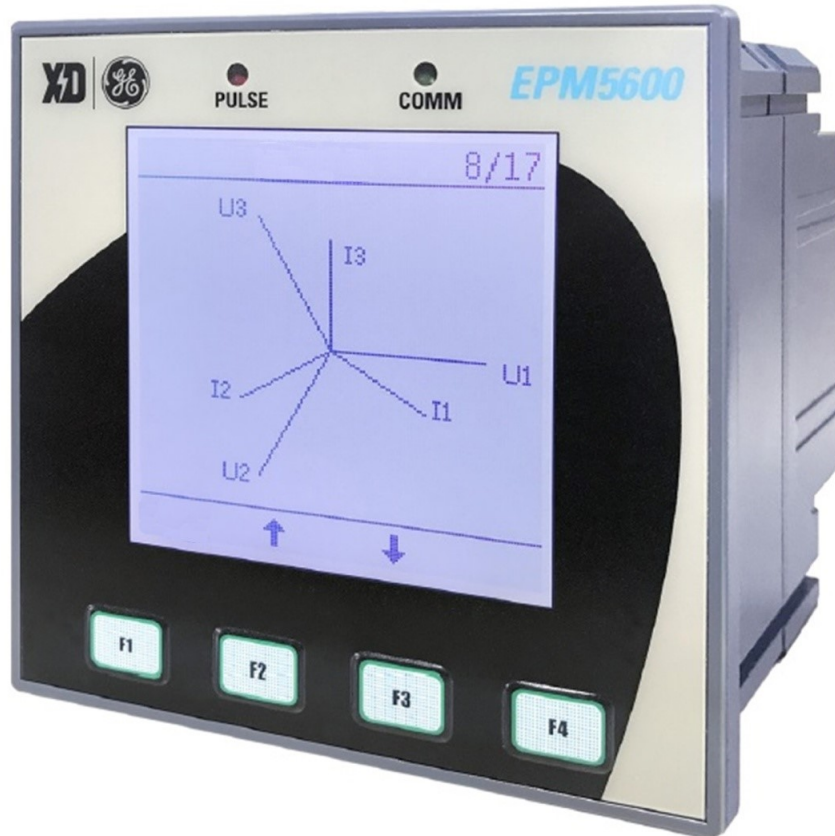


EPM5600

Three-phase Digital Multi-function Meter



User Manual

EPM5600: V1.0
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Table of Contents

- 1. Introduction.....1
 - 1.1 Overview..... 1
 - 1.2 Features 1
 - 1.3 EPM5600’application in Power and Energy Management Systems 4
 - 1.4 Getting More Information.....4
 - 1.5 Order Codes 5
- 2. Installation.....7
 - 2.1 Appearance.....7
 - 2.2 Unit Dimensions 7
 - 2.3 Terminal Dimensions..... 8
 - 2.4 Mounting 8
 - 2.5 Wiring connections.....9
 - 2.5.1 3-Phase 4-Wire(3P4W) Wye Direct Connection with 3CTs 10
 - 2.5.2 3-Phase 4-Wire(3P4W) Wye Direct Connection with 4CTs 10
 - 2.5.3 3-Phase 4-Wire(3P4W) Wye with 3PTs and 3CTs..... 10
 - 2.5.4 3-Phase 4-Wire(3P4W) Wye with 3PTs and 4CTs..... 11
 - 2.5.5 3-Phase 3-Wire(3P3W) Direct Delta Connection with 3CTs..... 11
 - 2.5.6 3-Phase 3-Wire(3P3W) Direct Delta Connection with 2CTs..... 12
 - 2.5.7 3-Phase 3-Wire(3P3W) Delta with 2PTs and 3CTs 12
 - 2.5.8 3-Phase 3-Wire (3P3W) Delta with 2PTs and 2CTs..... 13
 - 2.5.9 1-Phase 3-Wire (1P3W) Direct Connection with 2CTs 13
 - 2.5.10 1-Phase 2-Wire, UIn(1P2W-UIn) Direct Connection with 1CT 14
 - 2.5.11 1-Phase 2-Wire, UII(1P2W-UII) Direct Connection with 1CT..... 14
 - 2.6 Communications Wiring..... 15
 - 2.7 Digital or Pulse Input Wiring 15
 - 2.8 Digital (Relay) Output Wiring..... 15
 - 2.9 Pulse Output Wiring..... 16
 - 2.10 Analog Input Wiring..... 16
 - 2.11 Analog Output Wiring..... 16
 - 2.12 RTD Input Wiring 17
 - 2.13 Power Supply Wiring..... 17
- 3. Front Panel.....19
 - 3.1 Using the Front Panel Buttons..... 19
 - 3.2 Data Display 20
 - 3.2.1 U/I..... 20
 - 3.2.2 Power 21
 - 3.2.3 Energy..... 21
 - 3.2.4 Demand 21
 - 3.2.5 Harmonics 21
 - 3.2.6 Max./Min. 23
 - 3.2.7 TOU 24
 - 3.2.8 I/O..... 24



3.2.9 SOE	25
3.3 Setup Configuration via the Front Panel	25
3.3.1 Making Setup Changes	25
3.3.2 Setup Menu	27
3.3.3 Configuration	28
4. Applications	33
4.1 Inputs and Outputs	33
4.1.1 Digital Inputs	33
4.1.2 Digital Outputs	34
4.1.3 Energy Pulse Outputs	34
4.1.4 Analog Input	34
4.1.5 Analog Output	35
4.1.6 RTD Input	35
4.2 Power and Energy	35
4.2.1 Basic Measurements	35
4.2.2 Energy Measurements	36
4.2.3 Interval Energy Measurements	36
4.2.4 Demand Measurements	37
4.3 Power Quality	37
4.3.1 Phase Angles	37
4.3.2 Power Quality Parameters	37
4.3.3 Unbalance	39
4.4 Setpoints	39
4.5 Logging	41
4.5.1 Max./Min. Log	41
4.5.2 Peak Demand Log	42
4.5.3 Monthly Energy Log	42
4.5.4 Daily and Monthly Freeze Log (Optional)	43
4.5.5 SOE Log	44
4.5.6 Data Recorder (DR) Log (Optional)	44
4.6 Time of Use (TOU)	44
4.7 Diagnostics	46
5. Modbus Register Map	47
5.1 Basic Measurements	47
5.2 Energy Measurements	50
5.2.1 3-Phase Total Energy Measurements	50
5.2.2 Phase A (L1) Energy Measurements	51
5.2.3 Phase B (L2) Energy Measurements	52
5.2.4 Phase C (L3) Energy Measurements	52
5.2.5 Interval Energy Measurements	53
5.3 DI Pulse Counters	54
5.4 Harmonic Measurements	54
5.4.1 Power Quality Measurements	54
5.4.2 Current Harmonic Measurements	54



5.4.3 Voltage Harmonic Measurements.....	55
5.5 Demands	55
5.5.1 Present Demands	55
5.5.2 Predicted Demands	55
5.5.3 Peak Demand Log of This Month (Since Last Reset).....	55
5.5.4 Peak Demand Log of Last Month (Before Last Reset)	56
5.5.5 DemandData Structure.....	57
5.6 Max./Min. Log.....	57
5.6.1 Max. Log of This Month (Since Last Reset).....	57
5.6.2 Min. Log of This Month (Since Last Reset).....	58
5.6.3 Max. Log of LastMonth (Before Last Reset).....	58
5.6.4 Min. Log of LastMonth (Before Last Reset).....	59
5.6.5 Max./Min. Log Structure.....	60
5.7 Monthly Energy Log	60
5.8 Daily and Monthly Freeze Logs (Optional)	61
5.8.1 Daily Freeze Log	61
5.8.2 Monthly Freeze Log.....	62
5.9 SOE Log	63
5.10 Data Recorder Log (Optional)	67
5.11 Device Setup	68
5.11.1 Basic Setup Parameters	68
5.11.2 I/O Setup.....	71
5.11.3 Communication Setup Parameters	72
5.11.4 Setpoints Setup	73
5.11.5 Data Recorder Setup	74
5.12 TOU Setup	75
5.12.1 Basic	75
5.12.2 Season	76
5.12.3 Daily Profile.....	77
5.12.4 Alternate Days.....	79
5.13 Time	80
5.14 Remote Control	81
5.15 Clear/Reset Control	82
5.16 Meter Information	82
Appendix A Data Recorder Parameter List.....	85
Appendix B Data Recorder Default Settings.....	87
Appendix C BACNet MSTP Implementation.....	88
Appendix D N2 Implementation.....	94
Appendix E DNP Profile.....	96
Appendix F Technical Specifications.....	105
Appendix G Standards Compliance.....	107



1. Introduction

This manual explains how to use the EPM5600 Intelligent Multifunction Meter. Throughout the manual the term “meter” generally refers to all models.

This chapter provides an overview of the EPM5600 meter and summarizes many of its key features.

1.1 Overview

The EPM5600 Intelligent Multifunction Meter is XD-GE’s latest offer for the low-cost digital power/energy metering market. The EPM5600 features quality construction, multifunction measurements and a large, backlit, Dot-Matrix LCD that is easy to navigate. Housed in a standard DIN form factor measuring 96x96x88mm, it is perfectly suited for industrial, commercial and utility applications. Compliance with the IEC 62053-22 Class 0.5S Standard, it is a cost effective replacement for analog instrumentation and is capable of displaying 4 measurements at once. It optionally provides 14 input for Neutral Current measurement, a second RS485 port, up to six Digital Inputs for status monitoring, pulse counting or Tariff switching, up to four Relay Outputs for control and alarming applications, up to four Solid State Relays for energy pulsing as well as other I/O options for different applications.

You can setup the meter through its front panel or via our free Setup software. The meter is also supported by Management System. Following is a list of typical applications for the EPM5600:

- Industrial, Commercial and Utility Substation Metering
- Building, Factory and Process Automation
- Sub-metering and Cost Allocation
- Energy Management and Power Quality Monitoring

Contact XD-GE Technical Support at www.xd-ge-auto.com should you require further assistance with your application.

1.2 Features

Ease of use

- Large, backlit, Dot-Matrix LCD display with wide viewing angle
- Intuitive user interface
- LED indicators for Energy Pulsing and Communication activities
- Password-protected setup via front panel or free Setup software
- Easy installation with mounting clips, no tools required

Basic Measurements (True RMS)

- ULN, ULL per phase and Average
- Current per phase and Average with calculated Neutral
- kW, kvar, kVA, PF per phase and Total
- kWh, kvarh Import / Export / Net / Total and kVAh Total
- Frequency
- Device Operating Time (Running Hours)



- Optional I4 measurements
- Calculated Residual Current Ir (with optional I4 Input)

Advanced Measurements

- 1-Cycle Real-time U & I Waveform Display @ 1s update rate
- U and I THD, TOHD, TEHD and Individual Harmonics up to 31st
- Current TDD, TDD Odd, TDD Even, K-Factor and Crest Factor
- U and I Unbalance and Phase Angles
- Displacement PF
- Fundamental U, I and kW per phase
- Total Fundamental kW & Total Harmonic kW*
- U and I Symmetrical (Sequence) Components*
- kvarh Q1-Q4
- Interval Energy for kWh/kvarh Imp/Exp and kVAh
- Demands, Predicted Demands and Peak Demands for kW/kvar/kVA Total and per phase Current with Timestamp for This Month (or Since Last Reset) and Last Month (or Before Last Reset)
- Two TOU schedules, each providing
 - 12 Seasons
 - 20 Daily Profiles, each with 12 Periods in 15-minute interval
 - 90 Holidays or Alternate Days
 - 8 Tariffs, each providing the following information
 - kWh/kvarh Import/Export, kVAh
 - kW/kvar/kVA Max. Demands
- 12 Monthly Energy Logsof kWh/kvarh Import/Export/Total/Net, kVAh, kvarh Q1-Q4 as well as kWh/kvarh Import/Export and kVAh per Tariff

*Available in Firmware V1.00.03 or later

Setpoints

- 9 user programmable Setpoints with extensive list of monitoring parameters including Voltage, Current, Power and THD, ... etc.
- Configurable thresholds, time delays and DO triggers

SOE Log

- 100 events time-stamped to ± 1 ms resolution
- Recording events for Setup changes, Setpoint and DI status changes as well as DO operations

Max/Min Log

- Max./Min. Log with timestamp for parameters such as Voltage, Current, Ir (calculated), I4, Ir, Frequency, kW, kvar, kVA, PF, Unbalance, K-Factor, Crest-Factor and THD
- Configurable for This Month/Last Month or Since/Before Last Reset

Freeze Logs (Optional)

- 60 Daily Freeze Logs for kWh/kvarh/kVAh Total and kW/kvar/kVA Peak Demands.
- 36 Monthly Freeze Logs for kWh/kvarh/ kVAh Total and kW/kvar/kVA Peak Demands with Timestamp.



Data Recorder Log (Optional)

- 5 Data Recorders of 16 parameters each for real-time measurements, harmonics, energy, demand, TOU, Pulse Counters...etc.
- Recording interval from 1 minute to 40 days
- Configurable capacity up to a max. of 100 days at 15-minute interval

Diagnostics

- Frequency Out-of-Range, Loss of Voltage / Current
- kW Direction per phase and Total, Possible Incorrect CT Polarity
- Incorrect U& I Phase Sequence

Communications

- Optically isolated RS485 port at max. 38,400 bps
- Selectable Modbus RTU, BACnet MS/TP*, Metasys N2* and DNP 3.0~
- Optional 2nd RS485 port with Modbus RTU support only

*Available in Firmware V1.00.03 or later

~Available in Firmware V1.00.06 or later

Optional Inputs and Outputs

- **Digital Inputs**
 - Up to 6 channels, volts free dry contact, 24VDC internally wetted
 - 1000Hz sampling for status monitoring with programmable debounce
 - Pulse counting with programmable weight for each channel for collecting WAGES (Water, Air, Gas, Electricity, Steam) information
 - Tariff switching based on DI status
- **Digital Outputs**
 - Up to 4 Form A mechanical relays for alarming and general purpose control
- **Pulse Outputs**
 - Up to 4 Form A Solid State Relays for kWh and kvarh pulsing with Max. Load Voltage @ 50VDC and Max. Forward Current @ 50mA

Optional Expansion Modules

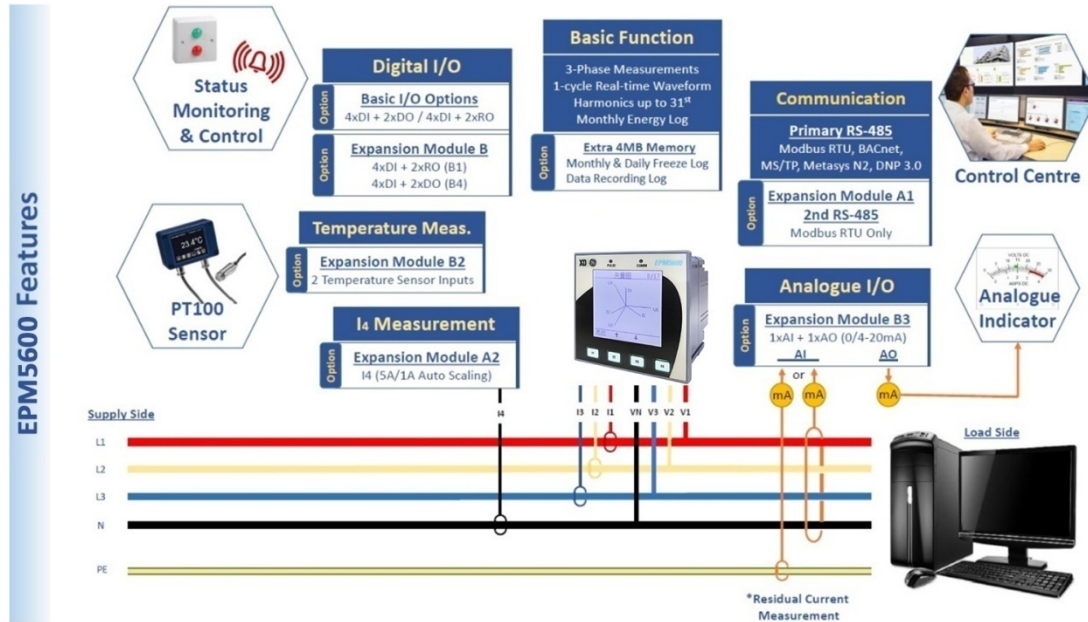
- **Expansion Module A Options**
 - I4 Input
 - 2nd RS485 port with optical isolation, supporting Modbus RTU
- **Expansion Module B Options**
 - 2xDigital Inputs and 2xRelay Outputs
 - 2xDigital Inputs and 2xSolid State Pulse Outputs
 - 2xRTD Inputs (PT100 sensor not included)
 - 1xAI and 1xAO (0/4-20mA)

System Integration

- Modbus RTU for easy integration into 3rd-party Energy Management, Automation or SCADA systems
- BACnet MSTP and Metasys N2 for Building Automation
- DNP 3.0 for Utility Substation Automation

1.3 EPM5600's application in Power and Energy Management Systems

The EPM5600 can be used to monitor 4P3W (Wye), 3P3W (Delta), 1P2W-UIn, 1P2W-Ull or 1P3W connected power system. Modbus communications allow real-time data, DI status and other information to be transmitted across a RS485 network to an Integrated Energy Management system such as PecStar® iEMS.



1.4 Getting More Information

Additional information is available from XD-GE via the following sources:

- Visit www.XD-GE-global.com
- Contact your local representative



1.5 Order Codes

The order codes for EPM5600 are shown below:

EPM5600	C	H	5	1	5	A	A1	B1	Description
Language	C								Chinese
	E								English
Power Supply	H								95 - 250V AC/DC, 47 - 440Hz
	L								20 - 60V DC
	S								95 - 480V AC/DC, 47 - 440Hz
Input Current			5						5A
			1						1A
Input Voltage				1					57.7/100V - 400/690V (Wye-Connection), 100V - 690V (Delta-Connection)
					5				45Hz - 65Hz
Basic Function						A			4 DI + 2 DO, 1 RS-485
						B			4 DI + 2 DO, 1 RS-485, 4MB Memory
Expansion A							X		No Module
							A1		RS-485
							A2		I4
Expansion B								X	No Module
								B1	2 DI + 2 DO
								B2	2 RTD



2. Installation



Caution

Installation of the EPM5600 should only be performed by qualified, competent personnel that have the appropriate training and experience with high voltage and current devices. The meter must be installed in accordance with all local and national electrical codes.

During the operation of the meter, hazardous voltages are present at the input terminals. Failure to observe precautions can result in serious or even fatal injury and equipment damage.

2.1 Appearance

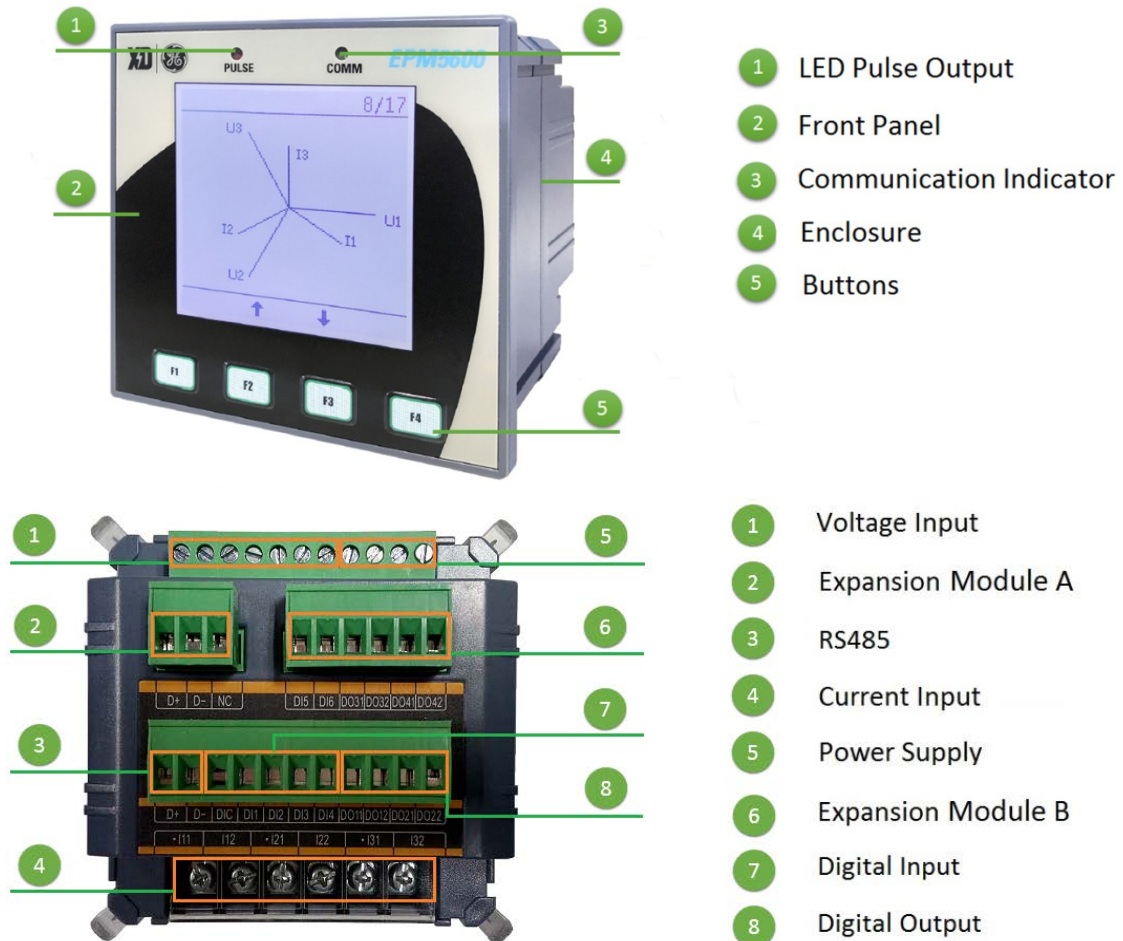


Figure 2-1 Appearance

2.2 Unit Dimensions

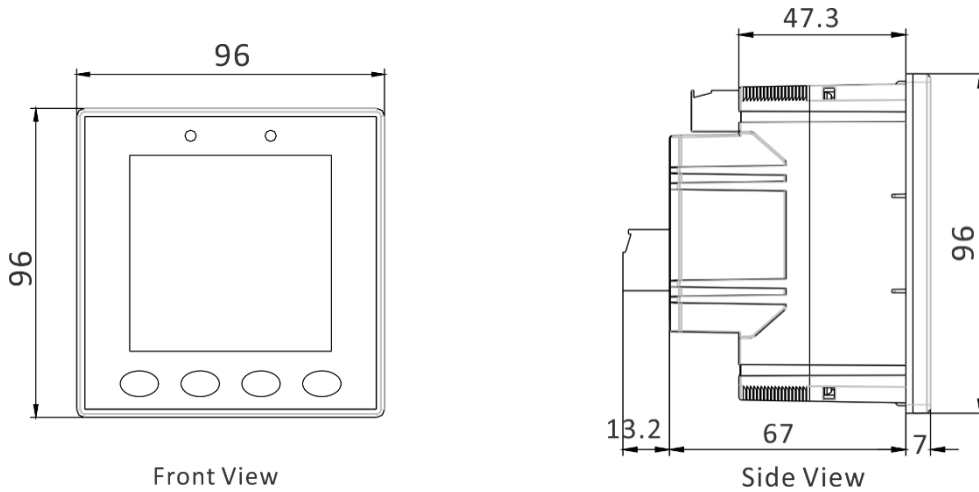


Figure 2-2 Unit Dimensions

2.3 Terminal Dimensions

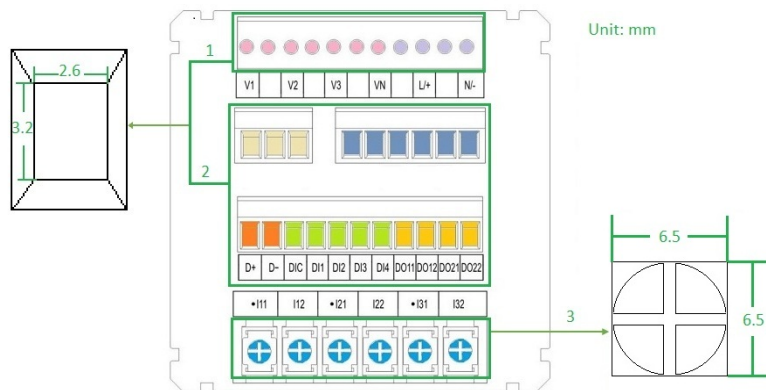


Figure 2-3 Terminal Dimensions

	Terminal	Terminal Dimensions	Wire Size	Max. Torque
1	Voltage Input	2.6mm x 3.2mm	1.5mm ²	5 kgf.cm/M3 (4.3 lb-in)
	Power Supply			
2	Expansion Module A & B	6.5mm x 6.5mm	1.0mm ² - 2.5mm ² (14AWG - 22AWG)	6.0 kgf.cm/M3 (5.2 lb-in)
	RS485			
	DI DO			
3	Current Input			

Table 2-1 Terminal Dimensions

2.4 Mounting

The EPM5600 should be installed in a dry environment with no dust and kept away from heat, radiation and electrical noise source.

Installation steps:

- Remove the installation clips from the meter
- Fit the meter through a 92mmx92mm cutout as shown in Figure 2-4

- Re-install the installation clips and push the clips tightly against the panel to secure the meter

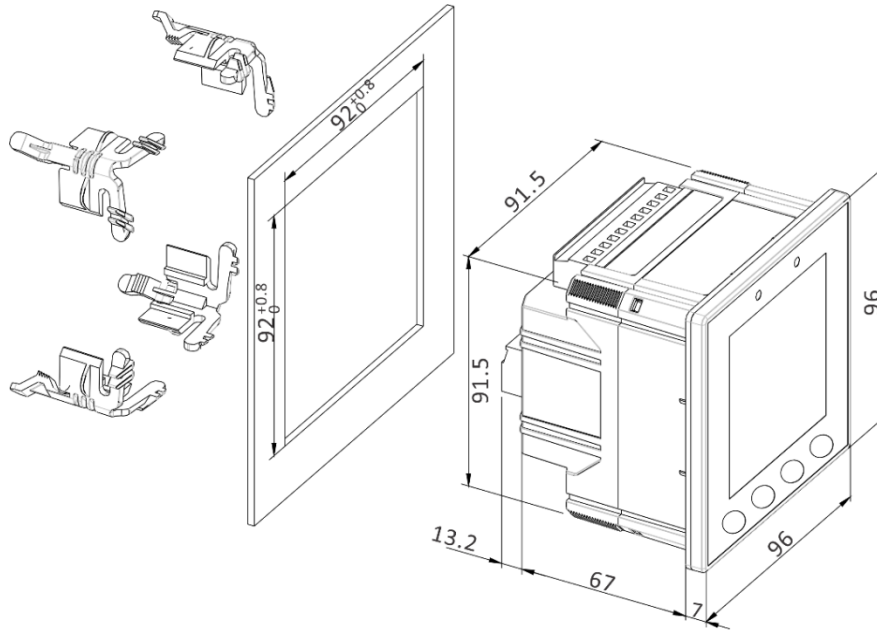


Figure 2-4 Panel Cutout Mounting

2.5 Wiring connections

EPM5600 can satisfy almost any three phase power systems. Please read this section carefully before installation and choose the correct wiring method for your power system. The following Wiring Modes are supported:

- 3-Phase 4-Wire(3P4W) Wye Direct Connection with 3CTs
- 3-Phase 4-Wire(3P4W) Wye Direct Connection with 4CTs
- 3-Phase 4-Wire(3P4W) Wye with 3PTs and 3CTs
- 3-Phase 4-Wire(3P4W) Wye with 3PTs and 4CTs
- 3-Phase 3-Wire(3P3W) Direct Delta Connection With 3CTs
- 3-Phase 3-Wire(3P3W) Direct Delta Connection with 2CTs
- 3-Phase 3-Wire(3P3W) Delta with 2PTs and 3CTs
- 3-Phase 3-Wire (3P3W) Delta with 2PTs and 2CTs
- 1-Phase 3-Wire (1P3W) Direct Connection with 2CTs
- 1-Phase 2-Wire, UII(1P2W-UII) Direct Connection with 1CT
- 1-Phase 2-Wire, UII(1P2W-UII) Direct Connection with 1CT



Caution

Under no circumstances should the PT secondary be shorted.

Under no circumstances should the CT secondary be open when the CT primary is energized. CT shorting blocks should be installed to allow for easy maintenance.

2.5.1 3-Phase 4-Wire(3P4W) Wye Direct Connection with 3CTs

Please consult the serial number label to ensure that the rated system phase voltage is less than or equal to the meter's rated phase voltage input specification. Set the **Wiring Mode** to **3P4W**.

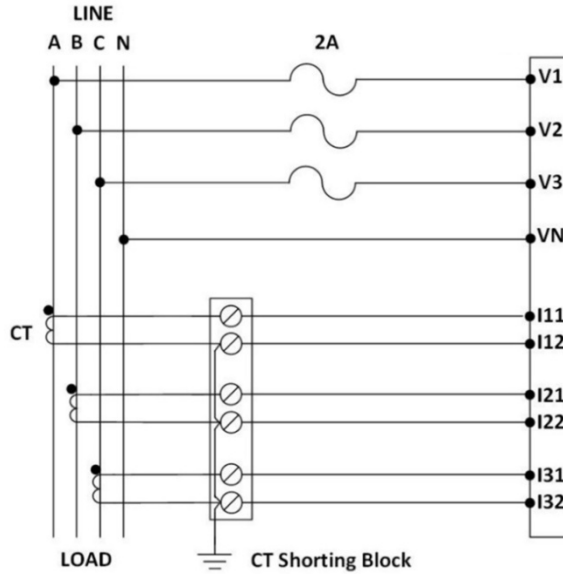


Figure 2-5 3P4W Direct Connection with 3CTs

2.5.2 3-Phase 4-Wire(3P4W) Wye Direct Connection with 4CTs

Please consult the serial number label to ensure that the rated system phase voltage is less than or equal to the meter's rated phase voltage input specification. Set the **Wiring Mode** to **3P4W**

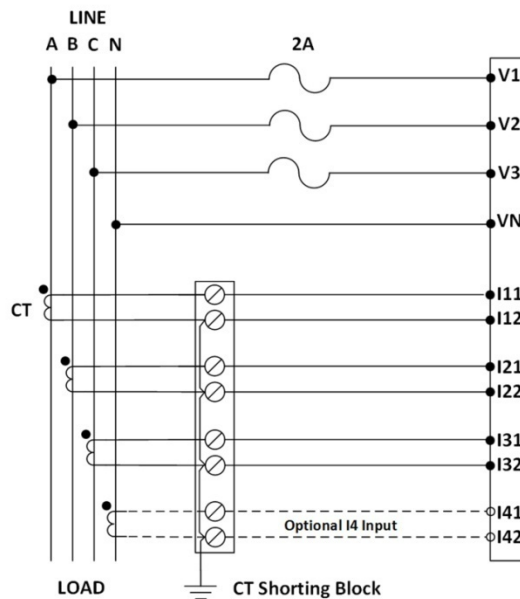


Figure 2-6 3P4W Direct Connection with 4CTs (Optional I41 & I42)

2.5.3 3-Phase 4-Wire(3P4W) Wye with 3PTs and 3CTs

Please consult the serial number label to ensure that the rated PT secondary voltage is less than or equal to the meter's rated phase voltage input specification. Set the **Wiring Mode** to **3P4W**.

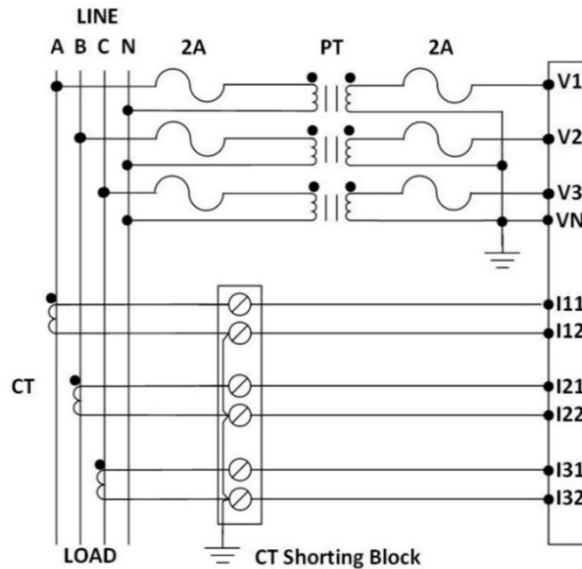


Figure 2-7 3P4W with 3PTs and 3CTs

2.5.4 3-Phase 4-Wire (3P4W) Wye with 3PTs and 4CTs

Please consult the serial number label to ensure that the rated PT secondary voltage is less than or equal to the meter's rated phase voltage input specification. Set the **Wiring Mode** to **3P4W**.

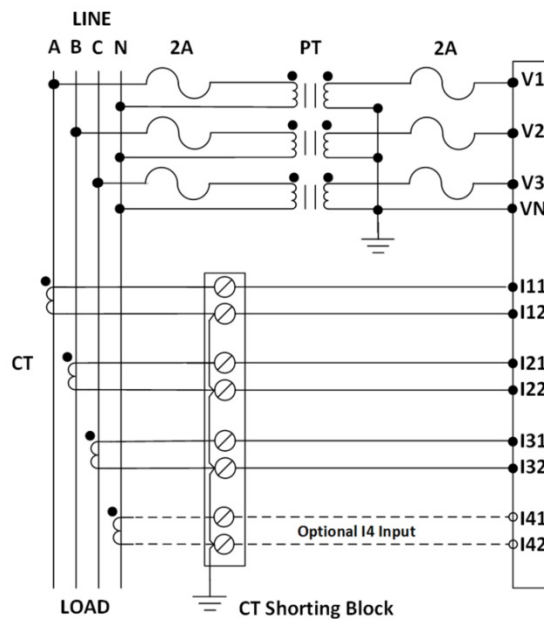


Figure 2-8 3P4W with 3PTs and 4CTs (Optional I41 & I42)

2.5.5 3-Phase 3-Wire (3P3W) Direct Delta Connection with 3CTs

Please consult the serial number label to ensure that the rated system line voltage is less than or equal to the meter's rated line voltage input specification. Set the **Wiring Mode** to **3P3W**.

