Series PM130
Powermeters

Installation and Operation Manual

BG0306 Rev. A1

LIMITED WARRANTY

The manufacturer offers the customer an 24-month functional warranty on the instrument for faulty workmanship or parts from date of dispatch from the distributor. In all cases, this warranty is valid for 36 months from the date of production. This warranty is on a return to factory basis.

The manufacturer does not accept liability for any damage caused by instrument malfunction. The manufacturer accepts no responsibility for the suitability of the instrument to the application for which it was purchased.

Failure to install, set up or operate the instrument according to the instructions herein will void the warranty.

Your instrument may be opened only by a duly authorized representative of the manufacturer. 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.

NOTE

The greatest care has been taken to manufacture and calibrate your instrument. However, these instructions do not cover all possible contingencies that may arise during installation, operation or maintenance, and all details and variations of this equipment are not covered by these instructions.

For additional information regarding installation, operation or maintenance of this instrument, contact the manufacturer or your local representative or distributor.

IMPORTANT

Please read the instructions this manual before performing installation, and take note of the following precautions:

- ☞ **Ensure** that all incoming AC power and other power sources are turned OFF before performing any work on the instrument. Failure to do so may result in serious or even fatal injury and/or equipment damage.

- ☞ **Before** connecting the instrument to the power source, check the labels on the side of the instrument to ensure that your instrument is equipped with the appropriate power supply voltage, input voltages, currents and communication protocol for your application.

- ☞ **Under** no circumstances should the instrument be connected to a power source if it is damaged.

☞ **To prevent** potential fire or shock hazard, do not expose the instrument to rain or moisture.

☞ **The secondary** of an external current transformer must never be allowed to be open circuit when the primary is energized. An open circuit can cause high voltages, possibly resulting in equipment damage, fire and even serious or fatal injury. Ensure that the current transformer wiring is made through shorting switches and is secured using an external strain relief to reduce mechanical strain on the screw terminals, if necessary.

☞ **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.**

Modbus is a trademark of Modicon, Inc.

☞**Read this manual thoroughly before connecting the meter to the current carrying circuits. During operation of the meter, hazardous voltages are present on input terminals. Failure to observe precautions can result in serious or even fatal injury or damage to equipment.**

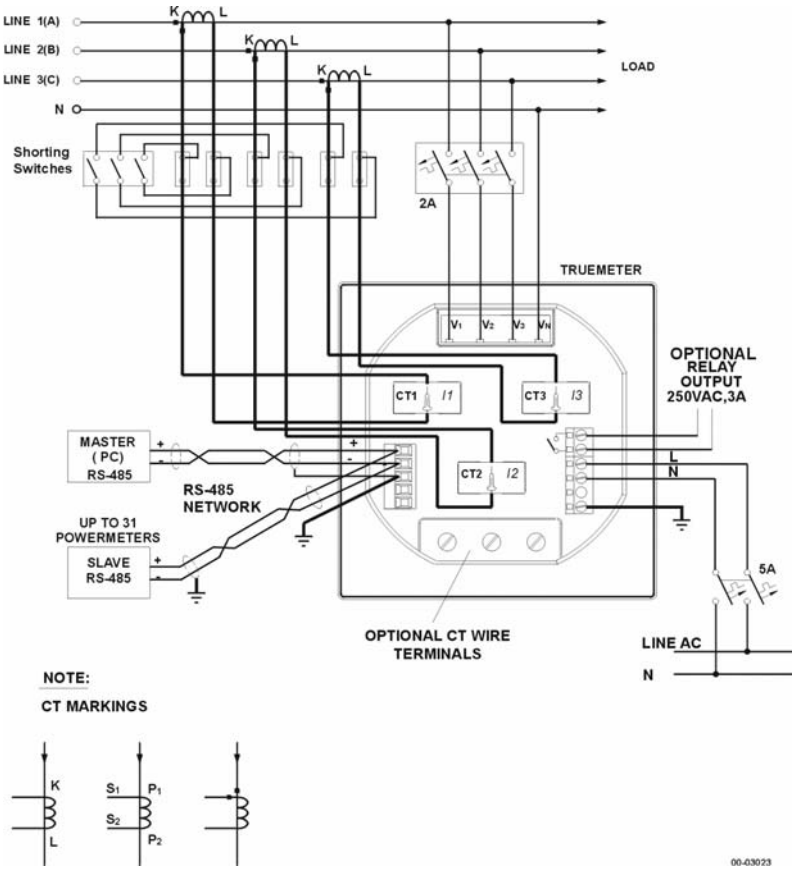
Table of Contents

Quick Start

TYPICAL INSTALLATION

(see Section 2.2.4 for full instructions)

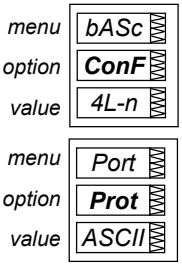
Wiring Mode: 4LL3



SETUP *(see Chapter 4 for full instructions)*

All setups can be performed directly on the front panel or via communications using PComTest communication software, except for Communications and Display setups which must be performed directly on the instrument panel.

Performing *Basic* and *Communications* Setup



Press SELECT ➔ CHG ➔ ENTER .
Press SELECT to activate middle window.
Press ▲▼ to scroll to desired *option*.
Press SELECT to activate lower window.
Press ▲▼ to scroll to desired *value*.
Press ENTER to save selected value.

Basic and Communications Setup Options (∗ default setting)

Code	Parameter	Options	Description
ConF	Wiring mode	3OP2 4Ln3∗ 3dir2 4LL3 3OP3 3Ln3 3LL3	3-wire open delta using 2 CTs 4-wire Wye using 3 PTs 3-wire direct connection using 2 CTs 4-wire Wye using 3 PTs 3-wire open delta using 3 CTs 4-wire Wye using 2 PTs 4-wire Wye using 2 PTs
Pt	PT ratio	1.0∗ - 6,500.0	The potential transformer ratio
Ct	CT primary current	1-50,000A (5*)	The primary rating of the current transformer
d.P E	Power demand period	1, 2, 5, 10, 15*, 20, 30, 60, E	The length of the period for power demand calculations, **in minutes**. E = external synchronization
n.dp E	Number of power demand periods	1-15 (1*)	The number of demand periods to be averaged for sliding window demands 1 = block interval demand calculation
A.dP	Ampere/Volt demand period	0-1800 (900*)	The length of the period for volt/ampere demand calculations, **in seconds** 0 = measuring peak current
buF	Averaging buffer size	8∗,16,32	The number of cycles for RMS sliding averaging
rSt	Reset enable/disable	diS∗, En	Protects all reset functions, both via the front panel or communications
Freq	Nominal frequency	50, 60 Hz	The nominal power utility frequency
Prot	Communications protocol	ASCII∗, rtu, dnP3	ASCII, Modbus RTU or DNP3.0 protocol
rS	Interface standard	485	RS-485 interface (not changeable)
Addr	Address	ASCII: *0∗-99*, Modbus: *1∗-247*, DNP3.0: *0∗-255*	
bAud	Baud rate	110, 300, 600, 1200, 2400, 4800, 9600*, 19200 bps	
dAtA	Data format	7E , 8E (7/8 bits, even parity), 8n* (8 bits, no parity)	

Chapter 1 Introduction

1.1 About This Manual

This manual is intended for the user of the *PM130* Powermeter. The *PM130* is a microprocessor-based instrument used for measurement, monitoring, and management of electrical parameters.

This chapter gives an overview of this manual and an introduction to the *PM130*.

Chapter 2, *Installation*, provides instructions for mechanical and electrical installation.

Chapter 3, *Using the Menus*, presents the structure of menus for setup and status viewing.

Chapter 4, *Setup Menus*, provides instructions for performing parameter setup via the front panel.

Chapter 5, *Data Display*, guides you through the display pages.

Chapter 6, *Viewing Status Information*, tells you how to access additional status information on the instrument. This information may be useful during installation.

Technical Specifications for the *PM130* are found in the Appendix.

1.2 About The *PM130*

The *PM130* is a compact panel mounted 3-phase AC Powermeter, specially designed to meet the requirements of users ranging from electrical panel builders to substation operators. The *PM130* is available in three models: the *PM130* for basic voltage, current and frequency measurements; the *PM130P* which adds power and power factor measurements; and the *PM130E* which adds power demands and energy measurements. All models are suitable for mounting on both 4-inch round and 92x92mm square cut-outs.

Features

Display: The front panel features bright LED displays (three windows, up to 38 pages) with adjustable display update time, and a LED **bar graph** showing percentage load with respect to user-definable nominal (100%) load current. In the common measurements group (see Chapter 5), ***Display Auto Scroll*** is available with a programmable scroll interval of 2 to 15 seconds.

Automatic return to the main screen is available after 30 seconds of uninterrupted use.

Setup is menu driven, with optional password protection.

Communications are available using an RS-485 standard, with ASCII/Modbus or ASCII/DNP3.0 protocols. 120 user assignable registers are available. Transmitter and receiver status are displayed on the status information page (see Chapter 6).

One multi-purpose relay (optional) is provided for energy pulsing (KYZ) or alarm and remote control. Up to 16 setpoints can be assigned to the relay.

Four time operation counters are provided which are operated and released by user-defined triggers. These are for counting total generator time or transformer or power line time overload.

External synchronization of the power demand interval is provided through communications in the *PM130E*.

Three user-selectable options are provided:

Power calculation mode (*P.cAL*):

Mode 1: Reactive power calculation (rEAc)

Active power P and reactive power Q are measured directly and apparent power $S = \sqrt{P^2 + Q^2}$

Mode 2: Non-active power calculation (nAct)

Active power is measured directly, and apparent power $S = V \times I$ (V, I - rms voltage and currents) and non-active power $N = \sqrt{S^2 - P^2}$

Mode 1 is recommended for electrical networks with low harmonic distortion (voltage THD < 5%, current THD < 10%); Mode 2 is recommended for all other cases. *(The PM130 does not measure harmonics; contact your distributor for information on instruments that provide harmonic measurement)*.

Energy rollover value (roll – *PM130E* only)

This option specifies the point at which the energy value rolls over to zero. For example, if the roll value is 10.E4, then the energy counter has 4 digits, i.e., energy is displayed up to 9999 kWh (kvarh, kVAh) with resolution 1 kW-hour.

Roll value	Maximum Energy	Resolution
10.E4	9999 kWh (kvarh, kVAh)	1 kWh (kvarh, kVAh)
10.E5	99999 kWh (kvarh, kVAh)	1 kWh (kvarh, kVAh)
10.E6	999.99 MWh (kvarh, kVAh)	10 kWh (kvarh, kVAh)
10.E7	9999.9 MWh (kvarh, kVAh)	100 kWh (kvarh, kVAh)
10.E8	99999. MWh (Mvarh, MVAh)	1 MWh (Mvarh, MVAh)

The roll value may be changed in accordance with the average load of the power line. For example, if average power equals 400 kW and the counter must reset every 3 months (2160 hours), then energy during this period equals 864000 (6 digits) and the roll = 10.E6.

Phase energy calculations mode (Ph.En)
This option is used to enable or disable phase energy calculations.

