

PMC-53A
Intelligent Multifunction Meter
User Manual
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Standards Compliance



DANGER

This symbol indicates the presence of danger that may result in severe injury or death and permanent equipment damage if proper precautions are not taken during the installation, operation or maintenance of the device.



CAUTION

This symbol indicates the potential of personal injury or equipment damage if proper precautions are not taken during the installation, operation or maintenance of the device.



DANGER

Failure to observe the following instructions may result in severe injury or death and/or equipment damage.

- Installation, operation and maintenance of the meter 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.
- Ensure that all incoming AC power and other power sources are turned OFF before performing any work on the meter.
- Before connecting the meter to the power source, check the label on top of the meter to ensure that it is equipped with the appropriate power supply, and the correct voltage and current input specifications for your application.
- During normal operation of the meter, hazardous voltages are present on its terminal strips and throughout the connected potential transformers (PT) and current transformers (CT). PT and CT secondary circuits are capable of generating lethal voltages and currents with their primary circuits energized. Follow standard safety precautions while performing any installation or service work (i.e. removing PT fuses, shorting CT secondaries, ...etc).
- Do not use the meter for primary protection functions where failure of the device can cause fire, injury or death. The meter should only be used for shadow protection if needed.
- Under no circumstances should the meter be connected to a power source if it is damaged.
- To prevent potential fire or shock hazard, do not expose the meter to rain or moisture.
- Setup procedures must be performed only by qualified personnel familiar with the instrument and its associated electrical equipment.
- DO NOT open the instrument under any circumstances.

Limited warranty

- CET Inc. (CET) offers the customer a minimum of 12-month functional warranty on the meter for faulty parts or workmanship from the date of dispatch from the distributor. This warranty is on a return to factory for repair basis.
- CET does not accept liability for any damage caused by meter malfunctions. CET accepts no responsibility for the suitability of the meter to the application for which it was purchased.
- Failure to install, set up or operate the meter according to the instructions herein will void the warranty.
- Only CET's duly authorized representative may open your meter. The unit should only be opened in a fully anti-static environment. Failure to do so may damage the electronic components and will void the warranty.

Table of Contents

Chapter 1 Introduction	1
1.1 Overview	1
1.2 Features	1
1.3 PMC-53A' Application in Power and Energy Management Systems	3
1.4 Getting more information	3
Chapter 2 Installation	4
2.1 Appearance	4
2.2 Unit Dimensions.....	5
2.3 Terminal Dimensions.....	5
2.4 Mounting	5
2.5 Wiring connections	6
2.5.1 3-Phase 4-Wire (3P4W) Wye Direct Connection with 3CTs	7
2.5.2 3-Phase 4-Wire (3P4W) Wye Direct Connection with 4CTs	7
2.5.3 3-Phase 4-Wire (3P4W) Wye with 3PTs and 3CTs.....	8
2.5.4 3-Phase 4-Wire (3P4W) Wye with 3PTs and 4CTs.....	8
2.5.5 3-Phase 3-Wire (3P3W) Direct Delta Connection with 3CTs.....	9
2.5.6 3-Phase 3-Wire (3P3W) Direct Delta Connection with 2CTs.....	9
2.5.7 3-Phase 3-Wire (3P3W) Delta with 2PTs and 3CTs	10
2.5.8 3-Phase 3-Wire (3P3W) Delta with 2PTs and 2CTs	10
2.5.9 1-Phase 3-Wire (1P3W) Direct Connection with 2CTs	11
2.5.10 1-Phase 2-Wire, ULN (1P2W-ULN) Direct Connection with 1CT	11
2.5.11 1-Phase 2-Wire, ULL (1P2W-ULL) Direct Connection with 1CT.....	12
2.6 Communications Wiring.....	12
2.7 Digital Input Wiring.....	12
2.8 Digital Output Wiring	13
2.9 Solid State Relay Wiring	13
2.10 Analog Input Wiring	13
2.11 Analog Output Wiring	14
2.12 RTD Input Wiring.....	14
2.13 Power Supply Wiring.....	14
Chapter 3 Front Panel	15
3.1 Using the Front Panel Buttons	15
3.2 Data Display	15
3.2.1 U/I.....	16
3.2.2 Power.....	16
3.2.3 Energy	16
3.2.4 Demand	16
3.2.5 Harmonics.....	17
3.2.6 Max./Min.	18
3.2.7 TOU	19
3.2.8 I/O	19
3.2.9 SOE	19
3.3 Setup Configuration via the Front Panel	20
3.3.1 Making Setup Changes	20
3.3.2 Setup Menu	20
3.3.3 Configuration	21
Chapter 4 Applications	26
4.1 Inputs and Outputs	26
4.1.1 Digital Inputs.....	26
4.1.2 Digital Outputs.....	26
4.1.3 Energy Pulse Outputs	27
4.1.4 Analog Input	27
4.1.5 Analog Output	27
4.1.6 RTD Input.....	27
4.2 Power and Energy	28
4.2.1 Basic Measurements	28

4.2.2 Energy Measurements.....	28
4.2.3 Interval Energy Measurements	28
4.2.4 Demand Measurements	29
4.3 Power Quality.....	29
4.3.1 Phase Angles.....	29
4.3.2 Power Quality Parameters	29
4.3.3 Unbalance.....	31
4.4 Setpoints	31
4.5 Logging.....	33
4.5.1 Max./Min. Log	33
4.5.2 Max. Demand Log.....	33
4.5.3 Monthly Energy Log.....	34
4.5.4 Daily and Monthly Freeze Log (Optional)	34
4.5.5 SOE Log.....	35
4.5.6 Data Recorder (DR) Log (Optional)	35
4.6 Time of Use (TOU).....	35
4.7 Diagnostics	36
4.7.1 Voltage Phase Loss.....	37
4.7.2 Current Phase Loss	37
Chapter 5 Modbus Register Map	38
5.1 Basic Measurements.....	38
5.2 Energy Measurements	40
5.2.1 3-Phase Total Energy Measurements	40
5.2.2 Phase A (L1) Energy Measurements	41
5.2.3 Phase B (L2) Energy Measurements	42
5.2.4 Phase C (L3) Energy Measurements	43
5.2.5 Interval Energy Measurements	44
5.3 DI Pulse Counters	44
5.4 Harmonic Measurements	44
5.4.1 Power Quality Measurements.....	44
5.4.2 Current Harmonic Measurements.....	44
5.4.3 Voltage Harmonic Measurements	45
5.5 Demands	45
5.5.1 Present Demands	45
5.5.2 Predicted Demands	45
5.5.3 Max. Demand Log of This Month (Since Last Reset)	46
5.5.4 Max. Demand Log of Last Month (Before Last Reset)	46
5.6 Max./Min. Log.....	47
5.6.1 Max. Log of This Month (Since Last Reset)	47
5.6.2 Min. Log of This Month (Since Last Reset).....	48
5.6.3 Max. Log of Last Month (Before Last Reset)	49
5.6.4 Min. Log of Last Month (Before Last Reset).....	49
5.6.5 Max./Min. Log Structure	50
5.7 Monthly Energy Log	50
5.8 Daily and Monthly Freeze Logs (Optional)	52
5.8.1 Daily Freeze Log	52
5.8.2 Monthly Freeze Log	52
5.9 SOE Log	53
5.10 Data Recorder Log (Optional).....	56
5.11 Device Setup	56
5.11.1 Basic Setup Parameters	56
5.11.2 I/O Setup	58
5.11.3 Communication Setup Parameters	59
5.11.4 Setpoints Setup.....	60
5.11.5 Data Recorder Setup.....	61
5.12 TOU Setup	62
5.12.1 Basic.....	62

5.12.2 Season	62
5.12.3 Daily Profile	63
5.12.4 Alternate Days	65
5.13 Time	66
5.14 Remote Control	66
5.15 Clear/Reset Control	67
5.16 Meter Information	68
Appendix A Data Recorder Parameter List	69
Appendix B Data Recorder Default Settings	70
Appendix C BACnet MSTP Implementation	71
Appendix D N2 Implementation	77
Appendix E DNP Profile	79
Appendix F Technical Specifications	87
Appendix G Standards Compliance	89
Appendix H Maintenance	90
Appendix I Ordering Guide	94
Contact us	95

Chapter 1 Introduction

This manual explains how to use the PMC-53A Intelligent Multifunction Meter. Throughout the manual the term “meter” generally refers to all models.

This chapter provides an overview of the PMC-53A meter and summarizes many of its key features.

1.1 Overview

The PMC-53A Intelligent Multifunction Meter is CET’s latest offer for the low-cost digital power/energy metering market. The PMC-53A features quality construction, multifunction measurements and a large, backlit, Dot-Matrix LCD that is easy to navigate and user friendly. 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, ANSI C12.20 Class 0.2 and EN 50470-1/3 Class C Standard, it is a cost effective replacement for analog instrumentation and is capable of displaying 4 measurements at once. It optionally provides I4 input for Neutral Current measurement, a second RS-485 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 PMC Setup software. The meter is also supported by our PecStar® iEMS Integrated Energy Management System. Following is a list of typical applications for the PMC-53A:

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

Contact CET Technical Support at support@cet-global.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 PMC Setup software
- Easy installation with mounting clips, no tools required

Basic Measurements (True RMS)

- ULN, ULL per Phase and Average with calculated Neutral-to-Ground Voltage (Ung*)
*The Ung is available in Firmware V1.00.11 or later and valid only when the **Wiring Mode** is **3P4W**
- Current per Phase and Average with calculated Neutral
- Current Load Factor per Phase and Average~
*The Current Load Factors are available in Firmware V1.00.15 or later
- 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
- kvarh Q1-Q4
- Fundamental U, I and kW per Phase*
- Total Fundamental kW & Total Harmonic kW*
- U and I Symmetrical (Sequence) Components*

- Interval Energy for kWh/kvarh Imp./Exp. and kVAh*
 - *Available in Firmware V1.00.03 or later
- Demands, Predicted Demands and Max. Demands for kW/kvar/kVA Total, I per Phase and Average as well as ULL Average (ULL avg~) with Timestamp for This Month (or Since Last Reset) and Last Month (or Before Last Reset)
 - ~Demands for I avg and ULL avg are available in Firmware V1.00.11 or later
- 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
 - Total and 3-phase kWh/kvarh Import/Export, kVAh
 - kW/kvar/kVA Max. Demands
- 12 Monthly Energy Logs of kWh/kvarh Import/Export/Total/Net, kVAh, kvarh Q1-Q4 as well as kWh/kvarh Import/Export and kVAh per Tariff

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
- Setup changes, Setpoint and DI status changes as well as DO operations

Max./Min. Log

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

Freeze Logs (Optional)

- 60 Daily Freeze Logs for kWh/kvarh/kVAh Total and kW/kvar/kVA Max. Demands
- 36 Monthly Freeze Logs for kWh/kvarh/kVAh Total and kW/kvar/kVA Max. 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, Incorrect CT Polarity
- Incorrect U & I Phase Sequence

Communications

- Optically isolated RS-485 port at max. 38,400 bps
- Selectable Modbus RTU, BACnet MS/TP*, Metasys N2* and DNP 3.0~
 - *The BACnet MS/TP and Metasys N2 are available in Firmware V1.00.03 or later
 - ~The DNP 3.0 is available in Firmware V1.00.06 or later
- Optional 2nd RS-485 port with Modbus RTU support only

Real-Time Clock

- Battery-backed Real-time Clock with 25ppm accuracy (<2s per day)

Optional Inputs and Outputs

- **Digital Inputs**
 - Up to 6 channels, volt 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

Optional Expansion Modules

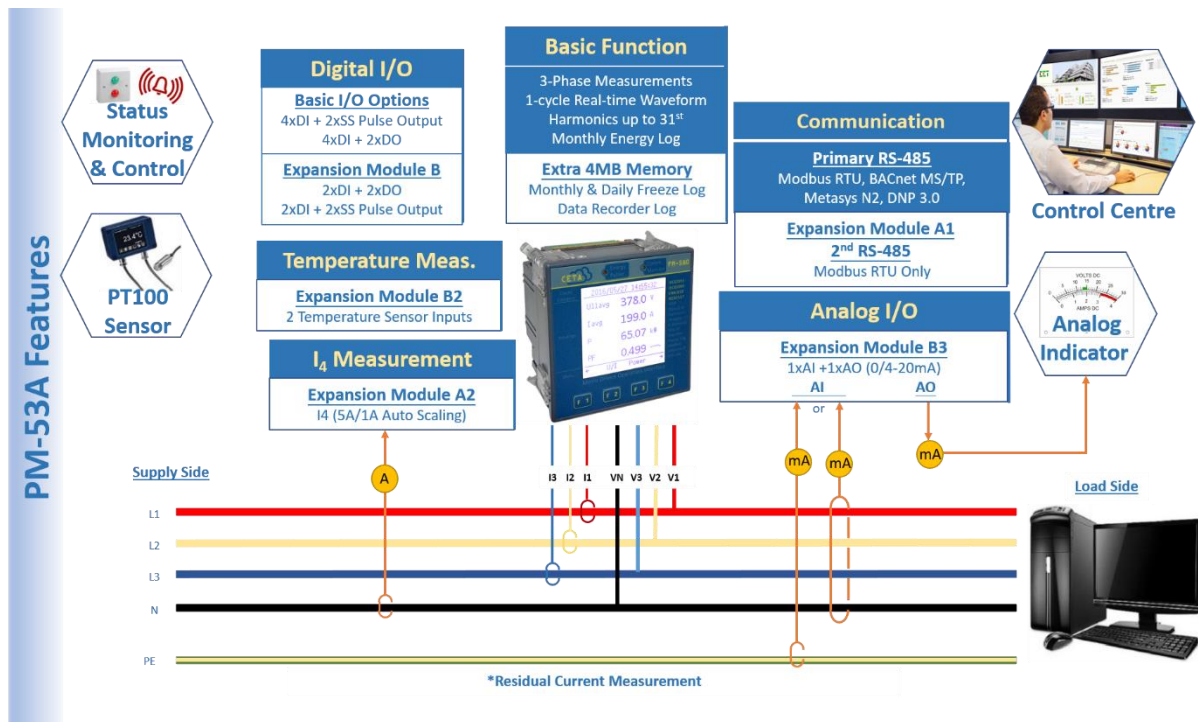
- **Expansion Module A Options**
 - I4 Input
 - 2nd RS-485 port with optical isolation, supporting Modbus RTU only
- **Expansion Module B Options**
 - 2xDigital Input and 2xDigital Output (Mechanical Relay)
 - 2xDigital Input and 2xSolid State Pulse Output
 - 2xRTD Input (PT100 sensor not included)
 - 1xAI and 1xAO (0/4-20mA)

System Integration

- Supported by CET's PecStar® iEMS and iEEM
- Easy integration into Johnson Controls Metasys with N2 or other Building Automation Systems with BACnet MS/TP or Modbus RTU
- DNP 3.0 for Utility Substation Automation

1.3 PMC-53A' Application in Power and Energy Management Systems

The PMC-53A can be used to monitor 3P4W (Wye), 3P3W (Delta), 1P2W-ULN, 1P2W-ULL or 1P3W connected power system. Modbus communications allow real-time data, DI status and other information to be transmitted across a RS-485 network to an Integrated Energy Management system such as PecStar® iEMS.



1.4 Getting more information

Additional information is available from CET via the following sources:

- Visit www.cet-global.com
- Contact your local representative
- Contact CET Technical Support directly via email at support@cet-global.com

Chapter 2 Installation



Caution

Installation of the PMC-53A 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

