PMC-592

Multi Circuit Power Monitor

User Manual

Version: V1.0

12/07/2014

Ceiec Electric Technology

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 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

- 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.

Table of Contents

Glossary

ATS	= Automatic Transfer Switch
CET	= Ceiec Electric Technology
DI	= Digital Input
DMD	= Present Demand
DO	= Digital Output
FIFO	= First In First Out
Fund.	= Fundamental
GB	= Giga Byte
HMI	= Human Machine Interface
Hn	= nth order Harmonic, integer multiple (n) of the Fundamental Frequency (50Hz or 60Hz)
IHn	= nth order Interharmonic represents all components between the (n-1)th and nth harmonic orders in RMS
HDn	= nth order Harmonic Distortion
IHDn	= nth order Interharmonic Distortion
IER	= Interval Energy Recorder
I4	= Zero Sequence Current
LED	= Light Emitting Diode
MB	= Mega Byte
MCPM	= Multi Circuit Power Monitor
MMR	= Max./Min. Recorder
MXR	= Max. Recorder
PQ	= Power Quality
RTC	= Real Time Clock
RTD	= Resistance Temperature Detector
SCCT	= Split-core CT
SM	= Sub Meter
SNMP	= Simple Network Management Protocol
SOE	= Sequence Of Events
STS	= Static Transfer Switch
TH	= Total Harmonic in RMS, excluding Fundamental
THD	= Total Harmonic Distortion
TOHD	= Total Odd Harmonic Distortion
TEHD	= Total Even Harmonic Distortion
VM	= Virtual Meter
WF	= Waveform
WFR	= Waveform Recorder
Udin	= Declared input voltage - Value obtained from the declared supply voltage by a transducer ratio
Usr	= Sliding Reference Voltage

Chapter 1 Introduction

This manual explains how to use the PMC-592 MCPM Multi-Circuit Power Monitor.

This chapter provides an overview of the PMC-592 and summarizes many of its key features.

1.1 Overview

The PMC-592 MCPM represents the latest offer from CET for monitoring PDUs in Data Center applications as well as other applications which require multi circuit monitoring. Housed in a compact metal enclosure, the PMC-592 features quality construction with multifunction and high-accuracy measurements, two Mains Inputs (each with 3 Voltage and 4 Current Inputs), up to 84 Branch Circuit Inputs and an optional touch-screen HMI. The PMC-592 comes standard with two Digital Inputs for status monitoring, two Relay Outputs for control or alarming as well as two RTD Inputs for temperature measurements. The standard SOE Log records all Setup changes, Setpoint alarms and DI/DO operations in 1ms resolution. With Ethernet and dual RS-485 as standard feature supporting Modbus RTU/TCP as well as SNMP, the PMC-592 becomes a vital component of an intelligent, multifunction monitoring solution for Data Center and Utility applications.

Typical Applications

- Power/Energy Monitoring for Data Centers' PDUs
- Utility Substation Multi-Circuit Monitoring
- Extensive logging capability with on-board memory
- Power Quality Monitoring and Waveform Recording
- Maximum Demand Indicator

The above are just a few of the many applications. Contact CET Technical Support should you require further assistance with your application.

1.2 Features

Ease of Use

- Status LEDs - Run, Fault and Comm. Activities
- Self-Diagnostic function
- Password-protected setup via built-in Web Interface, optional HMI Display or PecStar software
- Surface Mount

Dual Mains Inputs

- 3-Ø Voltage Inputs for 120VLN/208VLL, 220VLN/380VLL, 230VLN/400VLL, 240VLN/415VLL and 277VLN/480VLL systems
- 4-Ø Current Inputs for 5A or 1A CT, Starting current at 0.3% In

Branch CT Inputs

- Support Fixed-Core and Split-Core CTs
- 3/4" or 1" spacing center-on-center for Fixed-Core CT strip
- 100A Continuous Loading
- Starting Current at 100mA
- 500A Overload for 1 second

Flexible Configuration

- Programmable CT Polarity, CT Reference Voltage, CT Installation Mode (Sequential or Cross-over) and CT Installation Direction (Top or Bottom Feed)
- Programmable label for each Branch Current Input

Metering

- Mains Measurements
  - 2 Mains, each supporting 3 Voltage and 4 Current Inputs
  - VLN and VLL per phase and average
  - I per phase and average, Neutral Current measured
  - kW, kvar, kVA, PF per phase and total
  - Frequency
  - Loading Factor per phase
  - kWh Import/Export, kvarh Import/Export, kVAh Total
- Branch Circuits Measurements
  - 21, 42, 63 or 84 Branch Current Inputs
  - I, kW, kvar, kVA, PF, Loading Factor, kWh, kvarh, kVAh per branch

Demand Measurements

- I per phase, kW Total, kvar Total, kVA Total for Mains-I and Mains-II
- I, kW, kvar, kVA per branch
- Max Demands with timestamp for This Month, Last Month and Historical

Sub Meters (SM)

- Support 1-Ø, 2-Ø and 3-Ø Sub Meters without configuration

Virtual Meters (VM)

- Up to 10 Virtual Meters for arbitrary aggregation of kW, kWh, kvarh and kVAh from 1-Ø SMs

Power Quality Features

- Mains
  - V and I Unbalance based on Sequence Components
  - THD, TEHD, TOHD and Individual harmonic to 31st, K Factor for Current
- Branch
  - I THD for each branch

Logs

Interval Energy Recorder (IER) Log

- kWh Imp/Exp, kvarh Imp/Exp and kVAh for Mains Meters
- kWh, kvarh, kVAh per SM (1- Ø, 2-Ø and 3-Ø) and VM
- Configurable Recording Interval, Recording Depth and Start Time.
- Circular and Stop-When-Full mode

Max/Min Log

- Logging of Max/Min values for real-time measurements such as V, I, kW, kvar, kVA, PF, Frequency, Unbalance, THD for Mains and Branch for This Month, Last Month and Historical

SOE Log

- 1000 FIFO events time-stamped to ±1ms resolution
- Setup changes, Alarms, Setpoint events and I/O operations

Waveform Recorder (WFR) Log

- Samples/Cycles x # of Cycles: 16x600, 16x300, 32x300, 32x150, 64x150 or 64x75
- Simultaneous capture of Mains 3-Ø Voltage, 3-Ø Current and Neutral Current
- COMTRADE file format

Alarming

- Support High-High, High, Low, Low-Low and OFF Alarms
- Configurable Threshold and Time Delay for each branch
- Support Global, Mains-I and Mains-II Alarms
- Support Current, Voltage, Power, PF, Frequency, Unbalance, Harmonic Distortion, Temperature and DI status change Alarms and their respective Alarm Counters
- All alarms are recorded in the SOE Log

Digital Inputs and Digital Outputs

- 2 DI channels, volts free dry contact, 24VDC internally wetted for status monitoring with programmable debounce
- 2 DO channels for control and alarming

Communications

P1 - RS-485/422, P2 - RS-485

- Modbus RTU
- Optically isolated
- 1200 to 38,400 bps

P3 - Ethernet Ports

- 10/100BaseT
- Modbus TCP, Modbus RTU, HTTP, SMTP, SNTP and SNMP
- Firmware upgrade via Ethernet port

Time Synchronization

- Battery-backed real-time clock @ 6ppm (≤ 0.5s/day)
- Time Synchronization via SNTP protocol

System Integration

PecStar iEMS

The PMC-592 is supported by CET's PecStar iEMS. In addition, it can be easily integrated into other 3rd party systems because of its support of multiple communications ports as well as different industry standard protocols.

3rd Party System Integration

- Easy integration into Automation, Energy Management or SCADA systems via Modbus RTU, Modbus TCP or SNMP
- The on-board Web Server allows complete access to its data and supports the configuration for most of the setup parameters via a web browser without the use of any proprietary software

1.3 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-592 should only be performed by qualified, competent personnel that have the appropriate training and experience with high voltage and current devices. The device must be installed in accordance with all local and national electrical codes.

During the operation of the device, 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

2.1.1 Main Unit

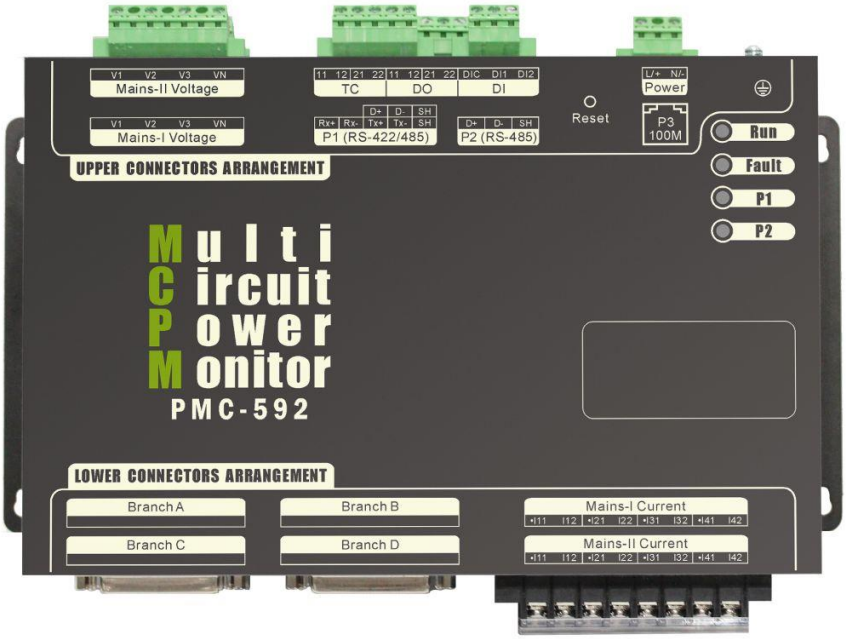


Figure 2-1 Main Unit

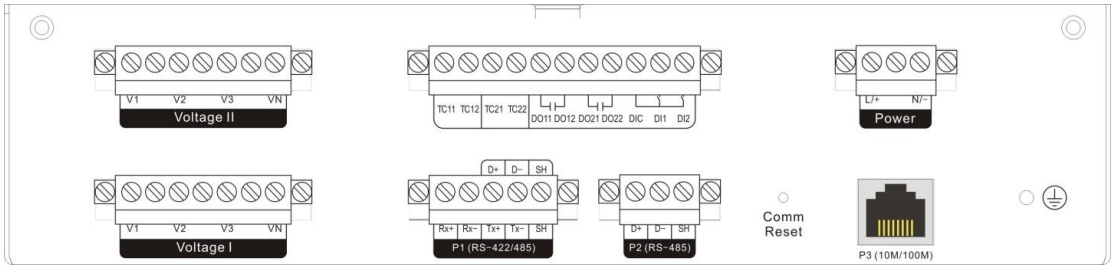


Figure 2-2 Main Unit Terminal Diagram - Top

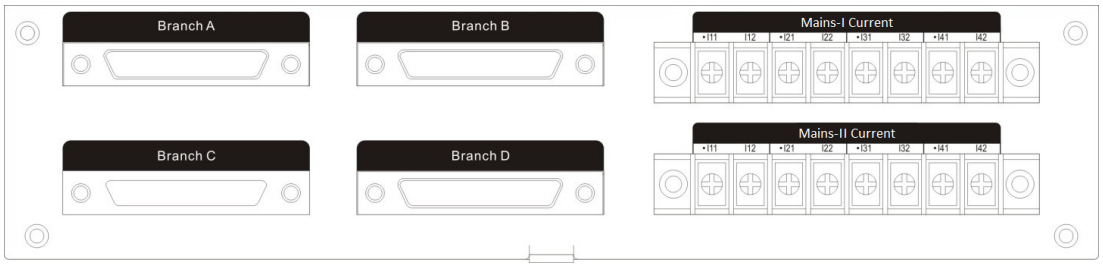


Figure 2-3 Main Unit Terminal Diagram - Bottom

2.1.2 HMI Display (Optional)

Figure 2-4 HMI Appearance

2.1.3 Accessories

CT Strips

Branch SCCT Adapter Board

Figure 2-5 CT Strips and Branch SCCT Adapter Board

Mains SCCT

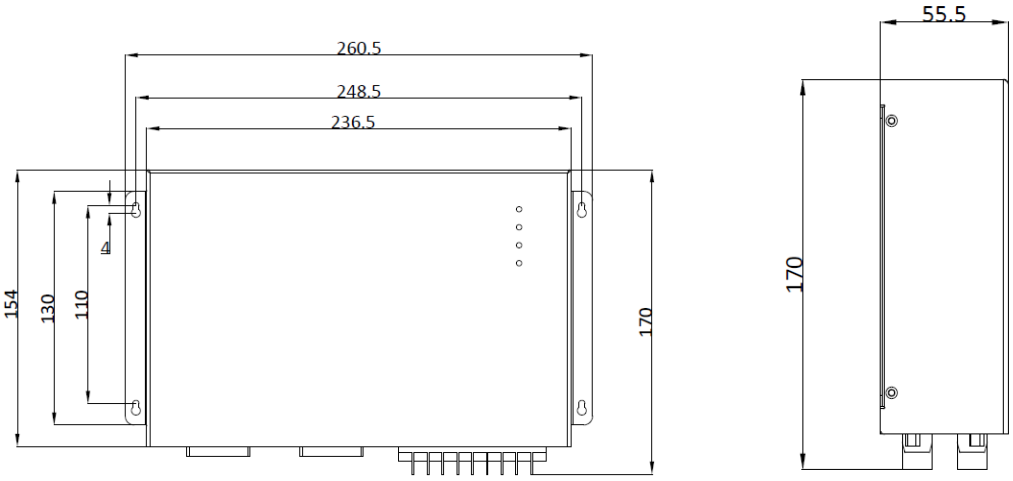
Branch SCCT

Branch Cable

Figure 2-6 Mains SCCT, Branch SCCT and Branch Cable

2.2 Dimensions

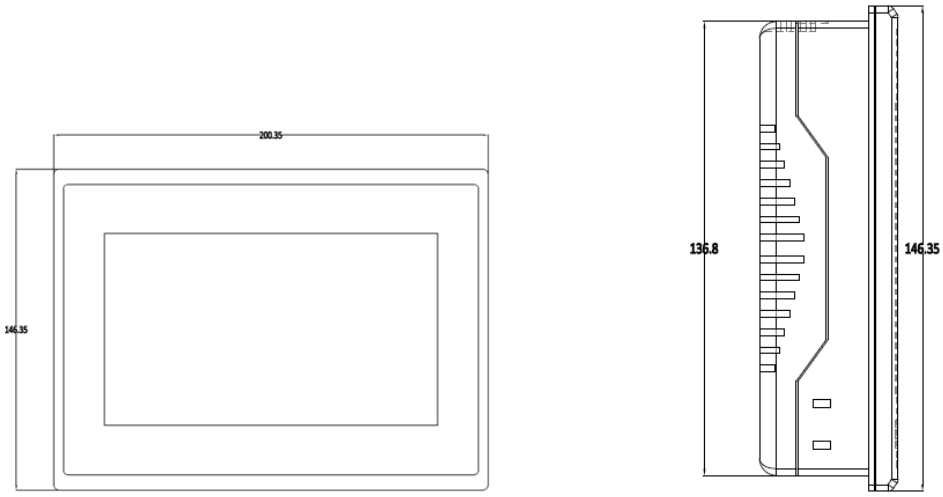
2.2.1 Main Unit



Front View Side View

Figure 2-7 Main Unit Dimensions

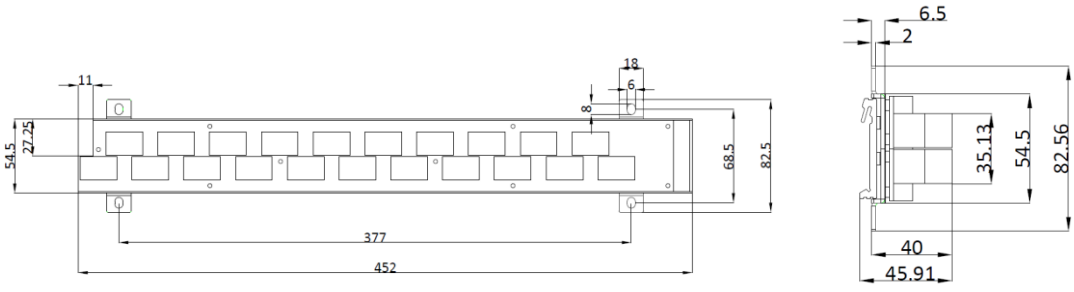
2.2.2 HMI (Optional)



Front View Side View

Figure 2-8 HMI Dimensions

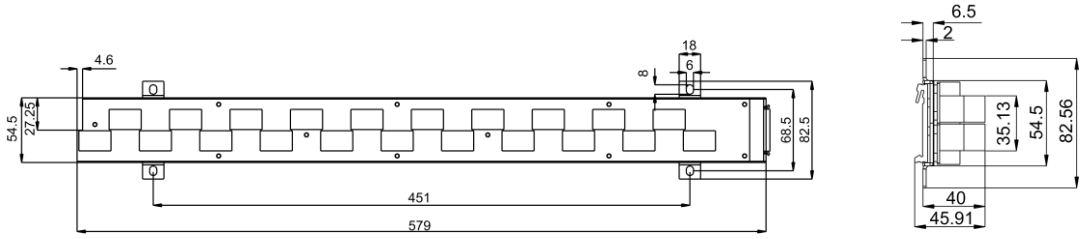
2.2.3 ¾" CT Strip



Top View Side View

Figure 2-9 ¾" CT Strip Dimensions

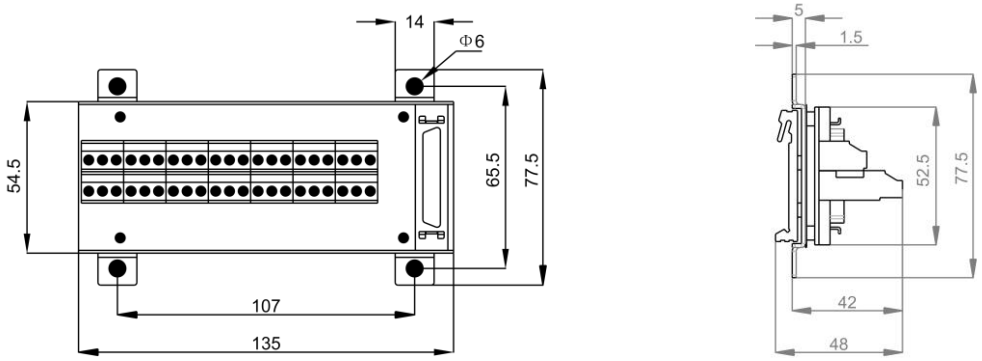
2.2.4 1" CT Strip



Top View Side View

Figure 2-10 1" CT Strip Dimensions

2.2.5 SCCT Adapter Board



Top View Side View

Figure 2-11 Branch SCCT Adapter Board Dimensions

2.2.6 Mains SCCT

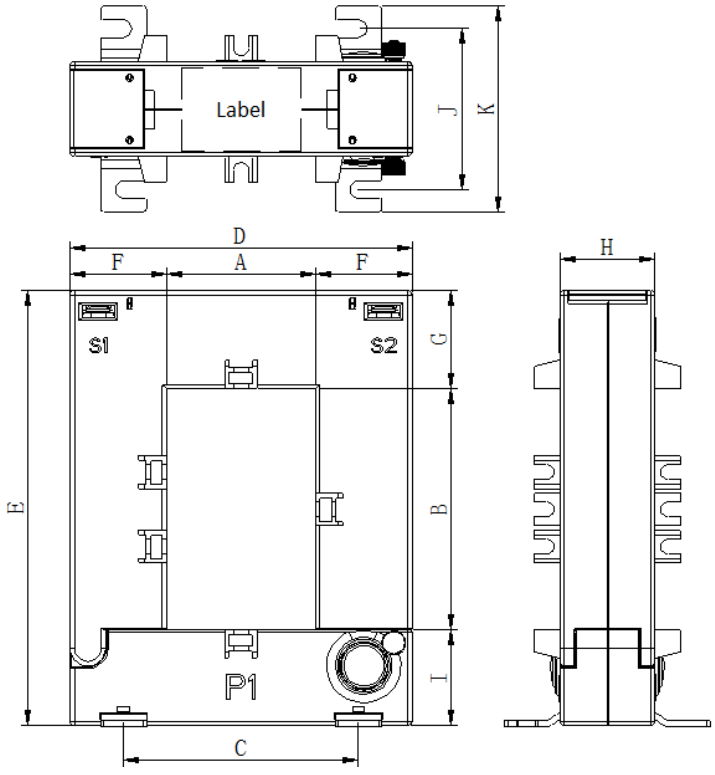


Figure 2-12 Mains SCCT Dimensions

There are four Mains SCCT models: PMC-SCCT-400A-1A-A, PMC-SCCT-600A-1A-A, PMC-SCCT-800A-1A-A and PMC-SCCT-1000A-1A-A. The dimensions are described below.

