PMC-53A-E

Ethernet Multifunction Meter

User Manual

Version: V2.0

September 12, 2025

Standards Compliance

CE

DANGER

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

CAUTION

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

DANGER

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

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

Limited warranty

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

Glossary

AI/AO	=	Analog Input/Output
CT	=	Current Transformer
DI/DO	=	Digital Input/Output
DMD	=	Demand
DR	=	Data Recorder
FIFO	=	First In First Out
HTTP	=	Hyper Text Transfer Protocol
I4	=	Measured Neutral Current
In	=	Calculated Neutral Current
IR or Ir	=	Residual Current
MB	=	Mega Byte
RMS	=	Root Mean Square
PAR	=	Peak to Average Ratio
PF	=	Power Factor
PT	=	Power Transformer
P Exp	=	Daily kWh Export Updated at 00:00
P Imp	=	Daily kWh Import Updated at 00:00
Q Exp	=	Daily kvarh Export Updated at 00:00
Q Imp	=	Daily kvarh Import Updated at 00:00
%(Q Imp/P Imp)	=	Daily kvarh Import/kWh Import in percentage
%(Q Exp/P Imp)	=	Daily kvarh Export/kWh Import in percentage
SNTP	=	Simple Network Time Protocol
SMTP	=	Simple Mail Transfer Protocol
SOE	=	Sequence of Events
TDD	=	Total Demand Distortion
TFTP	=	Trivial File Transfer Protocol
THD	=	Total Harmonics Distortion
TOHD	=	Total Odd Harmonics Distortion
TEHD	=	Total Even Harmonics Distortion
TOU	=	Time of Use
ULL/Ull	=	Line-to-Line Voltage
ULN/Uln	=	Line-to-Neutral Voltage
Ung	=	Neutral-to-Ground Voltage
WAGES	=	Water, Air, Gas, Electricity, Steam

Table of Contents

Chapter 1 Introduction

This manual explains how to use the PMC-53A-E Ethernet Multifunction Meter. Throughout the manual the term "meter" generally refers to all models.

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

1.1 Overview

The PMC-53A-E Ethernet Multifunction Meter is CET's latest offer for the digital power/energy metering market. Housed in a standard DIN form factor measuring 96x96x83.6mm, it is perfectly suited for industrial, commercial and utility applications requiring direct Ethernet connectivity. The PMC-53A-E features quality construction, multifunction measurements and a large, backlit, Dot-Matrix LCD that is easy to navigate and user friendly. Compliance with the IEC 62053-22 Class 0.2S/0.5S and ANSI C12.1 Class 0.2 Standards, it is a cost-effective replacement for analog instrumentation and is capable of displaying 4 measurements at once. It also optionally provides an I4 input for Neutral Current Measurement, one 0/4-20mA Analog Input for measuring external transducers signal as well as an Ir Input for Residual Current Measurement. With a standard 10Base-T/100Base-TX Ethernet port and an RS-485 port supporting multiple protocols, the PMC-53A-E can be easily integrated into Energy Management Systems as well as Building and Utility Automation Systems.

The following is a list of typical applications for the PMC-53A-E:

- 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 @ **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 the Front Panel, Web Interface or our free software
- Easy installation with mounting clips, no tools required

Basic Measurements (True RMS)

- ULN, ULL per Phase and Average with Neutral-to-Ground Voltage (Ung)*

  * The Ung is available in Firmware V1.01.00 or later and valid only when the **Wiring Mode** is **3P4W**
- Current per Phase and Average with calculated Neutral
- P, Q, S, PF per Phase and Total
- kWh, kvarh Import / Export / Net / Total and kVAh Total
- Frequency
- Device Operating Time (Running Hours)
- Optional Neutral Current (I4) and Residual Current (Ir) measurements

Advanced Measurements

- 1-Cycle Real-time U & I Waveform Display @ 1s update rate
- U and I THD, TOHD, TEHD and Harmonics analysis up to 63rd^
- Current TDD, TDD Odd, TDD Even, K-Factor and Crest Factor
- U and I Phase Angles
- Displacement PF
- Fundamental U, I and P per phase
- Total Fundamental P and Total Harmonic P
- U and I Unbalance and Sequence

- ULN, ULL Over/Under Deviation and Frequency Deviation^

  ^ The Individual Harmonic 32nd to 63rd, Voltage and Frequency Deviations are available in Firmware V2.00.00 or later
- %kvarh Imp/kWh Imp, %kvarh Exp/kWh Imp for Last Day & Last 30 Days*

  *Available in Firmware V1.01.00 or later
- Interval Energy for kWh/kvarh Imp/Exp and kVAh
- Present, Predicted and Maximum Demands for ULN, ULL, I per Phase and Average as well as P/Q/S Total with Timestamp for This Month & Last Month (or Since Last & Before Last Reset)*

  *Demands for ULN, ULL per Phase and Average and I Average are available in Firmware V1.01.00 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 monitoring parameters including Voltage, Current, Power, PF, Current and Power Demand, Unbalance and THD, etc.
- Configurable thresholds, time delays, DO and Alarm Email triggers

SOE Log

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

Max./Min. Log

- Max./Min. Log with Timestamp for Real-time measurements such as Voltage, Current, In, I4, Ir, Frequency, P, Q, S, PF, Unbalance, K-Factor, Crest Factor and THD
- Configurable for This Month/Last Month or Since/Before Last Reset

Freeze Logs

- 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 Timestamps.

Data Recorder Log

- 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 1250 days (>3 years) at 15-minute interval for 1 Data Recorder with 16 parameters for **HK BEC 2021 Compliant Recording***

  *Available in Firmware V1.01.00 or later

Diagnostics

- Frequency Out-of-Range, Loss of Voltage / Current
- P Direction per Phase and Total, Possible incorrect CT Polarity
- Incorrect U & I Phase Sequence
- Disconnection of Residual Current Input

Inputs and Outputs

- Digital Inputs
  - 4 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
  - 2 Form A Mechanical Relays for alarming and general purpose control
- Pulse Outputs (Optional)
  - 2 Form A Solid State Relays for kWh and kvarh pulsing

Optional Analog Inputs Module

- I4 Input for Neutral Current measurement
- Ir Input for Residual Current measurement (CT not included)
- 0/4-20mA DC Analog Input with programmable zero and full scales

Communications

- 1x10Base-T/100Base-TX Ethernet Port with RJ45 connector
- 1xOptically isolated RS-485 port with baud rate from 1.2kbps to 38.4kbps
- Built-in Web Server for easy data viewing and setup configurations
- Protocol supported: Modbus TCP/RTU, BACnet MS/TP, DNP 3.0, HTTP, SMTP, SNTP, TFTP and Ether-Gate

Real-time Clock

- Battery-backed Real-time Clock with 6ppm accuracy (<0.5s per day)

System Integration

- Supported by CET's PecStar® iEMS
- Easy integration into Building Automation Systems with BACnet MS/TP or Modbus RTU and Utility Substation Automation with DNP 3.0
- The on-board password protected Web Server allows complete access to its data and supports the configuration for most of the Setup parameters via a standard web browser.

1.3 PMC-53A-E application in Power and Energy Management Systems

The PMC-53A-E 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 an RS-485 network to an Integrated Energy Management system such as PecStar®.

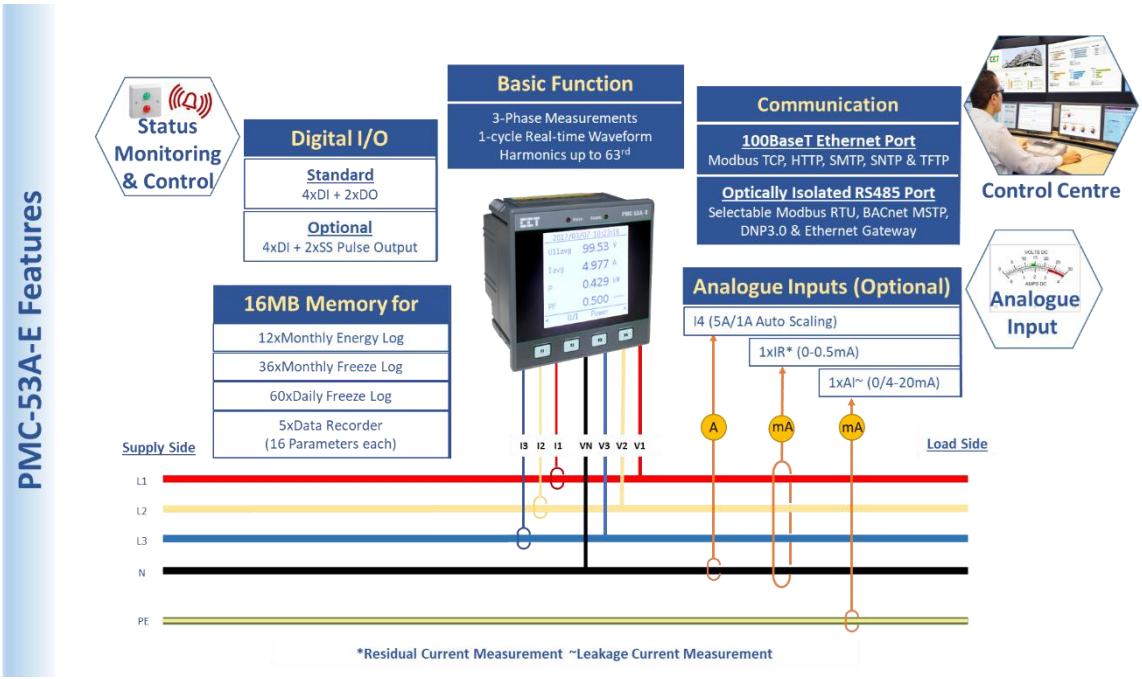


Figure 1-1 Application in Power and Management Systems

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 directly via email at support@cet-global.com

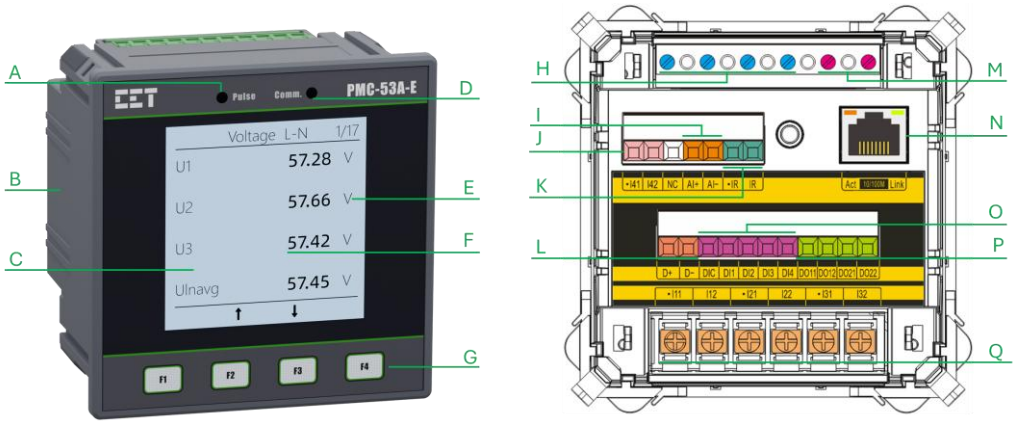
Chapter 2 Installation

Caution

Installation of the PMC-53A-E 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



A	LED Pulse Output	G	Buttons	M	Power Supply
B	Enclosure	H	Voltage Inputs	N	10Base-T/100Base-TX Ethernet Port
C	Front Panel	I	Analog Input*	O	Digital Inputs
D	Communication Indicator	J	I4 Input*	P	Digital Outputs
E	Units	K	Iresidual Input*	Q	Current Inputs
F	Measurements	L	RS-485 Port		

* Optional

Figure 2-1 Appearance

2.2 Unit Dimensions

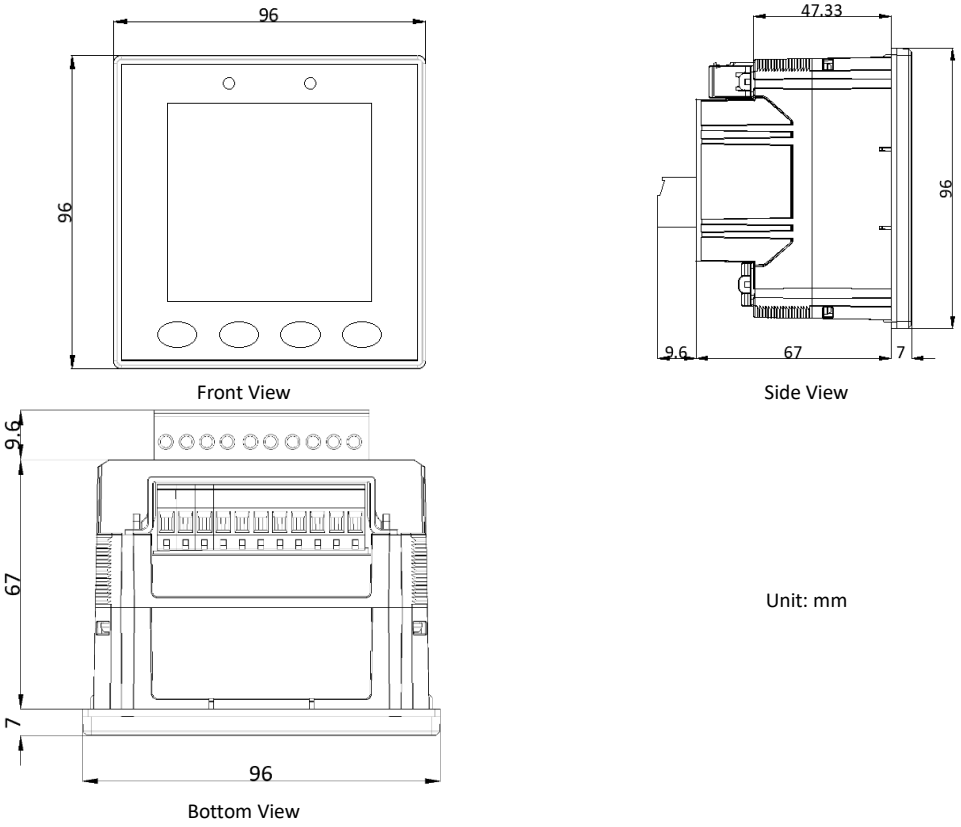
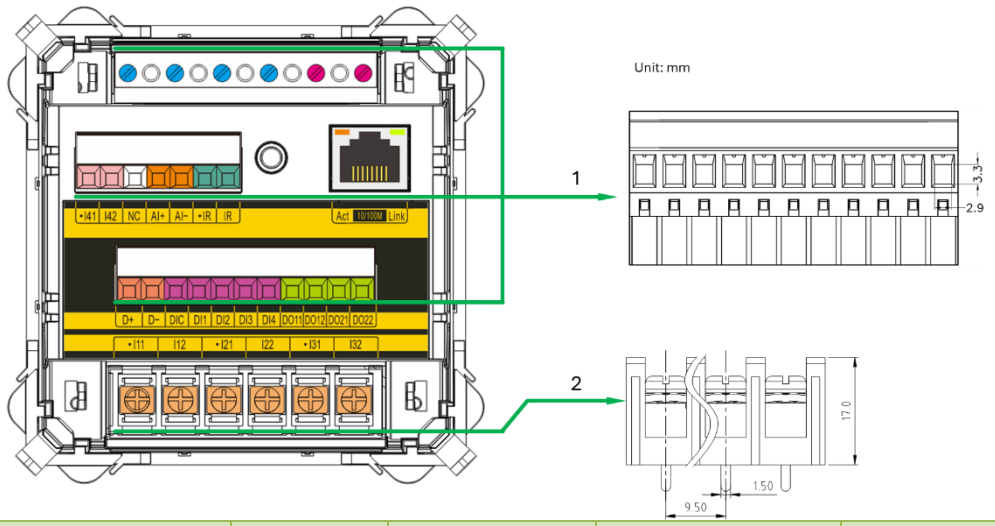


Figure 2-2 Unit Dimensions

2.3 Terminal Dimensions

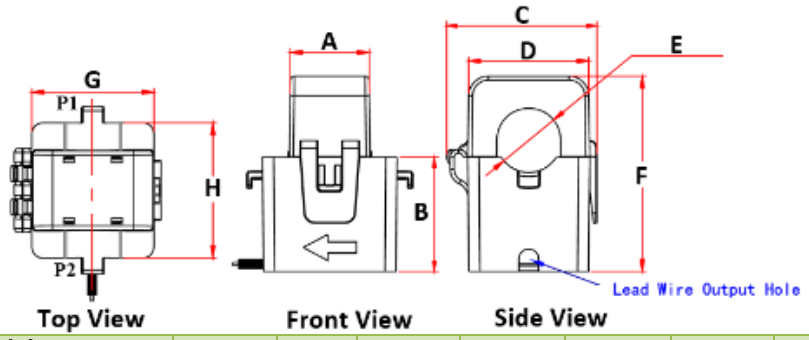


	Terminal	Terminal Dimensions	Wire Size	Tightening Torque	Max. Torque
1	Voltage Input Power Supply I4 Input, AI, Ir Input RS-485, DI, DO	2.9 x 3.3mm	0.2-3.5 mm^2 (28-12 AWG)	4 kgf.cm/M3 3.54 lb-in/0.4N.m	5.1 kgf.cm/M3 4.42 lb-in/0.5 N.m
2	Current Input	7.8 x 7.8mm	0.5-2.0mm^2 (22-14AWG)	7.1 kgf.cm/M3.5 6.28 lb-in/0.7 N.m	12 kgf.cm/M3.5 10.4 lb-in/1.17N.m

Figure 2-3 Terminal Dimensions

2.4 Split-Core Current Transformer Dimensions

- **100A/200A/400A to 40mA Output SCCT**

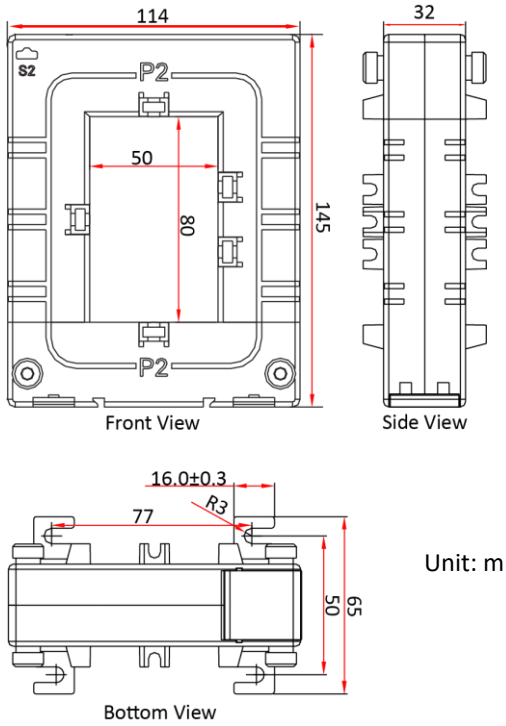


Model	A	B	C	D	E	F	G	H
PMC-SCCT-100A-40mA-16-A	19.9	28.6	38	30.26	Ø16.1	48.9	30.7	33.9
PMC-SCCT-200A-40mA-24-A	20	40.5	53.5	44.3	Ø24.1	70.0	45.0	40.2
PMC-SCCT-400A-40mA-35-A	22.5	47	67	57.3	Ø35.1	83	58.2	42.8

Unit: mm

Figure 2-4 100A/200A/400A to 40mA Output SCCT Dimensions

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



Unit: mm

Figure 2-5 800A Split Core CT Dimensions

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

Unit: mm

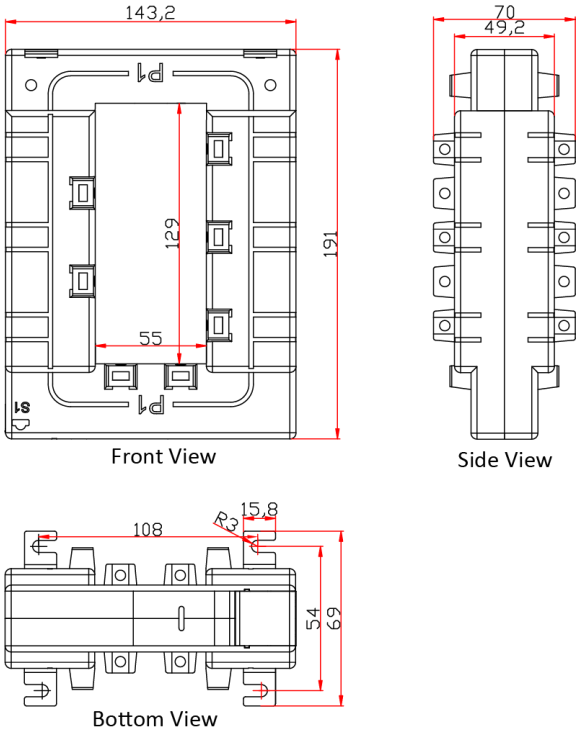
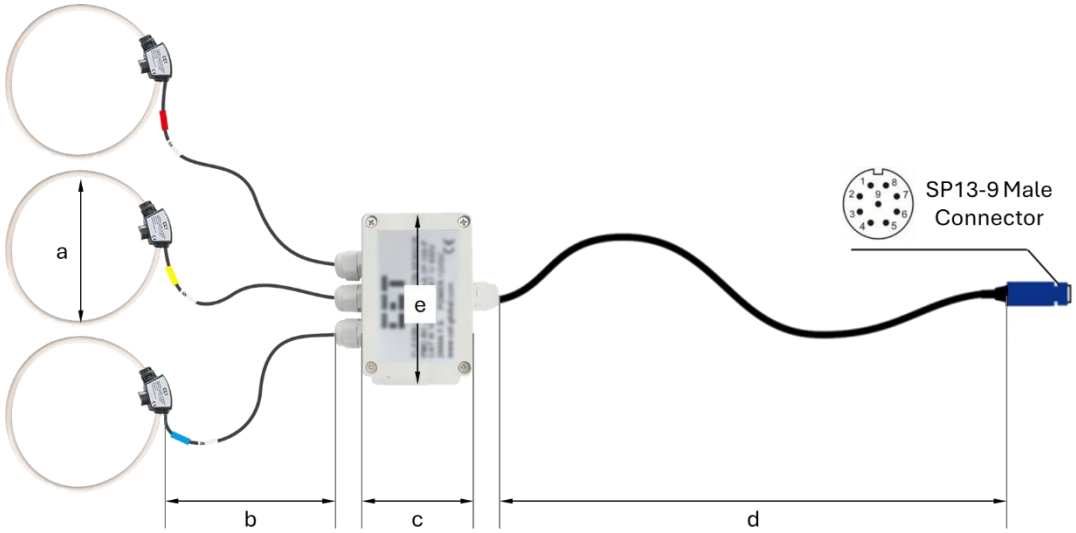


Figure 2-6 1600A Split Core CT Dimensions

2.5 Rogowski Coil Dimensions

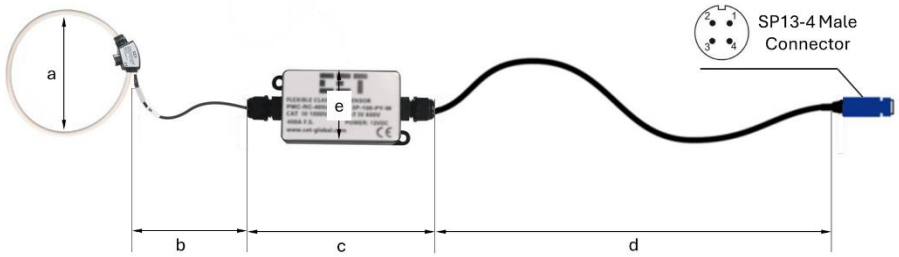
2.5.1 3-phase Rogowski Coil Dimensions



Model	Dimensions (mm)				
	a	b	c	d	e
PMC-RC-400A-40mA-3P-100-PY-W	100	250	69	2500	132
PMC-RC-1200A-40mA-3P-150-PY-W	150	250	69	2500	132
PMC-RC-2500A-40mA-3P-200-PY-W	200	250	69	2500	132
PMC-RC-5000A-40mA-3P-350-PY-W	350	250	69	2500	132

Figure 2-7 3-phase Rogowski Coil Dimensions

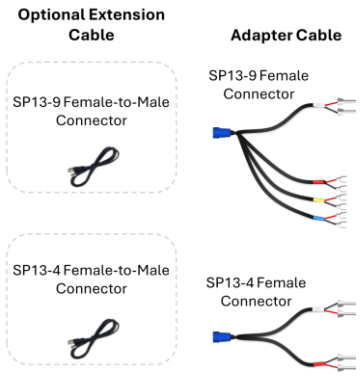
2.5.2 1-phase Rogowski Coil Dimensions



Model	Dimensions (mm)				
	a	b	c	d	e
PMC-RC-400A-40mA-1P-100-PY-W	100	250	115	2500	42
PMC-RC-1200A-40mA-1P-150-PY-W	150	250	115	2500	42
PMC-RC-2500A-40mA-1P-200-PY-W	200	250	115	2500	42
PMC-RC-5000A-40mA-1P-350-PY-W	350	250	115	2500	42

Figure 2-8 1-phase Rogowski Coil Dimensions

2.5.3 Rogowski Coil Accessories Dimensions



Application Range	Optional Extension Cable	Adapter Cable
3-phase Rogowski Coil	SP13-F-M-5, 5m SP13-9 Female-to-male connector	0.25m SP13-9 Female Connector
	SP13-F-M-10, 10m SP13-9 Female-to-male connector	
1-phase Rogowski Coil	SP13-4-F-M-5, 5m SP13-4 Female-to-male connector	0.25m SP13-4 Female Connector
	SP13-4-F-M-10, 10m SP13-4 Female-to-male connector	

Figure 2-9 Rogowski Coil Accessories Dimensions

2.6 Residual Current CT Dimensions

2.6.1 Solid Core CTs

- **CT517203 (160A, Ø=46mm)**

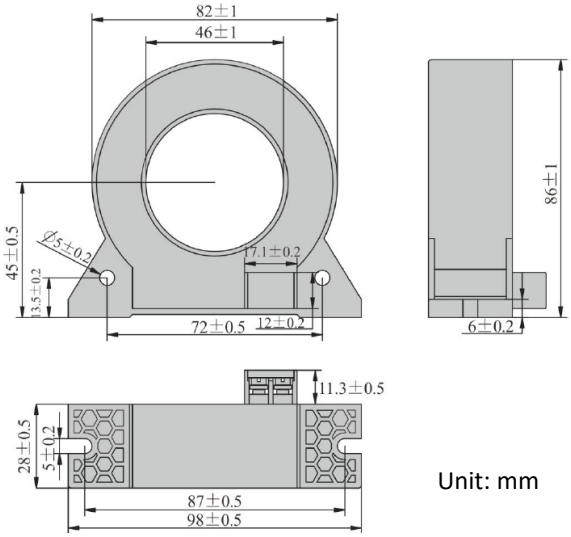


Figure 2-10 CT517203 Dimensions

- **CT517403 (400A, Ø=80mm)**

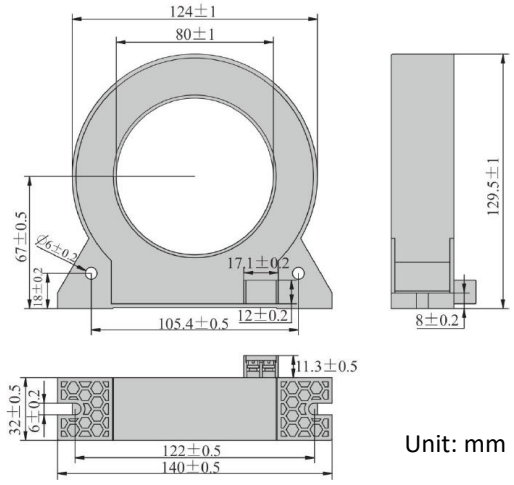
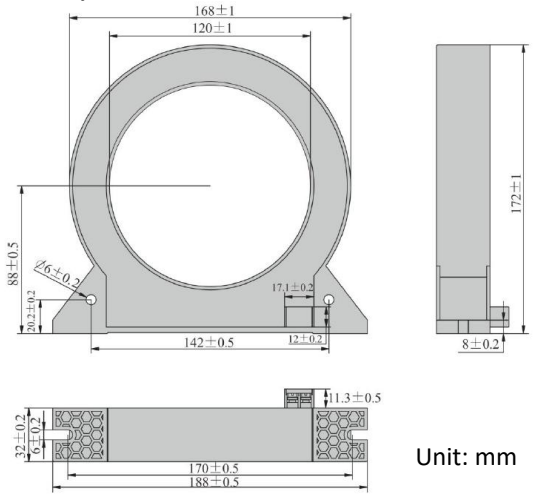


Figure 2-11 CT517403 Dimensions

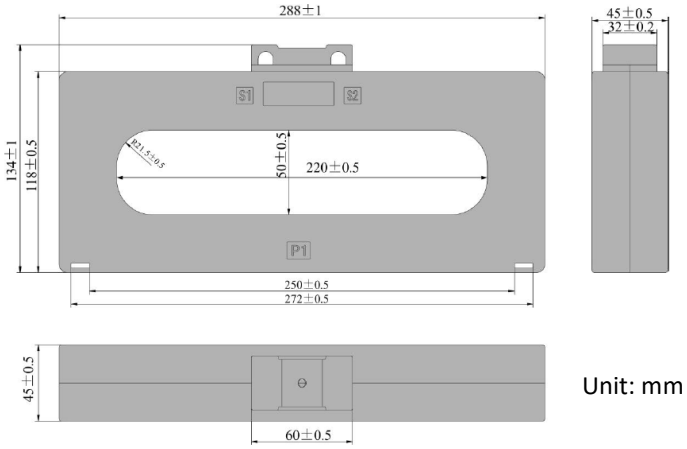
- **CT517603 (1000A, Ø=120mm)**



Unit: mm

Figure 2-12 CT517603 Dimensions

- **CT519703 (630A, 220x50mm)**



Unit: mm

Figure 2-13 CT519703 Dimensions

2.6.2 Split Core CTs

- **CT553203 (160A, Ø=48mm)**

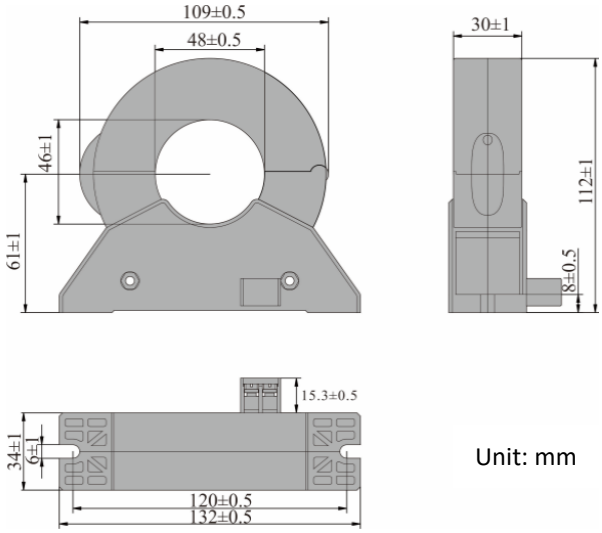


Figure 2-14 CT553203 Dimensions

- **CT553303 (225A, Ø=68mm)**

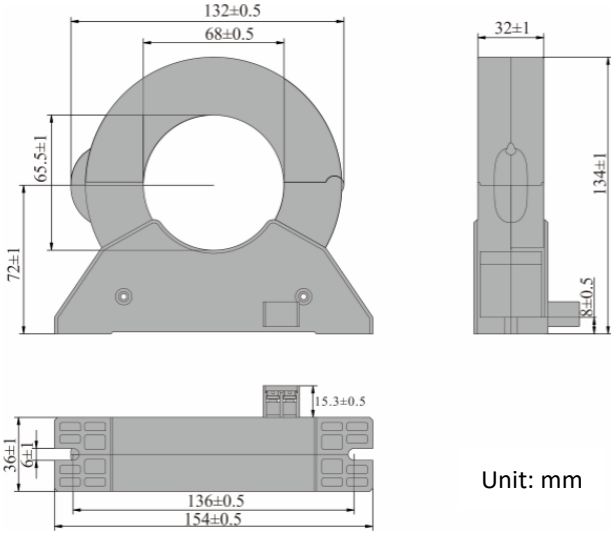


Figure 2-15 CT553303 Dimensions

2.7 Mounting

The PMC-53A-E 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 92x92mm cutout as shown in Figure 2-16
- Re-install the installation clips and push the clips tightly against the panel to secure the meter

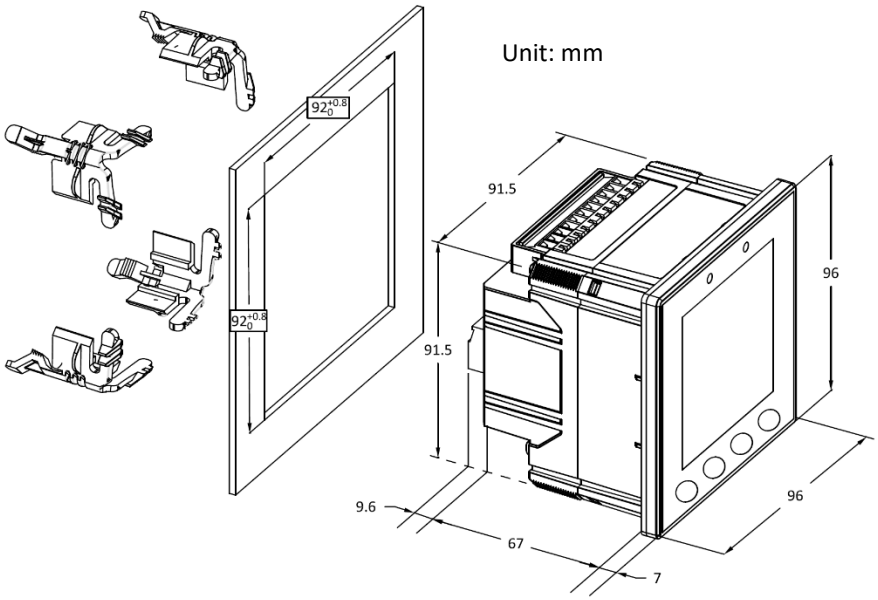


Figure 2-16 Panel Cutout Mounting

2.8 Wiring connections

PMC-53A-E 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 or 4CTs
- 3-Phase 4-Wire (3P4W) Wye with 3PTs and 3CTs or 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
- 3x1-Phase Direct Connection with 3CTs (Supported in Firmware V1.01.00 or later)

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.

2.8.1 3-Phase 4-Wire (3P4W) Wye Direct Connection with 3CTs or 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**.

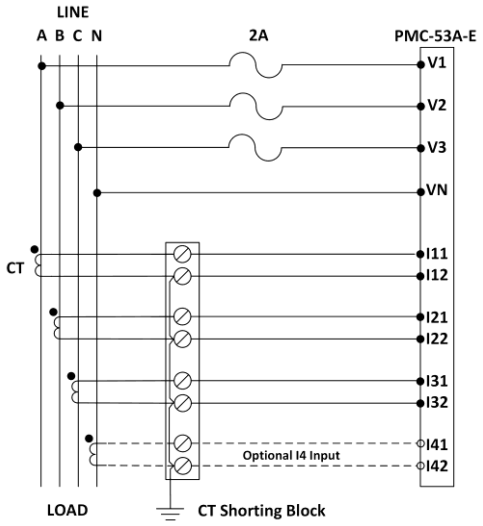


Figure 2-17 3P4W Direct Connection with 3CTs or 4CTs

2.8.2 3-Phase 4-Wire (3P4W) Wye with 3PTs and 3CTs or 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**.

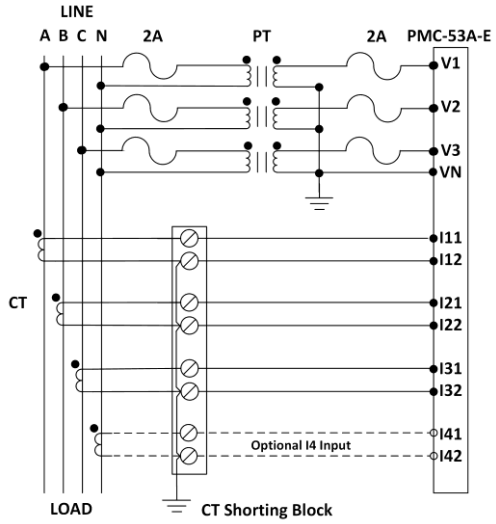


Figure 2-18 3P4W with 3PTs and 3CTs or 4CTs

2.8.3 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**.

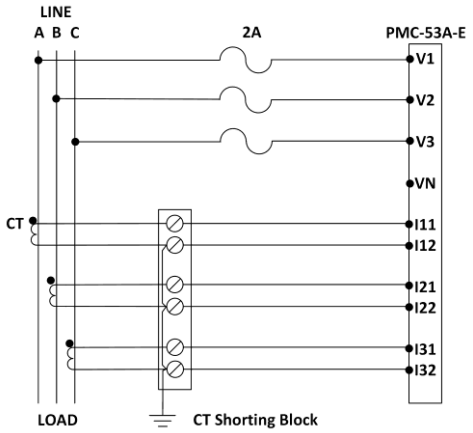


Figure 2-19 3P3W Direct Connection with 3CTs

2.8.4 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**.

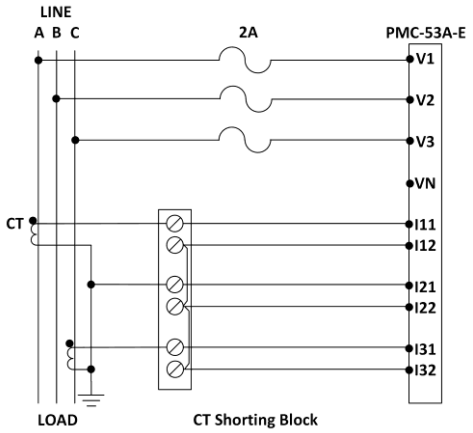


Figure 2-20 3P3W Direct Connection with 2CTs

2.8.5 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**.

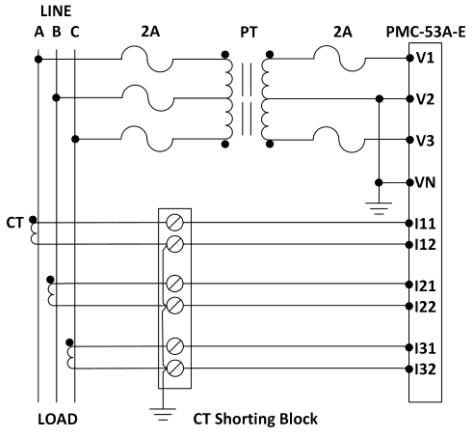


Figure 2-21 3P3W Delta with 2PTs and 3CTs

2.8.6 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**.

