PMC-33M-A

Digital Multifunction Meter

User Manual

Version: V1.0A

April 20, 2020

The information contained in this manual is believed to be accurate at the time of publication; however, CET assumes no responsibility for any errors which may appear here and reserves the right to make changes without notice. Please consult CET or your local representative for the latest product specifications.

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

Table of Contents

Chapter 1 Introduction

This manual explains how to use the PMC-33M-A Digital Multifunction Meter. Throughout the manual the term “meter” generally refers to all models.

This chapter provides an overview of the PMC-33M-A meter and summarizes many of its key features.

1.1 Overview

The PMC-33M-A Digital Multifunction Meter is CET’s latest offer for the economical digital power/energy metering market. Housed in a standard DIN form factor measuring 96x96x88mm, it is perfectly suited for industrial, commercial and utility applications. The PMC-33M-A features quality construction, multifunction true RMS measurements and a large, backlit, 7-segmant LCD. Compliance with the IEC 62053-22 Class 0.5S Standard, it is a cost effective replacement for analog instrumentation that is capable of displaying 3-phase measurements at once. The standard RS-485 port and Modbus RTU protocol support makes the PMC-33M-A a smart metering component for any Energy Management System.

You can setup the meter through its front panel or via our free PMC Setup software. The meter is also supported by our PecStar® iEMS Integrated Energy Management System. Following is a list of typical applications for the PMC-33M-A:

- 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 should you require further assistance with your application.

1.2 Features

Ease of use

- Large, backlit LCD display with wide viewing angle
- Easy to navigate with an intuitive user interface
- LED indicators for Energy Pulsing and Communications activities
- Password-protected setup via front panel or free PMC Setup software
- Easy installation with mounting clips, no tools required

Multifunction True RMS Measurements

- ULN, ULL per phase and Average
- Current per phase and Average with calculated Neutral Current
- kW, kvar, kVA, PF per phase and Total
- kWh, kvarh Import / Export / Net / Total, kVAh Total
- Frequency
- Device Operating Time (Running Hours)

Enhanced Measurements

- U and I THD, TOHD, TEHD
- Current TDD, TDD Odd, TDD Even, K-Factor, Crest-Factor
- U and I Unbalance and Phase Angles
- kvarh Q1-Q4

Diagnostics

- Frequency Out-of-Range, Loss of Voltage / Current
- kW Direction per phase and Total, Possible Incorrect CT Polarity
- Incorrect U & I Phase Sequence

Communications

- Optically isolated RS-485 port at max. 38,400 bps
- Standard Modbus RTU

Real-time Clock

- Equipped with a battery-backed Real-Time Clock with 25ppm accuracy (<2s per day)

System Integration

- Supported by CET's PecStar® iEMS
- Easy integration into 3rd-party Energy Management, Automation, SCADA or BMS systems via Modbus RTU

1.3 PMC-33M-A application in Power and Energy Management Systems

The PMC-33M-A can be used to monitor Wye or Delta connected power system. Modbus communications allow real-time data and other information to be transmitted across a RS-485 network to an Integrated Energy Management system such as PecStar iEMS®.

1.4 Getting more information

Additional information is available from CET via the following sources:

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

Chapter 2 Installation

Caution

Installation of the PMC-33M-A should only be performed by qualified and competent personnel who have the appropriate training and experience with high voltage and current devices. The meter must be installed in accordance with all local and national electrical codes.