Mode	A	B	C	D	E	F	G	H	I	J	K
PMC-SCCT-400A-1A-A	20	30	50	89	110	34	47	40	32	52.5	67.5
PMC-SCCT-600A-1A-A	50	80	78	114	145	32	32	32	33	52.5	67.5
PMC-SCCT-800A-1A-A	80	80	108	144	145	32	32	32	33	52.5	67.5
PMC-SCCT-1000A-1A-A	80	120	108	144	185	32	32	32	33	52.5	67.5

Unit: mm

Table 2-1 Mains SCCT Dimensions

2.2.7 Branch SCCT

Unit: mm

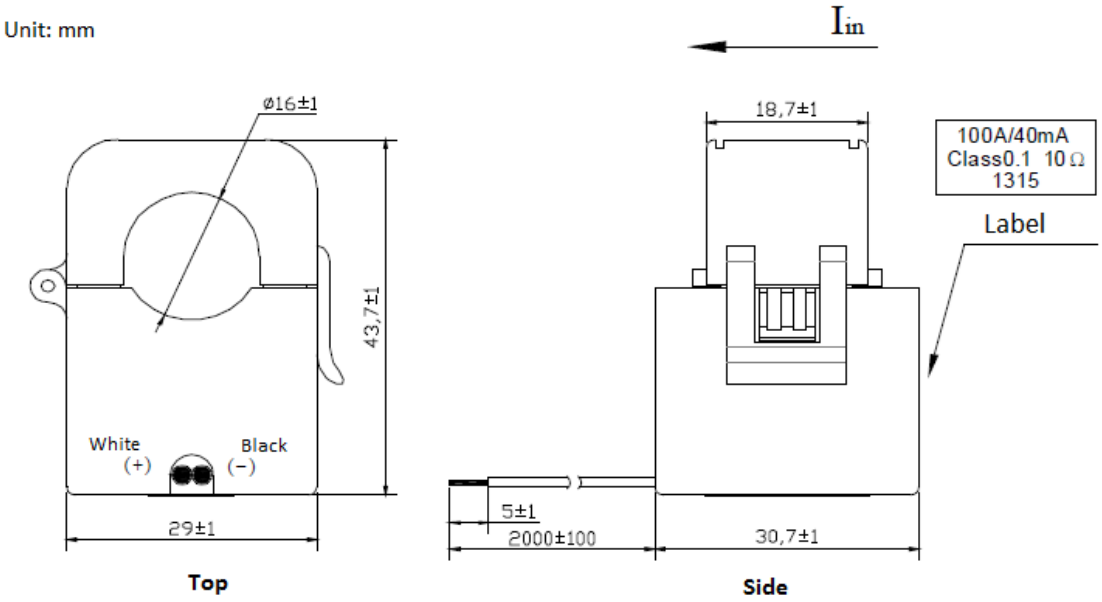


Figure 2-13 Branch SCCT Dimensions

2.3 Mounting

The PMC-592 should be installed in a dry environment without dust and kept away from heat, radiation and electrical noise sources. The PMC-592 is usually installed inside the PDU cabinet. Please reserve enough room for other accessories and make it convenient for future maintenance.

2.3.1 Mounting Main Unit

Installation steps:

- Pre-drill the mounting holes based on the mounting diagrams below.
- Mount the device by affixing the supplied screws to the mounting holes.

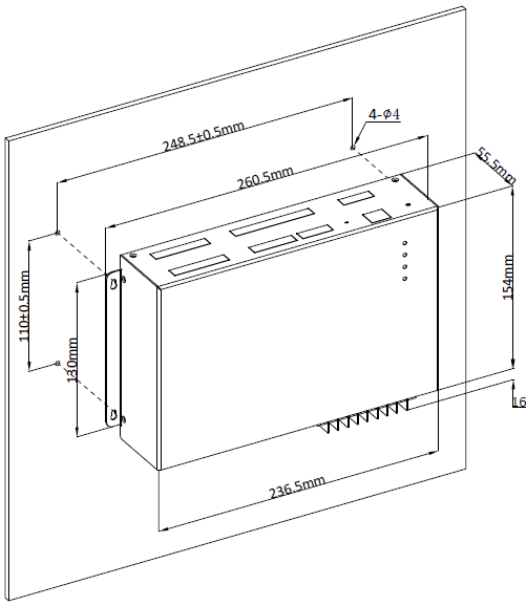


Figure 2-14 Mounting Main Unit

2.3.2 Mounting the Branch CTs

There are two types of Branch CT: Fixed-Core CTs on a CT Strip and Split-Core CTs. Select the appropriate mounting instructions below based on the type of Branch CTs used.

2.3.2.1 Mounting the CT Strip

The CT Strip supports two types of mounting – Surface and DIN Rail. Depending on the actual installation requirements, Polarity, Current Direction and Installation Method may be different. Please refer to Section **2.4.2 Branch Circuit Wiring and Sub Meter Assignment** for more information.

Surface Mounting

- Pre-drill the mounting holes based on the mounting diagrams below.
- Mount the device by affixing the supplied screws to the mounting holes through the CT Strip's mounting flange and then securing the CT Strip into position.

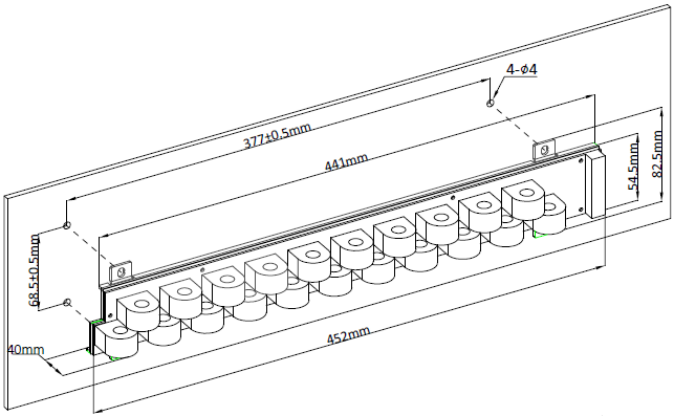


Figure 2-15 Surface Mounting

DIN-Rail Mounting

- The following description assumes the DIN Rail is mounted horizontally. The mounting orientation may be different in the actual situation.

- Before installation, make sure that the 35mm DIN-Rail is already in place.
- Align the top of the mounting clip at the back of the CT Strip at an angle against the top of the DIN rail as shown in the figure below.
- Rotate the bottom of the CT Strip towards the back while applying a slight downward pressure at the top to make sure that the device is completely and securely fixed on to the DIN rail.

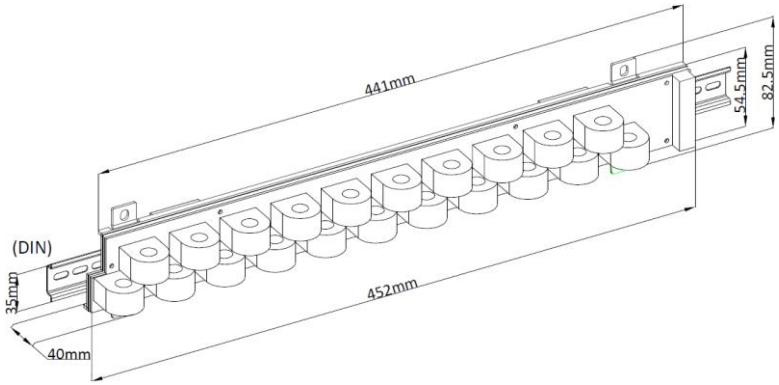


Figure 2-16 Mounting by DIN-Rail

2.3.2.2 Mounting the SCCT Adapter Board

Surface Mounting

- Pre-drill the mounting holes based on the mounting diagrams below.
- Mount the device by affixing the supplied screws to the mounting holes through the SCCT Adapter Board's mounting flange and then securing the adapter board into position.

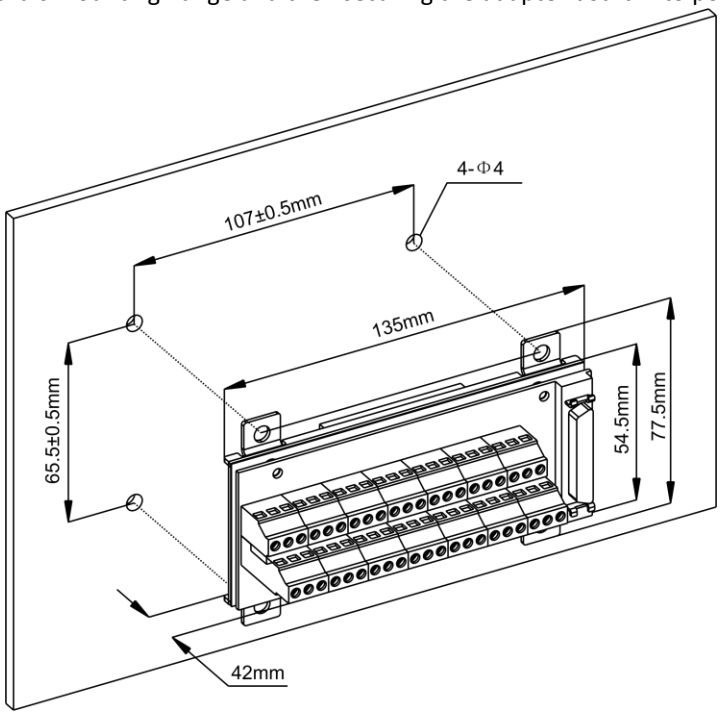


Figure 2-17 Mounting by Screw

DIN-Rail Mounting

- The following description assumes the DIN Rail is mounted horizontally. The mounting orientation may be different in the actual situation.
- Before installation, make sure that the 35mm DIN-Rail is already in place.
- Align the top of the mounting clip at the back of the adapter board at an angle against the top of the DIN rail as shown in the figure below.

- Rotate the bottom of the adapter board towards the back while applying a slight downward pressure at the top to make sure that the device is completely and securely fixed on to the DIN rail.

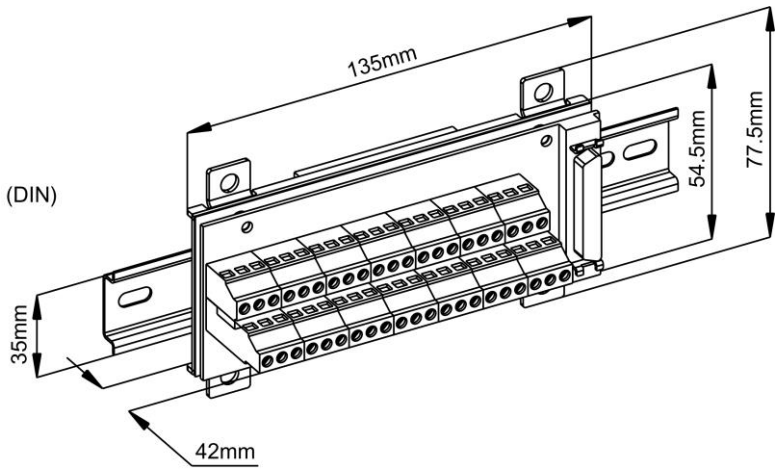


Figure 2-18 Mounting by DIN-Rail

2.3.2.3 Installing Mains SCCTs

The following instructions and figures describe the installation of the Mains SCCTs.

1. If SCCTs are used for the Mains Current Inputs, please ensure to select the 1A Mains Current Input option for the PMC-592. Before installing the Mains SCCTs, please ensure that SCCT's contact surface is clean and without contaminants for best accuracy performance.
2. It's very important to first connect the SCCT's output wires to the Mains Current Inputs before mounting the SCCT. Connect the White wire to Ix1 terminal and the Black wire to Ix2 terminal as shown below where x=1, 2, 3 or 4. Apply the correct torque to tighten the screws.
3. The SCCT's load direction as indicated by the arrow symbol on the CT and should be consistent with the Current flow of the Mains circuits. The CT Polarity can also be configured via the Web interface (Setup > Basic Setup) or through Reg. # 6008.

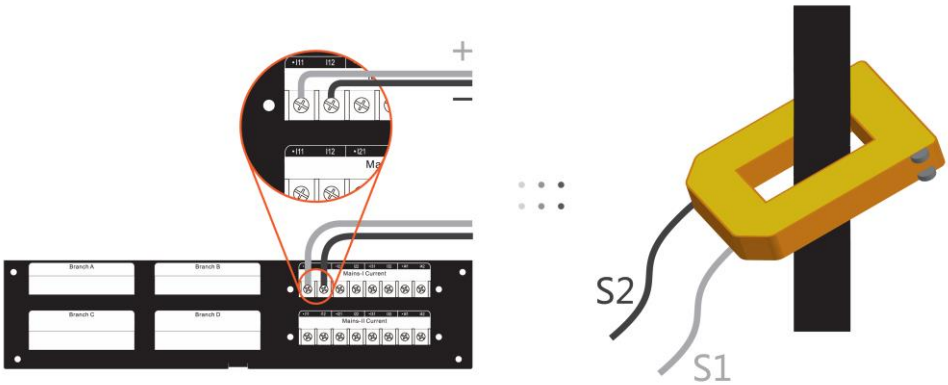


Figure 2-19 Connect SCCT to Mains

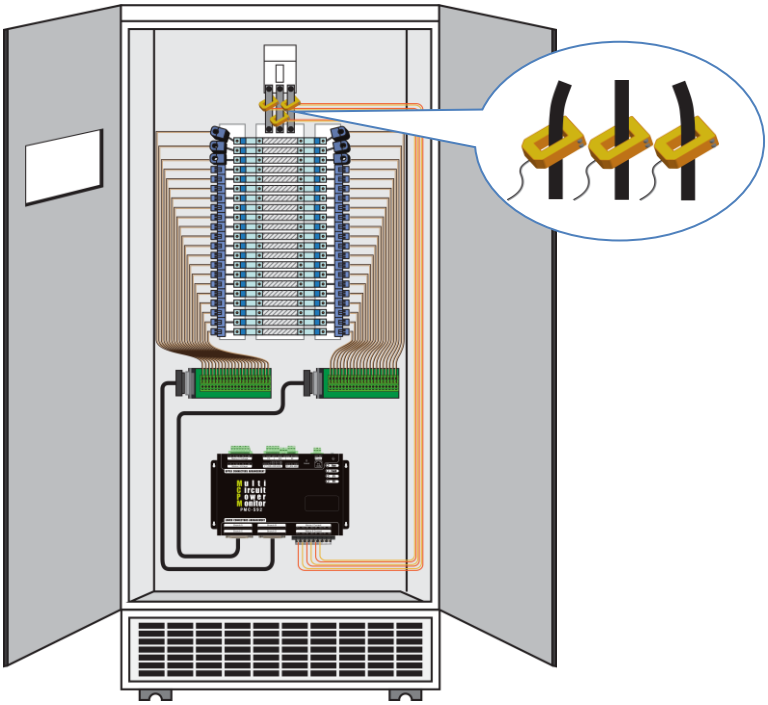


Figure 2-20 Mount Mains SCCT

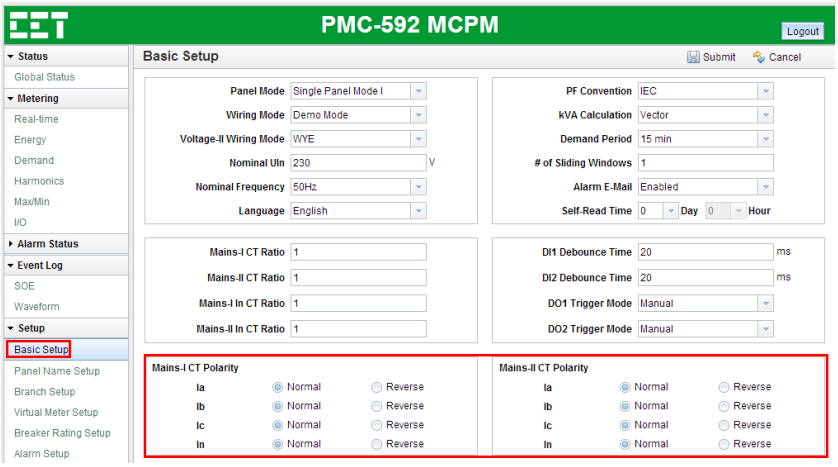


Figure 2-21 Set Mains CT Polarity via Web

2.3.2.4 Installing Branch SCCTs

The following instructions and figures describe the installation of the Branch SCCTs.

1. Before installing Branch SCCT, please ensure that the SCCT's contact surface is clean and without contaminants for best accuracy performance.
2. It's very important to first connect the SCCT's output wires to the SCCT Adapter Board before mounting the Branch SCCT. Connect the White wire to '+' terminal and the Black wire to '-' terminal as shown below at the appropriate branch circuit inputs. Apply the correct torque to tighten the screws.
3. The SCCT's load direction as indicated by the arrow symbol should be consistent with the Current flow of the branch circuits while mounting the SCCT.

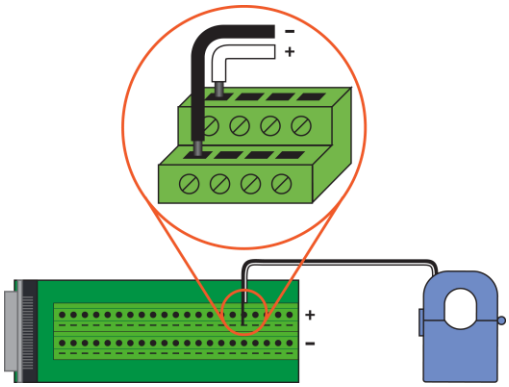


Figure 2-22 Connect SCCT to Adapter Board

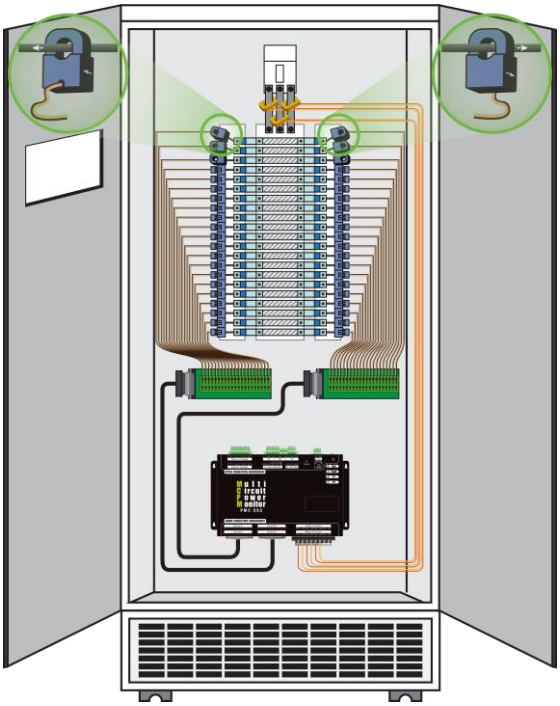


Figure 2-23 Install Cable

2.3.3 Mounting the HMI

The HMI should be mounted on the cabinet door with a minimum clearance of 105cm from the door to the inside components.

1. Put the HMI through the cutout.
2. Install the installation clips as per the diagram below.
3. Affix the supplied screws through the hole of the installation clips.
4. Tighten the screws against the back of the panel until the HMI is mounted securely in place.

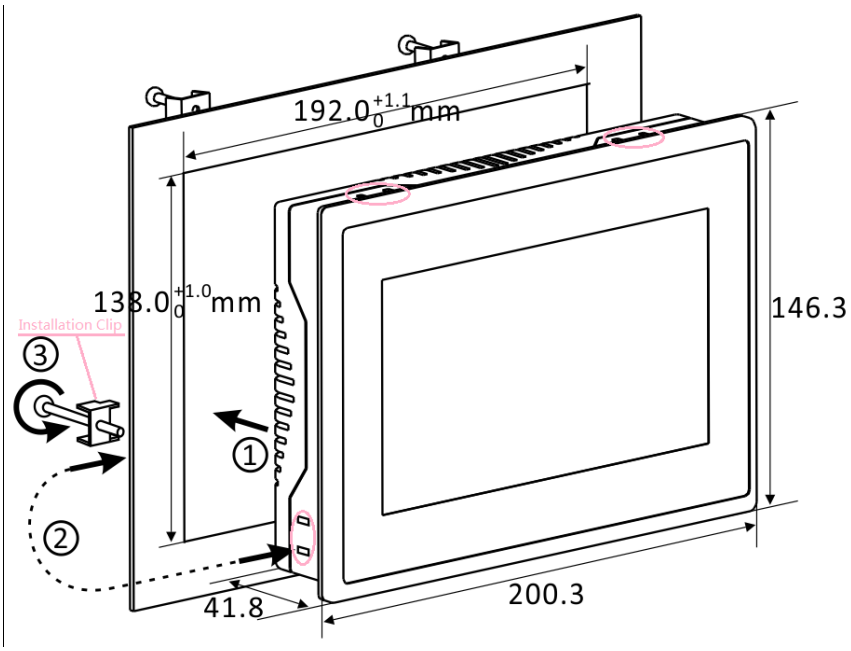


Figure 2-24 Mounting HMI

2.4 Wiring Connections

2.4.1 Panel Mode and Wiring

Caution

Under no circumstances should the PT secondary be shorted.

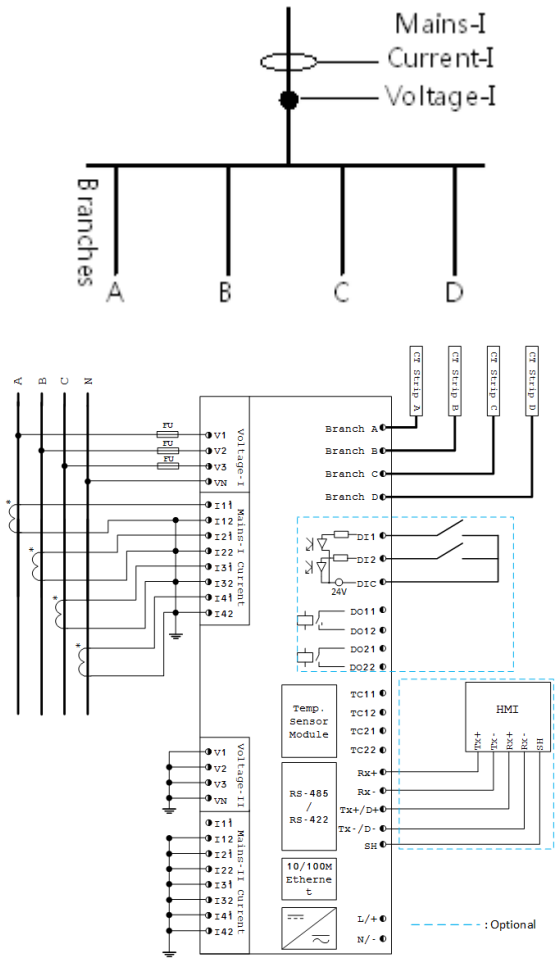
Under no circumstances should the CT secondary be open when the CT primary is energized. CT shorting blocks should be installed to allow for easy maintenance.

