PMC-53A-E

Intelligent Multifunction Meter

User Manual

Version: V1.0A

March 8, 2019

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
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	=	Line-to-Line Voltage
Uln	=	Line-to-Neutral 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 96x96x88mm, 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 0.5S and ANSI C12.20 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 100BaseT Ethernet port and a RS485 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 meter can be setup through its Front Panel, Web Interface or our free PMC Setup software. The meter is also supported by our PecStar® iEMS Integrated Energy Management System. Following is a list of typical applications for the PMC-53A-E:

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

Contact CET Technical Support @ 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 PMC Setup software
- Easy installation with mounting clips, no tools required

Basic Measurements

- ULN, ULL per phase and Average
- Current per phase and Average with calculated Neutral
- kW, kvar, kVA, PF per phase and Total
- 3-Phase Total and Per-phase 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
- U and I THD, TOHD, TEHD and Individual Harmonics up to 31st
- Current TDD, TDD Odd, TDD Even, K-Factor and Crest Factor
- U and I Unbalance and Phase Angles
- Displacement PF
- Fundamental U, I and kW per phase
- Total Fundamental kW and Total Harmonic kW
- U and I Symmetrical Components

- 12 Monthly Energy Logs of kWh/kvarh Import/Export/Total/Net, kVAh, kvarh Q1-Q4
- Interval Energy for kWh/kvarh Imp/Exp and kVAh
- Demands, Predicted Demands and Peak Demands for kW/kvar/kVA Total and per phase Current with Timestamp for This Month (or Since Last Reset) and Last Month (or Before Last Reset)
- Two TOU schedules, each providing
  - 12 Seasons
  - 20 Daily Profiles, each with 12 Periods in 15-minute interval
  - 90 Holidays or Alternate Days
  - 8 Tariffs, each providing the following information
    - 3-Phase Total and Per-phase kWh/kvarh Import/Export, kVAh
    - kW/kvar/kVA Max. Demands

Setpoints

- 9 user programmable Setpoints with extensive list of monitoring parameters including Voltage, Current, Power, 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 triggers

Max/Min Log

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

Freeze Logs

- 60 Daily Freeze Logs for kWh/kvarh/kVAh Total and kW/kvar/kVA Peak Demands
- 36 Monthly Freeze Logs for kWh/kvarh/kVAh Total and kW/kvar/kVA Peak Demands with 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 at 15-minute interval for 1 Data Recorder with 6 parameters

Diagnostics

- Frequency Out-of-Range, Loss of Voltage / Current
- kW 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, volts free dry contact, 24VDC internally wetted
  - 1000Hz sampling for status monitoring with programmable debounce
  - Pulse counting with programmable weight for each channel for collecting WAGES (Water, Air, Gas, Electricity, Steam) information
  - Tariff switching based on DI status
- Digital Outputs (Optional)
  - 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 input with programmable zero and full scales

Communications

- One 100BaseT Ethernet Port with RJ45 connector, supporting Modbus TCP, HTTP, SMTP, SNTP and TFTP
- One optically isolated RS485 port at max. 38,400 bps, supporting selectable protocol for Modbus RTU, BACnet MS/TP, DNP 3.0 and Ethernet Gateway

Real-time Clock

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

System Integration

- Supported by CET's PecStar® iEMS and iEEM
- 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-ULn, 1P2W-ULl or 1P3W connected power system. Modbus communications allow real-time data, DI status and other information to be transmitted across a RS485 network to an Integrated Energy Management system such as PecStar®.

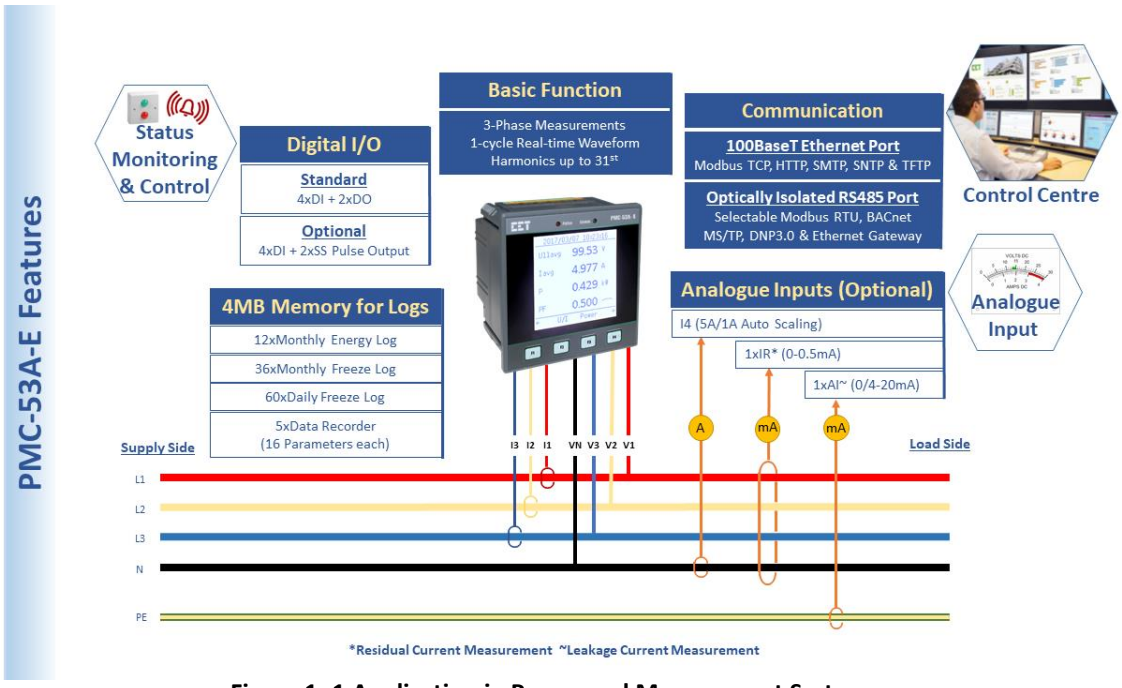


Figure 1- 1 Application in Power and Management Systems

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

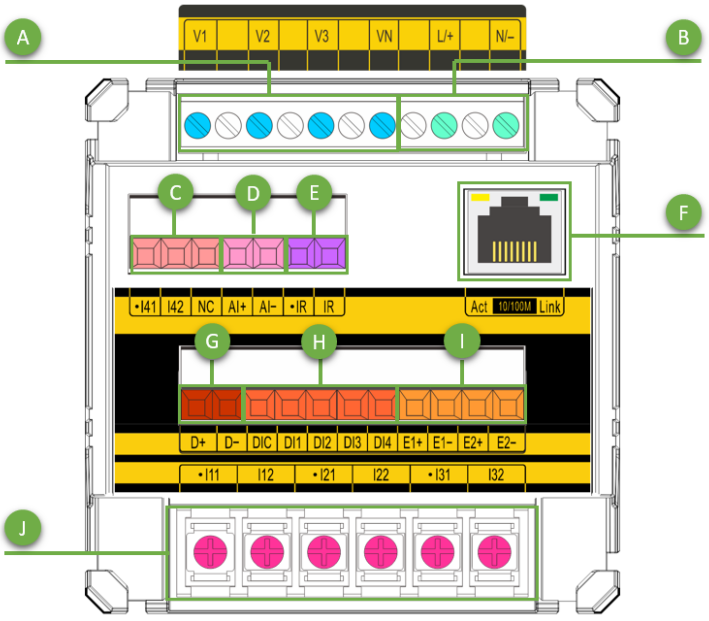
Installation of the PMC-53A-E should only be performed by qualified, competent personnel that have the appropriate training and experience with high voltage and current devices. The meter must be installed in accordance with all local and national electrical codes.

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

1 LED Pulse Output
2 Enclosure
3 Front Panel
4 Communication Indicator
5 Unit
6 Measurement
7 Buttons

Figure 2-1 Front Panel



A 3xVoltage Input
B Power Supply
C 1xI4 Input (Optional)
D 1xAnalog Input (Optional)
E 1xResidual Current (Optional)
F 1x10/100BaseT Ethernet Port
G 1xRS-485 Port
H 4xDigital Input
I 2xSS Pulse Output (Optional)
J 3xCurrent Input

Figure 2-2 Rear Panel

2.2 Unit Dimensions

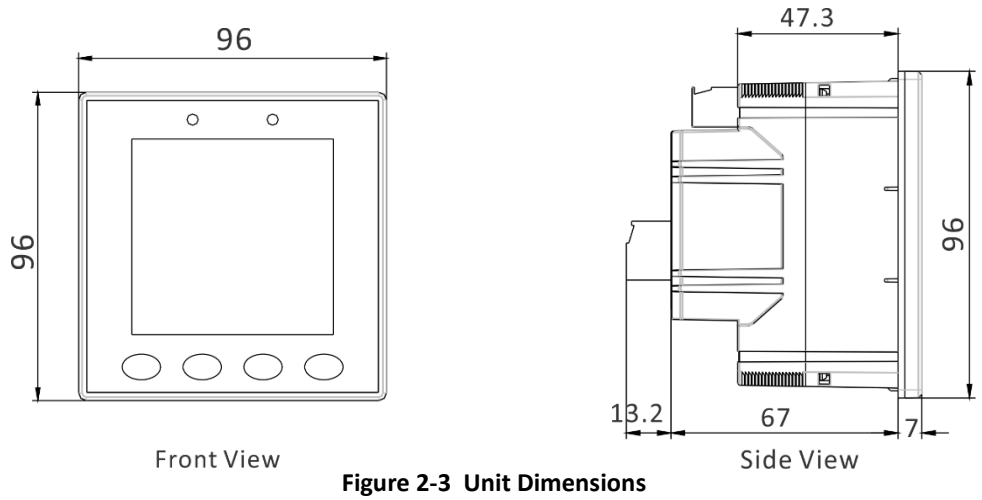


Figure 2-3 Unit Dimensions

2.3 Terminal Dimensions

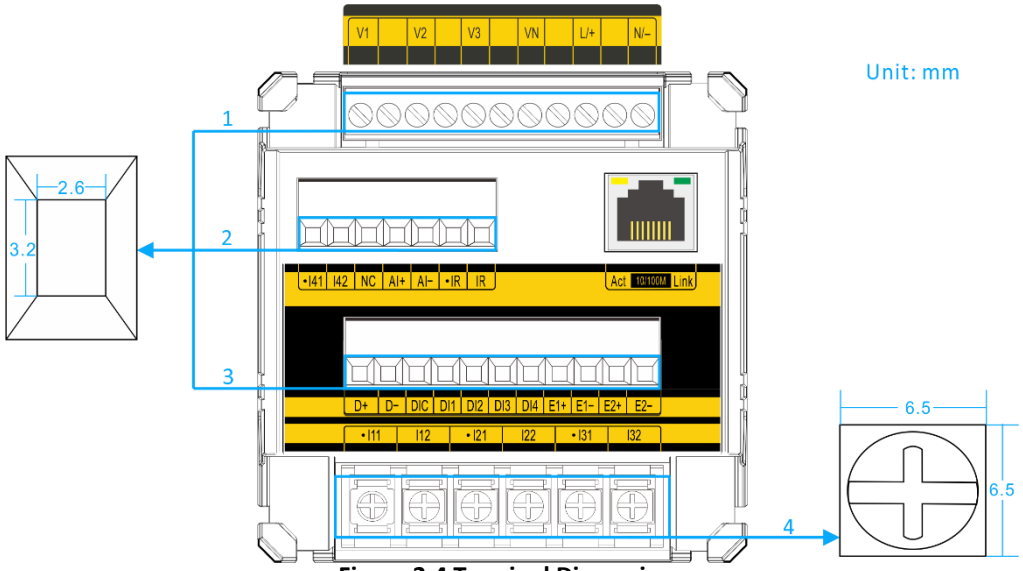


Figure 2-4 Terminal Dimensions

	Terminal	Terminal Dimensions	Wire Size	Max. Torque
1	Voltage Input Power Supply	2.6mm x 3.2mm	1.5mm^2	5 kgf.cm/M3 (4.3 lb-in)
2	I4 Input, AI, Ir Input			
3	RS485, DI, DO			
4	Current Input	6.5mm x 6.5mm	1.0mm^2 - 2.5mm^2 (14AWG - 22AWG)	6.0 kgf.cm/M3 (5.2 lb-in)

2.4 Residual Current CT Dimensions

2.4.1 Solid Core CTs

- **CT517203 (160A, Ø=46mm)**

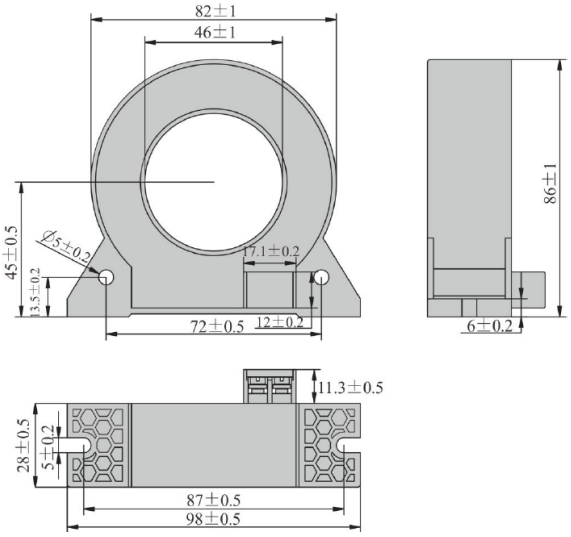


Figure 2-5 CT517203 Dimensions

- **CT517403 (400A, Ø=80mm)**

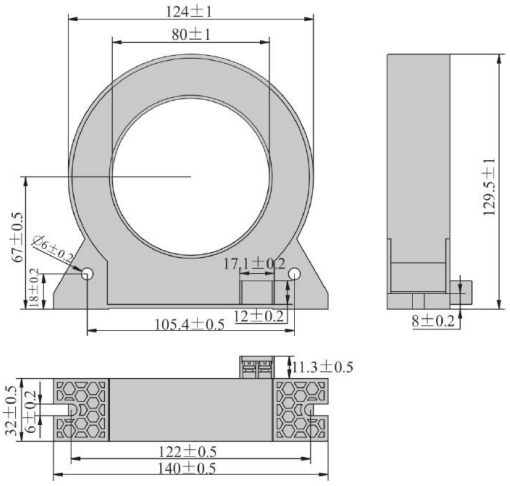


Figure 2-6 CT517403 Dimensions

- **CT517603 (1000A, Ø=120mm)**

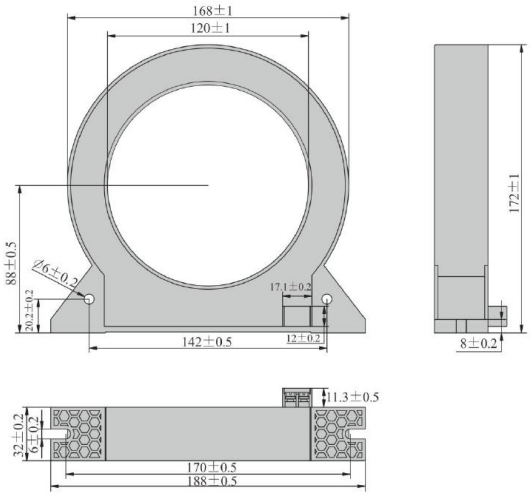


Figure 2-7 CT517603 Dimensions

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

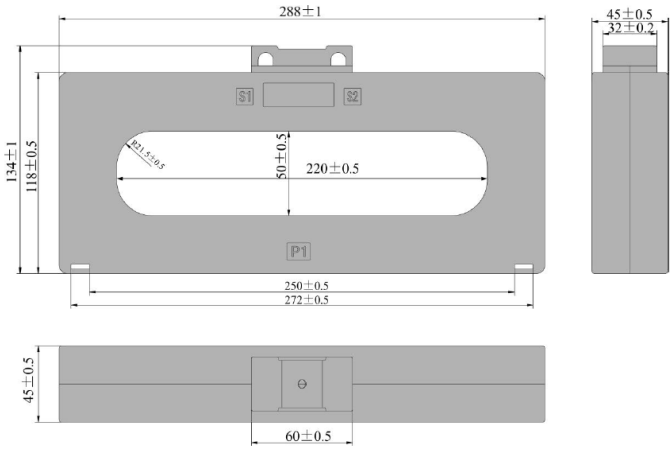


Figure 2-8 CT519703 Dimensions

2.4.2 Split Core CTs

- **CT553203 (160A, Ø=48mm)**

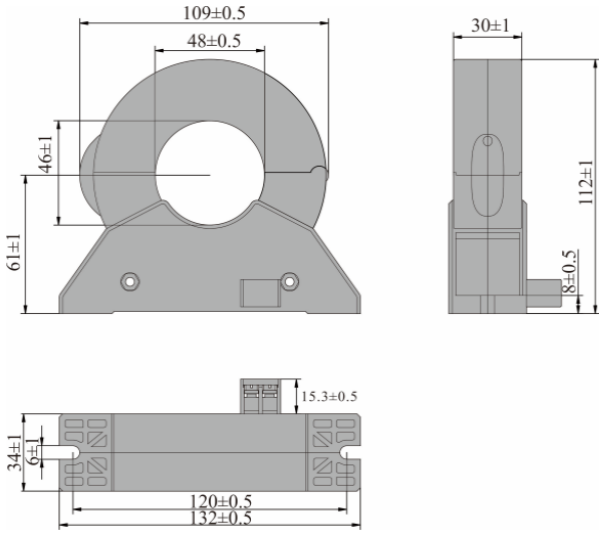


Figure 2-9 CT553203 Dimensions

- **CT553303 (225A, Ø=68mm)**

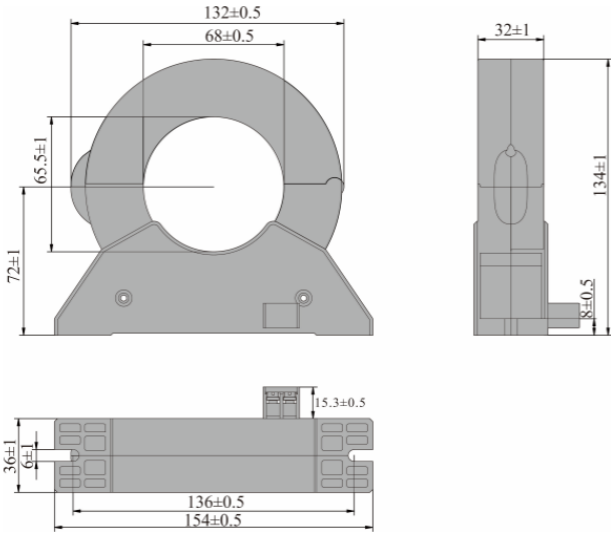


Figure 2-10 CT553303 Dimensions

2.5 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 92mmx92mm cutout as shown in **Figure 2-11**
- Re-install the installation clips and push the clips tightly against the panel to secure the meter

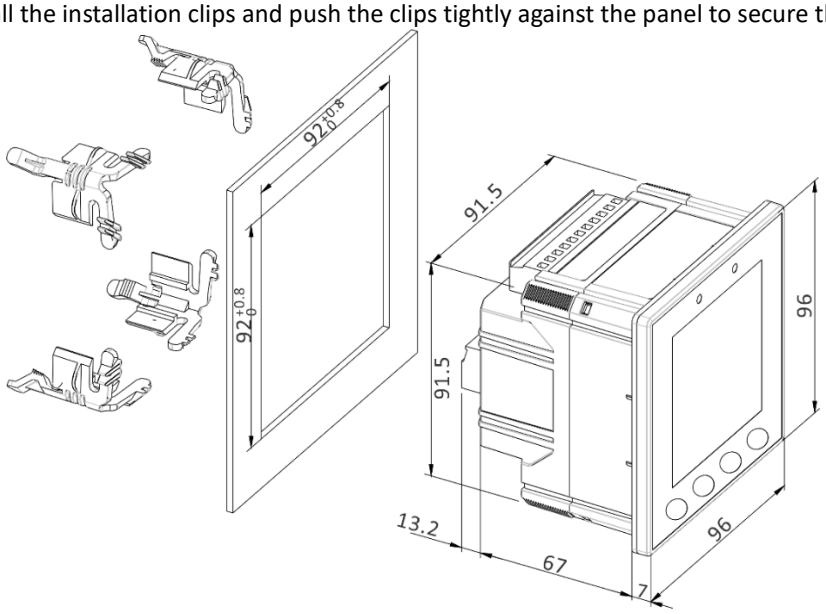


Figure 2-11 Panel Cutout Mounting

2.6 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-Uln) Direct Connection with 1CT
- 1-Phase 2-Wire, Ull (1P2W-Ull) Direct Connection with 1CT

Caution

Under no circumstances should the PT secondary be shorted.

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

2.6.1 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**.

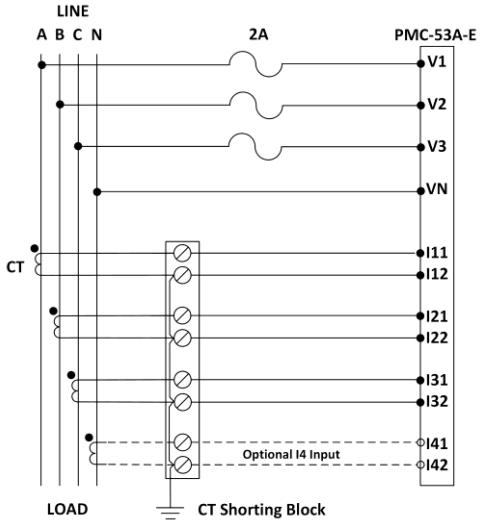


Figure 2-12 3P4W Direct Connection with 3CTs or 4CTs

2.6.2 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**.

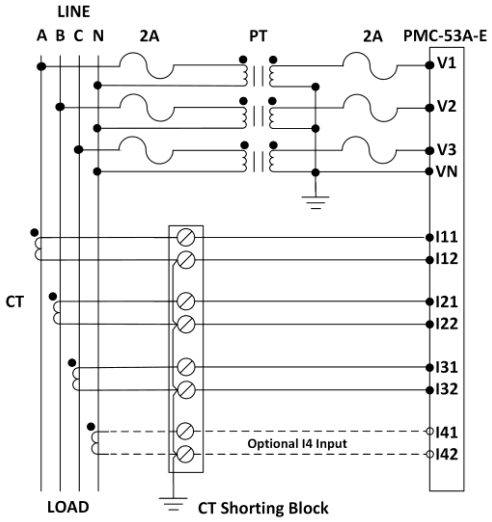


Figure 2-13 3P4W with 3PTs and 3CTs or 4CTs

2.6.3 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**.

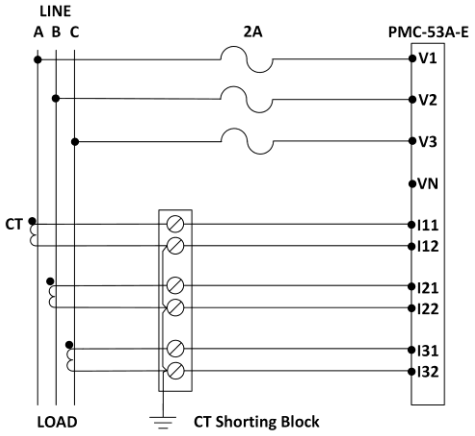


Figure 2-14 3P3W Direct Connection with 3CTs

2.6.4 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**.

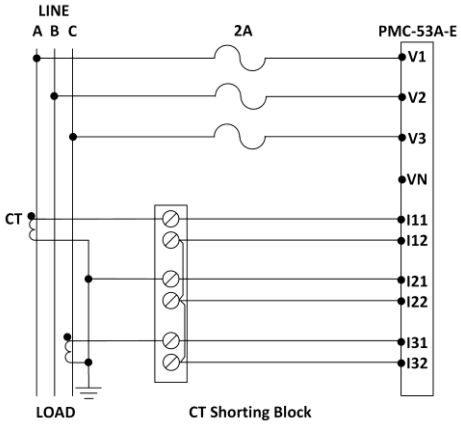


Figure 2-15 3P3W Direct Connection with 2CTs

2.6.5 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**.

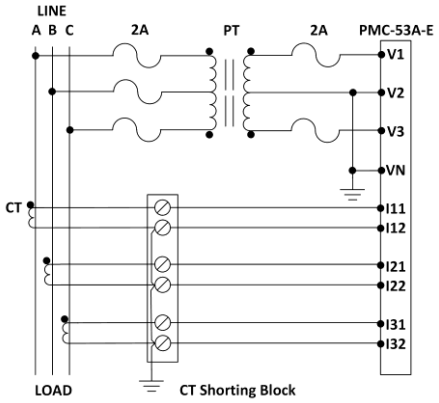


Figure 2-16 3P3W Delta with 2PTs and 3CTs

2.6.6 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**.

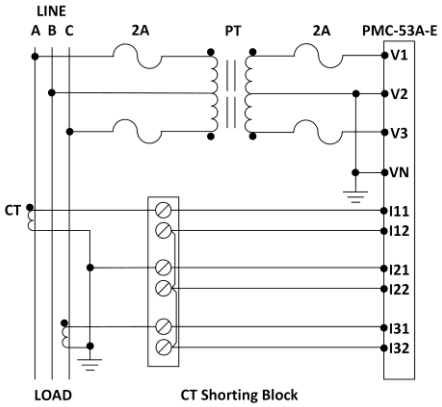


Figure 2-17 3P3W Delta with 2PTs and 2CTs

2.6.7 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**.

