

PMC-53 Series

Intelligent Multifunction Meter

User Manual

Version: V5.2A

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Standards Compliance



DANGER

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



CAUTION

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



DANGER

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

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

Limited warranty

- EcoXplore 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.
- EcoXplore does not accept liability for any damage caused by meter malfunctions. EcoXplore 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 EcoXplore's duly authorized representative may open your meter. The unit should only be opened in a fully anti-static environment. Failure to do so may damage the electronic components and will void the warranty.

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Chapter 1 Introduction

This manual explains how to use the PMC-53 Series Intelligent Multifunction Meter. Throughout the manual the term “meter” generally refers to all models. Differences between the models are indicated with the appropriate model number.

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

1.1 Overview

The PMC-53 Series Intelligent Multifunction Meter is EcoXplore's latest offer for the low-cost digital power/energy metering market. Housed in an industry standard DIN form factor measuring 96mmx96mmx75mm, it is perfectly suited for industrial, commercial and utility metering applications. The PMC-53 features quality construction, multifunction measurements and a large, backlit, easy to read LCD display. Compliance with the IEC 62053-22 Class 0.5S kWh Accuracy Standard, it is a cost effective replacement for analog instrumentation, capable of displaying 3-phase measurements at once. It optionally provides two Digital Inputs for status monitoring and two Digital Outputs for control, alarm or energy pulsing applications. Further, it has optional inputs for I residual as well as RTD temperature measurements for fire alarm monitoring, transformer temperature monitoring or other applications. The standard SOE Log records all setup changes, DI/Setpoint status changes and DO operations in 1ms resolution. With the standard RS485 port and Modbus protocol support, the PMC-53 becomes a vital component of an intelligent, multifunction monitoring solution for any Power and Energy Management systems.

You can setup the meter through its front panel or via our free PMC Setup software. The meter is also supported by our PecStar® Integrated Energy Management System.

The PMC-53 is available in three models: PMC-53V, PMC-53I and PMC-53M. Following is a list of typical applications for the PMC-53:

- Analog meter replacement
- Low and medium voltage applications
- Industrial and commercial panel metering
- Substation, factory and building automation
- Sub-metering, cost allocation
- Residual Current and Temperature monitoring

Contact EcoXplore should you require further assistance with your application. **1.2**

Features

Enhanced Measurements (Firmware Version V1.20.01 or later)

- Neutral Current, Displacement PF
- Voltage and Current Unbalance, THD and K-Factor
- kW Total, kvar Total, kVA Total and Current Demands/Peak Demands
- Voltage and Current Phase Angles

Ease of use

- Large, backlit, easy to read, 5-line LCD display with wide viewing angle
- Password-protected setup via front panel or free PMC Setup software
- Easy installation with mounting clips, no tools required
- Built in alarm buzzer for optional I residual and Temperature alarms

Setpoints

- 6 user programmable setpoints
- Configurable thresholds, time delays and DO triggers

SOE Log

- 32 events time-stamped to $\pm 1\text{ms}$ resolution
- Setup changes, Setpoint and DI status changes and DO operations

Communications

- Optically isolated RS485 port
- Selectable baud rate from 1200 bps to 19,200 bps
- Modbus RTU protocol

System Integration

- Supported by our PecStar® Integrated Energy Management System
- Easy integration into other Automation or SCADA systems

Optional features

I residual Input (Residual Current)

- Requires an optional, external Zero Sequence CT (1A nominal)
- Two levels of alarm – ALARM and TRIP. Each alarm level:
 - Can be enabled individually
 - Programmable threshold and time delay
 - Logs an SOE event, sounds the alarm buzzer AND triggers a dedicated DO when activated

RTD Temperature Input

- Requires an optional, external RTD temperature probe
- Programmable threshold and time delay
- Logs an SOE event, sounds the alarm buzzer AND triggers a dedicated DO when activated

Digital Inputs and Outputs

- Digital Inputs – 2 volts free dry contact, 24VDC internally wetted
- Digital Outputs – 2 Form A DO (mechanical) or Solid State (SS) relays
 - 2 DO relays
 - DO1 is for I residual or Temperature ALARM output if present AND enabled
 - DO2 is for I residual TRIP output if present AND enabled
 - 2 SS relays for kWh and kvarh pulsing

Models and Measurements

Measurements		Models	
Standard	PMC-53V	PMC-53I	PMC-53M
VLN and VLL per phase and Avg	■		■
Current per phase and Avg		■	■
Neutral Current*			■
Voltage and Current phase angles*			■
Frequency	■		■
kW, kvar, kVA per phase and Total			■
PF per phase and Total			■
Displacement PF per phase*			■
kWh, kvarh Import and Export			■
kVAh Total			■
Demands and Peak Demands*			■
Voltage and Current Unbalance*			■
Voltage and Current THD*			■
K-Factor*			■
RS485 / Modbus Protocol	■	■	■
LED Pulse Outputs			■
Optional Features			
I residual Input			1
RTD Temperature Input			1
DI	2	2	2
DO or SS Relay	2	2	2

* Available in Firmware Version V1.20.01 or later

1.3 PMC-53 series' application in Power and Energy Management Systems

The PMC-53 can be used to monitor Wye or Delta connected power system. Modbus communications allow real-time data, events, DI status and other information to be transmitted across a RS485 network to an Integrated Energy Management system such as PecStar®.

Power system connection

Wye power system
Delta power system

Communications

RS485, Modbus RTU
1200bps to 19200bps



Data analysis tools
Monitoring network
Third party software

Digital Inputs/ Outputs

Breaker Status Inputs
Control Outputs
LED Pulse Outputs

Analog Inputs

I Residual Input
RTD Temperature Input

1.4 Getting more information

Additional information is available from EcoXplore PTE LTD via the following sources:

- Visit www.EcoXplore.com
- Contact your local representative
- Contact EcoXplore directly via email or telephone

Chapter 2 Installation



Caution

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

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

2.1 Appearance

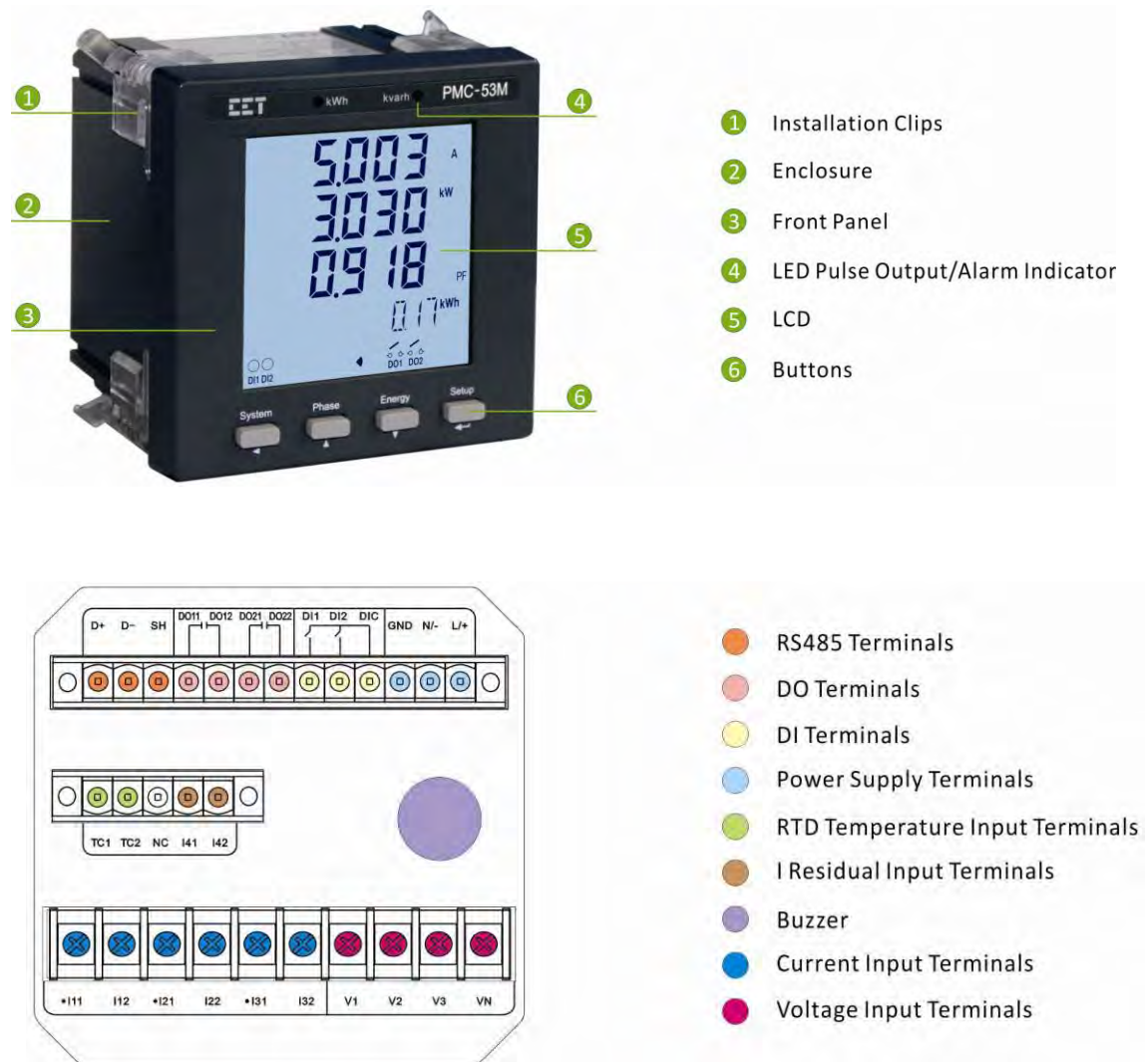


Figure 2-1 Appearance

2.2 Unit Dimensions

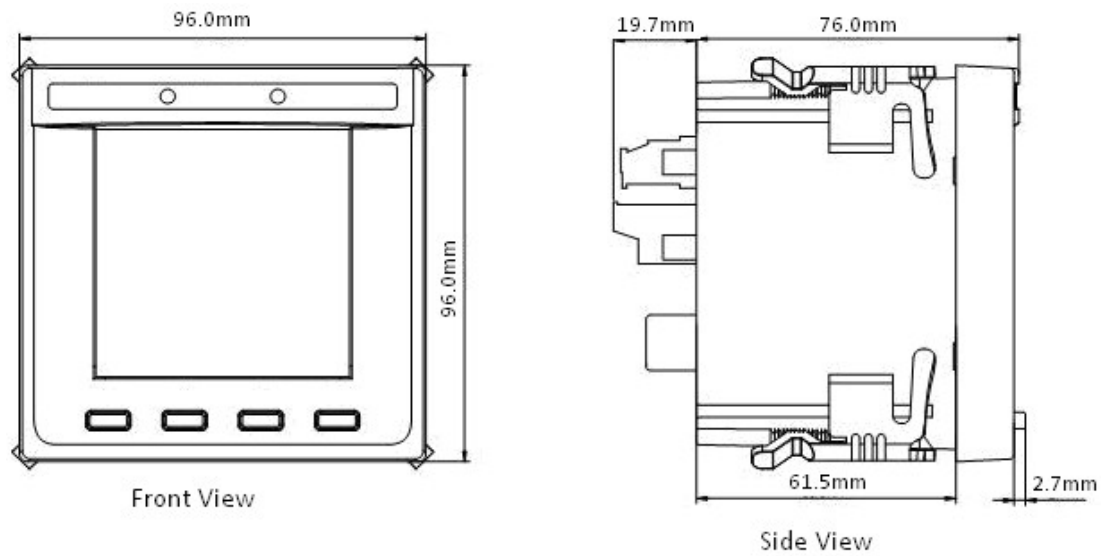


Figure 2-2 Dimensions

2.3 Mounting

The PMC-53 series meter 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 2-3
- Re-install the installation clips and push the clips tightly against the panel to secure the meter

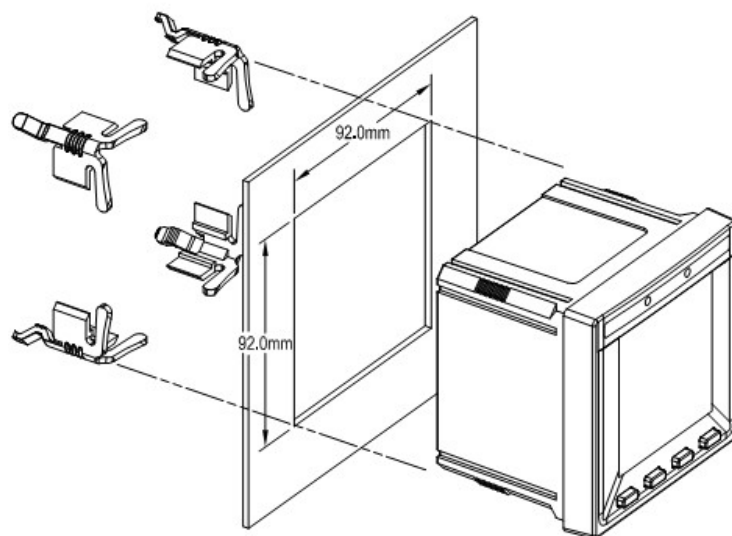


Figure 2-3 Panel Cutout

2.4 Wiring connections

PMC-53 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 Wye Direct Connection
- 3-phase 4-wire Wye with 3PTs and 3CTs
- 3-phase 3-wire open Delta Direct Connection
- 3-phase 3-wire open Delta with 2PTs and 3CTs.
- 3-phase 3-wire open Delta with 2PTs and 2CTs



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.

