positive kWh Log Assignment	0 to 3	1	---	F34	0 = NONE
	1291	Negative kWh Log Assignment	0 to 3	1	---	F34	0 = NONE
	1292	Positive kvarh Log Assignment	0 to 3	1	---	F34	0 = NONE
	1293	Negative kvarh Log Assignment	0 to 3	1	---	F34	0 = NONE
	1294	kVAh Log Assignment	0 to 3	1	---	F34	0 = NONE
	1295	Ia Demand Log Assignment	0 to 3	1	---	F34	0 = NONE
	1296	Ib Demand Log Assignment	0 to 3	1	---	F34	0 = NONE
	1297	Ic Demand Log Assignment	0 to 3	1	---	F34	0 = NONE
	1298	In Demand Log Assignment	0 to 3	1	---	F34	0 = NONE
	1299	P3 Demand Log Assignment	0 to 3	1	---	F34	0 = NONE
	129A	Q3 Demand Log Assignment	0 to 3	1	---	F34	0 = NONE
	129B	S3 Demand Log Assignment	0 to 3	1	---	F34	0 = NONE
	129C	Ia THD Log Assignment	0 to 3	1	---	F34	0 = NONE
	129D	Ib THD Log Assignment	0 to 3	1	---	F34	0 = NONE
	129E	Ic THD Log Assignment	0 to 3	1	---	F34	0 = NONE
	129F	In THD Log Assignment	0 to 3	1	---	F34	0 = NONE
	12A0	Van THD Log Assignment	0 to 3	1	---	F34	0 = NONE
	12A1	Vbn THD Log Assignment	0 to 3	1	---	F34	0 = NONE
	12A2	Vcn THD Log Assignment	0 to 3	1	---	F34	0 = NONE
	12A3	Vab THD Log Assignment	0 to 3	1	---	F34	0 = NONE

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents "OFF".
**** Minimum Setpoint value represents "OFF".
***** Maximum Setpoint value represents "UNLIMITED".

Table 7–1: PQMII Memory Map (Sheet 42 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
DATA LOGGER continued	12A4	Vbc THD Log Assignment	0 to 3	1	---	F34	0 = NONE
	12A5	Analog Input Log Assignment	0 to 3	1	---	F34	0 = NONE
	12A6	Reserved					
	to	↓	↓	↓	↓	↓	↓
	12BF	Reserved					
EVENT RECORDER	12C0	Event Recorder Memory Access Event Num	0 to 65535	1	---	F1	0
	12C1	Event Recorder Operation	0 to 1	1	---	F11	0 = DISABLE
	12C2	Event Recorder Event Enable Flags 1	0 to 65535	1	---	F105	65535
	12C3	Event Recorder Event Enable Flags 2	0 to 65535	1	---	F106	65535
	12C4	Event Recorder Event Enable Flags 3	0 to 65535	1	---	F107	65535
	12C5	Event Recorder Event Enable Flags 4	0 to 65535	1	---	F112	65535
	12C6	Reserved					
	to	↓	↓	↓	↓	↓	↓
	12CF	Reserved					
TRACE MEMORY	12D0	Trace Memory Usage	0 to 2	1	---	F37	0=1x36 cycles
	12D1	Trace Memory Trigger Mode	0 to 1	1	---	F38	0=ONE SHOT
	12D2	Ia Overcurrent Trigger Level	1 to 151***	1	% CT	F1	151=OFF
	12D3	Ib Overcurrent Trigger Level	1 to 151***	1	% CT	F1	151=OFF
	12D4	Ic Overcurrent Trigger Level	1 to 151***	1	% CT	F1	151=OFF
	12D5	In Overcurrent Trigger Level	1 to 151***		% CT	F1	151=OFF
	12D6	Va Overvoltage Trigger Level	20 to 151***	1	% VT	F1	151=OFF
	12D7	Vb Overvoltage Trigger Level	20 to 151***	1	% VT	F1	151=OFF
	12D8	Vc Overvoltage Trigger Level	20 to 151***	1	% VT	F1	151=OFF
	12D9	Va Undervoltage Trigger Level	20 to 151***	1	% VT	F1	151=OFF
	12DA	Vb Undervoltage Trigger Level	20 to 151***	1	% VT	F1	151=OFF
	12DB	Vc Undervoltage Trigger Level	20 to 151***	1	% VT	F1	151=OFF
	12DC	Switch Input A Trigger	0 to 2	1	---	F39	0=OFF
	12DD	Switch Input B Trigger	0 to 2	1	---	F39	0=OFF
	12DE	Switch Input C Trigger	0 to 2	1	---	F39	0=OFF
	12DF	Switch Input D Trigger	0 to 2	1	---	F39	0=OFF
	12E0	Trace Memory Trigger Delay	0 to 30	1	cycles	F1	0 cycles
	12E1	Trace Memory Waveform Selection	0 to 6	1	---	F40	0=Ia
	12E2	Trace Memory Trigger Relay	0 to 4	1	---	F29	0=OFF
	12E3	Reserved					
	to	↓	↓	↓	↓	↓	↓
	12EF	Reserved					
PRODUCT OPTIONS	12F0	Product Options Upgrade	1 to 23	1	---	F116	1=PQMII
	12F1	Product Modifications Upgrade MOD1	0 to 999	1	---	F1	0
	12F2	Product Modifications Upgrade MOD2	0 to 999	1	---	F1	0
	12F3	Product Modifications Upgrade MOD3	0 to 999	1	---	F1	0
	12F4	Product Modifications Upgrade MOD4	0 to 999	1	---	F1	0
	12F5	Product Modifications Upgrade MOD5	0 to 999	1	---	F1	0
	12F6	Passcode Input 1	32 to 127	1	---	F10	32
	12F7	Passcode Input 2	32 to 127	1	---	F10	32
	12F8	Passcode Input 3	32 to 127	1	---	F10	32
	12F9	Passcode Input 4	32 to 127	1	---	F10	32

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents "OFF".
**** Minimum Setpoint value represents "OFF".
***** Maximum Setpoint value represents "UNLIMITED".

Table 7–1: PQMII Memory Map (Sheet 43 of 43)

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FORMAT	FACTORY DEFAULT
PRODUCT OPTIONS continued	12FA	Passcode Input 5	32 to 127	1	---	F10	32
	12FB	Passcode Input 6	32 to 127	1	---	F10	32
	12FC	Passcode Input 7	32 to 127	1	---	F10	32
	12FD	Passcode Input 8	32 to 127	1	---	F10	32
	12FE	Passcode Input 9	32 to 127	1	---	F10	32
	12FF	Passcode Input 10	32 to 127	1	---	F10	32
	1300	Reserved					
	to	↓	↓	↓	↓	↓	↓
	131F	Reserved					
VOLTAGE DISTUR-BANCE RECORDER	1320	Record Selector	0 to 65535	1	---	F1	0
	1321	Sag Level % Nominal	20 to 100	1	%	F1***	OFF
	1322	Swell Level % Nominal	101 to 151	1	%	F1***	OFF
	1323	Reserved					
	to	↓	↓	↓	↓	↓	↓
	132F	Reserved					

Notes: *Data type depends on the Command Operation Code.
** Any valid Actual Values or Setpoints address.
*** Maximum Setpoint value represents “OFF”.
**** Minimum Setpoint value represents “OFF”.
***** Maximum Setpoint value represents “UNLIMITED”.

7.3.4 Memory Map Data Formats

Table 7–2: Data Formats (Sheet 1 of 19)

Code	Description	Bitmask
F1	**Unsigned Integer - Numerical Data**	FFFF
F2	**Signed Integer - Numerical Data**	FFFF
F3	**Unsigned Long Integer - Numerical Data**	FFFFFFFF
F4	**Signed Long Integer - Numerical Data**	FFFFFFFF
F5	**Hardware Version Code**	FFFF
	1 = A	---
	2 = B	---
	↓	↓
	26 = Z	---
F6	**Unsigned Integer - Current Key Press**	FFFF
	0000 = no key	---
	FE01 = Enter	---
	FE02 = Menu	---
	FE04 = Message Right	---
	FE08 = Value Up	---
	FD01 = Reset	---
	FD02 = Message Left	---

Table 7–2: Data Formats (Sheet 2 of 19)

Code	Description	Bitmask
	FD04 = Message Up	---
	FD08 = Value Down	---
	FB01 = Escape	---
	FB02 = Message Down	---
F7	**Unsigned Integer - Command**	FFFF
	1 = Reset	---
	2 = Alarm Relay On	---
	3 = Alarm Relay Off	---
	4 = Auxiliary Relay 1 On	---
	5 = Auxiliary Relay 1 Off	---
	6 = Auxiliary Relay 2 On	---
	7 = Auxiliary Relay 2 Off	---
	8 = Auxiliary Relay 3 On	---
	9 = Auxiliary Relay 3 Off	---
	10 = Set Clock Time	---
	11 = Set Clock Date	---
F7 con't	12 = Display 40 char. Flash Msg for 5 s	---
	13 = Simulate Keypress	---
	14 = Clear Energy Values	---
	15 = Clear Max. Demand Values	---
	16 = Clear Min./Max. Current Values	---
	17 = Clear Min./Max. Voltage Values	---
	18 = Clear Min./Max. Power Values	---
	19 = Clear Max. THD Values	---
	20 = Clear Switch Input Pulse Count	---
	21 = High Speed Sampling Trigger	---
	22 = Upload Mode Entry 2	---
	23 = Upload Mode Entry 1	---
	24 = Factory Setpoints Reload 2	---
	25 = Factory Setpoints Reload 1	---
	26 = Test Relays and LEDs	---
	27 = Waveform Capture Trigger	---
	28 = Start Data Log(s)	---
	29 = Stop Data Log(s)	---

Table 7–2: Data Formats (Sheet 3 of 19)

Code	Description	Bitmask
	30 = Resize Data Logs (valid only if both logs are stopped)	---
	31 = Clear Event Record	---
	32= Trigger Trace Memory	---
	33= Re-arm Trace Mem.	---
	34= Clear All Demand	---
	35= Clear Min./Max. Freq	---
	40 = Clear Voltage Disturbance Recorder	----
F8	**Unsigned Integer - Keypress Simulation**	FFFF
	49 = '1' = Menu	---
	50 = '2' = Escape	---
	51 = '3' = Reset	---
	52 = '4' = Enter	---
	53 = '5' = Message Up	---
	54 = '6' = Message Down	---
	55 = '7' = Message Left	---
	56 = '8' = Message Right	---
	57 = '9' = Value Up	---
	97 = 'a' = Value Down	---
F9	**Unsigned Integer - Relay/LED Test Data**	FFFF
	Alarm Relay	0001
	Auxiliary Relay 1	0002
	Auxiliary Relay 2	0004
	Auxiliary Relay 3	0008
	‘Alarm’ LED	0010
	‘Program’ LED	0020
	‘Simulation’ LED	0040
	‘Self Test’ LED	0080
	‘Alarm’ Relay LED	0100
	‘Aux 1’ Relay LED	0200
	‘Aux 2’ Relay LED	0400
	‘Aux 3’ Relay LED	0800
F10	**Two ASCII Characters**	FFFF
	32-127 = ASCII Character	7F00
	32-127 = ASCII Character	007F

Table 7–2: Data Formats (Sheet 4 of 19)

Code	Description	Bitmask
F11	**Unsigned Integer - Enable/Disable**	FFFF
	0 = Disable/OFF	---
	1 = Enable/ON	---
F12	**Unsigned Integer - Modbus Baud Rate**	FFFF
	0 = 1200	---
	1 = 2400	---
	2 = 4800	---
	3 = 9600	---
	4 = 19200	---
F13	**Unsigned Integer - Parity Type**	FFFF
	0 = None	---
	1 = Even	---
	2 = Odd	---

Table 7–2: Data Formats (Sheet 5 of 19)

Code	Description	Bitmask
F14	UNSIGNED INTEGER - ANALOG OUTPUT TYPE	FFFF
	0 = Not Used	---
	1 = Phase A Current	---
	2 = Phase B Current	---
	3 = Phase C Current	---
	4 = Neutral Current	---
	5 = Avg Phase Current	---
	6 = Current Unbalance	---
	7 = Voltage Van	---
	8 = Voltage Vbn	---
	9 = Voltage Vcn	---
	10 = Voltage Vab	---
	11 = Voltage Vbc	---
	12 = Voltage Vca	---
	13 = Avg Phase Voltage	---
	14 = Average Line Voltage	---
	15 = Voltage Unbalance	---
	16 = Frequency	---
	17 = 3Φ Power Factor	---
	18 = 3Φ Real Power (kW)	---
	19 = 3Φ Reactive Pwr (kvar)	---
	20 = 3Φ Apparent Pwr (kVA)	---
	21 = 3Φ Real Power (MW)	---
	22 = 3Φ Reactive Power (Mvar)	---
	23 = 3Φ Apparent Pwr (MVA)	---
	24 = Ph A Power Factor	---
	25 = Phase A Real Power	---
	26 = Ph A Reactive Power	---
	27 = Ph A Apparent Power	---
	28 = Ph B Power Factor	---
	29 = Phase B Real Power	---
	30 = Ph B Reactive Power	---
	31 = Ph B Apparent Power	---
	32 = Ph C Power Factor	---

Table 7–2: Data Formats (Sheet 6 of 19)

Code	Description	Bitmask
F14 con't	33 = Phase C Real Power	---
	34 = Ph C Reactive Power	---
	35 = Ph C Apparent Power	---
	36 = 3Φ Positive Real Energy Used	---
	37 = 3ΦPositive Reactive Energy Used	---
	38 = 3Φ Negative Real Energy Used	---
	39 = 3Φ Negative Reactive Energy Used	---
	40 = 3Φ Apparent Energy Used	---
	41 = Ph A Current Dmd	---
	42 = Ph B Current Dmd	---
	43 = Ph C Current Dmd	---
	44 = Neutral Current Dmd	---
	45 = 3Φ Real Power Dmd	---
	46 = 3Φ Reactive Power Demand	---
	47 = 3Φ Apparent Power Demand	---
	48 = 3Φ Current THD	---
	49 = 3Φ Voltage THD	---
	50 = Phase A Current THD	---
	51 = Phase B Current THD	---
	52 = Phase C Current THD	---
	53 = Voltage Van THD	---
	54 = Voltage Vbn THD	---
	55 = Voltage Vcn THD	---
	56 = Voltage Vab THD	---
	57 = Voltage Vbc THD	---
	58 = Neutral Current THD	---
	59 = Serial Control	---

Table 7–2: Data Formats (Sheet 7 of 19)

Code	Description	Bitmask
F15	**Unsigned Integer - VT Wiring**	FFFF
	0 = Off	---
	1 = 4 Wire Wye / 3 VTs	---
	2 = 4 Wire Wye Direct	---
	3 = 4 Wire Wye / 2 VTs	---
	4 = 3 Wire Delta / 2 VTs	---
	5 = 3 Wire Direct	---
	6 = Single Phase Direct	---
F16	**Unsigned Integer - Neutral Current Sensing**	FFFF
	0 = Off	---
	1 = Separate CT	---
	2 = Calculated	---
F17	**Unsigned Integer -Failsafe/Non-failsafe**	FFFF
	0 =Non-failsafe	---
	1 = Failsafe	---
F18	**Unsigned Integer - Unlatched / Latched**	FFFF
	0 = Unlatched	---
	1 = Latched	---
F19	**Unsigned Integer - Aux Relay Function**	FFFF
	0 = Off	---
	1 = Aux1 Relay	---
	2 = Aux2 Relay	---
	3 = Aux3 Relay	---
F20	**Unsigned Integer - Switch Function**	FFFF
	0 = Not Used	---
	1 = Alarm Relay	---
	2 = Auxiliary Relay 1	---
	3 = Auxiliary Relay 2	---
	4 = Auxiliary Relay 3	---
	5 = Pulse Input 1	---
	6 = New Demand Period	---
	7 = Setpoint Access	---
	8 = Select Main/Alt Analog Output	---

Table 7–2: Data Formats (Sheet 8 of 19)

Code	Description	Bitmask
F20 con't	9 = Select Main/Alt Analog Input	---
	10 = Pulse Input 2	---
	11 = Pulse Input 3	---
	12 = Pulse Input 4	---
	13 = Clear Energy	---
	14 = Clear Demand	---
F22	**Time Hours/minutes**	FFFF
	Hours: 0 = 12 am, 1 = 1 am,..., 23 = 11 pm	FF00
	Minutes: 0 to 59 in steps of 1	00FF
F23	**Unsigned Integer - Time Seconds**	FFFF
	Seconds: 0 = 0.000s,..., 59999 = 59.999s	---
F24	**Date Month/day**	FFFF
	Month: 1=January,..., 12=December	FF00
	Day: 1 to 31 in steps of 1	00FF
F25	**Unsigned Integer - Date Year**	FFFF
	Year: 1995, 1996,...	---
F26	**Unsigned Integer: Harmonic Spectrum Parameter**	FFFF
	0 = None	---
	1 = Phase A Current	---
	2 = Phase B Current	---
	3 = Phase C Current	---
	4 = Neutral Current	---
	5 = Voltage Vax	---
	6 = Voltage Vbx	---
	7 = Voltage Vcx	---
F27	**Unsigned Integer - Switch Activation**	FFFF
	0 = Open	---
	1 = Closed	---
F28	**Unsigned Integer: Demand Calculation**	FFFF
	0 = Thermal Exponential	---
	1 = Block Interval	---
	2 = Rolling Interval	---