The PMC-592 supports five panel modes. Please read this section carefully before installation and choose the correct wiring method for your panel.

- Single Panel Mode I
- Single Panel Mode II
- Dual Panel Mode I
- Dual Panel Mode II
- 1-Phase 3-Wire

2.4.1.1 Single Panel Mode I

1. Single Panel Mode I with One Mains Only



Application:

This configuration is the most common and applies to systems with a Single Mains only.

V1 = Mains-I Voltage Inputs

I1 = Mains-I Current Inputs

V2 = Mains-II Voltage Inputs (Not Used)

I2 = Mains-II Current Inputs (Not Used)

Power Calculation:

Mains-I Power = V1 × I1

Branch Power = V1 × Branch Current

Applicable Alarms:

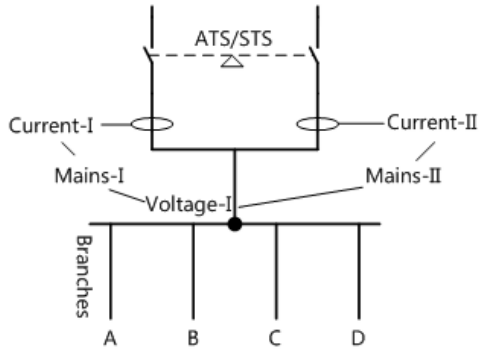
	Global	Mains-I
Voltage-I	●	○
Current/Power-I	●	○
CT Strip A/B	●	○
CT Strip C/D	●	○

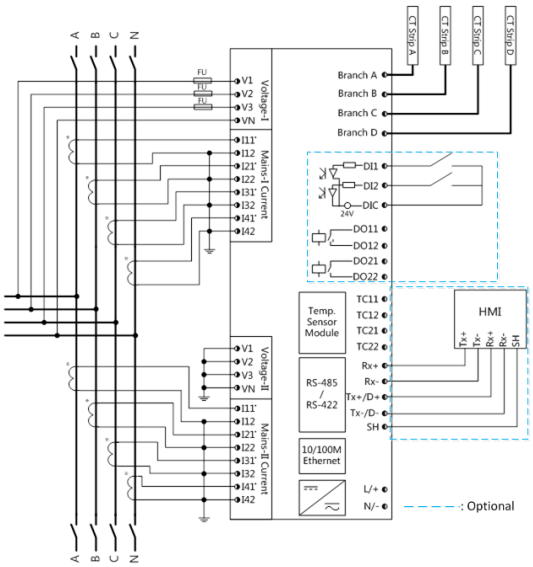
Notes:

All spare terminals that are Not Used, which include Mains-II Voltage and Current Inputs, should be connected to Ground.

Table 2-2 Single Panel Mode I with One Mains Only

2. Single Panel Mode I with Two Mains





Application:

This configuration applies to systems with two separate Mains that are controlled by an ATS (Automatic Transfer Switch) or STS (Static Transfer Switch) such that only one Mains is active at a time.

V1 = Mains-I Voltage Inputs

I1 = Mains-I Current Inputs

V2 = Mains-II Voltage Inputs (Not Used)

I2 = Mains-II Current Inputs

Power Calculation:

Mains-I Power = V1 × I1

Mains-II Power = V1 × I2

Branch Power = V1 × Branch Current

Applicable Alarms:

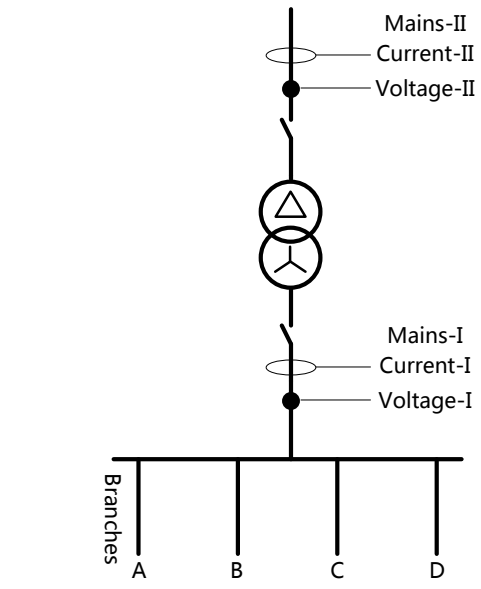
	Global	Mains-I	Mains-II
Voltage-I	●	o	o
Voltage-II	●	o	o
Current/Power-I	●	o	o
Current/Power-II	●	o	o
CT Strip A/B	●	o	o
CT Strip C/D	●	o	o

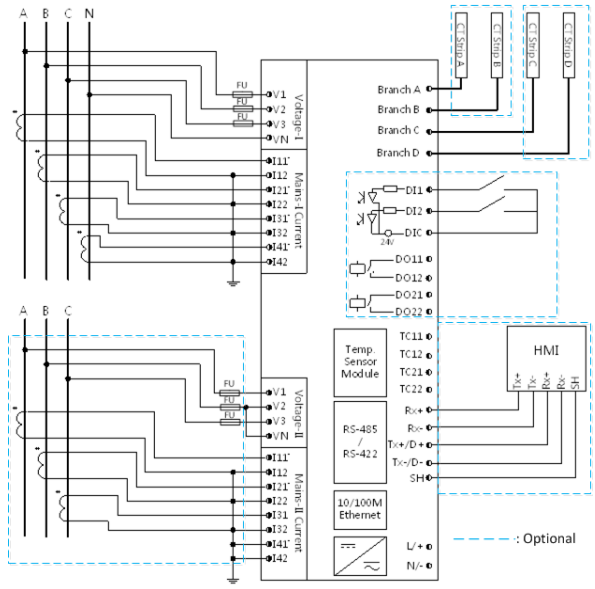
Notes:

The spare Mains-II Voltage terminals should be connected to Ground.

Table 2-3 Single Panel Mode I with Two Mains

2.4.1.2 Single Panel Mode II





Application:

This configuration applies to systems with a single Mains (Mains-I) only. However, Mains-II can be used to measure the electrical parameters before the Delta-Wye Isolation Transformer.

Voltage-II and Current-II can be disconnected if the PDU does not have an Isolation Transformer. This would be equivalent to the Single Panel Mode I with One Mains Only.

V1 = Mains-I Voltage Inputs

I1 = Mains-I Current Inputs

V2 = Mains-II Voltage Inputs

I2 = Mains-II Current Inputs

Power Calculation:

Mains-I Power = V1 × I1 (Wye)

Mains-II Power = V2 × I2 (Delta)

Branch Power = V1 × Branch Current

Applicable Alarms:

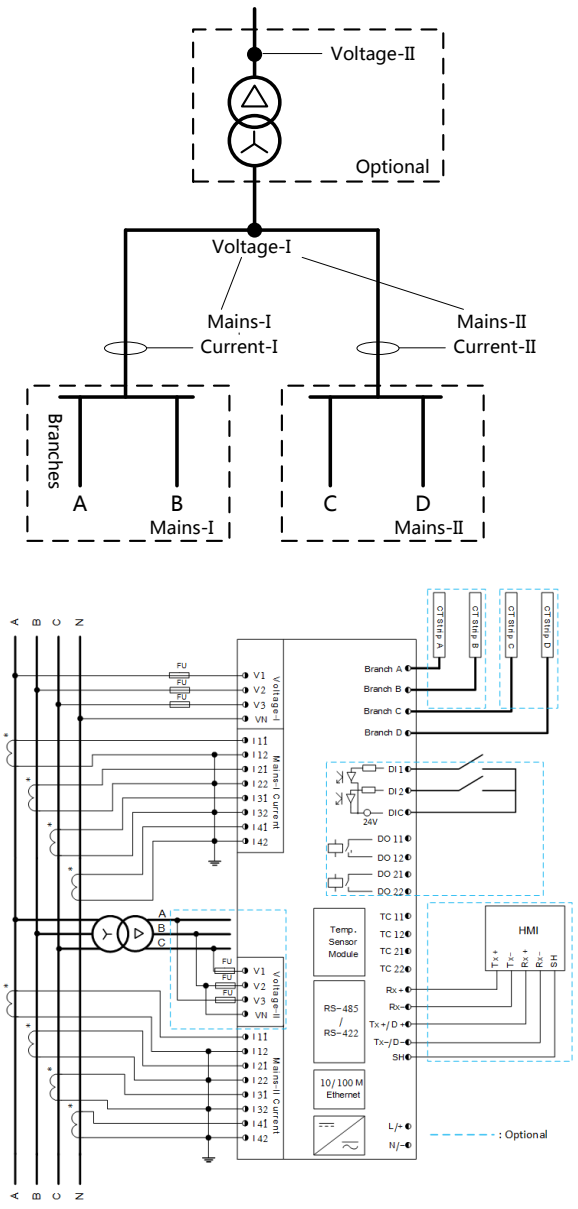
	Global	Mains-I	Mains-II
Voltage-I	●	o	o
Voltage-II	●	o	o
Current/Power-I	●	o	o
Current/Power-II	●	o	o
CT Strip A/B	●	o	o
CT Strip C/D	●	o	o

Notes:

The Mains Voltage Inputs support a maximum voltage of 480V for direct VLL connection. PT Ratio is not supported because the PMC-592 is intended to be used only on LV applications.

Table 2-4 Single Panel Mode II

2.4.1.3 Dual Panel Mode I



Application:

This configuration applies to systems with a Single Mains that are split into two Panels. Branches A and B belong to Mains-I while Branches C and D belong to Mains-II, as illustrated in the diagram on the left.

Mains-I and Mains-II are used to measure electrical parameters for Panel-I and Panel-II, respectively.

V1 = Mains-I Voltage Inputs

I1 = Mains-I Current Inputs

V2 = Optional (may be used to measure the Voltage Inputs before the Isolation Transformer)

I2 = Mains-II Current Inputs

Power Calculation:

Mains-I Power = V1 × I1

Mains-II Power = V1 × I2

Branch Power = V1 × Branch Current

Applicable Alarms:

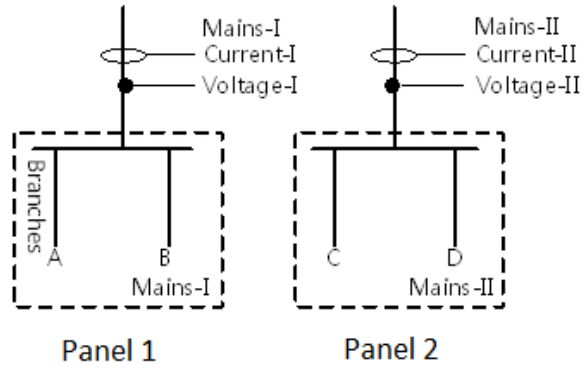
	Global	Mains-I	Mains-II
Voltage-I	●	○	○
Voltage-II	●	○	○
Current/Power-I	●	●	○
Current/Power-II	●	○	●
CT Strip A/B	●	●	○
CT Strip C/D	●	○	●

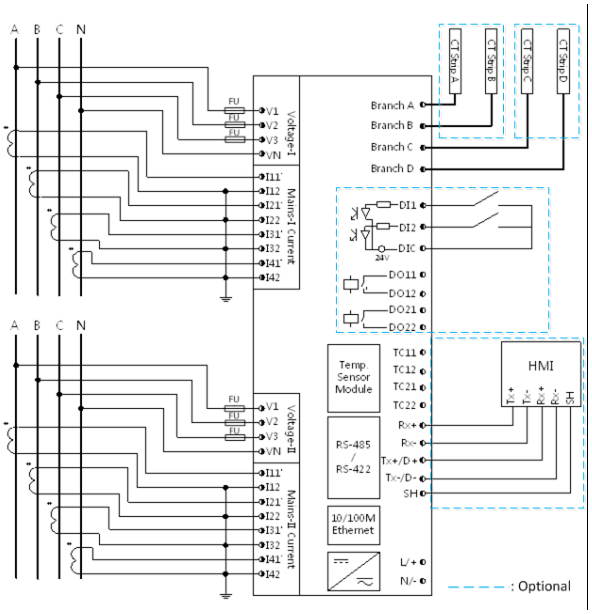
Notes:

The optional Mains-II Voltage terminals should be connected to Ground if not used.

Table 2-5 Dual Panel Mode I

2.4.1.4 Dual Panel Mode II





Application:

This configuration allows a single PMC-592 to monitor two independent PDU panels simultaneously and makes the PMC-592 the most economical product in the market.

V1 = Mains-I Voltage Inputs

I1 = Mains-I Current Inputs

V2 = Mains-II Voltage Inputs

I2 = Mains-II Current Inputs

Power Calculation:

Mains-I Power = V1 × I1
Mains-II Power = V2 × I2
Branch A, B Power = V1 × Panel 1 Branch Current
Branch C, D Power = V2 x Panel 2 Branch Current

Applicable Alarms:

	Global	Mains-I	Mains-II
Voltage-I	●	●	○
Voltage-II	●	○	●
Current/Power-I	●	●	○
Current/Power-II	●	○	●
CT Strip A/B	●	●	○
CT Strip C/D	●	○	●

Notes:

All spare Voltage and Current terminals that are not used should be connected to ground.

Table 2-6 Dual Panel Mode II

2.4.1.5 1-Phase 3-Wire (1P3W) Direct Connection

Please consult the Serial Number Label to ensure that the voltage to be measured is less than or equal to the meter's rated Voltage Input specification. The 1-Phase 3-Wire (1P3W) may only be used with Dual Panel Mode II where Mains-I and Mains-II (if used) may be wired in 1P3W mode.

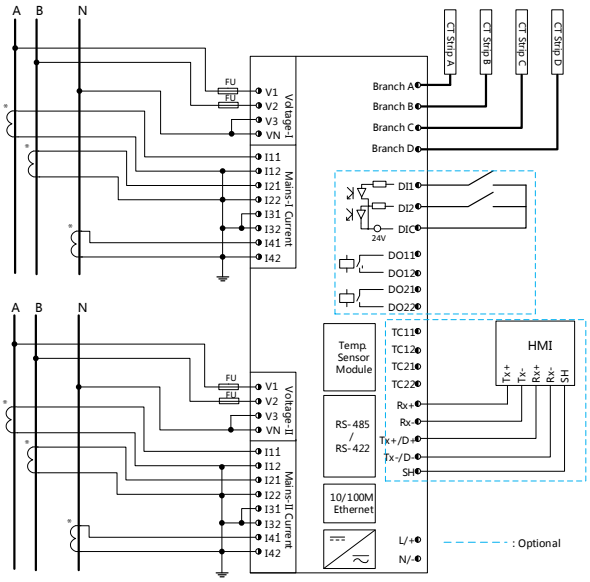


Figure 2-25 1P3W, Direct Connection

2.4.2 Branch Circuit Wiring and Sub Meter Assignment

The PMC-592 supports two Installation Modes for the CT Strips – Sequential and Cross-over. The following sections illustrate the relationship between each Branch CT and its corresponding Sub Meter (SM) assignment. The numbers inside each of the CT Strips are the Branch CT numbers. The numbers outside of the CT Strip represent their respective SM assignments based on the Installation Mode, CT Strip Installation Direction and CT Strip Polarity.

2.4.2.1 Sequential Mode

The PMC-592 supports three Sequential wiring modes. The following diagrams illustrate the details.

Note:

The CT Strips are located next to the breakers, and the spacing between CTs and breakers should be consistent.

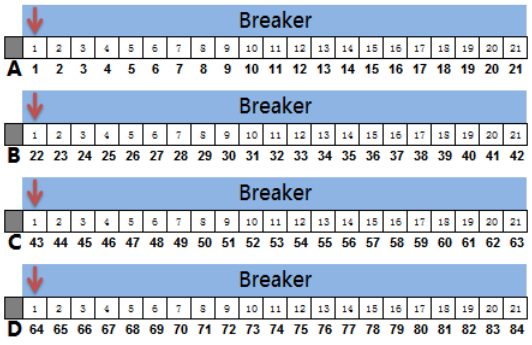
	**Horizontal Configuration:** Installation Mode (Reg. # 6520): 0 = Sequential Mode CT Strip A Installation Direction (Reg. # 6525): 0 = Top CT Strip B Installation Direction (Reg. # 6526): 0 = Top CT Strip C Installation Direction (Reg. # 6527): 0 = Top CT Strip D Installation Direction (Reg. # 6528): 0 = Top CT Strip A Polarity (Reg. # 6521): 0 = Normal CT Strip B Polarity (Reg. # 6522): 0 = Normal CT Strip C Polarity (Reg. # 6523): 0 = Normal CT Strip D Polarity (Reg. # 6524): 0 = Normal

Table 2-7 Sequential Mode I

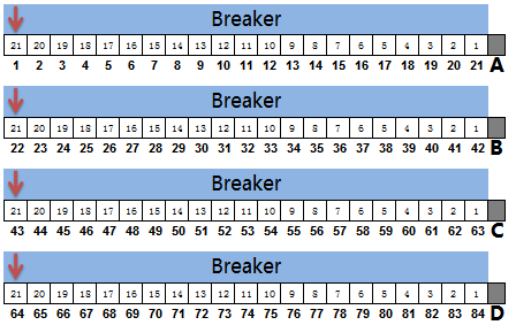
	**Horizontal Configuration:** Installation Mode (Reg. # 6520): 0 = Sequential Mode CT Strip A Installation Direction (Reg. # 6525): 1 = Bottom CT Strip B Installation Direction (Reg. # 6526): 1 = Bottom CT Strip C Installation Direction (Reg. # 6527): 1 = Bottom CT Strip D Installation Direction (Reg. # 6528): 1 = Bottom CT Strip A Polarity (Reg. # 6521): 1 = Reverse CT Strip B Polarity (Reg. # 6522): 1 = Reverse CT Strip C Polarity (Reg. # 6523): 1 = Reverse CT Strip D Polarity (Reg. # 6524): 1 = Reverse

Table 2-8 Sequential Mode II

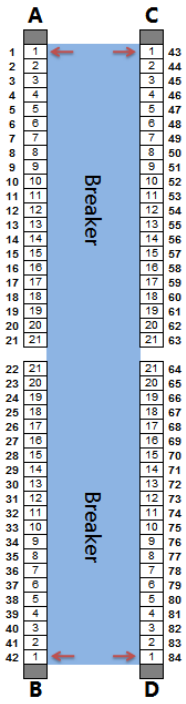
	**Vertical Configuration:** Installation Mode (Reg. # 6520): 0 = Sequential Mode CT Strip A Installation Direction (Reg. # 6525): 0 = Top CT Strip B Installation Direction (Reg. # 6526): 1 = Bottom CT Strip C Installation Direction (Reg. # 6527): 0 = Top CT Strip D Installation Direction (Reg. # 6528): 1 = Bottom CT Strip A Polarity (Reg. # 6521): 0 = Normal CT Strip B Polarity (Reg. # 6522): 1 = Reverse CT Strip C Polarity (Reg. # 6523): 1 = Reverse CT Strip D Polarity (Reg. # 6524): 0 = Normal

Table 2-9 Sequential Mode III

2.4.2.2 Cross-over Mode

The PMC-592 supports three Cross-over wiring modes. The following diagrams illustrate the details.

Note:

The CT Strips are located next to the breakers, and the spacing between CTs and breakers should be consistent.