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

2.1 Appearance

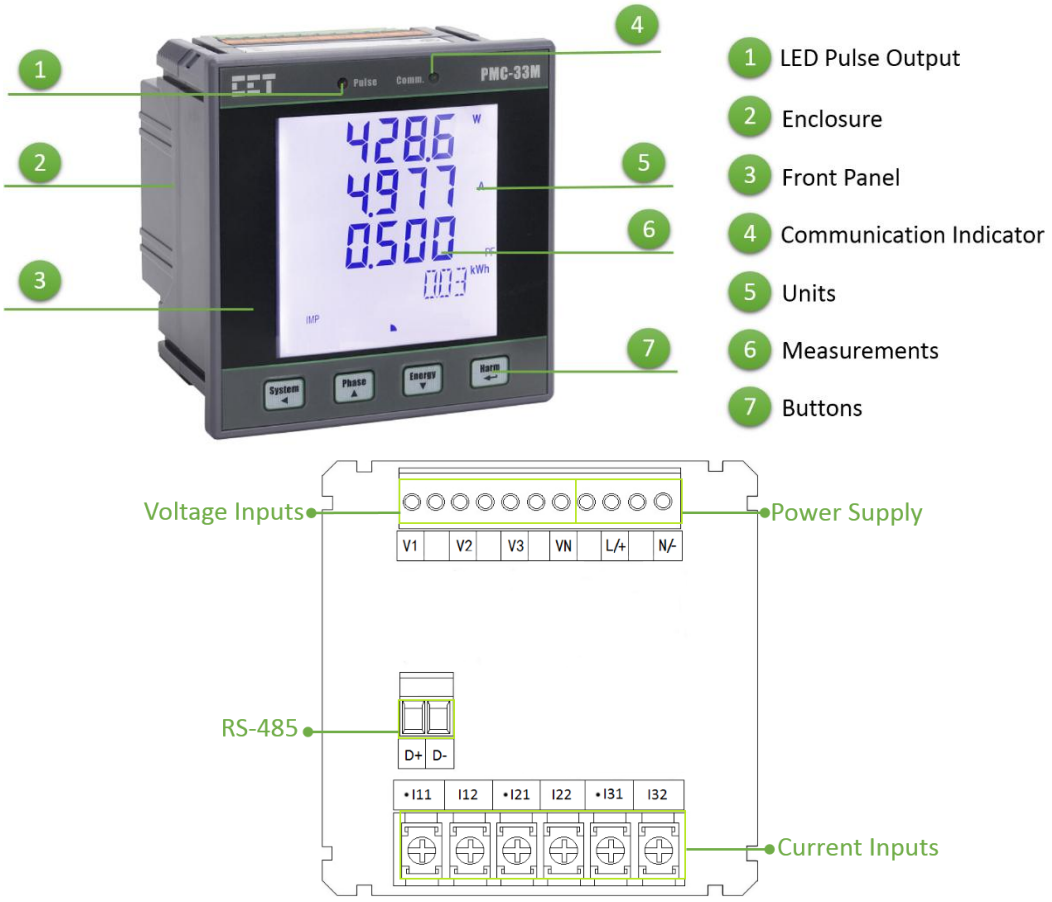


Figure 2-1 Appearance

2.2 Unit Dimensions

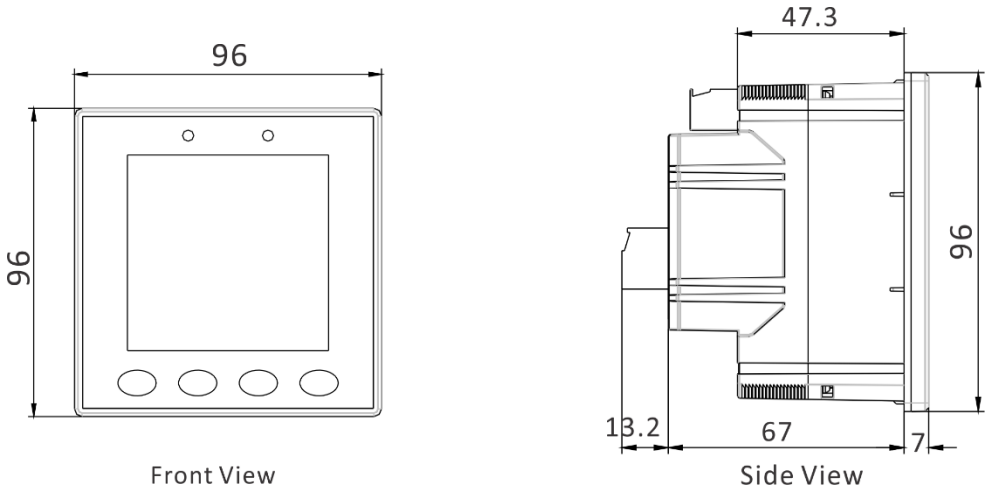


Figure 2-2 Unit Dimensions

2.3 Terminal Dimensions

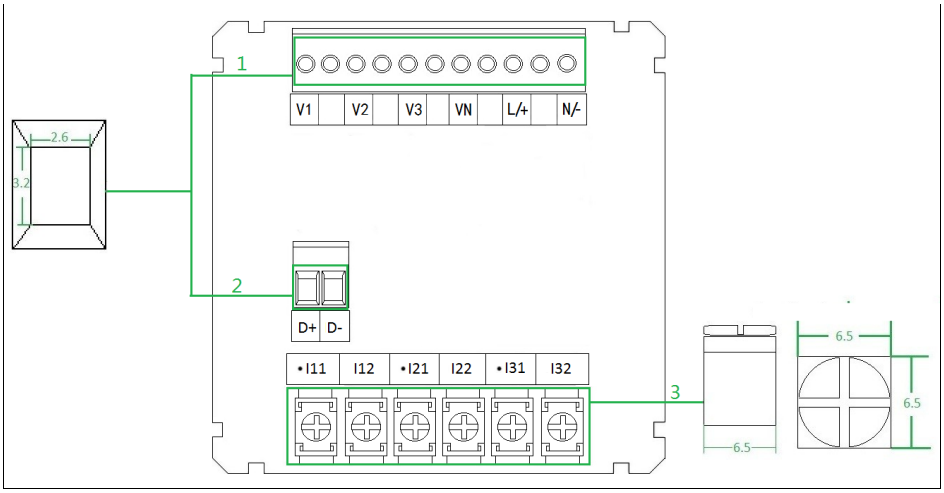


Figure 2-3 Terminal Dimensions

	Terminal	Terminal Dimensions	Wire Size	Max. Torque
1	Voltage Input Power Supply	2.6mm x 3.2mm	1.5mm²	5 kgf.cm/M3 (4.3 lb-in)
2	RS-485			
3	Current Input	6.5mm x 6.5mm	1.0mm² - 2.5mm² (14AWG - 22AWG)	6.0 kgf.cm/M3 (5.2 lb-in)

Table 2-1 Terminal Dimensions

2.4 Mounting

The PMC-33M-A should be installed in a dry environment with no dust and kept away from heat, radiation and electrical noise source.

Installation steps:

- Remove the installation clips from the meter
- Fit the meter through a 92mmx92mm cutout as shown in Figure 2-4
- Re-install the installation clips and push the clips tightly against the panel to secure the meter

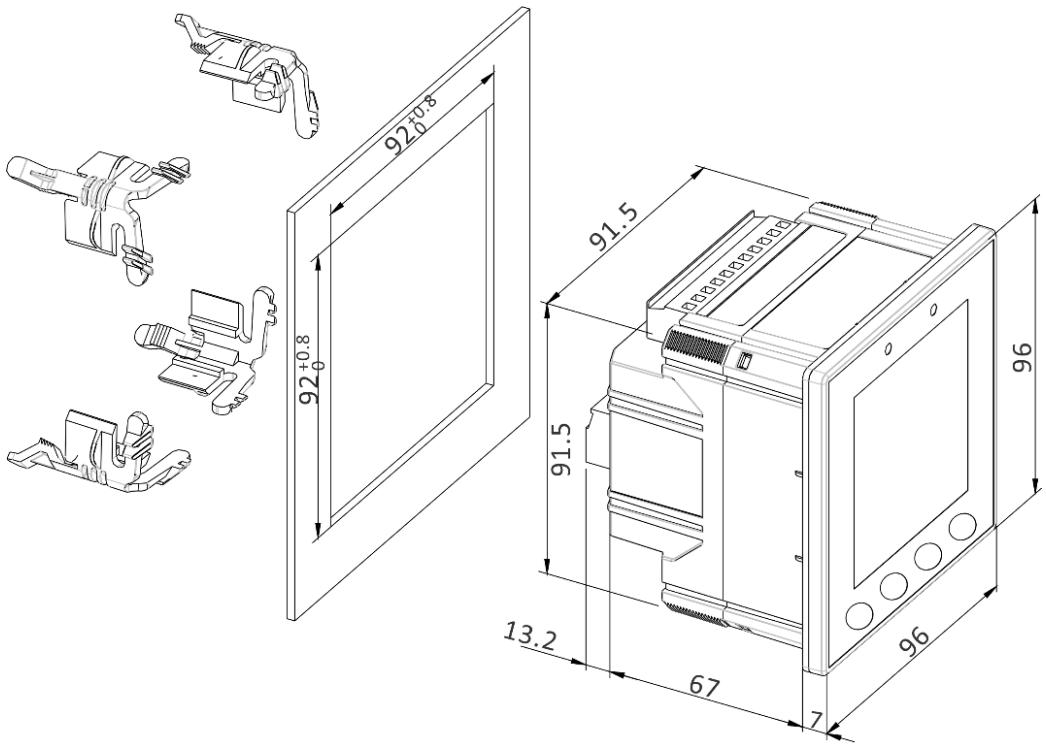


Figure 2-4 Panel Cutout Mounting

2.5 Wiring connections

PMC-33M-A can satisfy almost any three phase power systems. Please read this section carefully before installation and choose the correct wiring method for your power system. The following Wiring Modes are supported:

- 3-Phase 4-Wire (3P4W) Wye Direct Connection with 3CTs
- 3-Phase 4-Wire (3P4W) Wye with 3PTs and 3CTs
- 3-Phase 3-Wire (3P3W) Direct Delta Connection With 3CTs
- 3-Phase 3-Wire (3P3W) Direct Delta Connection with 2CTs
- 3-Phase 3-Wire (3P3W) Delta with 2PTs and 3CTs
- 3-Phase 3-Wire (3P3W) Delta with 2PTs and 2CTs
- 1-Phase 3-Wire (1P3W) Direct Connection with 2CTs
- 1-Phase 2-Wire, Uln (1P2W-Uln) Direct Connection with 1CT
- 1-Phase 2-Wire, Ull (1P2W-Ull) Direct Connection with 1CT

Caution

Under no circumstances should the PT secondary be shorted.

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

2.5.1 3-Phase 4-Wire (3P4W) Wye Direct Connection with 3CTs

Please consult the serial number label to ensure that the rated system phase voltage is less than or equal to the meter's rated phase voltage input specification. Set the **Wiring Mode** to **3P4W**.

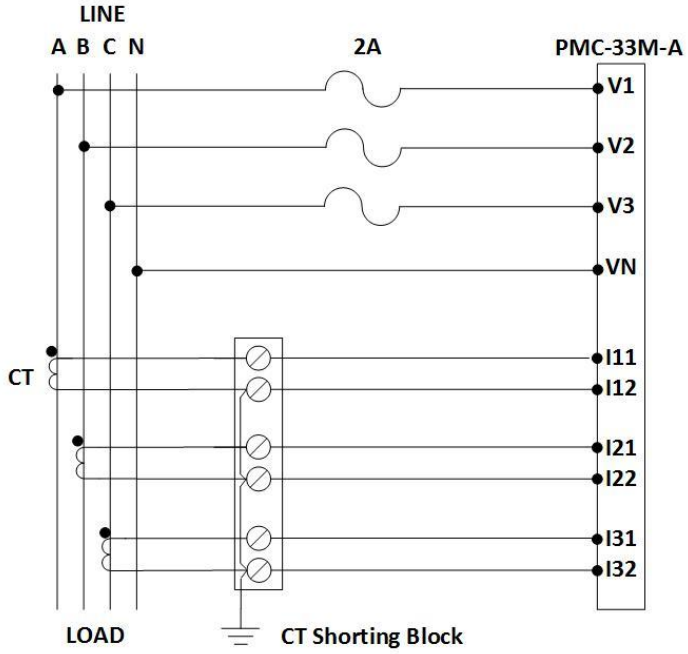


Figure 2-5 3P4W Direct Connection with 3CTs

2.5.2 3-Phase 4-Wire (3P4W) Wye with 3PTs and 3CTs

Please consult the serial number label to ensure that the rated PT secondary voltage is less than or equal to the meter's rated phase voltage input specification. Set the **Wiring Mode** to **3P4W**.

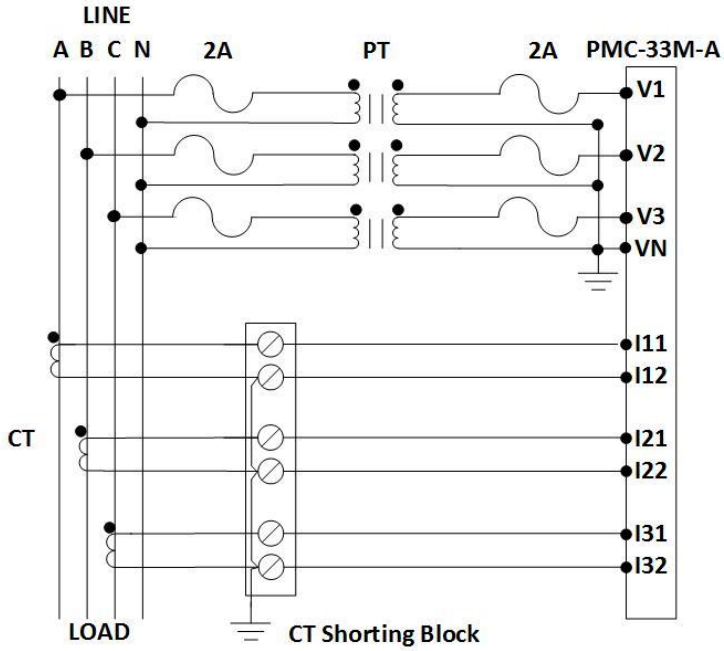


Figure 2-6 3P4W with 3PTs and 4CTs

2.5.3 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**.