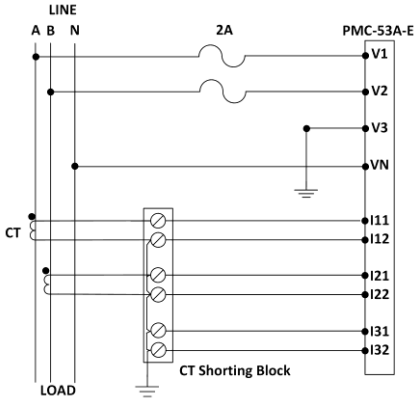


Figure 2-18 1P3W Direct Connection with 2CTs

2.6.8 1-Phase 2-Wire, Uln (1P2W-Uln) Direct Connection with 1CT

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

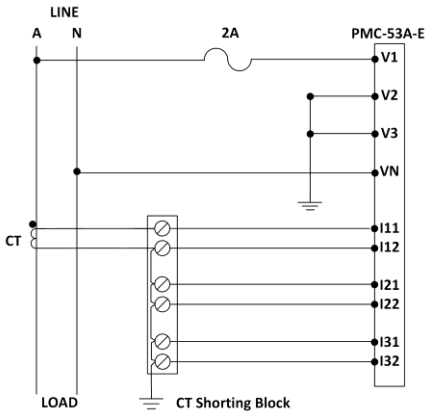


Figure 2-19 1P2W Uln Direct Connection with 1CT

2.6.9 1-Phase 2-Wire, Ull (1P2W-Ull) Direct Connection with 1CT

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

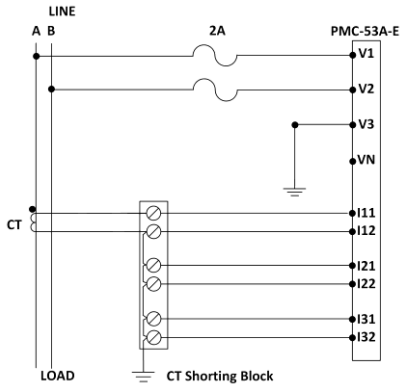


Figure 2-20 1P2W Ull Direct Connection with 1CT

2.7 Communications Wiring

2.7.1 Ethernet Port (10/100BaseT)

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

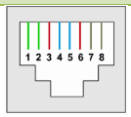
RJ45 Connector	Pin	Meaning
	1	Transmit Data+
	2	Transmit Data-
	3	Receive Data+
	4,5,7,8	NC
	6	Receive Data-

Table 2-1 RJ45 Connector Pin Description for 10/100BaseT Applications

2.7.2 RS485 Port

The following figure illustrates the RS485 communications connections on the PMC-53A-E:

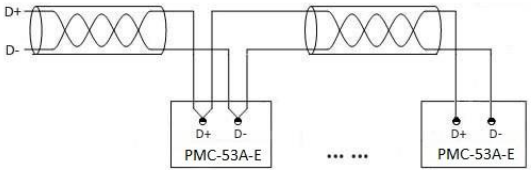


Figure 2-21 Communications Connections

The PMC-53A-E provides one standard RS485 port. Up to 32 devices can be connected on a RS485 bus. The overall length of the RS485 cable connecting all devices should not exceed 1200m.

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

2.8 Digital Input Wiring

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

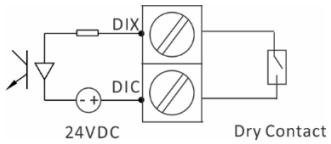


Figure 2-22 DI Connections

2.9 Digital Output Wiring

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

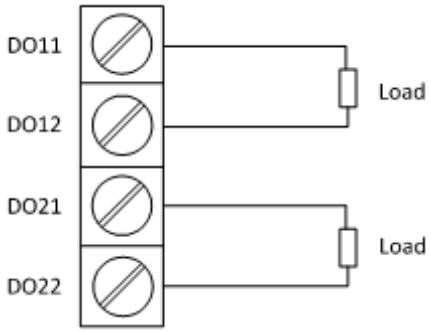


Figure 2-23 DO Connections

2.10 Pulse Output Wiring

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

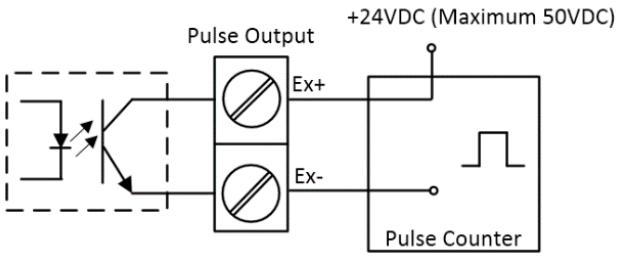


Figure 2-24 Pulse Output (Solid State Relay) Connections for Energy Pulsing

The following figure illustrates the Pulse Output (Solid State Relay) connections on the PMC-53A-E when the **DO Control Mode** setup register is programmed for Digital Output:

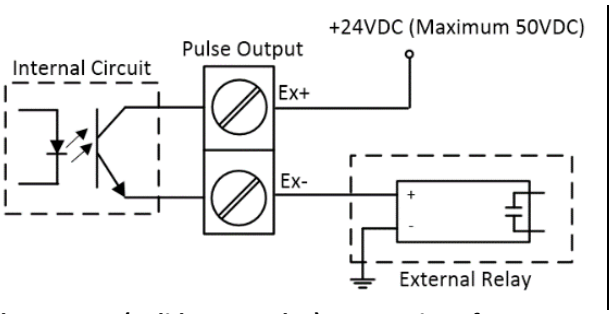


Figure 2-25 Pulse Output (Solid State Relay) Connections for Remote Control/Alarm

2.11 Analog Input Wiring

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

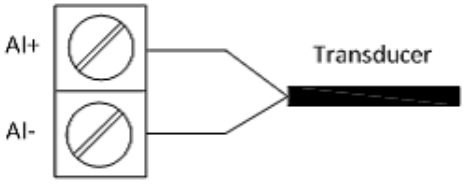


Figure 2-26 AI Connections

2.12 Residual Current (Ir) Wiring

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

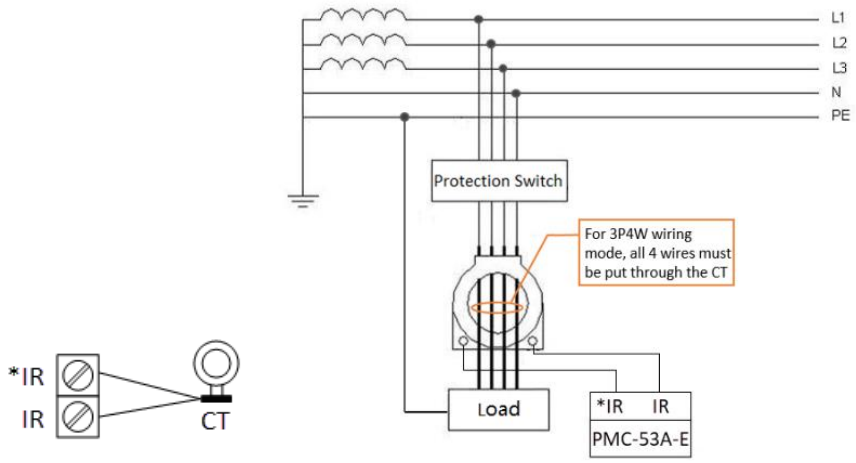


Figure 2-27 Residual Current Connections

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.

2.13 Power Supply Wiring

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

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

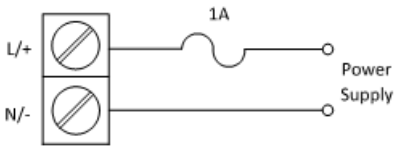


Figure 2-28 Power Supply Connections

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)	↑ (Increment)	↓ (Cursor Down)	↑ (Next)	↑ (Increment)
F4	→ (Menu Right)	→ (Menu Right) or Select Option or Null (Not Used)	Enter (Confirm)	OK (Confirm)	Enter (Select Parameter)	OK (Confirm)	OK (Confirm)

Table 3-1 Button Function

3.1.2 Data Display

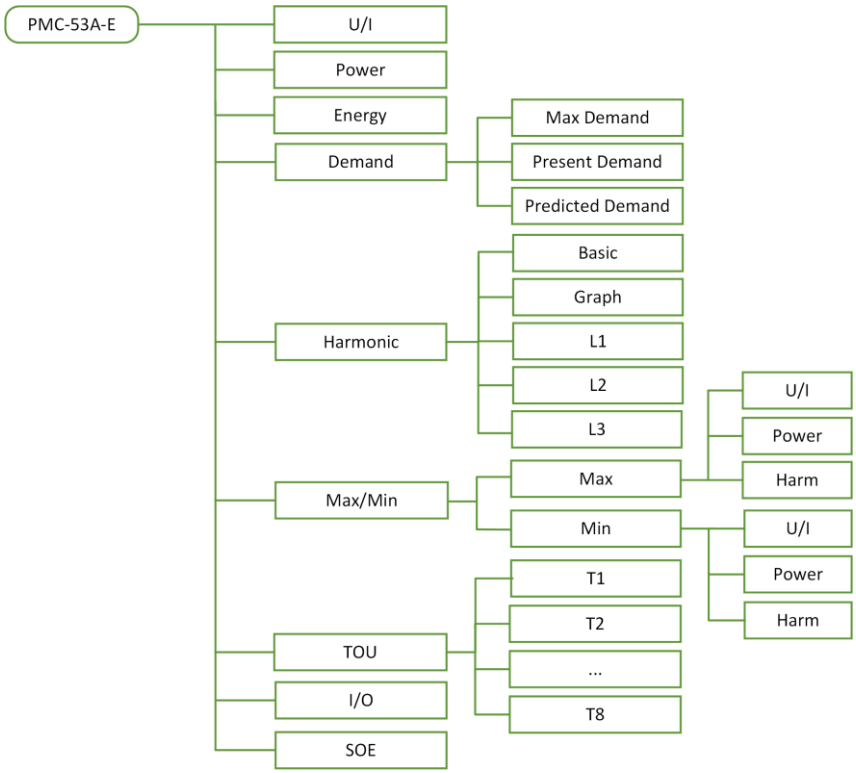


Figure 3-2 Data Display Menu

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 kW, kvar, kVA and PF measurements 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	Ull avg	I avg	kW Total	PF Total
	Display 1 (Voltage L-N)	U1	U2	U3	Uln avg
	Display 2 (Voltage L-L)	U12	U23	U31	Ull avg
	Display 3 (Current)	I1	I2	I3	I avg
	Display 4 (In/I4/Ir)	In	I4[1]	Ir[2]	
	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 (U Waveform)	U1			
	Display 10 (U Waveform)	U2			
	Display 11 (U Waveform)	U3			
	Display 12 (I Waveform)	I1			
	Display 13 (I Waveform)	I2			
	Display 14 (I Waveform)	I3			
	Display 15 (Operating Time)	Operating Time			
	Display 16 (U Fundamental)	U1[3]	U2[3]	U3[3]	
	Display 17 (I Fundamental)	I1[3]	I2[3]	I3[3]	

Table 3-2 U/I Display

Notes:
1) This parameter only appears if the meter is equipped with the corresponding I4 option.
2) This screen only shows a valid value when the Wiring Mode is set to 3P3W or 3P4W, otherwise, it shows "0".
3) For U/I Fundamental:

U1 = Uan, U2 = Ubn, U3 = Ucn in 3P4W mode
U1 = Uab, U2 = Ubc, U3 = Uca in 3P3W mode
I1 = Ia, I2 = Ib, I3 = Ic

3.1.2.2 Power

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

Table 3-3 Power Display

3.1.2.3 Energy

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

Table 3-4 Energy Display

3.1.2.4 Demand

Menu 1st 2nd	Display Screens	1st Row	2nd Row	3rd Row
<DMD>[1]	Default (Max)	kW Total	kvar Total	VA Total
		Timestamp	Timestamp	Timestamp
<Max>[2]	Display 1	kW Total	kvar Total	kVA Total
		Timestamp	Timestamp	Timestamp
	Display 2	I1	I2	I3
		Timestamp	Timestamp	Timestamp
<Pres>[3]	Display 1	kW Total	kvar Total	kVA Total
	Display 2	I1	I2	I3
<Pred>[4]	Display 1	kW Total	kvar Total	kVA Total
	Display 2	I1	I2	I3

Table 3-5 Demand Display

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

3.1.2.5 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 (U Sequence)	U1[3, 4]	U2[3, 4]	U0[3, 4]
	Display 8 (I Sequence)	I1[3, 4]	I2[3, 4]	I0[3, 4]
<Graph>	Display 1[2]	U1/U12 Harm. (Odd)		
	Display 2[2]	U2/U23 Harm. (Odd)		
	Display 3[2]	U3/U31 Harm. (Odd)		
	Display 4	I1 Harm. (Odd)		
	Display 5	I2 Harm. (Odd)		
	Display 6	I3 Harm. (Odd)		

<L1[5]>	Display 1 [HD (ODD)]	HD3 ~ HD15
	Display 2 [HD (ODD)]	HD17 ~ HD29
	Display 3 [HD (ODD)]	HD31
	Display 1 [HD (Even)]	HD2 ~ HD14
	Display 2 [HD (Even)]	HD16 ~ HD28
	Display 3 [HD (Even)]	HD30
<L2[5]>	Display 1 [HD (ODD)]	HD3 ~ HD15
	Display 2 [HD (ODD)]	HD17 ~ HD29
	Display 3 [HD (ODD)]	HD31
	Display 1 [HD (Even)]	HD2 ~ HD14
	Display 2 [HD (Even)]	HD16 ~ HD28
	Display 3 [HD (Even)]	HD30
<L3[5]>	Display 1 [HD (ODD)]	HD3 ~ HD15
	Display 2 [HD (ODD)]	HD17 ~ HD29
	Display 3 [HD (ODD)]	HD31
	Display 1 [HD (Even)]	HD2 ~ HD14
	Display 2 [HD (Even)]	HD16 ~ HD28
	Display 3 [HD (Even)]	HD30

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 1st to 31st Voltage and Current HD (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	Uln avg
			Timestamp	Timestamp	Timestamp	Timestamp
<Max>	<U/I>	Display 1	U1	U2	U3	Uln avg
			Timestamp	Timestamp	Timestamp	Timestamp
		Display 2	U12	U23	U31	Ull avg
			Timestamp	Timestamp	Timestamp	Timestamp
		Display 3	I1	I2	I3	I avg
			Timestamp	Timestamp	Timestamp	Timestamp
		Display 4	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	L1 U THD	L2 U THD	L3 U THD	
			Timestamp	Timestamp	Timestamp	
		Display 2	L1 I THD	L2 I THD	L3 I THD	
			Timestamp	Timestamp	Timestamp	
		Display 3	L1 K-Factor	L2 K-Factor	L3 K-Factor	
			Timestamp	Timestamp	Timestamp	
		Display 4	L1 C-Factor	L2 C-Factor	L3 C-Factor	
			Timestamp	Timestamp	Timestamp	
		Display 5	I Unbal.	U Unbal.		
			Timestamp	Timestamp		
<Min>	<U/I>	Display 1	U1	U2	U3	Uln avg
			Timestamp	Timestamp	Timestamp	Timestamp

		Display 2	U12	U23	U31	Ull avg
			Timestamp	Timestamp	Timestamp	Timestamp
		Display 3	I1	I2	I3	I avg
			Timestamp	Timestamp	Timestamp	Timestamp
		Display 4	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	L1 U THD	L2 U THD	L3 U THD	
			Timestamp	Timestamp	Timestamp	
		Display 2	L1 I THD	L2 I THD	L3 I THD	
			Timestamp	Timestamp	Timestamp	
		Display 3	L1 K-Factor	L2 K-Factor	L3 K-Factor	
			Timestamp	Timestamp	Timestamp	
		Display 4	L1 C-Factor	L2 C-Factor	L3 C-Factor	
			Timestamp	Timestamp	Timestamp	
		Display 5	I Unbal.	U Unbal.		
			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 (Peak Demand)	P	Q	S
		Timestamp	Timestamp	Timestamp
<T2[1]> . . . <T7[1]>	Display 1 (kWh)	Imp	Exp	
	Display 2 (kvarh)	Imp	Exp	
	Display 3 (kVAh)	Tot		
	Display 4 (Peak Demand)	P	Q	S
		Timestamp	Timestamp	Timestamp
<T8[1]>	Display 1 (kWh)	Imp	Exp	
	Display 2 (kvarh)	Imp	Exp	
	Display 3 (kVAh)	Tot		
	Display 4 (Peak 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:

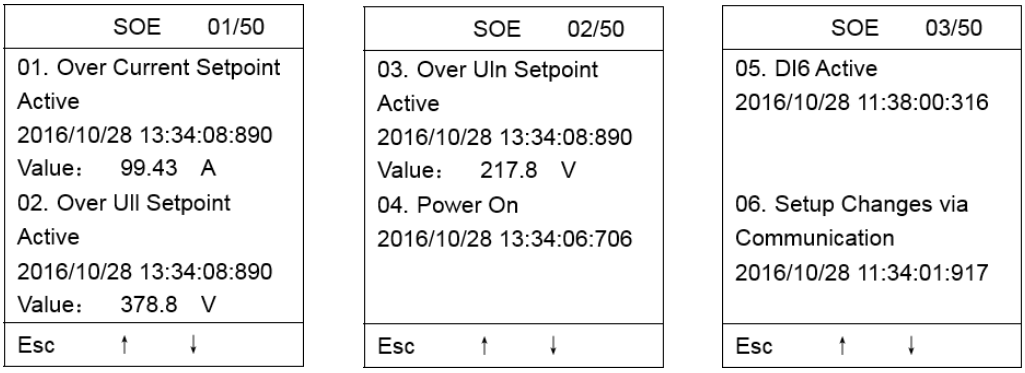


Figure 3-3 SOE Log Displays

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.

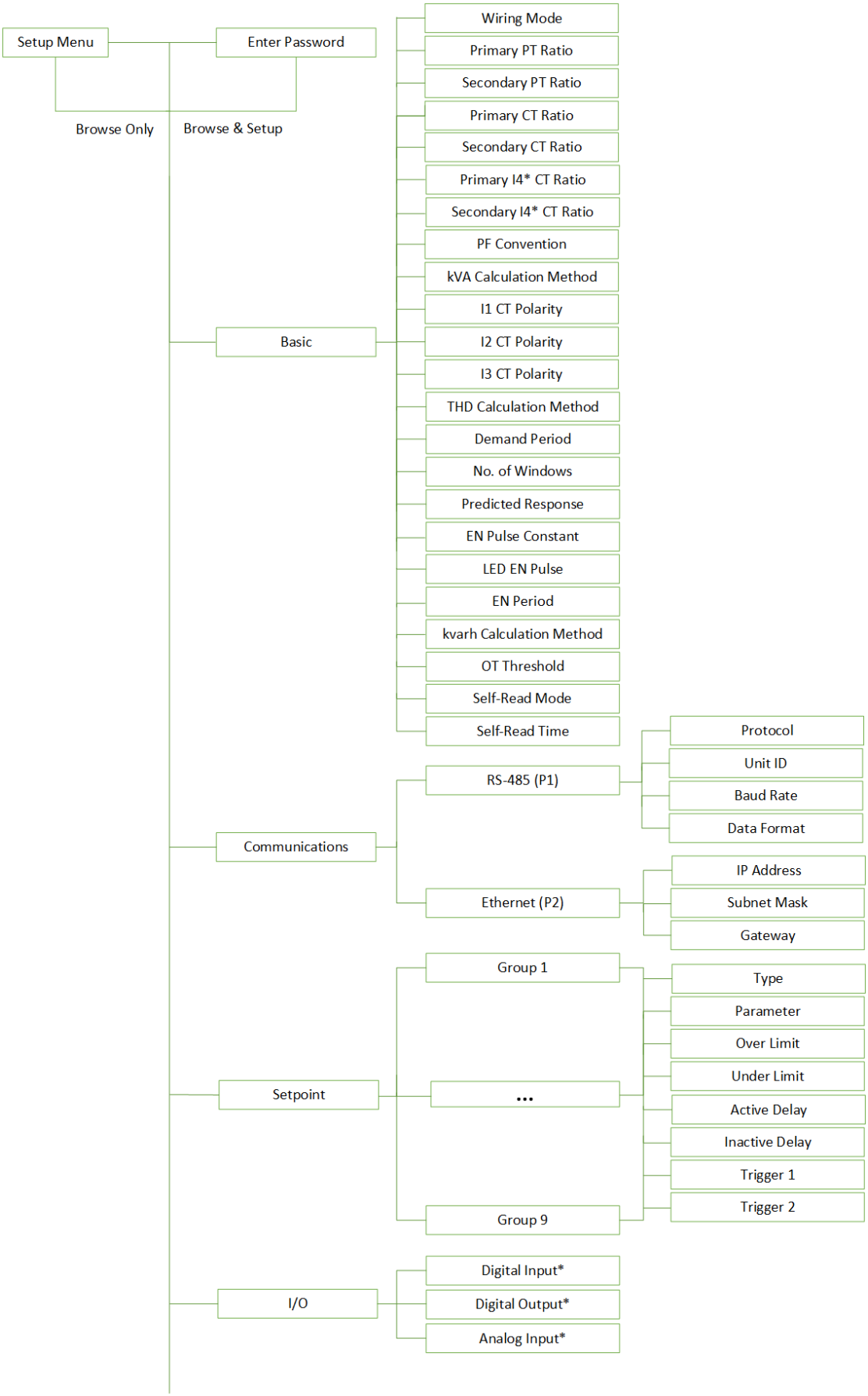
3) Changing and saving a setup parameter:

- 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



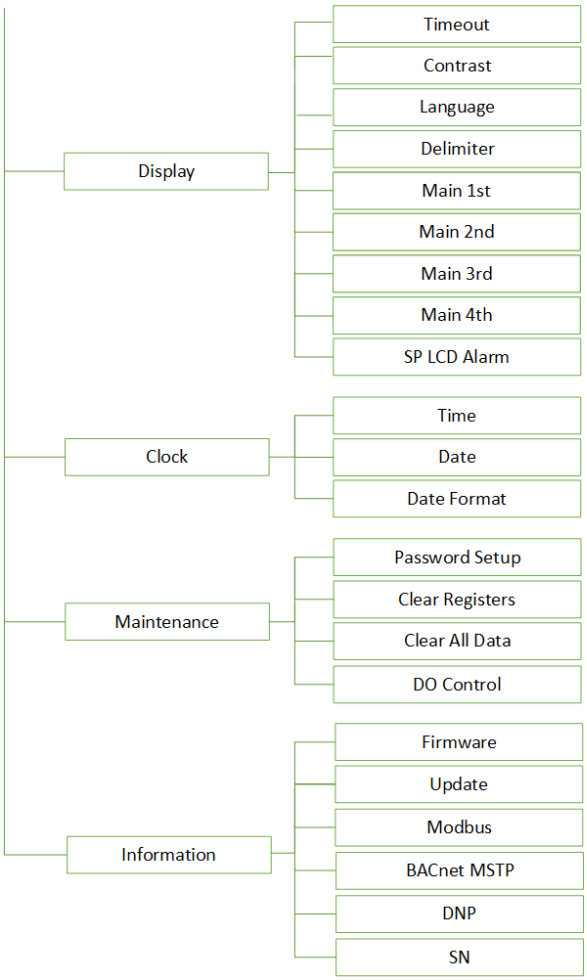


Figure 3-4 Setup Menu

3.1.3.3 Configuration

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

Label Menu 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	3P4W
PT Primary	PT Primary Ratio	1 to 1000000V	100V
PT Secondary	PT Secondary Ratio	1 to 690V	100V
CT Primary	CT Primary Ratio	1 to 30000A	5A
CT Secondary	CT Secondary Ratio	1 to 5A	5A
I4 Primary*	I4 Primary Ratio	1 to 30000A	5A
I4 Secondary*	I4 Secondary Ratio	1 to 5A	5A
PF Convention	PF Convention	IEC/IEEE/-IEEE[1]	IEC
kVA Calc.	kVA Calculation Method	Vector/Scalar[2]	Vector
I1 Polarity	I1 Polarity	Normal/Reverse	Normal
I2 Polarity	I2 Polarity		
I3 Polarity	I3 Polarity		
THD Calc.	Select between % of Fundamental or % of RMS	THDf/THDr[3]	THDf
DMD Period	Demand Interval	1 to 60 min	15
No. of Windows	Number of Sliding Windows	1 to 15	1
Predicted Resp.	Predicted Response	70 to 99	70

EN Pulse CNST	Pulse Constant	1000/3200/6400	1000
LED EN Pulse	Enable kWh/kvarh Energy Pulsing	Disabled/kWh/kvarh	kWh
EN Period	Interval Energy period	5 to 60 min	60
kvarh Calc.	kvarh Calculation Method	RMS/FUND	RMS
OT Threshold	Current Threshold of Device Operating Time	1 to 1000 (x0.001In)	1
S.R. Mode	Self-Read Mode to both Peak Demand and Max/Min Log	Auto/Manual	Manual
S.R. Time	Self-Read Time to both Peak Demand and Max/Min Log	See Note 4)	--D--H
Comm.			
RS485 (P1)			
Protocol	Protocol	Modbus/BACnet/ DNP/Gateway	Modbus
Unit ID	Modbus Address	Modbus: 1 to 247 BACnet: 1 to 247 DNP: 0 TO 65519	100
Baud Rate	Data rate in bits per second	1200/2400/4800/ 9600/19200/38400	9600
Data Format	Data Format	8N2/8O1/8E1/ 8N1/8O2/8E2	8E1
Ethernet (P2)			
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 5)	None
OvLim	Over Limit		0
UnLim	Under Limit		0
ActiveDelay	Active Delay	0 to 9999s	0
InactiveDelay	Inactive Delay	0 to 9999s	0
Trigger1	Setpoint Trigger1	See Note 6)	
Trigger2	Setpoint Trigger2	See Note 6)	
…			
Group #9			
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 5)	None
OvLim	Over Limit		0
UnLim	Under Limit		0
ActiveDelay	Active Delay	0 to 9999s	0
InactiveDelay	Inactive Delay	0 to 9999s	0
Trigger1	Setpoint Trigger1	See Note 6)	
Trigger2	Setpoint Trigger2	See Note 6)	
I/O			
Digital Input			
Function	DI Function		
DI1~DI3	Function Mode for DI1 to DI4	Digital Input / Pulse Counter / TOU Control	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	Debounce for DI1 to DI4	1 to 9999 ms	20 ms
…			
DI4			
Pulse Weight	Specifies the incremental value for each pulse received		
DI1	Pulse Weight for DI1 to DI4	1 to 1000000	1