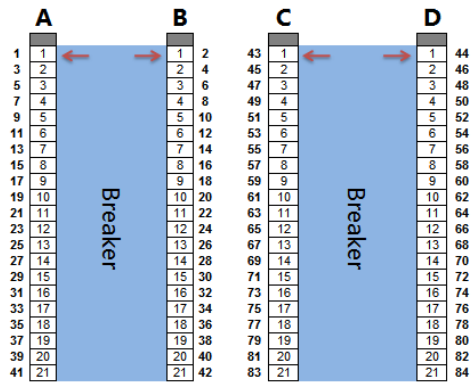
	**Vertical Configuration:** Installation Mode (Reg. # 6520): 1 = Cross-over Mode CT Strip A Installation Direction (Reg. # 6525): 0 = Top CT Strip B Installation Direction (Reg. # 6526): 0 = Top CT Strip C Installation Direction (Reg. # 6527): 0 = Top CT Strip D Installation Direction (Reg. # 6528): 0 = Top CT Strip A Polarity (Reg. # 6521): 0 = Normal CT Strip B Polarity (Reg. # 6522): 1 = Reverse CT Strip C Polarity (Reg. # 6523): 0 = Normal CT Strip D Polarity (Reg. # 6524): 1 = Reverse

Table 2-10 Cross-over Mode I

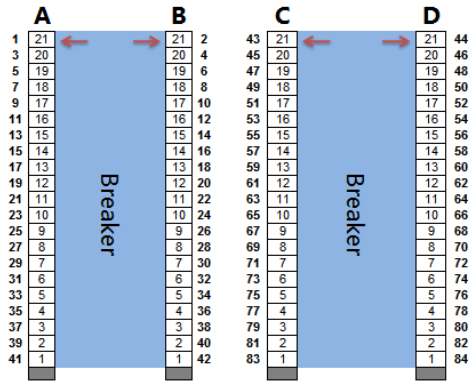
	**Vertical Configuration:** Installation Mode (Reg. # 6520): 1 = Cross-over Mode CT Strips A Installation Direction (Reg. # 6525): 1 = Bottom CT Strips B Installation Direction (Reg. # 6526): 1 = Bottom CT Strips C Installation Direction (Reg. # 6527): 1 = Bottom CT Strips D Installation Direction (Reg. # 6528): 1 = Bottom CT Strips A Polarity (Reg. # 6521): 1 = Reverse CT Strips B Polarity (Reg. # 6522): 0 = Normal CT Strips C Polarity (Reg. # 6523): 1 = Reverse CT Strips D Polarity (Reg. # 6524): 0 = Normal

Table 2-11 Cross-over Mode II

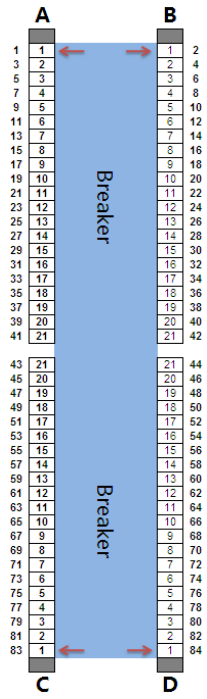
	**Vertical Configuration:** Installation Mode (Reg. # 6520): 0 = Sequential Mode CT Strip A Installation Direction (Reg. # 6525): 0 = Top CT Strip B Installation Direction (Reg. # 6526): 0 = Top CT Strip C Installation Direction (Reg. # 6527): 1 = Bottom CT Strip D Installation Direction (Reg. # 6528): 1 = Bottom CT Strip A Polarity (Reg. # 6521): 0 = Normal CT Strip B Polarity (Reg. # 6522): 1 = Reverse CT Strip C Polarity (Reg. # 6523): 1 = Reverse CT Strip D Polarity (Reg. # 6524): 0 = Normal

Table 2-12 Cross-over Mode III

2.5 Communications Wiring

2.5.1 Ethernet Port (10/100BaseT)

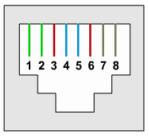
RJ45 Connector	Pin	Meaning
	1	Transmit Data+
	2	Transmit Data-
	3	Receive Data+
	4, 5, 7, 8	NC
	6	Receive Data-

Table 2-13 RJ45 Connector Pin Description for 10/100BaseT Applications

2.5.2 P1 (RS485/RS422) Wiring

The P1 port of PMC-592 can be used either as a RS485 port or a RS422 port. Both communication ports support the Modbus RTU protocol. Up to 32 devices can be connected on a RS485 bus. The overall length of the RS485 cable connecting all devices should not exceed 1200m.

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

The following figures illustrate the RS485 and RS422 communications connections on the P1 port of PMC-592:

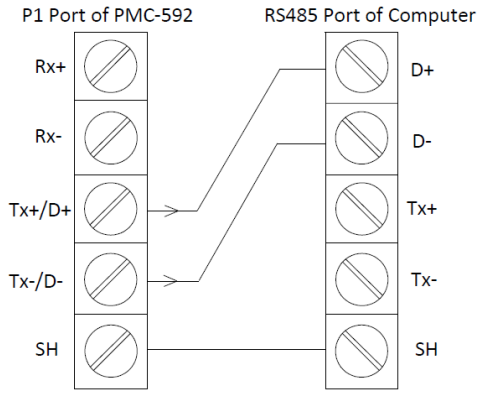


Figure 2-26 P1 (RS485) Connections

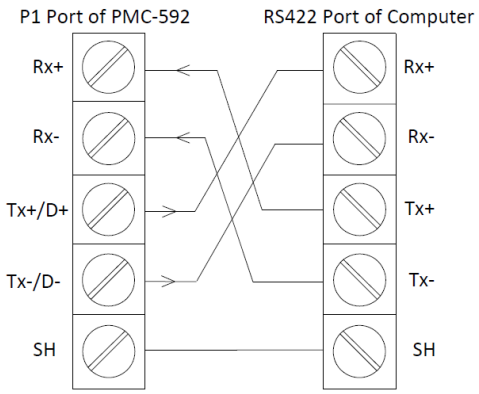


Figure 2-27 P1 (RS422) Connections

2.5.3 P2 (RS485) Wiring

The PMC-592 provides one RS-485 port (P2). The following figure illustrates the RS-485 communications connections on the PMC-592:

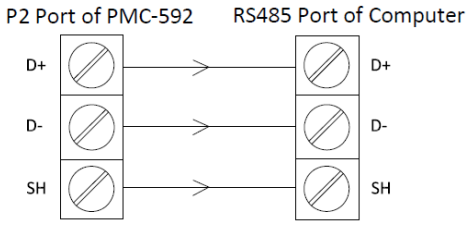


Figure 2-28 P2 (RS485) Communications Connections

2.5.4 HMI Wiring

The PMC-592 HMI communication connection has three modes of wiring.

The following figures illustrate the communications connections between the HMI and PMC-592's P1 and P2:

HMI Comm. Cable		Main Unit Ports	
Color	**Function**	**P1 (RS-422/485)**	**P2 (RS-485)**
Yellow	RX-/D-	TX-/D-	D-
Red	Rx+/D+	TX+/D+	D+
Black	TX-	RX-	-
Green	TX+	RX+	-

Blue	SH	SH	SH

Table 2-14 HMI Comm. Cable Description

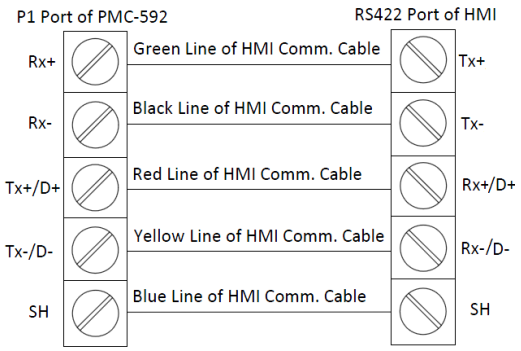


Figure 2-29 P1 (RS422) Connections

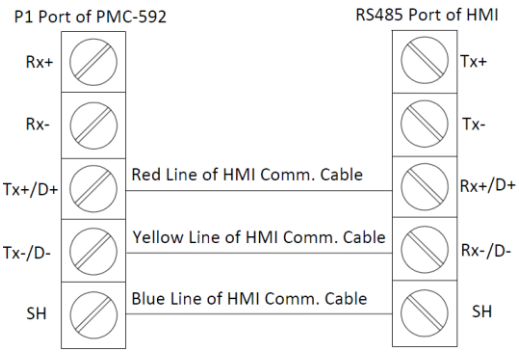


Figure 2-30 P1 (RS485) Connections

The following figure illustrates the communications connections between the P2 (RS485) of PMC-592 and HMI:

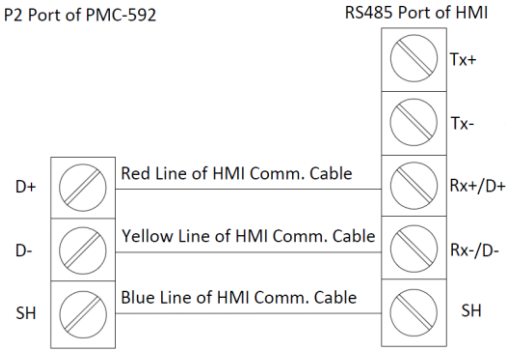


Figure 2-31 P2 (RS485) Communications Connections with HMI

2.6 Digital Input Wiring

The following figure illustrates the Digital Input connections on the PMC-592:

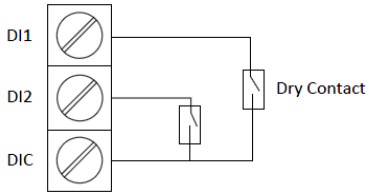


Figure 2-32 DI Connections

2.7 Digital Output Wiring

The following figure illustrates the Digital Output connections on the PMC-592:

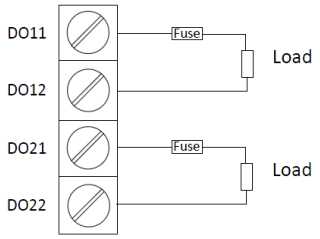


Figure 2-33 DO Connections

2.8 RTD Input Wiring

The following figure illustrates the Temperature Input connections on the PMC-592:

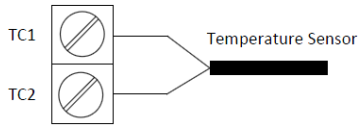


Figure 2-34 Temperature Input Connections

2.9 Main Unit 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.

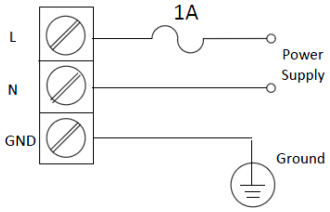


Figure 2-35 Power Supply Connections

2.10 HMI Power Supply Wiring

For DC supply, connect the positive wire to the L/+ terminal and the negative wire to the N/- terminal. Please be reminded that the HMI requires a 24VDC power supply.

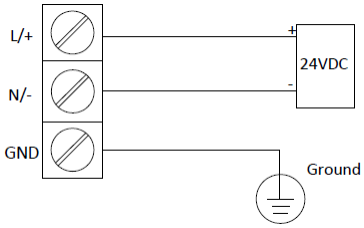


Figure 2-36 HMI Power Supply Connection

2.11 Chassis Ground Wiring

Connect the G terminal to earth ground.

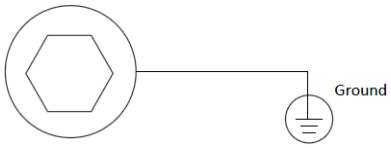


Figure 2-37 Chassis Ground connection

Chapter 3 User Interface

3.1 Front Panel LED Indicators

There are four LED indicators on the PMC-592's front panel as described in the following table.

LED Indicator	Color	Status	Description
Run	Green	Blinking once per second	System is running normally
Fault	Red	On	Abnormal Self-Diagnostics
		Blinking once per 0.5s	CT Strips Installation Error
P1 (RS422/RS485)	Green	Blinking	Receiving data
	Red	Blinking	Transmitting data
P2 (RS485)	Green	Blinking	Receiving data
	Red	Blinking	Transmitting data

Table 3-1 Front Panel LED Indicators

3.2 Web Interface

The default IP Address of the PMC-592's Ethernet Port (P3) is 192.168.0.100. Please make sure to configure the IP Addresses and Subnet Masks for the PMC-592 and the PC so that they are in the same subnet.

3.2.1 Setting PC's IP Address

To determine the PC's IP Address, go to **Control Panel**, and double-click on **Network and Sharing Center** and the **Network Connections** folder appears.

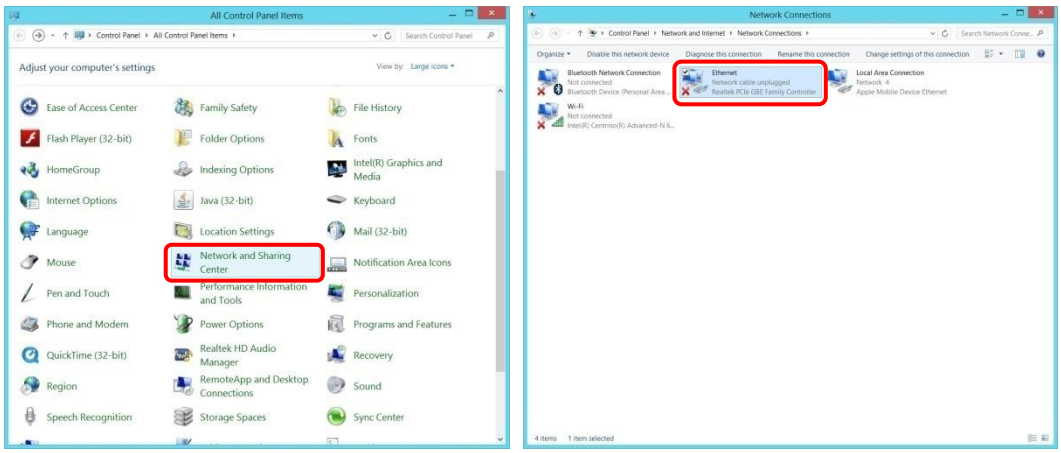


Figure 3-1 Control Panel and Network Connections

Double-click on the **Ethernet** adapter to open its dialog box. Then double-click on **Internet Protocol Version 4 (TCP/IPv4)** to show the PC's IP configuration.

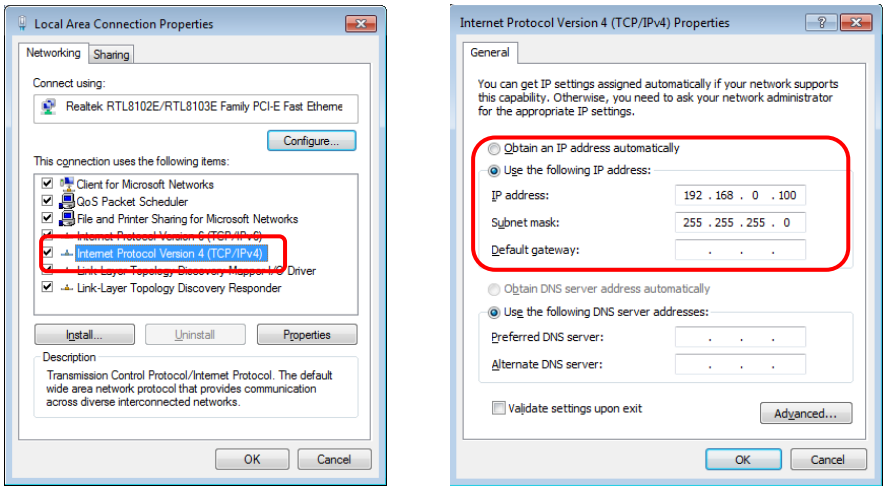


Figure 3-2 Setting PC's IP Address

3.2.2 Configure PMC-592's IP Address using the Touch-Screen HMI

To configure the PMC-592's IP Address, touch the **Setup** icon on the Main page, and then touch **Communication** icon to enter **Communication Setup**. Enter the IP Address, Subnet Mask and Gateway at the highlighted section below.

Figure 3-3 Configure PMC-592's IP Address

3.2.3 Accessing PMC-592's Web Interface

1) Enter the IP Address of the PMC-592 in the Address area of your Internet Explorer and then press **<Enter>**.
2) The PMC-592's Web Interface appears. There are six main menu items on the left-hand pane – **Global Status, Metering, Alarm Status, Event Log, Setup** and **Diagnostics**.
3) The user is not required to login to the Web interface to view data. Login is only required if changes to the setup parameters are being made.

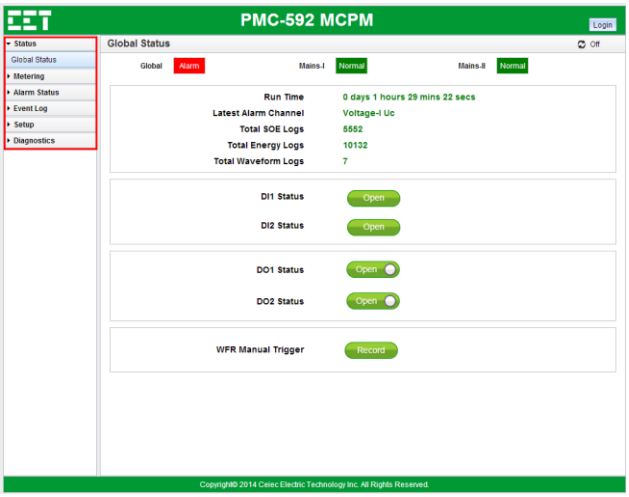


Figure 3-4 PMC-592's Web Interface

3.2.3.1 Global Status

The **Global Status** page includes following information:

Parameter	Description
Global/Mains-I/Mains-II	Displays if there are any Global, Mains-I or Mains-II Alarms
Run Time	Displays Main Unit's run time since the last power on. Click the **Refresh** icon at the upper right-hand corner and below the Logout button to enable/disable the **Auto Refresh** function.
Latest Alarm Channel	Displays the latest alarm's location.
Total SOE Logs	Displays the total number of SOE logs.
Total Energy Log	Displays the total number of energy logs.
Total Waveform Logs	Displays the total number of waveform logs.
DI1/DI2 Status	Displays DI1 and DI2 status.
DO1/DO2 Status	Displays DO1 and DO2 status.
WFR Manual Trigger	Click **Record** to trigger WFR manually. If **Auto Refresh** is turned on, the **Total Waveform Logs** number should be incremented.

Table 3-2 Global Status Description

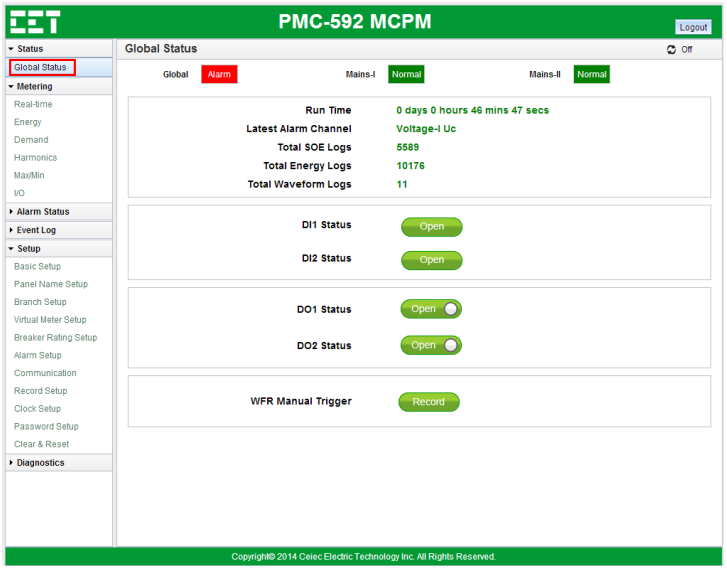


Figure 3-5 Status Interface

3.2.3.2 Metering

Click on the **Arrow** icon besides **Metering** to expand its sub-menu, which includes **Real Time, Energy, Demand, Harmonics, Max/Min** and **I/O.** The following sections provide a quick overview of the information available under **Metering**.

3.2.3.2.1 Real Time

Click **Real Time** on the left-hand pane and the following pages appear on the right-hand pane: **Mains**, **1-Phase (1-42)**, **1-Phase (43-84)**, **2-Phase**, **3-Phase** and **Virtual Meter**.

Tab	Function
Mains	Displays the parameters for Mains-I and Mains-II, which include Loading Factor, Voltage, Current, kW, kvar, kVA, PF, Current Unbalance and Temperature.
1-Phase (1-42)	Displays Current, Loading Factor, kW, kvar, kVA and PF for 1-Ø SM1 to SM42.
1-Phase (43-84)	Displays Current, Loading Factor, kW, kvar, kVA and PF for 1-Ø SM43 to SM84.
2-Phase	Displays Current, Loading Factor, kW, kvar, kVA and PF for 2-Ø SM1 to SM42.
3-Phase	Displays Current, Loading Factor, kW, kvar, kVA and PF for 3-Ø SM1 to SM28.
Virtual Meter	Displays kW for VM1 to VM10.

Table 3-3 Realtime Description

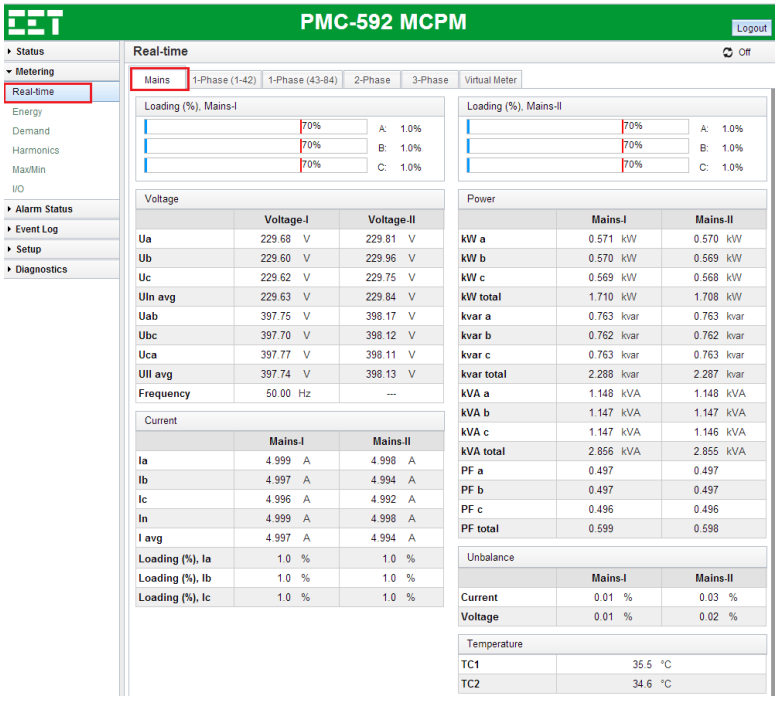


Figure 3-6 Mains Real-Time Interface

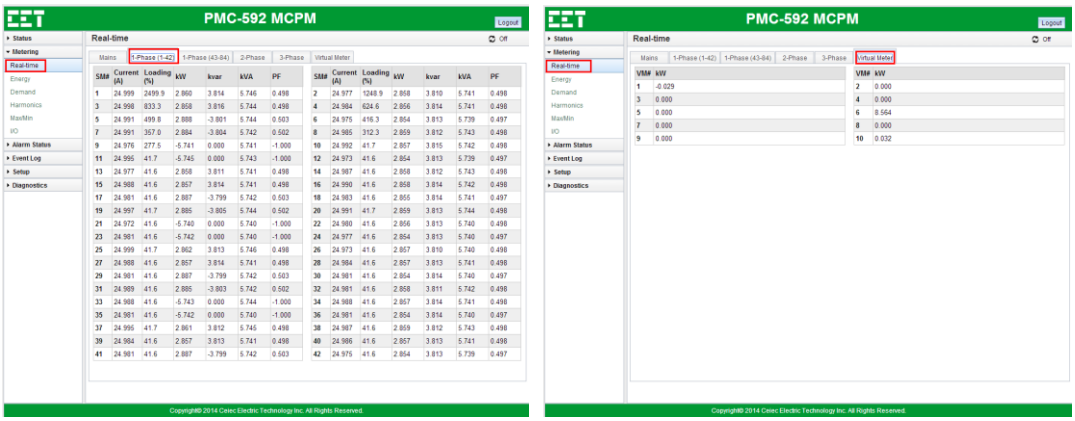


Figure 3-7 1-Ø (1-42) and Virtual Meter Real-Time Interface

3.2.3.2.2 Energy

Click **Energy** on the left-hand pane and the following pages appear on the right-hand pane: **Mains**, **1-Phase (1-42)**, **1-Phase (43-84)**, **2-Phase**, **3-Phase** and **Virtual Meter**.