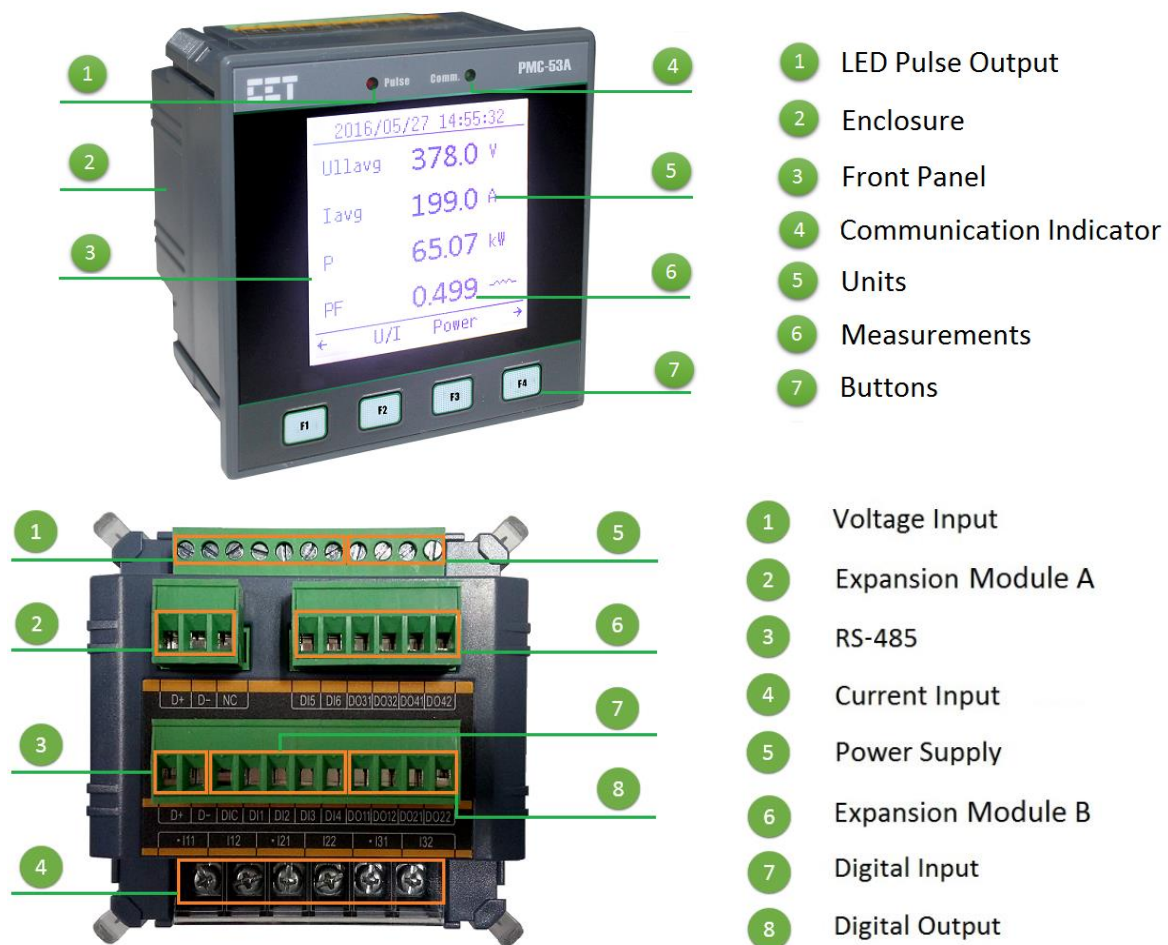


Figure 2-1 Appearance

2.2 Unit Dimensions

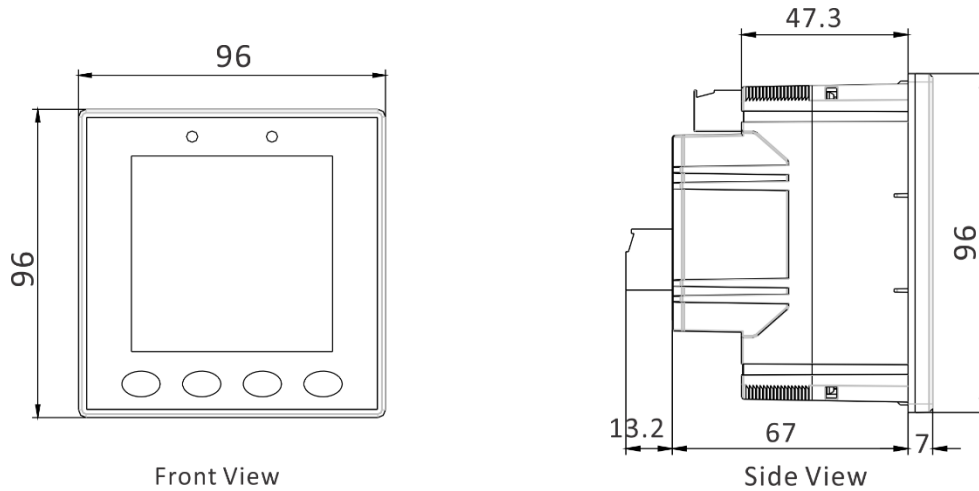


Figure 2-2 Unit Dimensions

2.3 Terminal Dimensions

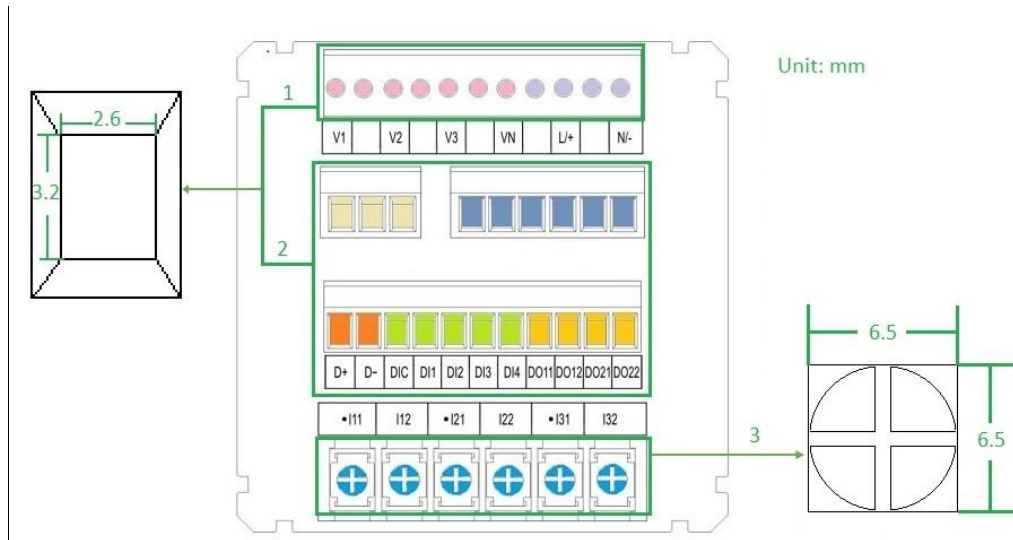


Figure 2-3 Terminal Dimensions

	Terminal	Terminal Dimensions	Wire Size	Max. Torque
1	Voltage Input Power Supply	2.6mm x 3.2mm	1.5mm ²	5 kgf.cm/M3 (5 lb-in)
2	Expansion Module A & B			
	RS-485			
	DI	6.5mm x 6.5mm	1.0mm ² - 2.5mm ² (14AWG - 22AWG)	6.0 kgf.cm/M3 (12 lb-in)
	DO			
3	Current Input			

Table 2-1 Terminal Dimensions

2.4 Mounting

The PMC-53A 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

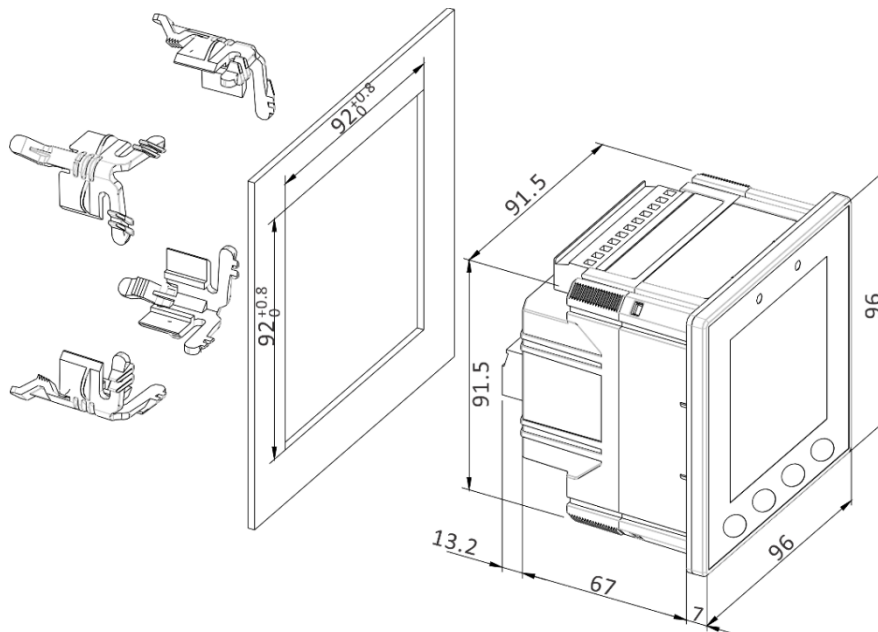


Figure 2-4 Panel Cutout Mounting

2.5 Wiring connections

PMC-53A 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, ULN (1P2W-ULN) Direct Connection with 1CT
- 1-Phase 2-Wire, ULL (1P2W-ULL) 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**.

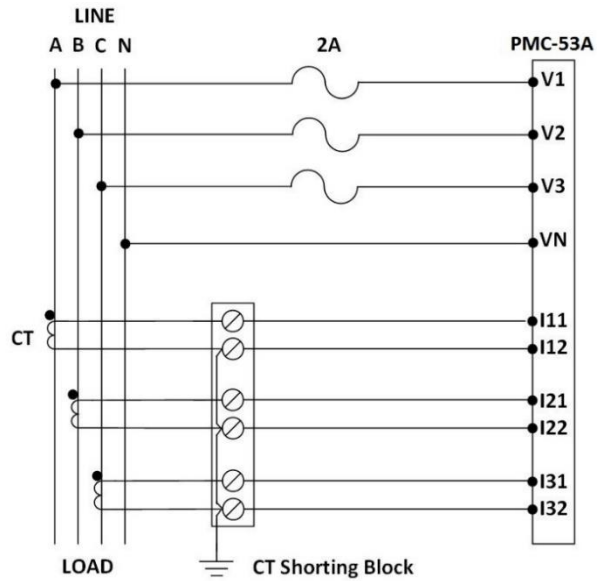


Figure 2-5 3P4W Direct Connection with 3CTs

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**.

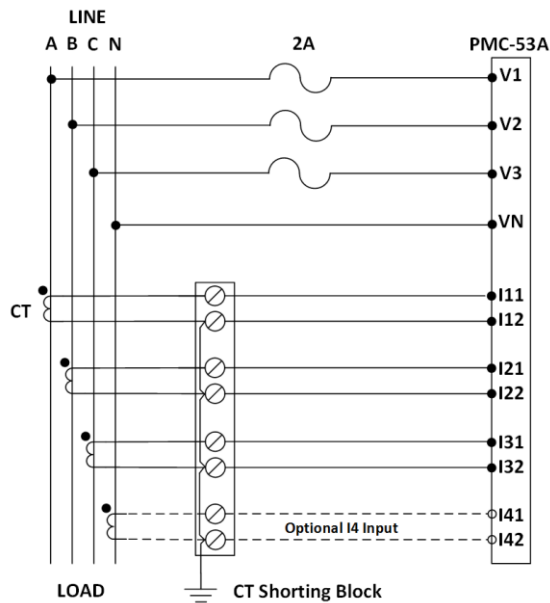


Figure 2-6 3P4W Direct Connection with 4CTs (Optional I41 & I42)

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**.

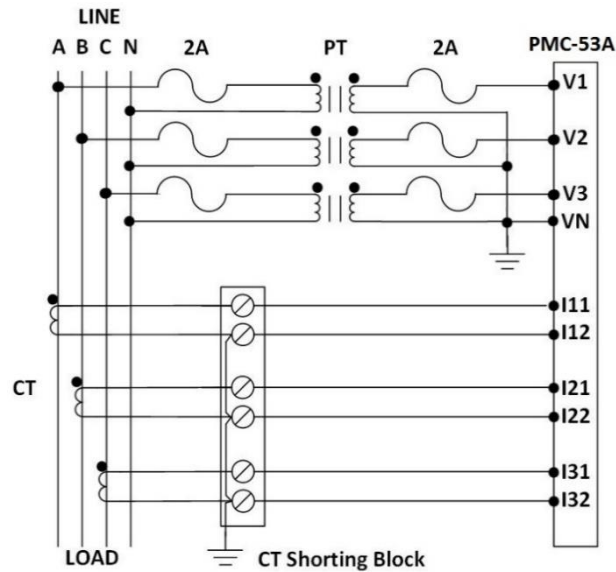


Figure 2-7 3P4W with 3PTs and 3CTs

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**.

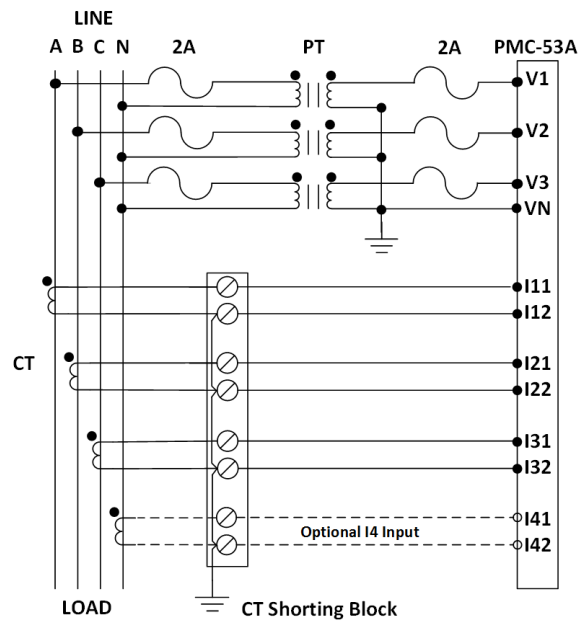


Figure 2-8 3P4W with 3PTs and 4CTs (Optional I41 & I42)

2.5.7 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**.

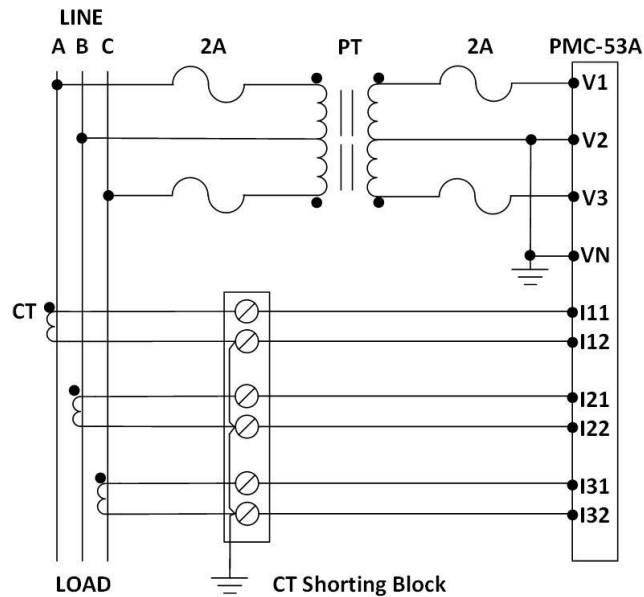


Figure 2-11 3P3W Delta with 2PTs and 3CTs

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**.

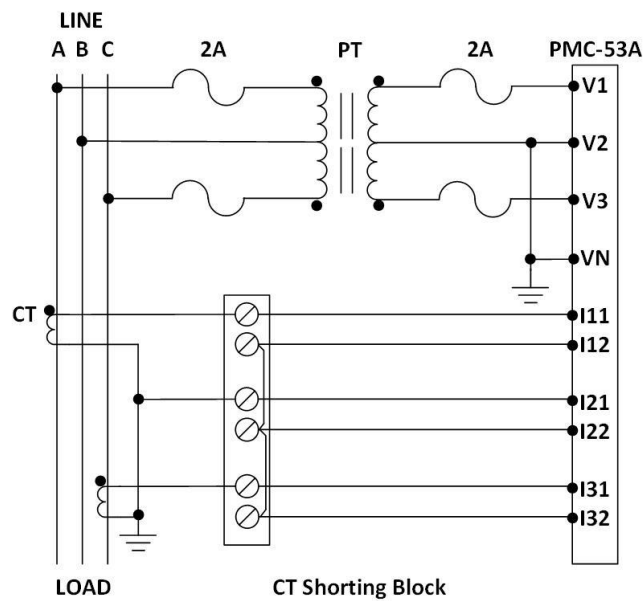


Figure 2-12 3P3W Delta with 2PTs and 2CTs

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**.

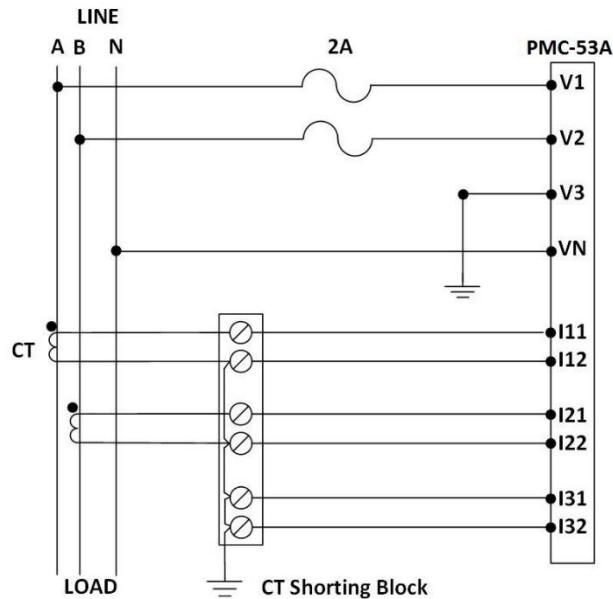


Figure 2-13 1P3W Direct Connection with 2CTs

2.5.10 1-Phase 2-Wire, ULN (1P2W-ULN) 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**.

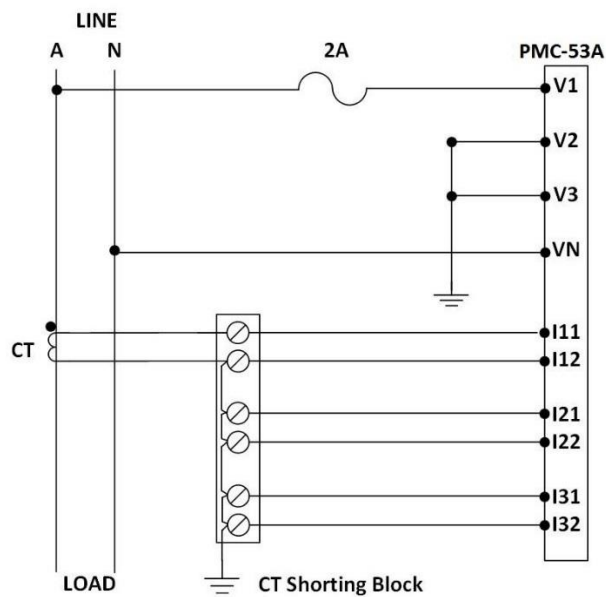


Figure 2-14 1P2W ULN Direct Connection with 1CT

2.5.11 1-Phase 2-Wire, ULL (1P2W-ULL) 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**.

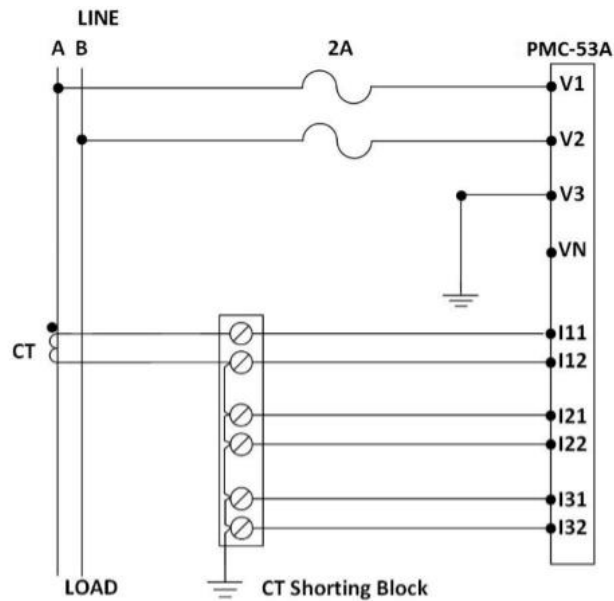


Figure 2-15 1P2W ULL Direct Connection with 1CT

2.6 Communications Wiring

The following figure illustrates the RS-485 communications connections on the PMC-53A:

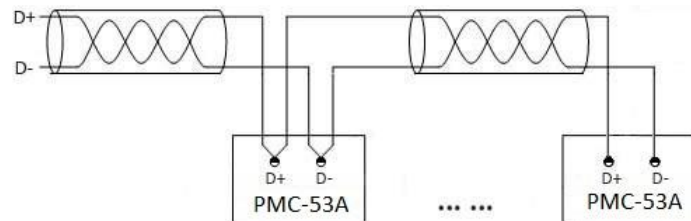


Figure 2-16 Communications Connections

The PMC-53A provides up to two RS-485 ports. Up to 32 devices can be connected on a RS-485 bus. The overall length of the RS-485 cable connecting all devices should not exceed 1200m.

If the master station does not have a RS-485 communications port, a RS-232/RS-485 or USB/RS-485 converter with optically isolated output and surge protection should be used.

2.7 Digital Input Wiring

The following figure illustrates the Digital Input connections on the PMC-53A:

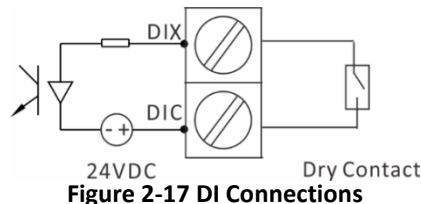


Figure 2-17 DI Connections

2.8 Digital Output Wiring

The following figure illustrates the Digital Output connections on the PMC-53A:

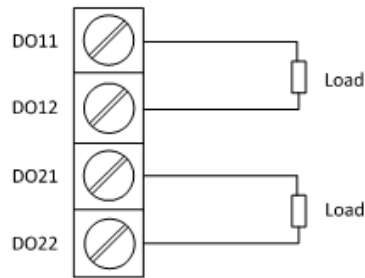


Figure 2-18 DO Connections

2.9 Solid State Relay Wiring

The following figure illustrates the Solid State Relay connections on the PMC-53A when the **DO Control Mode** setup register is programmed for **Energy Pulsing**:

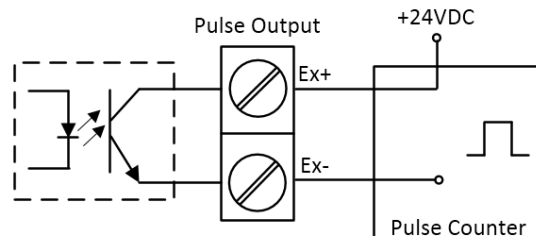


Figure 2-19 Solid State Relay Connections for Energy Pulsing

The following figure illustrates the Solid State Relay connections on the PMC-53A when the **DO Control Mode** setup register is programmed for **Remote Control/Alarm**:

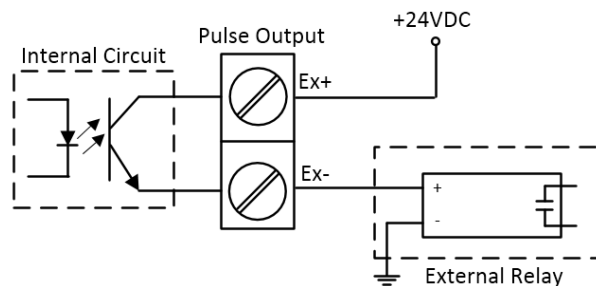


Figure 2-20 Solid State Relay Connections for Remote Control/Alarm

2.10 Analog Input Wiring

The following figure illustrates the Analog Input connections on the PMC-53A:

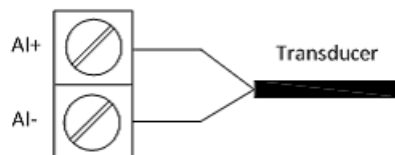


Figure 2-21 AI Connections

2.11 Analog Output Wiring

The following figure illustrates the Analog Output connections on the PMC-53A:



Figure 2-22 AO Connections

2.12 RTD Input Wiring

The following figure illustrates the RTD Input connections on the PMC-53A:

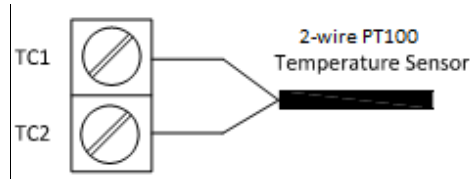


Figure 2-23 RTD Input Connections

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.