...			
DI4			
Digital Output			
Function	Specifies the function of the Pulse Output.		
DO1	DO Control Mode	▪ Digital Output ▪ kWh Import ▪ kWh Export ▪ kWh Total ▪ kvarh Import ▪ kvarh Export ▪ kvarh Total	Digital Output
DO2			
Pulse Width	Specifies the duration for which the relay output will be active when a remote control command is received to activate it.		
DO1	Pulse Width for DO1 to DO2	0 to 600 (x0.1s) (0=Latch Mode)	10
DO2			
Analog Input[7]			
Type	Select between 0-20mA or 4-20mA input	4-20mA/0-20 mA	4-20mA
Zero Scale	The value that corresponds to the minimum Analog Input of 0 or 4 mA	-999,999 to 999,999	400
Full Scale	The value that corresponds to the maximum Analog Input of 20 mA	-999,999 to 999,999	2000
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 8)	Option1
Main 1st	1st parameter of the Default Display	See Note 9)	Ullavg
Main 2nd	2nd parameter of the Default Display		Iavg
Main 3rd	3rd parameter of the Default Display		P (kW Total)
Main 4th	4th parameter of the Default Display		PF (PF Total)
SP LCD Alarm	Enable Splash LCD Alarm[10]	On/Off	On
Clock			
Time	Time	(20)YY-MM-DD	/
Date	Date	HH:MM:SS	/
Date Format	Date Format	YYMMDD/ MMDDYY/ DDMMYY	YYMMDD
Maintenance			
Password Setup			
New Password	Enter new password		
Confirm Password	Confirm new password		
Clear Registers			
Energy			
-	Clear all Energy Log	Yes/No	No
Demand			
Present Max	Clear Peak Demand Log of This Month (Since Last Reset)	Yes/No	No
All	Clear Present Demand, Peak Demand Log of This Month (Since Last Reset) and Last Month (Before Last Reset)	Yes/No	No
Max/Min			
Present	Clear Max/Min Log of This Month (Since Last Reset)	Yes/No	No
All	Clear Max/Min Log of This Month (Since Last Reset) and Last Month (Before Last Reset)	Yes/No	No
Operating Time			
Reset	Clear Device Operating Time	Yes/No	No

Pulse Counter			
All	Clear All DI Counters	Yes/No	No
DIx (x=1 to 4)	Clear DIx Pulse Counter	Yes/No	No
SOE Logs	Clear SOE Logs	Yes/No	No
Clear All Data			
-	Clear All of the above	Yes/No	No
DO Control			
DO1	DOx Manual Control	Normal/On/Off	Normal
DO2			
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) PF Convention (-IEEE is the same as IEEE but with the opposite sign):

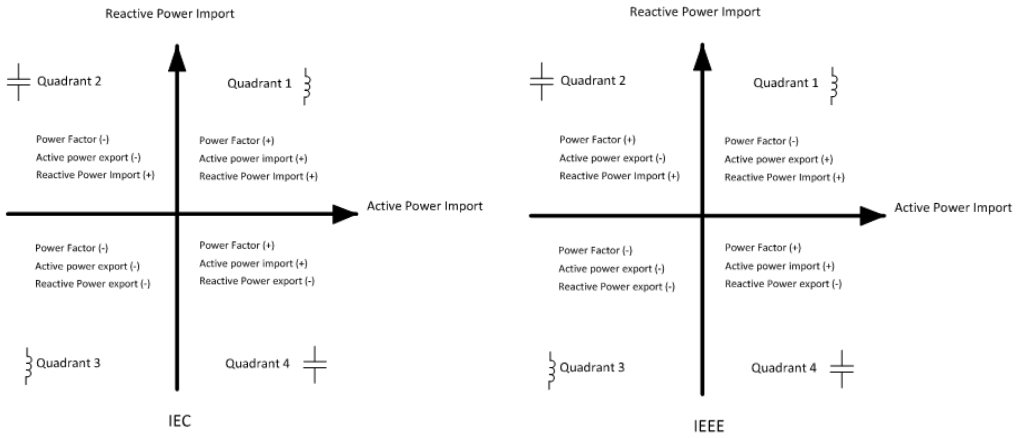


Figure 3-5 Power Factor Definitions

2) There are two methods to calculate kVA:

Vector: $kVA_{total}=\sqrt{kW_{total}^2+kVar_{total}^2}$

Scalar: $kVA_{total}=kVA_a+kVA_b+kVA_c$

3) 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.

4) The **Self-Read Time** setting is disabled if the **Self-Read Mode** is **Manual**.

5) 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 (kW Total)		0.001	W
7	Q (kvar Total)			var
8	S (kVA Total)			VA
9	PF (PF Total)			-
10	P DMD (kW Total Present Demand)			W
11	Q DMD (kvar Total Present Demand)			var
12	S (kVA Total Present Demand)			VA
13	P DMD Pred (kW Total Predicted Demand)			W
14	Q DMD Pred (kvar Total Predicted Demand)			var
15	S DMD Pred (kVA Total Predicted Demand)			VA
16	U THD		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, 2]	-	-	-
25	I4 (Measured)*	x1	0.001	A
26	AI*		1	-
27	IR (Residual Current) *	x1	0.001	A
28	U2 (Negative Symmetrical Component)	x1		V
29	U0 (Zero Symmetrical Component)			

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

Table 3-11 Setpoint Parameters

Notes:

1. When **Reversal** is set as the **Setpoint Parameter**, the **Setpoint Type** should be set to 1 (i.e., Over Setpoint). The **Setpoint Type**=2 (i.e., Under Setpoint) is invalid.
2. When **Reversal** is set as the **Setpoint Parameter** (with **Setpoint Type**=1), the **Over Limit** should be set as 0 and **Under Limit should be** as 1. The logic diagram for the Phase Reversal setpoint is illustrated in the following figure:

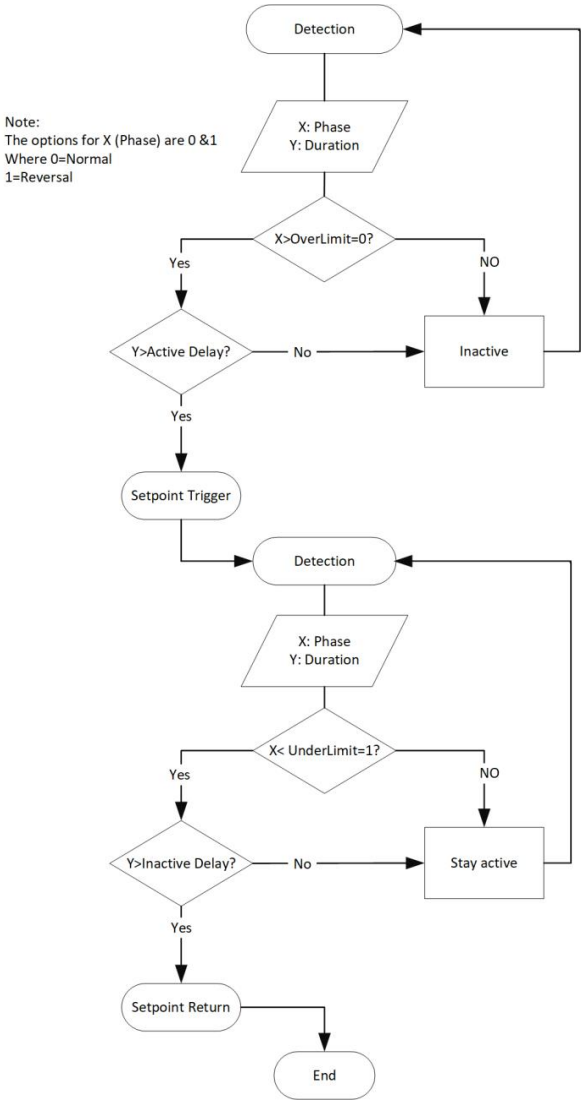


Figure 3-6 Reversal Setpoint Logic Diagram

6) 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 3-12 Setpoint Trigger

7) This menu only appears if the meter is equipped with the corresponding options.
8) The Delimiter setup register supports two options, 1 and 2:
Option 1: "," is used as the x1000 delimiter and "." as the decimal point (e.g. 123,456,789.0).
Option 2: " " is used as the x1000 delimiter and "," as the decimal point (e.g. 123 456 789,0).
9) The following table illustrates the parameters that can be selected for display in the **Default Display** screen.

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

Table 3-13 Default Display Parameters

10) Setting **SP LCD Alarm** to **On** would make the LCD blinking when there is a Setpoint occurred 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 3-14 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.

3.2.1 Setting PC's IP Address

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

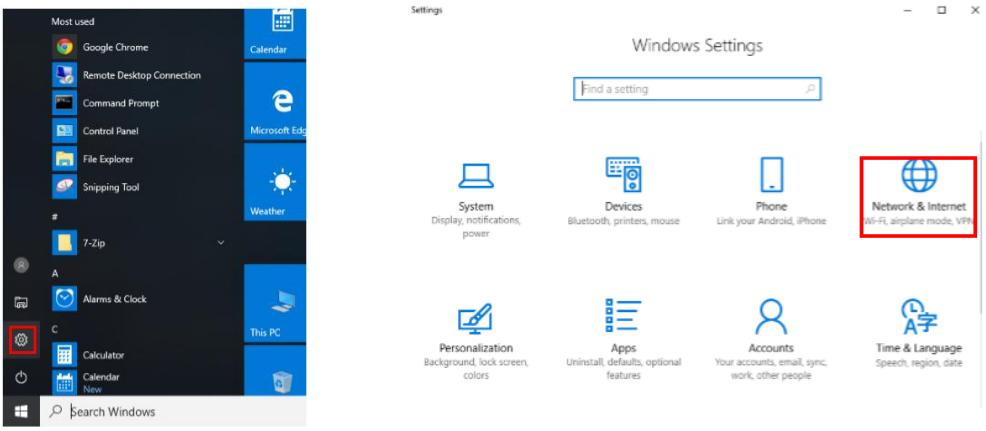


Figure 3-7 Settings-> Network & Internet on Windows 10

Select **Network & Internet** and then **Change adapter options** to find the Ethernet adapter. Double click on it and then select **Properties** to open the dialog box for configuring its Networking properties.

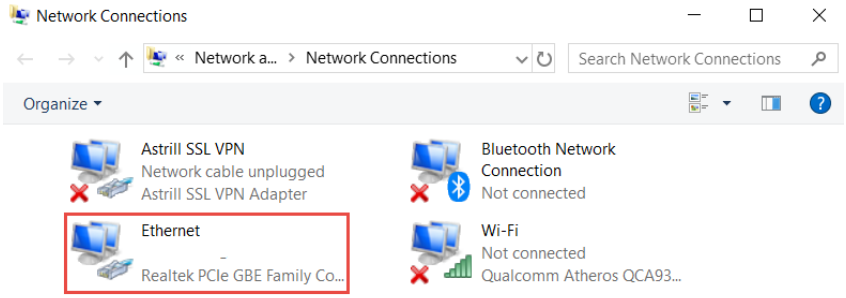


Figure 3-8 Network and Sharing Center

Double-click on **Internet Protocol Version 4 (TCP/IPv4)** to show/configure the Ethernet adapter's IP configuration.

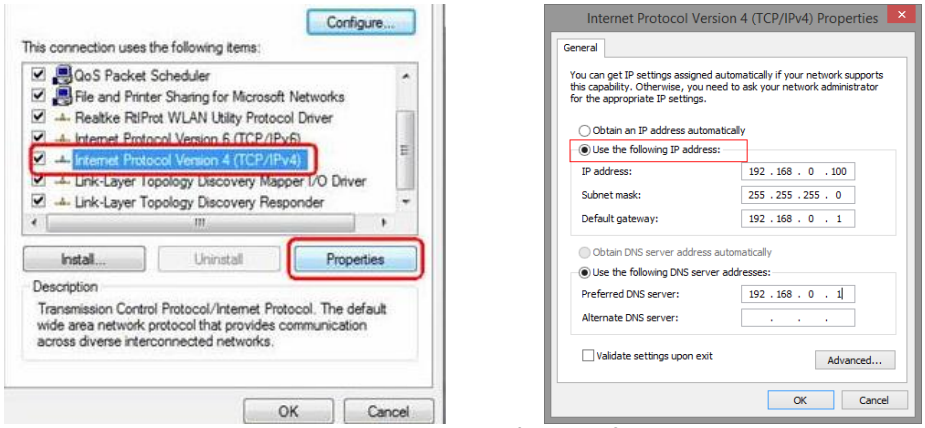


Figure 3-9 Ethernet Adapter's IP Configuration

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.

Ethernet (P2)			
IP Address			
	192.168.	0.100	
Subnet Mask			
	255.255.255.	0	
Gateway			
	192.168.	0.	1
Esc	↑	↓	Enter

Figure 3-10 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>**.

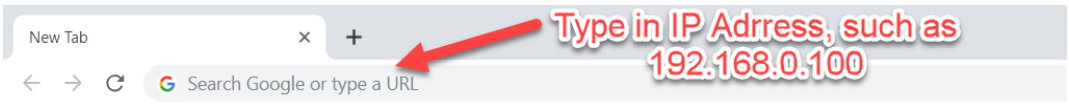


Figure 3-11 Web Login

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

Figure 3-12 Login Page

3.2.4 Overview

The PMC-53A-E's Web Interface provides a simple way to view the meter's measurements and configure its setup parameters. The following screen captures illustrate the PMC-53A-E's Web Interface. The Sub-Menu on the left-hand pane displays the available options under the selected item from the Main Menu at the top. It's recommended to disconnect from the meter's web server when it's not in use with the logout button at the upper right-hand corner. The PMC-53A-E's Web Server will terminate the client's connection after 3 minutes of inactivity.

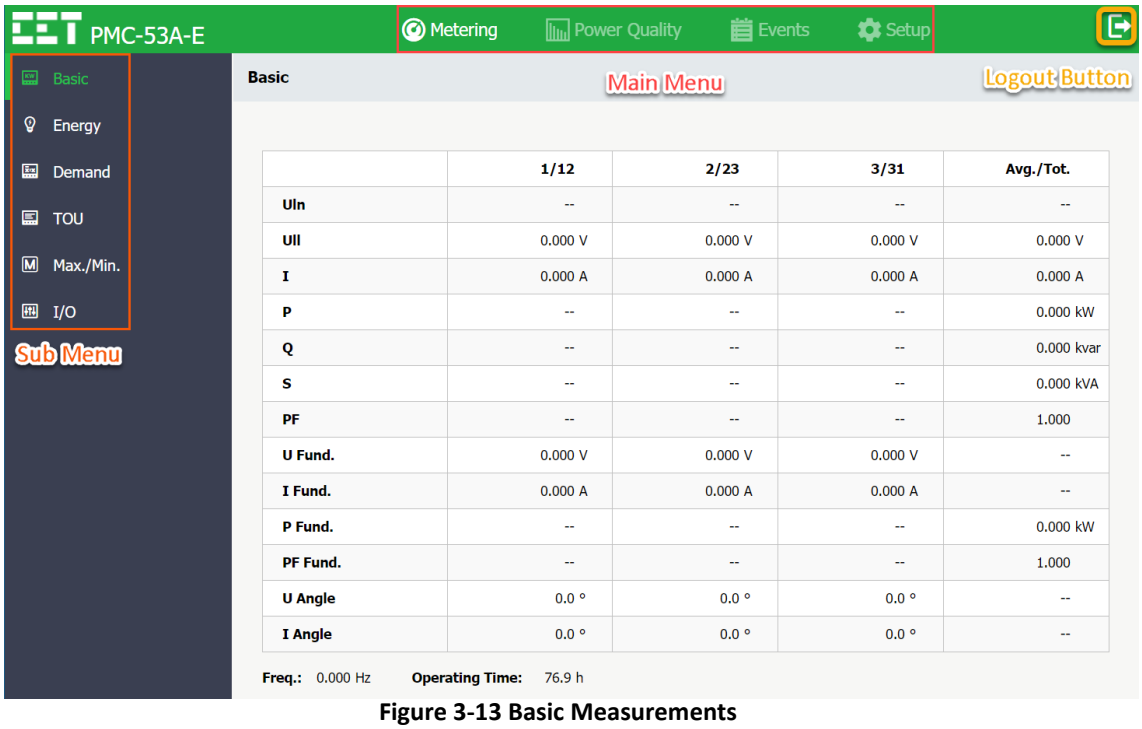
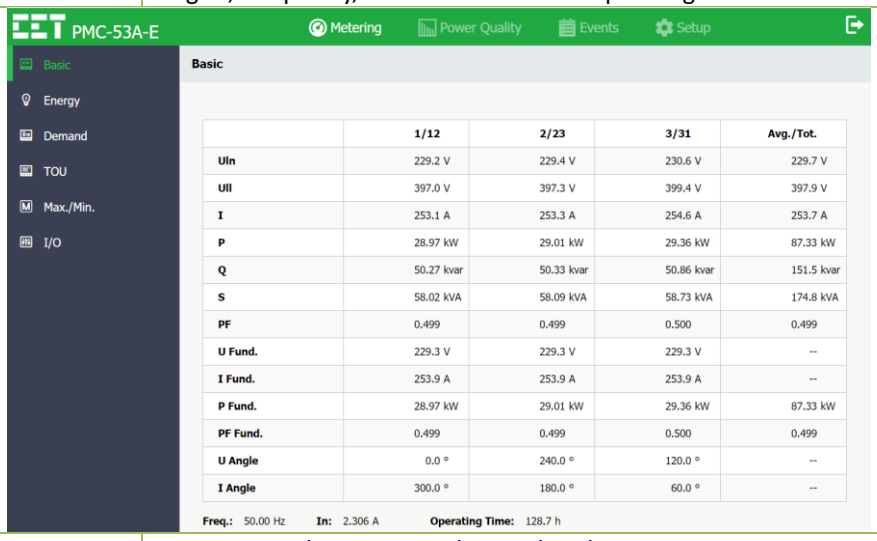
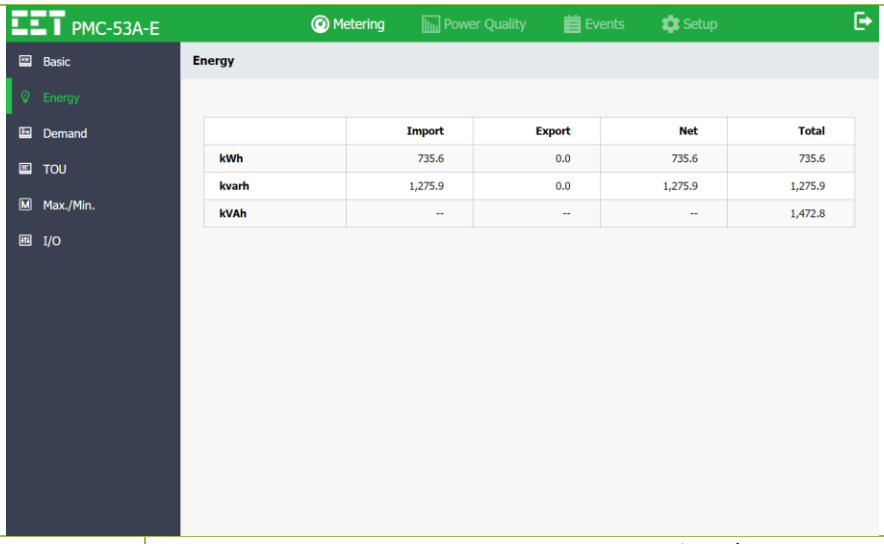


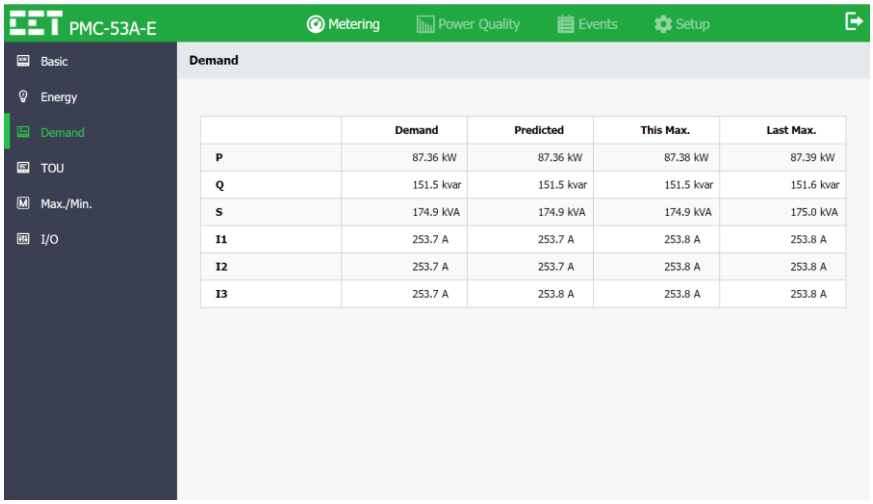
Figure 3-13 Basic Measurements

3.2.5 Detailed Description

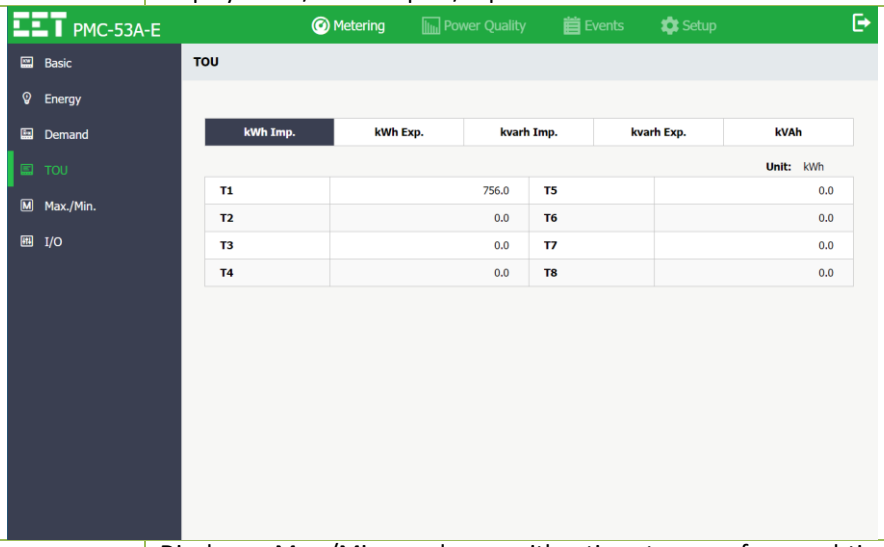
Main Menu	Sub Menu	Description
Metering	Basic	Displays Voltage, Current, Power, PF, Fundamental U/I/P/PF, Phase Angles, Frequency, Neutral Current and Operating Time.
		
	Energy	Displays kWh/kvarh Import/Export/Net/Total and kVAh Total.



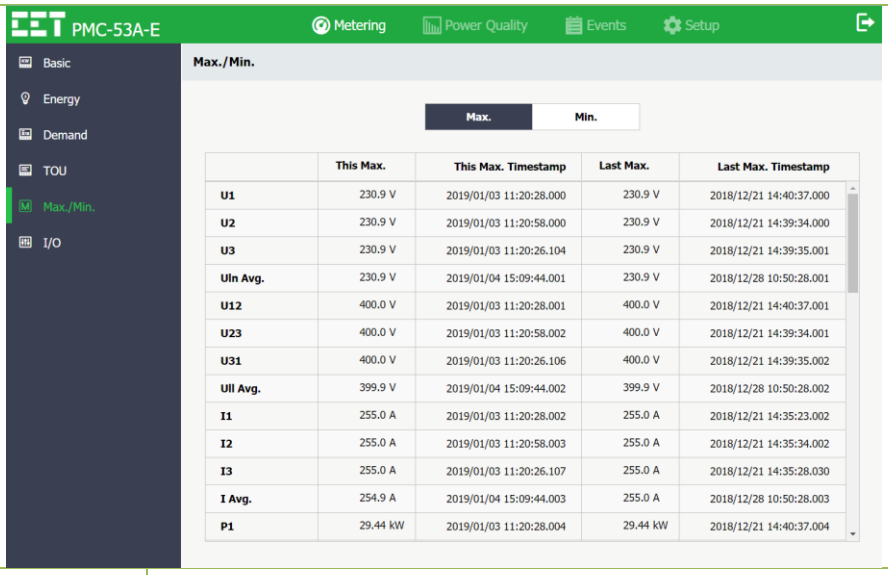
Demand	Displays Present, Predicted and Peak Demand (This/Last Month or Since/Before Last Reset) for P, Q, S and 3-Ø Current.



TOU	Displays kWh/kvarh Import/Export and kVAh for TOU Tariffs T1 to T8

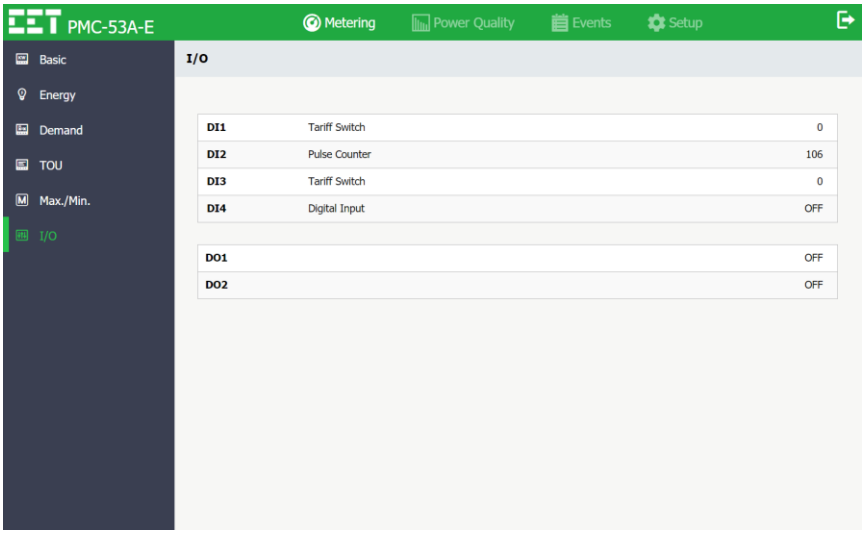


Max./Min.	Displays Max./Min. values with timestamps for real-time measurements for This Month/Last Month or Before Last Reset/Since Last Reset.