Table 7–2: Data Formats (Sheet 9 of 19)

Code	Description	Bitmask
F29	**Unsigned Integer: Alarm/Control Relay**	FFFF
	0 = Off	---
	1 = Alarm Relay	---
	2 = Auxiliary Relay 1	---
	3 = Auxiliary Relay 2	---
	4 = Auxiliary Relay 3	---
F30	**Unsigned Integer: Phases Required**	FFFF
	0 = Any One	---
	1 = Any Two	---
	2 = All Three	---
F31	**Unsigned Integer: Yes/No**	FFFF
	0 = No	---
	1 = Yes	---
F32	**Unsigned Integer: Data Log Mode**	FFFF
	0 = Run to Fill	---
	1 = Circulate	---
F33	**Unsigned Integer: Data Log Size Determination**	FFFF
	0 = Automatic	---
	1 = From Setpoint	---
F34	**Unsigned Integer: Data Log Selection**	FFFF
	0 = None	---
	1 = Log 1	---
	2 = Log 2	---
	3 = Log 1 and Log 2	---
F35	**Unsigned Integer: Data Log Status**	FFFF
	0 = Stopped	---
	1 = Running	---
F36	**Unsigned Integer: Cause Of Event**	FFFF
	0 = No Event	---
	1 = Clear Event Record	---
	2 = Power On	---
	3 = Power Off	---
	4 = Reset	---

Table 7–2: Data Formats (Sheet 10 of 19)

Code	Description	Bitmask
F36 con't	5 = Setpt Access Enabled	---
	6 = Switch A Alarm	---
	7 = Switch B Alarm	---
	8 = Switch C Alarm	---
	9 = Switch D Alarm	---
	10 = COM1 Fail Alarm	---
	11 = COM2 Fail Alarm	---
	12 = Self Test Alarm	---
	13 = Clock Not Set Alarm	---
	14 = Params Not Set Alrm	---
	15 = Underfreq Alarm	---
	16 = Overfreq Alarm	---
	17 = Undercurrent Alarm	---
	18 = Overcurrent Alarm	---
	19 = Neutral O/C Alarm	---
	20 = Undervoltage Alarm	---
	21 = Overvoltage Alarm	---
	22 = I Unbalance Alarm	---
	23 = V Unbalance Alarm	---
	24 = Phase Rev Alarm	---
	25 = PF Lead 1 Alarm	---
	26 = PF Lead 2 Alarm	---
	27 = PF Lag 1 Alarm	---
	28 = PF Lag 2 Alarm	---
	29 = Positive kW Alarm	---
	30 = Negative kW Alarm	---
	31 = Positive kvar Alarm	---
	32 = Negative kvar Alarm	---
	33 = +kW Demand Alarm	---
	34 = +kvar Dmd Alarm	---
	35 = –kW Demand Alarm	---
	36 = –kvar Dmd Alarm	---
	37 = kVA Demand Alarm	---
	38 = Phase A Current Demand Alarm	---

Table 7–2: Data Formats (Sheet 11 of 19)

Code	Description	Bitmask
F36 con't	39 = Phase B Current Demand Alarm	---
	40 = Phase C Current Demand Alarm	---
	41 = Neutral Current Demand Alarm	---
	42 = Pulse Input 1 Alarm	---
	43 = Current THD Alarm	---
	44 = Voltage THD Alarm	---
	45 = Analog In Main Alm	---
	46 = Analog In Alt Alarm	---
	47 = Data Log 1 Alarm	---
	48 = Data Log 2 Alarm	---
	49 = Switch A Alarm Clear	---
	50 = Switch B Alarm Clear	---
	51 = Switch C Alarm Clear	---
	52 = Switch D Alarm Clear	---
	53 = COM1 Fail Alarm Clr	---
	54 = COM2 Fail Alarm Clr	---
	55 = Self Test Alarm Clear	---
	56 = Clock Not Set Alarm Clear	---
	57 = Parameters Not Set Alarm Clear	---
	58 = Underfreq Alarm Clr	---
	59 = Overfreq Alarm Clear	---
	60 = U/C Alarm Clear	---
	61 = O/C Alarm Clear	---
	62 = Neutral Overcurrent Alarm Clear	---
	63 = U/V Alarm Clear	---
	64 = O/V Alarm Clear	---
	65 = Current Unbalance Alarm Clear	---
	66 = Voltage Unbalance Alarm Clear	---
	67 = Phase Reversal Alarm Clear	---
	68 = PF Lead 1 Alarm Clr	---
	69 = PF Lead 2 Alarm Clr	---
	70 = PF Lag 1 Alarm Clear	---
	71 = PF Lag 2 Alarm Clear	---

Table 7–2: Data Formats (Sheet 12 of 19)

Code	Description	Bitmask
F36 con't	72 = +kW Alarm Clear	---
	73 = –kW Alarm Clear	---
	74 = +kvar Alarm Clear	---
	75 = –kvar Alarm Clear	---
	76 = +kW Demand Alarm Clear	---
	77 = +kvar Demand Alarm Clear	---
	78 = –kW Demand Alarm Clear	---
	79 = –kvar Demand Alarm Clear	---
	80 = kVA Demand Alarm Clear	---
	81 = Phase A Current Demand Alarm Clear	---
	82 = Phase B Current Demand Alarm Clear	---
	83 = Phase C Current Demand Alarm Clear	---
	84 = Neutral Current Demand Alarm Clear	---
	85 = Pulse In 1 Alarm Clr	---
	86 = I THD Alarm Clear	---
	87 = V THD Alarm Clear	---
	88 = Analog Input Main Alarm Clear	---
	89 = Analog Input Alternate Alarm Clear	---
	90 = Data Log 1 Alarm Clr	---
	91 = Data Log 2 Alarm Clr	---
	92 = Pulse Input 2 Alarm	---
	93 = Pulse Input 3 Alarm	---
	94 = Pulse Input 4 Alarm	---
	95 = Pulse Count Total Alarm	---
	96 = Pulse In 2 Alarm Clr	---
	97 = Pulse In 3 Alarm Clr	---
	98 = Pulse In 4 Alarm Clr	---
	99 = Pulse Input Total Alarm Clear	---
	100 = Time Alarm	---
	101 = Time Alarm Clear	---
	102 = Trace Memory Trig	---

Table 7–2: Data Formats (Sheet 13 of 19)

Code	Description	Bitmask
F37	**Trace Memory Usage**	FFFF
	0 = 1 x 36 cycles	---
	1 = 2 x 18 cycles	---
	2 = 3 x 12 cycles	---
F38	**Trace Memory Trigger Mode**	FFFF
	0 = One Shot	---
	1 = Retrigger	---
F39	**Trace Memory Switch Input Trigger**	FFFF
	0 = Off	---
	1 = Open-to-closed	---
	2 = Closed-to-open	---
F40	**Trace Memory Waveform Selection**	FFFF
	0 = Ia	---
	1 = Ib	---
	2 = Ic	---
	3 = In	---
	4 = Va	---
	5 = Vb	---
	6 = Vc	---
F41	**Trace Memory Triggers**	FFFF
	0 = Trace Memory Not Triggered	---
	1 = Ia Overcurrent	---
	2 = Ib Overcurrent	---
	3 = Ic Overcurrent	---
	4 = In Overcurrent	---
	5 = Va Overvoltage	---
	6 = Vb Overvoltage	---
	7 = Vc Overvoltage	---
	8 = Va Undervoltage	---
	9 = Vb Undervoltage	---
	10 = Vc Undervoltage	---
	11 = Switch Input A	---
	12 = Switch Input B	---
	13 = Switch Input C	---

Table 7–2: Data Formats (Sheet 14 of 19)

Code	Description	Bitmask
	14 = Switch Input D	---
	15 = Serial Comms.	---
F43	**Pulse Input Totalization**	FFFF
	0 = 1+2	---
	1 = 1+3	---
	2 = 1+4	---
	3 = 2+3	---
	4 = 2+4	---
	5 = 3+4	---
	6 = 1+2+3	---
	7 = 1+3+4	---
	8 = 2+3+4	---
	9 = 1+2+3+4	---
	10 = 1+2+4	---
F44	**Phase CT Wiring**	FFFF
	0 = Phase A, B and C	---
	1 = Phase A and B only	---
	2 = Phase A and C only	---
	3 = Phase A only	---
F45	**CPU Speed**	FFFF
	0 = 16 MHz	---
	1 = 25 MHz	---
F47	**DNP Port**	FFFF
	0 = None	---
	1 = RS232	---
	2 = COM1	---
	3 = COM2	---
F100	**PQMII Options**	FFFF
	PQMII (Display Version)	0001
	T20 (4-20mA Transducer)	0002
	T1 (0-1mA Transducer)	0004
	C (Control) Option	0008
	A (Power Analysis) Option	0010

Table 7–2: Data Formats (Sheet 15 of 19)

Code	Description	Bitmask
F101	**Switch Input Status (0 = Open, 1 = Closed)**	FFFF
	Switch A	0100
	Switch B	0200
	Switch C	0400
	Switch D	0800
F102	**LED Status Flags: (0=Inactive, 1=Active)**	FFFF
	Aux 1 Relay	0001
	Aux 2 Relay	0002
	Aux 3 Relay	0004
	Alarm	0008
	Program	0010
	Simulation	0020
	Alarm Relay	0040
	Self Test	0080
F103	**LED Attribute Flags (0 = Flashing, 1 = Solid; Active)**	**FFFF**
	Aux 1 Relay	0001
	Aux 2 Relay	0002
	Aux 3 Relay	0004
	Alarm	0008
	Program	0010
	Simulation	0020
	Alarm Relay	0040
	Self Test	0080
F104	**Output Relay Flag (0=de-energized, 1=energized)**	FFFF
	Alarm Relay	0001
	Auxiliary Relay 1	0002
	Auxiliary Relay 2	0004
	Auxiliary Relay 3	0008

Table 7–2: Data Formats (Sheet 16 of 19)

Code	Description	Bitmask
F105	**Alarm Status Flags 1**	FFFF
	Phase Undercurrent Alarm	0001
	Phase Overcurrent Alarm	0002
	Neutral Overcurrent Alarm	0004
	Undervoltage Alarm	0008
	Overvoltage Alarm	0010
	Current Unbalance Alarm	0020
	Voltage Unbalance Alarm	0040
	Voltage Phase Reversal	0080
	PF Lead Alarm 1	0100
	PF Lead Alarm 2	0200
	Power Factor Lag Alarm 1	0400
	Power Factor Lag Alarm 2	0800
	Positive Real Power Alarm	1000
	Neg Real Power Alarm	2000
	Pos Reactive Power Alarm	4000
	Neg Reactive Power Alarm	8000
F106	**Alarm Status Flags 2**	FFFF
	Underfrequency Alarm	0001
	Overfrequency Alarm	0002
	Positive Real Power Demand Alarm	0004
	Positive Reactive Power Demand Alarm	0008
	Apparent Power Demand Alarm	0010
	Ph A Current Dmd Alarm	0020
	Ph B Current Dmd Alarm	0040
	Ph C Current Dmd Alarm	0080
	Neutral Current Demand Alarm	0100
	Switch A Alarm	0200
	Switch B Alarm	0400
	Switch C Alarm	0800
	Switch D Alarm	1000
	Internal Fault Alarm	2000
	Serial COM1 Failure Alarm	4000
	Serial COM2 Failure Alarm	8000

Table 7–2: Data Formats (Sheet 17 of 19)

Code	Description	Bitmask
F107	**Alarm Status Flags 3**	FFFF
	Clock Not Set Alarm	0001
	Parameters Not Set Alarm	0002
	Pulse Input 1 Alarm	0004
	Current THD Alarm	0008
	Voltage THD Alarm	0010
	Analog Input Main Alarm	0020
	Analog Input Alt Alarm	0040
	Data Log 1	0080
	Data Log 2	0100
	Negative Real Power Demand Alarm	0200
	Negative Reactive Power Demand Alarm	0400
	Pulse Input 2 Alarm	0800
	Pulse Input 3 Alarm	1000
	Pulse Input 4 Alarm	2000
	Totalized Pulse In Alarm	4000
	Time Alarm	8000
F108	**Internal Fault Error Code**	FFFF
	ADC Ref Out of Range	0001
	Reserved	0002
	Switch Input Circuit Fault	0004
	Reserved	0008
F109	**General Status**	FFFF
	Alarm Present	0001
	Clock Not Set	0002
	Clock Drifting	0004
	Data Log 1 Running	0008
	Data Log 2 Running	0010

Table 7–2: Data Formats (Sheet 18 of 19)

Code	Description	Bitmask
F110	**Data Logger Numbers**	FFFF
	Log 1	0001
	Log 2	0002
F111	**Event Record Switches And Relay Status**	FFFF
	Alarm Relay	0001
	Auxiliary Relay 1	0002
	Auxiliary Relay 2	0004
	Auxiliary Relay 3	0008
F112	**Event Recorder Event Enable Flags 4**	**FFFF**
	Power On	0001
	Power Off	0002
	Alarm / Control Reset	0004
	Setpoint Access Enable	0008
F113	**Trace Memory Triggered Flag Status**	FFFF
	0 = Trace Memory Not Triggered	---
	1 = Trace Memory Triggered	---
	2 to 16 = Not Used	
F114	**Power Alarms Level Base Units**	FFFF
	0 = kW/kVAR	---
	1 = MW/MVAR	---
	2 to 16 = Not Used	---
F115	**Phase Overcurrent Activation**	FFFF
	0 = Average	---
	1 = Maximum	---
	2 to 16 = Not Used	---
F116	**Product Options Upgrade**	FFFF
	1=PQMII	---
	3=PQMII-T20	---
	5=PQMII-T1	---
	7=PQMII-C	---
	9=PQMII-T20-C	---
	11=PQMII-T1-C	---
	13=PQMII-A	---
	15=PQMII-T20-A	---

Table 7–2: Data Formats (Sheet 19 of 19)

Code	Description	Bitmask
F116 ctd.	17=PQMII-T1-A	---
	19=PQMII-C-A	---
	21=PQMII-T20-C-A	---
	23=PQMII-T1-C-A	---
F117	**Invalid Serial Number Flag**	FFFF
	0=Serial Number Valid	---
	1= Serial Number Invalid	---
F118	**Voltage Disturbance Type**	FFFF
	Sag	0001
	Swell	0002
	Undervoltage	0004
	Overvoltage	0008
F119	**Voltage Disturbance Source**	FFFF
	Voltage Van	0001
	Voltage Vbn	0002
	Voltage Vcn	0004
	Voltage Vab	0008
	Reserved	0010
	Voltage Vca	0020

7.3.5 Analog Output Parameter Range

Table 7–3: Analog Output Parameter Range for Serial Ports (Sheet 1 of 3)

No.	Analog Out Parameter	Range	Step	Units/ scale	Default
0	Not Used	0	0	---	0
1	Phase A Current	0 to 150	1	%	0
2	Phase B Current	0 to 150	1	%	0
3	Phase C Current	0 to 150	1	%	0
4	Neutral Current	0 to 150	1	%	0
5	Average Phase Current	0 to 150	1	%	0
6	Current Unbalance	0 to 1000	1	0.1 ×%	0
7	Voltage Van	0 to 200	1	%	0
8	Voltage Vbn	0 to 200	1	%	0
9	Voltage Vcn	0 to 200	1	%	0
10	Voltage Vab	0 to 200	1	%	0
11	Voltage Vbc	0 to 200	1	%	0
12	Voltage Vca	0 to 200	1	%	0
13	Average Phase Voltage	0 to 200	1	%	0
14	Average Line Voltage	0 to 200	1	%	0
15	Voltage Unbalance	0 to 1000	1	0.1 ×%	0
16	Frequency	0 to 7500	1	0.01 × Hz	0
17	*3 Phase PF	–99 to +99	1	0.01 × PF	0
18	3 Phase kW	–32500 to +32500	1	kW	0
19	3 Phase kvar	–32500 to +32500	1	kvar	0
20	3 Phase kVA	0 to 65400	1	kVA	0
21	3 Phase MW	–32500 to +32500	1	0.1 × MW	0
22	3 Phase Mvar	–32500 to +32500	1	0.1 × Mvar	0
23	3 Phase MVA	0 to 65400	1	0.1 × MVA	0
24	*Phase A PF	–99 to +99	1	0.01 × PF	0
25	Phase A kW	–32500 to +32500	1	kW	0

* Since values of –0 and +0 both exist for power factor, the value stored in the PQMII serial register is the opposite of the value shown on the display. For example: if a range of 0.23 lead (–0.23) to 0.35 lag (+0.35) is required, –77 (–100 + 23)and +65 (100 – 35) must be sent.