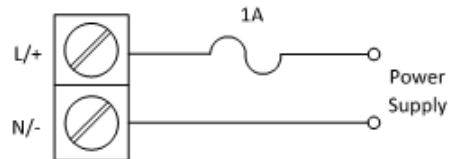


Figure 2-24 Power Supply Connections

Chapter 3 Front Panel

The PMC-53A 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.



Figure 3-1 Front Panel

3.1 Using the Front Panel Buttons

The PMC-53A'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

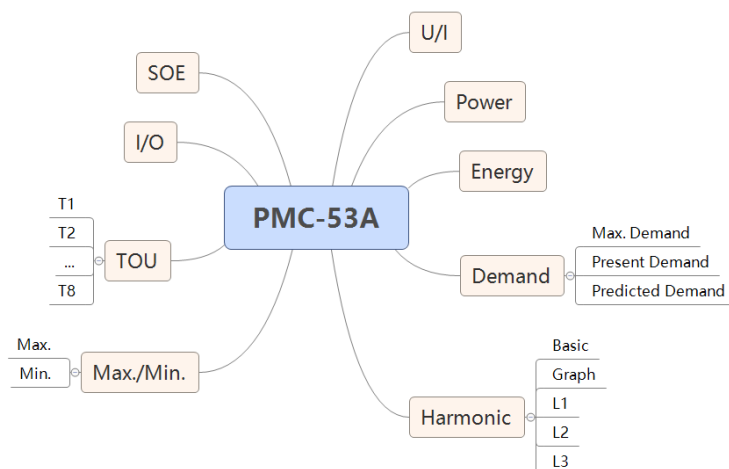


Figure 3-2 Data Display Menu

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 ULN, ULN 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	P	PF
	Display 1 (Voltage L-N)	U1	U2	U3	ULN avg
	Display 2 (Voltage L-L)	U12	U23	U31	ULL avg
	Display 3 (Currents)	I1	I2	I3	I avg
	Display 4 (Ung/In/I4/Ir)	Ung ^{~1}	In	I4 ²	Ir ^{#3}
	Display 5 (Frequency)	Frequency			
	Display 6 (Voltage Angle)	U1	U2	U3	
	Display 7 (Current Angle)	I1	I2	I3	
	Display 8 (Phasor Diagram)	Phasor Diagram			
	Display 9 (U1 Waveform) [#]	U1 Real-time 1-cycle Waveform			
	Display 10 (U2 Waveform) [#]	U2 Real-time 1-cycle Waveform			
	Display 11 (U3 Waveform) [#]	U3 Real-time 1-cycle Waveform			
	Display 12 (I1 Waveform) [#]	I1 Real-time 1-cycle Waveform			
	Display 13 (I2 Waveform) [#]	I2 Real-time 1-cycle Waveform			
	Display 14 (I3 Waveform) [#]	I3 Real-time 1-cycle Waveform			
	Display 15 (Operating Time)	Operating Time (Running Hours)			
	Display 16 (U Fundamental) [*]	U1 ⁴	U2 ⁴	U3 ⁴	
	Display 17 (I Fundamental) [*]	I1 ⁴	I2 ⁴	I3 ⁴	
	Display 18 (Load Factor %) [^]	I1	I2	I3	I avg

* Available in Firmware V1.00.03 or later, [#] available in Firmware V1.00.06 or later, [~]available in Firmware V1.00.11 or later, [^] available in Firmware V1.00.15 or later.

Table 3-2 U/I Display

Notes:

- 1) **Ung** only appears and displays a valid value when the **Wiring Mode** is set to **3P4W**.
- 2) **I4** only appears if the meter is equipped with the corresponding I4 option.
- 3) **Ir** only appears and displays a valid value when the **Wiring Mode** is set to **3P3W**, **3P4W** or **Demo**.
- 4) 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 (Total)	P	Q	S	PF
	Display 2 (P)	P1	P2	P3	P
	Display 3 (Q)	Q1	Q2	Q3	Q
	Display 4 (S)	S1	S2	S3	S
	Display 5 (PF)	PF1	PF2	PF3	PF
	Display 6 (dPF)	dPF1	dPF2	dPF3	
	Display 7 (P Fundamental) [*]	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 (Total)	kWh	kvarh	kVAh	
	Display 2 (kWh)	Imp.	Exp.	Net	Tot
	Display 3 (kvarh)	Imp.	Exp.	Net	Tot
	Display 4 (kVAh)	Tot			

Table 3-4 Energy Display

3.2.4 Demand

Press Button		Display Screens	1 st Row	2 nd Row	3 rd Row	4 th Row
<DMD> ¹	<Max> ²	Display 1	P	Q	S	
			Timestamp	Timestamp	Timestamp	
		Display 2	I1	I2	I3	I avg [~]

			Timestamp	Timestamp	Timestamp	Timestamp
		Display 3	ULL avg~ Timestamp			
	<Pres> ³	Display 1	P	Q	S	
		Display 2	I1	I2	I3	I avg~
		Display 3	ULL avg~			
	<Pred> ⁴	Display 1	P	Q	S	
		Display 2	I1	I2	I3	I avg~
		Display 3	ULL avg~			

~Available in Firmware V1.00.11 or later

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)]	HD03 ~ HD15		
		Display 2 [HD (ODD)]	HD17 ~ HD29		
		Display 3 [HD (ODD)]	HD31		
		Display 1 [HD (Even)]	HD02 ~ HD14		
		Display 2 [HD (Even)]	HD16 ~ HD28		
		Display 3 [HD (Even)]	HD30		
	<L2>	Display 1 [HD (ODD)]	HD03 ~ HD15		
		Display 2 [HD (ODD)]	HD17 ~ HD29		
		Display 3 [HD (ODD)]	HD31		
		Display 1 [HD (Even)]	HD02 ~ HD14		
		Display 2 [HD (Even)]	HD16 ~ HD28		
		Display 3 [HD (Even)]	HD30		
	<L3>	Display 1 [HD (ODD)]	HD03 ~ HD15		
		Display 2 [HD (ODD)]	HD17 ~ HD29		
		Display 3 [HD (ODD)]	HD31		
		Display 1 [HD (Even)]	HD02 ~ 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.>	<U/I>	Default (Max.)	U1	U2	U3	ULN avg
				Timestamp	Timestamp	Timestamp	Timestamp
			Display 1	U1	U2	U3	ULN avg
				Timestamp	Timestamp	Timestamp	Timestamp
			Display 2	U12	U23	U31	ULL avg
				Timestamp	Timestamp	Timestamp	Timestamp
			Display 3	I1	I2	I3	I avg
				Timestamp	Timestamp	Timestamp	Timestamp
			Display 4	In	I4	Ir*	Freq
				Timestamp	Timestamp	Timestamp	Timestamp
			Display 1	P1	P2	P3	P
				Timestamp	Timestamp	Timestamp	Timestamp
	<Power>	<Power>	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 (U THD)	L1	L2	L3	
				Timestamp	Timestamp	Timestamp	
			Display 2 (I THD)	L1	L2	L3	
				Timestamp	Timestamp	Timestamp	
			Display 3 (K-Factor)	L1	L2	L3	
				Timestamp	Timestamp	Timestamp	
			Display 4 (C-Factor)	L1	L2	L3	
				Timestamp	Timestamp	Timestamp	
			Display 6 (Unbalance)	Current	Voltage		
				Timestamp	Timestamp		
	<Min.>	<U/I>	Display 1	U1	U2	U3	ULN avg
				Timestamp	Timestamp	Timestamp	Timestamp
			Display 2	U12	U23	U31	ULL avg
				Timestamp	Timestamp	Timestamp	Timestamp
			Display 3	I1	I2	I3	I avg
				Timestamp	Timestamp	Timestamp	Timestamp
			Display 4	In	I4	Ir*	
				Timestamp	Timestamp	Timestamp	
			Display 5	Freq			
				Timestamp			
		<Power>	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 (U THD)	L1	L2	L3	
				Timestamp	Timestamp	Timestamp	
			Display 2 (I THD)	L1	L2	L3	
				Timestamp	Timestamp	Timestamp	
			Display 3 (K-Factor)	L1	L2	L3	
				Timestamp	Timestamp	Timestamp	
			Display 4 (C-Factor)	L1	L2	L3	
				Timestamp	Timestamp	Timestamp	
			Display 6 (Unbalance)	Current	Voltage		
				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)	Imp.	Exp.
		Display 2 (kvarh)	Imp.	Exp.
		Display 3 (kVAh)	Tot	
		Display 4 (Max. Demand)	P	Q
	<T2>	Display 1 (kWh)	Imp.	Exp.
		Display 2 (kvarh)	Imp.	Exp.
		Display 3 (kVAh)	Tot	
		Display 4 (Max. Demand)	P	Q
	<T7>	Display 1 (kWh)	Imp.	Exp.
		Display 2 (kvarh)	Imp.	Exp.
		Display 3 (kVAh)	Tot	
		Display 4 (Max. Demand)	P	Q
	<T8>	Display 1 (kWh)	Imp.	Exp.
		Display 2 (kvarh)	Imp.	Exp.
		Display 3 (kVAh)	Tot	
		Display 4 (Max. Demand)	P	Q

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	DI3, DI4	DI5 ¹ , DI6 ¹
	Display 2 (Pulse Counter)	DI1, DI2	DI3, DI4	DI5 ¹ , DI6 ¹
	Display 3 (DO Status)	DO1, DO2	DO3 ² , 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 PMC-53A with Firmware V1.00.03 or later supports the display of the SOE Log with up to 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 UII Setpoint Active 2016/10/28 13:34:08:890 Value: 378.8 V	03. Over UIn 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 3-3 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.

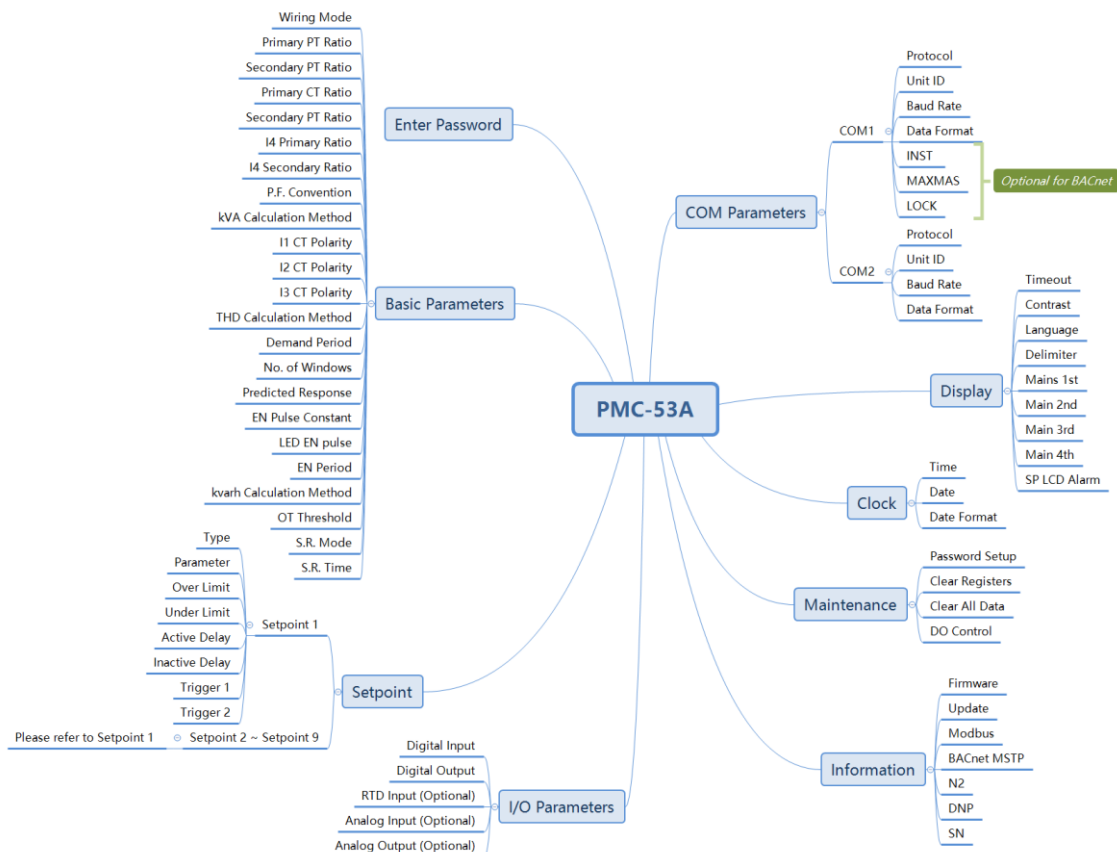
3) Changing and saving a setup parameter:

- 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



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	1 to 1000 (x0.001In)	1
	S.R. Mode		Self-Read Mode to both Max. Demand and Max./Min. Log	Auto/Manual	Manual
	S.R. Time		Self-Read Time to both Max. Demand and Max./Min. Log	Disabled if the S.R. Mode is Manual .	--D--H
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
	INST ¹		Object Identifier	0 to 4194302	26001
	MAXMAS ¹		Maximum number of Master	1 to 127	127
	LOCK ¹		Disable communication	Yes/No	Yes
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 ²		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 ³	Setpoint Trigger1	See Table 3-12	
Trigger2 ³	Setpoint Trigger2	See Table 3-12	
...			
Group #9			
Type	Setpoint Type	0=Disabled, 1=Over Setpoint 2=Under Setpoint	0
Parameter ²	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 ³	Setpoint Trigger1	See Table 3-12	
Trigger2 ³	Setpoint Trigger2	See Table 3-12	
I/O			
Digital Input			
Function	DI Function		
DI1	Function Mode for DI1 to DI6	Digital Input/ Pulse Counter/ Tariff Switch ⁵	Digital Input
...			
DI5 ⁴			
DI6 ⁴			
Debounce ⁴	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
...			
DI5 ⁴			
DI6 ⁴			
Pulse Weight ⁴	Specifies the incremental value for each pulse received		
DI1	Pulse Weight for DI1 to DI6	1 to 1000000	1
...			
DI5 ⁴			
DI6 ⁴			
Digital Output			
Pulse Width	Specifies the duration for which the relay output will be active when a remote control command is received to activate it.		
DO1 Pulse Width	Pulse Width for DO1 to DO4	0 to 600 (x0.1s) (0=Latch Mode)	10
DO2 Pulse Width			
DO3 Pulse Width ⁴			
DO4 Pulse Width ⁴			
Function	Specifies the function of the Digital Output.		
DO1 Function [#]	DO Control Mode	▪ Digital Output ▪ kWh Import ▪ kWh Export ▪ kWh Total ▪ kvarh Import ▪ kvarh Export ▪ kvarh Total	Digital Output
DO2 Function [#]			
DO3 Function ⁴			
DO4 Function ⁴			
RTD ⁴			
RTD1 Compensation	RTD Compensation ⁶	0 to 2000 (x0.01Ω)	0.00Ω
RTD2 Compensation			
Analog Input ⁴			
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 ⁴			
Type	Select between 0-20mA or 4-20mA output	4-20mA / 0-20mA	4-20mA
Key ⁷	The parameter to which the Analog Output is proportional	See Table 3-13	U12
Zero Scale	The parameter value that corresponds to the minimum Analog Output of 0 mA or 4	-999,999 to 999,999	0

	mA		
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 ⁸	Delimiter	Option1/Option2	Option1
Main 1st*	Default Display 1 st parameter	See Note 9)	ULL avg
Main 2nd*	Default Display 2 nd parameter		I avg
Main 3rd*	Default Display 3 rd parameter		P (kW Total)
Main 4th*	Default Display 4 th parameter		PF (PF Total)
SP LCD Alarm ^{~10}	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 ¹¹	Clear Present Energy Measurements and Energy Log	Yes/No	No
History ¹²	Clear Historical Monthly Energy Log	Yes/No	No
Demand			
Present Max	Clear Max. Demand Log of This Month (Since Last Reset)	Yes/No	No
All	Clear Present Demand, Max. 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
...			
DI5 ⁴			
DI6 ⁴			
SOE Logs*			
All	Clear All 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 ⁴			
DO4 ⁴			
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 MSTP Protocol 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	
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* Available in Firmware V1.00.03 or later

Available in Firmware V1.00.04 or later

~ Available in Firmware V1.00.06 or later

Table 3-10 Setup Parameters**Notes:**

- 1) **INST**, **MAXMAS** and **LOCK** parameters are only available when the COM1's Protocol is set to **BACnet**.
- 2) 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)		
4	In (Calculated)		A
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)~		

* Available only if the meter is equipped with the appropriate option

~ Available in Firmware V1.00.06 or later

Table 3-11 Setpoint Parameters

- 3) The table below illustrates the options for Setpoint Trigger.

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

Table 3-12 Setpoint Trigger

- 4) This menu only appears if the meter is equipped with the corresponding options.
- 5) **Tariff Switching** is available in Firmware V1.00.03 or later and only valid for DI1 to DI3.
- 6) Please refer to **Chapter 4.1.6** for a detailed description of RTD Compensation.
- 7) 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	U12	x1	V	10	S	x1	kVA
1	U23		V	11	PF	x1000	-
2	U31		V	12	Frequency	x100	-
3	ULL avg		V	13	P DMD	x1	kW
4	I1		A	14	Q DMD		kvar
5	I2		A	15	S DMD		kVA
6	I3		A	16	U1	x1	V

7	I avg	x1	A	17	U2		V
8	P		kW	18	U3		V
9	Q		kvar	19	ULN avg		V

Table 3-13 Analog Output Parameters

- 8) 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).
- 9) 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)	11	I avg	22	T3 kWh Imp.	33	U1 THD*
1	U2 (Ubn)	12	P (kW Total)	23	T4 kWh Imp.	34	U2 THD*
2	U3 (Ucn)	13	Q (kvar Total)	24	I1 (Ia) Demand	35	U3 THD*
3	ULN avg	14	S (kVA Total)	25	I2 (Ib) Demand	36	Ir*
4	U12 (Uab)	15	PF (PF Total)	26	I3 (Ic) Demand	37	I1 Load~
5	U23 (Ubc)	16	Frequency	27	kW Demand	38	I2 Load~
6	U31 (Uca)	17	kWh Import	28	kvar Demand*	39	I3 Load~
7	ULL avg	18	kWh Export	29	kVA Demand*	40	I avg Load~
8	I1 (Ia)	19	kWh Total	30	Fund. kW Total*		
9	I2 (Ib)	20	T1 kWh Imp.	31	dPF Total*		
10	I3 (Ic)	21	T2 kWh Imp.	32	I4*		

* Available in Firmware V1.00.06 or later, ~ available in Firmware V1.00.15 or later.