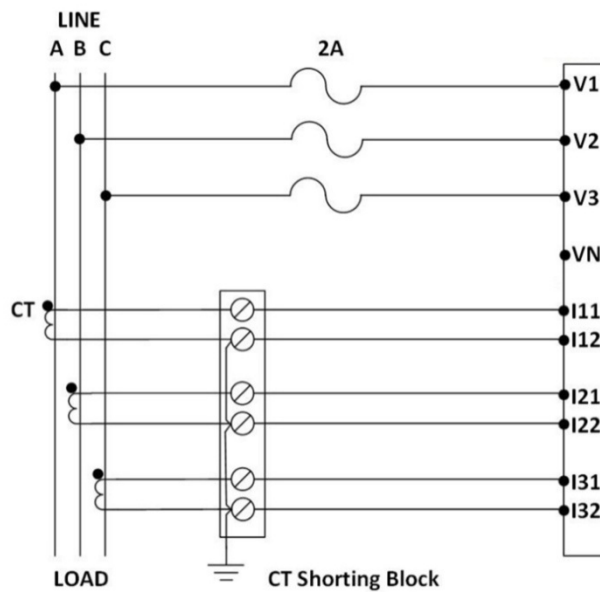


Figure 2-9 3P3W Direct Connection with 3CTs

2.5.6 3-Phase 3-Wire(3P3W) Direct Delta Connection with 2CTs

Please consult the serial number label to ensure that the rated system line voltage is less than or equal to the meter's rated line voltage input specification. Set the **Wiring Mode** to **3P3W**.

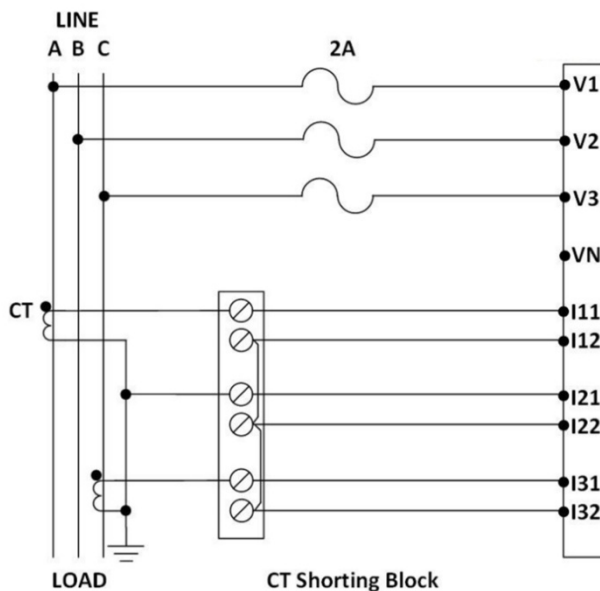


Figure 2-10 3P3W Direct Connection with 2CTs

2.5.7 3-Phase 3-Wire(3P3W) Delta with 2PTs and 3CTs

Please consult the serial number label to ensure that the rated PT secondary voltage is less than or equal to the meter's rated phase voltage input specification. Set the **Wiring Mode** to **3P3W**.

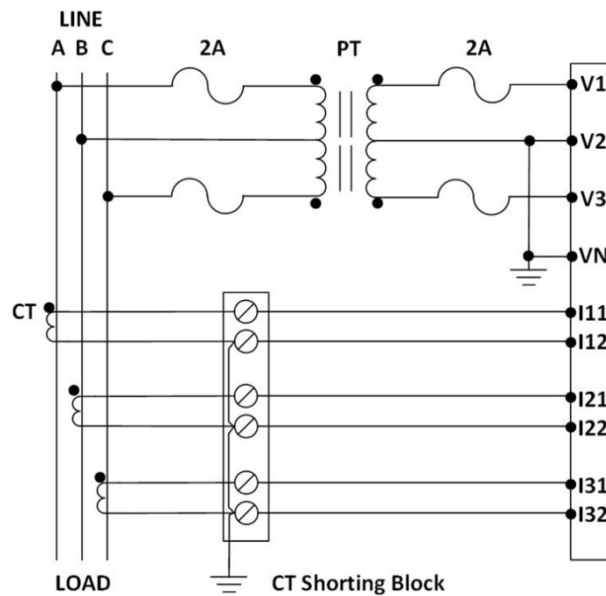


Figure 2-11 3P3W Delta with 2PTs and 3CTs

2.5.8 3-Phase 3-Wire (3P3W) Delta with 2PTs and 2CTs

Please consult the Serial Number Label to ensure that the rated PT secondary voltage is less than or equal to the meter's rated phase voltage input specification. Set the **Wiring Mode** to **3P3W**.

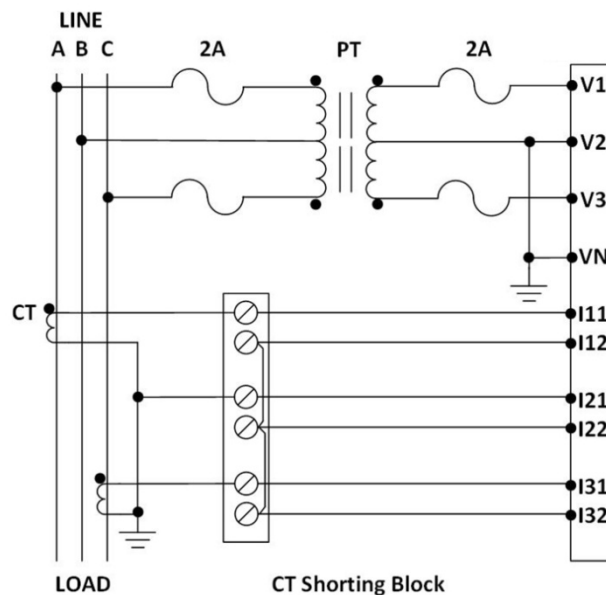


Figure 2-12 3P3W Delta with 2PTs and 2CTs

2.5.9 1-Phase 3-Wire (1P3W) Direct Connection with 2CTs

Please consult the Serial Number Label to ensure that the rated system phase voltage is less than or equal to the meter's rated phase voltage input specification. Set the **Wiring Mode** to **1P3W**.

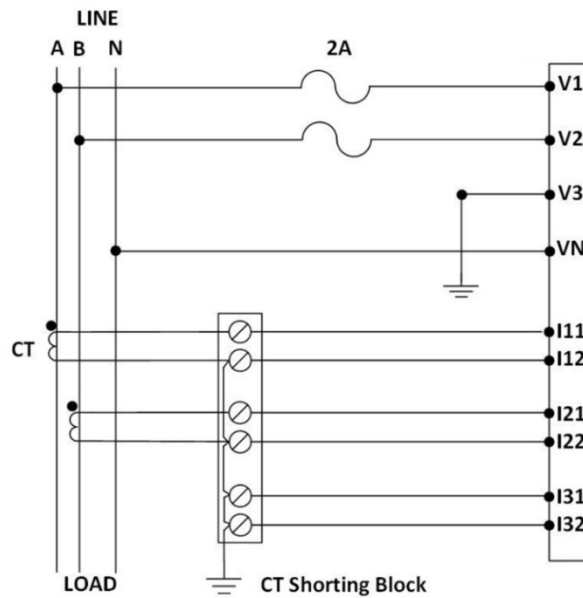


Figure 2-13 1P3W Direct Connection with 2CTs

2.5.10 1-Phase 2-Wire, UI_n(1P2W-UI_n) Direct Connection with 1CT

Please consult the Serial Number Label to ensure that the rated system phase voltage is less than or equal to the meter's rated phase voltage input specification. Set the **Wiring Mode** to **1P2W, L-N**.

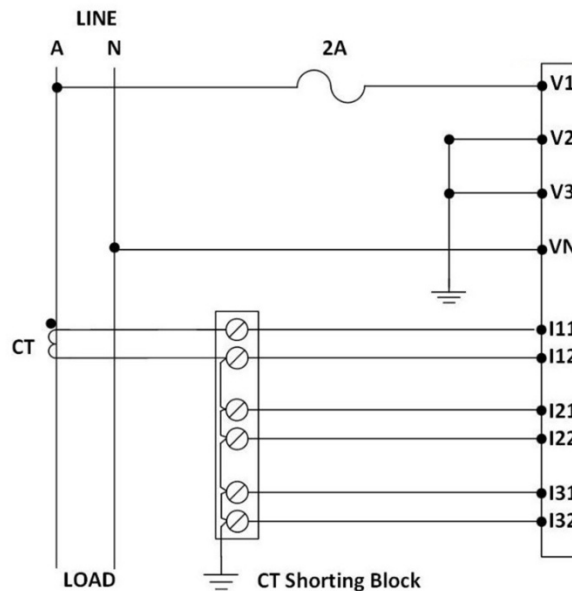


Figure 2-14 1P2WUI_n Direct Connection with 1CT

2.5.11 1-Phase 2-Wire, UII(1P2W-UII) Direct Connection with 1CT

Please consult the Serial Number Label to ensure that the rated system line voltage is less than or equal to the meter's rated phase voltage input specification. Set the **Wiring Mode** to **1P2W, L-L**.

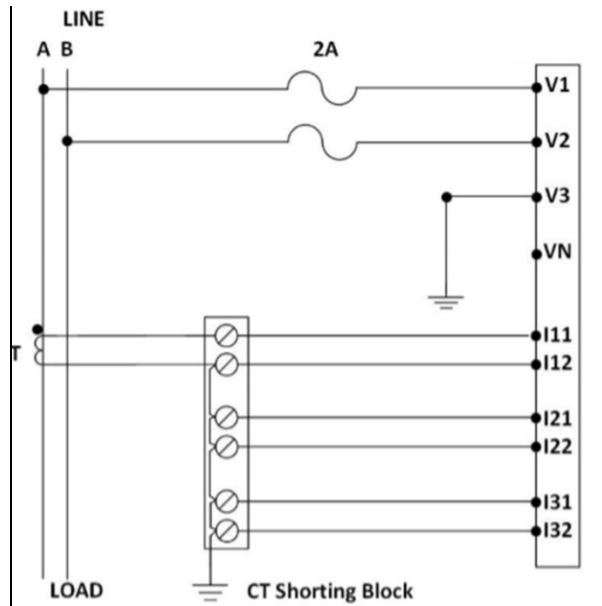


Figure 2-15 1P2WUI Direct Connection with 1CT

2.6 Communications Wiring

The following figure illustrates the RS485 communications connections on the EPM5600:

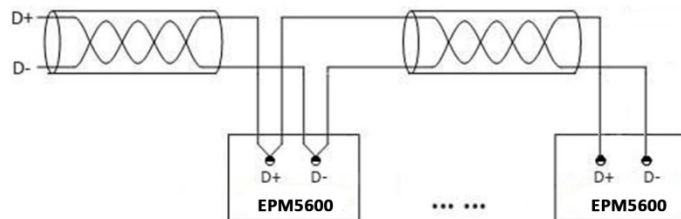


Figure 2-14 Communications Connections

The EPM5600 provides one standard RS485 port and one optional RS485. Up to 32 devices can be connected on a RS485 bus. The overall length of the RS485 cable connecting all devices should not exceed 1200m.

If the master station does not have a RS485 communications port, a RS232/RS485, USB/RS485 or Ethernet/RS485 converter with optically isolated output and surge protections should be used.

2.7 Digital or Pulse Input Wiring

The following figure illustrates the Digital Input connections on the the EPM5600:

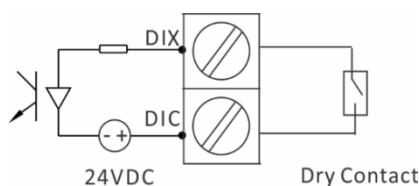


Figure 2-16 DI Connections

2.8 Digital (Relay) Output Wiring

The following figures illustrate the Digital (Relay) Output connections on the EPM5600:

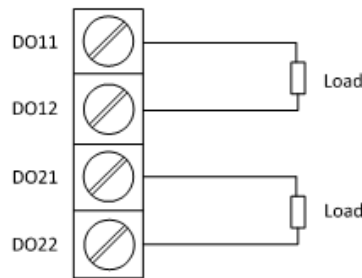


Figure 2-17 DO Connections

2.9 Pulse Output Wiring

The following figure illustrates the Pulse Output connections on the EPM5600 when the **DO Control Mode** setup register is programmed for Energy Pulsing:

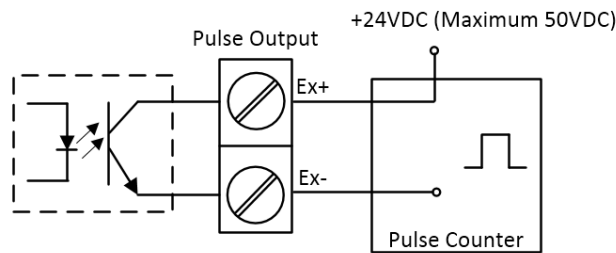


Figure 2-18 Pulse Output (Solid State Relay)Connections for Energy Pulsing

The following figure illustrates the Pulse Output (Solid State Relay) connections on the EPM5600 when the **DO Control Mode** setup register is programmed for RemoteControl/Alarm:

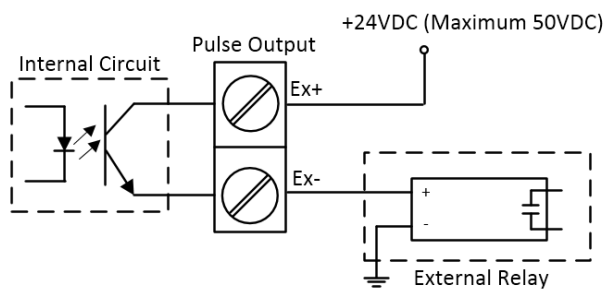


Figure 2-19 Pulse Output (Solid State Relay) Connections for Remote Control/Alarm

2.10 Analog Input Wiring

The following figure illustrates the Analog Input connections on the EPM5600:

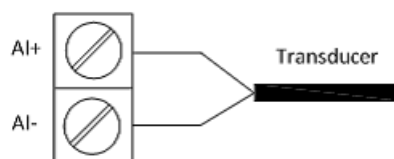


Figure 2-20 AIConnections

2.11 Analog Output Wiring

The following figure illustrates the Analog Output connections on the EPM5600:



Figure 2-21 AO Connections

2.12 RTD Input Wiring

The following figure illustrates the RTD Input connections on the EPM5600:

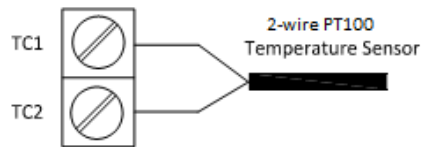


Figure 2-22 RTD InputConnections

2.13 Power Supply Wiring

For AC supply, connect the live wire to the L/+ terminal and the neutral wire to the N/- terminal.

For DC supply, connect the positive wire to the L/+ terminal and the negative wire to the N/- terminal.

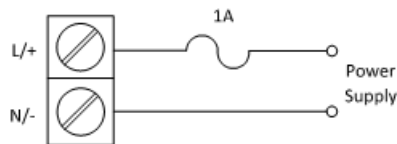


Figure 2-23 Power Supply Connections



3. Front Panel

The EPM5600 has a large, easy to read Dot-Matrix LCD display with backlight and four buttons for data display and meter configuration. This chapter introduces the front panel operations.

3.1 Using the Front Panel Buttons

The EPM5600's front panel has been designed with a menu-driven interface that is extremely user friendly such that all one has to do is to simply follow the menu at the bottom of the screen. The button definitions for F1 to F4 under **Display Mode** and **Setup Mode** are explained in the following table. **The default password is 0000 (four zeros).**

Button	Display Mode		Setup Mode				
	Main Menu	Sub Menus	Password Page	Enter Password	Browse/Setup Menu (Until a parameter is selected)	Enumerated Parameter	Numeric Parameter
F1	← (Menu Left)	Esc (Exit)	Esc (Exit)	Cancel (Exit)	Esc (Exit)	Cancel (Exit)	Cancel (Exit)
F2	Select Option	↑ (Page Up) or Select Option	Browse (View Only)	← (Shift Left)	↑ (Cursor Up)	← (Previous)	← (Shift Left)
F3	Select Option	↓ (Page Down) or Select Option	Null (Not Used)	↑ (Increment)	↓ (Cursor Down)	↑ (Next)	↑ (Increment)
F4	→ (Menu Right)	→ (Menu Right) or Select Option or Null (Not Used)	Enter (Confirm)	OK (Confirm)	Enter (Select Parameter)	OK (Confirm)	OK (Confirm)

Table 3-1 Button Function

3.2 Data Display

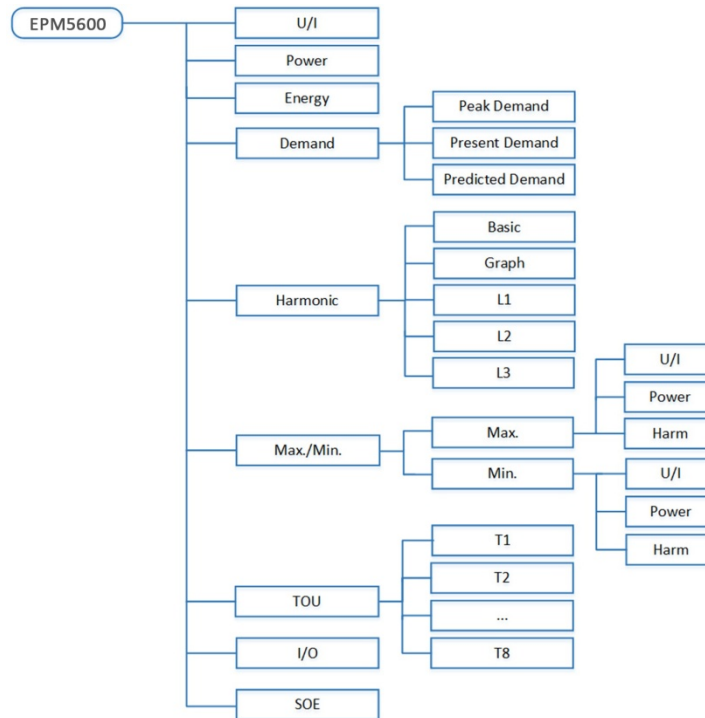


Figure 3-1 Data Display Menu

Throughout this document, the phase-to-neutral notations of A/B/C and L1/L2/L3 as well as the phase-to-phase notations of AB/BC/CA and L12/L23/L31 may be used interchangeably for specifying a certain parameter to be a phase-to-neutral or phase-to-phase value, respectively.

The following sections illustrate the available measurements for each display option. Depending on the **Wiring Mode** selected, certain measurements may not be available. For example, the per-phase UIn, UIn Average, I4, per-phase kW, kvar, kVA and PF measurements are not available when the **Wiring Mode** is set to 3P3W or 1P2W L-L.

3.2.1 U/I

Press Button	Display Screens	1 st Row	2 nd Row	3 rd Row	4 th Row
<U/I>	Default	Ull avg	I avg	kW Total	PF Total
	Display 1 (Volts L-N)	U1	U2	U3	Uln avg
	Display 2 (Volts L-L)	U12	U23	U31	Ull avg
	Display 3 (Currents)	I1	I2	I3	I avg
	Display 4 (In/I4/Ir)	In	I4 ¹	I ^{#2}	
	Display 5 (Frequency)	Frequency			
	Display 6 (Volts Angle)	U1	U2	U3	
	Display 7 (Currents Angle)	I1	I2	I3	
	Display 8 (Phasor Diagram)	Phasor Diagram			
	Display 9 (U Waveform) [#]	U1 Real-time 1-cycle Waveform			
	Display 10 (U Waveform) [#]	U2 Real-time 1-cycle Waveform			
	Display 11 (U Waveform) [#]	U3 Real-time 1-cycle Waveform			
	Display 12 (I Waveform) [#]	I1 Real-time 1-cycle Waveform			
	Display 13 (I Waveform) [#]	I2 Real-time 1-cycle Waveform			
	Display 14 (I Waveform) [#]	I3 Real-time 1-cycle Waveform			
Display 15 (Operating	Operating Time (Running Hours)				



	Time)				
	Display 16(U Fund)*	U1 ³	U2 ³	U3 ³	
	Display 17(I Fund)*	I1 ³	I2 ³	I3 ³	

* Available in Firmware V1.00.03 or later
 # Available in Firmware V1.00.06 or later

Table 3-2 U/I Display

Notes:

- 1) The I4 parameter only appears if the meter is equipped with the corresponding I4 option.
- 2) The I4 parameter only shows a valid value when the **Wiring Mode** is set to **3P3W** or **3P4W**; otherwise, it shows "0".
- 3) For U/I Fundamental:
 - U1 = Uan, U2 = Ubn, U3 = Ucn in **3P4W** mode
 - U1 = Uab, U2 = Ubc, U3 = Uca in **3P3W** mode
 - I1 = Ia, I2 = Ib, I3 = Ic

3.2.2 Power

Press Button	Display Screens	1 st Row	2 nd Row	3 rd Row	4 th Row
<Power>	Display 1	kW Total	kvar Total	kVA Total	PF Total
	Display 2	kW1	kW2	kW3	kW Total
	Display 3	kvar1	kvar2	kvar3	kvar Total
	Display 4	kVA1	kVA2	kVA3	kVA Total
	Display 5	PF1	PF2	PF3	PF Total
	Display 6	dPF1	dPF2	dPF3	
	Display 7 (P Fund)*	P1	P2	P3	P

* Available in Firmware V1.00.03 or later

Table 3-3 Power Display

3.2.3 Energy

Press Button	Display Screens	1 st Row	2 nd Row	3 rd Row	4 th Row
<Energy>	Display 1	kWh Total	kvarh Total	kVAh Total	
	Display 2	kWh Imp	kWh Exp	kWh Net	kWh Total
	Display 3	kvarh Imp	kvarh Exp	kvarh Net	kvarh Total
	Display 4	kVAh Total			

Table 3-4 Energy Display

3.2.4 Demand

Press Button	Display Screens	1 st Row	2 nd Row	3 rd Row	
<DMD> ¹	<Max> ²	Display 1	kW Total	kvar Total	kVA Total
			Timestamp	Timestamp	Timestamp
		Display 2	I1	I2	I3
			Timestamp	Timestamp	Timestamp
	<Pres> ³	Display 1	kW Total	kvar Total	kVA Total
			I1	I2	I3
		Display 2	kW Total	kvar Total	kVA Total
			I1	I2	I3

Table 3-5 Demand Display

Notes:

- 1) DMD = Demand
- 2) Max = Max. (Peak) Demand of This Month (Since Last Reset)
- 3) Pres = Present Demand
- 4) Pred = Predicted Demand

3.2.5 Harmonics

Press Button		Display Screens	1 st Row	2 nd Row	3 rd Row	
<Harmonics>	<Basic>	Display 1 ¹ (U THD)	U1/U12	U2/U23	U3/U31	
		Display 2 (I THD)	I1	I2	I3	
		Display 3 (TDD)	I1	I2	I3	
		Display 4 (K-Factor)	I1	I2	I3	
		Display 5(Crest Factor)	I1	I2	I3	
		Display 6(Unbalance)	Current	Voltage		
		Display 7 (U Sequence)*	U1 ^{2,3}	U2 ^{2,3}	U0 ^{2,3}	
		Display 8 (I Sequence)*	I1 ^{2,3}	I2 ^{2,3}	I0 ^{2,3}	
	<Graph>	Display 1 ¹	U1/U12 Harmonic Spectrum (Odd)			
		Display 2 ¹	U2/U23 Harmonic Spectrum (Odd)			
		Display 3 ¹	U3/U31 Harmonic Spectrum (Odd)			
		Display 4	I1 Harmonic Spectrum (Odd)			
		Display 5	I2 Harmonic Spectrum (Odd)			
		Display 6	I3 Harmonic Spectrum (Odd)			
	<L1>	Display 1 [HD (ODD)]	HD3 ~ HD15			
		Display 2 [HD (ODD)]	HD17 ~ HD29			
		Display 3 [HD (ODD)]	HD31			
		Display 1 [HD (Even)]	HD2 ~ HD14			
		Display 2 [HD (Even)]	HD16 ~ HD28			
		Display 3 [HD (Even)]	HD30			
		<L2>	Display 1 [HD (ODD)]	HD3 ~ HD15		
			Display 2 [HD (ODD)]	HD17 ~ HD29		
			Display 3 [HD (ODD)]	HD31		
			Display 1 [HD (Even)]	HD2 ~ HD14		
			Display 2 [HD (Even)]	HD16 ~ HD28		
			Display 3 [HD (Even)]	HD30		
	<L3>	Display 1 [HD (ODD)]	HD3 ~ HD15			
		Display 2 [HD (ODD)]	HD17 ~ HD29			
		Display 3 [HD (ODD)]	HD31			
		Display 1 [HD (Even)]	HD2 ~ HD14			
Display 2 [HD (Even)]		HD16 ~ HD28				
Display 3 [HD (Even)]		HD30				

* Available in Firmware V1.00.03 or later

Table 3-6 Harmonics Display

Notes:

- 1) When the **Wiring Mode** is **3P3W** or **1P2W L-L**, the phase A/B/C Voltage THD/TOHD/TEHD/HDxx mean phase AB/BC/CA Voltage THD/TOHD/TEHD/HDxx.
- 2) For U/I Symmetrical Components:

- U1/I1 = Positive Sequence Voltage/Current
- U2/I2 = Negative Sequence Voltage/Current
- U0/I0 = Zero Sequence Voltage/Current

3) This screen is not shown if the **Wiring Mode** is set to **1P2W LN**, **1P2W LL** or **1P3W**.

3.2.6 Max./Min.

Press Button		Display Screens	1 st Row	2 nd Row	3 rd Row	4 th Row	
<Max./Min.>	<Max.>	-	Default (Max.)	U1 Timestamp	U2 Timestamp	U3 Timestamp	Uln avg Timestamp
			Display 1	U1 Timestamp	U2 Timestamp	U3 Timestamp	Uln avg Timestamp
		Display 2	U12 Timestamp	U23 Timestamp	U31 Timestamp	Ull avg Timestamp	
			Display 3	I1 Timestamp	I2 Timestamp	I3 Timestamp	I avg Timestamp
		Display 4	Freq Timestamp	In Timestamp	I4 Timestamp	Ir* Timestamp	
			<Power>	Display 1	P1 Timestamp	P2 Timestamp	P3 Timestamp
		Display 2		Q1 Timestamp	Q2 Timestamp	Q3 Timestamp	Q Timestamp
		Display 3		S1 Timestamp	S2 Timestamp	S3 Timestamp	S Timestamp
		Display 4		PF1 Timestamp	PF2 Timestamp	PF3 Timestamp	PF Timestamp
		<Harm>	Display 1	L1 U THD Timestamp	L2 U THD Timestamp	L3 U THD Timestamp	
				Display 2	L1 I THD Timestamp	L2 I THD Timestamp	L3 I THD Timestamp
			Display 3	L1 K-Factor Timestamp	L2 K-Factor Timestamp	L3 K-Factor Timestamp	
	Display 4			L1 C-Factor Timestamp	L2 C-Factor Timestamp	L3 C-Factor Timestamp	
	Display 6		I Unbal. Timestamp	U Unbal. Timestamp			
	<Min.>	<U/I>	Display 1	U1 Timestamp	U2 Timestamp	U3 Timestamp	Uln avg Timestamp
				Display 2	U12 Timestamp	U23 Timestamp	U31 Timestamp
			Display	I1	I2	I3	I avg



		<Power>	3	Timestamp	Timestamp	Timestamp	Timestamp
			Display 4	Freq	In	I4	I4*
				Timestamp	Timestamp	Timestamp	Timestamp
			Display 1	P1	P2	P3	P
				Timestamp	Timestamp	Timestamp	Timestamp
			Display 2	Q1	Q2	Q3	Q
				Timestamp	Timestamp	Timestamp	Timestamp
			Display 3	S1	S2	S3	S
				Timestamp	Timestamp	Timestamp	Timestamp
			Display 4	PF1	PF2	PF3	PF
				Timestamp	Timestamp	Timestamp	Timestamp
			<Harm>	Display 1	L1 U THD	L2 U THD	L3 U THD
		Timestamp			Timestamp	Timestamp	
		Display 2		L1 I THD	L2 I THD	L3 I THD	
				Timestamp	Timestamp	Timestamp	
		Display 3		L1 K-Factor	L2 K-Factor	L3 K-Factor	
				Timestamp	Timestamp	Timestamp	
		Display 4		L1 C-Factor	L2 C-Factor	L3 C-Factor	
				Timestamp	Timestamp	Timestamp	
		Display 6		I Unbal.	U Unbal.		
Timestamp	Timestamp						

*Available in Firmware V1.00.06 or later

Table 3-7 Max./Min. Display

3.2.7 TOU

Press button	Display screens	1 st Row	2 nd Row	3 rd Row	
<TOU>	<T1>	Display 1 (kWh)	Import	Export	
		Display 2 (kvarh)	Import	Export	
		Display 3 (kVAh)	Total		
		Display 4 (Peak Demand)	P Timestamp	Q Timestamp	S Timestamp
	<T2>	Display 1 (kWh)	Import	Export	
		Display 2 (kvarh)	Import	Export	
		Display 3 (kVAh)	Total		
		Display 4 (Peak Demand)	P Timestamp	Q Timestamp	S Timestamp
	<T7>	Display 1 (kWh)	Import	Export	
		Display 2 (kvarh)	Import	Export	
		Display 3 (kVAh)	Total		
		Display 4 (Peak Demand)	P Timestamp	Q Timestamp	S Timestamp
<T8>	Display 1 (kWh)	Import	Export		
	Display 2 (kvarh)	Import	Export		
	Display 3 (kVAh)	Total			
	Display 4 (Peak Demand)	P Timestamp	Q Timestamp	S Timestamp	

Table 3-8 TOU Display

3.2.8 I/O

Press button	Display screens	1 st Row	2 nd Row	3 rd Row
--------------	-----------------	---------------------	---------------------	---------------------

<I/O>	Display 1 (DI Status)	DI1, DI2 ¹	DI3, DI4 ¹	DI5, DI6 ¹
	Display 2 (Pulse Counter)	DI1, DI2 ¹	DI3, DI4 ¹	DI5, DI6 ¹
	Display 3 (DO Status)	DO1, DO2 ²	DO3, DO4 ²	
	Display 4 (Analog Input)	AI ³		
	Display 5 (Analog Output)	AO ⁴		
	Display 6 (Temperature)	TC1 ⁵	TC2 ⁵	

Table 3-9 I/O

Notes:

- 1) This display only appears if the meter is equipped with the corresponding DI option.
- 2) This display only appears if the meter is equipped with the corresponding DO option.
- 3) This display only appears if the meter is equipped with the AI option.
- 4) This display only appears if the meter is equipped with the AO option.
- 5) This display only appears if the meter is equipped with the RTD option.

3.2.9 SOE

The EPM5600 with Firmware V1.00.03 or later supports the display of the SOE Log with upto 100 Events (2 Events per page) such as I/O Changes, Setpoint, ...etc, on the Front Panel. In addition, the SOE Log can be reset from the Front Panel.

Examples of Event Log Display:

SOE 01/50	SOE 02/50	SOE 03/50
01. Over Current Setpoint Active 2016/10/28 13:34:08:890 Value: 99.43 A 02. Over Ull Setpoint Active 2016/10/28 13:34:08:890 Value: 378.8 V	03. Over Uln Setpoint Active 2016/10/28 13:34:08:890 Value: 217.8 V 04. Power On 2016/10/28 13:34:06:706	05. DI6 Active 2016/10/28 11:38:00:316 06. Setup Changes via Communication 2016/10/28 11:34:01:917
Esc ↑ ↓	Esc ↑ ↓	Esc ↑ ↓

Figure 3-2 SOE Log Displays

3.3 Setup Configuration via the Front Panel

Pressing <←>/<F1> or <→>/<F2> to scroll the menu at the bottom until <Setup> appears and then press the button associated with <Setup> to browse or change the setup parameters.

3.3.1 Making Setup Changes

1) Entering the Password:

- Press <Setup> to enter the **Setup Mode**.
- Press <F4>/<Enter> to advance to the **Password** page.
- A correct password must be entered before changes are allowed. The factory default password is "0000".
- Press <F2>/<←> to shift the cursor to the left or <F3>/<↑> to increment the numeric value for the password.
- When the password has been entered, pressing <F4>/<OK> will advance to the setup menu if the password is correct.

2) Selecting a parameter to change:

-
- Press <F2>/<↑> or <F3>/<↓> to scroll to the desired sub-menu or parameter.
 - Press <F4>/<Enter> to select the sub-menu or parameter.
 - Repeat the step 2 until a setup parameter has been selected.
- 3) Changing and saving a setup parameter:**
- For a Numeric parameter, press <F2>/<←> to shift the cursor to the left or <F3>/<↑> to increment the numeric value
 - For an Enumerated parameter, press <F2>/<←> or <F3>/<↑> to scroll backward and forward in the selection list.
 - After modification, press <F4>/<OK> to save the change into memory or <Cancel> to exit the currently selected parameter without change.
 - Repeat step 3) until all setup parameters have been changed.
- 4) Exiting the Setup Mode**
- Press <F1>/<Esc> to return to the **Display Mode**.
 - Also, the **Setup Mode** will be automatically exited if there is a period of inactivity of 1 minute or longer.