Table 7–3: Analog Output Parameter Range for Serial Ports (Sheet 2 of 3)

No.	Analog Out Parameter	Range	Step	Units/ scale	Default
26	Phase A kvar	–32500 to +32500	1	kvar	0
27	Phase A kVA	0 to 65400	1	kVA	0
28	*Phase B PF	–99 to +99	1	0.01 × PF	0
29	Phase B kW	–32500 to +32500	1	kW	0
30	Phase B kvar	–32500 to +32500	1	kvar	0
31	Phase B kVA	0 to 65400	1	kVA	0
32	*Phase C PF	–99 to +99	1	0.01 × PF	0
33	Phase C kW	–32500 to +32500	1	kW	0
34	Phase C kvar	–32500 to +32500	1	kvar	0
35	Phase C kVA	0 to 65400	1	kVA	0
36	3 Phase +kWh Used	0 to 65400	1	kWh	0
37	3 Phase +kvarh Used	0 to 65400	1	kvarh	0
38	3 Phase -kWh Used	0 to 65400	1	kWh	0
39	3 Phase -kvarh Used	0 to 65400	1	kvarh	0
40	3 Phase kVAh Used	0 to 65400	1	kVAh	0
41	Phase A Current Demand	0 to 7500	1	A	0
42	Phase B Current Demand	0 to 7500	1	A	0
43	Phase C Current Demand	0 to 7500	1	A	0
44	Neutral Current Demand	0 to 7500	1	A	0
45	3 Phase kW Demand	–32500 to +32500	1	kW	0
46	3 Phase kvar Demand	–32500 to +32500	1	kvar	0
47	3 Phase kVA Demand	0 to 65400	1	kVA	0
48	3 Phase Current THD	0 to 1000	1	0.1 × %	0
49	Three Phase Voltage THD	0 to 1000	1	0.1 × %	0
50	Phase A Current THD	0 to 1000	1	0.1 × %	0
51	Phase B Current THD	0 to 1000	1	0.1 × %	0
52	Phase C Current THD	0 to 1000	1	0.1 × %	0
53	Voltage Van THD	0 to 1000	1	0.1 × %	0

* Since values of –0 and +0 both exist for power factor, the value stored in the PQMII serial register is the opposite of the value shown on the display. For example: if a range of 0.23 lead (–0.23) to 0.35 lag (+0.35) is required, –77 (–100 + 23)and +65 (100 – 35) must be sent.

Table 7–3: Analog Output Parameter Range for Serial Ports (Sheet 3 of 3)

No.	Analog Out Parameter	Range	Step	Units/ scale	Default
54	Voltage Vbn THD	0 to 1000	1	0.1 × %	0
55	Voltage Vcn THD	0 to 1000	1	0.1 × %	0
56	Voltage Vab THD	0 to 1000	1	0.1 × %	0
57	Voltage Vbc THD	0 to 1000	1	0.1 × %	0
58	Neutral Current THD	0 to 1000	1	0.1 × %	0
59	Serial Control	–32500 to +32500	1	---	0

* Since values of –0 and +0 both exist for power factor, the value stored in the PQMII serial register is the opposite of the value shown on the display. For example: if a range of 0.23 lead (–0.23) to 0.35 lag (+0.35) is required, –77 (–100 + 23)and +65 (100 – 35) must be sent.

7.4 DNP 3.0 Communications

7.4.1 DNP 3.0 Device Profile Document

The communications port configured as a DNP slave port must support the full set of features listed in the Level 2 DNP V3.00 Implementation (DNP-L2) described in Chapter 2 of the subset definitions. See the DNP protocol website at http://www.dnp.org for details

DNP 3.0: DEVICE PROFILE DOCUMENT	
Vendor Name: General Electric Multilin Inc.	
Device Name: PQMII Power Quality Meter	
Highest DNP Level Supported: For Requests: Level 2 For Responses: Level 2	Device Function: ☐ Master ☒ Slave
Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels Supported (the complete list is described in the attached table): none	
Maximum Data Link Frame Size (octets): Transmitted: 249 Received: 292	Maximum Application Fragment Size (octets): Transmitted: 2048 Received: 2048
Maximum Data Link Re-tries: ☒ None ☐ Fixed ☐ Configurable	Maximum Application Layer Re-tries: ☒ None ☐ Configurable
Requires Data Link Layer Confirmation: ☒ Never ☐ Always ☐ Sometimes ☐ Configurable	
Requires Application Layer Confirmation: ☐ Never ☐ Always ☒ When reporting Event Data ☐ When sending multi-fragment responses ☐ Sometimes ☐ Configurable	

Timeouts while waiting for:				
Data Link Confirm	☒ None	☐ Fixed	☐ Variable	☐ Configurable
Complete Appl. Fragment	☒ None	☐ Fixed	☐ Variable	☐ Configurable
Application Confirm	☐ None (fixed value is 5000 milliseconds)	☒ Fixed	☐ Variable	☐ Configurable
Complete Appl. Response	☒ None	☐ Fixed	☐ Variable	☐ Configurable
Others: (None)				

DNP 3.0: DEVICE PROFILE DOCUMENT (Continued)				
Executes Control Operations:				
Write Binary Outputs	☒ Never	❐ Always	❐ Sometimes	❐ Configurable
Select/Operate	☒ Never	❐ Always	❐ Sometimes	❐ Configurable
Direct Operate	❐ Never	☒ Always	❐ Sometimes	❐ Configurable
Direct Operate: No Ack	❐ Never	☒ Always	❐ Sometimes	❐ Configurable
Count > 1	☒ Never	❐ Always	❐ Sometimes	❐ Configurable
Pulse On	❐ Never	❐ Always	☒ Sometimes	❐ Configurable
Pulse Off	☒ Never	❐ Always	❐ Sometimes	❐ Configurable
Latch On	☒ Never	❐ Always	❐ Sometimes	❐ Configurable
Latch Off	☒ Never	❐ Always	❐ Sometimes	❐ Configurable
	No action is taken if Count is zero; Queue, Clear, Trip, Close, On-Time, and Off-Time fields are ignored			
Queue	☒ Never	❐ Always	❐ Sometimes	❐ Configurable
Clear Queue	☒ Never	❐ Always	❐ Sometimes	❐ Configurable

Reports Binary Input Change Events when no specific variations requested: ❐ Never ☒ Only time-tagged ❐ Only non-time-tagged ❐ Configurable to send both, one or the other	Reports time-tagged Binary Input Change Events when no specific variation requested: ❐ Never ☒ Binary Input Change With Time ❐ Binary Input Change With Relative Time ❐ Configurable
Sends Unsolicited Responses: ☒ Never ❐ Configurable ❐ Only certain objects ❐ Sometimes ❐ ENABLE/DISABLE UNSOLICITED Function codes supported	Sends Static Data in Unsolicited Responses: ☒ Never ❐ When Device Restarts ❐ When Status Flags Change
Default Counter Object/Variation: ❐ No Counters Reported ❐ Configurable ☒ Default Object / Default Variation ❐ Point-by-point list attached	Counters Roll Over at: ❐ No Counters Reported ❐ Configurable ☒ 16 Bits ☒ 32 Bits ❐ Other Value ❐ Point-by-point list attached
Sends Multi-Fragment Responses: ❐ Yes ☒ No	

7.4.2Implementation Table

The following table lists all objects recognized and returned by the PQMII. Additional information provided on the following pages includes lists of the default variations and defined point numbers returned for each object.

Implementation Table Notes:

1. For this object, the quantity specified in the request must be exactly 1 as there is only one instance of this object defined in the relay.
2. All static input data known to the relay is returned in response to a request for Class 0. This includes all objects of type 1 (Binary Input) and type 30 (Analog Input).

3. The point tables for Binary Input and Analog Input objects contain a field which defines which event class the corresponding static data has been assigned to.
4. For this object, the qualifier code must specify an index of 7 only.
5. Warm Restart (function code 14) is supported although it is not required by the DNP level 2 specification.
6. Object 1 Variation 1 always indicates On Line for all points.

Table 7–4: DNP Implementation Table

Object			Request		Response	
Obj	**Var**	**Description**	**Func Codes**	**Qual Codes (Hex)**	**Func Codes**	**Qual Codes (Hex)**
1	0	Binary Input - All Variations	1	06		
1	1	Binary Input	1	00, 01, 06	129	00, 01
1	2	Binary Input With Status (Note 6)	1	00, 01, 06	129	00, 01
2	0	Binary Input Change - All Variations	1	06, 07, 08		
2	1	Binary Input Change Without Time	1	06, 07, 08	129	17, 28
2	2	Binary Input Change With Time	1	06, 07, 08	129	17, 28
10	0	Binary Output - All Variations	1	06		
10	2	Binary Output Status	1	00, 01, 06	129	00, 01
12	1	Control Relay Output Block	3, 4, 5, 6	17, 28	129	17, 28
20	0	Binary Counter - All Variations	1, 7, 8, 9,10	06, 07, 08	129	00. 01
20	5	32-Bit Binary Counter Without Flag	1, 7, 8, 9, 10	06, 07, 08	129	00. 01
20	6	16-Bit Binary Counter Without Flag	1, 7, 8, 9, 10	06, 07, 08	129	00. 01
30	0	Analog Input - All Variations	1	06		
30	1	32-Bit Analog Input With Flag	1	00, 01, 06	129	00, 01
30	2	16-Bit Analog Input With Flag	1	00, 01, 06	129	00, 01
30	3	32-Bit Analog Input Without Flag	1	00, 01, 06	129	00, 01
30	4	16-Bit Analog Input Without Flag	1	00, 01, 06	129	00, 01
32	0	Analog Input Change - All Variations	1	06, 07, 08		
32	1	32-Bit Analog Input Change without Time	1	06, 07, 08	129	17, 28
32	2	16-Bit Analog Input Change without Time	1	06, 07, 08	129	17, 28
32	3	32-Bit Analog Input Change with Time	1	06, 07, 08	129	17, 28
32	4	16-Bit Analog Input Change with Time	1	06, 07, 08	129	17, 28
50	1	Time and Date	1, 2	07 (Note 1)	129	07
60	1	Class 0 Data (Note 2)	1	06	129	
60	2	Class 1 Data (Note 3)	1	06, 07, 08	129	
60	3	Class 2 Data (Note 3)	1	06, 07, 08	129	
60	4	Class 3 Data (Note 3)	1	06, 07, 08	129	
80	1	Internal Indications	2	00 (Note 4)	129	
		No object - Cold Start	13			
		No object - Warm Start (Note 5)	14			
		No object - enable unsolicited (parsed only)	20			
		No object - disable unsolicited (parsed only)	21			
		No object - Delay Measurement	23			

1, 2, 3, 4, 5, 6: see the IMPLEMENATION TABLE NOTES above.

7.4.3 Default Variations

The following table specifies the default variation for all objects returned by the relay. These are the variations that will be returned for the object in a response when no specific variation is specified in a request.

Table 7–5: Default Variations

Object	Description	Default Variation
1	Binary Input - Single Bit	1
2	Binary Input Change With Time	2
10	Binary Output Status	2
12	Control Relay Output Block	1
20	32-Bit Binary Counter Without Flag	5
30	16-Bit Analog Input Without Flag	2
32	16-Bit Analog Input Change Without Time	2

7.4.4 Internal Indication Bits

The following internal indication bits are supported:

Table 7–6: Internal Indication Bits

Character Position	Bit Position	Description
0	7	Device Restart: set when PQMII powers up, cleared by writing zero to object 80
0	4	Need Time -- set whenever the PQMII has a “CLOCK NOT SET” alarm, cleared by setting the clock
0	1	Class 1: indicates that class 1 events are available
0	2	Class 2: indicates that class 2 events are available
0	3	Class 3: indicates that class 2 events are available
1	3	Buffer Overflow: generally indicates that the host has not picked up the event data often enough

7.5 DNP Point Lists

7.5.1 Binary Input / Binary Input Change

The DNP point list for Binary Input / Binary Input Change Point List (objects 01 and 02, respectively), is shown below.

NOTE

This point is also reflected in the corresponding internal indication (IIN) bit in each response header.

Table 7–7: Binary Input / Binary Input Change Points (Sheet 1 of 4)

Index	Description	Event Class Assigned To
0	Alarm condition(s) active	Class 1
1	Clock not set *	Class 1
2	Clock drifting	Class 1
3	Internal error: ADC reference out of range	Class 1
4	Reserved	---
5	Internal error: switch input circuit fault	Class 1
6	PQMII (display) option installed **	Class 1
7	T20 (4-20 mA transducer) option installed **	Class 1
8	T1 (0-1 mA transducer) option installed **	Class 1
9	C (control) option installed **	Class 1
10	A (power analysis) option installed **	Class 1
11	Switch A closed	Class 1
12	Switch B closed	Class 1
13	Switch C closed	Class 1
14	Switch D closed	Class 1
15	Alarm relay energized	Class 1
16	Auxiliary relay 1 energized	Class 1
17	Auxiliary relay 2 energized	Class 1
18	Auxiliary relay 3 energized	Class 1
19	Aux 1 relay LED active	Class 1
20	Aux 2 relay LED active	Class 1

* This point is also reflected in the corresponding internal indication (IIN) bit in each response header.
** This point is not reflected in a Binary Input Change.

Table 7–7: Binary Input / Binary Input Change Points (Sheet 2 of 4)

Index	Description	Event Class Assigned To
21	Aux 3 relay LED active	Class 1
22	Alarm LED active	Class 1
23	Program LED active	Class 1
24	Simulation LED active	Class 1
25	Alarm relay LED active	Class 1
26	Self test LED active	Class 1
27	Reserved	---
28	Reserved	---
29	Reserved	---
30	Reserved	---
31	Reserved	---
32	Reserved	---
33	Reserved	---
34	Reserved	---
35	Alarm active: phase undercurrent	Class 1
36	Alarm active: phase overcurrent	Class 1
37	Alarm active: neutral overcurrent	Class 1
38	Alarm active: undervoltage	Class 1
39	Alarm active: overvoltage	Class 1
40	Alarm active: current unbalance	Class 1
41	Alarm active: voltage unbalance	Class 1
42	Alarm active: voltage phase reversal	Class 1
43	Alarm active: power factor lead alarm 1	Class 1
44	Alarm active: power factor lead alarm 2	Class 1
45	Alarm active: power factor lag alarm 1	Class 1
46	Alarm active: power factor lag alarm 2	Class 1
47	Alarm active: positive real power	Class 1
48	Alarm active: negative real power	Class 1
49	Alarm active: positive reactive power	Class 1

* This point is also reflected in the corresponding internal indication (IIN) bit in each response header.
** This point is not reflected in a Binary Input Change.

Table 7–7: Binary Input / Binary Input Change Points (Sheet 3 of 4)

Index	Description	Event Class Assigned To
50	Alarm active: negative reactive power	Class 1
51	Alarm active: underfrequency	Class 1
52	Alarm active: overfrequency	Class 1
53	Alarm active: real power demand	Class 1
54	Alarm active: reactive power demand	Class 1
55	Alarm active: apparent power demand	Class 1
56	Alarm active: phase A current demand	Class 1
57	Alarm active: phase B current demand	Class 1
58	Alarm active: phase C current demand	Class 1
59	Alarm active: Neutral demand	Class 1
60	Alarm active: switch A	Class 1
61	Alarm active: switch B	Class 1
62	Alarm active: switch C	Class 1
63	Alarm active: switch D	Class 1
64	Alarm active: internal fault	Class 1
65	Alarm active: serial COM1 failure	Class 1
66	Alarm active: serial COM2 failure	Class 1
67	Alarm active: clock not set	Class 1
68	Alarm active: parameters not set	Class 1
69	Alarm active: Pulse input 1	Class 1
70	Alarm active: current THD	Class 1
71	Alarm active: voltage THD	Class 1
72	Alarm active: analog input main	Class 1
73	Alarm active: analog input alt	Class 1
74	Alarm active: data log 1	Class 1
75	Alarm active: data log 2	Class 1
76	Alarm active: Negative real demand	Class 1
77	Alarm active: Negative reactive demand	Class 1
78	Alarm active: Pulse input 2	Class 1

* This point is also reflected in the corresponding internal indication (IIN) bit in each response header.
** This point is not reflected in a Binary Input Change.

Table 7–7: Binary Input / Binary Input Change Points (Sheet 4 of 4)

Index	Description	Event Class Assigned To
79	Alarm active: Pulse input 3	Class 1
80	Alarm active: Pulse input 4	Class 1
81	Alarm active: Pulse input total	Class 1
82	Alarm active: Time	Class 1

* This point is also reflected in the corresponding internal indication (IIN) bit in each response header.
** This point is not reflected in a Binary Input Change.