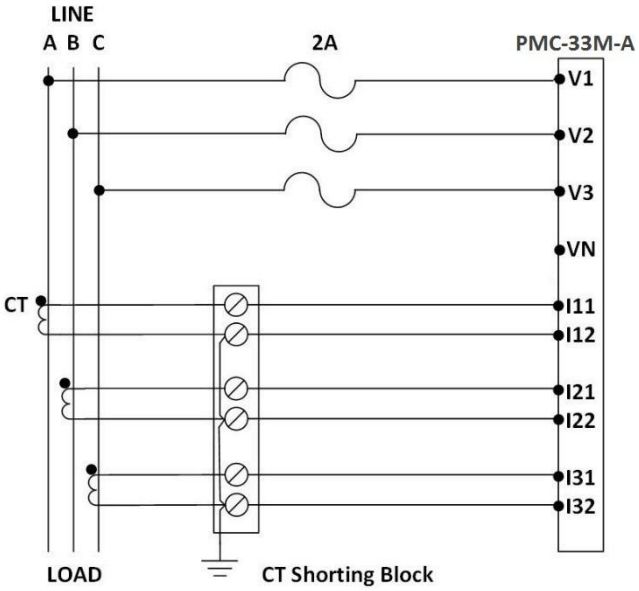


Figure 2-7 3P3W Direct Connection with 3CTs

2.5.4 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**.

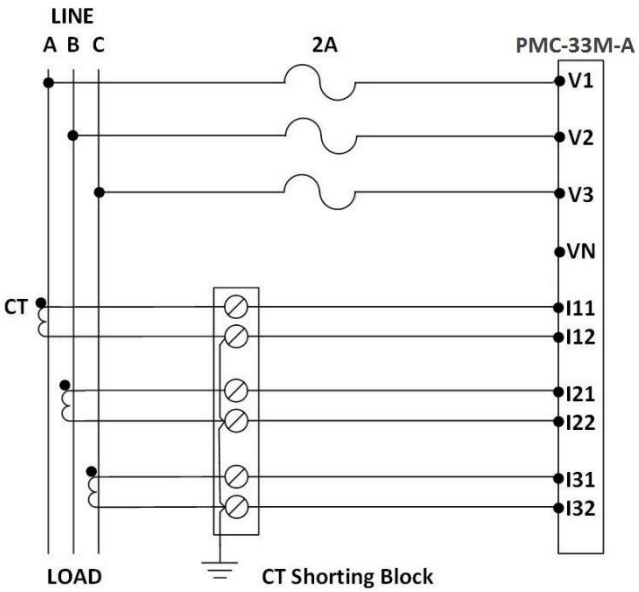


Figure 2-8 3P3W Direct Connection with 2CTs

2.5.5 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**.

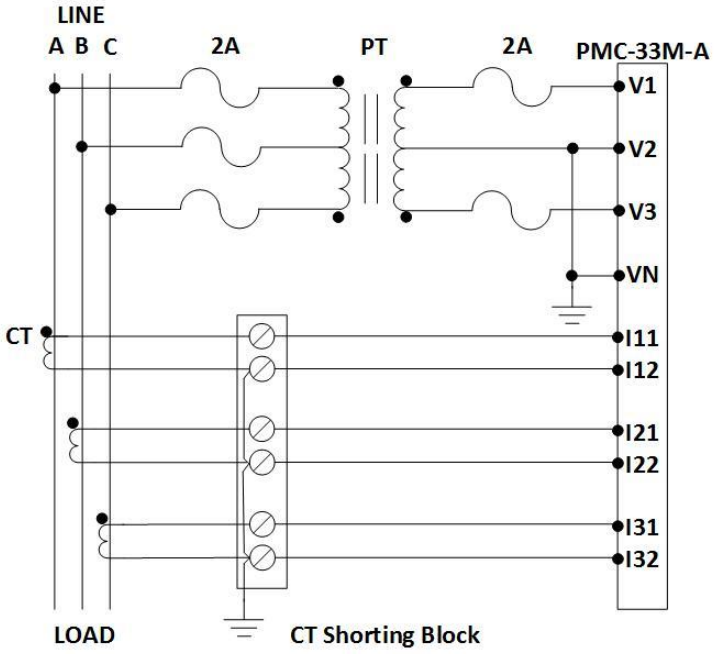


Figure 2-9 3P3W Delta with 2PTs and 3CTs

2.5.6 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**.

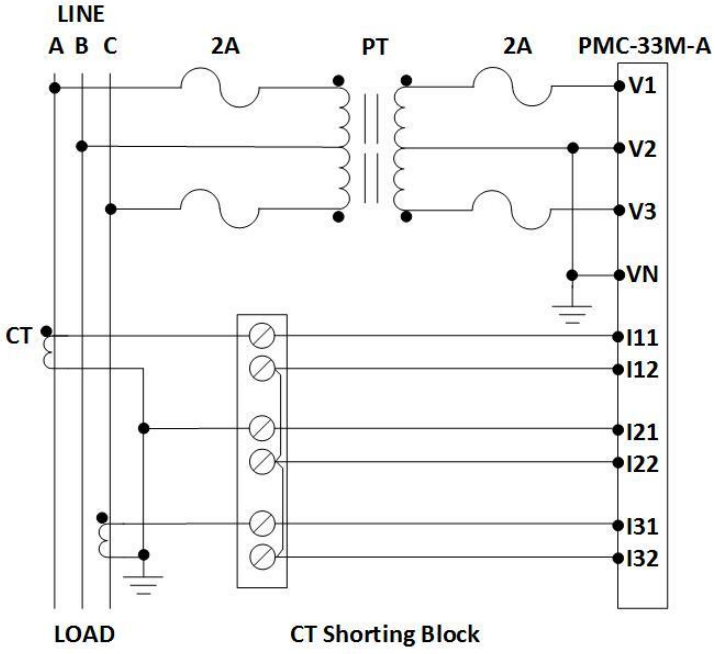


Figure 2-10 3P3W Delta with 2PTs and 2CTs

2.5.7 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**.

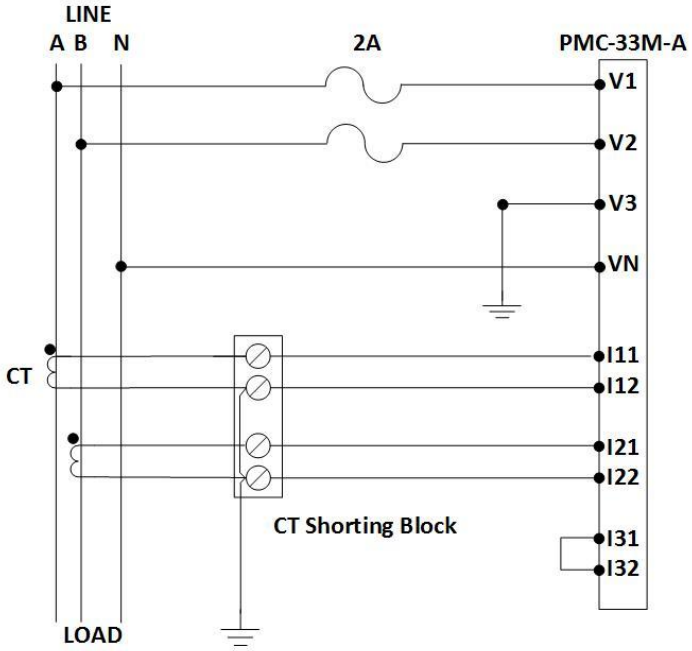


Figure 2-11 1P3W Direct Connection with 2CTs

2.5.8 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**.