Measured Parameters

Note: Real-time values are measured over 1 cycle of fundamental frequency; Average values are of 8, 16 or 32 real-time values

[P] [E] available in the PM130P/PM130E

Parameter	Display	Comm.	Output: Pulse	Output: Alarm
Average Values: Amps, Volts, Frequency			$ = setup via PC # = setup via panel	
Average RMS Voltage per phase	✓	✓		#$
Average RMS Current per phase	✓	✓		#$
Average Frequency	✓	✓		#$
Average Neutral Current	✓	✓		#$
Voltage & Current unbalance [P]	✓	✓		
Amps & Volt Demand Parameters				
Ampere Demand per phase		✓		#$
Volt Demand per phase [P] [E]		✓		#$
Ampere Maximum Demand per phase	✓	✓		
Voltage Max. Demand per phase [P] [E]	✓	✓		
Average Power values [P] [E]				
Average Active Power per phase	✓	✓		
Average Reactive Power per phase	✓	✓		
Average Apparent Power per phase	✓	✓		
Average Total Active Power	✓	✓		#$
Average Total Reactive Power	✓	✓		#$
Average Total Apparent Power	✓	✓		#$
Average Power Factor per phase	✓	✓		
Average Total Power Factor	✓	✓		#$
Power Demand Parameters [E]				
Active Power Accumulated Demand		✓		#$
Apparent Power Accumulated Demand		✓		#$
Active Power Demand		✓		#$
Active Power Sliding Demand		✓		#$
Apparent Power Demand		✓		#$
Apparent Power Sliding Demand		✓		#$
Active Power Predicted Demand		✓		#$
Apparent Power Predicted Demand		✓		#$

P E available in the PM130P/PM130E			Output	
Parameter	**Display**	**Comm.**	**Pulse**	**Alarm**
Active Power Maximum Demand	✓	✓		
Apparent Power Maximum Demand	✓	✓		
Energy Per Phase E				
Active Energy Import per phase	✓	✓		
Reactive Energy Import per phase	✓	✓		
Apparent Energy per phase	✓	✓		
Total Energy E				
Total Active Energy Import	✓	✓	#$	
Total Active Energy Export	✓	✓	#$	
Total Reactive Energy Import	✓	✓	#$	
Total Reactive Energy Export	✓	✓	#$	
Total Reactive Energy net		✓		
Total Reactive Energy Absolute			#$	
Total Apparent Energy	✓	✓	#$	
Min/Max Log				
Min/Max Volts	✓	✓		
Min/Max A, Neutral current P E		✓		
Min/Max frequency P E	✓	✓		
Min/Max kW, kvar, kVA, PF P E	✓	✓		
Real-time Amps, Volts, Frequency				
RT RMS Voltage per phase		✓		#$
RT RMS Current per phase		✓		#$
RT Frequency		✓		#$
RT Neutral Current		✓		
RT Voltage & Current unbalance P E		✓		#$
Real-time Power Values P E				
RT Active Power per phase		✓		
RT Reactive Power per phase		✓		
RT Apparent Power per phase		✓		
RT Total Active Power		✓		
RT Total Reactive Power		✓		
RT Total Apparent Power		✓		
RT Power Factor per phase		✓		
RT Total Power Factor		✓		
Phase Rotation	✓			#$
Counters	✓	✓		
Remote Relay Control		✓		
Alarm Trigger Status		✓		
Self-Diagnostic Tests	✓	✓		

Instrument Dimensions

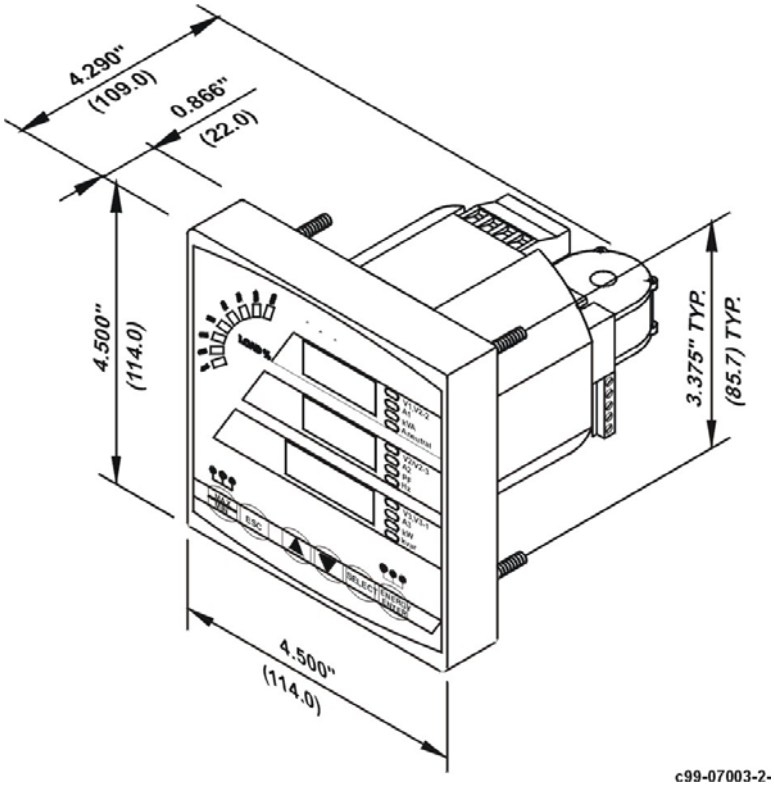


Figure 1-1 *PM130* Dimensions

Chapter 2 Installation

2.1 Mechanical Installation

1- Position Powermeter in cut-out

2- Affix the Powermeter using washers and nuts

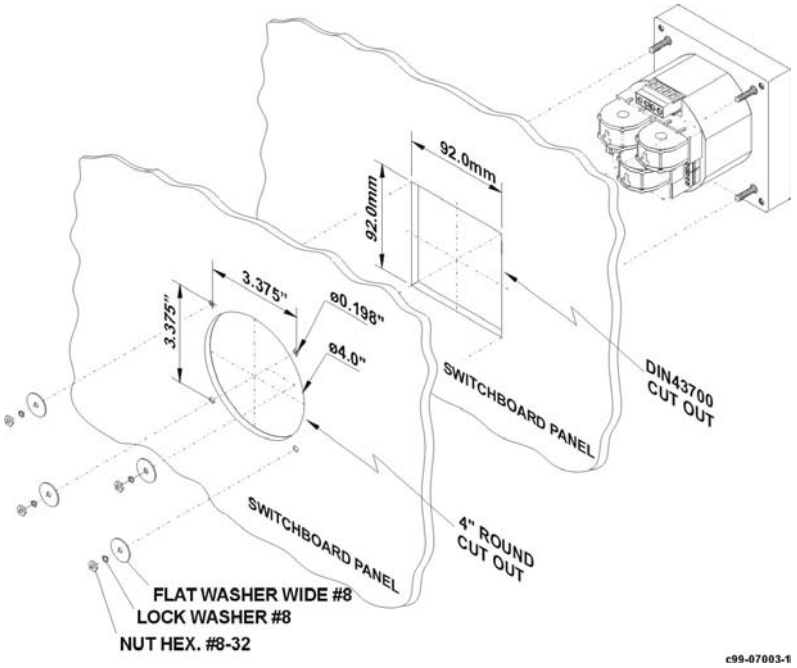


Figure 2-1 Mounting the *PM130* (Square or Round Cut-out)

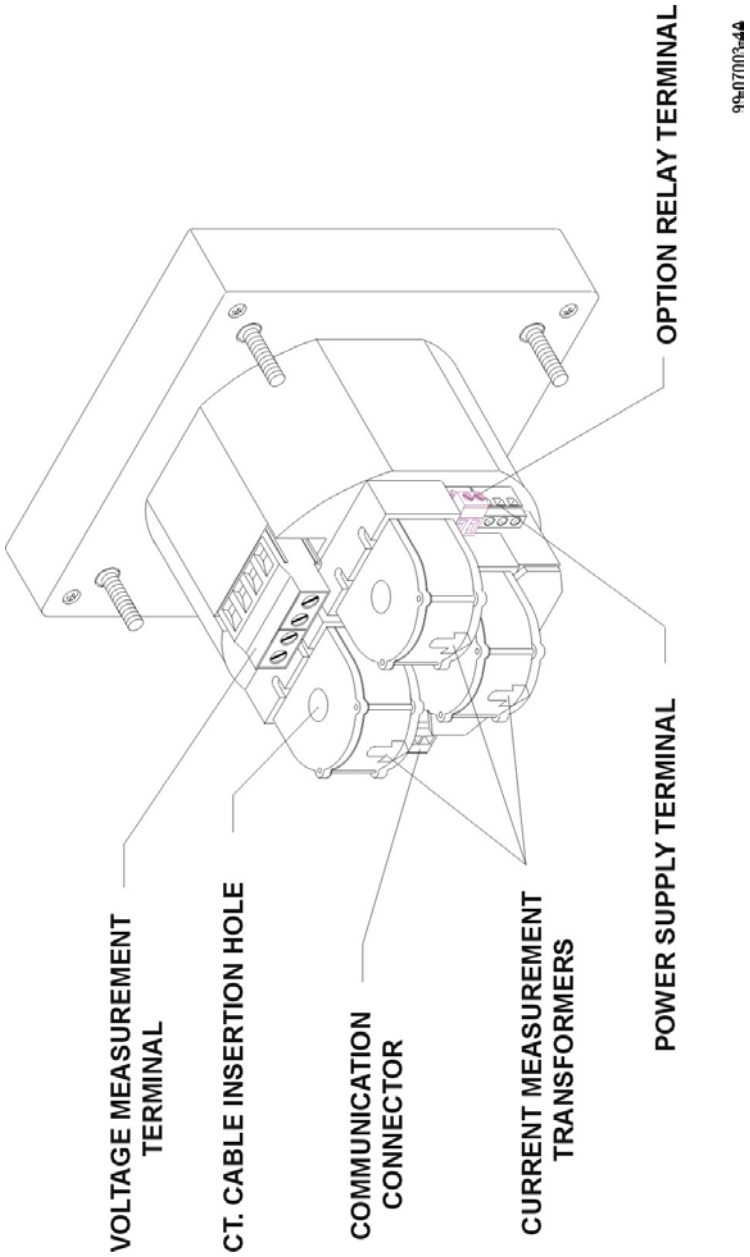
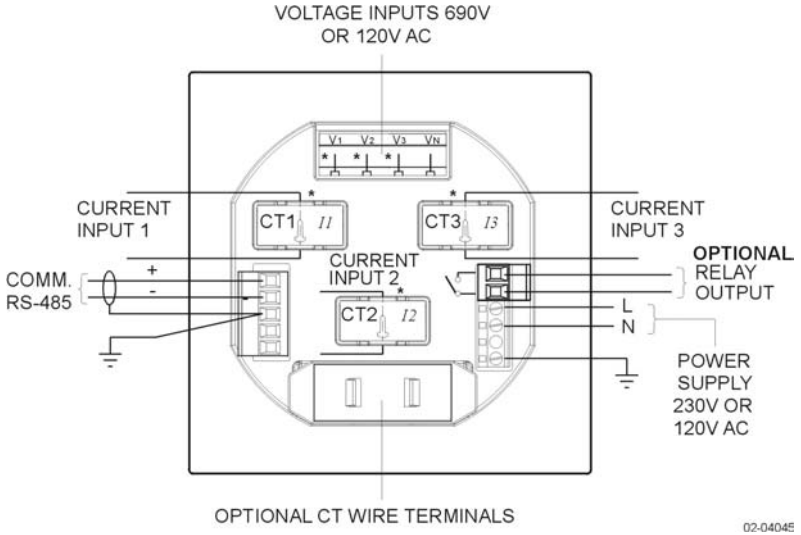


Figure 2-2 The *PM130* Terminations

2.2 Electrical Installation

> ☞ **Before installation ensure that all incoming power sources are shut OFF. Failure to observe this practice can result in serious or even fatal injury and damage to equipment.**

Connections to the *PM130* are made via terminals (voltage input, power supply, communication and optional relay output) and CT cores located on the rear of the instrument as shown in Figure 2-3.



Note: If your PM130 was not ordered with the optional relay, it will not have the relay connector.

Figure 2-3 *PM130* Connections - Rear View

2.2.1 Power Supply Connection

The power supply can be dedicated-fused, or from a monitored voltage if it is within the instrument's power supply range. Connection to the AC power supply is: Line to terminal L; Neutral to terminal N.

2.2.2 Current Inputs

To ensure accurate readings, the input current should not exceed 1.5A RMS for the 1A CT secondary, or 7.5A RMS for the 5A CT secondary.

The *PM130* does not have current terminals. To connect to the external CT, **you must pass the external CT wire through the instrument CT core** (see Figure 2-4).