	This Max.	This Max. Timestamp	Last Max.	Last Max. Timestamp
U1	230.9 V	2019/01/03 11:20:28.000	230.9 V	2018/12/21 14:40:37.000
U2	230.9 V	2019/01/03 11:20:58.000	230.9 V	2018/12/21 14:39:34.000
U3	230.9 V	2019/01/03 11:20:26.104	230.9 V	2018/12/21 14:39:35.001
Uln Avg.	230.9 V	2019/01/04 15:09:44.001	230.9 V	2018/12/28 10:50:28.001
U12	400.0 V	2019/01/03 11:20:28.001	400.0 V	2018/12/21 14:40:37.001
U23	400.0 V	2019/01/03 11:20:58.002	400.0 V	2018/12/21 14:39:34.001
U31	400.0 V	2019/01/03 11:20:26.106	400.0 V	2018/12/21 14:39:35.002
Ull Avg.	399.9 V	2019/01/04 15:09:44.002	399.9 V	2018/12/28 10:50:28.002
I1	255.0 A	2019/01/03 11:20:28.002	255.0 A	2018/12/21 14:35:23.002
I2	255.0 A	2019/01/03 11:20:58.003	255.0 A	2018/12/21 14:35:34.002
I3	255.0 A	2019/01/03 11:20:26.107	255.0 A	2018/12/21 14:35:28.030
I Avg.	254.9 A	2019/01/04 15:09:44.003	255.0 A	2018/12/28 10:50:28.003
P1	29.44 kW	2019/01/03 11:20:28.004	29.44 kW	2018/12/21 14:40:37.004

I/O	Displays the programmed functions and values for DI, DO and AI (if equipped).

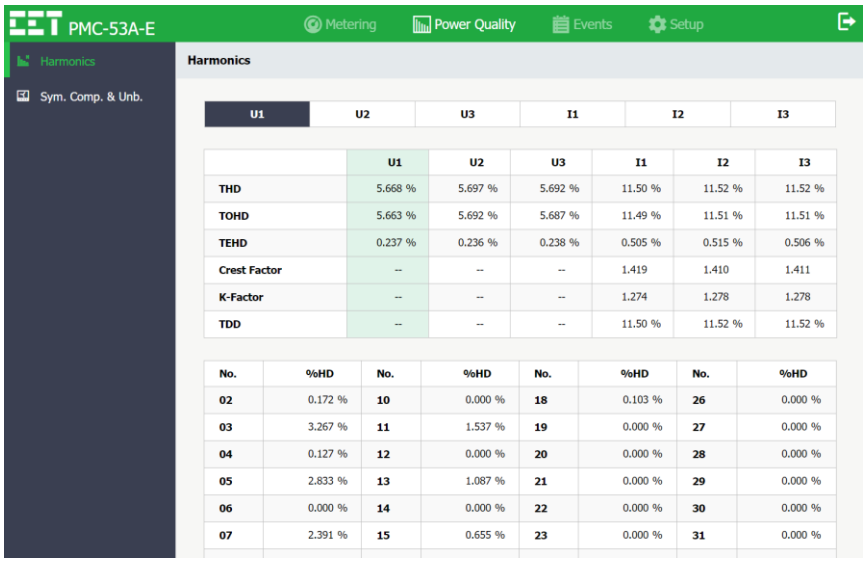


DI1	Tariff Switch	0
DI2	Pulse Counter	106
DI3	Tariff Switch	0
DI4	Digital Input	OFF

DO1	OFF
DO2	OFF

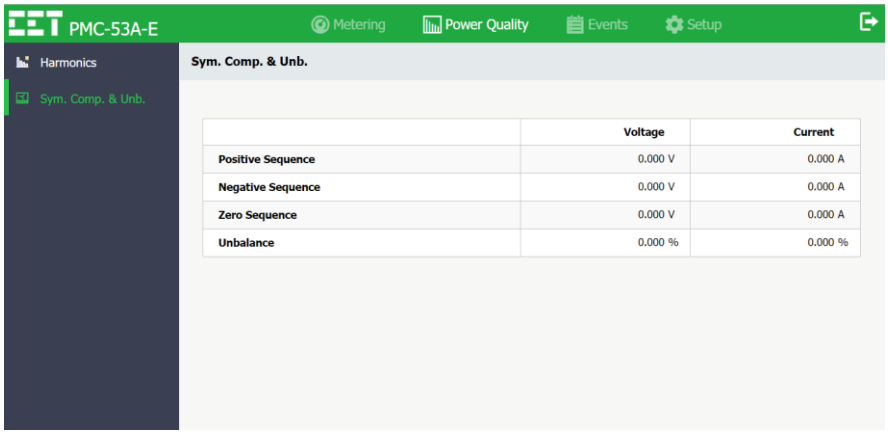
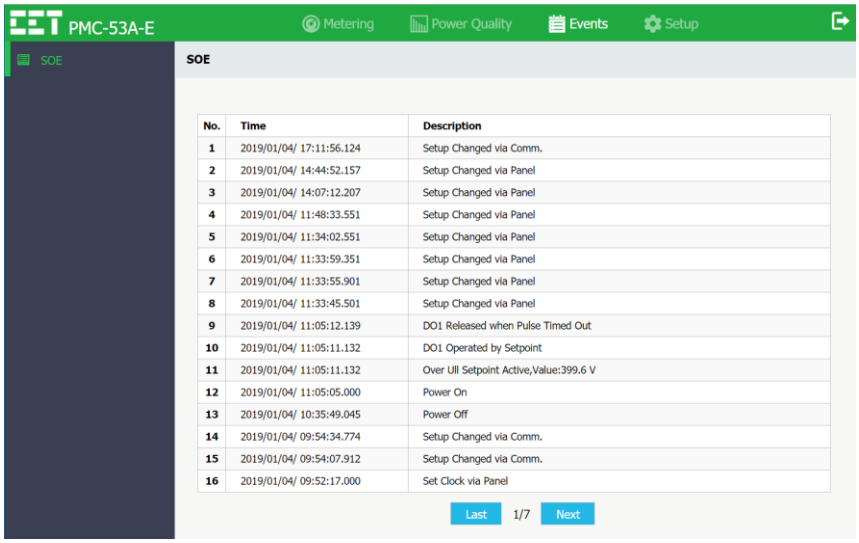
Harmonics	Displays THD, TIHD, TEHD, Crest Factor, K-Factor, TDD, and the 2nd to 31st individual harmonics for Voltage and Current.

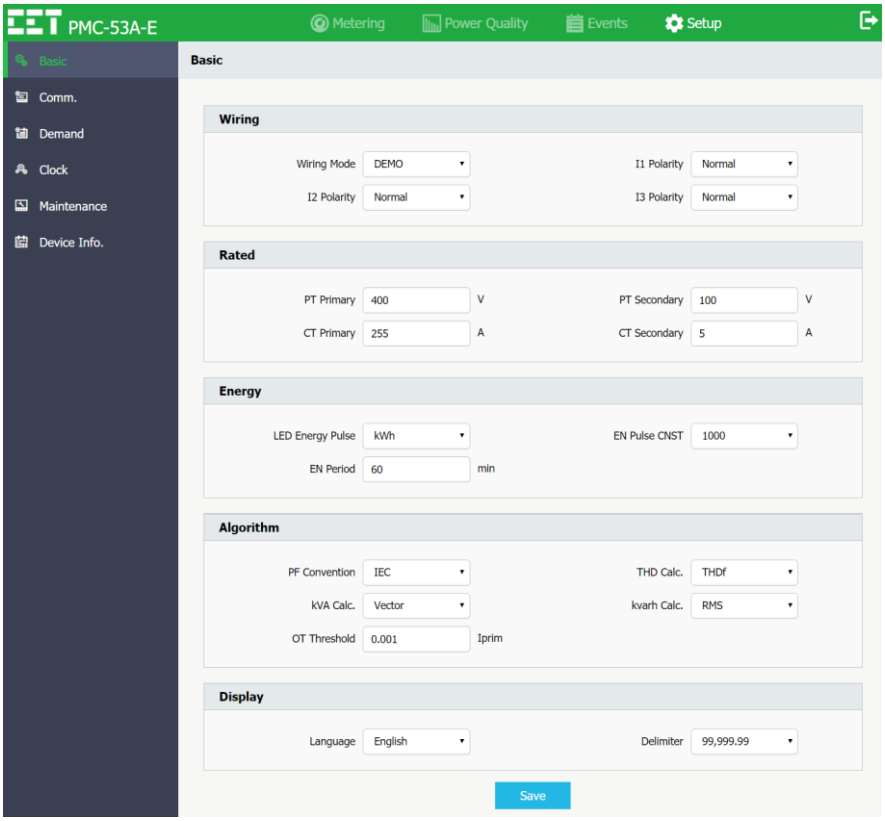
Power Quality



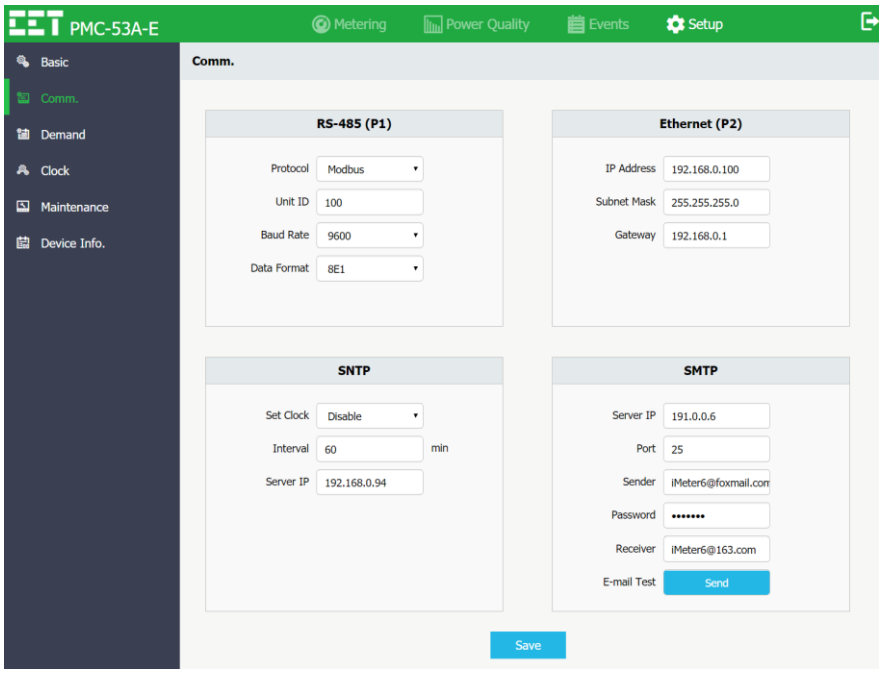
	U1	U2	U3	I1	I2	I3
THD	5.668 %	5.697 %	5.692 %	11.50 %	11.52 %	11.52 %
TOHD	5.663 %	5.692 %	5.687 %	11.49 %	11.51 %	11.51 %
TEHD	0.237 %	0.236 %	0.238 %	0.505 %	0.515 %	0.506 %
Crest Factor	--	--	--	1.419	1.410	1.411
K-Factor	--	--	--	1.274	1.278	1.278
TDD	--	--	--	11.50 %	11.52 %	11.52 %

No.	%HD	No.	%HD	No.	%HD	No.	%HD
02	0.172 %	10	0.000 %	18	0.103 %	26	0.000 %
03	3.267 %	11	1.537 %	19	0.000 %	27	0.000 %
04	0.127 %	12	0.000 %	20	0.000 %	28	0.000 %
05	2.833 %	13	1.087 %	21	0.000 %	29	0.000 %
06	0.000 %	14	0.000 %	22	0.000 %	30	0.000 %
07	2.391 %	15	0.655 %	23	0.000 %	31	0.000 %

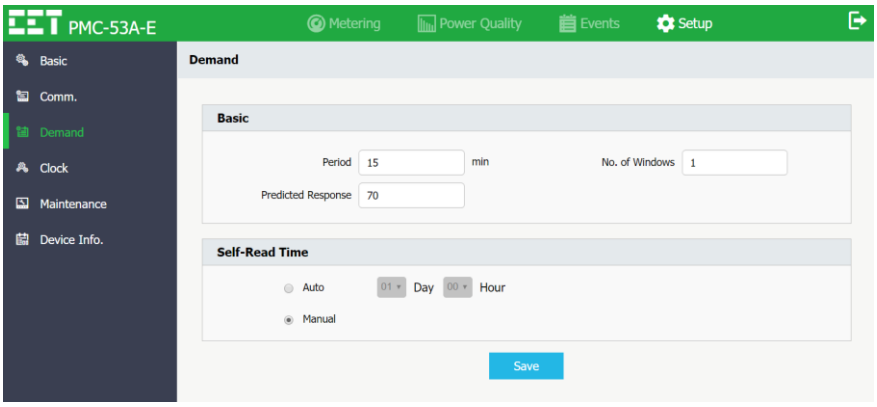
	Sym. Comp. & Unb.	Displays Positive, Negative, and Zero Sequence as well as Unbalance for Voltage and Current
		
Events	SOE	Display the SOE events with timestamps such as DI/DO Changes, Setpoint Alarms, Setup Changes, etc.
		
Setup	Basic[1]	Basic settings such as Wiring Mode, I1/I2/I3 Polaity, PT/CT Primary/Secondary and other setup parameters.



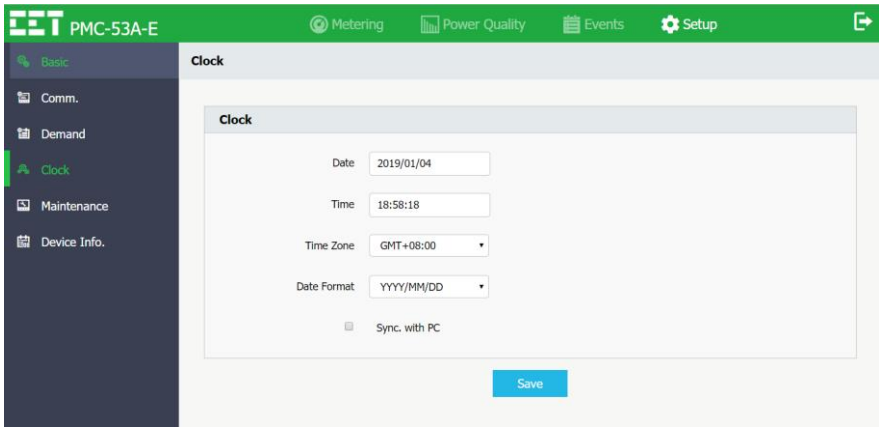
Comm.	RS-485 (P1), Ethernet (P2), SNTP and SMTP configuration.



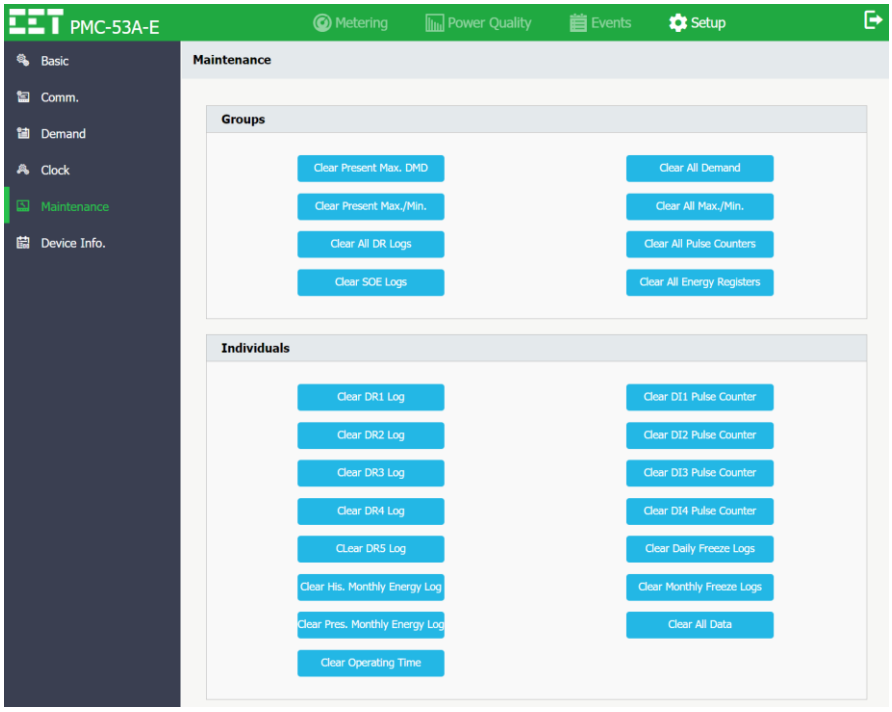
Demand	Demand and Self-Read Time configuration



Clock	Clock Settings including Date, Time, Time Zone and Date Format.



Maintenance[2]	Clear operation for different values and logs by group or individually.



Device Info.	Serial Number, MAC Address, Firmware Version and Date.

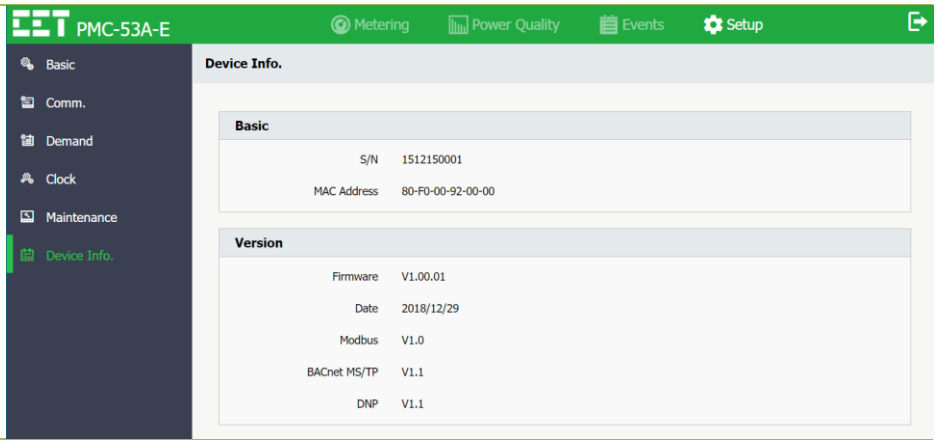
	

Table 3-15 Detailed Description of the On-board Web Server

Notes:

1. The following table illustrates the Range and Default Value for each parameter:

Parameter	Range/Default*	Parameter	Range/Default*	Parameter	Range/Default*
Wiring Mode	DEMO, 1P2W L-N, 1P2W L-L, 3P3W, 3P4W*				
CT Polarity					
I1	Reverse/Normal*	I2	Reverse/Normal*	I3	Reverse/Normal*
Rated Parameters					
PT Primary	1 to 1000000V; 100V*	CT Primary	1 to 30000A; 5A*	I4 Primary#	1 to 30000A; 5A*
PT Secondary	1 to 690V; 100V*	CT Secondary	1 to 5A; 5A*	I4 Secondary#	1 to 5A; 5A*
Energy Parameters					
LED Energy Pulse	Disabled/kvar/kW*	EN Pulse CNST	1000*/3200/6400	EN Period	5 to 60* minutes
Algorithm					
PF Convention	IEC*, IEEE, -IEEE	THD Cal.	THDf*/THDr	kVA Cal.	Vector*, Scalar
kvar Cal.	RMS*, Fund	OT Threshold	1 to 1000 (x0.001 Iprim)		
Display					
Language	English*		Delimiter	99,999.999* or 99 999,999	

This parameter only appears if the meter is equipped with the corresponding I4 option.

Table 3-16 Basic Setup Parameters

2. This web page allows the user to perform the following Clear functions:

Category	Button	Function
Groups	Clear Present Max. Demand	Clear Max. Demand of This Month
	Clear Present Max./Min	Clear Max./Min. Log of This Month
	Clear All DR Logs	Clear all the Data Recorder Logs
	Clear SOE Logs	Clear SOE Logs
	Clear All Demand	Clear all Demand registers and logs (including Present/Peak Demand for This/Last Month or Since/Before Last Reset)
	Clear All Max./Min.	Clear Max./Min. Log of This Month (Since Last Reset) and Last Month (Before Last Reset).
	Clear All Pulse Counters	Clear All Pulse Counters
	Clear All Energy Registers	Clear 3-Ø Total and Per-Phase Energy registers (including TOU and Interval Energy)
Individuals	Clear DR1 Log	Clear Data Recorder 1's Log
	Clear DR2 Log	Clear Data Recorder 2's Log
	Clear DR3 Log	Clear Data Recorder 3's Log
	Clear DR4 Log	Clear Data Recorder 4's Log
	Clear DR5 Log	Clear Data Recorder 5's Log
	Clear His. Monthly Energy Log	Clear Monthly Energy Log of the last 1 to 12 months
	Clear Pres. Monthly Energy Log	Clear Monthly Energy Log of the Present Month
	Clear DI1 Pulse Counter	Clear DI1 Pulse Counter
	Clear DI2 Pulse Counter	Clear DI2 Pulse Counter
	Clear DI3 Pulse Counter	Clear DI3 Pulse Counter
	Clear DI4 Pulse Counter	Clear DI4 Pulse Counter
	Clear Daily Freeze Logs	Clear all Daily Freeze Logs
	Clear Monthly Freeze Logs	Clear All Monthly Freeze Logs
	Clear All Data	Perform the Clear operation for all of the above

Table 3-17 Clear Operations

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 the Digital Inputs are available on the Front Panel LCD Display as well as through communications. Changes in Digital Input status are stored as events in the SOE Log in 1 ms resolution.

2) **Pulse Counting** — Pulse 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 1000 (ms) (Default=20ms)
DIx Pulse Weight	Specifies the incremental value for each received pulse. This is only used when a DI is configured as a Pulse Counter.	1* to 1,000,000

Default*

Table 4-1 DI Setup Parameters

4.1.2 Digital Outputs

The 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

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 1000/3200/6400 pulses per kWh/kvarh through the **EN Pulse CNST** setup parameter.

4.1.4 Analog Input

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 100, and the **AI ZERO** parameter should be programmed with the value -25. Therefore, when the output of the sensor is 20mA, the reading will be 100.00°C. When the output is 4mA, the reading will be -25.00°C. When the output is 12mA, the reading will be (100°C - (-25°C)) x (12mA-4mA) / (20mA-4mA) + (-25°C) = 37.50°C.

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	-
kW	●	●	●	●	-
kvar	●	●	●	●	-
kVA	●	●	●	●	-
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, kW, kvar, kVA and Power Factor are reserved.
2) 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 0.1 and a maximum value of ±99,999,999.9. When the maximum value is reached, the energy registers will automatically roll over to zero. The energy can be reset manually through the Front Panel or via communications. Further, the kWh/kvarh Import and Export for Per-Phase and Total, and the kVAh for Per-Phase and Total can be reset 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, kvar 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 average power consumption over a fixed interval (usually 15 minutes) based on the Sliding Window method. The PMC-53A-E provides Present Demand and Predicted Demand for Ia, Ib, Ic, kW Total, kvar Total and kVA Total, updated once a second, as well as Max Demand for Ia, Ib, Ic, kW Total, kvar Total and kVA Total of TOU Tariff 1 to 8 in This Month (Since Last Reset) and Last Month (Before Last Reset). Only Import Demand is provided for kW Total, kvar total and kVA Total. Predicted Demand is typically used for pre-alarming and to help users reduce power consumption using a Setpoint to warn that the Demand limit may be exceeded.

The PMC-53A-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: 6033)	The **Self-Read Time** allows the user to specify the time and day of the month for the Peak Demand Self-Read operation. The **Self-Read Time** supports three options: • A zero value means that the Self-Read will take place at 00:00 of the first day of each month. • A non-zero value means that the Self-Read will take place at a specific time and day based on the formula: Self-Read Time = Day * 100 + Hour where 0 ≤ Hour ≤ 23 and 1 ≤ Day ≤ 28. For example, the value 1512 means that the Self-Read will take place at 12:00pm on the 15th day of each month. • A 0xFFFF value will disable the Self-Read operation and replace it with manual operation. A manual reset will cause the Max. Demand of **This Month** to be transferred to the Max. Demand of **Last Month** and then reset. The terms **This Month** and **Last Month** will become **Since Last Reset** and **Before Last Reset**.	Default=0xFFFF
Predicted Response	The Predicated Response shows the speed of the	70 to 99

(Register: 6031)	predicted demand output. A value between 70 and 99 is recommended for a reasonably fast response. Specify a higher value for higher sensitivity.	Default=70

Table 4-4 Demand Setup

4.3 Power Quality

4.3.1 Phase Angles

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

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

4.3.2 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.

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

where

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

and

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

4.3.3 Harmonics

The PMC-53A-E provides Voltage and Current with THD, TOHD, TEHD and up to the 31st 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.

