

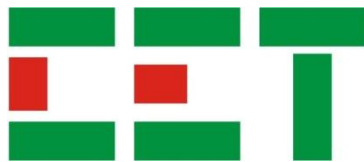
PMC-220

Single-Phase Multifunction Meter

User Manual

Version: V1.01

December 14, 2015



Ceiec Electric Technology

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Standards Compliance



DANGER

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



CAUTION

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



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

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

Limited warranty

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

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Chapter 1 Introduction

This manual explains how to use the PMC-220 Single-Phase Multifunction Meter. Throughout the manual the term “meter” generally refers to all models.

This chapter provides an overview of the PMC-220 meter and summarizes many of its key features.

1.1 Overview

The PMC-220 Single-Phase Multifunction Meter is CET’s latest offer for the low voltage energy metering market featuring DIN rail mount, compact construction, 63A direct input and high accuracy measurements. The PMC-220 complies with the IEC 62053-21 Class 1 kWh Accuracy Standard. With the standard RS-485 port and Modbus RTU protocol, the PMC-220 becomes a vital component of an intelligent, multifunction monitoring solution for any Energy Management Systems.

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

1.2 Features

- IEC 62053-21 Class 1
- Direct Input up to 63A without external CT
- Low starting current @ 20mA
- Multifunction measurements
 - Voltage, Current, kW, kvar, kVA, PF and Frequency
 - kWh and kvarh Imp/Exp/Tot/Net and kVAh
- 6½ digit Multifunction LCD Display
- Self-powered, no external control power required
- kWh LED Pulse Output
- Solid State Energy Pulse Output @ 1000 imp/kWh
- Standard RS-485 port with Modbus RTU support
- Easy installation with DIN rail mounting, no tools required