In the case of a retrofit where each external CT ends with two wires, pass one wire through the core and connect it to one of the instrument termination screws; connect the second wire from the termination screw to the external CT to close the loop. **One wire must pass through the core;** observe the arrow which indicates the current direction (see Figure 2-4).

2.2.3 Ground

Connect the ground *PM130* terminals of the power supply and communication connectors to the switchgear earth ground using 1.5 mm^2/14 AWG dedicated wire.

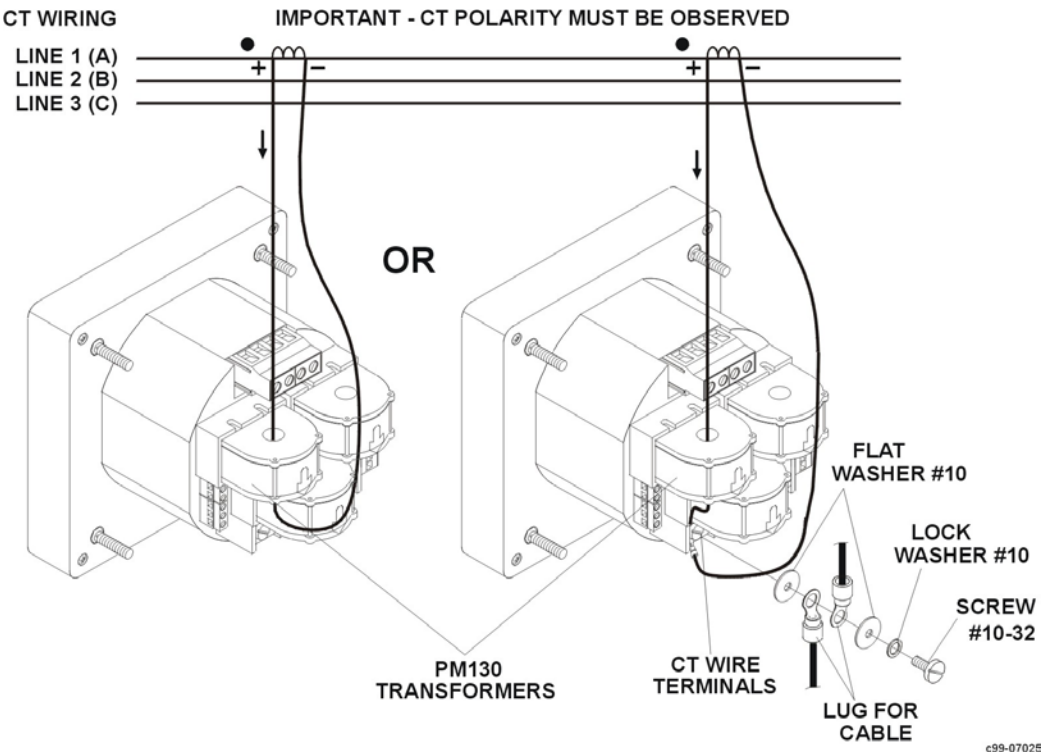
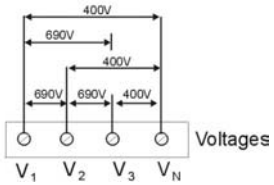


Figure 2-4 Current Input Connection

2.2.4 Voltage Inputs

690V Inputs (Standard):

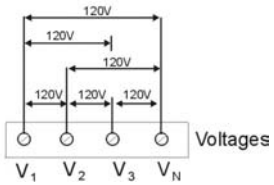
690V Input (Standard)



690V inputs are usually used with direct connection. Use any of the seven wiring configurations shown in *Figures 2-5* through *2-11*.

120V Inputs (Option U):

120V Input (Option U)



120V inputs usually implies use of a potential transformer (PT). The PT requires use of any of the four wiring configurations shown in *Figures 2-7* through *2-10*.

Wiring Configurations (See parameter setup instructions in Section 4.1)	**'Wiring Mode' Definition**	
3-wire direct connection using 2 CTs (2-element)	3dir2	(Figure 2-5)
4-wire WYE direct connection using 3 CTs (3-element)	4Ln3 or 4LL3	(Figure 2-6)
4-wire WYE connection using 3 PTs, 3 CTs (3-element)	4Ln3 or 4LL3	(Figure 2-7)
3-wire open delta connection using 2 PTs, 2 CTs (2-element)	3OP2	(Figure 2-8)
3-wire open delta connection using 2 PTs, 3 CTs (2½ -element)	3OP3	(Figure 2-9)
4-wire WYE connection using 2 PTs, 3 CTs (2½-element)	3Ln3 or 3LL3	(Figure 2-10)
4-wire delta direct connection using 3 CTs (3-element)	4Ln3 or 4LL3	(Figure 2-11)

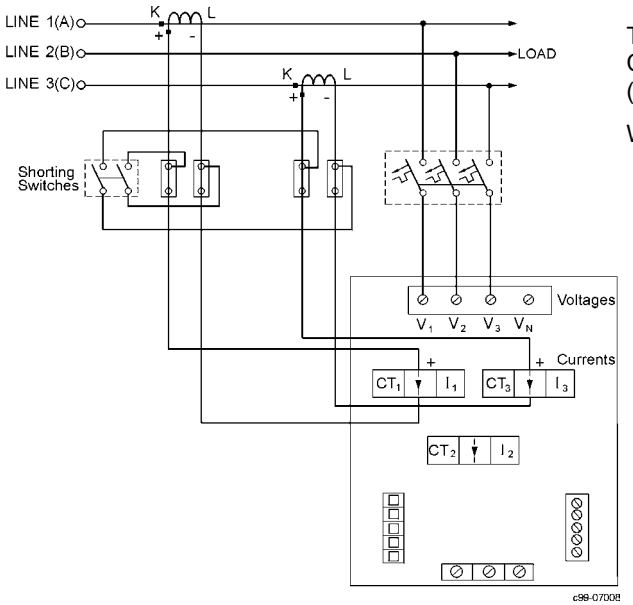


Figure 2-5

Three Wire Direct Connection Using 2 CTs (2-element)

Wiring Mode = **3dir2**

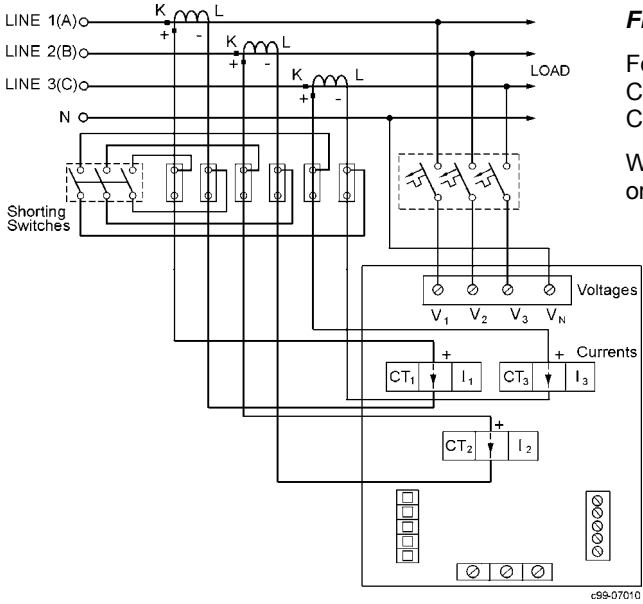


Figure 2-6

Four Wire WYE Direct Connection Using 3 CTs (3-element)

Wiring Mode = **4LL3** or **4Ln3**

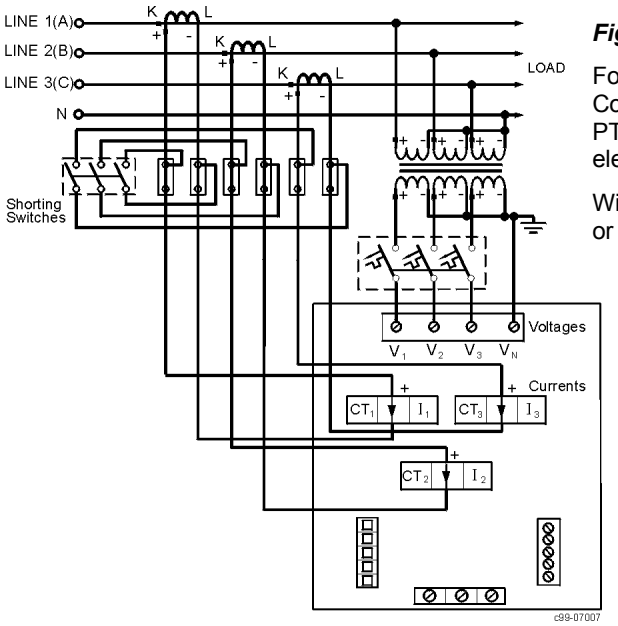


Figure 2-7

Four Wire WYE Connection Using 3 PTs, 3 CTs (3-element)

Wiring Mode = **4LL3** or **4Ln3**

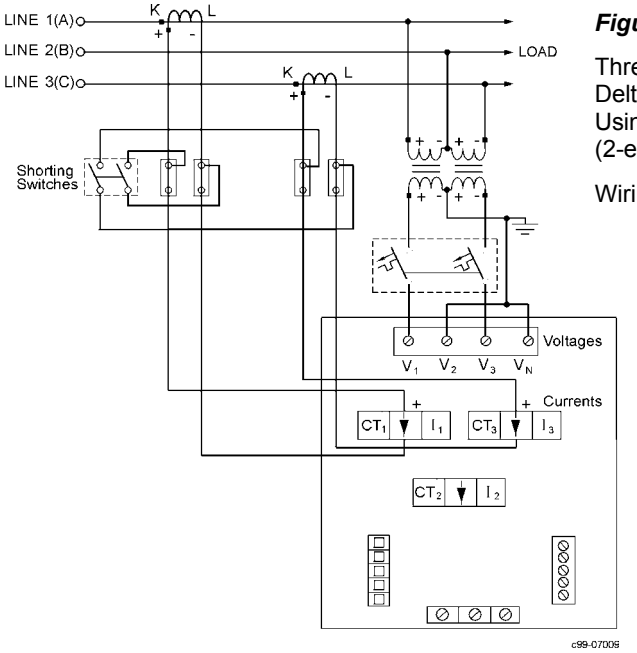


Figure 2-8

Three Wire Open Delta Connection Using 2 PTs, 2 CTs (2-element)

Wiring Mode = **3OP2**

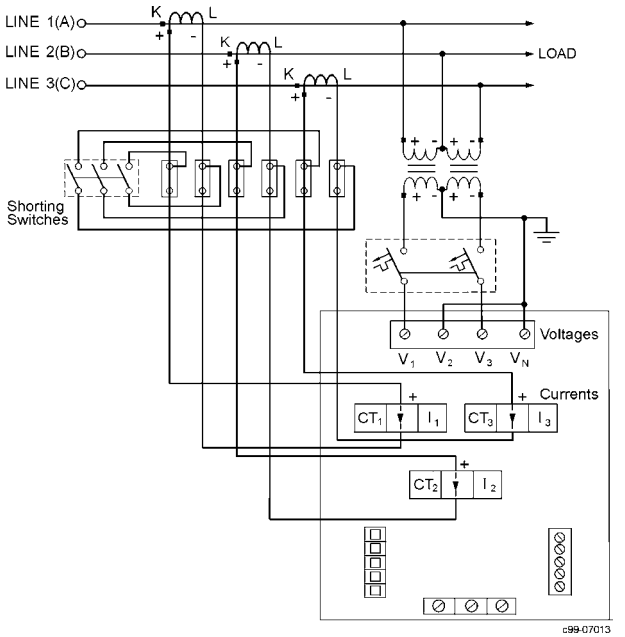


Figure 2-9

Three Wire Open Delta Connection Using 2 PTs, 3 CTs (2½-element)

Wiring Mode = **3OP3**

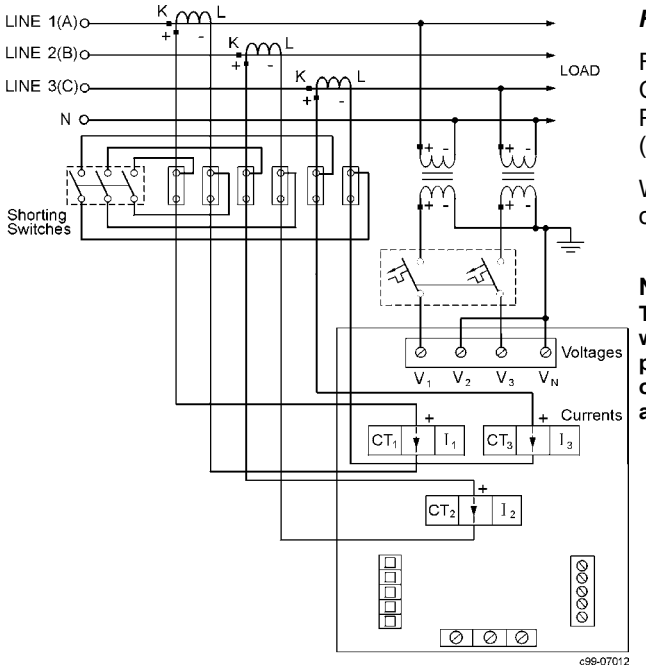


Figure 2-10

Four Wire Wye Connection Using 2 PTs, 3 CTs (2½-element)

Wiring Mode = **3LL3** or **3Ln3**

Note

This configuration will provide accurate power measurements only if the voltages are balanced.

