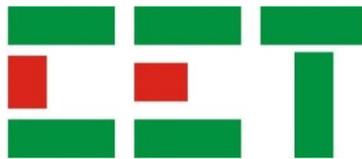


PMC-53A
Intelligent Multifunction Meter
User Manual
Version: V2.2
February 4, 2026



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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.



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.

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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 96x96x83.6mm, it is perfectly suited for industrial, commercial and utility applications. Compliance with the IEC 62053-22 Class 0.2S/0.5S, ANSI C12.1 Class 0.2 and EN 50470-1/3 Class C, 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 two 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 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
- Retrofit applications with Split-Core Current Transformers and Rogowski Coils

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 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 Loading Factor per Phase and Average~
~The Current Loading Factors are available in Firmware V1.00.15 or later
- P, Q, S, 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 63rd^
- Current TDD, TDD Odd, TDD Even, K-Factor and Crest Factor
- U and I Phase Angles
- U Under/Over Deviation and Frequency Deviation^
^ The Individual Harmonic 32nd to 63rd, Voltage and Frequency Deviation are available in Firmware V2.00.00 or later
- Displacement PF
- Fundamental U, I and P per Phase*
- Total Fundamental P & Total Harmonic P*

- U and I Unbalance and Sequence*
- kvarh Q1-Q4
- Interval Energy for kWh/kvarh Imp/Exp and kVAh*
*Available in Firmware V1.00.03 or later
- Demands, Predicted Demands and Max. Demands for P/Q/S Total, I per Phase and Average as well as ULL Average (ULL avg~) with Timestamp for This Month & Last Month (or Since Last Reset & 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
 - 90 Holidays or Alternate Days
 - 8 Tariffs, each providing the following information
 - Total and 3-phase kWh/kvarh Import/Export, kVAh
 - P/Q/S 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

Carbon Emission Metering (Available in the Firmware V2.00.02 or later)

- Carbon Emission measurements for This Month & This Year & Total Cumulative
- Configurable Carbon Emission Factor and Associated kWh Imp./Exp. for both Transmission & Distribution Lines & Load-side Power Generation Equipment
- Storage of up to 12 monthly and 12 annual historical Carbon Emission logs

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, P, Q, S, 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 P/Q/S Max. Demands
- 36 Monthly Freeze Logs for kWh/kvarh/kVAh Total and P/Q/S 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
- P 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 Comm. port with RS-485 Modbus RTU at max. 115,200 bps/ PROFIBUS DP^ at max. 1,500 kbps support
^ The PROFIBUS DP is available in Firmware V2.00.01 or later

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 2 Form A Solid State Relays for kWh and kvarh pulsing

Optional Expansion Modules

- **Expansion Module A Options**
 - I4 Input
 - 2nd Comm. port with optical isolation, supporting Modbus RTU at max. 115,200 bps /PROFIBUS DP[^] at max. 1,500 kbps
- **Expansion Module B Options**
 - 2xDigital Input and 2xDigital Output
 - 2xRTD Input (PT100 sensor not included)
 - 1xAI and 1xAO (0/4-20mA)
 - 2xAO (0/4-20mA)

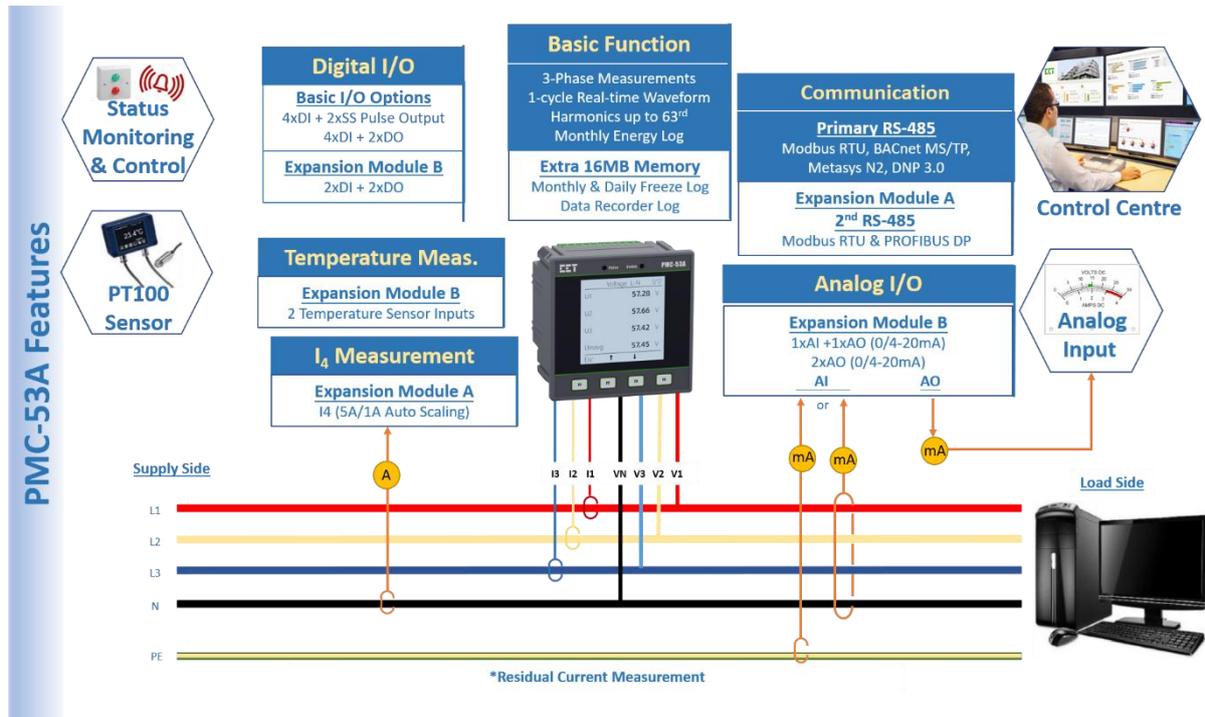
[^] The PROFIBUS DP is available in Firmware V2.00.01 or later

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 L-N, 1P2W L-L 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

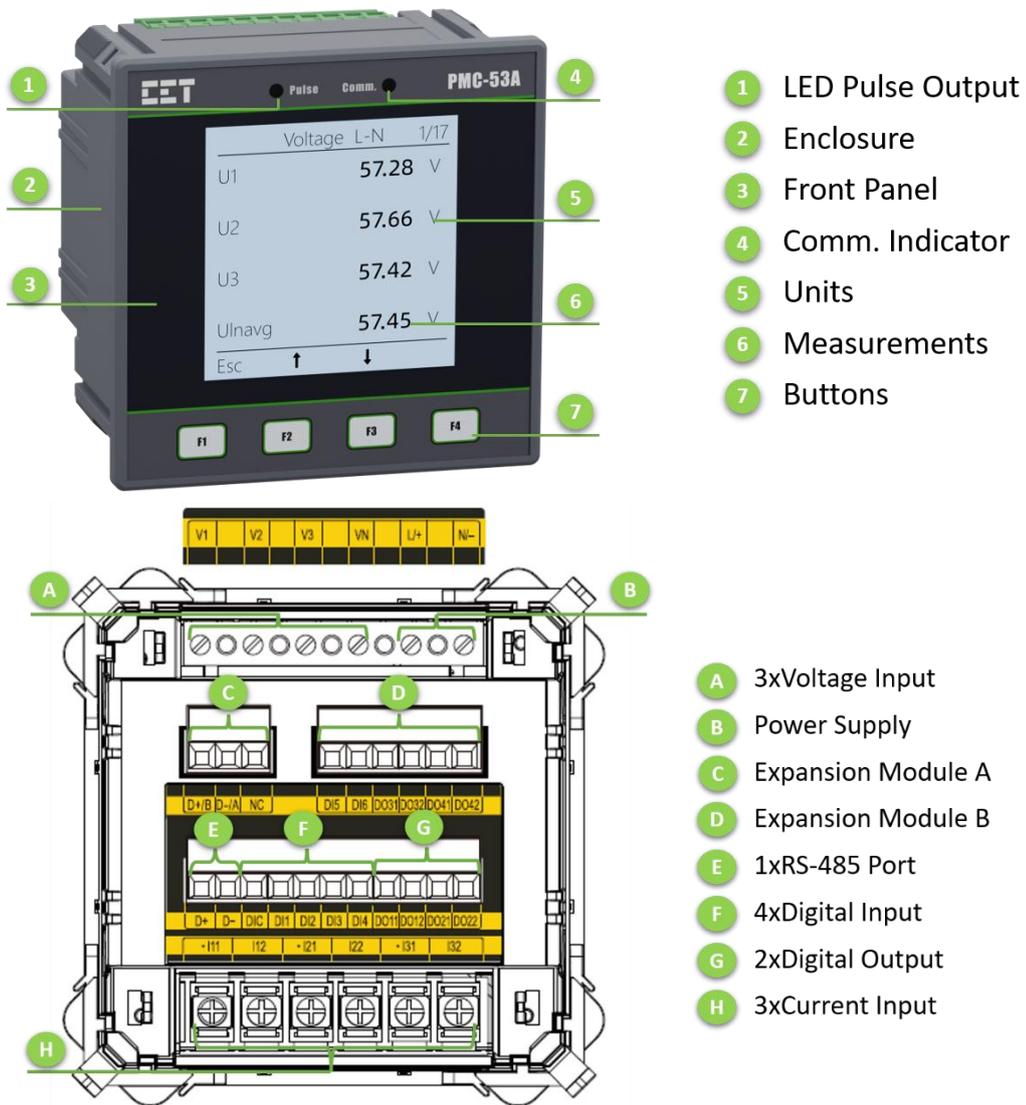


Figure 2-1 Appearance

2.2 Unit Dimensions

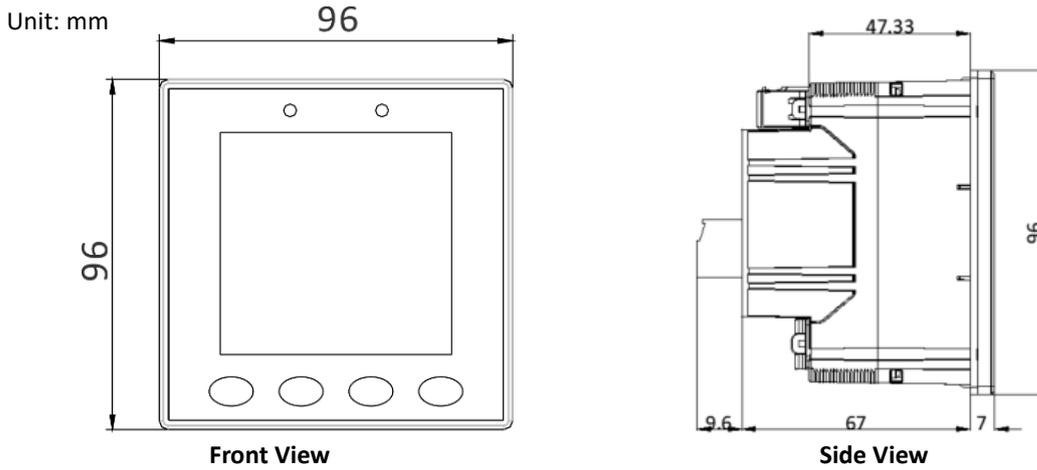


Figure 2-2 Unit Dimensions

2.3 Terminal Dimensions

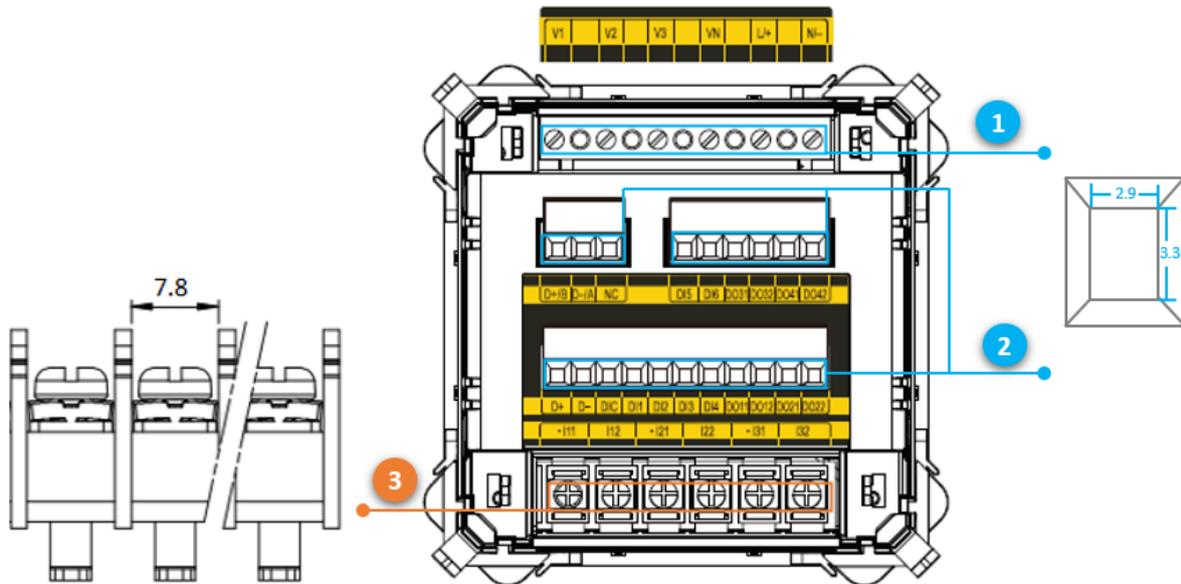


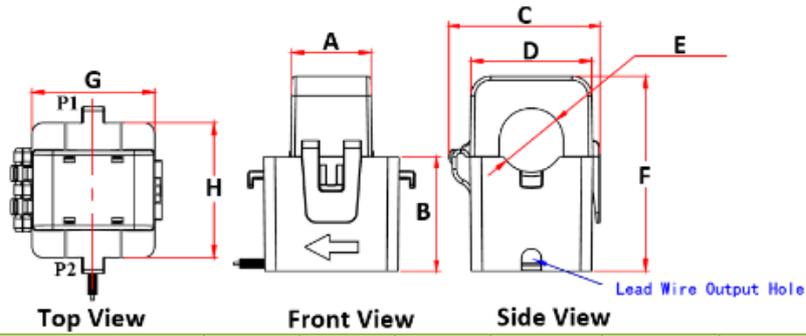
Figure 2-3 Terminal Dimensions

	Terminal	Terminal Dimensions/Pitches	Wire Size	Torque		
				Tightening	Max.	
1	Voltage Input	2.9mm x 3.3mm	0.2-3.5 mm ² (28-12 AWG)	0.4 N.m/ 4 kgf.cm/ 3.54 lb-in/ M3	0.5 N.m/ 5.1 kgf.cm/ 4.42 lb-in/ M3	
	Power Supply					
2	Expansion Module A & B					
	RS-485					
	DI					
	DO					
3	Current Input	7.8mm	0.5-2.0 mm ² (22-14 AWG)	0.71 N.m/ 7.1 kgf.cm/ 6.28 lb-in/ M3.5	1.17 N.m/ 12 kgf.cm/ 10.4 lb-in/ M3.5	

Table 2-1 Terminal Dimensions

2.4 Input Current SCCT Dimensions

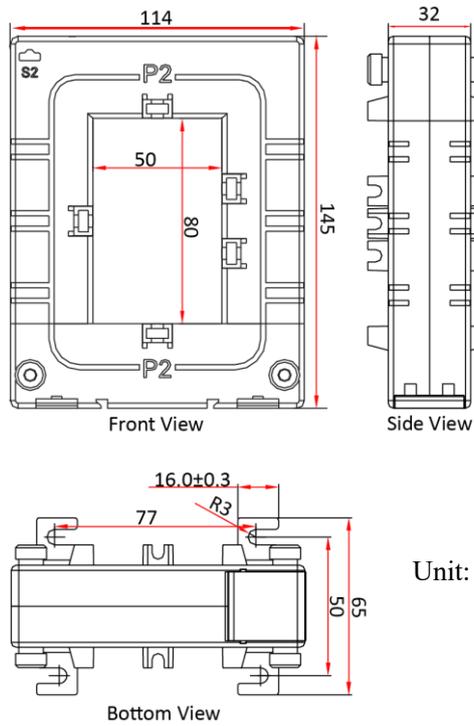
2.4.1 100A/200A/400A to 40mA Output SCCT



Model	A	B	C	D	E	F	G	H
PMC-SCCT-100A-40mA-16-A	19.9	28.6	38	30.26	∅16.1	48.9	30.7	33.9
PMC-SCCT-200A-40mA-24-A	20	40.5	53.5	44.3	∅24.1	70.0	45.0	40.2
PMC-SCCT-400A-40mA-35-A	22.5	47	67	57.3	∅35.1	83	58.2	42.8

Figure 2-4 100A/200A/400A to 40mA Output SCCT Dimensions (Unit: mm)

2.4.2 800A Split Core CT (PMC-SCCT-800A-40mA-A)



Unit: mm

Figure 2-5 800A Split Core CT Dimensions

2.4.3 1600A Split Core CT (PMC-SCCT-1600A-40mA-A)

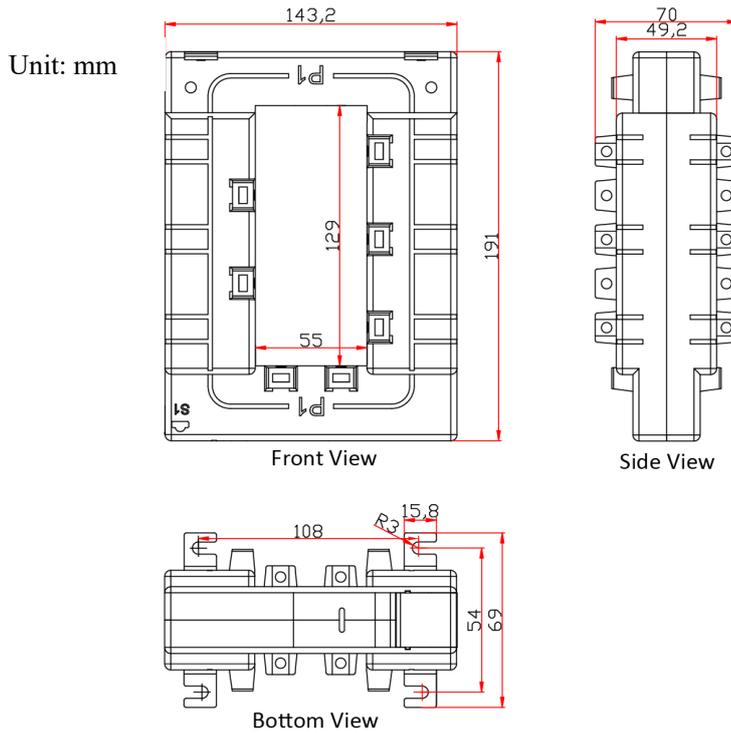


Figure 2-6 1600A Split Core CT Dimensions

2.5 Rogowski Coil Dimensions

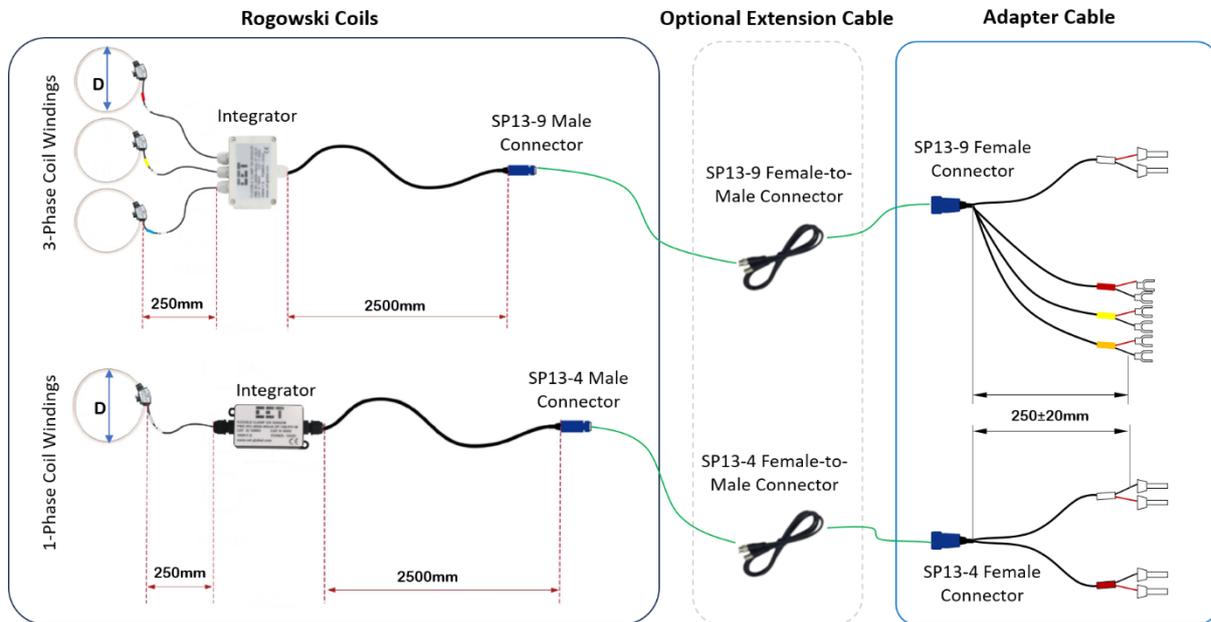


Figure 2-7 Rogowski Coils Dimensions

Rogowski Coils Model	Aperture (D)	Optional Extension Cable Model	Length
PMC-RC-400A-40mA-3P-100-PY-W-F	100mm	SP13-F-M-5 (3-Phase)	5m
PMC-RC-1200A-40mA-3P-150-PY-W-F	150mm	SP13-F-M-10 (3-Phase)	10m
PMC-RC-2500A-40mA-3P-200-PY-W-F	200mm	SP13-4-F-M-5 (1-Phase)	5m
PMC-RC-5000A-40mA-3P-350-PY-W-F	350mm	SP13-4-F-M-10 (1-Phase)	10m
PMC-RC-400A-40mA-1P-100-PY-W-N	100mm		
PMC-RC-1200A-40mA-1P-150-PY-W-N	150mm		
PMC-RC-2500A-40mA-1P-200-PY-W-N	200mm		
PMC-RC-5000A-40mA-1P-350-PY-W-F	350mm		