2.4.1 3-phase 4-wire Wye Direct Connection

Please consult the serial number label to ensure that the system phase voltage is less than or equal to the meter's voltage input specification.

Set the Wiring Mode to Wye.

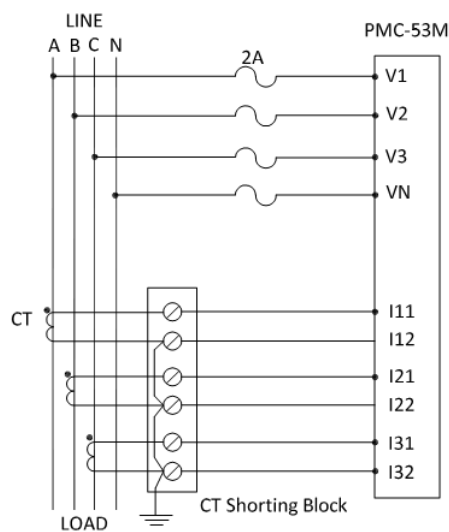


Figure 2-4 4-Wire Wye, Direct Connection

2.4.2 3-phase 4-wire Wye with 3PTs and 3CTs

Please consult the serial number label to ensure that the rated PT secondary voltage is less than or equal to the meter's voltage input specification.

Set the Wiring Mode to Wye.

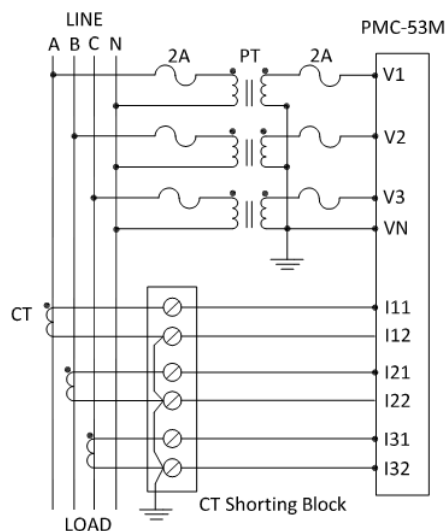


Figure 2-5 4-Wire Wye, 3PTs, 3CTs

2.4.3 3-phase 3-wire Open Delta Direct Connection

Please consult the serial number label to ensure that the rated PT secondary voltage is less than or equal to the meter's voltage input specification.

Set the Wiring Mode to Delta.

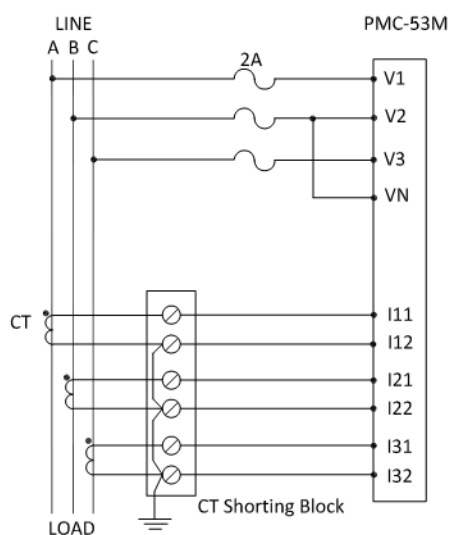


Figure 2-6 3-Wire DELTA, Direct Connection

2.4.4 3-phase 3-wire Open 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 voltage input specification.

Set the Wiring Mode to Delta.

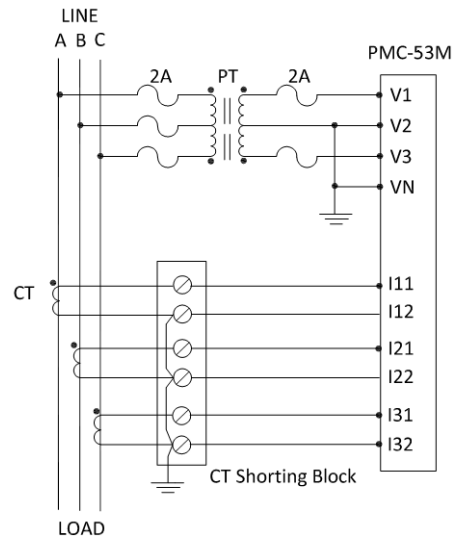


Figure 2-7 3-Wire DELTA, 2PTs, 3CTs

2.4.5 3-phase 3-wire Open 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 voltage input specification.

Set the Wiring Mode to Delta.

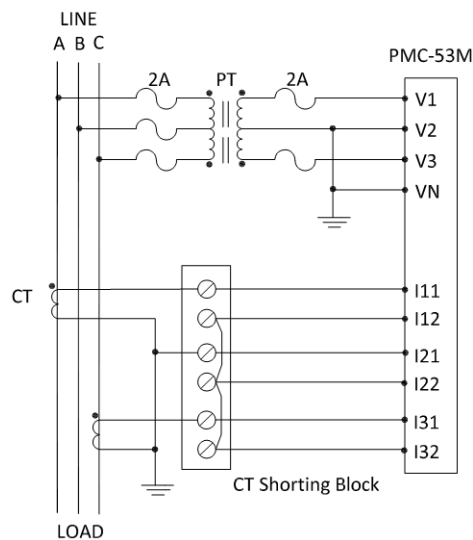


Figure 2-8 3-Wire DELTA, 2PTs, 2CTs

2.5 Communications Wiring

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

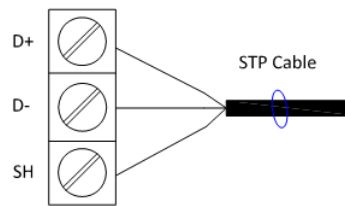


Figure 2-9 Communications Connections

The PMC-53 provides one RS485 port and supports the Modbus RTU protocol. 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.

2.6 Digital Input Wiring

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

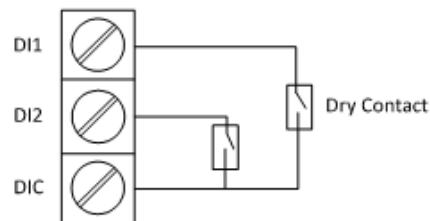


Figure 2-10 DI Connections

2.7 Digital Output Wiring

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

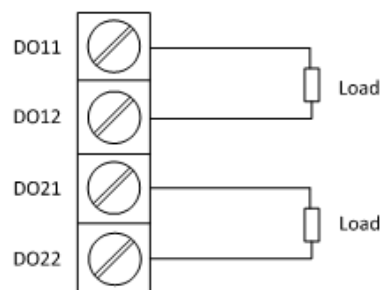


Figure 2-11 DO Connections

2.8 Pulse Output Wiring

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

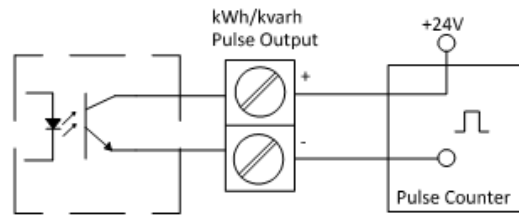


Figure 2-12 Pulse Output Connections

2.9 I residual Input Wiring

The following figure illustrates the I residual connections on the PMC-53:

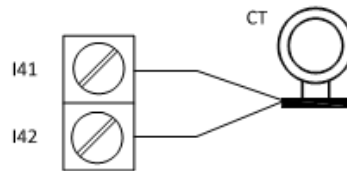


Figure 2-13 I residual Connections

2.10 Temperature Input Wiring

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

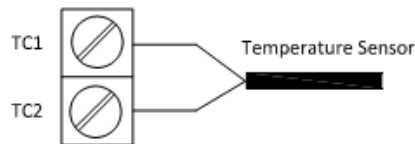


Figure 2-14 Temperature Input Connections

2.11 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. Connect the GND terminal to ground.

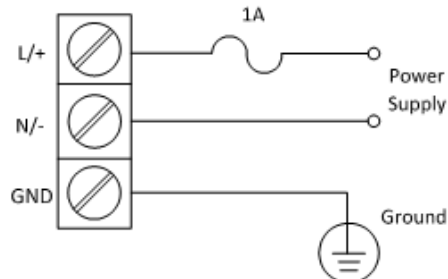


Figure 2-15 Power Supply Connections

Chapter 3 Front Panel

The PMC-53 series meter has a large, easy to read LCD display with backlight and four buttons for data display and meter configuration. This chapter introduces the front panel operations.



Figure 3-1 Front Panel

3.1 LCD Display

3.1.1 LCD Testing

Pressing both the <Phase> and the <Energy> buttons simultaneously for 2 seconds enters the LCD Testing mode. During testing, all LCD segments are illuminated for 1 second and then turned off for 1 second. This cycle will repeat 3 times to allow for the detection of faulty segments. The Alarm Buzzer will also sound during the test cycle if so equipped. The LCD will return to its normal display mode afterwards.

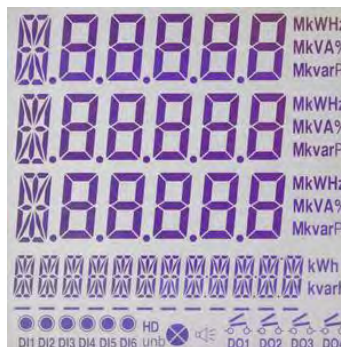


Figure 3-2 Full LCD Display

3.1.2 LCD Display Areas

This section provides a description of the LCD display areas. The PMC-53M LCD display can generally be divided into 5 areas:

- A: Displays special symbols for parameters such as I4, THD, Unbalance, Displacement PF, Voltage Phase Angle, Current Phase Angle and Demand
- B: Displays energy information such as kWh Import, kWh Export, kvarh Import, kvarh Export, and kVAh. The Residual Current and Temperature measurements are also displayed here if the PMC-53M is equipped with these optional inputs

- C: Displays the indicators for DI status, DO status, Harmonic Distortion (HD), Unbalance (unb), PF Quadrant and Alarm status
- D: Displays Measurement values
- E: Displays Measurement Units

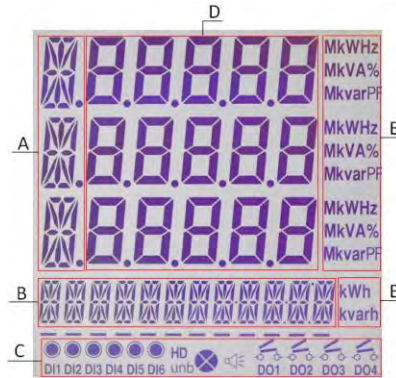


Figure 3-3 LCD Display

The following table shows the special LCD display symbols:

Area	Segments	Symbol Description					
A				Phase Voltage		Line Voltage	
				I4		Voltage/Current Unbalance	Demand
				Displacement PF		Va/Vb/Vc THD	Ia/Ib/Ic THD
				K-Factor		Va/Vb/Vc Angle	Ia/Ib/Ic Angle
				kVAh Indicator		kWh/kvarh Export Indicator	
				DI Open		DI Close	
C			HD		Unbalance		PF Quadrant
			Harmonic Distortion		Alarm Symbol		

Table 3-1 Special LCD Display Symbols

3.1.3 Peak Demand Display

The following special arrangements have been made for the display of the Peak Demand value and its timestamp with the appropriate units displayed in the Measurement Units area.