3.3.2 Setup Menu

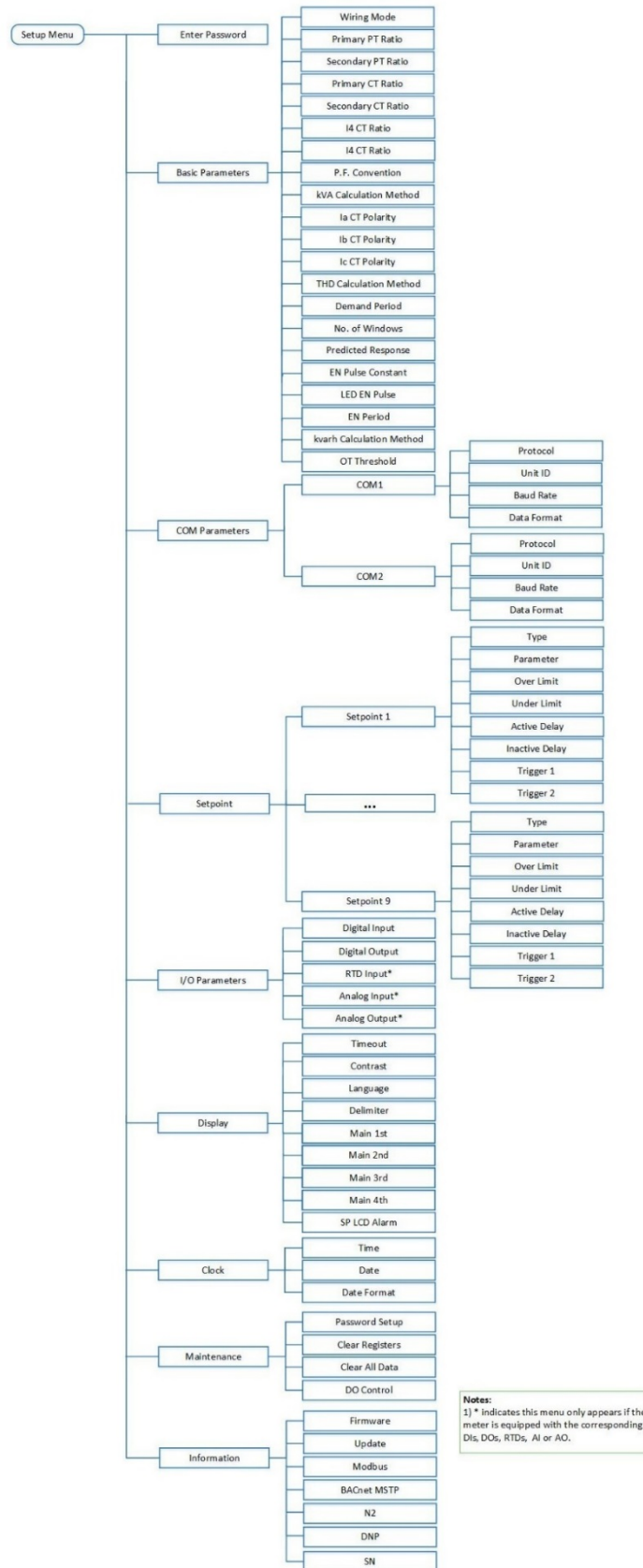


Figure 3-3 Setup Menu



3.3.3 Configuration

The Setup Configuration mode provides access to the following setup parameters:

Label			Description	Range	Default
1 st	2 nd	3 rd			
Password			Enter Password	0000 to 9999	0000
Basic					
Wiring Mode			Meter's Wiring Connection	DEMO/ 1P2W L-N/1P2W L-L/ 1P3W/3P3W/3P4W	3P4W
PT Primary			PT Primary Ratio	1 to 1000000V	100V
PT Secondary			PT Secondary Ratio	1 to 690V	100V
CT Primary			CT Primary Ratio	1 to 30000A	5A
CT Secondary			CT Secondary Ratio	1 to 5A	5A
I4 Primary~			I4 Primary Ratio	1 to 30000A	5A
I4 Secondary~			I4 Secondary Ratio	1 to 5A	5A
PF Convention			PF Convention	IEC/IEEE/-IEEE	IEC
kVA Calc.			kVA Calculation Method	Vector/Scalar	Vector
I1 Polarity			I1 Polarity	Normal/Reversed	Normal
I2 Polarity			I2 Polarity		
I3 Polarity			I3 Polarity		
THD Calc.			Select between % of Fundamental or % of RMS	THDf/THDr	THDf
DMD Period			Demand Interval	1 to 60 min	15
No. of Windows			Number of Sliding Windows	1 to 15	1
Predicted Resp.			Predicted Response	70 to 99	70
EN Pulse CNST			Pulse Constant	1000/3200	1000
LED EN Pulse			Enable kWh/kvarh Energy Pulsing	Disabled/kWh/kvarh	kWh
EN Period*			Interval Energy period	5 to 60 min	60
kvarh Calc.~			kvarh Calculation Method	RMS/FUND	RMS
OT Threshold~			Current Threshold of Device Operating Time	1to 1000 (x0.001In)	1
Comm.					
COM1					
Protocol			Protocol	Modbus/BACnet*/N2*/DNP ~	Modbus
Unit ID			Modbus Address	Modbus RTU/N2*: 1 to 247 BACnet/MSTP*: 1 to 127 DNP~: 0 to 65519	100
Baud Rate			Data rate in bits per second	1200/2400/4800/ 9600/19200/38400	9600
Data Format			Data Format	8N2/8O1/8E1/ 8N1/8O2/8E2	8E1
COM2					
Protocol			Protocol	Modbus	Modbus
Unit ID			Modbus Address	1 to 247	101
Baud Rate			Data rate in bits per second	1200/2400/4800/ 9600/19200/38400	9600
Data Format			Data Format	8N2/8O1/8E1/ 8N1/8O2/8E2	8E1
Setpoint*					
Group #1					
Type			Setpoint Type	0=Disabled, 1=Over Setpoint 2=Under Setpoint	0
Parameter ¹			Setpoint Source	See Table 3-11	None
OVLim			Over Limit		0
UNLim			Under Limit		0
ActiveDelay			Active Delay	0 to 9999s	10
InactiveDelay			Inactive Delay	0 to 9999s	10
Trigger1 ²			Setpoint Trigger1	See Table 3-12	



Trigger2 ²	Setpoint Trigger2	See Table 3-12	
...			
Group #9			
Type	Setpoint Type	0=Disabled, 1=Over Setpoint 2=Under Setpoint	0
Parameter ¹	Setpoint Source	See Table 3-11	None
OvLim	Over Limit		0
UnLim	Under Limit		0
ActiveDelay	Active Delay	0 to 9999s	0
InactiveDelay	Inactive Delay	0 to 9999s	10
Trigger1 ²	Setpoint Trigger1	See Table 3-12	10
Trigger2 ²	Setpoint Trigger2	See Table 3-12	
I/O			
Digital Input ³			
Function ³			
DI1	Function Mode for DI1 to DI6	Digital Input / Pulse Counter / Tariff Switch ⁴	Digital Input
...			
DI6			
Debounce ³	Specifies the minimum duration the DI must remain in the Active or Inactive state before a state change is considered to be valid.		
DI1	Debounce for DI1 to DI6	1 to 9999 ms	20 ms
...			
DI6			
Pulse Weight ³	Specifies the incremental value for each pulse received		
DI1	Pulse Weight for DI1 to DI6	1 to 1000000	1
...			
DI6			
Digital Output ³			
Pulse Width ³			
Specifies the duration for which the relay output will be active when a remote control command is received to activate it.			
DO1	Pulse Width for DO1 to DO4	0 to 600 (x0.1s) (0=Latch Mode)	10
DO2			
DO3			
DO4			
Function ³			
Specifies the function of the Digital Output.			
DO1 [#]	DO Control Mode	<ul style="list-style-type: none"> ▪ Remote Control / Alarm ▪ kWh Import ▪ kWh Export ▪ kWh Total ▪ kvarh Import ▪ kvarh Export ▪ kvarh Total 	Remote Control/ Alarm
DO2 [#]			
DO3			
DO4			
RTD ³			
RTD1 Compensation	RTD Compensation ⁵	0 to 2000 (x0.01Ω)	0.00Ω
RTD2 Compensation			
Analog Input ³			
Type	Select between 0-20mA or 4-20mA input	4-20mA / 0-20 mA	4-20mA
Zero Scale	The value that corresponds to the minimum Analog Input of 0 or 4 mA	-999,999 to 999,999	400
Full Scale	The value that corresponds to the maximum Analog Input of 20 mA	-999,999 to 999,999	2000
Analog Output ⁵			
Type	Select between 0-20mA or 4-20mA output	4-20mA / 0-20mA	4-20mA
Key ⁶	The parameter to which the Analog Output is proportional	See Table 3-13	Uab
Zero Scale	The parameter value that corresponds to the minimum Analog Output of 0 mA or 4 mA	-999,999 to 999,999	0



Full scale	The parameter value that corresponds to the maximum Analog Output of 20 mA	-999,999 to 999,999	0
Display			
Timeout	Backlight Timeout	0 to 60 min	5
Contrast	Display Contrast	0 to 9	5
Language	System Language	Chinese/English	English
Delimiter/	Delimiter	Option1/Option2	Option1
Main 1st*	Default Display 1 st parameter	See Note 8)	Ullavg
Main 2nd*	Default Display 2 nd parameter		lavg
Main 3rd*	Default Display 3 rd parameter		P (kW Total)
Main 4th*	Default Display 4 th parameter		PF (Total)
SP LCD Alarm~ ⁹	Enable Flashing LCD Alarm	On/Off	On
Clock			
Time	Time	(20)YY-MM-DD	/
Date	Date	HH:MM:SS	/
Date Format	Date Format	YYMMDD/ MMDDYY/ DDMMYY	YYMMDD
Maintenance			
Password Setup			
New Password	Enter new password		
Confirm Password	Confirm new password		
Clear Registers			
Energy			
Present ¹⁰	Clear Present Energy Measurements and Energy Log	Yes/No	No
History ¹¹	Clear Historical Monthly Energy Log	Yes/No	No
Demand			
Present Max	Clear Peak Demand Log of This Month (Since Last Reset)	Yes/No	No
All	Clear Present Demand, Peak Demand Log of This Month (Since Last Reset) and Last Month (Before Last Reset)	Yes/No	No
Max./Min.			
Present	Clear Max./Min. Log of This Month (Since Last Reset)	Yes/No	No
All	Clear Max./Min. Log of This Month (Since Last Reset) and Last Month (Before Last Reset)	Yes/No	No
Operating Time			
Reset	Clear Device Operating Time	Yes/No	No
Pulse Counter			
All	Clear All DI Counters	Yes/No	No
DI1	Clear DIx Pulse Counter	Yes/No	No
...			
DI6			
SOE Logs*	Clear SOE Logs	Yes/No	No
Clear All Data			
-	Clear All of the above	Yes/No	No
DO Control			
DO1	DOx Manual Control	Normal/On/Off	Normal
DO2			
DO3			



DO4			
Information	Check meter information		
Firmware	Firmware Version	e.g.V1.00.01	
Update	Date of the latest firmware update	e.g.20160701	
Modbus	Modbus Protocol Version	e.g. V1.4	
BACnet MSTP*	BACnet MSTPProtocol Version	e.g. V1.7	
N2*	N2 Protocol Version	e.g. V1.0	
DNP~	DNP Protocol Version	e.g. V1.0	
SN	Serial Number	e.g. 1506005094	

* Available in Firmw are V1.00.03 or later

#Available in Firmw are V1.00.04 or later

~Available in Firmw are V1.00.06 or later

Table 3-10 Setup Parameters

Notes:

1) The table below illustrates the Setpoint Parameters.

Key	Setpoint Parameter	Scale	Unit	
0	None	-	-	
1	Uln (Any Phase Voltage)	x1	V	
2	Ull (Any Line Voltage)			
3	I (Any Phase Current)			A
4	ln (Calculated)			
5	Frequency			Hz
6	P (kW Total)			W
7	Q (kvar Total)			var
8	S (kVA Total)			VA
9	PF (PF Total)			-
10	P DMD (kW Total Present Demand)			W
11	Q DMD (kvar Total Present Demand)			var
12	S DMD(kVA Total Present Demand)			VA
13	P DMD Pred (kW Total Predicted Demand)			W
14	Q DMD Pred (kvar Total Predicted Demand)			var
15	S DMD Pred (kVA Total Predicted Demand)			VA
16	U THD		100%	
17	U TOHD		100%	
18	U TEHD		100%	
19	I THD		100%	
20	I TOHD		100%	
21	I TEHD		100%	
22	U Unbal (Voltage Unbalance)		100%	
23	I Unbal (Current Unbalance)		100%	
24	Reversal (Phase Reversal) ³	-		
25	I4 (Measured)*	x1	A	
26	AI*		-	
27	Reserved	-	-	
28	RTD1*	x1	°C	
29	RTD2*			
30	Ir (Residual Current)~	x1	A	
31	U2 (-ve Sequence Unbalance)~	x1	V	
32	U0 (Zero Sequence Unbalance)~			

*Appears only if the device is equipped with the appropriate option

~ Available in Firmw are V1.00.06 or later

Table 3-11 Setpoint Parameters

2) The table below illustrates the options for Setpoint Trigger.

Key	Action	Key	Action
0	None	3	DO3 Closed
1	DO1 Closed	4	DO4 Closed
2	DO2 Closed	Others	Reserved

Table 3-12 Setpoint Trigger

3) This menu only appears if the meter is equipped with the corresponding options.

- 4) **Tariff Switching** is available in Firmware V1.00.03 or later and only valid for DI1 to DI3.
- 5) Please refer to Chapter 4.1.6 for a detailed description of RTD Compensation.
- 6) Analog Output Parameters

If **PF Total** or **Freq** is chosen as the AO parameter, the values for **ZERO** (zero scale) and **FULL** (full scale) should be set as 1000 or 100 times the actual value, respectively. The Units for Voltage, Current, kW, kvar, kVA and FREQ are V, A, kW, kvar, kVA and Hz, respectively.

Key	Parameter	Scale	Unit	Key	Parameter	Scale	Unit
0	Uab	x1	V	10	kVA Total	x1	kVA
1	Ubc		V	11	PF Total	x1000	-
2	Uca		V	12	Frequency	x100	-
3	Ull Average		V	13	kW Total Present Demand	x1	kW
4	Ia		A	14	kvar Total Present Demand		kvar
5	Ib		A	15	kVA Total Present Demand	kVA	
6	Ic		A	16	Uan	x1	V
7	I Average	A	17	Ubn	V		
8	kW Total	kW	18	Ucn	V		
9	kvar Total	x1	kvar	19	Uln Average		V

Table 3-13 Analog Output Parameters

- 7) The Delimiter setup register supports two options, 1 and 2:
 - Option 1: “,” is used as the x1000 delimiter and “.” as the decimal point (e.g. 123,456,789.0).
 - Option 2: “ ” is used as the x1000 delimiter and “,” as the decimal point (e.g. 123 456 789,0).
- 8) The following table illustrates the parameters that can be selected for display in the **Default Display** screen.

Key	Parameters	Key	Parameters	Key	Parameters	Key	Parameters
0	U1 (Uan)	10	I3 (Ic)	20	T1 kWh Imp	30	Fund.kW Total*
1	U2 (Ubn)	11	Iavg	21	T2 kWh Imp	31	dPF Total*
2	U3 (Ucn)	12	P (kW Total)	22	T3 kWh Imp	32	I4*
3	Ulnavg	13	Q (kvar Total)	23	T4 kWh Imp	33	U1 THD*
4	U12 (Uab)	14	S (kVA Total)	24	I1 (Ia) Demand	34	U2 THD*
5	U23 (Ubc)	15	PF (PF Total)	25	I2 (Ib) Demand	35	U3 THD*
6	U31 (Uca)	16	Frequency	26	I3 (Ic) Demand	36	Ir*
7	Ullavg	17	kWh Import	27	kW Demand		
8	I1 (Ia)	18	kWh Export	28	kvar Demand*		
9	I2 (Ib)	19	kWh Total	29	kVADemand*		

* Available in Firmware V1.00.06 or later

Table 3-14 Default Display Parameters

- 9) Setting **SP LCD Alarm** to **On** would make the LCD blink when there is an active Setpoint alarm, and pressing any button would jump to the first SOE log screen.
- 10) Select **Present** to clear 3-Phase Total Energy registers, Phase A/B/C Energy registers, Tariff Energy and Monthly Energy Log of the Present Month.
- 11) Select **History** to clear the Monthly Energy Log of the last 1 to 12 months, excluding the Monthly Energy Log for the Present Month.

4. Applications

4.1 Inputs and Outputs

4.1.1 Digital Inputs

The EPM5600 comes optionally with four or six self-excited Digital Inputs that are internally wetted at 24 VDC with a sampling frequency of 1000Hz and programmable debounce. The EPM5600 provides the following programmable functions for its digital inputs:

- 1) **Digital Input** The digital inputs are typically used for status monitoring which can help prevent equipment damage, improve maintenance, and track security breaches. The real-time statuses of the Digital Inputs are available on the front panel LCD Display as well as through communications. Changes in Digital Input status are stored as events in the SOE Log in 1 ms resolution.

- 2) **Pulse Counting** Pulse counting is supported with programmable pulse weight and facilitates WAGES (Water, Air, Gas, Electricity and Steam) information collection.

- 3) **Tariff Switching** Up to 3 Digital Inputs may be used to select to which of the 8 Tariffs the energy consumption should be accumulated. The 3 Digital Inputs (DI1, DI2 and DI3) represent 3 binary digits where Tariff 1=000, Tariff 2=001, ..., Tariff 8=111 where DI1 represents the least significant digit and DI3 represents the most significant digit. The **DI1 Function** setup register must first be programmed as a **Tariff Switch** before configuring DI2 with the same function. In other words, if DI1 is configured as a **Digital Input** or **Energy Pulse Counter** and DI2 is configured as a **Tariff Switch**, the TOU will continue to function based on the TOU Schedule. This feature is available in Firmware V1.00.03 or later.

The following table describes the DI's setup parameters:

Setup Parameter	Definition	Options
DIx Function	Each DI can be configured as a Digital Input or Pulse Counter. Only DI1 to DI3 can be set as Tariff Switch .	0=Digital Input* 1=Pulse Counter 2= Tariff Switch
DIx Debounce	Specifies the minimum duration the DI must remain in the Active or Inactive state before a state change is considered to be valid.	1 to 1000 (ms) (Default=20ms)
DIx Pulse Weight	Specifies the incremental value for each received pulse. This is only used when a DI is configured as a Pulse Counter.	1* to 1,000,000

Default*

Table 4-1 DI Setup Parameters

4.1.2 Digital Outputs

The EPM5600 comes optionally with two or four Form A Electrometrical Relays or Solid State Relays. Digital Outputs are normally used for setpoint alarming, load control, or remote control applications.

Digital Outputs on the EPM5600 can be used in the following applications:

- 1) **Front Panel Control** Manually operated from the front panel. Please refer to the **DO Control** setup parameter in Section 3.3.3 for a detailed description.
- 2) **Remote Control** Remotely operated over communications via our free Setup software or Management System.
- 3) **Control Setpoint** Control Setpoints can be programmed to trigger DO action upon becoming active. Please refer to Section 4.4 for a detailed description.

Since there are multiple ways to trigger the Digital Outputs on the EPM5600, a prioritized scheme has been developed to avoid conflicts between different applications. In general, Front Panel Control has the highest priority and can override other control schemes. Remote Control and Control Setpoint share the same priority, meaning that they can all be programmed to control the same Digital Output. This scheme is equivalent to having an implicit Logical OR operation for the control of a Digital Output and may be useful in providing a generic alarm output signal. However, the sharing of a Digital Output is not recommended if the user intends to generate a control signal in response to a specific setpoint condition.

4.1.3 Energy Pulse Outputs

The EPM5600 comes standard with one front panel LED Pulse Output for energy pulsing and can be equipped with two or four optional Solid State Relay Outputs for kWh and kvarh pulsing. Energy Pulse Outputs are typically used for accuracy testing. Energy Pulsing via the front panel LED can be enabled from the front panel through the **LED EN Pulse** setup parameter. The pulse constant can be configured as 1000/3200 pulses per kWh or kvarh through the **EN Pulse CNST** setup parameter.

4.1.4 Analog Input

The EPM5600 comes optionally with an Analog Input which can be programmed as 0mA to 20mA or 4mA to 20mA input. There are 3 setup parameters:

Type: Select between 0-20mA or 4-20mA input.

AI Zero: This value corresponds to the minimum Analog Input of 4 mA (for 4-20mA input) and has a range of -999,999 to +999,999.

AI Full: This value corresponds to the maximum Analog Input of 20 mA and has a range of -999,999 to +999,999.

For example, to measure the oil temperature of a transformer, connect the outputs of the temperature sensor to the AI terminals of the EPM5600. The temperature sensor outputs 4mA when the temperature is -25°C and 20mA when the temperature is 100°C. As such, the **Type**

parameter should be programmed as **4-20mA**. The **AI FULL** parameter should be programmed with the value 100, and the **AI ZERO** parameter should be programmed with the value -25. Therefore, when the output of the sensor is 20mA, the reading will be 100.00°C. When the output is 4mA, the reading will be -25.00°C. When the output is 12mA, the reading will be $(100^{\circ}\text{C} - (-25^{\circ}\text{C})) \times (12\text{mA}-4\text{mA}) / (20\text{mA}-4\text{mA}) + (-25^{\circ}\text{C}) = 37.50^{\circ}\text{C}$.

4.1.5 Analog Output

The EPM5600 comes optionally with one Analog Output which can be programmed as 0mA to 20mA or 4mA to 20mA output.

There are 4 setup parameters:

Type: Select between 0-20mA or 4-20mA output.

AO Zero: Defines the zero scale value of the parameter when the Analog Output is 0 or 4 mA according to the **AO Type**. The value ranges between -999,999 to +999,999.

AO Full: Defines the full scale value of the parameter when the Analog Output is 20 mA. The value ranges between -999,999 and +999,999.

Key: Defines the parameter to which the Analog Output is proportional. The Analog Output Parameters are listed in Table 3-13.

For example, an AO of 4-20mA is required to be proportional to Phase A current. The maximum value of phase A current is 2000A, and the minimum value is 500A. As such, the **Type** parameter should be programmed as **4-20mA**. The **Key** parameter should be programmed with Ia (Phase A Current). The **AO FULL** parameter should be programmed with the value 2000. The **AO ZERO** parameter should be programmed with the value 500. Therefore, when Phase A Current is 500A or below, The AO output is 4mA. When Phase A Current is 2000A, the AO output is 20mA. When Phase A Current is 1250A, the AO is $(1250\text{A}-500\text{A}) \times (20\text{mA}-4\text{mA}) / (2000\text{A}-500\text{A}) + 4\text{mA} = 12.00(\text{mA})$.

4.1.6 RTD Input

The EPM5600 optionally provides two RTD Inputs for temperature measurements. The PT100 sensors are optional and not included. The 2-wire outputs of the PT100 sensor are connected to the RTD Input of the EPM5600 if so equipped. The EPM5600 can provide accurate temperature monitoring with the optional RTD inputs for measuring the temperature of the Neutral Conductor, Transformer or other equipment. There is a RTD Compensation register for each channel which can be used to compensate the measurement accuracy, and the compensation can be set according to formula:

$$\text{RTD Compensation} = 0.29 \times L \text{ where } L \leq 8 \text{ is the PT100 sensor's cable length in m}$$

4.2 Power and Energy

4.2.1 Basic Measurements

The EPM5600 provides the following basic measurements which are available through the Front Panel or communications.

Parameter	Phase A	Phase B	Phase C	Total	Average
Uln	•	•	•	-	•



UII	•	•	•	-	•
Current	•	•	•	-	•
Neutral Current	-	-	-	In (Calculated)	I4 (Optional)
Residual Current~	-	-	-	Ir~	-
kW	•	•	•	•	-
kvar	•	•	•	•	-
kVA	•	•	•	•	-
Power Factor	•	•	•	•	-
Frequency	•	-	-	-	-
U Fundamental*	•	•	•		
I Fundamental*	•	•	•		
U Sequence*	U1 (Positive Sequence)		U2 (Negative Sequence)		U0 (Zero Sequence)
I Sequence*	I1 (Positive Sequence)		I2 (Negative Sequence)		I0 (Zero Sequence)

* Available in Firmware V1.00.03 or later.
 ~Available in Firmware V1.00.06 or later.

Table 4-2 Basic Measurements

4.2.2 Energy Measurements

The EPM5600 provides Energy parameters for active energy (kWh), reactive energy (kvarh) and apparent energy (kVAh) with a resolution of 0.1k and a maximum value of ±100,000,000.0. When the maximum value is reached, the energy registers will automatically roll over to zero. The energy can be reset manually through the Front Panel or via communications. Further, the energy can be preset to user defined values via communications.

The EPM5600 provides the following energy measurements:

3-Phase Energy	kWh Import/Export/Net/Total
	kWh Import/Export of TOU T1-8
	kvarh Import/Export/Net/Total
	kvarh Import/Export of TOU T1-8 kvarh of Q1/Q2/Q3/Q4
Per-Phase Energy (Phase A/B/C):	kVAh Total
	kVAh Total of TOU T1-8
	kWh Import/Export/Net/Total
	kWh Import/Export of TOU T1-8
Per-Phase Energy (Phase A/B/C):	kvarh Import/Export/Net/Total
	kvarh Import/Export of TOU T1-8
	kvarh of Q1/Q2/Q3/Q4
	kVAh kVAh of TOU T1-8

Table 4-3 Energy Measurement

4.2.3 Interval Energy Measurements

The EPM5600 provides Interval Energy measurements of kWh Import/Export, kvar Import/Export and kVAh since Firmware V1.00.03. The Interval Energy measurements represent the amount of energy consumed during the last completed interval as defined by **EN Period**. The Interval Energy Measurements can only be retrieved through communications and are not available on the Front Panel.

The Interval Energy Period (**EN Period**) setup parameter can be programmed from the Front Panel or through communications and allows the user to specify the interval for which the real-time energy consumption should be accumulated. Please note that changing the Interval

Energy Period would clear the present Interval Energy measurements.

4.2.4 Demand Measurements

Demand is defined as the average power consumption over a fixed interval (usually 15 minutes) based on the sliding window method. The EPM5600 provides Present Demand and Predicted Demand for Ia, Ib, Ic, kW Total, kvar Total and kVA Total as well as kW Total, kvar Total and kVA Total of TOU Tariff 1 to 8. Only Import Demand is provided for kW Total, kvar total and kVA Total. Predicted Demand is typically used for pre-alarms and to help users reduce power consumption using a Setpoint to warn that the Demand limit may be exceeded.

The EPM5600 provides the following setup parameters:

Setup Parameter	Definition	Options
Demand Period	1 to 60 minutes. For example, if the # of Sliding Windows is set as 1 and the Demand Period is 15, the demand cycle will be 1×15=15min.	1 to 60 min Default=15
# of Sliding Windows	Number of Sliding Windows.	1 to 15 Default=1
Self-Read Time	The Self-Read Time allows the user to specify the time and day of the month for the Peak Demand Self-Read operation. The Self-Read Time supports three options: <ul style="list-style-type: none"> • A zero value means that the Self-Read will take place at 00:00 of the first day of each month. • A non-zero value means that the Self-Read will take place at a specific time and day based on the formula: Self-Read Time = Day * 100 + Hour where 0 ≤ Hour ≤ 23 and 1 ≤ Day ≤ 28. For example, the value 1512 means that the Self-Read will take place at 12:00pm on the 15th day of each month. • A 0xFFFF value will disable the Self-Read operation and replace it with Manual operation. A manual reset will cause the Max. Demand of This Month to be transferred to the Max. Demand of Last Month and then reset. The terms This Month and Last Month will become Since Last Reset and Before Last Reset. 	Default=0xFFFF
Predicted Response	The Predicated Response shows the speed of the predicted demand output. A value between 70 and 99 is recommended for a reasonably fast response. Specify a higher value for higher sensitivity.	70 to 99 Default=70

Table 4-4 Demand Setup

4.3 Power Quality

4.3.1 Phase Angles

Phase analysis is used to identify the angle relationship between 3-phase Voltages and Currents.

For WYE connected systems, the per phase difference of the Current and Voltage angles should correspond to the per phase PF. For example, if the PF is 0.5 Lag and the Voltage phase angles are 0.0°, 240.0° and 120.0°, the Current phase angles should have the values of -60.0°, 180.0° and 60.0°.

4.3.2 Power Quality Parameters

The EPM5600 provides the following PQ parameters:

4.3.2.1 Harmonics

The EPM5600 provides harmonic analysis for THD, TOHD, TEHD and individual harmonics up to the 31st order. All harmonic parameters are available on the Front Panel and through communications. In addition, the EPM5600 also provides TDD, K-factor and Crest-factor measurements for Current.

4.3.2.2 TDD

Total Demand Distortion (TDD) is defined as the ratio of the RMS (Root Mean Square) of the Harmonic Current to the RMS of the Rated or Maximum Fundamental Current Demand.

TDD of Current is calculated by the formula below:

$$TDD = \frac{\sqrt{\sum_{h=1}^{h=\infty} (I_h)^2}}{I_L}$$

where

- I_L = Maximum Fundamental Current Demand
- h = Harmonic Order (1, 2, 3, 4, etc.)
- I_h = RMS Load Current at the nth Harmonic

4.3.2.3 K-Factor

K-Factor is defined as the weighted sum of the Harmonic Load Current according to their effects on transformer heating, as derived from ANSI/IEEE C57.110. A **K-Factor** of 1.0 indicates a linear load (no harmonics). The higher the **K-Factor**, the greater the harmonic heating effect.

$$K-Factor = \frac{\sum_{h=1}^{h=h_{max}} (I_h h)^2}{\sum_{h=1}^{h=h_{max}} (I_h)^2}$$

where

- I_h = $I_{h,h}$ Harmonic Current in RMS
- h_{max} = Highest harmonic order

4.3.2.4 Crest Factor

Crest Factor is defined as the **Peak to Average Ratio (PAR)**, and its calculation is illustrated below:

$$C = \frac{|X|_{peak}}{X_{rms}}$$

where

- $|X|_{peak}$ = Peak amplitude of the waveform
- X_{rms} = RMS value

The following table illustrates the available Voltage and Current Harmonics measurements on the EPM5600.

	Phase A/AB	Phase B/BC	Phase C/CA
Harmonic-Voltage	THD	THD	THD

Harmonic-Current	TEHD	TEHD	TEHD
	TOHD	TOHD	TOHD
	2 nd Harmonics	2 nd Harmonics	2 nd Harmonics

	31 st Harmonics	31 st Harmonics	31 st Harmonics
	THD	THD	THD
	TEHD	TEHD	TEHD
	TOHD	TOHD	TOHD
	TDD	TDD	TDD
	TEDD	TEDD	TEDD
TODD	TODD	TODD	
K-factor	K-factor	K-factor	
Crest-factor	Crest-factor	Crest-factor	
2 nd Harmonics	2 nd Harmonics	2 nd Harmonics	
...	
31 st Harmonics	31 st Harmonics	31 st Harmonics	

Table 4-5 Harmonic Measurements

4.3.3 Unbalance

The EPM5600 provides Voltage and Current Unbalance measurements. The calculation method of Voltage and Current Unbalances are listed below:

$$\text{Voltage Unbalance} = \frac{V2}{V1} \times 100\%$$

$$\text{Current Unbalance} = \frac{I2}{I1} \times 100\%$$

where

V1, V2 are the Positive and Negative Sequence Components for Voltage, respectively.

and

I1, I2 are the Positive and Negative Sequence Components for Current, respectively.

4.4 Setpoints

The EPM5600 comes standard with 9 user programmable Setpoints which provide extensive control by allowing a user to initiate an action in response to a specific condition. Typical setpoint applications include alarming, fault detection and power quality monitoring.

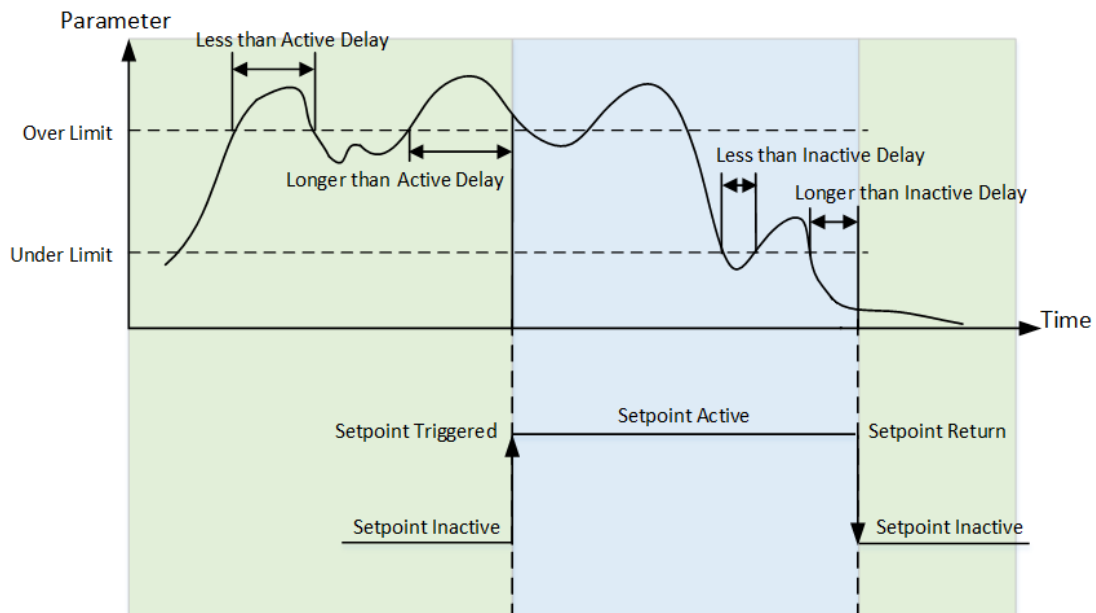
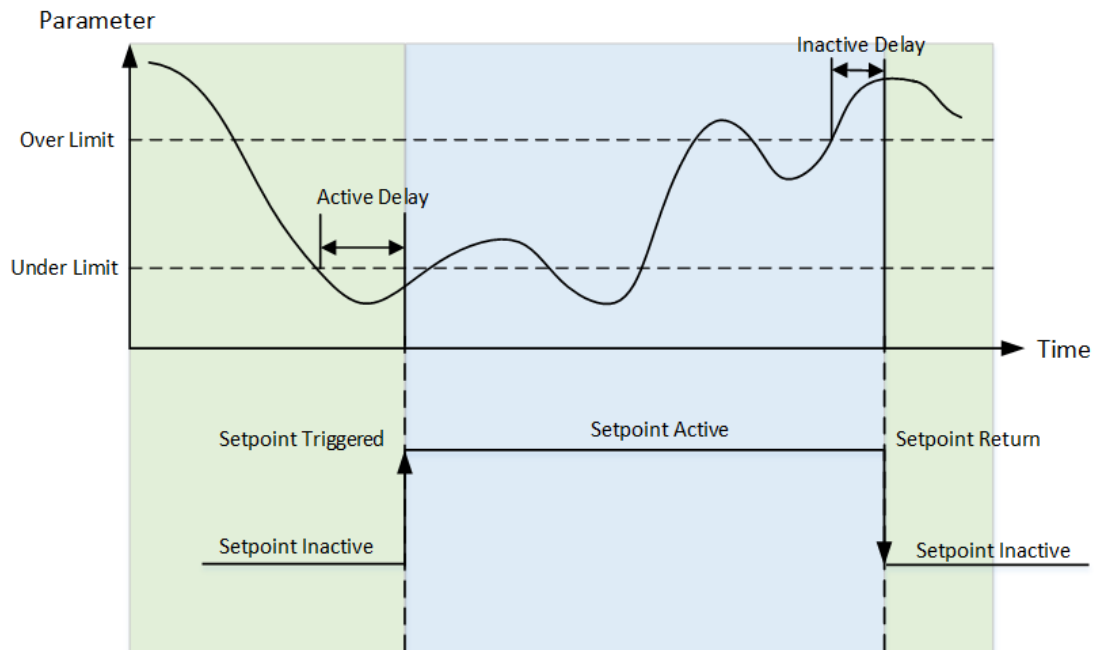


Figure 4-1 Over Setpoint

Figure 4-2 Under Setpoint

Setpoints can be programmed via the Front Panel or through communications and have the following setup parameters:

Setup Parameter	Definition	Options/Default*
Setpoint Type	Over or Under Setpoint.	0=Over Setpoint* 1=Under Setpoint
Setpoint Parameter	Specify the parameter to be monitored.	See Table 4-7
Over Limit	Specify the value that the setpoint parameter must exceed for Over Setpoint to become active or for Under Setpoint to become inactive.	0*
Under Limit	Specify the value that the setpoint parameter must go below for Over Setpoint to become inactive or for Under Setpoint to become active.	0*
Active Delay	Specify the minimum duration that the setpoint condition must be met before the setpoint becomes active. An event will be generated and stored in the SOE Log. The range of the Active Delay is between 0 and 9999 seconds.	0 to 9999s Default=10
Inactive Delay	Specify the minimum duration that the setpoint return condition must be met before the setpoint becomes inactive. An event will be generated and stored in the SOE Log. The range of the Inactive Delay is between 0 and 9999 seconds.	0 to 9999 Default=10
Setpoint Trigger	Specify what action a setpoint would take when it becomes active. Please refer to Table 4-8 below for a list of Setpoint Triggers.	See table 4-8

Table 4-6 Description for Setpoint Parameters

In addition, the LCD would blink when there is an active setpoint alarm if the **SP LCD Alarm** (Register #6048) is set to **Enable** via the Front Panel or through communications.