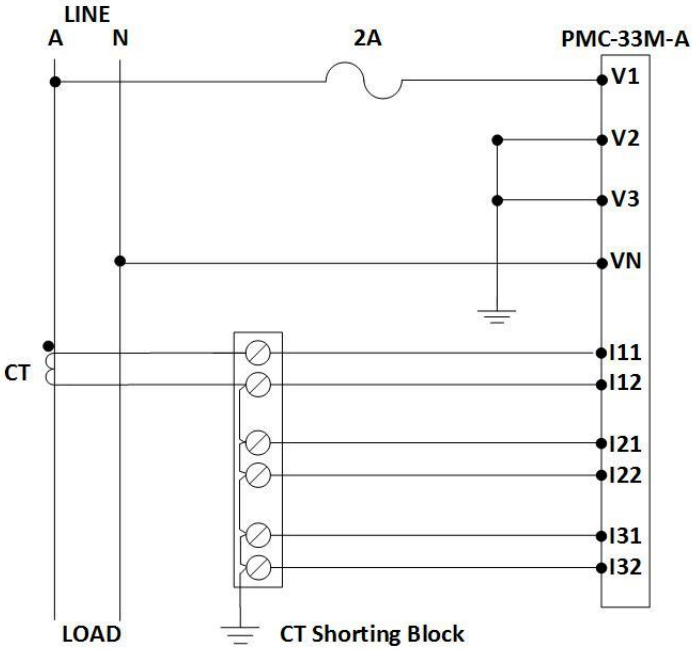


Figure 2-12 1P2W Uln Direct Connection with 1CT

2.5.9 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 phase voltage input specification. Set the **Wiring Mode** to **1P2W, L-L**.

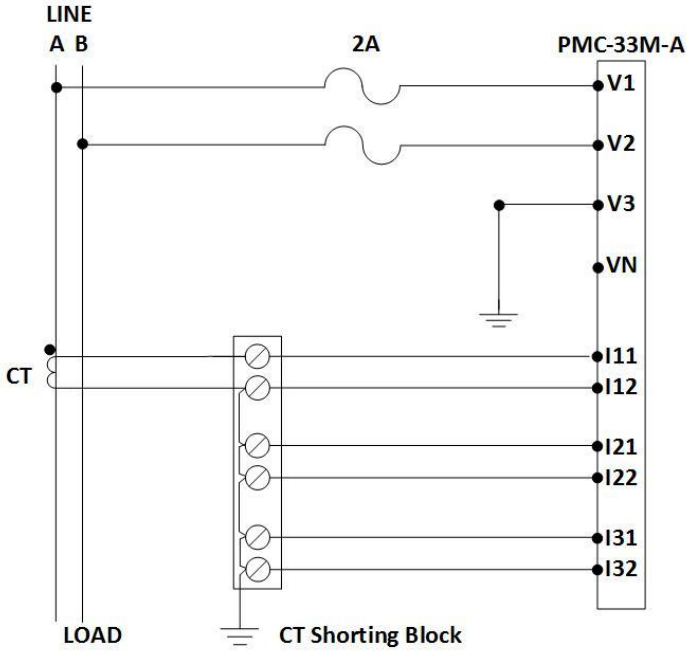


Figure 2-13 1P2W Ull Direct Connection with 1CT

2.6 Communications Wiring

The PMC-33M-A provides one standard RS-485 port which supports the Modbus RTU protocol. Up to 32 devices can be connected on a RS-485 bus. The overall length of the RS-485 cable connecting all devices should not exceed 1200m.

If the master station does not have a RS-485 communications port, a RS-232/RS-485 or USB/RS-485 converter with optically isolated output and surge protection should be used. The following figure illustrates the RS-485 communications connections on the PMC-33M-A:

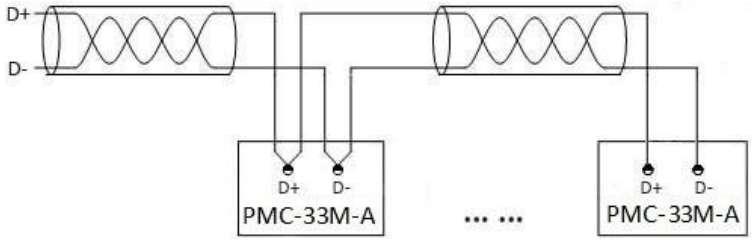


Figure 2-14 Communications Connections

2.7 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.

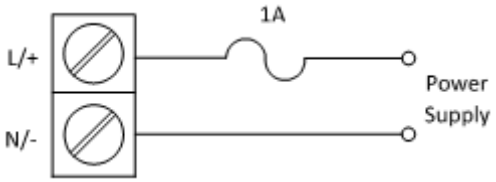


Figure 2-15 Power Supply Connections

Chapter 3 Front Panel

The PMC-33M-A 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 Display

3.1.1 LCD Testing

Pressing both the **<Phase>** and the **<Energy>** buttons simultaneously for 2 seconds enters the LCD Testing mode. All LCD segments and LED indicators are illuminated during testing. The LCD will return to its normal display mode when any button is pressed.

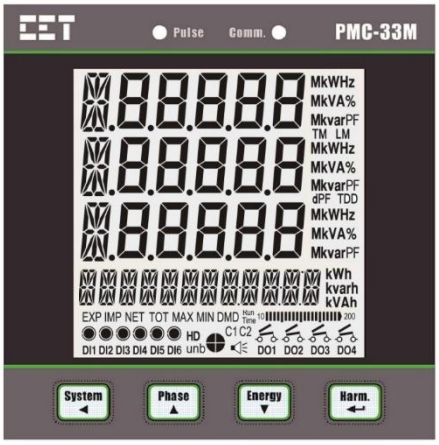


Figure 3-2 Full LCD Display

3.1.2 LCD Display Area

This section provides a description of the LCD display areas which can generally be divided into 4 areas:

A: Measurement values
B: Measurement symbols/units for parameters such as Voltage, Current, THD, Unbalance, PF, Voltage and Current Phase Angle...etc.
C: Energy Measurements
D: IMP, EXP, Net, TOT, Run Time, HD, Unb, PF Status Indicators

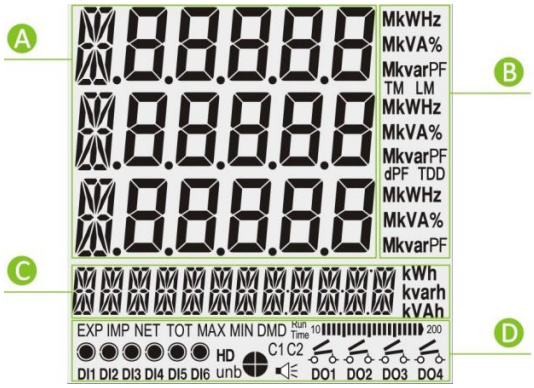


Figure 3-3 LCD Display

The following table shows the special LCD display symbols:

Area	Label	Description					
A	8	A	B	C	D	E	F
		G	H	I	J	K	L
		M	N	O	P	Q	R
		S	T	U	V	W	Y
		0	1	2	3	4	
		5	6	7	8	9	
	8	A	B	C	D	E	F
		G	H	I	J	K	L
		M	N	O	P	Q	R
		S	T	U	V	W	X
		Y	Z	0	1	2	3
		4	5	6	7	8	9
B	Hz MkW MkVA Mkvar % PF dPF TDD	Hz MkW MkVA Mkvar % Measurement Units for Freq. (Hz), Power (P, Q, S) and THD					
		PF Power Factor		dPF Displacement PF (Reserved)		TDD TDD	
C	kWh kvarh kVAh	Energy Measurement values Measurement Units for kWh, kvarh and kVAh					

D	DI1 DI2 DI3 DI4 DI5 DI6	Reserved			
	DO1 DO2 DO3 DO4	Reserved			
	HD unb DMD MAX MIN Run Time	HD Harmonic Distortion	unb Unbalance	DMD Demand (Reserved)	
		MAX Maximum (Reserved)		MIN Minimum (Reserved)	
		Run Time Run Time			
	10 200	Percentage			
	C1 C2	Reserved			
		Alarm Symbol	Q2 Q1 Q3 Q4 PF Quadrant – Q1/Q2/Q3/Q4		
	IMP EXP NET TOT	IMP Import	EXP Export	NET Net	TOT Total

Table 3-1 Special LCD display symbols

3.2 Using the Front Panel Buttons

The PMC-33M-A's front panel has been designed with a 4-button user-friendly interface that allows users to quickly scroll through most of the available measurements. **The default password is 0000 (four zeros).**

Buttons	Data Display Mode	Setup Configuration Mode
<**System/**◄>	Pressing this button scrolls through the available measurements in the **System** Menu.	• Before a parameter is selected for modification, pressing this button returns to the previous menu level if it's currently in a sub-menu. Otherwise, this button is ignored. • Once a numeric parameter is selected, pressing this button moves the cursor to the left by one position. Otherwise, this button is ignored.
<**Phase/**▲>	Pressing this button scrolls through the available per-phase measurements in the **Phase** Menu.	• Before a parameter is selected for modification, pressing this button goes back to the last parameter in a particular menu or sub-menu. • If a parameter is already selected, pressing this button increments a numeric value or goes back to the last enumerated value in the selection list.
<**Energy/**▼>	Pressing this button scrolls through the available Energy measurements in the **Energy** Menu.	• Before a parameter is selected for modification, pressing this button advances to the next parameter in a particular menu or sub-menu. • If a parameter is already selected, pressing this button decrements a numeric value or advances to the next enumerated value in the selection list.
<**Harm/**⏎>	Pressing this button scrolls through the available PQ measurements in the **Harmonic** Menu**.** Pressing this button for more than 2 seconds enters the **Setup Configuration** mode.	• Once inside the Setup Configuration mode, pressing this button selects a parameter for modification or chooses whether to enter a sub-menu by selecting YES or NO. • After changing the parameter pressing this button again saves the new setting into memory. • Pressing this button for more than 2 seconds anywhere exits Setup Configuration mode.