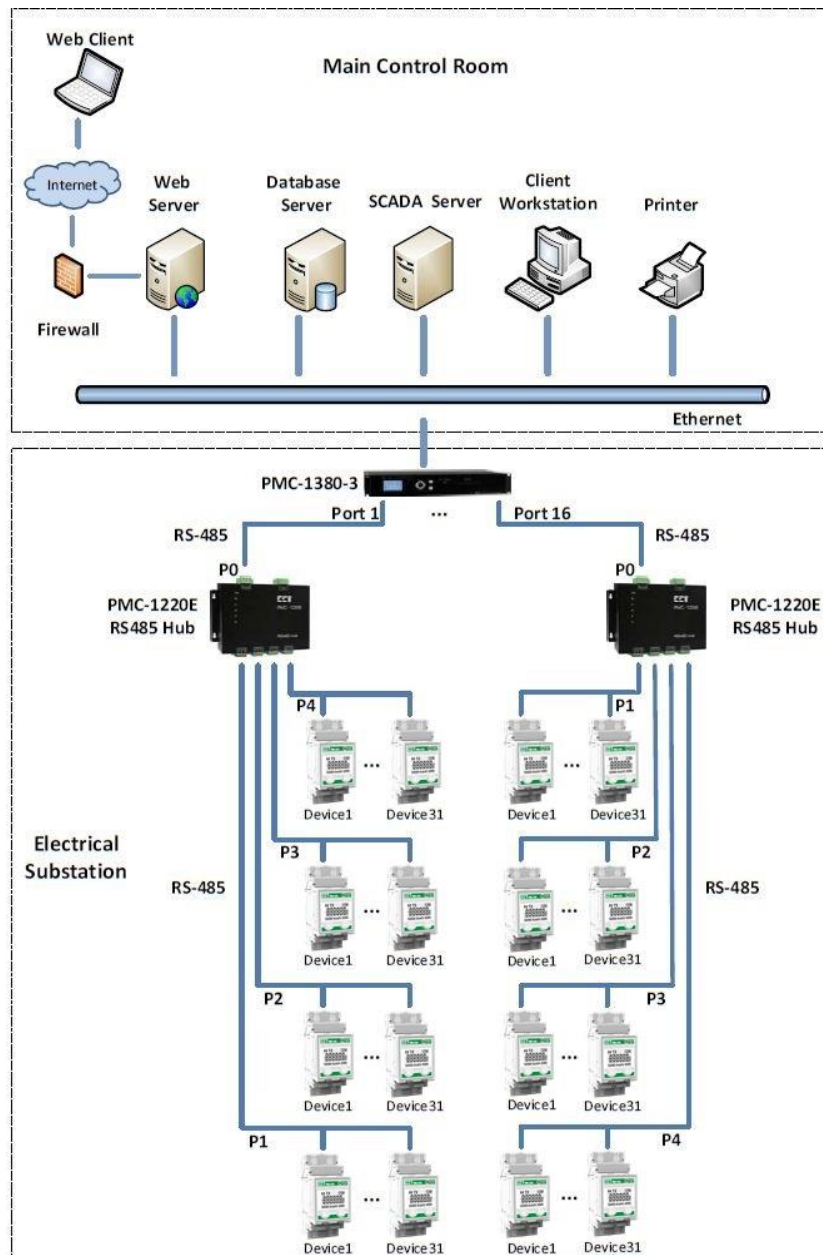
1.3 Applications

The PMC-220 can be used to monitor a 2-wire single-phase circuit. Modbus RTU 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.

The PMC-220 comes standard with one front panel LED Pulse Output and one Solid State Digital Outputs for kWh and kvarh pulsing. Energy Pulse Outputs are typically used for accuracy testing. Energy pulsing can be enabled via communications or through the front panel. The pulse constant is 1000 imp/kWh (1 pulse per Wh) and pulse width is fixed at 80ms±20ms.

The PMC-220 comes with an 8-digit LCD display for the kWh Imp/Exp, kvarh Imp/Exp and kVAh counters with a resolution of 0.01 kWh and a maximum value of 1,000,000.00. When the maximum value is reached, it will automatically roll over to zero. The kWh counter can be reset manually via communications or the front panel and preset to a user-defined value only via communications.

The following figure illustrates a typical application where the PMC-220s are used in an Energy Management System.



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 or telephone

Chapter 2 Installation



Caution

Installation of the PMC-220 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

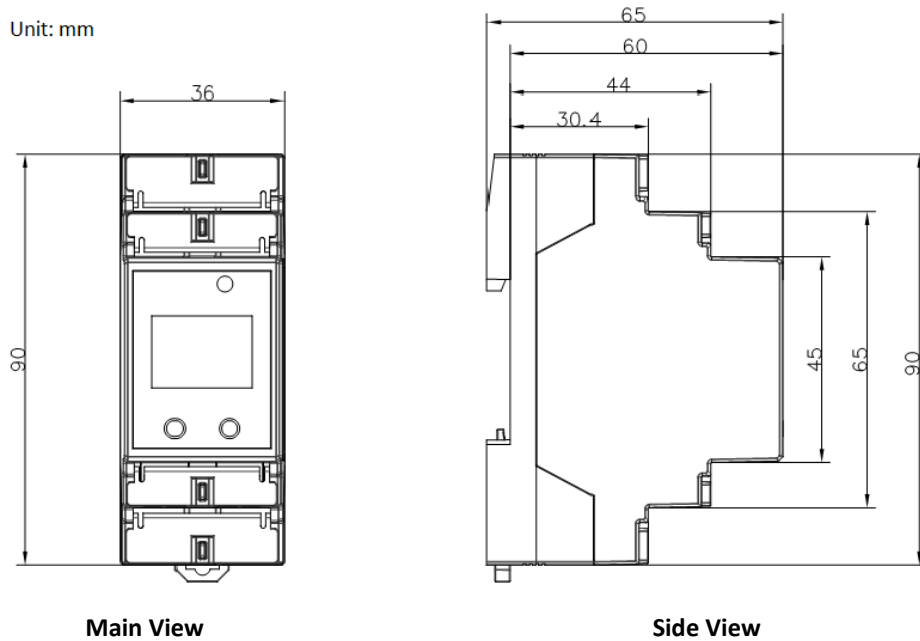


Figure 2-2 Dimensions

2.3 Mounting

The PMC-220 should be installed in a dry environment with no dust and kept away from heat, radiation and electrical noise source.