- a: Peak Demand Indicator - Ia, Ib, Ic, kW Import, kvar Import, kVA Total
- b: Peak Demand value
- c: Date portion of the Peak Demand timestamp
- d: Time portion of the Peak Demand timestamp

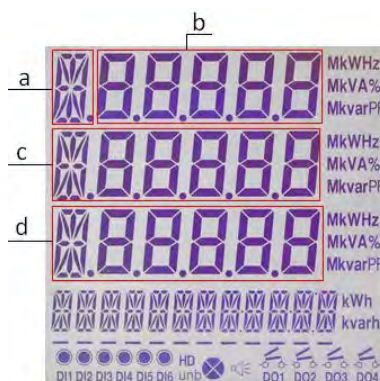


Figure 3-4 Peak Demand Display

Area	Symbol Description		
a		Ia Peak Demand Indicator	
		Ic Peak Demand Indicator	
b		kW Peak Demand Indicator	
		kvar Peak Demand Indicator	
c	Peak Demand Value		
d	Peak Demand Timestamp (Date Portion) - YY.MM.DD		
	Peak Demand Timestamp (Time Portion) - HH.MM.SS		

Table 3-2 Peak Demand Display

3.2 2 LED Indicators

The PMC-53M comes standard with two LED indicators on its front panel, labeled **kWh** and **kvarh**. The **kWh** indicator is green; and the **kvarh** indicator is red. The two LED indicators are used for kWh and kvarh pulsing if the **EN PULSE** is ENABLED (see Section 4.1.3 for Energy Pulsing). For PMC-53M equipped with the optional I residual and/or Temperature inputs and if **EN PULSE** is NOT ENABLED, the **kWh** indicator shows the meter's running state by blinking once per second, and the **kvarh** indicator shows that there are active I residual or Temperature alarms if lit (see Sections 4.3.3 and 4.3.4 for I residual and Temperature Setpoints).

3.3 Display Screen Types

The front panel provides two display modes: Data Display and Setup Configuration. There are four buttons on the front panel: **<System>**, **<Phase>**, **<Energy>** and **<Setup>**. The **<Setup>** button is only used when configuring the meter. The **<System>**, **<Phase>** and **<Energy>** buttons are used to view data on the front panel.

3.3.1 Default Screen

There is a default display screen for the PMC-53M as illustrated in Figures 3-5. If there is no activity for 3 minutes, the display will automatically return to the default display screen.



Figure 3-5 PMC-53M Default Display

3.3.2 Data Display

The following tables illustrate the display screens for the different PMC-53 models.

Press button	Display screens	First row	Second row	Third row
<System>	Display 1(default)	Vab	Vbc	Vca
	Display 2	Va ¹	Vb ¹	Vc ¹
	Display 3		Frequency	

Table 3-3 Data display screens of PMC-53V

	Display screens	First row	Second row	Third row
Default Display	Display 1(default)	Ia	Ib	Ic

Table 3-4 Data display screens of PMC-53I

Press button	Display screens	First row	Second row	Third row
<System>	Display 1(default)	I average	Total KW	Total P.F.
	Display 2	VLL average	Total kvar	Frequency
	Display 3	Total kW	Total kvar	Total kVA
	Display 4	VLN average(Wye) VLL average(Delta)	I average	Total kW
	Display 5*	I4		
	Display 6*		Voltage Unbalance	Current Unbalance
	Display 7*	Ia Demand	Ib Demand	Ic Demand
	Display 8*	kW Demand	kvar Demand	kVA Demand
	Display 9*	Ia Peak Demand	YY/MM/DD	HH/MM/SS
	Display 10*	Ib Peak Demand	YY/MM/DD	HH/MM/SS
	Display 11*	Ic Peak Demand	YY/MM/DD	HH/MM/SS
	Display 12*	kW Peak Demand	YY/MM/DD	HH/MM/SS
	Display 13*	kvar Peak Demand	YY/MM/DD	HH/MM/SS
	Display 14*	kVA Peak Demand	YY/MM/DD	HH/MM/SS
<Phase>	Display 1	Ia	Ib	Ic
	Display 2	Va ¹	Vb ¹	Vc ¹

	Display 3	Vab	Vbc	Vca
	Display 4	kW _a ¹	kW _b ¹	kW _c ¹
	Display 5	kvar _a ¹	kvar _b ¹	kvar _c ¹
	Display 6	kVA _a ¹	kVA _b ¹	kVA _c ¹
	Display 7	P.F. _a ¹	P.F. _b ¹	P.F. _c ¹
	Display 8*	dP.F. _a ¹	dP.F. _b ¹	dP.F. _c ¹
	Display 9*	Va THD	Vb THD	Vc THD
	Display 10*	Ia THD	Ib THD	Ic THD
	Display 11*	Ia K-Factor	Ib K-Factor	Ic K-Factor
	Display 12*	Va Angle	Vb Angle	Vc Angle
	Display 13*	Ia Angle	Ib Angle	Ic Angle
<Energy>	Display 1	kWh Import		
	Display 2	kWh Export		
	Display 3	kvarh Import		
	Display 4	kvarh Export		
	Display 5	KVAh		
	Display 6	I residual ²		
	Display 7	Temperature ³		

* Available in Firmware Version V1.20.01 or later

Table 3-5 Data display screens of PMC-53M

Notes:

- 1) When connected in Delta mode, the meter displays “-” instead of phase voltages.
- 2) This display only appears if the meter is equipped with the I residual Input. If the I residual Sensor is not connected, the display will show **N/C**.
- 3) This display only appears if the meter is equipped with the Temperature Input. If the RTD temperature probe is not connected or if the measured temperature is above 250°C, the display will show **N/C**. If the measured temperature is above 200°C and below 250°C, the display will show **OVER**, which means the measured value has exceeded the applicable measurement range.

3.4 Setup Configuration via the Front Panel

Pressing the <Setup> button for more than three seconds enters the Setup Configuration mode where the setup parameters can be changed. Upon completion, pressing the <Setup> button for more than three seconds returns to the Data Display mode.

3.4.1 Functions of buttons

The four front panel buttons take on different meanings in the Setup Configuration mode and are described below:

<Setup>: Pressing this button for more than three seconds toggles between Data Display mode and Setup Configuration mode. Once inside the Setup Configuration mode, pressing this button selects the parameter for modification. After changing the parameter, pressing this button again saves the new setting into memory.

<Phase>: Before a parameter is selected for modification, pressing this button advances to the next parameter in the menu. If a parameter is already selected, pressing this button increments a numeric value or advances to the next value in the selection list.

<Energy>: Before a parameter is selected for modification, pressing this button goes back to the last parameter in the menu. If a parameter is already selected, pressing this button decrements a numeric value or goes back to the last value in the selection list.

<System>: Pressing this button moves the cursor to the left by one position if the parameter being changed is a numeric value. Otherwise, this button is ignored.

Making setup changes:

- Press the **<Setup>** button for more than 3 seconds to access Setup Configuration mode.
- Press the **<Phase>** button to advance to the Password page.
- A correct password must be entered before changes are allowed. The factory default password is zero. Press the **<Setup>** button to select the parameter for modification. Use the **<System>**, **<Phase>** and **<Energy>** buttons to enter the correct password.

Selecting a parameter to change:

- Use the **<Phase>** and **<Energy>** button to scroll to the desired parameter.
- Press the **<Setup>** button to select the parameter. Once selected, the parameter value will blink.

Changing and saving a parameter:

- Use the **<System>**, **<Phase>** and **<Energy>** buttons to make modification to the selected parameter.
- After modification, press the **<Setup>** button to save the new value into memory.

Returning to Data Display mode:

- Pressing the **<Setup>** button for more than three seconds to return to the default display screen.

3.4.2 Reset the Alarm LED and Buzzer

If the PMC-53 is equipped with the Alarm Buzzer, the I residual and/or Temperature inputs, the **<System>** and **<Phase>** buttons are implemented with additional functions.

<System>: Pressing this button for 3 seconds resets the Alarm LED and Buzzer after the I residual and/or Temperature ALARM Setpoint has become inactive.

<Phase>: Pressing this button for 3 seconds mutes the Alarm Buzzer while the I residual and/or Temperature ALARM Setpoint is active.

3.4.3 Setup Menu

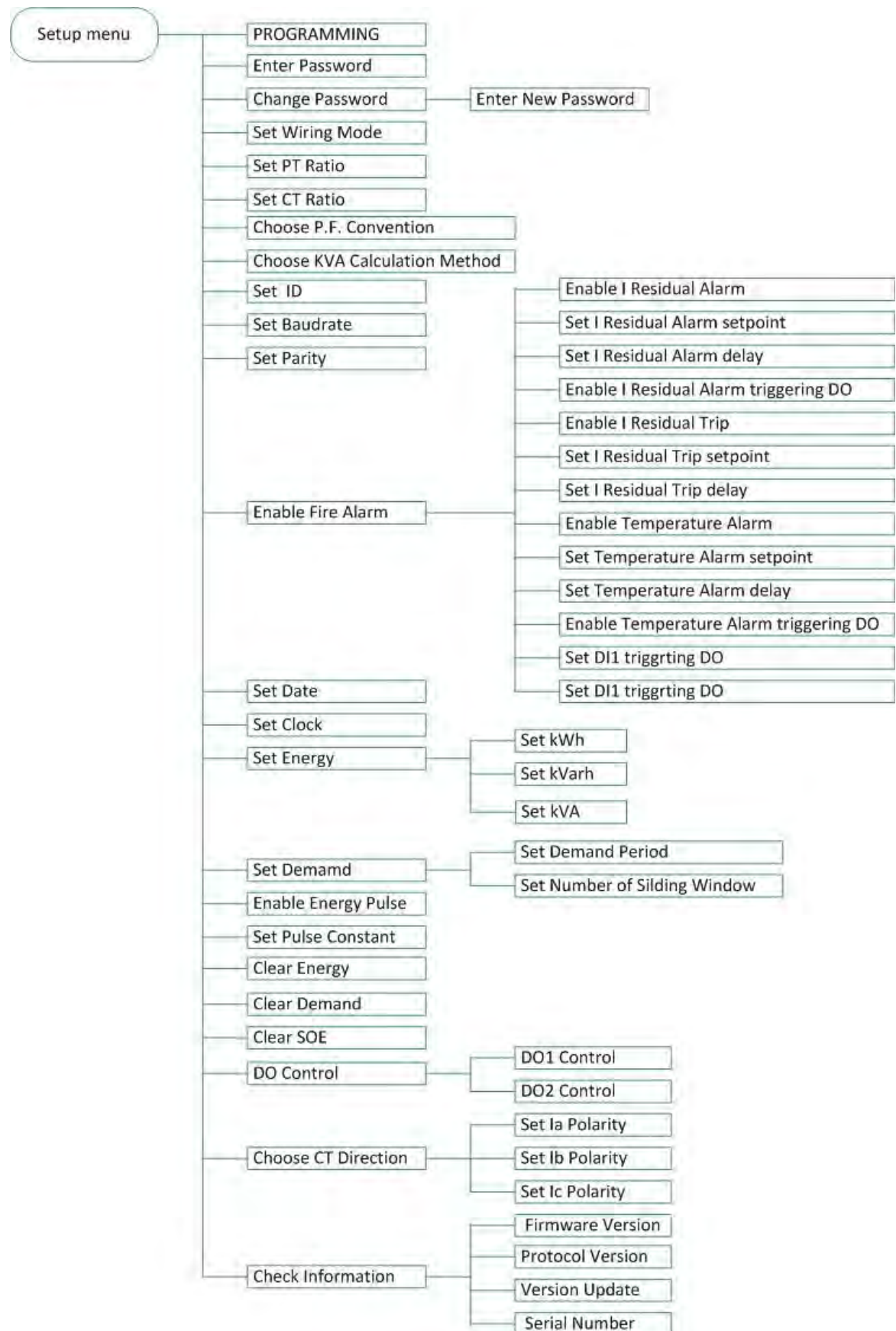


Figure 3-6 Setup Menu

3.4.4 Configuration

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

Label Menu 1 st 2 nd	Parameters	Description	Option(value)	Default	PMC-53 Model		
					V	I	M
PROGRAMMING		Setup Configuration Mode	/	/	▪	▪	▪
PASSWORD	Password	Enter Password	/	"0"	▪	▪	▪
SET PASS		Change Password?	YES/NO	NO	▪	▪	▪
NEW PASS	New Password	Change Password	0000 to 9999	"0"	▪	▪	▪
TYPE	Wiring Mode ¹	The wiring connection of the meter	WYE/DELTA/DEMO	WYE	▪		▪
PT	PT Ratio ²	PT Ratio	1 to 2,200	1	▪		▪
CT	CT Ratio ²	CT Ratio	1 to 30,000 (1A) 1 to 6,000 (5A)	1		▪	▪
PF SET	P.F. Convention ³	P.F. Convention	IEC/IEEE/-IEEE	IEC			▪
KVA SET	kVA Calculation ⁴	kVA Calculation Method	V/S	V			▪
ID	Meter Address	Meter Address	1-247	100	▪	▪	▪
BAUD	Baud rate	Data rate in bits per second	1200/2400/4800/ 9600/19200bps	9600	▪	▪	▪
CONFIG	Comm. Port Configuration	Data Format	8N2/8O1/8E1/8N1/8O2 /8E2	8E1	▪	▪	▪
ALARM		Configure Alarm	YES/NO	NO			▪
IR ALM	I residual ALARM ⁵	Enable I residual ALARM	ON/OFF	ON			▪
ALM SP	I residual ALARM SP ⁵	Set I residual ALARM Setpoint	30 -1000mA	500			▪
ALM DLY	I residual ALARM Delay ⁵	Set I residual ALARM Delay	0 - 600(x0.1s)	20			▪
ALM DO1	I residual ALARM Trigger ⁵	Enable I residual ALARM Trigger (DO1)	ON/OFF	ON			▪
IR TRP	I residual TRIP ⁵	Enable I residual TRIP	ON/OFF	ON			▪
TRP SP	I residual TRIP SP ⁵	Set I residual TRIP Setpoint	30 -1000(mA)	500			▪
TRP DLY	I residual TRIP Delay ⁵	Set I residual TRIP Delay	0 - 600(x0.1s)	20			▪