Table 3-2 Button Function

3.3 Data Display

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

The following sections illustrate the available measurements for each display option. Depending on the **Wiring Mode** selected, certain measurements may not be available. For example, the per-phase Uln, Uln Average, per-phase kW, kvar, kVA and PF measurements are not available when the **Wiring Mode** is set to 3P3W or 1P2W L-L.

3.3.1 System

Display Screens	1st Row	2nd Row	3rd Row
Display 1 (Default)	kW Total	I avg	PF Total
Display 2	Frequency	Uln avg[1]	Ull avg[1,2]
Display 3	kW Total	kvar Total	kVA Total
Display 4	Inc (In Calculated)[2,3,4]		
Display 5	U Unbalance[2,4]	I Unbalance[2,4]	
Display 6	Device Operating Time (Run Hours)		

Table 3-3 System Display

Notes:
1) Ull avg=U12 when the Wiring Mode is set to 1P3W.
2) This screen is not shown if the Wiring Mode is set to 1P2W L-N or 1P2W L-L.
3) This screen is not shown if the Wiring Mode is set to 3P3W.
4) This screen is not shown if the Wiring Mode is set to 1P3W.

3.3.2 Phase

Display Screens	1st Row	2nd Row	3rd Row
Display 1	U1[1,5]	U2[1,4,5]	U3[1,3,4,5]
Display 2	U12[4]	U23[3,4,5]	U31[3,4,5]
Display 3	I1	I2[4,5]	I3[3, 4,5]
Display 4	P1[1]	P2[1,4,5]	P3[1,3,4,5]
Display 5	Q1[1]	Q2[1,4,5]	Q3[1,3,4,5]
Display 6	S1[1]	S2[1,4,5]	S3[1,3,4,5]
Display 7	PF1[1]	PF2[1,4,5]	PF3[1,3,4,5]
Display 8	U1 Angle[2]	U2 Angle[2,4,5]	U3 Angle[2,3,4,5]
Display 9	I1 Angle	I2 Angle[4,5]	I3 Angle[3,4,5]

Table 3-4 Phase Display

Notes:
1) This screen is not shown if the Wiring Mode is set to 3P3W.
2) For U/I Angle:
   - U1 = Uan, U2 = Ubn, U3 = Ucn in 3P4W mode
   - U1 = Uab, U2 = Ubc, U3 = Uca in 3P3W and 1P2W L-L modes
3) This screen is not shown if the Wiring Mode is set to 1P3W.
4) This screen is not shown if the Wiring Mode is set to 1P2W L-N.
5) This screen is not shown if the Wiring Mode is set to 1P2W L-L.

3.3.3 Energy

Display Screens	1st Row	2nd Row	3rd Row
Display 1	kWh Imp		
Display 2	kWh Exp		
Display 3	kWh Net		
Display 4	kWh Total		
Display 5	kvarh Imp		
Display 6	kvarh Exp		
Display 7	kvarh Net		
Display 8	kvarh Total		
Display 9	kVAh		

Table 3-5 Energy Display

3.3.4 Harmonics

Display Screens	1st Row	2nd Row	3rd Row
Display 1	Voltage THD		
Display 2	Current THD		
Display 3	Voltage TOHD		
Display 4	Current TOHD		
Display 5	Voltage TEHD		
Display 6	Current TEHD		
Display 7	TDD		
Display 8	TDD Odd		
Display 9	TDD Even		
Display 10	K-Factor		
Display 11	Current Crest-Factor		

Table 3-6 Harmonics Display

3.4 Setup Configuration via the Front Panel

3.4.1 Making Setup Changes

1) Entering the Password:

- Press **<Harm/◄┘>** for two seconds to enter **Setup Configuration** mode, and the LCD displays **PROGRAMMING**.
- Press <**Energy/▼**> advance to the Password page.
- A correct password must be entered before changes are allowed. Press **<Harm/◄┘>** to enter the password. The factory default password is "0".
- Press <**System/◄**> to shift the cursor to the left by one position and press <**Phase/▲**> or <**Energy/▼**> to increment or decrement the numeric value for the password.
- When the password has been entered, press **<Harm/◄┘>** to save the password. If the entered password is correct, its value will be shown on the display. ******** is shown instead if the entered password is incorrect. Press <**Phase/▲** > or <**Energy/▼**> to scroll through the list of sub-menus. Once the desired sub-menu is reached, press **<Harm/◄┘>** to select it and then choose **YES** to enter the sub-menu. When finished, press <**System/◄**> to return to the main menu.

2) Selecting a parameter to change:

- Press <**Phase/▲**> or <**Energy/▼**> to scroll to the desired parameter within a sub-menu.
- Press **<Harm/◄┘>** to select a parameter. Once a parameter has been selected, its value will blink.

3) Changing and saving a setup parameter:

- For a Numeric parameter, press <**System/◄**> to shift the cursor to the left by one position or <**Phase/▲** > or <**Energy/▼**> to increment or decrement the numeric value.
- For an Enumerated parameter, press <**Phase/▲**> or <**Energy/▼**> to scroll through the enumerated list.
- After modification, press **<Harm/◄┘>** to save the change into memory.
- Repeat step 3) until all setup parameters have been changed.

4) Exiting the Setup Mode

- Press **<Harm/◄┘>** for two seconds to return to the **Data Display** Mode.
- Also, the **Setup Mode** will be automatically exited if there is a period of inactivity of 5 minutes or longer.

3.4.2 Setup Menu

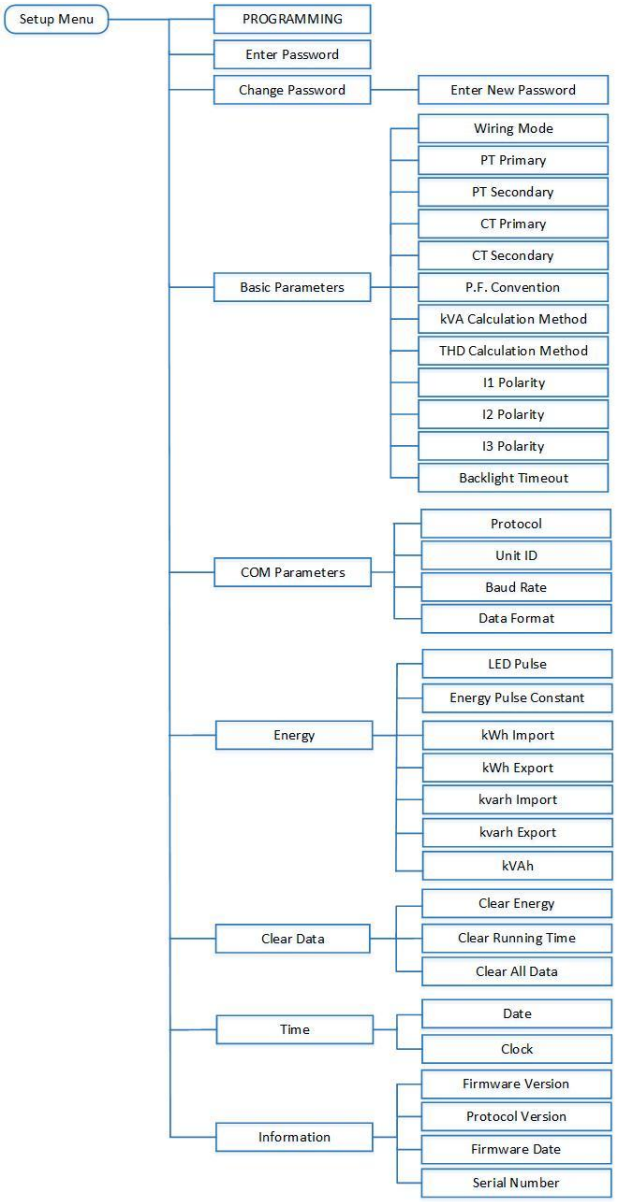


Figure 3-4 Setup Menu

3.4.3 Configuration

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

Label Menu Main Sub	Parameters	Description	Range	Default
PROGRAMMING	Programming	Setup Configuration	/	/
PASSWORD	Password	Enter Password	0 to 9999	0
PASS SET		Enter Sub Menu to change password?	YES/NO	NO
NEW PASS	New Password	Change Password	0000 to 9999	“0”
SYS SET		Enter sub menu to set basic parameters?	YES/NO	NO
TYPE	Wiring Mode	Meter’s Wiring Connection	DEMO/ 1P2W L-N/ 1P2W L-L/ 1P3W/ 3P3W/3P4W	3P4W