Table 2-3 Rogowski Coil and Optional Extension Cable

2.6 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 2-8
- Re-install the installation clips and push the clips tightly against the panel to secure the meter

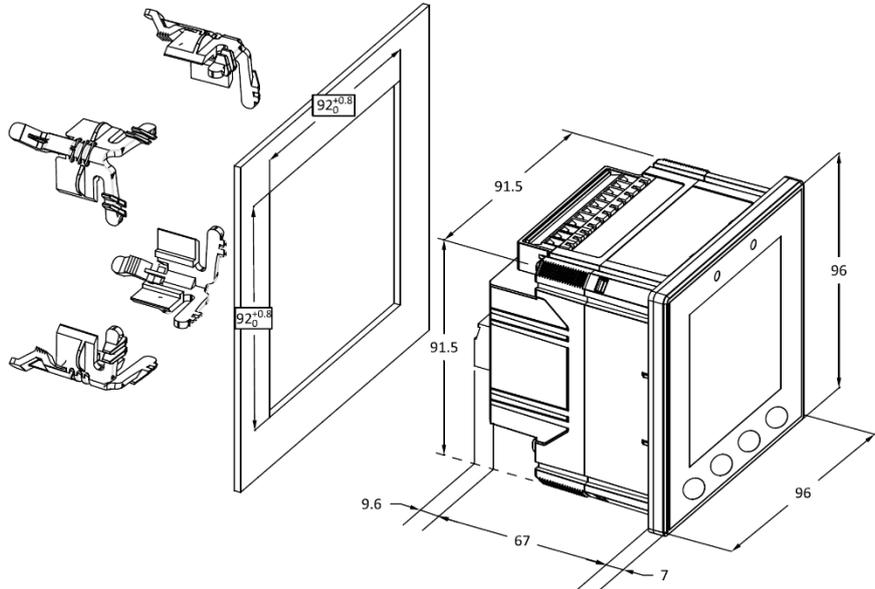


Figure 2-8 Panel Cutout Mounting

2.7 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 L-N) Direct Connection with 1CT
- 1-Phase 2-Wire, ULL (1P2W L-L) 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.

2.7.1 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**.

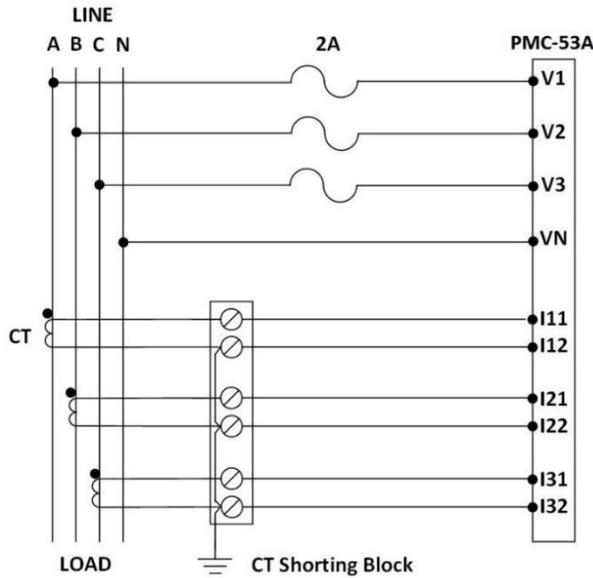


Figure 2-9 3P4W Direct Connection with 3CTs

2.7.2 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**.

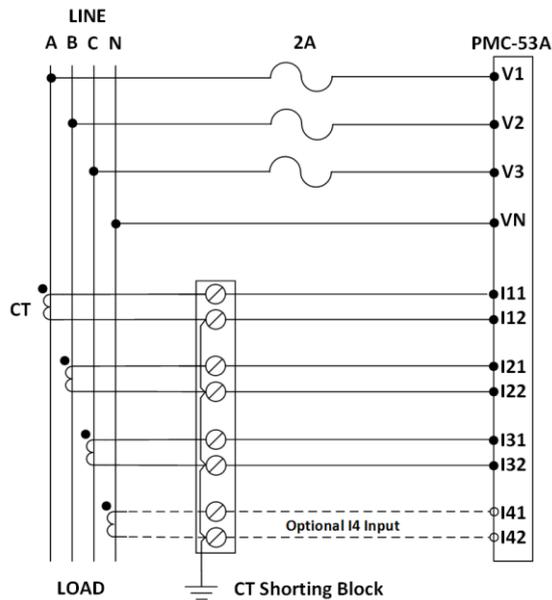


Figure 2-10 3P4W Direct Connection with 4CTs (Optional I41 & I42)

2.7.3 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**.

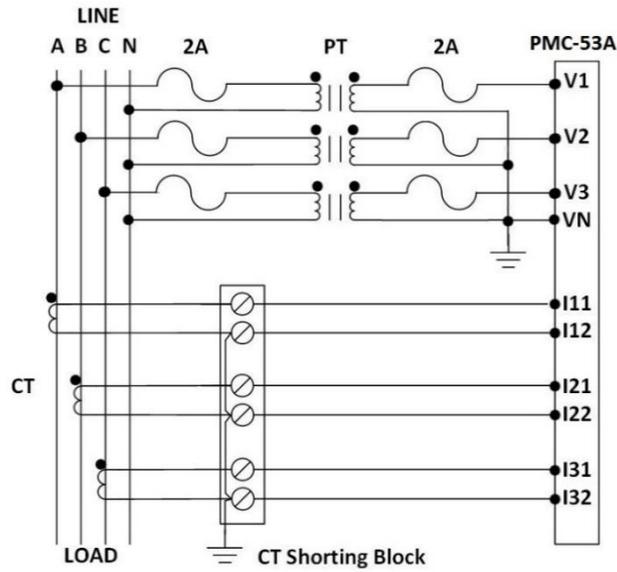


Figure 2-11 3P4W with 3PTs and 3CTs

2.7.4 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**.

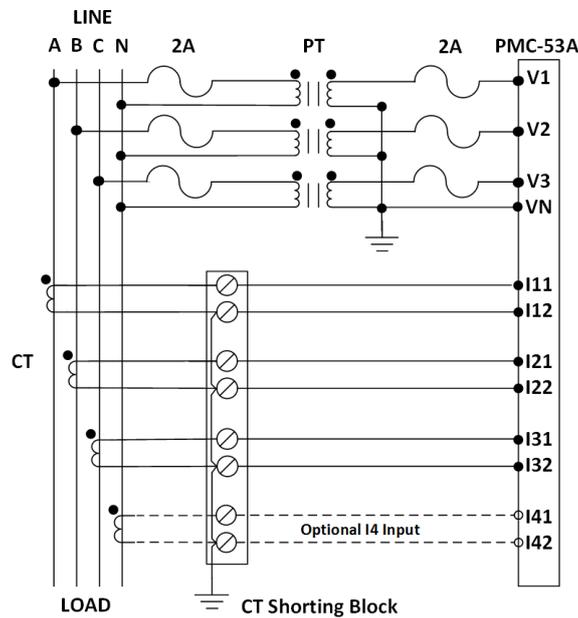


Figure 2-12 3P4W with 3PTs and 4CTs (Optional I41 & I42)

2.7.5 3-Phase 3-Wire (3P3W) Direct Delta Connection with 3CTs

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

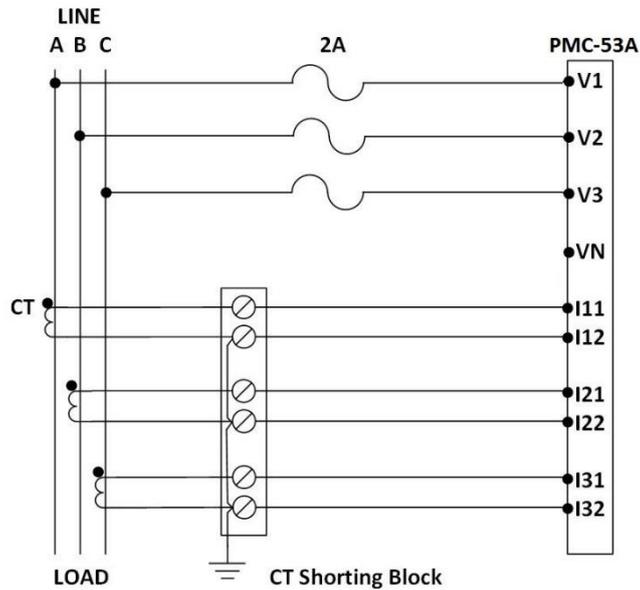


Figure 2-13 3P3W Direct Connection with 3CTs

2.7.6 3-Phase 3-Wire (3P3W) Direct Delta Connection with 2CTs

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

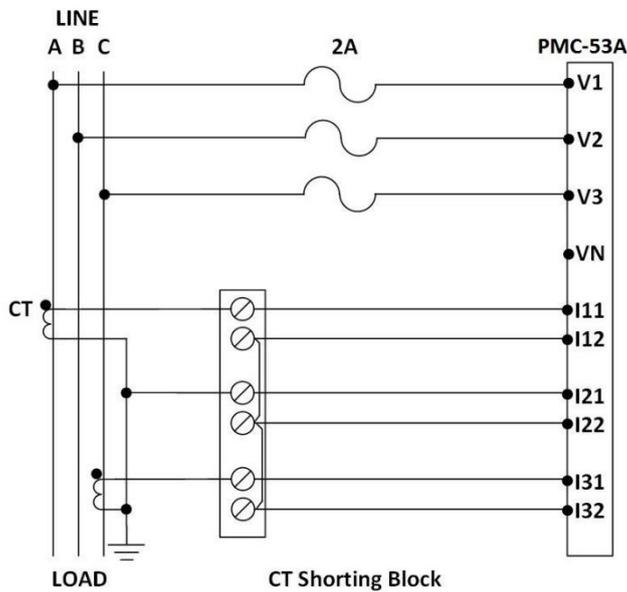


Figure 2-14 3P3W Direct Connection with 2CTs

2.7.7 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**.

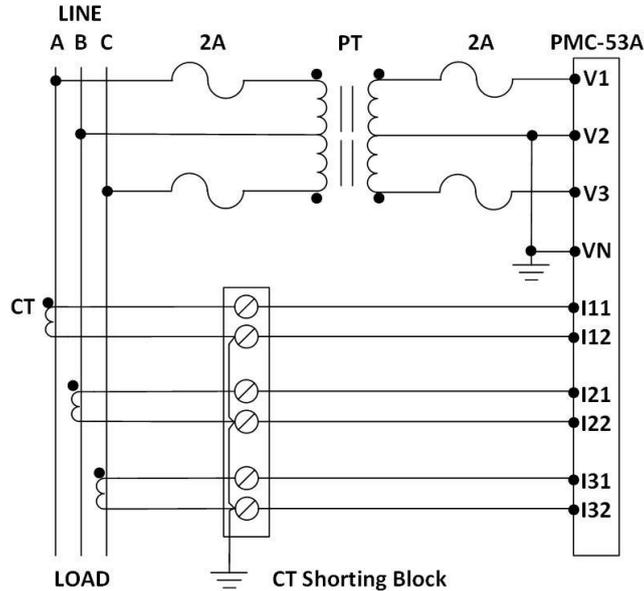


Figure 2-15 3P3W Delta with 2PTs and 3CTs

2.7.8 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**.

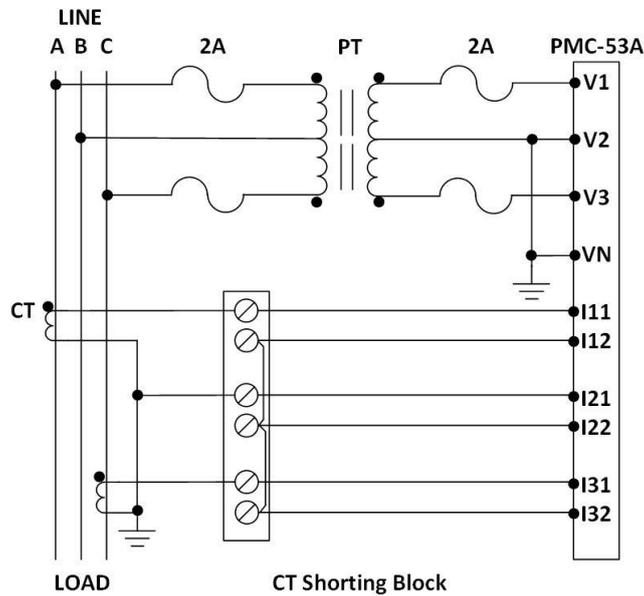


Figure 2-16 3P3W Delta with 2PTs and 2CTs

2.7.9 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**.

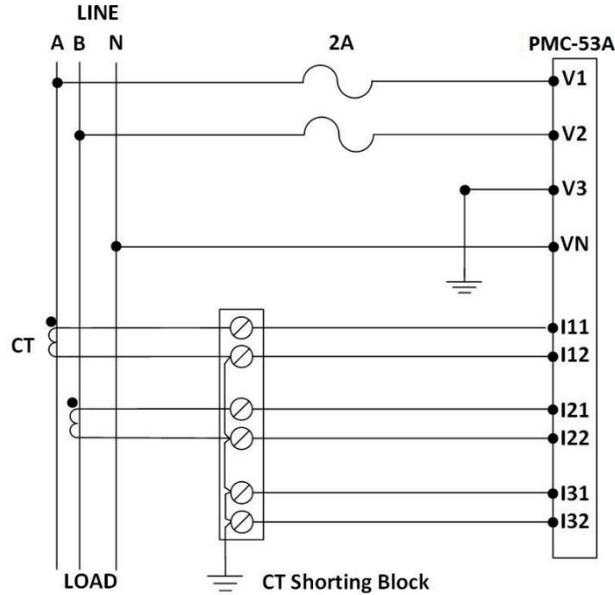


Figure 2-17 1P3W Direct Connection with 2CTs

2.7.10 1-Phase 2-Wire, ULN (1P2W L-N) Direct Connection with 1CT

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

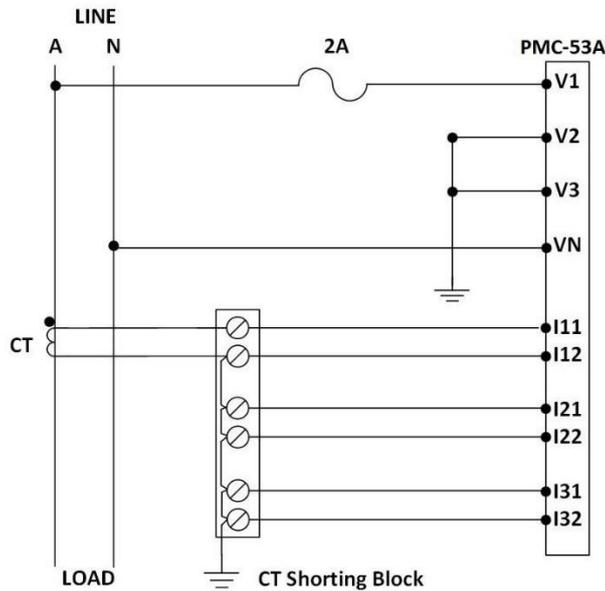


Figure 2-18 1P2W ULN Direct Connection with 1CT

2.7.11 1-Phase 2-Wire, ULL (1P2W L-L) 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**.

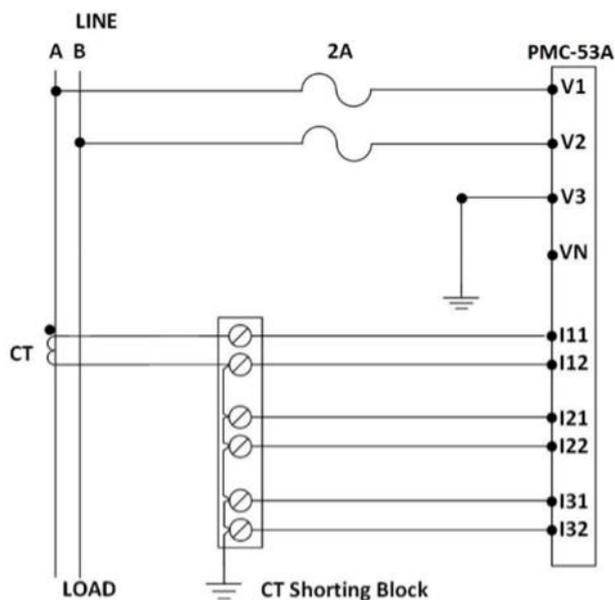


Figure 2-19 1P2W ULL Direct Connection with 1CT

2.8 SCCT Wiring



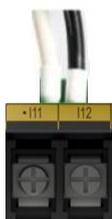
Caution

Please make sure that the circuit is de-energized before installing the SCCT for maximum safety. Do not open circuit the SCCT's secondary output under any circumstances while the circuit is energized. Failure to observe proper precaution while working with this product may result in severe injury or death.

2.8.1 Wiring for 100A/40mA, 200A/40mA or 400A/40mA SCCT

Steps:

- Wire the White and Black leads to Current Input terminals ·Ix1 (positive) and Ix2 (negative) on the PMC-53A, respectively.
- Open the SCCT by slightly pulling on the clip. Please ensure that SCCT's contact surface is clean and without contaminants for best accuracy performance.
- Put the cable through the opening of the SCCT and make sure that Current flow direction is aligned with the arrow marking on the SCCT. Close the SCCT and make sure that the clip is securely latched.
- Secure the cable to the SCCT with a wire strap.



a



b



c



d

Figure 2-20 100A/40mA, 200A/40mA or 400A/40mA SCCT Installation

2.8.2 Wiring for 800A/40mA or 1600A/40mA SCCT

Steps:

1. Connect the SCCT to the PMC-53A: wire the white lead to the SCCT's S1 and Current Input terminal ·Ix1 (positive) of the PMC-53A, and wire the black lead to the SCCT's S2 terminals and Ix2 (negative) of the PMC-53A.
2. Open the SCCT by removing the thumb-screws that hold the SCCT together and make sure that SCCT's contact surface is clean and without contaminants for best accuracy performance.
3. Install the SCCT around the busbar and then carefully secure it using the provided mounting fixtures such as mounting bolts and insulation caps as shown below.
4. Reassemble the SCCT and tighten the thumb screws.