ALM TMP	Temperature ALARM ⁵	Enable Temperature ALARM	ON/OFF	ON			▪
TMP SP	Temperature ALARM SP ⁵	Set Temperature ALARM Setpoint	55 -140(°C)	80			▪
TMP DLY	Temperature ALARM Delay ⁵	Set Temperature ALARM Delay	0 - 400(x0.1s)	20			▪
TMP DO1	Temperature ALARM Trigger ⁵	Set Temperature ALARM Trigger (DO1)	ON/OFF	OFF			▪
DI1 PRO	DI1 SP Output Trigger	Enable DI1 SP Output Trigger	OFF/DO1/DO2	OFF			▪
DI2 PRO	DI2 SP Output Trigger	Enable DI2 SP Output Trigger	OFF/DO1/DO2	OFF			▪
DATE	Date	Enter the Current Date	YY-MM-DD	/	▪	▪	▪
CLK	Time	Enter the Current Time	HH:MM:SS	/	▪	▪	▪
SET ENGY	Preset Energy Values	Preset Energy Values	YES/NO	NO			▪
kWh	kWh Import	Preset kWh Import Value	0 to 99,999,999.9	0			▪
-kWh*	kWh Export	Preset kWh Export Value	0 to 99,999,999.9	0			▪
kvarh	kvarh Import	Preset kvarh Import Value	0 to 99,999,999.9	0			▪
-kvarh*	kvarh Export	Preset kvarh Export Value	0 to 99,999,999.9	0			▪
kVAh	kVAh	Preset kVAh Export Value	0 to 99,999,999.9	0			▪
DMD SET*	Demand Parameters	Configure Demand Parameters	YES/NO	NO			▪
PERIOD	Demand Interval	Set Demand Interval	1, 2, 3, 5, 10, 15, 30, 60 (minutes)	15			▪
NUM	Number of Sliding Windows	Set Number of Sliding Windows	1-15	1			▪
EN PULSE	Energy Pulsing	Enable kWh and kvarh Energy Pulsing	YES/NO	NO			▪

EN CONST ⁶	Pulse Constant	Pulse Constant	1k(1000)/3.2k(3200)/ 5k(5000)/6.4k(6400)/ 12.8k(12800)	1k			▪
CLR ENGY	Clear Energy	Clear kWh, kvarh and kVAh	YES/NO	NO			▪
CLR DMD*	Clear Demand	Clear Peak Demands	YES/NO	NO			▪
CLR SOE	Clear SOE	Clear SOE Log	YES/NO	NO	▪	▪	▪
DO CTRL	DO Control Mode	Change DO Control Mode	YES/NO	NO	▪	▪	▪
DO1	DO1 Control Mode	DO1 Control Mode	NORMAL/ON/OFF	NORMAL	▪	▪	▪
DO2	DO2 Control Mode	DO2 Control Mode	NORMAL/ON/OFF	NORMAL	▪	▪	▪
CT REV	Reverse CT	Change CT Polarity	YES/NO	NO		▪	▪
I1 REV	Phase A CT	Reverse Phase A CT Polarity	YES/NO	NO		▪	▪
I2 REV	Phase B CT	Reverse Phase B CT Polarity	YES/NO	NO		▪	▪
I3 REV	Phase C CT	Reverse Phase C CT Polarity	YES/NO	NO		▪	▪
INFO	Information (Read Only)	Check Meter Information	YES/NO	NO	▪	▪	▪
5M	Version	Firmware Version	For example, 5M 11000 means the meter is PMC-53M and the firmware version is V1.10.00. 5M means PMC-53M; 5I means PMC-53I; 5V means PMC-53V	/	▪	▪	▪
PRO VER	Protocol Version	Protocol Version	e.g. 50 means V5.0	/	▪	▪	▪
UPDATE	Update Date	Firmware Update Date	e.g. 090821	/	▪	▪	▪
	Serial Number	Meter Serial Number	e.g. 0811280100	/	▪	▪	▪

* Available in Firmware Version V1.20.01 or later

Table 3-6 Setup Parameters

Notes:

- 1) The PMC-53V does not support the **DEMO** Wiring Mode.
- 2) PT Ratio × CT Ratio × Rated Phase Voltage Input × Rated Current Input × √3 must be less than 790,000,000.

3) Power Factor Convention

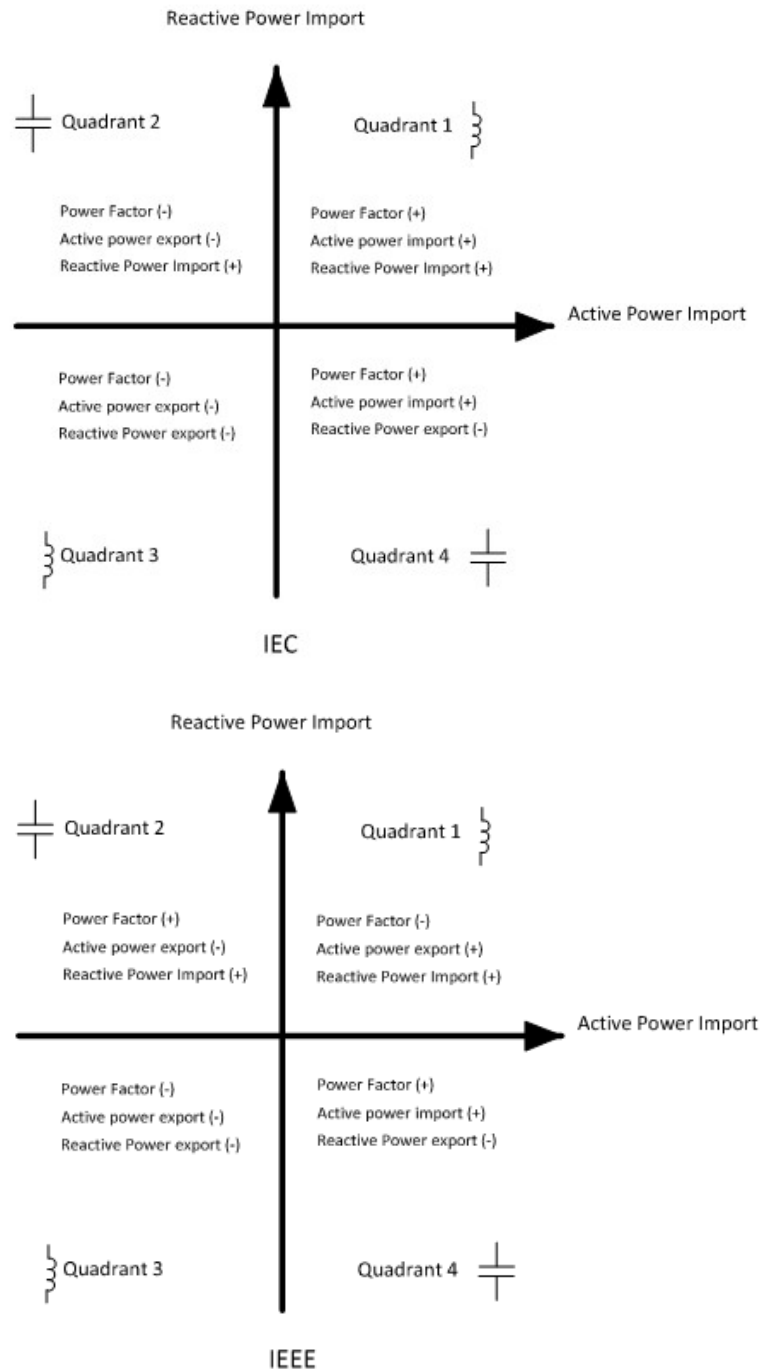


Figure 3-7 P.F. Convention

4) There are two ways to calculate kVA:

Mode V (Vector method): $kVA_{total} = \sqrt{kW_{total}^2 + kvar_{total}^2}$

Mode S (Scalar method): $kVA_{total} = kVA_a + kVA_b + kVA_c$

5) This menu only appears if the PMC-53 is equipped with the I residual and Temperature Inputs.

- 6) The PMC-53M provides the following pulse constant configurations for different input ratings:

PMC-53M Configurations	Pulse Constant Options (imp/kWh, imp/kvarh)	Default
57.75VLN/100VLL, 1A	1000/3200/5000/6400/12800	1000
57.75VLN/100VLL, 5A	1000/3200/5000/6400/12800	1000
220VLN/380VLL, 1A	1000/3200/5000/6400/12800	1000
220VLN/380VLL, 5A	1000/3200/5000	1000

Table 3-7 Pulse Constant

Chapter 4 Applications

4.1 Inputs and Outputs

4.1.1 Digital Inputs

The PMC-53 optionally provides two self-excited Digital Inputs that are internally wetted at 24 VDC. Digital Inputs are typically used for monitoring external status 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. Further, the PMC-53 Digital Input provides setpoint capability which can trigger output action when its status changes. Please refer to Section 4.3.2 for a complete description of the Digital Input Setpoints.

4.1.2 Digital Outputs

The PMC-53 optionally provides two Digital Outputs. They can be of either electromechanical or solid state type. Digital Outputs are normally used for setpoint alarming, load control, or remote control applications.

Digital Outputs on the PMC-53 can be used in the following applications:

- 1) **Front Panel Control:** Manually operated from the front panel. Please refer to the **DO CTRL** setup parameter in Section 3.4.4 for a detailed description.
- 2) **Remote Control:** Remotely operated over communications via our free PMC Setup software or the PecStar® Integrated Energy Management System.
- 3) **Control Setpoint:** Control Setpoints can be programmed to trigger DO action upon becoming active. Please refer to Section 4.3.1 for a detailed description.
- 4) **Digital Input Setpoint:** Digital Inputs can be programmed to trigger DO action upon becoming active. Please refer to Section 4.3.2 for a detailed description.
- 5) **I residual Setpoint:** If the PMC-53 is equipped with the optional I residual Input, the I residual ALARM and TRIP setpoints can be enabled to provide residual current monitoring and trigger DO actions in response to the I residual setpoints becoming active. Please refer to Section 4.3.3 for a detailed description.
- 6) **Temperature Setpoint:** If the PMC-53 is equipped with the optional Temperature input, the Temperature ALARM setpoint can be enabled to provide temperature monitoring and trigger DO action in response to the temperature setpoint becoming active. Please refer to Section 4.3.4 for a detailed description.

Since there are so many ways to utilize the Digital Outputs on the PMC-53, a prioritized scheme has been developed to avoid conflicts between different applications. In general, Front Panel

Control has the highest priority and can override any other applications. Next in the priority list is Remote Control.

I residual Setpoints, Temperature Setpoint and Digital Input Setpoints 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.

Control Setpoints have the lowest priority. It should also be noted that if I residual and/or Temperature inputs are equipped on the PMC-53, DO1 and DO2 will be reserved for the I residual and Temperature Setpoints whether they are actually enabled or not. If a Control Setpoint is programmed to trigger either DO1 or DO2 upon becoming active, the trigger action will not succeed because Control Setpoints have the lowest priority and therefore will not be able to control Digital Outputs when I residual and/or Temperature Inputs are present. However, Control Setpoints can still be used for monitoring and alarming purpose via our PecStar® Integrated Energy Management System.