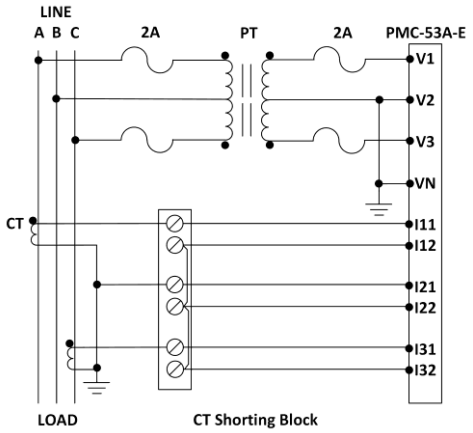


Figure 2-22 3P3W Delta with 2PTs and 2CTs

2.8.7 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**.

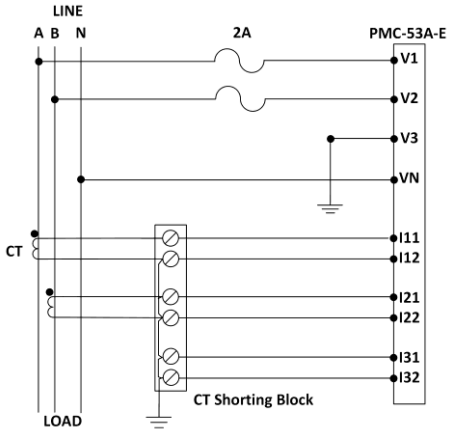


Figure 2-23 1P3W Direct Connection with 2CTs

2.8.8 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**.

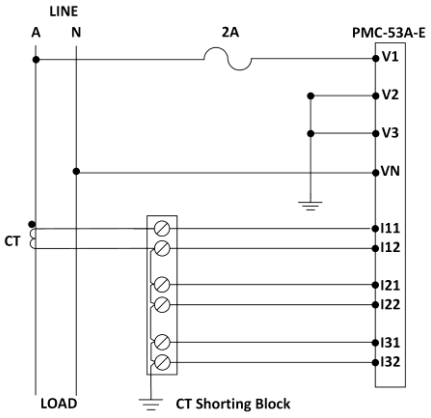


Figure 2-24 1P2W ULN Direct Connection with 1CT

2.8.9 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 line voltage input specification. Set the **Wiring Mode** to **1P2W, L-L**.

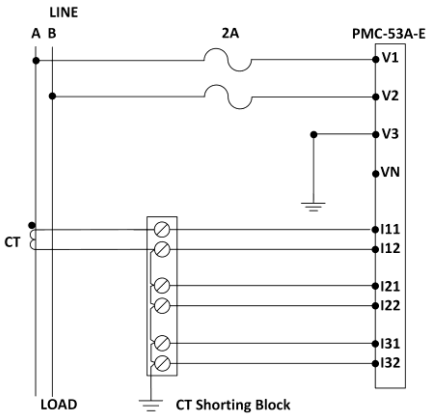


Figure 2-25 1P2W ULL Direct Connection with 1CT

2.8.10 3x1-Phase Direct Connection with 3CTs (Supported in Firmware V1.01.00 or later)

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 **3x1P**.

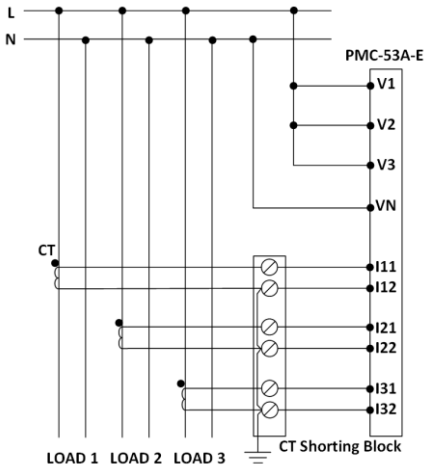


Figure 2-26 3x1-Phase Direct Connection with 3CTs

2.9 Split-Core Current Transformer Installation

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.

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

Steps:

a. Make sure that the maximum load Current is within the SCCT's measurement range indicated in the label.
b. Put on the necessary personal protective equipment and de-energize the circuit before installation.
c. Connect the SCCT's output, as shown in Figure #1 below, to the meter's Current Input terminal. Connect White Wire to Positive (•IX1) terminal. Connect Black Wire to Negative (Ix2) terminal.
d. Open the clip of the SCCT as shown in Figure #2 below and make sure that the SCCT's contact surface is clean and free of contaminants for best accuracy performance.
e. Install the SCCT around the conductor as shown in Figure #3 below and make sure that the Current flow direction is consistent with the SCCT's arrow indicator.
f. Close the SCCT and make sure that the clip is securely latched. A nylon cable tie or wire strap should be used to secure the SCCT to the conductor and prevent it from moving around.

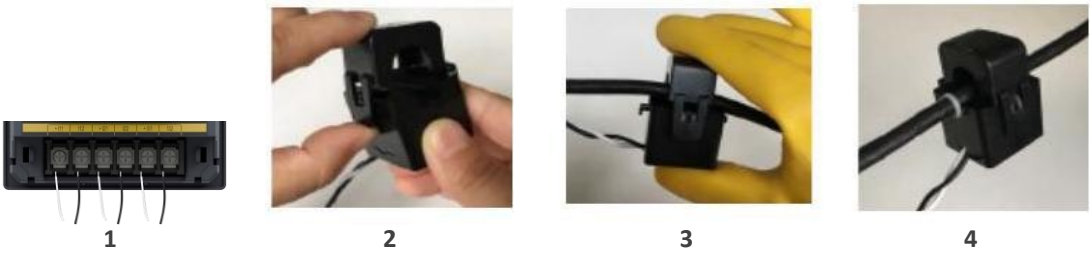


Figure 2-27 100A/40mA, 200A/40mA or 400A/40mA SCCT Installation

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

Steps:

1. Connect the meter's Positive and Negative Terminals to the SCCT's S1 and S2 terminals, respectively.
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.

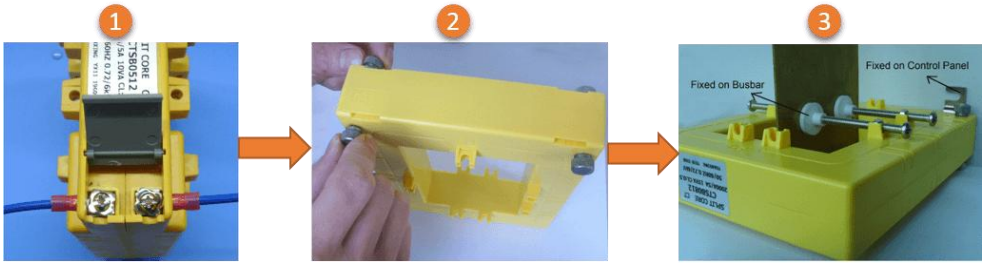


Figure 2-28 800A/40mA or 1600A/40mA SCCT installation

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.

2.10 Rogowski Coils Wiring

Steps:

1. Coil Installation.

   Note: No circuit interruption is required. The work can be carried out 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.

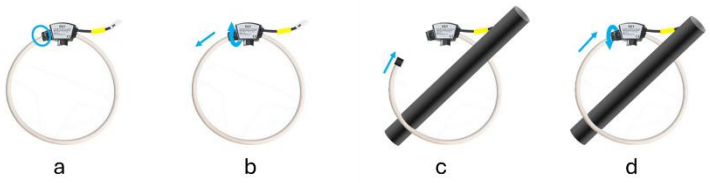


Figure 2-29 Rogowski Coil Installation Steps

2. Install all phase coils sequentially as per above procedure.
3. For 3-phase metering: connect coil's SP13-9 male connector directly to meter 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 meter via adapter cable, or to extension cable (SP13-4 female-to-male) for longer runs.
4. Apply 10-25VDC power for the Rogowski coils.

Notes:

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

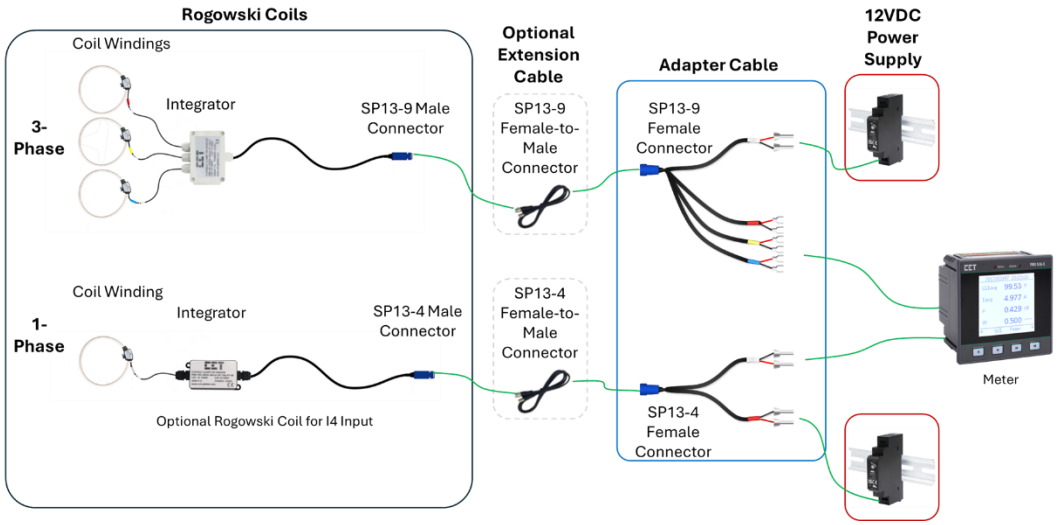


Figure 2-30 Rogowski Coil Wiring

2.11 Communications Wiring

2.11.1 Ethernet Port (10Base-T/100Base-TX)

The following table illustrates the pin definition for the RJ45 Ethernet connector.

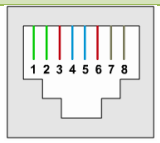
RJ45 Connector	Pin	Meaning
	1	Transmit Data+
	2	Transmit Data-
	3	Receive Data+
	4,5,7,8	NC
	6	Receive Data-

Table 2-1 **RJ45 Connector Pin Description for 10Base-T/100Base-TX Applications**

2.11.2 RS-485 Port

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

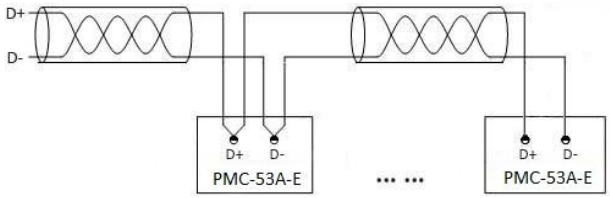


Figure 2-31 Communications Connections

The PMC-53A-E provides one standard RS-485 port. 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, an Ethernet-to-RS-485 gateway or USB/RS-485 converter with optically isolated output and surge protection should be used.

2.12 Digital Input Wiring

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

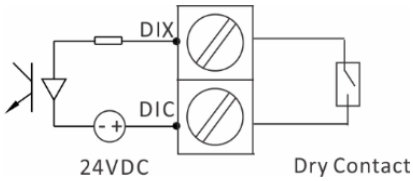


Figure 2-32 DI Connections

2.13 Digital Output Wiring

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

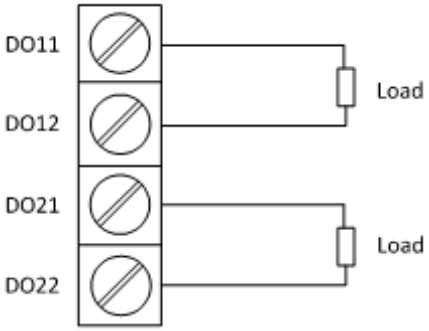


Figure 2-33 DO Connections

2.14 Solid State Relay Wiring

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

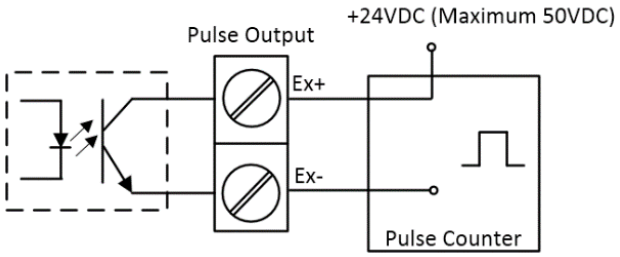


Figure 2-34 Solid State Relay Connections

2.15 Analog Input Wiring

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

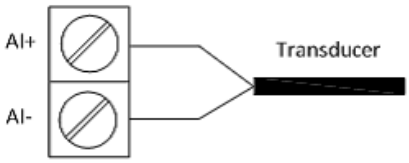


Figure 2-35 AI Connections

2.16 Residual Current (Ir) Wiring

The following figure illustrates the Residual Current connections on the PMC-53A-E:

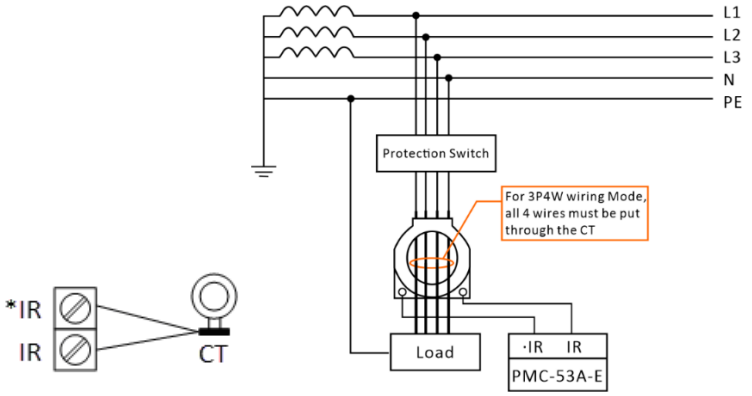


Figure 2-36 Residual Current Connections

Note:

1) The Residual Current terminals (either *IR and IR) should be left open and should not be connected to ground if unused. Otherwise, doing so would damage the device.

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.

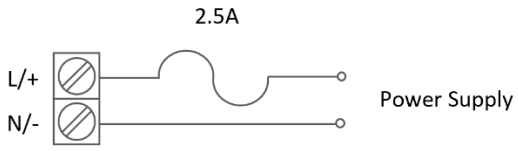


Figure 2-37 Power Supply Connections

Chapter 3 User Interface

3.1 Front Panel

The PMC-53A-E has a large, easy to read Dot-Matrix LCD display with backlight and four buttons for data display and meter configuration, one LED Pulse Output and a Communication Indicator.

Figure 3-1 Front Panel

3.1.1 Front Panel Buttons

The PMC-53A-E'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).**

	Display Mode		Setup Mode				
Button	**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)	↑ (Incre-ment)	↓ (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

3.1.2 Data Display

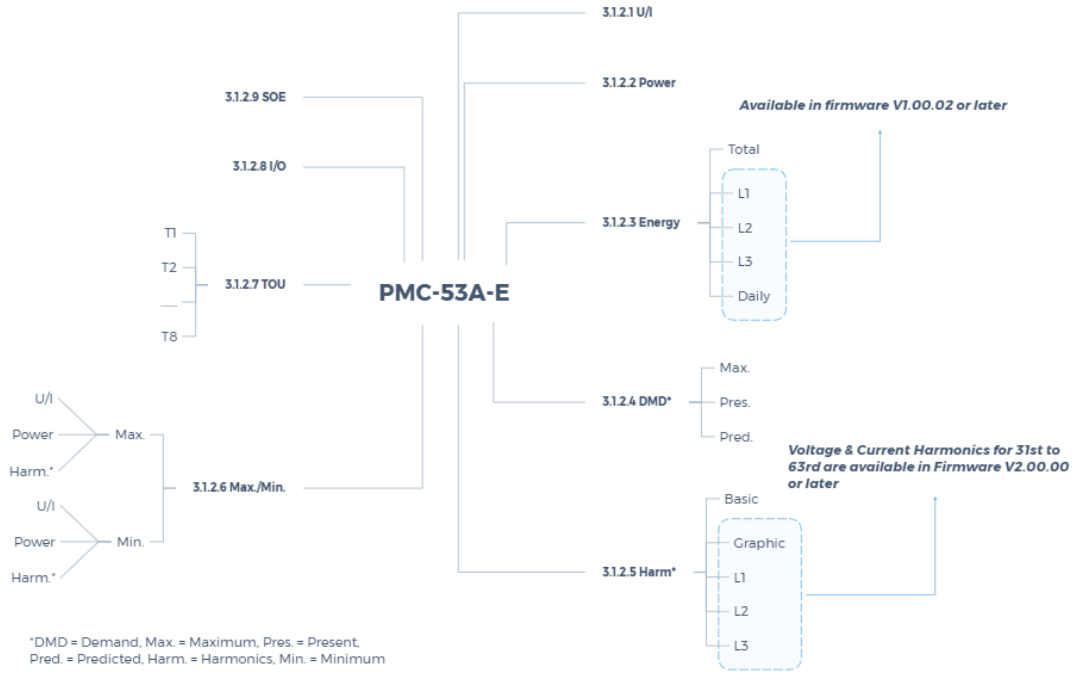


Figure 3-2 Data Display Menu

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

The following sections illustrate the available measurements for each display option. Depending on the **Wiring Mode** selected, certain measurements may not be available. For example, the per-phase ULN, ULN Average, I4, per-phase P, Q, S, PF and per-phase Energy measurements (available in FW V1.01.00 or later) are not available when the **Wiring Mode** is set to 3P3W or 1P2W L-L.

3.1.2.1 U/I

Menu	Display Screens	1st Row	2nd Row	3rd Row	4th Row
<U/I>	Default	Ullavg	Iavg	P Total	PF Total
	Display 1 (Voltage L-N)	U1	U2	U3	Ulnavg
	Display 2 (Voltage L-L)	U12	U23	U31	Ullavg
	Display 3 (Current)	I1	I2	I3	Iavg
	Display 4 (Ung/In/I4/Ir)	Ung*[1]	In[1]	I4[2]	Ir[3]
	Display 5 (Frequency)	Freq.			
	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			
	Display 16 (U Fund.)	U1[4]	U2[4]	U3[4]	
	Display 17 (I Fund.)	I1[4]	I2[4]	I3[4]	

* Ung (Neutral-to-Ground Voltage) is available in Firmware V1.01.00 or later.

Table 3-2 U/I Display

Notes:

1. **Ung** and **In** only appear 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

3.1.2.2 Power

Menu	Display Screens	1st Row	2nd Row	3rd Row	4th Row
<Power>	Display 1	P Total	Q Total	S Total	PF Total
	Display 2	P1	P2	P3	P Total
	Display 3	Q1	Q2	Q3	Q Total
	Display 4	S1	S2	S3	S Total
	Display 5	PF1	PF2	PF3	PF Total
	Display 6	dPF1	dPF2	dPF3	
	Display 7 (P Fund.)	P1	P2	P3	P

Table 3-3 Power Display

3.1.2.3 Energy

Menu 1st / 2nd	Display Screens	1st Row	2nd Row	3rd Row	4th Row	5th Row
<Energy>	Default <Total>	kWh Total	kvarh Total	kVAh Total		
<Total>	Display 1	kWh Total	kvarh Total	kVAh Total		
	Display 2	kWh Imp.	kWh Exp.	kWh Net	kWh Total	
	Display 3	kvarh Imp.	kvarh Exp.	kvarh Net	kvarh Total	
	Display 4	kVAh Total				
<L1>*	Display 1	kWh Total	kvarh Total	kVAh Total		
	Display 2	kWh Imp.	kWh Exp.	kWh Net	kWh Total	
	Display 3	kvarh Imp.	kvarh Exp.	kvarh Net	kvarh Total	
	Display 4	kVAh Total				
<L2>*	Display 1	kWh Total	kvarh Total	kVAh Total		
	Display 2	kWh Imp.	kWh Exp.	kWh Net	kWh Total	
	Display 3	kvarh Imp.	kvarh Exp.	kvarh Net	kvarh Total	
	Display 4	kVAh Total				
<L3>*	Display 1	kWh Total	kvarh Total	kVAh Total		
	Display 2	kWh Imp.	kWh Exp.	kWh Net	kWh Total	
	Display 3	kvarh Imp.	kvarh Exp.	kvarh Net	kvarh Total	
	Display 4	kVAh Total				
<Daily>*	Display 1 (Daily)	kWh Imp.	kWh Exp.	kvarh Imp.	kvarh Exp.	kVAh Total
	Display 2 (Daily)	%Q Imp./P Imp.		%Q Exp./P Imp.		
	Display 3 (30D Total)	%Q Imp./P Imp.		%Q Exp./P Imp.		

*Available in Firmware V1.01.00 or later

Table 3-4 Energy Display

3.1.2.4 Demand

Menu 1st / 2nd	Display Screens	1st Row	2nd Row	3rd Row	4th Row
<DMD>[1]	Default (Max.)	P Total	Q Total	S Total	
		Timestamp	Timestamp	Timestamp	
<Max.>[2]	Display 1	P Total	Q Total	S Total	
		Timestamp	Timestamp	Timestamp	
	Display 2	I1	I2	I3	Iavg*
		Timestamp	Timestamp	Timestamp	Timestamp*
	Display 3*	U1	U2	U3	Ulnavg
		Timestamp	Timestamp	Timestamp	Timestamp
	Display 4*	U12	U23	U31	Ullavg
		Timestamp	Timestamp	Timestamp	Timestamp
<Pres.>[3]	Display 1	P Total	Q Total	S Total	
	Display 2	I1	I2	I3	Iavg*
	Display 3*	U1	U2	U3	Ulnavg
	Display 4*	U12	U23	U31	Ullavg
<Pred.>[4]	Display 1	P Total	Q Total	S Total	
	Display 2	I1	I2	I3	Iavg*
	Display 3*	U1	U2	U3	Ulnavg
	Display 4*	U12	U23	U31	Ullavg

*Available in Firmware V1.01.00 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

3.1.2.5 Harmonics

Menu 1st 2nd	Display Screens	1st Row	2nd Row	3rd Row
<Harm.[1]>	Default	U1/U12 THD	U2/U23 THD	U3/U31 THD
<Basic>	Display 1[2] (U THD)	U1/U12 THD	U2/U23 THD	U3/U31 THD
	Display 2 (I THD)	I1 THD	I2 THD	I3 THD
	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[3, 4] (U Sequence)	U1	U2	U0
	Display 8[3, 4] (I Sequence)	I1	I2	I0
<Graph>	Display 1[2]	U1/U12 HD03 - HD31 Spectrum (Odd)		
	Display 2*[2]	U1/U12 HD33 - HD63 Spectrum (Odd)		
	Display 3[2]	U2/U23 HD03 - HD31 Spectrum (Odd)		
	Display 4*[2]	U2/U23 HD33 - HD63 Spectrum (Odd)		
	Display 5[2]	U3/U31 HD03 - HD31 Spectrum (Odd)		
	Display 6*[2]	U3/U31 HD33 - HD63 Spectrum (Odd)		
	Display 7	I1 HD03 - HD31 Spectrum (Odd)		
	Display 8*	I1 HD33 - HD63 Spectrum (Odd)		
	Display 9	I2 HD03 - HD31 Spectrum (Odd)		
	Display 10*	I2 HD33 - HD63 Spectrum (Odd)		
	Display 11	I3 HD03 - HD31 Spectrum (Odd)		
	Display 12*	I3 HD33 - HD63 Spectrum (Odd)		
<L1[5]>	Display 1 [HD (ODD)]	HD03 - HD15		
	Display 2 [HD (ODD)]	HD17 - HD29		
	Display 3 [HD (ODD)]*	HD31 - HD43		
	Display 4 [HD (ODD)]*	HD45 - HD57		
	Display 5 [HD (ODD)]*	HD59 - HD63		
	Display 6 [HD (Even)]	HD02 - HD14		
	Display 7 [HD (Even)]	HD16 - HD28		
	Display 8 [HD (Even)]*	HD30 - HD42		
	Display 9 [HD (Even)]*	HD44 - HD56		
	Display 10 [HD (Even)]*	HD58 - HD62		
<L2[5]>	Display 1 [HD (ODD)]	HD03 - HD15		
	Display 2 [HD (ODD)]	HD17 - HD29		
	Display 3 [HD (ODD)]*	HD31 - HD43		
	Display 4 [HD (ODD)]*	HD45 - HD57		
	Display 5 [HD (ODD)]*	HD59 - HD63		
	Display 6 [HD (Even)]	HD02 - HD14		
	Display 7 [HD (Even)]	HD16 - HD28		
	Display 8 [HD (Even)]*	HD30 - HD42		
	Display 9 [HD (Even)]*	HD44 - HD56		
	Display 10 [HD (Even)]*	HD58 - HD62		
<L3[5]>	Display 1 [HD (ODD)]	HD03 - HD15		
	Display 2 [HD (ODD)]	HD17 - HD29		
	Display 3 [HD (ODD)]*	HD31 - HD43		
	Display 4 [HD (ODD)]*	HD45 - HD57		
	Display 5 [HD (ODD)]*	HD59 - HD63		
	Display 6 [HD (Even)]	HD02 - HD14		
	Display 7 [HD (Even)]	HD16 - HD28		
	Display 8 [HD (Even)]*	HD30 - HD42		
	Display 9 [HD (Even)]*	HD44 - HD56		
	Display 10 [HD (Even)]*	HD58 - HD62		

*Available in Firmware V2.00.00 or later version.

Table 3-6 Harmonics Display

Notes:
1. Harm. = Harmonics
2. When the **Wiring Mode** is **3P3W** or **1P2W L-L**, the phase A/B/C Voltage THD/TOHD/TEHD/HD*xx* mean phase AB/BC/CA Voltage THD/TOHD/TEHD/HD*xx*.
3. For U/I Sequence Components:

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

4. This screen is not shown if the Wiring Mode is set to 1P2W LN, 1P2W LL or 1P3W.
5. L1 to L3 displays the Voltage and Current for HD02 to HD63 (ODD/Even) for phase A/B/C respectively.

3.1.2.6 Max./Min.

Menu 1st	2nd	3rd	Display Screens	1st Row	2nd Row	3rd Row	4th 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	Freq.	In	I4	Ir
				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 Voltage THD	L1	L2	L3	
				Timestamp	Timestamp	Timestamp	
			Display 2 Current THD	L1	L2	L3	
				Timestamp	Timestamp	Timestamp	
			Display 3 K-Factor	L1	L2	L3	
				Timestamp	Timestamp	Timestamp	
			Display 4 Crest Factor	L1 Crest Factor	L2 Crest Factor	L3 Crest Factor	
				Timestamp	Timestamp	Timestamp	
			Display 5 Unbalance	Current	Voltage		
				Timestamp	Timestamp		
<Min.>	<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	Freq.	In	I4	Ir
				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 Voltage THD	L1	L2	L3	
				Timestamp	Timestamp	Timestamp	
			Display 2 Current THD	L1	L2	L3	
				Timestamp	Timestamp	Timestamp	
			Display 3 K-Factor	L1	L2	L3	
				Timestamp	Timestamp	Timestamp	
			Display 4 Crest Factor	L1 Crest Factor	L2 Crest Factor	L3 Crest Factor	
				Timestamp	Timestamp	Timestamp	
			Display 5 Unbalance	Current	Voltage		
				Timestamp	Timestamp		

Table 3-7 Max./Min. Display

3.1.2.7 TOU

Menu 1st	2nd	Display screens	1st Row	2nd Row	3rd Row
<TOU>		Default (T1 kWh)	Imp.	Exp.	
	<T1[1]>	Display 1 (kWh)	Imp.	Exp.	
		Display 2 (kvarh)	Imp.	Exp.	
		Display 3 (kVAh)	Tot.		
		Display 4 (Max. Demand)	P	Q	S
			Timestamp	Timestamp	Timestamp
	<T2[1]>	Display 1 (kWh)	Imp.	Exp.	
	.	Display 2 (kvarh)	Imp.	Exp.	
	.	Display 3 (kVAh)	Tot.		
	.	Display 4 (Max. Demand)	P	Q	S
	<T7[1]>		Timestamp	Timestamp	Timestamp
	<T8[1]>	Display 1 (kWh)	Imp.	Exp.	
		Display 2 (kvarh)	Imp.	Exp.	
		Display 3 (kVAh)	Tot.		
		Display 4 (Max. Demand)	P	Q	S
			Timestamp	Timestamp	Timestamp

Table 3-8 TOU Display

Note:

1. When the Tariff switching is controlled by the TOU Schedule, only the configured Tariffs will be displayed. If the Tariff Switching is based on the DI status, please refer to Table 4-14 in **Section 4.6** to check the relationship between the number of active Tariffs and how many DIs are programmed as a Tariff Switch.

3.1.2.8 I/O

Menu	Display screens	1st Row	2nd Row	3rd Row	4thRow
<I/O>	Display 1 (DI Status)	DI1	DI2	DI3	DI4
	Display 2 (Pulse Counter)	DI1	DI2	DI3	DI4
	Display 3 (DO Status)	DO1[1]	DO2[1]		
	Display 4 (Analog Input)	AI[2]			

Table 3-9 I/O

Notes:

1) This display only appears if the meter is equipped with the corresponding DO option.
2) This display only appears if the meter is equipped with the AI option.

3.1.2.9 SOE

The PMC-53A-E 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:

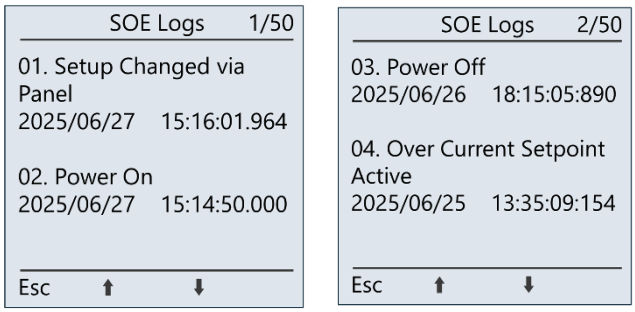


Figure 3-3 SOE Log Displays

3.1.3 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.

3.1.3.1 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 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 or "Incorrect Password!" message will pop out.

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 the configuration is done.

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.

3.1.3.2 Setup Menu

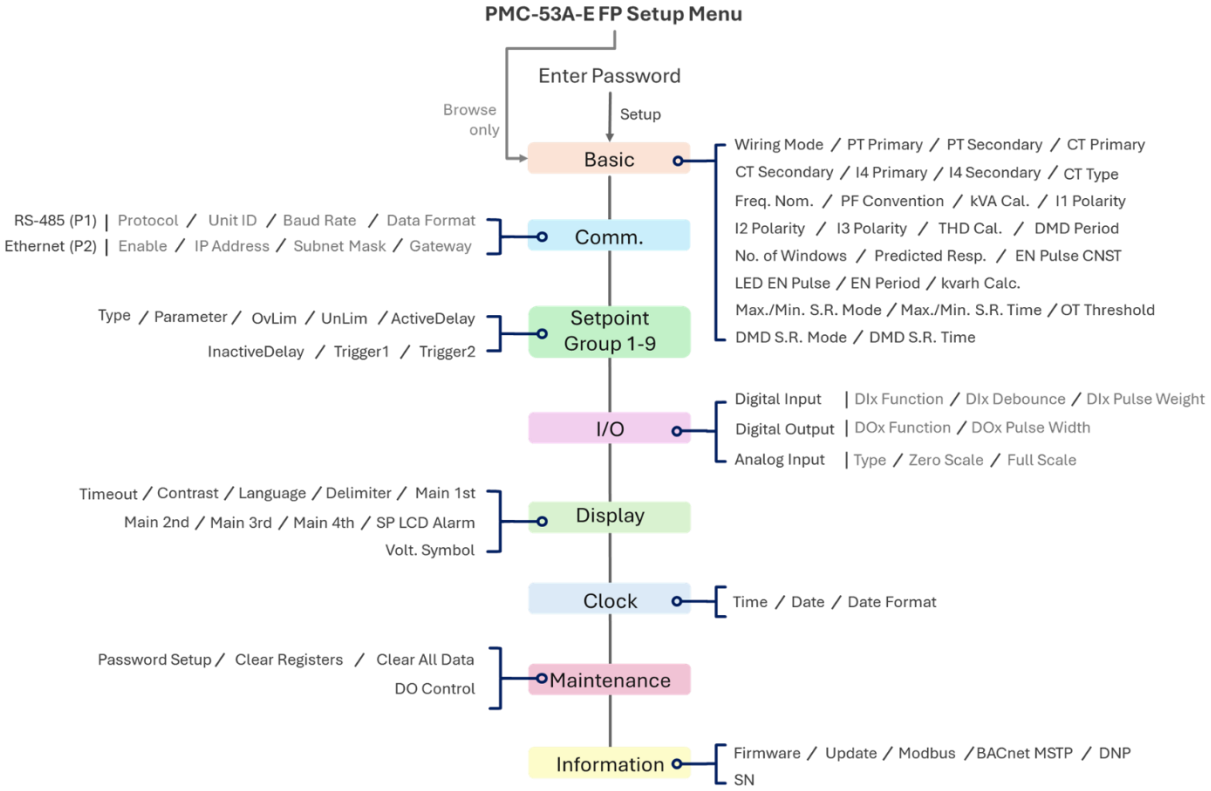


Figure 3-4 Setup Menu

3.1.3.3 Configuration

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

Menu Label 1st 2nd 3rd	Description	Range	Default
Password	Enter Password	0000 to 9999	0000
Basic			
Wiring Mode	Meter's Wiring Connection	DEMO/1P2W L-N/ 1P2W L-L/1P3W /3P3W/3P4W/3x1P	3P4W

PT Primary[1]	PT Primary Ratio	1 to 1000000V	100V
PT Secondary[1]	PT Secondary Ratio	1 to 690V	100V
CT Primary[2]	CT Primary Ratio	1 to 30000A	5A
CT Secondary[2]	CT Secondary Ratio	1 to 5A	5A
I4 Primary*	I4 Primary Ratio	1 to 30000A	5A
I4 Secondary*	I4 Secondary Ratio	1 to 5A	5A
CT Type[2, 3, 错误!未找到引用源。] *	External CT Types	100A SCCT/ 200A SCCT/ 400A SCCT/ 800A SCCT/ 1600A SCCT/ 400A RC/ 1200A RC/ 2500A RC/ 5000A RC	100A SCCT
Freq. Nom.	System Nominal Frequency		
PF Convention	PF Convention	IEC/IEEE/-IEEE	IEC
kVA Calc.	kVA Calculation Method	Vector/Scalar[5]	Vector
I1 Polarity	I1 Polarity	Normal/Reverse	Normal
I2 Polarity	I2 Polarity		
I3 Polarity	I3 Polarity		
THD Calc.	Select between % of Fundamental or RMS	THDf/THDr[6]	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[3, 错误!未找到引用源。]	Pulse Constant	1,000/3,200/6,400/10/ 100/5,000/10,000/25,000	3,200
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	Max./Min. Log Self-Read Mode	Auto/Manual	Manual
Max./Min. S.R. Time	Max./Min. Log Self-Read Time[7]	(1-28) Day (0-24) Hour	--D--H
OT Threshold	Current Threshold of Device Operating Time	1 to 1000 (x0.001In)	1
DMD S.R. Mode	Demand Log Self-Read Mode	Auto/Manual	Manual
DMD S.R. Time	Demand Log Self-Read Time[7]	(1-28) Day (0-24) Hour	--D--H
Comm.			
RS-485 (P1)			
Protocol	Protocol	Modbus/BACnet/ DNP/Gateway/Disable	Modbus
Unit ID	Modbus Address	Modbus: 1 to 247 BACnet: 1 to 127 DNP: 0 to 65519	100
Baud Rate[8]	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[9]	Object_Identifier	0 to 4194302	26001
MAXMAS[9]	Maximum number of Master	1 to 127	127
LOCK[9]	Disable communication	Yes/No	Yes
Ethernet (P2)			
Enable	Enable Ethernet	Yes/No	Yes
IP Address	Ethernet IP Address		192.168.0.100
Subnet Mask	Ethernet Subnet Mask		255.255.255.0
Gateway	Ethernet Gateway		192.168.0.1
Setpoint			
Group 1			
Type	Whether and how the Setpoint is triggered	0 = Disabled 1 = Over Setpoint 2 = Under Setpoint	0
Parameter	The parameter to be monitored.	See Note 10	None
OvLim	Over Limit		999,999
UnLim	Under Limit		0
ActiveDelay	Active Delay	0 to 9999s	10
InactiveDelay	Inactive Delay	0 to 9999s	10
Trigger1	Setpoint Trigger1	See Note 11	0
Trigger2	Setpoint Trigger2	See Note 11	0
…			
Group 9			
Type	Whether and how the Setpoint is	0 = Disabled	0

	triggered	1 = Over Setpoint 2 = Under Setpoint	
Parameter	The parameter to be monitored	See Note 10	None
OvLim	Over Limit		999,999
UnLim	Under Limit		0
ActiveDelay	Active Delay	0 to 9999s	10
InactiveDelay	Inactive Delay	0 to 9999s	10
Trigger1	Setpoint Trigger1	See Note 11	0
Trigger2	Setpoint Trigger2	See Note 11	0
I/O			
Digital Input			
Function	DI Function		
DI1~DI3	Function Mode for DI1 to DI4	Digital Input / Pulse Counter /Tariff Switch	Digital Input
DI4		Digital Input /Pulse Counter	
Debounce	Specifies the minimum duration the **DI** must remain in the Active or Inactive state before a state change is considered to be valid.		
DI1 ... DI4	Debounce for DI1 to DI4	1 to 9,999 ms	20 ms
Pulse Weight	Specifies the incremental value for each pulse received		
DI1 ... DI4	Pulse Weight for DI1 to DI4	1 to 1,000,000	1
Digital Output			
Function	Specifies the function of the Pulse Output.		
DO1[12] DO2[12]	DO Control Mode	▪ Digital Output ▪ kWh Import ▪ kWh Export ▪ kWh Total ▪ kvarh Import ▪ kvarh Export ▪ kvarh Total	Digital Output
Pulse Width	Specifies the duration for which the relay output will be active when a remote operate or setpoint trigger command is received to operate it.		
DO1 DO2	Pulse Width for DO1 to DO2	0 to 6000 (x0.1s) (0=Latch Mode)	0
Analog Input[13]*			
Type	Select between 0-20mA and 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
Display			
Timeout	Backlight Timeout	0 to 60 min	5
Contrast	Display Contrast	0 to 9	5
Language	System Language	Chinese/English	English
Delimiter	Delimiter	See Note 14	Option1
Main 1st	1st parameter of the Default Display	See Note 15	Ullavg
Main 2nd	2nd parameter of the Default Display		Iavg
Main 3rd	3rd parameter of the Default Display		P (P Total)
Main 4th	4th parameter of the Default Display		PF (PF Total)
SP LCD Alarm	Enable Splash LCD Alarm[16]	On / Off	On
Volt. Symbol	Voltage Symbol	IEC (U) / ANSI (V)	IEC (U)
Phase Label	Phase Label Symbol	123 / ABC	123
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	Clear all Real-time Energy	Yes/No	No
His. Monthly	Clear Historical Monthly Energy	Yes/No	No
30D Buffer	Clear 30D Total Energy	Yes/No	No
Demand			
Present Max.	Clear Max. Demand Log of This Month (Since Last Reset)	Yes/No	No
All	Clear Present Demand, Max. Demand Log of This Month (Since Last Reset) and Last Month (Before Last Reset)	Yes/No	No
Max./Min.			
Present	Clear Max./Min. Log of This Month (Since Last Reset)	Yes/No	No
All	Clear Max./Min. Log of This Month & 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
DIx (x=1 to 4)	Clear DIx Pulse Counter	Yes/No	No
SOE Logs			
All	Clear SOE Logs	Yes/No	No
Clear All Data			
Are you sure?	Clear All of the above	Yes/No	No
DO Control			
DO1	DOx Manual Control	Normal/On/Off	Normal
DO2			
Information	Check meter information		
Firmware	Firmware Version	e.g. V1.00.00	
Update	Date of the latest firmware update	e.g. 20180919	
Modbus	Modbus Protocol Version	e.g. V1.0	
BACnet MSTP	BACnet MSTP Protocol Version	e.g. V1.0	
DNP	DNP Protocol Version	e.g. V1.0	
SN	Serial Number	e.g. 1512150001	

* Appear only if the device is equipped with the appropriate option.