7.5.2 Binary Output / Control Relay Output

The DNP point list for Binary Outputs / Control Relay Outputs (objects 10 and 12, respectively) is shown below:

Table 7–8: Binary Output / Control Relay Output Points

Index	Description
0	Reset
1	Alarm relay on
2	Alarm relay off
3	Auxiliary relay 1 on
4	Auxiliary relay 1 off
5	Auxiliary relay 2 on
6	Auxiliary relay 2 off
7	Auxiliary relay 3 on
8	Auxiliary relay 3 off
9	Display 40 character flash message for 5 seconds (the display message must be set up using Modbus)
10	Clear energy values
11	Clear max. demand values
12	Clear min./max current values
13	Clear min./max voltage values
14	Clear min./max power values
15	Clear max. THD values
16	Clear switch input pulse count
17	Clear event record

Table 7–8: Binary Output / Control Relay Output Points

Index	Description
18	Simulate "MENU" keypress
19	Simulate "ESCAPE" keypress
20	Simulate "RESET" keypress
21	Simulate "ENTER" keypress
22	Simulate "MESSAGE UP" keypress
23	Simulate "MESSAGE DOWN" keypress
24	Simulate "MESSAGE LEFT" keypress
25	Simulate "MESSAGE RIGHT" keypress
26	Simulate "VALUE UP" keypress
27	Simulate "VALUE DOWN" keypress

NOTE

Index points 0 and 9 through 27 are not reflected in the Binary Output.

The following restrictions should be observed when using object 12 to control the points listed in the following table.

1. The **Count** field is checked first. If it is zero, the command will be accepted but no action will be taken. If this field is non-zero, the command will be executed exactly once regardless of its value.
2. The **Control Code** field of object 12 is then inspected:
   - A NUL Code will cause the command to be accepted without any action being taken.
   - A Code of "Pulse On" (1) is valid for all points. This is used to activate the function (e.g., Reset) associated with the point.
   - All other Codes are invalid and will be rejected.
   - The Queue, Clear, and Trip/Close sub-fields are ignored.
3. The **On Time** and **Off Time** fields are ignored. A "Pulse On" Code takes effect immediately when received. Thus, the timing is irrelevant.
4. The **Status** field in the response will reflect the success or failure of the control attempt thus:
   - A Status of "Request Accepted" (0) will be returned if the command was accepted.
   - A Status of "Request not Accepted due to Formatting Errors" (3) will be returned if the Control Code field was incorrectly formatted or an invalid Code was present in the command.
   - A Status of "Control Operation not Supported for this Point" (4) will be returned in response to a "Latch On" or "Latch Off" command

5. An operate of the Reset, alarm relay on/off or Aux Relay 1-3 on/off points may fail (even if the command is accepted) due to other inputs or conditions (e.g., alarm conditions) existing at the time. To verify the success or failure of an operate of these points it is necessary that the associated Binary Input(s) be examined after the control attempt is performed.
6. When using object 10 to read the status of a Binary Output, a read will always return zero.

7.5.3 Analog Input/Output Change

In the following point list for Analog Input/Output Change, the entry in the "Format" column indicates that the format of the associated data point can be determined by looking up the entry in *TABLE 7–2: Data Formats* on page 7–46. For example, an "F1" format is described in that table as a (16-bit) unsigned value without any decimal places. Therefore, the value read should be interpreted in this manner.

Table 7–9: Point List for Analog Input/Output Change (Sheet 1 of 6)

Point	Modbus Reg	Description	Unit / Value	Deadband	Format Code	Event Class Assigned To
0	1050	Phase CT Primary setpoint [1]	amps	1 unit	F1	3
1	1052	Neutral CT Primary setpoint [1]	amps	1 unit	F1	3
2	1054	VT Ratio setpoint [2]	0.1 × ratio	1 unit	F1	3
3	1055	VT Nominal Secondary Volts setpoint	volts	1 unit	F1	3
4	-	VT Nominal Ph-to-Ph Voltage [7] (VT Ratio × Nominal Sec. adjusted for wye or delta) [3]	32-bit volts	1 unit	F3	3
5	-	VT Nominal Phase-to-Neutral Voltage (VT Ratio × Nominal Sec. adjusted for wye or delta) [3]	32-bit volts	1 unit	F3	3
6	-	Nominal Single-Phase VA [4, 5] (VT Nominal Pri. × Phase CT Pri.)	32-bit VA	1 unit	F3	3
7	-	Nominal Three-Phase VA [5] (VT Nominal Pri. × Phase CT Pri. × 3)	32-bit VA	1 unit	F3	3
8	0240	Phase A Current	1000ths of nominal A	20 units	F1	1
9	0241	Phase B Current	1000ths of nominal	20 units	F1	1
10	0242	Phase C Current	1000ths of nominal	20 units	F1	1
11	0243	Average Current	1000ths of nominal	20 units	F1	1
12	0244	Neutral Current	1000ths of nominal	20 units	F1	1
13	0245	Current Unbalance	tenths of 1 percent	10 units	F1	2
14	0280	Voltage Van	1000ths of nominal V	20 units	F3	1
15	0282	Voltage Vbn	1000ths of nominal V	20 units	F3	1

footnote reference are located at the end of the table

Table 7–9: Point List for Analog Input/Output Change (Sheet 2 of 6)

Point	Modbus Reg	Description	Unit / Value	Deadband	Format Code	Event Class Assigned To
16	0284	Voltage Vcn	1000ths of nominal V	20 units	F3	1
17	0286	Average Phase Voltage	1000ths of nominal V	20 units	F3	1
18	0288	Voltage Vab	1000ths of nominal V	20 units	F3	1
19	028A	Voltage Vbc	1000ths of nominal V	20 units	F3	1
20	028C	Voltage Vca	1000ths of nominal V	20 units	F3	1
21	028E	Average Line Voltage	1000ths of nominal	20 units	F3	1
22	0290	Voltage Unbalance	0.1 x %	10 units	F1	2
23	02F0	3 Phase Real Power	1000ths of nominal VA	20 units	F4	2
24	02F2	3 Phase Reactive Power	1000ths of nominal VA	20 units	F4	2
25	02F4	3 Phase Apparent Power	1000ths of nominal VA	20 units	F3	2
26	02F6	3 Phase Power Factor	%	5 units	F2	2
27	02F7	Phase A Real Power	1000ths of nominal	20 units	F4	3
28	02F9	Phase A Reactive Power	1000ths of nominal	20 units	F4	3
29	02FB	Phase A Apparent Power	1000ths of nominal	20 units	F3	3
30	02FD	Phase A Power Factor	%	5 units	F2	3
31	02FE	Phase B Real Power	1000ths of nominal	20 units	F4	3
32	0300	Phase B Reactive Power	1000ths of nominal	20 units	F4	3
33	0302	Phase B Apparent Power	1000ths of nominal	20 units	F3	3
34	0304	Phase B Power Factor	%	5 units	F2	3
35	0305	Phase C Real Power	1000ths of nominal	20 units	F4	3
36	0307	Phase C Reactive Power	1000ths of nominal	20 units	F4	3
37	0309	Phase C Apparent Power	1000ths of nominal	20 units	F3	3
38	030B	Phase C Power Factor	%	5 units	F2	3
39	0400	Phase A Current Demand	1000ths of nominal	20 units	F1	3
40	0401	Phase B Current Demand	1000ths of nominal	20 units	F1	3
41	0402	Phase C Current Demand	1000ths of nominal	20 units	F1	3
42	0403	Neutral Current Demand	1000ths of nominal	20 units	F1	3
43	0404	3 Phase Real Power Demand	1000ths of nominal	20 units	F4	3
44	0406	3 Phase React Power Demand	1000ths of nominal	20 units	F4	3
45	0408	3 Phase Apparent Power Demand	1000ths of nominal	20 units	F3	3
46	0440	Frequency	0.01x Hz	.05 Hz	F1	1
47	0458	Main/Alternate Analog Input	Unit varies -- 32 bits	10	F3	2

footnote reference are located at the end of the table

Table 7–9: Point List for Analog Input/Output Change (Sheet 3 of 6)

Point	Modbus Reg	Description	Unit / Value	Deadband	Format Code	Event Class Assigned To
48	0470	Ia Crest Factor	0.001 x CF	-	F1	-
49	0471	Ib Crest Factor	0.001 x CF	-	F1	-
50	0472	Ic Crest Factor	0.001 x CF	-	F1	-
51	0473	Ia Trans Harmonic Derating Factor	0.001 x THDF	-	F1	-
52	0474	Ib Trans Harmonic Derating Factor	0.001 x THDF	-	F1	-
53	0475	Ic Trans Harmonic Derating Factor	0.001 x THDF	-	F1	-
54	0478	Phase A Current THD	0.1 x %	5.0%	F1	3
55	0479	Phase B Current THD	0.1 x %	5.0%	F1	3
56	047A	Phase C Current THD	0.1 x %	5.0%	F1	3
57	047B	Neutral Current THD	0.1 x %	5.0%	F1	3
58	047C	Voltage Van THD	0.1 x %	5.0%	F1	3
59	047D	Voltage Vbn THD	0.1 x %	5.0%	F1	3
60	047E	Voltage Vcn THD	0.1 x %	5.0%	F1	3
61	047F	Voltage Vab THD	0.1 x %	5.0%	F1	3
62	0480	Voltage Vbc THD	0.1 x %	5.0%	F1	3
63		Reserved				
64	04B4	Average Current THD	0.1 x %	5.0%	F1	3
65	04B5	Average Voltage THD	0.1 x %	5.0%	F1	3
66	0246	Phase A Current - Minimum	1000^{ths} of nominal A	1 unit	F1	3
67	0247	Phase B Current - Minimum	1000^{ths} of nominal A	1 unit	F1	3
68	0248	Phase C Current - Minimum	1000^{ths} of nominal A	1 unit	F1	3
69	0249	Neutral Current - Minimum	1000^{ths} of nominal A	1 unit	F1	3
70	024A	Current Unbalance - Minimum	tenths of 1 percent	1 unit	F1	3
71	024B	Phase A Current - Maximum	1000^{ths} of nominal A	1 unit	F1	3
72	024C	Phase B Current - Maximum	1000^{ths} of nominal A	1 unit	F1	3
73	024D	Phase C Current - Maximum	1000^{ths} of nominal A	1 unit	F1	3
74	024E	Neutral Current - Maximum	1000^{ths} of nominal A	1 unit	F1	3
75	024F	Current Unbalance - Maximum	tenths of 1 percent	1 unit	F1	3
76	0291	Voltage Van - Minimum	1000^{ths} of nominal V	1 unit	F3	3
77	0293	Voltage Vbn - Minimum	1000^{ths} of nominal V	1 unit	F3	3
78	0295	Voltage Vcn - Minimum	1000^{ths} of nominal V	1 unit	F3	3
79	0297	Voltage Vab - Minimum	1000^{ths} of nominal V	1 unit	F3	3

footnote reference are located at the end of the table

Table 7–9: Point List for Analog Input/Output Change (Sheet 4 of 6)

Point	Modbus Reg	Description	Unit / Value	Deadband	Format Code	Event Class Assigned To
80	0299	Voltage Vbc - Minimum	1000ths of nominal V	1 unit	F3	3
81	029B	Voltage Vca - Minimum	1000ths of nominal V	1 unit	F3	3
82	029D	Voltage Unbalance - Minimum	0.1 x %	1 unit	F1	3
83	029E	Voltage Van - Maximum	1000ths of nominal V	1 unit	F3	3
84	02A0	Voltage Vbn - Maximum	1000ths of nominal V	1 unit	F3	3
85	02A2	Voltage Vcn - Maximum	1000ths of nominal V	1 unit	F3	3
86	02A4	Voltage Vab - Maximum	1000ths of nominal V	1 unit	F3	3
87	02A6	Voltage Vbc - Maximum	1000ths of nominal V	1 unit	F3	3
88	02A8	Voltage Vca - Maximum	1000ths of nominal V	1 unit	F3	3
89	02AA	Voltage Unbalance - Maximum	0.1 x %	1 unit	F1	3
90	030C	3 Phase Real Power - Minimum	1000ths of nominal W	1 unit	F4	3
91	030E	3 Phase Reactive Power Minimum	1000ths of nom. kvar	1 unit	F4	3
92	0310	3 Phase Apparent Power Minimum	1000ths of nominal VA	1 unit	F3	3
93	0312	3 Phase Power Factor - Minimum	%	1 unit	F2	3
94	0313	3 Phase Real Power - Maximum	1000ths of nominal	1 unit	F4	3
95	0315	3 Phase Reactive Power Maximum	1000ths of nominal	1 unit	F4	3
96	0317	3 Phase Apparent Power Maximum	1000ths of nominal	1 unit	F3	3
97	0319	3 Phase Power Factor - Maximum	%	1 unit	F2	3
98	031A	Phase A Real Power - Minimum	1000ths of nominal	1 unit	F4	3
99	031C	Phase A Reactive Power Minimum	1000ths of nominal	1 unit	F4	3
100	031E	Phase A Apparent Power Minimum	1000ths of nominal	1 unit	F3	3
101	0220	Phase A Power Factor - Minimum	%	1 unit	F2	3
102	0321	Phase A Real Power - Maximum	1000ths of nominal	1 unit	F4	3
103	0323	Phase A Reactive Power Maximum	1000ths of nominal	1 unit	F4	3
104	0325	Phase A Apparent Power Maximum	1000ths of nominal	1 unit	F3	3
105	0327	Phase A Power Factor Maximum	%	1 unit	F2	3
106	0328	Phase B Real Power Minimum	1000ths of nominal	1 unit	F4	3
107	032A	Phase B Reactive Power Minimum	1000ths of nominal	1 unit	F4	3
108	032C	Phase B Apparent Power Minimum	1000ths of nominal	1 unit	F3	3

footnote reference are located at the end of the table

Table 7–9: Point List for Analog Input/Output Change (Sheet 5 of 6)

Point	Modbus Reg	Description	Unit / Value	Deadband	Format Code	Event Class Assigned To
109	032E	Phase B Power Factor Minimum	%	1 unit	F2	3
110	032F	Phase B Real Power Maximum	1000ths of nominal	1 unit	F4	3
111	0331	Phase B Reactive Power Maximum	1000ths of nominal	1 unit	F4	3
112	0333	Phase B Apparent Power Maximum	1000ths of nominal	1 unit	F3	3
113	0335	Phase B Power Factor Maximum	%	1 unit	F2	3
114	0336	Phase C Real Power Minimum	1000ths of nominal	1 unit	F4	3
115	0338	Phase C Reactive Power Minimum	1000ths of nominal	1 unit	F4	3
116	033A	Phase C Apparent Power - Minimum	1000ths of nominal	1 unit	F3	3
117	033C	Phase C Power Factor Minimum	%	1 unit	F2	3
118	033D	Phase C Real Power Maximum	1000ths of nominal	1 unit	F4	3
119	033F	Phase C Reactive Power Maximum	1000ths of nominal	1 unit	F4	3
120	0341	Phase C Apparent Power Maximum	1000ths of nominal	1 unit	F3	3
121	0343	Phase C Power Factor Maximum	%	1 unit	F2	3
122	040A	Phase A Current Demand Maximum	1000ths of nominal	1 unit	F1	3
123	040B	Phase B Current Demand Maximum	1000ths of nominal	1 unit	F1	3
124	040C	Phase C Current Demand Maximum	1000ths of nominal	1 unit	F1	3
125	040D	Neutral Current Demand Maximum	1000ths of nominal	1 unit	F1	3
126	040E	3 Phase Real Power Dmd Max	1000ths of nominal	1 unit	F4	3
127	0410	3 Phase React Power Dmd Max	1000ths of nominal	1 unit	F4	3
128	0412	3 Phase Apparent Power Dmd Max	1000ths of nominal	1 unit	F3	3
129	0441	Frequency Minimum	0.01 x Hz	.01 Hz	F1	3
130	0442	Frequency Maximum	0.01 x Hz	.01 Hz	F1	3
131	0482	Phase A Current THD - Maximum	0.1 x %	1 unit	F1	3
132	0483	Phase B Current THD - Maximum	0.1 x %	1 unit	F1	3
133	0484	Phase C Current THD - Maximum	0.1 x %	1 unit	F1	3
134	0485	Neutral Current THD - Maximum	0.1 x %	1 unit	F1	3
135	0486	Voltage Van THD - Maximum	0.1 x %	1 unit	F1	3
136	0487	Voltage Vbn THD - Maximum	0.1 x %	1 unit	F1	3
137	0488	Voltage Vcn THD - Maximum	0.1 x %	1 unit	F1	3

footnote reference are located at the end of the table

Table 7–9: Point List for Analog Input/Output Change (Sheet 6 of 6)

Point	Modbus Reg	Description	Unit / Value	Deadband	Format Code	Event Class Assigned To
138	0489	Voltage Vab THD - Maximum	0.1 x %	1 unit	F1	3
139	048A	Voltage Vbc THD - Maximum	0.1 x %	1 unit	F1	3
140		Reserved				
141	04C8	ADC Reference	-	20 units	F1	2
142	04CB	Current Key Press	-	1 unit	F8[1]	2
143	04CC	Internal Fault Error Code	-	1 unit	F108	2
144	0000	GE Multilin Product Device Code	always 73	-	F1	-
145	0001	Hardware Version Code	-	-	F5	-
146	0002	Main Software Version Code	-	-	F1	-
147	0003	Modification File Number 1	-	-	F1	-
148	0004	Boot Software Version Code	-	-	F1	-
149	0007	Modification File Number 2	-	-	F1	-
150	0008	Modification File Number 3	-	-	F1	-
151	0009	Modification File Number 4	-	-	F1	-
152	000A	Modification File Number 5	-	-	F1	-
153	0020	Serial Number Character 1 and 2	-	-	F10	-
154	0021	Serial Number Character 3 and 4	-	-	F10	-
155	0022	Serial Number Character 5 and 6	-	-	F10	-
156	0023	Serial Number Character 7 and 8	-	-	F10	-
157	0030	Manufacture Month/Day	-	-	F24	-
158	0031	Manufacture Year	-	-	F25	-
159	0032	Calibration Month/Day	-	-	F24	-
159	0033	Calibration Year	-	-	F25	-
footnote reference are located at the end of the table						

1. This point is used to reconstruct current values from the 1,000ths per-unit quantities given in the other points. Multiply the particular point by this one, and divide by 1000 to get amps.