Installation steps:

- Before installation, make sure that the DIN rail is already in place
- Move the installation clip at the bottom of the PMC-220 downward to the “unlock” position
- Mount the PMC-220 on the DIN rail
- Push the installation clip upward to the “lock” position to secure the PMC-220 on to the DIN Rail

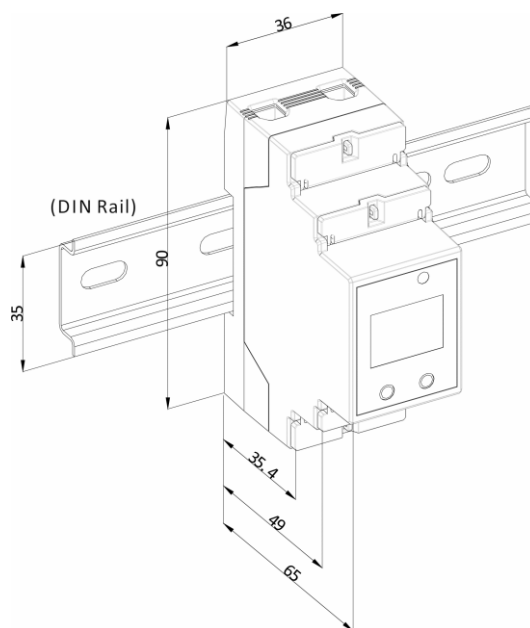


Figure 2-3 Installation

2.4 Input Wiring

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

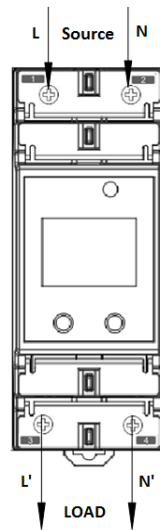


Figure 2-4 Input connections

2.5 RS-485 Wiring

The PMC-220 provides one standard RS-485 port and 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 outputs and surge protection should be used. The following figure illustrates the RS-485 communications connections on the PMC-220.

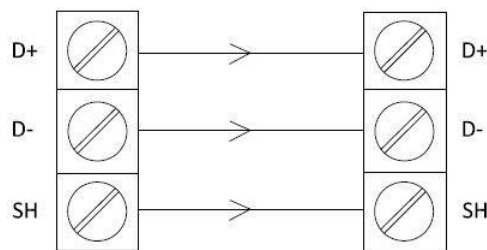


Figure 2-5 RS-485 Connections

2.6 Energy Pulse Output Wiring

The following figure illustrates the Pulse Output connection on the PMC-220.

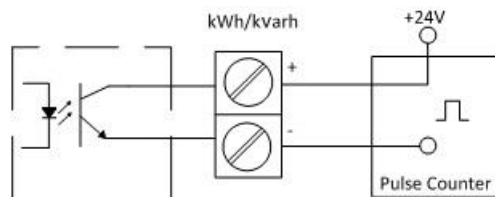


Figure 2-6 Energy Pulse Output Connections

Chapter 3 Front Panel

The meter's front panel is used for both display and configuration purposes. The LCD display screen and two buttons allow quick access to view measurements and meter information, configure the parameters and perform maintenance.

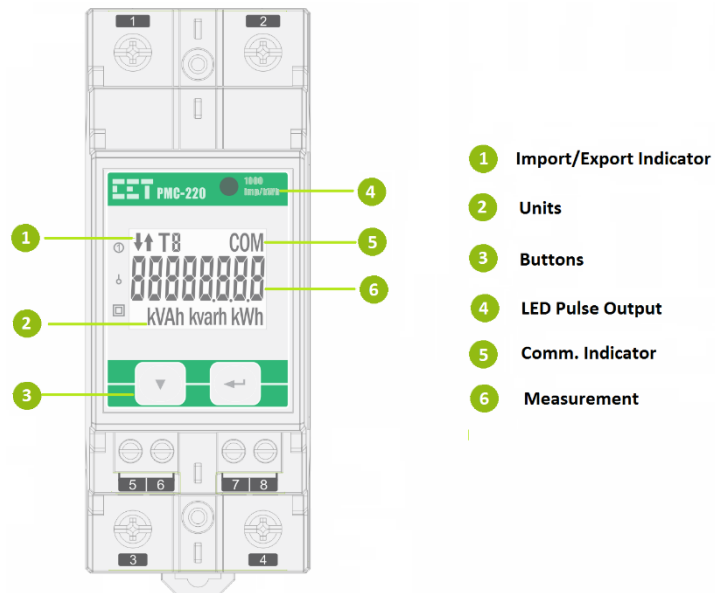


Figure 3-1 Front Panel Display

3.1 LCD Display

3.1.1 LED Pulse Output

The PMC-220 comes standard with a LED Pulse Output on its front panel, labeled **1000 Imp/kWh**. The LED Pulse Output is used for kWh pulsing if the **PULSE** is ENABLED.