4.1.3 Energy Pulse Outputs

The PMC-53 comes standard with two front panel LED Pulse Outputs and can be equipped with two additional Solid State Digital Outputs for kWh and kvarh pulsing. Energy pulsing can be enabled from the front panel through the **EN PULSE** setup parameter. Energy Pulse Outputs are typically used for accuracy testing. The pulse constant can be configured as 1000/3200/5000/6400/12800 imp/kxh, and the pulse width is fixed at 80ms. If the PMC-53 is equipped with two Solid State Digital Outputs for pulsing applications, Terminals DO1 and DO2 are reserved for kWh and kvarh Pulse Outputs, respectively.

Note:

If the PMC-53M is equipped with the optional I residual and/or Temperature inputs and **EN PULSE** is NOT ENABLED, these two front panel LEDs take on different meanings. The green kWh LED shows the running state by blinking once per second, and the red kvarh LED is lit if there are any active I residual or Temperature **ALARM** setpoints.

4.1.4 residual Input

The PMC-53 optionally provides an I residual Input along with an external Residual Current Sensor (see Appendix B) that has an input range of 20mA to 1200mA and an output range of 0 to 1.2V. The outputs of the Residual Current Sensor are connected to the I residual input terminals of the PMC-53 if so equipped. This is illustrated in Figure 4-1 below.

The I residual input provides accurate ground fault monitoring and is mainly used for indirect grounding protection to ensure personnel safety. Please refer to Section 4.3.3 for a complete description of the I residual Setpoint operation.

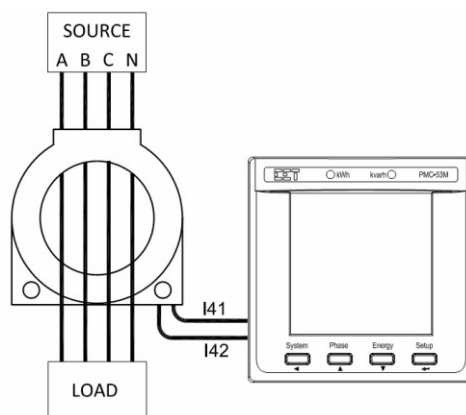


Figure 4-1 I Residual Connections

4.1.5 Temperature Input

The PMC-53 optionally provides a RTD Temperature Input along with an external RTD Temperature Sensor (see Appendix C) to provide temperature measurement. The outputs of the Temperature Sensor are connected to the Temperature Input of the PMC-53 if so equipped.

The Temperature Input provides accurate temperature monitoring and is mainly used for measuring the temperature of the Neutral Conductor, Transformer or other equipment that requires temperature monitoring. Please refer to Section 4.3.4 for a complete description of the Temperature Setpoint operation.

4.2 Power and Energy

4.2.1 Voltage and Current Phase Angles

Phase analysis is used to identify the angle relationship between the three-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 power factor 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° .

For Delta connected systems, the current phasors lag line-to-line voltage phasors by 30° . For example, if the total power factor for a balanced 3-phase system is 0.5 Lag and the line-to-line voltage phase angles are 0.0° , 240.0° and 120.0° , the current phase angles should have the values of -90.0° , 150.0° and 30.0° .

4.2.2 Energy

Basic energy parameters include active energy (kWh), reactive energy (kvarh) and apparent energy (kVAh) with a resolution of 0.1k and a maximum value of $\pm 99,999,999.9$. When the maximum value is reached, the energy registers will automatically roll over to zero.

The energy can be reset manually or preset to user-defined values through the front panel or via communications.

The PMC-53 provides the following energy measurements:

Active Energy	kWh Import	kWh Export
Reactive Energy	kvarh Import	kvarh Export
Apparent Energy	kVAh Total	

Table 4-1 Energy

4.2.3 Demands

Demand is defined as the average power consumption over a fixed interval (usually 15 minutes). The PMC-53 supports the sliding window demand calculation for Ia, Ib, Ic, kW Total, kvar Total and kVA Total. Demand has the following setup parameters which can be set up via the front panel or over communications:

of Sliding Windows: 1-15
Demand Period: 1, 2, 3, 5, 10, 15, 30, 60 minutes. For example, if the # of Sliding Windows is set as 1 and the Demand Period is 15 minutes, the demand cycle will be $1 \times 15 = 15$ minutes.

The PMC-53 provides the following Demand parameters. For Peak Demands, both the Peak Demand value as well as the time stamp are displayed on the front panel. Please refer to Section 3.3 Data Display for more information.

Real time Demand	kW Demand Ia Demand	kvar Demand Ib Demand	kVA Demand Ic Demand
Peak Demand	kW Peak Demand Ia Peak Demand	kvar Demand Ib Peak Demand	kVA Demand Ic Peak Demand

Table 4-2 Demand Parameters

4.3 Setpoints

The PMC-53 provides four different types of setpoints for different applications.

- 1) **Control Setpoint:** General purpose control and alarming applications.
- 2) **Digital Input Setpoint:** Provides control output actions in response to changes in Digital Input status.
- 3) **I residual Setpoint:** Residual Current monitoring and alarming
- 4) **Temperature Setpoint:** Temperature monitoring and alarming

4.3.1 Control Setpoints

The PMC-53 comes standard with 6 user programmable Control Setpoints which provide extensive control by allowing a user to initiate an action in response to a specific condition. The alarm symbol  at the bottom of the LCD display is lit if there are any active Control Setpoints. Typical setpoint applications include alarming and fault detection. The setpoints can be programmed over communications and have the following setup parameters:

- 1) **Setpoint Type:** Specifies the parameter to be monitored and the condition of monitoring (Over or Under). Table 4-3 below provides a list of Setpoint Parameters and their associated conditions.

- 2) **Setpoint Limit:** Specifies the value that the setpoint parameter must exceed for Over Setpoint or go below for Under Setpoint for the setpoint to become active. The Setpoint Return Limit is $0.95 \times \text{Setpoint Limit}$ for Over Setpoint and $1.05 \times \text{Setpoint Limit}$ for Under Setpoint.
- 3) **Setpoint Delay:** Specifies the minimum duration in seconds that the setpoint condition must be met before the setpoint becomes active. If the setpoint is already active, it specifies the minimum duration in seconds that the Setpoint Return condition must be met before the setpoint becomes inactive. An event will be generated and stored in the SOE Log for any setpoint status changes. The range of the **Setpoint Delay** is between 0 and 9,999 (seconds).
- 4) **Setpoint Trigger:** Specifies what action the setpoint will take when it becomes active. These actions include No Trigger or Trigger DOx.

The PMC-53 provides the following Setpoint Parameters:

Setpoint Type	Parameter	53V	53I	53M
Over	Phase Voltage (V)	▪		▪
	Line Voltage (V)	▪		▪
	Current (A)		▪	▪
	Total Active Power (kW)			▪
	Total Reactive Power (kvar)			▪
Under	Phase Voltage (V)	▪		▪
	Line Voltage (V)	▪		▪
	Power Factor ($\times 1000$)			▪

Table 4-3 Setpoint Parameters

4.3.2 Digital Input Setpoints

The Digital Input Setpoints can be used to monitor external status and provide alarming and control capability in response to the external status becoming active. The Digital Input Setpoints can be programmed from the front panel or via communications. To enable Digital Input Setpoints through the front panel, enter Setup Configuration mode, scroll to the **DI1_PRO** and **DI2_PRO** setup parameters and choose OFF, DO1 or DO2 from the selection list. The following table illustrates the operational behavior of the Digital Input Setpoints.

Digital Input Setpoint	DO1	DO2
Action	1) DO1 closes when the associated DI Setpoint becomes active for a duration longer than 100ms. 2) An event is generated and stored in the SOE Log.	1) DO2 closes when the associated DI Setpoint becomes active for a duration longer than 100ms. 2) An event is generated and stored in the SOE Log.
Release	1) The associated DI becomes inactive. 2) DO1 must be reset manually by	1) The associated DI becomes inactive. 2) DO2 would automatically

	holding down the <System> button for 3 seconds or via communications.	open 1 second later.
--	---	----------------------

Table 4-4 Digital Input Setpoint Details

4.3.3 I residual Setpoints

The I residual Setpoints can be used to monitor residual current and provide alarming and control capability if the residual current exceeds a pre-determined level. The PMC-53 provides two types of I residual Setpoints: ALARM and TRIP. The programming of the I residual Setpoints is supported through front panel operation and via communications. These two setpoints can be individually enabled, and their programming and operational details are illustrated in the following table.

I residual Setpoint	ALARM	TRIP
Mode	ON/OFF	ON/OFF
Setpoint Limit	30 to 1000 (mA)	30 to 1000 (mA)
Action/Release Delay	0 to 600 (x0.1S)	0 to 600 (x0.1S)
Setpoint Trigger	ON/OFF	-
Action	1) I residual $\geq 0.9 \times$ ALARM Setpoint Limit 2) The ALARM Setpoint becomes active when I residual has exceeded $0.9 \times$ ALARM Setpoint Limit for a duration longer than the Action Delay time. 3) When ALARM is active, an SOE event would be generated, the front panel Alarm LED would be lit and the Alarm buzzer would sound. 4) If Setpoint Trigger is enabled, DO1 would close. 5) While ALARM is active, the Alarm buzzer can be muted by holding down the <Phase> button for 3 seconds.	1) I residual $\geq$ I residual TRIP Setpoint Limit 2) The TRIP Setpoint becomes active when I residual has exceeded the TRIP Setpoint Limit for a duration longer than the Action Delay time. 3) When TRIP is active, an SOE event would be generated and DO2 would close.
Release	1) I residual $< 0.8 \times$ ALARM Setpoint Limit 2) The ALARM Setpoint becomes inactive when I residual is less than $0.8 \times$ ALARM Setpoint Limit for a duration longer than the Release Delay time. 3) The front panel Alarm LED, the Alarm buzzer, and DO1 (if	1) I residual $< 0.8 \times$ TRIP Setpoint Limit 2) The TRIP Setpoint becomes inactive when I residual is less than $0.8 \times$ TRIP Setpoint Limit for a duration longer than the Release Delay time. 3) DO2 would open automatically.

	enabled) must be reset manually by holding down the <System> button for 3 seconds or via communications after the residual ALARM has become inactive.	
--	--	--

Table 4-5 I Residual ALARM and TRIP Setpoints

4.3.4 Temperature Setpoint

The Temperature Setpoint can be used to monitor equipment temperature and provide alarming and control capability if the temperature measurement exceeds a pre-determined level.

The following table illustrates the operational behavior of the Temperature ALARM Setpoint.

Temperature Setpoint	ALARM
Mode	ON/OFF
ALARM Setpoint Limit	55 to 140(°C)
Action/Release Delay	0.0 to 400 (x0.1S)
ALARM Trigger (DO1)	ON/OFF
Action	1) Temperature $\geq$ ALARM Setpoint Limit 2) The ALARM Setpoint becomes active when the Temperature measurement has exceeded the ALARM Setpoint Limit for duration longer than the Action Delay time. 3) When ALARM is active, an SOE event would be generated, the front panel Alarm LED would be lit and the Alarm buzzer would sound. 4) If ALARM Trigger is enabled, DO1 would close. 5) While ALARM is active, the Alarm buzzer can be muted by holding down the <Phase> button for 3 seconds.
Release	1) Temperature $< 0.8 \times$ ALARM Setpoint Limit. 2) The ALARM becomes inactive when the Temperature measurement is less than $0.8 \times$ ALARM Setpoint Limit for a duration longer than the Release Delay time. 3) The front panel Alarm LED, the Alarm buzzer, and DO1 (if enabled) must be reset manually by holding down the <System> button for 3 seconds or via communications after the ALARM has become inactive.

Table 4-6 Temperature ALARM Setpoint

4.4 SOE

The PMC-53 can store up to 32 events such as power outage, setpoint status changes, relay actions, digital input status changes and setup changes in its non-volatile memory. Each event record includes the event classification, its relevant parameter values and a timestamp in 1ms resolution.

All event records can be retrieved via communications. If there are more than 32 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 Power Quality

4.5.1 armonics

The PMC-53 provides harmonic analysis for THD. All harmonic parameters are available through communications as well as the front panel LCD display.