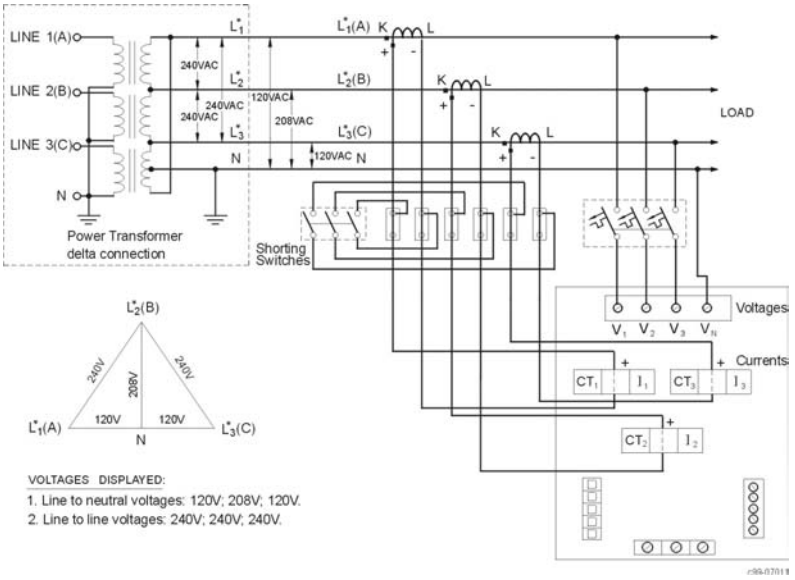


Figure 2-11 Four Wire Delta Direct Connection Using 3 CTs (3 element) Wiring Mode **= 4LL3** or **4Ln3**

2.2.5 Relay

One relay (optional) is provided for energy pulsing, alarms or remote control.

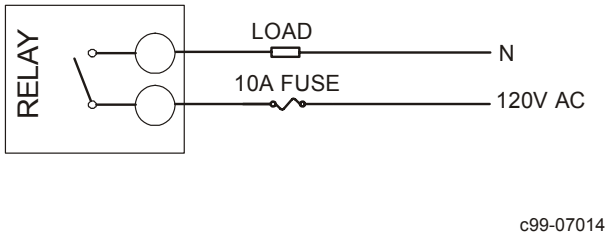


Figure 2-12 Relay Connection

2.2.6 Communications

A connection to the RS-485 communication port can be made from a distance of up to1200 meters, with up to 32 instruments on one multi-drop line.

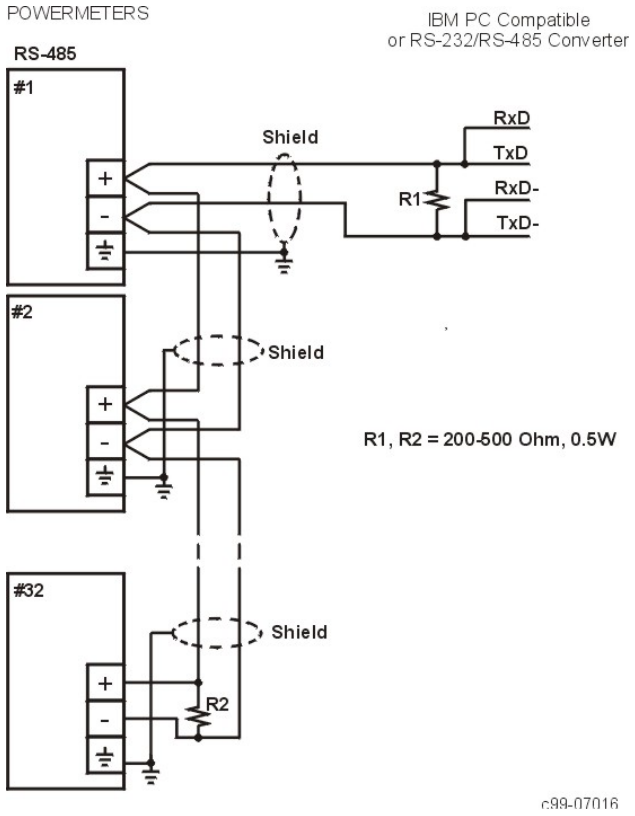


Figure 2-13 RS-485 Multidrop Computer Connection

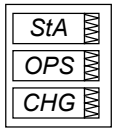
NOTE: Where an RS-232/RS-485 converter is used on a computer connection, R1 is not applicable since it is built in to the converter.

Activity on the communications port lines is indicated via the Status Information menu (see Chapter 6).

A full description of the communication protocols may be found in the *PM130 ASCII, Modbus* or *DNP3.0 Communications Manuals* provided with your instrument.

Chapter 3 Using The Menus

Press SELECT to enter the setup mode. The primary menus will appear:



- Status Information Menu (see Chapter 6)
- Setup Options Menu
- Setup Change Menu (see Chapter 4)

Press SELECT again to activate the window of the desired primary menu. Press ENTER .

Select ***CHG*** to initialize or modify the instrument setup, or to clear the accumulated values stored in the instrument. Entry to this menu can be protected by a password.

SELECT → CHG → ENTER

Select ***StA*** to view extended status information which may be useful during installation and in certain applications.

SELECT → StA → ENTER

Select ***OPS*** for *viewing* (not editing) the instrument setup options.

SELECT → OPS → ENTER

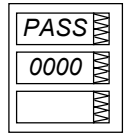
After selecting either *OPS* or *CHG,* the list of setup menus is displayed in the upper window. Figure 3-1 presents a complete menu list. Depending on the model of your instrument, some menus may not appear.

Password

The *Setup Change Menu* can be secured by a user-defined password comprised of 4 digits. The instrument is shipped with password protection disabled. To enable password protection, go to the *Access Control Menu* (see Section 4.13).

The *Password Menu* appears if password protection is enabled.

To enter a password:



- ✓ Set the first digit using the up and down arrow keys.
- ✓ Press SELECT to advance to the next digit. As you advance, the previous digit will become invisible.
- ✓ Set the other password digits in the same manner.
- ✓ Press ENTER to continue setup. If your password is incorrect, you will return to the *Primary Selection Menu.*

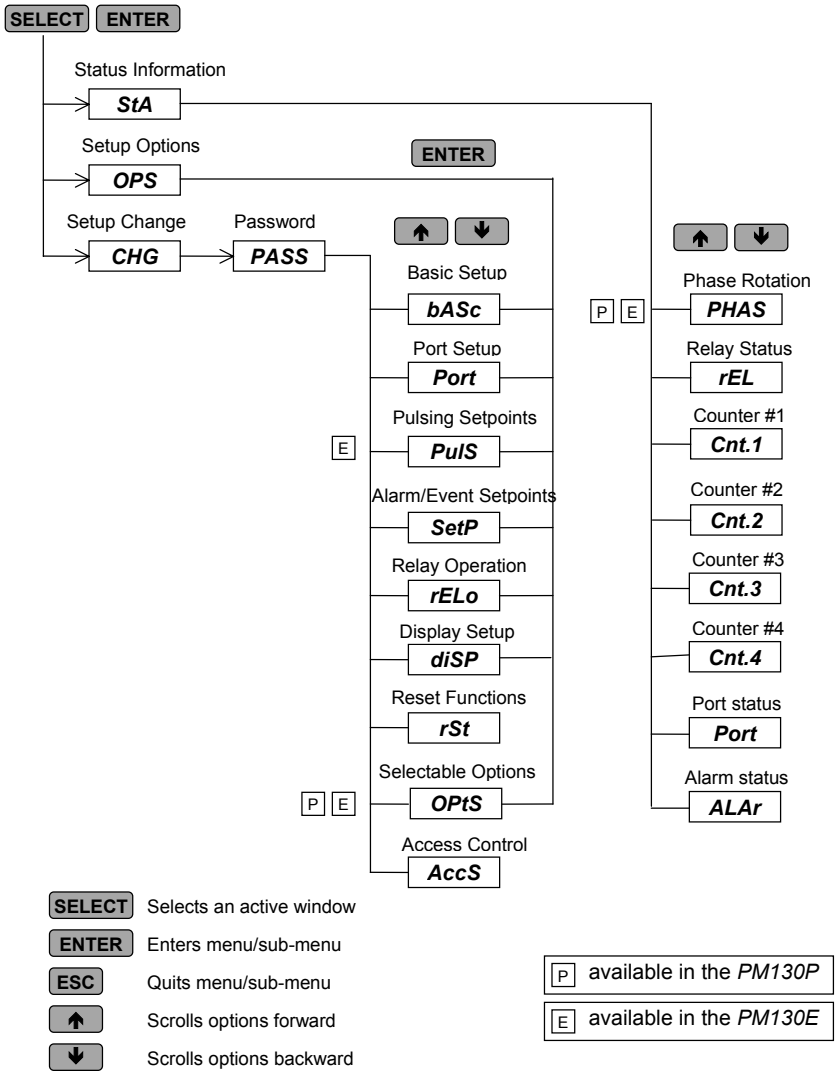


Figure 3-1 Menu Structure

Chapter 4 Setup Menus

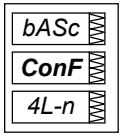
NOTE: Instrument setup can be performed directly on the front panel using the setup menus or via communications using PComTest communication software. PComTest is supplied with your instrument and provides full setup capabilities for your instrument. For information on using PComTest, refer to the user documentation supplied with your instrument.

4.1 Basic Setup Menu

SELECT ➔ *CHG* ➔ ENTER ➔ *bASc* ➔ ENTER

This menu contains the basic configuration options which define the general operating characteristics of your instrument, such as wiring mode, input scales, the size of the RMS averaging buffer, etc. Table 4-1 lists the basic setup options, their code names and applicable ranges.

Activate the middle window to scroll through the list of available options, and then activate the lower window to set the option value.



To select and view a setup option:

✓ Press SELECT to activate the middle window

✓ Use the up/down arrow keys to scroll to the desired option. The current value for this option appears in the lower window.

To change the value of the selected option:

✓ Press SELECT to make the lower window active.

✓ Press the up/down arrow keys to scroll to the desired value.

✓ Press ENTER to store the selected value, or press ESC to quit the setup menu.