3.1.2 LCD Display Symbols

The following table shows the special LED display symbols:

Label	Description					
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	

Table 3-1 LCD Display Symbols

3.2 LCD Testing

Pressing both the <↔> and the <▼> buttons simultaneously for 2 seconds enters the **LCD Test** mode. During testing, all LCD segments are illuminated and will blink on and off three times before returning to the **Data Display** mode.

3.3 Display Screen Types

The PMC-220 has a default display which can be set as one of two modes: **Fixed** mode which displays kWh Imp statically and **Energy Auto-Scroll** mode which displays kWh Imp, kWh Exp, kvarh Imp, kvarh Exp and kVAh in sequence in 4 seconds interval. The **Energy Auto-Scroll** setup parameter can only be set via communications.

In **Data Display** mode, pressing the <▼> button scrolls to the next parameter while pressing the <↔> button toggles between **Basic Measurements** and **Energy Measurements**.

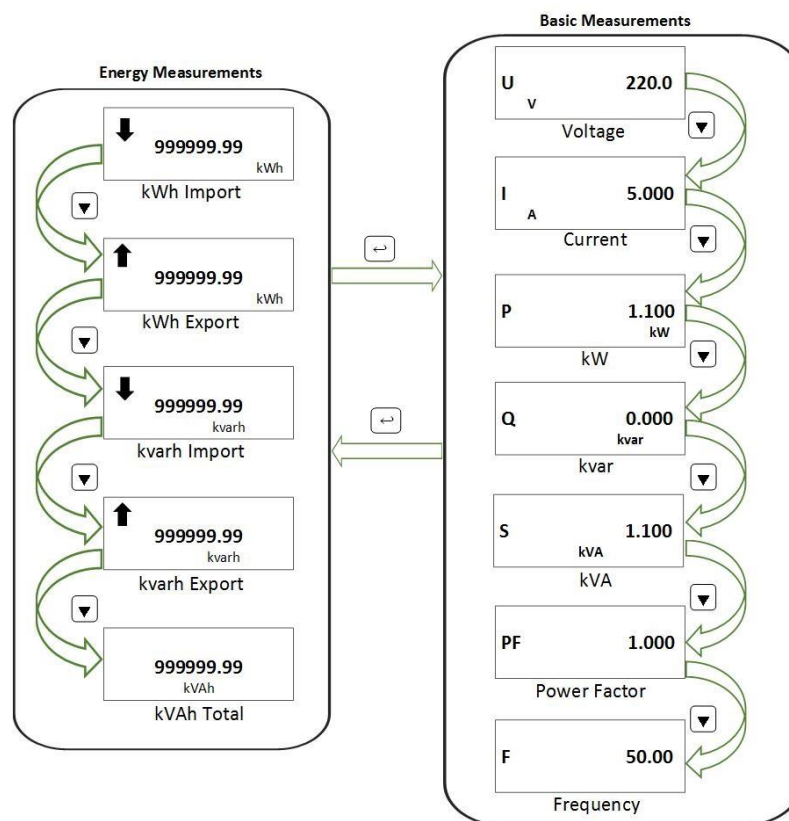


Figure 3-2 Measurements Screen

3.4 Setup Configuration via the Front Panel

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

3.4.1 Functions of buttons

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

<↔>: Pressing this button for two seconds toggles between **Data Display** mode and **Setup**

Configuration mode. Once inside the **Setup Configuration** mode and at the main menu, pressing this button selects a parameter for modification. Once selected, the parameter value blinks while it's being changed. If the selected parameter is a numeric value, pressing this button shifts the cursor to the left by one position. When the cursor has reached the left-most digit, pressing this button again will save the new setting into memory. The parameter will also stop blinking once the value has been saved.