Table 3-10 Setup Parameters

Notes:

1. The value of [PT Primary/PT Secondary] cannot exceed 10000.
2. The **CT Primary** and **CT Secondary** settings are configured automatically by the **CT Type** setting for Input Current option 4 that supports Split-Core CTs and Rogowski Coils. The corresponding CT Primary and CT Secondary ratios are 100:100, 200:100, 400:100, 800:100, 1600:100, 1200:100, 2500: 100 and 5000:100. Further, the **CT Primary** and **CT Secondary** cannot be manually changed for this option.
3. The **CT Type**, **3x1P** wiring mode and pulse constant **10/100 imp./kxh** options are available in Firmware V1.01.00 and later.
4. The **Rogowski Coil** input, **pulse constant 5,000/10,00/25,00 imp./kxh** options are available in Firmware V2.00.00 and later.
5. There are two methods to calculate kVA:

$$\text{Vector: } kVA_{total} = \sqrt{kW_{total}^2 + kvar_{total}^2}$$
$$\text{Scalar: } kVA_{total} = kVA_a + kVA_b + kVA_c$$

6. There are two methods to calculate THD:
   THDf:

$$THDf = \frac{\sqrt{\sum_{n=2}^{\infty} I_n^2}}{I_1} \times 100\%$$

   Where I_1 represents the RMS value of the fundamental component, and I_n represents the RMS value for the n^{th} harmonic with n for harmonic order.

   THDr:

$$THDr = \frac{\sqrt{\sum_{n=2}^{\infty} I_n^2}}{\sqrt{\sum_{n=1}^{\infty} I_n^2}} \times 100\%$$

Where I_n represents the RMS value for the n^{th} harmonic with n for harmonic order.

7. The **Self-Read Time** setting is disabled if the **Self-Read Mode** is **Manual**.
8. It's recommended to use high-speed data rate (9600/19200/38400 bps) for BACnet MS/TP communication.
9. **INST**, **MAXMAS** and **LOCK** parameters are only available when the COM1's Protocol is set to **BACnet**.
10. Please refer to **Section 4.4** for the Setpoint monitoring parameters.
11. The table below illustrates the options for Setpoint Trigger. Please keep in mind that when the DOx is set as Setpoint Trigger, the DOx Function should be configured as Digital Output correspondingly.

Key	Action	Key	Action
0	None	**1**	DO1 Closed
2	DO2 Closed	**3**	Email

Table 3-11 Setpoint Trigger

12. For the DO (Mechanical Relay), the **DOx Function** should be set to Digital Output. For the Solid State Pulse Output, the Dox Function should be set to energy pulse correspondingly.
13. This menu only appears if the meter is equipped with the corresponding options.
14. 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).

15. The following table illustrates the parameters that can be selected for display in the **Default Display** screen.

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

Table 3-12 Default Display Parameters

16. Setting **SP LCD Alarm** to **On** would make the LCD blinking when there is a Setpoint occurring and pressing any buttons to go to the first SOE log screen.

3.2 Web Interface

The PMC-53A-E's Web Interface is compatible with various web browsers.

Browser	Browser Version
Internet Explorer	IE10 and above
Firefox	24.0 and above
Google Chrome	35.0 and above

Table 3-13 Web Browser Supported

The default IP Address of the PMC-53A-E Ethernet Port is 192.168.0.100. Please make sure to configure the IP Address and Subnet Mask for the PMC-53A-E (via Front Panel or through communication) and the PC so that they are in the same subnet.

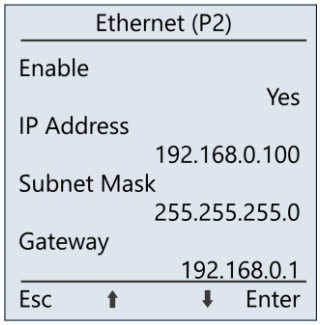


Figure 3-5 IP Address Settings on Front Panel

3.2.1 Setting PC's IP Address

To determine the PC's IP Address, click the **Start** icon, then the **Settings** button on Windows 10 (for other MS Windows systems, please refer to this **link** for more instructions).

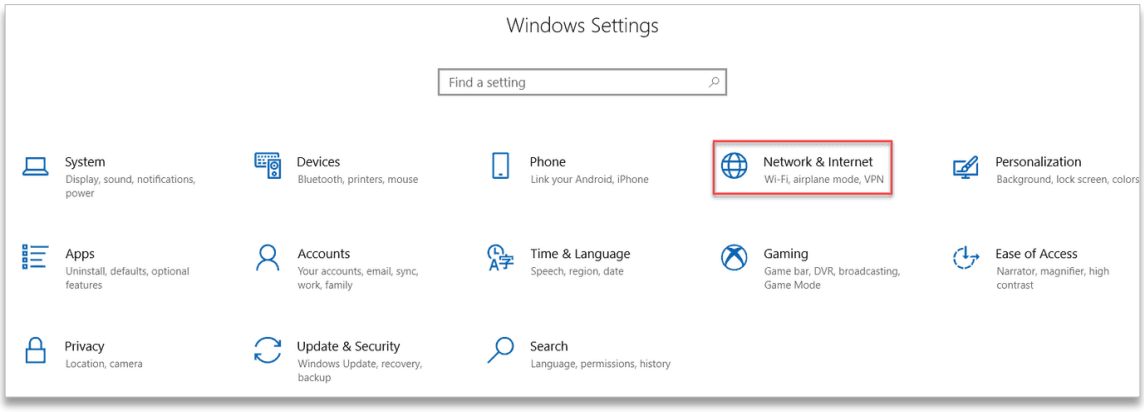


Figure 3-6 Settings-> Network & Internet

Click **Network & Internet**, select the **Change adapter options** and then find the appropriate Ethernet connection.

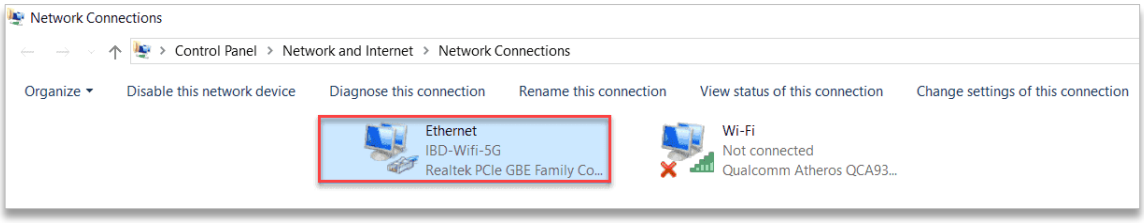


Figure 3-7 Network and Sharing Center

Right-click on it and select **Properties**. Then double-click on **Internet Protocol Version 4 (TCP/IPv4)** to show its IP configuration.

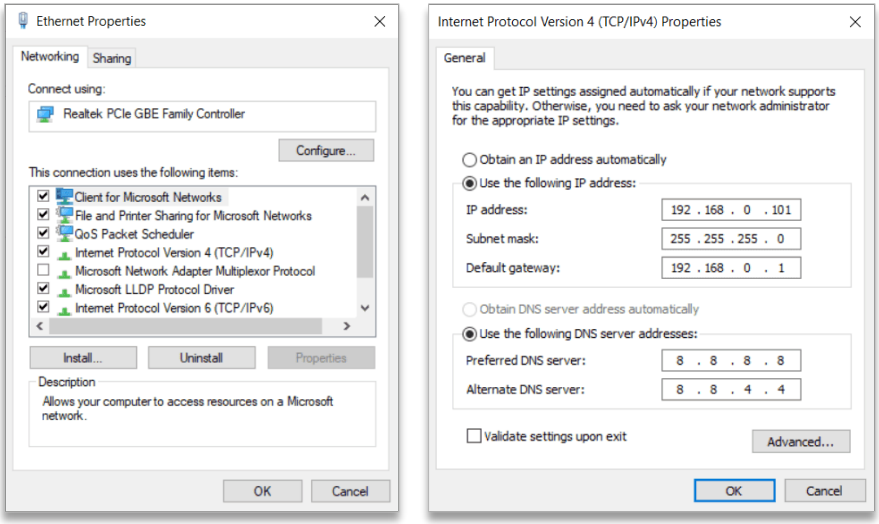


Figure 3-8 Setting PC's IP Address

3.2.2 Configure PMC-53A-E's IP Address

To configure the IP Address, navigate to **Setup** -> **Comm.** -> **Ethernet** on the Front Panel of the PMC-53A-E and then enter the IP address. The default IP address is 192.168.0.100.

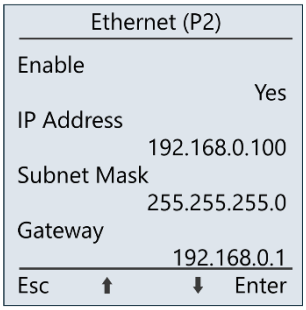


Figure 3-9 Setting PMC-53A-E's IP Address

3.2.3 Accessing the Web Interface

1) Enter the IP Address of the PMC-53A-E in the Address area of **Google Chrome** and then press **<Enter>**.

Figure 3-10 Web Login

2) The PMC-53A-E's Web Interface appears. The **Login** password is required, which is "0" by default.

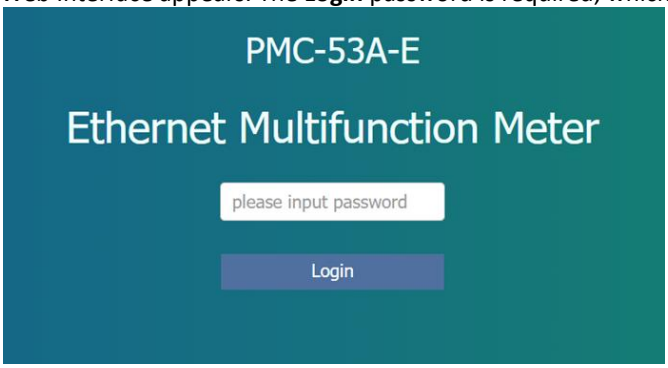


Figure 3-11 Login Page

3) For Firmware V1.01.00 or later, the user is required to login to the web interface to view data or change setup parameters with the appropriate user name and password.

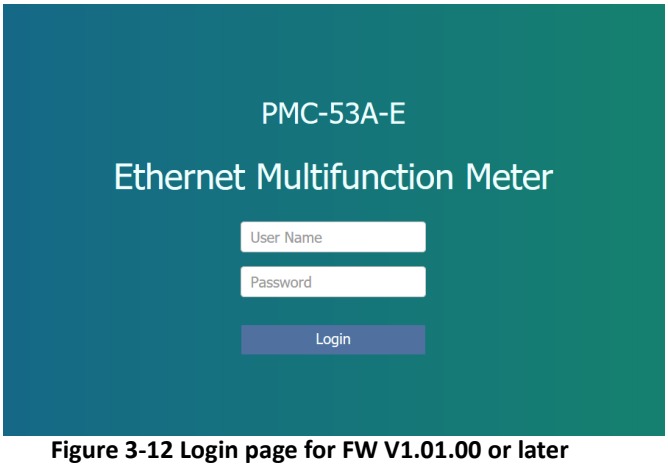


Figure 3-12 Login page for FW V1.01.00 or later

4) The figure below lists the different users and their corresponding authorities.

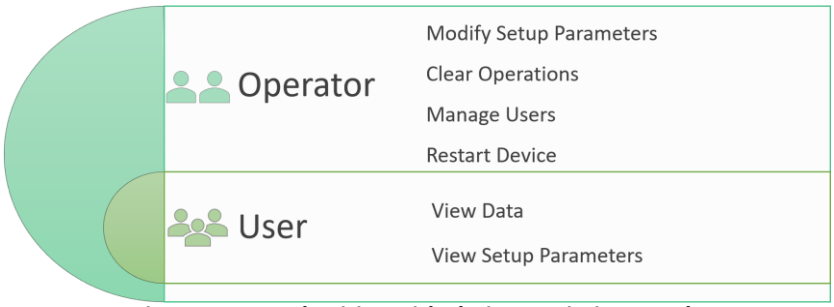


Figure 3-13 Authorities with their Permission Levels

As the figure shown, **Operator** has a higher permission than **User**. The default **Login Info.** for the operator and user accounts are listed below:

Account	Username	Password
Operator	operator	abcd1234-
User	user	abcd1234-

Table 3-14 **Default Username and Password for Operator and User accounts**

5) The PMC-53A-E's Web Interface appears after login. There are four items at the **Title Bar** – **Metering**, **Power Quality**, **Events** and **Setup**.

Figure 3-14 Title Bar

6) For Firmware V1.01.00 or later, the Web Interface's login password can be changed by clicking on the down arrow at the upper right-hand corner of the page and then selecting **Modify Password** as shown below. The new password must be between 8 and 16 characters and consist of a combination of numbers, letters (case-sensitive) and ASCII special characters.

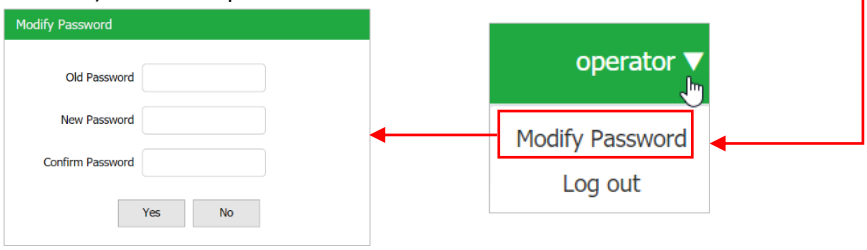


Figure 3-15 Change Web Interface Password

7) It's recommended to disconnect from the meter's web server when it's not in use with the Log out option as shown in the figure above. The PMC-53A-E's Web Server will terminate the client's connection after 5 minutes of inactivity.

3.2.3.1 Metering

The **Metering** menu consists of **Basic**, **Energy**, **Demand**, **TOU**, **Max./Min.**, **I/O** and **Freeze Log**.

3.2.3.1.1 Basic

The **Basic** page displays the 3-Φ ULN, ULL, I, P, Q, S, PF, U Fund., I Fund., P Fund. PF Fund., U Angle, I Angle, Average/Total, Operating Time, Frequency, I4 and Ir (optional) as well as In and Ung (Available in Firmware V1.01.00 or later).

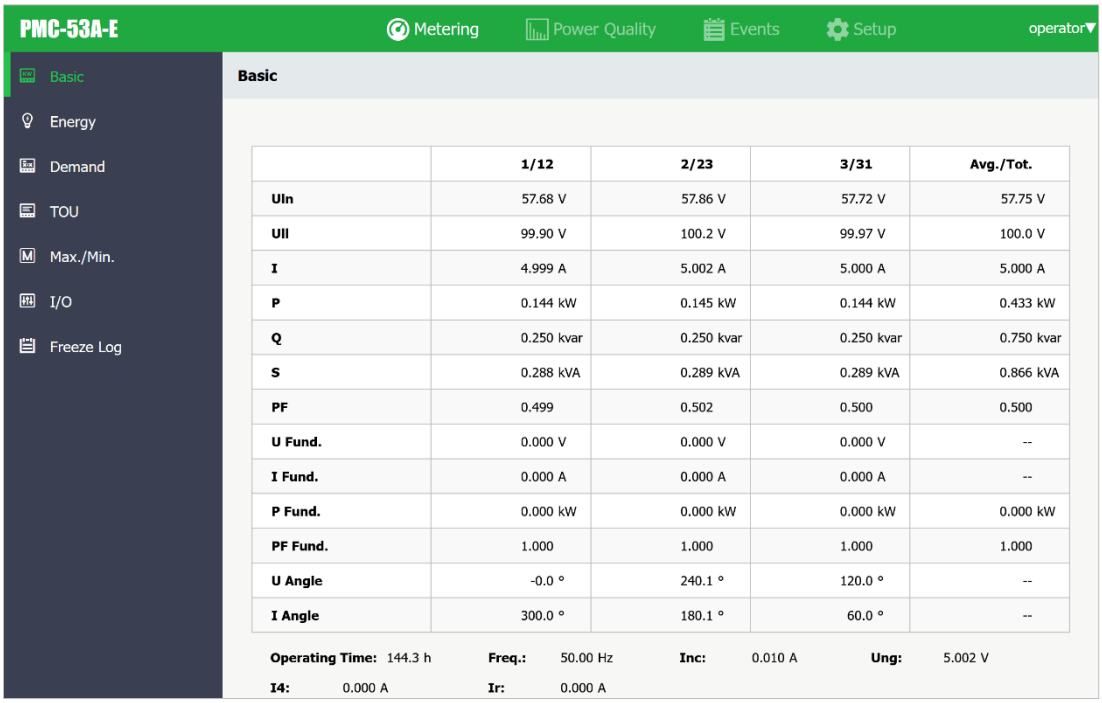


Figure 3-16 Basic Metering

3.2.3.1.2 Energy

The **Energy** pages display the Total and 3-Φ Energy as well as the Daily Energy report. Click Total, A, B, C or Daily at the top of the page to view the respective Energy data. Please note that the 3-Φ and Daily Energy are available in Firmware V1.01.00 or later.

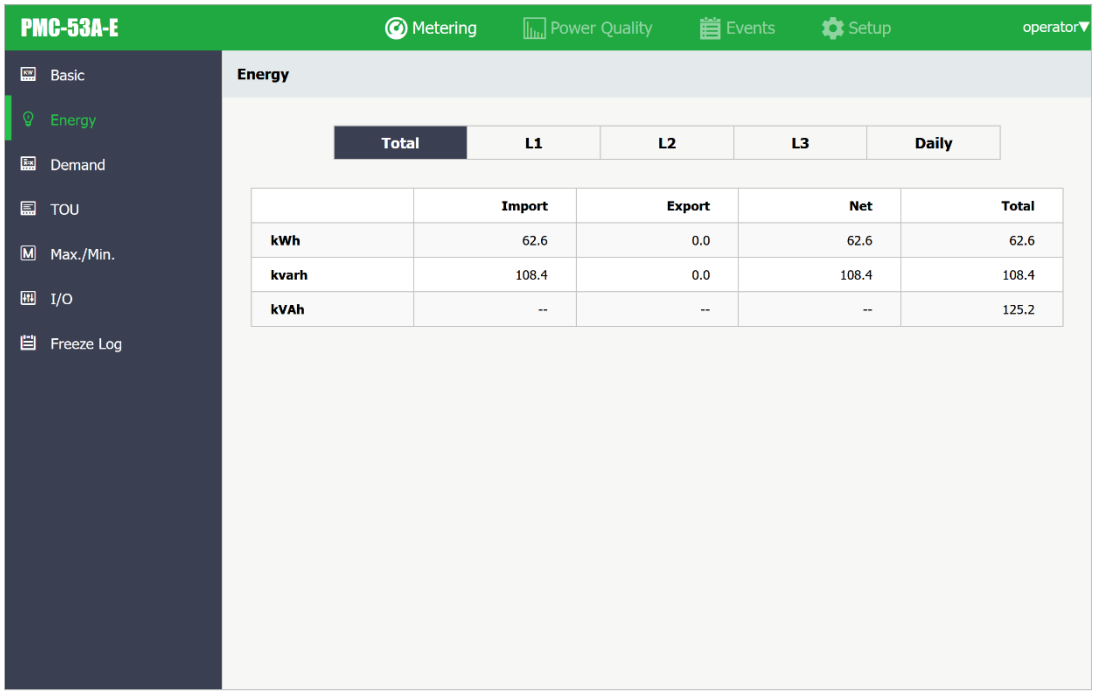


Figure 3-17 Total Energy

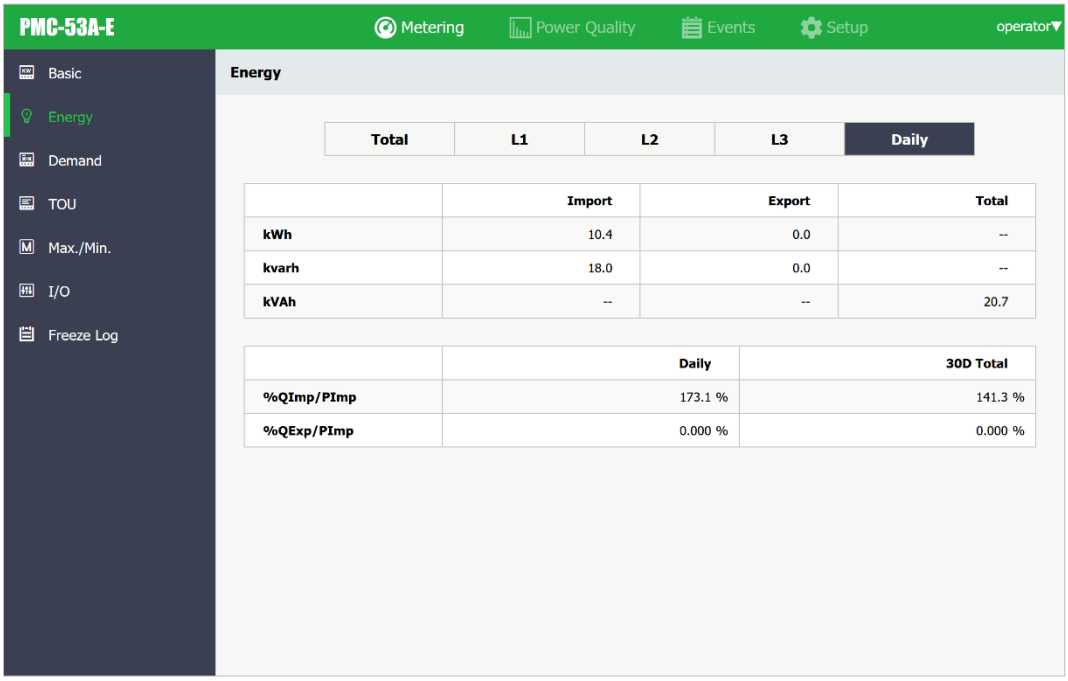
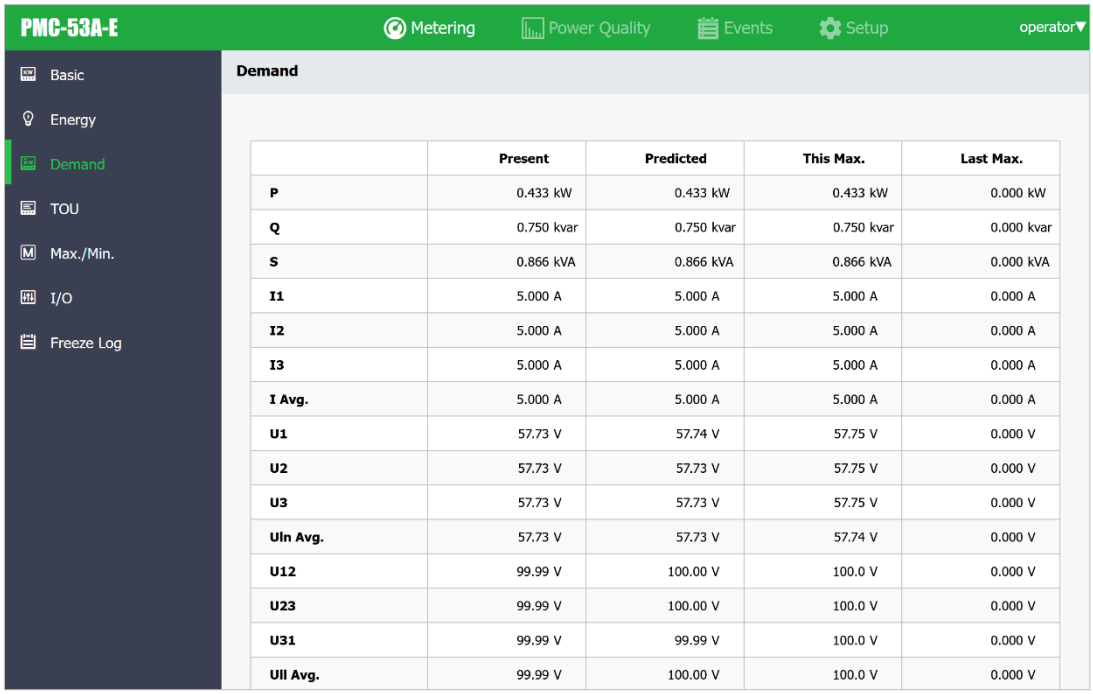


Figure 3-18 Daily Energy

3.2.3.1.3 Demand

The **Demand** page displays the Present/Predicted/This Max./Last Max. Demand for P, Q, S as well as 3-Φ I, ULN, ULL and Average (The 3-Φ I Average, ULN, ULL and Average are available in firmware V1.01.00 or later).

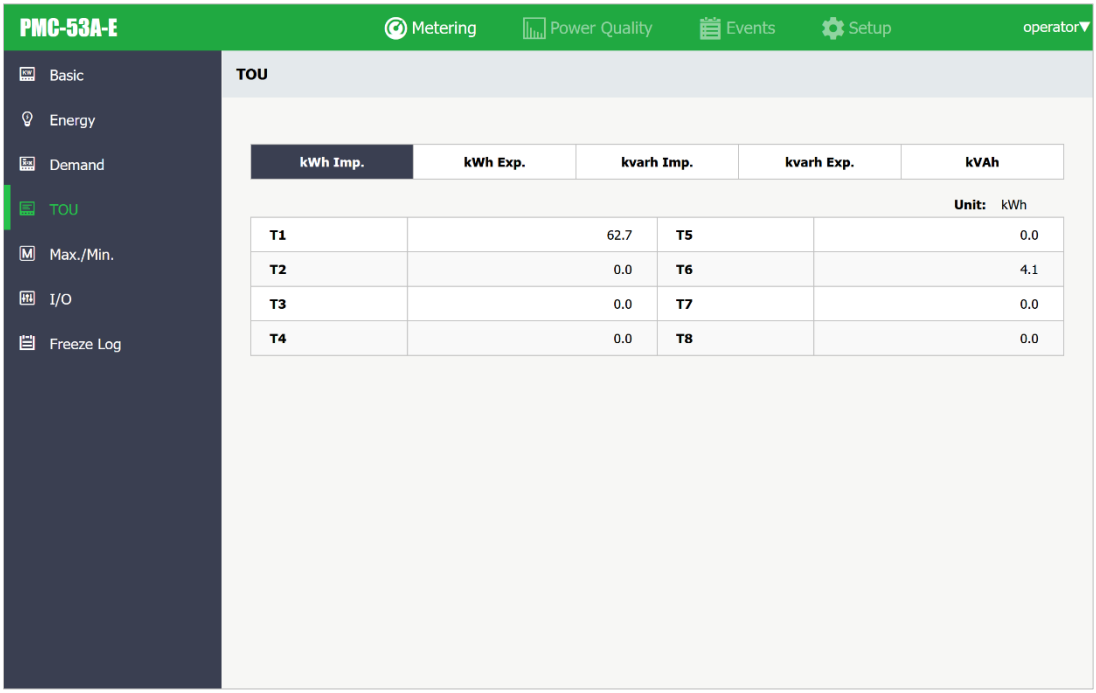


	Present	Predicted	This Max.	Last Max.
P	0.433 kW	0.433 kW	0.433 kW	0.000 kW
Q	0.750 kvar	0.750 kvar	0.750 kvar	0.000 kvar
S	0.866 kVA	0.866 kVA	0.866 kVA	0.000 kVA
I1	5.000 A	5.000 A	5.000 A	0.000 A
I2	5.000 A	5.000 A	5.000 A	0.000 A
I3	5.000 A	5.000 A	5.000 A	0.000 A
I Avg.	5.000 A	5.000 A	5.000 A	0.000 A
U1	57.73 V	57.74 V	57.75 V	0.000 V
U2	57.73 V	57.73 V	57.75 V	0.000 V
U3	57.73 V	57.73 V	57.75 V	0.000 V
Uln Avg.	57.73 V	57.73 V	57.74 V	0.000 V
U12	99.99 V	100.00 V	100.0 V	0.000 V
U23	99.99 V	100.00 V	100.0 V	0.000 V
U31	99.99 V	99.99 V	100.0 V	0.000 V
Ull Avg.	99.99 V	100.00 V	100.0 V	0.000 V

Figure 3-19 Demand

3.2.3.1.4 TOU

The **TOU** page displays the respective Tariff information for kWh Imp., kWh Exp., kvarh Imp., kvarh Exp. and kVAh.



kWh Imp. | kWh Exp. | kvarh Imp. | kvarh Exp. | kVAh

Unit: kWh

T1	62.7	T5	0.0
T2	0.0	T6	4.1
T3	0.0	T7	0.0
T4	0.0	T8	0.0

Figure 3-20 TOU

3.2.3.1.5 Max./Min.

The **Max./Min.** pages display This Max./Min. and Last Max./Min. measurements with timestamp.

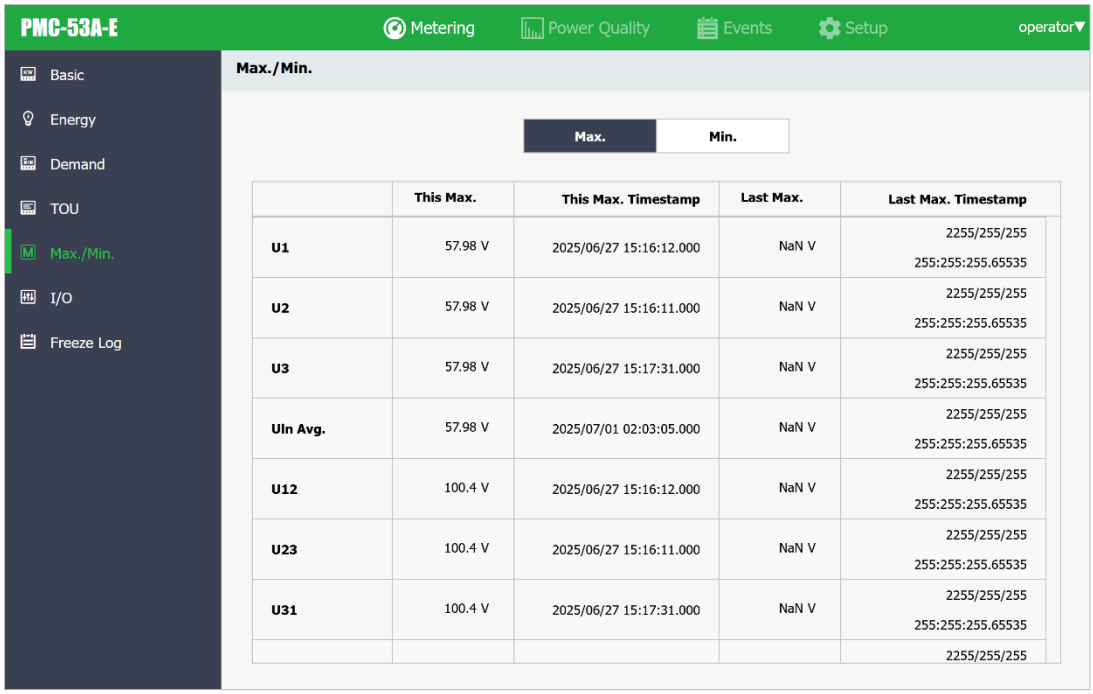


Figure 3-21 Max./Min.

3.2.3.1.6 I/O

The **I/O** page displays the I/O functions and status.

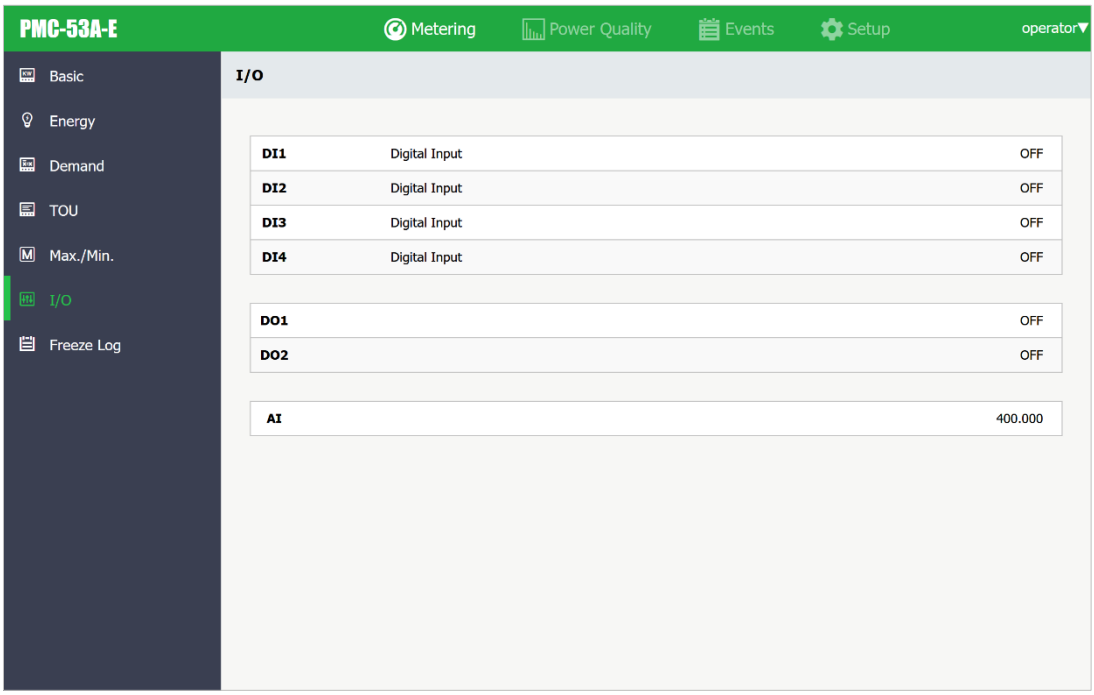


Figure 3-22 I/O

3.2.3.1.7 Freeze Log (Available in Firmware V1.01.00 or later)

The **Freeze Log** pages display the Daily or Monthly Freeze record for Energy and Max. Demand.