Table 3-14 Default Display Parameters

- 10) 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.
- 11) 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.
- 12) Select **History** to clear the Monthly Energy Log of the last 1 to 12 months, excluding the Monthly Energy Log for the Present Month.

Chapter 4 Applications

4.1 Inputs and Outputs

4.1.1 Digital Inputs

The PMC-53A 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 PMC-53A 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/Default*
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) 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

Table 4-1 DI Setup Parameters

4.1.2 Digital Outputs

The PMC-53A 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 PMC-53A 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 PMC Setup software or PecStar® iEMS Integrated Energy 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 PMC-53A, 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 PMC-53A 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 PMC-53A 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 PMC-53A. 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 PMC-53A 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 $(1250\text{A} - 500\text{A}) \times (20\text{mA} - 4\text{mA}) / (2000\text{A} - 500\text{A}) + 4\text{mA} = 12.00$ (mA).

4.1.6 RTD Input

The PMC-53A 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 PMC-53A if so equipped. The PMC-53A 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:

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

4.2 Power and Energy

4.2.1 Basic Measurements

The PMC-53A provides the following basic measurements which are available through the Front Panel or communications.

Parameter	Phase A	Phase B	Phase C	Total	Average
ULN	●	●	●	-	●
ULL	●	●	●	-	●
Neutral-to-Ground Voltage				Ung (Calculated) [#]	
Current	●	●	●	-	●
Neutral Current				In (Calculated)	I4 (Optional)
Residual Current				Ir [~]	
I Load Factor ^{1^}	●	●	●		●
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.

[#] Available in Firmware V1.00.11 or later and valid when the wiring mode is 3P4W. [^] Available in Firmware V1.00.15 or later.

Table 4-2 Basic Measurements

Notes:

1) The calculation method of I Load Factor is listed as below:

$$I \text{ Load Factor} = \frac{I}{CT \text{ Primary}}$$

Where *I* indicates *Ia*, *Ib*, *Ic* or *I avg* for *Ia* Load Factor, *Ib* Load Factor, *Ic* Load Factor and *I avg* Load Factor, respectively.

4.2.2 Energy Measurements

The PMC-53A 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. Moreover, the energy can be preset to user defined values via communications.

The PMC-53A 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
Per-Phase Energy (Phase A/B/C):	kvarh of Q1/Q2/Q3/Q4
	kVAh Total
	kVAh Total of TOU T1-8
	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
	kVAh
	kVAh of TOU T1-8

Table 4-3 Energy Measurement

4.2.3 Interval Energy Measurements

The PMC-53A 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 PMC-53A 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. The PMC-53A with firmware V1.00.11 or later also provides Present Demand and Predicted Demand for I Average (I avg) and ULL Average (ULL avg). Only Import Demand is provided for kW Total, kvar total and kVA Total. Predicted Demand is typically used for pre-alarming and to help users reduce power consumption using a Setpoint to warn that the Demand limit may be exceeded.

The PMC-53A 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 Max. Demand Self-Read operation. The Self-Read Time supports 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 * 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 PMC-53A provides the following PQ parameters:

4.3.2.1 Harmonics

The PMC-53A 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 PMC-53A 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 n^{th} 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.

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

where

I_h = h^{th} 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:

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

where

$|X|_{\text{peak}}$ = Peak amplitude of the waveform

X_{rms} = RMS value

The following table illustrates the available Voltage and Current Harmonics measurements on the PMC-53A.

	Phase A/AB	Phase B/BC	Phase C/CA
Harmonic-Voltage	THD	THD	THD
	TEHD	TEHD	TEHD
	TOHD	TOHD	TOHD
	2 nd Harmonics	2 nd Harmonics	2 nd Harmonics
	...	...	...
	31 st Harmonics	31 st Harmonics	31 st Harmonics
Harmonic-Current	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 PMC-53A 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 PMC-53A 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.

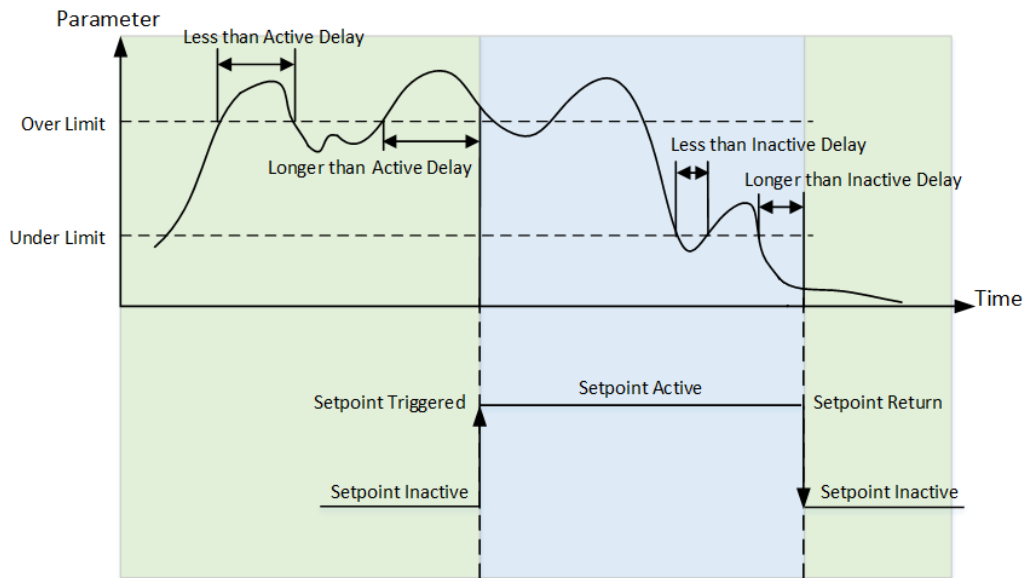


Figure 4-1 Over Setpoint

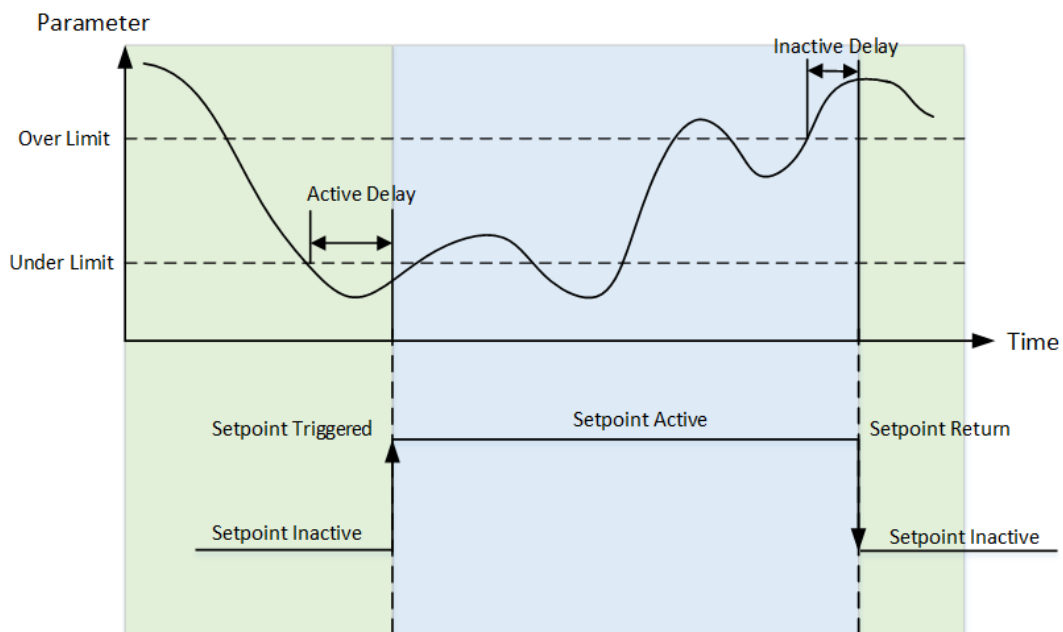


Figure 4-2 Under Setpoint

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

Setup Parameter	Definition	Options/Default*
Setpoint Type	Disable, Over or Under Setpoint.	0= Disabled 1= Over Setpoint* 2= 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.	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.	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** is enabled via the Front Panel or through communications (Register #6048).

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)		
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)	-	
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 PMC-53A's **Basic Function** option is "3" (4xDI+2xSS Pulse Output) or "A" (4xDI+2xDO Relay 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 PMC-53A records the **Max. Log** and **Min. Log** of **This Month (Since Last Reset)** and **Last Month (Before Last Reset)** with timestamp for the parameters listed in the Table 4-9. 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.

Max./Min. Parameters					
Ia	Ib	Ic	I avg	Uan	Ubn
Ucn	ULN avg	Uab	Ubc	Uca	ULL avg
kWa	kWb	kWc	kW Total	kvara	kvarb
kvarc	kvar Total	kVAa	kVAb	kVAc	kVA Total
PFa	PFb	PFc	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.	In (Calculated)		Ir*	

* Available in Firmware V1.00.06 or later

Table 4-9 Max./Min. Log

The same **Self-Read Time** for the Max. Demand Log 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 Max. Demand Log

The PMC-53A records the **Max. Demand** of **This Month (Since Last Reset)** and **Last Month (Before Last Reset)** with timestamp for the parameters listed in the Table 4-10. The Max. Demand of This Month (Since Last Reset) can be accessed from the Front Panel as well as communications while the Max. Demand of Last Month (Before Last Reset) only can be retrieved through communications. Please refer to **Section 4.2.4** for a complete description of the **Self-Read Time** and its operation.

Max. Demand Logs of This Month (Since Last Reset) and Last Month (Before Last Reset)
Ia
Ib
Ic
I avg (Available in Firmware V1.00.11 or later)
ULL avg (Available in Firmware V1.00.11 or later)
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 Max. Demand Log

4.5.3 Monthly Energy Log

The PMC-53A 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 PMC-53A 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
Apparent Energy	kVAh			
	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 PMC-53A 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 PMC-53A's Freeze Logs can freeze and record the following parameters:

Freeze Type	Parameters	Depth
Daily Freeze	kWh Total, kvarh Total, kVAh Total Max. Demands for kW Total, kvar Total and kVA Total	60
Monthly Freeze	kWh Total, kvarh Total, kVAh Total Max. 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 PMC-53A'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 PMC-53A 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 PMC-53A 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 PMC-53A 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 PMC-53A 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, Weekday3 and Alternate Days. The Alternate Day has the highest priority.	Weekday1, Weekday2, 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 PMC-53A provides the following information:

- Energy: kWh Import/Export, kvarh Import/Export, kVAh – Per Phase and Total
- Max. 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 PMC-53A provides wiring error detection for 3P4W and 3P3W wiring modes, which allow users to check for potential 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 error 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
- 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	Voltage Phase Loss (3P4W or 3P3W)
B03	Current Phase Loss (3P4W or 3P3W)
B04	RTD1 broken (RTD Input option only)
B05	RTD2 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 is 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

4.7.1 Voltage Phase Loss

The Voltage Phase Loss diagnostic is based on the following logic diagram (During Voltage Phase Loss, the Voltage Phase Reversal detection is invalid).

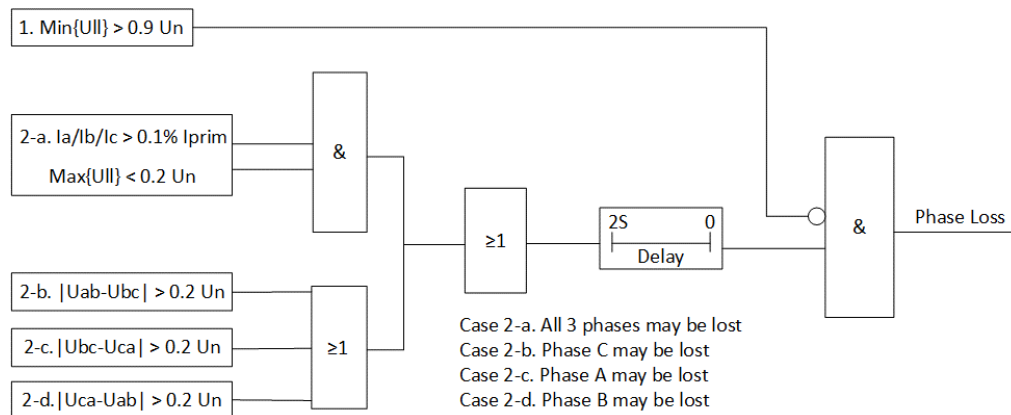


Figure 4-3 Voltage Phase Loss Logic

where U_n and I_{prim} represent the Voltage and Current nominal in Primary values. For the Voltage and Current Phase Loss detection to work correctly, the PT Primary and CT Primary should be configured to represent the respective nominal values.

4.7.2 Current Phase Loss

The following requirements should be met simultaneously for the **Current Phase Loss** status to be valid. During **Current Phase Loss**, the **Current Phase Reversal** detection is invalid.

- Any one or two phases Current = 0.
- At least one phase Current $\geq 0.1\% I_{\text{prim}}$

Chapter 5 Modbus Register Map

This chapter provides a complete description of the Modbus register map (**Protocol Version 1.7**) for the PMC-53A to facilitate the development of 3rd party communications driver for accessing information on the PMC-53A. For a complete Modbus Protocol Specification, please visit <http://www.modbus.org>. The PMC-53A 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 PMC-53A 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 avg	Float		
0008	RO	Uab	Float		
0010	RO	Ubc	Float		
0012	RO	Uca	Float		A
0014	RO	ULL avg	Float		
0016	RO	Ia	Float		
0018	RO	Ib	Float		
0020	RO	Ic	Float		W
0022	RO	I avg	Float		
0024	RO	kWa	Float		
0026	RO	kWb	Float		var
0028	RO	kWc	Float		
0030	RO	kW Total	Float		
0032	RO	kvara	Float		VA
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		Hz
0058	RO	Uan/Uab (3P3W) Angle	Float		°
0060	RO	Ubn/Ubc (3P3W) Angle	Float		°
0062	RO	Ucn/Uca (3P3W) Angle	Float		°
0064	RO	Ia Angle	Float		°
0066	RO	Ib Angle	Float		°
0068	RO	Ic Angle	Float		°
0070	RO	In (Calculated)	Float		A
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 Scaled ¹	Float		-
0084	RO	Reserved	Float		-
0086	RO	RTD1 ¹	Float		° C
0088	RO	RTD2 ¹	Float		

0090	RO	AO ¹	Float		-
0092	RO	Reserved	Float		-
0094	RO	Reserved	Float		-
0096	RO	DI Status ^{1,2}	UINT16		-
0097	RO	Reserved	UINT16		-
0098	RO	DO Status ^{1,3}	UINT16		-
0099	RO	Reserved	UINT16		-
0100	RO	Setpoint Status ⁴	UINT16		-
0101	RO	Wiring Diagnostic Status ⁵	UINT16		-
0102	RO	SOE Log Pointer ⁷	UINT32		-
0104	RO	Device Operating Time ⁶	UINT32	x0.1	0.1Hour
0106-0111	RO	Reserved	UINT32		-
0112	RO	Phase A Fundamental kW	Float	x1	W
0114	RO	Phase B Fundamental kW	Float		
0116	RO	Phase C Fundamental kW	Float		
0118	RO	Fundamental kW Total	Float		
0120	RO	Total Harmonic kW	Float		
0122	RO	DR #1 Log Pointer ^{1,7}	UINT32	-	-
0124	RO	DR #2 Log Pointer ^{1,7}	UINT32	-	-
0126	RO	DR #3 Log Pointer ^{1,7}	UINT32	-	-
0128	RO	DR #4 Log Pointer ^{1,7}	UINT32	-	-
0130	RO	DR #5 Log Pointer ^{1,7}	UINT32	-	-
0132	RO	Daily Freeze Log Pointer ⁸	UINT32	-	-
0134	RO	Monthly Freeze Log Pointer ⁸	UINT32	-	-
0136-0148	RO	Reserved	UINT32		
0150	RO	Uan/Uab Fundamental*	Float	x1	V
0152	RO	Ubn/Ubc Fundamental* ⁹	Float		
0154	RO	Ucn/Uca Fundamental* ⁹	Float		
0156	RO	Ia Fundamental*	Float	x1	A
0158	RO	Ib Fundamental* ⁹	Float		
0160	RO	Ic Fundamental* ⁹	Float		
0162	RO	U1 (Positive Sequence Voltage)* ¹⁰	Float	x1	V
0164	RO	U2 (Negative Sequence Voltage)* ¹⁰	Float		
0166	RO	U0 (Zero Sequence Voltage)* ¹⁰	Float		
0168	RO	I1 (Positive Sequence Current)* ¹⁰	Float	x1	A
0170	RO	I2 (Negative Sequence Current)* ¹⁰	Float		
0172	RO	I0 (Zero Sequence Current)* ¹⁰	Float		
0174	RO	I _r (Residual Current) [#]	Float		
0176	RO	U _{ng} (Calculated) ¹¹	Float	x1	V
0178	RO	Ia Load Factor [^]	Float	-	1 means 100%
0180	RO	Ib Load Factor [^]	Float	-	
0182	RO	Ic Load Factor [^]	Float	-	
0184	RO	I avg Load Factor [^]	Float	-	

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

~ Available in Firmware V1.00.11 or later, ^ available in Firmware V1.00.15 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 options.
- 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 **Setpoint Status** 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
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	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	Voltage Phase Loss (3P4W or 3P3W)
B03	Current Phase Loss (3P4W or 3P3W)
B04	RTD1 broken (RTD Input option only)
B05	RTD2 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 is 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 5-3 Wiring Diagnostic Status Register

- 6) 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.
- 7) The PMC-53A has one SOE Log and five Data Recorders. Each of these logs 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. If a Clear Log is performed through the Front Panel or via communications, its Log Pointer will be reset to zero, and the SOE Log Pointer will be immediately incremented by one with a new "Clear SOE" event. When the number of events is larger than the respective Log Depth, the latest 100 SOE logs or up to 10,000 DR Logs are stored on a FIFO basis.
- 8) The range of the Log Pointer for Daily Freeze Log and Monthly Freeze Log is between 0 and 0xFFFFFFFF.
- 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.
- 11) The **Ung (Calculated)** is available only when the **Wiring Mode** is **3P4W**, otherwise, it has no meaning and its register is 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	kvarh Export of T1	INT32		
0534	RW	kVAh of T1	INT32		kVAh
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	kvarh Export of T2	INT32		kvarh