Tab	Function
Mains	Displays kWh Imp/kWh Exp/kvarh Imp/kvarh Exp/kVAh Total for Mains-I and Mains-II.
1-Phase (1-42)	Displays kWh/kvarh/kVAh for 1-Ø SM1 to SM42.
1-Phase (43-84)	Displays kWh/kvarh/kVAh for 1-Ø SM43 to SM84.
2-Phase	Displays kWh/kvarh/kVAh for 2-Ø SM1 to SM42.
3-Phase	Displays kWh/kvarh/kVAh for 3-Ø SM1 to SM28.
Virtual Meter	Displays kWh/kvarh/kVAh for VM1 to VM10.

Table 3-4 Energy Page Description

Click the **Reset** icon on the right-most column to clear the specific energy measurements. Click the **Reset All** icon on the upper right-hand corner beside the **Refresh** icon to clear energy measurements for Mains-I, Mains-II, all Sub Meters and Virtual Meters.

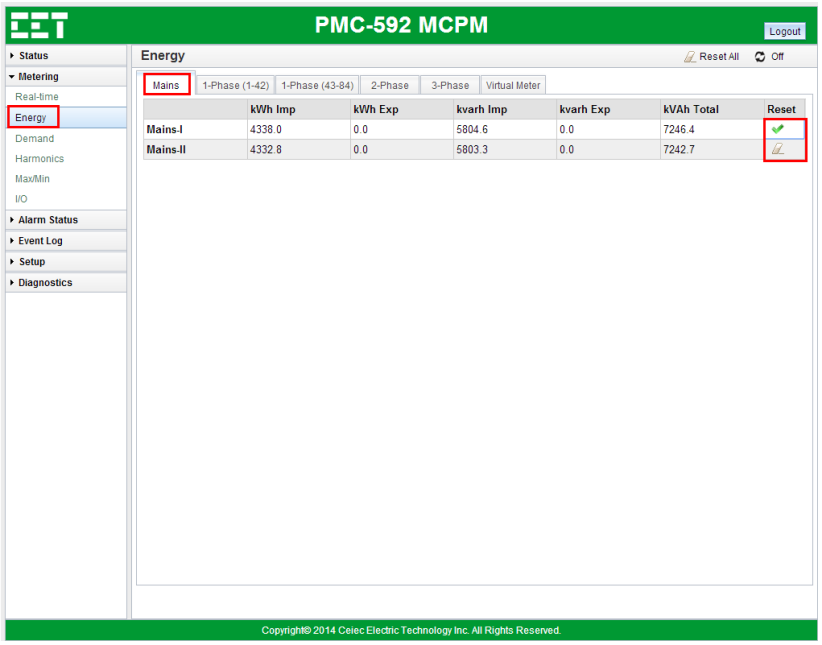


Figure 3-8 Meters Energy Interface

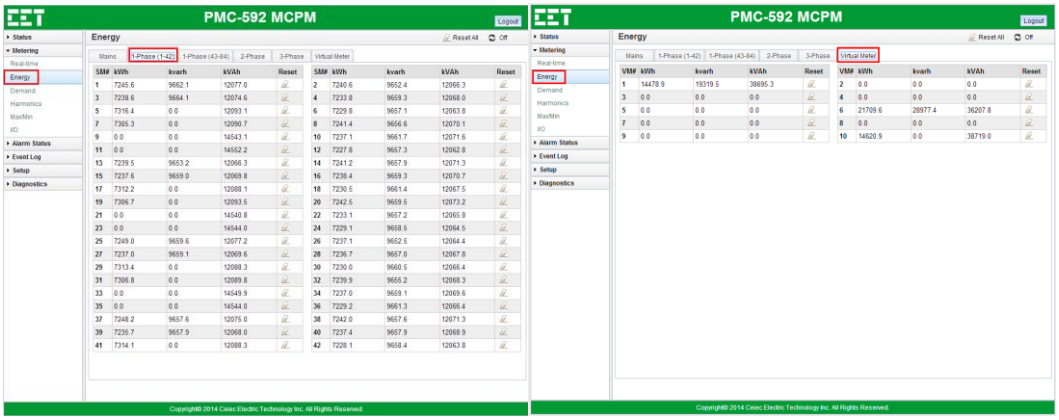


Figure 3-9 1-Ø (1-42) and Virtual Meter Energy Interface

3.2.3.2.3 Demand

Click **Demand** on the left-hand pane and the following pages appear on the right-hand pane: **Mains**, **1-Phase (1-42)**, **1-Phase (43-84)**, **2-Phase** and **3-Phase.** The **Demand** drop box at the upper left-hand corner of the right-hand pane provides the following measurement options to load for a particular page: **Demand of Real-time, Historical Max. Demand, Max. Demand of This Month and Max. Demand of Last Month.** The page displays the **Demand of Real Time** for Current, kW, kvar and kVA by default.

Tab	Function
Mains	Displays the selected Demand measurements for Mains-I and Mains-II.
1-Phase (1-42)	Displays the selected Demand measurements for the 1-Ø SM1 to SM42.
1-Phase (43-84)	Displays the selected Demand measurements for the 1-Ø SM43 to SM84.
2-Phase	Displays the selected Demand measurements for the 2-Ø SM1 to SM42.
3-Phase	Displays the selected Demand measurements for the 3-Ø SM1 to SM28.

Table 3-5 Demand Description

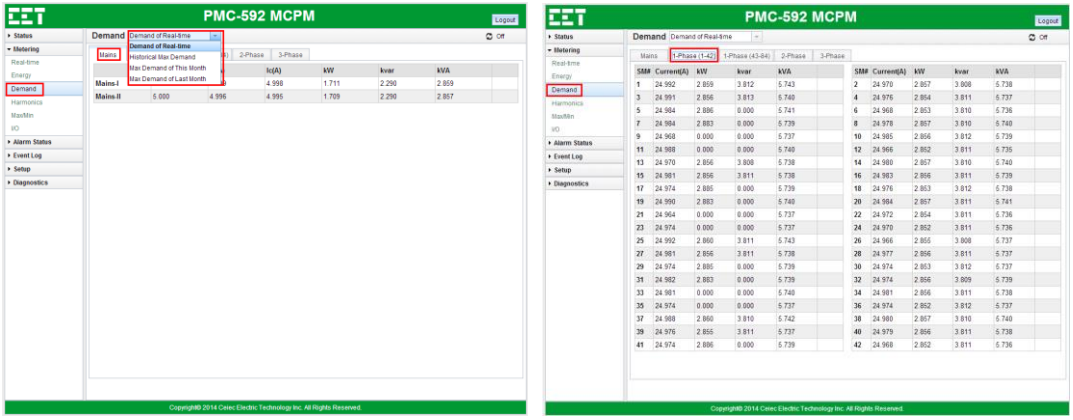


Figure 3-10 Demand Interface

3.2.3.2.4 Harmonics

Click **Harmonics** on the left-hand pane and the following pages appear on the right-hand pane: **Mains** and **Branches**.

Tab	Function
Mains	There are two drop boxes on the upper left-hand corner.

	The first drop box provides the following options to choose from: **Voltage-I, Voltage-II, Current-I, Current II**. The second drop box provides the following options to choose from: **Phase A, Phase B, Phase C**. The page will show the Harmonic Histogram, THD, TOHD, TEHD, K-Factor (Current only) and the Individual Harmonic values from H02 to H31 for the selected option.
Branches	Displays Current THD for the SM1 to SM84 Sub Meters.

Table 3-6 Harmonic Description

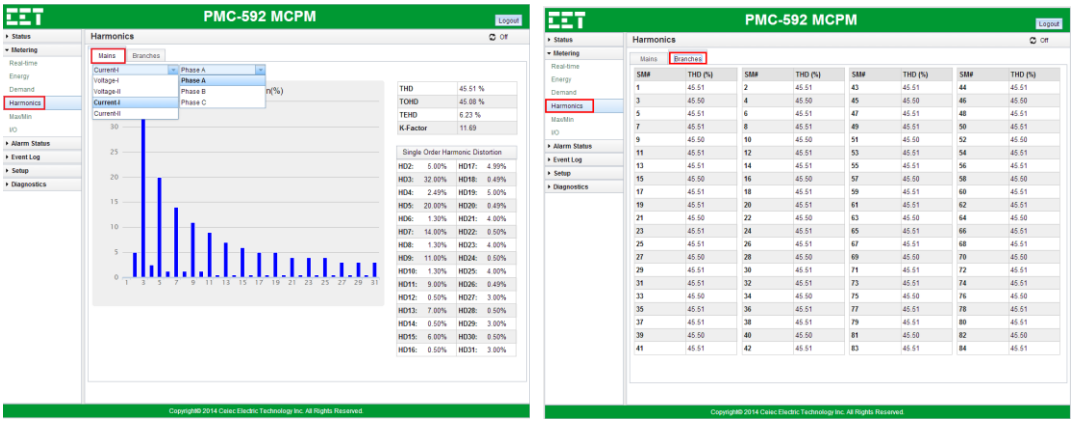


Figure 3-11 Harmonics Interface

3.2.3.2.5 Max/Min

Click **Max/Min** on the left-hand pane and the following pages appear on the right-hand pane: **Mains**, **1-Phase (1-42)**, **1-Phase (43-84)**, **2-Phase**, **3-Phase, Mains PQ** and **Branches PQ.** The **Max/Min** drop box at the upper left-hand corner of the right-hand pane provides the following measurement options to load for a particular page: **Historical Max, Historical Min, Max of This Month, Max of Last Month, Min of This Month,** and **Min of Last Month.**

Tab	Function
Mains	Displays the selected Max/Min option for the following parameters for Mains-I and Mains-II, respectively: Voltage, Current, Loading Factor, kW, kvar, kVA, PF, Unbalance and RTD.
1-Phase (1-42)	Displays the selected Max/Min option for the following parameters for the 1-Ø SM1 to SM42: Current, Loading Factor, kW, kvar, kVA and PF.
1-Phase (43-84)	Displays the selected Max/Min option for the following parameters for the 1-Ø SM43 to SM84: Current, Loading Factor, kW, kvar, kVA and PF.
2 Phase	Displays the selected Max/Min option for the following parameters for the 2-Ø SM1 to SM42: Current, Loading Factor, kW, kvar, kVA and PF.
3-Phase	Displays the selected Max/Min option for the following parameters for the 1-Ø SM1 to SM28: Current, Loading Factor, kW, kvar, kVA and PF.
Mains PQ	Displays the selected Max/Min option for the following parameters for Mains-I and Mains-II: Voltage THD/TOHD/TEHD and Current THD/TOHD/TEHD/K-Factor.
Branches PQ	Displays the selected Max/Min option for the following parameters for the SM1 to SM84: Current THD/TOHD/TEHD and K-Factor.

Table 3-7 Description of Max/Min Page

Click the **Reset All** icon on the upper right-hand corner beside the **Refresh** icon to clear all Max/Min log.

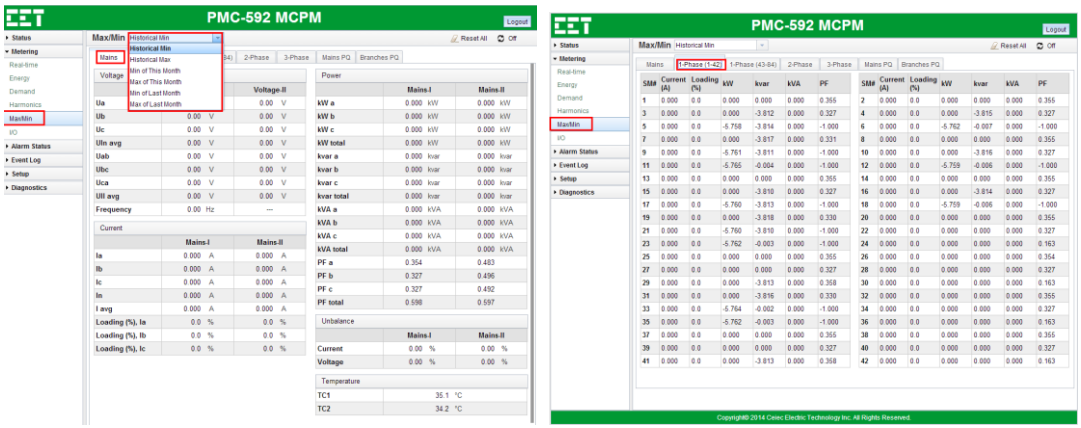


Figure 3-12 Mains and 1-Ø (1-42) Interface

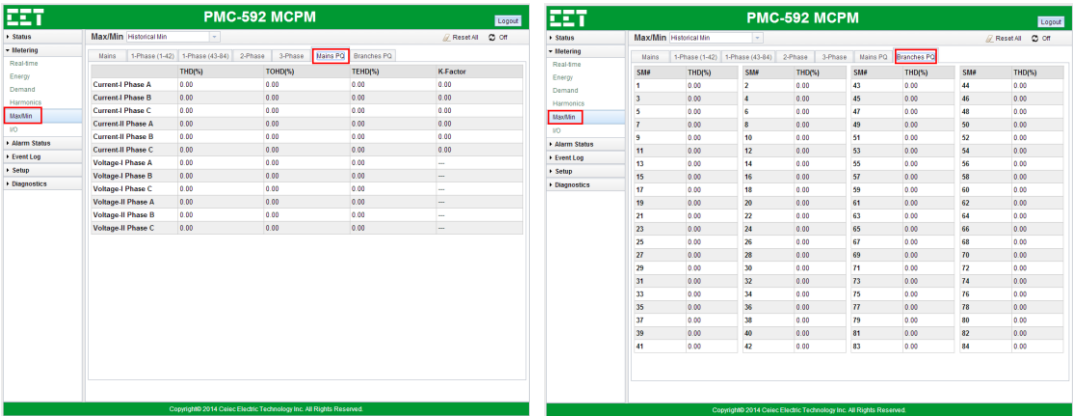


Figure 3-13 Mains and Branch PQ Interface

3.2.3.2.6 I/O

Click **I/O** on the left-hand pane and the following page appears on the right-hand pane, which displays the following information: **DI Status, DO Status** and the **SM1 to SM84 ON/OFF Status**.

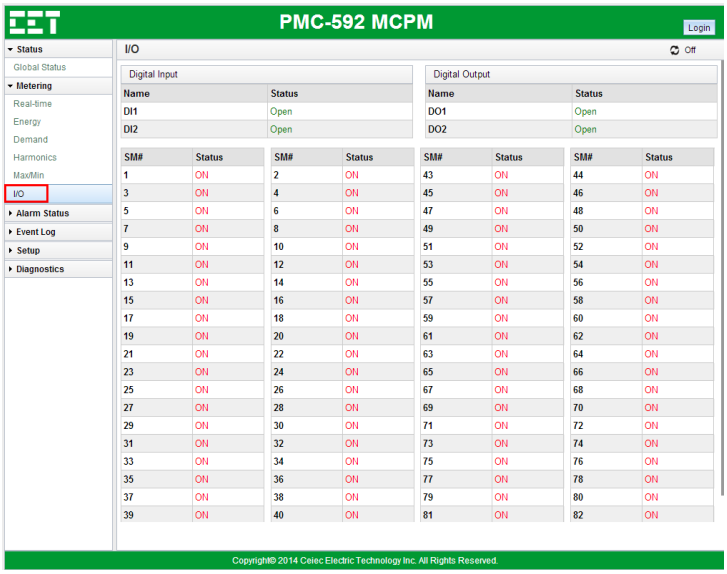


Figure 3-14 I/O Interface

3.2.3.3 Alarm Status

Click the **Arrow** icon beside **Alarm Status** on the left-hand pane to expand its sub-menu, which includes **Instant Alarm, Latched Alarm** and **Alarm Count.** The following sections provide a quick overview of the web pages available under **Alarm Status.**

3.2.3.3.1 Instantaneous Alarm

The **Instantaneous Alarm** page has two tabs: **Mains** and **Branches**.

Tab	Function
Mains	Displays the Instantaneous Alarm status for the following parameters: Global Alarm, Mains-I Alarm, Mains-II Alarm, as well as the following parameters for each of the two Mains: Voltage, Frequency, Current, kW, kvar, kVA, PF, kW Demand, kvar Demand, kVA Demand, Harmonics, Unbalance, DI and Temperature.
Branches	Displays the Instantaneous Alarm status for the SM1 to SM84 Sub Meters' Current.

Table 3-8 Description of Instantaneous Alarm Page

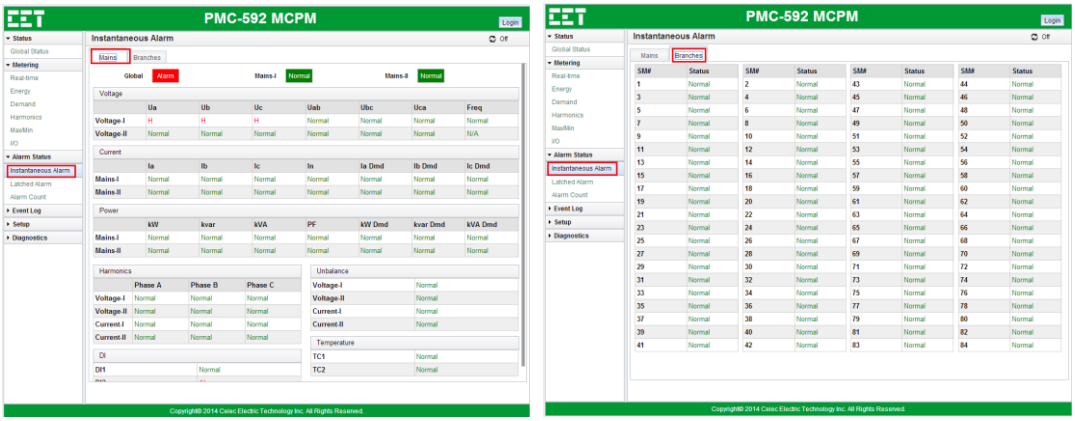


Figure 3-15 Instantaneous Alarm Interface

3.2.3.3.2 Latched Alarm

The **Latch Alarm** page has two tabs: **Mains** and **Branches**.

Tab	Function
Mains	Displays the Latched Alarm status for the following parameters: Global Alarm, Mains-I Alarm, Mains-II Alarm, as well as the following parameters for each of the two Mains: Voltage, Frequency, Current, kW, kvar, kVA, PF, kW Demand, kvar Demand, kVA Demand, Harmonics, Unbalance, DI and Temperature.
Branches	Displays Latched Alarm status for the SM1 to SM84 Sub Meters' Current.

Table 3-9 Latched Alarm Description

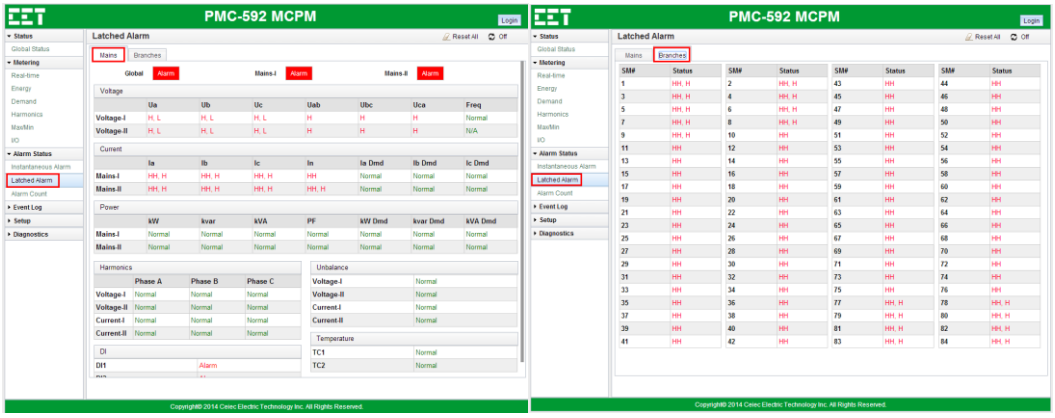


Figure 3-16 Latched Alarm Interface

3.2.3.3.3 Alarm Counter

The **Alarm Counter** page has two tabs: **Mains** and **Branches**.

Tab	Function
Mains	Displays all Mains' Alarm Counters.
Branches	Displays the Alarm counters for the SM1 to SM84 Sub Meters.

Table 3-10 Alarm Count Description

Click the **Reset** icon on the right-hand column to reset the specific counter. Click **Reset All** at the upper right-hand corner and beside the **Refresh** icon to clear all counters.