   For example, given a CT primary setpoint value of 3000 and an actual phase A current reading from the DUT of 1077 A, the reconstructed phase A current is:

$$\text{Ia(reconstructed)} = \frac{\text{Point 0} \times \text{Point 8}}{1000} = \frac{3000 \times 359}{1000} = 1077\text{ A}$$

2. The VT Ratio setpoint is always reported, but is not used if a direct (i.e., without VTs) voltage wiring scheme is configured. In this case the VT Ratio setpoint is ignored, and a ratio of 1.0:1 is used in the PQMII.
3. This point is used to reconstruct voltage values from the 1,000ths per-unit quantities given in the other points. Multiply the particular point by this one, and divide by 1000 to get volts. Since some SCADA systems do not read 32 bit values, you can also multiply the VT ratio and nominal secondary (both of which are 16 bit) in the master in cases where the nominal primary may exceed 32767 volts.

   For example, given a VT ratio of 300:1, a VT nominal secondary volts setting of 115 V, and an actual phase-neutral voltage reading from the DUT of 19919 V, we have:

$$\text{Van(reconstructed)} = \frac{\text{Point 5} \times \text{Point 14}}{1000} = \frac{577 \times 34500}{1000} = 19.91\text{ kV}$$

$$\text{Vbn(reconstructed)} = \frac{\text{Point 5} \times \text{Point 18}}{1000} = \frac{577 \times 59756}{1000} = 34.50\text{ kV}$$

4. This point is used to reconstruct power values from the 1,000ths per-unit quantities given in the other points. Multiply the particular point by this one, and divide by 1000 to get VA, kW or kvar.
5. The maximum value for Nominal Single-Phase VA and Nominal Three-Phase VA is 983010000 VA. When this value is over-range, it will indicate "1"; in this case, the DNP power values become the actual value and no formula is used.
6. In Modbus, the current keypress is reported with format code F6. In order to fit the value into a sixteen-bit signed value, F8 is used in DNP, with ASCII zero (48 decimal) returned when no key is pressed.
7. This point is not used for reconstructing any voltage values. The $\sqrt{3}$ difference between phase-to-phase and phase-to-neutral values is accounted for in the actual voltage points themselves. The VT nominal phase-to-neutral voltage (point 5) is used to reconstruct all voltage values.

7.5.4 Counters

The DNP point list for Binary Counters (object 20) is shown below:

Table 7–10: Counters Point List

Point Num	Modbus Register	Description	Unit	Format code
0	0450	Pulse Input 1	-	F3
1	0452	Pulse Input 2	-	F3
2	0454	Pulse Input 3	-	F3
3	0456	Pulse Input 4	-	F3
4	0460	Totalized Pulse Input	-	F3
5	03D0	3 Phase Positive Real Energy Used	kWh	F3
6	03D2	3 Phase Negative Real Energy Used	kWh	F3
7	03D4	3 Phase Positive React. Energy Used	kvarh	F3
8	03D6	3 Phase Negative React. Energy Used	kvarh	F3
9	03D8	3 Phase Apparent Energy Used	kVAh	F3
10	03DA	3 Phase Energy Used in Last 24 h	kWh	F3
11	03DC	3 Phase Energy Cost Since Reset	cents	F3
12	03DE	3 Phase Energy Cost Per Day	cents	F3

NOTE

Only counter points 0 to 4 can be cleared using function codes 9 and 10, and doing so disturbs the totals presented on the display and via Modbus communications. In general, the binary output points which clear data should be used if it is necessary to clear any of these counters.

GE Consumer & Industrial
Multilin

PQMII Power Quality Meter

Chapter 8: Applications

8.1 Event Recorder

8.1.1 List of Events

The Event Recorder stores all online data in a section of non-volatile memory when triggered by an event. The PQMII defines any of the following situations as an event:

Analog Input Alternate Alarm

Analog Input Alternate Alarm Clear

Analog Input Main Alarm

Analog Input Main Alarm Clear

Clear Event Record

Clock Not Set Alarm

Clock Not Set Alarm Clear

COM1 Fail Alarm

COM1 Fail Alarm Clear

COM2 Fail Alarm

COM2 Fail Alarm Clear

Current THD Alarm

Current THD Alarm Clear

Current Unbalance Alarm

Current Unbalance Alarm Clear

Data Log 1 Alarm

Data Log 1 Alarm Clear

Data Log 2 Alarm

Data Log 2 Alarm Clear

kVA Demand Alarm

kVA Demand Alarm Clear

Negative kvar Alarm

Negative kvar Alarm Clear

Negative kvar Demand Alarm

Negative kvar Demand Alarm Clear

Negative kW Alarm

Negative kW Alarm Clear

Negative kW Demand Alarm

Negative kW Demand Alarm Clear

Neutral Current Demand Alarm

Neutral Current Demand Alarm Clear

Neutral Overcurrent Alarm

Neutral Overcurrent Alarm Clear

Overcurrent Alarm

Overcurrent Alarm Clear

Overfrequency Alarm

Overfrequency Alarm Clear

Overvoltage Alarm

Overvoltage Alarm Clear

Parameters Not Set Alarm

Parameters Not Set Alarm Clear

Phase A Current Demand Alarm

Phase A Current Demand Alarm Clear

Phase B Current Demand Alarm

Phase B Current Demand Alarm Clear

Phase C Current Demand Alarm

Phase C Current Demand Alarm Clear

Phase Reversal Alarm

Phase Reversal Alarm Clear

Positive kvar Alarm

Positive kvar Alarm Clear

Positive kvar Demand Alarm

Positive kvar Demand Alarm Clear

Positive kW Alarm

Positive kW Alarm Clear

Positive kW Demand Alarm

Positive kW Demand Alarm Clear

Power Factor Lag 1 Alarm

Power Factor Lag 1 Alarm Clear

Power Factor Lag 2 Alarm

Power Factor Lag 2 Alarm Clear

Power Factor Lead 1 Alarm

Power Factor Lead 1 Alarm Clear

Power Factor Lead 2 Alarm

Power Factor Lead 2 Alarm Clear

Power Off

Power On

Pulse Count Total Alarm

Pulse Input 1 Alarm

Pulse Input 1 Alarm Clear

Pulse Input 2 Alarm

Pulse Input 2 Alarm Clear

Pulse Input 3 Alarm

Pulse Input 3 Alarm Clear

Pulse Input 4 Alarm

Pulse Input 4 Alarm Clear

Pulse Input Total Alarm Clear

Reset

Self Test Alarm

Self Test Alarm Clear

Setpoint Access Enabled

Switch A Alarm

Switch A Alarm Clear

Switch B Alarm

Switch B Alarm Clear

Switch C Alarm

Switch C Alarm Clear

Switch D Alarm

Switch D Alarm Clear

Time Alarm

Time Alarm Clear

Trace Memory Trigger

Undercurrent Alarm

Undercurrent Alarm Clear

Underfrequency Alarm

Up to 150 events can be stored in non-volatile memory for retrieval and review. The Event Recorder can be enabled, disabled, or cleared via the keypad or serial port. The following data is saved when an event occurs:

Analog Input (high)

Analog Input (low)

Date - Month/Day

Date - Year

Event Cause

Event Number

Frequency

I Unbalance

Ia

Ia Demand

Ia THD

Ib

Ib Demand

Ib THD

Ic

Ic Demand

Ic THD

In

In Demand

In THD

Internal Fault Error Code

kVAh (high)

kVAh (low)

Negative kvarh (high)

Negative kvarh (low)

Negative kWh (low)

Negative kWh (high)

P3 (high)

P3 (low)

P3 Demand (high)

P3 Demand (low)

Pa (high)

Pa (low)

Pb (high)

Pb (low)

Pc (high)

Pc (low)

PF3

PFa

PFb

PFc

Positive kvarh (high)

Positive kvarh (low)

Positive kWh (high)

Positive kWh (low)

Q3 (high)

Q3 (low)

Q3 Demand (high)

Q3 Demand (low)

Qa (high)

Qa (low)

Qb (high)

Qb (low)

Qc (high)

Qc (low)

S3 (high)

S3 (low)

S3 Demand (high)

S3 Demand (low)

Sa (low)

Sa (high)

Sb (high)

Sb (low)

Sc (high)

Sc (low)

Switches and Relays States

Time - Hours/Minutes

Time - Seconds

Trace Memory Trigger Cause

Underfrequency Alarm Clear

Undervoltage Alarm

Undervoltage Alarm Clear

V Unbalance

Vab (high)

Vab (low)

Vab THD

Van (high)

Van (low)

Van THD

Vbc (high)

Vbc (low)

Vbc THD

Vbn (high)

Vbn (low)

Vbn THD

Vca (high)

Vca (low)

Vcn (high)

Vcn (low)

Vcn THD

Voltage THD Alarm

Voltage THD Alarm Clear

Voltage Unbalance Alarm

Voltage Unbalance Alarm Clear

8.1.2 Access to Event Recorder Information

There are two ways to access Event Recorder Information:

- Access only the Records and data you wish to view
- Access the entire Event Record.

The Event Recorder is indexed by Event Number (1 to 150). To access a specific Event, the Event Number must be written to the PQMII memory map location 12C0h. The data specific to that Event can be read starting at memory map location 0AE0h. The specific

Event Number must be known to read the Event Recorder in this fashion. However, this Event Number is usually not known and the entire Event Record must be read. The easiest way to do this is to read the PQMII Memory Map location 0AD0h (Total Number of Events Since Last Clear) and loop through each Event Number indicated by the value from 0AD0h, reading the associated data pertaining to each Event. This requires 1 to 150 serial reads of 170 bytes each. Once this data is obtained, it can be interpreted based upon the format of each value as described in *Modbus Memory Map* on page 7–9. It is important to note that some memory map parameters are 32 bits (4 bytes) long and require 2 registers to contain their value, one for the two high bytes and one for the two low bytes.

NOTE

The operation of the Voltage Disturbance Recorder is similar to the Event Recorder. The differences between the two recorders are the Modbus addresses, the event data, and the number of events (150 compared to 500). Refer to the *Modbus Memory Map* on page 7–9 for additional details.

8.2 Interfacing Using Hyperterminal

8.2.1 Upgrading Firmware

When upgrading firmware, the PQMII may appear to lockup if there is an interruption on the communication port during the upload process. If the PQMII does not receive the necessary control signals for configuration during firmware upload, it could remain in a halted situation until reinitialized. The steps used by the EnerVista PQMII Setup Software to upload firmware to the PQMII are as follows:

1. Prepare the PQMII for firmware upgrade by saving setpoints to a file.
2. Erase the flash memory and verify it to be blank.
3. Upload the new firmware.
4. Verify the CRC when upload is complete.
5. Run the new code.

If the PQMII is interrupted prior to erasing the flash memory, it could be halted in a mode where the display will read **PQMII FLASH LOADER ENTER TEXT "LOAD"**.

If the computer being used to upload firmware has a screen saver enabled, and the screen saver operates during the upload process, the communication port will be interrupted during the launch of the screen saver. It is recommended to disable any screen saver prior to firmware upload.

There are two ways to alleviate this condition: one is to cycle power to the PQMII; the second is to interface with the PQMII using a terminal program, such as Hyperterminal, and perform the upload process manually.

8.2.2 Cycling Power

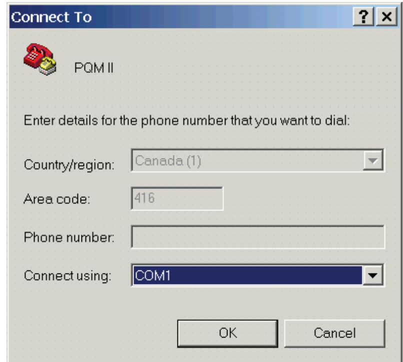
Remove and then re-apply control power to the PQMII. The PQMII should then run the existing firmware in its flash memory. If the PQMII does not run the firmware in flash memory, attempt the second method using Hyperterminal.

8.2.3 Hyperterminal

Hyperterminal is a terminal interface program supplied with Microsoft Windows. The following procedure describes how to setup Hyperterminal.

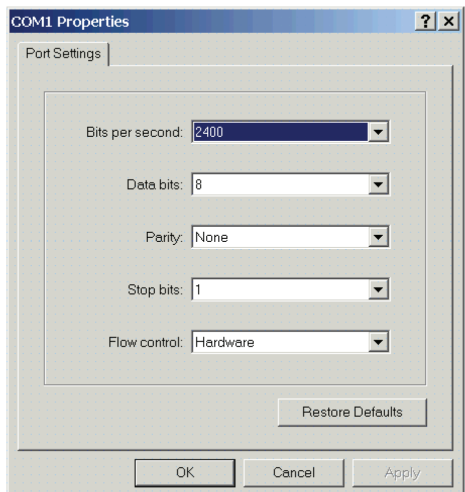
▷ **Run the program "hypertrm.exe" which is usually located in the Accessories folder of your PC.**

▷ **A Connection window will appear asking for a name. Use a name such as "PQMII" for the connection and click on OK. The following window appears.**



▷ Select the communications port of your PC that is connected to the PQMII.

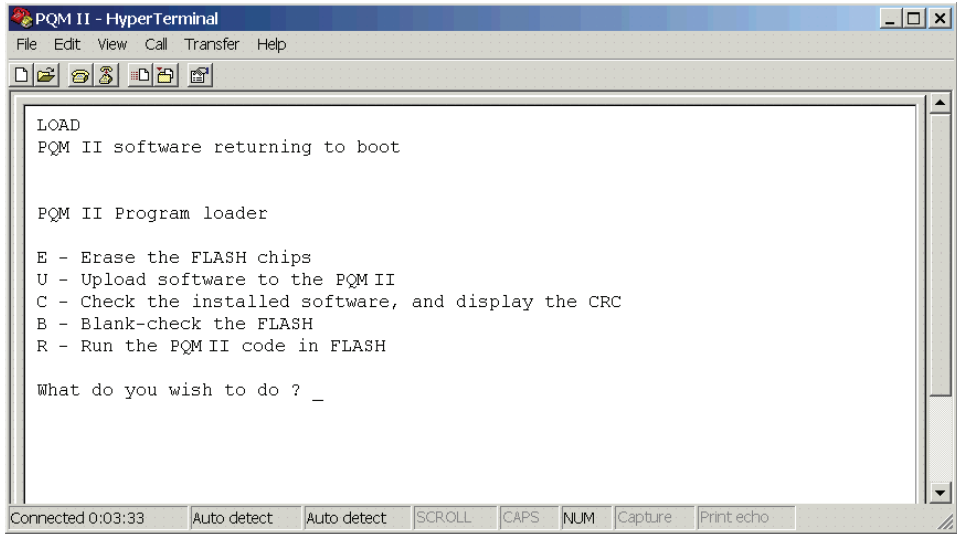
▷ Click on **OK**.
The following window will appear.



▷ Change the settings in the Properties window to match those shown above.

▷ Click on **OK**.
You should now have a link to the PQMII.

▷ Enter the text **LOAD** in uppercase in the text window of Hyperterminal.
The PQMII Boot Menu should appear in the text window.