- **Energy**

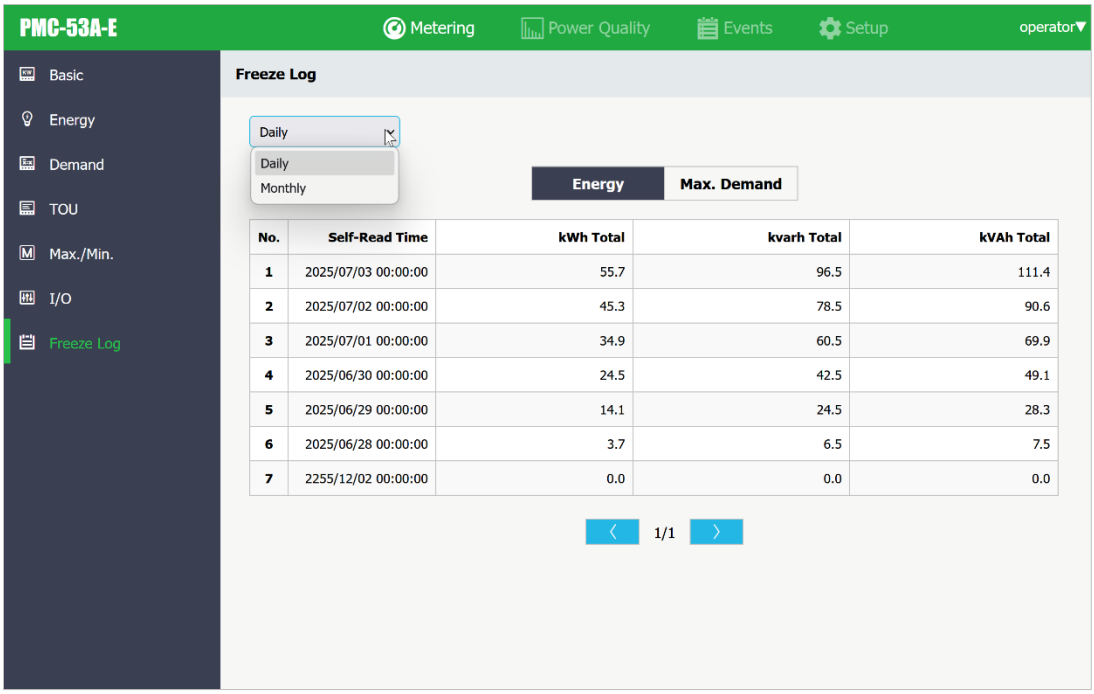


Figure 3-23 Freeze Energy

- **Max. Demand**

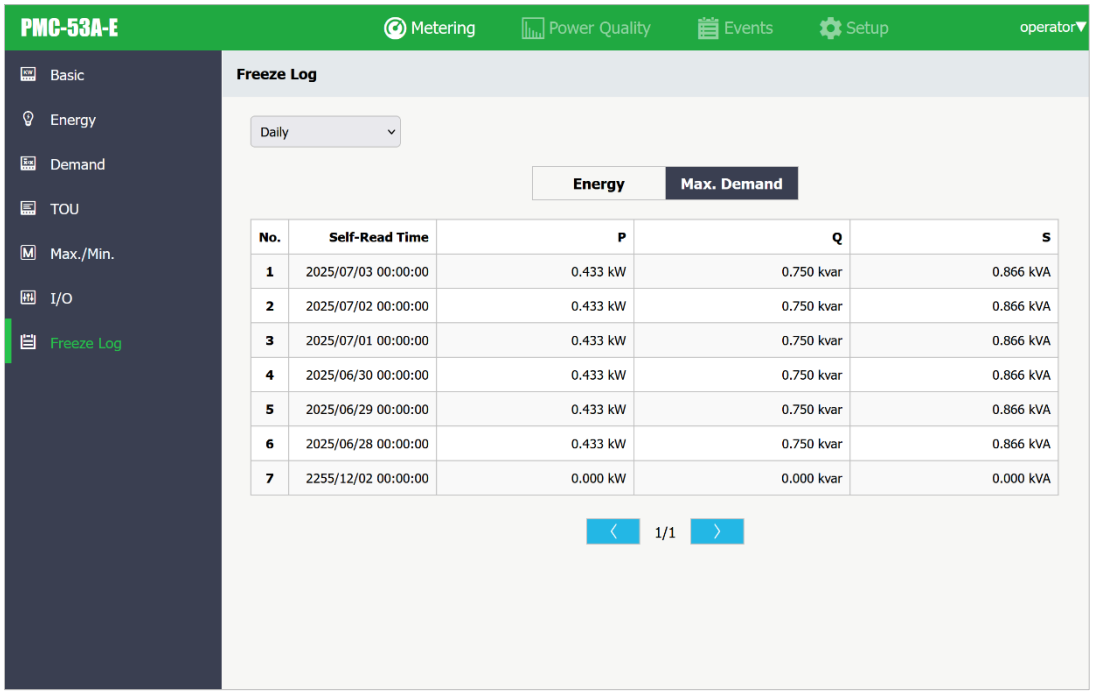


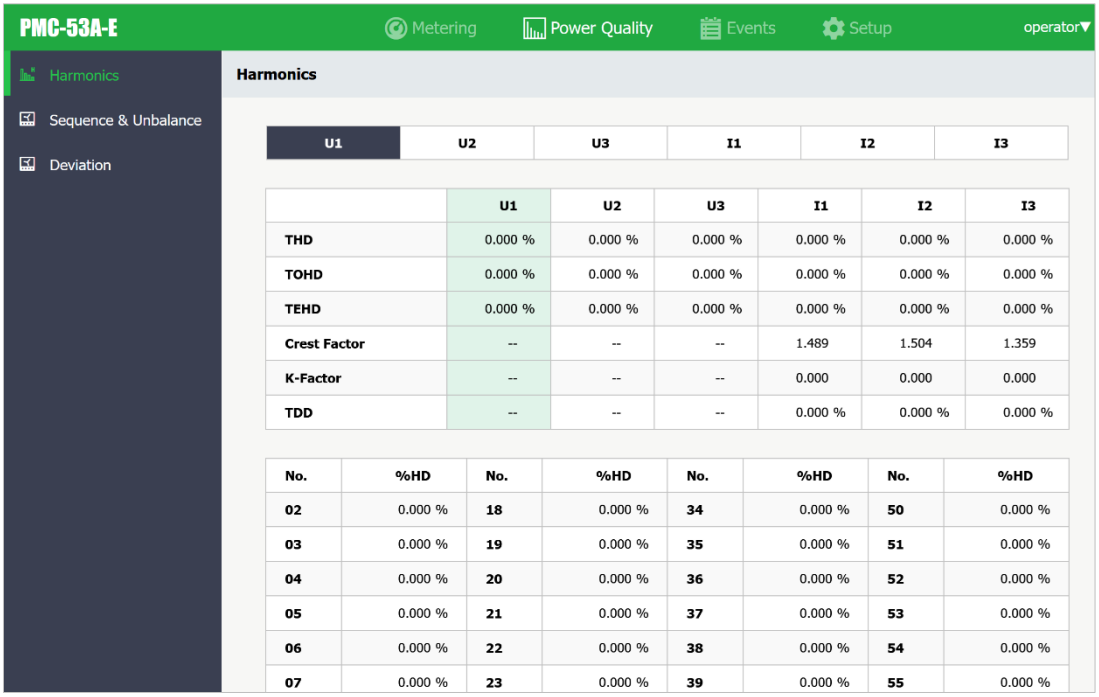
Figure 3-24 Freeze Max. Demand

3.2.3.2 Power Quality

The **Power Quality** Menu consists of **Harmonics**, **Sequence & Unbalance** and **Deviation**.

3.2.3.2.1 Harmonics

The **Harmonics** page displays the following parameters: THD, TOHD, TEHD, Crest Factor, K-Factor, TDD and Individual Harmonics data for 3-Φ Voltages and Currents.
The individual harmonics from 31st to 63rd are available in Firmware V2.00.00 and later.



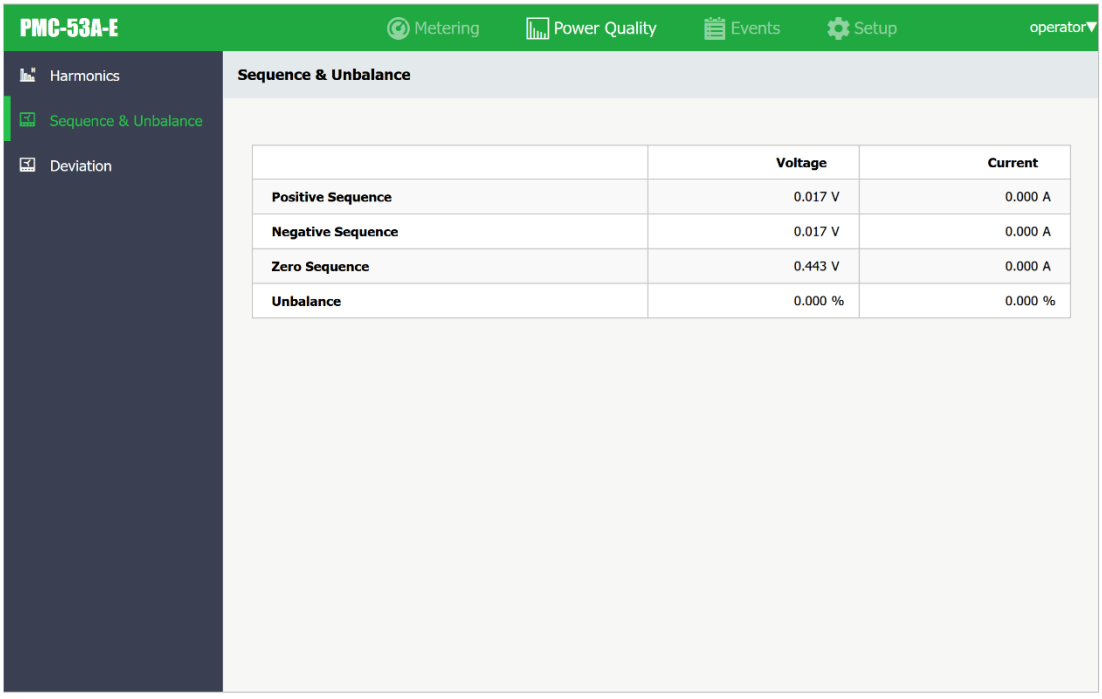
	U1	U2	U3	I1	I2	I3
THD	0.000 %	0.000 %	0.000 %	0.000 %	0.000 %	0.000 %
TOHD	0.000 %	0.000 %	0.000 %	0.000 %	0.000 %	0.000 %
TEHD	0.000 %	0.000 %	0.000 %	0.000 %	0.000 %	0.000 %
Crest Factor	--	--	--	1.489	1.504	1.359
K-Factor	--	--	--	0.000	0.000	0.000
TDD	--	--	--	0.000 %	0.000 %	0.000 %

No.	%HD	No.	%HD	No.	%HD	No.	%HD
02	0.000 %	18	0.000 %	34	0.000 %	50	0.000 %
03	0.000 %	19	0.000 %	35	0.000 %	51	0.000 %
04	0.000 %	20	0.000 %	36	0.000 %	52	0.000 %
05	0.000 %	21	0.000 %	37	0.000 %	53	0.000 %
06	0.000 %	22	0.000 %	38	0.000 %	54	0.000 %
07	0.000 %	23	0.000 %	39	0.000 %	55	0.000 %

Figure 3-25 Harmonics

3.2.3.2.2 Sequence & Unbalance

The **Sequence & Unbalance** page displays Positive/Negative/Zero Sequence and Unbalance for Voltage and Current.



	Voltage	Current
Positive Sequence	0.017 V	0.000 A
Negative Sequence	0.017 V	0.000 A
Zero Sequence	0.443 V	0.000 A
Unbalance	0.000 %	0.000 %

Figure 3-26 Sequence & Unbalance

3.2.3.2.3 Deviation

The **Deviation** page displays ULL and ULL Overdeviation/Underdeviation as well as Frequency Deviation. The Deviation measurements are available in Firmware V2.00.00 and later.

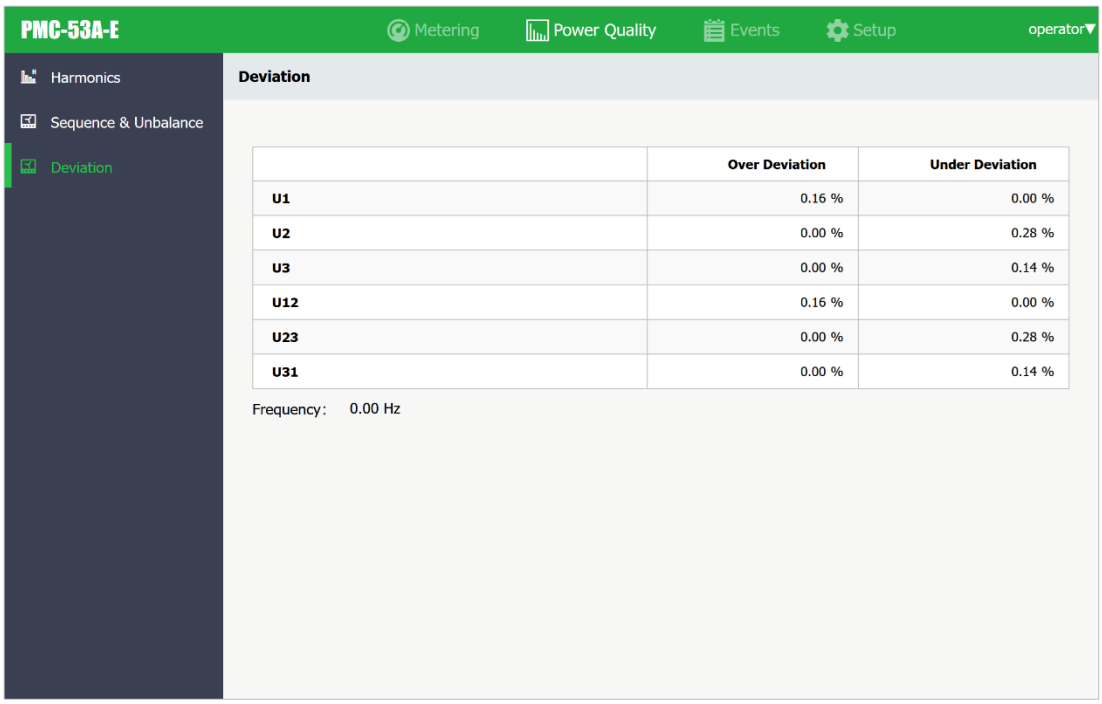


Figure 3-27Deviation

3.2.3.3 Events

3.2.3.3.1 SOE

The **SOE** page displays up to 100 events starting with the latest one. Press 〈 or 〉 to scroll through the available events.

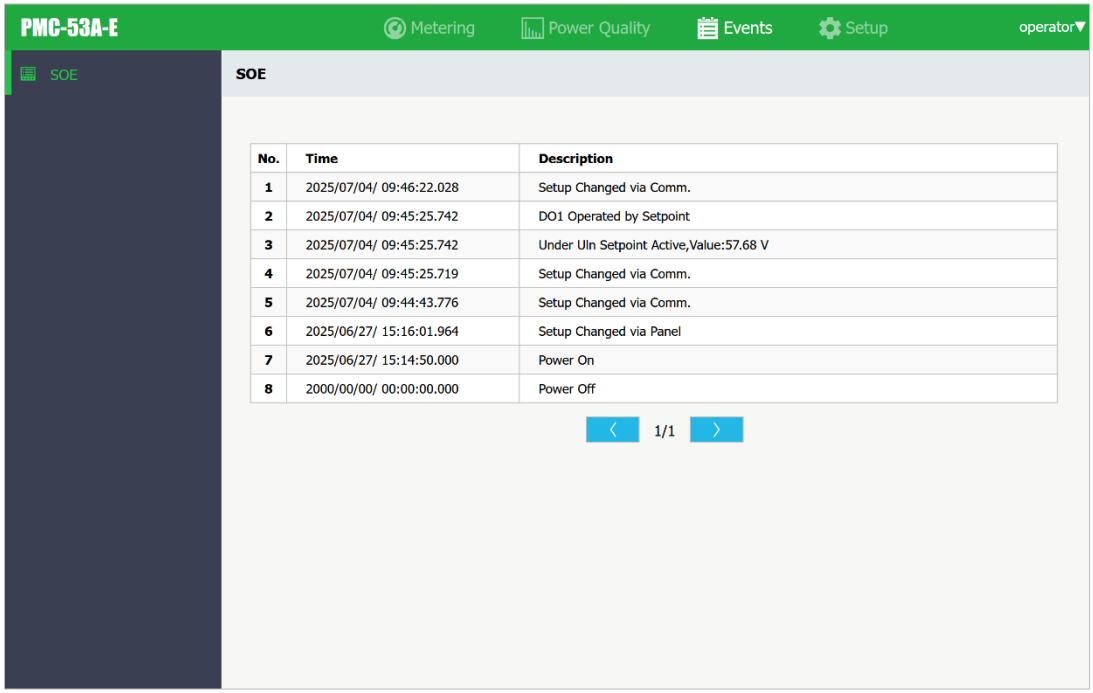


Figure 3-28 SOE

3.2.3.4 Setup

The **Setup** menu consists of **Basic**, **Comm.**, **Demand**, **I/O**, **Setpoint**, **Clock**, **Maintenance** and **Device Info.**

3.2.3.4.1 Basic

The Basic Setup page allows users to configure the settings for Wiring Mode, PT/CT, Energy, Algorithm and Display. Please refer to **Section 5.13.1** for more information about the parameters.

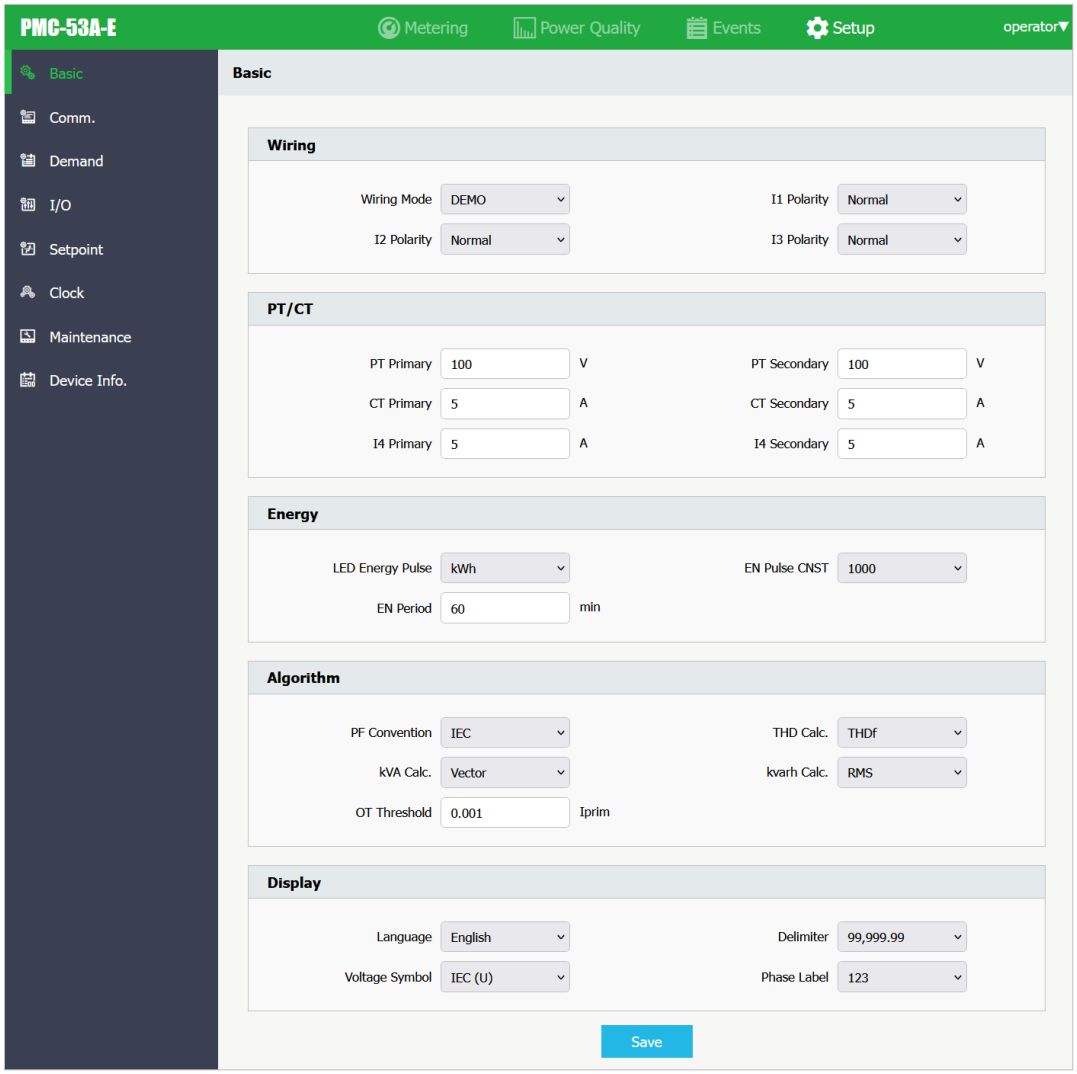


Figure 3-29 Basic Setup

3.2.3.4.2 Comm.

The Comm. Setup page allows users to configure the settings for RS-485 (P1), Ethernet (P2), SNTP, SMTP and the IP Port assignments for the various protocols, which are supported in Firmware V1.01.00 or later.

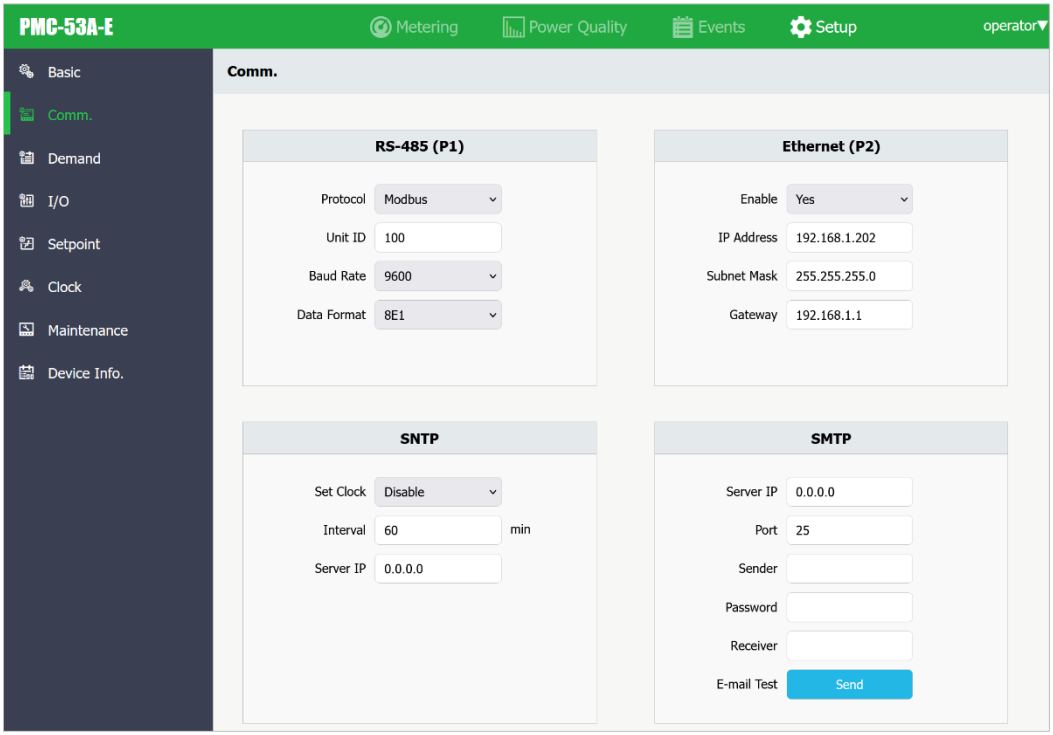


Figure 3-30 Comm. Setup

3.2.3.4.3 Demand

Please refer **to Section 4.2.4** for more information about the Demand parameters.

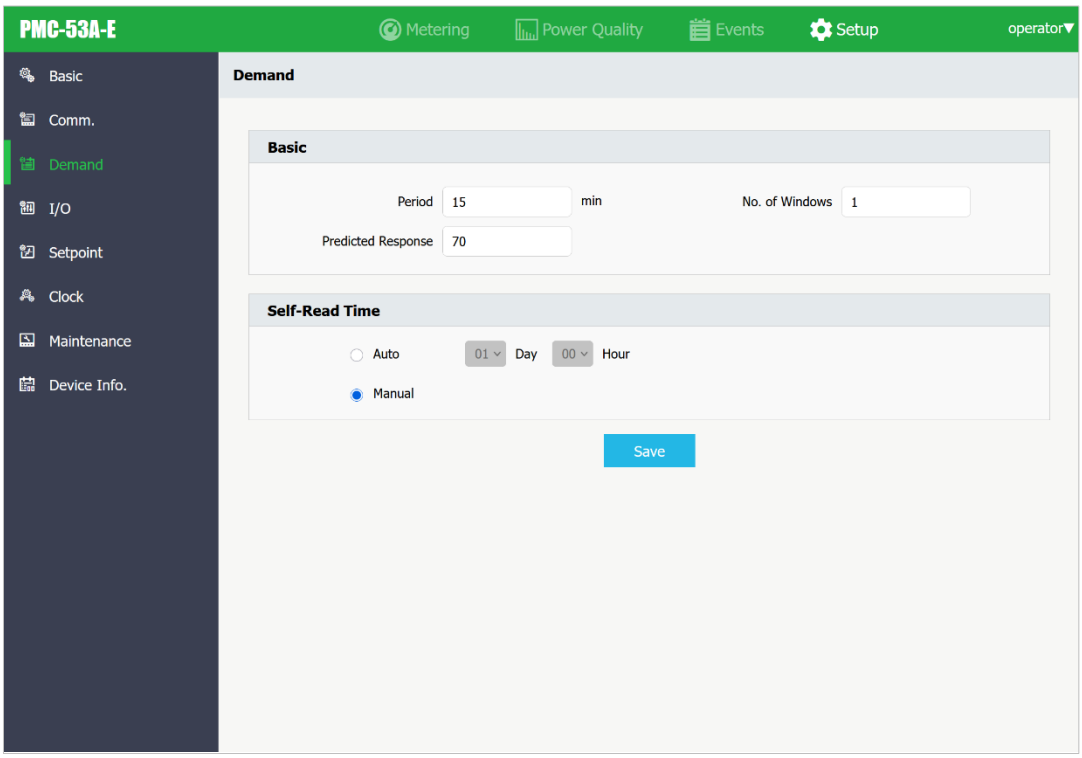


Figure 3-31 Demand Setup

3.2.3.4.4 I/O

The I/O Setup page is available in Firmware V1.01.00 or later and allows users to configure the settings for DI, DO and optional AI.

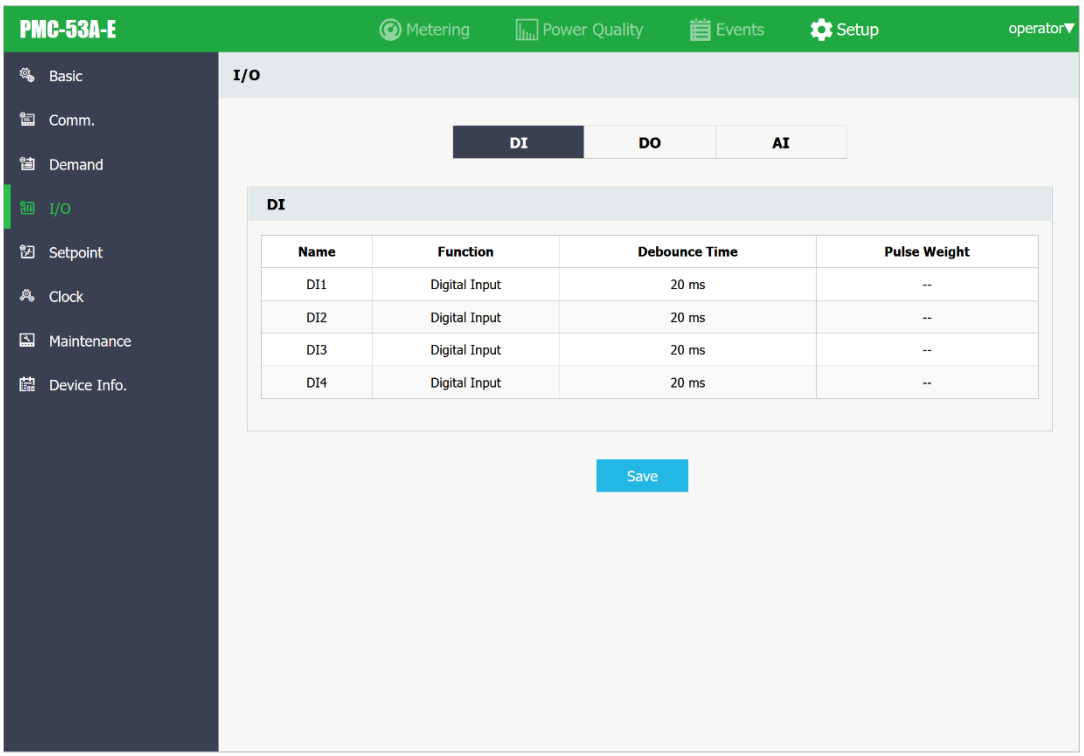


Figure 3-32 I/O Setup

- **DI** Click on a particular DI and the DIx Settings Dialog box appears. Please refer to Section 4.1.1 for more information about its setup parameters.

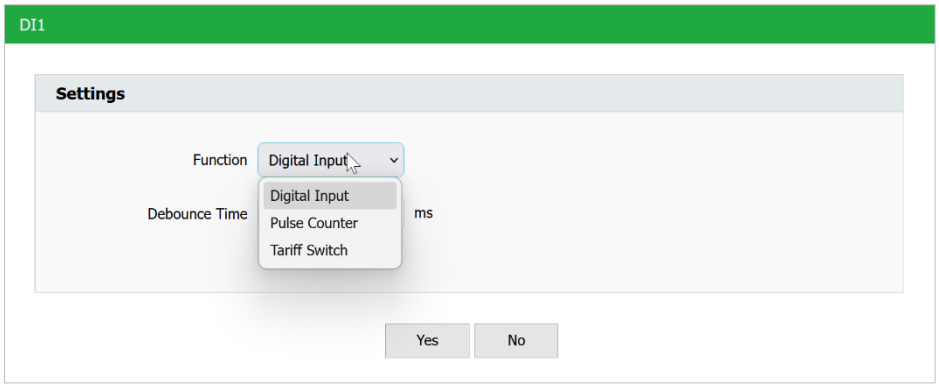


Figure 3-33 DIx Settings Dialog Box

- **DO** Please refer to Section 4.1.2 & 4.1.3 for more information about its setup parameters.

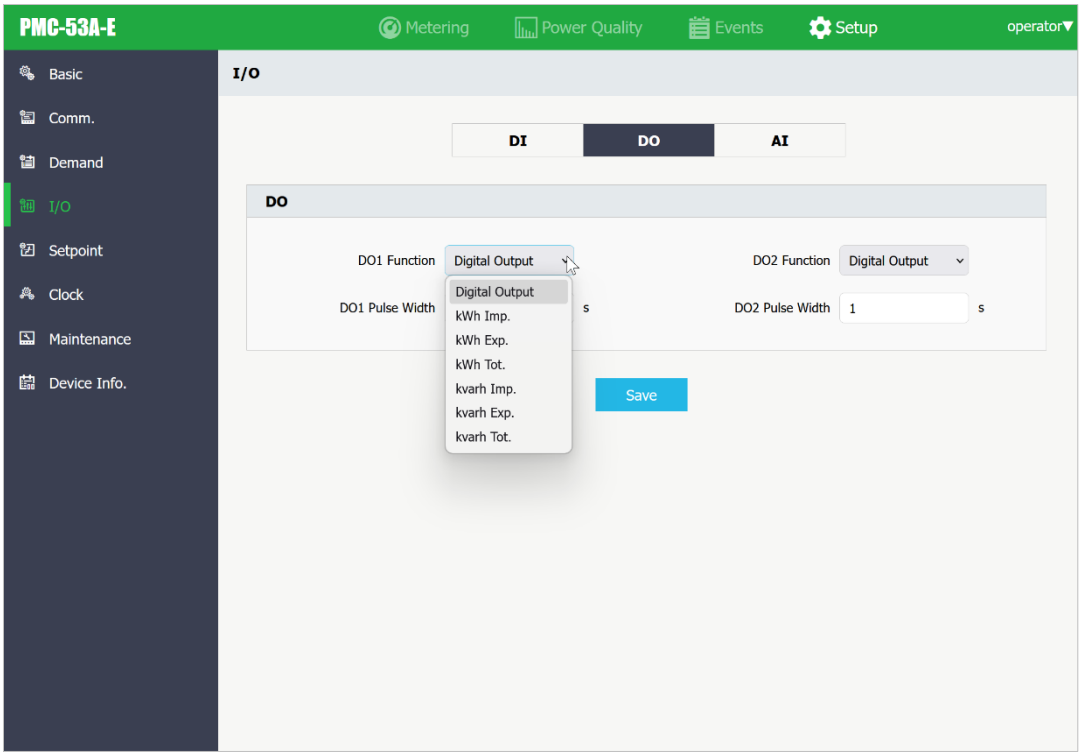


Figure 3-34 DO Settings

- **AI (optional)** Please refer to Section 4.1.4 for more information about its setup parameters.

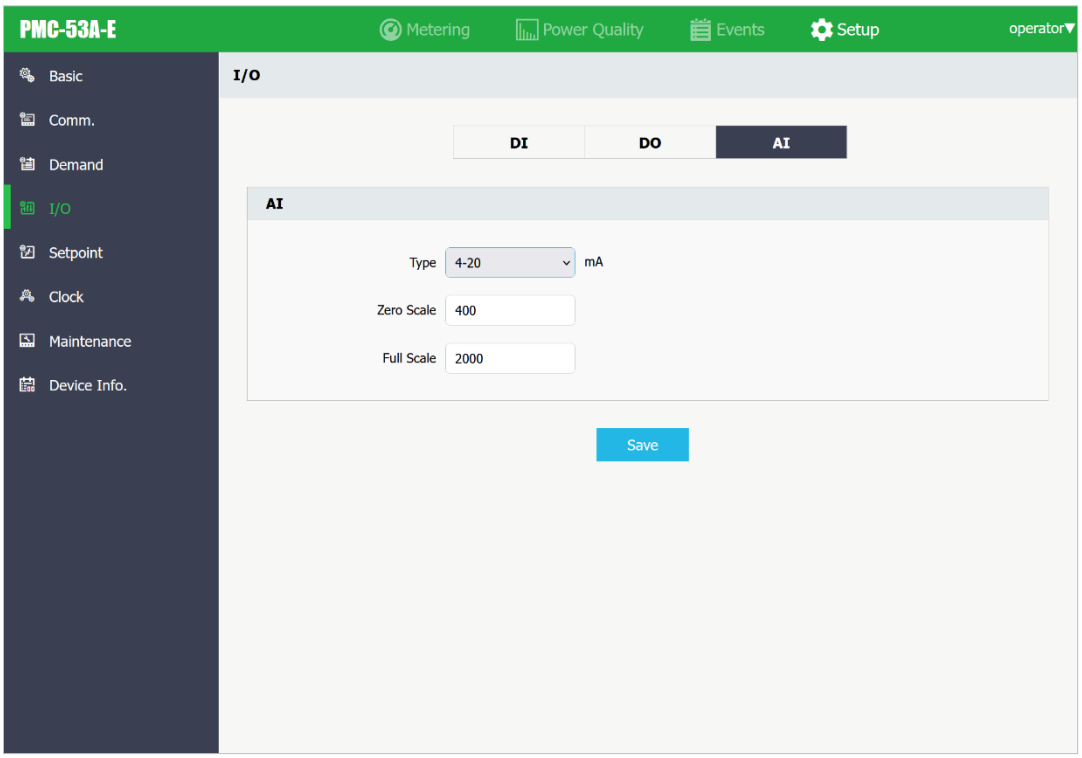


Figure 3-35 Optional AI Settings

3.2.3.4.5 Setpoint

The Setpoint Setup page is available in Firmware V1.01.00 or later.

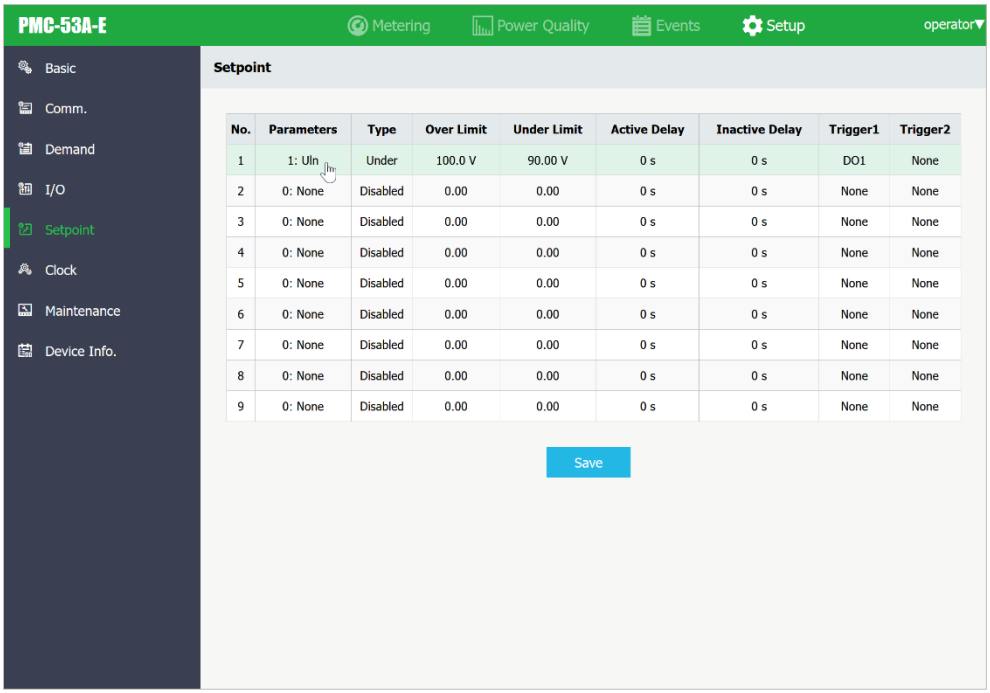


Figure 3-36 Setpoint Setup

Click on a particular Setpoint and the Setpoint Settings dialog box appears. Please refer to Section 4.4 for more information about its setup parameters.

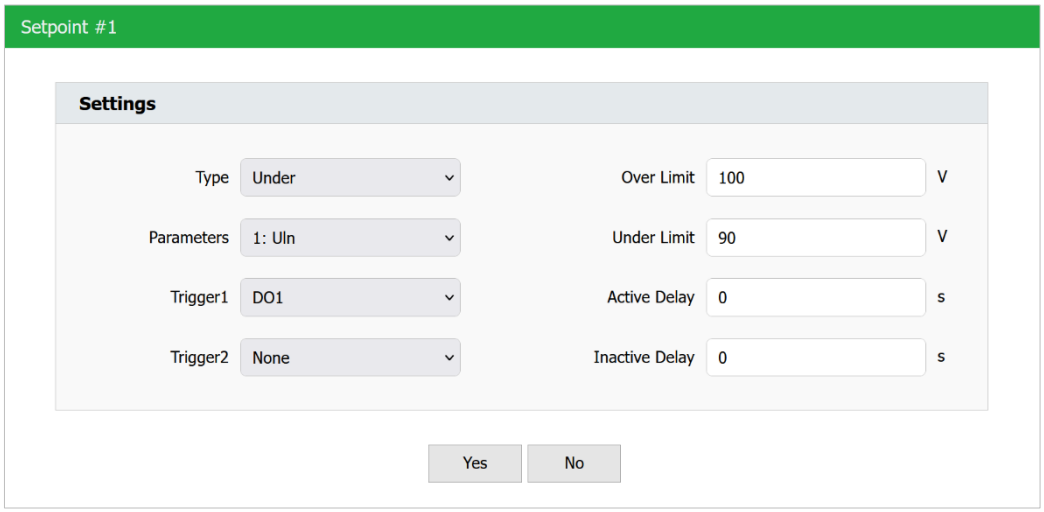


Figure 3-37 Setpoint Settings Dialog

3.2.3.4.6 Clock

The date and time can be updated manually or synchronized with a local PC by simply checking the **Sync. with PC** box.