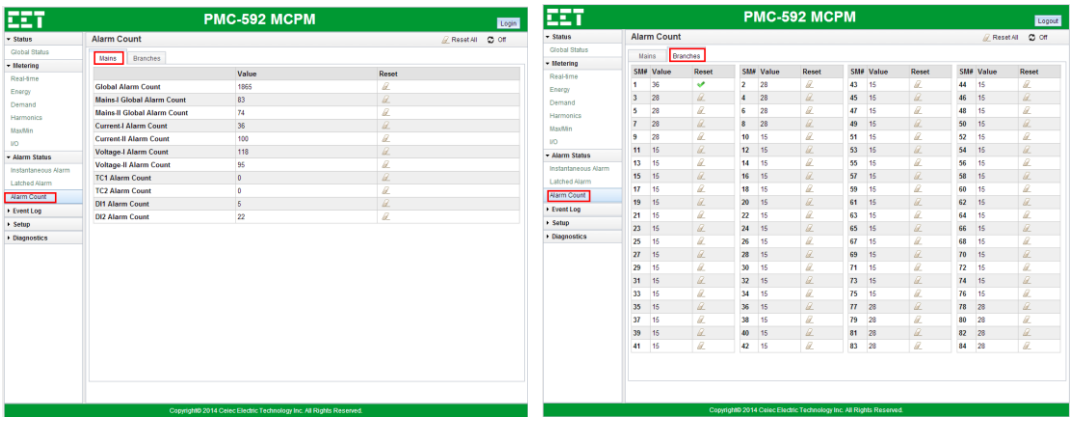


Figure 3-17 Alarm Counter Interface

3.2.3.4 Log

3.2.3.4.1 SOE

Click **SOE** on the left-hand pane and the following screen appears on the right-hand pane. Click the **Clear All** icon at the upper right-hand corner and beside the **Refresh** icon to clear the SOE Log. Caution should be exercised when taking this action.

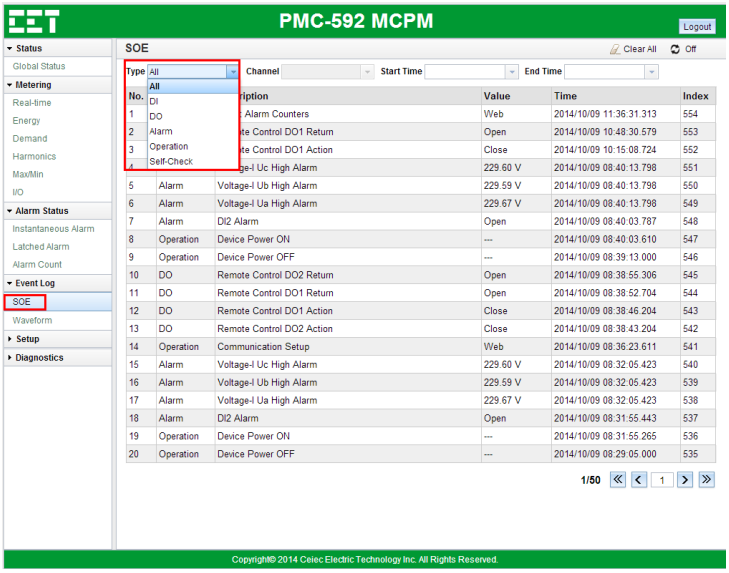


Figure 3-18 SOE Interface

Use the **Type** drop box to filter the events displayed based on alarm type. There are six options as shown in the following picture: **All, DI, DO, Alarm, Operation** and **Self-Check**. The event filtering can be further narrowed by setting the Start Time and End Time as shown in the following picture.

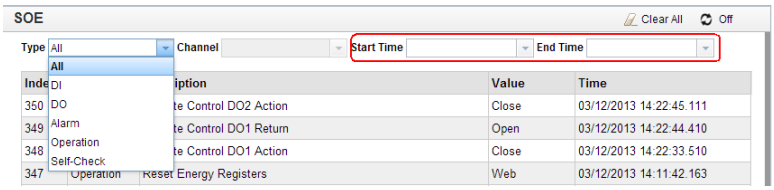


Figure 3-19 SOE Type Interface

Click the **Channel** drop box to filter the events displayed based on input type. The following picture shows the available options: **Mains-I/II power, Mains-I/II Voltage, Mains-I/II Current, Mains-I/II Voltage Unbalance, Mains-I/II Current Unbalance, Frequency, RTD1/RTD2, DI1/DI2** and **SM1 to SM84**.

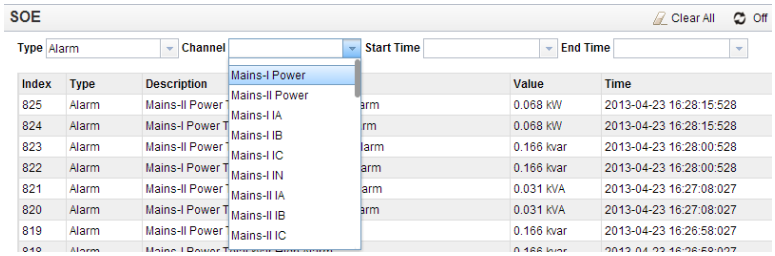


Figure 3-20 SOE Channel Interface

3.2.3.4.2 Waveform

Click **Waveform** on the left-hand pane and the following screen appears on the right-hand pane where the Waveform files in COMTRADE format (**.CFG** and **.DAT)** can be downloaded. Click the **Clear All** icon at the upper right-hand corner and beside the **Refresh** icon to clear the Waveform Log. Caution should be exercised when taking this action.

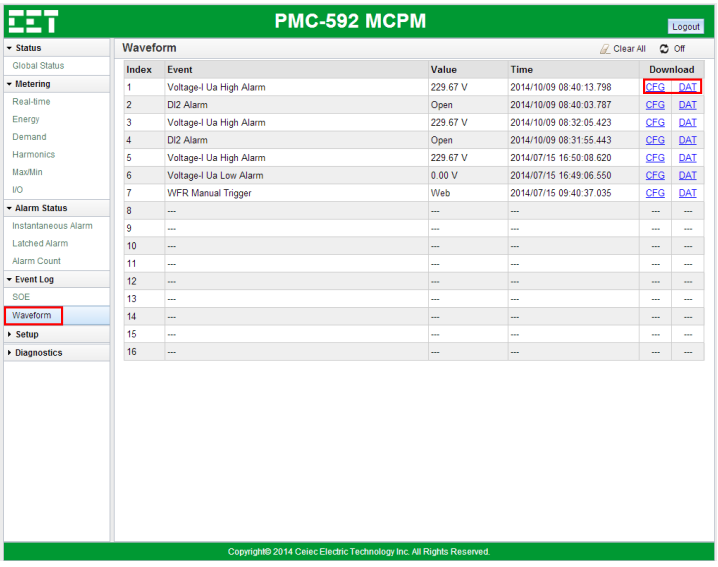


Figure 3-21 Waveform Interface

3.2.3.5 Setup

Click the **Arrow** icon beside **Setup** on the left-hand pane to expand its sub-menu, which includes **Basic Setup, Panel Name Setup, Branch Setup, Virtual Meter Setup, Alarm Setup, Communication, Record Setup, Clock Setup, Password Setup** and **Clear & Reset**.

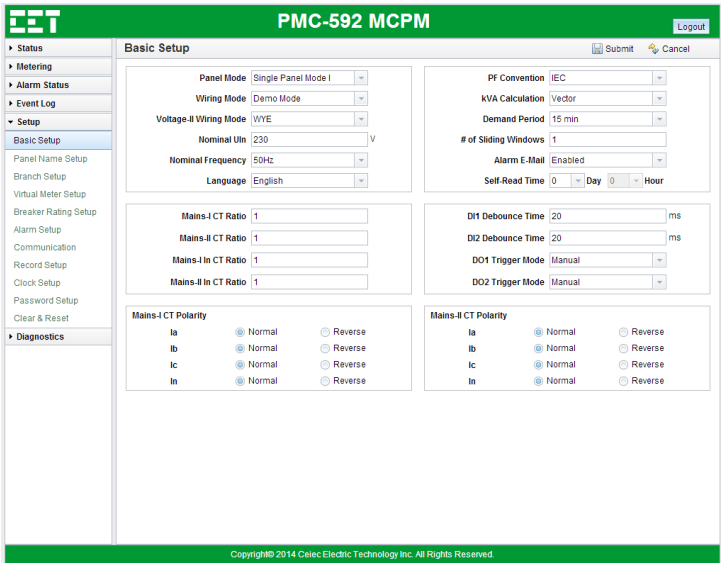


Figure 3-22 Basic Setup Interface

3.2.3.5.1 Basic Setup

Click **Basic Setup** on the left-hand pane and the above screen appears on the right-hand pane where the basic parameters can be changed as illustrated in the following table. Click **Submit** to save your changes or click **Cancel** to cancel your changes. The user is required to log in to the web interface before any changes can be made.

Parameter	Description	Options
Panel Mode	Specifies the installation mode. Please refer to section **2.4.2 Panel Mode** for more information.	• Single Panel Mode I* • Single Panel Mode II • Dual Panel Mode I • Dual Panel Mode II
Wring Mode	Specifies the wiring mode for Mains-I.	• WYE* • 1P3W˜ • Demo Mode
Voltage-II Wiring Mode	Specifies the wiring mode for Mains-II.	• WYE* • 1P3W˜ • DELTA
Nominal UIn	Specifies the system's nominal VLN voltage.	• Range: 90V to 277V • Default = 230V
Nominal Frequency	Specifies the system's nominal frequency.	• 50Hz* • 60Hz
Language	Specifies the displayed language.	• Simplified Chinese • English*
PF Convention	Specifies the Power Factor Convention. Please refer to Section **5.8.1 System Parameters** for more information.	• IEC* • IEEE • －IEEE
kVA Calculation	Specifies the kVA Calculation Method. Please refer to Section **5.8.1 System Parameters** for more information.	• Vector* • Scalar
Demand Period	Demand Cycle = # of Sliding Window x Demand Period.	1 to 60 minutes. Default = 15min
# of Sliding Windows		1 to 15 Default = 1

Alarm E-Mail	Specifies if the SMTP alarm email is enabled.	• Disabled* • Enabled
Self-Read Time	Specifies the time to transfer the Peak Demands and the Max/Min values from This Month to Last Month.	
Mains-I/Mains-II CT Ratio	Specifies the CT Ratio of Mains-I/Mains-II.	1A: 1 to 30000 5A: 1 to 6000 Default = 1
Mains-I/Mains-II In CT Ratio	Specifies the I4 CT Ratio of Mains-I/Mains-II.	1 to 10000 Default = 1
DI1/DI2 Debounce Time	Specifies the minimum duration the DI must remain in the Active or Inactive state before a DI state change is considered to be valid.	1 to 1000 (ms) Default = 20ms
DO1/DO2 Trigger Mode	Specifies which alarm would trigger DO1/DO2.	• Manual • Mains-I Instant. Alarm • Mains-II Instant. Alarm • Mains-I Latched Alarm • Mains-II Latched Alarm • Global Latched Alarm • Global Instant. Alarm
Mains-I CT Polarity	Specifies the Mains-I/Mains-II's Current Polarities for Ia, Ib, Ic and I4.	• Normal • Reverse
Mains-II CT Polarity		

*default
˜1P3W may only be used with Dual Panel Mode II

Table 3-11 Basic Setup Description

3.2.3.5.2 Panel Name Setup

Click **Panel Name Setup** on the left-hand pane and the following screen appears on the right-hand pane where the panel name and device name can be specified. Click **Submit** to save your changes or click **Cancel** to cancel your changes. The user is required to log in to the web interface before any changes can be made.

Parameter	Description	Value
Device Name	Specifies the device name.	Default: PMC-592 MCPM
Mains-I Name	Specifies the Mains-I panel name.	Default: MCPM Panel #1
Mains-II Name	Specifies the Mains-II panel name.	Default: MCPM Panel #2

Table 3-12 Panel Name Setup Description

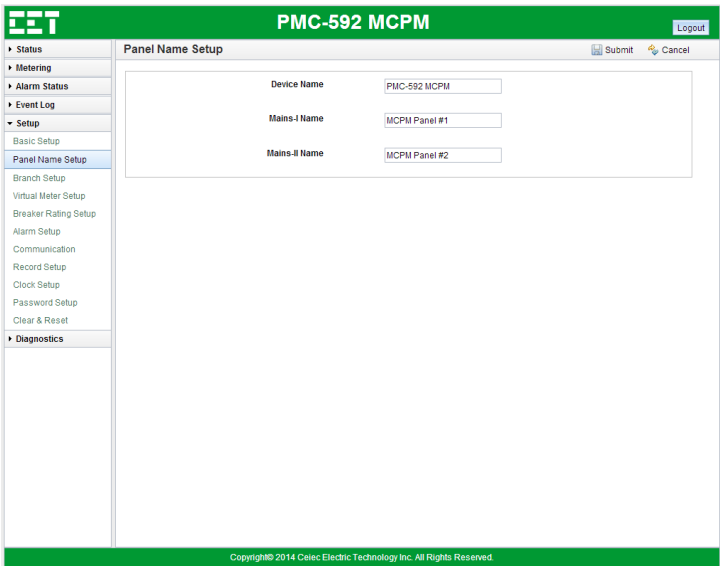


Figure 3-23 Panel Name Setup Interface

3.2.3.5.3 Branch Setup

Click on **Branch Setup** on the left-hand pane and the following screen appears on the right-hand pane where the CT Strips' Installation Mode, Polarity, Installation Direction and Voltage Phase can be changed. Click **Submit** to save your changes or click **Cancel** to cancel your changes. The user is required to log in to the web interface before any changes can be made.

Parameter	Description	Value
CT Strip Installation	Specifies CT Strip's Installation Mode. Please refer to Section **2.4.2 Branch Circuit Wiring and Sub Meter Assignment** for more information.	• Sequential Mode • Cross-over Mode
Polarity	Specifies the CT Strip's Polarity (direction of current flow). The Diagram in the web page will update accordingly based on the selection. Please refer to Section **2.4.2 Branch Circuit Wiring and Sub Meter Assignment** for more information.	• Normal • Reverse
Direction	Specifies the CT Strip's Installation Direction. Please refer to Section **2.4.2 Branch Circuit Wiring and Sub Meter Assignment** for more information.	• Top • Bottom
Batch Setup	Perform a Batch Setup of the corresponding Voltage Phase with each Branch Current for a CT Strip. The Phase column will be set automatically after the selection is made.	• ------(Batch Setup is disabled) • Standard (A/B/C/A…) • Reverse (C/B/A/C…) • 1P3W (A/B/A/B…) • Phase A • Phase B • Phase C

Table 3-13 Branch Setup Description

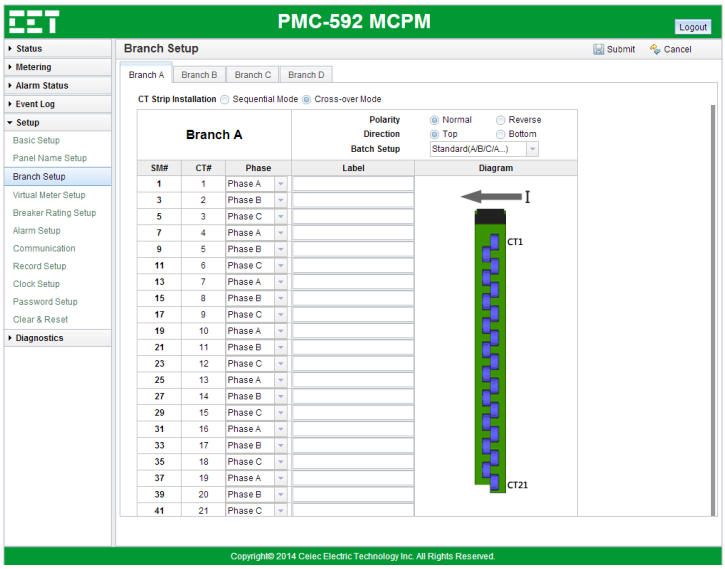


Figure 3-24 Branch Setup Interface

3.2.3.5.4 Virtual Meter Setup

Click **Virtual Meter Setup** on the left-hand pane and the following page appears on the right-hand pane.

1. Select a Virtual Meter by clicking on the VM's radio button, for example VM1.
2. Choose the Sub Meters that are to be aggregated for the selected VM by clicking on the check boxes of the Sub Meters in the **Virtual Meter *x* Settings** area. After each Sub Meter selection, the **Number of Branches** count to the right of the selected **VMx** will be updated immediately.

3. Click **Submit** to save your changes or click **Cancel** to cancel your changes. The user is required to log in to the web interface before any changes can be made.

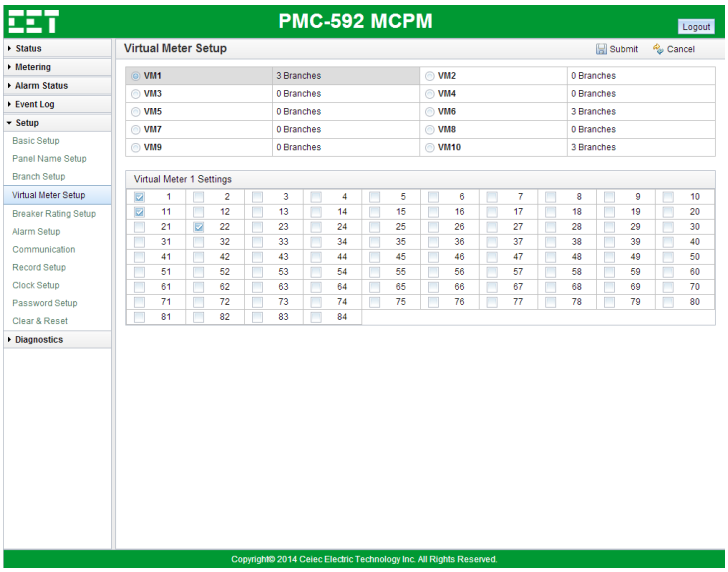


Figure 3-25 Virtual Meter Setup Interface

3.2.3.5.5 Breaker Rating Setup

Click **Breaker Rating Setup** on the left-hand pane and the following screen appears on the right-hand pane where the Breaker Ratings for the Mains and Branches can be configured. The Breaker Ratings are used for calculating the % Loading Factors for the corresponding channels. Batch setup can be performed at the bottom of the page by entering the Breaker Rating for each Branch circuit. Enter the Breaker Ratings based on the actual situation. Click **Submit** to save your changes or click **Cancel** to cancel your changes. The user is required to log in to the web interface before any changes can be made.

Notes:

1. The range of the Mains breaker rating is between 1 and 2000A.
2. The range of the Branch breaker rating is between 1 and 300A.

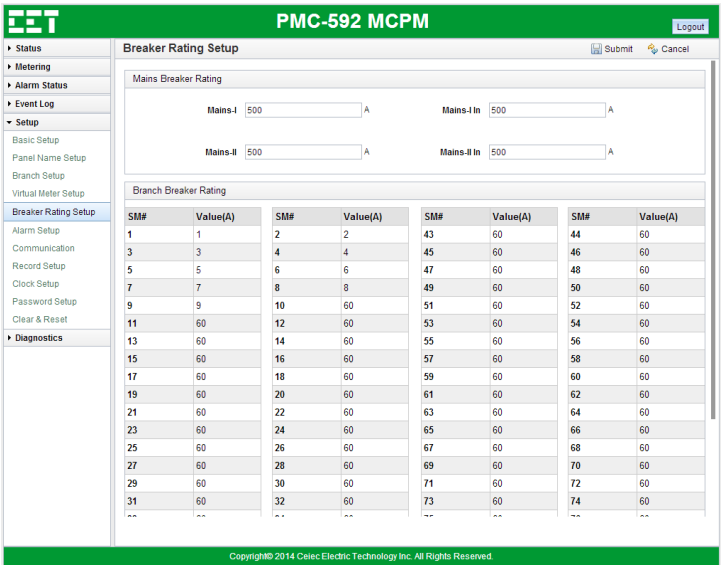


Figure 3-26 Breaker Rating Setup Interface

3.2.3.5.6 Alarm Setup

Click on **Alarm Setup** on the left-hand pane and the following screen appears on the right-hand pane where the Current Alarm, Voltage Alarm, Power Alarm, PQ Alarm, PF Alarm, Temperature Alarm and DI Alarm can be configured. Click **Submit** to save your changes or click **Cancel** to cancel your changes. Please refer to **Section 4.3 Alarm Setpoints** for a more detailed description.