PT1	PT Primary[1]	PT Primary Voltage	1 to 1,000,000V	100V
PT2	PT Secondary[1]	PT Secondary Voltage	1 to 690V	100V
CT1	CT Primary	CT Primary Current	1 to 30,000A	5A
CT2	CT Secondary	CT Secondary Current	1 to 5A	5A
PF	P.F. Convention[2]	PF Convention	IEC/IEEE/-IEEE	IEC
kVA	kVA Calculation[3]	kVA Calculation Method	V/S (V=Vector, S=Scalar)	V
THD SET.	THD Calculation[4]	Select between % of Fundamental or % of RMS	THDF/THDR	THDF
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
BLTO	Backlight Timeout	Backlight Timeout	0 to 6 mins	5
COM SET		Enter sub menu to set Comm. parameters?	YES/NO	NO
PRO	Protocol	Protocol	Modbus	Modbus
ID	Meter Address	Unit ID	1-247	100
BAUD	Baud Rate	Data rate in bits per second	1200/2400/ 4800/9600/ 19200/ 38400bps	9600
CONFIG	Comm. Port Configuration	Data Format	8N2/8O1/8E1/ 8N1/8O2/8E2	8E1
ENGY SET	Preset Energy Values	Enter sub menu to preset Energy Values	YES/NO	NO
LED	LED Pulsing	Enable kWh or kvarh LED Energy Pulsing	OFF/P/Q	P (kWh)
CNST	Pulse Constant	Pulse Constant	1000/3200	1000
IMP	kWh Import	Preset kWh Import Value	0 to 99,999,999.9	7803
EXP	kWh Export	Preset kWh Export Value	0 to 99,999,999.9	7803
IMP	kvarh Import	Preset kvarh Import Value	0 to 99,999,999.9	7803
EXP	kvarh Export	Preset kvarh Export Value	0 to 99,999,999.9	7803
	kVAh	Preset kVAh Value	0 to 99,999,999.9	7803
CLR SET		Enter sub menu to clear data	YES/NO	NO
CLR ENGY	Clear Energy	Clear the 3-Ø Total and Per-Phase Energy registers	YES/NO	NO
CLR OPTM	Clear Operating Time	Clear Device Operating Time	YES/NO	NO
CLR ALL	All data	Clear All of the above	YES/NO	NO
TM SET	Set date and time	Enter sub menu to set time?	YES/NO	NO
DAT	Date	Enter the Current Date	YYYY-MM-DD	/
CLK	Clock	Enter the Current Time	HH:MM:SS	/
INFO		View Device Information (Read Only)	Yes/No	
FW	Firmware Version	Firmware Version	e.g. 1.00.00 means V1.00.00	/
PRO VER	Protocol Version	Protocol Version	e.g. 2.1 means V2.1	/
UPDAT	Update Date	Firmware Update Date	e.g. 20160603	/
	Serial Number	Serial Number	e.g. 1506005094	/

Table 3-7 Setup Parameters

Notes:

1) The value of [PT Primary/PT Secondary] cannot exceeds 10000.
2) Power Factor Convention

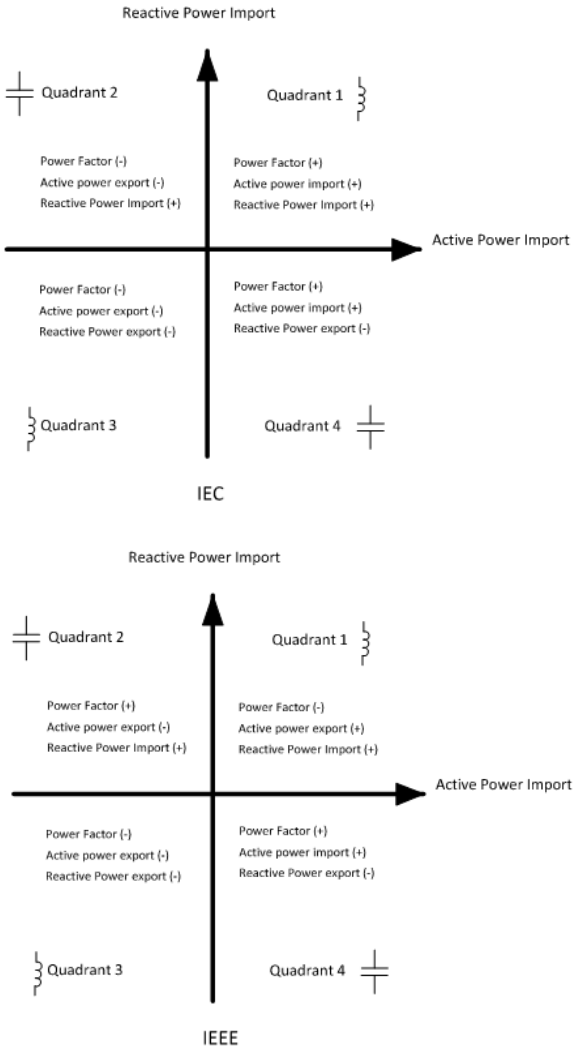


Figure 3-5 PF Convention

3) There are two ways to calculate kVA:

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

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

4) There are two ways to calculate THD:

THDf (based on Fundamental): $\mathrm{THD} = \frac{\sqrt{\sum_{n=2}^{\infty} I_n^{\,2}}}{I_1} \times 100\%$

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

THDr (based on RMS): $\mathrm{THD} = \frac{\sqrt{\sum_{n=2}^{\infty} I_n^{\,2}}}{\sqrt{\sum_{n=1}^{\infty} I_n^{\,2}}} \times 100\%$

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

Chapter 4 Applications

4.1 LED Energy Pulse Output

The PMC-33M-A comes standard with one front panel LED Pulse Output for energy pulsing. Energy Pulse Outputs are typically used for accuracy testing. Energy Pulsing via the front panel LED can be enabled from the front panel through the **LED EN Pulse** setup parameter. The pulse constant can be configured as 1000/3200 pulses per kWh or kvarh through the **EN Pulse CNST** setup parameter.

4.2 Power and Energy

4.2.1 Basic Measurements

The PMC-33M-A provides the following basic measurements which are available through the LCD display or communications.

Parameter	Phase A	Phase B	Phase C	Total	Average
Uln	●	●	●	-	●
Ull	●	●	●	-	●
Current	●	●	●	-	●
Neutral Current	-	-	-	In (Calculated)	-
kW	●	●	●	●	-
kvar	●	●	●	●	-
kVA	●	●	●	●	-
Power Factor	●	●	●	●	-
Frequency	●	-	-	-	-

Table 4-1 Basic Measurements

4.2.2 Energy Measurements

The PMC-33M-A provides Energy parameters for active energy (kWh), reactive energy (kvarh) and apparent energy (kVAh) with a resolution of 0.01k and a maximum value of ±10,000,000.00. 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-33M-A provides the following energy measurements:

3-Phase Energy	kWh Import/Export/Net/Total
	kvarh Import/Export/Net/Total kvarh of Q1/Q2/Q3/Q4
	kVAh Total
Per-Phase Energy (Phase A/B/C):	kWh Import/Export/Net/Total
	kvarh Import/Export/Net/Total kvarh of Q1/Q2/Q3/Q4
	kVAh

Table 4-2 Energy Measurement

4.3 Power Quality

4.3.1 Phase Angles

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

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

4.3.2 Power Quality Parameters

The PMC-33M-A provides the following PQ parameters:

4.3.2.1 Harmonics

The PMC-33M-A provides harmonic analysis for THD, TOHD, TEHD. All harmonic parameters are available on the front panel and through communications. In addition, the PMC-33M-A also provides TDD, K-factor and Crest-factor measurements for current.

4.3.2.2 TDD

Total Demand Distortion (TDD) is defined as the ratio of the root mean square (rms) of the harmonic current to the root mean square value of the rated or maximum demand fundamental current.
TDD of the current I is calculated by the formula below:

$$TDD = \frac{\sqrt{\sum_{h=1}^{h=\infty} (I_h)^2}}{I_L}$$

where

I_L = maximum demand of fundamental current

h = harmonic order (1, 2, 3, 4, etc.)

I_h = rms load current at the harmonic order h

4.3.2.3 K-Factor

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

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

where

I_h = h_{th} Harmonic Current in RMS

h_{max} = Highest harmonic order

4.3.2.4 Crest Factor

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

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

where

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

X_{rms} = RMS value

The following table illustrates the available Voltage and Current Harmonics measurements on the PMC-33M-A.