Key	Setpoint Parameter	Scale	Unit
0	None	-	-
1	Uln (Any Phase Voltage)	x1	V
2	Ull (Any Line Voltage)		
3	I (Any Phase Current)		A
4	In (Calculated)		Hz
5	Frequency		W
6	P (kW Total)		var
7	Q (kvar Total)		VA
8	S (kVA Total)		-
9	PF (PF Total)		W
10	P DMD (kW Total Present Demand)		var
11	Q DMD (kvar Total Present Demand)		VA
12	S DMD (kVA Total Present Demand)		W
13	P DMD Pred (kW Total Predicted Demand)		var
14	Q DMD Pred (kvar Total Predicted Demand)		VA
15	S DMD Pred (kVA Total Predicted Demand)		100%
16	U THD		100%
17	U TOHD		100%
18	U TEHD		100%
19	I THD		100%
20	I TOHD		100%
21	I TEHD		100%
22	U Unbal (Voltage Unbalance)	100%	
23	I Unbal (Current Unbalance)	100%	
24	Reversal (Phase Reversal) ³	-	
25	I4 (Measured)*	x1	A
26	AI*		-
27	Reserved	-	-
28	RTD1*	x1	°C
29	RTD2*		
30	Ir (Residual Current)~	x1	A
31	U2 (-ve Sequence Unbalance)~	x1	V
32	U0 (Zero Sequence Unbalance)~		

* Valid only if the device is equipped with the appropriate option
 ~ Available in Firmware V1.00.06 or later

Table 4-7 Setpoint Parameters

Key	Action	Key	Action
0	None	3	DO3 Closed
1	DO1 Closed	4	DO4 Closed
2	DO2 Closed	Others	Reserved

Table 4-8 Setpoint Triggers

Only when **DOx Mode** is set to **Remote Control/Setpoint** would setting the **Setpoint Trigger** to **DOx Closed** valid. In addition,

- Only when the EPM5600's **Basic Function** option is "3" (4xDI+3xRelay Output) or "A" (4xDI+2xSS Pulse Output) would setting the **Setpoint Trigger** to **DO1 Closed** or **DO2 Closed** have meaning.
- Only when the **Expansion Module B** is equipped with the "2xDI + 2xDO (Relay Output)" or "2xDI + 2xSS Pulse Output" options would setting the **Setpoint Trigger** to **DO3 Closed** or **DO4 Closed** have meaning.

4.5 Logging

4.5.1 Max./Min. Log

The EPM5600 records the **Max. Log** and **Min. Log of This Month (Since Last Reset)** and **Last Month (Before Last Reset)** with timestamp for 45 parameters. Each log includes the relevant

parameter value and its timestamp. The recorded data is stored in non-volatile memory and will not suffer any loss in the event of a power failure. The EPM5600's Max./Min. Log records the following parameters:

Max./Min. Parameters					
Ia	Ib	Ic	Iavg	Uan	Ubn
Ucn	Uln avg	Uab	Ubc	Uca	Ull avg
kW _a	kW _b	kW _c	kW Total	kvar _a	kvar _b
kvar _c	kvar Total	kVA _a	kVA _b	kVA _c	kVA Total
PFA	PF _b	PF _c	PF Total	Frequency	I4
Ia THD	Ib THD	Ic THD	Uan/Uab THD	Ubn/Ubc THD	Ucn/Uca THD
Ia K-Factor	Ib K-Factor	Ic K-Factor	Ia Crest-factor	Ib Crest-factor	Ic Crest-factor
U Unbal.	I Unbal.	I _n (Calculated)	I _r *		

* Available in Firmware V1.00.06 or later

Table 4-9 Max./Min. Log

The same **Self-Read Time** for the Peak Demand Logs is used to specify the time and day of the month for the Max./Min. Self-Read operation. Please refer to Section 4.2.4 for a complete description of the **Self-Read Time** and its operation. The Max./Min. Log of This Month can be reset manually from the Front Panel or via communications.

4.5.2 Peak Demand Log

The EPM5600 records the **Peak Demand of This Month (Since Last Reset)** and **Last Month (Before Last Reset)** with timestamp for Ia, Ib, Ic, kW Total, kvar Total and kVA Total as well as kW Total, kvar Total and kVA Total for TOU Tariffs 1 to 8. The Peak Demand of This Month (Since Last Reset) can be accessed from the Front Panel as well as communications while the Peak Demand of Last Month (Before Last Reset) can only be retrieved through communications. Please refer to Section 4.2.4 for a complete description of the **Self-Read Time** and its operation.

Peak Demand Logs of This Month (Since Last Reset) and Last Month (Before Last Reset)
Ia
Ib
Ic
kW Total
kvar Total
kVA Total
kW Total for TOU Tariffs 1 to 8
kvar Total for TOU Tariffs 1 to 8
kVA Total for TOU Tariffs 1 to 8

Table 4-10 Peak Demand Log

4.5.3 Monthly Energy Log

The EPM5600 stores monthly energy data for the present month and the last 12 months. The **Monthly Energy Log Self-read Time** setup parameter allows the user to specify the time and day of the month for the Recorder's Self-read operation via communications. The Monthly Energy Logs are stored in the meter's non-volatile memory and will not suffer any loss in the event of power failure, and they are stored on a First-In-First-Out basis where the newest log will overwrite the oldest.

The **Monthly Energy Log Self-Read Time** supports two options:

A zero value means that the Self-Read will take place at 00:00 of the first day of each month.

A non-zero value means that the Self-Read will take place at a specific time and day based on the formula: Energy Self-Read Time = Day x 100 + Hour where $0 \leq \text{Hour} \leq 23$ and $1 \leq \text{Day} \leq 28$. For example, the value 1512 means that the Self-Read will take place at 12:00pm on the 15th day of each month.

The Monthly Energy Logs can be reset manually through the front panel or via communications.

The EPM5600 provides the following energy data for the present month and the last 12 months:

Active Energy	kWh Import	kWh Export	kWh Net	kWh Total
	T1 kWh Import	T2 kWh Import	T3 kWh Import	T4 kWh Import
	T5 kWh Import	T6 kWh Import	T7 kWh Import	T8 kWh Import
	T1 kWh Export	T2 kWh Export	T3 kWh Export	T4 kWh Export
	T5 kWh Export	T6 kWh Export	T7 kWh Export	T8 kWh Export
Reactive Energy	kvarh Import	kvarh Export	kvarh Net	kvarh Total
	T1 kvarh Import	T2 kvarh Import	T3 kvarh Import	T4 kvarh Import
	T5 kvarh Import	T6 kvarh Import	T7 kvarh Import	T8 kvarh Import
	T1 kvarh Export	T2 kvarh Export	T3 kvarh Export	T4 kvarh Export
	T5 kvarh Export	T6 kvarh Export	T7 kvarh Export	T8 kvarh Export
	kvarh Q1	kvarh Q2	kvarh Q3	kvarh Q4
	kVAh			
Apparent Energy	T1 kVAh	T2 kVAh	T3 kVAh	T4 kVAh
	T5 kVAh	T6 kVAh	T7 kVAh	T8 kVAh

Table 4-11 Energy Measurements for each Monthly Energy Log Record

4.5.4 Daily and Monthly Freeze Log (Optional)

The EPM5600 optionally provides a **Daily Freeze Log** and a **Monthly Freeze Log** for Energy and Demand parameters and can store up to 60 daily freeze records (2 months) and 36 monthly freeze records (3 years). All Freeze Logs and their respective setup registers can only be accessed through communications. The EPM5600's Freeze Logs can freeze and record the following parameters:

Freeze Type	Parameters	Depth
Daily Freeze	kWh Total, kvarh Total, kVAh Total Peak Demands for kW Total, kvar Total and kVA Total	60
Monthly Freeze	kWh Total, kvarh Total, kVAh Total Peak Demands for kW Total, kvar Total and kVA Total with Timestamp	36

Table 4-12 Freeze Log

The **Daily Self-Read Time** setup parameter allows the user to specify the time of the day for the Daily Freeze Log Self-Read operation, while the **Monthly Self-Read Time** setup parameter allows the user to specify the time and day of the month for the Monthly Freeze Log Self-Read operation.

1) **Daily Freeze Self-Read Time** can be set to a zero value or a non-zero value:

- A zero value means that the Self-Read will take place at 00:00 everyday.
- A non-zero value means that the Self-Read will take place at a specific time of the day based on the formula: Self-Read time = (Hour x 100 + Min) where $0 \leq \text{Hour} \leq 23$ and $0 \leq \text{Min} \leq 59$. For example, the value 1512 means that the Self-Read will take place at 15:12 of each day.

- 2) **Monthly Freeze Self-Read Time** can be set to a zero value or a non-zero value:
- A zero value means that the Self-Read will take place at 00:00 of the first day of each month.
 - A non-zero value means that the Self-Read will take place at a specific time and day based on the formula: Monthly Self-Read Time = Day x 100 + Hour where $0 \leq \text{Hour} \leq 23$ and $1 \leq \text{Day} \leq 28$. For example, the value 1512 means that the Self-Read will take place at 12:00pm on the 15th day of each month.

4.5.5 SOE Log

The EPM5600's SOE Log can store up to 100 events such as Power-on, Power-off, Digital Input status changes, Digital Output status changes, Setup changes and Setpoint events in its non-volatile memory. Each event record includes the event classification, its relevant parameter values and a timestamp in ± 1 ms resolution. The SOE Log can be displayed on the Front Panel and retrieved via communications. If there are more than 100 events, the newest event will replace the oldest event on a First-In-First-Out basis. The SOE Log can be reset from the Front Panel or via communications.

4.5.6 Data Recorder (DR) Log (Optional)

The EPM5600 optionally provides five Data Recorders capable of recording a maximum of 16 parameters each. The Data Recorder Log is stored in the device's non-volatile memory and will not suffer any loss in the event of a power failure. The programming of the Data Recorder is only supported over communications. Each Data Recorder provides the following setup parameters:

Setup Parameters	Value/Option	Default
Trigger Mode	0=Disabled / 1=Triggered by Timer	1
Recording Mode	0=Stop-When-Full / 1=First-In-First-Out	1
Recording Depth	1 to 10,000(entry)	5760
Recording Interval	60 to 3,456,000 seconds	900 s
Offset Time	0 to 43,200 seconds, 0 indicates no offset	0
Number of Parameters	0 to 16	16
Parameter 1 to 16	See Appendix A for a complete list of parameters	See Appendix B

Table 4-13 Setup Parameters for Data Recorder

The Data Recorder Log is only operational when the values of **Trigger Mode**, **Recording Depth**, **Recording Interval**, and **Number of Parameters** are all non-zero.

The **Recording Offset** parameter can be used to delay the recording by a fixed time from the **Recording Interval**. For example, if the **Recording Interval** parameter is set to 3600 (hourly) and the **Recording Offset** parameter is set to 300 (5 minutes), the recording will take place at 5 minutes after the hour every hour, i.e. 00:05, 01:05, 02:05...etc. The value of the **Recording Offset** parameter should be less than the **Recording Interval** parameter.

4.6 Time of Use (TOU)

TOU is used for electricity pricing that varies depending on the time of day, day of week, and



season. The TOU system allows the user to configure an electricity price schedule inside the EPM5600 and accumulate energy consumption into different TOU tariffs based on the time of consumption. TOU programming is only supported through communications.

The TOU feature on EPM5600 supports two TOU schedules, which can be switched at a pre-defined time. Each TOU schedule supports:

- Up to 12 seasons
- 90 Holidays or Alternate Days
- 20 Daily Profiles, each with 12 Periods in 15-minute interval
- 8 Tariffs

Instead of using the TOU schedule to switch between Tariffs, the EPM5600 supports Tariff switching based on the status of DI1 to DI3 in Firmware V1.00.03 or later.

The 3 Digital Inputs (DI1, DI2 and DI3) represent 3 binary digits where Tariff 1=000, Tariff 2=001, Tariff 3= 010, ... Tariff 7=110 and Tariff 8=111 where DI1 represents the least significant digit and DI3 represents the most significant digit. As soon as DI1, DI2 and/or DI3 are configured as **Tariff Switches**, the current **TOU Tariff** will be determined by the status of the DIs, and the TOU Schedule will be ignored. The **DI1 Function** setup register must first be programmed as a **Tariff Switch** before configuring DI2 and DI3 with the same function. In other words, if DI1 is configured as a **Digital Input** or **Energy Pulse Counter**, and DI2 is configured as a **Tariff Switch**, the TOU will continue to function based on the TOU Schedule. The number of Tariffs supported depends on how many DIs are programmed as a Tariff Switch as indicated in the following table.

Tariff	DI Function		
	DI1 = Tariff Switch	DI2 & DI1 = Tariff Switch	DI3, DI2 & DI1 = Tariff Switch
T1	DI1 (0=T1)	DI2 + DI1 (00=T1)	DI3 + DI2 + DI1 (000=T1)
T2	DI1 (1=T2)	DI2 + DI1 (01=T2)	DI3 + DI2 + DI1 (001=T2)
T3	Not Available	DI2 + DI1 (10=T3)	DI3 + DI2 + DI1 (010=T3)
T4	Not Available	DI2 + DI1 (11=T4)	DI3 + DI2 + DI1 (011=T4)
T5	Not Available	Not Available	DI3 + DI2 + DI1 (100=T5)
T6	Not Available	Not Available	DI3 + DI2 + DI1 (101=T6)
T7	Not Available	Not Available	DI3 + DI2 + DI1 (110=T7)
T8	Not Available	Not Available	DI3 + DI2 + DI1 (111=T8)

Table 4-14 DIs and the Number of Tariffs Setup

Each TOU schedule has the following setup parameters and can only be programmed via communications:

Setup Parameters	Definition	Options
Daily Profile #	Specify a daily rate schedule which can be divided into a maximum of 12 periods in 15-min intervals. Up to 20 Daily Profiles can be programmed for each TOU schedule.	1 to 20, the first period starts at 00:00 and the last period ends at 24:00.
Season #	A year can be divided into a maximum of 12 seasons. Each season is specified with a Start Date and ends with the next season's Start Date.	1 to 12, starts from January 1 st
Alternate Days #	A day can be defined as an Alternate Day, such as May 1 st . Each Alternate Day is assigned a Daily Profile.	1 to 90.
Day Types	Specify the day type of the week. Each day of a week can be assigned a day type such as	Weekday1, Weekday2,



	Weekday1, Weekday2, Weekday3 and Alternate Days. The Alternate Day has the highest priority.	Weekday3 and Alternate Days
Switching Time	Specify when to switch from one TOU schedule to another. Writing 0xFFFFFFFF to this parameter disables switching between TOU schedules.	Format: YYYYMMDDHH Default=0xFFFFFFFF

Table 4-15 TOU Setup Parameters

For each of the 8 Tariff Rates, the EPM5600 provides the following information:

Energy: kWh Import/Export, kvarh Import/Export, kVAh – Per Phase and Total

Peak Demand: kW/kvar/kVA of This Month (Since Last Reset) and Last Month (Before Last Reset).

TOU data is available through the front panel and communications.

4.7 Diagnostics

The EPM5600 provides wiring error detection for 3P4W and 3P3W wiring modes, which allow users to check for possible problems especially during the initial commissioning stage. The following wiring errors may be detected:

- Frequency Out-of-Range
- Voltage / Current Phase Loss
- Incorrect Voltage and Current Phase Sequence
- kW Direction per phase and Total
- Possible Incorrect CT Polarity
- Broken RTD

Please note the detections above are based on the assumptions below:

- The Voltage and Current Phase Sequence are consistent
- kW is kW Import, which means the kW is over 0
- The wiring is correct
- 3P4W wiring mode supports all detections
- 3P3W wiring mode does not support the detection of Voltage Phase Loss, kW Direction per phase and CT Polarity

The Diagnostic register (0101) indicates the status of the wiring error detection with a bit value of 1 meaning active and 0 meaning inactive which are illustrated in table below:

Bit	Event
B00	Summary Bit (Set if any other bit is set)
B01	Frequency is out of range (45 to 65Hz) (3P4W or 3P3W)
B02	Any phase voltage < 10% of PT Primary (Register 6000) (3P4W only)
B03	Any phase current < 10% of CT Primary (Register 6004) (3P4W or 3P3W)
B04	RTD 1 broken (RTD Input option only)
B05	RTD 2 broken (RTD Input option only)
B06	Voltage Phase Reversal(3P4W only)
B07	Current Phase Reversal(3P4W or 3P3W)
B08	Negative kW Total may be abnormal (3P4W or 3P3W)
B09	Negative kWa may be abnormal (3P4W only)
B10	Negative kWb may be abnormal (3P4W only)
B11	Negative kWc may be abnormal (3P4W only)
B12	CTa polarity may be reversed (3P4W only)
B13	CTb polarity may be reversed (3P4W only)
B14	CTc polarity may be reversed (3P4W only)
B15	Reserved

Table 4-16 Wiring Diagnostic Register

5. Modbus Register Map

This chapter provides a complete description of the Modbus register map (**Protocol Version 1.4**) for the EPM5600 to facilitate the development of 3rd party communications driver for accessing information on the EPM5600. For a complete Modbus Protocol Specification, please visit <http://www.modbus.org>. The EPM5600 supports the following Modbus functions:

- 1) Read Holding Registers (Function Code 0x03)
- 2) Force Single Coil (Function Code 0x05)
- 3) Preset Multiple Registers (Function Code 0x10)

The following table provides a description of the different data formats used for the Modbus registers. The EPM5600 uses the Big Endian byte ordering system.

Format	Description
UINT16/INT16	Unsigned/Signed 16-bit Integer
UINT32/INT32	Unsigned/Signed 32-bit Integer
Float	IEEE 754 32-bit Single Precision Floating Point Number

5.1 Basic Measurements

Register	Property	Description	Format	Scale	Unit
0000	RO	Uan	Float	x1	V
0002	RO	Ubn	Float		
0004	RO	Ucn	Float		
0006	RO	Uln Average	Float		
0008	RO	Uab	Float		
0010	RO	Ubc	Float		
0012	RO	Uca	Float		
0014	RO	Ull Average	Float		
0016	RO	la	Float		
0018	RO	lb	Float		
0020	RO	lc	Float		
0022	RO	I Average	Float		
0024	RO	kWa	Float		
0026	RO	kWb	Float		
0028	RO	kWc	Float		
0030	RO	kW Total	Float		
0032	RO	kvara	Float		
0034	RO	kvarb	Float		
0036	RO	kvarc	Float		
0038	RO	kvar Total	Float		
0040	RO	kVAa	Float		
0042	RO	kVAb	Float		
0044	RO	kVAc	Float		
0046	RO	kVA Total	Float		
0048	RO	PFa	Float		
0050	RO	PFb	Float		
0052	RO	PFc	Float		
0054	RO	PF Total	Float		
0056	RO	Frequency	Float		
0058	RO	Uan/Uab (3P3W) Angle	Float		
0060	RO	Ubn/Ubc (3P3W) Angle	Float		
0062	RO	Ucn/Uca (3P3W) Angle	Float		
0064	RO	la Angle	Float		
0066	RO	lb Angle	Float		
0068	RO	lc Angle	Float		
0070	RO	In (Calculated)	Float		



0072	RO	I4 ¹	Float		
0074	RO	Displacement PFa	Float		-
0076	RO	Displacement PFb	Float		-
0078	RO	Displacement PFC	Float		-
0080	RO	Displacement PF Total	Float		-
0082	RO	AI ¹ Scaled	Float		-
0084	RO	Reserved	Float		-
0086	RO	RTD 1 ¹	Float		°C
0088	RO	RTD 2 ¹	Float		-
0090	RO	AO ¹	Float		-
0092	RO	Reserved	Float		-
0094	RO	Reserved	Float		-
0096	RO	DI Status ^{1,2}	UINT1 6		-
0097	RO	Reserved	UINT1 6		-
0098	RO	DO Status ^{1,3}	UINT1 6		-
0099	RO	Reserved	UINT1 6		-
0100	RO	Setpoint Status ⁴	UINT1 6		-
0101	RO	Wiring Diagnostic Status ⁵	UINT1 6		-
0102	RO	SOE Log Pointer ⁶	UINT3 2		-
0104	RO	Device Operating Time ⁷	UINT3 2	x0.1	0.1Hour
0106-0111	RO	Reserved	UINT3 2		-
0112	RO	Phase A Fundamental kW	Float		
0114	RO	Phase B Fundamental kW	Float		
0116	RO	Phase C Fundamental kW	Float	x1	W
0118	RO	Fundamental kW Total	Float		
0120	RO	Total Harmonic kW	Float		
0122	RO	DR #1 Log Pointer ^{1,6}	UINT3 2	-	-
0124	RO	DR #2 Log Pointer ^{1,6}	UINT3 2	-	-
0126	RO	DR #3 Log Pointer ^{1,6}	UINT3 2	-	-
0128	RO	DR #4Log Pointer ^{1,6}	UINT3 2	-	-
0130	RO	DR #5Log Pointer ^{1,6}	UINT3 2	-	-
0132-0148	RO	Reserved	UINT3 2		-
0150	RO	Uan/Uab Fundamental*	Float		
0152	RO	Ubn/Ubc Fundamental* ⁹	Float	x1	V
0154	RO	Ucn/Uca Fundamental* ⁹	Float		
0156	RO	Ia Fundamental*	Float		
0158	RO	Ib Fundamental* ⁹	Float	x1	A
0160	RO	Ic Fundamental* ⁹	Float		
0162	RO	U1 (Positive Sequence Voltage)* ¹⁰	Float		
0164	RO	U2 (Negative Sequence Voltage)* ¹⁰	Float	x1	V
0166	RO	U0 (Zero Sequence Voltage)* ¹⁰	Float		
0168	RO	I1 (Positive Sequence Current)* ¹⁰	Float		
0170	RO	I2 (Negative Sequence Current)* ¹⁰	Float	x1	A
0172	RO	I0 (Zero Sequence Current)* ¹⁰	Float		
0174	RO	Ir (Residual Current) [#]	Float		

* Available in Firmware V1.00.03 or later

[#] Available in Firmware V1.00.06 or later

Table 5-1 Basic Measurements

Notes:

- 1) I4, AI, RTD1, RTD2, AO, DI Status, DO Status and DRx Log Pointers are only meaningful if the meter is equipped with the corresponding option.
- 2) For the **DI Status** register, the bit values of B0 to B5 represent the states of DI1 to DI6, respectively, with “1” meaning Active (Closed) and “0” meaning Inactive (Open).
- 3) For the **DO Status** register, the bit values of B0 to B3 represent the states of DO1 to DO4, respectively, with “1” meaning Active (Closed) and “0” meaning Inactive (Open).
- 4) For the **SetpointStatus** register, the bit values indicate the various Setpoint states with “1” meaning Active and “0” meaning Inactive. The following table illustrates the details of the **Alarm Status** register.

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
Reserve d	Reserve d	Reserve d	Reserve d	Reserve d	Reserve d	Reserve d	Setpoint 9
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Setpoint 8	Setpoint 7	Setpoint 6	Setpoint 5	Setpoint 4	Setpoint 3	Setpoint 2	Setpoint 1

Table 5-2 Alarm Status Register

- 5) The following table illustrates the Wiring Diagnostic Status with 0 meaning Normal and 1 meaning Abnormal:

Bit	Event
B00	Summary Bit (Set if any other bit is set)
B01	Frequency is out of range (45 to 65Hz) (3P4W or 3P3W)
B02	Any phase voltage < 10% of PT Primary (Register 6000) (3P4W only)
B03	Any phase current < 10% of CT Primary (Register 6004) (3P4W or 3P3W)
B04	RTD 1 broken (RTD Input option only)
B05	RTD 2 broken (RTD Input option only)
B06	Voltage Phase Reversal(3P4W only)
B07	Current Phase Reversal(3P4W or 3P3W)
B08	Negative kW Totalmay be abnormal (3P4W or 3P3W)
B09	Negative kWa is may be abnormal (3P4W only)
B10	Negative kWb may be abnormal (3P4W only)
B11	Negative kWcmay be abnormal (3P4W only)
B12	CTapolarity may be reversed (3P4W only)
B13	CTb polarity may be reversed (3P4W only)
B14	CTc polarity may be reversed (3P4W only)
B15	Reserved

Table 5-3 Wiring Diagnostic Status Register

- 6) The range of the Log Pointers (SOE and DRx) is between 0 and 0xFFFFFFFFH. The Log Pointer is incremented by one for every new log generated and will roll over to 0 if its current value is 0xFFFFFFFFH. If a Clear SOE Log or Clear DRx Log is performed from the front panel or via communications, the corresponding Log Pointer will be reset to zero. Therefore, any 3rd party software should assume that a Clear Log action has been performed if it sees the SOE Log Pointer rolling over to zero or to a value that is smaller than its own pointer.
- 7) The **Device Operating Time** means the accumulated running time whenever any per-phase Current exceeds the **Current Threshold** of the **Device Operating Time** (Register #6049). The **Device Operating Time** data is stored in non-volatile memory and will not suffer any loss in the event of a power failure.
- 8) The EPM5600 has one SOE Log and five DR Logs. Each of these log has a Log Pointer that indicates its current logging position. The range of the **Log Pointer** is between 0 and 0xFFFFFFFF, and it is incremented by one for every new log generated and will roll over to 0 if its current value is 0xFFFFFFFF. A value of zero indicates that the SOE or DRx does not contain any Log. If a **Clear Log** is performed via communications, its **Log Pointer** will be reset to zero.

Use the following equation to determine the latest log location:

$$\text{Latest Log Location} = \text{Modulo} [\text{Log Pointer} / \text{LogDepth}]$$

where **Log Pointer** may be one of the following:

SOE Log Pointer, DR1 – DR5 Log Pointers



and **Log Depth** is as follows:

SOE Log Depth = 100 (fixed)

DRx Log Depth = DRx Recording Depth (see Section 5.11.5 Data Recorder Setup)

- 9) When the **Wiring Mode** is **1P2W L-N** or **1P2W L-L**, the L2 and L3 phase voltages and currents have no meaning, and their registers are reserved.
- 10) When the **Wiring Mode** is **1P2W L-N**, **1P2W L-L** or **1P3W**, the Sequence Components U1/I1, U2/I2 and U0/I0 have no meaning and their registers are reserved.

5.2 Energy Measurements

The Energy registers have a maximum value of 1,000,000,000 and will roll over to zero automatically when it is reached. The actual energy value is 0.1 times of the register value.

5.2.1 3-Phase Total Energy Measurements

Register	Property	Description	Format	Scale	Unit
0500	RW	kWh Import	INT32	x0.1	kWh
0502	RW	kWh Export	INT32		
0504	RO	kWh Net	INT32		
0506	RO	kWh Total	INT32		
0508	RW	kvarh Import	INT32		kvarh
0510	RW	kvarh Export	INT32		
0512	RO	kvarh Net	INT32		
0514	RO	kvarh Total	INT32		
0516	RW	kVAh	INT32		kVAh
0518	RW	kvarh Q1	INT32		kvarh
0520	RW	kvarh Q2	INT32		
0522	RW	kvarh Q3	INT32		
0524	RW	kvarh Q4	INT32		
0526	RW	kWh Import of T1	INT32		kWh
0528	RW	kWh Export of T1	INT32		kvarh
0530	RW	kvarh Import of T1	INT32		
0532	RW	kvarhExport of T1	INT32		
0534	RW	kVAh of T1	INT32		
0536	RW	kWh Import of T2	INT32		kWh
0538	RW	kWh Export of T2	INT32		kvarh
0540	RW	kvarh Import of T2	INT32		
0542	RW	kvarhExport of T2	INT32		
0544	RW	kVAh of T2	INT32		
0546	RW	kWh Import of T3	INT32		kWh
0548	RW	kWh Export of T3	INT32		kvarh
0550	RW	kvarh Import of T3	INT32		
0552	RW	kvarhExport of T3	INT32		
0554	RW	kVAh of T3	INT32		
0556	RW	kWh Import of T4	INT32		kWh
0558	RW	kWh Export of T4	INT32		kvarh
0560	RW	kvarh Import of T4	INT32		
0562	RW	kvarhExport of T4	INT32		
0564	RW	kVAh of T4	INT32		
0566	RW	kWh Import of T5	INT32		kWh
0568	RW	kWh Export of T5	INT32		kvarh
0570	RW	kvarh Import of T5	INT32		
0572	RW	kvarhExport of T5	INT32		
0574	RW	kVAh of T5	INT32		
0576	RW	kWh Import of T6	INT32		kWh
0578	RW	kWh Export of T6	INT32		kvarh
0580	RW	kvarh Import of T6	INT32		
0582	RW	kvarhExport of T6	INT32		
0584	RW	kVAh of T6	INT32		



0586	RW	kWh Import of T7	INT32		kWh
0588	RW	kWh Export of T7	INT32		kWh
0590	RW	kvarh Import of T7	INT32		kvarh
0592	RW	kvarhExport of T7	INT32		kvarh
0594	RW	kVAh of T7	INT32		kVAh
0596	RW	kWh Import of T8	INT32		kWh
0598	RW	kWh Export of T8	INT32		kWh
0600	RW	kvarh Import of T8	INT32		kvarh
0602	RW	kvarhExport of T8	INT32		kvarh
0604	RW	kVAh of T8	INT32		kVAh

Table 5-4 3-phase Total Energy Measurements

5.2.2 Phase A(L1) Energy Measurements

Register	Property	Description	Format	Scale	Unit
0620	RW	kWh Import	INT32	x0.1	kWh
0622	RW	kWh Export	INT32		
0624	RO	kWh Net	INT32		
0626	RO	kWh Total	INT32		
0628	RW	kvarh Import	INT32		kvarh
0630	RW	kvarh Export	INT32		
0632	RO	kvarh Net	INT32		
0634	RO	kvarh Total	INT32		
0636	RW	kVAh	INT32		kVAh
0638	RW	kvarh Q1	INT32		kWh
0640	RW	kvarh Q2	INT32		
0642	RW	kvarh Q3	INT32		
0644	RW	kvarh Q4	INT32		
0646	RW	kWh Import of T1	INT32		kvarh
0648	RW	kWh Export of T1	INT32		kWh
0650	RW	kvarh Import of T1	INT32		kWh
0652	RW	kvarh Export of T1	INT32		
0654	RW	kVAh of T1	INT32		
0656	RW	kWh Import of T2	INT32		kWh
0658	RW	kWh Export of T2	INT32		
0660	RW	kvarh Import of T2	INT32		kvarh
0662	RW	kvarh Export of T2	INT32		kVAh
0664	RW	kVAh of T2	INT32		kWh
0666	RW	kWh Import of T3	INT32		kvarh
0668	RW	kWh Export of T3	INT32		kVAh
0670	RW	kvarh Import of T3	INT32		kWh
0672	RW	kvarh Export of T3	INT32		kvarh
0674	RW	kVAh of T3	INT32		kVAh
0676	RW	kWh Import of T4	INT32		kWh
0678	RW	kWh Export of T4	INT32		
0680	RW	kvarh Import of T4	INT32		kvarh
0682	RW	kvarh Export of T4	INT32		kVAh
0684	RW	kVAh of T4	INT32		kWh
0686	RW	kWh Import of T5	INT32		
0688	RW	kWh Export of T5	INT32		kvarh
0690	RW	kvarh Import of T5	INT32		kVAh
0692	RW	kvarhExport of T5	INT32		kWh
0694	RW	kVAh of T5	INT32		
0696	RW	kWh Import of T6	INT32		kvarh
0698	RW	kWh Export of T6	INT32		kVAh
0700	RW	kvarh Import of T6	INT32	kWh	
0702	RW	kvarhExport of T6	INT32	kvarh	
0704	RW	kVAh of T6	INT32	kVAh	
0706	RW	kWh Import of T7	INT32	kWh	
0708	RW	kWh Export of T7	INT32		
0710	RW	kvarh Import of T7	INT32	kvarh	
0712	RW	kvarhExport of T7	INT32	kVAh	
0714	RW	kVAh of T7	INT32	kWh	
0716	RW	kWh Import of T8	INT32		
0718	RW	kWh Export of T8	INT32		



0720	RW	kvarh Import of T8	INT32		kvarh
0722	RW	kvarhExport of T8	INT32		kVAh
0724	RW	kVAh of T8	INT32		

Table 5-5 Phase A Energy Measurements

5.2.3 Phase B (L2) Energy Measurements

Register	Property	Description	Format	Scale	Unit
0740	RW	kWh Import	INT32	x0.1	kWh
0742	RW	kWh Export	INT32		
0744	RO	kWh Net	INT32		
0746	RO	kWh Total	INT32		
0748	RW	kvarh Import	INT32		kvarh
0750	RW	kvarh Export	INT32		
0752	RO	kvarh Net	INT32		
0754	RO	kvarh Total	INT32		
0756	RW	kVAh	INT32		kVAh
0758	RW	kvarh Q1	INT32		kvarh
0760	RW	kvarh Q2	INT32		
0762	RW	kvarh Q3	INT32		
0764	RW	kvarh Q4	INT32		
0766	RW	kWh Import of T1	INT32		kWh
0768	RW	kWh Export of T1	INT32		kvarh
0770	RW	kvarh Import of T1	INT32		
0772	RW	kvarh Export of T1	INT32		
0774	RW	kVAh of T1	INT32		
0776	RW	kWh Import of T2	INT32		kWh
0778	RW	kWh Export of T2	INT32		kvarh
0780	RW	kvarh Import of T2	INT32		
0782	RW	kvarh Export of T2	INT32		
0784	RW	kVAh of T2	INT32		
0786	RW	kWh Import of T3	INT32		kWh
0788	RW	kWh Export of T3	INT32		kvarh
0790	RW	kvarh Import of T3	INT32		
0792	RW	kvarh Export of T3	INT32		
0794	RW	kVAh of T3	INT32		
0796	RW	kWh Import of T4	INT32		kWh
0798	RW	kWh Export of T4	INT32		kvarh
0800	RW	kvarh Import of T4	INT32		
0802	RW	kvarh Export of T4	INT32		
0804	RW	kVAh of T4	INT32		
0806	RW	kWh Import of T5	INT32		kWh
0808	RW	kWh Export of T5	INT32		kvarh
0810	RW	kvarh Import of T5	INT32		
0812	RW	kvarhExport of T5	INT32		
0814	RW	kVAh of T5	INT32		
0816	RW	kWh Import of T6	INT32		kWh
0818	RW	kWh Export of T6	INT32		kvarh
0820	RW	kvarh Import of T6	INT32		
0822	RW	kvarhExport of T6	INT32		
0824	RW	kVAh of T6	INT32		
0826	RW	kWh Import of T7	INT32	kWh	
0828	RW	kWh Export of T7	INT32	kvarh	
0830	RW	kvarh Import of T7	INT32		
0832	RW	kvarhExport of T7	INT32		
0834	RW	kVAh of T7	INT32		
0836	RW	kWh Import of T8	INT32	kWh	
0838	RW	kWh Export of T8	INT32	kvarh	
0840	RW	kvarh Import of T8	INT32		
0842	RW	kvarhExport of T8	INT32		
0844	RW	kVAh of T8	INT32		

Table 5-6 Phase Benergy Measurements

5.2.4 Phase C (L3) Energy Measurements



Register	Property	Description	Format	Scale	Unit
0860	RW	kWh Import	INT32	x0.1	kWh
0862	RW	kWh Export	INT32		
0864	RO	kWh Net	INT32		
0866	RO	kWh Total	INT32		
0868	RW	kvarh Import	INT32		kvarh
0870	RW	kvarh Export	INT32		
0872	RO	kvarh Net	INT32		
0874	RO	kvarh Total	INT32		
0876	RW	kVAh	INT32		kVAh
0878	RW	kvarh Q1	INT32		kvarh
0880	RW	kvarh Q2	INT32		
0882	RW	kvarh Q3	INT32		
0884	RW	kvarh Q4	INT32		
0886	RW	kWh Import of T1	INT32		kWh
0888	RW	kWh Export of T1	INT32		kvarh
0890	RW	kvarh Import of T1	INT32		
0892	RW	kvarh Export of T1	INT32		
0894	RW	kVAh of T1	INT32		
0896	RW	kWh Import of T2	INT32		kWh
0898	RW	kWh Export of T2	INT32		kvar
0900	RW	kvarh Import of T2	INT32		
0902	RW	kvarh Export of T2	INT32		
0904	RW	kVAh of T2	INT32		
0906	RW	kWh Import of T3	INT32		kWh
0908	RW	kWh Export of T3	INT32		kvarh
0910	RW	kvarh Import of T3	INT32		
0912	RW	kvarh Export of T3	INT32		
0914	RW	kVAh of T3	INT32		
0916	RW	kWh Import of T4	INT32		kWh
0918	RW	kWh Export of T4	INT32		kvarh
0920	RW	kvarh Import of T4	INT32		
0922	RW	kvarh Export of T4	INT32		
0924	RW	kVAh of T4	INT32		
0926	RW	kWh Import of T5	INT32	kWh	
0928	RW	kWh Export of T5	INT32	kvarh	
0930	RW	kvarh Import of T5	INT32		
0932	RW	kvarhExport of T5	INT32		
0934	RW	kVAh of T5	INT32		
0936	RW	kWh Import of T6	INT32	kWh	
0938	RW	kWh Export of T6	INT32	kvarh	
0940	RW	kvarh Import of T6	INT32		
0942	RW	kvarhExport of T6	INT32		
0944	RW	kVAh of T6	INT32		
0946	RW	kWh Import of T7	INT32	kWh	
0948	RW	kWh Export of T7	INT32	kvarh	
0950	RW	kvarh Import of T7	INT32		
0952	RW	kvarhExport of T7	INT32		
0954	RW	kVAh of T7	INT32		
0956	RW	kWh Import of T8	INT32	kWh	
0958	RW	kWh Export of T8	INT32	kvarh	
0960	RW	kvarh Import of T8	INT32		
0962	RW	kvarhExport of T8	INT32		
0964	RW	kVAh of T8	INT32		

Table 5-7 Phase C Energy Measurements

5.2.5 Interval Energy Measurements

The Interval Energy registers have been added to the Modbus Map in Firmware V1.00.03 or later.