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

	Phase A/AB	Phase B/BC	Phase C/CA
Harmonic-Voltage	THD	THD	THD
	TEHD	TEHD	TEHD
	TOHD	TOHD	TOHD
	2nd Harmonics	2nd Harmonics	2nd Harmonics
		…	
	31st Harmonics	31st Harmonics	31st Harmonics
Harmonic-Current	THD	THD	THD
	TEHD	TEHD	TEHD
	TOHD	TOHD	TOHD
	TDD	TDD	TDD
	TEDD	TEDD	TEDD
	TODD	TODD	TODD
	K-Factor	K-Factor	K-Factor
	Crest Factor	Crest Factor	Crest Factor
	2nd Harmonics	2nd Harmonics	2nd Harmonics
		…	
	31st Harmonics	31st Harmonics	31st Harmonics

Table 4-5 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:

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

THDr:

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

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

4.4 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.

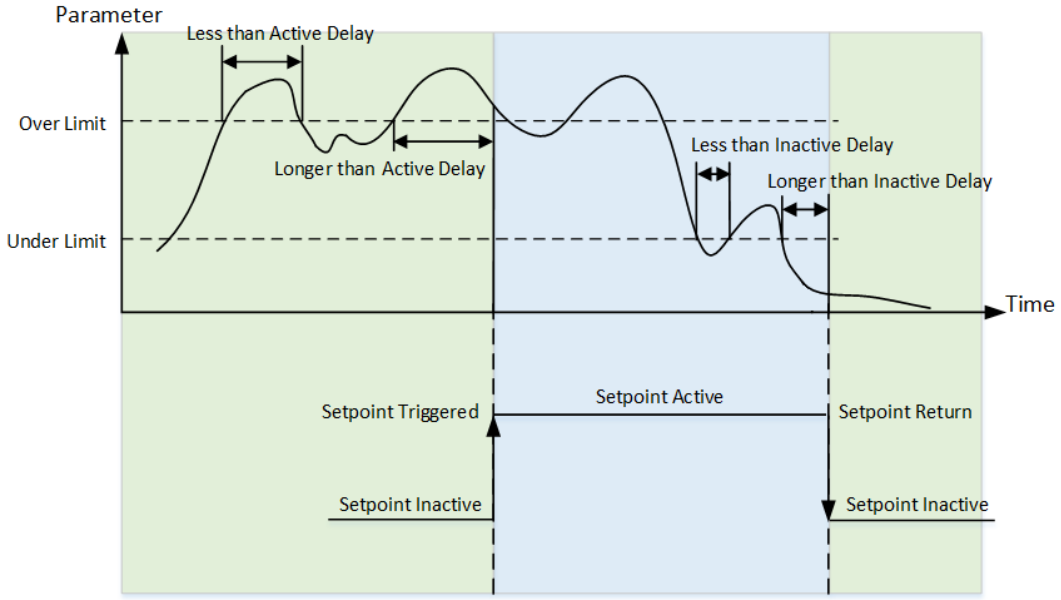


Figure 4-1 Over Setpoint

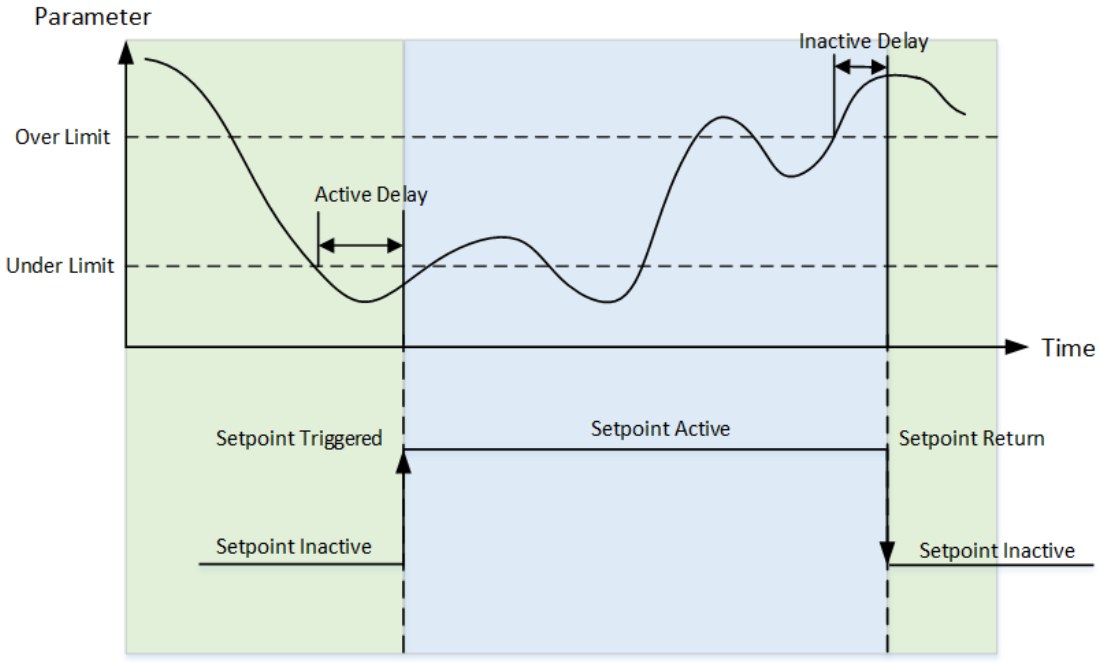


Figure 4-2 Under Setpoint

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

Setup Parameter	Definition	Options/Default*
Setpoint Type	Over or Under Setpoint.	0=Over Setpoint* 1=Under Setpoint
Setpoint Parameter	Specify the parameter to be monitored.	**See Table 4-7**
Over Limit	Specify the value that the setpoint parameter must exceed for Over Setpoint to become active or for Under Setpoint to become inactive.	0*

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

Table 4-6 Description for Setpoint Parameters

The table below illustrates the Setpoint Parameters. 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 (kW Total)		0.001	W
7	Q (kvar Total)			var
8	S (kVA Total)			VA
9	PF (PF Total)			-
10	P DMD (kW Total Present Demand)			W
11	Q DMD (kvar Total Present Demand)			var
12	S (kVA Total Present Demand)			VA
13	P DMD Pred (kW Total Predicted Demand)			W
14	Q DMD Pred (kvar Total Predicted Demand)			var
15	S DMD Pred (kVA Total Predicted Demand)			VA
16	U THD		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, 2]	-	-	-
25	I4 (Measured)*	x1	0.001	A
26	AI*		1	-
27	IR (Residual Current) *	x1	0.001	A
28	U2 (Voltage Negative Sequence Component)	x1		V
29	U0 (Voltage Zero Symmetrical Component)			

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

Table 4-7 Setpoint Parameters

Notes:

3. When **Reversal** is set as the **Setpoint Parameter**, the **Setpoint Type** should be set to 1 (i.e., Over Setpoint). The **Setpoint Type**=2 (i.e., Under Setpoint) is invalid.
4. When **Reversal** is set as the **Setpoint Parameter** (with **Setpoint Type**=1), the **Over Limit** should be set as 0 and **Under Limit should be** as 1. The logic diagram for the Phase Reversal setpoint is illustrated in the following figure:

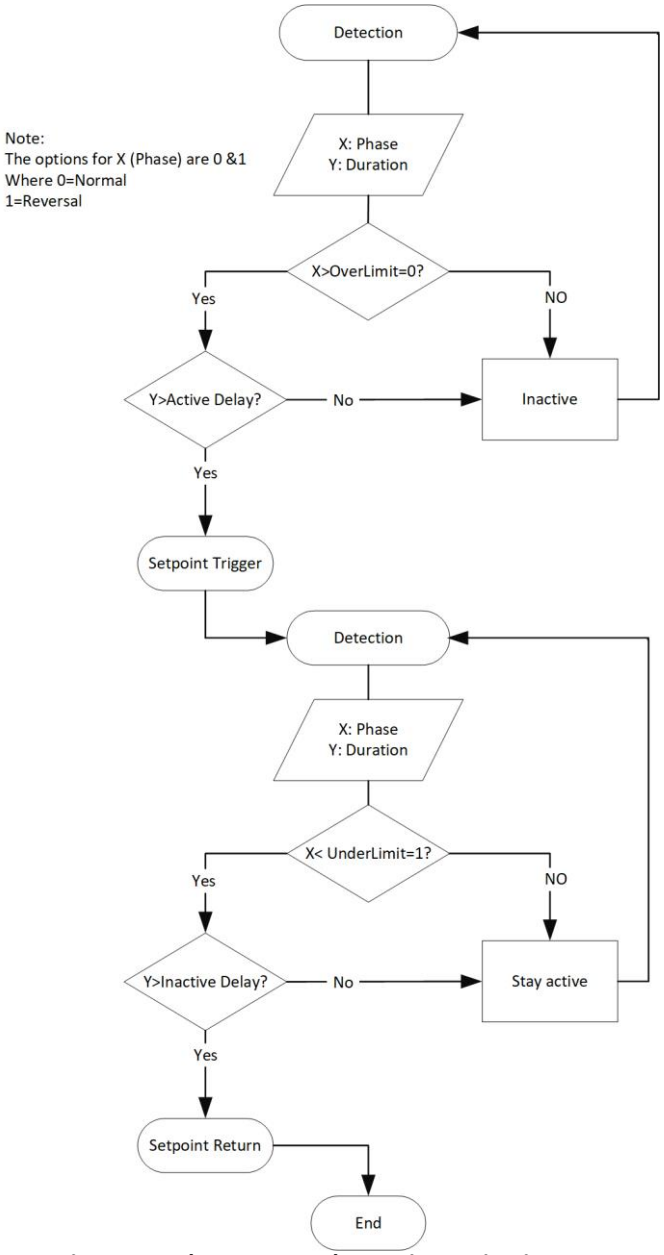


Figure 4-3 Phase Reversal Setpoint Logic Diagram

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

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

Table 4-8 Setpoint Trigger

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 avg	Uab	Ubc
Uca	Ull avg	Ia	Ib	Ic	I avg

kWa	kWb	kWc	kW Total	kvara	kvarb
kvarc	kvar Total	kVAa	kVAb	kVAc	kVA Total
PFa	PFb	PFc	PF Total	Frequency	Inc
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 Unbal.	I Unbal.	I4	Ir		

Table 4-9 Max/Min Log

The same **Self-Read Time** for the Peak 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 Peak Demand Log

The PMC-53A-E records the **Peak Demand** of **This Month (Since Last Reset)** and **Last Month (Before Last Reset)** with timestamp for Ia, Ib, Ic, kW Total, kvar Total and kVA Total as well as kW Total, kvar Total and kVA Total for TOU Tariffs 1 to 8. The Peak Demand of This Month (Since Last Reset) can be accessed via the Front Panel and through communications while the Peak 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.

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

Table 4-10 Peak Demand Log

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

Table 4-12 Freeze Log

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

1) **Daily Freeze Self-Read Time** can be set to a zero value or a non-zero value:
   - A zero value means that the Self-Read will take place at 00:00 everyday.
   - A non-zero value means that the Self-Read will take place at a specific time of the day based on the formula: Self-Read time = (Hour x 100 + Min) where 0 ≤ 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 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.

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

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)	5760
Recording Interval	60 to 3,456,000 seconds	900 s
Offset Time	0 to 43,200 seconds, 0 indicates no offset	0
Number of Parameters	0 to 16	16
Parameter 1 to 16	See **Appendix A** for a complete list of parameters	See **Appendix B**

Table 4-13 Setup Parameters for Data Recorder

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

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

4.6 Time of Use (TOU)

TOU is used for electricity pricing that varies depending on the time of day, day of week, and season. The TOU system allows the user to configure an electricity price schedule inside the PMC-53A-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 in 15-min intervals. Up to 20 Daily Profiles can be programmed for each TOU schedule.	1 to 20, the first period starts at 00:00 and the last period ends at 24:00.
Season #	A year can be divided into a maximum of 12 seasons. Each season is specified with a Start Date and ends with the next season's Start Date.	1 to 12, starting from January 1st
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. The 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

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

TOU data is available through the Front Panel (excluding Peak Demand for Last Month) and communications.

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 5.11.1 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**	192.168.0.94

Table 4-17 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[5]	See Note 2)
Password	SMTP Server's logon password for Sender's email address	See Note 3)
Receiver	Receiver's email address[5]	See Note 4)

Table 4-18 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) The default **Sender**'s email address is PMC-53A-E@foxmail.com.
3) The **Password** should not exceed 20 ASCII Characters.
4) The default **Receiver**'s email address is PMC-53A-E@163.com. Only one Receiver email address is supported.
5) Both the **Sender** and **Receiver** setup parameters should not exceed 36 ASCII characters.

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.

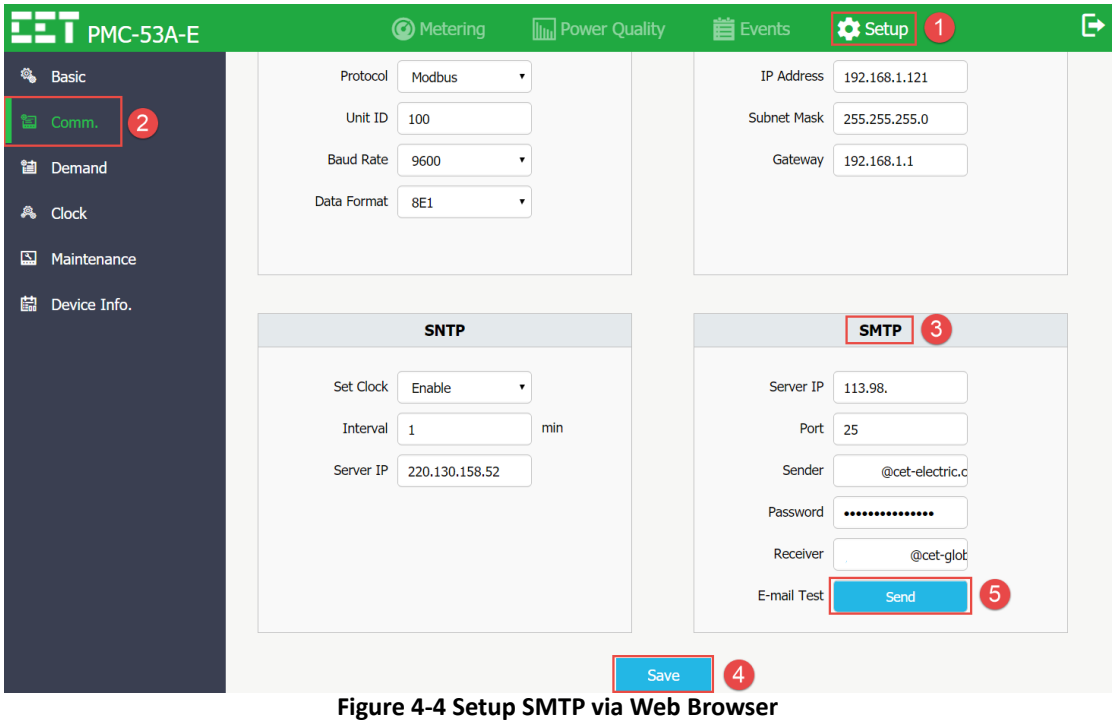


Figure 4-4 Setup SMTP via Web Browser

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** 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.

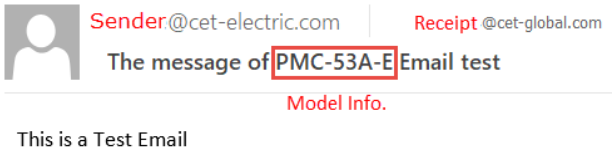


Figure 4-5 Example of a Test Email

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

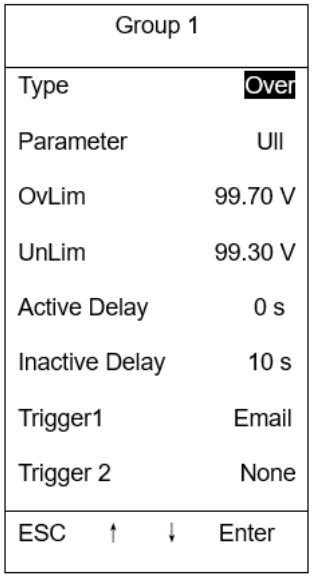


Figure 4-6 Over Ull Setpoint Configuration via Panel

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.

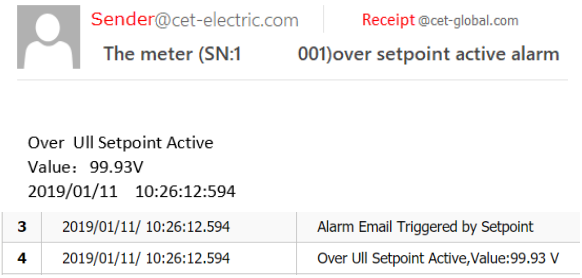


Figure 4-7 Email Alarm Results

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 RS485-enabled devices (e.g. PMC-53A) via the PMC-53A-E's Ethernet (P2) and RS485 port (P1). This eliminates the need for an additional, external Ethernet-to-RS485 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 RS485 port (P1). The RS485-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-53AE's Ethernet Gateway:

1) Go to **Setup**-> **Comm.**-> **RS485 (P1)** to change the **Protocol** setup parameter from the default setting of **Modbus** to **Gateway,** either via the Web Interface or Front Panel .

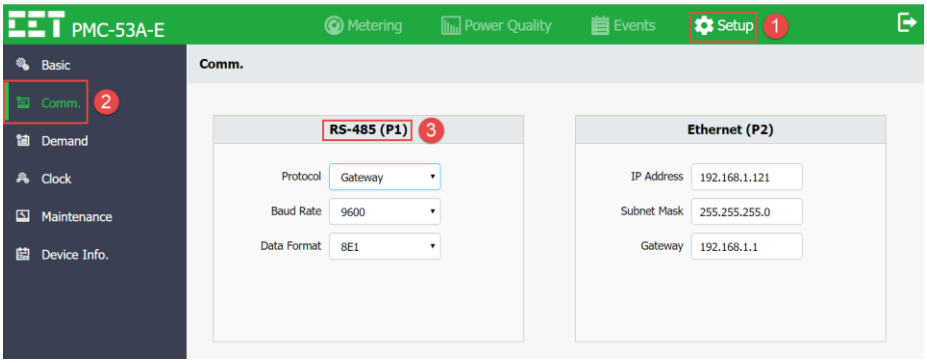


Figure 4-7 Select "Gateway" Mode on Web Server

2) Connect the RS485-enabled devices (i.e. PMC-53A) to the RS485 port (P1) of the PMC-53A-E.

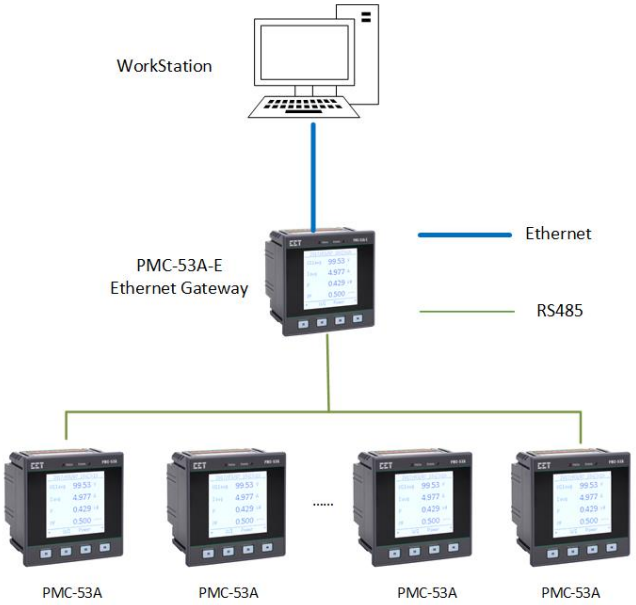


Figure 4-8 Typical Application for Ethernet Gateway

3) Configure the Master Software (e.g. PecStar iEMS) on the WorkStation to communicate with the RS485-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 RS485 port and the RS485-enabled devices.

5) The Master Software should be able to communicate with the RS485-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
- kW 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
- kW is kW Import, which means the kW is over 0
- 3P4W wiring mode supports all detections
- 3P3W wiring mode does not support the detection of Voltage Phase Loss, kW Direction per phase and CT Polarity

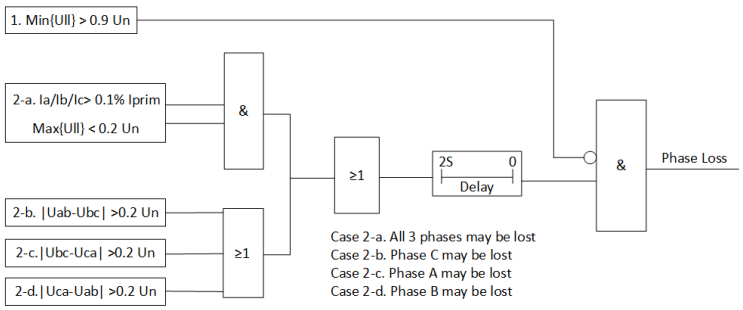
The Diagnostic register (0101) illustrated below indicates the status of the various wiring error detection with a bit value of 1 meaning active and 0 meaning inactive:

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 kW Total may be abnormal (3P4W or 3P3W)
B09	Negative kWa may be abnormal (3P4W only)
B10	Negative kWb may be abnormal (3P4W only)
B11	Negative kWc may be abnormal (3P4W only)
B12	CTa polarity may be reversed (3P4W only)
B13	CTb polarity may be reversed (3P4W only)
B14	CTc polarity may be reversed (3P4W only)
B15	Disconnection of Residual Current Input

Table 4-19 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).



where Un and Iprim represents the Voltage and Current nominal in Primary values

Figure 4-9 Voltage Phase Loss Logic

4.8.2 Current Phase Loss

The Current Phase Loss diagnostic is based on the two detections below (During Current Phase Loss, the Current Phase Reversal Detection is invalid):

1. Max {Ia, Ib, Ic} ≥ 0.1% Iprim
2. Min {Ia, Ib, Ic} = 0

4.8.3 Phase Reversal

The Phase Reversal is based on the Voltage/Current Angles detection. Following is the logic diagram.

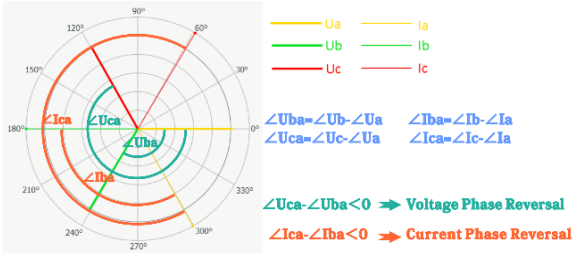


Figure 4-10 Phase Reversal Logic

Chapter 5 Modbus Register Map

This chapter provides a complete description of the Modbus register map (**Protocol Version 1.0**) for the PMC-53A-E to facilitate the development of 3rd party communications driver for accessing information on the PMC-53A-E. For a complete Modbus Protocol Specification, please visit http://**www.modbus.org**. 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)

The following table provides a description of the different data formats used for the Modbus registers. The PMC-53A-E uses the Big Endian byte ordering system.

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

5.1 Basic Measurements

Register	Property	Description	Format	Scale	Unit
0000	RO	Uan	Float	x1	V
0002	RO	Ubn	Float		
0004	RO	Ucn	Float		
0006	RO	Uln Average	Float		
0008	RO	Uab	Float		
0010	RO	Ubc	Float		
0012	RO	Uca	Float		
0014	RO	Ull Average	Float		
0016	RO	Ia	Float		A
0018	RO	Ib	Float		
0020	RO	Ic	Float		
0022	RO	I Average	Float		
0024	RO	kWa	Float		W
0026	RO	kWb	Float		
0028	RO	kWc	Float		
0030	RO	kW Total	Float		
0032	RO	kvara	Float		var
0034	RO	kvarb	Float		
0036	RO	kvarc	Float		
0038	RO	kvar Total	Float		
0040	RO	kVAa	Float		VA
0042	RO	kVAb	Float		
0044	RO	kVAc	Float		
0046	RO	kVA Total	Float		
0048	RO	PFa	Float		-
0050	RO	PFb	Float		-
0052	RO	PFc	Float		-
0054	RO	PF Total	Float		-
0056	RO	Frequency	Float		Hz
0058	RO	Uan/Uab (3P3W) Angle	Float		°
0060	RO	Ubn/Ubc (3P3W) Angle	Float		°
0062	RO	Ucn/Uca (3P3W) Angle	Float		°
0064	RO	Ia Angle	Float		°
0066	RO	Ib Angle	Float		°
0068	RO	Ic Angle	Float		°
0070	RO	In (Calculated)	Float		A
0072	RO	I4[1]	Float		
0074	RO	Displacement PFa	Float		-
0076	RO	Displacement PFb	Float		-
0078	RO	Displacement PFc	Float		-
0080	RO	Displacement PF Total	Float		-

0082	RO	AI[1] Scaled	Float		-
0084	RO	Iresidual[1]	Float		-
0086~0095	RO	Reserved	Float		-
0096	RO	DI Status[1,2]	UINT16		-
0097	RO	Reserved	UINT16		-
0098	RO	DO Status[1,3]	UINT16		-
0099	RO	Reserved	UINT16		-
0100	RO	Setpoint Status[4]	UINT16		-
0101	RO	Wiring Diagnostic Status[5]	UINT16		-
0102	RO	SOE Log Pointer[6]	UINT32		-
0104	RO	Device Operating Time[7]	UINT32	x0.1	0.1Hour
0106~0111	RO	Reserved	UINT32		-
0112	RO	Phase A Fundamental kW	Float	x1	W
0114	RO	Phase B Fundamental kW	Float		
0116	RO	Phase C Fundamental kW	Float		
0118	RO	Total Fundamental kW	Float		
0120	RO	Total Harmonic kW	Float		
0122	RO	DR #1 Log Pointer[6]	UINT32	-	-
0124	RO	DR #2 Log Pointer[6]	UINT32	-	-
0126	RO	DR #3 Log Pointer[6]	UINT32	-	-
0128	RO	DR #4 Log Pointer[6]	UINT32	-	-
0130	RO	DR #5 Log Pointer[6]	UINT32	-	-
0132	RO	Daily Freeze Log Pointer[8]	UINT16	-	-
0133	RO	Monthly Freeze Log Pointer[8]	UINT16	-	-
0134~0148	RO	Reserved	UINT32		-
0150	RO	Uan/Uab (3P3W, 1P2W LL) Fundamental	Float	x1	V
0152	RO	Ubn/Ubc (3P3W) Fundamental[9]	Float		
0154	RO	Ucn/Uca (3P3W) Fundamental[9]	Float		
0156	RO	Ia Fundamental	Float	x1	A
0158	RO	Ib Fundamental[9]	Float		
0160	RO	Ic Fundamental[9]	Float		
0162	RO	U1 (Positive Sequence Voltage)[10]	Float	x1	V
0164	RO	U2 (Negative Sequence Voltage)[10]	Float		
0166	RO	U0 (Zero Sequence Voltage)[10]	Float		
0168	RO	I1 (Positive Sequence Current)[10]	Float	x1	A
0170	RO	I2 (Negative Sequence Current)[10]	Float		
0172	RO	I0 (Zero Sequence Current)[10]	Float		

Table 5-1 Basic Measurements

Notes:

1) I4, AI, Ir, DI Status and DO Status are only meaningful if the meter is equipped with the corresponding option.
2) 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).
3) For the **DO Status** register, the bit values of B0 to B1 represent the states of DO1 and DO2, respectively, with "1" meaning Active (Closed) and "0" meaning Inactive (Open).
4) For the **Setpoint Status** register, the bit values indicate the various Setpoint states with "1" meaning Active and "0" meaning Inactive. The following table illustrates the details of the **Alarm Status** register.