	Phase A/AB	Phase B/BC	Phase C/CA
Harmonic-Voltage	THD	THD	THD
	TEHD	TEHD	TEHD
	TOHD	TOHD	TOHD
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

Table 4-3 Harmonic Measurements

4.3.3 Unbalance

The PMC-33M-A provides Voltage and Current Unbalance measurements. The calculation method of Voltage and Current Unbalances are listed below:

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

where
V1, V2 are the Positive and Negative Sequence Components for Voltage, respectively.
and
I1, I2 are the Positive and Negative Sequence Components for Current, respectively.

4.4 Diagnostics

The PMC-33M-A provides wiring error detection for 3P4W and 3P3W wiring modes, which allow users to check for possible 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

Please note the detections above are based on the assumptions below:

- The Voltage and Current Phase Sequence are consistent
- kW is kW Import, which means the kW is over 0
- The wiring is correct
- 3P4W wiring mode supports all detections
- 3P3W wiring mode does not support the detection of Voltage Phase Loss, kW Direction per phase

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

Bit	Event
B00	Summary Bit (Set if any other bit is set)
B01	Frequency is out of range (45 to 65Hz) (3P4W or 3P3W)
B02	Any phase voltage < 10% of PT Primary (Register 6000) (3P4W only)
B03	Any phase current < 10% of CT Primary (Register 6004) (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 is may be abnormal (3P4W only)
B10	Negative kWb may be abnormal (3P4W only)
B11	Negative kWc may be abnormal (3P4W only)
B12	CTa polarity may be reversed (3P4W only)
B13	CTb polarity may be reversed (3P4W only)
B14	CTc polarity may be reversed (3P4W only)
B15	Reserved

Table 4-4 Wiring Diagnostic Register

Chapter 5 Modbus Register Map

This chapter provides a complete description of the Modbus register map (**Protocol Version 1.0**) for the PMC-33M-A to facilitate the development of 3rd party communications driver for accessing information on the PMC-33M-A. For a complete Modbus Protocol Specification, please visit http://**www.modbus.org**. The PMC-33M-A 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-33M-A 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		
0002	RO	Ubn	Float		
0004	RO	Ucn	Float		
0006	RO	Uln Average	Float		V
0008	RO	Uab	Float		
0010	RO	Ubc	Float		
0012	RO	Uca	Float		
0014	RO	Ull Average	Float		
0016	RO	Ia	Float		
0018	RO	Ib	Float		A
0020	RO	Ic	Float		
0022	RO	I Average	Float		
0024	RO	kWa	Float		
0026	RO	kWb	Float		W
0028	RO	kWc	Float		
0030	RO	kW Total	Float		
0032	RO	kvara	Float		
0034	RO	kvarb	Float		var
0036	RO	kvarc	Float		
0038	RO	kvar Total	Float	x1	
0040	RO	kVAa	Float		
0042	RO	kVAb	Float		VA
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
0072~0100	RO	Reserved	Float		-
0101	RO	Wiring Diagnostic Status[1]	UINT16		-
0102	RO	Reserved	UINT32		-
0104	RO	Device Operating Time[2]	UINT32	x0.1	0.1Hour
0106~0118	RO	Reserved	UINT32		-
0120	RO	Total Harmonic kW	Float		

Table 5-1 Basic Measurements

Notes:

1) 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	Any phase voltage < 10% of PT Primary (Register 6000) (3P4W only)
B03	Any phase current < 10% of CT Primary (Register 6004) (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 is may be abnormal (3P4W only)
B10	Negative kWb may be abnormal (3P4W only)
B11	Negative kWc may be abnormal (3P4W only)
B12	CTa polarity may be reversed (3P4W only)
B13	CTb polarity may be reversed (3P4W only)
B14	CTc polarity may be reversed (3P4W only)
B15	Reserved

Table 5-2 Wiring Diagnostic Status Register

2) The **Device Operating Time** means the accumulated Operating Time whenever any per-phase Current exceeds 2% of $I_{nominal}$ (5A), which is 100mA. The Device Operating Time data is stored in non-volatile memory and will not suffer any loss in the event of a power failure.

5.2 Energy Measurements

The Energy registers have a maximum value of 1,000,000,000 and will roll over to zero automatically when it is reached. The actual energy value is 0.01 times of the register value.

5.2.1 3-Phase Total Energy Measurements

Register	Property	Description	Format	Scale	Unit
0500	RW	kWh Import	INT32	x0.01	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		

Table 5-3 3-phase Total Energy Measurements

5.2.2 Phase A (L1) Energy Measurements

Register	Property	Description	Format	Scale	Unit
0620	RW	kWh Import	INT32	x0.01	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		

Table 5-4 Phase A Energy Measurements

5.2.3 Phase B (L2) Energy Measurements

When the **Wiring Mode** is **1P2W L-N** or **1P2W L-L**, the L2 phase energy measurements have no meaning, and the following registers are reserved.

Register	Property	Description	Format	Scale	Unit
0740	RW	kWh Import	INT32	x0.01	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		

Table 5-5 Phase B Energy Measurements

5.2.4 Phase C (L3) Energy Measurements

When the **Wiring Mode** is **1P2W L-N, 1P2W L-L** or **1P3W**, the L3 phase energy measurements have no meaning, and the following registers are reserved.

Register	Property	Description	Format	Scale	Unit
0860	RW	kWh Import	INT32	x0.01	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		

Table 5-6 Phase C Energy Measurements

5.3 Harmonic Measurements

5.3.1 Power Quality Measurements

Register	Property	Description	Format	Scale	Unit
1300	RO	Ia TDD	Float	x1	-
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 5-7 Power Quality Measurements

Notes:

1) When the **Wiring Mode** is **1P2W L-N** or **1P2W L-L**, the Ib/Ic TDD/TDD Odd/TDD Even/K-factor/Crest-factor have no meaning, and their registers are reserved.
2) When the **Wiring Mode** is **1P3W,** the Ic TDD/TDD Odd/TDD Even/K-factor/Crest-factor have no meaning, and their registers are reserved.

5.3.2 Current Harmonic Measurements

Register	Property	Description	Format	Scale	Unit
1400	RO	Ia THD	Float	x1	-
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		

Table 5-8 Current Harmonic Measurements

Notes:

1) When the **Wiring Mode** is **1P2W L-N** or **1P2W L-L**, the Ib/Ic THD/TOHD/TEHD have no meaning, and their registers are reserved.
2) When the **Wiring Mode** is **1P3W**, the Ic THD/TOHD/TEHD have no meaning, and their registers are reserved.

5.3.3 Voltage Harmonic Measurements

Register	Property	Description	Format	Scale	Unit
1600	RO	Uan/Uab THD	Float	x1	-
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		

Table 5-9 Voltage Harmonic Measurements

Notes:

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

5.4 Device Setup

5.4.1 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*
6008~6018	RW	Reserved	UINT32	
6020	RW	Wiring Mode	UINT16	0=DEMO, 1=1P2W L-N, 2=1P2W L-L, 3=1P3W L-L-N 4=3P3W, 5=3P4W*
6021	RW	PF Convention	UINT16	0=IEC*, 1=IEEE, 2=-IEEE
6022	RW	kVA Calculation	UINT16	0=Vector*, 1=Scalar
6023	RW	Ia Polarity	UINT16	0=Normal*, 1=Reverse
6024	RW	Ib Polarity	UINT16	
6025	RW	Ic Polarity	UINT16	
6026~6027	RW	Reserved	UINT16	

6028	RW	THD Calculation[2]	UINT16	0= THDf*, 1= THDr
6029~6034	RW	Reserved	UINT16	
6035	RW	Energy Pulse Constant	UINT16	0=1000 imp/kxh* 1=3200 imp/kxh
6036	RW	LED Energy Pulse	UINT16	0=Disabled 1=kWh Total Energy Pulse* 2=kvarh Total Energy Pulse
6037	RW	Backlight Timeout	UINT16	0 to 60 mins, 5*

Table 5-10 Basic Setup Parameters

Notes:

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

2) There are two ways to calculate THD:

THDf (based on Fundamental): $$\mathrm{THD} = \frac{\sqrt{\sum_{n=2}^{\infty} I_n^{\,2}}}{I_1} \times 100\%$$

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

THDr (based on RMS): $$\mathrm{THD} = \frac{\sqrt{\sum_{n=2}^{\infty} I_n^{\,2}}}{\sqrt{\sum_{n=1}^{\infty} I_n^{\,2}}} \times 100\%$$

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

5.4.2 Communication Setup Parameters

Register	Property	Description	Format	Range, Default*
6400	RW	Port 1 Protocol	UINT16	0=Modbus RTU*
6401	RW	Port 1 Unit ID	UINT16	1 to 247, 100*
6402	RW	Port 1 Baud Rate[1]	UINT16	0=1200, 1=2400, 2=4800, 3=9600*, 4=19200, 5=38400
6403	RW	Port 1 Comm. Config.	UINT16	0=8N2, 1=8O1,2=8E1* 3=8N1, 4=8O2, 5=8E2

Table 5-11 Communication Setup

Notes:

1) If the **Baud Rate** is set to an invalid value, it will default to 9600bps automatically.