Table 4-1 Basic Setup Options (* default setting)

Code	*Parameter*	*Options*	*Description*
ConF	Wiring mode	3OP2	3-wire open delta using 2 CTs (2 element)
		4Ln3*	4-wire Wye using 3 PTs (3 element), line to neutral voltage readings
		3dir2	3-wire direct connection using 2 CTs (2 element)
		4LL3	4-wire Wye using 3 PTs (3 element), line to line voltage readings

Code	Parameter	Options	Description
ConF	Wiring mode	3OP3	3-wire open delta using 3 CTs (2½ element)
		3Ln3	4-wire Wye using 2 PTs (2½ element), line to neutral voltage readings
		3LL3	4-wire Wye using 2 PTs (2½ element), line to line voltage readings
Pt	PT ratio	1.0∗ - 6,500.0	The potential transformer ratio
Ct	CT primary current	1-50,000 (5*)	The primary rating of the current transformer, in A
d.P	Power demand period (***PM130E***)	1, 2, 5, 10, 15*, 20, 30, 60, E	The length of the period for power demand calculations, **in minutes**. E = external synchronization ①
n.dp	Number of power demand periods (***PM130E***)	1-15 (1*)	The number of demand periods to be averaged for sliding window demands 1 = block interval demand calculation
A.dP	Ampere/Volt demand period	0-1800 (900*)	The length of the period for volt/ampere demand calculations, **in seconds** 0 = measuring peak current
buF	Averaging buffer size	8∗,16,32	The number of measurements for RMS sliding averaging
rSt	Reset enable/disable	diS∗, En	Protects all reset functions, both via the front panel or communications.
Freq	Nominal frequency	50, 60 Hz ②	The nominal power utility frequency

① Synchronization of the power demand interval can be made through communications (see the *PM130* Communications Reference Guides) or via the front panel (see Section 4.9). If the power demand period is set to E, an external synchronization pulse denoting the start of the next demand interval can be simulated by using the synchronization command sent via communications.

② 60 Hz default for North America; elsewhere, default is 50Hz.

NOTES

1) The maximum value for CT PRIMARY CURRENT × PT RATIO is 10,000,000. If this product is greater, power related values will be zeroed.

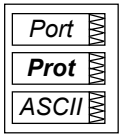
2) Always specify WIRING MODE, PT RATIO and CT PRIMARY CURRENT prior to setting up alarm setpoints, otherwise the alarm/event setpoints which use these parameters will automatically be disabled.

4.2 Communications Port Setup Menu

SELECT → CHG → ENTER ↑ ↓ → Port → ENTER

This menu allows you to access the communications port options that the *PM130* uses to communicate with a master computer. Table 4-2 lists the communications options, their code names and applicable choices.

Activate the middle window to scroll through the list of available options, and then activate the lower window to set the option value.



To select and view a setup option:

✓ Press SELECT to activate the middle window.
✓ Use the up/down arrow keys to scroll to the desired option. The option setting will appear in the lower window.

To change the selected option:

✓ Press SELECT to activate the lower window.
✓ Press the up/down arrow keys to scroll to the desired value.
✓ Press ENTER to store the selected value or press ESC to quit the setup menu.

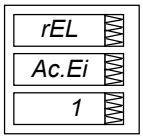
Table 4-2 Communications Options (∗ default setting)

Code	*Parameter*	*Options*	*Description*
Prot	Communications protocol	*ASCII*∗ *rtu* *dnP3*	ASCII protocol Modbus RTU protocol DNP3.0 protocol
rS	Interface standard	*485*	RS-485 (not changeable)
Addr	Address	*0*∗*-99 ASCII* *1*∗*-247 Modbus* *0*∗*-255 DNP3.0*	Powermeter address
bAud	Baud rate	*110* *300* *600* *1200* *2400* *4800* *9600*∗ *19.20*	110 baud 300 baud 600 baud 1200 baud 2400 baud 4800 baud 9600 baud 19,200 baud
dAtA	Data format	*7E* *8n*∗ *8E*	7 bits, even parity 8 bits, no parity 8 bits, even parity

4.3 Pulsing Output Setup Menu *(PM130E)*

SELECT → CHG → ENTER ↑ ↓ → PulS → ENTER

This menu allows you to program a relay (optional) provided by your *PM130E* instrument to output energy pulses. Available pulsing parameters are listed in Table 4-3.



To change the pulse relay setup:

- ✓ Press SELECT to activate the middle window.
- ✓ Use the up/down arrow keys to scroll to the desired output parameter. Selecting ***nonE*** disables pulsing through this relay.
- ✓ Press SELECT to activate the lower window.
- ✓ Use the up/down arrow keys to set the amount of unit-hours per pulse. The available range is 1-9999.
- ✓ Press ENTER to store the new setup, or press ESC to quit the setup without changes.

To quit the pulsing setup menu:

- ✓ From the upper window, press ESC or ENTER .

Table 4-3 Pulsing Output Parameters

Code	*Parameter*	*Units*
nonE	*Output disabled*	
Ac.Ei	Active energy import	kWh import (positive)
Ac.EE	Active energy export	kWh export (negative)
rE.Ei	Reactive energy import	kvarh import (inductive)
rE.EE	Reactive energy export	kvarh export (capacitive)
rE.Et	Reactive energy total	kvarh total (absolute)
AP.Et	Apparent energy total	kVAh total

NOTES

1. If your instrument is not equipped with the optional relay, then this setup parameter will not appear on the display.
2. You will not be able to store your setup in the instrument if you assigned a parameter to relay output with a zero number of unit-hours per pulse.
3. If a relay you allocated for pulsing has been manually operated or released, it reverts automatically to normal operation.
4. If a relay you allocated for pulsing has been engaged by an alarm/event setpoint, the setpoint is automatically disabled.

4.4 Alarm/Event Setpoints Setup Menu

SELECT → CHG → ENTER ↑ ↓ → SEtP → ENTER

Your instrument provides 16 alarm/event setpoints that can monitor a wide variety of events; in turn, these events can be programmed to trigger specific actions. This menu is used to specify the events to be monitored by the setpoints, and actions to be triggered by those events.

To program a setpoint (all 16 can be assigned to the relay) you need to define up to six setup parameters: the setpoint trigger parameter, operate and release limits, optional operate and release delays, and the setpoint action. Tables 4-4, 4-5 and 4-6 list the setpoint setup parameters, available triggers and setpoint actions.

Example:

SP 1 triG RHi.C1	Trigger parameter	Setpoint 1 is set to monitor the real-time high current on phase 1 (the **trigger** parameter).
SP 1 On 1200	Operate limit	The **operate (*On*) and release (*OFF*) limits** which determine setpoint operation are defined as 1200A and 1100A respectively.
SP 1 OFF 1100	Release limit	
SP 1 On d 5	Operate delay	The **delays before operation (*On d*) and release (*OFFd*)** are set at 5 seconds and 10 seconds respectively.
SP 1 OFFd 10	Release delay	
SP 1 Act rEL	Setpoint action	The **action** to be triggered is relay operation.

To select a setpoint:

✓ Scroll to the desired setpoint using the up/down arrow keys.

To view the setup options for the setpoint:

✓ Press SELECT to activate the middle window.

✓ Use the up/down arrow keys to scroll to the desired setup option. The value associated with this option is displayed in the lower window.

To change the selected setup option:

✓ Press [SELECT] to activate the lower window.
✓ Use the up/down arrow keys to scroll to the desired value.
✓ Press [ENTER] to store the new value.
✓ Press [ESC] to leave the value unchanged.

To store your new setup for the setpoint:

✓ From the middle window, press [ENTER].

To quit the setpoint setup without changes:

✓ From the middle window, press [ESC].

To quit the setpoints setup menu:

✓ From the upper window, press [ESC] or [ENTER].

NOTES

1. If your instrument is not equipped with the optional relay, then these setup parameters will not appear on the display.
2. When you enter the setpoints setup menu at the protected level, monitoring setpoints is temporarily suspended until you return to the main setup menu.
3. Each time you select a new trigger parameter, the operate and release limits are set by default to zero.
4. You will not be able to store your setpoint setup to the instrument if a setpoint action is directed to a relay allocated for pulsing.
5. The setpoint action directed to a relay output can be overridden using commands sent via communications. A relay can be manually operated or released. When the relay reverts to normal operation, it is automatically returned under setpoint control.

Table 4-4 Setpoint Setup Options (middle window)

Code	*Option*	*Description*
triG	Trigger parameter	The measurement parameter or signal to be monitored by the setpoint.
On	Operate limit	The threshold at which the setpoint becomes operative.
OFF	Release limit	The threshold at which the setpoint is released (becomes inoperative).
On d	Operate delay	Time delay (0.1 sec.resolution) before operation.
OFF d	Release delay	Time delay (0.1 sec. resolution) before release.
Act	Setpoint action	The action performed when the setpoint is operative.

Table 4-5 Setpoint Triggers
(lower window, when middle window is *triG*)

Code	*Parameter*		*Unit*	*Range*
nonE	Setpoint disabled			
	Phase Reversal			
POS.ro.	Positive phase rotation reversal ①			
NEG.ro.	Negative phase rotation reversal ①			
	Real-time Values on any Phase			
r. Hi. U	High voltage ③		V	0 to Vmax
r. Lo. U	Low voltage ③		V	0 to Vmax
r. Hi. C	High current		A	0 to Imax
r. Lo. C	Low current		A	0 to Imax
	Real-time Auxiliary Measurements			
r. Hi.Fr	High frequency ②		Hz	0 to 100.00
r. Lo.Fr	Low frequency ②		Hz	0 to 100.00
r. U.Unb	Voltage unbalance	P E	%	0 to 300
r. C.Unb	Current unbalance	P E	%	0 to 300
	Average Values per Phase			
A. Hi.C1	High current L1		A	0 to Imax
A. Hi.C2	High current L2		A	0 to Imax
A. Hi.C3	High current L3		A	0 to Imax
A. Lo.C1	Low current L1		A	0 to Imax
A. Lo.C2	Low current L2		A	0 to Imax
A. Lo.C3	Low current L3		A	0 to Imax
	Average Values on any Phase			
A. Hi. U	High voltage ③		V	0 to Vmax
A. Lo. U	Low voltage ③		V	0 to Vmax
A. Hi. C	High current		A	0 to Imax
A. Lo. C	Low current		A	0 to Imax
	Average Total Values	P E		
A. Hi.P.i	High total kW import (positive)		kW	0 to Pmax
A. Hi.P.E	High total kW export (negative)		kW	0 to Pmax
A. Hi.q.i	High total kvar import (positive)		kvar	0 to Pmax
A. Hi.q.E	High total kvar export (negative)		kvar	0 to Pmax
A. Hi. S	High total kVA		kVA	0 to Pmax
A. PF.LG	Low total PF Lag			0 to 1.000
A. PF.Ld	Low total PF Lead			0 to 1.000
	Average Auxiliary Measurements			
Ar neU.C	High neutral current		A	0 to Imax
Ar Hi.Fr	High frequency ②		Hz	0 to 100.00
Ar Lo.Fr	Low frequency ②		Hz	0 to 100.00
	Present Demands			
Hi d.U1	High volt demand L1 ③	P E	V	0 to Vmax
Hi d.U2	High volt demand L2 ③	P E	V	0 to Vmax
Hi d.U3	High volt demand L3 ③	P E	V	0 to Vmax
Hi d.C1	High ampere demand L1		A	0 to Imax
Hi d.C2	High ampere demand L2		A	0 to Imax
Hi d.C3	High ampere demand L3		A	0 to Imax

Code	Parameter		Unit	Range
Hi d.P	High block interval kW demand	E	kW	0 to Pmax
Hi d.S	High block interval kVA demand	E	kVA	0 to Pmax
Hi Sd.P	High sliding window kW demand	E	kW	0 to Pmax
Hi Sd.S	High sliding window kVA demand	E	kVA	0 to Pmax
Hi Ad.P	High accumulated kW demand	E	kW	0 to Pmax
Hi Ad.S	High accumulated kVA demand	E	kVA	0 to Pmax
Hi Pd.P	High predicted sliding window kW demand	E	kW	0 to Pmax
Hi Pd.S	High predicted sliding window kVA demand	E	kVA	0 to Pmax

P available in the *PM130P*

E available in the *PM130E*

The parameter limits are as follows:

Vmax (690 V input option) = 828 V @ PT Ratio = 1
Vmax (690 V input option) = 144 × PT Ratio [V] @ PT Ratio > 1
Vmax (120 V input option) = 144 × PT Ratio [V]
Imax (50% over-range) = 1.5 × CT primary current [A]
Pmax = (Imax × Vmax × 3)/1000 [kW] @ wiring mode 4Ln3 or 3Ln3
Pmax = (Imax × Vmax × 2)/1000 [kW] @ wiring mode 4LL3, 3OP2, 3dir2, 3OP3 or 3LL3

① The setpoint is operated when the actual phase sequence does not match the indicated normal phase rotation.