Bit15	**Bit14**	**Bit13**	**Bit12**	**Bit11**	**Bit10**	**Bit9**	**Bit8**
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Setpoint9
Bit7	**Bit6**	**Bit5**	**Bit4**	**Bit3**	**Bit2**	**Bit1**	**Bit0**
Setpoint8	Setpoint7	Setpoint6	Setpoint5	Setpoint4	Setpoint3	Setpoint2	Setpoint1

Table 5-2 Setpoint Alarm Status Register

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

Bit	**Event**
B00	Summary Bit (Set if any other bit is set)
B01	Frequency is out of range (45 to 65Hz) (3P4W or 3P3W)
B02	Voltage Phase Loss (3P4W 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 kW Total may be abnormal (3P4W or 3P3W)
B09	Negative kWa is may be abnormal (3P4W only)
B10	Negative kWb may be abnormal (3P4W only)
B11	Negative kWc may be abnormal (3P4W only)
B12	CTa polarity may be reversed (3P4W only)

B13	CTb polarity may be reversed (3P4W only)
B14	CTc polarity may be reversed (3P4W only)
B15	Disconnection of Residual Current Input

Table 5-3 Wiring Diagnostic Status Register

6) 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 **5.11.5 Data Recorder Setup**)
7) 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.
8) The range of the Log Pointer for Daily Freeze Log and Monthly Freeze Log is between 0 and 0xFFFF.
9) When the **Wiring Mode** is **1P2W L-N** or **1P2W L-L**, the L2 and L3 phase voltages and currents have no meaning, and their registers are reserved.
10) When the **Wiring Mode** is **1P2W L-N, 1P2W L-L** or **1P3W**, the Sequence Components U1/I1, U2/I2 and U0/I0 have no meaning and their registers are reserved.

5.2 Energy Measurements

The Energy registers have a maximum value of 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.

5.2.1 3-Phase Total Energy Measurements

Register	Property	Description	Format	Scale	Unit
0500	RW	kWh Import	INT32	x0.1	kWh
0502	RW	kWh Export	INT32		
0504	RO	kWh Net	INT32		
0506	RO	kWh Total	INT32		
0508	RW	kvarh Import	INT32		kvarh
0510	RW	kvarh Export	INT32		
0512	RO	kvarh Net	INT32		
0514	RO	kvarh Total	INT32		
0516	RW	kVAh	INT32		kVAh
0518	RW	kvarh Q1	INT32		kvarh
0520	RW	kvarh Q2	INT32		
0522	RW	kvarh Q3	INT32		
0524	RW	kvarh Q4	INT32		
0526	RW	kWh Import of T1	INT32		kWh
0528	RW	kWh Export of T1	INT32		
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 5-4 3-phase Total Energy Measurements

5.2.2 Phase A (L1) Energy Measurements

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

0704	RW	kVAh of T6	INT32		kVAh
0706	RW	kWh Import of T7	INT32		kWh
0708	RW	kWh Export of T7	INT32		
0710	RW	kvarh Import of T7	INT32		kvarh
0712	RW	kvarh Export of T7	INT32		
0714	RW	kVAh of T7	INT32		kVAh
0716	RW	kWh Import of T8	INT32		kWh
0718	RW	kWh Export of T8	INT32		
0720	RW	kvarh Import of T8	INT32		kvarh
0722	RW	kvarh Export of T8	INT32		
0724	RW	kVAh of T8	INT32		kVAh

Table 5-5 Phase A Energy Measurements

5.2.3 Phase B (L2) Energy Measurements

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

0840	RW	kvarh Import of T8	INT32		kvarh
0842	RW	kvarh Export of T8	INT32		
0844	RW	kVAh of T8	INT32		kVAh

Table 5-6 Phase B Energy Measurements

5.2.4 Phase C (L3) Energy Measurements

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

Table 5-7 Phase C Energy Measurements

5.2.5 Interval Energy Measurements

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

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

Table 5-8 Interval Energy Measurements

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.

5.3 DI Pulse Counters

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

Table 5-9 DI Pulse Counter

5.4 Power Quality Measurements

5.4.1 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		
1332	RO	Current Unbalance	Float		

Table 5-10 Power Quality Measurements

5.4.2 Current Harmonic Measurements

Register	Property	Description	Format	Scale	Unit
1400	RO	Ia THD	Float	x1	% (0.1 means 10%)
1402	RO	Ib THD	Float		
1404	RO	Ic THD	Float		
1406	RO	Ia TOHD	Float		
1408	RO	Ib TOHD	Float		
1410	RO	Ic TOHD	Float		
1412	RO	Ia TEHD	Float		
1414	RO	Ib TEHD	Float		
1416	RO	Ic TEHD	Float		
1418	RO	Ia HD02	Float		
1420	RO	Ib HD02	Float		
1422	RO	Ic HD02	Float		
1424~1590	RO	…	Float		
1592	RO	Ia HD31	Float		
1594	RO	Ib HD31	Float		
1596	RO	Ic HD31	Float		

Table 5-11 Current Harmonic Measurements

5.4.3 Voltage Harmonic Measurements

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

Table 5-12 Voltage Harmonic Measurements

Notes:

1) When the **Wiring Mode** is **3P3W** or **1P2W L-L**, the phase A/B/C Voltage THD/TOHD/TEHD/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.

5.5 Demands

5.5.1 Present Demands

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

Table 5-13 Present Demand Measurements

5.5.2 Predicted Demands

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

Table 5-14 Predicted Demand Measurements

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

Register	Property	Description	Format	Scale	Unit
3400~3405	RO	Ia	See **Section 5.5.5 Demand Data Structure**	x1	A
3406~3411	RO	Ib			
3412~3417	RO	Ic			
3418~3423	RO	kW Total			W
3424~3429	RO	kvar Total			var
3430~3435	RO	kVA Total			VA
3436~3441	RO	kW Total of T1			W
3442~3447	RO	kvar Total of T1			var
3448~3453	RO	kVA Total of T1			VA
3454~3459	RO	kW Total of T2			W
3460~3465	RO	kvar Total of T2			var
3466~3471	RO	kVA Total of T2			VA
3472~3477	RO	kW Total of T3			W

3478~3483	RO	kvar Total of T3			var
3484~3489	RO	kVA Total of T3			VA
3490~3495	RO	kW Total of T4			W
3496~3501	RO	kvar Total of T4			var
3502~3507	RO	kVA Total of T4			VA
3508~3513	RO	kW Total of T5			W
3514~3519	RO	kvar Total of T5			var
3520~3525	RO	kVA Total of T5			VA
3526~3531	RO	kW Total of T6			W
3532~3537	RO	kvar Total of T6			var
3538~3543	RO	kVA Total of T6			VA
3544~3549	RO	kW Total of T7			W
3550~3555	RO	kvar Total of T7			var
3556~3561	RO	kVA Total of T7			VA
3562~3567	RO	kW Total of T8			W
3568~3573	RO	kvar Total of T8			var
3574~3579	RO	kVA Total of T8			VA

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

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

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

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

5.5.5 Demand Data Structure

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

Table 5-17 Demand Data Structure

5.6 Max/Min Log

5.6.1 Max Log of This Month (Since Last Reset)

Register	Property	Description	Format	Scale	Unit
4000~4005	RO	Uan	See 5.6.5 Max/Min Log Structure	x1	V
4006~4011	RO	Ubn			
4012~4017	RO	Ucn			
4018~4023	RO	Uln Average			
4024~4029	RO	Uab			
4030~4035	RO	Ubc			
4036~4041	RO	Uca			
4042~4047	RO	Ull Average			
4048~4053	RO	Ia		x1	A
4054~4059	RO	Ib			
4060~4065	RO	Ic			
4066~4071	RO	I Average			
4072~4077	RO	kWa		x1	W
4078~4083	RO	kWb			
4084~4089	RO	kWc			
4090~4095	RO	kW Total			
4096~4101	RO	kvara		x1	var
4102~4107	RO	kvarb			
4108~4113	RO	kvarc			
4114~4119	RO	kvar Total			
4120~4125	RO	kVAa		x1	VA
4126~4131	RO	kVAb			
4132~4137	RO	kVAc			
4138~4143	RO	kVA Total			
4144~4149	RO	PFa		x1	-
4150~4155	RO	PFb			
4156~4161	RO	PFc			
4162~4167	RO	PF Total			
4168~4173	RO	Frequency		x1	Hz
4174~4179	RO	In (Calculated)		x1	A
4180~4185	RO	Uan/Uab THD		x1	-
4186~4191	RO	Ubn/Ubc THD			
4192~4197	RO	Ucn/Uca THD			
4198~4203	RO	Ia THD			
4204~4209	RO	Ib THD			
4210~4215	RO	Ic THD			
4216~4221	RO	Ia K-Factor			
4222~4227	RO	Ib K-Factor			
4228~4233	RO	Ic K-Factor			
4234~4239	RO	Ia Crest Factor			
4240~4245	RO	Ib Crest Factor			
4246~4251	RO	Ic Crest Factor			
4252~4257	RO	Voltage Unbalance			
4258~4263	RO	Current Unbalance			
4264~4269	RO	I4		x1	A
4270~4275	RO	Ir (Residual Current)			

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

5.6.2 Min Log of This Month (Since Last Reset)

Register	Property	Description	Format	Scale	Unit
4300~4305	RO	Uan	See 5.6.5 Max/Min Log Structure	x1	V
4306~4311	RO	Ubn			
4312~4317	RO	Ucn			
4318~4323	RO	Uln Average			
4324~4329	RO	Uab			
4330~4335	RO	Ubc			
4336~4341	RO	Uca			
4342~4347	RO	Ull Average			
4348~4353	RO	Ia		x1	A
4354~4359	RO	Ib			
4360~4365	RO	Ic			

4366~4371	RO	I Average			
4372~4377	RO	kWa		x1	W
4378~4383	RO	kWb			
4384~4389	RO	kWc			
4390~4395	RO	kW Total			
4396~4401	RO	kvara		x1	var
4402~4407	RO	kvarb			
4408~4413	RO	kvarc			
4414~4419	RO	kvar Total			
4420~4425	RO	kVAa		x1	VA
4426~4431	RO	kVAb			
4432~4437	RO	kVAc			
4438~4443	RO	kVA Total			
4444~4449	RO	PFa		x1	-
4450~4455	RO	PFb			
4456~4461	RO	PFc			
4462~4467	RO	PF Total			
4468~4473	RO	Frequency		x1	Hz
4474~4479	RO	In (Calculated)		x1	A
4480~4485	RO	Uan/Uab THD		x1	-
4486~4491	RO	Ubn/Ubc THD			
4492~4497	RO	Ucn/Uca THD			
4498~4503	RO	Ia THD			
4504~4509	RO	Ib THD			
4510~4515	RO	Ic THD			
4516~4521	RO	Ia K-Factor			
4522~4527	RO	Ib K-Factor			
4528~4533	RO	Ic K-Factor			
4534~4539	RO	Ia Crest Factor			
4540~4545	RO	Ib Crest Factor			
4546~4551	RO	Ic Crest Factor			
4552~4557	RO	Voltage Unbalance			
4558~4563	RO	Current Unbalance			
4564~4569	RO	I4		x1	A
4570~4575	RO	Ir (Residual Current)			

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

5.6.3 Max Log of Last Month (Before Last Reset)

Register	Property	Description	Format	Scale	Unit
4600~4605	RO	Uan	See 5.6.5 Max/Min Log Structure	x1	V
4606~4611	RO	Ubn			
4612~4617	RO	Ucn			
4618~4623	RO	Uln Average			
4624~4629	RO	Uab			
4630~4635	RO	Ubc			
4636~4641	RO	Uca			
4642~4647	RO	Ull Average			
4648~4653	RO	Ia		x1	A
4654~4659	RO	Ib			
4660~4665	RO	Ic			
4666~4671	RO	I Average			
4672~4677	RO	kWa		x1	W
4678~4683	RO	kWb			
4684~4689	RO	kWc			
4690~4695	RO	kW Total			
4696~4701	RO	kvara		x1	var
4702~4707	RO	kvarb			
4708~4713	RO	kvarc			
4714~4719	RO	kvar Total			
4720~4725	RO	kVAa		x1	VA
4726~4731	RO	kVAb			
4732~4737	RO	kVAc			
4738~4743	RO	kVA Total			
4744~4749	RO	PFa		x1	-
4750~4755	RO	PFb			

4756~4761	RO	PFc			
4762~4767	RO	PF Total			
4768~4773	RO	Frequency		x1	Hz
4774~4779	RO	In (Calculated)		x1	-
4780~4785	RO	Uan/Uab THD			
4786~4791	RO	Ubn/Ubc THD			
4792~4797	RO	Ucn/Uca THD			
4798~4803	RO	Ia THD			
4804~4809	RO	Ib THD			
4810~4815	RO	Ic THD			
4816~4821	RO	Ia K-Factor			
4822~4827	RO	Ib K-Factor			
4828~4833	RO	Ic K-Factor			
4834~4839	RO	Ia Crest Factor			
4840~4845	RO	Ib Crest Factor			
4846~4851	RO	Ic Crest Factor			
4852~4857	RO	Voltage Unbalance			
4858~4863	RO	Current Unbalance			
4864~4869	RO	I4		x1	A
4870~4875	RO	Ir (Residual Current)			

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

5.6.4 Min Log of Last Month (Before Last Reset)

Register	Property	Description	Format	Scale	Unit
4900~4905	RO	Uan	See 5.6.5 Max/Min Log Structure	x1	V
4906~4911	RO	Ubn			
4912~4917	RO	Ucn			
4918~4923	RO	Uln Average			
4924~4929	RO	Uab			
4930~4935	RO	Ubc			
4936~4941	RO	Uca			
4942~4947	RO	Ull Average			
4948~4953	RO	Ia		x1	A
4954~4959	RO	Ib			
4960~4965	RO	Ic			
4966~4971	RO	I Average			
4972~4977	RO	kWa		x1	W
4978~4983	RO	kWb			
4984~4989	RO	kWc			
4990~4995	RO	kW Total			
4996~5001	RO	kvara		x1	var
5002~5007	RO	kvarb			
5008~5013	RO	kvarc			
5014~5019	RO	kvar Total			
5020~5025	RO	kVAa		x1	VA
5026~5031	RO	kVAb			
5032~5037	RO	kVAc			
5038~5043	RO	kVA Total			
5044~5049	RO	PFa		x1	-
5050~5055	RO	PFb			
5056~5061	RO	PFc			
5062~5067	RO	PF Total			
5068~5073	RO	Frequency		x1	Hz
5074~5079	RO	In (Calculated)		x1	A
5080~5085	RO	Uan/Uab THD		x1	-
5086~5091	RO	Ubn/Ubc THD			
5092~5097	RO	Ucn/Uca THD			
5098~5103	RO	Ia THD			
5104~5109	RO	Ib THD			
5110~5115	RO	Ic THD			
5116~5121	RO	Ia K-Factor			
5122~5127	RO	Ib K-Factor			
5128~5133	RO	Ic K-Factor			
5134~5139	RO	Ia Crest Factor			
5140~5145	RO	Ib Crest Factor			

5146~5151	RO	Ic Crest Factor			
5152~5157	RO	Voltage Unbalance			
5158~5163	RO	Current Unbalance			
5164~5169	RO	I4		x1	A
5170~5175	RO	Ir (Residual Current)			

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

5.6.5 Max/Min Log Structure

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

Table 5-22 Max/Min Structure

5.7 Monthly Energy Log

Register	Property	Description	Format	Scale	Unit
0980	RW	Month[1]	INT16	0* to 12	
0981	RO	High-order Byte: Year (0-99) Low-order Byte: Month (1-12)	INT16	Time Stamp (20YY/MM/DD HH:MM:SS)	
0982	RO	High-order Byte: Day (1-31) Low-order Byte: Hour (0-23)	INT16		
0983	RO	High-order Byte: Minute (0-59) Low-order Byte: Second (0-59)	INT16		
0984	RW	kWh Import	INT32	x0.1	kWh
0986	RW	kWh Export	INT32		
0988	RO	kWh Net	INT32		
0990	RO	kWh Total	INT32		
0992	RW	kvarh Import	INT32	x0.1	kvarh
0994	RW	kvarh Export	INT32		
0996	RO	kvarh Net	INT32		
0998	RO	kvarh Total	INT32		
1000	RW	kVAh	INT32	x0.1	kVAh
1002	RW	kvarh Q1	INT32	x0.1	kvarh
1004	RW	kvarh Q2	INT32		
1006	RW	kvarh Q3	INT32		
1008	RW	kvarh Q4	INT32		
1010	RW	kWh Import of T1	INT32	x0.1	kWh
1012	RW	kWh Export of T1	INT32		
1014	RW	kvarh Import of T1	INT32	x0.1	kvarh
1016	RW	kvarh Export of T1	INT32		
1018	RW	kVAh of T1	INT32	x0.1	kVAh
1020	RW	kWh Import of T2	INT32	x0.1	kWh
1022	RW	kWh Export of T2	INT32		
1024	RW	kvarh Import of T2	INT32	x0.1	kvarh
1026	RW	kvarh Export of T2	INT32		
1028	RW	kVAh of T2	INT32	x0.1	kVAh
1030	RW	kWh Import of T3	INT32	x0.1	kWh
1032	RW	kWh Export of T3	INT32		
1034	RW	kvarh Import of T3	INT32	x0.1	kvarh
1036	RW	kvarh Export of T3	INT32		
1038	RW	kVAh of T3	INT32	x0.1	kVAh
1040	RW	kWh Import of T4	INT32	x0.1	kWh
1042	RW	kWh Export of T4	INT32		
1044	RW	kvarh Import of T4	INT32	x0.1	kvarh
1046	RW	kvarh Export of T4	INT32		
1048	RW	kVAh of T4	INT32	x0.1	kVAh
1050	RW	kWh Import of T5	INT32	x0.1	kWh
1052	RW	kWh Export of T5	INT32		
1054	RW	kvarh Import of T5	INT32	x0.1	kvarh
1056	RW	kvarh Export of T5	INT32		

1058	RW	kVAh of T5	INT32	x0.1	kVAh
1060	RW	kWh Import of T6	INT32	x0.1	kWh
1062	RW	kWh Export of T6	INT32		
1064	RW	kvarh Import of T6	INT32	x0.1	kvarh
1066	RW	kvarh Export of T6	INT32		
1068	RW	kVAh of T6	INT32	x0.1	kVAh
1070	RW	kWh Import of T7	INT32	x0.1	kWh
1072	RW	kWh Export of T7	INT32		
1074	RW	kvarh Import of T7	INT32	x0.1	kvarh
1076	RW	kvarh Export of T7	INT32		
1078	RW	kVAh of T7	INT32	x0.1	kVAh
1080	RW	kWh Import of T8	INT32	x0.1	kWh
1082	RW	kWh Export of T8	INT32		
1084	RW	kvarh Import of T8	INT32	x0.1	kvarh
1086	RW	kvarh Export of T8	INT32		
1088	RW	kVAh of T8	INT32	x0.1	kVAh

Table 5-23 Monthly Energy Log

Notes:

1) This register represents the Month when it is read. To read the Monthly Energy Log, this register must be first written to indicate to the 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.

5.8 Daily and Monthly Freeze Logs

5.8.1 Daily Freeze Log

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

Table 5-24 Daily Freeze Log

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.

5.8.2 Monthly Freeze Log

Register	Property	Description	Format	Scale	Unit
12500	RW	Index[1]	INT16	1 to 36	
12501	RO	High-order Byte: Year (0-99) Low-order Byte: Month (1-12)	INT16	-	
12502	RO	High-order Byte: Day (1-31) Low-order Byte: Hour (0-23)	INT16		
12503	RO	High-order Byte: Minute (0-59) Low-order Byte: Second (0-59)	INT16		
12504	RO	kWh Total	INT32	x0.1	kWh

12506	RO	kvarh Total	INT32	x0.1	kvarh
12508	RO	kVAh Total	INT32	x0.1	kVAh
12510~12515	RO	Peak Demand of kW Total	See Table 5-26 Demand Data Structure		
12516~12521	RO	Peak Demand of kvar Total			
12522~12527	RO	Peak Demand of kVA Total			

Table 5-25 Monthly Freeze Log

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

Table 5-26 Demand Data Structure

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.

5.9 SOE Log

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

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

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

Table 5-27 SOE Log

SOE Log Data Structure

Offset	Property	Description	Unit
+0	RO	Hi: Event Classification	See **Table 5-29 SOE Classification**
	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 5-28 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 5-40** 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 when Pulse Time out
	32	0		DO2 Released when Pulse Time out
3=Setpoint	1	1/0	Trigger Value / Return Value	Over Uln Setpoint Active/Return
	2	1/0		Over Ull Setpoint Active/Return
	3	1/0		Over Current Setpoint Active/Return
	4	1/0		Over In Setpoint Active/Return
	5	1/0		Over Frequency Setpoint Active/Return
	6	1/0		Over kW Total Setpoint Active/Return
	7	1/0		Over kvar Total Setpoint Active/Return
	8	1/0		Over kVA Total Setpoint Active/Return
	9	1/0		Over PF Total Setpoint Active/Return
	10	1/0		Over kW Total Present Demand Setpoint Active/Return
	11	1/0		Over kvar Total Present Demand Setpoint Active/Return
	12	1/0		Over kVA Total Present Demand Setpoint Active/Return
	13	1/0		Over kW Total Predicted Demand Setpoint Active/Return
	14	1/0		Over kvar Total Predicted Demand Setpoint Active/Return
	15	1/0		Over kVA Total Predicted Demand Setpoint Active/Return
	16	1/0		Over Voltage THD Setpoint Active/Return
	17	1/0		Over Voltage TOHD Setpoint Active/Return
	18	1/0		Over Voltage TEHD Setpoint Active/Return
	19	1/0		Over Current THD Setpoint Active/Return
	20	1/0		Over Current TOHD Setpoint Active/Return
	21	1/0		Over Current TEHD Setpoint Active/Return
	22	1/0		Over Voltage Unbalance Setpoint Active/Return
	23	1/0		Over Current Unbalance Setpoint Active/Return
	24	1/0		Reversal Phase Setpoint Active/Return
	25	1/0		Over I4 Setpoint Active/Return
	26	1/0		Over AI Setpoint Active/Return
	27			Over Ir (Residual Current) Setpoint Active/Return

	28	1/0		Over U2 (Negative Sequence) Setpoint Active/Return
	29	1/0		Over U0 (Zero Sequence) Setpoint Active/Return
	30~40			Reserved
	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 kW Total Setpoint Active/Return
	47	1/0		Under kvar Total Setpoint Active/Return
	48	1/0		Under kVA Total Setpoint Active/Return
	49	1/0		Under PF Total Setpoint Active/Return
	50	1/0		Under kW Total Present Demand Setpoint Active/Return
	51	1/0		Under kvar Total Present Demand Setpoint Active/Return
	52	1/0		Under kVA Total Present Demand Setpoint Active/Return
	53	1/0		Under kW Total Predicted Demand Setpoint Active/Return
	54	1/0		Under kvar Total Predicted Demand Setpoint Active/Return
	55	1/0		Under kVA Total Predicted Demand Setpoint Active/Return
	56	1/0		Under Voltage THD Setpoint Active/Return
	57	1/0		Under Voltage TOHD Setpoint Active/Return
	58	1/0		Under Voltage TEHD Setpoint Active/Return
	59	1/0		Under Current THD Setpoint Active/Return
	60	1/0		Under Current TOHD Setpoint Active/Return
	61	1/0		Under Current TEHD Setpoint Active/Return
	62	1/0		Under Voltage Unbalance Setpoint Active/Return
	63	1/0		Under Current Unbalance Setpoint Active/Return
	64	1/0		Under I4 Setpoint Active/Return
	65	1/0		Under AI Setpoint Active/Return
	66			Under Ir (Residual Current) Setpoint Active/Return
	67	1/0		Under U2 (Negative Sequence) Setpoint Active/Return
	68	1/0		Under U0 (Zero Sequence) Setpoint Active/Return
4=Self-diagnosis	1	1	0	System Parameter Fault
	2	1	0	Internal Parameter Fault
	3	1	0	TOU Parameter Fault
	4	1	0	Memory Fault
5=Operations	1	0	0	Power On
	2	0	0	Power Off
	3	0	0	Clear Present Energy via Panel[1]
	4	0	0	Clear Historical Monthly Energy Log via Panel[2]
	5	0	0	Clear Peak Demand Log of This Month (Since Last Reset) via the Front Panel
	6	0	0	Clear Present Demand, Peak Demand Log of This Month (Since Last Reset) and Last Month (Before Last Reset) via the Front Panel
	7	0	0	Clear Present Max/Min via Front Panel
	8	0	0	Clear All Max/Min via Front Panel