Register	Property	Description	Format	Scale	Unit
1100	RW	kWh Import	INT32	x0.1	kWh



1102	RW	kWh Export	INT32		
1104	RW	kvarh Import	INT32		kvarh
1106	RW	kvarh Export	INT32		
1108	RW	kVAh	INT32		kVAh

Table 5-8 Interval Energy Measurements

5.3 DI Pulse Counters

Register	Property	Description	Format	Range/Unit
1200	RW	DI1 Pulse Counter	UINT32	0 to 1,000,000,000 DI Pulse Counter= Pulse Counter x DI Pulse Weight
1202	RW	DI2 Pulse Counter	UINT32	
1204	RW	DI3 Pulse Counter	UINT32	
1206	RW	DI4 Pulse Counter	UINT32	
1208	RW	DI5 Pulse Counter	UINT32	
1210	RW	DI6 Pulse Counter	UINT32	

Table 5-9 DI Pulse Counter

5.4 Harmonic Measurements

5.4.1 Power Quality Measurements

Register	Property	Description	Format	Scale	Unit
1300	RO	la TDD	Float	x1	% (0.1 means 10%)
1302	RO	lb TDD	Float		
1304	RO	lc TDD	Float		
1306	RO	la TDD Odd	Float		
1308	RO	lb TDD Odd	Float		
1310	RO	lc TDD Odd	Float		
1312	RO	la TDD Even	Float		
1314	RO	lb TDD Even	Float		
1316	RO	lc TDD Even	Float		
1318	RO	la K-factor	Float		
1320	RO	lb K-factor	Float		-
1322	RO	lc K-factor	Float		
1324	RO	la Crest-factor	Float		
1326	RO	lbCrest-factor	Float		
1328	RO	lcCrest-factor	Float		
1330	RO	Voltage Unbalance	Float		
1332	RO	Current Unbalance	Float		

Table 5-10 Power Quality Measurements

5.4.2 Current Harmonic Measurements

Register	Property	Description	Format	Scale	Unit
1400	RO	la THD	Float	x1	% (0.1 means 10%)
1402	RO	lb THD	Float		
1404	RO	lc THD	Float		
1406	RO	la TOHD	Float		
1408	RO	lb TOHD	Float		
1410	RO	lc TOHD	Float		
1412	RO	la TEHD	Float		
1414	RO	lb TEHD	Float		
1416	RO	lc TEHD	Float		
1418	RO	la HD02	Float		
1420	RO	lb HD02	Float		
1422	RO	lc HD02	Float		
1424~1590	RO	...	Float		



1592	RO	Ia HD31	Float		
1594	RO	Ib HD31	Float		
1596	RO	Ic HD31	Float		

Table 5-11 Current Harmonic Measurements

5.4.3 Voltage Harmonic Measurements

Register	Property	Description	Format	Scale	Unit
1600	RO	Uan/Uab THD	Float	x1	% (0.1 means 10%)
1602	RO	Ubn/Ubc THD	Float		
1604	RO	Ucn/Uca THD	Float		
1606	RO	Uan/Uab TOHD	Float		
1608	RO	Ubn/Ubc TOHD	Float		
1610	RO	Ucn/Uca TOHD	Float		
1612	RO	Uan/Uab TEHD	Float		
1614	RO	Ubn/Ubc TEHD	Float		
1616	RO	Ucn/Uca TEHD	Float		
1618	RO	Uan/Uab HD02	Float		
1620	RO	Ubn/Ubc HD02	Float		
1622	RO	Ucn/Uca HD02	Float		
1624~1790	RO	...	Float		
1792	RO	Uan/Uab HD31	Float		
1794	RO	Ubn/Ubc HD31	Float		
1796	RO	Ucn/Uca HD31	Float		

Table 5-12 Voltage Harmonic Measurements

Notes:

- 1) When the **Wiring Mode** is **3P3W** or **1P2W L-L**, the phase A/B/C Voltage THD/TOHD/TEHD/HDxx mean phase AB/BC/CA Voltage THD/TOHD/TEHD/HDxx.
- 2) When the **Wiring Mode** is **1P2W L-N** or **1P2W L-L**, the L2 and L3 phase voltages THD/TOHD/TEHD/HDxx have no meaning, and their registers are reserved. When the **Wiring Mode** is **1P3W L-N**, the L3 phase voltages THD/TOHD/TEHD/HDxx have no meaning, and their registers are reserved.

5.5 Demands

5.5.1 Present Demands

Register	Property	Description	Format	Scale	Unit
3000	RO	Ia	Float	x1	A
3002	RO	Ib	Float		
3004	RO	Ic	Float		
3006	RO	kW Total	Float	x1	W
3008	RO	kvar Total	Float	x1	var
3010	RO	kVA Total	Float	x1	VA

Table 5-13 Present Demand Measurements

5.5.2 Predicted Demands

Register	Property	Description	Format	Scale	Unit
3200	RO	Ia	Float	x1	A
3202	RO	Ib	Float		
3204	RO	Ic	Float		
3206	RO	kW Total	Float	x1	W
3208	RO	kvar Total	Float	x1	var
3210	RO	kVA Total	Float	x1	VA

Table 5-14 Predicted Demand Measurements

5.5.3 Peak Demand Log of This Month (Since Last Reset)

Register	Property	Description	Format	Scale	Unit
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3400~3405	RO	la	See Section 5.5.5 Demand Data Structure	x1	A		
3406~3411	RO	lb			W		
3412~3417	RO	lc			var		
3418~3423	RO	kW Total			VA		
3424~3429	RO	kvar Total			W		
3430~3435	RO	kVA Total			var		
3436~3441	RO	kW Totalof T1			VA		
3442~3447	RO	kvarTotalof T1			W		
3448~3453	RO	kVA Totalof T1			var		
3454~3459	RO	kW Totalof T2			VA		
3460~3465	RO	kvarTotalof T2			W		
3466~3471	RO	kVA Totalof T2			var		
3472~3477	RO	kW Totalof T3			VA		
3478~3483	RO	kvarTotalof T3			W		
3484~3489	RO	kVA Totalof T3			var		
3490~3495	RO	kW Totalof T4			VA		
3496~3501	RO	kvar totalof T4			W		
3502~3507	RO	kVA Totalof T4			var		
3508~3513	RO	kW Totalof T5			VA		
3514~3519	RO	kvarTotalof T5			W		
3520~3525	RO	kVA Totalof T5			var		
3526~3531	RO	kW Totalof T6			VA		
3532~3537	RO	kvarTotalof T6			W		
3538~3543	RO	kVA Totalof T6			var		
3544~3549	RO	kW Totalof T7			VA		
3550~3555	RO	kvarTotalof T7			W		
3556~3561	RO	kVA Totalof T7			var		
3562~3567	RO	kW Totalof T8			VA		
3568~3573	RO	kvarTotalof T8			W		
3574~3579	RO	kVA Totalof T8			var		
							VA

Table 5-15 Peak Demand Log of This Month (Since Last Reset)

5.5.4 Peak Demand Log of Last Month (Before Last Reset)

Register	Property	Description	Format	Scale	Unit		
3600~3605	RO	la	See Section 5.5.5 Demand Data Structure	x1	A		
3606~3611	RO	lb			W		
3612~3617	RO	lc			var		
3618~3623	RO	kW Total			VA		
3624~3629	RO	kvar Total			W		
3630~3635	RO	kVA Total			var		
3636~3641	RO	kW Total of T1			VA		
3642~3647	RO	kvarTotal of T1			W		
3648~3653	RO	kVA Total of T1			var		
3654~3659	RO	kW Total of T2			VA		
3660~3665	RO	kvar Total of T2			W		
3666~3671	RO	kVA Total of T2			var		
3672~3677	RO	kW Total of T3			VA		
3678~3683	RO	kvarTotal of T3			W		
3684~3689	RO	kVA Total of T3			var		
3690~3695	RO	kW Total of T4			VA		
3696~3701	RO	kvarTotal of T4			W		
3702~3707	RO	kVA Total of T4			var		
3708~3713	RO	kW Total of T5			VA		
3714~3719	RO	kvarTotal of T5			W		
3720~3725	RO	kVA Total of T5			var		
3726~3731	RO	kW Total of T6			VA		
3732~3737	RO	kvarTotal of T6			W		
3738~3743	RO	kVA Total of T6			var		
3744~3749	RO	kW Total of T7			VA		
3750~3755	RO	kvarTotal of T7			W		
3756~3761	RO	kVA Total of T7			var		
3762~3767	RO	kW Total of T8			VA		
3768~3773	RO	kvarTotal of T8			W		
3774~3779	RO	kVA Total of T8			var		
							VA



Table 5-16 Peak Demand Log of Last Month (Before Last Reset)

5.5.5 DemandData Structure

Offset		Description
+0	High	Year -2000
	Low	Month
+1	High	Day
	Low	Hour
+2	High	Minute
	Low	Second
+3	-	Millisecond
+4~+5	-	Peak DemandValue

Table 5-17 Demand Data Structure

5.6 Max./Min. Log

5.6.1 Max. Log of This Month (Since Last Reset)

Register	Property	Description	Format	Scale	Unit
4000~4005	RO	Uan	See 5.6.5 Max./Min. Log Structure	x1	V
4006~4011	RO	Ubn			
4012~4017	RO	Ucn			
4018~4023	RO	Uln Average			
4024~4029	RO	Uab			
4030~4035	RO	Ubc			
4036~4041	RO	Uca			
4042~4047	RO	Ull Average			
4048~4053	RO	Ia			
4054~4059	RO	Ib			
4060~4065	RO	Ic			
4066~4071	RO	I Average			
4072~4077	RO	kWa			
4078~4083	RO	kWb			
4084~4089	RO	kWc			
4090~4095	RO	kW Total			
4096~4101	RO	kvara			
4102~4107	RO	kvarb			
4108~4113	RO	kvarc			
4114~4119	RO	kvar Total			
4120~4125	RO	kVAa			
4126~4131	RO	kVAb			
4132~4137	RO	kVAc			
4138~4143	RO	kVA Total			
4144~4149	RO	PFa			
4150~4155	RO	PFb			
4156~4161	RO	PFc			
4162~4167	RO	PF Total			
4168~4173	RO	Frequency			
4174~4179	RO	In (Calculated)			
4180~4185	RO	Uan/Uab THD			
4186~4191	RO	Ubn/Ubc THD			
4192~4197	RO	Ucn/Uca THD			
4198~4203	RO	Ia THD			
4204~4209	RO	Ib THD			
4210~4215	RO	Ic THD			
4216~4221	RO	Ia K-factor			
4222~4227	RO	Ib K-factor			
4228~4233	RO	Ic K-factor			
4234~4239	RO	IaCrest-factor			
4240~4245	RO	Ib Crest-factor			
4246~4251	RO	Ic Crest-factor			
4252~4257	RO	Voltage Unbalance			
4258~4263	RO	Current Unbalance			
				x1	A
				x1	-
				x1	Hz
				x1	A
				x1	-



4264~4269	RO	I4		x1	A
4270~4275	RO	Ir* (Residual Current)			

*Available in Firmware V1.00.06 or later

Table 5-18 Max. Log of This Month (Since Last Reset)

5.6.2 Min. Log of This Month (Since Last Reset)

Register	Property	Description	Format	Scale	Unit		
4300~4305	RO	Uan	See 5.6.5 Max./Min. Log Structure	x1	V		
4306~4311	RO	Ubn					
4312~4317	RO	Ucn					
4318~4323	RO	Uln Average					
4324~4329	RO	Uab					
4330~4335	RO	Ubc					
4336~4341	RO	Uca					
4342~4347	RO	Ull Average					
4348~4353	RO	Ia				x1	A
4354~4359	RO	Ib					
4360~4365	RO	Ic					
4366~4371	RO	I Average		x1	W		
4372~4377	RO	kW a					
4378~4383	RO	kW b					
4384~4389	RO	kW c					
4390~4395	RO	kW Total					
4396~4401	RO	kvar a		x1	var		
4402~4407	RO	kvar b					
4408~4413	RO	kvar c					
4414~4419	RO	kvar Total					
4420~4425	RO	kVA a		x1	VA		
4426~4431	RO	kVA b					
4432~4437	RO	kVA c					
4438~4443	RO	kVA Total					
4444~4449	RO	PF a		x1	-		
4450~4455	RO	PF b					
4456~4461	RO	PF c					
4462~4467	RO	PF Total		x1	Hz		
4468~4473	RO	Frequency					
4474~4479	RO	In (Calculated)		x1	A		
4480~4485	RO	Uan/Uab THD		x1	-		
4486~4491	RO	Ubn/Ubc THD					
4492~4497	RO	Ucn/Uca THD					
4498~4503	RO	Ia THD					
4504~4509	RO	Ib THD					
4510~4515	RO	Ic THD					
4516~4521	RO	Ia K-factor					
4522~4527	RO	Ib K-factor					
4528~4533	RO	Ic K-factor					
4534~4539	RO	Ia Crest-factor					
4540~4545	RO	Ib Crest-factor					
4546~4551	RO	Ic Crest-factor					
4552~4557	RO	Voltage Unbalance		x1	A		
4558~4563	RO	Current Unbalance					
4564~4569	RO	I4					
4570~4575	RO	Ir* (Residual Current)					

*Available in Firmware V1.00.06 or later

Table 5-19 Min. Log of This Month (Since Last Reset)

5.6.3 Max. Log of LastMonth (Before Last Reset)

Register	Property	Description	Format	Scale	Unit
4600~4605	RO	Uan	See 5.6.5 Max./Min. Log Structure	x1	V
4606~4611	RO	Ubn			
4612~4617	RO	Ucn			
4618~4623	RO	Uln Average			
4624~4629	RO	Uab			



4630~4635	RO	Ubc		
4636~4641	RO	Uca		
4642~4647	RO	Ull Average		
4648~4653	RO	Ia	x1	A
4654~4659	RO	Ib		
4660~4665	RO	Ic		
4666~4671	RO	I Average		
4672~4677	RO	kWa		
4678~4683	RO	kWb	x1	W
4684~4689	RO	kWc		
4690~4695	RO	kW Total		
4696~4701	RO	kvara		
4702~4707	RO	kvarb	x1	var
4708~4713	RO	kvarc		
4714~4719	RO	kvar Total		
4720~4725	RO	kVAa		
4726~4731	RO	kVAb	x1	VA
4732~4737	RO	kVAc		
4738~4743	RO	kVA Total		
4744~4749	RO	PFa		
4750~4755	RO	PFb	x1	-
4756~4761	RO	PFc		
4762~4767	RO	PF Total		
4768~4773	RO	Frequency	x1	Hz
4774~4779	RO	In (Calculated)		
4780~4785	RO	Uan/Uab THD		
4786~4791	RO	Ubn/Ubc THD		
4792~4797	RO	Ucn/Uca THD	x1	-
4798~4803	RO	Ia THD		
4804~4809	RO	Ib THD		
4810~4815	RO	Ic THD		
4816~4821	RO	Ia K-factor		
4822~4827	RO	Ib K-factor		
4828~4833	RO	Ic K-factor		
4834~4839	RO	Ia Crest-factor		
4840~4845	RO	Ib Crest-factor		
4846~4851	RO	Ic Crest-factor		
4852~4857	RO	Voltage Unbalance		
4858~4863	RO	Current Unbalance		
4864~4869	RO	I4	x1	A
4870~4875	RO	Ir* (Residual Current)		

*Available in Firmware V1.00.06 or later

Table 5-20 Max. Log of Last Month (Before Last Reset)

5.6.4 Min. Log of LastMonth (Before Last Reset)

Register	Property	Description	Format	Scale	Unit
4900~4905	RO	Uan	See 5.6.5 Max./Min. Log Structure	x1	V
4906~4911	RO	Ubn			
4912~4917	RO	Ucn			
4918~4923	RO	Uln Average			
4924~4929	RO	Uab			
4930~4935	RO	Ubc			
4936~4941	RO	Uca			
4942~4947	RO	Ull Average			
4948~4953	RO	Ia		x1	A
4954~4959	RO	Ib			
4960~4965	RO	Ic			
4966~4971	RO	I Average			
4972~4977	RO	kWa			
4978~4983	RO	kWb		x1	W
4984~4989	RO	kWc			
4990~4995	RO	kW Total			
4996~5001	RO	kvara		x1	var
5002~5007	RO	kvarb			



5008~5013	RO	kvarc		
5014~5019	RO	kvar Total		
5020~5025	RO	kVAa	x1	VA
5026~5031	RO	kVAb		
5032~5037	RO	kVAc		
5038~5043	RO	kVA Total		
5044~5049	RO	PFa	x1	-
5050~5055	RO	PFb		
5056~5061	RO	PFc		
5062~5067	RO	PF Total		
5068~5073	RO	Frequency	x1	Hz
5074~5079	RO	In (Calculated)	x1	A
5080~5085	RO	Uan/Uab THD	x1	-
5086~5091	RO	Ubn/Ubc THD		
5092~5097	RO	Ucn/Uca THD		
5098~5103	RO	Ia THD		
5104~5109	RO	Ib THD		
5110~5115	RO	Ic THD		
5116~5121	RO	Ia K-factor		
5122~5127	RO	Ib K-factor		
5128~5133	RO	Ic K-factor		
5134~5139	RO	IaCrest-factor		
5140~5145	RO	Ib Crest-factor		
5146~5151	RO	Ic Crest-factor		
5152~5157	RO	Voltage Unbalance		
5158~5163	RO	Current Unbalance		
5164~5169	RO	I4	x1	A
5170~5175	RO	Ir* (Residual Current)		

*Available in Firmware V1.00.06 or later

Table 5-21 Min. Log of Last Month (Before Last Reset)

5.6.5 Max./Min. Log Structure

Offset		Description
+0	High	Year - 2000
	Low	Month
+1	High	Day
	Low	Hour
+2	High	Minute
	Low	Second
+3	-	Millisecond
+4~+5	-	Max./Min.Value

Table 5-22 Max./Min. Structure

5.7 Monthly Energy Log

Register	Property	Description	Format	Scale	Unit
0980	RW	Month ¹	INT16	0* to 12	
0981	RO	High-order Byte: Year (0-99) Low-order Byte: Month (1-12)	INT16	Time Stamp (20YY/MM/DD HH:MM:SS)	
0982	RO	High-order Byte: Day (1-31) Low-order Byte: Hour (0-23)	INT16		
0983	RO	High-order Byte: Minute (0-59)	INT16		
		Low-order Byte: Second (0-59)			
0984	RW	kWh Import	INT32	x0.1	kWh
0986	RW	kWh Export	INT32		
0988	RO	kWh Net	INT32		
0990	RO	kWh Total	INT32		
0992	RW	kvarh Import	INT32	x0.1	kvarh
0994	RW	kvarh Export	INT32		
0996	RO	kvarh Net	INT32		
0998	RO	kvarh Total	INT32		



1000	RW	kVAh	INT32	x0.1	kVAh
1002	RW	kvarh Q1	INT32	x0.1	kvarh
1004	RW	kvarh Q2	INT32		
1006	RW	kvarh Q3	INT32		
1008	RW	kvarh Q4	INT32		
1010	RW	kWh Import of T1	INT32	x0.1	kWh
1012	RW	kWh Export of T1	INT32		
1014	RW	kvarh Import of T1	INT32	x0.1	kvarh
1016	RW	kvarh Export of T1	INT32		
1018	RW	kVAh of T1	INT32	x0.1	kVAh
1020	RW	kWh Import of T2	INT32		
1022	RW	kWh Export of T2	INT32	x0.1	kWh
1024	RW	kvarh Import of T2	INT32		
1026	RW	kvarh Export of T2	INT32	x0.1	kvarh
1028	RW	kVAh of T2	INT32		
1030	RW	kWh Import of T3	INT32	x0.1	kWh
1032	RW	kWh Export of T3	INT32		
1034	RW	kvarh Import of T3	INT32	x0.1	kvarh
1036	RW	kvarh Export of T3	INT32		
1038	RW	kVAh of T3	INT32	x0.1	kVAh
1040	RW	kWh Import of T4	INT32		
1042	RW	kWh Export of T4	INT32	x0.1	kWh
1044	RW	kvarh Import of T4	INT32		
1046	RW	kvarh Export of T4	INT32	x0.1	kvarh
1048	RW	kVAh of T4	INT32		
1050	RW	kWh Import of T5	INT32	x0.1	kWh
1052	RW	kWh Export of T5	INT32		
1054	RW	kvarh Import of T5	INT32	x0.1	kvarh
1056	RW	kvarhExport of T5	INT32		
1058	RW	kVAh of T5	INT32	x0.1	kVAh
1060	RW	kWh Import of T6	INT32		
1062	RW	kWh Export of T6	INT32	x0.1	kWh
1064	RW	kvarh Import of T6	INT32		
1066	RW	kvarhExport of T6	INT32	x0.1	kvarh
1068	RW	kVAh of T6	INT32		
1070	RW	kWh Import of T7	INT32	x0.1	kWh
1072	RW	kWh Export of T7	INT32		
1074	RW	kvarh Import of T7	INT32	x0.1	kvarh
1076	RW	kvarhExport of T7	INT32		
1078	RW	kVAh of T7	INT32	x0.1	kVAh
1080	RW	kWh Import of T8	INT32		
1082	RW	kWh Export of T8	INT32	x0.1	kWh
1084	RW	kvarh Import of T8	INT32		
1086	RW	kvarhExport of T8	INT32	x0.1	kvarh
1088	RW	kVAh of T8	INT32		

Table 5-23 Monthly EnergyLog

Notes:

- 1) This register represents the Month when it is read. To read the Monthly Energy Log, this register must be first written to indicate to the EPM5600 which log to load from memory. The range of this register is from 0 to 12, which represents the Present Month and the Last 12 Months. For example, if the current month is 2016/10, "0" means 2016/10, "1" means 2016/09, "2" means 2016/08, ... and "12" means "2015/10".
- 2) For each Monthly Energy Log, the time stamp shows the exact Self-Read Time (20YY/MM/DD HH:MM:SS) when the log was recorded. For the Monthly Energy Log of the Present Month, the time stamp shows the current time of the meter because the Present Month is not yet over.
- 3) The Monthly Energy Log for the Present Month can be modified, but the Monthly Energy Logs for the Last 12 Months are Read Only.

5.8 Daily and Monthly Freeze Logs (Optional)

5.8.1 Daily Freeze Log



Register	Property	Description	Format	Scale	Unit
12000	RW	Index ¹	INT16	1 to 60	
12001	RO	High-order Byte: Year (0-99) Low-order Byte: Month (1-12)	INT16	-	
12002	RO	High-order Byte: Day (1-31) Low-order Byte: Hour (0-23)	INT16		
12003	RO	High-order Byte: Minute (0-59) Low-order Byte: Second (0-59)	INT16		
12004	RO	kWh Total	INT32	x0.1	kWh
12006	RO	kvarh Total	INT32	x0.1	kvarh
12008	RO	kVAh Total	INT32	x0.1	kVAh
12010	RO	Peak Demand of kW Total	Float	x1	W
12012	RO	Peak Demand of kvar Total	Float	x1	var
12014	RO	Peak Demand of kVA Total	Float	x1	VA

Table 5-24 Daily Freeze Log

Notes:

- There is no Log Pointer that indicates the current logging position. Writing a value N between 1 and 60 to the **Index** register to retrieve the Daily Freeze Log of the Nth entry. For example, writing 1 to the **Index** register will retrieve yesterday's Daily Freeze Log. If N = 0 or N > 60, an exception response will be returned with the Illegal Data Value error code (0x03) as defined by the Modbus protocol. If all the returned values of the Nth Log Record (where 1 ≤ N ≤ 60) are all 0 (including the timestamp), this indicates that the returned Log Record is invalid and that the end of the Log has been reached. If the software is reading the Log for the very first time, it should start with N=1 and stop when either N=60 or when the returned Log Record is invalid. After that, all the software has to do is to read the Log on a daily basis with N=1.

5.8.2 Monthly Freeze Log

Register	Property	Description	Format	Scale	Unit
12500	RW	Index ¹	INT16	1 to 36	
12501	RO	High-order Byte: Year (0-99) Low-order Byte: Month (1-12)	INT16	-	
12502	RO	High-order Byte: Day (1-31) Low-order Byte: Hour (0-23)	INT16		
12503	RO	High-order Byte: Minute (0-59) Low-order Byte: Second (0-59)	INT16		
12504	RO	kWh Total	INT32	x0.1	kWh
12506	RO	kvarh Total	INT32	x0.1	kvarh
12508	RO	kVAh Total	INT32	x0.1	kVAh
12510~12515	RO	Peak Demand of kW Total	See Table 5-26 Demand Data Structure		
12516~12521	RO	Peak Demand of kvar Total			
12522~12527	RO	Peak Demand of kVA Total			

Table 5-25 Monthly Freeze Log

Offset	Description	
+0	High	Year -2000
	Low	Month
+1	High	Day
	Low	Hour
+2	High	Minute
	Low	Second
+3	-	Millisecond
+4~+5	-	Peak Demand Value

Table 5-26 Demand Data Structure

Notes:

- There is no Log Pointer that indicates the current logging position. Writing a value N



between 1 and 36 to the **Index** register to retrieve the Monthly Freeze Log of the Nth entry. For example, writing 1 to the **Index** register will retrieve last month's Monthly Freeze Log. If N = 0 or N > 36, an exception response will be returned with the Illegal Data Value error code (0x03) as defined by the Modbus protocol. If all the returned values of the Nth Log Record (where 1 ≤ N ≤ 36) are all 0 (including the timestamp), this indicates that the returned Log Record is invalid and that the end of the Log has been reached. If the software is reading the Log for the very first time, it should start with N=1 and stop when either N=36 or when the returned Log Record is invalid. After that, all the software has to do is to read the Log on a monthly basis with N=1.

5.9 SOE Log

The SOE Log Pointer points to the register address within the SOE Log where the next event will be stored. The following formula is used to determine the register address of the most recent SOE event referenced by the SOE Log Pointer value:

$$\text{Register Address} = 10000 + \text{Modulo}(\text{SOE Log Pointer} - 1 / 100) * 8$$

Register	Property	Description	Format
10000~10007	RO	Event 1	See Table 5-28 SOE Log Data Structure
10008~10015	RO	Event 2	
10016~10023	RO	Event 3	
10024~10031	RO	Event 4	
10032~10039	RO	Event 5	
10040~10047	RO	Event 6	
10048~10055	RO	Event 7	
10056~10063	RO	Event 8	
10064~10071	RO	Event 9	
10072~10079	RO	Event 10	
10080~10087	RO	Event 11	
10088~10095	RO	Event 12	
...		...	
10792~10799	RO	Event 100	

Table 5-27 SOE Log

Notes:

SOE Log Data Structure

Offset	Property	Description	Unit
+0	RO	High-order Byte: Event Classification	See Table 5-29 SOE Classification
	RO	Low-order Byte: Sub-Classification	
+1	RO	Record Time: Year	0-99 (Year-2000)
	RO	Record Time: Month	1 to 12
+2	RO	Record Time: Day	1 to 31
	RO	Record Time: Hour	0 to 23
+3	RO	Record Time: Minute	0 to 59
	RO	Record Time: Second	0 to 59
+4	RO	Record Time: Millisecond	0 to 999
+5	RO	High-order Byte: Reserved	-
	RO	Low-order Byte: Status ²	-
+6 to +7	RO	Event Value ²	-

Table 5-28 SOE Log Data Structure

SOE Classification

Event Classification	Sub-Classification	Status	Event Value	Description
1=DI Changes	1	1 / 0		DI1 Inactive / DI1 Active
	2	1 / 0		DI2 Inactive / DI2 Active
	3	1 / 0		DI3 Inactive / DI3 Active
	4	1 / 0		DI4 Inactive / DI4 Active
	5	1 / 0		DI5 Inactive / DI5 Active
	6	1 / 0		DI6 Inactive / DI6 Active

[#]Available in Firmware V1.00.06 or later



2=DO Changes	1	1 / 0		DO1 Operated/Released by Remote Control
	2	1 / 0		DO2 Operated/Released by Remote Control
	3	1 / 0		DO3 Operated/Released by Remote Control
	4	1 / 0		DO4 Operated/Released by Remote Control
	5~10			Reserved
	11	1 / 0		DO1 Operated/Released by Setpoint
	12	1 / 0		DO2 Operated/Released by Setpoint
	13	1 / 0		DO3 Operated/Released by Setpoint
	14	1 / 0		DO4 Operated/Released by Setpoint
	15~20			Reserved
	21	1 / 0		DO1 Operated/Released by Front Panel
	22	1 / 0		DO2 Operated/Released by Front Panel
	23	1 / 0		DO3 Operated/Released by Front Panel
	24	1 / 0		DO4 Operated/Released by Front Panel
	25~30			Reserved
	31	0		DO1 Released when Pulse Time out
	32	0		DO2 Released when Pulse Time out
	33	0		DO3 Released when Pulse Time out
	34	0		DO4 Released when Pulse Time out
	3=Setpoint	1	1 / 0	Trigger Value/Return Value
2		1 / 0	Over Ul _{ll} Setpoint Active/Return	
3		1 / 0	Over Current Setpoint Active/Return	
4		1 / 0	Over I _n Setpoint Active/Return	
5		1 / 0	Over Frequency Setpoint Active/Return	
6		1 / 0	Over kW Total Setpoint Active/Return	
7		1 / 0	Over kvar Total Setpoint Active/Return	
8		1 / 0	Over kVA Total Setpoint Active/Return	
9		1 / 0	Over PF Total Setpoint Active/Return	
10		1 / 0	Over kW Total Present Demand Setpoint Active/Return	
11		1 / 0	Over kvar Total Present Demand Setpoint Active/Return	
12		1 / 0	Over kVA Total Present Demand Setpoint Active/Return	
13		1 / 0	Over kW Total Predicted Demand Setpoint Active/Return	
14		1 / 0	Over kvar Total Predicted Demand Setpoint Active/Return	
15		1 / 0	Over kVA Total Predicted Demand Setpoint Active/Return	
16		1 / 0	Over Voltage THD Setpoint Active/Return	
17		1 / 0	Over Voltage TOHD Setpoint Active/Return	



	18	1 / 0	Over Voltage TEHD Setpoint Active/Return
	19	1 / 0	Over Current THD Setpoint Active/Return
	20	1 / 0	Over Current TOHD Setpoint Active/Return
	21	1 / 0	Over Current TEHD Setpoint Active/Return
	22	1 / 0	Over Voltage Unbalance Setpoint Active/Return
	23	1 / 0	Over Current Unbalance Setpoint Active/Return
	24	1 / 0	Reversal Phase Setpoint Active/Return
	25	1 / 0	Over I4 Setpoint Active/Return
	26	1 / 0	Over AI Setpoint Active/Return
	27		Reserved
	28	1 / 0	Over Temperature1 Setpoint Active/Return
	29	1 / 0	Over Temperature2 Setpoint Active/Return
	30	1 / 0	RTD 1 Broken
	31	1 / 0	RTD 2 Broken
	32	1 / 0	Over Ir (Residual Current) Setpoint* Active/Return
	33	1 / 0	Over U2 (Negative Sequence) Setpoint* Active/Return
	34	1 / 0	Over U0 (Zero Sequence) Setpoint* Active/Return
	35~40		Reserved
	41	1 / 0	Under UIn Setpoint Active/Return
	42	1 / 0	Under UII Setpoint Active/Return
	43	1 / 0	Under Current Setpoint Active/Return
	44	1 / 0	UnderIn Setpoint Active/Return
	45	1 / 0	Under Frequency Setpoint Active/Return
	46	1 / 0	Under kW Total Setpoint Active/Return
	47	1 / 0	Under kvar Total Setpoint Active/Return
	48	1 / 0	Under kVA Total Setpoint Active/Return
	49	1 / 0	Under PF Total Setpoint Active/Return
	50	1 / 0	Under kW Total Present Demand Setpoint Active/Return
	51	1 / 0	Under kvar Total Present Demand Setpoint Active/Return
	52	1 / 0	Under kVA Total Present Demand Setpoint Active/Return
	53	1 / 0	Under kW Total Predicted Demand Setpoint Active/Return
	54	1 / 0	Under kvar Total Predicted Demand Setpoint Active/Return
	55	1 / 0	Under kVA Total Predicted Demand Setpoint Active/Return
	56	1 / 0	Under Voltage THD Setpoint Active/Return
	57	1 / 0	Under Voltage TOHD Setpoint Active/Return
	58	1 / 0	Under Voltage TEHD Setpoint Active/Return
	59	1 / 0	Under Current THD Setpoint