- ▷ Type "**E**" to Erase the PQMII flash memory.
  Hyperterminal will ask you to verify that you wish to erase the flash memory; enter "**Y**" for yes. The Boot Menu appears again when complete.
- ▷ Now select "**B**" to blank check the flash memory.
  The PQMII Boot Menu will appear again when complete.
- ▷ Type "**U**" to upload software to the PQMII.
  The PQMII is now waiting for a firmware file.
- ▷ Select **Transfer** then **Send File** on the Hyperterminal task bar.
- ▷ Enter the location and the name of the firmware file you wish to send to the PQMII, and ensure the Protocol is **1KXmodem**.
- ▷ Click on **Send**.
  The PQMII will now proceed to receive the firmware file, this usually takes 3 to 4 minutes. When complete the Boot Menu will again appear.
- ▷ Type "**C**" to check the installed firmware.
- ▷ Type "**R**" to run the flash.
- ▷ If the CRC check is bad, erase the flash and re-install the firmware. If numerous bad CRC checks are encountered, it is likely that the file you are attempting to load is corrupted. Obtain a new file and try again. If attempts to use Hyperterminal are unsuccessful, consult the factory.

8.3 Phasor Implementation

8.3.1 Theory of Phasor Implementation

The purpose of the function Calc_Phasors within the PQMII firmware is to take a digitally sampled periodic signal and generate the equivalent phasor representation of the signal. In the conventional sense, a phasor depicts a purely sinusoidal signal which is what we're interested in here; we wish to calculate the phasor for a given signal at the fundamental power system frequency. The following Discrete Fourier Series equations calculate the phasor in rectangular co-ordinates for an arbitrary digitally sampled signal. The justification for the equations is beyond the scope of this document but can be found in some form in any text on signal analysis.

$$\text{Re}(g) = \frac{2}{n}\sum_{n=0}^{N-1} g_n \cdot \cos(\omega_0 nT)\ ;\quad \text{Im}(g) = \frac{2}{n}\sum_{n=0}^{N-1} g_n \cdot \sin(\omega_0 nT) \qquad \textbf{(EQ 0.1)}$$

where: Re(g) = real component of phasor
Im(g) = imaginary component of phasor
g = set of N digital samples = $\{g_0, g_1, \ldots, g_{N-1}\}$
g_n = nth sample from g
N = number of samples
f_0 = fundamental frequency in Hertz
$\omega_0 = 2\pi f_0$ = angular frequency in radians
$T = 1/(f_0 N)$ = time between samples

The PQMII Trace Memory feature is employed to calculate the phasors. The Trace Memory feature samples 16 times per cycle for two cycles for all current and voltage inputs. Substituting N = 16 (samples/cycle) into the equations yields the following for the real and imaginary components of the phasor:

$$\text{Re}(g) = \frac{1}{8}\left(g_0\cos 0 + g_1\cos\frac{\pi}{8} + g_2\cos\frac{2\pi}{8} + \ldots + g_{31}\cos\frac{31\pi}{8}\right) \qquad \textbf{(EQ 0.2)}$$

$$\text{Im}(g) = \frac{1}{8}\left(g_0\sin 0 + g_1\sin\frac{\pi}{8} + g_2\sin\frac{2\pi}{8} + \ldots + g_{31}\sin\frac{31\pi}{8}\right) \qquad \textbf{(EQ 0.3)}$$

The number of multiples in the above equation can be reduced by using the symmetry inherent in the sine and cosine functions which is illustrated as follows:

$$\begin{aligned} \cos\phi &= -\cos(\pi-\phi) = -\cos(\pi+\phi) = \cos(2\pi-\phi) \\ \sin\phi &= \sin(\pi-\phi) = -\sin(\pi+\phi) = -\sin(2\pi-\phi) \\ \cos\phi &= \sin\left(\frac{\pi}{2}-\phi\right) \end{aligned} \qquad \textbf{(EQ 0.4)}$$

Let $k_1 = \cos(\pi/8)$, $k_2 = \cos(\pi/4)$, $k_3 = \cos(3\pi/8)$; the equations for the real and imaginary components are reduced to:

$$\begin{aligned} \text{Re}(g) = \frac{1}{8}(&k_1(g_1 - g_7 - g_9 + g_{15} + g_{17} - g_{23} - g_{25} + g_{31}) \\ &+ k_2(g_2 - g_6 - g_{10} + g_{14} + g_{18} - g_{22} - g_{26} + g_{30}) \\ &+ k_3(g_3 - g_5 - g_{11} + g_{13} + g_{19} - g_{21} - g_{27} + g_{29}) + (g_0 - g_8 + g_{16} - g_{24})) \end{aligned} \qquad \textbf{(EQ 0.5)}$$

$$\mathrm{Im}(g) = \frac{1}{8}(k_1(g_3 + g_5 - g_{11} - g_{13} + g_{19} + g_{21} - g_{27} - g_{29}) \\ + k_2(g_2 + g_6 - g_{10} - g_{14} + g_{18} + g_{22} - g_{26} - g_{30}) \\ + k_3(g_1 + g_7 - g_9 - g_{15} + g_{17} + g_{23} - g_{25} - g_{31}) + (g_4 - g_{12} + g_{20} - g_{28})) \quad \textbf{(EQ 0.6)}$$

The number of subtractions can be reduced between the calculations of real and imaginary components by not repeating the same subtraction twice. The following subtractions are repeated:

$$\begin{array}{llll} \Delta_0 = g_0 - g_8 & \Delta_1 = g_1 - g_9 & \Delta_2 = g_2 - g_{10} & \Delta_3 = g_3 - g_{11} \\ \Delta_4 = g_4 = g_{12} & \Delta_5 = g_5 - g_{13} & \Delta_6 = g_6 - g_{14} & \Delta_7 = g_7 - g_{15} \\ \Delta_8 = g_{16} - g_{24} & \Delta_9 = g_{17} - g_{25} & \Delta_{10} = g_{18} - g_{26} & \Delta_{11} = g_{19} - g_{27} \\ \Delta_{12} = g_{20} - g_{28} & \Delta_{13} = g_{21} - g_{29} & \Delta_{14} = g_{22} - g_{30} & \Delta_{15} = g_{23} - g_{31} \end{array} \quad \textbf{(EQ 0.7)}$$

Substituting in the above 'delta' values results in the form of the equations that will be used to calculate the phasors:

$$\mathrm{Re}(g) = \frac{1}{8}(\Delta_0 + \Delta_8 + k_1(\Delta_1 - \Delta_7 + \Delta_9 - \Delta_{15}) + k_3(\Delta_3 - \Delta_5 + \Delta_{11} - \Delta_{13})) \\ \mathrm{Im}(g) = \frac{1}{8}(\Delta_4 + \Delta_{12} + k_1(\Delta_3 + \Delta_5 + \Delta_{11} + \Delta_{13}) + k_2(\Delta_1 + \Delta_7 + \Delta_9 + \Delta_{15})) \quad \textbf{(EQ 0.8)}$$

8.4 Triggered Trace Memory

8.4.1 Description

The Triggered Trace Memory can be used to detect and record system disturbances. The PQMII uses a dedicated continuous sampling rate of 16 samples per cycle to record fluctuations in voltage or current as per user defined levels. The PQMII calculates the true RMS value of one consecutive cycle, or 16 samples, and compares this value with the user-defined trigger levels to determine if it will record all sampled waveforms. The sampled waveforms include Ia, Ib, Ic, In, Va, Vb and Vc.

Since the PQMII requires a minimum 20 V for detection and has an upper voltage input limit of 600 V, the following limitation exists for the Trace Memory undervoltage and overvoltage trigger levels:

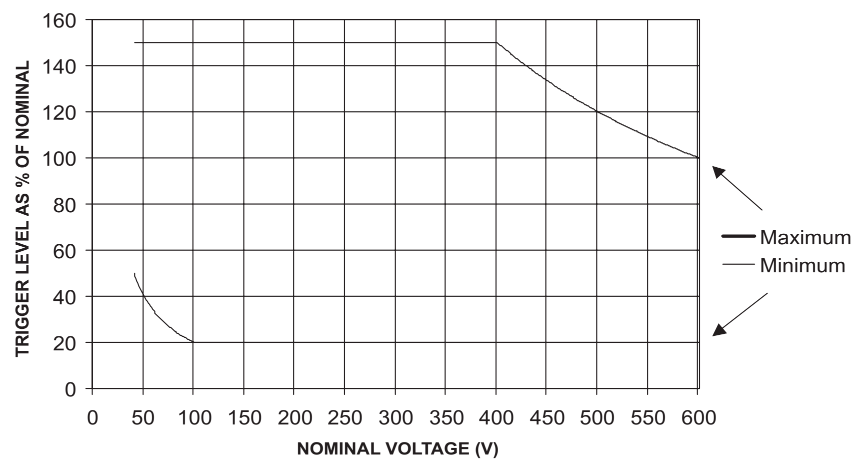


FIGURE 8–1: Trace Memory Phase Voltage Trigger Level Limits

8.5 Pulse Output

8.5.1 Pulse Output Considerations

Up to 4 SPDT Form C output relays are configurable as Pulse Initiators based on energy quantities calculated by the PQMII. Variables to consider when using the PQMII as a Pulse Initiator are:

- **PQMII Pulse Output Parameter**: The PQMII activates the assigned output relay based upon the energy quantity used as the base unit for pulse initiation. These energy quantities include ±kWhr, ±kVARh, and kVAh.
- **PQMII Pulse Output Interval**: The PQMII activates the assigned output relay at the accumulation of each Pulse Output Interval as defined by the user. This interval is based upon system parameters such that the PQMII pulse output activates at a rate not exceeding the Pulse Acceptance Capability of the end receiver.
- **PQMII Pulse Output Width**: This user defined parameter defines the duration of the pulse initiated by the PQMII when a quantity of energy equal to the Pulse Output Interval has accumulated. It is based upon system parameters such that the PQMII pulse output will activate for a duration that is within the operating parameters of the end receiver.
- **PQMII Output Relay Operation**: This user defined parameter defines the normal state of the PQMII output relay contacts, i.e. Fail-safe or Non-Failsafe.
- **Pulse Acceptance Capability of the End Receiver**: This parameter is normally expressed as any one of the following: (a) Pulses per Demand Interval; (b) Pulses per second, minute or hour; (c) Minimum time between successive closures of the contacts.
- **Type of Pulse Receiver**: There are 4 basic types of Pulse receivers: a) Three-wire, every pulse counting; b) Three-wire, every other pulse counting; c) Two-wire, Form A normally open, counts only each contact closure; d) Two-wire, counts every state change, i.e. recognizes both contact closure and contact opening.
- **Maximum Energy Consumed over a Defined Interval**: This is based upon system parameters and defines the maximum amount of energy that may be accumulated over a specific time.

8.5.2 Connecting to an End Receiver Using KYZ Terminals

Typical end receivers require a contact closure between KY or KZ based upon the type of receiver. The PQMII Pulse Output feature can be used with either two- or three-wire connections. The PQMII activates the designated Output Relay at each accumulation of the defined Pulse Output Interval for the defined Pulse Output Width. Therefore, each PQMII contact operation represents one interval. For end receivers that count each closure and opening of the output contacts, the PQMII Pulse Output Interval should be adjusted to match the registration of the end receiver. For example, if the end receiver counts each closure as 100 kWh and each opening as 100 kWh, the PQMII Pulse Output Interval should be set to 200 kWh.

The PQMII Output Relays can be configured as Failsafe or Non-Failsafe to match the normally open/closed configuration of the KY and KZ connections at the end receiver. The K connection is always made to the COM connection of the designated PQMII output relay, and the Y and Z connections can be made to the N/O or N/C connections based upon the type of end receiver.

8.6 Data Logger Implementation

8.6.1 Data Logger Structure

The Data Logger allows various user defined parameters to be continually recorded at a user-defined rate. The Data Logger uses 64 samples/cycle data. The PQMII has allocated 196608 bytes of memory for Data Log storage. The memory structure is partitioned into 1536 blocks containing 64×2 byte registers as shown below:

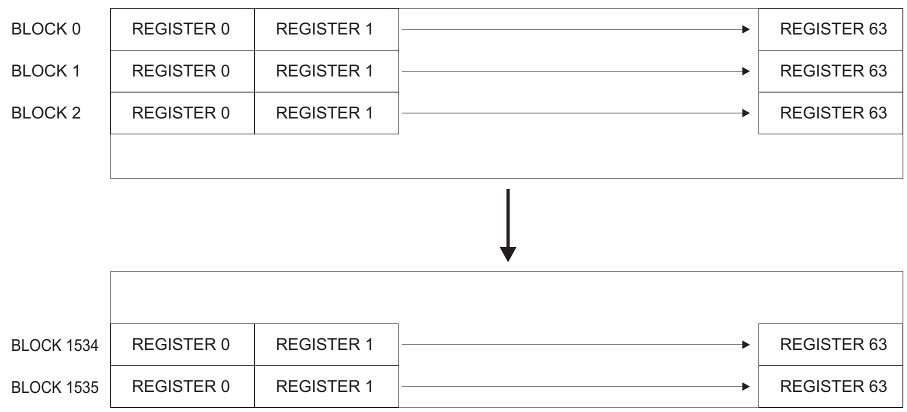


FIGURE 8–2: Data Logger Memory Structure

Each entry into the Data Log is called a Record. The Record can vary in size depending upon the parameters the user wishes to log. The memory structure can also be partitioned into 2 separate Data Logs. The size of the 2 logs is user-definable. The top of each Data Log contains what is called the Header. Each Data Log Header contains the following information:

- **Log Time Interval**: The user-defined interval that the data log stores entries.
- **Present Log Time and Date**: The time and date of the most recent Record.
- **Log Start Block #**: Block number containing the first byte of the logged data.
- **Log Start Register #**: The Register number containing the first two bytes of the logged data.
- **Log Record Size**: The size of each Record entry into the Data Log based upon the user-defined Data Log structure.
- **Log Total Records**: The total number of records available based upon the user defined Data Log parameter structure.
- **Block number of First Record**: A pointer to the block containing the first record in the Data Log.
- **Register number of First Record**: A pointer to the register containing the first record in the Data log.
- **Log Pointer to First Item of First Record**: A pointer to the first record in the Data Log.
- **Block number of Next Record to Write**: A pointer to the block containing the last record in the Data Log.

- **Register number of Next Record to Write**: A pointer to the register containing the last record in the Data Log.
- **Log Pointer to First Item of Record After Last**: A pointer to the next record to be written into the Data Log.
- **Log Status: The current status of the Data Log**; i.e.: Running or Stopped.
- **Log Records Used**: The number of records written into the Data Log.
- **Log Time Remaining Until Next Reading**: A counter showing how much time remains until the next record is to be written into the Data Log.

8.6.2 Modes of Operation

The Data Logger has 2 modes of operation, Run to Fill and Circulate. In the Run to Fill mode, the Data Log will stop writing records into the memory structure when there is not enough memory to add another record. Depending on the size of each record, the Data Log may not necessarily use the entire 196,608 bytes of storage available. In the Circulate mode, the Data Log will continue to write new Records into the Log beyond the last available Record space. The Log will overwrite the first Record after the Header and continue to overwrite the Records to follow until the user wishes to stop logging data. The Log will act as a rolling window of data in time, going back in time as far as the amount of records times the Log Time Interval will allow in the total space of memory available.

8.6.3 Accessing Data Log Information

The Data Log can be accessed using the EnerVista PQMII Setup Software or manually via the serial port. Access via the EnerVista PQMII Setup Software is described in *Data Logger* on page 4–12. Access manually via the serial port as follows:

1. Set the Block of data you wish to access at 1268h in the PQMII Memory Map.
2. Read the required amount of data from the 64 Registers in the Block.

Accessing the Data Log in this manner assumes that the user knows which Block they wish to access, and knows the size of each Record based upon the parameters they have selected to log.

The easiest way to access the data in the Data Log is to read the entire log and export this data into a spreadsheet for analysis. This requires defining the Block to be read, starting at Block 0, and reading all 128 bytes of data in each of the 64 Registers within the Block. You would then define Blocks 1, 2, 3, etc., and repeat the reading of the 64 Registers for each block, until Block 1535. This requires 1536 reads of 128 bytes each. The data can then be interpreted based upon the parameter configuration.

8.6.4 Interpreting Data Log Information

Using two (2) Data Logs in the “Run to Fill” mode, the Data Log is configured as shown below.

Blocks 0 and 1 are reserved for Data Logger Data Interval information. Block 2 contains header information for both Data Logs. The first 32 registers of Block 2 are reserved for Data Log 1 header information, and the remaining 32 registers are reserved for Data Log 2 header information. The first register of Data Log information resides at Register 0 of Block 3. This leaves 196224 bytes of data storage.