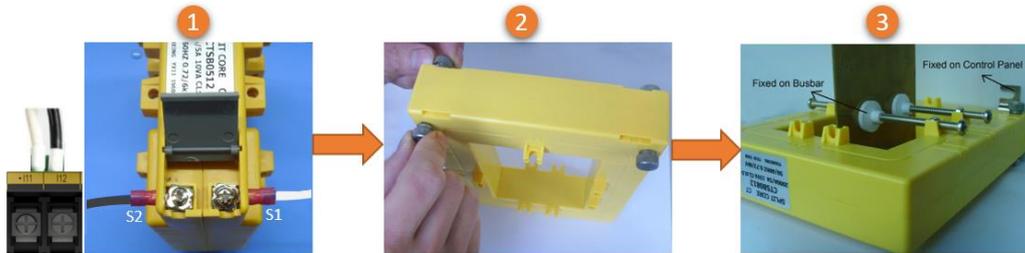


Figure 2-21 800A/40mA or 1600A/40mA SCCT installation

Notes:

1. Please separate the adjacent CTs by about 2 cm to reduce potential magnetic interference.
2. Please ensure the Load Current does not exceed the CT's Primary Current specification.

2.9 Rogowski Coils Wiring

Notes

- Please keep coil away from strong EMI sources when possible.
- For 3-phase metering, use phase-matched coils for individual phases.

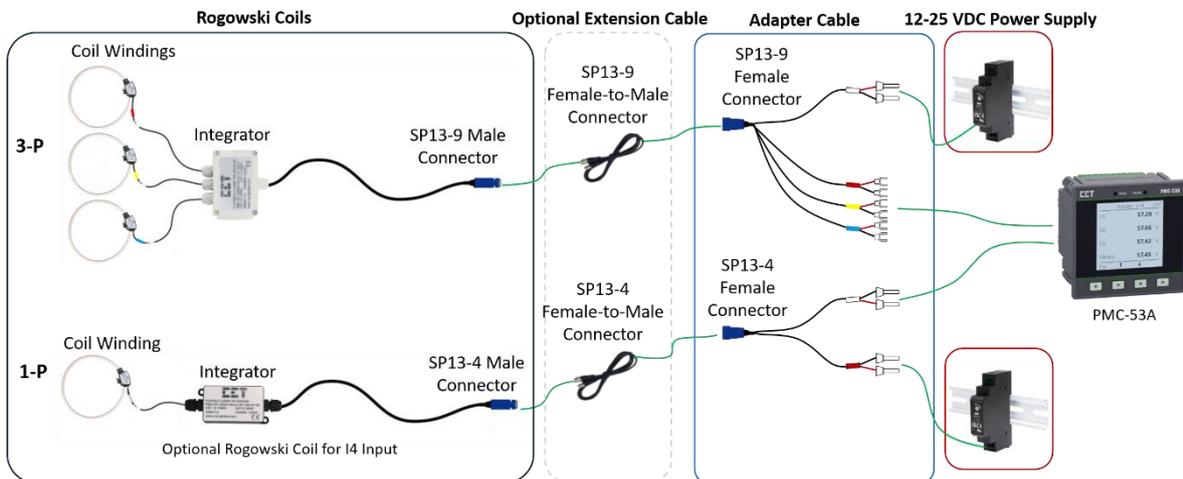


Figure 2-22 Rogowski Coils Wiring

Steps:

1. Coil Installation. Note: no circuit interruption required - work on energized conductors.
 - a. Locate the clip on the base unit's housing.
 - b. Unscrew the clip and pull out coil from base unit.
 - c. Loop the coil around the conductor to be measured. Align the arrow marker on the base unit with the presumed current flow direction.
 - d. Re-insert coil into the base unit and screw the clip to secure the coil.



Figure 2-23 Rogowski Coil Installation Steps

2. Repeat Step 1 to install all phase coils sequentially.
3. Connect Male Connector to the PMC-53A via Adapter Cable and/or optional Extension Cable.
 - For 3-phase metering: connect coil’s SP13-9 male connector directly to PMC-53A via adapter cable, or to extension cable (SP13-9 female-to-male) for longer runs.
 - For I4 metering: uses SP13-4 male connector directly to PMC-53A via adapter cable, or to extension cable (SP13-4 female-to-male) for longer runs.
4. Apply 10-25VDC power supply for the Rogowski coils.

2.10 Communications Wiring

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

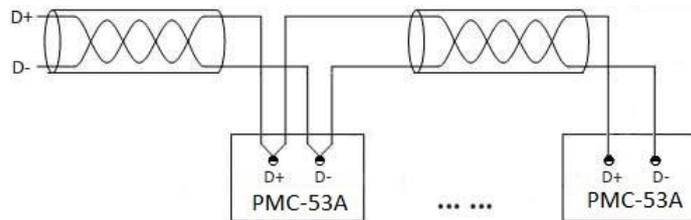


Figure 2-24 Communications Connections

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.

2.11 Digital Input Wiring

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

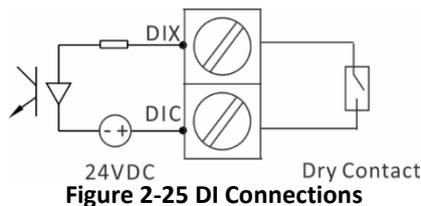


Figure 2-25 DI Connections

2.12 Digital Output Wiring

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

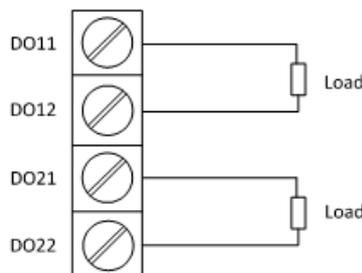


Figure 2-26 DO Connections

2.13 Solid State Relay Wiring

The following figure illustrates the Solid State Relay connections on the PMC-53A:

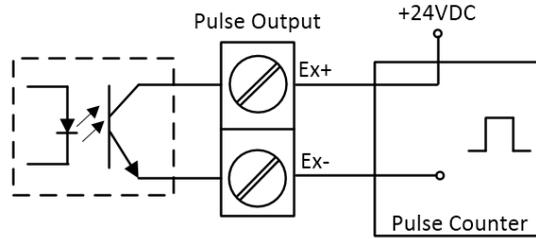


Figure 2-27 Solid State Relay Connections

2.14 Analog Input Wiring

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

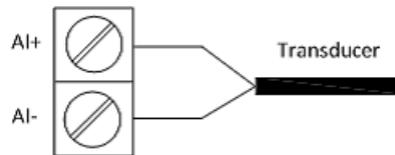


Figure 2-28 AI Connections

2.15 Analog Output Wiring

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



Figure 2-29 AO Connections

2.16 RTD Input Wiring

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

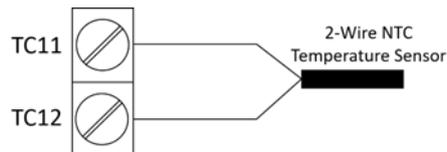


Figure 2-30 RTD Input Connections

2.17 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.

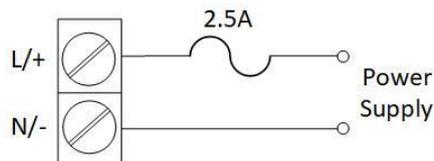


Figure 2-31 Power Supply Connections

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

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 P, Q, S and PF measurements are not available when the **Wiring Mode** is set to 3P3W or 1P2W L-L.

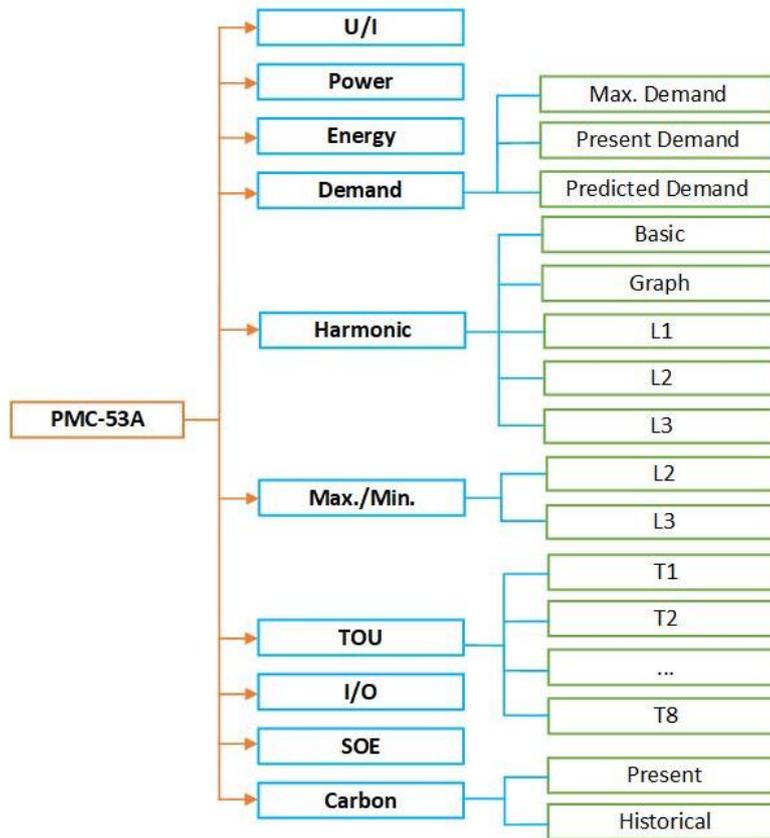


Figure 3-2 Data Display Menu

3.2.1 U/I

Press Button	Display Screens	1 st Row	2 nd Row	3 rd Row	4 th Row
<U/I>	Default	Ullavg	lavg	P	PF
	Display 1 (Voltage L-N)	U1	U2	U3	Ullavg
	Display 2 (Voltage L-L)	U12	U23	U31	Ullavg
	Display 3 (Currents)	I1	I2	I3	lavg
	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 Fund.) [*]	U1 ⁴	U2 ⁴	U3 ⁴	
	Display 17 (I Fund.) [*]	I1 ⁴	I2 ⁴	I3 ⁴	
Display 18 (Loading %) [^]	I1	I2	I3	lavg	

* 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	dPF
	Display 7 (P Fund.)*	P1	P2	P3	P

* Available in Firmware V1.00.03 or later

Table 3-3 Power Display

3.2.3 Energy

Press Button	Display Screens	1 st Row	2 nd Row	3 rd Row	4 th Row
<Energy>	Display 1 (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 (Power)	P	Q	S	
			Timestamp	Timestamp	Timestamp	
		Display 2 (Current)	I1	I2	I3	Iavg~
			Timestamp	Timestamp	Timestamp	Timestamp
	<Pres.> ³	Display 3 (Ull)	Ullavg~			
			Timestamp			
		Display 1 (Power)	P	Q	S	
	<Pred.> ⁴	Display 2 (Current)	I1	I2	I3	Iavg~
		Display 3 (Ull)	Ullavg~			
		Display 1 (Power)	P	Q	S	
		Display 2 (Current)	I1	I2	I3	Iavg~
		Display 3 (Ull)	Ullavg~			

~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 HD03 ~ HD31 Spectrum (Odd)		
		Display 2 ^{1,4}	U1/U12 HD33 ~ HD63 Spectrum (Odd)		
		Display 3 ¹	U2/U23 HD03 ~ HD31 Spectrum (Odd)		
		Display 4 ^{1,4}	U2/U23 HD33 ~ HD63 Spectrum (Odd)		
		Display 5 ¹	U3/U31 HD03 ~ HD31 Spectrum (Odd)		
		Display 6 ^{1,4}	U3/U31 HD33 - HD63 Spectrum (Odd)		
		Display 7 ¹	I1 HD03 ~ HD31 Spectrum (Odd)		
		Display 8 ^{1,4}	I1 HD33 ~ HD63 Spectrum (Odd)		
		Display 9 ¹	I2 HD03 ~ HD31 Spectrum (Odd)		
		Display 10 ^{1,4}	I2 HD33 ~ HD63 Spectrum (Odd)		
		Display 11 ¹	I3 HD03 ~ HD31 Spectrum (Odd)		

		Display 12 ^{1,4}	I3 HD33 ~ HD63 Spectrum (Odd)
	<L1>	Display 1 [HD (ODD)]	HD03 ~ HD15
		Display 2 [HD (ODD)]	HD17 ~ HD29
		Display 3 [HD (ODD)] ⁴	HD31 ~ HD43
		Display 4 [HD (ODD)] ⁴	HD45 ~ HD57
		Display 5 [HD (ODD)] ⁴	HD59 ~ HD63
		Display 6 [HD (Even)]	HD02 ~ HD14
		Display 7 [HD (Even)]	HD16 ~ HD28
		Display 8 [HD (Even)] ⁴	HD30 ~ HD42
		Display 9 [HD (Even)] ⁴	HD44 ~ HD56
		Display 10 [HD (Even)] ⁴	HD58 ~ HD62
	<L2>	Display 1 [HD (ODD)]	HD03 ~ HD15
		Display 2 [HD (ODD)]	HD17 ~ HD29
		Display 3 [HD (ODD)] ⁴	HD31 ~ HD43
		Display 4 [HD (ODD)] ⁴	HD45 ~ HD57
		Display 5 [HD (ODD)] ⁴	HD59 ~ HD63
		Display 6 [HD (Even)]	HD02 ~ HD14
		Display 7 [HD (Even)]	HD16 ~ HD28
		Display 8 [HD (Even)] ⁴	HD30 ~ HD42
		Display 9 [HD (Even)] ⁴	HD44 ~ HD56
		Display 10 [HD (Even)] ⁴	HD58 ~ HD62
	<L3>	Display 1 [HD (ODD)]	HD03 ~ HD15
		Display 2 [HD (ODD)]	HD17 ~ HD29
		Display 3 [HD (ODD)] ⁴	HD31 ~ HD43
		Display 4 [HD (ODD)] ⁴	HD45 ~ HD57
		Display 5 [HD (ODD)] ⁴	HD59 ~ HD63
		Display 6 [HD (Even)]	HD02 ~ HD14
		Display 7 [HD (Even)]	HD16 ~ HD28
		Display 8 [HD (Even)] ⁴	HD30 ~ HD42
		Display 9 [HD (Even)] ⁴	HD44 ~ HD56
		Display 10 [HD (Even)] ⁴	HD58 ~ HD62

* 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 L-N**, **1P2W L-L** or **1P3W**.
- 4) This screen is available in Firmware V2.00.00 or later.

3.2.6 Max./Min.

Press Button		Display Screens	1 st Row	2 nd Row	3 rd Row	4 th Row	
<Max./Min.>	-	Default (Max)	U1	U2	U3	Ulnavg	
			Timestamp	Timestamp	Timestamp	Timestamp	
	<Max.>	<U/I>	Display 1	U1	U2	U3	Ulnavg
				Timestamp	Timestamp	Timestamp	Timestamp
			Display 2	U12	U23	U31	Ullavg
				Timestamp	Timestamp	Timestamp	Timestamp
			Display 3	I1	I2	I3	Iavg
				Timestamp	Timestamp	Timestamp	Timestamp
		Display 4	In	I4	Ir*	Freq	
			Timestamp	Timestamp	Timestamp	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	L1	L2	L3			

			(U THD)	Timestamp	Timestamp	Timestamp		
			Display 2 (I THD)	L1	L2	L3		
			Display 3 (K-Factor)	Timestamp	Timestamp	Timestamp		
			Display 4 (Crest Factor)	L1	L2	L3		
			Display 5 (Unbalance)	Current	Voltage			
			<U/I>	Display 1	U1	U2	U3	Ulnavg
				Display 2	U12	U23	U31	Ullavg
				Display 3	I1	I2	I3	Iavg
				Display 4	In	I4	Ir*	
				Display 5	Freq			
			<Power>	Display 1	P1	P2	P3	P
				Display 2	Q1	Q2	Q3	Q
				Display 3	S1	S2	S3	S
				Display 4	PF1	PF2	PF3	PF
			<Harm.>	Display 1 (U THD)	L1	L2	L3	
				Display 2 (I THD)	Timestamp	Timestamp	Timestamp	
				Display 3 (K-Factor)	L1	L2	L3	
				Display 4 (Crest Factor)	L1	L2	L3	
				Display 5 (Unbalance)	Current	Voltage		

*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	S
	<T2>	Display 1 (kWh)	Imp	Exp	
		Display 2 (kvarh)	Imp	Exp	
		Display 3 (kVAh)	Tot		
		Display 4 (Max. Demand)	P	Q	S
	<T7>	Display 1 (kWh)	Imp	Exp	
		Display 2 (kvarh)	Imp	Exp	
		Display 3 (kVAh)	Tot		
		Display 4 (Max. Demand)	P	Q	S
<T8>	Display 1 (kWh)	Imp	Exp		
	Display 2 (kvarh)	Imp	Exp		
	Display 3 (kVAh)	Tot			
	Display 4 (Max. Demand)	P	Q	S	

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)	AO1 ⁴	AO2 ⁵	
	Display 6 (Temperature)	TC1 ⁶	TC2 ⁶	

Table 3-9 I/O

Notes:

- 1) This display only appears if the meter is equipped with the Expansion Module B B1 option.
- 2) This display only appears if the meter is equipped with the Expansion Module B B1 option.
- 3) This display only appears if the meter is equipped with the Expansion Module B B3 option.
- 4) This display only appears if the meter is equipped with the Expansion Module B B3 or B5 option.
- 5) This display only appears if the meter is equipped with the Expansion Module B B5 option.
- 6) This display only appears if the meter is equipped with the Expansion Module B B2 option.