0544	RW	kVAh of T2	INT32		kVAh
0546	RW	kWh Import of T3	INT32		kWh
0548	RW	kWh Export of T3	INT32		
0550	RW	kvarh Import of T3	INT32		kvarh
0552	RW	kvarh Export of T3	INT32		
0554	RW	kVAh of T3	INT32		kVAh
0556	RW	kWh Import of T4	INT32		kWh
0558	RW	kWh Export of T4	INT32		
0560	RW	kvarh Import of T4	INT32		kvarh
0562	RW	kvarh Export of T4	INT32		
0564	RW	kVAh of T4	INT32		kVAh
0566	RW	kWh Import of T5	INT32		kWh
0568	RW	kWh Export of T5	INT32		
0570	RW	kvarh Import of T5	INT32		kvarh
0572	RW	kvarh Export of T5	INT32		
0574	RW	kVAh of T5	INT32		kVAh
0576	RW	kWh Import of T6	INT32		kWh
0578	RW	kWh Export of T6	INT32		
0580	RW	kvarh Import of T6	INT32		kvarh
0582	RW	kvarh Export of T6	INT32		
0584	RW	kVAh of T6	INT32		kVAh
0586	RW	kWh Import of T7	INT32		kWh
0588	RW	kWh Export of T7	INT32		
0590	RW	kvarh Import of T7	INT32		kvarh
0592	RW	kvarh Export of T7	INT32		
0594	RW	kVAh of T7	INT32		kVAh
0596	RW	kWh Import of T8	INT32		kWh
0598	RW	kWh Export of T8	INT32		
0600	RW	kvarh Import of T8	INT32		kvarh
0602	RW	kvarh Export of T8	INT32		
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		
0650	RW	kvarh Import of T1	INT32		kWh
0652	RW	kvarh Export of T1	INT32		
0654	RW	kVAh of T1	INT32		kVAh
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		
0664	RW	kVAh of T2	INT32		kVAh
0666	RW	kWh Import of T3	INT32		kWh
0668	RW	kWh Export of T3	INT32		
0670	RW	kvarh Import of T3	INT32		kvarh
0672	RW	kvarh Export of T3	INT32		
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		
0684	RW	kVAh of T4	INT32		kVAh
0686	RW	kWh Import of T5	INT32		kWh
0688	RW	kWh Export of T5	INT32		
0690	RW	kvarh Import of T5	INT32		kvarh
0692	RW	kvarh Export of T5	INT32		
0694	RW	kVAh of T5	INT32		kVAh
0696	RW	kWh Import of T6	INT32		kWh
0698	RW	kWh Export of T6	INT32		
0700	RW	kvarh Import of T6	INT32		kvarh
0702	RW	kvarh Export of T6	INT32		
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	kvarh Export of T7	INT32		
0714	RW	kVAh of T7	INT32		kVAh
0716	RW	kWh Import of T8	INT32		kWh
0718	RW	kWh Export of T8	INT32		
0720	RW	kvarh Import of T8	INT32		kvarh
0722	RW	kvarh Export of T8	INT32		
0724	RW	kVAh of T8	INT32		kVAh

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		
0770	RW	kvarh Import of T1	INT32		kvarh
0772	RW	kvarh Export of T1	INT32		
0774	RW	kVAh of T1	INT32		kVAh
0776	RW	kWh Import of T2	INT32		kWh
0778	RW	kWh Export of T2	INT32		
0780	RW	kvarh Import of T2	INT32		kvarh
0782	RW	kvarh Export of T2	INT32		
0784	RW	kVAh of T2	INT32		kVAh
0786	RW	kWh Import of T3	INT32		kWh
0788	RW	kWh Export of T3	INT32		
0790	RW	kvarh Import of T3	INT32		kvarh
0792	RW	kvarh Export of T3	INT32		
0794	RW	kVAh of T3	INT32		kVAh
0796	RW	kWh Import of T4	INT32		kWh
0798	RW	kWh Export of T4	INT32		
0800	RW	kvarh Import of T4	INT32		kvarh
0802	RW	kvarh Export of T4	INT32		
0804	RW	kVAh of T4	INT32		kVAh
0806	RW	kWh Import of T5	INT32		kWh
0808	RW	kWh Export of T5	INT32		
0810	RW	kvarh Import of T5	INT32		kvarh
0812	RW	kvarh Export of T5	INT32		
0814	RW	kVAh of T5	INT32		kVAh
0816	RW	kWh Import of T6	INT32		kWh
0818	RW	kWh Export of T6	INT32		

0820	RW	kvarh Import of T6	INT32		kvarh
0822	RW	kvarh Export of T6	INT32		
0824	RW	kVAh of T6	INT32		kVAh
0826	RW	kWh Import of T7	INT32		kWh
0828	RW	kWh Export of T7	INT32		
0830	RW	kvarh Import of T7	INT32		kvarh
0832	RW	kvarh Export of T7	INT32		
0834	RW	kVAh of T7	INT32		kVAh
0836	RW	kWh Import of T8	INT32		kWh
0838	RW	kWh Export of T8	INT32		
0840	RW	kvarh Import of T8	INT32		kvarh
0842	RW	kvarh Export of T8	INT32		
0844	RW	kVAh of T8	INT32		kVAh

Table 5-6 Phase B Energy 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		
0890	RW	kvarh Import of T1	INT32		kvarh
0892	RW	kvarh Export of T1	INT32		
0894	RW	kVAh of T1	INT32		kVAh
0896	RW	kWh Import of T2	INT32		kWh
0898	RW	kWh Export of T2	INT32		
0900	RW	kvarh Import of T2	INT32		kvar
0902	RW	kvarh Export of T2	INT32		
0904	RW	kVAh of T2	INT32		kVAh
0906	RW	kWh Import of T3	INT32		kWh
0908	RW	kWh Export of T3	INT32		
0910	RW	kvarh Import of T3	INT32		kvarh
0912	RW	kvarh Export of T3	INT32		
0914	RW	kVAh of T3	INT32		kVAh
0916	RW	kWh Import of T4	INT32		kWh
0918	RW	kWh Export of T4	INT32		
0920	RW	kvarh Import of T4	INT32		kvarh
0922	RW	kvarh Export of T4	INT32		
0924	RW	kVAh of T4	INT32		kVAh
0926	RW	kWh Import of T5	INT32		kWh
0928	RW	kWh Export of T5	INT32		
0930	RW	kvarh Import of T5	INT32		kvarh
0932	RW	kvarh Export of T5	INT32		
0934	RW	kVAh of T5	INT32		kVAh
0936	RW	kWh Import of T6	INT32		kWh
0938	RW	kWh Export of T6	INT32		
0940	RW	kvarh Import of T6	INT32		kvarh
0942	RW	kvarh Export of T6	INT32		
0944	RW	kVAh of T6	INT32		kVAh
0946	RW	kWh Import of T7	INT32		kWh
0948	RW	kWh Export of T7	INT32		
0950	RW	kvarh Import of T7	INT32		kvarh
0952	RW	kvarh Export of T7	INT32		
0954	RW	kVAh of T7	INT32		kVAh
0956	RW	kWh Import of T8	INT32		kWh

0958	RW	kWh Export of T8	INT32		
0960	RW	kvarh Import of T8	INT32		
0962	RW	kvarh Export of T8	INT32		kvarh
0964	RW	kVAh of T8	INT32		kVAh

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	RO	kWh Import	INT32	x0.1	kWh
1102	RO	kWh Export	INT32		
1104	RO	kvarh Import	INT32		kvarh
1106	RO	kvarh Export	INT32		
1108	RO	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	Ia TDD	Float	x1	% (0.1 means 10%)
1302	RO	Ib TDD	Float		
1304	RO	Ic TDD	Float		
1306	RO	Ia TDD Odd	Float		
1308	RO	Ib TDD Odd	Float		
1310	RO	Ic TDD Odd	Float		
1312	RO	Ia TDD Even	Float		
1314	RO	Ib TDD Even	Float		
1316	RO	Ic TDD Even	Float		
1318	RO	Ia K-Factor	Float		-
1320	RO	Ib K-Factor	Float		
1322	RO	Ic K-Factor	Float		
1324	RO	Ia Crest-Factor	Float		
1326	RO	Ib Crest-Factor	Float		
1328	RO	Ic Crest-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	Ia THD	Float	x1	% (0.1 means 10%)
1402	RO	Ib THD	Float		
1404	RO	Ic THD	Float		
1406	RO	Ia TOHD	Float		
1408	RO	Ib TOHD	Float		
1410	RO	Ic TOHD	Float		
1412	RO	Ia TEHD	Float		
1414	RO	Ib TEHD	Float		
1416	RO	Ic TEHD	Float		
1418	RO	Ia HD02	Float		
1420	RO	Ib HD02	Float		
1422	RO	Ic 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
3012	RO	I avg~	Float	x1	A
3014~3027	RO	Reserved	Float		
3028	RO	ULL avg~	Float	x1	V

~Available in Firmware V1.00.11 or later

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
3212	RO	I avg~	Float	x1	A
3214~3227	RO	Reserved	Float		
3228	RO	ULL avg~	Float	x1	V

~Available in Firmware V1.00.11 or later

Table 5-14 Predicted Demand Measurements

5.5.3 Max. Demand Log of This Month (Since Last Reset)

Register	Property	Description	Format	Scale	Unit
3400~3405	RO	Ia	See Section 5.5.5 Demand Data Structure	x1	A
3406~3411	RO	Ib			
3412~3417	RO	Ic			
3418~3423	RO	kW Total			W
3424~3429	RO	kvar Total			var
3430~3435	RO	kVA Total			VA
3436~3441	RO	kW Total of T1			W
3442~3447	RO	kvar Total of T1			var
3448~3453	RO	kVA Total of T1			VA
3454~3459	RO	kW Total of T2			W
3460~3465	RO	kvar Total of T2			var
3466~3471	RO	kVA Total of T2			VA
3472~3477	RO	kW Total of T3			W
3478~3483	RO	kvar Total of T3			var
3484~3489	RO	kVA Total of T3			VA
3490~3495	RO	kW Total of T4			W
3496~3501	RO	kvar Total of T4			var
3502~3507	RO	kVA Total of T4			VA
3508~3513	RO	kW Total of T5			W
3514~3519	RO	kvar Total of T5			var
3520~3525	RO	kVA Total of T5			VA
3526~3531	RO	kW Total of T6			W
3532~3537	RO	kvar Total of T6			var
3538~3543	RO	kVA Total of T6			VA
3544~3549	RO	kW Total of T7			W
3550~3555	RO	kvar Total of T7			var
3556~3561	RO	kVA Total of T7			VA
3562~3567	RO	kW Total of T8			W
3568~3573	RO	kvar Total of T8			var
3574~3579	RO	kVA Total of T8			VA
...	RO	Reserved			
3900~3905	RO	I avg~		x1	A
3906~3947	RO	Reserved			
3948~3953	RO	ULL avg~		x1	V

~Available in Firmware V1.00.11 or later

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

5.5.4 Max. Demand Log of Last Month (Before Last Reset)

Register	Property	Description	Format	Scale	Unit
3600~3605	RO	Ia	See Section 5.5.5 Demand Data Structure	x1	A
3606~3611	RO	Ib			
3612~3617	RO	Ic			
3618~3623	RO	kW Total			W
3624~3629	RO	kvar Total			var
3630~3635	RO	kVA Total			VA
3636~3641	RO	kW Total of T1			W
3642~3647	RO	kvar Total of T1			var
3648~3653	RO	kVA Total of T1			VA
3654~3659	RO	kW Total of T2			W
3660~3665	RO	kvar Total of T2			var
3666~3671	RO	kVA Total of T2			VA
3672~3677	RO	kW Total of T3			W
3678~3683	RO	kvar Total of T3			var
3684~3689	RO	kVA Total of T3			VA
3690~3695	RO	kW Total of T4			W
3696~3701	RO	kvar Total of T4			var
3702~3707	RO	kVA Total of T4			VA
3708~3713	RO	kW Total of T5			W
3714~3719	RO	kvar Total of T5			var
3720~3725	RO	kVA Total of T5			VA
3726~3731	RO	kW Total of T6			W
3732~3737	RO	kvar Total of T6			var
3738~3743	RO	kVA Total of T6			VA

3744~3749	RO	kW Total of T7			W
3750~3755	RO	kvar Total of T7			var
3756~3761	RO	kVA Total of T7			VA
3762~3767	RO	kW Total of T8			W
3768~3773	RO	kvar Total of T8			var
3774~3779	RO	kVA Total of T8			VA
3780~3785	RO	I avg~		x1	A
3786~3827	RO	Reserved			
3828~3833	RO	ULL avg~		x1	V

~Available in Firmware V1.00.11 or later

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

Demand Data Structure

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

Table 5-17 Demand Data Structure

5.6 Max./Min. Log

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

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 avg			
4024~4029	RO	Uab			
4030~4035	RO	Ubc			
4036~4041	RO	Uca		x1	A
4042~4047	RO	ULL avg			
4048~4053	RO	Ia			
4054~4059	RO	Ib		x1	W
4060~4065	RO	Ic			
4066~4071	RO	I avg			
4072~4077	RO	kWa		x1	var
4078~4083	RO	kWb			
4084~4089	RO	kWc			
4090~4095	RO	kW Total		x1	VA
4096~4101	RO	kvara			
4102~4107	RO	kvarb			
4108~4113	RO	kvarc		x1	-
4114~4119	RO	kvar Total			
4120~4125	RO	kVAa			
4126~4131	RO	kVAb		x1	Hz
4132~4137	RO	kVAc			
4138~4143	RO	kVA Total			
4144~4149	RO	PFa		x1	A
4150~4155	RO	PFb			
4156~4161	RO	PFc			
4162~4167	RO	PF Total		x1	-
4168~4173	RO	Frequency			
4174~4179	RO	In (Calculated)			
4180~4185	RO	Uan/Uab THD		x1	-
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	Ia Crest-Factor			
4240~4245	RO	Ib Crest-Factor			
4246~4251	RO	Ic Crest-Factor			
4252~4257	RO	Voltage Unbalance			
4258~4263	RO	Current Unbalance			
4264~4269	RO	I4			
4270~4275	RO	Ir* (Residual Current)		x1	A

* 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 avg			
4324~4329	RO	Uab			
4330~4335	RO	Ubc			
4336~4341	RO	Uca			
4342~4347	RO	ULL avg			
4348~4353	RO	Ia		x1	A
4354~4359	RO	Ib			
4360~4365	RO	Ic			
4366~4371	RO	I avg			
4372~4377	RO	kWa		x1	W
4378~4383	RO	kWb			
4384~4389	RO	kWc			
4390~4395	RO	kW Total			
4396~4401	RO	kvara		x1	var
4402~4407	RO	kvarb			
4408~4413	RO	kvarc			
4414~4419	RO	kvar Total			
4420~4425	RO	kVAa		x1	VA
4426~4431	RO	kVAb			
4432~4437	RO	kVAc			
4438~4443	RO	kVA Total			
4444~4449	RO	PFa		x1	-
4450~4455	RO	PFb			
4456~4461	RO	PFc			
4462~4467	RO	PF Total			
4468~4473	RO	Frequency		x1	Hz
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			
4558~4563	RO	Current Unbalance			
4564~4569	RO	I4			
4570~4575	RO	Ir* (Residual Current)		x1	A

* 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 Last Month (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 avg			
4624~4629	RO	Uab			
4630~4635	RO	Ubc			
4636~4641	RO	Uca		x1	A
4642~4647	RO	ULL avg			
4648~4653	RO	Ia			
4654~4659	RO	Ib		x1	W
4660~4665	RO	Ic			
4666~4671	RO	I avg			
4672~4677	RO	kWa		x1	var
4678~4683	RO	kWb			
4684~4689	RO	kWc			
4690~4695	RO	kW Total		x1	VA
4696~4701	RO	kvara			
4702~4707	RO	kvarb			
4708~4713	RO	kvarc		x1	-
4714~4719	RO	kvar Total			
4720~4725	RO	kVAa			
4726~4731	RO	kVAb		x1	Hz
4732~4737	RO	kVAc			
4738~4743	RO	kVA Total			
4744~4749	RO	PFa		x1	-
4750~4755	RO	PFb			
4756~4761	RO	PFc			
4762~4767	RO	PF Total		x1	-
4768~4773	RO	Frequency			
4774~4779	RO	In (Calculated)			
4780~4785	RO	Uan/Uab THD		x1	-
4786~4791	RO	Ubn/Ubc THD			
4792~4797	RO	Ucn/Uca THD			
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		x1	A
4858~4863	RO	Current Unbalance			
4864~4869	RO	I4			
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 Last Month (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 avg			
4924~4929	RO	Uab			
4930~4935	RO	Ubc			
4936~4941	RO	Uca		x1	A
4942~4947	RO	ULL avg			
4948~4953	RO	Ia			
4954~4959	RO	Ib			
4960~4965	RO	Ic			
4966~4971	RO	I avg			

4972~4977	RO	kWa		x1	W
4978~4983	RO	kWb			
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	Ia Crest-Factor			
5140~5145	RO	Ib Crest-Factor			
5146~5151	RO	Ic Crest-Factor			
5152~5157	RO	Voltage Unbalance		x1	A
5158~5163	RO	Current Unbalance			
5164~5169	RO	I4			
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 (0-37) 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) Low-order Byte: Second (0-59)	INT16		
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	x0.1	kWh
1022	RW	kWh Export of T2	INT32		
1024	RW	kvarh Import of T2	INT32	x0.1	kvarh
1026	RW	kvarh Export of T2	INT32		
1028	RW	kVAh of T2	INT32	x0.1	kVAh
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	x0.1	kWh
1042	RW	kWh Export of T4	INT32		
1044	RW	kvarh Import of T4	INT32	x0.1	kvarh
1046	RW	kvarh Export of T4	INT32		
1048	RW	kVAh of T4	INT32	x0.1	kVAh
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	kvarh Export of T5	INT32		
1058	RW	kVAh of T5	INT32	x0.1	kVAh
1060	RW	kWh Import of T6	INT32	x0.1	kWh
1062	RW	kWh Export of T6	INT32		
1064	RW	kvarh Import of T6	INT32	x0.1	kvarh
1066	RW	kvarh Export of T6	INT32		
1068	RW	kVAh of T6	INT32	x0.1	kVAh
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	kvarh Export of T7	INT32		
1078	RW	kVAh of T7	INT32	x0.1	kVAh
1080	RW	kWh Import of T8	INT32	x0.1	kWh
1082	RW	kWh Export of T8	INT32		
1084	RW	kvarh Import of T8	INT32	x0.1	kvarh
1086	RW	kvarh Export of T8	INT32		
1088	RW	kVAh of T8	INT32	x0.1	kVAh

Table 5-23 Monthly Energy Log

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 PMC-53A 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 (0-37) 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	Max. Demand of kW Total	Float	x1	W
12012	RO	Max. Demand of kvar Total	Float	x1	var
12014	RO	Max. 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 (0-37) 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	Max. Demand of kW Total	See Table 5-26 Demand Data Structure		
12516~12521	RO	Max. Demand of kvar Total			
12522~12527	RO	Max. 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	-	Max. 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 current logging position within the SOE Log where the next event will be stored. The following formula is used to determine the starting register address of the SOE log referenced by a particular SOE Log Pointer value: Register Address = 10000 + Modulo[(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	0-37 (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	-
+6 to +7	RO	Event Value	-

Table 5-28 SOE Log Data Structure

SOE Classification

Event Classification	Sub-Classification	Status	Event Value	Description
1=DI Changes	1	1 / 0		DI1 Active/DI1 Inactive
	2	1 / 0		DI2 Active/DI2 Inactive
	3	1 / 0		DI3 Active/DI3 Inactive
	4	1 / 0		DI4 Active/DI4 Inactive
	5	1 / 0		DI5 Active/DI5 Inactive
	6	1 / 0		DI6 Active/DI6 Inactive
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 by Pulse Width
	32	0		DO2 Released by Pulse Width
	33	0		DO3 Released by Pulse Width