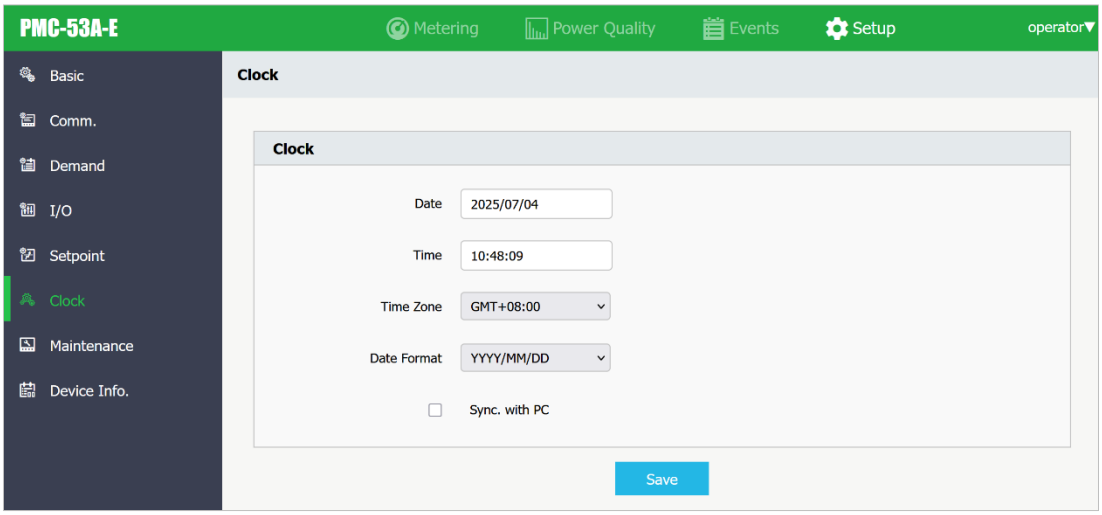


Figure 3-38 Clock Setup

3.2.3.4.7 Maintenance

The Maintenance page is available in Firmware V1.01.00 or later for **Operator** account only.

- **Clear** Perform the various **Clear** operations by groups or individually.

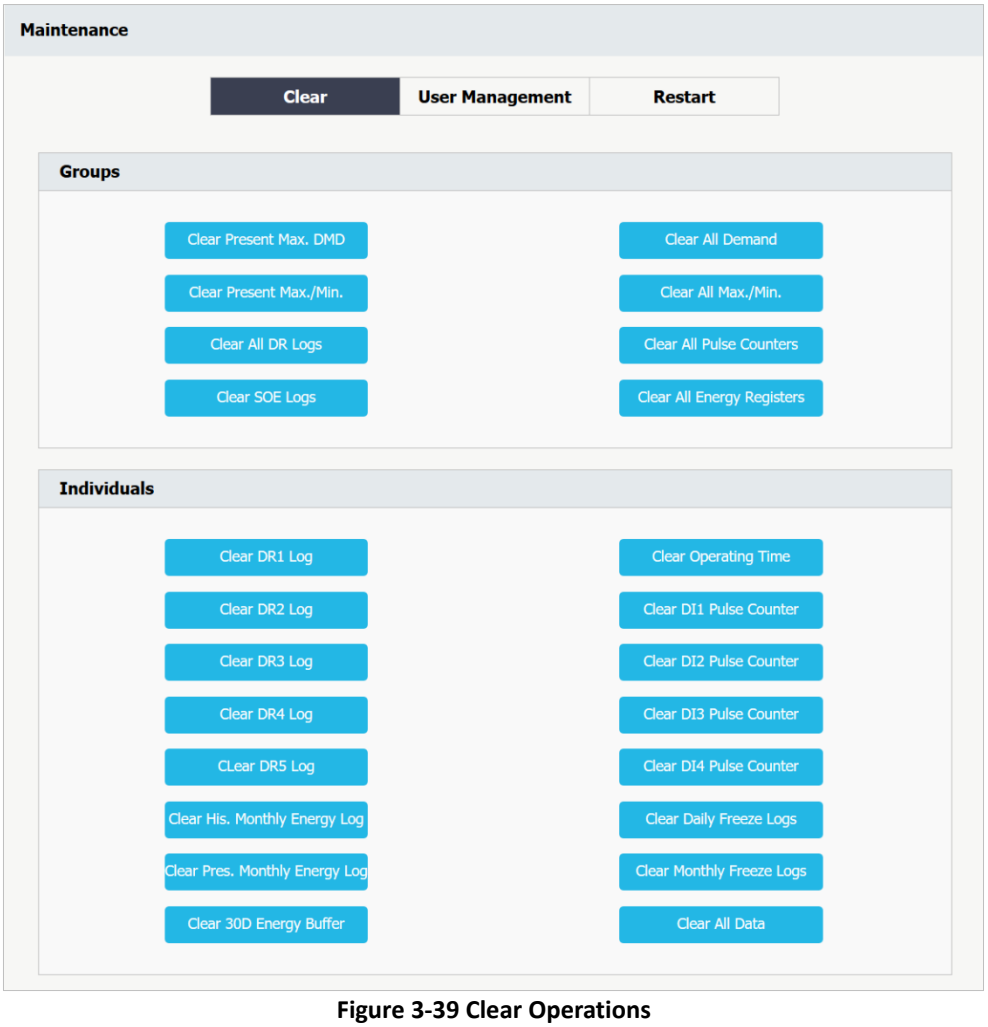


Figure 3-39 Clear Operations

- **User Management** In Firmware V1.01.00 or later, the user with **Operator** authority can click ⊕ to add a new user account or 🗑 to remove an existing user account. The Username must be between 3 and 15 characters long and consist of a combination of numbers, letters or "_" (Underscore) where the first character must be a letter.

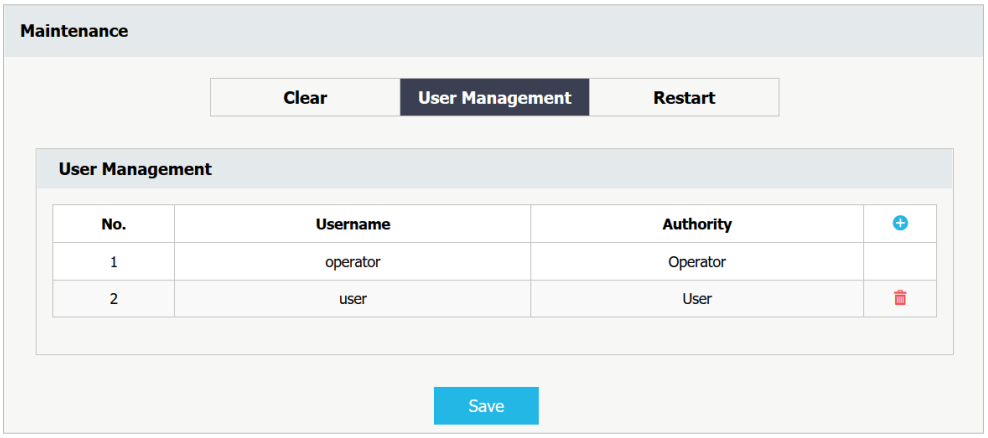


Figure 3-40 User Management

- **Restart** Click Reboot to restart the device. The user is required to login again afterwards.

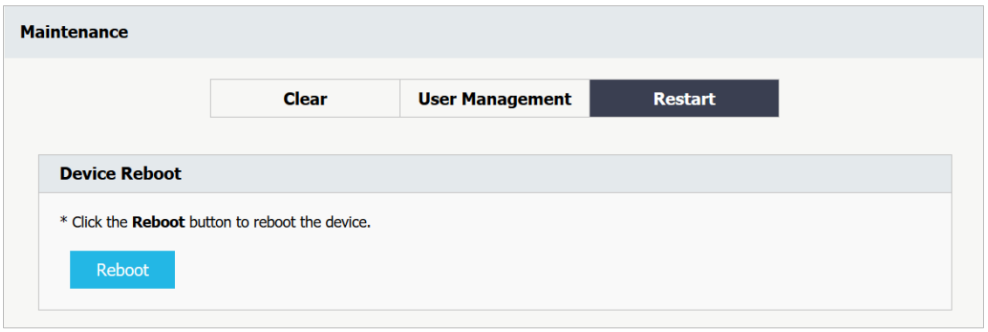


Figure 3-41 Restart

3.2.3.4.8 Device Info.

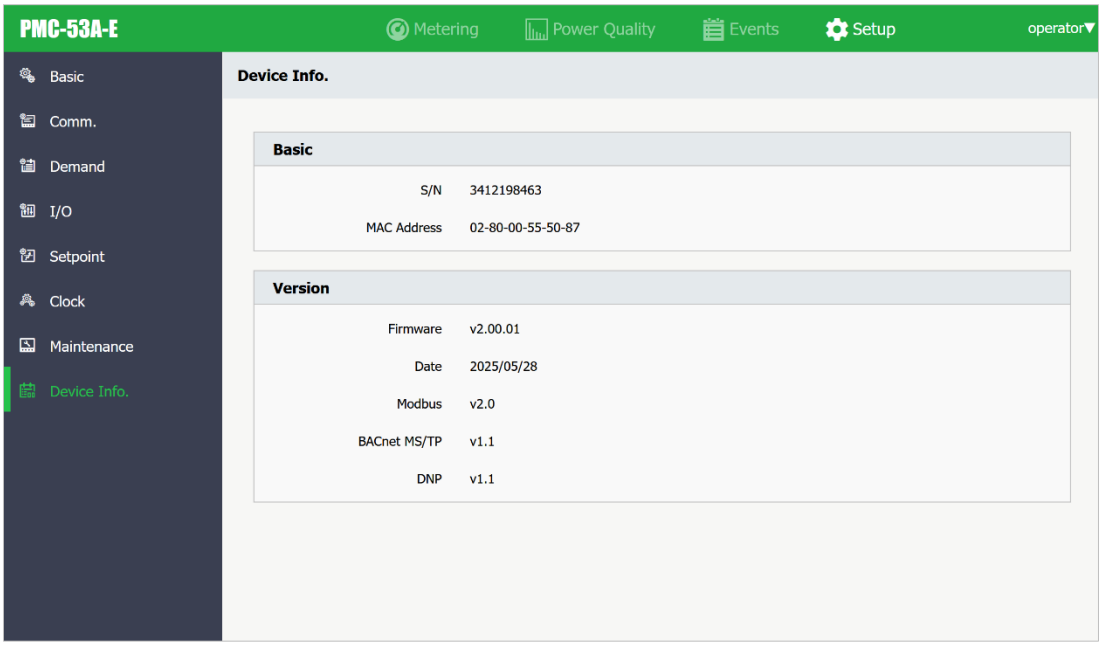


Figure 3-42 Device Info.

Chapter 4 Applications

4.1 Inputs and Outputs

4.1.1 Digital Inputs

The PMC-53A-E comes standard with four self-excited Digital Inputs that are internally wetted at 24 VDC with a sampling frequency of 1000Hz and programmable debounce. The PMC-53A-E 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 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 counter 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.

The following table describes the DI's setup parameters:

Setup Parameter	Definition	Options
DIx Function	Each **DI** can be configured as a Digital Input or Pulse Counter. Only DI1 to DI3 can be set as **Tariff Switch**.	0=Digital Input* 1=Pulse Counter 2=Tariff Switch
DIx Debounce	Specifies the minimum duration the **DI** must remain in the Active or Inactive state before a state change is considered to be valid.	1 to 9,999 (ms), 20*
DIx Pulse Weight	Specifies the incremental value for each received pulse. This is only used when a DI is configured as a Pulse Counter.	1* to 1,000,000

Default*

Table 4-1 DI Setup Parameters

4.1.2 Digital Outputs

The PMC-53A-E comes standard with two Form A Electrometrical Relays. Digital Outputs are normally used for setpoint alarming, load control, or remote control applications.

Digital Outputs on the PMC-53A-E 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 3.1.3** 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-E, 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 (Optional)

The PMC-53A-E comes standard with one Front Panel LED Pulse Output for energy pulsing and can be equipped with two optional Solid State Digital Outputs for kWh and kvarh pulsing, replacing the default Digital Outputs. 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 10/100/1000/3200/5000/6400/10000/25000 impulses per kWh/kvarh through the **EN Pulse CNST** setup parameter.

Note:
The constant 10/100/5000/10000/25000 are supported in the Firmware V2.00.00 and later.

4.1.4 Analog Input (Optional)

The PMC-53A-E 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-E. 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 of 100, and the **AI ZERO** parameter should be programmed with the value of -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°C - (-25°C)) x (12mA-4mA) / (20mA-4mA) + (-25°C) = 37.50°C.

4.1.5 IR Input (Optional)

The PMC-53A-E comes optionally with one IR input for Residual Current measurement via an external Residual Current transformer. The IR measurement can be set as the Setpoint Source to trigger an alarm when a threshold value is exceeded. The 3-Phase and Neutral conductors should be wired through the Residual Current CT without the PE (Protective Earth) wire as illustrated below.

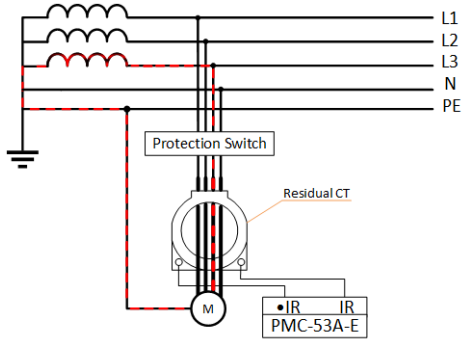


Figure 4-1 Example for Residual Current Measurement

4.2 Power and Energy

4.2.1 Basic Measurements

The PMC-53A-E 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	●	●	●	-	●
Current	●	●	●	-	●
Neutral Current	-	-	-	In (Calculated)	I4 (Optional)
Residual Current	-	-	-	Ir (Optional)	-
Neutral-to-Ground Voltage	-	-	-	Ung	-

P	●	●	●	●	-
Q	●	●	●	●	-
S	●	●	●	●	-
PF	●	●	●	●	-
dPF	●	●	●	●	-
Frequency	●				
U Fundamental	●	●	●		
I Fundamental	●	●	●		
P Fundamental	●	●	●	●	

Table 4-2 Basic Measurements

Notes:
1) When the Wiring Mode is 3P3W, the per-phase ULN, P, Q, S and Power Factor are reserved.
2) The Ung and Ing measurements are valid only when the Wiring Mode is 3P4W.
3) The Frequency detection priority is: U1 (U12) > U2 (U23) > U3 (U31). For example, if U1=0, the U2 signal would be used for Frequency detection instead. If both U1 and U2 are 0, the U3 signal would be used for Frequency detection.

4.2.2 Energy Measurements

The PMC-53A-E 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 kXh. When the maximum value is reached, the energy registers will automatically roll over to zero. The Real-time energy can be reset manually through the Front Panel or via communications.

The PMC-53A-E provides the following energy measurements:

Per-Phase & 3-Phase	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-E provides Interval Energy measurements of kWh Import/Export, kvarh Import/Export and kVAh. 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 or Web Interface.

The Interval Energy Period (**EN Period**) setup parameter can be programmed from the Front Panel, Web Interface 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 highest average power consumption over a fixed interval (usually 15 minutes) within the billing period. The PMC-53A-E provides Present and Predicted Demand for P /Q/ S Total, 3-Phase ULL, ULN, Currents and Average updated once a second, as well as Max. Demand (See Section 4.5.2) in This Month (Since Last Reset) and Last Month (Before Last Reset). 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-E provides the following setup parameters:

Setup Parameter	Definition	Options
Demand Period (Register: 6029)	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 (Register: 6030)	Number of Sliding Windows.	1 to 15 Default=1
Self-Read Time (Register: 6154)	The **Self-Read Time** allows the user to specify the time and day of the month for the Max. Demand Self-Read operation. The **Self-Read Time** supports three options: • A zero value means that the Self-Read will take place at	Default=0xFFFF

	00:00 of the first day of each month. • A non-zero value means that the Self-Read will take place at a specific time and day based on the formula: Self-Read Time = Day * 100 + Hour where 0 ≤ Hour ≤ 23 and 1 ≤ Day ≤ 28. For example, the value 1512 means that the Self-Read will take place at 12:00pm on the 15th day of each month. • A 0xFFFF value will disable the Self-Read operation and replace it with manual operation. A manual reset will cause the Max. Demand of **This Month** to be transferred to the Max. Demand of **Last Month** and then reset. The terms **This Month** and **Last Month** will become **Since Last Reset** and **Before Last Reset**.	
Predicted Response (Register: 6031)	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

4.2.5 Reactive Energy Monitoring

This feature is only available in Firmware V1.01.00 or later.

In many countries, there is often a penalty for over Reactive Energy consumption. The PMC-53A-E has implemented the following parameters to help monitor both kvarh Import and kvarh Export as a percentage of kWh Import on a daily basis as well as the running total from the last 30 days.

The following is a list of parameters calculated by the PMC-53A-E for the purpose of monitoring the rate of kvarh (Import and Export) consumption relative kWh Import:

P Imp.	Daily kWh Import
P Exp.	Daily kWh Export
Q Imp.	Daily kvarh Import
Q Exp.	Daily kvarh Export
S Total	Daily kVAh Total
%(Q Imp./P Imp.)	Daily %(kvarh Import/kWh Import)
%(Q Exp./P Imp.)	Daily %(kvarh Export/kWh Import)
30D Total %(Q Imp./P Imp.)	30 days running total %(kvarh Import/kWh Import)
30D Total %(Q Exp./P Imp.)	30 days running total %(kvarh Export/kWh Import)

Table 4-5 Reactive Energy Monitoring Parameters

The above parameters are updated daily at 00:00 based on yesterday's **P Imp.**, **Q Imp.** and **Q Exp**. An internal circular buffer is used to accumulate a 30-day running total of **P Imp.**, **Q Imp.** and **Q Exp.**, based on the sliding window calculation, to arrive at the **30D Total %(Q Imp./P Imp.)** and **30D Total % (Q Exp./P Imp.)** values. The **Daily** and **30D Total %(Q Imp./P Imp.)** are available on the Front Panel, Web Interface and via communications. Also, the internal buffer for the 30-day running total calculation can be reset via the Front Panel, Web Interface and Communications.

The PMC-53A-E can further be configured to generate a Setpoint alarm for **Daily %(Q Imp./P Imp.)** and/or **Daily %(Q Exp./P Imp.)** and trigger an email if so desired on a daily basis to alert the customers if they have exceeded their Reactive Energy quota the previous day so that appropriate measure can be taken to correct their consumption trend. Please refer to **4.4 Setpoints** for more information.

4.3 Power Quality

4.3.1 Phase Angles

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

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

4.3.2 Unbalance & Sequence Components

The PMC-53A-E provides Voltage and Current Unbalance measurements. The calculation method of Voltage and Current Unbalances is based on the ratio of Positive and Negative Sequence Components.

$$\text{Voltage Unbalance} = \frac{U2}{U1} \times 100\% \qquad \text{Current Unbalance} = \frac{I2}{I1} \times 100\%$$

where

U1, U2 are the Positive and Negative Sequence Components for Voltage, respectively.

and

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

4.3.3 Harmonics

The PMC-53A-E provides Voltage and Current with THD, TOHD, TEHD and up to the 63rd individual harmonics analysis. Additionally, TDD, K-Factor, and Crest Factor for Current are provided as well. All harmonic parameters are available via the Front Panel or through communications.

Note: The voltage and current harmonics from the 32nd to 63rd orders are available in the firmware V2.00.00 and later.

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

	Phase A/AB	Phase B/BC	Phase C/CA
Harmonic-Voltage	THD/TEHD/TOHD	THD/TEHD/TOHD	THD/TEHD/TOHD
	2nd Harmonics	2nd Harmonics	2nd Harmonics
	...		
	63rd Harmonics	63rd Harmonics	63rd Harmonics
Harmonic-Current	THD/TEHD/TOHD	THD/TEHD/TOHD	THD/TEHD/TOHD
	TDD	TDD	TDD
	TDD Even	TDD Even	TDD Even
	TDD Odd	TDD Odd	TDD Odd
	K-Factor	K-Factor	K-Factor
	Crest Factor	Crest Factor	Crest Factor
	2nd Harmonics	2nd Harmonics	2nd Harmonics
	...		
	63rd Harmonics	63rd Harmonics	63rd Harmonics

Table 4-6 Harmonic Measurements

Notes:
1) When the wiring mode is 1P2W L-L or 1P2W L-N, the harmonic measurements for Phase B/BC and C/CA are invalid.
2) When the wiring mode is 1P3W, the harmonic measurements for Phase C/CA are invalid.

4.3.3.1 THD & Fundamental

There are two methods for calculating the **THD**, which are based on Fundamental (THDf) and RMS (THDr). **Fundamental** is defined as the lowest frequency of a periodic waveform.

THDf:

$$\text{THDf} = \frac{\sqrt{\sum_{n=2}^{\infty} I_n^2}}{I_1} \times 100\%$$

THDr:

$$\text{THDr} = \frac{\sqrt{\sum_{n=2}^{\infty} I_n^2}}{\sqrt{\sum_{n=1}^{\infty} I_n^2}} \times 100\%$$

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

4.3.3.2 TDD

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

TDD of Current is calculated by the formula below:

$$TDD = \frac{\sqrt{\sum_{n=1}^{\infty} I_n^2}}{I_L} \times 100\%$$

where

I_L = Maximum Fundamental Current Demand

n = Harmonic Order (1, 2, 3, 4, etc.)

I_n = RMS Load Current at the n^{th} Harmonic

4.3.3.3 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.

$$\mathrm{K-Factor} = \frac{\sum_{n=1}^{n=n_{max}} (I_n \cdot n)^2}{\sum_{n=1}^{n=n_{max}} I_n^2}$$

where

I_n= n_{th} Harmonic Current in RMS

n_{max}=Highest Harmonic order

4.3.3.4 Crest Factor

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

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

where

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

X_{rms} = RMS value

4.3.4 Frequency and Voltage Deviations

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

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

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

where $f_{nominal}$ is the Nominal Frequency

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

For the ULN:

If U_{pu} < 100

ULN Underdeviation = 100 - U_{pu}

ULN Overdeviation=0

If U_{pu} > 100

ULN Underdeviation =0

ULN Overdeviation = 100 - U_{pu}

where $U_{pu}=\frac{100*ULN*\sqrt{3}}{Un}$

For the ULL:

If Upu < 100

ULL Underdeviation = 100 - U_{pu}

ULL Overdeviation=0

If Upu > 100

ULL Underdeviation =0

ULL Overdeviation = 100 - U_{pu}

where $U_{pu}=\frac{100*ULL}{Un}$

4.4 Setpoints

The PMC-53A-E 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.

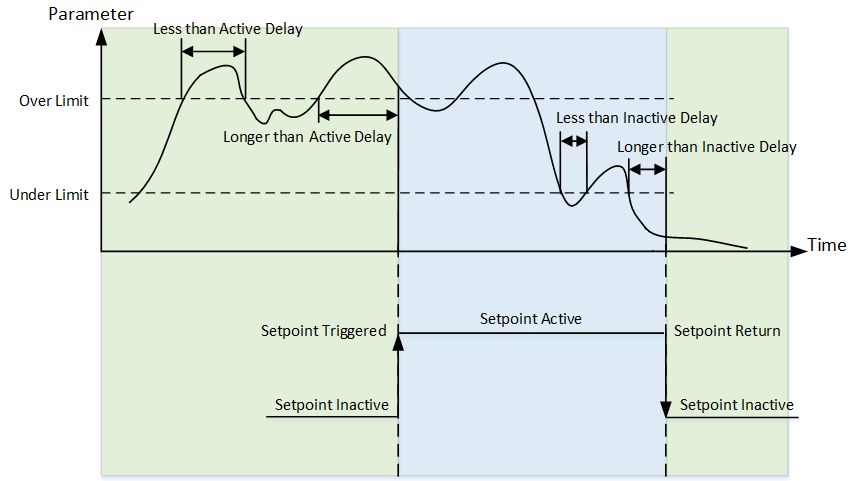


Figure 4-2 Over Setpoint

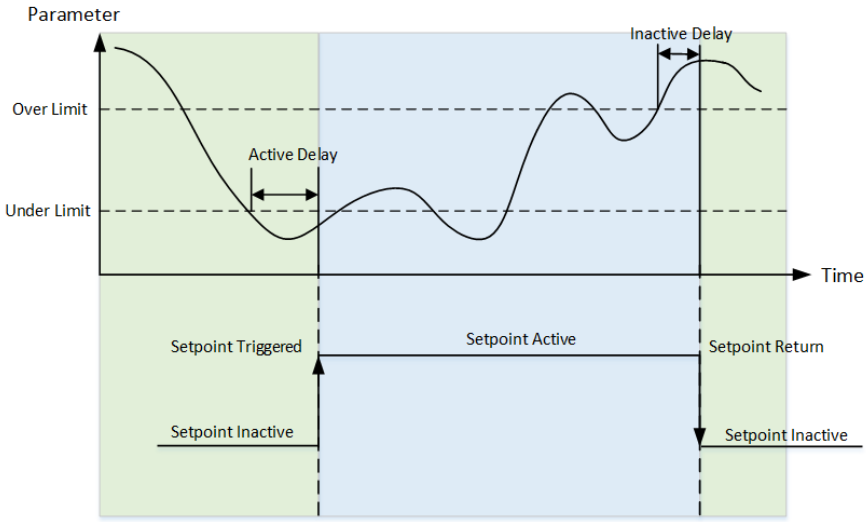


Figure 4-3 Under Setpoint

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=Disable* 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.	999,999*
Under Limit	Specify the value that the setpoint parameter must go below for Over Setpoint to become inactive or for Under Setpoint to become active.	0*
Active Delay	Specify the minimum duration that the setpoint condition must be met before the setpoint becomes active. An event will be generated and stored in the SOE Log. The range of the **Active Delay** is between 0 and 9999 seconds.	0 to 9999s 10*
Inactive Delay	Specify the minimum duration that the setpoint return condition must be met before the setpoint becomes inactive. An event will be generated and stored in the SOE Log. The range of the **Inactive Delay** is between 0 and 9999 seconds.	0 to 9999s 10*
Setpoint Trigger	Specify what action a setpoint would take when it becomes active.	0=None*, 1=DO1, 2=DO2, 3=Email

Table 4-7 Description for Setpoint Parameters

The table below illustrates the Setpoint Parameters to be monitored. In addition, the LCD would blink when a setpoint becomes active and if the **SP LCD Alarm** (Register #6048) is set to **Enable**.

Key	Setpoint Parameter	Scale	Resolution	Unit
0	None	-	-	-
1	ULN (Any Phase Voltage)	x1	0.001	V
2	ULL (Any Line Voltage)			
3	I (Any Phase Current)			A
4	In (Calculated)			
5	Frequency		0.01	Hz
6	P (P Total)		0.001	W
7	Q (Q Total)			var
8	S (S Total)			VA
9	PF (PF Total)			-
10	P DMD (P Total Present Demand)			W
11	Q DMD (Q Total Present Demand)			var
12	S (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		0.01%	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)[1]	-	-	-
25	I4 (Measured)*	x1	0.001	A
26	AI*		0.01	-
27	IR (Residual Current) *		0.001	A
28	U2 (Negative Sequence)			V
29	U0 (Zero Symmetrical Sequence)			
30	%QImp./PImp.^[2]		0.01%	100%
31	%QExp./PImp.^[2]			
32	Ia Demand	x1	0.001	A
33	Ib Demand			
34	Ic Demand			
35	I Average Demand			
36	Ia Predicted Demand			
37	Ib Predicted Demand			
38	Ic Predicted Demand			
39	I Average Predicted Demand			

* Appear only if the device is equipped with the appropriate option.
^ Available in Firmware V1.01.00 or later.

Table 4-8 Setpoint Parameters

Notes:

1. If **Reversal** is configured as the **Setpoint Parameter**, the **Setpoint Type** should be set to **Over**. It's invalid to configure **Reversal** as an **Under Setpoint**. In addition, the **Over Limit** and **Under Limit** should be set as 0 and 1, respectively.
2. If **%QImp./PImp.** or **%QExp./PImp.** is configured as the **Setpoint Parameter**, the **Setpoint Type** should be set as **Over Setpoint**. The **Over Limit** should be set as required, and the **Under Limit** setting is ignored. If the Setpoint becomes active, an event will be triggered which records the measurement value at the time of the event. The Setpoint will return automatically at 00:00 the following day because this particular Setpoint is designed to reset itself daily.

4.5 Logging

4.5.1 Max./Min. Log

The PMC-53A-E records the **Max. Log** and **Min. Log** of **This Month (Since Last Reset)** and **Last Month (Before Last Reset)** with timestamp for 45 parameters. Each log includes the relevant parameter value and its timestamp. The recorded data is stored in the device's non-volatile memory and will not suffer any loss in the event of a power failure. The PMC-53A-E's Max./Min. Log records the following parameters:

Max./Min. Parameters					
Uan	Ubn	Ucn	ULN Average	Uab	Ubc
Uca	ULL Average	Ia	Ib	Ic	I Average

Pa	Pb	Pc	P Total	Qa	Qb
Qc	Q Total	Sa	Sb	Sc	S Total
PFa	PFb	PFc	PF Total	Frequency	In
Uan/Uab THD	Ubn/Ubc THD	Ucn/Uca THD	Ia THD	Ib THD	Ic THD
Ia K-Factor	Ib K-Factor	Ic K-Factor	Ia Crest Factor	Ib Crest Factor	Ic Crest Factor
U Unbalance	I Unbalance	I4	Ir		

Table 4-9 Max./Min. Log

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

4.5.2 Max. Demand Log

The PMC-53A-E records the **Max. Demand** of **This Month (Since Last Reset)** and **Last Month (Before Last Reset)** with timestamp for Ia, Ib, Ic, P Total, Q Total and S Total as well as P Total, Q Total and S Total for TOU Tariffs 1 to 8. The Max. Demand of This Month (Since Last Reset) can be accessed via the Front Panel and through communications while the Max. Demand of Last Month (Before Last Reset) only can be retrieved through communications. Please refer to **Section 4.2.4** for a complete description of the **Self-Read Time** and its operation.

Max. Demand Logs of This Month (Since Last Reset) and Last Month (Before Last Reset)
Ia
Ib
Ic
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 4-10 Max. Demand Log

Notes:
1) When the wiring mode is 1P2W L-L or 1P2W L-N, the demand measurements for Phase B and C are invalid.
2) When the wiring mode is 1P3W, the demand measurements for Phase C are invalid.

4.5.3 Monthly Energy Log

The PMC-53A-E 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 ≤ 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.

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

The PMC-53A-E provides the following energy data for the present month and the last 12 months:

Active Energy	kWh Import	kWh Export	kWh Net	kWh Total
	T1 kWh Import	T2 kWh Import	T3 kWh Import	T4 kWh Import
	T5 kWh Import	T6 kWh Import	T7 kWh Import	T8 kWh Import
	T1 kWh Export	T2 kWh Export	T3 kWh Export	T4 kWh Export
	T5 kWh Export	T6 kWh Export	T7 kWh Export	T8 kWh Export
Reactive Energy	kvarh Import	kvarh Export	kvarh Net	kvarh Total
	T1 kvarh Import	T2 kvarh Import	T3 kvarh Import	T4 kvarh Import
	T5 kvarh Import	T6 kvarh Import	T7 kvarh Import	T8 kvarh Import
	T1 kvarh Export	T2 kvarh Export	T3 kvarh Export	T4 kvarh Export
	T5 kvarh Export	T6 kvarh Export	T7 kvarh Export	T8 kvarh Export

	kvarh Q1	kvarh Q2	kvarh Q3	kvarh Q4
Apparent Energy	kVAh			
	T1 kVAh	T2 kVAh	T3 kVAh	T4 kVAh
	T5 kVAh	T6 kVAh	T7 kVAh	T8 kVAh

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

4.5.4 Daily and Monthly Freeze Log

The PMC-53A-E 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-E'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 4-12 Freeze Log

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

1) **Daily Freeze Self-Read Time** can be set to a zero value or a non-zero value:
   - A zero value means that the Self-Read will take place at 00:00 every day.
   - 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 ≤ Hour ≤ 23 and 0 ≤ Min ≤ 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 ≤ 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.

4.5.5 SOE Log

The PMC-53A-E'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 or Web Interface or retrieved via communications for display. If there are more than 100 events, the newest event will replace the oldest event on a First-In-First-Out basis. The SOE Log can be reset from the Front Panel or via communications.

4.5.6 Data Recorder (DR) Log

The PMC-53A-E provides five Data Recorders capable of recording a maximum of 16 parameters each with a minimum recording interval of 60s. 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.

Hardware V1 and Firmware V1.00.00.

The PMC-53A-E's 4MB log memory is divided equally into 5 buffers of 800kB each. By default, each DR is allocated one 800kB buffer, which can hold a maximum ~118 days of recording with 16 parameters at 15-minute interval. This is equivalent to having a **Recording Depth** of ~11,377 data records (~118 days x 24 hours per day x 4 data records per hour).

The Data Recorder can be configured to use more than one 800kB buffer if it's required to maintain recording for a longer period of time. For example, if the entire 4MB log memory is used for a single Data Recorder, it can be configured to hold a maximum of 592 days (1.62 years) of recording with 16 parameters at 15-minute interval. This is equivalent to having a **Recording Depth** of 56,888 data records (592 days x 24 hours per day x 4 data records per hour). In order to do this, it's necessary to free the log

memory occupied by Data Recorders #2 to #5 by setting their respective **Number of Parameters** and **Recording Depth** setup parameters to 0.

The PMC-53A-E's Data Recorder has been enhanced such that it can support a maximum **Recording Depth** of 120,000 records (compared to the max. of 10,000 in PMC-53A), which is equivalent to 1250 days (~3.4 years) of recording at 15-minute interval. However, only one Data Recorder can be configured with a maximum of 6 parameters and 120,000 records.

The following formula can be used to calculate how many bytes would be required for a single record with n parameters where $0 \le n \le 16$.

No. of Bytes per Record = n x 4 + Timestamp @ 8 bytes

With 16 parameters, the no. of bytes required = 16 x 4 + 8 = 72 bytes. If a Data Recorder is allocated a single 800kB buffer, its **Recording Depth** = 800kB / 72 bytes = 11,377 records.

It should be noted that the above calculation is used to illustrate the internal organization of the data storage and is only an approximation of the actual implementation. The following table defines how many records are actually available for the different number of parameters in each 800kB buffer.

No. of Parameters	No. of Records	No. of Parameters	No. of Records
1	68,200	9	18,600
2	51,200	10	17,000
3	40,800	11	15,600
4	34,000	12	14,600
5	29,200	13	13,600
6	25,600	14	12,800
7	22,600	15	12,000
8	20,400	16	11,200

Firmware V1.01.00 or later

The total available log memory of the PMC-53A-E has been increased to 8MB and is equally divided into 1600kB for each Data Recorder. A maximum Recording Depth of 110,000, equivalent to 1145 days (~3.14 years), can be configured for one Data Recorder with 16 parameters at 15-minute recording interval.

Hardware V2 and Firmware V2.00.00 or later

The total available log memory of the PMC-53A-E has been increased to 16MB and is equally divided into 3200kB for each Data Recorder. A maximum Recording Depth of 120,000, equivalent to 1250 days (~3.42 years), can be configured for one Data Recorder with 16 parameters at 15-minute recording interval. In order to do that, it's necessary to free up sufficient buffer occupied by other DR groups. Please note that modifying the Recording Depth of one group will clear the recorded DR Logs and reset their Log Pointers.

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 120,000 (entry)	See **Appendix B**
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	See **Appendix B**
Parameter 1 to 16	See **Appendix A** for a complete list of parameters	See **Appendix B**

Table 4-13 Setup Parameters for Data Recorder

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

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

4.6 Time of Use (TOU)

TOU is used for electricity pricing that varies depending on the time of day, day of week, and season. The TOU system allows the user to configure an electricity price schedule inside the PMC-53A-E 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-E 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-E supports Tariff switching based on the status of DI1 to DI3.

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

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

Table 4-14 DIs and the Number of Tariffs Setup

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

Setup Parameters	Definition	Options
Daily Profile #	Specify a daily rate schedule which can be divided into a maximum of 12 periods. 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, starting from any day.
Alternate Days #	A day can be defined as an Alternate Day, such as May 1st. 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. Alternate Day has the highest priority.	Weekday1, Weekday2, Weekday3 & Alternate Days.
Switching Time	Specify when to switch from one TOU schedule to another. Writing 0xFFFFFFFF to this parameter disables switching between TOU schedules.	Format: YYYYMMDDHH Default=0xFFFFFFFF

Table 4-15 TOU Setup Parameters

For each of the 8 Tariff Rates, the PMC-53A-E provides the following information:
Energy: kWh Import/Export, kvarh Import/Export, kVAh for Per-Phase and Total
Max. Demand: P/Q/S of This Month (Since Last Reset) and Last Month (Before Last Reset).
The TOU data is available via communications, the Front Panel or Web Interface (excluding the Max. Demand for P, Q and S).

4.7 Communications

4.7.1 SNTP

SNTP (Simple Network Time Protocol) can be used to synchronize the PMC-53A-E's clock through the connected Ethernet port providing that the network has been properly configured for the PMC-53A-E to connect to a **SNTP Server**, wherever it may reside. The programming of the **SNTP** setup parameters are supported via the Web Interface and Modbus communications. The **SNTP server** provides the following setup parameters:

Setup Parameters	Definition	Default
Set Clock	Disable/Enable SNTP	Disabled
Time Zone	See **Section 5.13.1 Basic Setup Parameters, Register 6053**	26 (GMT+08:00)
Interval	SNTP Time Sync. Interval from 1 to 1440 minutes	60
Server IP	The IP Address of the **SNTP Server**	0.0.0.0

Table 4-16 SNTP Setup Parameters

4.7.2 SMTP

The PMC-53A-E can be configured to send Alarm Emails based on the Simple Mail Transfer Protocol (SMTP).

Setup Parameters	Definition	Options/Default*
Server IP	The IP Address of the SMTP Server	See Note 1
Port	The IP Port No. for the SMTP Server	0 to 65535, 25*
Sender	Sender's email address	See Note 2, Null*
Password	SMTP Server's logon password for Sender's email address	See Note 3
Receiver	Receiver's email address	See Note 2&4, Null*

Table 4-17 SMTP Setup Parameters

Notes:

1) The SMTP Server's IP Address, for example, 192.40.165.68, should be programmed into the **Server IP** setup parameter.
2) Both the **Sender** and **Receiver** setup parameters should not exceed 36 ASCII characters.
3) The **Password** should not exceed 20 ASCII Characters.
4) Only one Receiver email address is supported.

Here is an example on how to configure a Setpoint to trigger an Alarm Email:

1. Click on **Setup** -> **Comm.** and configure the **SMTP** settings as shown below. Please note that all the **SMTP** setup parameters should be entered correctly.