② The actual frequency range is 45.00 - 65.00 Hz.

③ For 4LN3 or 3LN3 wiring modes, voltages will be line-to-neutral; for any other wiring mode, they will be line-to-line.

Table 4-6 Setpoint Actions (lower window, when middle window is *Act*)

Code	Action
nonE	No action ①
rEL	Operate relay
In.Cn.1	Increment counter #1
In.Cn.2	Increment counter #2
In.Cn.3	Increment counter #3
In.Cn.4	Increment counter #4
ti.Cn.1	Count operating time using counter #1 ②
ti.Cn.1	Count operating time using counter #2 ②
ti.Cn.1	Count operating time using counter #3 ②
ti.Cn.1	Count operating time using counter #4 ②

① When a setpoint is operated, its status is always stored to the alarm status register even if no action is assigned to the setpoint. The alarm status can be inspected and cleared from the front panel through the *Status Information Menu* (see Section 6.2) or via communications.

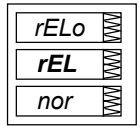
② This action converts a common event counter to the time counter which measures time at 0.1 hour resolution while the setpoint is in the operated state. Each time counter has a non-volatile shadow counter which counts time at 1 second resolution before the corresponding time counter is incremented. Time counters can be inspected via the Status Information Menu. They are labeled by an *hour* mark in the middle window.

4.5 Relay Operation Control Menu

SELECT ➔ *CHG* ➔ ENTER ↑ ↓ ➔ *rELo* ➔ ENTER

This menu allows you to set the relay operation mode: non-failsafe or failsafe. Failsafe relay operation is the opposite of normal operation where relay contacts are closed when a relay is operated (activated), and are open when a relay is released (de-activated). In failsafe mode, an alarm is activated by a non-energized relay which will open in all cases when an alarm condition is present or an alarm setpoint is not operational either due to a loss of control power or due to corruption of the setpoint setup configuration. A failsafe relay is closed only if it is under setpoint control and no alarm conditions exist, or if it is manually operated via communications.

To change the relay operation mode:



- ✓ Press SELECT to activate the lower window.
- ✓ Use the up/down arrow keys to set the desired option. Select ***nor*** for normal (non-failsafe) relay operation, or select ***FSAFE*** for failsafe relay operation.
- ✓ Press ENTER to store your new setting or press ESC to leave your previous setting unchanged.

To quit the setup menu:

✓ From the middle window, press ESC or ENTER .

NOTES

1. You will not be able to change the relay operation mode if a relay has been allocated for pulsing.
2. When a failsafe relay is allocated for pulsing, it automatically reverts to normal operation.

4.6 Display Setup Menu

SELECT → CHG → ENTER ↑ ↓ → diSP → ENTER

This menu allows you to view and change display properties. Table 4-7 lists available options with their code names and applicable ranges.

Table 4-7 Display Options (* default setting)

Display	Code	Parameter	Options	Description
diSP **UPdt** 0.5	UPdt	Update time	0.1 – 10.0 s (0.5)*	defines interval between display updates
diSP **ScrL** 5	ScrL	Auto scroll interval	nonE* 2-15 s	disables/enables auto scroll on common measurements display; defines auto scroll interval
diSP **rEtn** 5	rEtn	Auto return to the main screen	diS*, En	Disables/enables auto return to the main screen after 30 seconds of uninterrupted use
diSP **bAr** 5000	bAr	Nominal load current for LED bar graph	0-50000A (0*)	defines the nominal load (100%) level for the bar graph display (0 = CT primary current)
diSP **Ph.P** diS	Ph.P	Phase powers display mode P E	diS*, En	disables/enables display of phase powers in common measurements

P available in the *PM130P* E available in the *PM130E*

To select a display option:

✓ Press SELECT to activate the middle window, and then use the up/down arrow keys to scroll to the desired option.

To change the display option:

✓ Press SELECT to activate the lower window.
✓ Use the up/down arrow keys to set the desired option.
✓ Press ENTER to store your new setting or press ESC to leave your previous setting unchanged.

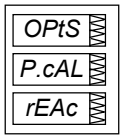
To quit the display setup menu:

✓ From the middle window, press ESC or ENTER.

4.7 User Selectable Options Menu

SELECT → CHG → ENTER ↑ ↓ → OPtS → ENTER

This menu allows you to change options which relate to the instrument features and functionality. Table 4-8 lists all available options with their code names and applicable ranges.



To select an option:

✓ Press SELECT to activate the middle window, and then use the up/down arrow keys to scroll to the desired option.

To change the selected option:

✓ Press SELECT to activate the lower window.
✓ Use the up/down arrow keys to set the desired value.
✓ Press ENTER to store your new setting or ESC to leave the previous setting unchanged.

To quit the display setup menu:

✓ From the middle window, press ESC or ENTER .

Table 4-8 User Selectable Options (∗ default setting)

Code	*Parameter*	*Options*	*Description*
P.cAL	Power calculation mode [P] [E]	*rEAc**	Using reactive power
		nAct	Using non-active power
roLL	Energy roll value [E]	*10.E4*	10,000
		10.E5	100,000
		10.E6	1,000,000
		10.E7	10,000,000
		*10.E8**	100,000,000
Ph.En	Phase energy measurements [E]	*diS*, En*	Enables/disables measurements of energies per phase

[P] available in the *PM130P*

[E] available in the *PM130E*

4.8 Access Control Menu

SELECT → *CHG* → ENTER ↑ ↓ → *AccS* → ENTER

This menu can be only accessed via the *Setup Change Menu (CHG)*. It is used in order to:

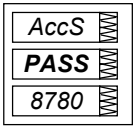
- change the user password
- enable or disable password check

To view an option setting:

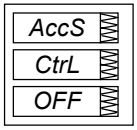
✓ Press SELECT to activate the middle window.

✓ Use the up/down arrow keys to scroll to the desired option (*PASS* or *CtrL*).

Password Setting



Password Protection Control



To change the password:

✓ Press SELECT to activate the lower window.

✓ Use the up/down arrow keys to modify the password. The password can be up to four digits long.

✓ Press ENTER to store your new password, or ESC to leave the password unchanged.

To enable/disable password checking:

✓ Press SELECT to activate the middle window, and then use the up/down arrow keys to move to the ***CtrL*** entry.

✓ Press SELECT to activate the lower window.

✓ Use the up/down arrow keys to change the password checking status: select ***OFF*** to disable password protection, or select ***On*** to enable password protection.

✓ Press SELECT to store your new option, or ESC to leave the option unchanged.

To quit the setup menu:

✓ From the middle window, press ESC or ENTER.

Store your password in a safe place. If you do not provide the correct password, you will need to contact your local distributor for the super-user password to override password protection.

4.9 Reset/Synchronization Menu

SELECT → CHG → ENTER ↑ ↓ → rSt → ENTER

This menu allows you to reset to zero the accumulators and Min/Max registers in your instrument, and also to synchronize the power demand interval in the *PM130E*. The menu can be only accessed via the *Setup Change Menu (CHG)*. If the reset is disabled from the *Basic Setup Menu* (see Section 4.1), you will not be able to enter this menu.

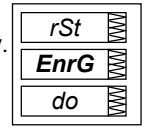
The menu uses the following labels:

[E] available in the *PM130E*

EnrG	Resets total accumulated energies	[E]
dnd	Resets all total maximum demands	[E]
P.dnd	Resets total power maximum demands	[E]
A.dnd	Resets volt/ampere maximum demands	
Cnt	Resets all event/time counters	
Cnt.1	Resets counter # 1	
Cnt.2	Resets counter # 2	
Cnt.3	Resets counter # 3	
Cnt.4	Resets counter # 4	
Lo.Hi	Resets Min/Max registers (does not affect maximum demands)	
d.Snc	Provides synchronization of the power demand interval (see **Notes** below)	[E]

To reset the desired locations:

- ✓ Press [SELECT] to activate the middle window; use the up/ down arrow keys to scroll to the desired data location entry.
- ✓ Press [SELECT] to activate the lower window.
- ✓ Press and hold [ENTER] for about 5 seconds until the ***do*** label is replaced with ***done***; release the key. You will return to the middle window.
- ✓ Press [ESC] to quit the menu.



NOTES:

If you select the *d.Snc* entry, take into consideration the following:

1) If the power demand period is specified in minutes (see Section 4.1, Basic Setup Options), this action provides synchronization of the instrument's internal timer. If the time expired from the beginning of the current demand interval is more than 30 seconds, the new demand interval starts immediately, otherwise synchronization is delayed until the next demand interval.
2) The synchronization is made exactly 5 seconds after you first press and hold [ENTER].

If the CHG is not secured by a password, fast reset of the Min/Max registers, maximum demands and energies can be done from the data display mode (see Section 5.1) and counters from the status information menu (see Section 6.1) without entering the reset menu.

Chapter 5 Data Display

5.1 Navigating in the Display Mode

The front panel has a simple interface that allows you to display numerous measurement parameters in up to 38 display pages. For easier reading, the parameters are divided into three groups, each accessible by a designated key. These are:

- **Common measurements** - no selection key
- **Min/Max measurements** - selected by the MAX/MIN key
- **Energy measurements** - selected by the ENERGY key

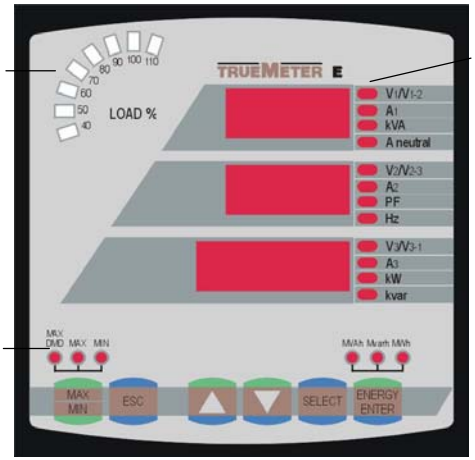
The up/down arrow keys are used as follows in the *Display Mode*:

↓ Scrolls through the pages downward (forward)

↑ Scrolls through the pages upward (backward)

↑ ↓ Returns to the first page within current measurement group

For each display page, up to three parameters can be displayed.



The **Load** bar graph displays the amount, in percent, of the current load with respect to user-defined nominal load current. The highest current measured by the PM130 is divided by the nominal load current as defined in the Display Setup Menu (see Section 4.6) and expressed as a percent by the LEDs (40% to 110%) which are lit. For example, if all LEDs up to and including 90% are lit, this means that the load is 90%-100% of the nominal load current. If the nominal load current is set to 0, the CT primary current setup is used.

In the *Display Mode*, the front panel display is updated approximately twice per second; you can adjust the display update rate via the *Display Setup Menu* (see Section 4.6).

Tables 5-1 and 5-2 list all displayed parameters and their LED indicators.

NOTES

1. The common measurements group does not have a designated indicator LED. If no indicator LED is lit up below the display, this means that the common measurement parameters are being displayed at this time. To return to the common measurements from another group, just press the same key that you used to display this group (the key pointed to by an illuminated LED).
2. When you move to another measurement group, the instrument stores your last location; when you return to the previous group, the instrument restores the last page. At power up, the instrument always returns to the common measurements group and shows you the last page that was displayed prior to loss of power.

Selecting a Display Page

✓ Press the up/down arrow keys to scroll through display pages.

Selecting Common Measurements

✓ Press the key pointed to by the illuminated round LED below the front panel display. If no LED is lit up, this means that the front panel displays the common measurements parameters.