	34	0		DO4 Released by Pulse Width
3=Setpoint	1	1 / 0	Trigger Value / Return Value	Over ULN Setpoint Active/Return
	2	1 / 0		Over ULL Setpoint Active/Return
	3	1 / 0		Over I Setpoint Active/Return
	4	1 / 0		Over In Setpoint Active/Return
	5	1 / 0		Over Frequency Setpoint Active/Return
	6	1 / 0		Over P Total Setpoint Active/Return
	7	1 / 0		Over Q Total Setpoint Active/Return
	8	1 / 0		Over S Total Setpoint Active/Return
	9	1 / 0		Over PF Total Setpoint Active/Return
	10	1 / 0		Over P Total DMD Setpoint Active/Return
	11	1 / 0		Over Q Total DMD Setpoint Active/Return
	12	1 / 0		Over S Total DMD Setpoint Active/Return
	13	1 / 0		Over P Total Pred. DMD Setpoint Active/Return
	14	1 / 0		Over Q Total Pred. DMD Setpoint Active/Return
	15	1 / 0		Over S Total Pred. DMD 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 Unbal. Setpoint Active/Return
	23	1 / 0		Over Current Unbal. Setpoint Active/Return
	24	1 / 0		Phase Reversal 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 RTD1 Setpoint Active/Return
	29	1 / 0		Over RTD2 Setpoint Active/Return
	30	1 / 0		RTD1 Wiring Alarm Active
	31	1 / 0		RTD2 Wiring Alarm Active
	32	1 / 0		Over Ir Setpoint* Active/Return
	33	1 / 0		Over U2 Sequence Setpoint* Active/Return
	34	1 / 0		Over U0 Sequence Setpoint* Active/Return
	35~40			Reserved
	41	1 / 0		Under ULN Setpoint Active/Return
	42	1 / 0		Under ULL Setpoint Active/Return
	43	1 / 0		Under I Setpoint Active/Return
	44	1 / 0		Under In Setpoint Active/Return
	45	1 / 0		Under Frequency Setpoint Active/Return
	46	1 / 0		Under P Total Setpoint Active/Return
	47	1 / 0		Under Q Total Setpoint Active/Return
	48	1 / 0		Under S Total Setpoint Active/Return
	49	1 / 0		Under PF Total Setpoint Active/Return
	50	1 / 0		Under P Total DMD Setpoint Active/Return
	51	1 / 0		Under Q Total DMD Setpoint Active/Return
	52	1 / 0		Under S Total DMD Setpoint Active/Return
	53	1 / 0		Under P Total Pred. DMD Setpoint Active/Return
	54	1 / 0		Under Q Total Pred. DMD Setpoint Active/Return
	55	1 / 0		Under S Total Pred. DMD 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 Unbal. Setpoint Active/Return
	63	1 / 0		Under Current Unbal. 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 RTD1 Setpoint Active/Return
	68	1 / 0		Under RTD2 Setpoint Active/Return
	69	1 / 0		Under Ir Setpoint* Active/Return
	70	1 / 0		Under U2 Sequence Setpoint* Active/Return
	71	1 / 0		Under U0 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 Panel ¹
	4	0	0	Clear His. Monthly Energy Log via Panel ²
	5	0	0	Clear Present Max. DMD via Panel
	6	0	0	Clear All Demand via Panel
	7	0	0	Clear Present Max./Min. via Panel
	8	0	0	Clear All Max./Min. via Panel
	9	0	0	Clear All Data via Panel ³
	10	0	0	Clear SOE Logs via Panel
	11	0	x=1 to 6	Clear Dlx Pulse Counter via Panel
	12	0	0	Clear All Pulse Counter via Panel
	13	0	0	Clear Operating Time via Panel
	14	0	0	Set Clock via Panel
	15	0	0	Setup Changed via Panel
	16~17	0	...	Reserved
	18	0	0	Restore Factory Default via Panel
	19~29	0	...	Reserved
	30	0	0	Clear All Energy Registers via Comm. ⁴
	31	0	0	Clear Pres. Monthly Energy Log via Comm. ⁵
	32	0	0	Clear His. Monthly Energy Log via Comm. ⁶
	33	0	0	Clear Present Max. DMD via Comm.
	34	0	0	Clear All Demand via Comm.
	35	0	0	Clear Present Max./Min. Logs via Comm.
	36	0	0	Clear All Max./Min. Logs via Comm.
	37	0	0	Clear All Data via Comm. ³
	38	0	0	Clear SOE Logs via Comm.
	39	0	x=1 to 6	Clear Dlx Pulse Counter via Comm.
	40	0	0	Clear All Pulse Counters via Comm.
	41	0	0	Clear Operating Time via Comm.
	42	0	0	Restore Factory Default via Comm.
	43	0	0	Setup Changes via Comm.
	44	0	0	Preset Energy Values via Comm.
	45	0	0	Preset TOU Energy Values via Comm.
	46	0	1~4	Switch TOU Schedule ⁷
	47	0	1~5	Clear DRx Log via Comm.
	48	0	0	Clear All DR logs via Comm.
	49	0	0	Clear Daily Freeze Logs via Comm.
	50	0	0	Clear Monthly Freeze Logs via Comm.

* Available in Firmware V1.00.06 or later

Table 5-29 SOE Event Classification

- 1) **Clear Present Energy** 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 His. 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 Panel** or **Comm.** means to clear 3-Phase Total Energy registers, Phase A/B/C Energy registers, Monthly Energy Log of the Present Month, All Max. 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 Pres. Monthly Energy Log** means to clear the Monthly Energy Log of the Present Month.
- 6) **Clear His. 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 #1 Log Buffer	See Table 5-32 Standard DR Log Structure
20038~20075	RO	DR #2 Log Buffer	
20076~20113	RO	DR #3 Log Buffer	
20114~20151	RO	DR #4 Log Buffer	
20152~20189	RO	DR #5 Log Buffer	

Table 5-31 DR Log

Offset	Property	Description	Format
+0	RW	DR Recorder Index	UINT32
+2	RO	High-order Byte: Year (0-37) 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:

- Writing a value n to the Data Recorder Index will load the n th Log into the buffer from memory, and the valid range of the DR Index is:
 - Between **1** and **DR Log Pointer** when DR Log Pointer $\leq$ DR Log Depth (see **Section 5.11.5** for DR Log Depth)
 - Between **DR Log Pointer - (DR Log Depth - 1)** and **DR Log Pointer** when the DR Log Pointer $>$ DR Log Depth
- Writing a pointer value that points to a Log Record that is either already expired or has not been generated yet to the Data Recorder Index 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 L-L-N, 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	
6028	RW	THD Calculation ²	UINT16	0=THDf*, 1=THDr
6029	RW	Demand Period	UINT16	1 to 60 (minutes), 15*
6030	RW	Number of Sliding Windows	UINT16	1 to 15, 1*
6031	RW	Predicted Response	UINT16	70 to 99, 70*
6032	RW	Arm before Execute	UINT16	0=Disabled*, 1=Enabled
6033	RW	Self-Read Time ³	UINT16	0xFFFF*
6034	RW	Monthly Energy Log Self-Read Time ⁵	UINT16	0*

6035	RW	Energy Pulse Constant	UINT16	0=1000 imp/kxh* 1=3200 imp/kxh
6036	RW	LED Energy Pulse	UINT16	0=Disabled, 1=kWh*, 2=kvarh
6037	RW	Backlight Time-out	UINT16	0 to 60 (mins), 5*
6038	RW	System Language	UINT16	1=English* 2=Traditional Chinese
6039	RW	Date Format	UINT16	0=YYMMDD*, 1=MMDDYY 2=DDMMYY
6040	RW	Delimiter ⁴	UINT16	0=Option 1*, 1=Option 2
6041	RW	Monthly Freeze Self-Read Time ⁵	UINT16	0*
6042	RW	Daily Freeze Self-Read Time ⁶	UINT16	0*
6043	RW	Default Display 1 st parameter ⁷	UINT16	0 to 36, 7* (ULL avg)
6044	RW	Default Display 2 nd parameter ⁷	UINT16	0 to 36, 11* (I avg)
6045	RW	Default Display 3 rd parameter ⁷	UINT16	0 to 36, 12* (P)
6046	RW	Default Display 4 th parameter ⁷	UINT16	0 to 36, 15* (PF)
6047	RW	EN Period ⁸	UINT16	5 to 60* min
6048	RW	Setpoint LCD Flash Alarm~	UINT16	0=Enabled*, 1=Disabled
6049	RW	Current Threshold of Device Operating Time~	UINT16	1* to 1000 (x0.001In)
6050	RW	kvarh Calculation~	UINT16	0=RMS*, 1=kvarh Fund.
6051	RW	DNP Polling Object~ ⁹	UINT16	0 to 65535, 0x3F*
6052	RW	Time Zone ¹⁰	UINT16	0-32, 26*

~ 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 Max. Demand 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	Parameters	Key	Parameters	Key	Parameters	Key	Parameters
0	U1 (Uan)	11	I avg	22	T3 kWh Imp.	33	U1 THD*
1	U2 (Ubn)	12	P (kW Total)	23	T4 kWh Imp.	34	U2 THD*
2	U3 (Ucn)	13	Q (kvar Total)	24	I1 (Ia) Demand	35	U3 THD*
3	ULLN avg	14	S (kVA Total)	25	I2 (Ib) Demand	36	Ir*
4	U12 (Uab)	15	PF (PF Total)	26	I3 (Ic) Demand	37	Ia Load Factor~
5	U23 (Ubc)	16	Frequency	27	kW Demand	38	Ib Load Factor~
6	U31 (Uca)	17	kWh Import	28	kvar Demand*	39	Ic Load Factor~
7	ULL avg	18	kWh Export	29	kVA Demand*	40	I avg Load Factor~
8	I1 (Ia)	19	kWh Total	30	Fund. kW Total*		
9	I2 (Ib)	20	T1 kWh Imp.	31	dPF Total*		
10	I3 (Ic)	21	T2 kWh Imp.	32	I4*		

*Available in Firmware V1.00.06 or later. ~ Available in Firmware V1.00.15 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, Default*
0	Object 1: Binary Inputs	0=Disabled 1=Enabled*
1	Object 10: Binary Outputs	
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	

Table 5-35 DNP Polling Objects

- 10) The following table lists the Codes for different Time Zones.

Code	Time Zone	Offset (min)	Code	Time Zone	Offset (min)
0	GMT-12:00	-720	17	GMT+3:30	210
1	GMT-11:00	-660	18	GMT+4:00	240
2	GMT-10:00	-600	19	GMT+4:30	270
3	GMT-9:00	-540	20	GMT+5:00	300
4	GMT-8:00	-480	21	GMT+5:30	330
5	GMT-7:00	-420	22	GMT+5:45	345
6	GMT-6:00	-360	23	GMT+6:00	360
7	GMT-5:00	-300	24	GMT+6:30	390
8	GMT-4:00	-240	25	GMT+7:00	420
9	GMT-3:30	-210	26	GMT+8:00	480
10	GMT-3:00	-180	27	GMT+9:00	540
11	GMT-2:00	-120	28	GMT+9:30	570
12	GMT-1:00	-60	29	GMT+10:00	600
13	GMT-0:00	0	30	GMT+11:00	660
14	GMT+1:00	60	31	GMT+12:00	720
15	GMT+2:00	120	32	GMT+13:00	780
16	GMT+3:00	180			

Table 5-78 Time Zones

5.11.2 I/O Setup

Register	Property	Description	Format	Range, Default*
6200	RW	DI1 Function	UINT16	0 = Digital Input* 1=Pulse Counting 2 =Tariff Switch~
6201	RW	DI2 Function	UINT16	
6202	RW	DI3 Function	UINT16	
6203	RW	DI4 Function	UINT16	
6204	RW	DI5 Function ¹	UINT16	
6205	RW	DI6 Function ¹	UINT16	1 to 9999 ms, 20*
6206~6207		Reserved		
6208	RW	DI1 Debounce	UINT16	
6209	RW	DI2 Debounce	UINT16	
6210	RW	DI3 Debounce	UINT16	
6211	RW	DI4 Debounce	UINT16	
6212	RW	DI5 Debounce ¹	UINT16	1* to 1000000
6213	RW	DI6 Debounce ¹	UINT16	
6214~6215		Reserved		
6216	RW	DI1 Pulse Weight	UINT32	
6218	RW	DI2 Pulse Weight	UINT32	

6220	RW	DI3 Pulse Weight	UINT32	0 = Remote Control/Setpoint* 1 = kWh Import 2 = kWh Export 3 = kWh Total 4 = kvarh Import 5 = kvarh Export 6 = kvarh Total
6222	RW	DI4 Pulse Weight	UINT32	
6224	RW	DI5 Pulse Weight ¹	UINT32	
6226	RW	DI6 Pulse Weight ¹	UINT32	
6228		Reserved	UINT32	
6230	RW	DO1 Mode ^{#2}	UINT16	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}	UINT16	
6232	RW	DO3 Mode ³	UINT16	
6233	RW	DO4 Mode ³	UINT16	
6234	RW	Reserved	UINT16	
6235	RW	Reserved	UINT16	-
6236	RW	DO1 Pulse Width	UINT16	0 to 6000 (x0.1s), 10* (0 = Latch Mode)
6237	RW	DO2 Pulse Width	UINT16	
6238	RW	DO3 Pulse Width	UINT16	
6239	RW	DO4 Pulse Width	UINT16	
6240~6247		Reserved	UINT16	
6248	RW	RTD1 Compensation ¹	UINT16	0 to 2000 (x0.01Ω), 0*
6249	RW	RTD2 Compensation ¹	UINT16	0 to 2000 (x0.01Ω), 0*
6250	RW	AI Type ¹	UINT16	0 = 4~20mA*, 1 = 0~20mA
6251	RW	AI Zero Scale ¹	INT32	-999,999 to +999,999 (Default = 400)
6253	RW	AI Full Scale ¹	INT32	-999,999 to +999,999 (Default = 2000)
6255~6259	RW	Reserved	UINT16	-
6260	RW	AO Type ¹	UINT16	0 = 4~20mA*, 1 = 0~20mA
6261	RW	AO Key ^{1,4}	UINT16	0* to 19
6262	RW	AO Zero Scale ¹	INT32	-999,999 to +999,999 (Default = 0)
6264	RW	AO Full Scale ¹	INT32	-999,999 to +999,999 (Default = 0)

~ The **Tariff Switch** option is supported in Firmware V1.00.03 or later

Available in Firmware V1.00.04 or later

Table 5-35 I/O Setup Parameters

Notes:

- 1) This register is valid only if the device is equipped with the appropriate option.
- 2) This is available only when the **Basic Function** option is "3" (4xDI and 2xSS Pulse Output) or "A" (4xDI+2xDO Relay 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	x1000	-
2	Uca		V	12	Frequency	x100	-
3	ULL avg		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 avg	x1	A	17	Ubn		V
8	kW Total		kW	18	Ucn		V
9	kvar Total		kvar	19	ULN avg		V

Table 5-36 Analog Output Parameters

5.11.3 Communication Setup Parameters

Register	Property	Description	Format	Range, Default*
6400	RW	Port 1 Protocol	UINT16	0=Modbus RTU* 1=BACnet/MSTP ¹ 2=N2 ¹ , 3=DNP ²
6401	RW	Port 1 Unit ID	UINT16	Modbus RTU/N2: 1 to 247 BACnet/MSTP: 1 to 127 DNP: 0 to 65519 Default=100

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

Table 5-37 Communication Setup

Notes:

- 1) 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.
- 2) Available in Firmware V1.00.06 or later. Please refer to Appendix E for the detailed information of DNP.
- 3) 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 PMC-53A provides the following 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)		
4	In (Calculated)		A
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 (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~	x1	V
32	U0~		

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

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 PMC-53A 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 PMC-53A's **Basic Function** option is "3" (4xDI+2xSS Pulse Output) or "A" (4xDI+2xDO Relay 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	

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 Appendices A and B for a complete list of the Data Recorder Parameters and the default configuration for each DR, respectively.
+8	RW	Parameter #2 ¹	UINT16	
+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 PMC-53A 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	
22	RW	Season #6: Weekday#2 Daily Profile	UINT16	0* to 19
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	
26	RW	Season #7: Weekday#2 Daily Profile	UINT16	0* to 19
27	RW	Season #7: Weekday#3 Daily Profile	UINT16	
28	RW	Season #8: Start Date	UINT16	See Season #2: Start Date
29	RW	Season #8: Weekday#1 Daily Profile	UINT16	
30	RW	Season #8: Weekday#2 Daily Profile	UINT16	0* to 19
31	RW	Season #8: Weekday#3 Daily Profile	UINT16	
32	RW	Season #9: Start Date	UINT16	See Season #2: Start Date
33	RW	Season #9: Weekday#1 Daily Profile	UINT16	
34	RW	Season #9: Weekday#2 Daily Profile	UINT16	0* to 19
35	RW	Season #9: Weekday#3 Daily Profile	UINT16	
36	RW	Season #10: Start Date	UINT16	See Season #2: Start Date
37	RW	Season #10: Weekday#1 Daily Profile	UINT16	
38	RW	Season #10: Weekday#2 Daily Profile	UINT16	0* to 19
39	RW	Season #10: Weekday#3 Daily Profile	UINT16	
40	RW	Season #11: Start Date	UINT16	See Season #2: Start Date
41	RW	Season #11: Weekday#1 Daily Profile	UINT16	
42	RW	Season #11: Weekday#2 Daily Profile	UINT16	0* to 19
43	RW	Season #11: Weekday#3 Daily Profile	UINT16	
44	RW	Season #12: Start Date	UINT16	See Season #2: Start Date
45	RW	Season #12: Weekday#1 Daily Profile	UINT16	
46	RW	Season #12: Weekday#2 Daily Profile	UINT16	0* to 19
47	RW	Season #12: Weekday#3 Daily Profile	UINT16	

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 PMC-53A 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
				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 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 PMC-53A 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 Alternate 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:

Byte 3	Byte 2	Byte 1	Byte 0
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 PMC-53A – Year / Month / Day / Hour / Minute / Second (Registers # 60000 to 60002) and UNIX Time (Register # 60004). When sending time to the PMC-53A 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	RW	UINT16	0-37 (Year-2000)
				1 to 12
60001	9001	RW	UINT16	1 to 31
				0 to 23
60002	9002	RW	UINT16	0 to 59
				0 to 59
60003	9003	RW	UINT16	0 to 999
60004 ~ 60005	9004 ~ 9005	RW	UINT32	0x386D4380 to 0x 7FE8177F The corresponding time is 2000.01.01 00:00:00 to 2037.12.31 23:59:59 (GMT 0:00 Time Zone)

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 PMC-53A 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 PMC-53A 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 Max. 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	Clear Monthly Freeze Log		
9617	WO	Clear Daily Freeze Log		
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	Clear All 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 Max. Demand of This Month** register to clear Max. Demand Log of This Month (Since Last Reset) when the **Self-Read Time** register is set for automatic Self-Read operation. The Max. 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 Max. Demand of This Month (Since Last Reset) will be transferred to the Max. 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, Max. 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, 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 PMC-53A that was manufactured on January 3 rd , 2017
60227~60228	9827	RO	Reserved	UINT16	
60229	9829	RO	Feature Code	UINT16	Bits 0 to 2 (Expansion A): 000=None 001=RS-485 010=I4 011=SPI
					Bits 3 to 5 (Expansion B): 000=None 001=1xAI + 1xAO 010=2xDI + 2xDO 011=2xRTD 100=2xDI + 2xSS Pulse Output 101=Reserved
					Bit 6 (Flash: 4MB Memory): 0=Disabled 1=Enabled
					Bits 7 to 8: (Base Unit): 00=4xDI + 2xDO 01=None 10=4xDI + 2xSS Pulse Output
					Bits 15 to 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 "PMC-53A" 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 "PMC-53A"