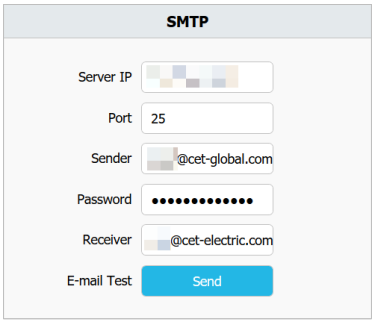


Figure 4-4 Setup SMTP via Web Browser

2. Click **Save** to store the configuration in the PMC-53A-E. The message "✓**Successful**" will appear if the configuration is accepted by the meter. Then click **Send** for **Email Test** as illustrated in the above figure. The message "✓**Successful**" will appear if a test email has been successfully sent to the **Receiver**, who should receive the following Test Email. However, if the "✓**Successful**" message is not displayed, it means that the test email has not been sent successfully because of incorrect configuration.

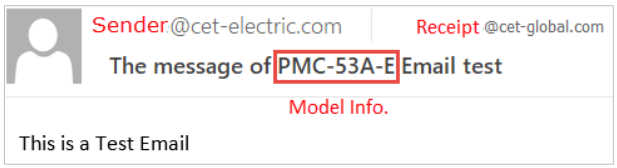


Figure 4-5 Example of a Test Email

3. Configure an **Over ULL Setpoint** via the Front Panel as illustrated below. Set **Trigger1** as **Email**.

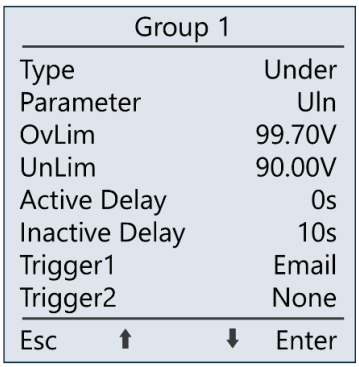
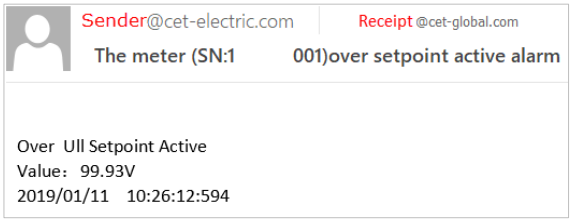


Figure 4-6 Over ULL Setpoint Configuration via Panel

4. When the ULL measurement goes above the configured **Over Limit** of 99.70Vac, an Alarm Email will be sent to the Receiver by the PMC-53A-E, providing that the SMTP configuration is correct. In addition, an event will be recorded in the SOE Log to indicate that an Alarm Email has been triggered by a Setpoint.



3	2019/01/11/ 10:26:12.594	Alarm Email Triggered by Setpoint
4	2019/01/11/ 10:26:12.594	Over Ull Setpoint Active,Value:99.93 V

Figure 4-7 Email Alarm Results

4.7.3 Ethernet Gateway

The PMC-53A-E's **Ethernet Gateway** feature supports Modbus communications between the Master Software (e.g. PecStar iEMS) on a Local Area Network and other RS-485-enabled devices (e.g. PMC-53A) via the PMC-53A-E's Ethernet (P2) and RS-485 port (P1). This eliminates the need for an additional, external Ethernet-to-RS-485 Gateway, simplifies the overall network design and saves cost. The Master Software sends a "Modbus RTU over TCP/IP" packet (Modbus RTU packet, i.e. the payload, encapsulated in a TCP/IP frame) to the PMC-53A-E's Ethernet port at its IP Address and IP Port No. 6000. The PMC-53A-E receives this "Modbus RTU over TCP/IP" packet at its Ethernet port, extracts the "encapsulated" Modbus RTU packet, i.e. the payload, from the TCP/IP frame and then in turn forwards it to its RS-485 port (P1). The RS-485-enabled device receives the Modbus RTU packet and sends its response back to the PMC-53A-E, which in turn encapsulates the Modbus RTU response packet in a TCP/IP frame, sends it back to the Master Software over Ethernet and completes the transaction.

The following illustrates the steps of configuring the PMC-53A-E's Ethernet Gateway:

1) Go to **Setup**-> **Comm.**-> **RS-485 (P1)** to change the **Protocol** setup parameter from the default setting of **Modbus** to **Gateway,** either via the Web Interface or Front Panel.

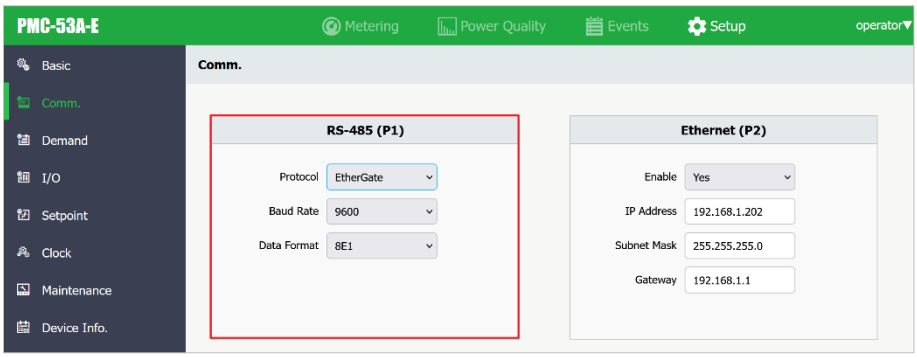


Figure 4-8 Select "Gateway" Mode on Web Server

2) Connect the RS-485-enabled devices (i.e. PMC-53A) to the RS-485 port (P1) of the PMC-53A-E.

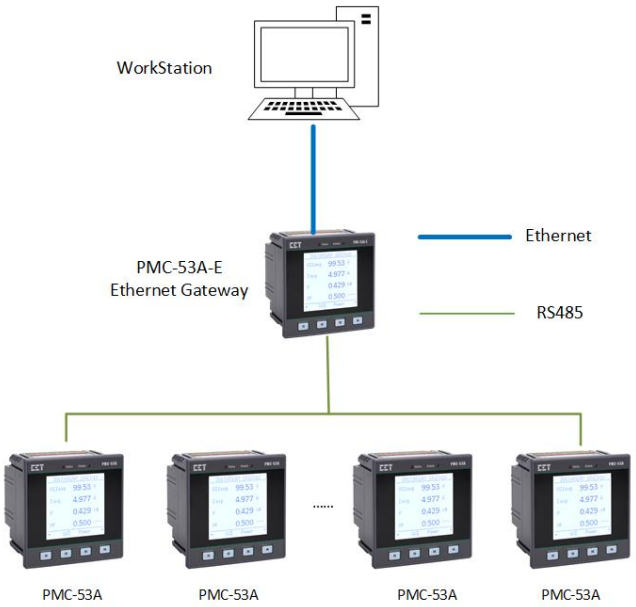


Figure 4-9 Typical Application for Ethernet Gateway

3) Configure the Master Software (e.g. PecStar iEMS) on the WorkStation to communicate with the RS-485-enabled devices via PMC-53A-E's Ethernet port at IP port No. 6000. It should be noted that the Master Software must support the **Modbus RTU over TCP/IP** protocol for this to work.

4) Make sure the serial port settings such as Baud Rate and Data Format are identical between the PMC-53A-E's RS-485 port and the RS-485-enabled devices.

5) The Master Software should be able to communicate with the RS-485-enabled devices via the PMC-53A-E's Ethernet Gateway, providing that all the necessary configuration is correct.

4.8 Diagnostics

The PMC-53A-E provides wiring error detection for 3P4W and 3P3W wiring modes and allows the user 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
- Disconnection of Residual Current Input

Please note that the error detection above is based on the following assumptions:

- The Voltage and Current Phase Sequences 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) illustrated below indicates the status of the various wiring error detection with a bit value of 1 meaning active and 0 meaning inactive:

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 only)
B03	Current Phase Loss (3P4W or 3P3W)
B04-B05	Reserved
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 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	Disconnection of Residual Current Input

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).

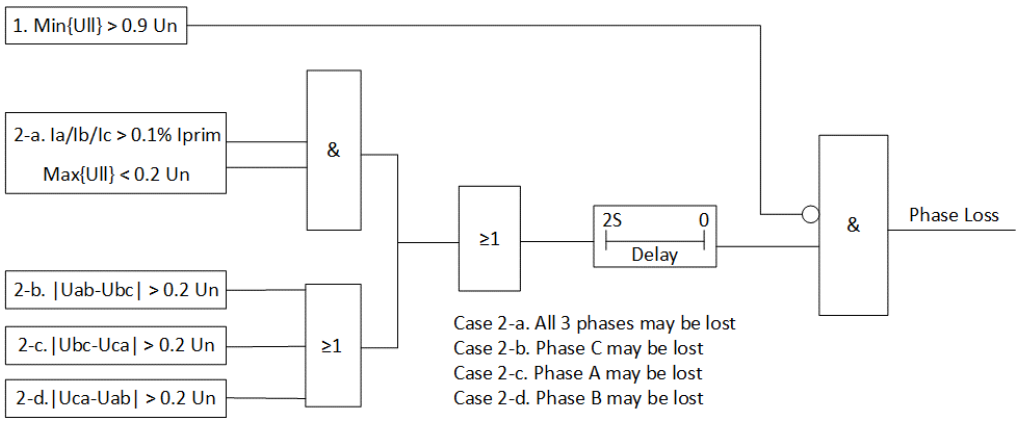


Figure 4-10 Voltage Phase Loss Logic

where Un and Iprim 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 ≥ 0.1%Iprim

Chapter 5 Modbus Register Map

This chapter provides a complete description of the Modbus register map (**Protocol Version 2.1**) for the PMC-53A-E to facilitate the development of 3rd party Modbus RTU communications driver for accessing the information on the meter.

The PMC-53A-E 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)

For a complete Modbus Protocol Specification, please visit http://www.modbus.org.

5.1 Function Code and Data Format

5.1.1 03 (0x03) Read Holding Registers

The following table illustrates the Data Format for Read Holding Registers Request/Response packet.

Request Packet (Master Station to PMC-53A-E)	
Field Name	**Bytes**
Slave Address	1 Byte
Function Code (0x03)	1 Byte
Starting Address Hi	1 Byte
Starting Address Lo	1 Byte
No. of Registers Hi	1 Byte
No. of Registers Lo	1 Byte
Error Check (CRC)	2 Bytes

Response Packet (PMC-53A-E to Master Station)	
Field Name	**Bytes**
Slave Address	1 Byte
Function Code (0x03)	1 Byte
Byte Count N	1 Byte
Data 1 Hi	1 Byte
Data 1 Lo	1 Byte
…	
Data N/2 Hi	1 Byte
Data N/2 Lo	1 Byte
Error Check (CRC)	2 Bytes

Table 5-1 Data Format for 0x03 Request/Response Packet

5.1.2 05 (0x05) Force Single Coil

The following table illustrates the Data Format for Force Single Coil Arm/Execute Request/Response packet.

Arm Request/Response

Request Packet (Master Station to PMC-53A-E)	
Field Name	**Bytes**
Slave Address	1 Byte
Function Code (0x05)	1 Byte
Output Address Hi	1 Byte
Output Address Lo	1 Byte
Output Value Hi (0xFF)	1 Byte
Output Value Lo (0x00)	1 Byte
Error Check (CRC)	2 Bytes

Response Packet (PMC-53A-E to Master Station)	
Field Name	**Bytes**
Slave Address	1 Byte
Function Code (0x05)	1 Byte
Output Address Hi	1 Byte
Output Address Lo	1 Byte
Output Value Hi (0xFF)	1 Byte
Output Value Lo (0x00)	1 Byte
Error Check (CRC)	2 Bytes

Table 5-2 Data Format for 0x05 Arm Request/Response Packet

Execute Request/Response

Request Packet (Master Station to PMC-53A-E)	
Field Name	**Bytes**
Slave Address	1 Byte
Function Code (0x05)	1 Byte
Output Address Hi	1 Byte
Output Address Lo	1 Byte
Output Value Hi (0xFF)	1 Byte
Output Value Lo (0x00)	1 Byte
Error Check (CRC)	2 Bytes

Response Packet (PMC-53A-E to Master Station)	
Field Name	**Bytes**
Slave Address	1 Byte
Function Code (0x05)	1 Byte
Output Address Hi	1 Byte
Output Address Lo	1 Byte
Output Value Hi (0xFF)	1 Byte
Output Value Lo (0x00)	1 Byte
Error Check (CRC)	2 Bytes

Table 5-3 Data Format for 0x05 Execute Request/Response Packet

The PMC-53A-E 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 (40301), which is enabled by default. Before executing an OPEN or CLOSE command on a Relay 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.

5.1.3 16 (0x10) Write Multiple Registers

The following table illustrates the Data Format for Write Multiple Registers request/response packet.

Request Packet (Master Station to PMC-53A-E)	
Field Name	**Bytes**
Slave Address	1 Byte
Function Code (0x10)	1 Byte
Starting Address Hi	1 Byte
Starting Address Lo	1 Byte
No. of Registers Hi	1 Byte
No. of Registers Lo	1 Byte
Byte Count N	1 Byte
Data 1 Hi	1 Byte
Data 1 Lo	1 Byte
…	
Data N/2 Hi	1 Byte
Data N/2 Lo	1 Byte
Error Check (CRC)	2 Bytes

Response Packet (PMC-53A-E to Master Station)	
Field Name	**Bytes**
Slave Address	1 Byte
Function Code (0x10)	1 Byte
Starting Address Hi	1 Byte
Starting Address Lo	1 Byte
No. of Registers Hi	1 Byte
No. of Registers Lo	1 Byte
Error Check (CRC)	2 Bytes

Table 5-4 Data Format for 0x10 Request/Response Packet

5.2 Register Format

The following table provides a description of the different data formats used for the Modbus registers.

Format	Description
UINT16/INT16	Unsigned/signed 16-bit integer
UINT32/INT32	Unsigned/signed 32-bit integer
INT64	Signed 64-bit integer
FLOAT	IEEE 754 32-bit floating point number (single precision)
BITMAP	16-bit or 32-bit binary register where each bit represents a specific quantity
CHAR	16-bit binary register which represents a single Unicode character.

Table 5-5 Register Format

5.3 Basic Measurements

Register	Property	Description	Format	Scale	Unit
0000	RO	Uan	Float	x1	V
0002	RO	Ubn	Float		
0004	RO	Ucn	Float		
0006	RO	ULN Average	Float		
0008	RO	Uab	Float		
0010	RO	Ubc	Float		
0012	RO	Uca	Float		
0014	RO	ULL Average	Float		
0016	RO	Ia	Float		A
0018	RO	Ib	Float		
0020	RO	Ic	Float		
0022	RO	I Average	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)[1]	Float		A
0072	RO	I4[2]	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[2] Scaled	Float		-
0084	RO	Iresidual[2]	Float		A
0086~0095	RO	Reserved	Float		-
0096	RO	DI Status[2,3]	UINT16		-
0097	RO	Reserved	UINT16		-
0098	RO	DO Status[2,4]	UINT16		-
0099	RO	Reserved	UINT16		-
0100	RO	Setpoint Status[5]	UINT16		-
0101	RO	Wiring Diagnostic Status[6]	UINT16		-
0102	RO	SOE Log Pointer[7]	UINT32		-
0104	RO	Device Operating Time[8]	UINT32	x0.1	0.1Hour
0106~0111	RO	Reserved	UINT32	-	-
0112	RO	Phase A Fundamental P	Float		
0114	RO	Phase B Fundamental P	Float		
0116	RO	Phase C Fundamental P	Float	x1	W
0118	RO	Total Fundamental P	Float		
0120	RO	Total Harmonic P	Float		
0122	RO	DR #1 Log Pointer[7]	UINT32	-	-
0124	RO	DR #2 Log Pointer[7]	UINT32	-	-
0126	RO	DR #3 Log Pointer[7]	UINT32	-	-
0128	RO	DR #4 Log Pointer[7]	UINT32	-	-
0130	RO	DR #5 Log Pointer[7]	UINT32	-	-
0132	RO	Daily Freeze Log Pointer[9]	UINT16	-	-
0133	RO	Monthly Freeze Log Pointer[9]	UINT16	-	-
0134~0148	RO	Reserved	UINT32		-
0150	RO	Uan/Uab (3P3W, 1P2W LL) Fundamental	Float		
0152	RO	Ubn/Ubc (3P3W) Fundamental[10]	Float	x1	V
0154	RO	Ucn/Uca (3P3W) Fundamental[10]	Float		
0156	RO	Ia Fundamental	Float		
0158	RO	Ib Fundamental	Float	x1	A
0160	RO	Ic Fundamental	Float		
0162	RO	U1 (Positive Sequence Voltage)[11]	Float		
0164	RO	U2 (Negative Sequence Voltage) [11]	Float	x1	V
0166	RO	U0 (Zero Sequence Voltage) [11]	Float		
0168	RO	I1 (Positive Sequence Current) [11]	Float		
0170	RO	I2 (Negative Sequence Current) [11]	Float	x1	A
0172	RO	I0 (Zero Sequence Current) [11]	Float		
0174	RO	Ung[1]	Float	x1	V

Table 5-6 Basic Measurements

Notes:

1. In and Ung measurements are only available for 3P4W wiring mode.
2. I4, AI, Ir, DI Status and DO Status are only meaningful if the meter is equipped with the corresponding option.
3. For the **DI Status** register, the bit values of B0 to B3 represent the states of DI1 to DI4, respectively, with “1” meaning Active (Closed) and “0” meaning Inactive (Open).
4. For the **DO Status** register, the bit values of B0 to B1 represent the states of DO1 and DO2, respectively, with “1” meaning

Operated (Closed) and "0" meaning Released (Open).

5. The B0 to B8 indicate the various states for Setpoint 1 to 9 with a bit value of "1" meaning Active and "0" meaning Inactive.
6. 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 only)
B03	Current Phase Loss (3P4W or 3P3W)
B04	Reserved
B05	Reserved
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	Disconnection of Residual Current Input

Table 5-7 Wiring Diagnostic Status Register

7. The PMC-53A-E has one SOE Log and five DR Logs. 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. A value of zero indicates that the SOE or DRx does not contain any Log. If a **Clear Log** is performed via communications, its **Log Pointer** will be reset to zero and immediately incremented by one with a new "Clear SOE via Communications" event. When the number of events is larger than the Log Depth, only the latest 100 SOE Logs (up to 120000 DR Logs) will be stored on a FIFO basis.

   Use the following equation to determine the latest log location:
   Latest Log Location = Modulo [**Log Pointer**/**Log Depth**]
   where **Log Pointer** may be one of the following:
   SOE Log Pointer, DR1 - DR5 Log Pointers
   and **Log Depth** is as follows:
   SOE Log Depth = 100 (fixed)
   DRx Log Depth = DRx Recording Depth (see **Section 5.13.5 Data Recorder Setup**)
8. The **Device Operating Time** means the accumulated Operating Time whenever any per-phase Current exceeds **Current Threshold of 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.
9. The range of the Log Pointer for Daily Freeze Log and Monthly Freeze Log is between 0 and 0xFFFF.
10. 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.
11. When the **Wiring Mode** is **1P2W L-N, 1P2W L-L** or **1P3W**, the Sequence Components U1/I1, U2/I2 and U0/I0 have no meaning and their registers are reserved.

5.4 Energy Measurements

The Energy registers have a maximum value of 999,999,999 and will roll over to zero automatically when it is reached. The actual energy value is 0.1 times of the register value.

5.4.1 3-Phase Total Energy Measurements

Register	Property	Description	Format	Scale	Unit
0500	RW	kWh Import	INT32	x0.1	kWh
0502	RW	kWh Export	INT32		
0504	RO	kWh Net	INT32		
0506	RO	kWh Total	INT32		
0508	RW	kvarh Import	INT32		kvarh
0510	RW	kvarh Export	INT32		
0512	RO	kvarh Net	INT32		
0514	RO	kvarh Total	INT32		
0516	RW	kVAh	INT32		kVAh
0518	RW	kvarh Q1	INT32		kvarh
0520	RW	kvarh Q2	INT32		
0522	RW	kvarh Q3	INT32		
0524	RW	kvarh Q4	INT32		
0526	RW	kWh Import of T1	INT32		kWh
0528	RW	kWh Export of T1	INT32		
0530	RW	kvarh Import of T1	INT32		kvarh

0532	RW	kvarh Export of T1	INT32		
0534	RW	kVAh of T1	INT32		kVAh
0536	RW	kWh Import of T2	INT32		kWh
0538	RW	kWh Export of T2	INT32		
0540	RW	kvarh Import of T2	INT32		kvarh
0542	RW	kvarh Export of T2	INT32		
0544	RW	kVAh of T2	INT32		kVAh
0546	RW	kWh Import of T3	INT32		kWh
0548	RW	kWh Export of T3	INT32		
0550	RW	kvarh Import of T3	INT32		kvarh
0552	RW	kvarh Export of T3	INT32		
0554	RW	kVAh of T3	INT32		kVAh
0556	RW	kWh Import of T4	INT32		kWh
0558	RW	kWh Export of T4	INT32		
0560	RW	kvarh Import of T4	INT32		kvarh
0562	RW	kvarh Export of T4	INT32		
0564	RW	kVAh of T4	INT32		kVAh
0566	RW	kWh Import of T5	INT32		kWh
0568	RW	kWh Export of T5	INT32		
0570	RW	kvarh Import of T5	INT32		kvarh
0572	RW	kvarh Export of T5	INT32		
0574	RW	kVAh of T5	INT32		kVAh
0576	RW	kWh Import of T6	INT32		kWh
0578	RW	kWh Export of T6	INT32		
0580	RW	kvarh Import of T6	INT32		kvarh
0582	RW	kvarh Export of T6	INT32		
0584	RW	kVAh of T6	INT32		kVAh
0586	RW	kWh Import of T7	INT32		kWh
0588	RW	kWh Export of T7	INT32		
0590	RW	kvarh Import of T7	INT32		kvarh
0592	RW	kvarh Export of T7	INT32		
0594	RW	kVAh of T7	INT32		kVAh
0596	RW	kWh Import of T8	INT32		kWh
0598	RW	kWh Export of T8	INT32		
0600	RW	kvarh Import of T8	INT32		kvarh
0602	RW	kvarh Export of T8	INT32		
0604	RW	kVAh of T8	INT32		kVAh

Table 5-8 3-phase Total Energy Measurements

5.4.2 Per-Phase Energy Measurements

Registers			Property	Description	Format	Scale	Unit
L1	L2	L3					
0620	0740	0860	RW	kWh Import	INT32		kWh
0622	0742	0862	RW	kWh Export	INT32		
0624	0744	0864	RO	kWh Net	INT32		
0626	0746	0866	RO	kWh Total	INT32		
0628	0748	0868	RW	kvarh Import	INT32		kvarh
0630	0750	0870	RW	kvarh Export	INT32		
0632	0752	0872	RO	kvarh Net	INT32		
0634	0754	0874	RO	kvarh Total	INT32		
0636	0756	0876	RW	kVAh	INT32		kVAh
0638	0758	0878	RW	kvarh Q1	INT32		kWh
0640	0760	0880	RW	kvarh Q2	INT32		
0642	0762	0882	RW	kvarh Q3	INT32	x0.1	
0644	0764	0884	RW	kvarh Q4	INT32		
0646	0766	0886	RW	kWh Import of T1	INT32		kvarh
0648	0768	0888	RW	kWh Export of T1	INT32		
0650	0770	0890	RW	kvarh Import of T1	INT32		kWh
0652	0772	0892	RW	kvarh Export of T1	INT32		
0654	0774	0894	RW	kVAh of T1	INT32		
0656	0776	0896	RW	kWh Import of T2	INT32		kWh
0658	0778	0898	RW	kWh Export of T2	INT32		
0660	0780	0900	RW	kvarh Import of T2	INT32		kvarh
0662	0782	0902	RW	kvarh Export of T2	INT32		
0664	0784	0904	RW	kVAh of T2	INT32		kVAh

0666	0786	0906	RW	kWh Import of T3	INT32		kWh
0668	0788	0908	RW	kWh Export of T3	INT32		
0670	0790	0910	RW	kvarh Import of T3	INT32		kvarh
0672	0792	0912	RW	kvarh Export of T3	INT32		
0674	0794	0914	RW	kVAh of T3	INT32		kVAh
0676	0796	0916	RW	kWh Import of T4	INT32		kWh
0678	0798	0918	RW	kWh Export of T4	INT32		
0680	0800	0920	RW	kvarh Import of T4	INT32		kvarh
0682	0802	0922	RW	kvarh Export of T4	INT32		
0684	0804	0924	RW	kVAh of T4	INT32		kVAh
0686	0806	0926	RW	kWh Import of T5	INT32		kWh
0688	0808	0928	RW	kWh Export of T5	INT32		
0690	0810	0930	RW	kvarh Import of T5	INT32		kvarh
0692	0812	0932	RW	kvarh Export of T5	INT32		
0694	0814	0934	RW	kVAh of T5	INT32		kVAh
0696	0816	0936	RW	kWh Import of T6	INT32		kWh
0698	0818	0938	RW	kWh Export of T6	INT32		
0700	0820	0940	RW	kvarh Import of T6	INT32		kvarh
0702	0822	0942	RW	kvarh Export of T6	INT32		
0704	0824	0944	RW	kVAh of T6	INT32		kVAh
0706	0826	0946	RW	kWh Import of T7	INT32		kWh
0708	0828	0948	RW	kWh Export of T7	INT32		
0710	0830	0950	RW	kvarh Import of T7	INT32		kvarh
0712	0832	0952	RW	kvarh Export of T7	INT32		
0714	0834	0954	RW	kVAh of T7	INT32		kVAh
0716	0836	0956	RW	kWh Import of T8	INT32		kWh
0718	0838	0958	RW	kWh Export of T8	INT32		
0720	0840	0960	RW	kvarh Import of T8	INT32		kvarh
0722	0842	0962	RW	kvarh Export of T8	INT32		
0724	0844	0964	RW	kVAh of T8	INT32		kVAh

Table 5-9 Per-Phase Energy Measurements

5.4.3 Interval Energy Measurements

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 5-10 Interval Energy Measurements

Note:

1) The **EN Period** (Register# 6047) determines how long the Interval Energy Measurements will be updated. For example, if **EN Period** = 60 min, the Interval Energy Measurements will be refreshed hourly on the hour.

5.4.4 Reactive Energy Monitoring (Available in Firmware V1.01.00 or later)

Register	Property	Description	Format	Scale	Unit
1250	RW	Index[1]	UINT16	0 to 30	
1251	RO	High-order Byte: Year (0-99) Low-order Byte: Month (1-12)	Timestamp		
1252	RO	High-order Byte: Day (1-31) Low-order Byte: Hour (0-23)			
1253	RO	High-order Byte: Minute (0-59) Low-order Byte: Second (0-59)			
1254	RO	kWh Import	INT32	x0.1	kWh
1256	RO	kWh Export	INT32		
1258	RO	kvarh Import	INT32	x0.1	kWh
1260	RO	kvarh Export	INT32		
1262	RO	kVAh	INT32	x0.1	kWh

Table 5-11 Daily Energy Buffer

Notes:

1. To read the Daily Energy Buffer, the **Index** register must be first written to indicate to the device which daily measurements to load from memory. The range of this register is from 0 to 30, which represents This Day and the Last 30 Days. For example, if the current date is 2016/10/01, “0” means this day, “1” means 2016/09/30, etc., and “30” means 2016/09/01.

2. The Daily Energy Buffer for This Day can be modified but the Daily Energy buffers for the Last 30D are Read Only.

Register	Property	Description	Format	Scale	Unit
1290	RO	Daily %QImp/PImp	Float	x1	- (0.1 means 10%)
1292	RO	Daily %QExp/PImp	Float		
1294	RO	30D Total %QImp/PImp	Float		
1296	RO	30D Total %QExp/PImp	Float		

Table 5-12 Reactive Energy Monitoring

5.5 DI Pulse Counters

Register	Property	Description	Format	Range/Unit
1200	RW	DI1 Pulse Counter	UINT32	0 to 999,999,999 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	

Table 5-13 DI Pulse Counter

5.6 Power Quality Measurements

5.6.1 Basic PQ 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		- (0.1 means 10%)
1332	RO	Current Unbalance	Float		
1334	RO	Ua Overdeviation^	Float		
1336	RO	Ub Overdeviation^	Float		
1338	RO	Uc Overdeviation^	Float		
1340	RO	Ua Underdeviation^	Float		
1342	RO	Ub Underdeviation^	Float		
1344	RO	Uc Underdeviation^	Float		
1346	RO	Uab Overdeviation^	Float		
1348	RO	Ubc Overdeviation^	Float		
1350	RO	Uca Overdeviation^	Float		
1352	RO	Uab Underdeviation^	Float		
1354	RO	Ubc Underdeviation^	Float		
1356	RO	Uca Underdeviation^	Float		
1358	RO	Frequency Deviation^	Float		

^Available in Firmware V2.00.00 or later.

Table 5-14 Power Quality Measurements

Notes:

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

5.6.2 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^	Float		
1802	RO	Ib HD32^	Float		
1804	RO	Ic HD 32^	Float		
...	RO	...	Float		
1986	RO	Ia HD63^	Float		
1988	RO	Ib HD63^	Float		
1990	RO	Ic HD63^	Float		

^Available in Firmware V2.00.00 or later.

Table 5-15 Current Harmonic Measurements

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

^Available in Firmware V2.00.00 or later.

Table 5-16 Voltage Harmonic Measurements

Notes:

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

5.7 Demands

5.7.1 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 Average^	Float	x1	A
3014	RO	Ua^	Float	x1	V
3016	RO	Ub^	Float	x1	V
3018	RO	Uc^	Float	x1	V
3020	RO	ULN Average^	Float	x1	V
3022	RO	Uab^	Float	x1	V
3024	RO	Ubc^	Float	x1	V
3026	RO	Uca^	Float	x1	V
3028	RO	ULL Average^	Float	x1	V

^Available in Firmware V1.01.00 or later.

Table 5-17 Present Demand Measurements

Note:

1. 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-N,** the L3 phase measurements have no meaning, and their registers are reserved.

5.7.2 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 Average^	Float	x1	A
3214	RO	Ua^	Float	x1	V
3216	RO	Ub^	Float	x1	V
3218	RO	Uc^	Float	x1	V
3220	RO	ULN Average^	Float	x1	V
3222	RO	Uab^	Float	x1	V
3224	RO	Ubc^	Float	x1	V
3226	RO	Uca^	Float	x1	V
3228	RO	ULL Average^	Float	x1	V

^Available in Firmware V1.01.00 or later.

Table 5-18 Predicted Demand Measurements

Note:

1. 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-N,** the L3 phase measurements have no meaning, and their registers are reserved.

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

Register	Property	Description	Format	Unit
3400~3405	RO	Ia	See **Section 5.7.5 Demand Data Structure**	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
3900~3905	RO	I Average^	See **Section 5.7.5 Demand Data Structure**	A
3906~3911	RO	Ua^		V
3912~3917	RO	Ub^		V
3918~3923	RO	Uc^		V
3924~3929	RO	ULN Average^		V
3930~3935	RO	Uab^		V
3936~3941	RO	Ubc^		V
3942~3947	RO	Uca^		V
3948~3953	RO	ULL Average^		V

^Available in Firmware V1.01.00 or later.

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

Note:

1. 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-N,** the L3 phase measurements have no meaning, and their registers are reserved.

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

Register	Property	Description	Format	Unit
3600~3605	RO	Ia	See **Section 5.7.5 Demand Data Structure**	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 Average^	See **Section 5.7.5 Demand Data Structure**	A
3786~3791	RO	Ua^		V
3792~3797	RO	Ub^		V
3798~3803	RO	Uc^		V

3804~3809	RO	ULN Average^		V
3810~3815	RO	Uab^		V
3816~3821	RO	Ubc^		V
3822~3827	RO	Uca^		V
3828~3833	RO	ULL Average^		V

^Available in Firmware V1.01.00 or later.

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

Note:

1. 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-N,** the L3 phase measurements have no meaning, and their registers are reserved.

5.7.5 Demand Data Structure

Offset		Description	Format	Range
+0	High	Year - 2000	UINT16	00 to 99
	Low	Month	UINT16	1 to 12
+1	High	Day	UINT16	1 to 31
	Low	Hour	UINT16	0 to 23
+2	High	Minute	UINT16	0 to 59
	Low	Second	UINT16	0 to 59
+3	-	Millisecond	UINT16	0 to 999
+4~+5	-	Max. Demand Value	Float	

Table 5-21 Demand Data Structure

5.8 Max./Min. Log

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

Register	Property	Description	Format	Unit
4000~4005	RO	Uan	**See Section 5.8.5 Max./Min. Log Structure**	V
4006~4011	RO	Ubn		
4012~4017	RO	Ucn		
4018~4023	RO	ULN Average		
4024~4029	RO	Uab		
4030~4035	RO	Ubc		
4036~4041	RO	Uca		
4042~4047	RO	ULL Average		
4048~4053	RO	Ia		A
4054~4059	RO	Ib		
4060~4065	RO	Ic		
4066~4071	RO	I Average		
4072~4077	RO	Pa		W
4078~4083	RO	Pb		
4084~4089	RO	Pc		
4090~4095	RO	P Total		
4096~4101	RO	Qa		var
4102~4107	RO	Qb		
4108~4113	RO	Qc		
4114~4119	RO	Q Total		
4120~4125	RO	Sa		VA
4126~4131	RO	Sb		
4132~4137	RO	Sc		
4138~4143	RO	S Total		
4144~4149	RO	PFa		-
4150~4155	RO	PFb		
4156~4161	RO	PFc		
4162~4167	RO	PF Total		
4168~4173	RO	Frequency		Hz
4174~4179	RO	In (Calculated)		A
4180~4185	RO	Uan/Uab THD[2]		- (0.1 stands for 10%)
4186~4191	RO	Ubn/Ubc THD[2]		
4192~4197	RO	Ucn/Uca THD[2]		
4198~4203	RO	Ia THD		
4204~4209	RO	Ib THD		
4210~4215	RO	Ic THD		

4216~4221	RO	Ia K-Factor		-
4222~4227	RO	Ib K-Factor		-
4228~4233	RO	Ic K-Factor		-
4234~4239	RO	Ia Crest Factor		-
4240~4245	RO	Ib Crest Factor		-
4246~4251	RO	Ic Crest Factor		-
4252~4257	RO	Voltage Unbalance		-
4258~4263	RO	Current Unbalance		(0.1 stands for 10%)
4264~4269	RO	I4		A
4270~4275	RO	Ir (Residual Current)		

Table 5-22 Max. Log of This Month (Since Last Reset)

Notes:

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

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

Register	Property	Description	Format	Unit
4300~4305	RO	Uan	**See Section 5.8.5 Max./Min. Log Structure**	V
4306~4311	RO	Ubn		
4312~4317	RO	Ucn		
4318~4323	RO	ULN Average		
4324~4329	RO	Uab		
4330~4335	RO	Ubc		
4336~4341	RO	Uca		
4342~4347	RO	ULL Average		
4348~4353	RO	Ia		A
4354~4359	RO	Ib		
4360~4365	RO	Ic		
4366~4371	RO	I Average		
4372~4377	RO	Pa		W
4378~4383	RO	Pb		
4384~4389	RO	Pc		
4390~4395	RO	P Total		
4396~4401	RO	Qa		var
4402~4407	RO	Qb		
4408~4413	RO	Qc		
4414~4419	RO	Q Total		
4420~4425	RO	Sa		VA
4426~4431	RO	Sb		
4432~4437	RO	Sc		
4438~4443	RO	S Total		
4444~4449	RO	PFa		-
4450~4455	RO	PFb		
4456~4461	RO	PFc		
4462~4467	RO	PF Total		
4468~4473	RO	Frequency		Hz
4474~4479	RO	In (Calculated)		A
4480~4485	RO	Uan/Uab THD^2		-- (0.1 stands for 10%)
4486~4491	RO	Ubn/Ubc THD^2		
4492~4497	RO	Ucn/Uca THD^2		
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		(0.1 stands for 10%)
4564~4569	RO	I4		A
4570~4575	RO	Ir (Residual Current)		

Table 5-23 Min. Log of This Month (Since Last Reset)

Notes:

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

5.8.3 Max. Log of Last Month (Before Last Reset)

Register	Property	Description	Format	Unit
4600~4605	RO	Uan	See Section 5.8.5 Max./Min. Log Structure	V
4606~4611	RO	Ubn		
4612~4617	RO	Ucn		
4618~4623	RO	ULN Average		
4624~4629	RO	Uab		
4630~4635	RO	Ubc		
4636~4641	RO	Uca		
4642~4647	RO	ULL Average		
4648~4653	RO	Ia		A
4654~4659	RO	Ib		
4660~4665	RO	Ic		
4666~4671	RO	I Average		
4672~4677	RO	Pa		W
4678~4683	RO	Pb		
4684~4689	RO	Pc		
4690~4695	RO	P Total		
4696~4701	RO	Qa		var
4702~4707	RO	Qb		
4708~4713	RO	Qc		
4714~4719	RO	Q Total		
4720~4725	RO	Sa		VA
4726~4731	RO	Sb		
4732~4737	RO	Sc		
4738~4743	RO	S Total		
4744~4749	RO	PFa		-
4750~4755	RO	PFb		
4756~4761	RO	PFc		
4762~4767	RO	PF Total		
4768~4773	RO	Frequency		Hz
4774~4779	RO	In (Calculated)		A
4780~4785	RO	Uan/Uab THD		- (0.1 stands for 10%)
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		- (0.1 stands for 10%)
4858~4863	RO	Current Unbalance		
4864~4869	RO	I4		A
4870~4875	RO	Ir (Residual Current)		

Table 5-24 Max. Log of Last Month (Before Last Reset)

Notes:

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

5.8.4 Min. Log of Last Month (Before Last Reset)

Register	Property	Description	Format	Unit

4900~4905	RO	Uan	See Section 5.8.5 Max./Min. Log Structure	V
4906~4911	RO	Ubn		
4912~4917	RO	Ucn		
4918~4923	RO	ULN Average		
4924~4929	RO	Uab		
4930~4935	RO	Ubc		
4936~4941	RO	Uca		
4942~4947	RO	ULL Average		
4948~4953	RO	Ia		A
4954~4959	RO	Ib		
4960~4965	RO	Ic		
4966~4971	RO	I Average		
4972~4977	RO	Pa		W
4978~4983	RO	Pb		
4984~4989	RO	Pc		
4990~4995	RO	P Total		
4996~5001	RO	Qa		var
5002~5007	RO	Qb		
5008~5013	RO	Qc		
5014~5019	RO	Q Total		
5020~5025	RO	Sa		VA
5026~5031	RO	Sb		
5032~5037	RO	Sc		
5038~5043	RO	S Total		
5044~5049	RO	PFa		-
5050~5055	RO	PFb		
5056~5061	RO	PFc		
5062~5067	RO	PF Total		
5068~5073	RO	Frequency		Hz
5074~5079	RO	In (Calculated)		A
5080~5085	RO	Uan/Uab THD		- (0.1 stands for 10%)
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		- (0.1 stands for 10%)
5158~5163	RO	Current Unbalance		
5164~5169	RO	I4		A
5170~5175	RO	Ir (Residual Current)		

Table 5-25 Min. Log of Last Month (Before Last Reset)

Notes:

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

5.8.5 Max./Min. Log Structure

Offset		Description	Format	Range
+0	High	Year - 2000	UINT16	00 to 99
	Low	Month	UINT16	1 to 12
+1	High	Day	UINT16	1 to 31
	Low	Hour	UINT16	0 to 23
+2	High	Minute	UINT16	0 to 59
	Low	Second	UINT16	0 to 59
+3	-	Millisecond	UINT16	0 to 999
+4~+5	-	Max./Min. Value	Float	

Table 5-26 Max./Min. Structure

5.9 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)	Timestamp	Time Stamp (20YY/MM/DD HH:MM:SS)	
0982	RO	High-order Byte: Day (1-31) Low-order Byte: Hour (0-23)			
0983	RO	High-order Byte: Minute (0-59) Low-order Byte: Second (0-59)			
0984	RW	kWh Import	INT32	x0.1	kWh
0986	RW	kWh Export	INT32		
0988	RO	kWh Net	INT32		
0990	RO	kWh Total	INT32		
0992	RW	kvarh Import	INT32	x0.1	kvarh
0994	RW	kvarh Export	INT32		
0996	RO	kvarh Net	INT32		
0998	RO	kvarh Total	INT32		
1000	RW	kVAh	INT32	x0.1	kVAh
1002	RW	kvarh Q1	INT32	x0.1	kvarh
1004	RW	kvarh Q2	INT32		
1006	RW	kvarh Q3	INT32		
1008	RW	kvarh Q4	INT32		
1010	RW	kWh Import of T1	INT32	x0.1	kWh
1012	RW	kWh Export of T1	INT32		
1014	RW	kvarh Import of T1	INT32	x0.1	kvarh
1016	RW	kvarh Export of T1	INT32		
1018	RW	kVAh of T1	INT32	x0.1	kVAh
1020	RW	kWh Import of T2	INT32	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 5-27 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 device 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, etc., 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.