Global Alarm Settings, Current and Current Demand Alarm

Parameter	Description	Value
Global Alarm Setting		
Universal Hysteresis	The hysteresis rate for calculating the Return Threshold for all Alarms	Range: 0 to 10% Default: 2.0%
ON/OFF Threshold	The ON Threshold that applies to all Current channels for switching from the OFF to ON state.	Range: 0 to 10% Default: 5.0%
ON Time	The time delay for the Current ON status.	Range: 0 to 9999s Default: 10
OFF Time	The time delay for the Current OFF status.	Range: 0 to 9999s Default: 30
Current		
Alarm Enable	Specifies if the Current Alarm is enabled for **Mains-I**, **Mains-II** and **Branches**.	Mains-I, Mains-II, Branches Default: Mains-I
Threshold	Specifies the threshold for the following Alarm Levels: **High-High**, **High**, **Low** and **Low-Low**. High-High and High are considered to be Over Setpoints while Low and Low-Low are Under Setpoints.	Range: 0 to 100%
Time Delay	Specifies the time delay for the various alarms.	Range: 0 to 9999s
Current Demand		
Alarm Enable	Specifies if the Current Demand Alarm is enabled.	Mains-I, Mains-II
Threshold	Specifies the threshold for the following Alarm Levels: **High-High**, **High**, **Low** and **Low-Low**. High-High and High are considered to be Over Setpoints while Low and Low-Low are Under Setpoints.	Range: 0 to 100%
Time Delay	Specifies the time delay for the various alarms.	Range: 0 to 9999s

Table 3-14 Current Alarm Description

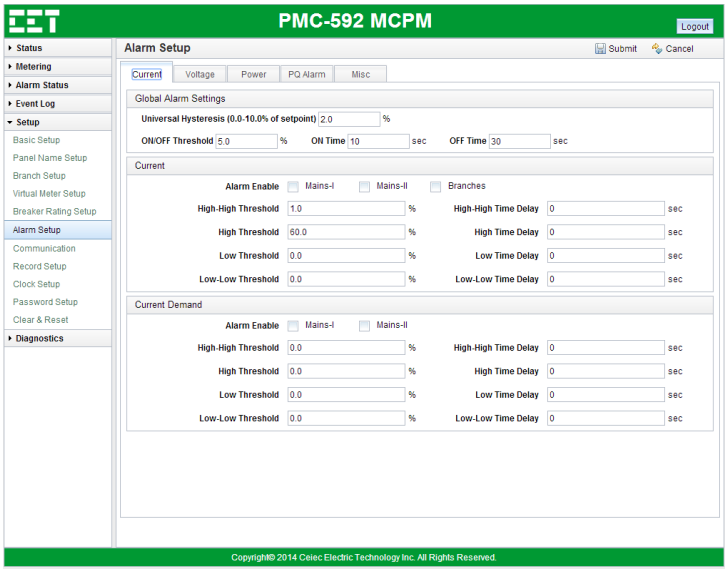


Figure 3-27 Current Alarm Setup Interface

Voltage Alarm

Parameter	Description	Value
Voltage LN		
Alarm Enable	Specifies if the Voltage LN Alarm is enabled.	Voltage-I, Voltage -II
Threshold	Specifies the threshold for the following Alarm Levels: **High** and **Low**.	Range: 0 to 300V
Time Delay	Specifies the time delay for the various alarms.	Range: 0 to 9999s
Voltage LL		
Alarm Enable	Specifies if the Voltage LL Alarm is enabled.	Voltage-I, Voltage -II
Threshold	Specifies the threshold for the following Alarm Levels: **High** and **Low**.	Range: 0 to 500V
Time Delay	Specifies the time delay for the various alarms.	Range: 0 to 9999s
Frequency		
Threshold	Specifies the threshold for the following Alarm Levels: **High** and **Low**.	Range: 45 to 65Hz
Time Delay	Specifies the time delay for the various alarms.	Range: 0 to 9999s

Table 3-15 Voltage Alarm Description

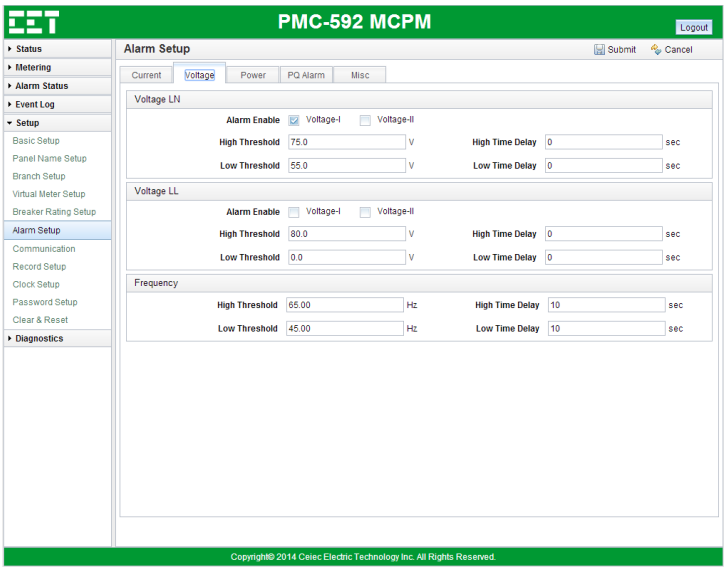


Figure 3-28 Voltage Alarm Setup Interface

Power Alarm

Parameter	Description	Value
Power		
Alarm Enable	Specifies if the Power Alarm is enabled.	Mains-I, Mains -II
Threshold	Specifies the threshold for the following Alarm Levels for kW, kvar and kVA: **High** and **Low**.	Range: 0 to 100%
Time Delay	Specifies the time delay for the various alarms.	Range: 0 to 9999s
Demand		
Alarm Enable	Specifies if the Power Demand Alarm is enabled.	Mains-I, Mains -II
Threshold	Specifies the threshold for the following Alarm Levels for kW, kvar, kVA Demands: **High** and **Low**.	Range: 0 to 100%
Time Delay	Specifies the time delay for the various alarms.	Range: 0 to 9999s

Table 3-16 Power Alarm Description

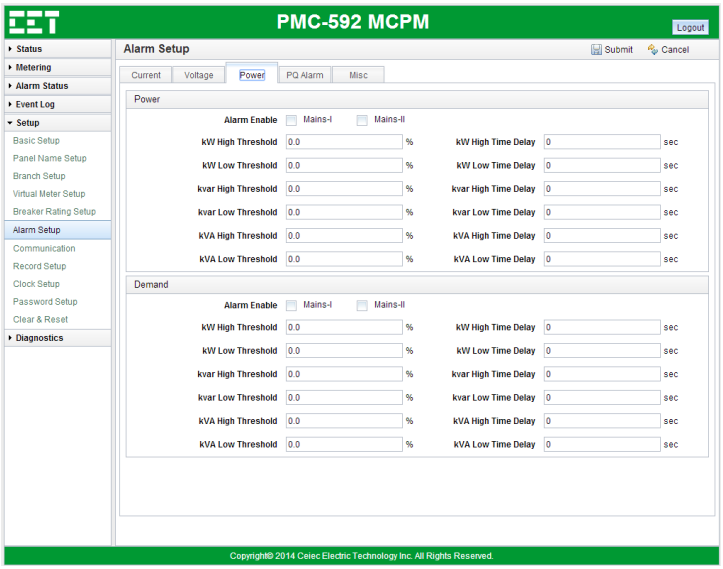


Figure 3-29 Power Alarm Setup Interface

PQ Alarm

Parameter	Description	Value
Voltage Unbalance		
Alarm Enable	Specifies if the Voltage Unbalance Alarm is enabled.	Voltage-I, Voltage-II
Voltage Unb. Threshold	Specifies the threshold for the Voltage Unbalance Alarm.	Range: 0 to 100%
Voltage Unb. Time Delay	Specifies the time delay for the Voltage Unbalance Alarm.	Range: 0 to 9999s
Current Unbalance		
Alarm Enable	Specifies if the Current Unbalance Alarm is enabled.	Current-I, Current-II
Current Unb. Threshold	Specifies the threshold for the Current Unbalance Alarm.	Range: 0 to 100%
Current Unb. Time Delay	Specifies the time delay for the Current Unbalance Alarm.	Range: 0 to 9999s
Harmonics		
Alarm Enable	Specifies if the Harmonics Alarm is enabled.	Current-I, Current-II, Voltage-I, Voltage-II
Threshold	Specifies the threshold for the THD/TOHD/TEHD Alarms.	Range: 0 to 100%
Time Delay	Specifies the time delay for the THD/TOHD/TEHD alarms.	Range: 0 to 9999s

Table 3-17 PQ Alarm Description

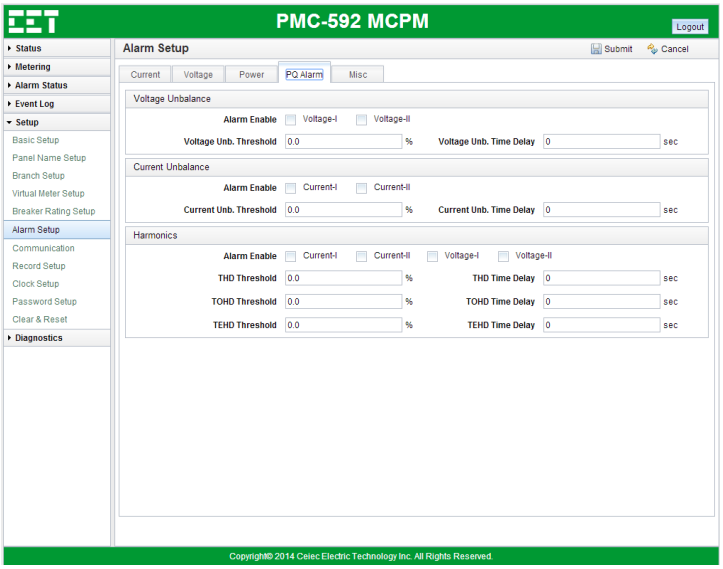


Figure 3-30 PQ Alarm Setup Interface

Misc Alarm

Parameter	Description	Value
PF		
Alarm Enable	Specifies if the Power Factor Alarm is enabled.	Mains-I, Mains-II
Threshold	Specifies the threshold for the following Alarm Levels for PF: **High** and **Low**.	Range: 0.0000 to 1.0000
Time Delay	Specifies the time delay for the various alarms.	Range: 0 to 9999s
Temperature		
Threshold	Specifies the threshold for the following Alarm Levels for TC1 and TC2: **High-High** and **High**.	Range: 0 to 200°C
Time Delay	Specifies the time delay for the various alarms.	Range: 0 to 9999s
DI		
Alarm Mode	Specifies if the DI1 and DI2 Alarms are enabled.	DI1, DI2
Time Delay	Specifies the time delay for the DI1 and DI2 Alarms.	Range: 0 to 9999s

Table 3-18 Misc Alarm Description

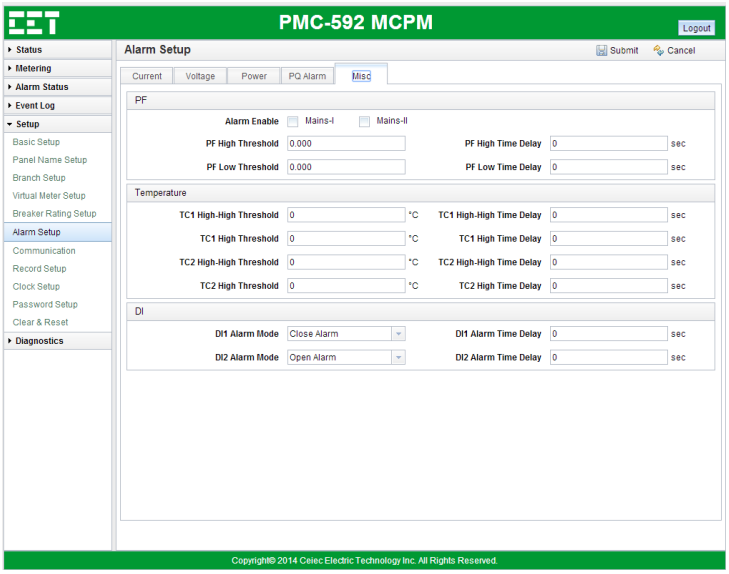


Figure 3-31 Misc Alarm Setup Interface

3.2.3.5.7 Communication Setup

Click on **Communication Setup** on the left-hand pane and the following screen appears on the right-hand pane where the P1/P2/P3 communication parameters, Email settings and SNMP settings can be configured. Click **Submit** to save your changes or click **Cancel** to cancel your changes. The user is required to log in to the web interface before any changes can be made.

Parameter	Description	Value
P1 (COM1) / P2 (COM2)		
Unit ID	Specifies the Unit ID of P1 and P2.	Range: 1 to 247.
Baud rate	Specifies the Baud rate for P1 and P2.	1200, 2400, 4800, 9600, 19200, 38400.
Data Format	Specifies the Data Format for P1 and P2.	8N2, 8O1, 8E1, 8N1, 8O2, 8E2.
P3 (Ethernet)		
IP Address	Specifies the IP address for P3.	Default: 192.168.0.100
Subnet Mask	Specifies the Subnet Mask for P3.	Default: 255.255.255.0
Gateway	Specifies the Gateway Address for P3.	Default: 192.168.0.1
E-mail Settings		
SMTP Server IP	Specifies the of SMTP Server's IP address.	Default: 0.0.0.0
Sender Email	Specifies the Sender's Email Address.	Default: sender@example.com
Sender Email Password	Specifies the Email password.	
Receiver Email	Specifies the Receiver's Email address.	Default: receiver@example.com
SNMP Notification		
Subscribe Event	Specifies which type of SOE events will be sent via SNMP.	• DI Events • DO Events • Alarm Events • Operation Events • Self-Check Events
Receive IP	Specifies the SNMP Client's IP Address that will receive the subscribed SOE events via SNMP.	Default: 0.0.0.0

Table 3-19 Communication Setup Description

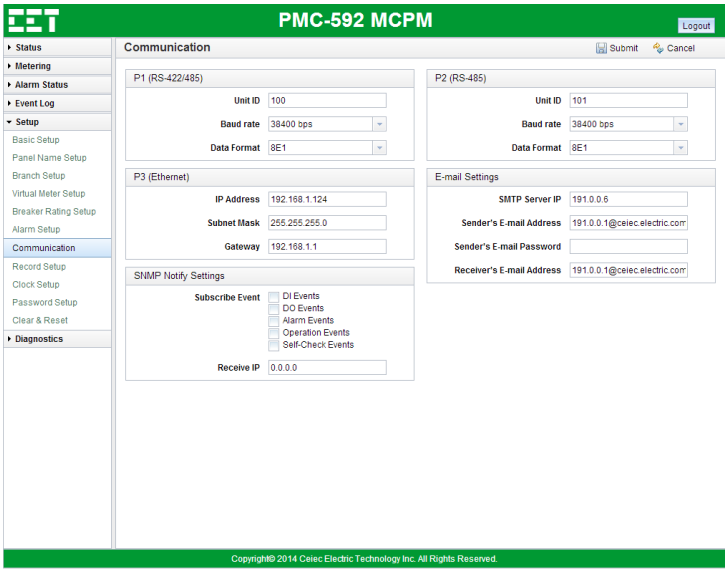


Figure 3-32 Communication Setup Interface

3.2.3.5.8 Record Setup

Click **Record Setup** on the left-hand pane and the following screen appears on the right-hand pane where the Waveform Recorder (WFR) settings and Interval Energy Recorder (IER) settings can be configured. Click **Submit** to save your changes or click **Cancel** to cancel your changes. The user is required to log in to the web interface before any changes can be made. The following table describes each parameter.

Parameter	Description	Value
Waveform Record Setup (WFR)		
Waveform Format	Specifies the WRF Format in # of Samples x # of Cycles	• 64 Samples x 75 Cycles* • 64 Samples x 150 Cycles • 32 Samples x 75 Cycles • 32 Samples x 300 Cycles • 16 Samples x 300 Cycles • 16 Samples x 600 Cycles
Pre-fault Cycles	Specifies the number of pre-fault cycles.	Range: 1 to 10 Cycles Default: 5
Energy Log Setup (Interval Energy Recorder)		
Recording Mode	Specifies the IER's (Interval Energy Recorder) Recording Mode.	• Disabled* • Stop-When-Full • First-In-First-Out
Recording Depth	Specifies the IER's Recording Depth. This would provide a maximum energy recording for 35 days @ 5min, 104 days @ 15min or 417 days @ 60min.	Range: 0 to 10000
Recording Interval	Specifies the IER's Recording Interval.	• 5mins* • 10mins • 15mins • 30mins • 60mins
Start Time	Specifies when to start the IER. This is useful if the user wants to record the energy consumption for a specific period of time in conjunction with the Stop-When-Full Recording Mode.	Format: DD/MM/YYYY HH:MM:SS

*Default

Table 3-20 Record Setup Description

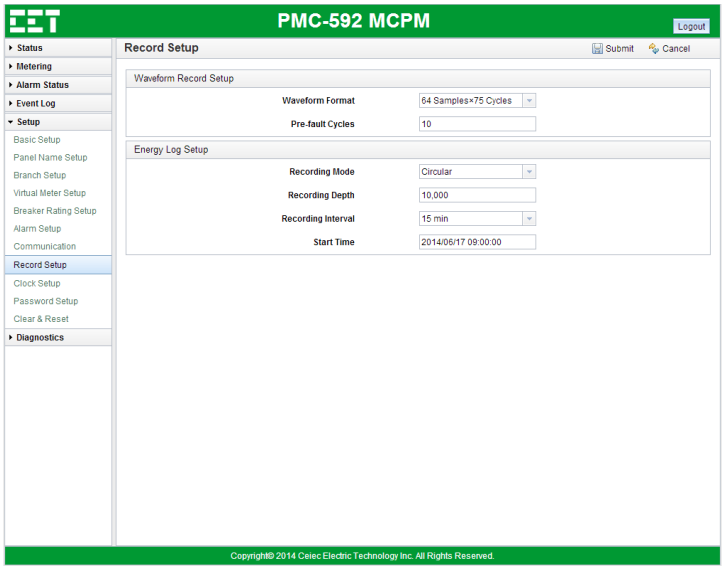


Figure 3-33 Record Setup Interface

3.2.3.5.9 Clock Setup

Click on **Clock Setup** on the left-hand pane and the following screen appears on the right-hand pane where the device time and SNTP Time Sync. mechanism can be configured. The user is required to log in to the web interface before any changes can be made.

Parameter	Description	Value
Device Time		
PC's Date & Time	Check the **Sync with PC** checkbox to synchronize device time with PC time.	N/A
Device Time	Present time on device.	
Device Date	Present date on device.	
Time Zone	Specifies the device's Time Zone.	Default: OMP +08:00
Date Format	Specifies the device's Date Format.	YYYY/MM/DD (Default) MM/DD/YYYY DD/MM/YYYY
SNTP Time Sync.		
SNTP Time Sync	Specifies if SNTP Time Sync. is enabled	Enabled, Disabled.
SNTP Time Sync Period	Specify the SNTP Time Sync. Interval.	10 to 1440 min (Default=60 min)
SNTP Server IP	Specify SNTP Sever IP Address.	Default: 0.0.0.0

Table 3-21 Clock Setup Description

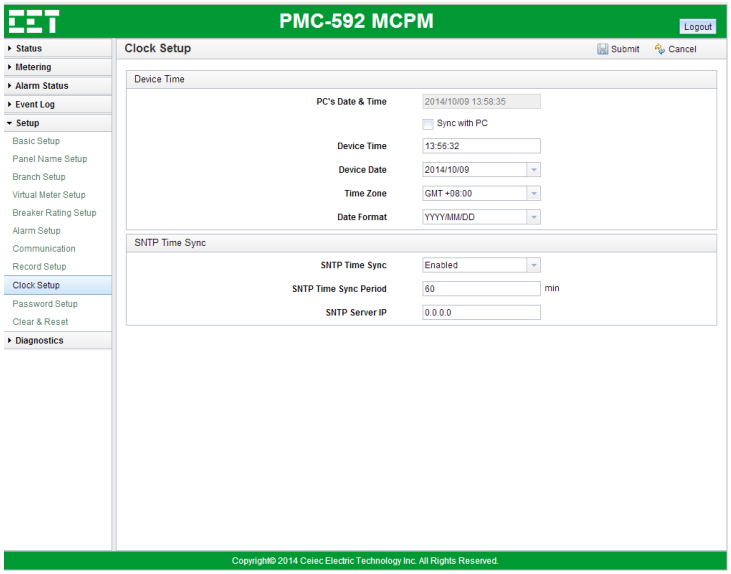


Figure 3-34 Clock Setup Interface

3.2.3.5.10 Password Setup

Choose **Setup > Password Setup** on the left-hand pane and the following screen appears on the right-hand pane.

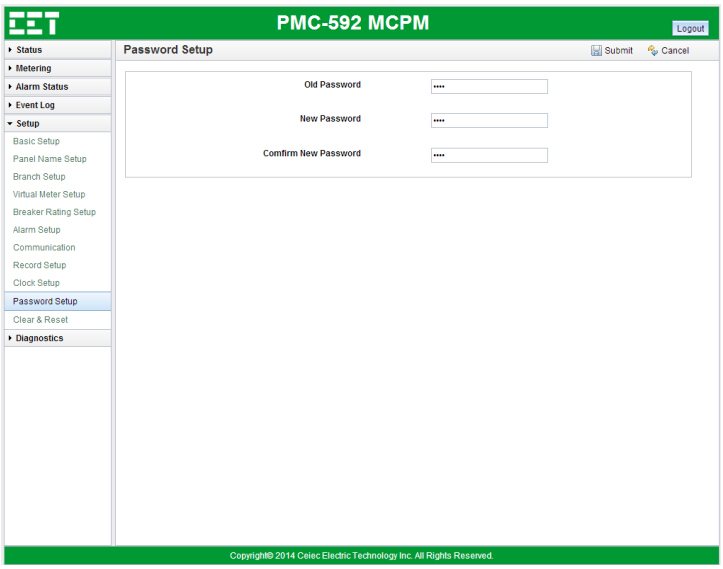


Figure 3-35 Password Setup Interface

1. The user is required to log in to the web interface before any changes can be made.
2. Enter the Old Password, New Password and Confirm New Password.
3. Click **Submit** to save your changes or click **Cancel** to cancel your changes.

3.2.3.5.11 Clear & Reset

Click **Clear & Reset** on the left-hand pane and the following screen appears on the right-hand pane.

1. Click the **Reset** icon on the right-hand column for the specific item and a Confirmation dialog box appears.
2. Click **OK** to confirm or **Cancel** to cancel the **Reset** operation.

Note:

All Alarms, Counters and Logs will be reset via **Reset & Clear All**. Caution should be exercised when taking this action.