	9	0	0	Clear All Data via Front Panel[3]
	10	0	0	Clear SOE Log via Front Panel
	11	0	x=1 to 4	Clear DIx Pulse Counter via Front Panel
	12	0	0	Clear All Pulse Counter via Front Panel
	13	0	0	Clear Device Operating Time via Front Panel
	14	0	0	Set Clock via Front Panel
	15	0	0	Setup Changed via Front Panel
	16~17	0	…	Reserved
	18	0	0	Restore Factory via Front Panel
	19~29	0	…	Reserved
	30	0	0	Clear All Energy Registers via Communications[4]
	31	0	0	Clear Present Monthly Energy Log via Communications[5]
	32	0	0	Clear Historical Monthly Energy log via Communications[6]
	33	0	0	Clear Peak Demand of This Month (Since Last Reset) via Communications
	34	0	0	Clear All Demand Registers via Communications
	35	0	0	Clear Max./Min. Logs of This Month (Since Last Reset) via Communications
	36	0	0	Clear All Max/Min Logs via Communications
	37	0	0	Clear All Data via Communications[3]
	38	0	0	Clear SOE Log via Communications
	39	0	x=1 to 4	Clear DIx Pulse Counter via Communications
	40	0	0	Clear All DI Pulse Counters via Communications
	41	0	0	Clear Device Operating Time via Communications
	42	0	0	Restore Factory via Communications
	43	0	0	Setup Changes via Communications
	44	0	0	Preset Energy Value via Communications
	45	0	0	Setup TOU Energy via Communications
	46	0	1~4	Switch TOU Schedule[7]
	47	0	1~5	Clear DRx Log via Communications
	48	0	0	Clear All DR logs via Communications
	49			Clear Daily Freeze Log via Communications
	50			Clear Monthly Freeze Log via Communication
6 Alarm Email	1	0	0	Setpoint Trigger Alarm Email

Table 5-29 SOE Event Classification

Notes:

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

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

Table 5-30 TOU Switch Records

5.10 Data Recorder Log

Register	Property	Description	Format
20000~20037	RO	DR Log #1 Buffer	See Table 5-32 Standard DR Log Structure
20038~20075	RO	DR Log #2 Buffer	
20076~20113	RO	DR Log #3 Buffer	
20114~20151	RO	DR Log #4 Buffer	
20152~20189	RO	DR Log #5 Buffer	

Table 5-31 DR Log

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

Table 5-32 DR Data Buffer Structure

Notes:

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

5.11 Device Setup

5.11.1 Basic Setup Parameters

Register	Property	Description	Format	Range, Default*
6000	RW	PT Primary[1]	UINT32	1 to 1,000,000 V, 100*
6002	RW	PT Secondary	UINT32	1 to 690V, 100*
6004	RW	CT Primary	UINT32	1 to 30,000A, 5*
6006	RW	CT Secondary	UINT32	1 to 5A, 5*
6008~6010	RW	Reserved		
6012	RW	I4 Primary	UINT32	1 to 30,000A, 5*
6014	RW	I4 Secondary	UINT32	1 to 5A, 5*
6016~6018	RW	Reserved		
6020	RW	Wiring Mode	UINT16	0=DEMO, 1=1P2W L-N, 2=1P2W L-L, 3=1P3W L-L-N 4=3P3W, 5=3P4W*
6021	RW	PF Convention	UINT16	0=IEC*, 1=IEEE, 2=-IEEE
6022	RW	kVA Calculation	UINT16	0=Vector*, 1=Scalar
6023	RW	Ia Polarity	UINT16	0=Normal*, 1=Reverse
6024	RW	Ib Polarity	UINT16	
6025	RW	Ic Polarity	UINT16	
6026~6027	RW	Reserved		
6028	RW	THD Calculation[2]	UINT16	0= THDf*, 1= THDr
6029	RW	Demand Period	UINT16	1 to 60 (minutes), 15*
6030	RW	Number of Sliding Windows	UINT16	1 to 15, 1*
6031	RW	Predicted Response	UINT16	70 to 99, 70*
6032	RW	Arm before Execute	UINT16	0=Disabled*, 1=Enabled
6033	RW	Self-Read Time[3]	UINT16	0*
6034	RW	Monthly Energy Log Self-Read Time[4]	UINT16	0*
6035	RW	Energy Pulse Constant	UINT16	0=1000 imp/kxh* 1=3200 imp/kxh 2=6400 imp/kxh
6036	RW	LED Energy Pulse	UINT16	0=Disabled 1=kWh* 2=kvarh

6037	RW	Backlight Time-out	UINT16	0 to 60 (mins), 5*
6038	RW	System Language	UINT16	1=English
6039	RW	Date Format	UINT16	0=YYMMDD* 1=MMDDYY 2=DDMMYY
6040	RW	Delimiter[5]	UINT16	0=Option 1*, 1=Option 2 See Note 4
6041	RW	Monthly Freeze Self-Read Time[6]	UINT16	0*
6042	RW	Daily Freeze Self-Read Time[7]	UINT16	0*
6043	RW	1st parameter of the Default Display[8]	UINT16	0 to 36, 7*
6044	RW	2nd parameter of the Default Display[8]	UINT16	0 to 36, 11*
6045	RW	3rd parameter of the Default Display[8]	UINT16	0 to 36, 12*
6046	RW	4th parameter of the Default Display[8]	UINT16	0 to 36, 15*
6047	RW	EN Period[9]	UINT16	5 to 60* min
6048	RW	Setpoint Splash 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[10]	UINT16	0 to 65535, 0x3F*
6052	RW	SNTP Enable	UINT16	0=Disabled*, 1=Enabled
6053	RW	Time Zone[11]	UINT16	0 to 32, 26*
6054	RW	SNTP Sync. Interval[12]	UINT16	1 to 1440 (min), 60*
6055	RW	SNTP Server Address	UINT32	If IP address is 192.168.8.94, write "0xC0A8085E" to this register
6057	RW	SMTP IP Port	UINT16	0 to 65535, 25*
6058	RW	SMTP Server Address	UINT32	If address is 191.0.0.6, write "0XBF000006" to this register
6060~6095	RW	Sender Email	UINT16	See Note (13)
6096~6115	RW	Logon Password	UINT16	See Note (14)
6116~6151	RW	Receiver Email	UINT16	See Note (15)

Table 5-33 Basic Setup Parameters

Notes:

1) The value of [PT Primary/PT Secondary] cannot exceed 10000.

2) There are two ways to calculate THD:

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.

3) The **Self-Read Time** applies to both the Peak Demand Log as well as the Max/Min Log and supports the following three options:
   - A zero value means that the Self-Read will take place at 00:00 of the first day of each month.
   - A non-zero value means that the Self-Read will take place at a specific time and day based on the formula: Self-Read Time = (Day x 100 + Hour) where 0 ≤ 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.

4) 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.

5) 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).

6) The **Monthly Freeze Self-Read Time** supports only two options:
   - A zero value means that the Self-Read will take place at 00:00 of the first day of each month.
   - A non-zero value means that the Self-Read will take place at a specific time and day based on the formula: Self-Read Time = Day * 100 + Hour where 0 ≤ 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.
7) The **Daily Freeze Self-Read Time** can be set to a zero value or a non-zero value:
   - A zero value means that the Self-Read will take place at 00:00 everyday.
   - A non-zero value means that the Self-Read will take place at a specific time of the day based on the formula: Self-Read time = (Hour x 100 + Min) where 0 ≤ 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.
8) The following table illustrates the parameters that can be selected for display in the **Default Display** screen.

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

Table 5-34 Default Display Parameters

9) The Interval Energy will be reset once the **EN Period** is changed.
10) The DNP Rolling Polling Objects are list in table below:

Bit	Object Description	Option
B00	Object 1: Binary Inputs	0=Disabled 1=Enabled*
B01	Object 10: Binary Output	
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 5-35 DNP Polling Objects

11) 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 5-36 Time Zones

12) The SNTP Sync. Interval should be set between 10 and 1440 minutes.
13) 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, the default 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".
14) 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"
15) 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".

5.11.2 I/O Setup

Register	Property	Description	Format	Range, Default*
6200	RW	DI1 Function	UINT16	0 = Digital Input* 1=Pulse Counting 2 =Tariff Switch
6201	RW	DI2 Function	UINT16	
6202	RW	DI3 Function	UINT16	
6203	RW	DI4 Function	UINT16	
6204~6207		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	RW	Reserved		
6236	RW	DO1 Pulse Width	UINT16	0 to 6000 (x0.1s), 10* (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 (Default = 400)
6253	RW	AI Full Scale	INT32	-999,999 to +999,999 (Default = 2000)
6255~6259	RW	Reserved		

Table 5-37 I/O Setup Parameters

5.11.3 Communication Setup Parameters

Register	Property	Description	Format	Range, Default*
6400	RW	Serial Port Protocol	UINT16	0=Modbus RTU* 1=BACnet 2= DNP , 3=Gateway
6401	RW	Serial Port Unit ID	UINT16	Modbus RTU: 1 to 247 BACnet/MSTP: 1 to 127 DNP: 0 to 65519 100*
6402	RW	Serial Port Baud Rate	UINT16	0=1200, 1=2400, 2=4800, 3=9600*, 4=19200, 5=38400
6403	RW	Serial Port Comm. Config.	UINT16	0=8N2, 1=8O1, 2=8E1* 3=8N1, 4=8O2, 5=8E2
6404	RW	Ethernet Port-IP Address	UINT32	If IP address is 192.168.8.97, write “0xC0A80861” to this register
6406	RW	Ethernet Port-Subnet Mask	UINT32	
6408	RW	Ethernet Port-Gateway	UINT32	

Table 5-38 Communication Setup

5.11.4 Setpoints Setup

Register	Property	Description		Format	Range, Default*
6500	RW	Setpoint #1	Setpoint Type	UINT16	0=Disabled* 1=Over Setpoint 2=Under Setpoint
6501	RW		Parameters[1]	UINT16	0 to 29 0=None*
6502	RW		Over Limit	Float	0*
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 29
6582	RW		Over Limit	Float	0*
6584	RW		Under Limit	Float	0*
6586	RW		Active Delay	UINT16	0 to 9999 s, 10*
6587	RW		Inactive Delay	UINT16	0 to 9999 s, 10*
6588	RW		Trigger Action 1[2]	UINT16	0 to 3
6589	RW		Trigger Action 2[2]	UINT16	

Table 5-39 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 (kW Total)		0.001	W
7	Q (kvar Total)			var
8	S (kVA Total)			VA
9	PF (PF Total)			-
10	P DMD (kW Total Present Demand)			W
11	Q DMD (kvar Total Present Demand)			var
12	S (kVA Total Present Demand)			VA
13	P DMD Pred (kW Total Predicted Demand)			W
14	Q DMD Pred (kvar Total Predicted Demand)			var
15	S DMD Pred (kVA Total Predicted Demand)			VA
16	U THD		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, 2]	-	-	-
25	I4 (Measured)*	x1	0.001	A
26	AI*		1	-
27	IR (Residual Current) *	x1	0.001	A
28	U2 (Voltage Negative Sequence Component)	x1		V
29	U0 (Voltage Zero Symmetrical Component)			

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

Table 5-40 Setpoint Parameters

Notes:

5. When **Reversal** is set as the **Setpoint Parameter**, the **Setpoint Type** should be set to 1 (i.e., Over Setpoint). The **Setpoint Type**=2 (i.e., Under Setpoint) is invalid.
6. When **Reversal** is set as the **Setpoint Parameter** (with **Setpoint Type**=1), the **Over Limit** should be set as 0 and **Under Limit should be** as 1. The logic diagram for the Phase Reversal setpoint is illustrated in the following figure:

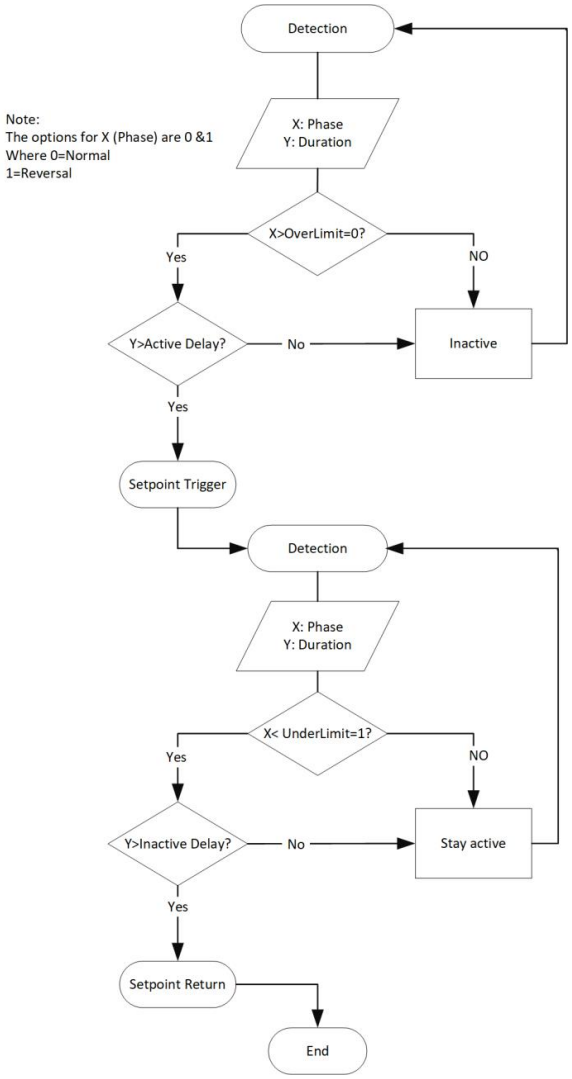


Figure 5-1 Reversal Setpoint Logic Diagram

3) 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 5-41 Setpoint Trigger

5.11.5 Data Recorder Setup

Register	Property	Description	Format
6600~6623	RW	Data Recorder #1*	See Table 5-43 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 5-42 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 5-43 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**.

5.12 TOU Setup

5.12.1 Basic

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

Table 5-44 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 (0-37)	Month (1-12)	Day (1-31)	Hour (00-23)

Table 5-45 TOU Switch Time Format

5.12.2 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	
8	RW	Season #3: Start Date	UINT16	See Season #2: Start Date
9	RW	Season #3: Weekday#1 Daily Profile	UINT16	0* to 19
10	RW	Season #3: Weekday#2 Daily Profile	UINT16	
11	RW	Season #3: Weekday#3 Daily Profile	UINT16	
12	RW	Season #4: Start Date	UINT16	See Season #2: Start Date
13	RW	Season #4: Weekday#1 Daily Profile	UINT16	0* to 19
14	RW	Season #4: Weekday#2 Daily Profile	UINT16	
15	RW	Season #4: Weekday#3 Daily Profile	UINT16	
16	RW	Season #5: Start Date	UINT16	See Season #2: Start Date
17	RW	Season #5: Weekday#1 Daily Profile	UINT16	0* to 19
18	RW	Season #5: Weekday#2 Daily Profile	UINT16	
19	RW	Season #5: Weekday#3 Daily Profile	UINT16	
20	RW	Season #6: Start Date	UINT16	See Season #2: Start Date
21	RW	Season #6: Weekday#1 Daily Profile	UINT16	0* to 19
22	RW	Season #6: Weekday#2 Daily Profile	UINT16	
23	RW	Season #6: Weekday#3 Daily Profile	UINT16	
24	RW	Season #7: Start Date	UINT16	See Season #2: Start Date
25	RW	Season #7: Weekday#1 Daily Profile	UINT16	0* to 19
26	RW	Season #7: Weekday#2 Daily Profile	UINT16	
27	RW	Season #7: Weekday#3 Daily Profile	UINT16	
28	RW	Season #8: Start Date	UINT16	See Season #2: Start Date
29	RW	Season #8: Weekday#1 Daily Profile	UINT16	0* to 19
30	RW	Season #8: Weekday#2 Daily Profile	UINT16	
31	RW	Season #8: Weekday#3 Daily Profile	UINT16	
32	RW	Season #9: Start Date	UINT16	See Season #2: Start Date
33	RW	Season #9: Weekday#1 Daily Profile	UINT16	0* to 19
34	RW	Season #9: Weekday#2 Daily Profile	UINT16	
35	RW	Season #9: Weekday#3 Daily Profile	UINT16	
36	RW	Season #10: Start Date	UINT16	See Season #2: Start Date
37	RW	Season #10: Weekday#1 Daily Profile	UINT16	0* to 19
38	RW	Season #10: Weekday#2 Daily Profile	UINT16	
39	RW	Season #10: Weekday#3 Daily Profile	UINT16	
40	RW	Season #11: Start Date	UINT16	See Season #2: Start Date
41	RW	Season #11: Weekday#1 Daily Profile	UINT16	0* to 19
42	RW	Season #11: Weekday#2 Daily Profile	UINT16	
43	RW	Season #11: Weekday#3 Daily Profile	UINT16	
44	RW	Season #12: Start Date	UINT16	See Season #2: Start Date
45	RW	Season #12: Weekday#1 Daily Profile	UINT16	0* to 19
46	RW	Season #12: Weekday#2 Daily Profile	UINT16	
47	RW	Season #12: Weekday#3 Daily Profile	UINT16	

Table 5-46 Season Setup

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

5.12.3 Daily Profile

The PMC-53A-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 5-49 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 5-47 TOU #1's Daily Profile Setup

Register	Property	Description	Format
8200~8223	RW	Daily Profile #1	See Table 5-49 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 5-48 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 5-49 Daily Profile Data Structure

Notes:

1) **Daily Profile #1's Period #1 Start Time** is always 00:00 and cannot be modified.
2) Setting a Period's **Start Time** as 0xFFFF terminates the Daily Profile's settings. All 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 interval of a period should be 15n (n=1, 2, etc.) minutes.
4) The **Start Time** of a particular Period must be later than the previous Period's .

5.12.4 Alternate Days

Each Alternate Day is assigned a Daily Profile and has a higher priority than Season. If a particular date is set as an Alternate Day, its assigned Daily Profile will override the "normal" Daily Profile for this day according 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	Table 5-51
2	RW	Alternate Day #1 Daily Profile	UINT16	0* to 19
3	RW	Alternate Day #2 Date[1]	UINT32	Table 5-51
5	RW	Alternate Day #2 Daily Profile	UINT16	0* to 19
6	RW	Alternate Day #3 Date[1]	UINT32	Table 5-51
8	RW	Alternate Day #3 Daily Profile	UINT16	0* to 19
9	RW	Alternate Day #4 Date[1]	UINT32	Table 5-51
11	RW	Alternate Day #4 Daily Profile	UINT16	0* to 19
12	RW	Alternate Day #5 Date[1]	UINT32	Table 5-51
14	RW	Alternate Day #5 Daily Profile	UINT16	0* to 19
15	RW	Alternate Day #6 Date[1]	UINT32	Table 5-51
17	RW	Alternate Day #6 Daily Profile	UINT16	0* to 19
18	RW	Alternate Day #7 Date[1]	UINT32	Table 5-51
19	RW	Alternate Day #7 Daily Profile	UINT16	0* to 19
21	RW	Alternate Day #8 Date[1]	UINT32	Table 5-51
22	RW	Alternate Day #8 Daily Profile	UINT16	0* to 19
24	RW	Alternate Day #9 Date[1]	UINT32	Table 5-51
25	RW	Alternate Day #9 Daily Profile	UINT16	0* to 19
27	RW	Alternate Day #10 Date[1]	UINT32	Table 5-51
29	RW	Alternate Day #10 Daily Profile	UINT16	0* to 19
…		…		Table 5-51
…		…		0* to 19
240	RW	Alternate Day #81 Date[1]	UINT32	Table 5-51
162	RW	Alternate Day #81 Daily Profile	UINT16	0* to 19
243	RW	Alternate Day #82 Date[1]	UINT32	Table 5-51
245	RW	Alternate Day #82 Daily Profile	UINT16	0* to 19
246	RW	Alternate Day #83 Date[1]	UINT32	Table 5-51
248	RW	Alternate Day #83 Daily Profile	UINT16	0* to 19
249	RW	Alternate Day #84 Date[1]	UINT32	Table 5-51
251	RW	Alternate Day #84 Daily Profile	UINT16	0* to 19
252	RW	Alternate Day #85 Date[1]	UINT32	Table 5-51
254	RW	Alternate Day #85 Daily Profile	UINT16	0* to 19
255	RW	Alternate Day #86 Date[1]	UINT32	Table 5-51
256	RW	Alternate Day #86 Daily Profile	UINT16	0* to 19
258	RW	Alternate Day #87 Date[1]	UINT32	Table 5-51
260	RW	Alternate Day #87 Daily Profile	UINT16	0* to 19
261	RW	Alternate Day #88 Date[1]	UINT32	Table 5-51
263	RW	Alternate Day #88 Daily Profile	UINT16	0* to 19
264	RW	Alternate Day #89 Date[1]	UINT32	Table 5-51
266	RW	Alternate Day #89 Daily Profile	UINT16	0* to 19
267	RW	Alternate Day #90 Date[1]	UINT32	Table 5-51
269	RW	Alternate Day #90 Daily Profile	UINT16	0* to 19

Table 5-50 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 (0-37)	Month (1-12)	Day (1-31)

Table 5-51 Date Format

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

5.13 Time

There are two sets of Time registers supported by the PMC-53A-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 to at the same time, both Time register sets will be updated to reflect the new time specified in the UNIX Time register set (60004) and the time specified in registers 60000-60002 will be ignored. Writing to the Millisecond register (60003) is optional during a Time Set operation. When broadcasting time, the function code must be set to 0x10 (Pre-set Multiple Registers). Incorrect date or time values will be rejected by the meter. In addition, attempting to write a Time value less than Jan 1, 2000 00:00:00 will be rejected.

Register		Property	Description	Format	Note
60000	9000	RW	High-order Byte: Year	UINT16	0-37 (Year-2000)
			Low-order Byte: Month		1 to 12
60001	9001	RW	High-order Byte: Day	UINT16	1 to 31
			Low-order Byte: Hour		0 to 23
60002	9002	RW	High-order Byte: Minute	UINT16	0 to 59
			Low-order Byte: Second		0 to 59
60003	9003	RW	Millisecond	UINT16	0 to 999
60004 ~ 60005	9004 ~ 9005	RW	UNIX Time	UINT32	0x386D4380 to 0x 7FE8177F The corresponding time is 2000.01.01 00:00:00 to 2037.12.31 23:59:59 (GMT+00:00 Time Zone)

Table 5-52 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).

5.14 Remote Control

The DO Control registers are implemented as both "Write-Only" Modbus Coil Registers (0XXXXX) and Modbus Holding Registers (4XXXXX), which can be controlled with the Force Single Coil command (Function Code 0x05) or the Preset Multiple Hold Registers (Function Code 0x10). The PMC-53A-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 5-53 DO Control

5.15 Clear/Reset Control

Register	Property	Description	Format	Note
9600	WO	Clear Historical Monthly Energy Log[1]	UINT16	Writing "0xFF00" to the register to execute the described action.
9601	WO	Clear All Energy Registers[2]		
9602	WO	Clear Present Monthly Energy Log[3]		
9603	WO	Clear Peak Demand of This Month (Since Last Reset)[4]		

9604	WO	Clear All Demand Registers[5]		
9605	WO	Clear Max/Min Logs of This Month (Since Last Reset)[6]		
9606	WO	Clear All Max/Min Log[7]		
9607	WO	Clear Device Operating Time		
9608	WO	Clear All Data[8]		
9609	WO	Clear SOE Log		
9610	WO	Clear DI1 Pulse Counter		
9611	WO	Clear DI2 Pulse Counter		
9612	WO	Clear DI3 Pulse Counter		
9613	WO	Clear DI4 Pulse Counter		
9614	WO	Clear 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		

Table 5-54 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 Peak Demand of This Month** register to clear Peak Demand Log of This Month (Since Last Reset) when the **Self-Read Time** register is set for automatic Self-Read operation. The Peak Demand of Last Month will not be cleared. If the **Self-Read Time** register is set for manual operation with a register value of 0xFFFF, the Peak Demand of This Month (Since Last Reset) will be transferred to the Peak Demand of Last Month (Before Last Reset) and then cleared.
5) Writing 0xFF00 to the **Clear All Demand** register to clear all Demand registers and logs, including Real-time Present Demand, Peak Demand Log of This Month (Since Last Reset) and Last Month (Before Last Reset).
6) Writing 0xFF00 to the **Clear Max/Min Log of This Month** register to clear the Max/Min log of This Month (Since Last Reset) when the **Self-Read Time** register is set for automatic Self-Read operation. The Max/Min log of Last Month will not be cleared. If the **Self-Read Time** register is set for manual operation with a register value of 0xFFFF, the Max/Min log of This Month (Since Last Reset) will be transferred to the Max/Min log of Last Month (Before Last Reset) and then cleared.
7) Writing 0xFF00 to the **Clear All Max/Min Log** register to clear both the Max/Min Log of This Month (Since Last Reset) and the Max/Min Log of Last Month (Before Last Reset).
8) Writing 0xFF00 to the **Clear All Data** register to perform the Clear operation for the actions specified in registers # 9600 to # 9607, registers # 9609 to # 9615, registers # 9618 to 9624 and Interval Energy Measurements.