5.10 Daily and Monthly Freeze Logs

5.10.1 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)	Timestamp		
12002	RO	High-order Byte: Day (1-31) Low-order Byte: Hour (0-23)			
12003	RO	High-order Byte: Minute (0-59) Low-order Byte: Second (0-59)			
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	Float	x1	W
12012	RO	Max. Demand of Q Total	Float	x1	var
12014	RO	Max. Demand of S Total	Float	x1	VA

Table 5-28 Daily Freeze Log

Note:

1) Writing a value N between 1 and 60 to the **Index** register to retrieve the Daily Freeze Log of the N_{th} 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 N^{th} Log Record (where $1 \le N \le 60$) 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.

5.10.2 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)	Timestamp		
12502	RO	High-order Byte: Day (1-31) Low-order Byte: Hour (0-23)			
12503	RO	High-order Byte: Minute (0-59) Low-order Byte: Second (0-59)			
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 5-30		W
12516~12521	RO	Max. Demand of Q Total			var
12522~12527	RO	Max. Demand of S Total			VA

Table 5-29 Monthly Freeze Log

Offset		Description	Format	Range
+0	High	Year - 2000	UINT16	00 to 99
	Low	Month	UINT16	1 to 12
+1	High	Day	UINT16	1 to 31
	Low	Hour	UINT16	0 to 23
+2	High	Minute	UINT16	0 to 59
	Low	Second	UINT16	0 to 59
+3	-	Millisecond	UINT16	0 to 999
+4~+5	-	Max. Demand Value	Float	

Table 5-30 Demand Data Structure

Note:

1) Writing a value N between 1 and 36 to the **Index** register to retrieve the Monthly Freeze Log of the N_{th} 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 N^{th} Log Record (where $1 \le N \le 36$) 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.

5.11 SOE Log

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

Register Address = 10000 + Modulo[SOE Log Pointer-1/100]*8

Register	Property	Description	Format
10000~10007	RO	Event 1	See Table 5-32
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 5-31 SOE Log

SOE Log Data Structure

Offset	Property	Description	Range/Note
+0	RO	Hi: Event Classification	See Table 5-33
	RO	Lo: Sub-Classification	
+1	RO	Hi: Year	0-99 (Year-2000)
	RO	Lo: Month	1 to 12
+2	RO	Hi: Day	1 to 31
	RO	Lo: Hour	0 to 23
+3	RO	Hi: Minute	0 to 59
	RO	Lo: Second	0 to 59
+4	RO	Millisecond	0 to 999
+5	RO	Hi: Reserved	-
	RO	Lo: Status[1]	-
+6 to +7	RO	Event Value[2]	-

Table 5-32 SOE Log Data Structure

Notes:

1. The return value "01" means DI Inactive/ DO Operated/Alarm (including Setpoint & Diagnosis); and the return value "00" means DI Active/ DO Released/Setpoint Return.
2. The returned Event Value (for SOE Event Classification=Setpoint only) is in Float format, and please refer to Table 5-44 to check the Unit for each parameter.

SOE Classification

Event Classification	Sub-Classification	Status	Event Value	Description
1=DI Changes	1	1/0		DI1 Inactive / DI1 Active
	2	1/0		DI2 Inactive / DI2 Active
	3	1/0		DI3 Inactive / DI3 Active
	4	1/0		DI4 Inactive / DI4 Active
2=DO Changes	1	1/0		DO1 Operated/Released by Remote Control
	2	1/0		DO2 Operated/Released by Remote Control
	3~10			Reserved
	11	1/0		DO1 Operated/Released by Setpoint
	12	1/0		DO2 Operated/Released by Setpoint
	13~20			Reserved
	21	1/0		DO1 Operated/Released by Front Panel
	22	1/0		DO2 Operated/Released by Front Panel

	23~30			Reserved
	31	0		DO1 Released by Pulse Width
	32	0		DO2 Released by Pulse Width
3=Setpoint	1	1/0	Trig-ger Value / Re-turn Value	Over ULN Setpoint Active/Return
	2	1/0		Over ULL Setpoint Active/Return
	3	1/0		Over Current Setpoint Active/Return
	4	1/0		Over In Setpoint Active/Return
	5	1/0		Over Frequency Setpoint Active/Return
	6	1/0		Over P Total Setpoint Active/Return
	7	1/0		Over Q Total Setpoint Active/Return
	8	1/0		Over S Total Setpoint Active/Return
	9	1/0		Over PF Total Setpoint Active/Return
	10	1/0		Over P Total DMD Setpoint Active/Return
	11	1/0		Over Q Total DMD Setpoint Active/Return
	12	1/0		Over S Total DMD Setpoint Active/Return
	13	1/0		Over P Total Pred. DMD Setpoint Active/Return
	14	1/0		Over Q Total Pred. DMD Setpoint Active/Return
	15	1/0		Over S Total Pred. DMD Setpoint Active/Return
	16	1/0		Over Voltage THD Setpoint Active/Return
	17	1/0		Over Voltage TOHD Setpoint Active/Return
	18	1/0		Over Voltage TEHD Setpoint Active/Return
	19	1/0		Over Current THD Setpoint Active/Return
	20	1/0		Over Current TOHD Setpoint Active/Return
	21	1/0		Over Current TEHD Setpoint Active/Return
	22	1/0		Over Voltage Unbalance Setpoint Active/Return
	23	1/0		Over Current Unbalance Setpoint Active/Return
	24	1/0		Phase Reversal Setpoint Active/Return
	25	1/0		Over I4 Setpoint Active/Return
	26	1/0		Over AI Setpoint Active/Return
	27	1/0		Over Ir Setpoint Active/Return
	28	1/0		Over U2 Sequence Setpoint Active/Return
	29	1/0		Over U0 Sequence Setpoint Active/Return
	30	1/0		Over Daily %QImp/PImp Setpoint Active/Return*[1]
	31	1/0		Over Daily %QExp/PImp Setpoint Active/Return*[1]
	32	1/0		Over I1 Demand Setpoint Active/Return*
	33	1/0		Over I2 Demand Setpoint Active/Return*
	34	1/0		Over I3 Demand Setpoint Active/Return*
	35	1/0		Over Iavg Demand Setpoint Active/Return*
	36	1/0		Over I1 Pred. Demand Setpoint Active/Return*
	37	1/0		Over I2 Pred. Demand Setpoint Active/Return*
	38	1/0		Over I3 Pred. Demand Setpoint Active/Return*
	39	1/0		Over Iavg Pred. Demand Setpoint Active/Return*
	41	1/0		Under ULN Setpoint Active/Return
	42	1/0		Under ULL Setpoint Active/Return
	43	1/0		Under Current Setpoint Active/Return
	44	1/0		Under In Setpoint Active/Return
	45	1/0		Under Frequency Setpoint Active/Return
	46	1/0		Under P Total Setpoint Active/Return
	47	1/0		Under Q Total Setpoint Active/Return
	48	1/0		Under S Total Setpoint Active/Return
	49	1/0		Under PF Total Setpoint Active/Return
	50	1/0		Under P Total DMD Setpoint Active/Return
	51	1/0		Under Q Total DMD Setpoint Active/Return
	52	1/0		Under S Total DMD Setpoint Active/Return
	53	1/0		Under P Total Pred. DMD Setpoint Active/Return
	54	1/0		Under Q Total Pred. DMD Setpoint Active/Return
	55	1/0		Under S Total Pred. DMD Setpoint Active/Return
	56	1/0		Under Voltage THD Setpoint Active/Return
	57	1/0		Under Voltage TOHD Setpoint Active/Return
	58	1/0		Under Voltage TEHD Setpoint Active/Return
	59	1/0		Under Current THD Setpoint Active/Return
	60	1/0		Under Current TOHD Setpoint Active/Return
	61	1/0		Under Current TEHD Setpoint Active/Return
	62	1/0		Under Voltage Unbalance Setpoint Active/Return
	63	1/0		Under Current Unbalance Setpoint Active/Return
	64	1/0		Under I4 Setpoint Active/Return

	65	1/0		Under AI Setpoint Active/Return
	66	1/0		Under Ir Setpoint Active/Return
	67	1/0		Under U2 Sequence Setpoint Active/Return
	68	1/0		Under U0 Sequence Setpoint Active/Return
	71	1/0		Under I1 Demand Setpoint Active/Return*
	72	1/0		Under I2 Demand Setpoint Active/Return*
	73	1/0		Under I3 Demand Setpoint Active/Return*
	74	1/0		Under Iavg Setpoint Active/Return*
	75	1/0		Under I1 Pred. Demand Setpoint Active/Return*
	76	1/0		Under I2 Pred. Demand Setpoint Active/Return*
	77	1/0		Under I3 Pred. Demand Setpoint Active/Return*
	78	1/0		Under Iavg Pred. Setpoint Active/Return*
4=Self-diag-nosis	1	1	0	System Parameter Fault
	2	1	0	Factory Setup 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[2]
	4	0	0	Clear His. Monthly Energy Log via Panel[3]
	5	0	0	Clear Present Max. DMD via the Panel
	6	0	0	Clear All Demand via the 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[4]
	10	0	0	Clear SOE Log via Panel
	11	0	x=1~4	Clear DIx Pulse Counter via Panel
	12	0	0	Clear All Pulse Counters 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	Clear 30D Energy Buffer via Panel*
	20~29	0	...	Reserved
	30	0	0	Clear All Energy Registers via Comm.[5]
	31	0	0	Clear Pres. Monthly Energy Log via Comm.[6]
	32	0	0	Clear His. Monthly Energy Log via Comm.[7]
	33	0	0	Clear Present Max. DMD via Comm.
	34	0	0	Clear All Demand via Comm.
	35	0	0	Clear Present Max./Min. via Comm.
	36	0	0	Clear All Max./Min. Logs via Comm.
	37	0	0	Clear All Data via Comm.[4]
	38	0	0	Clear SOE Log via Comm.
	39	0	x=1~4	Clear DIx Pulse Counter via Comm.
	40	0	0	Clear All DI Pulse Counters via Comm.
	41	0	0	Clear Operating Time via Comm.
	42	0	0	Restore Factory Default via Comm.
	43	0	0	Setup Changed via Comm.
	44	0	0	Preset Energy Values via Comm.
	45	0	0	Setup TOU Energy Values via Comm.
	46	0	1~4	Switch TOU Schedule[8]
	47	0	1~5	Clear DRx Log via Comm.
	48	0	0	Clear All DR logs via Comm.
	49	0	0	Clear Daily Freeze Log via Comm.
	50	0	0	Clear Monthly Freeze Log via Comm.
	51	0	0	Clear 30D Energy Buffer via Comm.*
6=Alarm Email	1	0	0	Alarm Email Triggered by Setpoint

*Available in Firmware V1.01.00 or later.

Table 5-33 SOE Event Classification

Notes:

1) The returned value of **Over Daily %QImp/PImp Setpoint** and **%QExp/PImp Setpoint** is NaN, which has no meaning.
2) **Clear Present Energy via Panel** means to clear 3-Phase Total Energy registers, Phase A/B/C Energy registers (including TOU Energy & Interval Energy), and Monthly Energy Log of the Present Month.
3) **Clear His. Monthly Energy Log via Panel** means to clear the Monthly Energy Log of the last 1 to 12 months, excluding the

Monthly Energy Log for the Present Month.

4) **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.
5) **Clear All Energy Registers via Comm.** means to clear the 3-Φ Total and Per-Phase energy registers (including TOU Energy & Interval Energy).
6) **Clear Pres. Monthly Energy Log via Comm.** means to clear the Monthly Energy Log of the Present Month.
7) **Clear His. Monthly Energy Log via Comm.** means to clear Monthly Energy Log of the last 1 to 12 months, excluding the Monthly Energy Log for the Present Month
8) 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 5-34 TOU Switch Records

5.12 Data Recorder Log

Register	Property	Description	Format
20000~20037	RO	DR Log #1 Buffer	See Table 5-36 DR Data Buffer 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 5-35 DR Log

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

Table 5-36 DR Data Buffer Structure

Notes:

1) Writing n to the **DR Log X Pointer** register will load the Log Record at pointer position n into the DR Log X Buffer from the device's memory, and the valid range of the DR Index is:
   - Between ***1*** and ***DR Log Pointer*** when DR Log Pointer ⩽ DR Log Depth (see **Section 5.13.5** 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 **DR Log X Pointer** register will generate an exception response with the **Illegal Data Value** error code (0x03) as defined by the Modbus protocol.

5.13 Device Setup

5.13.1 Basic Setup Parameters

Register	Property	Description	Format	Range, Default*
6000	RW	PT Primary[1]	UINT32	1 to 1,000,000V, 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	5A/1A Input: 1 to 5A, 5* CT Input: 100*
6008	RW	CT Type[3, 4]	UINT32	1=100A*, 2=200A, 3=400A, 4=800A, 5=1600A, 6=400A Rogowski Coil 7=1200A Rogowski Coil 8=2500A Rogowski Coil 9=5000A Rogowski Coil
6010	--	Reserved	--	--
6012	RW	I4 Primary	UINT32	1 to 30,000A, 5*
6014	RW	I4 Secondary	UINT32	1 to 5A, 5*
6016~6018	--	Reserved	--	--
6019	RW	Frequency Nominal	UINT16	0=50Hz*, 1=60Hz
6020	RW	Wiring Mode[3]	UINT16	0=DEMO, 1=1P2W L-N, 2=1P2W L-L, 3=1P3W L-L-N 4=3P3W, 5=3P4W*, 6=3x1P
6021	RW	PF Convention	UINT16	0=IEC*, 1=IEEE, 2=-IEEE
6022	RW	S Calculation	UINT16	0=Vector*, 1=Scalar
6023	RW	Ia Polarity	UINT16	0=Normal*, 1=Reverse
6024	RW	Ib Polarity	UINT16	
6025	RW	Ic Polarity	UINT16	
6026~6027	--	Reserved	--	--
6028	RW	THD Calculation[5]	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[6]	UINT16	0xFFFF*
6034	RW	Monthly Energy Self-Read Time[7]	UINT16	0*
6035	RW	Energy Pulse Constant[4]	UINT16	0=1,000 imp./kxh 1=3,200 imp./kxh* 2=6,400 imp./kxh 3=10 imp./kxh 4=100 imp./kxh 5=5,000 imp./kxh 6=10,000 imp./kxh 7=25,000 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	0=Chinese, 1=English*
6039	RW	Date Format	UINT16	0=YYMMDD*, 1=MMDDYY 2=DDMMYY
6040	RW	Delimiter[8]	UINT16	0=Option 1*, 1=Option 2
6041	RW	Monthly Freeze Self-Read Time[9]	UINT16	0*
6042	RW	Daily Freeze Self-Read Time[10]	UINT16	0*
6043	RW	1st parameter of Default Display[11]	UINT16	0 to 36, 7*
6044	RW	2nd parameter of Default Display[11]	UINT16	0 to 36, 11*
6045	RW	3rd parameter of Default Display[11]	UINT16	0 to 36, 12*
6046	RW	4th parameter of Default Display[11]	UINT16	0 to 36, 15*
6047	RW	EN Period[12]	UINT16	5 to 60* min
6048	RW	SP LCD 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[13]	UINT16	0 to 65535, 0x3F*
6052	RW	SNTP Enable	UINT16	0=Disabled*, 1=Enabled
6053	RW	Time Zone[14]	UINT16	0 to 32, 26*
6054	RW	SNTP Sync. Interval[15]	UINT16	1 to 1440 (min), 60*
6055	RW	SNTP Server Address	UINT32	0.0.0.0*
6057	RW	SMTP IP Port	UINT16	0 to 65535, 25*
6058	RW	SMTP Server Address	UINT32	0.0.0.0*
6060~6095	RW	Sender Email	UINT16	See Note 16, Null*
6096~6115	RW	Logon Password	UINT16	See Note 17, Null*
6116~6151	RW	Receiver Email	UINT16	See Note 18, Null*
6152	RW	Voltage Symbol[19]	UINT16	0=IEC (U)*, 1=ANSI
6153	RW	Phase Label[19]	UINT16	0=123*, 2=ABC
6154	RW	Max. Demand Log Self-Read Time[6]	UINT16	0xFFFF*

Table 5-37 Basic Setup Parameters

Notes:

1. The value of [**PT Primary**/**PT Secondary**] cannot exceed 10000.
2. The **CT Primary** and **CT Secondary** settings are configured automatically by the **CT Type** setting for Input Current option 4 that supports Split-Core CTs and Rogowski Coils. The corresponding CT Primary : CT Secondary ratios are automatically set to 100:100, 200:100, 400:100, 800:100, 1600:100, 1200:100, 2500:100 and 5000: 100 in CT Type option order. Further, the values written to **CT Primary** and **CT Secondary** would be invalid.
3. The **CT Type** parameter, **3x1P** wiring mode and pulse constant 10/100 imp./kxh options are available in Firmware V1.01.00 or later.
4. The Rogowski Coil input and pulse constant 5,000/10,000/25,000 imp./kxh are supported in Firmware V2.00.00 and later.
5. There are two ways to calculate THD:

   THDf:

$$THDf = \frac{\sqrt{\sum_{n=2}^{\infty} I_n^2}}{I_1} \times 100\%$$

   where I_1 represents the RMS value of the fundamental component, and I_n represents the RMS value for the n^{th} harmonic with n for harmonic order.

   THDr:

$$THDr = \frac{\sqrt{\sum_{n=2}^{\infty} I_n^2}}{\sqrt{\sum_{n=1}^{\infty} I_n^2}} \times 100\%$$

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

6. The **Max./Min. Log** and **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 ≤ Hour ≤ 23 and 1 ≤ Day ≤ 28. For example, the value 1512 means that the Self-Read will take place at 12:00pm on the 15th day of each month.
   - A 0xFFFF value means the automatic self-read operation is disabled and the log will be transferred manually.
7. The **Self-Read Time** applies to the Monthly Energy Log supports the following 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 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.
8. The **Delimiter** setup register supports two options, 1 and 2:
   Option 1: "," is used as the x1000 delimiter and "." as the decimal point (e.g. 123,456,789.0).
   Option 2: " " is used as the x1000 delimiter and "," as the decimal point (e.g. 123 456 789,0).
9. The **Monthly Freeze Self-Read Time** supports only two options:
   - A zero value means that the Self-Read will take place at 00:00 on the first day of each month.
   - A non-zero value means that the Self-Read will take place at a specific time and day based on the formula: Self-Read Time = Day * 100 + Hour where 0 ≤ Hour ≤ 23 and 1 ≤ Day ≤ 28. For example, the value 1512 means that the Self-Read will take place at 12:00pm on the 15th day of each month.
10. 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 every day.
    - 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 ≤ Hour ≤ 23 and 0 ≤ Min ≤ 59. For example, the value 1512 means that the Self-Read will take place at 15:12 each day.
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)	10	I3 (Ic)	20	T1 kWh Imp.	30	Fund. P Total
1	U2 (Ubn)	11	Iavg	21	T2 kWh Imp.	31	dPF Total
2	U3 (Ucn)	12	P (P Total)	22	T3 kWh Imp.	32	I4
3	Ullavg	13	Q (Q Total)	23	T4 kWh Imp.	33	U1 THD
4	U12 (Uab)	14	S (S Total)	24	I1 (Ia) Demand	34	U2 THD
5	U23 (Ubc)	15	PF (PF Total)	25	I2 (Ib) Demand	35	U3 THD
6	U31 (Uca)	16	Frequency	26	I3 (Ic) Demand	36	Ir
7	Ullavg	17	kWh Import	27	P Demand		
8	I1 (Ia)	18	kWh Export	28	Q Demand		
9	I2 (Ib)	19	kWh Total	29	S Demand		

Table 5-38 Default Display Parameters

12. The Interval Energy will be reset once the **EN Period** is changed.
13. The DNP Rolling Polling Objects are listed in table below:

Bit	Object Description	Options/Default*
B00	Object 1: Binary Inputs	0=Disabled 1=Enabled*
B01	Object 10: Binary Outputs	
B02	Object 20: 32-Bit Binary Counters	
B03	Object 20: 16-Bit Binary Counters	
B04	Object 21: Analog Inputs	
B05	Object 30: Analog Output	
B06	Reserved	

Table 5-39 DNP Polling Objects

14. SNTP doesn't support Daylight Saving Time (DST). The following table lists the supported Time Zones:

Code	Time Zone	Code	Time Zone
0	GMT-12:00	**17**	GMT+03:30
1	GMT-11:00	**18**	GMT+04:00
2	GMT-10:00	**19**	GMT+04:30
3	GMT-09:00	**20**	GMT+05:00
4	GMT-08:00	**21**	GMT+05:30
5	GMT-07:00	**22**	GMT+05:45
6	GMT-06:00	**23**	GMT+06:00
7	GMT-05:00	**24**	GMT+06:30
8	GMT-04:00	**25**	GMT+07:00
9	GMT-03:30	**26**	GMT+08:00
10	GMT-03:00	**27**	GMT+09:00
11	GMT-02:00	**28**	GMT+09:30
12	GMT-01:00	**29**	GMT+10:00
13	GMT+00:00	**30**	GMT+11:00
14	GMT+01:00	**31**	GMT+12:00
15	GMT+02:00	**32**	GMT+13:00
16	GMT+03:00		

Table 5-40 Time Zones

15. The SNTP Sync. Interval should be set between 10 and 1440 minutes.
16. This string register specifies the sender email address that appears in the “From” field of the email. This string may be up to 35 characters long. Please add the value zero “0000” at the end of the string as the string terminator. For example, if the sender email address is **PMC-53A-E@foxmail.com**, set the registers as” 0050 004D 0043 002D 0035 0033 0041 002D 0045 0040 0066 006F 0078 006D 0061 0069 006C 002E 0063 006F 006D 0000”.
17. This string register specifies the Logon Password to login the “Sender Email” account. This string may be up to 19 characters long. Please add the value zero “0000” at the end of the string as the string terminator. For example, if the password is “PMC-53A-E”, set the registers as “0050 004D 0043 002D 0035 0033 0041 002D 0045 0000”
18. This string register specifies the destination email address that appears in the “To” field of the email. This string may be up to 35 characters long. Please add the value zero “0000” at the end of the string as the string terminator. For example, if the email address is **PMC-53A-E@gmail.com**, so set the registers as” 0050 004D 0043 002D 0035 0033 0041 002D 0045 0040 0067 006D 0061 0069 006C 002E 0063 006F 006D 0000”.
19. The Voltage Symbol and Phase Label registers are available in Firmware V1.01.00 or later.

5.13.2 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	0 = Digital Input* 1=Pulse Counting
6204~6207	--	Reserved	--	--
6208	RW	DI1 Debounce	UINT16	1 to 9999 ms, 20*
6209	RW	DI2 Debounce	UINT16	
6210	RW	DI3 Debounce	UINT16	
6211	RW	DI4 Debounce	UINT16	
6212~6215	--	Reserved	--	--
6216	RW	DI1 Pulse Weight	UINT32	1* to 1000000
6218	RW	DI2 Pulse Weight	UINT32	
6220	RW	DI3 Pulse Weight	UINT32	
6222	RW	DI4 Pulse Weight	UINT32	
6224~6228	--	Reserved	--	--
6230	RW	DO1 Mode	UINT16	0 = Remote Control/Setpoint* 1 = kWh Import 2 = kWh Export 3 = kWh Total 4 = kvarh Import 5 = kvarh Export 6 = kvarh Total
6231	RW	DO2 Mode	UINT16	
6232~6235	--	Reserved	--	--
6236	RW	DO1 Pulse Width	UINT16	0 to 6000 (x0.1s), 0* (Latch Mode)
6237	RW	DO2 Pulse Width	UINT16	
6238~6249	--	Reserved	--	--
6250	RW	AI Type	UINT16	0 = 4~20mA*, 1 = 0~20mA
6251	RW	AI Zero Scale	INT32	-999,999 to +999,999, 400*
6253	RW	AI Full Scale	INT32	-999,999 to +999,999, 2000*

Table 5-41 I/O Setup Parameters

5.13.3 Communication Setup Parameters

Register	Property	Description	Format	Range, Default*
6400	RW	Port 1 Protocol[1]	UINT16	0=Modbus RTU*, 1=BACnet 2= DNP, 3=EtherGate, 4=Disable
6401	RW	Port 1 Unit ID	UINT16	Modbus RTU: 1 to 247 BACnet/MSTP: 1 to 127 DNP: 0 to 65519 100*
6402	RW	Port 1 Baud Rate	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	Ethernet IP Address	UINT32	192.168.0.100*
6406	RW	Ethernet Subnet Mask	UINT32	255.255.255.0*
6408	RW	Ethernet Gateway	UINT32	192.168.0.1*
6410	RW	Ethernet (P2) Enable[1]	UINT16	0=No, 1=Yes*
6411	RW	Modbus TCP Port[1, 2]	UINT16	1 to 65535, 502*
6412	RW	Modbus RTU Port[1, 2]	UINT16	1 to 65535, 27011*
6413	RW	EtherGate Port[1, 2]	UINT16	1 to 65535, 6000*
6414	RW	TFTP Port[1, 2]	UINT16	1 to 65535, 69*
6415	RW	Web Port[1, 2]	UINT16	1 to 65535, 80*

Table 5-42 Communication Setup

Notes:

1. The enabling and disabling of the Serial (P1) and Ethernet (P2) ports via Registers 6400 and 6410, respectively, as well as the configurations for IP Ports via Registers 6411 to 6415, are available in Firmware V1.01.00 or later.
2. Modification to the assigned IP Ports requires a device reboot to take effect.

5.13.4 Setpoints Setup

Register	Property	Description		Format	Range, Default*
6500	RW	Setpoint #1	Setpoint Type	UINT16	0=Disabled* 1=Over Setpoint

					2=Under Setpoint
6501	RW		Parameters[1]	UINT16	0 to 39, 0=None*
6502	RW		Over Limit	Float	999999*
6504	RW		Under Limit	Float	0*
6506	RW		Active Delay	UINT16	0 to 9999 s, 10*
6507	RW		Inactive Delay	UINT16	0 to 9999 s, 10*
6508	RW		Trigger Action 1[2]	UINT16	0* to 3
6509	RW		Trigger Action 2[2]	UINT16	
...		...			...
6580	RW	Setpoint #9	Setpoint Type	UINT32	0=Disabled* 1=Over Setpoint 2=Under Setpoint
6581	RW		Parameter[1]	UINT16	0 to 39, 0=None*
6582	RW		Over Limit	Float	999999*
6584	RW		Under Limit	Float	0*
6586	RW		Active Delay	UINT16	0 to 9999 s, 10*
6587	RW		Inactive Delay	UINT16	0 to 9999 s, 10*
6588	RW		Trigger Action 1[2]	UINT16	0* to 3
6589	RW		Trigger Action 2[2]	UINT16	

Table 5-43 Setpoint Setup Parameters

Notes:

1) The table below illustrates the Setpoint Parameters.

Key	Setpoint Parameter	Scale	Resolution	Unit
0	None	-	-	-
1	ULN (Any Phase Voltage)	x1	0.001	V
2	ULL (Any Line Voltage)			
3	I (Any Phase Current)			A
4	In (Calculated)			
5	Frequency		0.01	Hz
6	P (P Total)		0.001	W
7	Q (Q Total)			var
8	S (S Total)			VA
9	PF (PF Total)			-
10	P DMD (P Total Present Demand)			W
11	Q DMD (Q Total Present Demand)			var
12	S (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		0.01%	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 (Any Phase Reversal)[1]	-	-	-
25	I4 (Measured)*	x1	0.001	A
26	AI*		1	-
27	IR (Residual Current) *	x1	0.001	A
28	U2 (Voltage Negative Sequence)	x1		V
29	U0 (Voltage Zero Sequence)			
30	%QImp/PImp^[2]	X1	0.01%	100%
31	%QExp/PImp^[2]			
32	Ia Demand	x1	0.001	A
33	Ib Demand			
34	Ic Demand			
35	I Average Demand			
36	Ia Predicted Demand			
37	Ib Predicted Demand			
38	Ic Predicted Demand			
39	I Average Predicted Demand			

* Appear only if the device is equipped with the appropriate option.

^ Available in Firmware V1.01.00 or later

Table 5-44 Setpoint Parameters

Notes:

1. If **Reversal** is configured as the **Setpoint Parameter**, the **Setpoint Type** should be set to **Over**. It's invalid to configure **Reversal** as an **Under Setpoint**. In addition, the **Over Limit** and **Under Limit** should be set as 0 and 1, respectively.
2. If **%QImp/PImp** or **%QExp/PImp** is configured as the **Setpoint Parameter**, the **Setpoint Type** should be set as **Over Setpoint**. The **Over Limit** should be set as required, and the **Under Limit** setting is invalid. If the Setpoint becomes active, it will trigger the SOE event with a measurement. The Setpoint will return at 00:00 the following day with a value of 0 because this particular Setpoint will reset daily.

2) The table below illustrates the options for Setpoint Trigger. Please keep in mind that when the DOx is set as Setpoint Trigger, the DOx Function should be configured as Digital Output correspondingly.

Key	Action	Key	Action
0	None	**1**	DO1 Closed
2	DO2 Closed	**3**	Email

Table 5-45 Setpoint Trigger

5.13.5 Data Recorder Setup

Register	Property	Description	Format
6600~6623	RW	Data Recorder #1*	See Table 5-47 DR Setup Parameter Data Structure
6624~6647	RW	Data Recorder #2*	
6648~6671	RW	Data Recorder #3*	
6672~6695	RW	Data Recorder #4*	
6696~6719	RW	Data Recorder #5*	

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

Table 5-46 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]	UINT32	0 to 120,000
+4	RW	Recording Interval[1]	UINT32	60 to 3,456,000 s
+6	RW	Recording Offset[2]	UINT16	0 to 43,200 s
+7	RW	Number of Parameters[1]	UINT16	0 to 16
+8	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.
+9	RW	Parameter #2[1]	UINT16	
+10	RW	Parameter #3[1]	UINT16	
…	RW	…	UINT16	
+23	RW	Parameter #16[1]	UINT16	

Table 5-47 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. Thus **Recording Offset** < **Recording Interval**.
3) The following table illustrates different types of Data Recorder parameters.

Type	Scale	Format	Unit
Voltage	1	FLOAT	V
Current	1	FLOAT	A
Power	1	FLOAT	W/var/VA
PF	1	FLOAT	None
Frequency	1	FLOAT	Hz
Unbalance	1	FLOAT	100%
THD	1	FLOAT	100%
DI Counter	1	UINT32	None
kWh/kvarh/kVAh	10	INT32	0.01 kWh/kvarh/kVAh

Table 5-48 Different Types of Data Recorder Parameters

5.14 TOU Setup

5.14.1 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(Default) 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 5-49 TOU Basic Setup

Notes:

1) If DI1 is not programmed as a **Tariff Switch**, the TOU will 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 **Section 4.6.**
2) The following table illustrates the data structure for the TOU Switch Time. For example, 0x1003140C indicates a switch time of 12:00pm on March 20th, 2016. Writing 0xFFFFFFFF to this register disables the switching between TOU Schedule.

Byte 3	Byte 2	Byte 1	Byte 0
Year-2000 (00-99)	Month (1-12)	Day (1-31)	Hour (00-23)

Table 5-50 TOU Switch Time Format

5.14.2 Season

The PMC-53A-E 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. Moreover, all the registers in the same set of Season should be written in the identical frame.

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	
…	RW	…	UINT16	See Season #2: Start Date
…	RW	…	UINT16	0* to 19
…	RW	…	UINT16	
…	RW	…	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 5-51 Season Setup

Notes:

1) **Start Date** for Season #1 can be 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.

5.14.3 Daily Profile

The PMC-53A-E has two sets of Daily Profile setup parameters, one for each TOU.

Register	Property	Description	Format
7200~7223	RW	Daily Profile #1	See Table 5-54 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 5-52 TOU #1's Daily Profile Setup

Register	Property	Description	Format
8200~8223	RW	Daily Profile #1	See Table 5-54 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 5-53 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
			Low-order Byte: Min		Min = 0, 15, 30, 45
+3	RW	Period #2 Tariff		UINT16	0=T1, …, 7=T8
+4	RW	Period #3 Start Time		UINT16	See Period #2 Start Time
+5	RW	Period #3 Tariff		UINT16	0=T1, …, 7=T8
+6	RW	Period #4 Start Time		UINT16	See Period #2 Start Time
+7	RW	Period #4 Tariff		UINT16	0=T1, …, 7=T8
+8	RW	Period #5 Start Time		UINT16	See Period #2 Start Time
+9	RW	Period #5 Tariff		UINT16	0=T1, …, 7=T8
+10	RW	Period #6 Start Time		UINT16	See Period #2 Start Time
+11	RW	Period #6 Tariff		UINT16	0=T1, …, 7=T8
+12	RW	Period #7 Start Time		UINT16	See Period #2 Start Time
+13	RW	Period #7 Tariff		UINT16	0=T1, …, 7=T8
+14	RW	Period #8 Start Time		UINT16	See Period #2 Start 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 5-54 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 later Daily Profile' setup parameters will be ignored**,** and the previous Period's duration is from its **Start Time** to the end of the day.
3) The **Start Time** of a particular Period must be later than the previous Period's.

5.14.4 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-E 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	See Table 5-56
2	RW	Alternate Day #1 Daily Profile	UINT16	0* to 19
3	RW	Alternate Day #2 Date[1]	UINT32	See Table 5-56
5	RW	Alternate Day #2 Daily Profile	UINT16	0* to 19
6	RW	Alternate Day #3 Date[1]	UINT32	See Table 5-56
8	RW	Alternate Day #3 Daily Profile	UINT16	0* to 19
9	RW	Alternate Day #4 Date[1]	UINT32	See Table 5-56
11	RW	Alternate Day #4 Daily Profile	UINT16	0* to 19
12	RW	Alternate Day #5 Date[1]	UINT32	See Table 5-56
14	RW	Alternate Day #5 Daily Profile	UINT16	0* to 19
15	RW	Alternate Day #6 Date[1]	UINT32	See Table 5-56
17	RW	Alternate Day #6 Daily Profile	UINT16	0* to 19
18	RW	Alternate Day #7 Date[1]	UINT32	See Table 5-56
19	RW	Alternate Day #7 Daily Profile	UINT16	0* to 19
21	RW	Alternate Day #8 Date[1]	UINT32	See Table 5-56
22	RW	Alternate Day #8 Daily Profile	UINT16	0* to 19
24	RW	Alternate Day #9 Date[1]	UINT32	See Table 5-56
25	RW	Alternate Day #9 Daily Profile	UINT16	0* to 19
27	RW	Alternate Day #10 Date[1]	UINT32	See Table 5-56
29	RW	Alternate Day #10 Daily Profile	UINT16	0* to 19
…		…		See Table 5-56
…		…		0* to 19
240	RW	Alternate Day #81 Date[1]	UINT32	See Table 5-56
162	RW	Alternate Day #81 Daily Profile	UINT16	0* to 19
243	RW	Alternate Day #82 Date[1]	UINT32	See Table 5-56
245	RW	Alternate Day #82 Daily Profile	UINT16	0* to 19
246	RW	Alternate Day #83 Date[1]	UINT32	See Table 5-56
248	RW	Alternate Day #83 Daily Profile	UINT16	0* to 19
249	RW	Alternate Day #84 Date[1]	UINT32	See Table 5-56
251	RW	Alternate Day #84 Daily Profile	UINT16	0* to 19
252	RW	Alternate Day #85 Date[1]	UINT32	See Table 5-56
254	RW	Alternate Day #85 Daily Profile	UINT16	0* to 19
255	RW	Alternate Day #86 Date[1]	UINT32	See Table 5-56
256	RW	Alternate Day #86 Daily Profile	UINT16	0* to 19
258	RW	Alternate Day #87 Date[1]	UINT32	See Table 5-56
260	RW	Alternate Day #87 Daily Profile	UINT16	0* to 19
261	RW	Alternate Day #88 Date[1]	UINT32	See Table 5-56
263	RW	Alternate Day #88 Daily Profile	UINT16	0* to 19
264	RW	Alternate Day #89 Date[1]	UINT32	See Table 5-56
266	RW	Alternate Day #89 Daily Profile	UINT16	0* to 19

267	RW	Alternate Day #90 Date[1]	UINT32	See Table 5-56
269	RW	Alternate Day #90 Daily Profile	UINT16	0* to 19

Table 5-55 Alternate Days Setup

Note:

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

Byte 3	Byte 2	Byte 1	Byte 0
Reserved	Year-2000 (00-99)	Month (1-12)	Day (1-31)

Table 5-56 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.