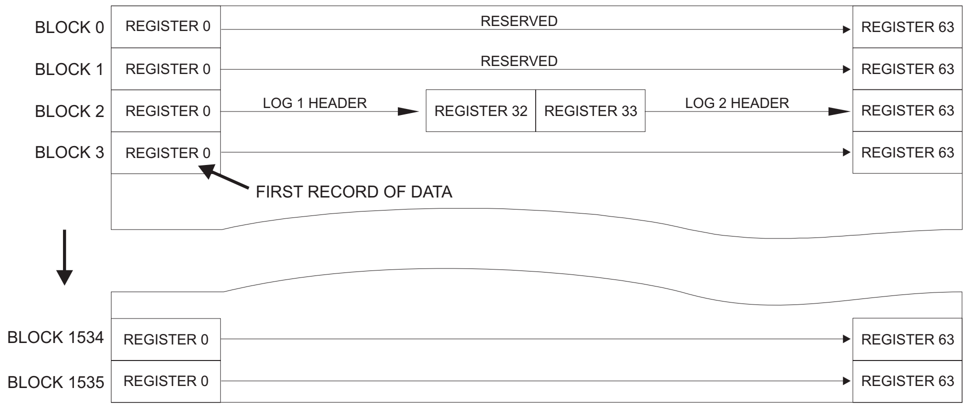


FIGURE 8–3: Data Log Configuration

The location of the first Record in Log 2 will depend upon the Log configuration. Its location is determined by reading the Log 2 Header value for Log Start Address at location 0AB2 and 0AB3 in the memory map. The Log Start Address consists of the block number (0AB2) and the register number (0AB3) which represents the location of the first record within the Data Log memory structure. This location will always be the starting address for Data Log 2 for the given configuration. Adding or deleting parameters to the configuration will change the Log 2 Starting Address.

The log pointers contain a value from 0 to 196607 representing a byte within the data Log memory structure. Add 1 to this number and then divide this number by 64 (number of registers in a Block). Then divide this number by 2 (number of bytes in a register), and truncate the remainder of the division to determine the Block number. Multiplying the remainder of the division by 64 will determine the Register number. For example, if the Log pointer: “Log 2 Pointer to First Item of First Record” was 34235, then the Block and Register numbers containing the first record of Log 2 are:

$$\text{Block Number} = (34235 + 1) / 64 / 2 = 267.46875$$

Therefore, Block Number 267 contains the starting record.

$$\text{Record Number} = 0.46875 \times 64 = 30$$

Therefore, Register Number 30 contains the first byte of Log 2 data. These calculations can be avoided by using the pre-calculated values for Block Number and Record number located just prior to the pointer (0AB7 and 0AB8).

The Data Logs will use the maximum amount of memory available, minus a 1 record buffer, based upon the user configuration. For Example, if the Record Size for a given configuration was 26 bytes, and there were 28 bytes of memory left in the memory structure, the Data Logger will not use those last 28 bytes, regardless of the mode of operation. The Data Logger uses the following formula to determine the total record space available:

Total Space = (196224 / Record Size) – 1

As in the example, the total space calculated would be 196224 / 26 – 1 = 7546.07. This equates to 7546 records with 28 bytes of unused memory at the end of Block 1536. The total amount of space used in the structure can also be found in the Log Header in the Log Total Records field.

Address 1270h in the PQMII Memory Map is the Holding Register for the first available parameter for use by the Data Logs. The Data Logs will place the user-selected parameters into their respective Record structures based upon their respective order in the PQMII Memory Map.

For example, if Positive kWh, Frequency and Current Unbalance were selected as measured parameters, they would be placed into the Record structure in the following order: Unbalance (2 bytes, 16-bit value), Frequency (2 bytes, 16-bit value), and Positive kWh (4 bytes, 32-bit value). The Data Log Parameters table on the following page illustrates the order of parameters and their size.

Therefore, the Record size would be 8 bytes. To put a time value associated with each Record, you must read the Log Time and Date from the Header. This is the time of the most recent Record in the Log. To time stamp the first Record used, multiply the Log Time Interval by the Log Records Used and subtract this number from the time associated with the last Record. To determine the time associated with any Record, add the Log Time Interval times the Record to be read to the time associated with the first Record in the Log.

For example:

Log Time Interval:3600
Log Time, Hours/Minutes:02 30
Log Time, Seconds:30300
Log Date, Month:06 15
Log Date, Year:1997
Log Records Used:1600

The last Record entry time is interpreted as 2:30 AM, 30.300 seconds, June 15, 1997. The Log Time Interval is 3600 seconds, or 1 hour. Taking the Log Records Used (1600) and multiplying this by the Log Time Interval (3600) gives 5760000 seconds. This translates into 66 days and 16 hours. Subtracting backwards on a calendar from the time for the last Record gives a time and date of 10:30:30.000 AM, April 9, 1997. This is the time stamp for the first Record. Time stamping the remaining Records requires adding 3600 seconds for each Record starting from the time associated with the first Record. It is important to note that when in the Circulate mode, and the Data Log fills the available memory, the Log wraps around the first available Register of the memory structure and the Log Pointer to First Item of First Record will float along in time with each additional entry into the Log. For example, if the Data Log has wrapped around the available memory more than once, the Log Pointer to First Item of First Record will always be preceded in memory by the Log Pointer to First Item of Record After Last. As each new entry is written into the Log, these two pointers move down to the next record space in memory, overwriting the first entry into the log as of the Present Log Time and Date.

8.6.5 Data Log Parameters

Listed below are the parameters available for capturing data via the Data Logger. Note that these parameters will be placed within the Record structure of the Data Log in the order and size that they appear in this table.

Table 8–1: Data Log Parameters

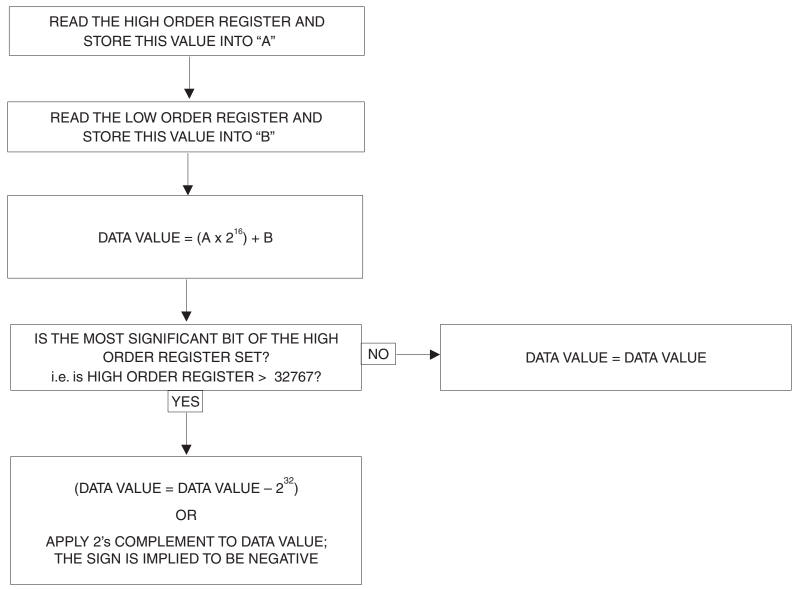
DATA LOG PARAMETER	SIZE (bytes)	DATA LOG PARAMETER	SIZE (bytes)	DATA LOG PARAMETER	SIZE (bytes)
Ia	2	PFa	2	kVAh	4
Ib	2	Pb	4	Ia Demand	2
Ic	2	Qb	4	Ib Demand	2
Iavg	2	Sb	4	Ic Demand	2
In	2	PFb	2	In Demand	2
I Unbalance	2	Pc	4	P3 Demand	4
Van	4	Qc	4	Q3 Demand	4
Vbn	4	Sc	4	S3 Demand	4
Vcn	4	PFc	2	Ia THD	2
Vpavg	4	P3	4	Ib THD	2
Vab	4	Q3	4	Ic THD	2
Vbc	4	S3	4	In THD	2
Vca	4	PF3	2	Van THD	2
Vlavg	4	Frequency	2	Vbn THD	2
V Unbalance	2	Positive kWh	4	Vcn THD	2
Pa	4	Negative kWh	4	Vab THD	2
Qa	4	Positive kvarh	4	Vbc THD	2
Sa	4	Negative kvarh	4	Analog Input	4

where: I = current; V = Voltage; P = Real Power; Q = Reactive Power; S = Apparent Power; PF = Power Factor; THD = Total Harmonic Distortion

8.7 Reading Long Integers from the Memory Map

8.7.1 Description

The PQMII memory map contains data formatted as a long integer type, or 32 bits. Because the Modbus protocol maximum register size is 16 bits, the PQMII stores long integers in 2 consecutive register locations, 2 high order bytes, and 2 low order bytes. The data can be retrieved by the following logic:



8.7.2 Example

Reading a positive 3 Phase Real Power actual value from the PQMII:

Register	Actual Value	Description	Units & Scale	Format
02F0	004Fh	3 Phase Real Power (high)	0.01 × kW	F4
02F1	35D1h	3 Phase Real Power (low)	0.01 × kW	F4

Following the method described above, we have:

DATA VALUE = $(004F \times 2^{16}) + 35D1$ hexadecimal
= 5177344 + 13777 converted to decimal
= 5191121 decimal

The most significant bit of the High Order register is not set, therefore the Data Value is as calculated. Applying the Units and Scale parameters to the Data Value, we multiply the Data Value by 0.01 kW. Therefore the resultant value of 3 Phase Real Power as read from the memory map is 51911.21 kW.

Reading a negative 3 Phase Real Power actual value from the PQMII:

Register	Actual Value	Description	Units & Scale	Format
02F0	FF3Ah	3 Phase Real Power (high)	0.01 × kW	F4
02F1	EA7Bh	3 Phase Real Power (low)	0.01 × kW	F4

Following the method described above:

DATA VALUE	$= (FF3A \times 2^{16}) + EA7B$	hexadecimal
	$= (65338 \times 2^{16}) + 60027$	converted to decimal
	$= 4282051195$	decimal

The most significant bit of the High Order register is set, therefore the Data Value is:

DATA VALUE = DATA VALUE – 2^{32} = 4282051195 – 4294967296 = –12916101

Multiply the Data Value by 0.01 kW according to the Units and Scale parameter. The resultant 3 Phase Real Power value read from the memory map is –129161.01 kW.

8.8 Pulse Input Application

8.8.1 Description

The PQMII has up to 4 Logical Switch Inputs that can be configured as Pulse Input Counters. Variables to consider when using the PQMII as a Pulse Input Counter are:

- **PQMII Switch Input A(D) Function**: Defines the functionality to be provided by the PQMII Switch Input. For use as a Pulse Input Counter, the PQMII Switch Input to be used must be assigned as either Pulse Input 1, 2, 3, or 4.
- **PQMII Switch Input A(D) Activation**: Set to Open or Closed. The PQMII will see the operation of the Switch Input in the state as defined by this parameter.
- **PQMII Switch Input A(D) Name**: Defines the name given to each of the Switch Inputs used. It is used as a label only and has no bearing on the operation of the Switch Input.
- **PQMII Pulse Input (Units)**: Represents the name given to the base units that the PQMII Pulse Input(s) will be counting. It is used as a label only and has no bearing on the operation of the Pulse Input.
- **PQMII Pulse Input 1(4) Value**: This value is assigned to each counting operation as determined by the Switch Input.
- **PQMII Totalized Pulse Input**: Creates a summing register of the various Pulse Inputs configured. It can be configured for any combination of the PQMII Switch Inputs used as Pulse Inputs.

8.8.2 PQMII Pulse Input(s) with a Pulse Initiator using KYZ Terminals

Typical end receivers require a contact closure between KY or KZ based upon the type of receiver. Because of the multi-functional parameters of the PQMII Switch Inputs, the PQMII Switch Inputs are not labeled with KYZ markings as a dedicated pulse input device. However, the PQMII can still be used as a pulse counter. The PQMII Switch Inputs require a signal from the PQMII Switch Common terminal to be activated. The PQMII configured as a Pulse Counter can be used with Two-Wire Pulse Initiators. The Pulse Initiator must provide a dry contact operation. The Switch Common terminal of the PQMII is connected to the K terminal of the Pulse Initiator. The PQMII Switch Input assigned to count pulses can be connected to the Y or the Z terminal of the Pulse Initiator, depending on the operation of the Pulse Initiator, i.e. Open or Closed. The PQMII Pulse Input (value) must be assigned to match the pulse value of the Pulse Initiator, i.e if the Pulse Initiator delivers a dry contact closure for every 100kWh, the PQMII Pulse Input (value) must also be set to 100.

Various operating parameters must be taken into account. The PQMII Switch Inputs require a minimum 100ms operation time to be detected. The duration of the contact operation can be indefinite. The internal Switch Input circuit of the PQMII is itself switched on and off at the times when the PQMII is reading the status of the Switch Inputs. Monitoring the input to one of the PQMII Switch Inputs will reveal a pulsed 24VDC waveform, not a constant signal. Standard wiring practice should be adhered to when making connections to the PQMII Switch Inputs, i.e. avoiding long runs of cable along current carrying conductors or any other source of EMI. An induced voltage on the Switch Input can cause malfunction of the Switch Input.

8.9 Pulse Totalizer Application

8.9.1 Description

The PQMII has up to 4 Logical Switch Inputs that can be configured as Pulse Input Counters. One common application of these Pulse Inputs is their use as an energy totalizer for more than one circuit. One PQMII can totalize input from up to 4 different sources and sum these results into a single register. Variables to consider when using the PQMII as a Pulse Input Counter are:

- **PQMII Switch Input A(D) Function**: Defines the functionality to be provided by the PQMII Switch Input. For use as a Pulse Input Counter, the PQMII Switch Input to be used must be assigned as either Pulse Input 1, 2, 3, or 4.
- **PQMII Switch Input A(D) Activation**: Set to Open or Closed. The PQMII will see the operation of the Switch Input in the state as defined by this parameter.
- **PQMII Switch Input A(D) Name**: Defines the name given to each of the Switch Inputs used. It is used as a label only and has no bearing on the operation of the Switch Input.
- **PQMII Pulse Input (Units)**: Represents the name given to the base units that the PQMII Pulse Input(s) will be counting. It is used as a label only and has no bearing on the operation of the Pulse Input.
- **PQMII Pulse Input 1(4) Value**: This value is assigned to each counting operation as determined by the Switch Input.
- **PQMII Totalized Pulse Input**: This parameter creates a summing register of the various Pulse Inputs configured. It can be configured for any combination of the PQMII Switch Inputs used as Pulse Inputs.

8.9.2 Totalizing Energy from Multiple Metering Locations

The diagram below shows an example of a PQMII being used to totalize the energy from 4 other PQMIIs. PQMIIs 1 through 4 have each of their respective Aux1 relays configured for Pulse Output functionality (refer to *Pulse Output* on page 8–8 for details). The Switch Common output from PQMII#4 is fed to the common contact of the Aux1 relays on PQMIIs 1 through 4. The N/O contact of Aux1 for PQMIIs 1 through 4 will operate based upon the setup as described in the Pulse Output functionality section of the PQMII manual. The Totalized Pulse Input register of PQMII#4 can be set to sum the counts from Switch Inputs 1 through 4, thus giving a total energy representation for the 4 metering locations. The count value for each Pulse Input on PQMII#4 can be set to match the Pulse Output Interval as programmed on each PQMII. For example, if PQMII#1 had a Pulse Output Interval = 100 kWhr, and PQMII#2 had a Pulse Output Interval = 10 kWhr, then Pulse Input 1 on PQMII#4 would have the Pulse Input Value set for 100 and Pulse Input 2 on PQMII#4 would have the Pulse Input Value set for 10.

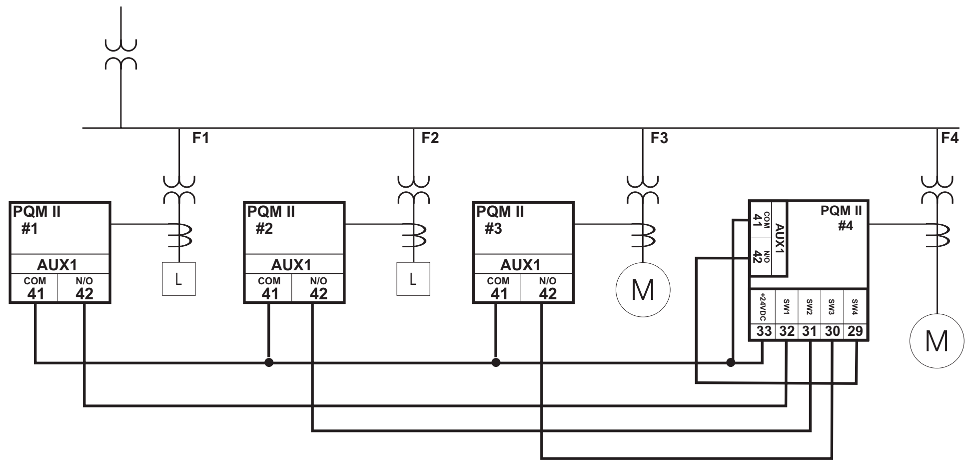


FIGURE 8–4: Multiple Metering Locations

Various operating parameters must be taken into account. The PQMII Switch Inputs require a minimum 100 ms operation time to be detected. Therefore the Pulse Output Width should be equal to or greater than 100 ms. The duration of the contact operation can be indefinite. The internal Switch Input circuit of the PQMII is switched on and off at the times when the PQMII is reading the Switch Inputs status. Monitoring the input to one of the PQMII Switch Inputs will reveal a pulsed 24 V DC waveform, not a constant signal. Standard wiring practice should be adhered to when making connections to the PQMII Switch Inputs, i.e. avoiding long runs of cable along current carrying conductors or any other source of EMI. An induced voltage on the Switch Input can cause malfunction of the Switch Input.