The PMC-53 provides the following Harmonic measurements:

Harmonics	Va THD	Vb THD	Vc THD
	Ia THD	Ib THD	Ic THD
	Ia K-Factor	Ib K-Factor	Ic K-Factor

Table 4-7 Harmonic Measurements

4.5.2 balance

The PMC-53 can measure Voltage and Current Unbalances. The calculation method of Voltage and Current Unbalances is listed below:

$$\text{Voltage Unbalance} = \frac{[|V_a - V_{avg}|, |V_b - V_{avg}|, |V_c - V_{avg}|]_{\text{MAX}}}{V_{avg}} \times 100\%$$

$$\text{Current Unbalance} = \frac{[|I_a - I_{avg}|, |I_b - I_{avg}|, |I_c - I_{avg}|]_{\text{MAX}}}{I_{avg}} \times 100\%$$

Chapter 5 Modbus Register Map

This chapter provides a complete description of the Modbus register map (**Protocol Version 6.0**) for the PMC-53 series power meter to facilitate the development of 3rd party communications driver for accessing information on the PMC-53. In general, the registers on the PMC-53 are implemented as Modbus Holding Registers (4XXXXX) with the exception of the DO Control registers, which are implemented as “Write Only” Modbus Coil Registers (0XXXXX). The PMC-53 supports **6-digit addressing** scheme and 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 register addresses are listed without the Modbus Address Prefix, 4 for Holding Registers and 0 for Coil Registers. Therefore, it's not necessary to subtract 400001 for Holding Registers or 000001 for Coil Registers to obtain the starting address number. For a complete Modbus Protocol Specification, please visit <http://www.modbus.org>.

5.1 Basic Measurements

Register	Property	Description	Format	Scale/Unit	PMC-53 Model		
					V	I	M
40000	RO	Va ¹	UINT32	×100, V ²	▪		▪
40002	RO	Vb ¹	UINT32	×100, V	▪		▪
40004	RO	Vc ¹	UINT32	×100, V	▪		▪
40006	RO	VLN average	UINT32	×100, V	▪		▪
40008	RO	Vab	UINT32	×100, V	▪		▪
40010	RO	Vbc	UINT32	×100, V	▪		▪
40012	RO	Vca	UINT32	×100, V	▪		▪
40014	RO	VLL average	UINT32	×100, V	▪		▪
40016	RO	Ia	UINT32	×1000, A		▪	▪
40018	RO	Ib	UINT32	×1000, A		▪	▪
40020	RO	Ic	UINT32	×1000, A		▪	▪
40022	RO	I average	UINT32	×1000, A		▪	▪
40024	RO	kWa ¹	INT32	×1000, kW			▪
40026	RO	kWb ¹	INT32	×1000, kW			▪
40028	RO	kWc ¹	INT32	×1000, kW			▪
40030	RO	ΣkW	INT32	×1000, kW			▪
40032	RO	kvara ¹	INT32	×1000, kvar			▪
40034	RO	kvarb ¹	INT32	×1000, kvar			▪
40036	RO	kvarc ¹	INT32	×1000, kvar			▪
40038	RO	Σkvar	INT32	×1000, kvar			▪
40040	RO	kVAa ¹	INT32	×1000, kVA			▪
40042	RO	kVAb ¹	INT32	×1000, kVA			▪
40044	RO	kVAc ¹	INT32	×1000, kVA			▪
40046	RO	ΣkVA	INT32	×1000, kVA			▪

40048	RO	PFa ¹	INT16	×1000	■
40049	RO	PFb ¹	INT16	×1000	■
40050	RO	PFc ¹	INT16	×1000	■
40051	RO	ΣPF	INT16	×1000	■
40052	RO	FREQ	UINT16	×100, HZ	■
40053	RO	I4*	UINT32	×1000, A	■
40055	RO	Voltage Unbalance*	UINT16	×1000	■
40056	RO	Current Unbalance*	UINT16	×1000	■
40057	RO	dPFa ^{*,1}	INT16	×1000	■
40058	RO	dPFb ^{*,1}	INT16	×1000	■
40059	RO	dPFc ^{*,1}	INT16	×1000	■
40060	RO	kW Demand*	INT32	×1000, kW	■
40062	RO	kvar Demand*	INT32	×1000, kvar	■
40064	RO	kVA Demand*	INT32	×1000, kVA	■
40066	RO	Ia Demand*	UINT32	×1000, A	■
40068	RO	Ib Demand*	UINT32	×1000, A	■
40070	RO	Ic Demand*	UINT32	×1000, A	■
40072	RO	Va Angle*	UINT16	× 100, °	■
40073	RO	Vb Angle*	UINT16	× 100, °	■
40074	RO	Vc Angle*	UINT16	× 100, °	■
40075	RO	Ia Angle*	UINT16	× 100, °	■
40076	RO	Ib Angle*	UINT16	× 100, °	■
40077	RO	Ic Angle*	UINT16	× 100, °	■
40078	RO	I residual ^{#,3}	UINT16	×10, mA	■
40079	RO	Temperature ^{#,4}	INT16	×10, °C	■
40080 - 40094		Reserved			
40095	RO	Alarm ^{#,5}	Bitmap	■ ■	■
40096	RO	DO Status ^{#,6}	Bitmap	■ ■	■
40097	RO	DI Status ^{#,7}	Bitmap	■ ■	■
40098	RO	SOE Pointer ^{#,8}	UNIT32	■ ■	■

* Available in Firmware Version V1.20.01 and Protocol Version V6.0 or later

Register address for this register has been changed from Protocol Version 5.0 or earlier

Table5-1 Basic Measurements

Notes:

- 1) When the **Wiring Mode** is Delta, the per phase line-to-neutral voltages, kW, kvars, kVAs and PFs have no meaning, and their registers are reserved.
- 2) “×100, V” indicates the value returned in the register is 100 times the actual engineering value with the unit V (voltage). For example, if the register contains a value 22003, the actual voltage is 22003/100=220.03V.

- 3) When the residual current sensor is not connected, the value in register 40078 is 0x7FFF.
- 4) When the temperature sensor was broken or not connected, the value in register 40079 is 30000. When the temperature is below -40°C, the value in register 40079 is -400.
- 5) The Alarm register indicates the various alarm states with a bit value of 1 meaning active and 0 meaning inactive. The following table illustrates the details of the Alarm register. For PMC-53I and PMC-53V, B0 to B2 are reserved.

Bit	Alarm Event
B0	I residual ALARM
B1	I residual TRIP
B2	Temperature ALARM
B3	Setpoint 1
B4	Setpoint 2
B5	Setpoint 3
B6	Setpoint 4
B7	Setpoint 5
B8	Setpoint 6
Other bits	Reserved

Table 5-2 Alarm Register (40095)

- 6) For the **DO Status** register, the bit values of B0 and B1 represent the states of DO1 and DO2, respectively, with “1” meaning active (closed) and “0” meaning inactive (open).
- 7) For the **DI Status** register, the bit values of B0 and B1 represent the states of DI1 and DI2, respectively, with “1” meaning active (closed) and “0” meaning inactive (open).
- 8) The range of the **SOE Pointer** is between 0 and 0xFFFFFFFF. The **SOE Pointer** is incremented by one for every event generated, and will roll over to 0 if its current value is 0xFFFFFFFF. Since the **SOE Pointer** is a 32-bit value and the SOE Log capacity is relatively small with only 32 events in the PMC-53, an assumption has been made that the **SOE Pointer** will never roll over. If a **CLR SOE** is performed from the front panel or via communications, the **SOE Pointer** will be reset to zero and then immediately incremented by one with a new “Setup Changes via Front Panel” or “Setup Changes via Communications” event. Therefore, any 3rd party software should assume that a **CLR SOE** action has been performed if it sees the **SOE Pointer** rolling over to one or to a value that is smaller than its own pointer. In this case, the new **SOE Pointer** also indicates the number of events in the SOE Log if it is less than 32. Otherwise, there will always be 32 events in the SOE Log.

5.2 Energy Measurements

Register	Property	Description	Format	unit	PMC-53 Model		
					V	I	M
40100	RW	kWh Import	UINT32	x0.1kWh			▪
40102	RW	kWh Export	UINT32	X0.1kWh			▪
40104		Reserved					
40106	RW	kvarh Import	UINT32	X0.1kvarh			▪

40108	RW	kvarh Export	UINT32	X0.1kvarh			▪
40110		Reserved					
40112	RW	kVAh	UINT32	X0.1kVAh			▪

Table 5-3 Energy Measurements

Note:

The Energy registers have a maximum value of 999,999,999 in units of 0.1 kWh and will roll over to zero automatically when it is reached.

5.3 Peak Demands

The value of the Peak Demand register is 1000 times the actual value.

Register	Property	Description	Format
40500	RO	kW Peak Demand	See Table 5-5 DMD-LOG
40504	RO	kvar Peak Demand	
40508	RO	kVA Peak Demand	
40512	RO	Ia Peak Demand	
40516	RO	Ib Peak Demand	
40520	RO	Ic Peak Demand	

Table 5-4 kW Peak Demand

Offset	Description
+0	Peak Demand High-order Word
+1	Peak Demand Low-order Word
+2	UNIX Time High-order Word
+3	UNIX Time Low-order Word

Table 5-5 DMD-LOG Data Structure

5.4 Harmonic Measurements

The value of the THD returned is 10000 times the actual value. For example, if the register contains a value of 1031, the actual harmonic value is 0.1031 or 10.31%. The value of the K Factor data returned is 10 times the actual value.

Register	Property	Description	Format	Multiplier
40703	RO	Ia K Factor	UINT16	×10
40704	RO	Ib K Factor	UINT16	×10
40705	RO	Ic K Factor	UINT16	×10
40706 - 40717		Reserved		
40718	RO	Va THD	UINT16	×10000
40719	RO	Vb THD	UINT16	×10000
40720	RO	Vc THD	UINT16	×10000
40721	RO	Ia THD	UINT16	×10000
40722	RO	Ib THD	UINT16	×10000
40723	RO	Ic THD	UINT16	×10000

Table 5-6 Harmonics Measurements

5.5 Setup Parameters

Register	Property	Description	Format	Range/Unit	PMC-53 Model		
					V	I	M
41000	RW	I residual ALARM Setpoint ¹	UINT16	30 to 1000 (mA) (Default = 500)			▪
41001	RW	I residual ALARM Delay ¹	UINT16	0 to 600 (x0.1s) (Default = 20)			▪
41002	RW	I residual TRIP Delay ¹	UINT16	0 to 600 (x0.1s) (Default = 20)			▪
41003	RW	Temperature ALARM Delay ²	UINT16	0 to 400 (x0.1s) (Default = 20)			▪
41004	RW	I residual TRIP Setpoint ¹	UINT16	30 to 1000 (mA) (Default = 500)			▪
41005	RW	Temperature ALARM Setpoint ²	UINT16	55 to 140 (°C) (Default = 80)			▪
41006	RW	Alarm Enable ^{1,2}	Bitmap ³				▪
41007- 41009		Reserved					
41010	RW	PT Ratio ⁴	UINT16	1* to 2200	▪		▪
41011	RW	CT Ratio ⁴	UINT16	1* to 6000(5A input) 1* to 30000(1A input)		▪	▪
41012	RW	Wiring Mode	UINT16	0=WYE* 1=DELTA 2=DEMO	▪		▪
41013	RW	Unit ID	UINT16	1 to 247 (Default = 100)	▪	▪	▪
41014	RW	Baud rate	UINT16	0=1200 1=2400 2=4800 3=9600* 4=19200	▪	▪	▪
41015	RO	Comm. Config.	UINT16	0=8N2 1=8O1 2=8E1* 3=8N1 4=8O2 5=8E2	▪	▪	▪
41016 - 41018		Reserved					
41019	WO	Clear Energy	UINT16	Writing "0xFF00" to the register clears the kWh,			▪

				kvarh and kVAh registers.			
41020	WO	Clear SOE	UINT16	Writing "0xFF00" to the register resets the SOE Pointer to "0"	▪	▪	▪
41021	RW	DO1 Pulse Width	UINT16	0 to 6000 (x0.1s) 0 = Latch Mode (Default = 10)	▪	▪	▪
41022	RW	DO2 Pulse Width	UINT16				
41023 - 41024		Reserved					
41025	RW	Setpoint 1	Setpoint Data Structure ⁵		▪	▪	▪
41029	RW	Setpoint 2					
41033	RW	Setpoint 3					
41037	RW	Setpoint 4					
41041	RW	Setpoint 5					
41045	RW	Setpoint 6					
41049	RW	DI1 Setpoint Trigger	UINT16	0=Disabled* 1=DO1 2=DO2			▪
41050	RW	DI2 Setpoint Trigger	UINT16	0=Disabled* 1=DO1 2=DO2			▪
41051 - 41052		Reserved					
41053	RW	PF Convention	UINT16	B1B0: 00=IEC* 01=IEEE 10=-IEEE			▪
41054	RW	kVA Calculation	UINT16	B1B0: 00=Vector* 01 =Scalar			▪
41055		Reserved					
41056	RW	Phase A CT	UINT16	0=Normal* 1=Reversed		▪	▪
41057	RW	Phase B CT	UINT16	0=Normal* 1=Reversed		▪	▪
41058	RW	Phase C CT	UINT16	0=Normal* 1=Reversed		▪	▪
.....		Reserved	UINT16				
41223	RW	Demand Period [#]	UINT16	1, 2, 3, 5, 10, 15*, 30, 60mins			▪
41224	RW	Number of	UINT16	1* to 15			▪

		Sliding Windows [#]					
41225		Reserved					
41226	WO	Clear Peak Demands [#]	UINT16	Writing "0xFF00" to the register resets the Peak Demand to "0"			▪

[#] Available in Firmware Version V1.20.01 and Protocol Version V6.0 or later

*Default

Table5-7 Setup Parameters

Notes:

- 1) Registers 41000-41002, 41004 and 41006 are valid only if the meter is equipped with the I residual Input. Otherwise, they are reserved.
- 2) Registers 41003, 41005 and 41006 are valid only if the meter is equipped with the Temperature Input. Otherwise, they are reserved.
- 3) The bitmap definition of the Alarm Enable register is shown in the following table. For Bits 0 to 4, the value "1" means that the specified function is enabled; otherwise, it is disabled. Bits 5 to 15 are reserved.