3.2.9 Carbon Emission

Press button	Display Screens	1 st Row	2 nd Row	3 rd Row	
<Carbon>	<Pres>	Display 1 ² (Carbon Emissions)	This Month	This Year	Total
		Display 2 ³ (Cur Carbon Factors)	Trans Carbon Factors ⁴	Power Carbon Factors ⁴	
	<His ² >	Display 1 to Display 2 (His Month Emiss)	Prev. 1 to Prev. 6 (Last 1 to 6 Monthly Carbon Emissions) Prev. 7 to Prev. 12 (Last 7 to 12 Monthly Carbon Emissions)		
		Display 3 to Display 4 (His Year Emiss)	Prev. 1 to Prev. 6 (Last 1 to 6 Annual Carbon Emissions) Prev. 7 to Prev. 12 (Last 7 to 12 Annual Carbon Emissions)		
	<Graph>	Display 1 (Monthly)	Last 12 Month Graph		
		Display 2 (Annual)	Last 12 Year Graph		

Table 3-9 Carbon Emission

Notes:

- 1) The Carbon Emission displays are available in the Firmware V2.00.02 or later.
- 2) The default unit for **Carbon Emissions** (Pres & His) is KgCO2. When the value exceeds 1000 kg, the unit will switch to tCO2.
- 3) The unit of Carbon Factors is tCO2/MWh.
- 4) Trans Carbon Factors = Transmission & Distribution Lines Carbon Factors
Power Carbon Factors = Load-side Power Generation Equipment Carbon Factors

3.2.10 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	03. Over UIn Setpoint Active 2016/10/28 13:34:08:890 Value: 217.8 V	05. DI6 Active 2016/10/28 11:38:00:316
02. Over Ull Setpoint Active 2016/10/28 13:34:08:890 Value: 378.8 V	04. Power On 2016/10/28 13:34:06:706	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

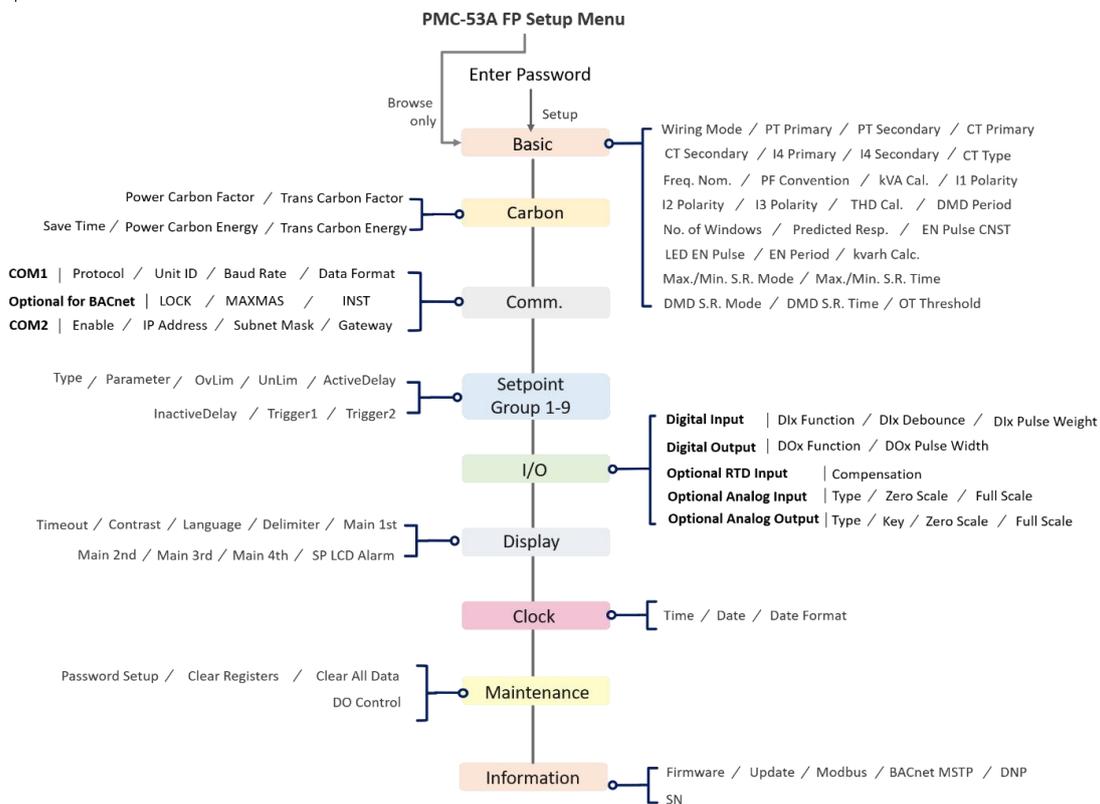


Figure 3-4 Setup Menu

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 1,000,000V	100V
	PT Secondary		PT Secondary Ratio	1 to 690V	100V
	CT Primary		CT Primary Ratio	1 to 30,000A	5A
	CT Secondary		CT Secondary Ratio	1 to 5A	5A
	I4 Primary~		I4 Primary Ratio	1 to 30,000A	5A
	I4 Secondary~		I4 Secondary Ratio	1 to 5A	5A
	CT Type ¹		External CT Types	100A SCCT/200A SCCT/400A SCCT/800A SCCT/1600A SCCT 400A RC/1200A RC 2500A RC/5000A RC	-
	Freq. Nom.		Frequency Nominal	50Hz/60Hz	50Hz
	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 ¹⁵	10/100/1000/3200/5000 10000/25000	3200
	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
	Max/Min S.R. Mode ¹⁶		Self-Read Mode to Max./Min. Log	Auto/Manual	Manual
	Max/Min S.R. Time ¹⁶		Self-Read Time to Max./Min. Log	Disabled if the Max/Min S.R. Mode is Manual .	--D--H
	DMD SR Mode		Self-Read Mode to Max. Demand	Auto/Manual	Manual
	DMD SR Time		Self-Read Time to Max. Demand	Disabled if the DMD S.R. Mode is Manual .	--D--H
	OT Threshold~		Current Threshold of Device Operating Time	1 to 1000 (x0.001In)	1
Carbon ¹⁷					
	Trans Carbon Factor		Carbon Emission Factor of the Transmission & Distribution Lines	0 to 20000 (x0.0001 tCO2/MWh)	5703
	Power Carbon Factor		Carbon Emission Factor of the Load-side Power Generation Equipment	0 to 20000 (x0.0001 tCO2/MWh)	5703
	Trans Carbon Energy		Associated Energy of the Transmission & Distribution Lines	kWh Imp., kWh Exp.	kWh Imp.
	Power Carbon Energy		Associated Energy of the Load- side Power Generation Equipment	kWh Imp., kWh Exp.	kWh Exp.
	Save Time		Self-read date of Monthly Carbon Emission logs	1 to 28	1
Comm.					
COM1					
	Protocol		Protocol	Modbus/BACnet*/N2*/DNP~	Modbus
	Unit ID		Modbus Address	Modbus RTU/N2*: 1 to 247 BACnet MS/TP*: 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 ²	Object_Identifier	0 to 4194302	26001
MAXMAS ²	Maximum number of Master	1 to 127	127
LOCK ²	Disable communication	Yes/No	Yes
COM2			
Protocol	Protocol	Modbus, Profibus ¹⁵	Modbus
When Protocol is set to Modbus			
Unit ID	Modbus Address	1 to 247	101
Baud Rate	Data rate in bits per second (bps)	1200/2400/4800 9600/19200/38400 57600/115200 ¹⁸	9600
Data Format	Data Format	8N2/8O1/8E1/8N1/8O2/8E2	8E1
When Protocol is set to Profibus			
Unit ID	Profibus Address	1 to 125	1
Baud Rate	Date Rate (kbps)	9.6/19.2/45.45/93.75/187.5 500/1500	1500
Data Format	Data Format (Read Only)	8E1	8E1
Setpoint*			
Group #1			
Type	Setpoint Type	0=Disabled, 1=Over Setpoint 2=Under Setpoint	0
Parameter ³	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 ⁴	Setpoint Trigger1	See Table 3-12	
Trigger2 ⁴	Setpoint Trigger2	See Table 3-12	
...			
Group #9			
Type	Setpoint Type	0=Disabled, 1=Over Setpoint 2=Under Setpoint	0
Parameter ³	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
Trigger 1 ⁴	Setpoint Trigger1	See Table 3-12	
Trigger 2 ⁴	Setpoint Trigger2	See Table 3-12	
I/O			
Digital Input			
Function			
DI1	Function Mode for DI1 to DI6	Digital Input Pulse Counter Tariff Switch ⁵	Digital Input
...			
DI5 ⁶			
DI6 ⁶			
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 ⁶			
DI6 ⁶			
Pulse Weight ⁴	Specifies the incremental value for each pulse received		
DI1	Pulse Weight for DI1 to DI6	1 to 1000000	1
...			
DI5 ⁶			
DI6 ⁶			
Digital Output			
Function			
DO1 Function ^{6,7#}	DO Control Mode	<ul style="list-style-type: none"> ▪ Digital Output ▪ kWh Import ▪ kWh Export ▪ kWh Total ▪ kvarh Import ▪ kvarh Export 	Digital Output
DO2 Function ^{6,7#}			
DO3 Function ^{6,7}			
DO4 Function ^{6,7}			

		■ kvarh Total	
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 6000 (x0.1s) (0=Latch Mode)	0
DO2 Pulse Width			
DO3 Pulse Width ⁶			
DO4 Pulse Width ⁶			
RTD Params ⁶			
RTD1 Compensation	RTD Compensation ⁸	0 to 2000 (x0.01Ω)	0.00Ω
RTD2 Compensation			
Analog Input ⁶			
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 ⁶			
AOx Type	Select between 0-20mA or 4-20mA output	4-20mA / 0-20mA	4-20mA
AOx Key ⁹	The parameter to which the Analog Output is proportional	See Table 3-13	U12
AOx Zero Scale	The parameter value that corresponds to the minimum Analog Output of 0 mA or 4 mA	-999,999 to 999,999	0
AOx 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	2
Language	System Language	Chinese/English	English
Delimiter ¹⁰	Delimiter	Option1/Option2	Option1
Main 1st*	Default Display 1 st parameter	See Note 10)	Ullavg
Main 2nd*	Default Display 2 nd parameter		lavg
Main 3rd*	Default Display 3 rd parameter		P (kW Total)
Main 4th*	Default Display 4 th parameter		PF (PF Total)
SP LCD Alarm ^{~12}	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 ¹³	Clear Present Energy Measurements and Energy Log	Yes/No	No
History ¹⁴	Clear Historical Monthly Energy Log	Yes/No	No
Demand			
Present Max	Clear Max. Demand Log of This Month (or Since Last Reset)	Yes/No	No
All	Clear Present Demand, Max. Demand Log of This Month & Last Month (or Since Last Reset & Before Last Reset)	Yes/No	No
Max/Min			
Present	Clear Max./Min. Log of This Month (or Since Last Reset)	Yes/No	No
All	Clear Max./Min. Log of This Month & Last Month (or Since Last Reset & 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 ⁶			
DI6 ⁶			
SOE Logs*			
	Clear SOE Logs		
Clear SOE	Clear All SOE Logs	Yes/No	No
Clear All Data			
-	Clear All of the above	Yes/No	No
DO Control			
DO1 ⁶	DOx Manual Control	Normal/ON/OFF	Normal
DO2 ⁶			
DO3 ⁶			
DO4 ⁶			
Information			
	Check meter information		
Firmware	Firmware Version	e.g. V1.00.01	
Update	Date of the latest firmware update	e.g. 20160701	
Modbus	Modbus Protocol Version	e.g. V1.4	
BACnet MSTP*	BACnet MS/TP 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	

* 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:

- The **CT Type** is available in Firmware V2.00.01 or later and will only be displayed when the Input Current Option is "4" for use with SCCTs or Rogowski Coils at 40mA secondary.
When the Input Current option is "4", the the **CT Primary** and **CT Secondary** will be set automatically according to the configured **CT Type**. The **CT Primary** value is set to the Primary Input of the selected Split-Core CT (for example, 100A for 100A SCCT) or Rogowski Coil (for example, 1200A for 1200A RC), and the **CT Secondary** is fixed at 100.
- INST**, **MAXMAS** and **LOCK** parameters are only available when the COM1's Protocol is set to **BACnet**.
- 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			
6	P (kW Total)			
7	Q (kvar Total)			
8	S (kVA Total)			
9	PF (PF Total)			
10	P DMD (kW Total Present Demand)			
11	Q DMD (kvar Total Present Demand)			
12	S DMD (kVA Total Present Demand)			
13	P DMD Pred. (kW Total Predicted Demand)			
14	Q DMD Pred. (kvar Total Predicted Demand)			
15	S DMD Pred. (kVA Total Predicted Demand)			
16	U THD	100%		
17	U TOHD			
18	U TEHD			
19	I THD			
20	I TOHD			
21	I TEHD			
22	U Unbal. (Voltage Unbalance)			
23	I Unbal. (Current Unbalance)			
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 (Negative Sequence)~	x1	V
32	U0 (Zero Sequence)~		

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

Table 3-11 Setpoint Parameters

- 4) The table below lists the which combinations of **Basic Function** and **Expansion Module B** will make the following options of Setpoint Trigger are available. Please refer to **Appendix H Ordering Guide** for details.

Basic Function	Expansion Module B	0	1	2	3	4
		None	DO1 Closed	DO2 Closed	DO3 Closed	DO4 Closed
1/2/3/B	None	■	--	--	--	--
A	B1	■	■	■	■	■
A	B2/B3/B5/None	■	■	■	--	--
1/2/3/B	B1	■	■	■	--	--

■ Available -- Unavailable

Table 3-12 Setpoint Trigger

- 5) **Tariff Switching** is available in Firmware V1.00.03 or later and only valid for DI1 to DI3.
 6) This menu only appears if the meter is equipped with the corresponding options.
 7) For the DO (Mechanical Relay), the **DOx Function** should be set to **Digital Output**.
 For the SS Pulse Output, the **DOx Function** can be set to **kWh/kvarh Import/Export/Total** and cannot be set to **Digital Output**.
 8) Please refer to **Chapter 4.1.6** for a detailed description of RTD Compensation.
 9) 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, P, Q, S 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	Ullavg		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	Iavg		A	17	U2		V	
8	P		x1	kW	18		U3	V
9	Q			kvar	19		Ulnavg	V

Table 3-13 Analog Output Parameters

- 10) 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).
 11) 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	Iavg	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	Ulnavg	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	P Demand	38	I2 Load~
6	U31 (Uca)	17	kWh Import	28	Q Demand*	39	I3 Load~
7	Ullavg	18	kWh Export	29	S Demand*	40	Iavg Load~
8	I1 (Ia)	19	kWh Total	30	Fund. P 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

- 12) 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.
 13) 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.
 14) Select **History** to clear the Monthly Energy Log of the last 1 to 12 months, excluding the Monthly Energy Log for the Present Month.

- 15) The constants 5000, 10000 and 25000 are supported from the firmware V2.00.00 and the constants 10 and 100 are supported from the firmware V2.00.01.
- 16) This is available in Firmware V2.00.01 or later.
- 17) This is available in Firmware V2.00.02 or later.
- 18) COM2 supports Modbus baud rates of 57600 and 115200 in Firmware V2.00.02 or later.

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 9999 (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 Mechanical 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 optional equipped with two 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 10/100/1000/3200/5000/10000/25000 pulses per kWh or kvarh through the **EN Pulse CNST** setup parameter. The constants 5000, 10000 and 25000 are supported from the firmware V2.00.00 and the constants 10 and 100 are supported from the firmware V2.00.01.

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 or two Analog Outputs 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 Loading Factor ^{1^}	●	●	●		●
P	●	●	●	●	-
Q	●	●	●	●	-
S	●	●	●	●	-
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 Loading Factor is listed as below:

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

Where *I* indicates *Ia*, *Ib*, *Ic* or *I avg* for *Ia* Loading Factor, *Ib* Loading Factor, *Ic* Loading Factor and *I avg* Loading 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 kvarh of Q1/Q2/Q3/Q4
	kVAh Total kVAh Total of TOU T1-8
Per-Phase Energy (Phase A/B/C):	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, kvarh 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, P Total, Q Total and S Total as well as P Total, Q Total and S 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 P Total, Q total and S 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 Mode/Time	<p>The DMD SR Mode and DMD SR Time are used to specify the mode and specific time and day of the month for the Max./Min. Self-Read operation.</p> <ul style="list-style-type: none"> ▪ Setting DMD SR Mode to a specific value means automatic self-read operation: <ul style="list-style-type: none"> ▪ A zero value means that the Self-Read will take place at 00:00 of the first day of each month. ▪ A non-zero value means that the Self-Read will take place at a specific time and day based on the formula: Self-Read Time = (Day x 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. ▪ Setting DMD SR Mode to 0xFFFF value means the automatic self-read operation is disabled and the log will be transferred manually. 	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 Carbon Emission

Carbon emissions, primarily in the form of carbon dioxide (CO2), are the leading cause of climate change, necessitating urgent global action to reduce them. For the electric power sector, the carbon emissions are mainly generated during electricity generation, transmission and distribution (T&D) line, as well as load-side consumption. The latter covers two core energy flows: electricity drawn from the public grid and electricity generated by on-site distributed generation (DG) systems.

The universal carbon emission calculation formula: $E=AD \times EF$

Where E = Carbon Emissions, AD = Activity Data and EF = Emission Factor.

Therefore, $E_{total}=E_{forward} \times EF_{grid} + E_{reverse} \times EF_{onsite}$

When no DG systems are installed at the load side, the cumulative value of reverse active energy ($E_{reverse}$) is automatically recorded as 0 MWh by the device.

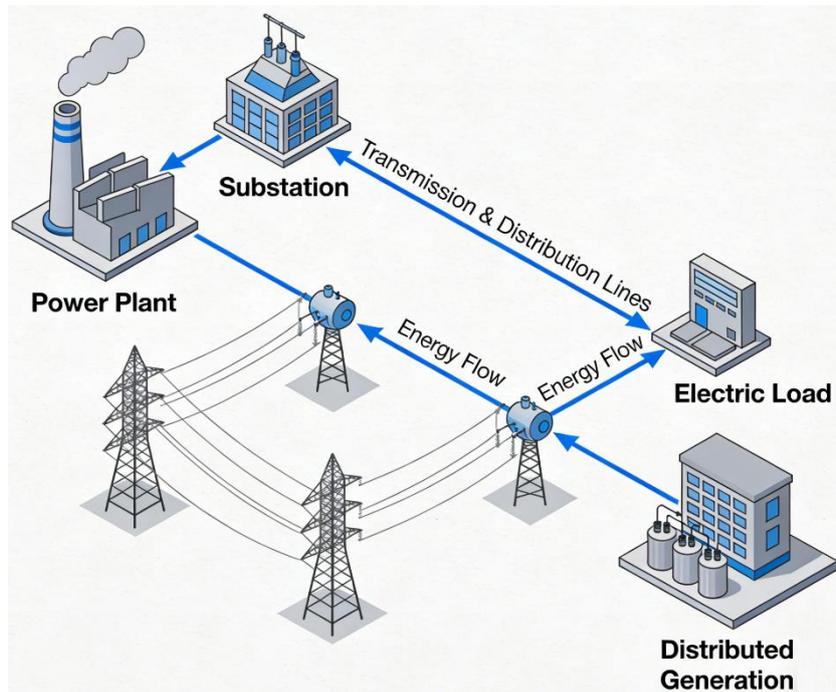


Figure 4-1 Electric Power System Carbon Emission Measurement Model

The PMC-53A with Firmware V2.00.02 features the carbon emission metering function that provides carbon emission measurements for This Month & This Year & Total Cumulative, and supports the storage of up to 12 monthly and 12 annual historical Carbon Emission logs. Both real-time carbon emission measurements and historical carbon emission logs can be retrieved from the Front Panel or through communications.

The PMC-53A provides the following carbon emission setup parameters can be programmed via the Front Panel or through communications:

Setup Parameter	Definition	Options, Default*
T&D Line Carbon Factor	Specifies Carbon Emission Factor of the Transmission & Distribution Lines.	0 to 20000, 5703* (x0.0001 tCO ₂ /MWh)
Power Carbon Factor	Specifies Carbon Emission Factor of the Load-side Power Generation Equipment.	0 to 20000, 5703* (x0.0001 tCO ₂ /MWh)
T&D Line Carbon Energy	Specifies associated Energy of the Transmission & Distribution Lines.	0=kWh Imp.* 1=kWh Exp.
Power Carbon Energy	Specifies associated Energy of the Load-side Power Generation Equipment.	0=kWh Imp., 1=kWh Exp.*
Self-Read Date of Monthly Carbon Emissions	Self-read date of Monthly Carbon Emission logs	1* to 28

Table 4-5 Carbon Emission Setup

4.4 Power Quality

4.4.1 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°.

4.4.2 Power Quality Parameters

The PMC-53A provides the following PQ parameters:

4.4.2.1 Harmonics

The PMC-53A provides harmonic analysis for THD, TOHD, TEHD and individual harmonics up to the 63rd order. The harmonics of 32nd to 63rd orders are available in the Firmware V2.00.00 or later. 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.

4.4.2.2 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

4.4.2.3 K-Factor

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

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

where

I_h = h^{th} Harmonic Current in RMS

h_{\max} = Highest harmonic order

4.4.2.4 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
	63 rd Harmonics	63 rd Harmonics	63 rd 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
	63 rd Harmonics	63 rd Harmonics	63 rd Harmonics

Table 4-6 Harmonic Measurements

4.4.3 Unbalance

The PMC-53A provides Voltage and Current Unbalance measurements. The calculation method of Voltage and Current Unbalances are listed below:

$$\text{Voltage Unbalance} = \frac{V2}{V1} \times 100\% \qquad \text{Current Unbalance} = \frac{I2}{I1} \times 100\%$$

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.

4.4.4 Frequency Deviation and Voltage Deviation

The PMC-53A with Firmware V2.00.00 or later is capable of measuring **Frequency Deviation** and **Voltage Deviation**. The **Deviation** measurement can be accessed through communications.

The PMC-53A computes **Freq. Deviation** as per below:

$$\text{Freq. Deviation} = f - f_{\text{nominal}}$$

where f_{nominal} is the Nominal Frequency

The PMC-53A provides the ability to capture **Voltage Deviation** as per below:

For the ULN:

If $U_{pu} < 100$

ULN Under Deviation = $100 - U_{pu}$

ULN Over Deviation = 0

If $U_{pu} > 100$

ULN Under Deviation = 0

ULN Over Deviation = $100 - U_{pu}$

where $U_{pu} = \frac{100 \cdot U_{ln} \cdot \sqrt{3}}{U_n}$

For the ULL:

If $U_{pu} < 100$

ULL Under Deviation = $100 - U_{pu}$

ULL Over Deviation = 0

If $U_{pu} > 100$

ULL Under Deviation = 0

ULL Over Deviation = $100 - U_{pu}$

where $U_{pu} = \frac{100 \cdot U_{ll}}{U_n}$

4.5 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.