				Active/Return
	60	1 / 0		Under Current TOHD Setpoint Active/Return
	61	1 / 0		Under Current TEHD Setpoint Active/Return
	62	1 / 0		Under Voltage Unbalance Setpoint Active/Return
	63	1 / 0		Under Current Unbalance Setpoint Active/Return
	64	1 / 0		Under I4 Setpoint Active/Return
	65	1 / 0		Under AI Setpoint Active/Return
	66			Reserved
	67	1 / 0		Under Temperature1 Setpoint Active/Return
	68	1 / 0		Under Temperature2 Setpoint Active/Return
	69	1 / 0		Under Ir (Residual Current) Setpoint* Active/Return
	70	1 / 0		Under U2 (Negative Sequence) Setpoint* Active/Return
	71	1 / 0		Under U0 (Zero Sequence) Setpoint* Active/Return
4=Self-diagnosis	1	1	0	System Parameter Fault
	2	1	0	Internal Parameter Fault
	3	1	0	TOU Parameter Fault
	4	1	0	Memory Fault
5=Operations	1	0	0	Power On
	2	0	0	Power Off
	3	0	0	Clear Present Energy via Front Panel ¹
	4	0	0	Clear Historical Monthly Energy Log via Front Panel ²
	5	0	0	Clear Peak Demand Log of This Month (Since Last Reset) via the Front Panel
	6	0	0	Clear Present Demand, Peak Demand Log of This Month (Since Last Reset) and Last Month (Before Last Reset) via the Front Panel
	7	0	0	Clear Present Max./Min. via Front Panel
	8	0	0	Clear All Max./Min. via Front Panel
	9	0	0	Clear All Data via Front Panel ³
	10	0	0	Clear SOE Log via Front Panel
	11	0	x=1 to 6	Clear DIx Pulse Counter via Front Panel
	12	0	0	Clear All Pulse Counter via Front Panel
	13	0	0	Clear Device Operating Time via Front Panel
	14	0	0	Set Clock via Front Panel
	15	0	0	Setup Changed via Front Panel
	16~17	0	...	Reserved
	18	0	0	Restore Factory Default via Front Panel
	19~29	0	...	Reserved
	30	0	0	Clear All Energy Registers via Communications ⁴
	31	0	0	Clear Present Monthly Energy Log via Communications ⁵
32	0	0	Clear Historical Monthly Energy Log via Communications ⁶	
33	0	0	Clear Peak Demand of This Month (Since Last Reset)	



				via Communications
	34	0	0	Clear All Demand Registers via Communications
	35	0	0	Clear Max./Min. Logs of This Month (Since Last Reset) via Communications
	36	0	0	Clear All Max./Min. Logs via Communications
	37	0	0	Clear All Data via Communications ³
	38	0	0	Clear SOE Log via Communications
	39	0	x=1 to 6	Clear Dlx Pulse Counter via Communications
	40	0	0	Clear All DI Pulse Counters via Communications
	41	0	0	Clear Device Operating Time via Communications
	42	0	0	Restore Factory Default via Communications
	43	0	0	Setup Changes via Communications
	44	0	0	Preset Energy Value via Communications
	45	0	0	Setup TOU Energy via Communications
	46	0	1~4	Switch TOU Schedule ⁷
	47	0	1~5	Clear DRx Log via Communications
	48	0	0	Clear All DR logs via Communications

Table 5-29 SOE Event Classification

- 1) **Clear Present Energy Log** means to clear 3-Phase Total Energy registers, Phase A/B/C Energy registers, Tariff Energy and Monthly Energy Log of the Present Month.
- 2) **Clear Historical Monthly Energy Log** means to clear the Monthly Energy Log of the last 1 to 12 months, excluding the Monthly Energy Log for the Present Month.
- 3) **Clear All Data via Front Panel** or **Communication** means to clear 3-Phase Total Energy registers, Phase A/B/C Energy registers, Monthly Energy Log of the Present Month, All Peak Demands, All Max./Min. Logs, Device Operating Time, All DI Pulse Counters, All DR Logs and All Freeze Logs.
- 4) **Clear All Energy Registers** means to clear the 3-Ø Total and Per-Phase energy registers.
- 5) **Clear Present Monthly Energy Log** means to clear the Monthly Energy Log of the Present Month.
- 6) **Clear Historical Monthly Energy Log** means to clear Monthly Energy Log of the last 1 to 12 months, excluding the Monthly Energy Log for the Present Month.
- 7) The event values of **Switch TOU Schedule** are illustrated in the table below:

Record Value	Description
1	Switch Schedule 1 to Schedule 2 manually
2	Switch Schedule 2 to Schedule 1 manually
3	Switch Schedule 1 to Schedule 2 automatically
4	Switch Schedule 2 to Schedule 1 automatically

Table 5-30 TOU Switch Records

5.10 Data Recorder Log (Optional)

Register	Property	Description	Format
20000~20037	RO	DR Log #1 Buffer	See Table 5-32 Standard DR Log Structure
20038~20075	RO	DR Log #2 Buffer	
20076~2011	RO	DR Log #3 Buffer	



3		
20114~2015 1	RO	DR Log #4 Buffer
20152~2018 9	RO	DR Log #5 Buffer

Table 5-31 DR Log

Offset	Property	Description	Format
+0	RW	DR Log X Pointer	UINT32
+2	RO	High-order Byte: Year (0-99) Low-order Byte: Month (1-12)	UINT16
+3	RO	High-order Byte: Day (1-31) Low-order Byte: Hour (0-23)	UINT16
+4	RO	High-order Byte: Minute (0-59) Low-order Byte: Second (0-59)	UINT16
+5	RO	Millisecond	UINT16
+6~+7	RO	Parameter #1	Float
+8~+9	RO	Parameter #2	
+10~+11		Parameter #3	
...		...	
+36~+37	RO	Parameter #16	

Table 5-32 DR Data Buffer Structure

Notes:

- 1) Writing n to the **DR Log X Pointer** register will load the Log Record at pointer position n into the DR Log X Buffer from the device's memory.
- 2) Writing a pointer value that points to a Log Record that is either already expired or has not been generated yet to the **DR Log X Pointer** register will generate an exception response with the Illegal Data Value error code (0x03) as defined by the Modbus protocol.

5.11 Device Setup

5.11.1 Basic Setup Parameters

Register	Property	Description	Format	Range, Default*
6000	RW	PT Primary ¹	UINT32	1 to 1,000,000 V, 100*
6002	RW	PT Secondary	UINT32	1 to 690V, 100*
6004	RW	CT Primary	UINT32	1 to 30,000A, 5*
6006	RW	CT Secondary	UINT32	1 to 5A, 5*
6008~6010	RW	Reserved	UINT32	
6012	RW	I4 Primary	UINT32	1 to 30,000A, 5*
6014	RW	I4 Secondary	UINT32	1 to 5A, 5*
6016~6018	RW	Reserved	UINT32	
6020	RW	Wiring Mode	UINT16	0=DEMO, 1=1P2W L-N, 2=1P2W L-L, 3=1P3W 4=3P3W, 5=3P4W*
6021	RW	PF Convention	UINT16	0=IEC*, 1=IEEE, 2=- IEEE
6022	RW	kVA Calculation	UINT16	0=Vector*, 1=Scalar
6023	RW	Ia Polarity	UINT16	0=Normal*, 1=Reverse
6024	RW	Ib Polarity	UINT16	
6025	RW	Ic Polarity	UINT16	
6026~6027	RW	Reserved	UINT16	

			6	
6028	RW	THD Calculation ²	UINT1 6	0= THDf*, 1= THDr
6029	RW	Demand Period	UINT1 6	1 to 60 (minutes), 15*
6030	RW	Number of Sliding Windows	UINT1 6	1 to 15, 1*
6031	RW	Predicted Response	UINT1 6	70 to 99, 70*
6032	RW	Arm before Execute	UINT1 6	0=Disabled*, 1=Enabled
6033	RW	Self-Read Time ³	UINT1 6	0xFFFF*
6034	RW	Monthly Energy Log Self-Read Time ⁴	UINT1 6	0*
6035	RW	Energy Pulse Constant	UINT1 6	0=1000 imp/kxh* 1=3200 imp/kxh
6036	RW	LED Energy Pulse	UINT1 6	0=Disabled 1=kWh* 2=kvarh
6037	RW	BacklightTime-out	UINT1 6	0 to 60 (mins), 5*
6038	RW	System Language	UINT1 6	1=English
6039	RW	Date Format	UINT1 6	0=YYMMDD* 1=MMDDYY 2=DDMMYY
6040	RW	Delimiter ⁴	UINT1 6	0=Option 1*, 1=Option 2 See Note 4
6041	RW	Monthly Freeze Self-Read Time ⁵	UINT1 6	0*
6042	RW	Daily Freeze Self-Read Time ⁶	UINT1 6	0*
6043	RW	Default Display ^{1st} parameter ⁷	UINT1 6	0 to 36, 7* (Ullavg)
6044	RW	Default Display ^{2nd} parameter ⁷	UINT1 6	0 to 36, 11* (lavg)
6045	RW	Default Display ^{3rd} parameter ⁷	UINT1 6	0 to 36, 12* (P)
6046	RW	Default Display ^{4th} parameter ⁷	UINT1 6	0 to 36, 15* (PF)
6047	RW	EN Period ⁸	UINT1 6	5 to 60* min
6048	RW	Setpoint LCD Flash Alarm~	UINT1 6	0=Enabled*, 1=Disabled
6049	RW	Current Threshold of Device Operating Time~	UINT1 6	1* to 1000 (x0.001In)
6050	RW	kvarh Calculation~	UINT1 6	0=RMS*, 1=kvarh Fund.
6051	RW	DNP Polling Object~ ⁹	UINT1 6	0 to 65535, 0x3F*

[#]Available in Firmware V1.00.03 or later

~ Available in Firmware V1.00.06 or later

Table 5-33 Basic Setup Parameters

Notes:

- 1) The value of [PT Primary/PT Secondary] cannot exceed 10000.
- 2) There are two ways to calculate THD:

$$\text{THDf (based on Fundamental): THD} = \frac{\sqrt{\sum_{n=2}^{\infty} I_n^2}}{I_1} \times 100\%$$

where I_n represents the RMS value for the n^{th} harmonic and I_1 represents the RMS value of the Fundamental component.

$$\text{THDr (based on RMS): THD} = \frac{\sqrt{\sum_{n=2}^{\infty} I_n^2}}{\sqrt{\sum_{n=1}^{\infty} I_n^2}} \times 100\%$$

where I_n represents the RMS value for the n^{th} harmonic.

- 3) The **Self-Read Time** applies to both the PeakDemand Log as well as the Max./Min. Log and supports the following three options:
 - A zero value means that the Self-Read will take place at 00:00 of the first day of each month.
 - A non-zero value means that the Self-Read will take place at a specific time and day based on the formula: Self-Read Time = (Day x 100 + Hour) where $0 \leq \text{Hour} \leq 23$ and $1 \leq \text{Day} \leq 28$. For example, the value 1512 means that the Self-Read will take place at 12:00pm on the 15th day of each month.
 - A 0xFFFF value means the automatic self-read operation is disabled and the log will be transferred manually.
- 4) The **Delimiter** setup register supports two options, 1 and 2:
 - Option 1: “,” is used as the x1000 delimiter and “.” as the decimal point (e.g. 123,456,789.0).
 - Option 2: “” is used as the x1000 delimiter and “.” as the decimal point (e.g. 123 456 789.0).
- 5) The **Monthly Energy Log Self-Read Time** and **Monthly Freeze Self-Read Time** support only two options:
 - A zero value means that the Self-Read will take place at 00:00 of the first day of each month.
 - A non-zero value means that the Self-Read will take place at a specific time and day based on the formula: Self-Read Time = Day * 100 + Hour where $0 \leq \text{Hour} \leq 23$ and $1 \leq \text{Day} \leq 28$. For example, the value 1512 means that the Self-Read will take place at 12:00pm on the 15th day of each month.
- 6) The **Daily Freeze Self-Read Time** can be set to a zero value or a non-zero value:
 - A zero value means that the Self-Read will take place at 00:00 everyday.
 - A non-zero value means that the Self-Read will take place at a specific time of the day based on the formula: Self-Read time = (Hour x 100 + Min) where $0 \leq \text{Hour} \leq 23$ and $0 \leq \text{Min} \leq 59$. For example, the value 1512 means that the Self-Read will take place at 15:12 of each day.
- 7) The following table illustrates the parameters that can be selected for display in the **Default Display** screen.

Key	Parameter	Key	Parameters	Key	Parameters	Key	Parameters
0	U1 (Uan)	10	I3 (Ic)	20	T1 kWh Imp	30	Fund.kW Total*
1	U2 (Ubn)	11	Iavg	21	T2 kWh Imp	31	dPF Total*
2	U3 (Ucn)	12	P (kW Total)	22	T3 kWh Imp	32	I4*
3	Ulnavg	13	Q (kvar Total)	23	T4 kWh Imp	33	U1 THD*
4	U12 (Uab)	14	S (kVA Total)	24	I1 (Ia) Demand	34	U2 THD*
5	U23 (Ubc)	15	PF (PF Total)	25	I2 (Ib) Demand	35	U3 THD*
6	U31 (Uca)	16	Frequency	26	I3 (Ic) Demand	36	Ir*
7	Ulnavg	17	kWh Import	27	kW Demand		
8	I1 (Ia)	18	kWh Export	28	kvar Demand*		
9	I2 (Ib)	19	kWh Total	29	kVADemand*		

*Available in Firmware V1.00.06 or later

Table 5-34 Default Display Parameters

- 8) The **Interval Energy** registers will be reset once the **EN Period** is changed.
- 9) The **DNP Polling Objects** are listed in table below:

Bit	Object Description	Option
0	Object 1: Binary Inputs	0=Disabled 1=Enabled*
1	Object 10: Binary Output	
2	Object 20: 32-Bit Binary Counters	
3	Object 20: 16-Bit Binary Counters	



4	Object 30: Analog Inputs Primary Readings	
5	Object 40: Analog Output Status	
6 to 15	Reserved	

Table5-35 DNP Polling Objects

5.11.2 I/O Setup

Register	Property	Description	Format	Range, Default*	
6200	RW	DI1 Function	UINT1 6	0= Digital Input* 1=Pulse Counting 2 =Tariff Switch [†]	
6201	RW	DI2 Function	UINT1 6		
6202	RW	DI3 Function	UINT1 6		
6203	RW	DI4 Function	UINT1 6		
6204	RW	DI5 Function	UINT1 6		
6205	RW	DI6 Function	UINT1 6		
6206~6207		Reserved			
6208	RW	DI1 Debounce	UINT1 6	1 to 9999 ms, 20*	
6209	RW	DI2 Debounce	UINT1 6		
6210	RW	DI3 Debounce	UINT1 6		
6211	RW	DI4 Debounce	UINT1 6		
6212	RW	DI5 Debounce	UINT1 6		
6213	RW	DI6 Debounce	UINT1 6		
6214~6215		Reserved			
6216	RW	DI1 Pulse Weight	UINT3 2	1* to 1000000	
6218	RW	DI2 Pulse Weight	UINT3 2		
6220	RW	DI3 Pulse Weight	UINT3 2		
6222	RW	DI4 Pulse Weight	UINT3 2		
6224	RW	DI5 Pulse Weight	UINT3 2		
6226	RW	DI6 Pulse Weight	UINT3 2		
6228		Reserved	UINT3 2		
6230	RW	DO1 Mode ^{#2}	UINT1 6	0= Remote Control/Setpoint* 1= kWh Import 2= kWh Export 3= kWh Total 4= kvarh Import 5= kvarh Export 6= kvarh Total	
6231	RW	DO2 Mode ^{#2}	UINT1 6		
6232	RW	DO3 Mode ³	UINT1 6		
6233	RW	DO4 Mode ³	UINT1 6		
6234	RW	Reserved	UINT1 6		-
6235	RW	Reserved	UINT1 6		-
6236	RW	DO1 Pulse Width	UINT1 6	0 to 6000 (x0.1s), 10* (0 = Latch Mode)	
6237	RW	DO2Pulse Width	UINT1 6		

6238	RW	DO3 Pulse Width	UINT16	
6239	RW	DO4 Pulse Width	UINT16	
6240~6247		Reserved	UINT16	-
6248	RW	RTD 1 Compensation	UINT16	0 to 2000 (x0.01Ω), 0*
6249	RW	RTD 2 Compensation	UINT16	0 to 2000 (x0.01Ω), 0*
6250	RW	AI Type	UINT16	0 = 4~20mA* 1 = 0~20mA
6251	RW	AI Zero Scale	INT32	-999,999 to +999,999 (Default = 400)
6253	RW	AI Full Scale	INT32	-999,999 to +999,999 (Default = 2000)
6255~6259	RW	Reserved	UINT16	-
6260	RW	AO Type	UINT16	0 = 4~20mA* 1 = 0~20mA
6261	RW	AO Key ⁴	UINT16	0* to 19
6262	RW	AO Zero Scale	INT32	-999,999 to +999,999 (Default = 0)
6264	RW	AO Full Scale	INT32	-999,999 to +999,999 (Default = 0)

*Available in Firmware V1.00.04 or later

Table 5-35 I/O Setup Parameters

Notes:

- 1) The **Tariff Switch** option is supported in Firmware V1.00.03 or later.
- 2) This is available only when the **Basic Function** option is "3" (4xDI and 2xRelay Output) or "A" (4xDI and 2xSS Pulse Output). Please refer to the **Ordering Guide** for more details.
- 3) This is available only when **Expansion Module B** is equipped with the "B4" option (2xDI and 2xSS Pulse Output). Please refer to the **Ordering Guide** for more details.
- 4) Analog Output Parameters:
The Units for Voltage, Current, kW, kvar, kVA and Frequency are V, A, kW, kvar, kVA and Hz, respectively.

Key	Parameter	Scale	Unit	Key	Parameter	Scale	Unit
0	Uab	x1	V	10	kVA Total	x1	kVA
1	Ubc		V	11	PF Total	x100	-
2	Uca		V	12	Frequency	x100	-
3	Ull Average		V	13	kW Total Present Demand	x1	kW
4	Ia		A	14	kvar Total Present Demand		kvar
5	Ib		A	15	kVA Total Present Demand		kVA
6	Ic		x1	A	16	Uan	x1
7	I Average	A		17	Ubn	V	
8	kW Total	kW		18	Ucn	V	
9	kvar Total	kvar		19	Uln Average	V	

Table 5-36 Analog Output Parameters

5.11.3 Communication Setup Parameters

Register	Property	Description	Format	Range, Default*
6400	RW	Port1 Protocol	UINT16	0=Modbus RTU* 1=BACnet/MSTP# 2=N2#, 3=DNP~
6401	RW	Port1 Unit ID	UINT16	Modbus RTU/N2: 1 to 247 BACnet/MSTP: 1 to 127 DNP: 0 to 65519



				Default=100
6402	RW	Port1 Baud Rate ¹	UINT16	0=1200, 1=2400, 2=4800, 3=9600*, 4=19200, 5=38400
6403	RW	Port1 Comm. Config.	UINT16	0=8N2, 1=8O1, 2=8E1*, 3=8N1, 4=8O2, 5=8E2
6404	RW	Port2 Protocol	UINT16	0=Modbus RTU*
6405	RW	Port2 Unit ID	UINT16	1 to 247, 101*
6406	RW	Port2 Baud Rate ¹	UINT16	0=1200, 1=2400, 2=4800, 3=9600*, 4=19200, 5=38400
6407	RW	Port2 Comm. Config.	UINT16	0=8N2, 1=8O1, 2=8E1*, 3=8N1, 4=8O2, 5=8E2

Available in Firmware V1.00.03 or later. Please refer to Appendices C and D for the detailed information of BACnet MSTP and N2 protocol.

~Available in Firmware V1.00.06 or later. Please refer to **Appendix E** for the detailed information of DNP.

Table 5-37 Communication Setup

Notes:

- 1) If the **Baud Rate** is set to an invalid value, it will default to 9600bps automatically.

5.11.4 Setpoints Setup

Register	Property	Description		Format	Range, Default*
6500	RW	Setpoint #1	Setpoint Type	UINT16	0=Disabled* 1=Over Setpoint 2=Under Setpoint
6501	RW		Parameters ¹	UINT16	0 to 32
6502	RW		Over Limit ²	Float	0*
6504	RW		Under Limit ²	Float	0*
6506	RW		Active Delay	UINT16	0 to 9999 s, 10*
6507	RW		Inactive Delay	UINT16	0 to 9999 s, 10*
6508	RW		Trigger Action 1 ³	UINT16	0 to 4
6509	RW		Trigger Action 2 ³	UINT16	
...	
6580	RW	Setpoint #9	Setpoint Type	UINT32	0=Disabled* 1=Over Setpoint 2=Under Setpoint
6581	RW		Parameter ¹	UINT16	0* to 32
6582	RW		Over Limit	Float	0*
6584	RW		Under Limit	Float	0*
6586	RW		Active Delay	UINT16	0 to 9999 s, 10*
6587	RW		Inactive Delay	UINT16	0 to 9999 s, 10*
6588	RW		Trigger Action 1 ²	UINT16	0 to 4
6589	RW		Trigger Action 2 ²	UINT16	

Table 5-38 Setpoint Setup Parameters

Notes:

- 1) The EPM5600 provides the following setpoint parameters:

Key	Setpoint Parameter	Scale	Unit
0	None	-	-
1	UIn (Any Phase Voltage)	x1	V
2	UII (Any Line Voltage)		
3	I (Any Phase Current)		
4	In (Calculated)		
5	Frequency		
6	P (kW Total)		
7	Q (kvar Total)		
8	S (kVA Total)		
9	PF (PF Total)		
10	P DMD (kW Total Present Demand)		
11	Q DMD (kvar Total Present Demand)		
12	S (kVA Total Present Demand)		
13	P DMD Pred (kW Total Predicted Demand)		



14	Q DMD Pred (kvar Total Predicted Demand)		var
15	S DMD Pred (kVA Total Predicted Demand)		VA
16	U THD		100%
17	U TOHD		100%
18	U TEHD		100%
19	I THD		100%
20	I TOHD		100%
21	I TEHD		100%
22	U Unbal (Voltage Unbalance)		100%
23	I Unbal (Current Unbalance)		100%
24	Reversal (Phase Reversal) ³	-	
25	I4 (Measured)*	x1	A
26	AI*		-
27	Reserved	-	-
28	RTD1*		
29	RTD2*	x1	°C
30	Ir (Residual Current)~	x1	A
31	U2~		
32	U0~	x1	V

* Valid only if the device is equipped with the appropriate option
 ~ Available in Firmware V1.00.06

Table 5-39 Setpoint Parameters

- 2) For Over Setpoint, the setpoint parameter must exceed the **Over Limit** to become active and go below the **Under Limit** to become inactive.
 For Under Setpoint, the setpoint parameter must go below the **Under Limit** to become active and exceed the **Over Limit** to become inactive.
- 3) The EPM5600 provides the following Setpoint Triggers:

Key	Action	Key	Action
0	None	3	DO3 Closed ⁴
1	DO1 Closed ⁴	4	DO4 Closed ⁴
2	DO2 Closed ⁴	Others	Reserved

Table 5-40 Setpoint Triggers

- 4) Only when **DOx Mode** is set to **Remote Control/Setpoint**, setting Setpoint Triggers to DOx Closed is valid. In addition,
 - Only when the EPM5600's **Basic Function** option is "3" (4xDI+3xRelay Output) or "A" (4xDI+2xSS Pulse Output) would setting the **Setpoint Trigger** to **DO1 Closed** or **DO2 Closed** have meaning.
 - Only when the **Expansion Module B** is equipped with the "2xDI + 2xDO (Relay Output)" or "2xDI + 2xSS Pulse Output" options would setting the **Setpoint Trigger** to **DO3 Closed** or **DO4 Closed** have meaning.

5.11.5 Data Recorder Setup

Register	Property	Description	Format
6600~6622	RW	Data Recorder #1*	See Table 5-42 DR Setup Parameter Data Structure
6623~6645	RW	Data Recorder #2*	
6646~6668	RW	Data Recorder #3*	
6669~6691	RW	Data Recorder #4*	
6692~6714	RW	Data Recorder #5*	

* Please refer to Appendix B for the default configuration for the Data Recorders.

Table 5-41 Data Recorder Setup

Offset	Property	Description	Format	Range
+0	RW	Trigger Mode	UINT16	0=Disabled 1=Triggered by Timer
+1	RW	Recording Mode ¹	UINT16	0=Stop-when-Full 1=First-In-First-Out
+2	RW	Recording Depth ¹	UINT16	0 to 10,000
+3	RW	Recording Interval ¹	UINT32	60 to 3456000s
+5	RW	Offset Time ²	UINT16	0 to 43200s
+6	RW	Number of Parameters ¹	UINT16	0 to 16
+7	RW	Parameter #1 ¹	UINT16	Please refer to



+8	RW	Parameter #2 ¹	UINT16	Appendices A and B for a complete list of the Data Recorder Parameters and the default configuration for each DR, respectively.
+9	RW	Parameter #3 ¹	UINT16	
...	RW	...	UINT16	
+22	RW	Parameter #16 ¹	UINT16	

Table 5-42 DR Setup Parameter Data Structure

Notes:

- 1) Changing any of these Data Recorder setup registers will reset the Data Recorder.
- 2) **Recording Offset** can be used to delay the recording by a fixed amount of time from the **Recording Interval**. For example, if the **Recording Interval** is set to 3600 (hourly) and the **Recording Offset** is set to 300 (5 minutes), the recording will take place at 5 minutes after the hour every hour, i.e. 00:05, 01:05, 02:05...etc. The value of the **Recording Offset** parameter should be less than the **Recording Interval** parameter.

5.12 TOU Setup

5.12.1 Basic

Register	Property	Description	Format	Range/Option
7000	RO	Current Tariff ¹	UINT16	0=T1, 1=T2, 2=T3, 3=T4 4=T5, 5=T6, 6=T7, 7=T8
7001	RO	Current Season	UINT16	0 to 11 (Season #1 to #12)
7002	RO	Current Period	UINT16	0 to 11 (Period #1 to #12)
7003	RO	Current Daily Profile No.	UINT16	0 to 19 (Daily Profile #1 to #20)
7004	RO	Current Day Type	UINT16	0=Weekday1 1=Weekday2 2=Weekday3 3= Alternate Day
7005	RO	Current TOU No.	UINT16	0=TOU #1 1=TOU #2
7006	RW	TOU Switch Time	UINT32	See Note (1)
7008	WO	Switch TOU Manually	UINT16	Write 0xFF00 to manually switch the TOU schedules
7009	RW	Sunday Setup	UINT16	0=Weekday1* 1=Weekday2 2=Weekday3
7010	RW	Monday Setup	UINT16	
7011	RW	Tuesday Setup	UINT16	
7012	RW	Wednesday Setup	UINT16	
7013	RW	Thursday Setup	UINT16	
7014	RW	Friday Setup	UINT16	
7015	RW	Saturday Setup	UINT16	

Table 5-43 TOU Basic Setup

Notes:

- 1) If DI1 is not programmed as a **Tariff Switch**, the TOU will function based on the TOU Schedule. If at least one DI (DI1) is programmed as a **Tariff Switch**, the TOU Schedule will no longer be used and the Tariff switching will be based on the status of the DIs.
- 2) The following table illustrates the data structure for the TOU Switch Time. For example, 0x1003140C indicates a switch time of 12:00pm on March 20th, 2016. Writing 0xFFFFFFFF to this register disables the switching between TOU Schedule.

Byte 3	Byte 2	Byte 1	Byte 0
Year-2000 (0-37)	Month (1-12)	Day (1-31)	Hour (00-23)

Table 5-44 TOU Switch Time Format



5.12.2 Season

The EPM5600 has two sets of Season setup parameters, one for each TOU. The Base Addresses for the two sets are 7100 and 8100, respectively, where the Register Address = Base Address + Offset. For example, the register address for TOU #1's Season #2's Start Date is 7100+4 = 7104.

Offset	Property	Description	Format	Range/Default*
0	RW	Season #1: Start Date	UINT16	0x0101*
1	RW	Season #1: Weekday#1 Daily Profile	UINT16	0* to 19
2	RW	Season #1: Weekday#2 Daily Profile	UINT16	
3	RW	Season #1: Weekday#3 Daily Profile	UINT16	
4	RW	Season #2: Start Date	UINT16	High-order Byte: Month Low-order Byte: Day
5	RW	Season #2: Weekday#1 Daily Profile	UINT16	0* to 19
6	RW	Season #2: Weekday#2 Daily Profile	UINT16	
7	RW	Season #2: Weekday#3 Daily Profile	UINT16	
8	RW	Season #3: Start Date	UINT16	See Season #2: Start Date
9	RW	Season #3: Weekday#1 Daily Profile	UINT16	0* to 19
10	RW	Season #3: Weekday#2 Daily Profile	UINT16	
11	RW	Season #3: Weekday#3 Daily Profile	UINT16	
12	RW	Season #4: Start Date	UINT16	See Season #2: Start Date
13	RW	Season #4: Weekday#1 Daily Profile	UINT16	0* to 19
14	RW	Season #4: Weekday#2 Daily Profile	UINT16	
15	RW	Season #4: Weekday#3 Daily Profile	UINT16	
16	RW	Season #5: Start Date	UINT16	See Season #2: Start Date
17	RW	Season #5: Weekday#1 Daily Profile	UINT16	0* to 19
18	RW	Season #5: Weekday#2 Daily Profile	UINT16	
19	RW	Season #5: Weekday#3 Daily Profile	UINT16	
20	RW	Season #6: Start Date	UINT16	See Season #2: Start Date
21	RW	Season #6: Weekday#1 Daily Profile	UINT16	0* to 19
22	RW	Season #6: Weekday#2 Daily Profile	UINT16	
23	RW	Season #6: Weekday#3 Daily Profile	UINT16	
24	RW	Season #7: Start Date	UINT16	See Season #2: Start Date
25	RW	Season #7: Weekday#1 Daily Profile	UINT16	0* to 19
26	RW	Season #7: Weekday#2 Daily Profile	UINT16	
27	RW	Season #7: Weekday#3 Daily	UINT16	



		Profile	6	
28	RW	Season #8: Start Date	UINT1 6	See Season #2: Start Date
29	RW	Season #8: Weekday#1 Daily Profile	UINT1 6	0* to 19
30	RW	Season #8: Weekday#2 Daily Profile	UINT1 6	
31	RW	Season #8: Weekday#3 Daily Profile	UINT1 6	
32	RW	Season #9: Start Date	UINT1 6	See Season #2: Start Date
33	RW	Season #9: Weekday#1 Daily Profile	UINT1 6	0* to 19
34	RW	Season #9: Weekday#2 Daily Profile	UINT1 6	
35	RW	Season #9: Weekday#3 Daily Profile	UINT1 6	
36	RW	Season #10: Start Date	UINT1 6	See Season #2: Start Date
37	RW	Season #10: Weekday#1 Daily Profile	UINT1 6	0* to 19
38	RW	Season #10: Weekday#2 Daily Profile	UINT1 6	
39	RW	Season #10: Weekday#3 Daily Profile	UINT1 6	
40	RW	Season #11: Start Date	UINT1 6	See Season #2: Start Date
41	RW	Season #11: Weekday#1 Daily Profile	UINT1 6	0* to 19
42	RW	Season #11: Weekday#2 Daily Profile	UINT1 6	
43	RW	Season #11: Weekday#3 Daily Profile	UINT1 6	
44	RW	Season #12: Start Date	UINT1 6	See Season #2: Start Date
45	RW	Season #12: Weekday#1 Daily Profile	UINT1 6	0* to 19
46	RW	Season #12: Weekday#2 Daily Profile	UINT1 6	
47	RW	Season #12: Weekday#3 Daily Profile	UINT1 6	

Table 5-45 Season Setup

Notes:

- 1) **Start Date** for Season #1 is Jan. 1st and cannot be modified.
- 2) Setting a Season's **Start Date** as 0xFFFF terminates the TOU's Season settings. All subsequent Seasons' setup parameters will be ignored since the previous Season's duration is from its **Start Date** to the end of the year.
- 3) The **Start Date** of a particular Season must be later than the previous Season's.

5.12.3 Daily Profile

The EPM5600 has two sets of Daily Profile setup parameters, one for each TOU.