5.15 Time

There are two sets of Time registers supported by the PMC-53A-E – Year / Month / Day / Hour / Minute / Second (Registers # 60000 to 60002) and UNIX Time (Register # 60004). When sending time to the PMC-53A-E 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 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.

Register		Property	Description	Format	Note
60000	9000	RW	High-order Byte: Year	Timestamp	10-90 (Year-2000)
			Low-order Byte: Month		1 to 12
60001	9001	RW	High-order Byte: Day		1 to 31
			Low-order Byte: Hour		0 to 23
60002	9002	RW	High-order Byte: Minute		0 to 59
			Low-order Byte: Second		0 to 59
60003	9003	RW	Millisecond		0 to 999
60004 ~ 60005	9004 ~ 9005	RW	UNIX Time	UINT32	0x4B3D3B00~0xE398E47F The corresponding time is 2010.01.01 00:00:00 to 2090.12.31 23:59:59 (GMT+00:00 Time Zone)

Table 5-57 Time Registers

Note:

1) The UNIX time in GMT+00:00 Time Zone should be used when writing the meter's time. The meter will compute internally and display in Local Time based on the setting of the Time Zone setup register (#6053).

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

Register	Property	Description	Format	Note
9100	WO	Arm DO1 Close	UINT16	Writing "0xFF00" to the register to perform the described action.
9101	WO	Execute DO1 Close	UINT16	
9102	WO	Arm DO1 Open	UINT16	
9103	WO	Execute DO1 Open	UINT16	
9104	WO	Arm DO2 Close	UINT16	
9105	WO	Execute DO2 Close	UINT16	
9106	WO	Arm DO2 Open	UINT16	

9107	WO	Execute DO2 Open	UINT16	

Table 5-58 DO Control

5.17 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 Daily Freeze Log		
9615	WO	Clear Monthly Freeze Log		
9616	WO	Reserved		
9617	WO	Send Testing Email		
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 Last 30D Energy Buffer^		

^ Available in Firmware V1.01.00 or later

Table 5-59 Clear Control

Notes:

1) Writing 0xFF00 to the **Clear Historical Monthly Energy Log** register means 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 3-Phase Total Energy registers and Phase A/B/C Energy registers, including TOU Energy and Interval Energy.

3) Writing 0xFF00 to the **Clear Present Monthly Energy Log** register means to clear the Monthly Energy Log of the Present Month.

4) Writing 0xFF00 to the **Clear Max. Demand of This Month** register to clear Max. Demand Log of This Month (Since Last Reset) when the **Self-Read Time** register is set for automatic Self-Read operation. The Max. Demand of Last Month will not be cleared. If the **Self-Read Time** register is set for manual operation with a register value of 0xFFFF, the Max. Demand of This Month (Since Last Reset) will be transferred to the Max. Demand of Last Month (Before Last Reset) and then cleared.

5) Writing 0xFF00 to the **Clear All Demand** register to clear all Demand registers and logs, including Real-time Present Demand, Max. Demand Log of This Month (Since Last Reset) and Last Month (Before Last Reset).

6) Writing 0xFF00 to the **Clear Max./Min. Log of This Month** register to clear the Max./Min. log of This Month (Since Last Reset) when the **Self-Read Time** register is set for automatic Self-Read operation. The Max./Min. log of Last Month will not be cleared. If the **Self-Read Time** register is set for manual operation with a register value of 0xFFFF, the Max./Min. log of This Month (Since Last Reset) will be transferred to the Max./Min. log of Last Month (Before Last Reset) and then cleared.

7) Writing 0xFF00 to the **Clear All Max./Min. Log** register to clear both the Max./Min. Log of This Month (Since Last Reset) and the Max./Min. Log of Last Month (Before Last Reset).

8) Writing 0xFF00 to the **Clear All Data** register to perform the Clear operation for the actions specified in registers # 9600 to # 9607, registers # 9609 to # 9615, registers # 9618 to 9624 and Interval Energy Measurements.

5.18 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	9827~9828	RO	Reserved	UINT16	
60229	9829	RO	Extension Module	UINT16	See Note 2)

Table 5-60 Meter Information

Notes:

1. The Meter Model appears from registers 60200 to 60219 and contains the ASCII encoding of the string "PMC-53A-E" 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	0x2D	-
60208	0x45	E
60209-60219	0x20	Null

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

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

Other Bits	B4 to B5 (I/O)	B2 to B3 (Current Input)	B1	B0 (Analog Inputs)
Reserved	0=4xDI + 2xDO	0=5A Class 0.5S / 5A Class 0.2S / 1A Class 0.5S	Reserved	0=None
	1=4xDI + 2xSS Pulse Output	1=1A Class 0.2S		1=AI+I4+Ir
		2=CT Input		

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 Average	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 Average	22	Sb	36	In (Calculated)
9	Ia	23	Sc	37	I4
10	Ib	24	S Total	38	AI Scaled
11	Ic	25	PFa	39	Ir (Residual Current)
12	I Average	26	PFb		
13	Pa	27	PFc		
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
U and I HD32 to HD63^					
333	Uan HD32	429	Ia HD32		
334	Uan HD32	430	Ib HD32		
335	Uan HD32	431	Ic HD32		
…	…	…	…		
426	Uan HD63	522	Ia HD63		
427	Uan HD63	523	Ib HD63		
428	Uan HD63	524	Ic HD63		

^ Available only for Firmware V2.00.00 or later.

Energy Measurements (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	Reserved	285	kWh Import of T2	305	kWh Import of T6
266		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)		
Per-Phase Energy Measurements* (Format: INT32)					
332	Phase A kWh Import	341	Phase B kWh Import	350	Phase C kWh Import
333	Phase A kWh Export	342	Phase B kWh Export	351	Phase C kWh Export
334	Phase A kWh Net	343	Phase B kWh Net	352	Phase C kWh Net
335	Phase A kWh Total	344	Phase B kWh Total	353	Phase C kWh Total
336	Phase A kvarh Import	345	Phase B kvarh Import	354	Phase C kvarh Import
337	Phase A kvarh Export	346	Phase B kvarh Export	355	Phase C kvarh Export
338	Phase A kvarh Net	347	Phase B kvarh Net	356	Phase C kvarh Net
339	Phase A kvarh Total	348	Phase B kvarh Total	357	Phase C kvarh Total
340	Phase A kVAh Total	349	Phase B kVAh Total	358	Phase C kVAh Total
Reactive Energy Monitoring*					
359	Daily kWh Import (INT32)	363	Daily kVAh (INT32)		
360	Daily kWh Export (INT32)	364	Daily %QImp/PImp (Float)		
361	Daily kvarh Import (INT32)	365	Daily %QExp/PImp (Float)		
362	Daily kvarh Export (INT32)				

*Available only for Firmware V1.01.00 or later

Appendix B Data Recorder Default Settings

Parameter	DR 1	DR 2	DR 3	DR 4	DR 5
Trigger Mode	Triggered by Timer	Triggered by Timer	Triggered by Timer	Triggered by Timer	Triggered by Timer
Recording Mode	FIFO	FIFO	FIFO	FIFO	FIFO
Recording Depth	5760	5760	5760	5760	0
Recording Interval	900s	900s	900s	900s	900s
Recording Offset	0	0	0	0	0
No. of Parameters	15	16	16	15	16
Parameter 1	kWh Import	Uab	Uan	Uan/Uab THD	U12
Parameter 2	kWh Export	Ubc	Ubn	Ubn/Ubc THD	U23
Parameter 3	kWh Total	Uca	Ucn	Ucn/Uca THD	U31
Parameter 4	kWh Net	Ullavg	Ullavg	Ia THD	I1
Parameter 5	kvarh Import	Ia	Pa	Ib THD	I2
Parameter 6	kvarh Export	Ib	Pb	Ic THD	I3
Parameter 7	kvarh Total	Ic	Pc	Ia TDD	In
Parameter 8	kvarh Net	I avg	Qa	Ib TDD	PF Total
Parameter 9	kVAh Total	In (Calculated)	Qb	Ic TDD	kWh Import (Total)
Parameter 10	P Total Demand	P Total	Qc	Ia K-Factor	S Demand (Total)
Parameter 11	Q Total Demand	Q Total	Sa	Ib K-Factor	U1/U12 THD
Parameter 12	S Total Demand	S Total	Sb	Ic K-Factor	U2/U23 THD
Parameter 13	Ia Demand	PF Total	Sc	Ia Crest Factor	U3/U31 THD
Parameter 14	Ib Demand	Freq	PFa	Ib Crest Factor	I1 THD
Parameter 15	Ic Demand	U Unbalance	PFb	Ic Crest Factor	I2 THD
Parameter 16	None	I Unbalance	PFc	None	I3 THD

* Default

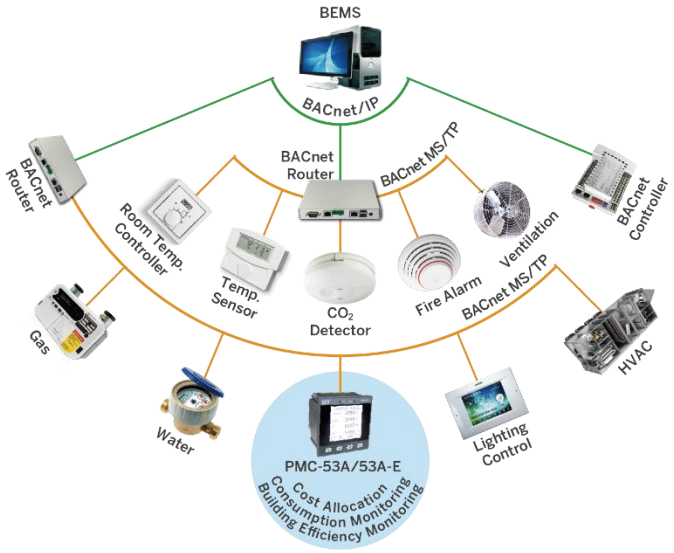
Appendix C BACnet MS/TP Implementation

1. Basic Information

The **PMC-53A-E** is a **BACnet Smart Actuator (B-SA)** compliant with **ANSI/ASHRAE-135**, designed for seamless integration into building automation systems via **BACnet MS/TP (Master-Slave/Token Passing)**. As a cost-effective, field-deployable device, it provides deterministic control and monitoring for HVAC, lighting, and other building applications. The following section details its BACnet MS/TP configuration, **PICS (Protocol Implementation Conformance Statement)**, supported objects/properties, and interoperability features, including the following **BIBBs**:

- **Data Sharing**: DS-RP-B, DS-RPM-B, DS-WP-B
- **Device/Network Management**: DM-DOB-B, DM-TS-B, DM-DDB-B, DM-RD-B

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 and 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.



2. Protocol Implementation Conformance Statement

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-E
Applications Software Version	V2.00.00
Firmware Revision	V1.00.00
Protocol Version	1
Protocol Revision	22
Description	Server
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, Baudrates: 9600/19200/38400
Device Address Binding	None

Networking Options	None
Character Sets Support	UTF-8

3. Objects and Properties

3.1 Supported Object Types and Properties

Object Type	Optional Property	Writable Property	Function
Device Object	• Location • Description • Local_Time • Local_Date • Max_Master • Max_Info_Frames	• Object_Name • Location • Description • Object_Identifier • System_Status • APDU_Timeout • Number_Of_APDU_Retries • Max_Master • Max_Info_Frames	• BACnet Device Characteristics
Analog Input Object	• Description • Reliability	• Present_Value • Out_Of_Service	Real-time measurements • Voltage and Current • Power and Power Factor • Sequence and Unbalance • DI Pulse Counters • Demand and Energy • Harmonic measurements
Analog Value Object	• Description • Priority_Array • Relinquish_Default	• Present_Value • Relinquish_Default	• Basic settings • Clear operations
Binary Input Object	• Description	• Present_Value • Out_Of_Service • Polarity	• Digital Input status
Binary Output Object	• Inactive_Text • Active_Text • Description	• Present_Value	• Digital Output status
Network Port Object	• Max_Master • Max_Info_Frames • MAC Address • Network_Number • Network_Number_Quality • APDU_Length	• BACnet_IP_Mode • FD_Subscription_Lifetime	• Network Port Configuration and Properties

Notes:

1. None of the objects are dynamically creatable using the CreateObject service.
2. None of the objects are dynamically deletable using the DeleteObject service.
3. The proprietary property is not supported on this device.

3.2 Device Object

Property	Description	O/R/W[1]	Stored	Range/Options, Default*
Object_Identifier	The unique device ID number for the meter in the format of [DEVICE: #].	W	Y	0 to 4194302, 26001*
Object_Name	Unique object name internetwork-wide	W	Y	Up to 32 characters, Simple Server*
Object_Type	Object type	R	--	Device (8)
System_Status	The physical and logical status of the BACnet device	R	--	Operational (0)
Vendor_Name	Manufacturer of the BACnet device	R	--	CET
Vendor_Identifier	BACnet vendor identifier for CET Electric Inc.	R	--	593
Model_Name	Device model number	R	--	PMC-53A-E
Firmware _Revision	BACnet firmware version, stored in an x.x.x format	R	--	For example, V1.00.00
Application_Software_Version	Meter firmware version, stored in an x.x.x format	R	--	For example, V2.00.00
Location	The physical location of the BACnet device	O	Y	Up to 64 characters, LOCAL*

Description	Optional description of the meter	O	Y	Up to 64 characters, Intelligent Multifunction Meter*
Protocol_Version	BACnet protocol version	R	--	For example, version 1
Protocol_Revision	BACnet standard minor revision level	R	--	For example, 22
Protocol_Services_Supported	BACnet services supported by the meter	R	--	See note 3
Protocol_Object_Types_Supported	BACnet object types supported by the meter	R	--	See note 4
Object_List	BACnetARRAY of BACnetObjectIdentifier	R	--	See to 3.7
Max_Apdu_Length_Accepted	Maximum APDU packet size that the meter can accept	R	--	480*
Segmentation_Supported	The meter does not support segmentation	R	--	NO_SEGMENTATION (3)
Apdu_Timeout	The amount of time in ms before the meter tries to resend a confirmed message that has not been answered	W	Y	0 to 65535 (ms), 3000*
Number_Of_Apdu_Retries	Maximum number of times that an unanswered APDU shall be retransmitted	W	Y	0 to 255, 3*
Max_Master	The highest allowable address for master nodes.	W	--	1 to 127, 127*
Max_Info_Frame	The maximum number of information frames the node may send before it must pass the token.	W	--	1 to 255, 1*
Device_Address_Binding	A BACnetLIST of BACnetAddressBinding	R	--	{} (the device address binding list is always blank)
Database_Revision	A logical revision number for the device's database	R	--	For example, 0
Local_Time	The current time on the meter in HH:MM:SS format	O	--	Configuration by timing
Local_Date	The current date on the meter in YYYY/MM/DD format	O	--	

Notes:

1. O/R/W = Optional, required Readable or required Writable properties. See **Clause 12.1.2 Object Type and Property Conformance** in ANSI / ASHRAE-135-2020.
2. Stored: Y = the value of the property stored in the meter's nonvolatile memory.
3. Supported BACnet services by the meter are:

   --Object Access Services

   - ReadProperty
   - ReadPropertyMultiple
   - WriteProperty

   --Remote Device Management Services

   - ReinitializeDevice
   - TimeSynchronization
   - I-AM
   - I-Have
   - Who-Has
   - Who-Is
4. Supported BACnet objects by the meter are:
   - Device object
   - Analog Input object
   - Analog Value object
   - Binary Input object
   - Binary Output object
   - Network Port object

3.3 Analog Input Objects (PMC-53A-E'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-E. 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	Ua	R	V	
AI 0002	Ub	R	V	
AI 0004	Uc	R	V	
AI 0006	ULN Average	R	V	
AI 0008	Uab	R	V	
AI 0010	Ubc	R	V	
AI 0012	Uca	R	V	
AI 0014	ULL Average	R	V	
AI 0016	Ia	R	A	
AI 0018	Ib	R	A	
AI 0020	Ic	R	A	
AI 0022	I Average	R	A	
AI 0024	Pa	R	kW	
AI 0026	Pb	R	kW	
AI 0028	Pc	R	kW	
AI 0030	P Total	R	kW	
AI 0032	Qa	R	kvar	
AI 0034	Qb	R	kvar	
AI 0036	Qc	R	kvar	
AI 0038	Q Total	R	kvar	
AI 0040	Sa	R	kvar	
AI 0042	Sb	R	kVA	
AI 0044	Sc	R	kVA	
AI 0046	S Total	R	kVA	
AI 0048	PFa	R		0 to 1
AI 0050	PFb	R		0 to 1
AI 0052	PFc	R		0 to 1
AI 0054	PF Total	R		0 to 1
AI 0056	Freq.	R	Hz	
AI 0070	In (Calculated)	R	A	
AI 0072	I4 (Optional Measurement)	R	A	
AI 0082	AI (Optional Measurement)	R		
AI 0084	Ir (Optional Measurement)	R	A	
AI 0500	kWh Import	R	kWh	0 to 99999999.9
AI 0502	kWh Export	R	kWh	0 to 99999999.9
AI 0504	kWh Net	R	kWh	0 to 99999999.9
AI 0506	kWh Total	R	kWh	0 to 99999999.9
AI 0508	kvarh Import	R	kvarh	0 to 99999999.9
AI 0510	kvarh Export	R	kvarh	0 to 99999999.9
AI 0512	kvarh Net	R	kvarh	0 to 99999999.9
AI 0514	kvarh Total	R	kvarh	0 to 99999999.9
AI 0516	kVAh	R	kVAh	
AI3006	P Demand	R	kW	
AI 3008	Q Demand	R	kvar	
AI 3010	S Demand	R	kVA	
AI 3000	Ia Demand	R	A	
AI 3002	Ib Demand	R	A	
AI 3004	Ic Demand	R	A	
AI 3418	P Max. Demand	R	kW	

AI 3424	Q Max. Demand	R	kvar	
AI 3430	S Max. Demand	R	kVA	
AI 3400	Ia Max. Demand	R	A	
AI 3406	Ib Max. Demand	R	A	
AI 3412	Ic Max. Demand	R	A	
AI 1600	Ua THD	R	%	
AI 1602	UbTHD	R	%	
AI 1604	Uc THD	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	R		0 to 1
AI 0076	dPFb	R		0 to 1
AI 0078	dPFc	R		0 to 1
AI 0058	Ua Angle	R	°	
AI 0060	Ub Angle	R	°	
AI 0062	Uc Angle	R	°	
AI 0064	Ia Angle	R	°	
AI 0066	Ib Angle	R	°	
AI 0068	Ic Angle	R	°	
AI 0104	Run Hours	R	h	
AI 0526	Interval kWh Import	R	kWh	0 to 99999999.9
AI 0528	Interval kWh Export	R	kWh	0 to 99999999.9
AI 0530	Interval kvarh Import	R	kvarh	0 to 99999999.9
AI 0532	Interval kvarh Export	R	kvarh	0 to 99999999.9
AI 0534	Interval kVAh	R	kVAh	0 to 99999999.9
AI 1200	DI #1 Counter	R		
AI 1202	DI #2 Counter	R		
AI 1204	DI #3 Counter	R		
AI 1206	DI #4 Counter	R		

Notes:

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

3.4 Analog Value Objects (PMC-53A-E's Basic Setup Registers)

Optional Properties Supported: Description, Relinquish_Default, Priority_Array

Writable Properties: Present_Value, 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.

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	0 to 999 V	100*
AV 6002	PT Secondary#	R/W	1 to 690 V	100*
AV 6004	CT Primary	R/W	1 to 30000 A	5*
AV 6006	CT Secondary	R/W	1 to 5/100 A	5*

AV 6012	I4 Primary	R/W	1 to 30000 A	5*
AV 6014	I4 Secondary	R/W	1 to 5 A	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 6: 3x1P	3P4W*
AV 6021	PF Convention	R/W	0 = IEC 1 = IEEE 2 = -IEEE	0*
AV 6022	kVA Calculation	R/W	0 = Vector 1 = Scalar	0*
AV 6028	THD Calculation	R/W	0: THDf 1: THDr	0*
AV 6029	Demand Period	R/W	1~60 mins	15*
AV 6030	Number of Sliding Windows	R/W	1 to 15	1*
AV 6047	Interval Energy Period	R/W	5~60	60*
AV 9603	Clear Present Peak Demand	W	65280 (Default=0)	Writing ”0xFF00” to the register resets the present Peak Demand to “0”
AV 9601	Clear Energy	W	65280 (Default = 0)	Writing “0xFF00” to the register clears the kWh, kvarh and kVAh registers
AV 9610	Clear DI #1 Counter	W	65280 (Default = 0)	Writing “0xFF00” to the register clears the DI #X Counter
AV 9611	Clear DI #2 Counter	W		
AV 9612	Clear DI #3 Counter	W		
AV 9613	Clear DI #4 Counter	W		

3.5 Binary Input Objects (PMC-53A-E’s Digital Inputs)

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

Register	Description	Property	Note
BI0	DI 1	R	0 = Inactive, 1 = Active
BI1	DI 2	R	0 = Inactive, 1 = Active
BI2	DI 3	R	0 = Inactive, 1 = Active
BI3	DI 4	R	0 = Inactive, 1 = Active

3.6 Binary Output Objects (PMC-53A-E’s Digital Outputs)

Optional Properties Supported: Inactive_Text, Active_Text, Description
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-E supports Inactive_Text, Active_Text optional properties and all required Binary_Output object properties. Present_Value, Out_Of_Service and Polarity properties can be written, but these are non-volatile after modification. The Present_Value can only be written when the Out_Of_Service is true to change the state of the Digital Output and will be written as W when the Out_Of_Service is false.

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

3.7 Network Port Objects

Optional Properties Supported: MAC_Address, Max_Master, Max_Info_Frames

Writable Properties: Max_Master, Max_Info_Frames

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	=9600/19200/38400 (bps)
R/W	Max_Master	1~127 (Default = 127)
R/W	Max_Info_Frames	1~255 (Default = 1)

3.8 Additional Front Panel Setup Parameters for BACnet MSTP

The following BACnet MSTP setup parameters should be configured via the PMC-53A-E's Front Panel before connecting the PMC-53A-E to a BACnet MSTP 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 MSTP 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 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-E**					
Highest DNP Level Supported: For Requests: **Level 1** For Responses: **Level 1**			Device Function: ☐ Master ■ **Slave**		
Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP levels Supported (the complete list is described in the attached table):					
Maximum Data Link Frame Size (octets): Transmitted: **292** Received: **292**			Maximum Application Fragment Size (octets): Transmitted: **1024** Received: **300**		
Maximum Data Link Re-tries: ■ **None** ☐ Fixed ☐ Configurable			Maximum Application Layer Re-tries: ■ **None** ☐ Configurable		
Requires Data Link Layer Confirmation: ■ **Never** ☐ Always ☐ Sometimes ☐ Configurable					
Requires Application Layer Confirmation: ■ **Never** ☐ Always ☐ When reporting Event Data (Slave devices only) ☐ When sending multi-fragment responses (Slave devices only) ☐ Sometimes ☐ Configurable					
Timeouts while waiting for:					
Data Link Confirm:	■ **None**	☐ Fixed at ___	☐ Variable	☐ Configurable	
Complete Appl. Fragment:	■ **None**	☐ Fixed at ___	☐ Variable	☐ Configurable	
Application Confirm:	■ **None**	☐ Fixed at ___	☐ Variable	☐ Configurable	
Complete Appl. Response:	■ **None**	☐ Fixed at ___	☐ Variable	☐ Configurable	
Others: Transmission Delay, configurable Select/Operate Arm Timeout, fixed at 15 seconds					
Sends/Executes Control Operations:					
WRITE Binary Outputs	■ **Never**	☐ Always	☐ Sometimes	☐ Configurable	
SELECT/OPERATE	☐ Never	■ **Always**	☐ Sometimes	☐ Configurable	
DIRECT OPERATE	☐ Never	■ **Always**	☐ Sometimes	☐ Configurable	
DIRECT OPERATE - NO ACK	■ **Never**	☐ Always	☐ Sometimes	☐ Configurable	
Count > 1	■ **Never**	☐ Always	☐ Sometimes	☐ Configurable	
Pulse On:	■ **Never**	☐ Always	☐ Sometimes	☐ Configurable	
Pulse Off:	■ **Never**	☐ Always	☐ Sometimes	☐ Configurable	
Latch On	☐ Never	■ **Always**	☐ Sometimes	☐ Configurable	
Latch Off	☐ Never	■ **Always**	☐ Sometimes	☐ Configurable	
Queue:	■ **Never**	☐ Always	☐ Sometimes	☐ Configurable	
Clear Queue:	■ **Never**	☐ Always	☐ Sometimes	☐ Configurable	
Attach explanation if "Sometimes" or "Configurable" was checked for any operation.					

DNP V3.0	
Reports Binary Input Change Events when no specific variation requested: ■ **Never** ☐ Only time-tagged ☐ Only non-time-tagged ☐ Configurable to send time-tagged or non-time-tagged	Reports time-tagged Binary Input Change Events when no specific variation requested: ■ **Never** ☐ Binary Input Change with Time ☐ Binary Input Change with Relative Time ☐ Configurable to send Binary Input Change With Time and Binary Input Change With Relative Time
Sends Unsolicited Responses: ■ **Never** ☐ Configurable - enable/disable ☐ Only certain objects ☐ Sometimes (attach explanation) ☐ ENABLE/DISABLE UNSOLICITED Function codes supported	Sends Static Data in Unsolicited Responses: ■ **Never** ☐ When Device Restarts ☐ When Status Flags Change No other options are permitted.
Default Counter Object/Variation: ☐ No Counters Reported ☐ Configurable ☐ Default Object Default Variation: ■ **Point-by-point list attached**	Counters Roll Over at: ☐ No Counters Reported ☐ Configurable ☐ 16 Bits ☐ 32 Bits ☐ Other Value: _____ ■ **Point-by-point list attached**
Sends Multi-Fragment Responses ☐ Yes ■ **No** ☐ Configurable	
Sequential File Transfer Support: Append File Mode ☐ Yes ■ **No** Custom Status Code Strings ☐ Yes ■ **No** Permissions Field ☐ Yes ■ **No** File Events Assigned to Class ☐ Yes ■ **No** File Events Send Immediately ☐ Yes ■ **No** Multiple Blocks in a Fragment ☐ Yes ■ **No** Max. Number of Files Open: **0**	

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-E	Code (hex)	Description	PMC-53A-E
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-E can be assigned to a device address between 0 and 65519. After device restarts, 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 PMC-53A-E is designed to support the DNP 3.0 protocol on one RS-485 port only at any one time.

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

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".

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

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

Point	Description	Format	Range
0	Reserved	UINT8	
1	Clear All Energy Registers	UINT8	Always 0
2	Reserved	UINT8	
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	Reserved	UINT8	
14	Reserved	UINT8	
15	Clear All Pulse Counters	UINT8	Always 0
16	DO1	UINT8	Bit Flags
17	DO2	UINT8	Bit Flags
18	Reserved	UINT8	
19	Reserved	UINT8	
20-29	Reserved		
30-43	Wiring Diagnostics Status[1]	UINT8	Bit Flags

Notes:

1) The following table shows the details of Point 30-43.

No.	Event
30	Frequency is out of range (45 to 65Hz) (3P4W or 3P3W)
31	Any phase voltage < 10% of PT Primary (Register 6000) (3P4W only)
32	Any phase current < 10% of CT Primary (Register 6004) (3P4W or 3P3W)
33	Reserved
34	Reserved
...	Voltage Phase Reversal (3P4W only)
	Current Phase Reversal (3P4W or 3P3W)
	Negative P Total may be abnormal (3P4W or 3P3W)
	Negative Pa 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)
44	Disconnection of Residual Current Input

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	Reserved	UINT8	
1	Clear All Energy Registers	UINT8	N/A
2	Reserved	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	Reserved	UINT8	
14	Reserved	UINT8	
15	Clear All Pulse Counters	UINT8	N/A
16	DO1	UINT8	Bit Flags
17	DO2	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	UINT32	1	1	0-999,999,999
19	DI2 Pulse Counter	UINT32	1		
20	DI3 Pulse Counter	UINT32	1		
21	DI4 Pulse Counter	UINT32	1		

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	Energy Scale	UINT16	10
1	I0-I4, Ir, PF, Scale	UINT16	1000
2	Scale for U, Freq, Phase Angle, THD, TDD, K Factor, Crest Factor & Unbalance	UINT16	100
3	Scale for AI and Power	UINT16	1
4	Firmware Version[1]	UINT16	0-65535

Notes:

1) The read-out value 10000 represents the Version is V1.00.00.

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[1]	INT32	x1000	-
26	PFb[1]	INT32		
27	PFc[1]	INT32		
28	PF Total	INT32		
29	Freq.	INT32	x100	Hz
30	Uan/Uab (3P3W) Angle	INT32	x100	°
31	Ubn/Ubc (3P3W) Angle	INT32		
32	Ucn/Uca (3P3W) Angle	INT32		
33	Ia Angle	INT32		
34	Ib Angle	INT32		
35	Ic Angle	INT32		
36	In (Calculated)	INT32	x1000	A
37	I4	INT32		
38	Ir	INT32		
39	Displacement PFa	INT32	x1000	-
40	Displacement PFb[1]	INT32		
41	Displacement PFc[1]	INT32		
42	Displacement PF Total	INT32		
43	AI Scaled	INT32	x1	-
44	Reserved	INT32	x100	˚C
45	Reserved	INT32		
46	Reserved	INT32	x1	-
47	Device Operating Time	INT32	x10	h
48	Pa Fundamental	INT32	x1	W
49	Pb Fundamental[1]	INT32		
50	Pc Fundamental[1]	INT32		
51	P Total Fundamental	INT32		
52	Total Harmonic P	INT32		
53	Uan/Uab Fundamental	INT32	x100	V
54	Ubn/Ubc Fundamental	INT32		
55	Ucn/Uca Fundamental	INT32		
56	Ia Fundamental	INT32	x1000	A
57	Ib Fundamental[1]	INT32		
58	Ic Fundamental[1]	INT32		
59	U1 (+ve Sequence Voltage)[2]	INT32	x100	V
60	U2 (-ve Sequence Voltage)[2]	INT32		
61	U0 (Zero Sequence Voltage)[2]	INT32		

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

Notes:

1) When the Wiring Mode is 1P2W L-N or 1P2W L-L, the L2 and L3 phase voltages and currents have no meaning, and their registers are reserved.

2) When the Wiring Mode is 1P2W L-N, 1P2W L-L or 1P3W, the Sequence Components U1/I1, U2/I2 and U0/I0 have no meaning and their registers are reserved.

Object 40 - Analog Output Status Objects

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

Point	Property	Description	Format	Range
0	RO	Class 0 Objects Set	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 Objects Set	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 E Technical Specifications

Voltage Inputs (V1, V2, V3, VN)	
Standard Un	400VLN/690VLL*
Range	10V to 2Un
Overload	2xUn continuous, 5xUn for 1s
Burden	<0.02VA per phase
Measurement Category	CAT III 600V
Frequency	45-65Hz
Current Inputs (·I11, I12, ·I21, I22, ·I31, I32, ·I41, I42)	
Standard	5A (Optional 1A)
Range	0.1% to 200% In
Starting Current	0.1% In
Overload	2xIn continuous, 20xIn for 1s
Burden	<0.15VA per phase @ 5A
SCCT Options	100A/200A/400A/800A/1600A to 40mA Output
Rogowski Coil Options	400A/1200A/2500A/5000A to 40mA Output
Power Supply (L/+, N/-)	
Standard	60-250VAC, ±10%, 47-440Hz 24-250VDC, ±10%
Burden	<4W
Overvoltage Category	OVC III up to 300VLN
Digital Inputs (DI1, DI2, DI3, DI4, DIC)	
Type	Dry contact, 24VDC internally wetted
Sampling	1000Hz
Hysteresis	1ms minimum
Digital Outputs (DO11, DO12, DO21, DO22)	
Type	Form A Mechanical Relay
Loading	5A @ 250VAC or 30VDC
Load Type	Resistive
Optional SS Pulse Outputs (E1+, E1-, E2+, E2-)	
Type	Form A Solid State Relay
Isolation	Optical
Load Type	Resistive
Output	Optocoupler output as ON-OFF
Max. Load Voltage	50VDC
Max. Forward Current	50mA
Optional Residual Current Input (·IR, IR)	
In	0.5mA
Range	2% to 200% In
CT Type	Solid-Core or Split-Core Residual Current Sensor
Optional Analog Input (AI+, AI-)	
Type	0-20 / 4-20 mA DC
Overload	24 mA DC maximum
Installation Torque	
Current Inputs	7.1 kgf.cm / M3.5 / 6.28 lb-in / 0.7 N.m
Power Supply, Voltage Inputs, RS-485 and I/O	4 kgf.cm / M3 / 3.54 lb-in / 0.4N.m
Environmental Conditions	
Operating Temp.	-25°C to 70°C
Storage Temp.	-40°C to 85°C
Humidity	5% to 95% non-condensing
Atmospheric Pressure	70 kPa to 106 kPa
Altitude	< 2000m
Pollution Degree	2
Location / Mounting	For indoor use only
Mechanical Characteristics	
Panel Cutout	92x92 mm (3.62”x3.62”)
Unit Dimensions	96x96x83.6 mm
IP Rating	IP65 (Front Panel), IP30 (Body)

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

~Rogowski Coil Inputs are supported in Firmware V2.00.00 or later. Please refer to **Accessories** table below for more information.

Accessories

Residual Current CT	
Solid-Core	160A (CT517203, Ø=46mm) 400A (CT517403, Ø=80mm) 630A (CT519703, 220x50mm) 1000A (CT517603, Ø=120mm)
Split-Core	160A (CT553203, Ø=48mm) 225A (CT553303, Ø=68mm)
Primary Input	1A (Residual Current)
Secondary Output	0.5mA
Range	2-200%
Overload	2A (Residual Current)
Accuracy	Class 0.5 (Solid-Core), Class 3 (Split-Core)
Frequency	50 / 60Hz
Dielectric Strength	3kV rms @ 1 minute
Operating Temp.	-25°C to +70°C (Solid-Core) -12°C to +45°C (Split-Core)
Storage Temp.	-40°C to +85°C (Solid-Core) -25°C to +70°C (Split-Core)
Split-Core CT	
Models	100A (PMC-SCCT-100A-40mA-16-A, Ø =16mm) 200A (PMC-SCCT-200A-40mA-24-A, Ø =24mm) 400A (PMC-SCCT-400A-40mA-35-A, Ø =35mm) 800A (PMC-SCCT-800A-40mA-A, 80x50mm) 1600A (PMC-SCCT-1600A-40mA-A, 130x55mm)
Primary Input	100A/200A/400A/800A/1600A
Secondary Output	40mA
Range	0.15%-120%In
Accuracy	Class 0.5
Frequency	50 / 60Hz
Operating Temp.	-20°C to +50°C
Rogowski Coils	
Models	
3-Phase Rogowski Coil	400A (PMC-RC-400A-3P-100-PY-W-F, Ø =100mm) 1200A (PMC-RC-1200A-3P-150-PY-W-F, Ø =150mm) 2500A (PMC-RC-1200A-3P-200-PY-W-F, Ø =200mm) 5000A (PMC-RC-5000A-3P-350-PY-W-F, Ø =350mm)
1-Phase Rogowski Coil	400A (PMC-RC-400A-1P-100-PY-W-N, Ø =100mm) 1200A (PMC-RC-1200A-1P-150-PY-W-N, Ø =150mm) 2500A (PMC-RC-1200A-1P-200-PY-W-N, Ø =200mm) 5000A (PMC-RC-5000A-1P-350-PF-W-N, Ø =350mm)
Primary Input	400A/1200A/2500A/5000A
Secondary Output	40mA
Range	5%-110%In
Accuracy	±0.5% (5%-110%In @25 °C)
Operating Temp.	-25°C to +70°C

Accuracy

Parameters	Accuracy			Resolution
	5A/1A Input		SCCT/Rogowski Coil Input	
	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 Input	±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		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
Ir Input	±0.5%			0.001A
THD	IEC 61000-4-7 Class II			0.001%
K-Factor	IEC 61000-4-7 Class II			0.001
Phase Angle	±1°			0.1°

Appendix F Standards Compliance

Safety Requirements	
CE LVD 2014 / 35 / EU cULus Listed	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
Electrical Safety in Low Voltage Distribution Systems up to 1000Vac 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 Waves	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
BACnet Conformance Certificate	
BTL Listing	Certificate No.: BTL-31239

Appendix G Ordering Guide

Version 20250620

Product Code	Description
PMC-53A-E Ethernet Multifunction Meter	
Basic Function	
E	Dot-Matrix LCD, Monthly & Daily Freeze Log, Data Recorder, 16MB Memory, 1x10Base-T/100Base-TX Ethernet Port and 1xRS-485 (Modbus RTU, BACnet MSTP and DNP 3.0)
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	60-250VAC ± 10%, 47-440Hz 24-250VDC ± 10%
Frequency	
5	45Hz-65Hz
I/O	
A	4xDI + 2xDO (Mechanical Relay)
B	4xDI + 2xSS Pulse Output
Analog Inputs	
X	None
A*^	I4 + AI (0/4-20mA) + Ir (0-0.5mA)
Language	
E	English
Accuracy#	
2*	Class 0,2S for Active Energy
" "	Class 0,5S for Active Energy

PMC-53A	-	E	-	5	9	2	5	A	X	E	2	**PMC-53A-E-5925AXE2 (Class 0,2S Standard Model)**
PMC-53A	-	E	-	5	9	2	5	A	X	E		**PMC-53A-E-5925AXE (Class 0,5S Standard Model)**

* Additional charges apply

^ I4 specifications of Analog Input Option A are consistent with those of the selected Input Current Option.

The Accuracy Option represents for the accuracy of main unit. The Accuracy Option "2" is only available to Input Current Option "5" (for 5A Input) and "1". For Input Current option "4", the accuracy of main unit is Class 0,5S, excluding the accuracy of the externally connected SCCTs and Rogowski Coils.

Contact us

CET Electric Technology Inc.
Email: support@cet-global.com
Web: www.cet-global.com