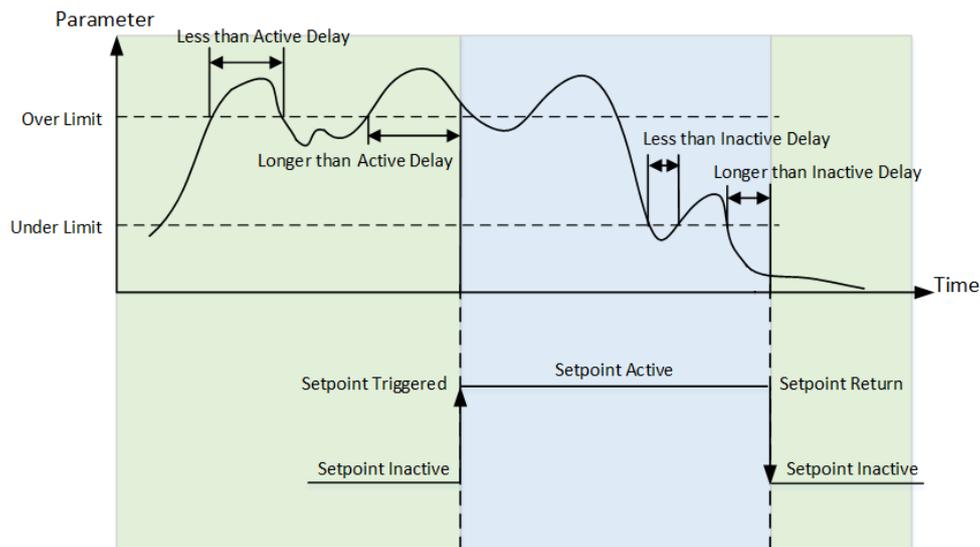


Figure 4-2 Over Setpoint

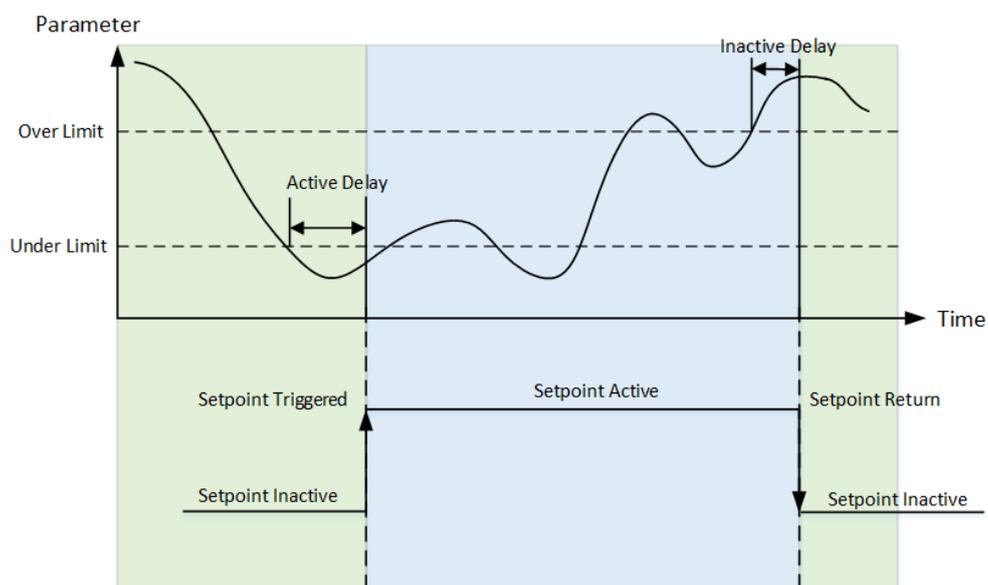


Figure 4-3 Under Setpoint

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 9999s 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 4-7 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 (P Total Present Demand)		W
11	Q DMD (Q Total Present Demand)		var
12	S DMD (S Total Present Demand)		VA
13	P DMD Pred (P Total Predicted Demand)		W
14	Q DMD Pred (Q Total Predicted Demand)		var

15	S DMD Pred (S 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*		
29	RTD2*	x1	°C
30	Ir (Residual Current)~	x1	A
31	U2 (Negative Sequence)~		
32	U0 (Zero Sequence)~	x1	V

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

~ Available in Firmware V1.00.06 or later

Table 4-8 Setpoint Parameters

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

Table 4-9 Setpoint Triggers

Only when **DOx Mode** is set to **Digital Output** would setting the **Setpoint Trigger** to **DOx Closed** valid. In addition, the table below lists the which combinations of **Basic Function** and **Expansion Module B** will make DOx Closed is available. Please refer to **Appendix H Ordering Guide** for details.

Basic Function	Expansion Module B	DO1 Closed	DO2 Closed	DO3 Closed	DO4 Closed
A	B1	■	■	■	■
A	B2/B3/B5/None	■	■	--	--
1/2/3/B	B1	■	■	--	--

■ Available -- Unavailable

Table 4-10 Available DO Triggers

4.6 Logging

4.6.1 Max./Min. Log

The PMC-53A records the **Max. Log** and **Min. Log** of This Month & Last Month (or Since Last Reset & Before Last Reset) with timestamp for 46 parameters. Each log includes the relevant parameter value and its timestamp. The recorded data is stored in non-volatile memory and will not suffer any loss in the event of a power failure. The PMC-53A's Max./Min. Log records the following parameters:

Max./Min. Parameters					
Ia	Ib	Ic	I avg	Uan	Ubn
Ucn	ULN avg	Uab	Ubc	Uca	ULL avg
Pa	Pb	Pc	P Total	Qa	Qb
Qc	Q Total	Sa	Sb	Sc	S 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 4-11 Max./Min. Log

The **Max/Min SR Mode** and **Max/Min SR Time** are used to specify the mode and specific time and day of the month for the Max./Min. Self-Read operation.

- Setting **Max/Min SR Mode** to a specific value means automatic self-read operation:
 - 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.

- Setting **Max/Min SR Mode** to 0xFFFF value means the automatic self-read operation is disabled and the log will be transferred manually.

The Max./Min. Log of This Month can be reset manually from the Front Panel or via communications.

4.6.2 Max. Demand Log

The PMC-53A records the **Max. Demand** of This Month & Last Month (or Since Last Reset & 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 & Last Month (or Since Last Reset & 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)
	P Total
	Q Total
	S Total
	P Total for TOU Tariffs 1 to 8
	Q Total for TOU Tariffs 1 to 8
	S Total for TOU Tariffs 1 to 8

Table 4-12 Max. Demand Log

4.6.3 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 4-13 Energy Measurements for each Monthly Energy Log Record

4.6.4 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 P Total, Q Total and S Total	60
Monthly Freeze	kWh Total, kvarh Total, kVAh Total Max. Demands for P Total, Q Total and S Total with Timestamp	36

Table 4-14 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.

4.6.5 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.

4.6.6 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 4-15 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.

4.7 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 4-16 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 any time of day 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 any day
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 4-17 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: P/Q/S of This Month & Last Month (or Since Last Reset & Before Last Reset).

TOU data is available through the front panel and communications.

4.8 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
- P 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
- P is P Import, which means the P is over 0
- 3P4W wiring mode supports all detections
- 3P3W wiring mode does not support the detection of Voltage Phase Loss, P 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 P Total may be abnormal (3P4W or 3P3W)
B09	Negative Pa is may be abnormal (3P4W only)
B10	Negative Pb may be abnormal (3P4W only)
B11	Negative Pc 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 4-18 Wiring Diagnostic Register

4.8.1 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).

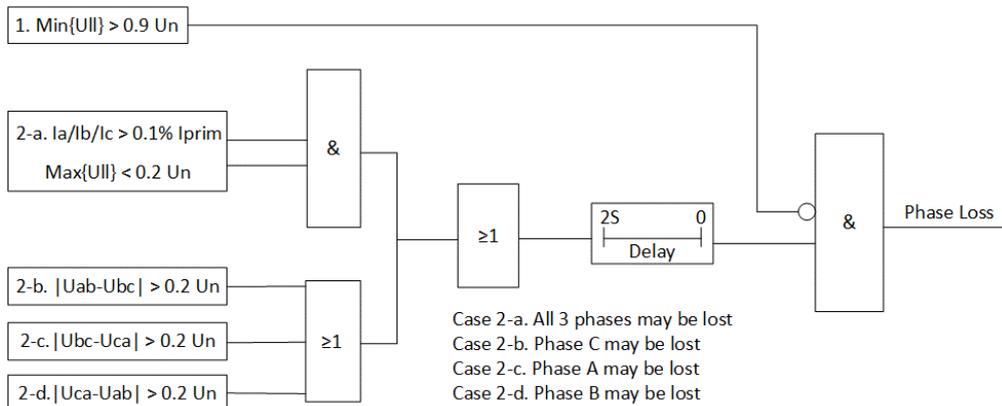


Figure 4-4 Voltage Phase Loss Logic

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.

4.8.2 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.

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

Chapter 5 Modbus Register Map

This chapter provides a complete description of the Modbus register map (**Protocol Version 2.2**) 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			
0014	RO	ULL avg	Float			
0016	RO	Ia	Float		A	
0018	RO	Ib	Float			
0020	RO	Ic	Float			
0022	RO	I avg	Float			
0024	RO	Pa	Float		W	
0026	RO	Pb	Float			
0028	RO	Pc	Float			
0030	RO	P Total	Float			
0032	RO	Qa	Float		var	
0034	RO	Qb	Float			
0036	RO	Qc	Float			
0038	RO	Q Total	Float			
0040	RO	Sa	Float		VA	
0042	RO	Sb	Float			
0044	RO	Sc	Float			
0046	RO	S 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	AO1 ¹	Float		-
0092	RO	AO2 ¹	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	Pa Fundamental	Float		
0114	RO	Pb Fundamental	Float		
0116	RO	Pc Fundamental	Float	x1	W
0118	RO	P Total Fundamental	Float		
0120	RO	P Total Harmonic	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		
0152	RO	Ubn/Ubc Fundamental* ⁹	Float	x1	V
0154	RO	Ucn/Uca Fundamental* ⁹	Float		
0156	RO	Ia Fundamental*	Float		
0158	RO	Ib Fundamental* ⁹	Float	x1	A
0160	RO	Ic Fundamental* ⁹	Float		
0162	RO	U1 (Positive Sequence Voltage)* ¹⁰	Float		
0164	RO	U2 (Negative Sequence Voltage)* ¹⁰	Float	x1	V
0166	RO	U0 (Zero Sequence Voltage)* ¹⁰	Float		
0168	RO	I1 (Positive Sequence Current)* ¹⁰	Float		
0170	RO	I2 (Negative Sequence Current)* ¹⁰	Float		
0172	RO	I0 (Zero Sequence Current)* ¹⁰	Float	x1	A
0174	RO	Ir (Residual Current) [#]	Float		
0176	RO	Ung (Calculated) ¹¹	Float	x1	V
0178	RO	Ia Loading Factor [^]	Float	-	
0180	RO	Ib Loading Factor [^]	Float	-	
0182	RO	Ic Loading Factor [^]	Float	-	1 means 100%
0184	RO	I avg Loading Factor [^]	Float	-	
0186	RO	This Month Carbon Emission ¹²	Float		
0188	RO	This Year Carbon Emission ¹²	Float	x1	kgCO2
0190	RO	Total Cumulative Carbon Emission ¹²	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, AO1, AO2, 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 P Total may be abnormal (3P4W or 3P3W)
B09	Negative Pa is may be abnormal (3P4W only)
B10	Negative Pb may be abnormal (3P4W only)
B11	Negative Pc 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.
- 12) The Carbon Emission measurements are available in Firmware V2.00.02 or later.

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		
0520	RW	kvarh Q2	INT32		
0522	RW	kvarh Q3	INT32		
0524	RW	kvarh Q4	INT32		kvarh
0526	RW	kWh Import of T1	INT32		
0528	RW	kWh Export of T1	INT32		
0530	RW	kvarh Import of T1	INT32		
0532	RW	kvarh Export of T1	INT32		kVAh
0534	RW	kVAh of T1	INT32		
0536	RW	kWh Import of T2	INT32		kWh
0538	RW	kWh Export of T2	INT32		

0540	RW	kvarh Import of T2	INT32		kvarh
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		kWh
0550	RW	kvarh Import of T3	INT32		kvarh
0552	RW	kvarh Export of T3	INT32		kvarh
0554	RW	kVAh of T3	INT32		kVAh
0556	RW	kWh Import of T4	INT32		kWh
0558	RW	kWh Export of T4	INT32		kWh
0560	RW	kvarh Import of T4	INT32		kvarh
0562	RW	kvarh Export of T4	INT32		kvarh
0564	RW	kVAh of T4	INT32		kVAh
0566	RW	kWh Import of T5	INT32		kWh
0568	RW	kWh Export of T5	INT32		kWh
0570	RW	kvarh Import of T5	INT32		kvarh
0572	RW	kvarh Export of T5	INT32		kvarh
0574	RW	kVAh of T5	INT32		kVAh
0576	RW	kWh Import of T6	INT32		kWh
0578	RW	kWh Export of T6	INT32		kWh
0580	RW	kvarh Import of T6	INT32		kvarh
0582	RW	kvarh Export of T6	INT32		kvarh
0584	RW	kVAh of T6	INT32		kVAh
0586	RW	kWh Import of T7	INT32		kWh
0588	RW	kWh Export of T7	INT32		kWh
0590	RW	kvarh Import of T7	INT32		kvarh
0592	RW	kvarh Export of T7	INT32		kvarh
0594	RW	kVAh of T7	INT32		kVAh
0596	RW	kWh Import of T8	INT32	kWh	
0598	RW	kWh Export of T8	INT32	kWh	
0600	RW	kvarh Import of T8	INT32	kvarh	
0602	RW	kvarh Export of T8	INT32	kvarh	
0604	RW	kVAh of T8	INT32	kVAh	

Table 5-4 3-phase Total Energy Measurements

5.2.2 Phase A (L1) Energy Measurements

Register	Property	Description	Format	Scale	Unit
0620	RW	kWh Import	INT32	x0.1	kWh
0622	RW	kWh Export	INT32		
0624	RO	kWh Net	INT32		
0626	RO	kWh Total	INT32		
0628	RW	kvarh Import	INT32		kvarh
0630	RW	kvarh Export	INT32		
0632	RO	kvarh Net	INT32		
0634	RO	kvarh Total	INT32		
0636	RW	kVAh	INT32		kVAh
0638	RW	kvarh Q1	INT32		kWh
0640	RW	kvarh Q2	INT32		
0642	RW	kvarh Q3	INT32		
0644	RW	kvarh Q4	INT32		
0646	RW	kWh Import of T1	INT32		kvarh
0648	RW	kWh Export of T1	INT32		
0650	RW	kvarh Import of T1	INT32		
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		
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		
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		
0682	RW	kvarh Export of T4	INT32		kvarh
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		
0742	RW	kWh Export	INT32		kWh
0744	RO	kWh Net	INT32		
0746	RO	kWh Total	INT32		
0748	RW	kvarh Import	INT32		
0750	RW	kvarh Export	INT32		kvarh
0752	RO	kvarh Net	INT32		
0754	RO	kvarh Total	INT32		
0756	RW	kVAh	INT32		kVAh
0758	RW	kvarh Q1	INT32		
0760	RW	kvarh Q2	INT32		kvarh
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		kvarh
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		kvarh
0962	RW	kvarh Export of T8	INT32		
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		
1334	RO	Uan Over Deviation ¹	Float		
1336	RO	Ubn Over Deviation ¹	Float		
1338	RO	Ucn Over Deviation ¹	Float		
1340	RO	Uan Under Deviation ¹	Float		
1342	RO	Ubn Under Deviation ¹	Float		
1344	RO	Ucn Under Deviation ¹	Float		
1346	RO	Uab Over Deviation ¹	Float		
1348	RO	Ubc Over Deviation ¹	Float		
1350	RO	Uca Over Deviation ¹	Float		
1352	RO	Uab Under Deviation ¹	Float		
1354	RO	Ubc Under Deviation ¹	Float		
1356	RO	Uca Under Deviation ¹	Float		
1358	RO	Frequency Deviation ¹	Float		

Table 5-10 Power Quality Measurements

Notes:

- 1) The Voltage and Frequency Deviation are available in the Firmware V2.00.00 or later.
 When the Wiring Mode is **1P2W L-N**, only Uan under/over deviation are available, others would be 0.
 When the Wiring Mode is **1P2W L-L**, only Uab under/over deviation are available, others would be 0.
 When the Wiring Mode is **1P3W**, only Uan/Ubn/Uab under/over deviation are available, others would be 0.
 When the Wiring Mode is **3P3W**, only Uab/Ubc/Uca under/over deviation are available, others would be 0.

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		
1800	RO	Ia HD32 ¹	Float		
1802	RO	Ib HD32 ¹	Float		
1804	RO	Ic HD32 ¹	Float		
1806~1984	RO	...	Float		
1986	RO	Ia HD63 ¹	Float		
1988	RO	Ib HD63 ¹	Float		
1990	RO	Ic HD63 ¹	Float		

Table 5-11 Current Harmonic Measurements

Notes:

- 1) The Current HD32 to HD63 are available in the Firmware V2.00.00 or later.