Register	Property	Description	Format
7200~7223	RW	Daily Profile #1	See Table 5-48 Daily Profile Data Structure
7224~7247	RW	Daily Profile #2	
7248~7271	RW	Daily Profile #3	
7272~7295	RW	Daily Profile #4	
7296~7319	RW	Daily Profile #5	
7320~7343	RW	Daily Profile #6	
7344~7367	RW	Daily Profile #7	
7368~7391	RW	Daily Profile #8	
7392~7415	RW	Daily Profile #9	
7416~7439	RW	Daily Profile #10	
7440~7463	RW	Daily Profile #11	



7464~7487	RW	Daily Profile #12
7488~7511	RW	Daily Profile #13
7512~7535	RW	Daily Profile #14
7536~7559	RW	Daily Profile #15
7560~7583	RW	Daily Profile #16
7584~7607	RW	Daily Profile #17
7608~7631	RW	Daily Profile #18
7632~7655	RW	Daily Profile #19
7656~7679	RW	Daily Profile #20

Table 5-46 TOU #1's Daily Profile Setup

Register	Property	Description	Format
8200~8223	RW	Daily Profile #1	See Table 5-48 Daily Profile Data Structure
8224~8247	RW	Daily Profile #2	
8248~8271	RW	Daily Profile #3	
8272~8295	RW	Daily Profile #4	
8296~8319	RW	Daily Profile #5	
8320~8343	RW	Daily Profile #6	
8344~8367	RW	Daily Profile #7	
8368~8391	RW	Daily Profile #8	
8392~8415	RW	Daily Profile #9	
8416~8439	RW	Daily Profile #10	
8440~8463	RW	Daily Profile #11	
8464~8487	RW	Daily Profile #12	
8488~8511	RW	Daily Profile #13	
8512~8535	RW	Daily Profile #14	
8536~8559	RW	Daily Profile #15	
8560~8583	RW	Daily Profile #16	
8584~8607	RW	Daily Profile #17	
8608~8631	RW	Daily Profile #18	
8632~8655	RW	Daily Profile #19	
8656~8679	RW	Daily Profile #20	

Table 5-47 TOU #2's Daily Profile Setup

Offset	Property	Description	Format	Note
+0	RW	Period #1 Start Time	UINT16	0x0000
+1	RW	Period #1 Tariff	UINT16	0=T1, ..., 7=T8
+2	RW	Period #2 Start Time	UINT16	0 ≤ Hour < 24
		High-order Byte: Hour Low-order Byte: Min		Min = 0, 15, 30, 45
+3	RW	Period #2 Tariff	UINT16	0=T1, ..., 7=T8
+4	RW	Period #3 Start Time	UINT16	See Period #2 Start Time
+5	RW	Period #3 Tariff	UINT16	0=T1, ..., 7=T8
+6	RW	Period #4 Start Time	UINT16	See Period #2 Start Time
+7	RW	Period #4 Tariff	UINT16	0=T1, ..., 7=T8
+8	RW	Period #5 Start Time	UINT16	See Period #2 Start Time
+9	RW	Period #5 Tariff	UINT16	0=T1, ..., 7=T8
+10	RW	Period #6 Start Time	UINT16	See Period #2 Start Time
+11	RW	Period #6 Tariff	UINT16	0=T1, ..., 7=T8
+12	RW	Period #7 Start Time	UINT16	See Period #2 Start Time
+13	RW	Period #7 Tariff	UINT16	0=T1, ..., 7=T8
+14	RW	Period #8 Start Time	UINT16	See Period #2 Start



			6	Time
+15	RW	Period #8 Tariff	UINT16	0=T1, ..., 7=T8
+16	RW	Period #9 Start Time	UINT16	See Period #2 Start Time
+17	RW	Period #9 Tariff	UINT16	0=T1, ..., 7=T8
+18	RW	Period #10 Start Time	UINT16	See Period #2 Start Time
+19	RW	Period #10 Tariff	UINT16	0=T1, ..., 7=T8
+20	RW	Period #11 Start Time	UINT16	See Period #2 Start Time
+21	RW	Period #11 Tariff	UINT16	0=T1, ..., 7=T8
+22	RW	Period #12 Start Time	UINT16	See Period #2 Start Time
+23	RW	Period #12 Tariff	UINT16	0=T1, ..., 7=T8

Table 5-48 Daily Profile Data Structure

Notes:

- 1) **Daily Profile#1's Period #1 Start Time** is always 00:00 and cannot be modified.
- 2) Setting a Period's **Start Time** as 0xFFFF terminates the Daily Profile's settings. All subsequent Daily Profiles' setup parameters will be ignored, and the previous Period's duration is from its **Start Time** to the end of the day.
- 3) The minimum interval of a period is 15 minutes.
- 4) The **Start Time** of a particular Period must be later than the previous Period's.

5.12.4 Alternate Days

Each Alternate Day is assigned a Daily Profile and has a higher priority than Season. If a particular date is set as an Alternate Day, its assigned Daily Profile will override the "normal" Daily Profile for this day according to the TOU settings.

The EPM5600 has two sets of Alternate Days setup parameters, one for each TOU. The Base Addresses for the two sets are 7700 and 8700, respectively, where the Register Address = Base Address + Offset. For example, the register address for TOU #2's Alternative Day #2's Date is 8700+3 = 8703.

Offset	Property	Description	Format	Range/Default*
0	RW	Alternate Day #1 Date ¹	UINT32	Table 5-50
2	RW	Alternate Day #1 Daily Profile	UINT16	0* to 19
3	RW	Alternate Day #2 Date ¹	UINT32	Table 5-50
5	RW	Alternate Day #2 Daily Profile	UINT16	0* to 19
6	RW	Alternate Day #3 Date ¹	UINT32	Table 5-50
8	RW	Alternate Day #3 Daily Profile	UINT16	0* to 19
9	RW	Alternate Day #4 Date ¹	UINT32	Table 5-50
11	RW	Alternate Day #4 Daily Profile	UINT16	0* to 19
12	RW	Alternate Day #5 Date ¹	UINT32	Table 5-50
14	RW	Alternate Day #5 Daily Profile	UINT16	0* to 19
15	RW	Alternate Day #6 Date ¹	UINT32	Table 5-50
17	RW	Alternate Day #6 Daily Profile	UINT16	0* to 19
18	RW	Alternate Day #7 Date ¹	UINT32	Table 5-50
19	RW	Alternate Day #7 Daily Profile	UINT16	0* to 19
21	RW	Alternate Day #8 Date ¹	UINT32	Table 5-50
22	RW	Alternate Day #8 Daily Profile	UINT16	0* to 19
24	RW	Alternate Day #9 Date ¹	UINT32	Table 5-50
25	RW	Alternate Day #9 Daily Profile	UINT16	0* to 19
27	RW	Alternate Day #10 Date ¹	UINT32	Table 5-50



29	RW	Alternate Day #10 Daily Profile	UINT16	0* to 19
...		...		Table 5-50
...		...		0* to 19
240	RW	Alternate Day #81 Date ¹	UINT32	Table 5-50
162	RW	Alternate Day #81 Daily Profile	UINT16	0* to 19
243	RW	Alternate Day #82 Date ¹	UINT32	Table 5-50
245	RW	Alternate Day #82 Daily Profile	UINT16	0* to 19
246	RW	Alternate Day #83 Date ¹	UINT32	Table 5-50
248	RW	Alternate Day #83 Daily Profile	UINT16	0* to 19
249	RW	Alternate Day #84 Date ¹	UINT32	Table 5-50
251	RW	Alternate Day #84 Daily Profile	UINT16	0* to 19
252	RW	Alternate Day #85 Date ¹	UINT32	Table 5-50
254	RW	Alternate Day #85 Daily Profile	UINT16	0* to 19
255	RW	Alternate Day #86 Date ¹	UINT32	Table 5-50
256	RW	Alternate Day #86 Daily Profile	UINT16	0* to 19
258	RW	Alternate Day #87 Date ¹	UINT32	Table 5-50
260	RW	Alternate Day #87 Daily Profile	UINT16	0* to 19
261	RW	Alternate Day #88 Date ¹	UINT32	Table 5-50
263	RW	Alternate Day #88 Daily Profile	UINT16	0* to 19
264	RW	Alternate Day #89 Date ¹	UINT32	Table 5-50
266	RW	Alternate Day #89 Daily Profile	UINT16	0* to 19
267	RW	Alternate Day #90 Date ¹	UINT32	Table 5-50
269	RW	Alternate Day #90 Daily Profile	UINT16	0* to 19

Table 5-49 Alternate Days Setup

Notes:

1) The following table illustrates the data structure of the Date register:

Byte3	Byte2	Byte1	Byte0
Reserved	Year-2000 (0-37)	Month (1-12)	Day (1-31)

Table 5-50 Date Format

When the Year and/or Month are set as **0xFF**, it means the Alternate Day is repetitive by year and/or month, i.e. the same day of every year or every month is an Alternate Day.

5.13 Time

There are two sets of Time registers supported by the EPM5600 – Year / Month / Day / Hour / Minute / Second (Registers # 60000 to 60002) and UNIX Time (Register # 60004). When sending time to the EPM5600 over Modbus communications, care should be taken to only write one of the two Time register sets. All registers within a Time register set must be written in a single transaction. If registers 60000 to 60004 are being written to at the same time, both Time register sets will be updated to reflect the new time specified in the UNIX Time register set (60004) and the time specified in registers 60000-60002 will be ignored. Writing to the Millisecond register (60003) is optional during a Time Set operation. When broadcasting time, the function code must be set to 0x10 (Pre-set Multiple Registers). Incorrect date or time values will be rejected by the meter. In addition, attempting to write a Time value less than Jan 1, 2000 00:00:00 will be rejected.

Register	Property	Description	Format	Note
60000	9000	High-order Byte: Year	UINT16	0-37 (Year-2000)
		Low-order Byte: Month		
60001	9001	High-order Byte: Day	UINT16	1 to 31
		Low-order Byte: Hour		
60002	9002	High-order Byte: Minute	UINT16	0 to 59
		Low-order Byte: Second		
60003	9003	Millisecond	UINT16	0 to 999
60004	9004	UNIX Time	UINT32	0x386D4380 to 0x



~ 60005	~ 9005		2	7FE8177F The corresponding time is 2000.01.01 00:00:00 to 2037.12.31 23:59:59 (GMT 0:00 Time Zone)
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Table 5-51 Time Registers

5.14 Remote Control

The DO Control registers are implemented as both “Write-Only” Modbus Coil Registers (0XXXXX) and Modbus Holding Registers (4XXXXX), which can be controlled with the Force Single Coil command (Function Code 0x05) or the Preset Multiple Hold Registers (Function Code 0x10). The EPM5600 does not support the Read Coils command (Function Code 0x01) because DO Control registers are “Write-Only”. The DO Status register 0098 should be read instead to determine the current DO status.

The EPM5600 adopts the ARM before EXECUTE operation for the remote control of its Digital Outputs if this function is enabled through the **Arm Before Execute Enable** Setup register (6032), which is disabled by default. Before executing an OPEN or CLOSE command on a Digital Output, it must be “Armed” first. This is achieved by writing the value 0xFF00 to the appropriate register to “Arm” a particular DO operation. The DO will be “Disarmed” automatically if an “Execute” command is not received within 15 seconds after it has been “Armed”. If an “Execute” command is received without first having received an “Arm” command, the meter ignores the “Execute” command and returns the 0x04 exception code.

Register	Property	Description	Format	Note
9100	WO	Arm DO1 Close	UINT16	Writing “0xFF00” to the register to perform the described action.
9101	WO	Execute DO1 Close	UINT16	
9102	WO	Arm DO1 Open	UINT16	
9103	WO	Execute DO1 Open	UINT16	
9104	WO	Arm DO2 Close	UINT16	
9105	WO	Execute DO2 Close	UINT16	
9106	WO	Arm DO2 Open	UINT16	
9107	WO	Execute DO2 Open	UINT16	
9108	WO	Arm DO3 Close	UINT16	
9109	WO	Execute DO3 Close	UINT16	
9110	WO	Arm DO3 Open	UINT16	
9111	WO	Execute DO3 Open	UINT16	
9112	WO	Arm DO4 Close	UINT16	
9113	WO	Execute DO4 Close	UINT16	
9114	WO	Arm DO4 Open	UINT16	
9115	WO	Execute DO4 Open	UINT16	

Table 5-52 DO Control

5.15 Clear/Reset Control

Register	Property	Description	Format	Note
9600	WO	Clear Historical Monthly Energy Log ¹	UINT16	Writing "0xFF00" to the register to execute the described action.
9601	WO	Clear All Energy Registers ²		
9602	WO	Clear Present Monthly Energy Log ³		
9603	WO	Clear Peak Demand of This Month (Since Last Reset) ⁴		
9604	WO	Clear All Demand Registers ⁵		
9605	WO	Clear Max/Min Logs of This Month (Since Last Reset) ⁶		
9606	WO	Clear All Max./Min. Log ⁷		
9607	WO	Clear Device Operating Time		
9608	WO	Clear All Data ⁸		
9609	WO	Clear SOE Log		
9610	WO	Clear DI1 Pulse Counter		
9611	WO	Clear DI2 Pulse Counter		
9612	WO	Clear DI3 Pulse Counter		
9613	WO	Clear DI4 Pulse Counter		
9614	WO	Clear DI5 Pulse Counter		
9615	WO	Clear DI6 Pulse Counter		
9616	WO	Reserved		
9617	WO	Reserved		
9618	WO	Clear All Pulse Counters		
9619	WO	Clear Data Recorder #1 Log		
9620	WO	Clear Data Recorder #2 Log		
9621	WO	Clear Data Recorder #3 Log		
9622	WO	Clear Data Recorder #4 Log		
9623	WO	Clear Data Recorder #5 Log		
9624	WO	ClearAll Data Recorder Log		

Table 5-53 Clear Control

Notes:

- 1) Writing 0xFF00 to the **Clear Historical Monthly Energy Log** register to clear the Monthly Energy Log of the last 1 to 12 months, excluding the Monthly Energy Log for the Present Month.
- 2) Writing 0xFF00 to the **Clear All Energy Registers** register to clear the 3-Ø Total and Per-Phase energy registers.
- 3) Writing 0xFF00 to the **Clear Present Monthly Energy Log** register to clear the Monthly Energy Log of the Present Month.
- 4) Writing 0xFF00 to the **Clear Peak Demand of This Month** register to clear Peak Demand Log of This Month (Since Last Reset) when the **Self-Read Time** register is set for automatic Self-Read operation. The Peak Demand of Last Month will not be cleared. If the **Self-Read Time** register is set for manual operation with a register value of 0xFFFF, the Peak Demand of This Month (Since Last Reset) will be transferred to the Peak Demand of Last Month (Before Last Reset) and then cleared.
- 5) Writing 0xFF00 to the **Clear All Demand** register to clear all Demand registers and logs, including Real-time Present Demand, Peak Demand Log of This Month (Since Last Reset) and Last Month (Before Last Reset).
- 6) Writing 0xFF00 to the **Clear Max./Min. Log of This Month** register to clear the Max./Min. log of This Month (Since Last Reset) when the **Self-Read Time** register is set for automatic Self-Read operation. The Max./Min. log of Last Month will not be cleared. If the **Self-Read Time** register is set for manual operation with a register value of 0xFFFF, the Max./Min. log of This Month (Since Last Reset) will be transferred to the Max./Min. log of Last Month (Before Last Reset) and then cleared.
- 7) Writing 0xFF00 to the **Clear All Max./Min. Log** register to clear both the Max./Min Log of This Month (Since Last Reset) and the Max./Min. Log of Last Month (Before Last Reset).
- 8) Writing 0xFF00 to the **Clear All Data** register to perform the Clear operation for the actions specified in registers # 9600 to 9607, registers # 9609 to # 9615, registers # 9618 to 9624 and Daily and Monthly Freeze Logs.

5.16 Meter Information



Register		Property	Description	Format	Note
60200~60219	9800~9819	RO	Meter model ¹	UINT16	See Note 1)
60220	9820	RO	Firmware Version	UINT16	e.g. 10000 shows the version is V1.00.00
60221	9821	RO	Protocol Version	UINT16	e.g. 10 shows the version is V1.0
60222	9822	RO	Firmware Update Date: Year-2000	UINT16	e.g. 140110 means January 10, 2014
60223	9823	RO	Firmware Update Date: Month	UINT16	
60224	9824	RO	Firmware Update Date: Day	UINT16	
60225	9825	RO	Serial Number	UINT32	e.g. 1701030100 means the 100 th PEM353 that was manufactured on January 3 rd , 2017
60227	9827	RO	Reserved	UINT16	
60228	9828	RO	Reserved	UINT16	
60229	9829	RO	Feature Code	UINT16	Bit 0 to Bit 2 (Expansion A): 000=None 001=RS485 010=I4 011=SPI Bit 3 to Bit 5 (Expansion B): 000=None 001=1xAI + 1xAO 010=2xDI + 2xDO 011=2xRTD 100=2xDI + 2x SS Pulse Output 101=Reserved Bit 6 (Flash): 0=Disabled 1=Enabled Bit 8 to Bit 7 (Basic Function): 00=4xDI + 2xDO 01=None 10=4xDI + 2 x SS Pulse Output Bit 15 to Bit 16: Reserved

* Available in Firmware V1.00.04 or later

Table 5-54 Meter Information

Notes:

- 1) The Meter Model appears from registers 60200 to 60219 and contains the ASCII encoding of the string "EPM5600" as shown in the following table.

Register	Value(Hex)	ASCII
60200	0x50	P
60201	0x4D	M
60202	0x43	C
60203	0x2D	-
60204	0x35	5
60205	0x33	3
60206	0x41	A
60207-60219	0x20	Null

Table 5-55 ASCII Encoding of "EPM5600"





Appendix A Data Recorder Parameter List

ID	Description	ID	Description	ID	Description
Real-time Measurements					
0	None	14	kWb	28	PF Total
1	Uan	15	kWc	29	Frequency
2	Ubn	16	kW Total	30	Uan/Uab Angle
3	Ucn	17	kvara	31	Ubn/Ubc Angle
4	Uln Average	18	kvarb	32	Ucn/Uca Angle
5	Uab	19	kvarc	33	la Angle
6	Ubc	20	kvar Total	34	lb Angle
7	Uca	21	kVAa	35	lc Angle
8	Ull Average	22	kVAb	36	In (Calculated)
9	la	23	kVAc	37	I4
10	lb	24	kVA Total	38	RTD 1
11	lc	25	PFa	39	RTD 2
12	I Average	26	PFb	40	AI Scaled
13	kWa	27	PFc	33 2	Ir* (Residual Current)
Power Quality					
41	Phase A Fundamental kW	59	lb Crest -Factor	16 0	Ubn/Ubc HD31
42	Phase B Fundamental kW	60	lc Crest -Factor	16 1	Ucn/Uca HD31
43	Phase C Fundamental kW	61	Voltage Unbalance	16 2	la THD
44	Fundamental kW Total	62	Current Unbalance	16 3	lb THD
45	Total Harmonic kW	63	Uan/Uab THD	16 4	lc THD
46	la TDD	64	Ubn/Ubc THD	16 5	la TOHD
47	lb TDD	65	Ucn/Uca THD	16 6	lb TOHD
48	lc TDD	66	Uan/Uab TOHD	16 7	lc TOHD
49	la TOHD	67	Ubn/Ubc TOHD	16 8	la TEHD
50	lb TOHD	68	Ucn/Uca TOHD	16 9	lb TEHD
51	lc TOHD	69	Uan/Uab TEHD	17 0	lc TEHD
52	la TEHD	70	Ubn/Ubc TEHD	17 1	la HD02
53	lb TEHD	71	Ucn/Uca TEHD	17 2	lb HD02
54	lc TEHD	72	Uan/Uab HD02	17 3	lc HD02
55	la K-Factor	73	Ubn/Ubc HD02
56	lb K-Factor	74	Ucn/Uca HD02	25 8	la HD31
57	lc K-Factor	25 9	lb HD31
58	la Crest-Factor	159	Uan/Uab HD31	26 0	lc HD31
Energy Measurements					
26 1	DI1 Pulse Counter	281	kWh Export of T1	30 1	kWh Export of T5
26 2	DI2 Pulse Counter	282	kvarh Import of T1	30 2	kvarh Import of T5
26 3	DI3 Pulse Counter	283	kvarh Export of T1	30 3	kvarh Export of T5
26 4	DI4 Pulse Counter	284	kVAh of T1	30 4	kVAh of T5
26 5	DI5 Pulse Counter	285	kWh Import of T2	30 5	kWh Import of T6



266	DI6 Pulse Counter	286	kWh Export of T2	306	kWh Export of T6
267	kWh Import	287	kvarh Import of T2	307	kvarh Import of T6
268	kWh Export	288	kvarhExport of T2	308	kvarhExport of T6
269	kWh Net	289	kVAh of T2	309	kVAh of T6
270	kWh Total	290	kWh Import of T3	310	kWh Import of T7
271	kvarh Import	291	kWh Export of T3	311	kWh Export of T7
272	kvarh Export	292	kvarh Import of T3	312	kvarh Import of T7
273	kvarh Net	293	kvarhExport of T3	313	kvarhExport of T7
274	kvarh Total	294	kVAh of T3	314	kVAh of T7
275	kVAh	295	kWh Import of T4	315	kWh Import of T8
276	kvarh Q1	296	kWh Export of T4	316	kWh Export of T8
277	kvarh Q2	297	kvarh Import of T4	317	kvarh Import of T8
278	kvarh Q3	298	kvarhExport of T4	318	kvarhExport of T8
279	kvarh Q4	299	kVAh of T4	319	kVAh of T8
280	kWh Import of T1	300	kWh Import of T5		
Demand Measurements					
320	Ia Present Demand	326	Ia Peak Demand Log of This Month (Since Last Reset)		
321	Ib Present Demand	327	Ib Peak Demand Log of This Month (Since Last Reset)		
322	Ic Present Demand	328	Ic Peak Demand Log of This Month (Since Last Reset)		
323	kW Total Present Demand	329	kW Peak Demand Log of This Month (Since Last Reset)		
324	kvar Total Present Demand	330	kvar Peak Demand Log of This Month (Since Last Reset)		
325	kVA Total Present Demand	331	kVA Peak Demand Log of This Month (Since Last Reset)		

* Available in Firmware V1.00.06 or later



Appendix B Data Recorder Default Settings

Parameter	DR 1	DR 2	DR 3	DR 4	DR 5
Trigger Mode	Triggered by Timer	Triggered by Timer	Triggered by Timer	Triggered by Timer	Triggered by Timer
Recording Depth	5760	5760	5760	5760	5760
Recording Interval	900s	900s	900s	900s	900s
Recording Offset	0	0	0	0	0
Number of Parameters	15	16	16	15	16
Parameter 1	kWh Import	Uab	Uan	Uan/Uab THD	T1 kWh Imp.
Parameter 2	kWh Export	Ubc	Ubn	Ubn/Ubc THD	T1 kWh Exp.
Parameter 3	kWh Total	Uca	Ucn	Ucn/Uca THD	T1 kvarh Imp.
Parameter 4	kWh Net	UII avg	UIIn avg	Ia THD	T1 kvarh Exp.
Parameter 5	kvarh Import	Ia	kWa	Ib THD	T2 kWh Imp.
Parameter 6	kvarh Export	Ib	kWb	Ic THD	T2 kWh Exp.
Parameter 7	kvarh Total	Ic	kWc	Ia TDD	T2 kvarh Imp.
Parameter 8	kvarh Net	I avg	kvara	Ib TDD	T2 kvarh Exp.
Parameter 9	kVAh Total	I _n (Calculated)	kvarb	Ic TDD	T3 kWh Imp.
Parameter 10	kW Total Demand	kW Total	kvarc	Ia K-Factor	T3 kWh Exp.
Parameter 11	kvar Total Demand	kvar Total	kVAa	Ib K-Factor	T3 kvarh Imp.
Parameter 12	kVA Total Demand	kVA Total	kVA b	Ic K-Factor	T3 kvarh Exp.
Parameter 13	Ia Demand	PF Total	kVAc	Ia Crest Factor	T4 kWh Imp.
Parameter 14	Ib Demand	Freq	P.F.a	Ib Crest Factor	T4 kWh Exp.
Parameter 15	Ic Demand	V Unbalance	P.F.b	Ic Crest Factor	T4 kvarh Imp.
Parameter 16	None	I Unbalance	P.F.c	None	T4 kvarh Exp.

Appendix C BACnet MSTP Implementation

1) Basic Information

The EPM5600 with the Firmware V1.00.03 or later supports the BACnet MS/TP protocol and can easily be connected to a BACnet MS/TP network using an off-the shelf BACnet router. The EPM5600 provides four types of BACnet objects. Standard Protocol Implementation Conformance Statement (PICS) as illustrated in table below describes the required characteristics of the BACnet implementation.

Item	Description
Date	March 20, 2017
Vendor Name	XD-GE
Model Name	EPM5600
Applications Software Version	1.00.03
Firmware Revision	1.0
Protocol Version	1
Protocol Revision	7
Description	Intelligent Multifunction Meter
Standardized Device	BACnet Smart Actuator (B-SA)
Interoperability Building Blocks supported	DS-RP-B, DS-RPM-B, DS-WP-B, DM-DOB-B, DM-TS-B, DM-DDB-B
Segmentation Capability	Not Supported
Data Link Layer Options	MS/TP Master, Baud rate(s): 1200, 2400, 4800, 9600, 19200, 38400
Device Address Binding	None
Networking Options	None
Character Sets Support	ANSI X3.4

2) Device Objects

- **Optional Properties Supported:** Description, Local_Time, Local_Date, Location
- **Writable Properties:** Object_Identifier, Number_Of_APDU_Reries, APDU_Timeout, System_Status, Object_Name, Location, Description, Max_Master, Max_Info_Frame, Local_Time, Local_Date
- **Property Range Restrictions:** Object_Identifier - valid range is between 0 and 4194302; Object_Name - limited to 32 characters; Location - limited to 64 characters; Description - limited to 64 characters; Max_Master – valid range is between 1 and 127.

The following table illustrates the Device Objects on the EPM5600:

Property*	Description	Range/Values	Default
R/W	Object_Identifier	0 to 4194302	26001
R/W	Object_Name	Up to 32 characters	Simple Server
R/W	System_Status	Operational (0)	
R	Object_Type	Device (8)	
R	Vendor_Name	XD-GE	
R/W	Vendor_Identifier	593	
R	Model_Name	EPM5600	
R	Firmware_Revision	1	
R	Application_Software_Version	1.00.03	
R/W	Location	Up to 64 characters	LOCAL
R/W	Description	Up to 64 characters	Intelligent Multifunction Meter
R	Protocol_Version	1	
R	Protocol_Revision	7	
R	Protocol_Service_Supported ¹	Please see notes below	
R	Protocol_Object_Types_Supported ²	Please see notes	



		below	
R	Object_List	Please refer to sections 3) to 6)	
R	Max_APDU_Length_Accepted	480	
R	Segmentation	NO_SEGMENTATION (3)	
R/W	APDU_Timeout	0~65535	3000
R/W	Number_Of_APDU_Retries	0~255	3
R/W	Max_Master	1 to 127	127
R/W	Max_Info_Frame	1	
R	Device_Address_Binding	{}	
R	Database_Revision	0	
R	Local_Time	Configuration by timing	12:00:00:00
R	Local_Date	Configuration by timing	2016.07.01

* R = Read Only; R/W = Read/Write

Notes:

- 1) Supported services:
 - ReadProperty
 - ReadPropertyMultiple
 - WriteProperty
 - TimeSynchronization
 - Who-Has
 - Who-Is, I-Am, I-Have
- 2) Supported object types:
 - Analog-Input
 - Analog-Value
 - Binary-Input
 - Binary-Output
 - Device

3) Analog Input Objects (EPM5600's Real-Time Parameters)

Optional Properties Supported: Description, Reliability

Use the Present_Value property of the Analog_Input objects for all read-only numeric variables in EPM5600. These objects support the Description and Reliability optional properties and all required Analog_Input object properties. None of them are writable. The values that are not instantaneous (i.e. Accumulated Energy, Peak Demand) are non-volatile.

Register	Description	Property	Unit	Range	
AI 0000	Uan ¹	R	V		
AI 0002	Ubn ¹	R			
AI 0004	Ucn ¹	R			
AI 0006	ULN average ¹	R			
AI 0008	Uab	R			
AI 0010	Ubc	R			
AI 0012	Uca	R			
AI 0014	ULL average	R			
AI 0016	Ia	R		A	
AI 0018	Ib	R			
AI 0020	Ic	R			
AI 0022	I average	R			
AI 0024	kWa ¹	R	kW		
AI 0026	kWb ¹	R			



AI 0028	kWc ¹	R			
AI 0030	kW Total	R			
AI 0032	kvara ¹	R	kvar		
AI 0034	kvarb ¹	R			
AI 0036	kvarc ¹	R			
AI 0038	kvar Total	R			
AI 0040	kVAa ¹	R	kVA		
AI 0042	kVAb ¹	R			
AI 0044	kVAc ¹	R			
AI 0046	kVA Total	R			
AI 0048	PFa ¹	R		0 to 1	
AI 0050	PFb ¹	R			
AI 0052	PFc ¹	R			
AI 0054	PF Total	R			
AI 0056	Frequency	R	Hz		
AI 0070	Neutral Current (Calculated)	R	A		
AI 0072	I4 (Optional Measurement)	R	A		
AI 0082	AI	R			
AI 0086	RTD1	R	°C		
AI 0088	RTD2	R	°C		
AI 0090	AO	R			
AI 0174	I _r	R	A		
AI 0500	kWh Import	R	kWh	0 to 99999999.9	
AI 0502	kWh Export	R			
AI 0504	kWh Net	R			
AI 0506	kWh Total	R			
AI 0508	kvarh Import*	R	kvarh		
AI 0510	kvarh Export*	R			
AI 0512	kvarh Net*	R			
AI 0514	kvarh Total*	R			
AI 0516	kVAh*	R	kWh		
AI3006	kW Total Demand	R	kW		
AI 3008	kvar Total Demand	R	kvar		
AI 3010	kVA Total Demand	R	kVA		
AI 3000	I _a Demand	R			
AI 3002	I _b Demand	R	A		
AI 3004	I _c Demand	R			
AI 3418	kW Total Peak Demand	R	kW		
AI 3424	kvar Total Peak Demand	R	kvar		
AI 3430	kVA Total Peak Demand	R	kVA		
AI 3400	I _a Peak Demand	R			
AI 3406	I _b Peak Demand	R	A		
AI 3412	I _c Peak Demand	R			
AI 1600	U _{an} THD ²	R			
AI 1602	U _{bn} THD ²	R			
AI 1604	U _{cn} THD ²	R			
AI 1400	I _a THD	R			
AI 1402	I _b THD	R			
AI 1404	I _c THD	R			
AI 1318	I _a K Factor	R	%		
AI 1320	I _b K Factor	R			
AI 1322	I _c K Factor	R			
AI 1300	I _a TDD	R			
AI 1302	I _b TDD	R			
AI 1304	I _c TDD	R			
AI 1324	I _a Crest Factor	R			
AI 1326	I _b Crest Factor	R			
AI 1328	I _c Crest Factor	R			
AI 1330	U Unbalance	R			
AI 1332	I Unbalance	R			
AI 0074	dPFa ¹	R		0 to 1	
AI 0076	dPFb ¹	R	-		
AI 0078	dPFc ¹	R			
AI 0058	U _{an} Angle ³	R	°		
AI 0060	U _{bn} Angle ³	R			



AI 0062	Ucn Angle ^o	R		
AI 0064	Ia Angle	R		
AI 0066	Ib Angle	R		
AI 0068	Ic Angle	R		
AI 0104	Operating Time	R	h	
AI 0526	Interval kWh Import	R	kWh	0 to 99999999.9
AI 0528	Interval kWh Export	R		
AI 0530	Interval kvarh Import*	R	kvarh	
AI 0532	Interval kvarh Export*	R		
AI 0534	Interval kVAh*	R	kWh	
AI 1200	DI #1 Counter	R		0 to 999,999,999
AI 1202	DI #2 Counter	R		
AI 1204	DI #3 Counter	R		
AI 1206	DI #4 Counter	R		
AI 1208	DI #5 Counter	R		
AI 1210	DI #6 Counter	R		

*There are no unit types for kvarh and kVAh in BACnet so the return values are in unit of kWh.

Notes:

- 1) When the **Wiring Mode** is 3P3W, the per phase line-to-neutral voltages, kW, kvars, kVAs and PFs have no meaning, and their registers are reserved.
- 2) Uan/Ubn/Ucn THD = Uab/Ubc/Uca THD in 3P3W Wiring Mode and represent the harmonics of the line voltages.
- 3) Uan/Ubn/Ucn Angle = Uab/Ubc/Uca Angle in 3P3W Wiring Mode and represent the phase angles of the line voltages.

4) Analog Value Objects (EPM5600's Basic Setup Registers)

Optional Properties Supported: Description, Relinquish_Default, Priority_Array

Writable Properties: Present_Value, Out_Of_Service, Units, Relinquish_Default

Use the PresentValue property of the AnalogValue object for some writable variables in the meter other than those used specifically for BACnet configuration or Time Synchronization. Values are checked when written, and errors are returned for invalid entries. The table below describes how the Setup Registers of the EPM5600 are represented in BACnet, their valid ranges, their defaults as well as how they are used. EPM5600 supports the Description, Relinquish_Default and Priority_Array optional properties. Writable properties include Present_Value, Out_Of_Service, Units and Relinquish_Default, but Units are not non-volatile after modification.

Register	Description	Property	Unit/ Range	Default/Note
AV 6000	PT Primary High [#]	R/W	0 to 1000 kV	0
AV 6001	PT Primary Low [#]	R/W	1 to 999 V	100
AV 6002	PT Secondary [#]	R/W	1 to 690	100
AV 6004	CT Primary	R/W	1 to 30000	5
AV 6006	CT Secondary	R/W	1 to 5	5
AV 6012	I4 Primary	R/W	1 to 30000	5
AV 6014	I4 Secondary	R/W	1 to 5	5
AV 6020	Wiring Mode	R/W	0 = DEMO 1 = 1P2W L-N	5



			2 = 1P2W L-L, 3 = 1P3W L-L-N 4 = 3P3W, 5 = 3P4W	
AV 6021	PF Convention	R/W	0 = IEC, 1 = IEEE, 2 = - IEEE	0
AV 6022	kVA Calculation	R/W	0 = Vector, 1 = Scalar	0
AV 6028	THD Calculation	R/W	0 = THDf, 1 = THDr	0
AV 6029	Demand Period	R/W	1 to 60 min	15
AV 6030	Number of Sliding Windows	R/W	1 to 15	1
AV 6047	Interval Energy Period	R/W	5 to 60 min	60
AV 9603	Clear Present Peak Demand	W	65280	Default = 0 Writing "0xFF00" to the register to execute the described action.
AV 9601	Clear Energy	W	65280	
AV 9610	Clear DI #1 Counter	W	65280	
AV 9611	Clear DI #2 Counter	W	65280	
AV 9612	Clear DI #3 Counter	W	65280	
AV 9613	Clear DI #4 Counter	W	65280	
AV 9614	Clear DI #5 Counter	W	65280	
AV 9615	Clear DI #6 Counter	W	65280	

#PT Ratio × CT Ratio × Rated Phase Voltage Input × Rated Current Input × √3 must be less than 790,000,000.

5) Binary Input Objects (EPM5600's Digital Inputs)

Optional Properties Supported: Description, Reliability

Use the Present_Value properties of the Binary_Input objects as alerts for conditions of potential concern regarding system measurements. These objects support the Description and Reliability optional properties and all required Binary_Input object properties. None of them are writable.

Register	Description	Property	Note
B10	DI 1	R	0 = Inactive, 1 = Active
B11	DI 2	R	0 = Inactive, 1 = Active
B12	DI 3	R	0 = Inactive, 1 = Active
B13	DI 4	R	0 = Inactive, 1 = Active
B14	DI 5	R	0 = Inactive, 1 = Active
B15	DI 6	R	0 = Inactive, 1 = Active

6) Binary Output Objects (EPM5600's Digital Outputs)

Optional Properties Supported: Inactive_Text, Active_Text

Use the Present_Value property of the Binary_Output objects as alerts for DO conditions. Reading Binary_Output objects have the highest priority. EPM5600 supports Inactive_Text, Active_Text optional properties and all required Binary_Output object properties. Present_Value, Out_Of_Service and Polarity properties can be written, but these are non-volatile after modification. The Present_Value can only be written when the Out_Of_Service is true to change the state of the Digital Output and will be written as W when the Out_Of_Service is false.



Register	Description	Property	Note
BO0	DO 1	R/W	0 = Inactive, 1 = Active
BO1	DO 2	R/W	0 = Inactive, 1 = Active
BO2	DO 3	R/W	0 = Inactive, 1 = Active
BO3	DO 4	R/W	0 = Inactive, 1 = Active

7) Additional Front Panel Setup Parameters for BACnet MS/TP

The following BACnet MS/TP setup parameters should be configured via the EPM5600's Front Panel before connecting the EPM5600 to a BACnet MS/TP network.