Bit	4	3	2	1	0
Function	Temperature ALARM DO1 Trigger	I residual ALARM DO1 Trigger	Temperature ALARM Enable	I residual TRIP Enable	I residual ALARM Enable

Table 5-8 Alarm Enable Register Bitmap Definition (41006)

- 4) $PT \text{ Ratio} \times CT \text{ Ratio} \times \text{Rated Phase Voltage Input} \times \text{Rated Current Input} \times \sqrt{3}$ must be less than 790,000,000.
- 5) Setpoint Data Structure

Offset	Format	Description	
+0 (low-order)	UINT16	Over Setpoint	Under Setpoint
		1=VLN, 2=VLL, 3=I, 4=ΣP, 5=ΣQ	6=VLN, 7=VLL, 8=ΣPF
+0 (high-order)		Setpoint Trigger: 0= No Trigger, 1=Trigger DO1, 2=Trigger DO2	
+1	UINT32	Setpoint Limit	
+3	UINT16	Setpoint Delay: 0 to 9999 (seconds)	

Table 5-9 Setpoint Data Structure

The Setpoint Limit for PF is 1000 times the actual PF value. For example, if the actual desired limit is 0.866, the Setpoint Limit should be specified as 866.

5.6 SOE Log

Each SOE event occupies 7 registers as shown in the following table. The SOE LOG Data Structure is described in Table 5-11.

Register	Property	Description	Format	Mode		
				V	I	M
42000-42006	RO	Event 1	See Table 5-11 SOE LOG Data Structure	▪	▪	▪
42007-42013	RO	Event 2		▪	▪	▪
42014-42020	RO	Event 3		▪	▪	▪
42021-42027	RO	Event 4		▪	▪	▪
42028-42034	RO	Event 5		▪	▪	▪
42035-42041	RO	Event 6		▪	▪	▪
42042-42048	RO	Event 7		▪	▪	▪
42049-42055	RO	Event 8		▪	▪	▪
42056-42062	RO	Event 9		▪	▪	▪
42063-42069	RO	Event 10		▪	▪	▪
42070-42076	RO	Event 11		▪	▪	▪
42077-42083	RO	Event 12		▪	▪	▪
42084-42090	RO	Event 13		▪	▪	▪
42091-42097	RO	Event 14		▪	▪	▪
42098-42104	RO	Event 15		▪	▪	▪
42105-42111	RO	Event 16		▪	▪	▪
.....						
42217-42223	RO	Event 32		▪	▪	▪

Table 5-10 SOE Log

Notes:

1) SOE LOG Data Structure

Offset	Property	Description
+0	RO	Reserved
+1	RO	Event Classification (See Table 5-12)
+2	RO	Event Value High-order Word
+3	RO	Event Value Low-order Word
+4	RO	Event Time Millisecond (0 to 999)
+5	RO	Event Time High-order Word (UNIX time in Second)
+6	RO	Event Time Low-order Word (UNIX time in Second)

Table 5-11 SOE LOG Data Structure

2) SOE Event Classification

Value	1	2	3	4
Meaning	DI1 close	DI1 open	DI2 close	DI2 open
Value	11	12	13	14
Meaning	DO1 close	DO1 open	DO2 close	DO2 open
Value	22	31	32	33-40
Meaning	Power Outage	Setup Changes via Front Panel	Setup Changes via Communications	Reserved
Value	41	42	43	44
Meaning	DI1 triggered DO1	DI1 triggered DO2	DI2 triggered DO1	DI2 triggered DO2

Value	51	52	53	54
Meaning	Ir ALARM Active	Ir TRIP Active	Temperature ALARM Active	Ir ALARM Inactive
Value	55	56-59	60	61
Meaning	Temperature ALARM Inactive	Reserved	Over VLN Setppoint Active	Over VLL Setpoint Active
Value	62	63	64	65
Meaning	Over Current Setpoint Active	Over kW Total Setpoint Active	Over kvar Total Setpoint Active	Under VLN Setpoint Active
Value	66	67	68	69
Meaning	Under VLL Setpoint Active	Under PF Setpoint Active	Under VLN Setpoint Inactive	Under VLL Setpoint Inactive
Value	70	71	72	73
Meaning	Over Current Setpoint Inactive	Over kW Total Setpoint Inactive	Over kvar Total Setpoint Inactive	Under VLN Setpoint Inactive
Value	74	75		
Meaning	Under VLL Setpoint Inactive	Under PF Setpoint Inactive		

Table 5-12 SOE Event Classification

5.7 Time

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

Register	Property	Description	Format	Note
60000	RW	High-order Byte: Year	UINT16	0-99 (Year-2000)
		Low-order Byte: Month		1 to 12
60001	RW	High-order Byte: Day	UINT16	1 to 31
		Low-order Byte: Hour		0 to 23
60002	RW	High-order Byte: Minute	UINT16	0 to 59
		Low-order Byte: Second		0 to 59
60003	RW	Millisecond	UINT16	0 to 999
60004	RW	UNIX Time*	UINT32	(0 to 3155759999) This time shows the number

				of seconds since 00:00:00 January 1, 1970
--	--	--	--	--

* Available in Firmware Version V1.20.01 and Protocol Version V6.0 or later

Table 5-13 Time Registers

5.8 DO Control

The DO Control registers are implemented as “Write-Only” Modbus Coil Registers (0XXXXX) and can be controlled with the Force Single Coil command (Function Code 0x05). The PMC-53 does not support the Read Coils command (Function Code 0x01) because DO Control registers are “Write-Only”. Register 40066 (DO Status) should be read instead to determine the current DO status.

The PMC-53 adopts the ARM before EXECUTE operation for the remote control of its Digital Outputs. 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” 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	Format	Description
60064	WO	UINT16	Arm DO1 close
60065	WO	UINT16	Execute DO1 close
60066	WO	UINT16	Arm DO1 open
60067	WO	UINT16	Execute DO1 open
60068	WO	UINT16	Arm DO2 close
60069	WO	UINT16	Execute DO2 close
60070	WO	UINT16	Arm DO2 open
60071	WO	UINT16	Execute DO2 open
60072-60127			Reserved
60128	WO	UINT16	Arm the reset of Alarm LED and Buzzer
60129	WO	UINT16	Execute the reset of Alarm LED and Buzzer

Table 5-14 DO Control Registers

5.9 Meter Information

Register	Property	Description	Format	Note
60200- 60219	RO	Meter model ¹	UINT16	See Table 5-16
60220	RO	Firmware Version	UINT16	e.g. 10000 means V1.00.00
60221	RO	Protocol Version	UINT16	e.g. 40 means V4.0
60222	RO	Firmware Update Date: Year-2000	UINT16	e.g. 080709 means July 9, 2008
60223	RO	Firmware Update Date: Month	UINT16	
60224	RO	Firmware Update Date: Day	UINT16	
60225	RO	Serial Number:	UINT32	e.g. 0908471895 means that

		XX(Year-2000) - XX(Month) - XX(Lot Number) - XXXX(Meter Number) [#]		this meter was the 1895 th meter manufactured in Lot 47 of August 2009
60227-60228	RO	Reserved	UINT16	
60229	RO	Feature Number	UINT16	B2B1B0: 000=0 DI + 0 DO 001=2 DI 010=2DI + 2 DO 011=2DI + 2 DO (SS Relay)
			UINT16	B4B3: 00=No I residual + No Temperature Inputs 01=1 I residual + 1 Temperature Inputs 10=1 I residual Input 11=1 Temperature Input
			UINT16	B5 to B15 are reserved
60230	RO	Current Input	UINT16	1 / 5 (A)
60231	RO	Voltage Input	UINT16	100 / 380 (V)

[#] Register address and definition for this register has been changed from Protocol Version 5.0 or earlier

Table 5-15 Meter Information

Note:

- 1) The Meter Model appears in registers 60200 to 60219 and contains the ASCII encoding of the string "PMC-53M" 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	0x4D	M
60207-60219	0x20	Null

Table 5-16 ASCII Encoding of "PMC-53M"

Revision History

Revision	Date	Description
4.0A	20100623	First Edition
5.0A	20110225	P2: Added the explanation for the graphic symbols for Danger and Caution P7: Updated the description for Figures descriptions P9: Updated the Models and Measurements Table P18: Added Section 3.1.2 LCD Display Areas P20: Added Section 3.1.3 Peak Demand Display Added Section 3.2 LED Indicators P22: Updated Table 3-5 Data display screens of PMC-53M P24: Updated Figure 3-4 Setup Menu P25: Updated Table 3-6 Setup Parameters P31: Added Section 4.2 Power and Energy P36: Added Section 4.5 Power Quality P37: Updated Table5-1 Basic Measurements P40: Added Section 5.3 Peak Demands P40: Added Section 5.4 Harmonics Measurements P41: Updated Table5-7 Setup Parameters P46: Added the description for UNIX Time registers P48: Added "Revision History" P49: Updated the Power Supply specification in Appendix A Updated the Voltage Input specification in Appendix A P51: Added the Pollution Degree and Measurement Category to the Technical Specifications in Appendix A P51: Updated the Residual Current Sensor Ordering Guide in Appendix B P54: Updated the Standards Compliance Table in Appendix C P55: Updated the PMC-53 Ordering Guide in Appendix E
V5.2A	20120207	P9: Updated the application figure P11: Updated the Figure 2-1 Appearance P14: Added the Figure 2-6 3-wire Delta, Direct Connection P16: Updated Figure 2-10 RS485 Communication Connections P18: Update Figure 3-1 Front Panel P24: Updated the Figure 3-6 Setup Menu P27: Added the Pulse Constant in Table 3-5 Setup Parameters P56: Updated the PMC-53 Ordering Guide in Appendix E

Appendix A Technical Specifications

Voltage Inputs (V1, V2, V3, VN)	
Standard	220VLN/380VLL
Optional	57.7VLN/100VLL
Range	10% to 120% Un
PT Ratio	1-2200
Overload	1.2xUn continuous, 2xUn for 1s
Burden	<0.1VA per phase
Frequency	45-65Hz
Current Inputs (I11, I12, I21, I22, I31, I32)	
Standard	5A
Optional	1A
Range	0.1% to 120% In
CT Ratio	1-6,000 (5A) or 1-30,000 (1A)
Overload	1.2xIn continuous, 20xIn for 1s
Burden	<0.3VA per phase
Power Supply (L+, N-, GND)	
Standard	95-250VAC/DC, $\pm 10\%$, 47-440Hz
Burden	<3W
Digital Inputs (DI1, DI2, DIC)	
Type	Dry contact, 24VDC internally wetted
Sampling	1000Hz
Hysteresis	40ms minimum
Digital Outputs (DO11, DO12, DO21, DO22)	
Type	Form A Mechanical Relay
Loading	5A @ 250VAC or 30VDC
Pulse Outputs (kWh, kvarh)	
Type	Form A Solid State Relay
Isolation	Optical
Max. Load Voltage	80V
Max. Forward Current	50mA
I residual Input (I41, I42)	
Nominal Input	1V
Range	1% to 120% Nominal
RTD Temperature Input (TC1, TC2)	
Type	2-wire Pt100
Range	-40 °C to 200 °C
Alarm Buzzer	
Sound level	85dB at 1m
I residual Sensor (Zero Sequence CT)	
Nominal Current	1A
Output	1V
Overload	1.2A