<▼>: Before an item is selected, pressing this button scrolls to the next setup parameter. If the selected parameter is a numeric value, pressing this button increments the selected digit. If the selected parameter is an enumerated value, pressing this button scrolls through the enumerated list. Pressing the <↔> button will save the current enumerated value.

Making setup changes:

- Press the <↔> button for two seconds to enter the **Setup Configuration** mode.
- Press the <▼> 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 <▼> button to select the parameter for modification. Use the <▼> and <↔> buttons to enter the correct password.
- Use the <▼> button to scroll to the desired parameter.
- Press the <↔> button to select the parameter. Once selected, the parameter value will blink.
- Use the <↔> and <▼> buttons to make modification to the selected parameter.
- Pressing the <↔> button for two seconds to exit the **Setup Configuration** mode.

3.4.2 Configuration

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

Label	Parameters	Description	Option(value)	Default
PROG	Programming	Setup Configuration Mode	/	/
PW	Password	Enter Password	0~9999	0
SET PW	Set Password	Enter New Password	0~9999	0
ID	Unit ID	Com. Unit ID	1~247	100
BD	Baud Rate	Data rate in bits per second (bps)	1200/2400/4800/ 9600/19200	9600
CFG	Comm. Port Configuration	Data Format	8N2/8O1/8E1/8N1	8E1
PULSE	Energy Pulsing	Enable Energy Pulsing	YES/NO	NO
CLR EN		Clear Energy	YES/NO	NO
FW	Version	Firmware Version	For example, 1.00.00 means the firmware version is V1.00.00.	/
PROT	Protocol	Protocol Version	e.g. 10 means V1.0	/

Table 3-2 Setup Parameters

3.4.3 Setup Configuration

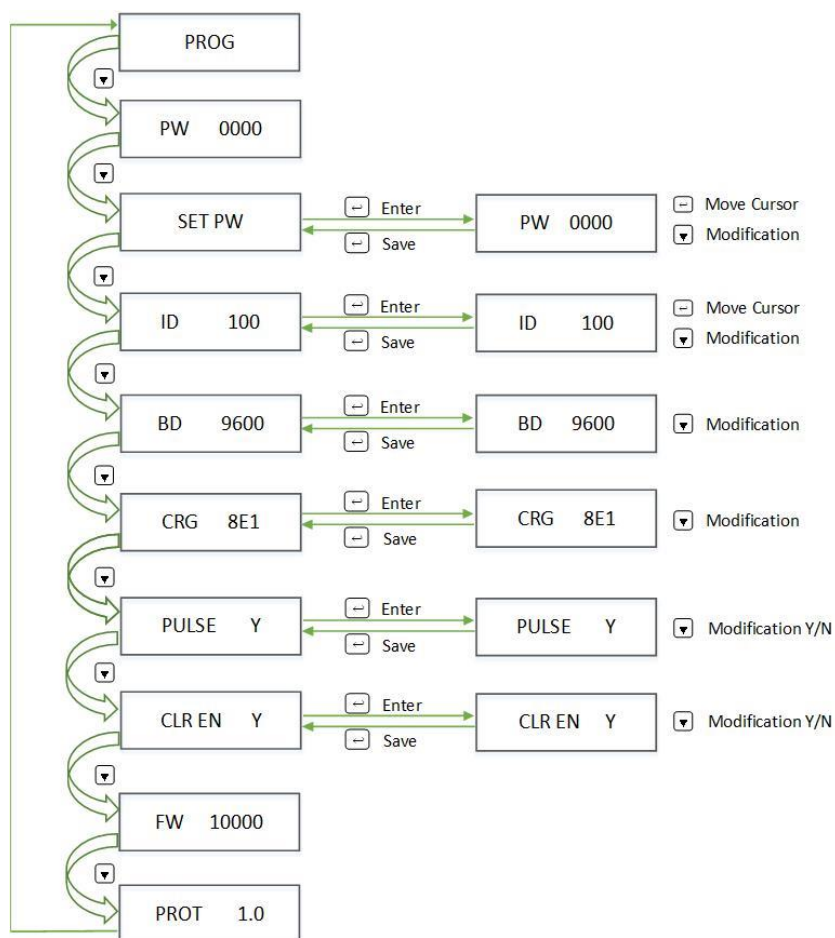


Figure 3-3 Setup Configuration

Chapter 4 Modbus Register Map

This chapter provides a complete description of the Modbus register map (**Protocol Version 1.0**) for the PMC-220 to facilitate the development of 3rd party communications driver for accessing information on the PMC-220. The PMC-220 supports the following Modbus functions:

- 1) Read Holding Registers (Function Code 0x03)
- 2) Preset Multiple Registers (Function Code 0x10)

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

4.1 Basic Measurements

Register	Property	Description	Format	Scale/Unit
0000	RO	V	Float	V
0002	RO	I	Float	A
0004	RO	kW	Float	kW
0006	RO	kvar	Float	kvar
0008	RO	kVA	Float	kVA
0010	RO	P.F.	Float	-
0012	RO	Frequency	Float	Hz
0014~0039	Reserved			

Table 4-1 Basic Measurements

4.2 Energy Measurements

Register	Property	Description	Format	Scale/Unit
0040	RW	kWh Import	INT32	x0.01, kWh
0042	RW	kWh Export	INT32	x0.01, kWh
0044	RO	kWh Net	INT32	x0.01, kWh
0046	RO	kWh Total	INT32	x0.01, kWh
0048	RW	kvarh Import	INT32	x0.01, kvarh
0050	RW	kvarh Export	INT32	x0.01, kvarh
0052	RO	kvarh Net	INT32	x0.01, kvarh
0054	RO	kvarh Total	INT32	x0.01, kvarh
0056	RW	kVAh	INT32	x0.01, kVAh

Table 4-2 Energy Measurements

Notes:

- 1) The Energy registers have a maximum value of 100,000,000 in units of 0.01 kWh (1,000,000.00) and will roll over to zero automatically when it is reached.
- 2) The kWh Imp, Exp and Total registers' value are positive, and the kWh Net registers' can be either positive or negative, where a positive value means kWh Imp is greater than kWh Exp while a negative value means kWh Exp is greater than kWh Imp.
- 3) The kWh counter can be reset manually via communications or the front panel and preset to a user-defined value only via communications.

4.3 Device Setup

4.3.1 Basic Setup Parameters

Register	Property	Description	Format	Range/Unit
6000	RW	PF Convention	UINT16	0=IEC*, 1=IEEE, 2=-IEEE
6001	RW	CT Polarity	UINT16	0*=Normal, 1=Reversed
6002	RW	Solid State Pulse Output ¹	UINT16	0=Disabled, 1*= kWh Imp, 2= kWh Exp, 3= kWh Total 4= kvarh Imp, 5= kvarh Exp 6= kvarh Total
6003	RW	LED Pulse Output Enable	UINT16	0= Disabled, 1*= Enabled

6004	RW	Default Display ²	UINT16	0*= kWh Import, 1= Energy Auto-Scroll
------	----	------------------------------	--------	--

*Default

Table 4-3 Basic Setup Parameters

Notes:

- 1) The Pulse Constant is fixed at 1000 imp/kXh.
- 2) The **Energy Auto-Scroll** mode displays the following energy measurements in sequence in 4 seconds interval: kWh Import, kWh Export, kvarh Import, kvarh Export and kVAh.

4.3.2 Communication Setup Parameters

Register	Property	Description	Format	Range/Scale
6100		Reserved		
6101	RW	Unit ID	UINT16	1 to 247, (Default=100)
6102	RW	Baud Rate	UINT16	0=1200, 1=2400, 2=4800 3*=9600, 4=19200
6103	RW	Comm. Config.	UINT16	0=8N2, 1=8O1 2*=8E1, 3=8N1

*Default

Table 4-4 Communication Setup

4.4 Time

There are two sets of Time registers supported by the PMC-220 – Year / Month / Day / Hour / Minute / Second (Register # 60000 to 60002) and UNIX Time (Register # 60004). When sending time to the PMC-220 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	High-order Byte: Year	UINT16	0-37 (Year-2000)
		Low-order Byte: Month		1 to 12
60001	9001	High-order Byte: Day	UINT16	1 to 31
		Low-order Byte: Hour		0 to 23
60002	9002	High-order Byte: Minute	UINT16	0 to 59
		Low-order Byte: Second		0 to 59
60003	9003	Millisecond	UINT16	0 to 999
60004	9004	UNIX Time	UINT32	This time shows the number of seconds since 00:00:00 January 1, 1970

Table 4-5 Time Registers

4.5 Clear Control

Register	Property	Description	Format	Note
9600	WO	Clear Energy	UINT16	Writing "0xFF00" to this register will clear all energy registers.