Parameters	Description	Option/Range	Default
MAC	MS/TP ID [^]	0 to 127	100
INST	Object Identifier [#]	0 to 4194302	26001
MAXMAS	Maximum Number of Master	0 to 127	127
LOCK	Disable communication	YES/NO	NO
BAUD	Baud rate	1200/2400/4800/9600/19200/38400	9600
CONFIG	Comm. Port Configuration	8N1/8E1/8O1/8N2/8E2/8O2	8E1

[^]The MS/TP ID is similar to the Modbus unit ID conceptually

[#]The Object Identifier is similar to the IP address of an Ethernet network conceptually and is required to be unique within the entire BACnet network



Appendix D N2 Implementation

The EPM5600 with Firmware V1.00.03 or later supports the JCI's Metasys N2 protocol, in addition to BACnet MS/TP, which allows it to connect directly to the Metasys N2 Network. The user can select the desired protocol via the Front Panel's **COMM** menu. The N2 protocol assigns key analog parameters to ADF points. The Command Register with override capability is used to reset groups of parameters held in the device.

Before integrating the EPM5600 into a Metasys N2 Network, please make sure that all N2 devices are configured, started and running properly. No more than 32 N2 devices should be connected to an NCM's N2 Bus segment, and no more than 100 N2 devices when repeaters are used. There are no additional communication setup parameters for the Metasys N2 protocol.

Item	Description
Device Address	1-247 (100*)
Baud Rate	1200/2400/4800/9600*/19200/38400
Interface	RS485 Half Duplex
Word Length	8
Stop Bits	1*/2
Parity	Even*/Odd/None

* Default

1) Supported N2 Commands

Command	EPM5600's Response
Identify Device Type	VND
Synchronization Time	Supported
Poll Without Ack	Always respond with No COS Poll Response
Poll With Ack	Always respond with No COS Poll Response
Read Analog Input	Supported
Override Analog Input	Only used to override the Command Register. When an unsupported command is received, the EPM5600 will respond with the Undefined Command Error Code 0x01.

2) Map Table

AI Point	EPM5600		AIPoint	EPM5600		
	Parameter	Unit		Parameter	Unit	
1	Uan ¹	V	47	kW Total Peak Demand	kW	
2	Ubn ¹		48	kvar Total Peak Demand	kvar	
3	Ucn ¹		49	kVA Total Peak Demand	kVA	
4	ULN average ¹	V	50	Ia Peak Demand	A	
5	Uab		51	Ib Peak Demand		
6	Ubc		52	Ic Peak Demand		
7	Uca		53	Uan THD ²		
8	ULL average		54	Ubn THD ²		
9	Ia		55	Ucn THD ²		
10	Ib	A	56	Ia THD	%	
11	Ic		57	Ib THD		
12	I average		58	Ic THD		
13	kWa ¹		kW	59		Ia K Factor
14	kWb ¹	60		Ib K Factor		
15	kWc ¹	61		Ic K Factor		
16	kW Total	kvar	62	Ia TDD	%	
17	kvara ¹		63	Ib TDD		
18	kvarb ¹		64	Ic TDD		
19	kvarc ¹		65	Ia Crest Factor		
20	kvar Total		66	Ib Crest Factor		-



21	kVAa ¹	kVA	67	Ic Crest Factor	%
22	kVAb ¹		68	U Unbalance	
23	kVAc ¹		69	I Unbalance	
24	kVA Total	-	70	dPFa	-
25	PFa ¹		71	dPFb	
26	PFb ¹		72	dPFc	
27	PFc ¹		73	Uan Angle ³	
28	PF Total	Hz	74	Ubn Angle ³	°
29	Frequency		75	Ucn Angle ³	
30	Neutral Current (Calculated)		A	76	
31	I4 (Optional Measurement)	A	77	Ib Angle	h
32	kWh Import	kWh	78	Ic Angle	
33	kWh Export		79	Operating Time	
34	kWh Total		80	Interval kWh Import ⁴	kWh
35	kWh Net	81	Interval kWh Export ⁴		
36	kvarh Import	kvarh	82	Interval kvarh Import ⁴	kvarh
37	kvarh Export		83	Interval kvarh Export ⁴	
38	kvarh Total		84	Interval kVAh ⁴	
39	kvarh Net	85	DI #1 Counter		
40	kVAh	kVAh	86	DI #2 Counter	
41	kW Total Demand	kW	87	DI #3 Counter	
42	kvar Total Demand	kvar	88	DI #4 Counter	
43	kVA Total Demand	kVA	89	DI #5 Counter	
44	Ia Demand	A	90	DI #6 Counter	
45	Ib Demand		91	Clear ⁵	
46	Ic Demand				

Notes:

- 1) When the **Wiring Mode** is 3P3W, the per phase line-to-neutral voltages, kW, kvar, kVA and PFs have no meaning, and their ADF points are reserved.
- 2) Uan/Ubn/Ucn THD = Uab/Ubc/Uca THD in 3P3W Wiring Mode and represent the harmonics of the line voltages.
- 3) Uan/Ubn/Ucn Angle = Uab/Ubc/Uca Angle in 3P3W Wiring Mode and represent the phase angles of the line voltages.
- 4) Interval Energy Period (EN Period) can be modified via the Front Panel.
- 5) The Command register, ADF point 91, is used to reset groups of accumulated values held in the device. The following table illustrates the override values written to the Command register and their corresponding actions. It is not essential to release the Command Register for the reset to operate. The last Command (156003) is reserved, and the device will respond with 0 if received.

Override Value for Command Register	Action
156001	All Energy values
156002	All Demand values
156003	Reserved



Appendix E DNP Profile

This section contains the DNP Device Profile Information according to the standard format defined in the DNP 3.0 Subset Definitions Document and should provide a complete application configuration guide.

DNP V3.0	
Vendor Name: XD-GE	
Device Name: EPM5600	
Highest DNP Level Supported: For Requests: Level 1 For Responses: Level 1	Device Function: <input type="checkbox"/> Master <input checked="" type="checkbox"/> 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):	
Maximum Data Link Frame Size (octets): Transmitted: 292 Received: 292	Maximum Application Fragment Size (octets): Transmitted: 1024 Received: 300
Maximum Data Link Re-tries: <input checked="" type="checkbox"/> None <input type="checkbox"/> Fixed <input type="checkbox"/> Configurable	Maximum Application Layer Re-tries: <input checked="" type="checkbox"/> None <input type="checkbox"/> Configurable
Requires Data Link Layer Confirmation: <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable	
Requires Application Layer Confirmation: <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> When reporting Event Data (Slave devices only) <input type="checkbox"/> When sending multi-fragment responses (Slave devices only) <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable	
Timeouts while waiting for: Data Link Confirm: <input checked="" type="checkbox"/> None <input type="checkbox"/> Fixed at ___ <input type="checkbox"/> Variable <input type="checkbox"/> Configurable Complete Appl. Fragment: <input checked="" type="checkbox"/> None <input type="checkbox"/> Fixed at ___ <input type="checkbox"/> Variable <input type="checkbox"/> Configurable Application Confirm: <input checked="" type="checkbox"/> None <input type="checkbox"/> Fixed at ___ <input type="checkbox"/> Variable <input type="checkbox"/> Configurable Complete Appl. Response: <input checked="" type="checkbox"/> None <input type="checkbox"/> Fixed at ___ <input type="checkbox"/> Variable <input type="checkbox"/> Configurable Others: Transmission Delay, configurable Select/Operate Arm Timeout, fixed at 15 seconds	
Sends/Executes Control Operations: WRITE Binary Outputs <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable SELECT/OPERATE <input type="checkbox"/> Never <input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable DIRECT OPERATE <input type="checkbox"/> Never <input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable DIRECT OPERATE - NO ACK <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable	



Count > 1	<input checked="" type="checkbox"/> Never Configurable	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/>
Pulse On:	<input checked="" type="checkbox"/> Never Configurable	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/>
Pulse Off:	<input checked="" type="checkbox"/> Never Configurable	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/>
Latch On	<input type="checkbox"/> Never	<input checked="" type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/>
Latch Off	<input type="checkbox"/> Never	<input checked="" type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/>
Queue:	<input checked="" type="checkbox"/> Never Configurable	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/>
ClearQueue:	<input checked="" type="checkbox"/> Never Configurable	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/>

Attach explanation if "Sometimes" or "Configurable" was checked for any operation.

DNP V3.0

<p>Reports Binary Input Change Events when no specific variation requested:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Never <input type="checkbox"/> Only time-tagged <input type="checkbox"/> Only non-time-tagged <input type="checkbox"/> Configurable to send time-tagged or non-time-tagged 	<p>Reports time-tagged Binary Input Change Events when no specific variation requested:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Never <input type="checkbox"/> Binary Input Change with Time <input type="checkbox"/> Binary Input Change with Relative Time <input type="checkbox"/> Configurable to send Binary Input Change With Time and Binary Input Change With Relative Time 																		
<p>Sends Unsolicited Responses:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Never <input type="checkbox"/> Configurable - enable/disable <input type="checkbox"/> Only certain objects <input type="checkbox"/> Sometimes (attach explanation) <input type="checkbox"/> ENABLE/DISABLE UNSOLICITED Function codes supported 	<p>Sends Static Data in Unsolicited Responses:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Never <input type="checkbox"/> When Device Restarts <input type="checkbox"/> When Status Flags Change <p>No other options are permitted.</p>																		
<p>Default Counter Object/Variation:</p> <ul style="list-style-type: none"> <input type="checkbox"/> No Counters Reported <input type="checkbox"/> Configurable <input type="checkbox"/> Default Object <p>Default Variation:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Point-by-point list attached 	<p>Counters Roll Over at:</p> <ul style="list-style-type: none"> <input type="checkbox"/> No Counters Reported <input type="checkbox"/> Configurable <input type="checkbox"/> 16 Bits <input type="checkbox"/> 32 Bits <input type="checkbox"/> Other Value: _____ <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Point-by-point list attached 																		
<p>Sends Multi-Fragment Responses</p> <ul style="list-style-type: none"> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Configurable 																			
<p>Sequential File Transfer Support:</p> <table border="0"> <tr> <td>Append File Mode</td> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> </tr> <tr> <td>Custom Status Code Strings</td> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> </tr> <tr> <td>Permissions Field</td> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> </tr> <tr> <td>File Events Assigned to Class</td> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> </tr> <tr> <td>File Events Send Immediately</td> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> </tr> <tr> <td>Multiple Blocks in a Fragment</td> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> </tr> </table> <p>Max. Number of Files Open: 0</p>		Append File Mode	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Custom Status Code Strings	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Permissions Field	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	File Events Assigned to Class	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	File Events Send Immediately	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Multiple Blocks in a Fragment	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Append File Mode	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No																	
Custom Status Code Strings	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No																	
Permissions Field	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No																	
File Events Assigned to Class	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No																	
File Events Send Immediately	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No																	
Multiple Blocks in a Fragment	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No																	

Level 1 Implementation (DNP-L1)

OBJECT	REQUEST (slave must parse)	RESPONSES (master must parse)
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Obj	Var	Description	Func Codes (dec)	Qual Code (hex)	Func Codes (dec)	Qual Code (hex)
1	2	Binary Input Status with Flag	1	0x06	129	0x00
10	2	Binary Output Status	1	0x06	129	0x00
12	1	Control Relay Output Block	3,4,5	0x28	129	0x28
20	5	32-Bit Binary Counter without Flag	1	0x06	129	0x00
20	6	16-Bit Binary Counter without Flag	1	0x06	129	0x00
30	3	32-Bit Analog Input without Flag	1	0x06	129	0x00
40	2	16-BIT ANALOG OUTPUT STATUS	1	0x06	129	0x00
41	2	16-BIT ANALOG OUTPUT BLOCK	3,4,5	0x28	129	0x28
50	1	Date and Time	1	0x07	129	0x07
60	1	Class 0 Data	1	0x06	129	
80	1	Internal Indicator	2	0x00	129	
N/A	N/A	Cold Restart (respond Obj. 52:2)	13	N/A	129	0x07

Application Layer's Function and Qualifier Code Description

Function Code			Qualifier Code		
Code (dec)	Description	EPM5600	Code (hex)	Description	EPM5600
0	Confirm		0x00	8-bit start/stop indices	√
1	Read	√	0x01	16-bit start/stop indices	
2	Write	√	0x06	Request for all points	√
3	Select	√	0x07	Single field index, 8-bit format	√
4	Operate	√	0x08	Single field index, 16-bit format	
5	Direct Operate With Acknowledge	√	0x17	Control point	
6	Direct Operate Without Acknowledge		0x28	Control point	√
7	Freeze with Acknowledge				
8	Immediate Freeze - No Acknowledge				
9	Freeze and Clear with Acknowledge				
10	Freeze and Clear - No Acknowledge				
13	Cold Restart	√			
20	Enable Spontaneous Messages	√			
21	Disable Spontaneous Messages	√			
22	Assign Classes				
23	Delay Measurement				
129	Solicited Response	√			
130	Unsolicited Response				

Data Link Layer

The EPM5600 can be assigned a device address between 0 and 65519. After device restart, Function Code 0 (Reset of Remote Link) must be executed to enable DNP communication. The following table describes which Data Link Layer functions are supported.

Request			Response		
Func. Code	Description	EPM5600	Func. Code	Description	EPM5600
0	Reset of Remote Link	√	0	ACK - Positive Acknowledgement	√
1	Reset of User Process		1	NACK - Message Not Accepted, Link Busy	√



2	Test Function for Link		2	Not Used	
3	User Data		3	Not Used	
4	Unconfirmed User Data	√	4	Not Used	
5	Not Used		5	Not Used	
6	Not Used		6	Not Used	
7	Not Used		7	Not Used	
8	Not Used		8	Not Used	
9	Request Link Status	√	9	Not Used	
10	Not Used		10	Not Used	
11	Not Used		11	Status of Link	√
12	Not Used		12	Not Used	
13	Cold Restart	√	13	Respond Object 52:2	√
14	Not Used		14	Link Service Not Functioning	
15	Not Used		15	LinkService Not Used or Implemented	

Physical Layer

The Port 1 RS-485 is designed to support the DNP 3.0 protocol.

Port Configuration	Description	Notes
Port Name	COM1	
Baud Rate	1200/2400/4800/9600*/19200/38400	Default*
Parity	8E1*/8O1/8N1/8E2/8O2/8N2	

DNP Point Map

Object 1 - Binary Input Status with Flags (Included in Class 0 responses)

Read with Object 1, Variation 2, and Qualifier 6.

Point	Description	Format	Range
0	DI1 ¹	UINT8	Bit Flags
1	DI2 ¹	UINT8	Bit Flags
2	DI3 ¹	UINT8	Bit Flags
3	DI4 ¹	UINT8	Bit Flags
4	DI5 ^{1,2}	UINT8	Bit Flags
5	DI6 ^{1,2}	UINT8	Bit Flags

Supported Flags:

Bit 0 (ONLINE): 0=Offline, 1=Online

Bit 7 (STATE): 0=Off, 1=On

Notes:

- 1) If the Device Model does not support DI, the Bit 0 and Bit 7 for the bytes of all DI status above would be set to "0".
- 2) If 4xDIs are supported on the Device Model, the Bit 0 and Bit 7 in bytes for DI5 and DI6 status would be set to "0".

Object 10 - Binary Output States (Included in Class 0 responses)

Read with Object 10, Variation 2, and Qualifier 6.

Point	Description	Format	Range
0	Clear Present Energy Log	UINT8	Always 0
1	Clear All Energy Registers	UINT8	Always 0
2	Clear Present Monthly Energy Log	UINT8	Always 0
3	Clear Peak Demand of This Month (Since Last Reset)	UINT8	Always 0
4	Clear All Demand Registers	UINT8	Always 0
5	Clear Max/Min Logs of This Month (Since Last Reset)	UINT8	Always 0
6	Clear All Max./Min. Log	UINT8	Always 0
7	Clear Device Operating Time	UINT8	Always 0
8	Clear All Data	UINT8	Always 0
9	Clear DI1 Pulse Counter	UINT8	Always 0
10	Clear DI2 Pulse Counter	UINT8	Always 0
11	Clear DI3 Pulse Counter	UINT8	Always 0
12	Clear DI4 Pulse Counter	UINT8	Always 0
13	Clear DI5 Pulse Counter	UINT8	Always 0
14	Clear DI6 Pulse Counter	UINT8	Always 0



15	Clear All Pulse Counters	UINT8	Always 0
16	DO1 ¹	UINT8	Bit Flags
17	DO2 ¹	UINT8	Bit Flags
18	DO3 ^{1,2}	UINT8	Bit Flags
19	DO4 ^{1,2}	UINT8	Bit Flags
20-29	Reserved		
30-43	Wiring Diagnostics Status	UINT8	Bit Flags

Notes:

- 1) If the Device Model does not support DO, the Bit 0 and Bit 7 for the bytes of all DO status above would be set to "0".
- 2) If 2xDOs are supported on the Device Model, the Bit 0 and Bit 7 in bytes for DO3 and DO4 status would be set to "0".
- 3) The following table shows the details of Point 30-43.

No.	Event
30	Frequency is out of range (45 to 65Hz) (3P4W or 3P3W)
31	Any phase voltage < 10% of PT Primary (Register 6000) (3P4W only)
32	Any phase current < 10% of CT Primary (Register 6004) (3P4W or 3P3W)
33	RTD 1 broken (RTD Input option only)
34	RTD 2 broken (RTD Input option only)
...	Voltage Phase Reversal (3P4W only)
	Current Phase Reversal (3P4W or 3P3W)
	Negative kW Total may be abnormal (3P4W or 3P3W)
	Negative kWa is may be abnormal (3P4W only)
	Negative kWb may be abnormal (3P4W only)
	Negative kWc may be abnormal (3P4W only)
	CTa polarity may be reversed (3P4W only)
CTb polarity may be reversed (3P4W only)	
43	CTc polarity may be reversed (3P4W only)

Supported Flags:

Bit 0 (ONLINE):

0= Offline, which represents that the control of the Output could not be implemented.

1= Online, which represents that the Output works properly, once control request has been sent, the command could be correctly implemented.

Bit 7 (STATE): 0=Off, 1=On

Object 12 - Control Relay Outputs

Responds to Function Codes: 03 (Select), 04 (Operate) and 05 (Direct Operate), Variation 1, Qualifier 0x28, with a Count of 1 only. Only one control object at a time may be specified.

Point	Description	Format	Range
0	Clear Present Energy Log	UINT8	N/A
1	Clear All Energy Registers	UINT8	N/A
2	Clear Present Monthly Energy Log	UINT8	N/A
3	Clear Peak Demand of This Month (Since Last Reset)	UINT8	N/A
4	Clear All Demand Registers	UINT8	N/A
5	Clear Max/Min Logs of This Month (Since Last Reset)	UINT8	N/A
6	Clear All Max./Min. Log	UINT8	N/A
7	Clear Device Operating Time	UINT8	N/A
8	Clear All Data	UINT8	N/A
9	Clear DI1 Pulse Counter	UINT8	N/A
10	Clear DI2 Pulse Counter	UINT8	N/A
11	Clear DI3 Pulse Counter	UINT8	N/A
12	Clear DI4 Pulse Counter	UINT8	N/A
13	Clear DI5 Pulse Counter	UINT8	N/A
14	Clear DI6 Pulse Counter	UINT8	N/A
15	Clear All Pulse Counters	UINT8	N/A
16	DO1	UINT8	Bit Flags
17	DO2	UINT8	Bit Flags
18	DO3	UINT8	Bit Flags
19	DO4	UINT8	Bit Flags



Please refer to the **DNP V3.00 Data Object Library** document for a detailed description of the Object Coding format for the Control Relay Output Block as well as the meanings of the returned Status.

Object 20 - 32-BIT Binary Counters - Primary Readings (Included in Class 0 responses)

Read with Object 20, Variation 5, and Qualifier 6.

Point	Description	Format	Unit	Scale	Range
0	kWh Import	INT32	kWh	10	0-999,999,999
1	kWh Export	INT32	kWh		
2	kWh Net	INT32	kWh		
3	kWh Total	INT32	kWh		
4	kvarh Import	INT32	kvarh		
5	kvarh Export	INT32	kvarh		
6	kvarh Net	INT32	kvarh		
7	kvarh Total	INT32	kvarh		
8	kVAh	INT32	kVAh		
9	kvarh Q1	INT32	kvarh		
10	kvarh Q2	INT32	kvarh		
11	kvarh Q3	INT32	kvarh		
12	kvarh Q4	INT32	kvarh		
13	Interval kWh Import	INT32	kWh		
14	Interval kWh Export	INT32	kWh		
15	Interval kvarh Import	INT32	kvarh		
16	Interval kvarh Export	INT32	kvarh		
17	Interval kVAh	INT32	kVAh		
18	DI1 Pulse Counter ¹	UINT32	1	1	0-999,999,999
19	DI2 Pulse Counter ¹	UINT32	1		
20	DI3 Pulse Counter ¹	UINT32	1		
21	DI4 Pulse Counter ¹	UINT32	1		
22	DI5 Pulse Counter ^{1,2}	UINT32	1		
23	DI6 Pulse Counter ^{1,2}	UINT32	1		

Notes:

- 1) If the Device Model does not support DI, all DI Pulse Counters would be set to "0".
- 2) If 4xDIs are supported on the Device Model, DI5 and DI6 Pulse Counter would be set to "0".

Object 20 - 16-BIT Binary Counters - Primary Readings(Included in Class 0 responses)

Read with Object 20, Variation 6, and Qualifier 6.

Point	Description	Format	Range
0	Scale for Energy and Operating Time	UINT16	10
1	Scale for Current, PF, I Seq., I Fund., and I Demand	UINT16	1000
2	Scale for U, Freq, Phase Angle, RTD, U Fund., U Seq., THD, TDD, K Factor, Crest-factor and Unbalance	UINT16	100
3	Scale for AI, AO, Power and Power Demand	UINT16	1
4	Firmware Version ¹	UINT16	0-65535
5	Feature Code ²	UINT16	0-65535

Notes:

- 1) The read-out value 10000 represents the Version is V1.00.00.
- 2) The following table illustrates the details of Feature Code. Bit 6 and Bit 9 to Bit 15 for the Byte are reserved. Points for I4, AI Scaled, RTD1, RTD2 and AO in Object 30 are only meaningful if the meter is equipped with the corresponding option.

Bit 7 to Bit 8 (Basic I/O Function)	Bit 3 to Bit 5 (Expansion Module B)	Bit 0 to Bit 2 (Expansion Module A)
00=4xDI+2xDO 01=None 10=4xDI+2xSS Pulse Output	000=None 001=1xAI + 1xAO 010=2xDI + 2xDO 011=2xRTD 100=2xDI + 2x SS Pulse Output 101=Reserved	000=None 001=RS485 010=I4 011=SPI

Object 30 - Analog Inputs Primary Readings (Included in Class 0 responses)



Read with Object 30, Variation 3, and Qualifier 6.

Point	Description	Format	Scale	Unit
0	Meter Health	INT32	Always 0	-
1	Uan	INT32	x100	V
2	Ubn ¹	INT32		
3	Ucn ¹	INT32		
4	Uln Average	INT32		
5	Uab	INT32		
6	Ubc	INT32		
7	Uca	INT32		
8	Ull Average	INT32		
9	Ia	INT32	x1000	A
10	Ib ¹	INT32		
11	Ic ¹	INT32		
12	I average	INT32		
13	kWa	INT32	x1	W
14	kWb ¹	INT32		
15	kWc ¹	INT32		
16	kW Total	INT32		
17	kvara	INT32		
18	kvarb ¹	INT32		var
19	kvarc ¹	INT32		
20	kvar Total	INT32		
21	kVAa	INT32		
22	kVAb ¹	INT32		
23	kVAc ¹	INT32	VA	
24	kVA Total	INT32		
25	P.F.a	INT32		
26	P.F.b ¹	INT32	x1000	-
27	P.F.c ¹	INT32		
28	P.F. Total	INT32		
29	FREQ	INT32	x100	Hz
30	Uan/Uab (3P3W) Angle	INT32	x100	°
31	Ubn/Ubc (3P3W) Angle	INT32		
32	Ucn/Uca (3P3W) Angle	INT32		
33	Ia Angle	INT32		
34	Ib Angle	INT32		
35	Ic Angle	INT32		
36	In (Calculated)	INT32	x1000	A
37	I4	INT32		
38	Ir	INT32		
39	Displacement PFa	INT32	x1000	-
40	Displacement PFb ¹	INT32		
41	Displacement PFC ¹	INT32		
42	Displacement PF Total	INT32		
43	AI Scaled	INT32	x1	-
44	RTD 1	INT32	x100	°C
45	RTD 2	INT32		
46	AO	INT32	x1	-
47	Device Operating Time	INT32	x10	h
48	Phase A Fundamental kW	INT32	x1	W
49	Phase B Fundamental kW ¹	INT32		
50	Phase C Fundamental kW ¹	INT32		
51	Fundamental kW Total	INT32		
52	Total Harmonic kW	INT32		
53	Uan/Uab Fundamental	INT32	x100	V
54	Ubn/Ubc Fundamental	INT32		
55	Ucn/Uca Fundamental	INT32		
56	Ia Fundamental	INT32	x1000	A
57	Ib Fundamental ¹	INT32		
58	Ic Fundamental ¹	INT32		
59	U1 (+ve Sequence Voltage) ²	INT32	x100	V
60	U2 (-ve Sequence Voltage) ²	INT32		
61	U0 (Zero Sequence Voltage) ²	INT32		



62	I1 (+ve Sequence Current) ²	INT32	x1000	A
63	I2 (-ve Sequence Current) ²	INT32		
64	I0 (Zero Sequence Current) ²	INT32	x100	-
65	Ia TDD	INT32		
66	Ib TDD	INT32		
67	Ic TDD	INT32		
68	Ia K Factor	INT32		
69	Ib K Factor	INT32		
70	Ic K Factor	INT32		
71	Ia Crest-factor	INT32		
72	Ib Crest-factor	INT32		
73	Ic Crest-factor	INT32		
74	Voltage Unbalance	INT32		
75	Current Unbalance	INT32		
76	Uan/Uab THD	INT32		
77	Ubn/Ubc THD	INT32		
78	Ucn/Uca THD	INT32		
79	Ia THD	INT32		
80	Ib THD	INT32		
81	Ic THD	INT32		
82	Ia Present Demand	INT32	x1000	A
83	Ib Present Demand	INT32		
84	Ic Present Demand	INT32		
85	ΣkW Present Demand	INT32	x1	W
86	Σkvar Present Demand	INT32		var
87	ΣkVA Present Demand	INT32		VA
88	Ia Peak Demand of This Month (Since Last Reset)	INT32	x1000	A
89	Ib Peak Demand of This Month (Since Last Reset)	INT32		
90	Ic Peak Demand of This Month (Since Last Reset)	INT32		
91	ΣkW Peak Demand of This Month (Since Last Reset)	INT32	x1	W
92	Σkvar Peak Demand of This Month (Since Last Reset)	INT32		var
93	ΣkVA Peak Demand of This Month (Since Last Reset)	INT32		VA
94	Ia Peak Demand of Last Month (Before Last Reset)	INT32	x1000	A
95	Ib Peak Demand of Last Month (Before Last Reset)	INT32		
96	Ic Peak Demand of Last Month (Before Last Reset)	INT32		
97	ΣkW Peak Demand of Last Month (Before Last Reset)	INT32	x1	W
98	Σkvar Peak Demand of Last Month (Before Last Reset)	INT32		var
99	ΣkVA Peak Demand of Last Month (Before Last Reset)	INT32		VA

Notes:

- 1) When the Wiring Mode is 1P2WL-N or 1P2WL-L, the L2 and L3 phase voltages and currents have no meaning, and their registers are reserved.
- 2) When the Wiring Mode is 1P2WL-N, 1P2WL-L or 1P3W, the Sequence Components U1/I1, U2/I2 and U0/I0 have no meaning and their registers are reserved.

Object 40 - Analog Output Status Objects

Read with Object 40, Variation 2, and Qualifier 6.

Point	Property	Description	Format	Range
0	RO	Class 0 Points	UINT16	0-65535

Object 41 - Analog Output Command Objects

Responds to Function Codes: 03 (Select), 04 (Operate) and 05 (Direct Operate), Variation 2, Qualifier 0x28, with a Count of 1 only.

Point	Property	Description	Format	Range
0	WO	Class 0 Points	UINT16	0-65535

Note: The following table illustrates the details of Bit Values for Class 0 Points.



Bit Point	Descriptions	Value
Bit0	Object 1 - Binary Input Status Included in Class 0 responses?	0=No,1=Yes (default)
Bit 1	Object 10 - Binary Output States Included inClass 0 responses?	0=No,1=Yes (default)
Bit 2	Object 20 - 32 BIT Binary Counters Included in Class 0 responses?	0=No,1=Yes (default)
Bit 3	Object 20 - 16 BIT Binary Counters Included in Class 0 responses?	0=No,1=Yes (default)
Bit 4	Object 30 -Analog Inputs Included in Class 0 responses?	0=No,1=Yes (default)
Bit 5	Object 40 -Analog Output Status Included in Class 0 responses?	0=No,1=Yes (default)
Bit 6- Bit15	Reserved	

Object 50 - Date and Time

Read and Write function is supported for thisobject, which occupies 6 bytes for the device's time.The time shows the number of UNIX milliseconds since 00:00:00 January 1, 1970, calculated by UNIXseconds*1000 + milliseconds.

Object 60 - Class Objects

Read with Function Code 1, Variation 1, and Qualifier 6.Only Class 0 polls are supported.

Object 80 - Internal Indicator

This is a Write Only function.Clear the Restart Bit with Function Code 2, Variation 1, Qualifier 0.

Point	Description	Format	Range
7	Device Restart	UINT8	0-1



Appendix F Technical Specifications

Voltage Inputs (V1, V2, V3, VN)	
Standard Un	400VLN/690VLL
Range	10V to 1.2Un
Overload	1.2xUn continuous, 2xUn for 1s
Burden	<0.02VA per phase
Measurement Category	CAT III up to 600VLL
Frequency	45-65Hz
Current Inputs (I11, I12, I21, I22, I31, I32)	
Standard In=5A/1A Auto-scale	Class 0.5S for 5A and Class 1 for 1A
Optional In=1A	Class 0.5S
Range	0.1% to 200% In
Starting Current	0.1% In
Overload	2xIn continuous, 20xIn for 1s
Measurement Category	CAT III up to 600VLL
Burden	<0.15VA per phase
Optional I4 Input (I41, I42)	
In	5A (5A/1A Auto-Scale)
Range	0.1% to 120% In
Starting Current	0.1% In
Power Supply (L+, N-, GND)	
Standard	95-250VAC/DC, ±10%, 47-440Hz
Optional	20-60VDC
Optional	95-480VAC/DC, ±10%, 47-440Hz
Burden	<2W
Overvoltage Category	CAT III up to 300VLN
Digital Inputs (DI1, DI2, DI3, DI4, DIC)	
Type	Dry contact, 24VDC internally wetted
Sampling	1000Hz
Hysteresis	1ms minimum
Digital Outputs (DO11, DO12, DO21, DO22)	
Type	Form A Mechanical Relay
Loading	5A @ 250VAC or 30VDC
Pulse Outputs (kWh, kvarh)	
Type	Form A Solid State Relay
Isolation	Optical
Max. Load Voltage	80V
Max. Forward Current	50mA
Installation Torque	
Current Inputs	1.3 N.m
Power Supply, Voltage Inputs, RS485 and I/O	0.5 N.m
Environmental Conditions	
Operating Temp.	-25°C to 70°C
Storage Temp.	-40°C to 85°C
Humidity	5% to 95% non-condensing
Atmospheric Pressure	70 kPa to 106 kPa
Mechanical Characteristics	
Panel Cutout	92x92 mm (3.62"x3.62")
Unit Dimensions	96x96x88 mm
IP Rating	65



Accuracy

Parameters	Accuracy	Resolution
Voltage	$\pm 0.2\%$ Reading + 0.05% F.S.	0.001V
Current	$\pm 0.2\%$ Reading + 0.05% F.S.	0.001A
I4 (measurement)	$\pm 0.2\%$	0.001A
kW, kvar, kVA	$\pm 0.5\%$ Reading + 0.05% F.S.	0.001k
kWh, kVAh	IEC 62053-22 Class 0.5S	0.1kXh
kvarh	IEC 62053-23 Class 2	0.1kvarh
P.F.	$\pm 0.5\%$	0.001
Frequency	± 0.02 Hz	0.01Hz
THD	IEC 61000-4-7 Class B	0.001%
K-Factor	IEC 61000-4-7 Class B	0.001
Phase angles	$\pm 1^\circ$	0.1°

Appendix G Standards Compliance

Safety Requirements	
CE LVD 2014 / 35 / EU cTUVus for UL/CSA Certification	EN61010-1: 2010 EN61010-2-030: 2010 UL 61010-1: 2012 UL 61010-2-030: 2012 CAN/CSA-C22.2 No.61010-1: 2012 CSA C22.2 No. 61010-2-030-12
Electrical safety in low voltage distribution systems up to 1000Vac and 1500 Vdc	IEC 61557-12: 2008 (PMD)
Insulation AC Voltage: 2.5kV @ 1 minute Insulation Resistance: >100MΩ Impulse voltage: 6kV, 1.2/50μs	IEC 62052-11: 2003 IEC 62052-22: 2003
Electromagnetic Compatibility CE EMC Directive 2014 / 30 / EU (EN 61326: 2013)	
Immunity Tests	
Electrostatic discharge	EN 61000-4-2: 2009
Radiated fields	EN 61000-4-3: 2006+A1: 2008+A2: 2010
Fast transients	EN 61000 - 4 - 4: 2012
Surges	EN 61000 - 4 - 5: 2014
Conducted disturbances	EN 61000 - 4 - 6: 2009
Magnetic Fields	EN 61000 - 4 - 8: 2010
V Dips, Interruptions & Variations	EN 61000-4-11:2004
Oscillatory waves	EN 61000 - 4 - 12: 2006
Radio Disturbances	CISPR 22:2006, Level B
Emission Tests	
Limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment	EN 55011: 2009 + A1: 2010 (CISPR 11)
Limits and methods of measurement of radio disturbance characteristics of information technology equipment	EN 55022: 2010+AC: 2011 (CISPR 22)
Limits for harmonic current emissions for equipment with rated current ≤16 A	EN 61000-3-2: 2014
Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current ≤16 A	EN 61000-3-3: 2013
Emission standard for industrial environments	EN 61000-6-4: 2007+A1: 2011
Testing and measurement techniques - Ring wave immunity test.	EN 61000-4-12: 2006
Radiated Emissions	FCC 47CFR 15.109 Class B
Conducted Emissions	FCC 47CFR 15.107 Class B
Mechanical Tests	
Spring Hammer Test	IEC 62052-11: 2003
Vibration Test	IEC 62052-11: 2003
Shock Test	IEC 62052-11: 2003