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		
2000	RO	Uan/Uab HD32 ¹	Float		
2002	RO	Ubn/Ubc HD32 ¹	Float		
2004	RO	Ucn/Uca HD32 ¹	Float		
2006~2184	RO	...	Float		
2186	RO	Uan/Uab HD63 ¹	Float		
2188	RO	Ubn/Ubc HD63 ¹	Float		
2190	RO	Ucn/Uca HD63 ¹	Float		

Table 5-12 Voltage Harmonic Measurements

Notes:

- 1) The Voltage HD32 to HD63 are available in the Firmware V2.00.00 or later.
- 2) 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.
- 3) 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	P Total	Float	x1	W
3008	RO	Q Total	Float	x1	var
3010	RO	S 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	P Total	Float	x1	W
3208	RO	Q Total	Float	x1	var
3210	RO	S 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	P Total			W
3424~3429	RO	Q Total			var
3430~3435	RO	S Total			VA
3436~3441	RO	P Total of T1			W
3442~3447	RO	Q Total of T1			var
3448~3453	RO	S Total of T1			VA
3454~3459	RO	P Total of T2			W
3460~3465	RO	Q Total of T2			var
3466~3471	RO	S Total of T2			VA
3472~3477	RO	P Total of T3			W
3478~3483	RO	Q Total of T3			var
3484~3489	RO	S Total of T3			VA
3490~3495	RO	P Total of T4			W
3496~3501	RO	Q Total of T4			var
3502~3507	RO	S Total of T4			VA
3508~3513	RO	P Total of T5			W
3514~3519	RO	Q Total of T5			var
3520~3525	RO	S Total of T5			VA
3526~3531	RO	P Total of T6			W
3532~3537	RO	Q Total of T6			var

3538~3543	RO	S Total of T6			VA
3544~3549	RO	P Total of T7			W
3550~3555	RO	Q Total of T7			var
3556~3561	RO	S Total of T7			VA
3562~3567	RO	P Total of T8			W
3568~3573	RO	Q Total of T8			var
3574~3579	RO	S 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	P Total					W
3624~3629	RO	Q Total					var
3630~3635	RO	S Total					VA
3636~3641	RO	P Total of T1					W
3642~3647	RO	Q Total of T1					var
3648~3653	RO	S Total of T1					VA
3654~3659	RO	P Total of T2					W
3660~3665	RO	Q Total of T2					var
3666~3671	RO	S Total of T2					VA
3672~3677	RO	P Total of T3					W
3678~3683	RO	Q Total of T3					var
3684~3689	RO	S Total of T3					VA
3690~3695	RO	P Total of T4					W
3696~3701	RO	Q Total of T4					var
3702~3707	RO	S Total of T4					VA
3708~3713	RO	P Total of T5					W
3714~3719	RO	Q Total of T5					var
3720~3725	RO	S Total of T5					VA
3726~3731	RO	P Total of T6					W
3732~3737	RO	Q Total of T6					var
3738~3743	RO	S Total of T6					VA
3744~3749	RO	P Total of T7					W
3750~3755	RO	Q Total of T7					var
3756~3761	RO	S Total of T7					VA
3762~3767	RO	P Total of T8					W
3768~3773	RO	Q Total of T8					var
3774~3779	RO	S 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)

5.5.5 Demand Data Structure

Offset		Description	Format	Range
+0	High	Year - 2000	UINT16	0 to 99
	Low	Month		1 to 12
+1	High	Day	UINT16	1 to 31
	Low	Hour		0 to 23
+2	High	Minute	UINT16	0 to 59
	Low	Second		0 to 59
+3	-	Millisecond	UINT16	0 to 999
+4~+5	-	Max. Demand Value	Float	

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					
4042~4047	RO	ULL avg					
4048~4053	RO	Ia				x1	A
4054~4059	RO	Ib					
4060~4065	RO	Ic					
4066~4071	RO	I avg		x1	W		
4072~4077	RO	Pa					
4078~4083	RO	Pb					
4084~4089	RO	Pc					
4090~4095	RO	P Total		x1	var		
4096~4101	RO	Qa					
4102~4107	RO	Qb					
4108~4113	RO	Qc					
4114~4119	RO	Q Total					
4120~4125	RO	Sa				x1	VA
4126~4131	RO	Sb					
4132~4137	RO	Sc					
4138~4143	RO	S Total				x1	-
4144~4149	RO	PFa					
4150~4155	RO	PFb					
4156~4161	RO	PFc		x1	Hz		
4162~4167	RO	PF Total					
4168~4173	RO	Frequency		x1	A		
4174~4179	RO	In (Calculated)		x1			
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	x1	A			
4258~4263	RO	Current Unbalance					
4264~4269	RO	I4					
4270~4275	RO	Ir* (Residual Current)					

* Available in Firmware V1.00.06 or later

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

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

Register	Property	Description	Format	Scale	Unit
4300~4305	RO	Uan	See 5.6.5 Max./Min. Log Structure	x1	V
4306~4311	RO	Ubn			
4312~4317	RO	Ucn			
4318~4323	RO	ULN 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	Pa	x1	W
4378~4383	RO	Pb		
4384~4389	RO	Pc		
4390~4395	RO	P Total		
4396~4401	RO	Qa	x1	var
4402~4407	RO	Qb		
4408~4413	RO	Qc		
4414~4419	RO	Q Total		
4420~4425	RO	Sa	x1	VA
4426~4431	RO	Sb		
4432~4437	RO	Sc		
4438~4443	RO	S 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	x1	A
4570~4575	RO	Ir* (Residual Current)		

* Available in Firmware V1.00.06 or later

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

5.6.3 Max. Log of 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		x1	A
4630~4635	RO	Ubc			
4636~4641	RO	Uca			
4642~4647	RO	ULL avg			
4648~4653	RO	Ia		x1	W
4654~4659	RO	Ib			
4660~4665	RO	Ic			
4666~4671	RO	I avg			
4672~4677	RO	Pa	x1	var	
4678~4683	RO	Pb			
4684~4689	RO	Pc			
4690~4695	RO	P Total			
4696~4701	RO	Qa	x1	var	
4702~4707	RO	Qb			
4708~4713	RO	Qc			
4714~4719	RO	Q Total			

4720~4725	RO	Sa	x1	VA
4726~4731	RO	Sb		
4732~4737	RO	Sc		
4738~4743	RO	S Total		
4744~4749	RO	PFa	x1	-
4750~4755	RO	PFb		
4756~4761	RO	PFc		
4762~4767	RO	PF Total		
4768~4773	RO	Frequency	x1	Hz
4774~4779	RO	In (Calculated)	x1	-
4780~4785	RO	Uan/Uab THD		
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		
4858~4863	RO	Current Unbalance		
4864~4869	RO	I4	x1	A
4870~4875	RO	Ir* (Residual Current)		

* Available in Firmware V1.00.06 or later

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

5.6.4 Min. Log of 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		x1	A
4930~4935	RO	Ubc			
4936~4941	RO	Uca			
4942~4947	RO	ULL avg			
4948~4953	RO	Ia		x1	W
4954~4959	RO	Ib			
4960~4965	RO	Ic			
4966~4971	RO	I avg			
4972~4977	RO	Pa		x1	var
4978~4983	RO	Pb			
4984~4989	RO	Pc			
4990~4995	RO	P Total			
4996~5001	RO	Qa	x1	VA	
5002~5007	RO	Qb			
5008~5013	RO	Qc			
5014~5019	RO	Q Total			
5020~5025	RO	Sa	x1	-	
5026~5031	RO	Sb			
5032~5037	RO	Sc			
5038~5043	RO	S 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				
5158~5163	RO	Current Unbalance				
5164~5169	RO	I4				
5170~5175	RO	Ir* (Residual Current)			x1	A

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	Format	Range
+0	High	Year - 2000	UINT16	0 to 99
	Low	Month		1 to 12
+1	High	Day	UINT16	1 to 31
	Low	Hour		0 to 23
+2	High	Minute	UINT16	0 to 59
	Low	Second		0 to 59
+3	-	Millisecond	UINT16	0 to 999
+4~+5	-	Max./Min. Value	Float	

Table 5-22 Max./Min. Structure

5.7 Monthly Energy Log

Register	Property	Description	Format	Scale	Unit
0980	RW	Month ¹	INT16	0* to 12	
0981	RO	High-order Byte: Year (0-99) Low-order Byte: Month (1-12)	INT16	Time Stamp (20YY/MM/DD HH:MM:SS)	
0982	RO	High-order Byte: Day (1-31) Low-order Byte: Hour (0-23)	INT16		
0983	RO	High-order Byte: Minute (0-59) 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 (0-99) Low-order Byte: Month (1-12)	INT16	-	
12002	RO	High-order Byte: Day (1-31) Low-order Byte: Hour (0-23)	INT16		
12003	RO	High-order Byte: Minute (0-59) Low-order Byte: Second (0-59)	INT16		
12004	RO	kWh Total	INT32	x0.1	kWh
12006	RO	kvarh Total	INT32	x0.1	kvarh
12008	RO	kVAh Total	INT32	x0.1	kVAh
12010	RO	Max. Demand of P Total	See Table 5-25 Demand Data Structure	x1	W
12012	RO	Max. Demand of Q Total		x1	var
12014	RO	Max. Demand of S Total		x1	VA

Table 5-24 Daily Freeze Log

Offset		Description	Format	Range
+0	High	Year - 2000	UINT16	0 to 99
	Low	Month		1 to 12
+1	High	Day	UINT16	1 to 31
	Low	Hour		0 to 23
+2	High	Minute	UINT16	0 to 59
	Low	Second		0 to 59
+3	-	Millisecond	UINT16	0 to 999
+4~+5	-	Max. Demand Value	Float	

Table 5-25 Demand Data Structure

Notes:

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

5.8.2 Monthly Freeze Log

Register	Property	Description	Format	Scale	Unit
12500	RW	Index ¹	INT16	1 to 36	
12501	RO	High-order Byte: Year (0-99) Low-order Byte: Month (1-12)	INT16	-	
12502	RO	High-order Byte: Day (1-31) Low-order Byte: Hour (0-23)	INT16		
12503	RO	High-order Byte: Minute (0-59) Low-order Byte: Second (0-59)	INT16		
12504	RO	kWh Total	INT32	x0.1	kWh
12506	RO	kvarh Total	INT32	x0.1	kvarh
12508	RO	kVAh Total	INT32	x0.1	kVAh
12510~12515	RO	Max. Demand of P Total	See Table 5-27	x1	W
12516~12521	RO	Max. Demand of Q Total		x1	var
12522~12527	RO	Max. Demand of S Total		x1	VA

Table 5-26 Monthly Freeze Log

Offset		Description	Format	Range
+0	High	Year - 2000	UINT16	0 to 99
	Low	Month		1 to 12
+1	High	Day	UINT16	1 to 31
	Low	Hour		0 to 23
+2	High	Minute	UINT16	0 to 59
	Low	Second		0 to 59
+3	-	Millisecond	UINT16	0 to 999
+4~+5	-	Max. Demand Value	Float	

Table 5-27 Demand Data Structure

Notes:

- 1) 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 5-29 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 5-28 SOE Log

Notes:

SOE Log Data Structure

Offset	Property	Description	Range/Note
+0	RO	High-order Byte: Event Classification	See Table 5-30 SOE Classification
	RO	Low-order Byte: Sub-Classification	
+1	RO	Record Time: Year -2000	0-99
	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 5-29 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 Inc 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		Reversal Phase Setpoint Active/Return
	25	1 / 0		Over I4 Setpoint Active/Return
	26	1 / 0		Over AI Setpoint Active/Return
	27			Reserved
	28	1 / 0		Over 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 Inc 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	0	0	Set Carbon via Panel
20	0	0	Clear His Carbon via Panel ⁸
21	0	0	Clear Real Carbon via Panel ⁸
22~29	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 DIx 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.
51	0	0	Setup Carbon via Comm.
52	0	0	Clear His Carbon via Comm. ⁸
53	0	0	Clear Real Carbon via Comm. ⁸

* Available in Firmware V1.00.06 or later

Table 5-30 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-Φ 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 5-31 TOU Switch Records

- 8) **Clear His Carbon via Panel or Comm.** means to clear last 12 monthly carbon emission logs and last 12 annual carbon emission logs.
Clear Real Carbon via Panel or Comm. means to clear This Month & This Year & Total Cumulative Carbon Emission measurements.

5.10 Data Recorder Log (Optional)

Register	Property	Description	Format
20000~20037	RO	DR Log #1 Buffer	See Table 5-33 Standard DR Log Structure
20038~20075	RO	DR Log #2 Buffer	
20076~20113	RO	DR Log #3 Buffer	
20114~20151	RO	DR Log #4 Buffer	
20152~20189	RO	DR Log #5 Buffer	

Table 5-32 DR Log

Offset	Property	Description	Format
+0	RW	DR Recorder Index	UINT32
+2	RO	High-order Byte: Year (0-99) Low-order Byte: Month (1-12)	UINT16
+3	RO	High-order Byte: Day (1-31) Low-order Byte: Hour (0-23)	UINT16
+4	RO	High-order Byte: Minute (0-59) Low-order Byte: Second (0-59)	UINT16
+5	RO	Millisecond (0-999)	UINT16
+6~+7	RO	Parameter #1	See Appendix A
+8~+9	RO	Parameter #2	
+10~+11		Parameter #3	
...		...	
+36~+37	RO	Parameter #16	

Table 5-33 DR Data Buffer Structure

Notes:

- 1) 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 ≤ 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
- 2) 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 Carbon Emission Log

5.11.1 Monthly Carbon Emission Log

Register	Property	Description	Format	Scale	Unit
5500	RW	Month ¹	INT16	0 to 12	
5501	RO	High-order Byte: Year (0-99) Low-order Byte: Month (1-12)	INT16	-	
5502	RO	High-order Byte: Day (1-31) Low-order Byte: Hour (0-23)	INT16		
5503	RO	High-order Byte: Minute (0-59) Low-order Byte: Second (0-59)	INT16		
5504	RO	Monthly Carbon Emission	FLOAT	x1	kgCO2

Table 5-34 Monthly Carbon Emission Log

Notes:

- 1) This register represents the Month when it is read. To read the Monthly Carbon Emission 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 2025/10, “0” means 2025/10, “1” means 2025/09, “2” means 2025/08, ... and “12” means “2024/10”.
- 2) The Monthly Carbon Emission Log for the Last 12 Months are Read Only.

5.11.2 Annual Carbon Emission Log

Register	Property	Description	Format	Scale	Unit
5600	RW	Year ¹	INT16	0 to 12	
5601	RO	High-order Byte: Year (0-99) Low-order Byte: Month (1-12)	INT16	-	
5602	RO	High-order Byte: Day (1-31) Low-order Byte: Hour (0-23)	INT16		
5603	RO	High-order Byte: Minute (0-59) Low-order Byte: Second (0-59)	INT16		
5604	RO	Annual Carbon Emission	FLOAT	x1	kgCO2

Table 5-35 Annual Carbon Emission Log

Notes:

- 1) This register represents the Year when it is read. To read the Annual Carbon Emission 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 Year and the Last 12 years. For example, if the current year is 2025, "0" means 2025, "1" means 2024, "2" means 2023, ... and "12" means "2013".
- 2) The Annual Carbon Emission Log for the Last 12 years are Read Only.

5.12 Device Setup

5.12.1 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 ²	UINT32	1 to 30,000A, 5*
6006	RW	CT Secondary ²	UINT32	1 to 5A*
6008	RW	CT Type ²	UINT32	1=100A SCCT, 2=200A SCCT 3=400A SCCT, 4=800A SCCT 5=1600A SCCT 6=400A Rogowski Coil 7=1200A Rogowski Coil 8=2500A Rogowski Coil 9=5000A Rogowski Coil
6010	RW	Reserved	UINT32	
6012	RW	I4 Primary	UINT32	1 to 30,000A, 5*
6014	RW	I4 Secondary	UINT32	1 to 5A*
6016~6018	RW	Reserved	UINT32	
6019	RW	Nominal Frequency	UINT16	0=50Hz*, 1=60Hz
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	
6024	RW	Ib Polarity	UINT16	
6025	RW	Ic Polarity	UINT16	
6026~6027	RW	Reserved	UINT16	
6028	RW	THD Calculation ³	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	Max./Min. Log Self-Read Time ⁴	UINT16	0xFFFF*
6034	RW	Monthly Energy Log Self-Read Time ⁵	UINT16	0*
6035	RW	Energy Pulse Constant ⁶	UINT16	0=1000 imp/kxh 1=3200 imp/kxh* 2=5000 imp/kxh 3=10000 imp/kxh 4=25000 imp/kxh 5=10 imp/kxh 6=100 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 ⁷	UINT16	0=Option 1*, 1=Option 2
6041	RW	Monthly Freeze Self-Read Time ⁵	UINT16	0*
6042	RW	Daily Freeze Self-Read Time ⁸	UINT16	0*
6043	RW	Default Display 1 st parameter ⁹	UINT16	0 to 40, 7* (ULL avg)
6044	RW	Default Display 2 nd parameter ⁹	UINT16	0 to 40, 11* (I avg)
6045	RW	Default Display 3 rd parameter ⁹	UINT16	0 to 40, 12* (P)
6046	RW	Default Display 4 th parameter ⁹	UINT16	0 to 40, 15* (PF)
6047	RW	EN Period ¹⁰	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~ ¹¹	UINT16	0 to 65535, 0x3F*
6052	RW	Time Zone ¹²	UINT16	0-32, 26*
6053	RW	Max. Demand Log Self-Read Time ⁴	UINT16	0xFFFF*
6054	RW	LCD Contrast	UINT16	0 to 9, 2*

~ Available in Firmware V1.00.06 or later

Table 5-36 Basic Setup Parameters

Notes:

- 1) The value of [PT Primary/PT Secondary] cannot exceed 10000.
- 2) The **CT Type** is available in Firmware V2.00.01 or later.
The **CT Primary** and **CT Secondary** will be set automatically according to the configured **CT Type** for Input Current option "4" that supports Split-Core CTs or Rogowski Coils. The **CT Primary** value is set to the Primary Input of the selected Split-Core CT or Rogowski Coil, and the **CT Secondary** is fixed at 100.
- 3) 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.

- 4) The **Max./Min. Log Self-Read Time** and the **Max. Demand Log Self-Read Time** support 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.
- 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 constant 5000/10000/25000 are supported from the firmware V2.00.00 and the constant 10/100 are supported from the firmware V2.00.01.
- 7) The **Delimiter** setup register supports two options, 1 and 2:
 - Option 1: “,” is used as the x1000 delimiter and “.” as the decimal point (e.g. 123,456,789.0).
 - Option 2: “ ” is used as the x1000 delimiter and “.” as the decimal point (e.g. 123 456 789,0).
- 8) The **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.
- 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	Ia Loading Factor~
5	U23 (Ubc)	16	Frequency	27	P Demand	38	Ib Loading Factor~

6	U31 (Uca)	17	kWh Import	28	Q Demand*	39	Ic Loading Factor~
7	ULL avg	18	kWh Export	29	S Demand*	40	I avg Loading Factor~
8	I1 (Ia)	19	kWh Total	30	Fund. P 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 5-37 Default Display Parameters

10) The **Interval Energy** registers will be reset once the **EN Period** is changed.

11) 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 5-38 DNP Polling Objects

12) 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 5-39 Time Zones

5.12.2 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	
6206~6207		Reserved		1 to 9999 ms, 20*
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	
6213	RW	DI6 Debounce ¹	UINT16	1* to 1000000
6214~6215		Reserved		
6216	RW	DI1 Pulse Weight	UINT32	
6218	RW	DI2 Pulse Weight	UINT32	
6220	RW	DI3 Pulse Weight	UINT32	
6222	RW	DI4 Pulse Weight	UINT32	
6224	RW	DI5 Pulse Weight ¹	UINT32	0 = Digital Output*
6226	RW	DI6 Pulse Weight ¹	UINT32	
6228		Reserved	UINT32	
6230	RW	DO1 Function ^{2,4}	UINT16	

6231	RW	DO2 Function ^{#2,4}	UINT16	1 = kWh Import 2 = kWh Export 3 = kWh Total 4 = kvarh Import 5 = kvarh Export 6 = kvarh Total
6232	RW	DO3 Function ^{3,4}	UINT16	
6233	RW	DO4 Function ^{3,4}	UINT16	
6234~6235	RW	Reserved	UINT16	
6236	RW	DO1 Pulse Width	UINT16	
6237	RW	DO2 Pulse Width	UINT16	
6238	RW	DO3 Pulse Width ³	UINT16	0* to 6000 (x0.1s), (0 = Latch Mode)
6239	RW	DO4 Pulse Width ³	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, 400*
6253	RW	AI Full Scale ¹	INT32	-999,999 to +999,999, 2000*
6255~6259		Reserved	UINT16	-
6260	RW	AO1 Type ¹	UINT16	0 = 4~20mA*, 1 = 0~20mA
6261	RW	AO1 Key ^{1,4}	UINT16	0* to 19
6262	RW	AO1 Zero Scale ¹	INT32	-999,999 to +999,999, 0*
6264	RW	AO1 Full Scale ¹	INT32	-999,999 to +999,999, 0*
6266	RW	AO2 Type ¹	UINT16	0 = 4~20mA*, 1 = 0~20mA
6267	RW	AO2 Key ^{1,4}	UINT16	0* to 19
6268	RW	AO2 Zero Scale ¹	INT32	-999,999 to +999,999, 0*
6270	RW	AO2 Full Scale ¹	INT32	-999,999 to +999,999, 0*

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

#Available in Firmware V1.00.04 or later

Table 5-40 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 “B1” option [2xDI and 2xDO (Mechanical Relay)]. Please refer to the **Ordering Guide** for more details.
- 4) For the DO (Mechanical Relay), the **DO Mode** should be set to **Digital Output**.
For the SS Pulse Output, the **DO Mode** can be set to **kWh/kvarh Import/Export/Total** and cannot be set to **Digital Output**.
- 5) Analog Output Parameters:
The Units for Voltage, Current, P, Q, S and Frequency are V, A, kW, kvar, kVA and Hz, respectively.

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

Table 5-41 Analog Output Parameters

5.12.3 Carbon Emission Setup Parameters

Register	Property	Description	Format	Range, Default*
6300	RW	Transmission & Distribution Lines Carbon Factor	UINT16	0-20000, 5703* (x0.0001 tCO2/MWh)
6301	RW	Load-side Power Generation Equipment Carbon Factor	UINT16	0-20000, 5703* (x0.0001 tCO2/MWh)
6402	RW	Associated Energy of Transmission & Distribution Lines	UINT16	0=kWh Imp.* 1=kWh Exp.
6403	RW	Associated Energy of Load-side Power Generation Equipment	UINT16	0=kWh Imp.* 1=kWh Exp.*
6304	RW	Self-Read Date of Monthly Carbon Emissions ¹	UINT16	1* to 28

Table 5-42 Carbon Emission Setup Parameters

Notes:

1) Historical annual carbon emission log is fixed to execute transfer and storage at 00:00:00 on January 1st of each year. For historical monthly carbon emission log, a specific day can be configured for transfer and storage, which will be executed at 00:00:00 on the configured day.