Accuracy	1%
Frequency	50 / 60Hz
Line length	4000mm
Dielectric Strength	2.5kV @ 1 minute
I residual Sensor Models	PMC-MIR-35, PMC-MIR-50, PMC-MIR-75, PMC-MIR-120
RTD Temperature Sensor	
Material	Platinum Resistor Pt100
Range	-50°C to 200°C
Accuracy	$\pm(0.30+0.005 t)$
Cable Length	3000mm
Protective Tube Length	30mm
RTD Models	PMC-DN-30, PMC-DN-50, PMC-DN-55, PMC-DN-60
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	96x96x75 mm (3.8"x3.8"x3.0")
IP Rating	52
Shipping Weight	0.55 kg
Shipping Dimensions	170x160x150 mm (6.7"x6.3"x5.9")
Measurement Category	III

Accuracy

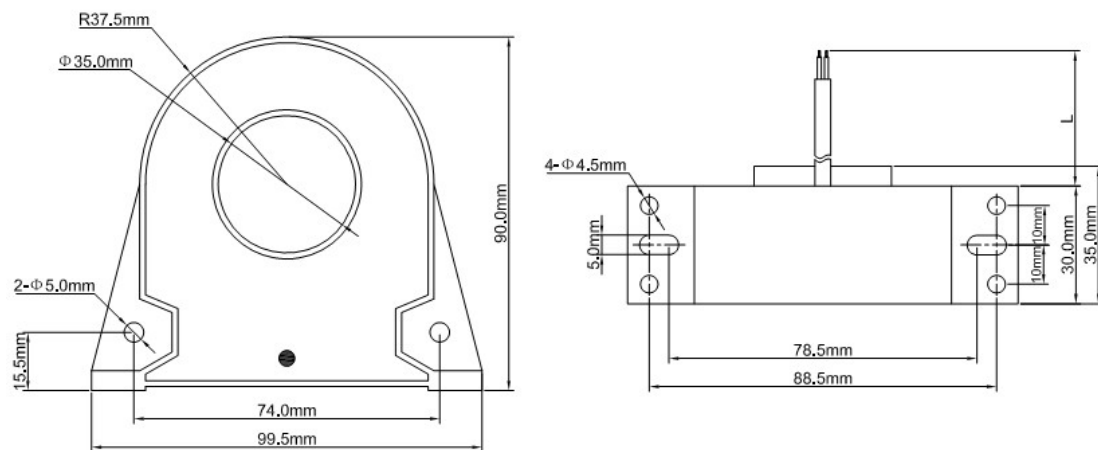
Parameters	Accuracy	Resolution
Voltage	$\pm 0.2\%$ reading	0.01V
Current	$\pm 0.2\%$ reading + 0.05% F.S.	0.001A
Neutral Current	1% F.S.	0.001A
kW, kVA	IEC 62053-22 Class 0.5S	0.001k
kWh, kVAh	IEC 62053-22 Class 0.5S	0.1kXh
kvar / kvarh	IEC 62053-21 Class 2	0.001k / 0.1kvarh
P.F.	IEC 62053-22 Class 0.5S	0.001
Frequency	± 0.02 Hz	0.01Hz
THD	IEC 61000-4-7 Class B	0.1%
K-Factor	IEC 61000-4-7 Class B	0.1
Phase angles	$\pm 1^\circ$	0.01°
I residual	$\pm 1\%$ F.S.	0.1mA
Temperature	$\pm 1^\circ\text{C}$	0.1°C

Appendix B Residual Current Sensor (Zero Sequence CT)

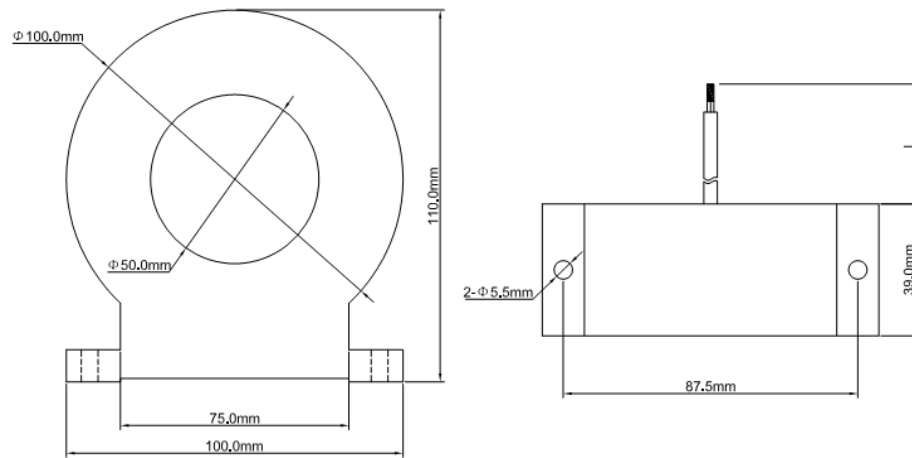
Ordering Guide

Model	Diameter of cable hole	Range of Phase current	Weight
PMC-MIR-35	35mm	0A to 63A	<400g
PMC-MIR-50	50mm	63A to 125A	<800g
PMC-MIR-75	75mm	125A to 250A	<1200g
PMC-MIR-120	120mm	250A to 1000A	<1500g
Technical Specification			
Primary current		1A (r.m.s)	
Overload		1.2A	
Second Voltage		1V (r.m.s)	
Accuracy		1%	
Frequency		50/60HZ	
Line length		4000mm	
Environmental Condition			
Operation Temperature		-35°C to 65°C	
Storage Temperature		-40°C to 75°C	
Testing			
Dielectric Strength		2.5kV (3mA/1Min)	

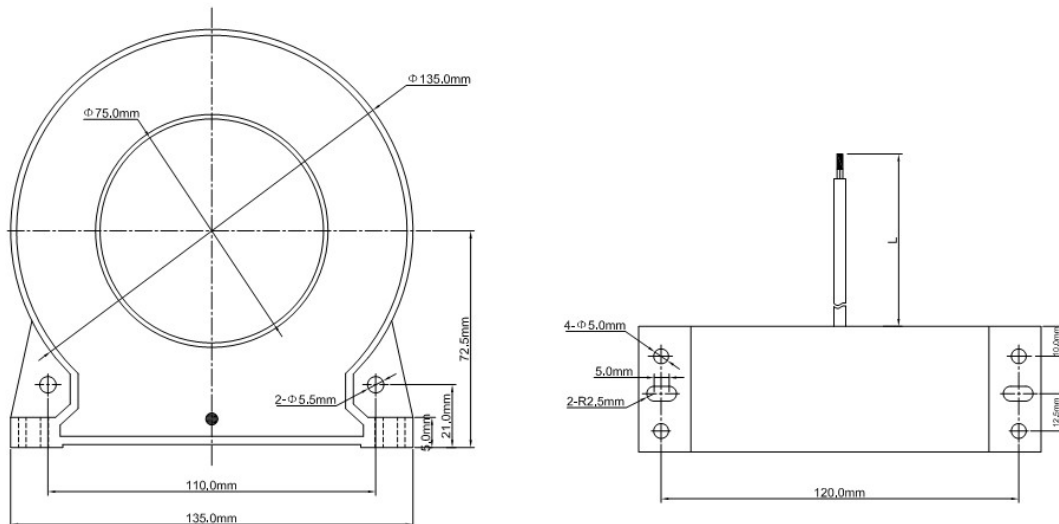
1) PMC-MIR-35, the hole diameter is 35mm



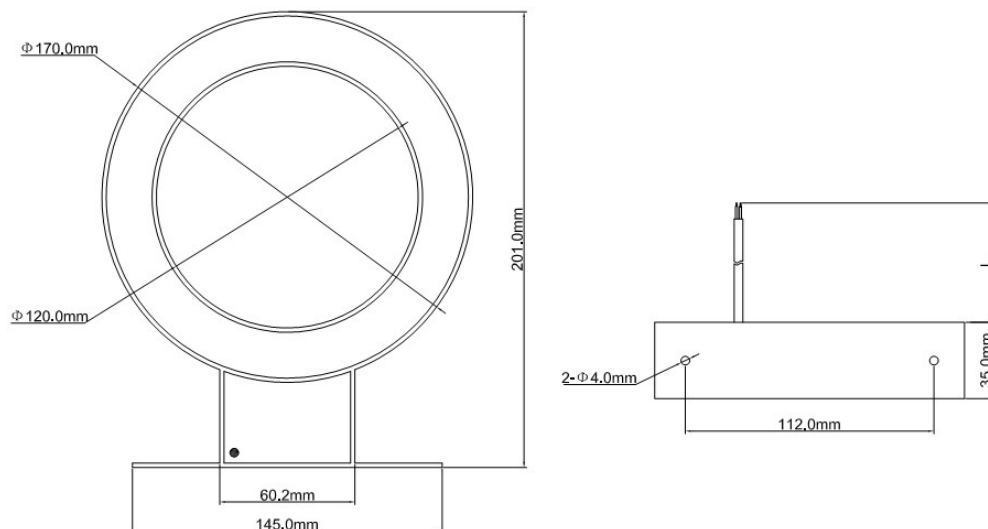
2) PMC-MIR-50, the hole diameter is 50mm



3) PMC-MIR-75, the hole diameter is 75mm



4) PMC-MIR-120, the hole diameter is 120mm



Appendix C Temperature Sensor



Hoop Model	Diameter Range of Hoop	Weight
PMC-DN-30	18 to 32mm	<=58g
PMC-DN-50	27 to 51mm	<=62g
PMC-DN-55	33 to 57mm	<=64g
PMC-DN-60	40 to 63mm	<=66g
Technical Specification		
Material	Platinum resistor Pt100	
Work Range	-40°C to 200°C	
Accuracy	$\pm(0.30+0.005 t)$	
Line Length	3000mm	
Protective Tube Length	30mm	

Appendix D Standards Compliance

Safety Requirements		
CE LVD 2006/95/EC		EN61010-1-1-2001
Insulation		IEC 60255-5-2000
Dielectric Test		2kV @ 1 minute
Insulation Resistance		>100MΩ
Impulse Voltage Insulation		5kV, 1.2/50μs
Electromagnetic Compatibility as per CE EMC 2004/108/EC (EN 61326: 2006)		
Immunity Tests		
Electrostatic discharge		IEC 61000-4-2: 2008 Level III
Radiated fields		IEC 61000-4-3: 2008 (10 V/m)
Fast transients		IEC 61000-4-4: 2004 Level III
Surges		IEC 61000-4-5: 2005 Level III
Conducted disturbances		IEC 61000-4-6: 2008 Level III
Magnetic Fields		IEC 61000-4-8: 2009 Level IV
Oscillatory waves		IEC 61000-4-12: 2006 Level III
Electromagnetic Emission		IEC 60255-25: 2000
Emission Tests		
Limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment		EN 55011: 2009 (CISPR 11)
Limits and methods of measurement of radio disturbance characteristics of information technology equipment		EN 55022: 2006+A1: 2007 (CISPR 22)
Limits for harmonic current emissions for equipment with rated current ≤16 A		EN 61000-3-2: 2006+A1: 2009
Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current ≤16 A		EN 61000-3-3: 2006
Emission standard for residential, commercial and light-industrial environments		EN 61000-6-3: 2007
Electromagnetic Emission Tests for Measuring Relays and Protection Equipment		IEC 60255-25: 2000
Mechanical Tests		
Vibration Test	Response	IEC 60255-21-1:1998 Level I
	Endurance	IEC 60255-21-1:1998 Level I
Shock Test	Response	IEC 60255-21-2:1998 Level I
	Endurance	IEC 60255-21-2:1998 Level I
Bump Test		IEC 60255-21-2:1998 Level I



Appendix E Ordering Guide

											
Product Code						Description					
PMC-53M Intelligent Multifunction Meter											
Basic Function											
M						3-phase real-time multi-function parameters					
Input Current											
5						5A					
1						1A					
Input Voltage											
1						57.7/100V					
3						220/380V					
Power Supply											
2						95-250VAC/VDC, 47-440Hz					
3						18-72VDC					
System Frequency											
5						50Hz					
6						60Hz					
I/O											
X						None					
B						2DI+ 2DO					
C*						2DI + 2 SS Pulse Outputs					
Display Screen											
C						LCD					
I residual and RTD Inputs											
X						None					
A*						1 I residual and 1 RTD inputs^					
Communications											
X						None					
A						1xRS-485 Port, Modbus					
B*						1xRS-485 Port, Bacnet/MSTP					
PMC-53	M	-	5	3	2	5	B	C	X	A	PMC-53M-5325BCXA (Standard Model)

* Additional charges apply

^When I residual and RTD are selected, I/O option C is not available

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