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 avg	18	kvarb	32	Ucn/Uca Angle
5	Uab	19	kvarc	33	Ia Angle
6	Ubc	20	kvar Total	34	Ib Angle
7	Uca	21	kVAa	35	Ic Angle
8	ULL avg	22	kVAb	36	In (Calculated)
9	Ia	23	kVAc	37	I4
10	Ib	24	kVA Total	38	RTD1
11	Ic	25	PFa	39	RTD2
12	I avg	26	PFb	40	AI Scaled
13	kWa	27	PFc	332	Ir* (Residual Current)
Power Quality					
41	Phase A Fundamental kW	59	Ib Crest-Factor	160	Ubn/Ubc HD31
42	Phase B Fundamental kW	60	Ic Crest-Factor	161	Ucn/Uca HD31
43	Phase C Fundamental kW	61	Voltage Unbalance	162	Ia THD
44	Fundamental kW Total	62	Current Unbalance	163	Ib THD
45	Total Harmonic kW	63	Uan/Uab THD	164	Ic THD
46	Ia TDD	64	Ubn/Ubc THD	165	Ia TOHD
47	Ib TDD	65	Ucn/Uca THD	166	Ib TOHD
48	Ic TDD	66	Uan/Uab TOHD	167	Ic TOHD
49	Ia TDD Odd	67	Ubn/Ubc TOHD	168	Ia TEHD
50	Ib TDD Odd	68	Ucn/Uca TOHD	169	Ib TEHD
51	Ic TDD Odd	69	Uan/Uab TEHD	170	Ic TEHD
52	Ia TDD Even	70	Ubn/Ubc TEHD	171	Ia HD02
53	Ib TDD Even	71	Ucn/Uca TEHD	172	Ib HD02
54	Ic TDD Even	72	Uan/Uab HD02	173	Ic HD02
55	Ia K-Factor	73	Ubn/Ubc HD02	...	...
56	Ib K-Factor	74	Ucn/Uca HD02	258	Ia HD31
57	Ic K-Factor	...	...	259	Ib HD31
58	Ia Crest-Factor	159	Uan/Uab HD31	260	Ic HD31
Energy Measurements					
261	DI1 Pulse Counter	281	kWh Export of T1	301	kWh Export of T5
262	DI2 Pulse Counter	282	kvarh Import of T1	302	kvarh Import of T5
263	DI3 Pulse Counter	283	kvarh Export of T1	303	kvarh Export of T5
264	DI4 Pulse Counter	284	kVAh of T1	304	kVAh of T5
265	DI5 Pulse Counter	285	kWh Import of T2	305	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	kvarh Export of T2	308	kvarh Export 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	kvarh Export of T3	313	kvarh Export 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	kvarh Export of T4	318	kvarh Export 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 Max. Demand Log of This Month (Since Last Reset)		
321	Ib Present Demand	327	Ib Max. Demand Log of This Month (Since Last Reset)		
322	Ic Present Demand	328	Ic Max. Demand Log of This Month (Since Last Reset)		
323	kW Total Present Demand	329	kW Max. Demand Log of This Month (Since Last Reset)		
324	kvar Total Present Demand	330	kvar Max. Demand Log of This Month (Since Last Reset)		
325	kVA Total Present Demand	331	kVA Max. 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	ULL avg	ULN 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	In (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	kVAb	Ic K-Factor	T3 kvarh Exp.
Parameter 13	Ia Demand	PF Total	kVAc	Ia C-Factor	T4 kWh Imp.
Parameter 14	Ib Demand	Freq	PFa	Ib C-Factor	T4 kWh Exp.
Parameter 15	Ic Demand	U Unbalance	PFb	Ic C-Factor	T4 kvarh Imp.
Parameter 16	None	I Unbalance	PFc	None	T4 kvarh Exp.

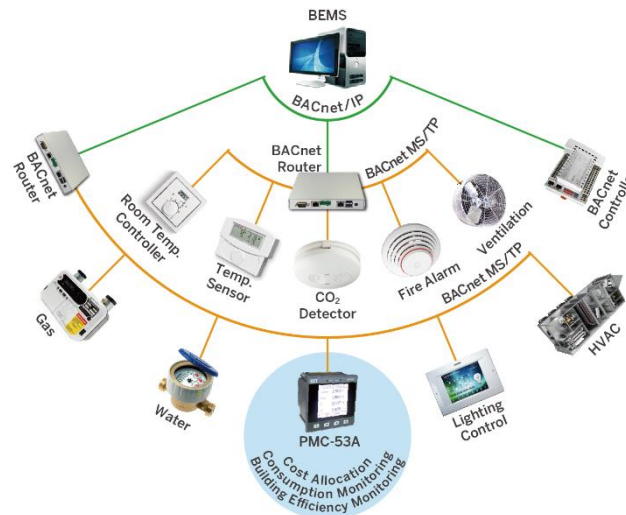
Appendix C BACnet MSTP Implementation

1) Basic Information

The PMC-53A with the Firmware V1.00.03 or later supports the BACnet MS/TP protocol which allows the device to be directly and conveniently integrated into any Building Energy Management Systems (BEMS) without requiring external protocol conversion. The addition of digital power/energy meters such as the PMC-53A facilitates:

- Real-time energy consumption monitoring
- Locating potential energy wastage
- Effective energy usage optimization
- Demand reduction
- Cost allocation

BACnet is designed to promote interoperability among various hardware devices and software applications for Building Automation Control and Management, which includes Heating, Ventilating and Air Conditioning (HVAC), Lighting, Security Access and Fire Detection systems as well as their associated equipment. The BACnet protocol defines a standard for information exchange among building automation devices and applications regardless of manufacturers or the particular building service that they perform.



The PMC-53A supports five types of BACnet objects, which can be easily integrated into any BACnet compatible BEMS such as JCI Metasys, Reliable Controls, Contemporary Controls, Delta Controls, Optergy...etc. The monitoring, control and management of electrical loads can be performed in a similar fashion that BACnet objects are used to represent custom operation sequences for mechanical equipment. The PMC-53A provides four types of BACnet objects.

- Device Object – Device Properties
- Analog Input Object – Real-Time Parameters
- Analog Value Object – Setup Parameters
- Binary Input Object – Digital Inputs
- Binary Output Object – Digital Outputs

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	CET
Model Name	PMC-53A
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 PMC-53A:

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	CET	
R/W	Vendor_Identifier	593	
R	Model_Name	PMC-53A	
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:

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

3) Analog Input Objects (PMC-53A'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 PMC-53A. 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, Max. 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	In	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	Ir	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	
AI 3006	kW Total Demand	R	kW	
AI 3008	kvar Total Demand	R	kvar	
AI 3010	kVA Total Demand	R	kVA	
AI 3000	Ia Demand	R	A	
AI 3002	Ib Demand	R		
AI 3004	Ic Demand	R		
AI 3418	kW Total Max. Demand	R	kW	
AI 3424	kvar Total Max. Demand	R	kvar	
AI 3430	kVA Total Max. Demand	R	kVA	
AI 3400	Ia Max. Demand	R	A	
AI 3406	Ib Max. Demand	R		
AI 3412	Ic Max. Demand	R		
AI 1600	Uan THD ²	R	%	

AI 1602	Ubn THD ²	R		
AI 1604	Ucn THD ²	R		
AI 1400	Ia THD	R		
AI 1402	Ib THD	R		
AI 1404	Ic THD	R		
AI 1318	Ia K-Factor	R		
AI 1320	Ib K-Factor	R		
AI 1322	Ic K-Factor	R		
AI 1300	Ia TDD	R		
AI 1302	Ib TDD	R		
AI 1304	Ic TDD	R		
AI 1324	Ia Crest-Factor	R		
AI 1326	Ib Crest-Factor	R		
AI 1328	Ic 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	Uan Angle ³	R	°	
AI 0060	Ubn Angle ³	R		
AI 0062	Ucn Angle ³	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:

- 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.
- Uan/Ubn/Ucn THD = Uab/Ubc/Uca THD in 3P3W Wiring Mode and represent the harmonics of the line voltages.
- 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 (PMC-53A's Basic Setup Registers)

Optional Properties Supported: Description, Relinquish_Default, Priority_Array

Writable Properties: Present_Value, Out_Of_Service, Units, Relinquish_Default

Use the Present Value property of the Analog Value 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 PMC-53A are represented in BACnet, their valid ranges, their defaults as well as how they are used. PMC-53A 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 2 = 1P2W L-L, 3 = 1P3W L-L-N 4 = 3P3W, 5 = 3P4W	5
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 Max. 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 × $\sqrt{3}$ must be less than 790,000,000.

5) Binary Input Objects (PMC-53A'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
BI0	DI 1	R	0 = Inactive, 1 = Active
BI1	DI 2	R	0 = Inactive, 1 = Active
BI2	DI 3	R	0 = Inactive, 1 = Active
BI3	DI 4	R	0 = Inactive, 1 = Active
BI4	DI 5	R	0 = Inactive, 1 = Active
BI5	DI 6	R	0 = Inactive, 1 = Active

6) Binary Output Objects (PMC-53A'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. PMC-53A 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 PMC-53A's Front Panel before connecting the PMC-53A 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 PMC-53A 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 PMC-53A 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	RS-485 Half Duplex
Word Length	8
Stop Bits	1*/2
Parity	Even*/Odd/None

* Default

1) Supported N2 Commands

Command	PMC-53A'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 PMC-53A will respond with the Undefined Command Error Code 0x01.

2) Map Table

AI Point	PMC-53A		AI Point	PMC-53A	
	Parameter	Unit		Parameter	Unit
1	Uan ¹	V	47	kW Total Max. Demand	kW
2	Ubn ¹		48	kvar Total Max. Demand	kvar
3	Ucn ¹		49	kVA Total Max. Demand	kVA
4	ULN avg ¹	V	50	Ia Max. Demand	A
5	Uab		51	Ib Max. Demand	
6	Ubc		52	Ic Max. Demand	
7	Uca	A	53	Uan THD ²	%
8	ULL avg		54	Ubn THD ²	
9	Ia		55	Ucn THD ²	
10	Ib	kW	56	Ia THD	-
11	Ic		57	Ib THD	
12	I avg		58	Ic THD	
13	kWa ¹	kvar	59	Ia K-Factor	%
14	kWb ¹		60	Ib K-Factor	
15	kWc ¹		61	Ic K-Factor	
16	kW Total	kVA	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		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	In	A	76	Ia Angle	°
31	I4 (Optional Measurement)	A	77	Ib Angle	

32	kWh Import	kWh	78	Ic Angle	
33	kWh Export		79	Operating Time	h
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	kVAh
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:

- When the **Wiring Mode** is 3P3W, the per phase line-to-neutral voltages, kW, kvars, kVAs and PFs have no meaning, and their ADF points are reserved.
- $U_{an}/U_{bn}/U_{cn} \text{ THD} = U_{ab}/U_{bc}/U_{ca} \text{ THD}$ in 3P3W Wiring Mode and represent the harmonics of the line voltages.
- $U_{an}/U_{bn}/U_{cn} \text{ Angle} = U_{ab}/U_{bc}/U_{ca} \text{ Angle}$ in 3P3W Wiring Mode and represent the phase angles of the line voltages.
- Interval Energy Period (EN Period) can be modified via the Front Panel.
- 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: CET				
Device Name: PMC-53A				
Highest DNP Level Supported:		Device Function:		
For Requests: Level 1		☐ Master		
For Responses: Level 1		☒ 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):		Maximum Application Fragment Size (octets):		
Transmitted: 292		Transmitted: 1024		
Received: 292		Received: 300		
Maximum Data Link Re-tries:		Maximum Application Layer Re-tries:		
☒ None		☒ None		
☐ Fixed		☐ Configurable		
☐ Configurable				
Requires Data Link Layer Confirmation:				
☒ Never				
☐ Always				
☐ Sometimes				
☐ Configurable				
Requires Application Layer Confirmation:				
☒ Never				
☐ Always				
☐ When reporting Event Data (Slave devices only)				
☐ When sending multi-fragment responses (Slave devices only)				
☐ Sometimes				
☐ Configurable				
Timeouts while waiting for:				
Data Link Confirm:	☒ None	☐ Fixed at ____	☐ Variable	☐ Configurable
Complete Appl. Fragment:	☒ None	☐ Fixed at ____	☐ Variable	☐ Configurable
Application Confirm:	☒ None	☐ Fixed at ____	☐ Variable	☐ Configurable
Complete Appl. Response:	☒ None	☐ Fixed at ____	☐ Variable	☐ Configurable
Others: Transmission Delay, configurable				
Select/Operate Arm Timeout, fixed at 15 seconds				
Sends/Executes Control Operations:				
WRITE Binary Outputs	☒ Never	☐ Always	☐ Sometimes	☐ Configurable
SELECT/OPERATE	☐ Never	☒ Always	☐ Sometimes	☐ Configurable
DIRECT OPERATE	☐ Never	☒ Always	☐ Sometimes	☐ Configurable
DIRECT OPERATE - NO ACK	☒ Never	☐ Always	☐ Sometimes	☐ Configurable
Count > 1	☒ Never	☐ Always	☐ Sometimes	☐ Configurable
Pulse On:	☒ Never	☐ Always	☐ Sometimes	☐ Configurable
Pulse Off:	☒ Never	☐ Always	☐ Sometimes	☐ Configurable
Latch On	☐ Never	☒ Always	☐ Sometimes	☐ Configurable
Latch Off	☐ Never	☒ Always	☐ Sometimes	☐ Configurable
Queue:	☒ Never	☐ Always	☐ Sometimes	☐ Configurable
Clear Queue:	☒ Never	☐ Always	☐ Sometimes	☐ Configurable
Attach explanation if "Sometimes" or "Configurable" was checked for any operation.				
DNP V3.0				
Reports Binary Input Change Events when no specific variation requested:		Reports time-tagged Binary Input Change Events when no specific variation requested:		
☒ Never		☒ Never		

☐ Only time-tagged ☐ Only non-time-tagged ☐ Configurable to send time-tagged or non-time-tagged	☐ Binary Input Change with Time ☐ Binary Input Change with Relative Time ☐ Configurable to send Binary Input Change With Time and Binary Input Change With Relative Time																					
Sends Unsolicited Responses: ☒ Never ☐ Configurable - enable/disable ☐ Only certain objects ☐ Sometimes (attach explanation) ☐ ENABLE/DISABLE UNSOLICITED Function codes supported	Sends Static Data in Unsolicited Responses: ☒ Never ☐ When Device Restarts ☐ When Status Flags Change No other options are permitted.																					
Default Counter Object/Variation: ☐ No Counters Reported ☐ Configurable ☐ Default Object Default Variation: ☒ Point-by-point list attached	Counters Roll Over at: ☐ No Counters Reported ☐ Configurable ☐ 16 Bits ☐ 32 Bits ☐ Other Value: _____ ☒ Point-by-point list attached																					
Sends Multi-Fragment Responses ☐ Yes ☒ No ☐ Configurable																						
Sequential File Transfer Support: <table style="width: 100%; border: none;"> <tr> <td style="width: 30%;">Append File Mode</td> <td style="width: 10%; text-align: center;">☐ Yes</td> <td style="width: 10%; text-align: center;">☒ No</td> </tr> <tr> <td>Custom Status Code Strings</td> <td style="text-align: center;">☐ Yes</td> <td style="text-align: center;">☒ No</td> </tr> <tr> <td>Permissions Field</td> <td style="text-align: center;">☐ Yes</td> <td style="text-align: center;">☒ No</td> </tr> <tr> <td>File Events Assigned to Class</td> <td style="text-align: center;">☐ Yes</td> <td style="text-align: center;">☒ No</td> </tr> <tr> <td>File Events Send Immediately</td> <td style="text-align: center;">☐ Yes</td> <td style="text-align: center;">☒ No</td> </tr> <tr> <td>Multiple Blocks in a Fragment</td> <td style="text-align: center;">☐ Yes</td> <td style="text-align: center;">☒ No</td> </tr> <tr> <td>Max. Number of Files Open:</td> <td style="text-align: center;">0</td> <td></td> </tr> </table>		Append File Mode	☐ Yes	☒ No	Custom Status Code Strings	☐ Yes	☒ No	Permissions Field	☐ Yes	☒ No	File Events Assigned to Class	☐ Yes	☒ No	File Events Send Immediately	☐ Yes	☒ No	Multiple Blocks in a Fragment	☐ Yes	☒ No	Max. Number of Files Open:	0	
Append File Mode	☐ Yes	☒ No																				
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Permissions Field	☐ Yes	☒ No																				
File Events Assigned to Class	☐ Yes	☒ No																				
File Events Send Immediately	☐ Yes	☒ No																				
Multiple Blocks in a Fragment	☐ Yes	☒ No																				
Max. Number of Files Open:	0																					

Level 1 Implementation (DNP-L1)

OBJECT			REQUEST (slave must parse)		RESPONSES (master must parse)	
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	PMC-53A	Code (hex)	Description	PMC-53A
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 PMC-53A 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	PMC-53A	Func. Code	Description	PMC-53A
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	Link Service 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	Default*
Baud Rate	1200/2400/4800/9600*/19200/38400	
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 Max. 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	Voltage Phase Loss (3P4W or 3P3W)
32	Current Phase Loss (3P4W or 3P3W)
33	RTD1 broken (RTD Input option only)
34	RTD2 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 Max. 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 6 (Flash: 4MB Memory)	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	0=Disabled 1=Enabled	000=None 001=1xAI + 1xAO 010=2xDI + 2xDO 011=2xRTD 100=2xDI + 2x SS Pulse Output 101=Reserved	000=None 001=RS-485 010=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		var
18	kvarb ¹	INT32		
19	kvarc ¹	INT32		VA
20	kvar Total	INT32		
21	kVAa	INT32		
22	kVAb ¹	INT32		
23	kVAc ¹	INT32		
24	kVA Total	INT32		
25	PFa	INT32	x1000	-
26	PFb ¹	INT32		
27	PFc ¹	INT32		
28	PF 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	RTD1	INT32	x100	°C
45	RTD2	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	x100	V
53	Uan/Uab Fundamental	INT32		
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		
65	Ia TDD	INT32	x100	-
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 Max. Demand of This Month (Since Last Reset)	INT32	x1000	A
89	Ib Max. Demand of This Month (Since Last Reset)	INT32		
90	Ic Max. Demand of This Month (Since Last Reset)	INT32		
91	ΣkW Max. Demand of This Month (Since Last Reset)	INT32	x1	W
92	Σkvar Max. Demand of This Month (Since Last Reset)	INT32		var
93	ΣkVA Max. Demand of This Month (Since Last Reset)	INT32		VA
94	Ia Max. Demand of Last Month (Before Last Reset)	INT32	x1000	A
95	Ib Max. Demand of Last Month (Before Last Reset)	INT32		
96	Ic Max. Demand of Last Month (Before Last Reset)	INT32		
97	ΣkW Max. Demand of Last Month (Before Last Reset)	INT32	x1	W
98	Σkvar Max. Demand of Last Month (Before Last Reset)	INT32		var
99	ΣkVA Max. Demand of Last Month (Before Last Reset)	INT32		VA

Notes:

- 1) 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.
- 2) 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.