5.16 Meter Information

Register		Property	Description	Format	Note
60200~60219	9800~9819	RO	Meter model[1]	UINT16	See Note 1)
60220	9820	RO	Firmware Version	UINT16	e.g. 10000 shows the version is V1.00.00
60221	9821	RO	Protocol Version	UINT16	e.g. 10 shows the version is V1.0
60222	9822	RO	Firmware Update Date: Year-2000	UINT16	e.g. 140110 means January 10, 2014
60223	9823	RO	Firmware Update Date: Month	UINT16	
60224	9824	RO	Firmware Update Date: Day	UINT16	
60225	9825	RO	Serial Number	UINT32	e.g. 1701030100 means the 100th PEM353 that was manufactured on January 3rd, 2017
60227	9827	RO	Reserved	UINT16	
60228	9828	RO	Reserved	UINT16	
60229	9829	RO	Extension Module	UINT16	See Note 2)

Table 5-55 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 5-56 ASCII Encoding of “PMC-53A-E”

2) Bit 0=0 represents the Standard Model without the I4+AI+Ir option while Bit 0=1 represents the Model with the I4+AI+Ir option. Bits 1 to 15 are reserved.

Appendix A Data Recorder Parameter List

ID	Description	ID	Description	ID	Description
Real-time Measurements (Format: Float)					
0	None	14	kWb	28	PF Total
1	Uan	15	kWc	29	Frequency
2	Ubn	16	kW Total	30	Uan/Uab Angle
3	Ucn	17	kvara	31	Ubn/Ubc Angle
4	Uln Average	18	kvarb	32	Ucn/Uca Angle
5	Uab	19	kvarc	33	Ia Angle
6	Ubc	20	kvar Total	34	Ib Angle
7	Uca	21	kVAa	35	Ic Angle
8	Ull Average	22	kVAb	36	In (Calculated)
9	Ia	23	kVAc	37	I4
10	Ib	24	kVA Total	38	AI Scaled
11	Ic	25	PFa	39	Ir (Residual Current)
12	I Average	26	PFb	40	Fundamental Power Total
13	kWa	27	PFc		
Power Quality (Format: Float)					
41	Phase A Fundamental kW	59	Ib Crest -Factor	160	Ubn/Ubc HD31
42	Phase B Fundamental kW	60	Ic Crest -Factor	161	Ucn/Uca HD31
43	Phase C Fundamental kW	61	Voltage Unbalance	162	Ia THD
44	Fundamental kW Total	62	Current Unbalance	163	Ib THD
45	Total Harmonic kW	63	Uan/Uab THD	164	Ic THD
46	Ia TDD	64	Ubn/Ubc THD	165	Ia TOHD
47	Ib TDD	65	Ucn/Uca THD	166	Ib TOHD
48	Ic TDD	66	Uan/Uab TOHD	167	Ic TOHD
49	Ia TOHD	67	Ubn/Ubc TOHD	168	Ia TEHD
50	Ib TOHD	68	Ucn/Uca TOHD	169	Ib TEHD
51	Ic TOHD	69	Uan/Uab TEHD	170	Ic TEHD
52	Ia TEHD	70	Ubn/Ubc TEHD	171	Ia HD02
53	Ib TEHD	71	Ucn/Uca TEHD	172	Ib HD02
54	Ic TEHD	72	Uan/Uab HD02	173	Ic HD02
55	Ia K-Factor	73	Ubn/Ubc HD02	⋯	…
56	Ib K-Factor	74	Ucn/Uca HD02	258	Ia HD31
57	Ic K-Factor	…	…	259	Ib HD31
58	Ia Crest Factor	159	Uan/Uab HD31	260	Ic HD31
Energy Measurements (**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 Peak Demand Log of This Month (Since Last Reset)		
321	Ib Present Demand	327	Ib Peak Demand Log of This Month (Since Last Reset)		
322	Ic Present Demand	328	Ic Peak Demand Log of This Month (Since Last Reset)		
323	kW Total Present Demand	329	kW Peak Demand Log of This Month (Since Last Reset)		
324	kvar Total Present Demand	330	kvar Peak Demand Log of This Month (Since Last Reset)		
325	kVA Total Present Demand	331	kVA Peak Demand Log of This Month (Since Last Reset)		

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

Appendix C BACNet MSTP Implementation

1) Basic Information

The PMC-53A-E supports the BACnet MS/TP protocol and can easily be connected to a BACnet MS/TP network using an off-the shelf BACnet router. The PMC-53A-E provides four types of BACnet objects. Standard Protocol Implementation Conformance Statement (PICS) as illustrated in table below describes the required characteristics of the BACnet implementation.

Item	Description
Date	March 20, 2017
Vendor Name	CET
Model Name	PMC-53A-E
Applications Software Version	1.00.00
Firmware Revision	1.0
Protocol Version	1
Protocol Revision	7
Description	Intelligent Multifunction Meter
Standardized Device	BACnet Smart Actuator (B-SA)
Interoperability Building Blocks supported	DS-RP-B, DS-RPM-B, DS-WP-B, DM-DOB-B, DM-TS-B, DM-DDB-B
Segmentation Capability	Not Supported
Data Link Layer Options	MS/TP Master, Baud rate(s): 1200, 2400, 4800, 9600, 19200, 38400
Device Address Binding	None
Networking Options	None
Character Sets Support	ANSI X3.4

2) Device Objects

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

The following table illustrates the Device Objects on the PMC-53A-E:

Property*	Description	Range/Values	Default
R/W	Object_Identifier	0 to 4194302	26001
R/W	Object_Name	Up to 32 characters	Simple Server
R/W	System_Status	Operational (0)	
R	Object_Type	Device (8)	
R	Vendor_Name	CET	
R/W	Vendor_Identifier	593	
R	Model_Name	PMC-53A-E	
R	Firmware_Revision	1	
R	Application_Software_Version	1.00.00	
R/W	Location	Up to 64 characters	LOCAL
R/W	Description	Up to 64 characters	Intelligent Multifunction Meter
R	Protocol_Version	1	
R	Protocol_Revision	7	
R	Protocol_Service_Supported[1]	Please see notes below	
R	Protocol_Object_Types_Supported[2]	Please see notes below	
R	Object_List	Please refer to sections 3) to 6)	
R	Max_APDU_Length_Accepted	480	
R	Segmentation	NO_SEGMENTATION (3)	
R/W	APDU_Timeout	0~65535	3000
R/W	Number_Of_APDU_Retries	0~255	3
R/W	Max_Master	1 to 127	127
R/W	Max_Info_Frame	1	
R	Device_Address_Binding	{}	

R	Database_Revision	0	
R	Local_Time	Configuration by timing	12:00:00:00
R	Local_Date	Configuration by timing	2016.07.01

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

Notes:

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

3) Analog Input Objects (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, Peak Demand) are non-volatile.

Register	Description	Property	Unit	Range
AI 0000	Uan[1]	R	V	
AI 0002	Ubn[1]	R		
AI 0004	Ucn[1]	R		
AI 0006	ULN average[1]	R		
AI 0008	Uab	R		
AI 0010	Ubc	R		
AI 0012	Uca	R		
AI 0014	ULL average	R		
AI 0016	Ia	R	A	
AI 0018	Ib	R		
AI 0020	Ic	R		
AI 0022	I average	R		
AI 0024	kWa[1]	R	kW	
AI 0026	kWb[1]	R		
AI 0028	kWc[1]	R		
AI 0030	kW Total	R		
AI 0032	kvara[1]	R	kvar	
AI 0034	kvarb[1]	R		
AI 0036	kvarc[1]	R		
AI 0038	kvar Total	R		
AI 0040	kVAa[1]	R	kVA	
AI 0042	kVAb[1]	R		
AI 0044	kVAc[1]	R		
AI 0046	kVA Total	R		
AI 0048	PFa[1]	R		0 to 1
AI 0050	PFb[1]	R		
AI 0052	PFc[1]	R		
AI 0054	PF Total	R		
AI 0056	Frequency	R	Hz	
AI 0070	Neutral Current (Calculated)	R	A	
AI 0072	I4 (Optional Measurement)	R	A	
AI 0082	AI	R		
AI 0084	Ir	R	A	
AI 0500	kWh Import	R	kWh	0 to

AI 0502	kWh Export	R		99999999.9
AI 0504	kWh Net	R		
AI 0506	kWh Total	R		
AI 0508	kvarh Import*	R	kvarh	
AI 0510	kvarh Export*	R		
AI 0512	kvarh Net*	R		
AI 0514	kvarh Total*	R		
AI 0516	kVAh*	R	kWh	
AI 3006	kW Total Demand	R	kW	
AI 3008	kvar Total Demand	R	kvar	
AI 3010	kVA Total Demand	R	kVA	
AI 3000	Ia Demand	R	A	
AI 3002	Ib Demand	R		
AI 3004	Ic Demand	R		
AI 3418	kW Total Peak Demand	R	kW	
AI 3424	kvar Total Peak Demand	R	kvar	
AI 3430	kVA Total Peak Demand	R	kVA	
AI 3400	Ia Peak Demand	R	A	
AI 3406	Ib Peak Demand	R		
AI 3412	Ic Peak Demand	R		
AI 1600	Uan THD[2]	R	%	
AI 1602	Ubn THD[2]	R		
AI 1604	Ucn THD[2]	R		
AI 1400	Ia THD	R		
AI 1402	Ib THD	R		
AI 1404	Ic THD	R		
AI 1318	Ia K Factor	R		
AI 1320	Ib K Factor	R		
AI 1322	Ic K Factor	R		
AI 1300	Ia TDD	R		
AI 1302	Ib TDD	R		
AI 1304	Ic TDD	R		
AI 1324	Ia Crest Factor	R		
AI 1326	Ib Crest Factor	R		
AI 1328	Ic Crest Factor	R		
AI 1330	U Unbalance	R		
AI 1332	I Unbalance	R		
AI 0074	dPFa[1]	R	-	0 to 1
AI 0076	dPFb[1]	R		
AI 0078	dPFc[1]	R		
AI 0058	Uan Angle[3]	R	°	
AI 0060	Ubn Angle[3]	R		
AI 0062	Ucn Angle[3]	R		
AI 0064	Ia Angle	R		
AI 0066	Ib Angle	R		
AI 0068	Ic Angle	R		
AI 0104	Operating Time	R	h	
AI 0526	Interval kWh Import	R	kWh	0 to 99999999.9
AI 0528	Interval kWh Export	R		
AI 0530	Interval kvarh Import*	R	kvarh	
AI 0532	Interval kvarh Export*	R		
AI 0534	Interval kVAh*	R	kWh	
AI 1200	DI #1 Counter	R	-	0 to 999,999,999
AI 1202	DI #2 Counter	R		
AI 1204	DI #3 Counter	R		
AI 1206	DI #4 Counter	R		

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

Notes:

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

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

Optional Properties Supported: Description, Relinquish_Default, Priority_Array

Writable Properties: Present_Value, Out_Of_Service, Units, Relinquish_Default

Use the Present Value property of the Analog Value object for some writable variables in the meter other than those used specifically for BACnet configuration or Time Synchronization. Values are checked when written, and errors are returned for invalid entries. The table below describes how the Setup Registers of the PMC-53A-E are represented in BACnet, their valid ranges, their defaults as well as how they are used. PMC-53A-E supports the Description, Relinquish_Default and Priority_Array optional properties. Writable properties include Present_Value, Out_Of_Service, Units and Relinquish_Default, but Units are not non-volatile after modification.

Register	Description	Property	Unit/ Range	Default/Note
AV 6000	PT Primary High[#]	R/W	0 to 1000 kV	0
AV 6001	PT Primary Low[#]	R/W	1 to 999 V	100
AV 6002	PT Secondary[#]	R/W	1 to 690	100
AV 6004	CT Primary	R/W	1 to 30000	5
AV 6006	CT Secondary	R/W	1 to 5	5
AV 6012	I4 Primary	R/W	1 to 30000	5
AV 6014	I4 Secondary	R/W	1 to 5	5
AV 6020	Wiring Mode	R/W	0 = DEMO 1 = 1P2W L-N 2 = 1P2W L-L 3 = 1P3W L-L-N 4 = 3P3W, 5 = 3P4W	5
AV 6021	PF Convention	R/W	0 = IEC, 1 = IEEE, 2 = -IEEE	0
AV 6022	kVA Calculation	R/W	0 = Vector, 1 = Scalar	0
AV 6028	THD Calculation	R/W	0 = THDf, 1 = THDr	0
AV 6029	Demand Period	R/W	1 to 60 min	15
AV 6030	Number of Sliding Windows	R/W	1 to 15	1
AV 6047	Interval Energy Period	R/W	5 to 60 min	60
AV 9603	Clear Present Peak Demand	W	65280 Default = 0	Writing "0xFF00" to the register to execute the described action.
AV 9601	Clear Energy	W		
AV 9610	Clear DI #1 Counter	W		
AV 9611	Clear DI #2 Counter	W		
AV 9612	Clear DI #3 Counter	W		
AV 9613	Clear DI #4 Counter	W		

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

5) Binary Input Objects (PMC-53A-E's Digital Inputs)

Optional Properties Supported: Description, Reliability

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

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

6) Binary Output Objects (PMC-53A-E's Digital Outputs)

Optional Properties Supported: Inactive_Text, Active_Text

Use the Present_Value property of the Binary_Output objects as alerts for DO conditions. Reading Binary_Output objects have the highest priority. PMC-53A-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

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

The following BACnet MS/TP setup parameters should be configured via the PMC-53A-E's Front Panel before connecting the PMC-53A-E to a BACnet MS/TP network.

Parameters	Description	Option/Range	Default
MAC	MS/TP ID^	0 to127	100
INST	Object Identifier#	0 to 4194302	26001
MAXMAS	Maximum Number of Master	0 to 127	127
LOCK	Disable communication	YES/NO	NO
BAUD	Baud rate	1200/2400/4800/9600/19200/38400	9600
CONFIG	Comm. Port Configuration	8N1/8E1/8O1/8N2/8E2/8O2	8E1

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

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

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

Request			Response		
Func. Code	Description	PMC-53A	Func. Code	Description	PMC-53A
0	Reset of Remote Link	√	0	ACK - Positive Acknowledgement	√
1	Reset of User Process		1	NACK - Message Not Accepted, Link Busy	√
2	Test Function for Link		2	Not Used	
3	User Data		3	Not Used	
4	Unconfirmed User Data	√	4	Not Used	
5	Not Used		5	Not Used	
6	Not Used		6	Not Used	
7	Not Used		7	Not Used	
8	Not Used		8	Not Used	
9	Request Link Status	√	9	Not Used	
10	Not Used		10	Not Used	
11	Not Used		11	Status of Link	√
12	Not Used		12	Not Used	
13	Cold Restart	√	13	Respond Object 52:2	√
14	Not Used		14	Link Service Not Functioning	
15	Not Used		15	Link Service Not Used or Implemented	

Physical Layer

The 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 Peak Demand of This Month (Since Last Reset)	UINT8	Always 0
4	Clear All Demand Registers	UINT8	Always 0
5	Clear Max/Min Logs of This Month (Since Last Reset)	UINT8	Always 0
6	Clear All Max./Min. Log	UINT8	Always 0
7	Clear Device Operating Time	UINT8	Always 0
8	Clear All Data	UINT8	Always 0
9	Clear DI1 Pulse Counter	UINT8	Always 0
10	Clear DI2 Pulse Counter	UINT8	Always 0
11	Clear DI3 Pulse Counter	UINT8	Always 0
12	Clear DI4 Pulse Counter	UINT8	Always 0
13	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 kW Total may be abnormal (3P4W or 3P3W)
	Negative kWa is may be abnormal (3P4W only)
	Negative kWb may be abnormal (3P4W only)
	Negative kWc may be abnormal (3P4W only)
	CTa polarity may be reversed (3P4W only)
	CTb polarity may be reversed (3P4W only)
43	CTc polarity may be reversed (3P4W only)
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 Peak Demand of This Month (Since Last Reset)	UINT8	N/A
4	Clear All Demand Registers	UINT8	N/A
5	Clear Max/Min Logs of This Month (Since Last Reset)	UINT8	N/A
6	Clear All Max./Min. Log	UINT8	N/A
7	Clear Device Operating Time	UINT8	N/A
8	Clear All Data	UINT8	N/A
9	Clear DI1 Pulse Counter	UINT8	N/A
10	Clear DI2 Pulse Counter	UINT8	N/A
11	Clear DI3 Pulse Counter	UINT8	N/A
12	Clear DI4 Pulse Counter	UINT8	N/A
13	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 and 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	kWa	INT32	x1	W
14	kWb[1]	INT32		
15	kWc[1]	INT32		
16	kW Total	INT32		
17	kvara	INT32		var
18	kvarb[1]	INT32		
19	kvarc[1]	INT32		
20	kvar Total	INT32		
21	kVAa	INT32		VA
22	kVAb[1]	INT32		
23	kVAc[1]	INT32		
24	kVA Total	INT32		
25	P.F.a[1]	INT32	x1000	-
26	P.F.b[1]	INT32		
27	P.F.c[1]	INT32		
28	P.F. Total	INT32		
29	FREQ	INT32	x100	Hz
30	Uan/Uab (3P3W) Angle	INT32	x100	°
31	Ubn/Ubc (3P3W) Angle	INT32		
32	Ucn/Uca (3P3W) Angle	INT32		
33	Ia Angle	INT32		
34	Ib Angle	INT32		
35	Ic Angle	INT32		
36	In (Calculated)	INT32	x1000	A
37	I4	INT32		
38	Ir	INT32		
39	Displacement PFa	INT32	x1000	-
40	Displacement PFb[1]	INT32		
41	Displacement PFc[1]	INT32		
42	Displacement PF Total	INT32		
43	AI Scaled	INT32	x1	-
44	Reserved	INT32	x100	°C
45	Reserved	INT32		
46	Reserved	INT32	x1	-
47	Device Operating Time	INT32	x10	h
48	Phase A Fundamental kW	INT32	x1	W
49	Phase B Fundamental kW[1]	INT32		
50	Phase C Fundamental kW[1]	INT32		
51	Fundamental kW Total	INT32		
52	Total Harmonic kW	INT32		
53	Uan/Uab Fundamental	INT32	x100	V
54	Ubn/Ubc Fundamental	INT32		
55	Ucn/Uca Fundamental	INT32		
56	Ia Fundamental	INT32	x1000	A
57	Ib Fundamental[1]	INT32		
58	Ic Fundamental[1]	INT32		
59	U1 (+ve Sequence Voltage)[2]	INT32	x100	V

60	U2 (-ve Sequence Voltage)^2	INT32		
61	U0 (Zero Sequence Voltage)^2	INT32		
62	I1 (+ve Sequence Current)^2	INT32		
63	I2 (-ve Sequence Current)^2	INT32	x1000	A
64	I0 (Zero Sequence Current)^2	INT32		
65	Ia TDD	INT32		
66	Ib TDD	INT32		
67	Ic TDD	INT32		
68	Ia K Factor	INT32		
69	Ib K Factor	INT32		
70	Ic K Factor	INT32		
71	Ia Crest Factor	INT32		
72	Ib Crest Factor	INT32		
73	Ic Crest Factor	INT32	x100	-
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		
83	Ib Present Demand	INT32	x1000	A
84	Ic Present Demand	INT32		
85	∑kW Present Demand	INT32		W
86	∑kvar Present Demand	INT32	x1	var
87	∑kVA Present Demand	INT32		VA
88	Ia Peak Demand of This Month (Since Last Reset)	INT32		
89	Ib Peak Demand of This Month (Since Last Reset)	INT32	x1000	A
90	Ic Peak Demand of This Month (Since Last Reset)	INT32		
91	∑kW Peak Demand of This Month (Since Last Reset)	INT32		W
92	∑kvar Peak Demand of This Month (Since Last Reset)	INT32	x1	var
93	∑kVA Peak Demand of This Month (Since Last Reset)	INT32		VA
94	Ia Peak Demand of Last Month (Before Last Reset)	INT32		
95	Ib Peak Demand of Last Month (Before Last Reset)	INT32	x1000	A
96	Ic Peak Demand of Last Month (Before Last Reset)	INT32		
97	∑kW Peak Demand of Last Month (Before Last Reset)	INT32		W
98	∑kvar Peak Demand of Last Month (Before Last Reset)	INT32	x1	var
99	∑kVA Peak 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 1.2Un
Overload	1.2xUn continuous, 2xUn for 1s
Burden	<0.02VA per phase
Measurement Category	CAT III up to 600VLL
Frequency	45-65Hz
Current Inputs (I11, I12, I21, I22, I31, I32)	
In	Standard 5A (5A/1A Auto-Scale), Optional 1A
Range	0.1% to 200% In
Starting Current	0.1% In
Overload	2xIn continuous, 20xIn for 1s
Measurement Category	CAT III up to 600VLL
Burden	<0.15VA per phase @ 5A
Power Supply (L+, N-, GND)	
Standard	95-250VAC/DC, ±10%, 47-440Hz
Optional	20-60VDC
Burden	<3W
Overvoltage Category	CAT III up to 300VLN
Digital Inputs (DI1, DI2, DI3, DI4, DIC)	
Type	Dry contact, 24VDC internally wetted
Sampling	1000Hz
Hysteresis	1ms minimum
Digital Outputs (DO11, DO12, DO21, DO22)	
Type	Form A Mechanical Relay
Loading	5A @ 250VAC or 30VDC
Pulse Outputs (E1+, E1-, E2+, E2-)	
Type	Form A Solid State Relay
Isolation	Optical
Max. Load Voltage	80V
Max. Forward Current	50mA
Optional I4 Input (·I41, I42)	
In	5A (5A/1A Auto-Scale)
Range	0.1% to 200% In
Starting Current	0.1% In
Optional Residual Current Input (*IR, IR)	
In	0.5mA
Range	2% to 500% In
CT Type	Solid-Core or Split-Core Residual Current CT
Optional Analog Input (AI+, AI-)	
Type	0-20 / 4-20 mA
Overload	24 mA maximum
Residual Current CT	
Load Current (Solid Core)	160A (CT517203, Ø=46mm) 400A (CT517403, Ø=80mm) 630A (CT519703, 220x50mm) 1000A (CT517603, Ø=120mm)
Load Current (Split Core)	160A (CT553203, Ø=48mm) 225A (CT553303, Ø=68mm)
Primary Input	1A (Residual Current)
Secondary Output	0.5mA
Range	2-200%
Overload	44A (Residual Current)
Accuracy	Class 0.5 (Solid Core), Class 3 (Split Core)
Frequency	50/60Hz
Dielectric Strength	3kV rms @ 1 minute
Operating Temperature	-25°C to +70°C (Solid Core) -12°C to +45°C (Split Core)
Storage Temperature	-40°C to +85°C (Solid Core) -25°C to +70°C (Split Core)
Installation Torque	
Current Inputs	1.3 N.m
Power Supply, Voltage Inputs, RS485 and I/O	0.5 N.m
Environmental Conditions	
Operating Temp.	-25°C to 70°C
Storage Temp.	-40°C to 85°C
Humidity	5% to 95% non-condensing
Atmospheric Pressure	70 kPa to 106 kPa

Mechanical Characteristics	
Panel Cutout	92x92 mm (3.62”x3.62”)
Unit Dimensions	96x96x88 mm
IP Rating	IP65 (Front Panel), IP30 (Body)

Accuracy

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

Appendix F Standards Compliance

Safety Requirements	
CE LVD 2014 / 35 / EU	EN61010-1: 2010 EN61010-2-030: 2010
Electrical safety in low voltage distribution systems up to 1000Vac and 1500 Vdc	IEC 61557-12: 2008 (PMD)
Insulation AC Voltage: 2.5kV @ 1 minute Insulation Resistance: >100MΩ Impulse voltage: 6kV, 1.2/50μs	IEC 62052-11: 2003 IEC 62053-22: 2003
Electromagnetic Compatibility CE EMC Directive 2014 / 30 / EU (EN 61326: 2013)	
Immunity Tests	
Electrostatic discharge	EN 61000-4-2: 2009
Radiated fields	EN 61000-4-3: 2006+A1: 2008+A2: 2010
Fast transients	EN 61000-4-4: 2012
Surges	EN 61000-4-5: 2006
Conducted disturbances	EN 61000-4-6: 2009
Magnetic Fields	EN 61000-4-8: 2010
V Dips, Interruptions & Variations	EN 61000-4-11:2004
Oscillatory waves	EN 61000-4-12: 2006
Radio Disturbances	CISPR 22:2006, Level B
Emission Tests	
Limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment	EN 55011: 2009 + A1: 2010 (CISPR 11)
Limits and methods of measurement of radio disturbance characteristics of information technology equipment	EN 55022: 2010+AC: 2011 (CISPR 22)
Limits for harmonic current emissions for equipment with rated current ≤16 A	EN 61000-3-2: 2014
Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current ≤16 A	EN 61000-3-3: 2013
Emission standard for industrial environments	EN 61000-6-4: 2007+A1: 2011
Testing and measurement techniques - Ring wave immunity test.	EN 61000-4-12: 2006
Mechanical Tests	
Spring Hammer Test	IEC 62052-11: 2003
Vibration Test	IEC 62052-11: 2003
Shock Test	IEC 62052-11: 2003

Appendix G Ordering Guide

CET Electric Technology

Version 20180906

Product Code	Description
PMC-53A-E Ethernet Multifunction Meter	
Basic Funciton	
E	Dot-Matrix LCD, Monthly & Daily Freeze Log, Data Recorder Log, 4MB Memory, 1x100BaseT Ethernet Port and 1xRS-485 (Modbus RTU, BACnet MSTP and DNP 3.0)
Input Current	
5	5A/1A Auto-Scaling (Class 0.5S for 5A and Class 1 for 1A)
1	1A (Class 0.5S)
Input Voltage	
9	400VLN/690VLL
Power Supply	
2	95-250 VAC/DC, 47-440Hz
3*	20-60VDC
Frequency	
5	45Hz-65Hz
I/O	
A	4xDI + 2xRO (Relay Output)
B	4xDI + 2xSS Pulse Output
Analog Inputs	
X	None
A*	I4 (5A/1A Auto-Scaling) + AI (0/4-20mA) + Ir (0-0.5mA)
Language	
E	English

PMC-53A	-	E	5	9	2	5	A	X	E	PMC-53A-E5925AXE (Standard Model)

* Additional charges apply

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