5.5 Time

There are two sets of Time registers supported by the PMC-33M-A – Year / Month / Day / Hour / Minute / Second (Registers # 60000 to 60002) and UNIX Time (Register # 60004). When sending time to the PMC-33M-A 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	9004	RW	UNIX Time	UINT32	0x386D4380 to 0x 7FE8177F

~ 60005	~ 9005				The corresponding time is 2000.01.01 00:00:00 to 2037.12.31 23:59:59 (GMT 0:00 Time Zone)

Table 5-12 Time Registers

5.6 Clear/Reset Control

Register	Property	Description	Format	Note
9600	WO	Reserved	UINT16	Writing "0xFF00" to the register to execute the described action.
9601	WO	Clear 3-Ø Total and Per-Phase Energy Registers		
9602~9606	WO	Reserved		
9607	WO	Clear Device Operating Time		
9608	WO	Clear All Data[1]		

Table 5-13 Clear Control

Notes:

1) Writing 0xFF00 to the **Clear All Data** register to perform the Clear operation for the actions specified in registers # 9601 and # 9607.

5.7 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 PMC-33M-A that was manufactured on January 3rd, 2017

Table 5-14 Meter Information

Notes:

1) The Meter Model appears from registers 60200 to 60219 and contains the ASCII encoding of the string "PMC-33M-A" as shown in the following table.

Register	Value(Hex)	ASCII
60200	0x50	P
60201	0x4D	M
60202	0x43	C
60203	0x2D	-
60204	0x33	3
60205	0x33	3
60206	0x4D	M
60207	0x2D	-
60208	0x41	A
60209-60219	0x20	Null

Table 5-15 ASCII Encoding of "PMC-33M-A"

Appendix A Technical Specifications

Voltage Inputs (V1, V2, V3, VN)	
Un	400Uln/690Ull
Range	10V to 1.2xUn
Overload	1.2xUn continuous, 2xUn for 1s
Burden	<0.02VA per phase
Measurement Category	CAT III up to 600V
Frequency	45-65Hz
Current Inputs (I11, I12, I21, I22, I31, I32)	
In	5A (5A/1A Auto-Scaling)
Range	0.1% to 200% In
Starting Current	0.1% In
Overload	2xIn continuous, 20xIn for 1s
Measurement Category	CAT III up to 600V
Burden	<0.15VA per phase
Power Supply (L+, N-, GND)	
Standard	95-250VAC/DC, ±10%, 47-440Hz
Burden	2W
Overvoltage Category	CAT III up to 300V
Installation Torque	
Voltage / Current Inputs	1.3 N.m
Power Supply, RS485, 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	65

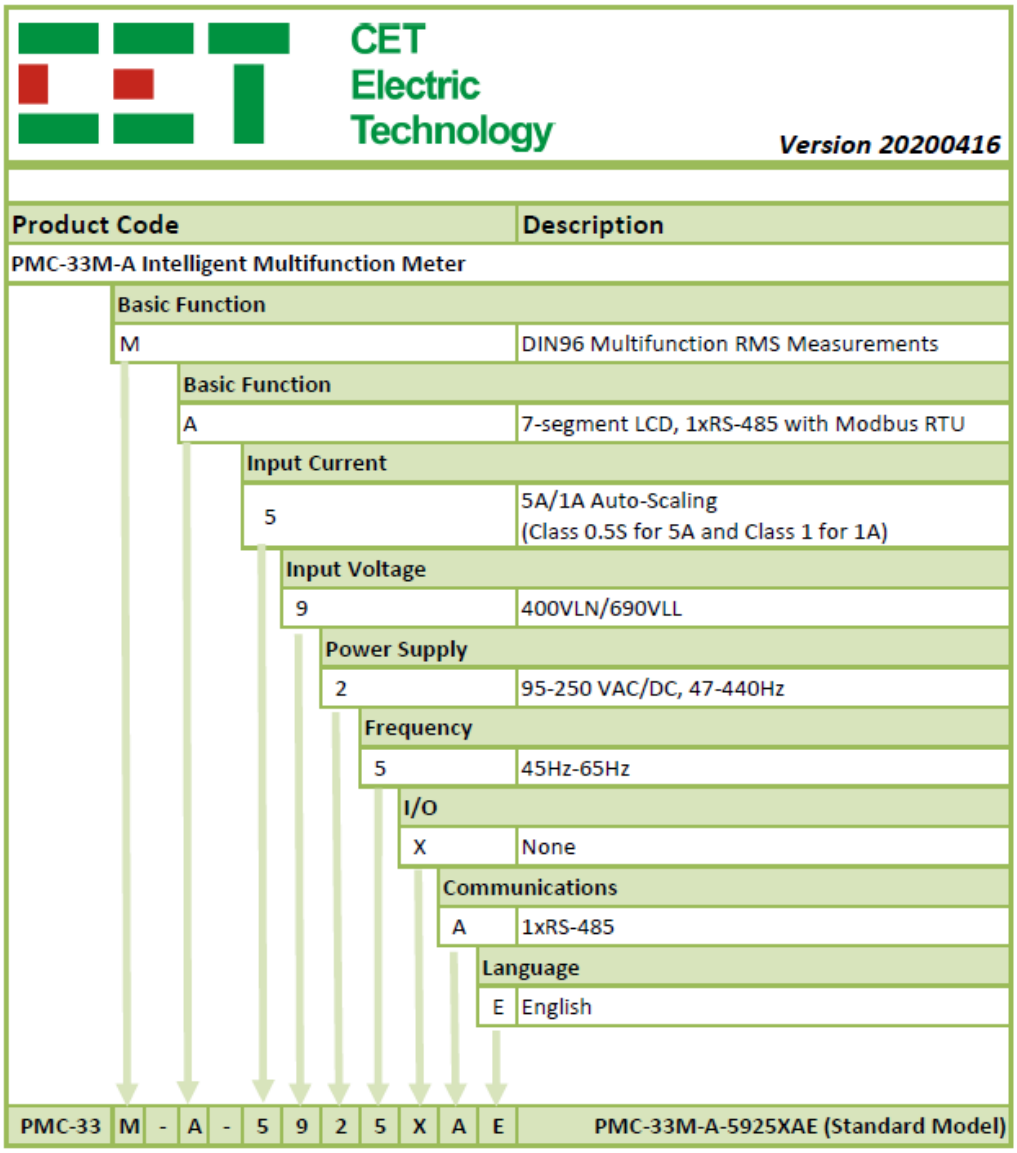
Accuracy

Parameters	Accuracy	Resolution
Voltage	±0.2% Reading + 0.05% F.S.	0.001V
Current	±0.2% Reading + 0.05% F.S.	0.001A
kW, kvar, kVA	±0.5% Reading + 0.05% F.S.	0.001kX
kWh, kVAh	IEC 62053-22 Class 0.5S	0.01kXh
kvarh	IEC 62053-23 Class 2	0.01kvarh
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	0.1
Phase angles	±1°	0.1°

Appendix B Standards Compliance

Safety Requirements	
CE LVD 2014 / 35 / EU	EN 61010-1: 2010, EN 61010-2-030: 2010
Electrical safety in low voltage distribution systems up to 1000Vac and 1500 Vdc	IEC 61557-12: 2008 (PMD)
Insulation Dielectric test: 2kV @ 1 minute Impulse voltage: 6kV, 1.2/50μs	IEC 62052-11: 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: 2004+A1: 2010
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 residential, commercial and light-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 C Ordering Guide



CET Electric Technology

Version 20200416

Product Code	Description
PMC-33M-A Intelligent Multifunction Meter	
Basic Function	
M	DIN96 Multifunction RMS Measurements
Basic Function	
A	7-segment LCD, 1xRS-485 with Modbus RTU
Input Current	
5	5A/1A Auto-Scaling (Class 0.5S for 5A and Class 1 for 1A)
Input Voltage	
9	400VLN/690VLL
Power Supply	
2	95-250 VAC/DC, 47-440Hz
Frequency	
5	45Hz-65Hz
I/O	
X	None
Communications	
A	1xRS-485
Language	
E	English

PMC-33	M	-	A	-	5	9	2	5	X	A	E	PMC-33M-A-5925XAE (Standard Model)

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