When Display Auto Scroll is in effect (see Section 4.6), the display will scroll automatically within 30 seconds after any of the following:

- power up
- returning to the common measurements display
- pressing either arrow key

✓ Press either arrow key to pause scrolling at the current page.

Selecting Min/Max Measurements

✓ Press the **MAX/MIN** key. Use the up/down arrow keys to scroll through Min/Max measurements.

Selecting Energy Measurements

✓ Press the **ENERGY** key. Use the up/down arrow keys to scroll through the different energy readings.

Auto Return to the Main Screen

If display Auto Return option is enabled (see Section 4.6), the display will automatically return to the main screen from any other measurement screen after 30 seconds of uninterrupted use.

Fast Reset of Accumulated Data

When changing data via the front panel is not secured by a password, you can reset the Min/Max registers, maximum demands and energies from the display mode without entering the reset menu.

✓ Select the display page of the data you want to reset. To reset:

- Min/Max log registers: select a Min/Max page from the Min/Max measurements display (where a Max or Min round LED is illuminated).
- Ampere and volt maximum demands: select the ampere or volt maximum demand page from the Min/Max measurements display (where a MAX DMD LED is illuminated, and volts or amps LEDs at the right are lit).
- Power maximum demands: select the power maximum demand page from the Min/Max measurements display (where a MAX DMD LED is illuminated, and kVA/MVA and kW/MW LEDs at the right are lit).
- Total and phase energies: select the energy measurements display.

✓ While holding the SELECT key, press and hold ENTER for about 5 seconds. The displayed data is reset to zero.

5.2 Data Display Formats

The display windows are labeled in the table as follows: 1 = upper window, 2 = middle window, 3 = lower window.

Table 5-1 Displayed Parameters for the *PM130*

Page	*Window*	*Indicator LED*	*Parameter* ①	*Digits*	*Unit* ②
			Common Measurements		
1	1	**V1/V1-2**	Voltage L12	4	V/kV
1	2	**V2/V2-3**	Voltage L23	4	V/kV
1	3	**V3/V3-1**	**L.** Voltage L31	4	V/kV
2	1	**V1/V1-2**	Voltage L1 ④	4	V/kV
2	2	**V2/V2-3**	Voltage L2 ④	4	V/kV
2	3	**V3/V3-1**	**P.** Voltage L3 ④	4	V/kV
3	1	**A1**	Current L1	4	A/kA
3	2	**A2**	Current L2	4	A/kA
3	3	**A3**	Current L3	4	A/kA
4	1	**A Neut**	Neutral current	4	A/kA
4	2	**Hz**	Frequency	4	Hz
4	3	**Phase Rot.**	Phase rotation sequence (POS/NEG/ERR)	4	

Page	*Window*	*Indicator LED*	*Parameter ①*	*Digits*	*Unit ②*
			Min/Max Measurements		
		MIN			
1	1	**V1/V1-2**	Min. real-time voltage L1/L12 ③	4	V/kV
1	2	**V2/V2-3**	Min. real-time voltage L2/L23 ③	4	V/kV
1	3	**V3/V3-1**	Min. real-time voltage L3/L31 ③	4	V/kV
		MAX			
2	1	**V1/V1-2**	Max. real-time voltage L1/L12 ③	4	V/kV
2	2	**V2/V2-3**	Max. real-time voltage L2/L23 ③	4	V/kV
2	3	**V3/V3-1**	Max. real-time voltage L3/L31 ③	4	V/kV
		MAX DMD			
3	1	**A1**	Max. ampere demand L1	4	A/kA
3	2	**A2**	Max. ampere demand L2	4	A/kA
3	3	**A3**	Max. ampere demand L3	4	A/kA

① Displayed readings for all electrical quantities except Min/Max log are sliding average values.

② Voltage and current readings with a decimal point are displayed in kV and kA. When the value width exceeds the window resolution, the right-most digits are truncated.

③ When the 4LN3 or 3LN3 wiring mode is selected, the voltages will be line-to-neutral; for any other wiring mode, they will be line-to-line voltages.

④ Displayed only in the 4LN3 or 3LN3 wiring mode.

⑤ ' L' and ' P' indicators appear only in the case of 4LN3 or 3LN3 wiring modes where both line-to-line and line-to-neutral voltages are present.

Table 5-2 Displayed Parameters for the *PM130P/PM130E*

Page	*Window*	*Indicator LED*	*Parameter* ①	*Digits*	*Unit* ②
			Common Measurements		
1	1	**V1/V1-2**	Voltage L12	4	V/kV
1	2	**V2/V2-3**	Voltage L23	4	V/kV
1	3	**V3/V3-1**	**L.** Voltage L31	4	V/kV
2	1	**V1/V1-2**	Voltage L1 ⑦	4	V/kV
2	2	**V2/V2-3**	Voltage L2 ⑦	4	V/kV
2	3	**V3/V3-1**	**P.** Voltage L3 ⑦	4	V/kV
3	1	**A1**	Current L1	4	A/kA
3	2	**A2**	Current L2	4	A/kA
3	3	**A3**	Current L3	4	A/kA
4	1	**kVA**	Total kVA	4	kVA/MVA
4	2	**PF**	Total power factor	4	
4	3	**kW**	Total kW	4	kW/MW
5	1	**A NEUT**	Neutral current	4	A/kA
5	2	**Hz**	Frequency	4	Hz
5	3	**kvar**	Total kvar	4	kvar/Mvar
6	1		**Ph.L1** ④		Label
6	2	**PF**	Power factor L1	4	
6	3	**kW**	kW L1	4	kW/MW
7	1	**kVA**	kVA L1	4	kVA/MVA
7	2		**Ph.L1** ④		Label
7	3	**kvar**	kvar L1	4	kvar/Mvar
8	1		**Ph.L2** ④		Label
8	2	**PF**	Power factor L2	4	
8	3	**kW**	kW L2	4	kW/MW
9	1	**kVA**	kVA L2	4	kVA/MVA
9	2		**Ph.L2** ④		Label
9	3	**kvar**	kvar L2	4	kvar/Mvar
10	1		**Ph.L3** ④		Label
10	2	**PF**	Power factor L3	4	
10	3	**kW**	kW L3	4	kW/MW
11	1	**kVA**	kVA L3	4	kVA/MVA
11	2		**Ph.L3** ④		Label
11	3	**kvar**	kvar L3	4	kvar/Mvar
12	1		**U.Unb**		Label
12	3		Voltage unbalance	4	%
13	1		**C.Unb**		Label
13	3		Current unbalance	4	%

Page	*Window*	*Indicator LED*	*Parameter ⓵*	*Digits*	*Unit ⓶*
			Min/Max Measurements		
		MIN			
1	1	**V1/V1-2**	Min. real-time voltage L1/L12 ⑥	4	V/kV
1	2	**V2/V2-3**	Min. real-time voltage L2/L23 ⑥	4	V/kV
1	3	**V3/V3-1**	Min. real-time voltage L3/L31 ⑥	4	V/kV
2	1	**A1**	Min. real-time current L1	4	A/kA
2	2	**A2**	Min. real-time current L2	4	A/kA
2	3	**A3**	Min. real-time current L3	4	A/kA
3	1	**kVA**	Min. real-time total kVA	4	kVA/MVA
3	2	**PF**	Min. real-time total power factor	4	
3	3	**kW**	Min. real-time total kW	4	kW/MW
4	1	**A NEUT**	Min. real-time neutral current	4	A/kA
4	2	**Hz**	Min. real-time frequency	4	Hz
4	3	**kvar**	Min. real-time total kvar	4	kvar/Mvar
		MAX			
5	1	**V1/V1-2**	Max. real-time voltage L1/L12 ⑥	4	V/kV
5	2	**V2/V2-3**	Max. real-time voltage L2/L23 ⑥	4	V/kV
5	3	**V3/V3-1**	Max. real-time voltage L3/L31 ⑥	4	V/kV
6	1	**A1**	Max. real-time current L1	4	A/kA
6	2	**A2**	Max. real-time current L2	4	A/kA
6	3	**A3**	Max. real-time current L3	4	A/kA
7	1	**kVA**	Max. real-time total kVA	4	kVA/MVA
7	2	**PF**	Max. real-time total power factor	4	
7	3	**kW**	Max. real-time total kW	4	kW/MW
8	1	**A NEUT**	Max. real-time neutral current	4	A/kA
8	2	**Hz**	Max. real-time frequency	4	Hz
8	3	**kvar**	Max. real-time total kvar	4	kvar/Mvar
		MAX DMD			
9	1	**V1**	Max. volt demand L1/L12⑥	4	V/kV
9	2	**V2**	Max. volt demand L2/L23⑥	4	V/kV
9	3	**V3**	Max. volt demand L3/L31⑥	4	V/kV

Page	*Window*	*Indicator LED*	*Parameter* ①	*Digits*	*Unit* ②
10	1	**A1**	Max. ampere demand L1	4	A/kA
10	2	**A2**	Max. ampere demand L2	4	A/kA
10	3	**A3**	Max. ampere demand L3	4	A/kA
11	1	**kVA**	Max. sliding window kVA demand E	4	kVA/MVA
11	2	**PF**	Power factor at max. kVA demand	4	
11	3	**kW**	Max. sliding window kW demand E	4	kW/MW
			Total Energies ③ E		
1	1	**MWh**	**Ac.En.**		Label
1	2		**IP.**		Label
1	3		MWh import	5	MWh
2	1	**Mvarh**	**rE.En.**		Label
2	2		**IP.**		Label
2	3		Mvarh import	5	Mvarh
3	1	**MVAh**	**AP.En.**		Label
3	3		MVAh	5	MVAh
4	1	**MWh**	**Ac.En.**		Label
4	2		**EP.**		Label
4	3		MWh export	5	MWh
5	1	**Mvarh**	**rE.En.**		Label
5	2		**EP.**		Label
5	3		Mvarh export	5	Mvarh
			Phase Energies ⑤ E		
6	1	**MWh**	**Ac.En.**		Label
6	2		**IP.L1**		Label
6	3		MWh import L1	5	MWh
7	1	**Mvarh**	**rE.En.**		Label
7	2		**IP.L1**		Label
7	3		Mvarh import L1	5	Mvarh
8	1	**MVAh**	**AP.En.**		Label
8	2		**L1**		Label
8	3		MVAh L1	5	MVAh
9	1	**MWh**	**Ac.En.**		Label
9	2		**IP.L2**		Label
9	3		MWh import L2	5	MWh
10	1	**Mvarh**	**rE.En.**		Label
10	2		**IP.L2**		Label
10	3		Mvarh import L2	5	Mvarh

Page	Window	Indicator LED	Parameter ①	Digits	Unit ②
11	1	**MVAh**	**AP.En.**		Label
11	2		**L2**		Label
11	3		MVAh L2	5	MVAh
12	1	**MWh**	**Ac.En.**		Label
12	2		**IP.L3**		Label
12	3		MWh import L3	5	MWh
13	1	**Mvarh**	**rE.En.**		Label
13	2		**IP.L3**		Label
13	3		Mvarh import L3	5	Mvarh
14	1	**MVAh**	**AP.En.**		Label
14	2		**L3**		Label
14	3		MVAh L3	5	MVAh

[E] available in the *PM130E*

① Display readings for all electrical quantities except Min/Max log and energies are sliding average values.

② Voltage and current readings with a decimal point are displayed in kV and kA. Power readings with a decimal point are displayed in MW, Mvar, and MVA. When the value width is over the window resolution, the right most digits are truncated.

③ By default, the maximum range for energy readings is 99,999,999 MWh/Mvarh/MVAh. Beyond this value, the reading will roll over to zero. When the energy reading exceeds the window resolution, the right-most digits are truncated. To avoid truncation, you can change the energy roll value to lower limit via the *User Selectable Options* menu (see Section 4.7). Negative (exported) energy readings are displayed without a sign.