5.12.4 Communication Setup Parameters

Register	Property	Description	Format	Range, Default*
6400	RW	Port 1 Protocol	UINT16	0=Modbus RTU* 1=BACnet MS/TP ¹ 2=N2 ¹ , 3=DNP ²
6401	RW	Port 1 Unit ID	UINT16	Modbus RTU/N2: 1 to 247 BACnet MS/TP: 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* 1=Profibus ⁴
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 6=57600 ⁴ , 7=115200 ⁴
6407	RW	Port 2 Comm. Config.	UINT16	0=8N2, 1=8O1, 2=8E1* 3=8N1, 4=8O2, 5=8E2
6408	RW	Profibus Unit ID ^{5,6}	UINT16	1* to 125
6409	RW	Profibus Baud Rate ^{5,6}	UINT16	0=9.6 kbps, 1=19.2 kbps 2=45.45 kbps, 3=93.75 kbps 4=187.5 kbps, 5=500 kbps 6=1500 kbps*
6410	RO	Profibus Comm. Config ^{5,6}	UINT16	2=8E1*

Table 5-43 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 MS/TP 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.
- 4) COM2 supports Modbus baud rates of 57600 and 115200 in Firmware V2.00.02 or later.
- 5) Available in the Firmware V2.00.01 or later.
- 6) Valid only when the **Port 2 Protocol** is set to **Profibus**.

5.12.5 Setpoints Setup

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

6589	RW		Trigger Action 2 ²	UINT16	
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Table 5-44 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			
6	P (kW Total)		W	
7	Q (kvar Total)			
8	S (kVA Total)		var	
9	PF (PF Total)			
10	P DMD (kW Total Present Demand)		x1	W
11	Q DMD (kvar Total Present Demand)			
12	S (kVA Total Present Demand)			
13	P DMD Pred (kW Total Predicted Demand)			VA
14	Q DMD Pred (kvar Total Predicted Demand)			
15	S DMD Pred (kVA Total Predicted Demand)			
16	U THD		100%	
17	U TOHD			
18	U TEHD			
19	I THD			
20	I TOHD			
21	I TEHD			
22	U Unbal (Voltage Unbalance)			100%
23	I Unbal (Current Unbalance)			
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 (Negative Sequence)~		x1	V
32	U0 (Zero Sequence)~			

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

Table 5-45 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 5-46 Setpoint Triggers

4) Only when **DOx Function** is set to **Digital Output**, setting Setpoint Triggers to DOx Closed is valid. In addition, the table below lists the which combinations of **Basic Function** and **Expansion Module B** will make DOx Closed is available. Please refer to **Appendix H Ordering Guide** for details.

Basic Function	Expansion Module B	DO1 Closed	DO2 Closed	DO3 Closed	DO4 Closed
A	B1	■	■	■	■
A	B2/B3/B5/None	■	■	--	--
1/2/3/B	B1	■	■	--	--

■ Available -- Unavailable

Table 5-47 Available DO Triggers

5.12.6 Data Recorder Setup

Register	Property	Description	Format
6600~6622	RW	Data Recorder #1	See Table 5-49 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 5-48 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 5-49 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.

5.13 TOU Setup

5.13.1 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 5-50 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.

Bit 24 to 31	Bit 16 to 23	Bit 9 to 15	Bit 0 to 8
Year-2000 (0-99)	Month (1-12)	Day (1-31)	Hour (00-23)

Table 5-51 TOU Switch Time Format

5.13.2 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	0* to 19
22	RW	Season #6: Weekday#2 Daily Profile	UINT16	
23	RW	Season #6: Weekday#3 Daily Profile	UINT16	
24	RW	Season #7: Start Date	UINT16	See Season #2: Start Date
25	RW	Season #7: Weekday#1 Daily Profile	UINT16	0* to 19
26	RW	Season #7: Weekday#2 Daily Profile	UINT16	
27	RW	Season #7: Weekday#3 Daily Profile	UINT16	
28	RW	Season #8: Start Date	UINT16	See Season #2: Start Date
29	RW	Season #8: Weekday#1 Daily Profile	UINT16	0* to 19
30	RW	Season #8: Weekday#2 Daily Profile	UINT16	
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	0* to 19
34	RW	Season #9: Weekday#2 Daily Profile	UINT16	
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	0* to 19
38	RW	Season #10: Weekday#2 Daily Profile	UINT16	
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	0* to 19
42	RW	Season #11: Weekday#2 Daily Profile	UINT16	
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	0* to 19
46	RW	Season #12: Weekday#2 Daily Profile	UINT16	
47	RW	Season #12: Weekday#3 Daily Profile	UINT16	

Table 5-52 Season Setup

Notes:

- 1) **Start Date** for Season #1 can be set as any day within the calendar year.
- 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.

5.13.3 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 5-55 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 5-53 TOU #1’s Daily Profile Setup

Register	Property	Description	Format
8200~8223	RW	Daily Profile #1	See Table 5-55 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 5-54 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	High-order Byte: Hour	UINT16	0 ≤ Hour < 24 Min = 0, 15, 30, 45
			Low-order Byte: Min		
+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 5-55 Daily Profile Data Structure

Notes:

- 1) **Daily Profile #1's Period #1 Start Time** can be set to any time of day.
- 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.

5.13.4 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 Alternative Day #2's Date is 8700+3 = 8703.

Offset	Property	Description	Format	Range/Default*
0	RW	Alternate Day #1 Date ¹	UINT32	Table 5-57
2	RW	Alternate Day #1 Daily Profile	UINT16	0* to 19
3	RW	Alternate Day #2 Date ¹	UINT32	Table 5-57
5	RW	Alternate Day #2 Daily Profile	UINT16	0* to 19
6	RW	Alternate Day #3 Date ¹	UINT32	Table 5-57
8	RW	Alternate Day #3 Daily Profile	UINT16	0* to 19
9	RW	Alternate Day #4 Date ¹	UINT32	Table 5-57
11	RW	Alternate Day #4 Daily Profile	UINT16	0* to 19
12	RW	Alternate Day #5 Date ¹	UINT32	Table 5-57
14	RW	Alternate Day #5 Daily Profile	UINT16	0* to 19
15	RW	Alternate Day #6 Date ¹	UINT32	Table 5-57
17	RW	Alternate Day #6 Daily Profile	UINT16	0* to 19
18	RW	Alternate Day #7 Date ¹	UINT32	Table 5-57
19	RW	Alternate Day #7 Daily Profile	UINT16	0* to 19
21	RW	Alternate Day #8 Date ¹	UINT32	Table 5-57
22	RW	Alternate Day #8 Daily Profile	UINT16	0* to 19
24	RW	Alternate Day #9 Date ¹	UINT32	Table 5-57
25	RW	Alternate Day #9 Daily Profile	UINT16	0* to 19
27	RW	Alternate Day #10 Date ¹	UINT32	Table 5-57
29	RW	Alternate Day #10 Daily Profile	UINT16	0* to 19
...		...		Table 5-57
...		...		0* to 19
240	RW	Alternate Day #81 Date ¹	UINT32	Table 5-57
162	RW	Alternate Day #81 Daily Profile	UINT16	0* to 19
243	RW	Alternate Day #82 Date ¹	UINT32	Table 5-57
245	RW	Alternate Day #82 Daily Profile	UINT16	0* to 19
246	RW	Alternate Day #83 Date ¹	UINT32	Table 5-57
248	RW	Alternate Day #83 Daily Profile	UINT16	0* to 19
249	RW	Alternate Day #84 Date ¹	UINT32	Table 5-57
251	RW	Alternate Day #84 Daily Profile	UINT16	0* to 19
252	RW	Alternate Day #85 Date ¹	UINT32	Table 5-57
254	RW	Alternate Day #85 Daily Profile	UINT16	0* to 19

255	RW	Alternate Day #86 Date ¹	UINT32	Table 5-57
256	RW	Alternate Day #86 Daily Profile	UINT16	0* to 19
258	RW	Alternate Day #87 Date ¹	UINT32	Table 5-57
260	RW	Alternate Day #87 Daily Profile	UINT16	0* to 19
261	RW	Alternate Day #88 Date ¹	UINT32	Table 5-57
263	RW	Alternate Day #88 Daily Profile	UINT16	0* to 19
264	RW	Alternate Day #89 Date ¹	UINT32	Table 5-57
266	RW	Alternate Day #89 Daily Profile	UINT16	0* to 19
267	RW	Alternate Day #90 Date ¹	UINT32	Table 5-57
269	RW	Alternate Day #90 Daily Profile	UINT16	0* to 19

Table 5-56 Alternate Days Setup

Notes:

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

Bit 24 to 31	Bit 16 to 23	Bit 9 to 15	Bit 0 to 8
Reserved	Year-2000 (0-99)	Month (1-12)	Day (1-31)

Table 5-57 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.

5.14 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	High-order Byte: Year
		Low-order Byte: Month		
60001	9001	RW	UINT16	High-order Byte: Day
		Low-order Byte: Hour		
60002	9002	RW	UINT16	High-order Byte: Minute
		Low-order Byte: Second		
60003	9003	RW	UINT16	Millisecond
60004	9004	RW	UINT32	0x4B3D3B00 to 0xE398E47F The corresponding time is 2010.01.01 00:00:00 to 2090.12.31 23:59:59 (GMT 0:00 Time Zone)
~	~			
60005	9005			

Table 5-58 Time Registers

5.15 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

9101	WO	Execute DO1 Close	UINT16	the register to perform the described action.
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 5-59 DO Control

5.16 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		
9625	WO	Clear Historical Monthly and Annual Carbon Emission Log		
9626	WO	Clear Carbon Emission measurements of This Month and This Year		

Table 5-60 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-Φ 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 & Last Month (or Since Last Reset & 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 and registers # 9609 to 9626,.

5.17 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	
60227~60228	9827	RO	Reserved	UINT16	
60229	9829	RO	Feature Code	UINT16	See Note 2)

* Available in Firmware V1.00.04 or later

Table 5-61 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 5-62 ASCII Encoding of "PMC-53A"

- 2) The following table illustrates the details for the Feature Code register.

Bits 7 to 8 (Base Unit)	Bit 6 (16MB Flash Memory)	Bits 3 to 5 (Expansion Module B)	Bits 0 to 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=2xAO 101=Reserved	000=None 001=RS-485 010=I4
	Bits 12 to 15	Bits 10 to 11 (Current Input)	Bit 9 (Accuracy)
	Reserved	0=5A 1=1A 2=40mA (SCCT or Rogowski Coils)	0=0.5S 1=0.2S

Table 5-63 Feature Code for PMC-53A

Appendix A Data Recorder Parameter List

ID	Description	ID	Description	ID	Description
Real-time Measurements (Format: Float)					
0	None	14	Pb	28	PF Total
1	Uan	15	Pc	29	Frequency
2	Ubn	16	P Total	30	Uan/Uab Angle
3	Ucn	17	Qa	31	Ubn/Ubc Angle
4	ULN avg	18	Qb	32	Ucn/Uca Angle
5	Uab	19	Qc	33	Ia Angle
6	Ubc	20	Q Total	34	Ib Angle
7	Uca	21	Sa	35	Ic Angle
8	ULL avg	22	Sb	36	In (Calculated)
9	Ia	23	Sc	37	I4
10	Ib	24	S Total	38	RTD1
11	Ic	25	PFa	39	RTD2
12	I avg	26	PFb	40	AI Scaled
13	Pa	27	PFc	332	Ir* (Residual Current)
Power Quality (Format: Float)					
41	Phase A Fundamental P	59	Ib Crest Factor	160	Ubn/Ubc HD31
42	Phase B Fundamental P	60	Ic Crest Factor	161	Ucn/Uca HD31
43	Phase C Fundamental P	61	Voltage Unbalance	162	Ia THD
44	Fundamental P Total	62	Current Unbalance	163	Ib THD
45	Total Harmonic P	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 (DIx Pulse Counter Format: UINT32, Others Format: INT32)					
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 (Format: Float)					
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	P Total Present Demand	329	P Max. Demand Log of This Month (Since Last Reset)		
324	Q Total Present Demand	330	Q Max. Demand Log of This Month (Since Last Reset)		
325	S Total Present Demand	331	S Max. Demand Log of This Month (Since Last Reset)		
U and I HD32 to HD63 (Format: Float)					
333	Uan HD32	429			Ia HD32

CET Electric Technology

334	Uan HD32	430	lb HD32
335	Uan HD32	431	lc HD32
...
426	Uan HD63	522	la HD63
427	Uan HD63	523	lb HD63
428	Uan HD63	524	lc HD63

* 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				
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	Pa	Ib THD	T2 kWh Imp.
Parameter 6	kvarh Export	Ib	Pb	Ic THD	T2 kWh Exp.
Parameter 7	kvarh Total	Ic	Pc	Ia TDD	T2 kvarh Imp.
Parameter 8	kvarh Net	I avg	Qa	Ib TDD	T2 kvarh Exp.
Parameter 9	kVAh Total	In (Calculated)	Qb	Ic TDD	T3 kWh Imp.
Parameter 10	P Total Demand	P Total	Qc	Ia K-Factor	T3 kWh Exp.
Parameter 11	Q Total Demand	Q Total	Sa	Ib K-Factor	T3 kvarh Imp.
Parameter 12	S Total Demand	S Total	Sb	Ic K-Factor	T3 kvarh Exp.
Parameter 13	Ia Demand	PF Total	Sc	Ia Crest Factor	T4 kWh Imp.
Parameter 14	Ib Demand	Freq	PFa	Ib Crest Factor	T4 kWh Exp.
Parameter 15	Ic Demand	U Unbalance	PFb	Ic Crest Factor	T4 kvarh Imp.
Parameter 16	None	I Unbalance	PFc	None	T4 kvarh Exp.

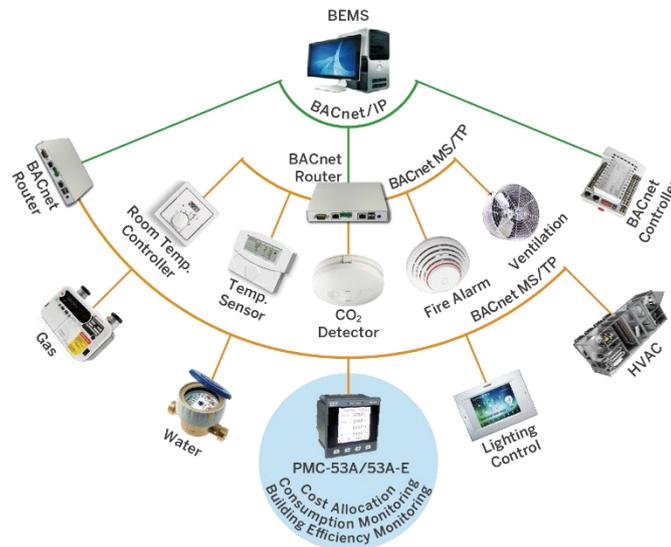
Appendix C BACnet MS/TP Implementation

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.

- 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	April 21, 2025
Vendor Name	CET
Model Name	PMC-53A
Applications Software Version	V2.00.00
Firmware Revision	V1.00.00
Protocol Version	1
Protocol Revision	22
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, DM-RD-B
Segmentation Capability	Not Supported
Data Link Layer Options	MS/TP Master, Baud rate(s): 9600, 19200, 38400
Device Address Binding	None
Networking Options	None
Character Sets Support	UTF-8

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	V1.00.00	
R	Application_Software_Version	V2.00.00	
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	22	
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) Network Port Objects

Optional Properties Supported: MAC_Address, Max_Master, Max_Info_Frames

Writable Properties: Max_Master, Max_Info_Frames

The following table illustrates Network Port Objects on the PMC-53A:

Property*	Description	Range/Values
R	Object_Identifier	1
R	Object_Name	MS/TP Port
R	Object_Type	Network Port(56)
R	Network_Type	MSTP(2)
R	Protocol_Level	BACnet Application(2)
R	Changes_Pending	false
R	Link_Speed	9600 or 19200 or 38400
R/W	Max_Master	1~127 (Default = 127)
R/W	Max_Info_Frames	1~255 (Default = 1)

4) 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	Pa ¹	R	kW	
AI 0026	Pb ¹	R		
AI 0028	Pc ¹	R		
AI 0030	P Total	R		
AI 0032	Qa ¹	R	kvar	
AI 0034	Qb ¹	R		
AI 0036	Qc ¹	R		
AI 0038	Q Total	R		
AI 0040	Sa ¹	R	kVA	
AI 0042	Sb ¹	R		
AI 0044	Sc ¹	R		
AI 0046	S 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	AO1	R		
AI 0092	AO2	R		
AI 0174	Ir	R	A	
AI 0500	kWh Import	R	kWh	0 to

AI 0502	kWh Export	R		99999999.9	
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	kVAh		
AI 3006	P Total Demand	R	kW		
AI 3008	Q Total Demand	R	kvar		
AI 3010	S Total Demand	R	kVA		
AI 3000	Ia Demand	R	A		
AI 3002	Ib Demand	R			
AI 3004	Ic Demand	R			
AI 3418	P Total Max. Demand	R	kW		
AI 3424	Q Total Max. Demand	R	kvar		
AI 3430	S 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	kVAh		
AI 1200	DI1 Counter	R	-		0 to 999,999,999
AI 1202	DI2 Counter	R			
AI 1204	DI3 Counter	R			
AI 1206	DI4 Counter	R			
AI 1208	DI5 Counter	R			
AI 1210	DI6 Counter	R			

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

Notes:

- a) 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.
- b) Uan/Ubn/Ucn THD = Uab/Ubc/Uca THD in 3P3W Wiring Mode and represent the harmonics of the line voltages.
- c) Uan/Ubn/Ucn Angle = Uab/Ubc/Uca Angle in 3P3W Wiring Mode and represent the phase angles of the

line voltages.

5) 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 DI1 Counter	W	65280	
AV 9611	Clear DI2 Counter	W	65280	
AV 9612	Clear DI3 Counter	W	65280	
AV 9613	Clear DI4 Counter	W	65280	
AV 9614	Clear DI5 Counter	W	65280	
AV 9615	Clear DI6 Counter	W	65280	

[#] PT Primary / PT Secondary Must be less than 10000.