Table 4-6 Clear Control

4.6 Meter Information

Register Address		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	

Table 4-7 Meter Information

Note:

- 1) The Meter Model appears in registers 60200 to 60219 and contains the ASCII encoding of the string "PMC-220" as shown in the following table.

Register	Value(Hex)	ASCII
60200	0x50	P
60201	0x4D	M
60202	0x43	C
60203	0x2D	-
60204	0x32	2
60205	0x32	2
60206	0x30	0
60207-60219	0x20	Null

Table 4-8 ASCII Encoding of "PMC-220"

Appendix A Technical Specifications

Inputs (L, N)	
Voltage (Un)	240VAC
Range	0.4 to 1.1 Un
Current (Ib / Imax)	5A / 63A
Starting Current	0.4% Ib (0.02A)
Minimum Current	5% Ib (0.25A)
Frequency	45Hz-65Hz
Power Supply	Self-powered from 0.4 to 1.1 Un
Maximum Wire Size	25 mm ² (4 AWG)
Torque for Current Inputs	2.5 N.m.
Communications	
RS-485	Modbus RTU
Maximum Wire Size	1.5 mm ² (16 AWG)
Torque for RS-485 Terminals	0.45 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	70kPa to 106kPa
Mechanical Characteristics	
Unit Dimensions	36x65x90mm
Shipping Weight	0.18kg
Shipping Dimensions	120x103x42mm
Mounting	DIN-Rail Mounting

Accuracy

Parameters	Accuracy	Resolution
Voltage	$\pm 0.5\%$ reading	0.1V
Current	$\pm 0.5\%$ reading	0.001A
kW, kVA	IEC 62053-21 Class 1	0.001kX
kvar	IEC 62053-23 Class 2	0.001kvar
kWh	IEC 62053-21 Class 1	0.01kWh
kvarh	IEC 62053-23 Class 2	0.01kvarh
P.F	$\pm 1.0\%$	0.001
Frequency	$\pm 0.02\text{Hz}$	0.01Hz

Appendix B Standards Compliance

Safety Requirements		
Insulation		IEC 60255-5-2000
Dielectric test		2kV @ 1 minute
Insulation resistance		>100MΩ
Impulse voltage		10kV, 1.2/50μs
Electromagnetic Compatibility EMC 2004/108/EC (EN 61326: 2006)		
Immunity Tests		
Electrostatic discharge		IEC 61000-4-2:2001 Level IV
Radiated fields		IEC 61000-4-3:2002 (10 V/m)
Fast transients		IEC 61000-4-4:2004 Level IV
Surges		IEC 61000-4-5:2005 Level IV
Conducted disturbances		IEC 61000-4-6:2006 Level III
Magnetic Fields		IEC 61000-4-8:2009 Level IV
Oscillatory waves		IEC 61000-4-12:2006 Level III
Radio Disturb		CISPR 22: 2006 Class B
Mechanical Tests		
Vibration Test	Response	IEC 60255-21-1 Level I
	Endurance	IEC 60255-21-1 Level I
Shock Test	Response	IEC 60255-21-2 Level I
	Endurance	IEC 60255-21-2 Level I
Bump Test		IEC 60255-21-2 Level I

Appendix C Ordering Guide

		Ceiec Electric Technology		Version 20150714	
Product Code				Description	
PMC-220 Digital Single-Phase Energy Meter					
Input Current					
C				5A (63A Max), Direct Input	
Input Voltage					
3				95V-240V AC ±10%	
System Frequency					
5				45Hz-65Hz	
Communications					
A				1xRS-485	
Language					
E				English	
PMC-220	-	C	3	5	A E
					PMC-220-C35AE (Standard Model)

Contact us

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