GE Consumer & Industrial
Multilin

PQMII Power Quality Meter

Chapter 9: Warranty

9.1 GE Multilin Device Warranty

9.1.1 Warranty Statement

General Electric Multilin (GE Multilin) warrants each device it manufactures to be free from defects in material and workmanship under normal use and service for a period of 24 months from date of shipment from factory.

In the event of a failure covered by warranty, GE Multilin will undertake to repair or replace the device providing the warrantor determined that it is defective and it is returned with all transportation charges prepaid to an authorized service centre or the factory. Repairs or replacement under warranty will be made without charge.

Warranty shall not apply to any device which has been subject to misuse, negligence, accident, incorrect installation or use not in accordance with instructions nor any unit that has been altered outside a GE Multilin authorized factory outlet.

GE Multilin is not liable for special, indirect or consequential damages or for loss of profit or for expenses sustained as a result of a device malfunction, incorrect application or adjustment.

For complete text of Warranty (including limitations and disclaimers), refer to GE Multilin Standard Conditions of Sale.

GE Consumer & Industrial
Multilin

PQMII Power Quality Meter

Appendix A

A.1 Mod 506: Capacitor Bank Switching

A.1.1 Description

The standard PQM software has been altered to allow the four output relays to be used for 4 step capacitor bank switching.

A.1.2 Setpoints

The following messages have been added to the PQMII setpoint structure to accommodate this modification. The messages are located in setpoints page **S4 ALARMS ⇨⇩ CONTROL ⇨⇩ MOD 506 SETPOINTS** (after the **MISCELLANEOUS** heading).

PATH: SETPOINTS ⇨⇩ S4 ALARMS/CONTROL ⇨⇩ MOD 506 SETPOINTS

■ MOD 506 [▷] SETPOINTS		STEP 1 RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
	MESSAGE	STEP 1 PICKUP ≥ +600 kvar	*Range: 0.1 to 6500.0 kvar in steps of 0.1*
	MESSAGE	STEP 1 DROPOUT ≤ 0.0 kvar	*Range: –3250.0 to 3250.0 kvar in steps of 0.1*
	MESSAGE	STEP 1 PICKUP DELAY: 1.0 min	*Range: 0.1 to 60.0 min in steps of 0.1*
	MESSAGE	STEP 1 DISABLE TIME: 5.0 min	*Range: 0.1 to 60.0 min in steps of 0.1*
	MESSAGE	STEP 2 RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
	MESSAGE	STEP 2 PICKUP ≥ +600 kvar	*Range: 0.1 to 6500.0 kvar in steps of 0.1*

	Display	Range
MESSAGE	STEP 2 DROPOUT ≤ 0.0 kvar	*Range: –3250.0 to 3250.0 kvar in steps of 0.1*
MESSAGE	STEP 2 PICKUP DELAY: 1.0 min	*Range: 0.1 to 60.0 min in steps of 0.1*
MESSAGE	STEP 2 DISABLE TIME: 5.0 min	*Range: 0.1 to 60.0 min in steps of 0.1*
MESSAGE	STEP 3 RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE	STEP 3 PICKUP ≥ +600 kvar	*Range: 0.1 to 6500.0 kvar in steps of 0.1*
MESSAGE	STEP 3 DROPOUT ≤ 0.0 kvar	*Range: –3250.0 to 3250.0 kvar in steps of 0.1*
MESSAGE	STEP 3 PICKUP DELAY: 1.0 min	*Range: 0.1 to 60.0 min in steps of 0.1*
MESSAGE	STEP 3 DISABLE TIME: 5.0 min	*Range: 0.1 to 60.0 min in steps of 0.1*
MESSAGE	STEP 4 RELAY: OFF	*Range: Alarm, Aux1, Aux2, Aux3, Off*
MESSAGE	STEP 4 PICKUP ≥ +600 kvar	*Range: 0.1 to 6500.0 kvar in steps of 0.1*
MESSAGE	STEP 4 DROPOUT ≤ 0.0 kvar	*Range: –3250.0 to 3250.0 kvar in steps of 0.1*
MESSAGE	STEP 4 PICKUP DELAY: 1.0 min	*Range: 0.1 to 60.0 min in steps of 0.1*
MESSAGE	STEP 4 DISABLE TIME: 5.0 min	*Range: 0.1 to 60.0 min in steps of 0.1*
MESSAGE	SYSTEM STABILIZA- TION TIME: 5.0 min	*Range: 0.1 to 60.0 min in steps of 0.1*
MESSAGE	LOW VOLTAGE LEVEL: 100 V	*Range: 30 to 65000 V in steps of 10 or OFF*
MESSAGE	LOW VOLTAGE DETECT DELAY: 1.0 s	*Range: 0.5 to 600.0 s in steps of 0.5*
MESSAGE	STEP PRIORITY: 1, 2, 3, 4	*Range: 24 combinations*

- **STEP 1(4) RELAY**: The state of the output relay assigned in this message will be controlled by the **STEP** it is assigned to. Once a relay has been assigned to a particular step, it will not activate upon any other PQMII conditions (i.e. pulse output, alarm, etc.). If a particular relay has not been assigned to any **STEP**, it will function as per standard PQMII implementation.

- **STEP 1(4) PICKUP**: When the three-phase kvar value is positive and it becomes equal to or exceeds the value set in this setpoint the output relay assigned to the **STEP** will energize providing the conditions in all other setpoints are met.
- **STEP 1(4) DROPOUT**: When the three-phase kvar value becomes less than or equal to the value set in this setpoint the output relay assigned to the **STEP** will de-energize. Since over compensation is possible, the dropout value can be set to negative vars.
- **STEP 1(4) PICKUP DELAY**: The **STEP** will turn on after the delay set in this setpoint has elapsed assuming all other conditions have been met.

NOTE

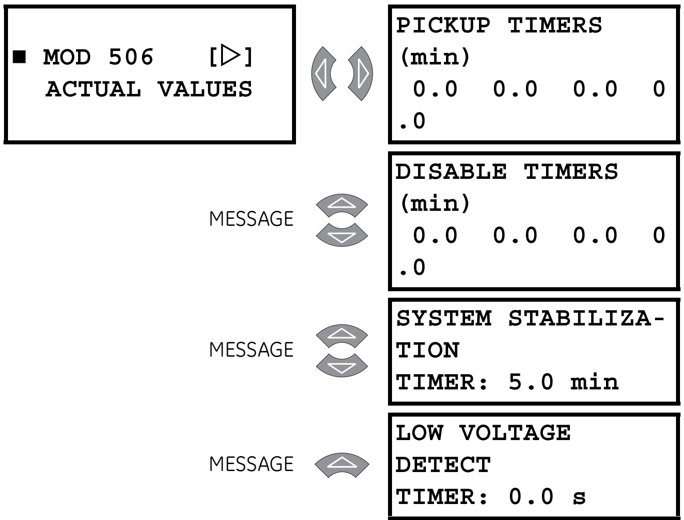
This delay setting will start counting down once the **SYSTEM STABILIZATION TIME** setting has elapsed.

- **STEP 1(4) DISABLE TIME**: When **STEP** turns off, it is not allowed to turn back on until the time set in this setpoint has elapsed. This allows the capacitors to discharge before being re-energized again.
- **SYSTEM STABILIZATION TIME**: When any action is performed (turning **STEPS** on/off or low voltage is detected), the system must be allowed to stabilize for the time set in this setpoint before any further actions can be performed. This time is necessary to allow the system to stabilize without the capacitors trying to recharge
- **LOW VOLTAGE LEVEL**: When the system voltage (average three-phase voltage) becomes equal to or less than this setpoint, all **STEPS** are turned off. Upon recovery (three-phase voltage is greater than this setpoint) the time set in the **SYSTEM STABILIZATION TIME** setpoint must have elapsed before any actions will be performed. If this feature is not required, set it to "Off".
- **LOW VOLTAGE DETECT DELAY**: In some cases where noise or spikes are present on the line it may not be desirable to detect low voltage right away, therefore, this setpoint can be used to delay the detection until voltage is definitely low.
- **STEP PRIORITY**: The **STEP PRIORITY** setpoint determines the sequence the **STEPS** are allowed to turn on in a case where the condition may be satisfied by more than one **STEP**. Therefore, the **STEP** with the highest priority will be energized first. If the **STEP** with highest priority is already energized, the **STEP** with second highest priority will be used, and so forth. The **STEP** priority is set from highest to lowest (left to right) when viewing this setpoint. For example, "1,2,3,4" signifies that **STEP 1** has the highest priority and **STEP 4** has the lowest priority. Note that only one **STEP** is allowed to turn on or off at a time.

A.1.3 Actual Values

The following messages have been added to the PQMII actual values structure to accommodate this modification. The messages are located in actual values page **A2 STATUS ⇨⇩ MOD 506 ACTUAL VALUES**.

PATH: ACTUAL VALUES ⇨⇩ A2 STATUS ⇨⇩ MOD 506 ACTUAL VALUES



- **PICKUP TIMERS**: These timers are loaded with the **STEP 1(4) PICKUP DELAY** setpoint settings when the required conditions are met. The timers are displayed beginning with **STEP 1** on the left and ending with **STEP 4** on the right.
- **DISABLE TIMERS**: These timers are loaded with the **STEP 1(4) DISABLE TIME** setpoint settings when the required conditions are met. The timers are displayed beginning with **STEP 1** on the left and ending with **STEP 4** on the right.
- **SYSTEM STABILIZATION TIMER**: This timer is continuously loaded with the **SYSTEM STABILIZATION TIME** setpoint setting and will only start to count down to 0 when the system becomes stable.
- **LOW VOLTAGE DETECT TIMER**: This timer is loaded with the **LOW VOLTAGE DETECT DELAY** setpoint setting when low voltage is detected and will start to count down to 0.

NOTE

If the power to the PQMII is removed all timers are cleared to 0.

A.1.4 Conditions Required to Energize a STEP

The following conditions are required to energize **STEP 1**. The same conditions apply to **STEPS 2** through **4**.

- Three-phase voltage is greater than the **LOW VOLTAGE LEVEL** setting.
- The system kvars are equal to or have exceeded the setting in **STEP 1 PICKUP** setpoint.
- The programmed **SYSTEM STABILIZATION TIME** has elapsed.
- The programmed **STEP 1 PICKUP DELAY** has elapsed.
- **STEP 1** has the highest priority as set in the **STEP PRIORITY** setpoint or all other **STEPS** do not meet all of the above conditions.

A.1.5 Additions to Modbus Memory Map

The following two sections are added to the Modbus Memory Map for Mod 506. For additional information on Modbus, refer to Chapter 7: *Communications*.

GROUP	ADDR (HEX)	DESCRIPTION	RANGE	STEP VALUE	UNITS and SCALE	FOR-MAT	FACTORY DEFAULT
MOD 506 ACTUAL VALUES	0E10	Step 1 Pickup Timer	---	---	0.1 ×	F1	---
	0E11	Step 2 Pickup Timer	---	---	0.1 ×	F1	---
	0E12	Step 3 Pickup Timer	---	---	0.1 ×	F1	---
	0E13	Step 4 Pickup Timer	---	---	0.1 ×	F1	---
	0E14	Step 1 Disable Timer	---	---	0.1 ×	F1	---
	0E15	Step 2 Disable Timer			0.1 ×	F1	---
	0E16	Step 3 Disable Timer	---	---	0.1 ×	F1	---
	0E17	Step 4 Disable Timer	---	---	0.1 ×	F1	---
	0E18	System Stabilization	---	---	0.1 ×	F1	---
	0E19	Low Voltage Detect	---	---	0.1 ×	F1	---
MOD 506 SETPOINTS	1300	Step 1 Relay	0 to 4	1	---	F1	0 = OFF
	1301	Step 1 Pickup Level	1 to 65000	1	kvar	F1	6000=600.0 kvar
	1302	Step 1 Dropout Level	–32000 to 32000	1	kvar	F2	0=0.0 kvar
	1303	Step 1 Pickup Delay	1 to 600	1	min	F1	10=1.0 min
	1304	Step 1 Disable Time	1 to 600	1	min	F1	50=5.0 min
	1305	Step 2 Relay	0 to 4	1	---	F1	0 = OFF
	1306	Step 2 Pickup Level	1 to 65000	1	kvar	F1	6000=600.0 kvar
	1307	Step 2 Dropout Level	–32000 to 32000	1	kvar	F2	0=0.0 kvar
	1308	Step 2 Pickup Delay	1 to 600	1	min	F1	10=1.0 min
	1309	Step 2 Disable Time	1 to 600	1	min	F1	50=5.0 min
	130A	Step 3 Relay	0 to 4	1	---	F1	0 = OFF
	130B	Step 3 Pickup Level	1 to 65000	1	kvar	F1	6000=600.0 kvar
	130C	Step 3 Dropout Level	–32000 to 32000	1	kvar	F2	0=0.0 kvar
	130D	Step 3 Pickup Delay	1 to 600	1	min	F1	10=1.0 min
MOD 506 SETPOINTS continued	130E	Step 3 Disable Time	1 to 600	1	min	F1	50=5.0 min
	130F	Step 4 Relay	0 to 4	1	---	F1	0 = OFF
	1310	Step 4 Pickup Level	1 to 65000	1	kvar	F1	6000=600.0 kvar
	1311	Step 4 Dropout Level	–32000 to 32000	1	kvar	F2	0=0.0 kvar
	1312	Step 4 Pickup Delay	1 to 600	1	min	F1	10=1.0 min
	1313	Step 4 Disable Time	1 to 600	1	min	F1	50=5.0 min
	1314	System Stabilization	1 to 600	1	min	F1	50=5.0 min
	1315	Low Voltage Detect Level	30 to 65000	1	V	F1	100 V
	1316	Low Voltage Detect Delay	5 to 6000	1	s	F1	10=1.0 s
	1317	Step Sequence	0 to 23	1	---	F42	0="1,2,3,4"

The following memory map format has also been added:

CODE	DESCRIPTION	BITMASK
F42	**Step Sequence Priority**	FFFF
	0 = "1, 2, 3, 4"	---
	1 = "1, 2, 4, 3"	---
	2 = "1, 3, 2, 4"	---

CODE	DESCRIPTION	BITMASK
	3 = "1, 3, 4, 2"	---
	4 = "1, 4, 2, 3"	---
	5 = "1, 4, 3, 2"	---
	6 = "2, 1, 3, 4"	---
	7 = "2, 1, 4, 3"	---
	8 = "2, 3, 1, 4"	---
	9 = "2, 3, 4, 1"	---
	10 = "2, 4, 1, 3"	---
	11 = "2, 4, 3, 1"	---
	12 = "3, 1, 2, 4"	---
	13 = "3, 1, 4, 2"	---
	14 = "3, 2, 1, 4"	---
	15 = "3, 2, 4, 1"	---
	16 = "3, 4, 1, 2"	---
	17 = "3, 4, 2, 1"	---
	18 = "4, 1, 2, 3"	---
	19 = "4, 1, 3, 2"	---
	20 = "4, 2, 1, 3"	---
	21 = "4, 2, 3, 1"	---
	22 = "4, 3, 1, 2"	---
	23 = "4, 3, 2, 1"	---

A.2 Revision History

A.2.1 Release Dates

Table A–1: Release Dates

MANUAL	GE PART NO.	PQMII REVISION	RELEASE DATE
GEK-106435	1601-0118-A1	1.0x	17 September 2003
GEK-106435A	1601-0118-A2	1.0x	06 November 2003
GEK-106435B	1601-0118-A3	2.0x	01 December 2003
GEK-106435C	1601-0118-A4	2.0x	02 December 2003
GEK-106435D	1601-0118-A5	2.1x	18 June 2004
GEK-106435E	1601-0118-A6	2.2x	Not released
GEK-106435F	1601-0118-A7	2.2x	15 May 2006
GEK-106435G	1601-0118-A8	2.2x	22 February 2007

A.2.2 Release Notes

Table A–2: Major Updates for GEK-106435G

PAGE (A7)	SECT (A8)	CHANGE	DESCRIPTION
Title	Title	Update	Manual part number to 1601-0120-A8
	1.6.1	Update	Voltage Input Specification change
	5.2.6	Text Addn.	Modbus time and date setting
	2.2.8	Text Change	Switch Input

Table A–3: Major Updates for GEK-106435F

PAGE (A5)	PAGE (A7)	CHANGE	DESCRIPTION
Title	Title	Update	Manual part number to 1601-0120-A7
7-9	7-9	Update	Updated Modbus Memory Map
7-58	7-58	Update	Updated Default Variations section
7-59	7-59	Update	Updated Binary Input/ Binary Input Change section
7-62	7-62	Update	Updated Analog Input/Output Change section

Index

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

XYZ