④ Per phase power and power factor readings are displayed only in 4LN3/4LL3 and 3LN3/3LL3 wiring modes (see Section 4.1) if the phase powers display is enabled in the *Display Setup* menu (see Section 4.6).

⑤ Phase energy readings are displayed only in 4LN3/4LL3 and 3LN3/3LL3 wiring modes if they are enabled in the *User Selectable Options* menu (see Section 4.7).

⑥ When the 4LN3 or 3LN3 wiring mode is selected, the voltages will be line-to-neutral; for any other wiring mode, they will be line-to-line voltages.

⑦ Displayed only in the 4LN3 or 3LN3 wiring mode.

5.3 Self-Test Diagnostics Display

The *PM130* periodically performs self-test diagnostics during operation. If the instrument fails the test, it discards the last measurement results, and an error code is displayed for one second on all LEDs. Error codes are listed in Table 5-3. Code '8' indicates normal operation.

Frequent failures may be the result of excessive electrical noise in the region of the instrument. If the instrument continuously resets itself, contact your local distributor.

Table 5-3 Self-Test Diagnostic Codes

Code	*Meaning*
1	ROM error
2	RAM error
3	Watch dog timer reset
4	Sampling failure
5	Out of control trap
7	Timing failure
8	Normal power up
9	External reset (warm restart)

NOTE

The *PM130* provides a self-check alarm register accessible through communications that indicates possible problems with instrument hardware or setup configuration. The hardware problems are indicated by the appropriate bits which are set whenever the instrument fails self-test diagnostics or in the event of loss of power. The setup problems are indicated by the dedicated bit which is set when either configuration register is corrupted. In this event, your instrument will use the default configuration. For more information on the self-check alarm register, refer to the communications reference guides provided with your instrument.

Chapter 6 Viewing Status Information

Through the *Status Information Menu (STA)*, it is possible to view the status of various instrument features.

6.1 The Status Information Menu

SELECT ➔ *StA* ➔ ENTER

***To enter the Status Information Menu*:**

- ✓ From the display mode, press SELECT to enter the *Primary Selection Menu*.
- ✓ Press SELECT to activate the ***StA*** window.
- ✓ Press ENTER .

To select a display page:

- ✓ Press the up/down arrow keys to scroll through the display pages.

To quit the menu and return to the display mode:

- ✓ Press ESC or ENTER .

Front Panel Display

When you are in the *Status Information Menu*, the front panel display is updated approximately four times per second and shows you a wide variety of status information that you can review by scrolling through display pages.

The status parameters are designated by the abbreviated labels in the upper and/or middle window. The upper window flashes, indicating that you are in the menu display.

Viewing and Clearing Alarms

Whenever a setpoint signals an alarm, it is latched to non-volatile memory and remains when the alarm condition disappears. Alarms which have occurred can be inspected and cleared all together through the *Status Information Menu*. When a number of alarms are present, use the up and down keys to scroll through all alarms.

To clear alarms:

- ✓ From the *Status Information Menu, s*elect either display page where an alarm is displayed.

✓ While holding the SELECT key, press and hold ENTER for about 5 seconds until the alarm trigger code displayed in the lower window changes to "none".

Fast Reset of Counters

When changing data via the front panel is not secured by a password, you can reset the counters from the *Status Information Menu* display without entering the reset menu:

✓ Select the page where the counter you want to reset is displayed.
✓ While holding the SELECT key, press and hold ENTER for about 5 seconds. The displayed data is reset to zero.

6.2 Status Display Formats

Table 6-1 lists all the displays available from the *Status Information Menu*. The display windows are labeled in the table as follows: 1 = upper window, 2 = middle window, 3 = lower window.

[P] available in the *PM130P*
[E] available in the *PM130E*

Table 6-1 Status Information

Page	*Window*	*Parameter*	*Digits*	*Unit*
1	1	**PHAS** [P] [E]		Label
1	2	**rOt**		Label
1	3	Phase rotation sequence (POS/NEG/ERR)	4	
2	1	**rEL**		Label
2	3	Relay status	1	
3	1	**Cnt.1**		Label
3	3	Counter #1	5	
4	1	**Cnt.2**		Label
4	3	Counter #2	5	
5	1	**Cnt.3**		Label
5	3	Counter #3	5	
6	1	**Cnt.4**		Label
6	3	Counter #4	5	
7	1	**Port**		Label
7	2	**rd.** Receiver status (flashing **r** while receiving data)	1	
7	3	**td.** Transmitter status (flashing **t** while transmitting data)	1	
8	1	**Alar**		Label
8	2	**SP.** Alarm setpoint number	4	
8	3	Alarm trigger code (see Table 4-5)	5	

Appendix: Technical Specifications

Input and Output Ratings

3 voltage inputs	*690 V: (standard)*	DIRECT INPUT - Nominal: 690V line-to-line voltage, 790V maximum; 400V line-to-neutral, 460V maximum - Burden: <0.5 VA INPUT USING PT - Burden: <0.15 VA
	120 V: (optional)	INPUT USING PT - Nominal: 120V line-to-line voltage, 144V maximum - Burden: <0.1 VA
3 current inputs *(galvanically isolated)*	*5A: (standard)*	INPUT VIA CT with 5A secondary output Burden: 2.5 to 4 mm^2 (13-11 AWG) wire from CT Overload withstand: 15A RMS continuous, 250A RMS for 1 second
	1A: (optional)	INPUT VIA CT with 1A secondary output Burden: 2.5 to 4 mm^2 (13-11 AWG) wire from CT Overload withstand: 3A RMS continuous, 50A RMS for 1 second
Voltage input terminals		UL recognized E129258 Maximum wire section: 4 mm^2 (10 AWG)
Optically isolated communication port		EIA RS-485 standard Maximum wire section: 2.5 mm^2 (12 AWG)
Relay output		Relay rated at 3A, 250 V AC / 3A, 30 V DC / 0.5A, 110 V DC Maximum wire section: 1.5 mm^2 (14 AWG) 2 contacts (SPST Form A)

Display	3 windows high-brightness 7-segment digit LEDs 3 color LED bar graph 40-110%

Power Supply

Galvanically isolated power supply (factory set) 120 or 230 V AC	Maximum wire section: 1.5 mm^2 (14 AWG) 88-138V AC or 176-265V AC; 50/60 Hz; Burden: 5 VA

Environmental Conditions

Operating temperature	-20°C to +60°C (-4°F to +140°F)
Storage temperature	-25°C to +80°C (-13°F to +176°F)
Humidity	0 to 95% non-condensing

Construction

Instrument body	Case enclosure: flame resistant ABS & Polycarbonate blend Dimensions: 114.3 x 114.3 x 109 mm (4.5 x 4.5 x 4.29 “) Mounting: 4-inch round or 92x92mm square cut-out
Instrument weight	0.70 kg (1.54 lb.)

Standards Compliance

UL File # E129258

CE-EMC: 89/336/EEC as amended by 92/31/EEC and 93/68/EEC
CE-LVD: 72/23/EEC as amended by 93/68/EEC and 93/465/EEC
Harmonized standards to which conformity is declared:
EN55011:1991; EN50082-1:1992; EN61010-1:1993; A2/1995

EN50081-2:1994 EMC Generic Emission Standard - Industrial Environment
EN50082-2:1995 EMC Generic Immunity Standard - Industrial Environment
EN55022: 1994 Class A
EN61000-4-2: 1995 Electrostatic Discharge
EN61000-4-4: 1995 Electrical Fast Transient
EN61000-4-8: 1993 Power Frequency Magnetic Field
ENV50140: 1993 Radio Frequency Electromagnetic Field, Amplitude Modulated
ENV50204: 1995 (200Hz) Radio Frequency Electromagnetic Field, Pulse Modulated
ENV50141: 1993 Radio Frequency Common Mode, Amplitude Modulated

ANSI C37.90.1: 1989 Surge Withstand Capability
ANSI C62.41 - 1991 Standard Surge

Measurement Specifications

Parameter	Full scale		Accuracy, % Rdg	Accuracy, % FS	Accuracy, % Conditions	Range	Display resolution (%Rdg) ② @ range
Voltage	120V×PT @ 120V **or** 400V×PT @ 690V	For **Ln** reading and for 3OP2/3OP3 wiring modes		0.3	10% to 120% FS	0 to 999,000 V	1 V @ 1V to 9,999 V ≤0.1% @ 10,000 V to 999,000 V Starting voltage 1.5% FS
	208V×PT @ 120V **or** 690V×PT @ 690V	For **LL** reading except 3OP2/3OP3 wiring modes					
Line current	CT PRIMARY CURRENT			0.3	2% to 150% FS	0 to 60,000 A	1 A @ 1A to 9,999 A ≤0.1% @ 10,000 A to 60,000 A Starting current 0.75% FS
Active power	0.36×PT×CT @ 120V input 1.2×PT×CT @ 690V input			0.5	|PF| ≥ 0.5 ①	-2,000,000 to +2,000,000 kW	1 kW @ 1kW to 9,999 kW ≤0.1% @ 10 MW to 2,000 MW
Reactive power	0. 36×PT×CT @ 120V input 1.2×PT×CT @ 690V input			0.5	|PF| ≤ 0.9 ①	-2,000,000 to +2,000,000 kvar	1 kvar @ 1kvar to 9,999 kvar ≤0.1% @ 10 Mvar to 2,000 Mvar
Apparent power	0. 36×PT×CT @ 120V input 1.2×PT×CT @ 690V input			0.5	|PF| ≥ 0.5 ①	0 to 2,000,000 kVA	1 kVA @ 1kVA to 9,999 kVA ≤0.1% @ 10 MVA to 2,000 MVA
Power factor	1			1	|PF| ≥ 0.5, U ≥ 10% FSU I ≥ 10% FSI	-0.999 to +1.000	0.001
Frequency			0.1			45.00 to 65.00 Hz	0.01 Hz

Parameter	Full scale	Accuracy, %			Range	Display resolution (%Rdg) ②
		Rdg	FS	Conditions		@ range
Neutral (unbalanced) current	CT PRIMARY CURRENT		0.6	2% to 150% FS	0 to 60,000 A	1 A @ 1A to 9,999 A ≤0.1% @ 10,000 A to 60,000 A
Ampere demand	*same as for current*					
kW demand (block & sliding)	*same as for kW*					
kVA demand (block & sliding)	*same as for kVA*					
Active energy Import & Export		*according to power accuracy* ③			0 to 99,999 MWh	1 kWh @ 1 to 99,999 kWh 10 kWh @ 100.00 to 999.99 MWh 100 kWh @ 1000.0 to 9999.9 MWh 1MWh @ 10.0 to 99.99 GWh
Reactive energy Import & Export		*according to power accuracy* ③			0 to 99,999 Mvarh	1 kvarh @ 1 to 99,999 kvarh 10 kvarh @ 100.00 to 999.99 Mvarh 100 kvarh @ 1000.0 to 9999.9 Mvarh 1Mvarh @ 10.000 to 99.999 Gvarh
Apparent energy		*according to power accuracy* ③			0 to 99,999 MVAh	1 kVAh @ 1 to 99,999 kVAh 10 kVAh @ 100.00 to 999.99 MVAh 100 kVAh @ 1000.0 to 9999.9 MVAh 1MVAh @ 10.000 to 99.999 GVAh

Key:

PT = external potential transformer ratio
CT, CT Primary Current = primary current rating of external current transformer
FSU = voltage full scale
FSI = current full scale

① @ 10% to 120% of voltage FS and 2% to 150% of current FS
② Higher resolution is achievable via communications
③ Where the current is > 10% FS, the energy accuracy is better than 1.5% Rdg.

Additional Notes

1. Accuracy is expressed as ± (percentage of reading + percentage of full scale) ± 1 digit. This does not include inaccuracies introduced by the user's potential and current transformers.
2. Specifications assume a reference temperature of 20 - 26 °C.
3. Specifications for kvar, kVA and PF assume voltage and current waveforms with THD ≤ 5%
4. Ordinary measurement error is considerably less than the specified accuracy which indicates maximum error.

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