6) 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	DI1	R	0 = Inactive, 1 = Active
BI1	DI2	R	0 = Inactive, 1 = Active
BI2	DI3	R	0 = Inactive, 1 = Active
BI3	DI4	R	0 = Inactive, 1 = Active
BI4	DI5	R	0 = Inactive, 1 = Active
BI5	DI6	R	0 = Inactive, 1 = Active

7) 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	DO1	R/W	0 = Inactive, 1 = Active
BO1	DO2	R/W	0 = Inactive, 1 = Active
BO2	DO3	R/W	0 = Inactive, 1 = Active
BO3	DO4	R/W	0 = Inactive, 1 = Active

8) 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	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	P Total Max. Demand	kW
2	Ubn ¹		48	Q Total Max. Demand	kvar
3	Ucn ¹		49	S 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	Pa ¹	kvar	59	Ia K-Factor	%
14	Pb ¹		60	Ib K-Factor	
15	Pc ¹		61	Ic K-Factor	
16	P Total	kVA	62	Ia TDD	-
17	Qa ¹		63	Ib TDD	
18	Qb ¹		64	Ic TDD	
19	Qc ¹	%	65	Ia Crest Factor	-
20	Q Total		66	Ib Crest Factor	
21	Sa ¹		67	Ic Crest Factor	
22	Sb ¹	%	68	U Unbalance	%
23	Sc ¹		69	I Unbalance	
24	S Total		70	dPFa	
25	PFa ¹	-	71	dPFb	-
26	PFb ¹		72	dPFc	
27	PFc ¹		73	Uan Angle ³	
28	PF Total	°	74	Ubn Angle ³	°
29	Frequency		75	Ucn Angle ³	
30	In		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	DI1 Counter	
40	kVAh	kVAh	86	DI2 Counter	
41	P Total Demand	kW	87	DI3 Counter	
42	Q Total Demand	kvar	88	DI4 Counter	
43	S Total Demand	kVA	89	DI5 Counter	
44	Ia Demand	A	90	DI6 Counter	
45	Ib Demand		91	Clear ⁵	
46	Ic Demand				

Notes:

- a) 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.
- b) $U_{an}/U_{bn}/U_{cn}$ THD = $U_{ab}/U_{bc}/U_{ca}$ THD in 3P3W Wiring Mode and represent the harmonics of the line voltages.
- c) $U_{an}/U_{bn}/U_{cn}$ Angle = $U_{ab}/U_{bc}/U_{ca}$ Angle in 3P3W Wiring Mode and represent the phase angles of the line voltages.
- d) Interval Energy Period (EN Period) can be modified via the Front Panel.
- e) 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: For Requests: Level 1 For Responses: Level 1	Device Function: <input type="checkbox"/> Master <input checked="" type="checkbox"/> Slave
Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP levels Supported (the complete list is described in the attached table):	
Maximum Data Link Frame Size (octets): Transmitted: 292 Received: 292	Maximum Application Fragment Size (octets): Transmitted: 1024 Received: 300
Maximum Data Link Re-tries: <input checked="" type="checkbox"/> None <input type="checkbox"/> Fixed <input type="checkbox"/> Configurable	Maximum Application Layer Re-tries: <input checked="" type="checkbox"/> None <input type="checkbox"/> Configurable
Requires Data Link Layer Confirmation: <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable	
Requires Application Layer Confirmation: <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> When reporting Event Data (Slave devices only) <input type="checkbox"/> When sending multi-fragment responses (Slave devices only) <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable	
Timeouts while waiting for: Data Link Confirm: <input checked="" type="checkbox"/> None <input type="checkbox"/> Fixed at ___ <input type="checkbox"/> Variable <input type="checkbox"/> Configurable Complete Appl. Fragment: <input checked="" type="checkbox"/> None <input type="checkbox"/> Fixed at ___ <input type="checkbox"/> Variable <input type="checkbox"/> Configurable Application Confirm: <input checked="" type="checkbox"/> None <input type="checkbox"/> Fixed at ___ <input type="checkbox"/> Variable <input type="checkbox"/> Configurable Complete Appl. Response: <input checked="" type="checkbox"/> None <input type="checkbox"/> Fixed at ___ <input type="checkbox"/> Variable <input type="checkbox"/> Configurable Others: Transmission Delay, configurable Select/Operate Arm Timeout, fixed at 15 seconds	
Sends/Executes Control Operations: WRITE Binary Outputs <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable SELECT/OPERATE <input type="checkbox"/> Never <input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable DIRECT OPERATE <input type="checkbox"/> Never <input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable DIRECT OPERATE - NO ACK <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable Count > 1 <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable Pulse On: <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable Pulse Off: <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable Latch On <input type="checkbox"/> Never <input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable Latch Off <input type="checkbox"/> Never <input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable Queue: <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable Clear Queue: <input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> 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: <input checked="" type="checkbox"/> Never	Reports time-tagged Binary Input Change Events when no specific variation requested: <input checked="" type="checkbox"/> Never

<input type="checkbox"/> Only time-tagged <input type="checkbox"/> Only non-time-tagged <input type="checkbox"/> Configurable to send time-tagged or non-time-tagged	<input type="checkbox"/> Binary Input Change with Time <input type="checkbox"/> Binary Input Change with Relative Time <input type="checkbox"/> Configurable to send Binary Input Change With Time and Binary Input Change With Relative Time
Sends Unsolicited Responses: <input checked="" type="checkbox"/> Never <input type="checkbox"/> Configurable - enable/disable <input type="checkbox"/> Only certain objects <input type="checkbox"/> Sometimes (attach explanation) <input type="checkbox"/> ENABLE/DISABLE UNSOLICITED Function codes supported	Sends Static Data in Unsolicited Responses: <input checked="" type="checkbox"/> Never <input type="checkbox"/> When Device Restarts <input type="checkbox"/> When Status Flags Change No other options are permitted.
Default Counter Object/Variation: <input type="checkbox"/> No Counters Reported <input type="checkbox"/> Configurable <input type="checkbox"/> Default Object Default Variation: <input checked="" type="checkbox"/> Point-by-point list attached	Counters Roll Over at: <input type="checkbox"/> No Counters Reported <input type="checkbox"/> Configurable <input type="checkbox"/> 16 Bits <input type="checkbox"/> 32 Bits <input type="checkbox"/> Other Value: _____ <input checked="" type="checkbox"/> Point-by-point list attached
Sends Multi-Fragment Responses <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Configurable	
Sequential File Transfer Support: Append File Mode <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Custom Status Code Strings <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Permissions Field <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No File Events Assigned to Class <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No File Events Send Immediately <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Multiple Blocks in a Fragment <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No 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	
Baud Rate	1200/2400/4800/9600*/19200/38400	Default*
Parity	8E1*/8O1/8N1/8E2/8O2/8N2	

DNP Point Map

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

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

Point	Description	Format	Range
0	DI1 ¹	UINT8	Bit Flags
1	DI2 ¹	UINT8	Bit Flags
2	DI3 ¹	UINT8	Bit Flags
3	DI4 ¹	UINT8	Bit Flags

4	DI5 ^{1,2}	UINT8	Bit Flags
5	DI6 ^{1,2}	UINT8	Bit Flags

Supported Flags:

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

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

Notes:

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

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

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

Point	Description	Format	Range
0	Clear Present Energy Log	UINT8	Always 0
1	Clear All Energy Registers	UINT8	Always 0
2	Clear Present Monthly Energy Log	UINT8	Always 0
3	Clear 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 P Total may be abnormal (3P4W or 3P3W)
	Negative Pa is may be abnormal (3P4W only)
	Negative Pb may be abnormal (3P4W only)
	Negative Pc 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 AOs in Object 30 are only meaningful if the meter is equipped with the corresponding option.

Bits 7 to 8 (Base Unit)	Bit 6 (16MB Flash Memory)	Bits 3 to 5 (Expansion B)	Bits 0 to 2 (Expansion 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=2xAO 101=Reserved	000=None 001=RS-485 010=I4
	Bits 12 to 15	Bits 10 to 11 (Current Input)	Bits 9 (Accuracy)
	Reserved	0=5A 1=1A 2=40mA (SCCT or Rogowski Coils)	0=0.5S 1=0.2S

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	Pa	INT32	x1	W
14	Pb ¹	INT32		
15	Pc ¹	INT32		
16	P Total	INT32		
17	Qa	INT32		var
18	Qb ¹	INT32		
19	Qc ¹	INT32		
20	Q Total	INT32		
21	Sa	INT32	VA	
22	Sb ¹	INT32		
23	Sc ¹	INT32		
24	S 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		

CET Electric Technology

33	Ia Angle	INT32		
34	Ib Angle	INT32		
35	Ic Angle	INT32		
36	In (Calculated)	INT32		
37	I4	INT32	x1000	A
38	Ir	INT32		
39	Displacement PFa	INT32		
40	Displacement PFb ¹	INT32	x1000	-
41	Displacement PFc ¹	INT32		
42	Displacement PF Total	INT32		
43	AI Scaled	INT32	x1	-
44	RTD1	INT32	x100	°C
45	RTD2	INT32		
46	AO1	INT32	x1	-
47	AO2			
48	Device Operating Time	INT32	x10	h
49	Phase A Fundamental P	INT32		
50	Phase B Fundamental P ¹	INT32		
51	Phase C Fundamental P ¹	INT32	x1	W
52	Fundamental P Total	INT32		
53	Total Harmonic P	INT32		
54	Uan/Uab Fundamental	INT32		
55	Ubn/Ubc Fundamental	INT32	x100	V
56	Ucn/Uca Fundamental	INT32		
57	Ia Fundamental	INT32		
58	Ib Fundamental ¹	INT32	x1000	A
59	Ic Fundamental ¹	INT32		
60	U1 (+ve Sequence Voltage) ²	INT32		
61	U2 (-ve Sequence Voltage) ²	INT32	x100	V
62	U0 (Zero Sequence Voltage) ²	INT32		
63	I1 (+ve Sequence Current) ²	INT32		
64	I2 (-ve Sequence Current) ²	INT32	x1000	A
65	I0 (Zero Sequence Current) ²	INT32		
66	Ia TDD	INT32		
67	Ib TDD	INT32		
68	Ic TDD	INT32		
69	Ia K-Factor	INT32		
70	Ib K-Factor	INT32		
71	Ic K-Factor	INT32		
72	Ia Crest Factor	INT32		
73	Ib Crest Factor	INT32		
74	Ic Crest Factor	INT32	x100	-
75	Voltage Unbalance	INT32		
76	Current Unbalance	INT32		
77	Uan/Uab THD	INT32		
78	Ubn/Ubc THD	INT32		
79	Ucn/Uca THD	INT32		
80	Ia THD	INT32		
81	Ib THD	INT32		
82	Ic THD	INT32		
83	Ia Present Demand	INT32		
84	Ib Present Demand	INT32	x1000	A
85	Ic Present Demand	INT32		
86	∑P Present Demand	INT32		W
87	∑Q Present Demand	INT32	x1	var
88	∑S Present Demand	INT32		VA
89	Ia Max. Demand of This Month (Since Last Reset)	INT32		
90	Ib Max. Demand of This Month (Since Last Reset)	INT32	x1000	A
91	Ic Max. Demand of This Month (Since Last Reset)	INT32		
92	∑P Max. Demand of This Month (Since Last Reset)	INT32		W
93	∑Q Max. Demand of This Month (Since Last Reset)	INT32	x1	var
94	∑S Max. Demand of This Month (Since Last Reset)	INT32		VA
95	Ia Max. Demand of Last Month (Before Last Reset)	INT32		
96	Ib Max. Demand of Last Month (Before Last Reset)	INT32	x1000	A
97	Ic Max. Demand of Last Month (Before Last Reset)	INT32		
98	∑P Max. Demand of Last Month (Before Last Reset)	INT32		W
99	∑Q Max. Demand of Last Month (Before Last Reset)	INT32	x1	var

100	ΣS Max. Demand of Last Month (Before Last Reset)	INT32		VA
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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 Range	400VLN/690VLL*
Overload	10V to 2xUn
Burden	2xUn continuous, 5xUn for 1s
Measurement Category	<0.02VA per phase
Frequency	CAT III up to 600V
	45-65Hz
Current Inputs (-I11, I12, -I21, I22, -I31, I32)	
Standard In Range	5A (Optional 1A)
Starting Current	0.1% to 200% In
Overload	0.1% In
Burden	2xIn continuous, 20xIn for 1s
CT Options~	<0.15VA per phase @ 5A
SCCT	100A/200A/400A/800A/1600A to 40mA
Rogowski Coils	400A/1200A/2500A/5000A to 40mA
Optional I4 Input (-I41, I42)	
In Range	5A (5A/1A Auto-Scaling)
Starting Current	0.1% to 200% In
CT Options~	0.1% In
SCCT	100A/200A/400A/800A/1600A to 40mA
Rogowski Coils	400A, 1200A, 2500A, 5000A to 40mA
Power Supply (L/+, N/-)	
Standard (cULus Listed)	60-250VAC ±10%, 47-440Hz
Burden	24-250VDC ± 10%
Overvoltage Category	<6W
	OVC III up to 300VLN
Optional Digital Inputs (DI1, DI2, DI3, DI4, DI5, DI6, DIC)	
Type	Dry contact, 24VDC internally wetted
Sampling	1000Hz
Hysteresis	1ms minimum
Optional Digital Outputs (DO11, DO12, DO21, DO22, DO31, DO32, DO41, DO42)	
Type	Form A Mechanical Relay
Loading	5A @ 250VAC or 30VDC (only 30VDC is cULus Listed)
Load Type	Resistive
Optional 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±20ms
Max. Load Voltage	50VDC
Max. Forward Current	50mA
Optional Analog Inputs (AI+, AI-)	
Type	0/4-20 mA DC
Overload	24mA
Optional Analog Outputs (AO+, AO-, or AO1+, AO1-, AO2+, AO2-)	
Type	0/4-20 mA DC
Loading	500Ω maximum
Overload	24mA maximum
Optional RTD Inputs (TC11, TC12, TC21, TC22)	
Type	Platinum Resistor PT100 (Sensor Not Included)
Range	-50°C to 200°C
Accuracy	±(0.30+0.005 t)
Cable Length	3000mm
Protective Tube Length	30mm
Max. Installation Torque	
Current Inputs	7.1 kgf.cm/6.28 lb-in/0.7 N.m/M3.5
Power Supply, Voltage Inputs, RS-485 and I/O	4 kgf.cm/3.54 lb-in/0.4 N.m/M3
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	96x96x83.6mm
IP Rating	IP65

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

~CT options are available in Firmware V2.00.01 or later. Please refer to **Accessories Technical Specification** table below for more information.

Accessories Technical Specification

Split-Core CT for Current Input	
Models	PMC-SCCT-100A-40mA-16-A (100A, Ø=16mm) PMC-SCCT-200A-40mA-24-A (200A, Ø=24mm) PMC-SCCT-400A-40mA-35-A (400A, Ø=35mm) PMC-SCCT-800A-40mA-A (800A, 80x50mm) PMC-SCCT-1600A-40mA-A (1600A, 130x55mm)
Primary Input	100A/200A/400A/800A/1600A
Secondary Output	40mA
Range	0.15%-120%In
Accuracy	Class 0.5
Frequency	50Hz / 60Hz
Operating Temperature	-20°C to +50°C
Rogowski Coils for Current Input	
Models	
3-Phase	PMC-RC-400A-40mA-3P-100-PY-W-F (400A, Ø=100mm) PMC-RC-1200A-40mA-3P-150-PY-W-F (1200A, Ø=150mm) PMC-RC-2500A-40mA-3P-200-PY-W-F (2500A, Ø=200mm) PMC-RC-5000A-40mA-3P-350-PY-W-F (5000A, Ø=350mm)
1-Phase	PMC-RC-400A-40mA-1P-100-PY-W-N (400A, Ø=100mm) PMC-RC-1200A-40mA-1P-150-PY-W-N (1200A, Ø=150mm) PMC-RC-2500A-40mA-1P-200-PY-W-N (2500A, Ø=200mm) PMC-RC-5000A-40mA-1P-350-PY-W-F (5000A, Ø=350mm)
Primary Input	400A/1200A/2500A/5000A
Secondary Output	40mA
Accuracy	0.5%, (5%-110%) In @25°C
Phase Error	≤5' (≥10A)
Linearity	±0.2% F.S. (10% to 110%) In
Bandwidth	30Hz to 5kHz
External Sampling Resistor	≤20Ω
Burden	≤5W
OA Output	≤0.01A
Temperature drift	200ppm/°C
Power Supply	10-25 VDC
Storage Temperature	-40°C to 85°C
Operating Temperature	-25°C to 70°C
Humidity	≥80% non-condensing
Flame Rating	UL 94 V-0
Frequency	50Hz / 60Hz
Insulation Voltage	5kV
Overvoltage Category	1000V CAT III, 600V CAT IV
Compliance	EN 61326-1 / EN 61010-1

Accuracy

Parameters	Accuracy			Resolution
	5A/1A Input		SCCT/Rogowski Coil	
	Class 0.2S	Class 0.5S		
Voltage	±0.1%	±0.2%	±0.5%	0.001V
Current	±0.1%	±0.2%	±0.5%	0.001A
I4 (measurement)	±0.1%	±0.2%	±0.5%	0.001A
P, Q, S	±0.2%	±0.5%	±1%	0.001kX
kWh, kVAh	IEC 62053-22 Class 0.2S/ IEC 62053-22 Class 0.5S ANSI C12.1 Class 0.2 EN 50470-1/3: 2006 Class C		IEC 62053-21 Class 1	0.1kXh
kvarh	IEC 62053-24 Class 0.5S IEC 62053-23 Class 2		IEC 62053-24 Class 1 IEC 62053-23 Class 2	0.1kvarh
PF	±0.2%	±0.5%	±1%	0.001
Frequency	±0.01Hz	±0.02Hz	±0.02Hz	0.01Hz
THD	IEC 61000-4-7 Class II			0.01%
K-Factor	IEC 61000-4-7 Class II			0.001
Phase Angle	±1°			0.1°

Appendix G Standards Compliance

Safety Requirements	
CE LVD 2014 / 35 / EU cULus Listed MID per 2014/32/EU	EN61010-1: 2010+A1: 2019 EN IEC 61010-2-030: 2021+A11: 2021 UL 61010-1, Ed.3, Rev. 06/06/2023 CAN/CSA C22.2 NO. 61010-1, Ed.3 UL 61010-2-030, Ed.2 CSA C22.2 NO. 61010-2-030:18, Ed.2 EN 50470-1: 2006 EN 50470-3: 2006
Electrical Safety in Low Voltage Distribution Systems up to 1000 Vac and 1500 Vdc	IEC 61557-12: 2021 (PMD)
Insulation AC Voltage: 3.6kV @ 1 minute Insulation Resistance: >100MΩ Impulse Voltage: 6kV, 1.2/50μs	EN61010-1: 2010+A1: 2019 IEC 62052-31: 2015
Electromagnetic Compatibility CE EMC Directive 2014 / 30 / EU (EN IEC 61326: 2021)	
Immunity Tests	
Electrostatic Discharge	EN 61000-4-2: 2009
Radiated Fields	EN IEC 61000-4-3: 2020
Fast Transients	EN 61000-4-4: 2012
Surges	EN 61000-4-5: 2014+A1: 2017
Conducted Disturbances	EN 61000-4-6: 2014+AC: 2015
Magnetic Fields	EN 61000-4-8: 2010
Voltage Dips and Interruptions	EN IEC 61000-4-11: 2020
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+A1: 2017+A11: 2020+A2: 2021
Electromagnetic Compatibility of Multimedia Equipment - Emission Requirements	EN 55032: 2015+A11: 2020+A1: 2020
Limits for Harmonic Current Emissions for Equipment with Rated Current ≤16 A	EN IEC 61000-3-2: 2019+A1: 2021
Limitation of Voltage Fluctuations and Flicker in Low-Voltage Supply Systems for Equipment with Rated Current ≤16 A	EN 61000-3-3: 2013+A1: 2019+A2: 2021
Emission Standard for Industrial Environments	EN IEC 61000-6-4: 2019
Radiated Emissions	FCC 47CFR Part 15 Subpart B Class B ANSI C63.4: 2014
Conducted Emissions	FCC 47CFR Part 15 Subpart B Class B ANSI C63.4: 2014
Mechanical Tests	
Spring Hammer Test	IEC 62052-31: 2015
Vibration Test	IEC 62052-11: 2020
Shock Test	IEC 62052-11: 2020
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
BACnet Conformance Certificate	
BTL Listing	Certificate No.: BTL-31239

Appendix H Ordering Guide

 Version 20250620	
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, 16MB 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, 16MB Memory
Input Current	
5	5A (5A/1A Auto-Scaling)
1	1A
4	For use with 100A, 200A, 400A, 800A, 1600A to 40mA Split-Core CTs and 400A, 1200A, 2500A, 5000A to 40mA Rogowski Coils
Input Voltage	
9	400VLN/690VLL
Power Supply	
2	60-250 VAC ± 10%, 47-440Hz 24-250 VDC ± 10%
Frequency	
5	45Hz-65Hz
Language	
E	English
Expansion A*	
A1	1xRS-485 / 1xProfibus DP
A2^	I4
Expansion B*	
B1	2xDI + 2xDO (Mechanical Relay)
B2	2xRTD (PT100 sensors not included)
B3	1xAI + 1xAO (0/4-20mA)
B5	2xAO
Accuracy	
2*	Class 0,25 for Active Energy
" "	Class 0,55 for Active Energy
PMC-53A - 1 5 9 2 5 E - - - 2	PMC-53A-15925E-2 (Class 0,25 Standard Model)
PMC-53A - 1 5 9 2 5 E - - - -	PMC-53A-15925E (Class 0,55 Standard Model)
* Additional charges apply	
^ Models PMC-53A-X5925E (X=1, 2, 3, A, B) are certified for MID Class C.	
^ I4 specifications of Expansion A2 are consistent with those of the selected Input Current Option.	
1) Model No. with no Expansion A or B can be written as PMC-53A-15925E-X (X=2 or Null)	
2) Model No. with only one Expansion can be written as PMC-53A-15925E-Ax-X or PMC-53A-15925E-Bx-X (X=2 or Null)	
3) Model No. with both Expansions can be written as PMC-53A-15925E-Ax-Bx-X (X=2 or Null)	
4) Options B1 for Expansion B are invalid with options 1 and 2 under Basic Function.	

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