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
Bit 0	Object 1 - Binary Input Status Included in Class 0 responses?	0=No, 1=Yes (default)
Bit 1	Object 10 - Binary Output States Included in Class 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- Bit 15	Reserved	

Object 50 - Date and Time

Read and Write function is supported for this object, 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 UNIX seconds*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	400ULN/690ULL*
Range	10V to 1.2Un
Overload	1.2xUn continuous, 2xUn for 1s
Burden	<0.02VA per phase
Measurement Category	CAT III up to 600V
Frequency	45-65Hz
Current Inputs (I11, I12, I21, I22, I31, I32)	
Standard In	5A (Optional 1A)
Range	0.1% to 200% In
Starting Current	0.1% In
Overload	2xIn continuous, 20xIn for 1s
Measurement Category	CAT III up to 600V
Burden	<0.15VA per phase @ 5A
Optional I4 Input (I41, I42)	
In	5A (5A/1A Auto-Scaling)
Range	0.1% to 200% In
Starting Current	0.1% In
Power Supply (L+, N-)	
Standard	95-250VAC/DC, $\pm 10\%$, 47-440Hz (UL Approved)
Optional	20-60VDC
Burden	<2W
Overvoltage Category	CAT III up to 300ULN
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 (only 30VDC is UL approved)
Load Type	Resistive
Pulse Outputs (E1+, E1-, E2+, E2-)	
Type	Form A Solid State Relay
Isolation	Optical
Load Type	Resistive
Output	Optocoupler output as ON-OFF
Pulse Width	80ms $\pm$ 20ms
Max. Load Voltage	50VDC (24VDC is approved by UL)
Max. Forward Current	50mA (4mA is approved by UL)
Optional Analog Inputs	
Type	0/4-20 mA
Overload	24mA
Optional Analog Outputs	
Type	0/4-20 mA
Loading	500 Ω maximum
Overload	24mA maximum
Optional RTD Inputs	
Type	Platinum Resistor PT100 (Sensor Not Included)
Range	-50°C to 200°C
Accuracy	$\pm(0.30+0.005 t)$
Cable Length	3000mm
Protective Tube Length	30mm
Installation Torque	
Current Inputs	12lb-in (1.3N.m)
Power Supply, Voltage Inputs, RS-485 and I/O	5lb-in (0.5N.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
Altitude	< 2000m

Pollution Degree	2
Location / Mounting	For indoor use only
Mechanical Characteristics	
Panel Cutout	92x92mm (3.62"x3.62")
Unit Dimensions	96x96x88mm
IP Rating	IP65

*Max. 400Y690Vac WYE connection (earthed neutral), and 600 Vac Delta Connection/Single phase Connection

Accuracy

Parameters	Accuracy	Resolution
Voltage	$\pm 0.2\%$	0.001V
Current	$\pm 0.2\%$	0.001A
I4 (measurement)	$\pm 0.2\%$	0.001A
P, Q, S	$\pm 0.5\%$	0.001kX
kWh, kVAh	IEC 62053-22 Class 0.5S ANSI C12.20 Class 0.2 EN 50470-1/3: 2006 Class C	0.1kXh
kvarh	IEC 62053-24 Class 0.5S IEC 62053-23 Class 2	0.1kvarh
PF	$\pm 0.5\%$	0.001
Frequency	$\pm 0.02\text{Hz}$	0.01Hz
THD	IEC 61000-4-7 Class B	0.01%
K-Factor	IEC 61000-4-7 Class B	0.001
Phase Angle	$\pm 1^\circ$	0.1°

Appendix G Standards Compliance

Safety Requirements	
CE LVD 2014 / 35 / EU cULus Listed MID per 2014/32/EU	EN 61010-1: 2010 EN 61010-2-030: 2010 UL 61010-1 Ed. 3 CAN/CSA C22.2 NO. 61010-1-12 Ed. 3 UL 61010-2-030 Ed. 2 CSA C22.2 NO. 61010-2-030: 18 Ed. 2 UL 61010-2-201 Ed. 2 CSA C22.2 NO. 61010-2-201 Ed. 2 EN 50470-1: 2006 EN 50470-3: 2006
Electrical Safety in Low Voltage Distribution Systems up to 1000Vac and 1500 Vdc	IEC 61557-12: 2018 (PMD)
Insulation AC Voltage: 4kV @ 1 minute Insulation Resistance: >100MΩ Impulse voltage: 6kV, 1.2/50μs	IEC 62052-11: 2020 IEC 62053-22: 2020 EN 50470-1: 2006
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+A1: 2017
Conducted Disturbances	EN 61000-4-6: 2014
Magnetic Fields	EN 61000-4-8: 2010
Voltage Dips and Interruptions	EN 61000-4-11:2004+A1: 2017
Ring Wave	EN 61000-4-12: 2017
Emission Tests	
Limits and Methods of Measurement of Electromagnetic Disturbance Characteristics of Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment	EN 55011: 2016
Electromagnetic Compatibility of Multimedia Equipment - Emission Requirements	EN 55032: 2015
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
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
Revenue Metering Type Test Approval	
MID per EU Directive 2014/32/EU	Certificate No.: 0120/SGS0427
NMIM of Malaysia per OIML R46	Approval No.: ATS-0026-20

Appendix H Maintenance

Overview



Caution

Do not open the meter case.

Do not attempt to repair any components of the meter.

Failure to follow these instructions can result in equipment damage and void the product warranty.

The meter does not contain any user-serviceable parts. If the meter requires service, contact your local representative. Opening the meter will void the product warranty.

Lost Front Panel Password

If you lose your Front Panel password, contact your local representative or distributor for assistance on how to reset your meter's password. Please have your meter's serial number available for reference.

Wiring Diagnostics Information

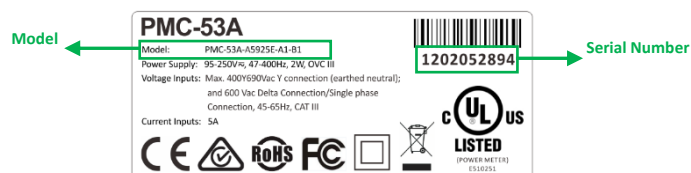
The meter provides you with wiring diagnostics information to help with troubleshooting. Please refer to **Section 4.7** for details.

Firmware Version, Model and Serial Number

You can view the meter's firmware version and serial number from the Front Panel via **Setup > Information**

You can view the device's model and serial number from the serial label at the back of the meter.

For example:



Firmware Upgrade

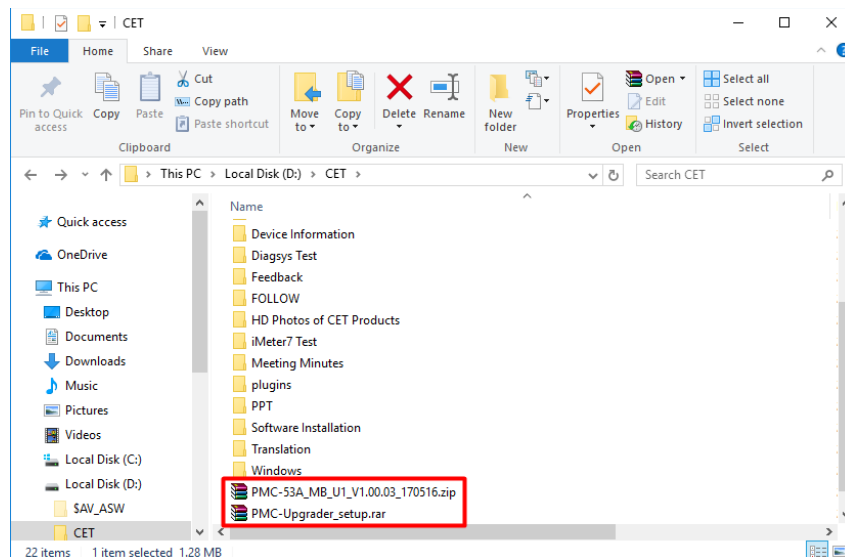
There are a number of reasons why you may want to upgrade your meter's firmware:

- Improve meter performance
- Enhance existing meter features and functions
- Achieve compliance to new industry standards

Upgrade Requirements

In order to upgrade the meter, you need to:

- Connect a PC running Windows OS with the meter's COM Port using a USB/RS-485 Converter
Supported OS: Computer with Windows XP / Windows 7 / Windows 8 / Windows 10 / Windows 11
- Make sure the new Firmware file and PMC-Upgrader installation package are already on your computer.
Contact CET Technical Support at support@cet-global.com should you require further assistance.



Upgrading Your Meter



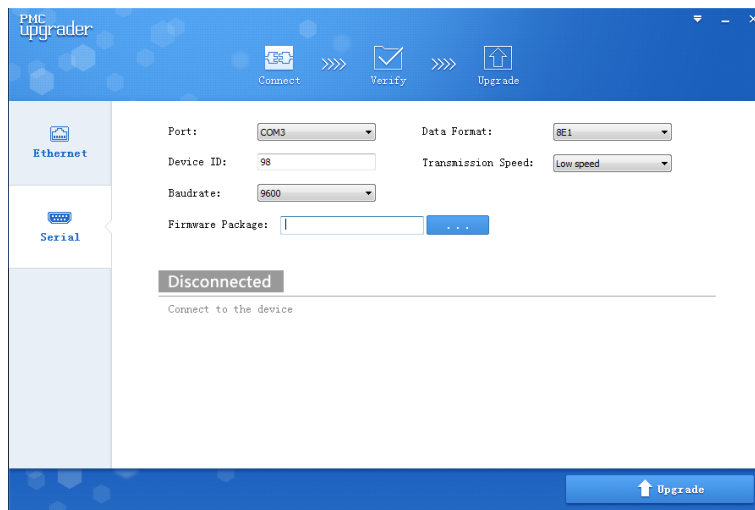
Caution

Do not turn off power to the meter while firmware upgrade is in progress. Failure to follow these instructions can result in equipment damage.

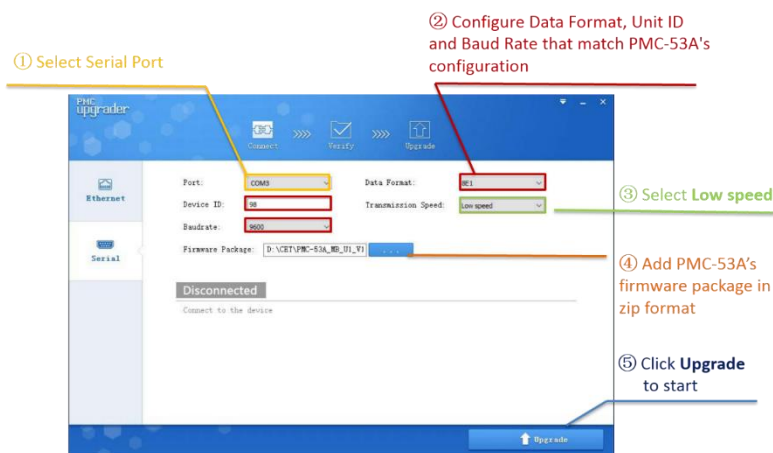
- 1) Double click the installation package and then click **Next** to continue.
 - 2) Click **Browse** to select installation path and click **Next** to continue.
 - 3) Select whether to create shortcuts in start menu folder and click **Next** to continue.
 - 4) Select whether to create a desktop icon and click **Next** to continue.
 - 5) Click **Install** to start the installation.
 - 6) Click **Finish** to complete the installation
2. Use the USB/RS-485 Converter to connect the PC with the PMC-53A's COM Port.



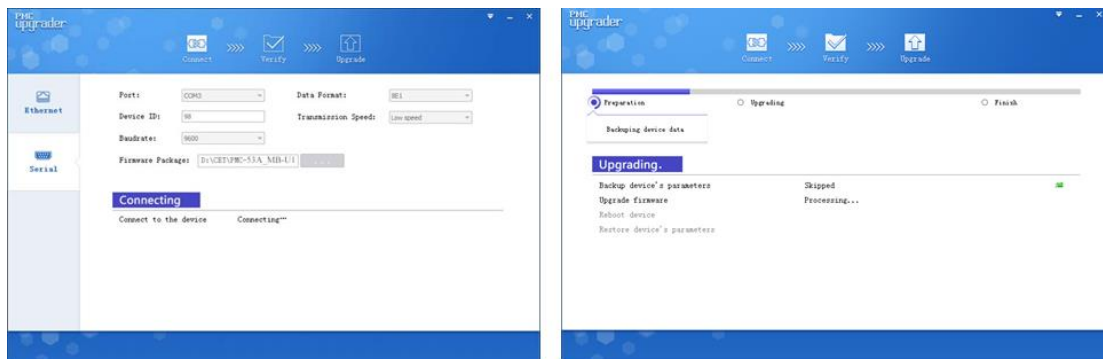
3. Double click the desktop icon to open the PMC-Upgrader and select Serial connection.



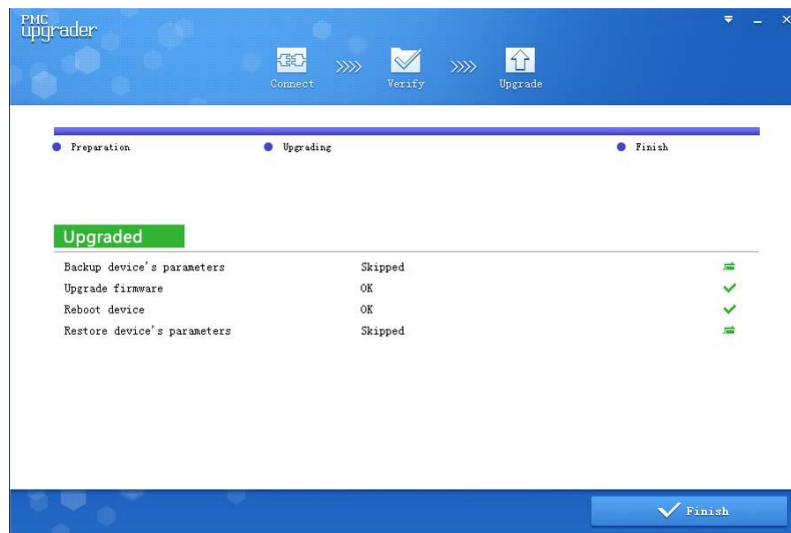
4. Setup Serial parameters. Please refer to figure below.



5. After clicking **Upgrade**, the connection with the PMC-53A will be established and then the parameters backup will be processed automatically.

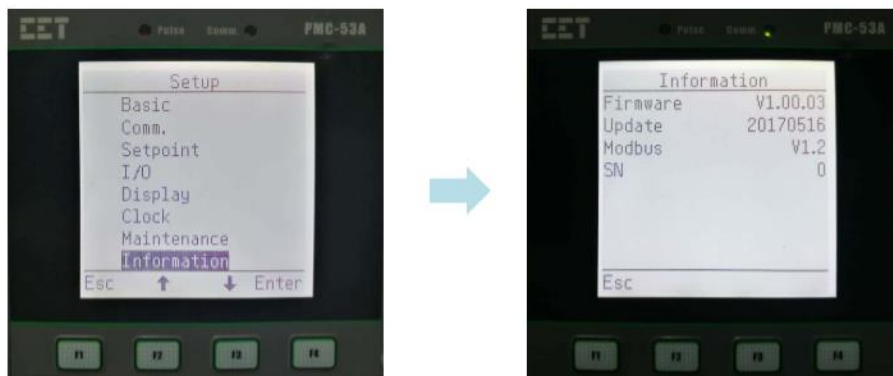


6. The entire firmware upgrade process may take about two minutes. Please do not terminate the upgrade process while the meter is being upgraded.
7. The meter's parameters will be automatically restored after the firmware has been successfully upgraded.



8. Confirm the PMC-53A's firmware version via the front panel.

- 1) Click <Setup>.
- 2) Enter password "0000".
- 3) Select **Information**.



FAQ

Problem	Possible Solutions
No display after power on	1. Please check the power source to make sure that it's compatible with the meter's power supply rating. 2. Restart the meter.
The meter cannot work normally after power on.	1. Restart the meter.
Voltage or Current readings are incorrect	1. Please confirm that the Wiring Mode setting matches the actual wiring. 2. Please confirm that the PT/CT's Primary and Secondary ratios are configured correctly.
RS-485 communication is abnormal	1. Please check to make sure the Communication Setup Parameters are consistent with the computer. 2. Please check to make sure the USB/RS-485 converter or Ethernet-to-RS-485 gateway is in good condition. 3. Check to make sure that the + and - wires are connected correctly on the entire loop. 4. Restart the meter.

Appendix I Ordering Guide

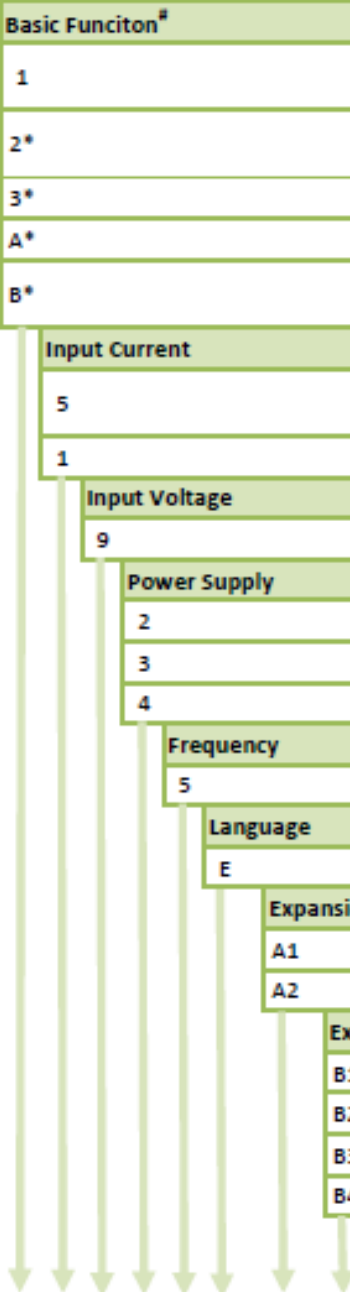


CET

Electric

Technology

Version 20200824

Product Code		Description
PMC-53A Intelligent Multifunction Meter		
	Basic Function*	
	1	Dot-Matrix LCD, 1xRS-485 with Multiple Protocol, Monthly Energy Log
	2*	Model 1 + Monthly & Daily Freeze Log, Data Recording Log, 4MB Memory
	3*	Model 1 + 4xDI + 2xSS Pulse Output
	A*	Model 1 + 4xDI + 2xDO (Mechanical Relay)
	B*	Model A + Monthly & Daily Freeze Log, Data Recording Log, 4MB Memory
	Input Current	
	5	5A/1A Auto-Scaling (Class 0.5S for 5A and Class 1 for 1A)
	1	1A
	Input Voltage	
	9	400ULN/690ULL
	Power Supply	
	2	95-250 VAC/DC, 47-440Hz
	3	20-60VDC
	4	95-480 VAC/DC, 47-440Hz
	Frequency	
	5	45Hz-65Hz
	Language	
	E	English
	Expansion A*	
	A1	1xRS-485
	A2	I4 (5A/1A Auto-Scaling)
	Expansion B*	
	B1	2xDI + 2xDO (Mechanical Relay)
	B2	2xRTD (PT100 sensors not included)
	B3	1xAI + 1xAO (0/4-20mA)
	B4	2xDI + 2xSS Pulse Output
PMC-53A	- 1 5 9 2 5 E - -	PMC-53A-15925E (Standard Model)

* Additional charges apply

Models PMC-53A-X5925E (X=1, 2, 3, A, B) are certified for MID Class C.

1) Model No. with only one Expansion can be written as PMC-53A-15925E-Ax or PMC-53A-15925E-Bx

2) Model No. with both Expansions can be written as PMC-53A-15925E-Ax-Bx

3) Options B1 and B4 for Expansion B are invalid with options 1, and 2 under Basic Function.

Contact us

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