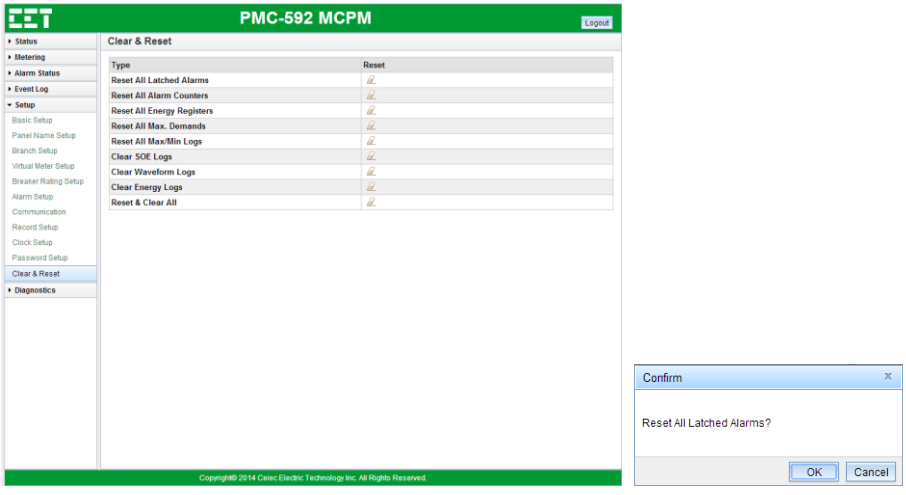


Figure 3-36 Clear & Reset Interface

3.2.3.6 Diagnostics

3.2.3.6.1 Diagnostics

Click **Diagnostics** on the left-hand pane and the following screen appears on the right-hand pane to show the **Overview** and **Diagnostics**.

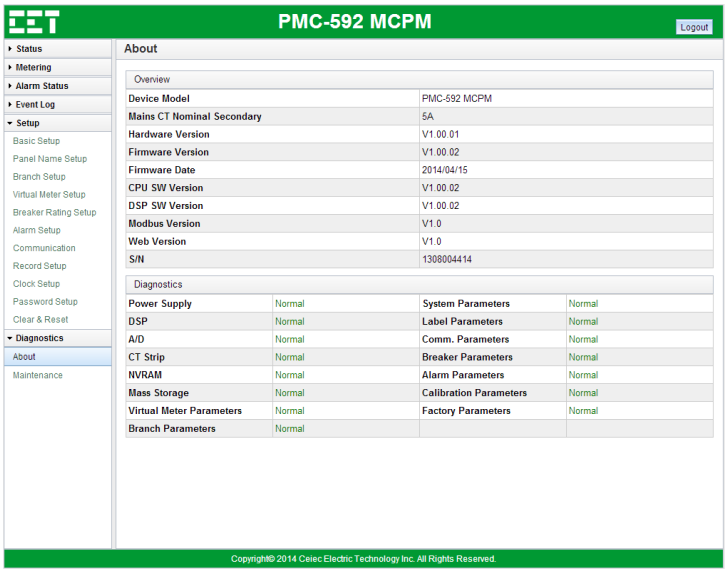


Figure 3-37 Diagnostics Interface

3.2.3.6.2 Maintenance

Click **Maintenance** on the left-hand pane and the following screen appears on the right-hand pane. The table below illustrates each page's function.

Tab	Function
Backup & Restore	Backup or restore the device configuration.
Factory Defaults	Reset the device configuration to Factory Defaults. Internal calibration and any factory-used only parameters would not be reset.
Firmware Upgrade	Perform firmware upgrade.
Misc	Reboot device, Test sending Alarm E-mail, Download MIB file.
Tool	Provide the download link for the Energy Log Viewer tool.

Table 3-22 Maintenance Interface Description

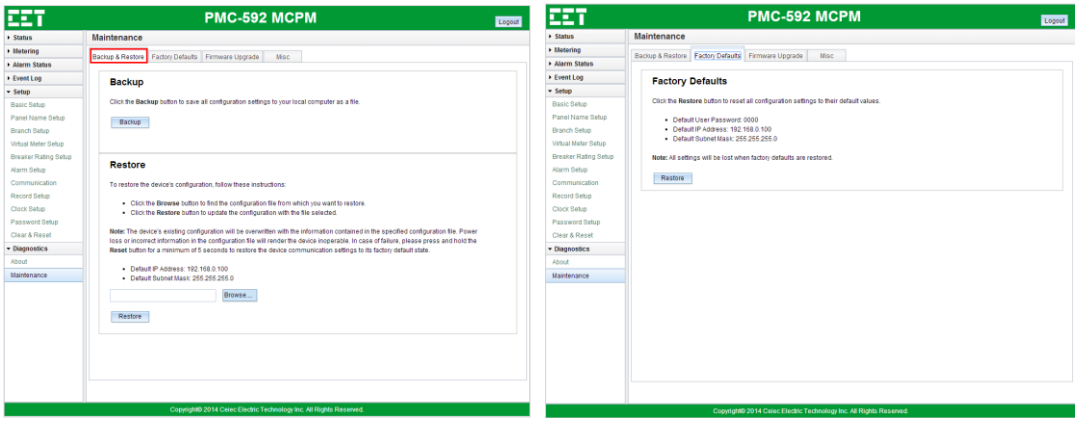


Figure 3-38 Backup & Restore and Factory Defaults Interface

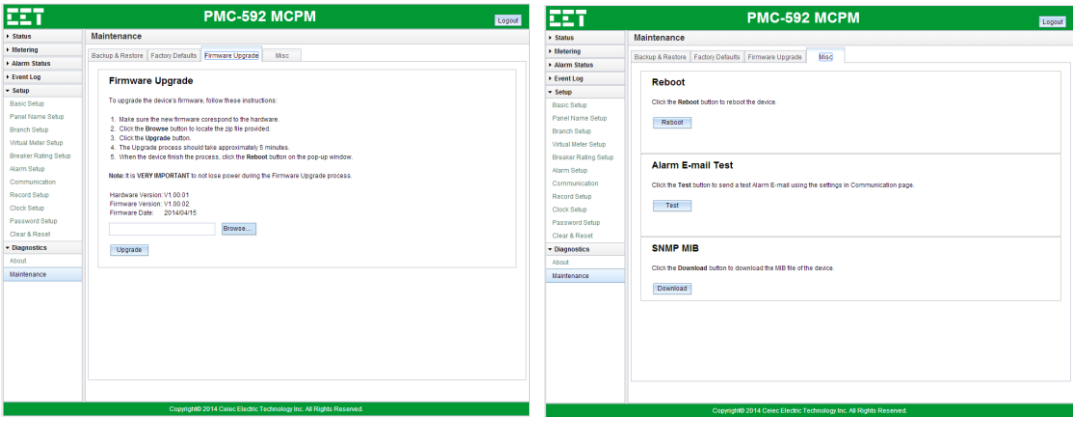


Figure 3-39 Firmware Upgrade and Misc Interface

3.3 HMI Display (Optional)

The PMC-592 may be equipped with an optional touch-screen HMI. The following figure illustrates the Main Display of the HMI.

Figure 3-40 HMI's Main Display

3.3.1 Menu Tree and Display Hierarchy

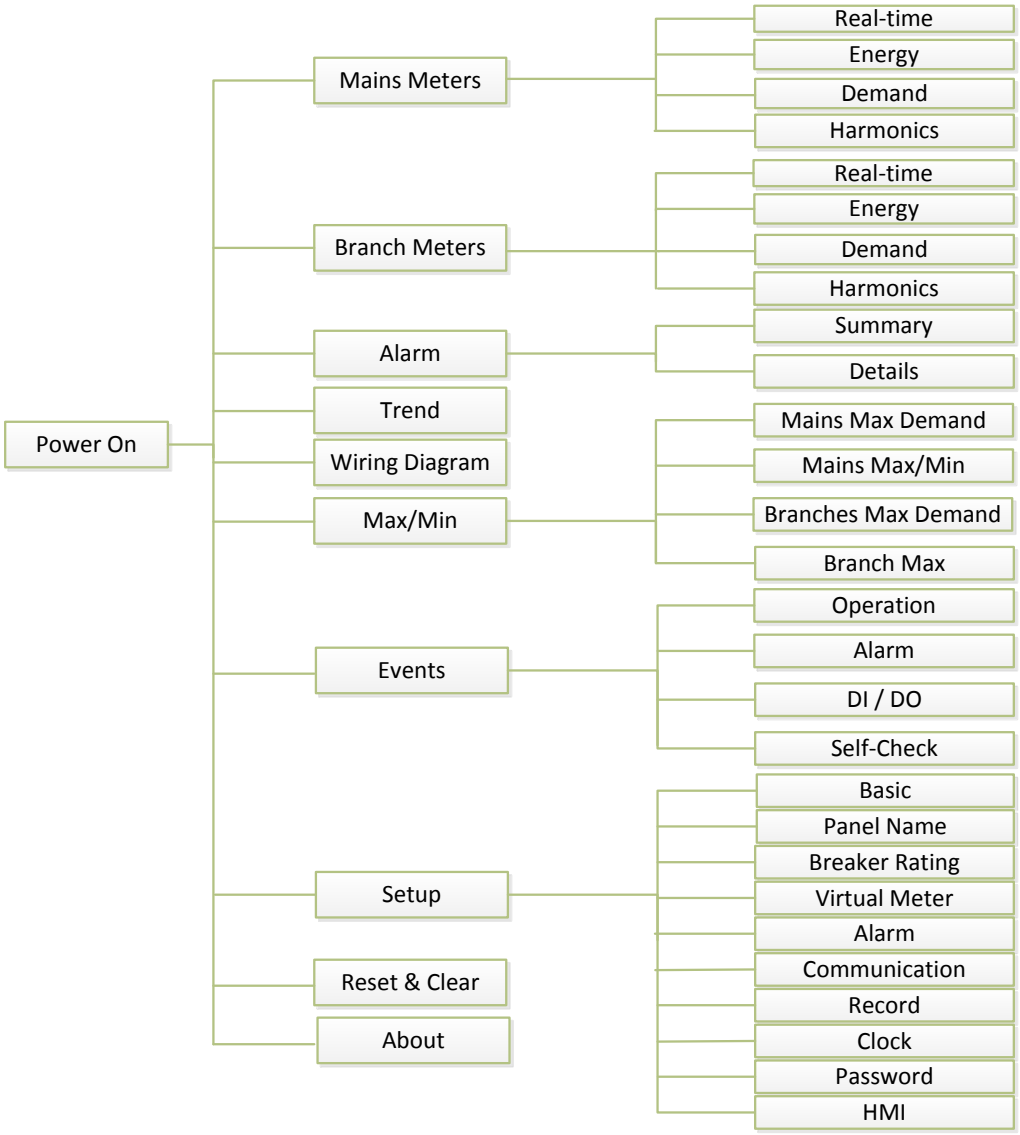


Figure 3-41 Menu Tree

Category **Topic** **Page**

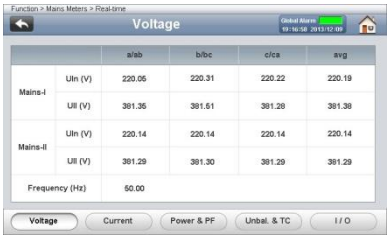
Figure 3-42 Hierarchy of Menu

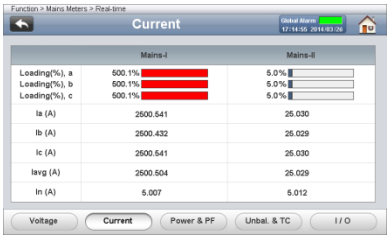
The HMI Display is organized in a hierarchy that consists of **Categories**, **Topics** and **Pages**. There are 10 icons in the **Main Display**, and each icon represents a **Category**. Each **Category** displays a specific type of information and may have one or more **Topics**. Each **Topic** may provide one or more **Pages** of measurement information.

3.3.2 HMI

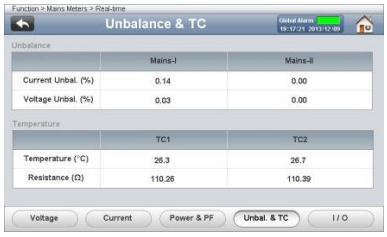
The PMC-592 features an optional touch-screen HMI with an intuitive graphical user interface that makes it extremely simple to operate. Touch an icon in the Main Display page to display the measurement information for a particular **Category**. For example, touch **Mains Meters** to see the available **Topics**, which include **Real-time, Energy/Demand** and **Harmonic**. Touch the **Real-time** icon to display the available **Pages** or sub-menu, which include **Voltage**, **Current**, **Power & PF**, **Unbal & TC** and **IO**. At the **Page** level, there may be other buttons which would allow the user to select the Voltage or Current Phase as well as **Left** and **Right** Arrows to display additional information.

The following table provides an overview of this display hierarchy.

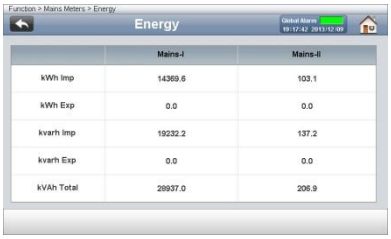
<table>
<tr><th>Category > Topic</th><th colspan="2">Pages</th></tr>
<tr><td rowspan="3">Mains Meter > Real-time</td><td> 

Voltage</td><td> 

Current</td></tr>
<tr><td> 

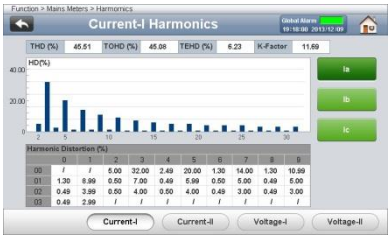
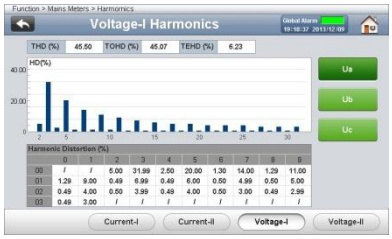
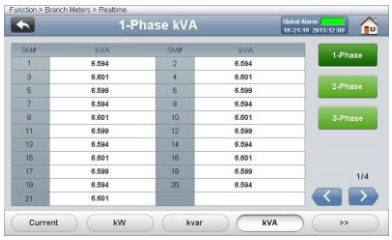
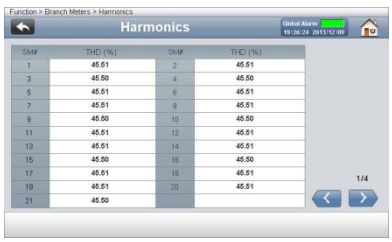
Power & PF</td><td> 

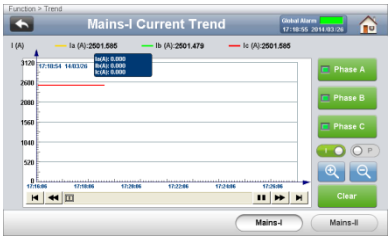
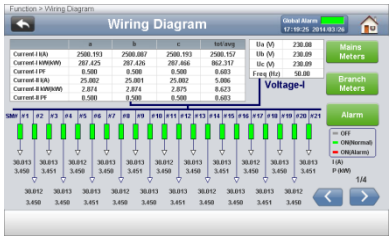
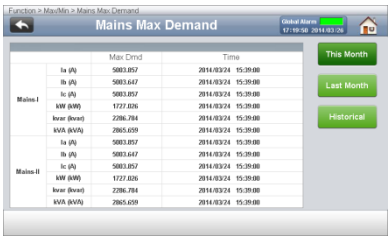
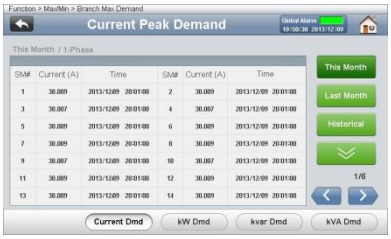
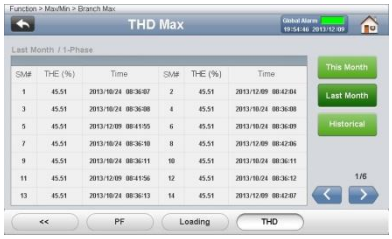
Unbalance & TC</td></tr>
<tr><td colspan="2"> 

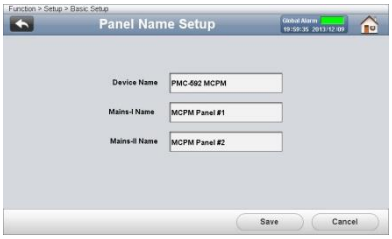
I / O</td></tr>
<tr><td>Mains Meter > Energy/Demand</td><td> 

Energy</td><td> 

Demand</td></tr>
</table>

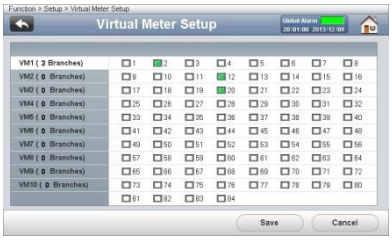
Mains Meter > Harmonic	 **Current**	 **Voltage**
Branch Meters > Realtime	 **Current**	 **kW**
	 **kvar**	 **kVA**
	 **PF**	 **Loading**
Branch Meters > Energy	 **kWh**	 **kvarh**
Branch Meters > Demand/Harmonics	 **Demand**	 **Harmonics**

Alarm	 **Summary**	 **Details**
Trend/Wiring Diagram	 **Trend**	 **Wiring Diagram**
Max/Min	 **Mains Max Demand**	 **Mains Max/Min**
	 **Branch Max Demand**	 **Branch Max**
Events		
Setup	 **Login**	 **Basic Setup**



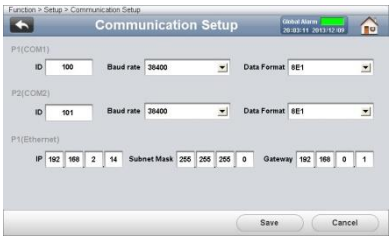
Panel Name Setup

Breaker Rating Setup



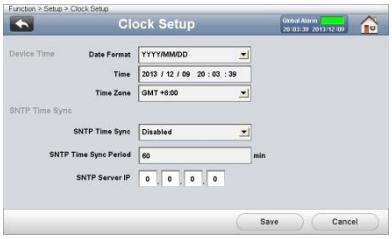
Virtual Meter Setup

Alarm Setup



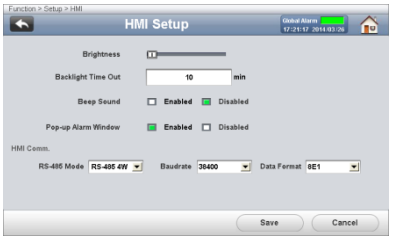
Communication Setup

Record Setup



Clock Setup

Change Password



HMI Setup

Clear & Reset

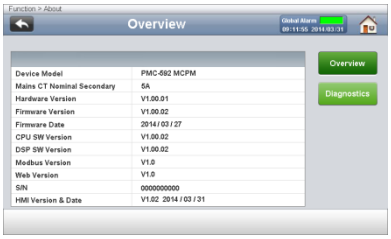
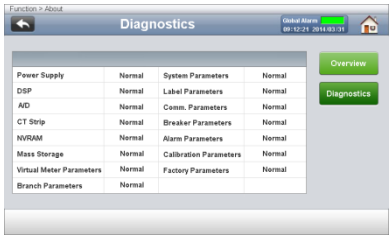
About		
	Overview	**Diagnostics**

Table 3-23 Display Hierarchy

Chapter 4 Applications

4.1 Inputs and Outputs

4.1.1 Digital Inputs

The PMC-592 is equipped with 2 self-excited **Digital Inputs** (**DIs**) that are internally wetted at 24 VDC. Each **DI** has the following setup parameters:

Setup Parameter	Definition	Options
DIx Mode (Reg. # 6018~6019)	The **DI** can ONLY be configured as a Status Input.	0 = Status Input*
DIx Debounce (Reg. # 6016~6017)	Specifies the minimum duration the **DI** must remain in the Active or Inactive state before a DI state change is considered to be valid.	1 to 1000 (ms) (Default = 20ms)

*Default

Table 4-1 Definition for DI Parameters

DIs are typically used for monitoring external status which can help prevent equipment damage, improve maintenance, and track security breaches. The real-time statuses of the DIs are available on the Web Interface, HMI as well as through communications. Changes in DI status are stored as events in the SOE Log in 1 ms resolution. The following figures illustrate how to program a particular DI for Status monitoring via web or HMI.

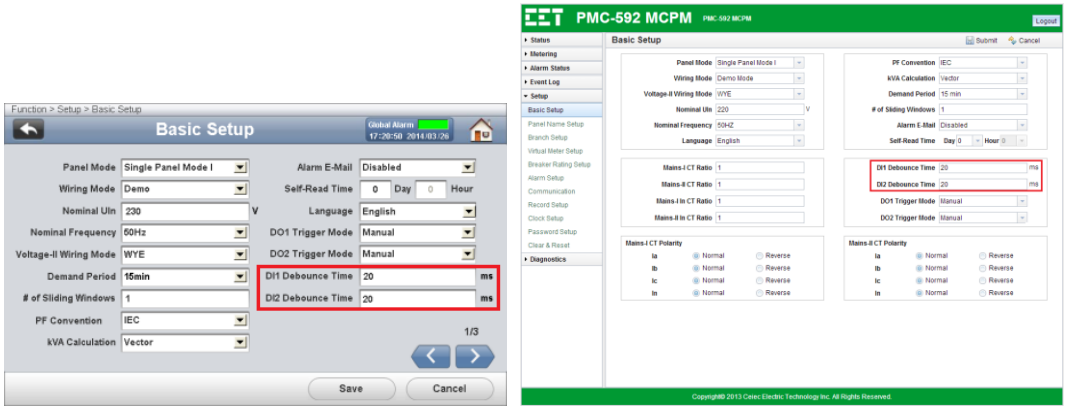


Figure 4-1 Programming DI via HMI and Web

4.1.2 Digital Outputs

DOs are normally used for setpoint alarming, load control, or remote control applications.

DOs on the PMC-592 can be programmed to be triggered by the following options: **Manual**, **Mains-I Instant. Alarm**, **Mains-II Instant. Alarm**, **Mains-I Latched Alarm**, **Mains-II Latched Alarm**, **Global Latched Alarm**, **Global Instant. Alarm**.

The following figures illustrate how to program a particular DO via web or HMI.

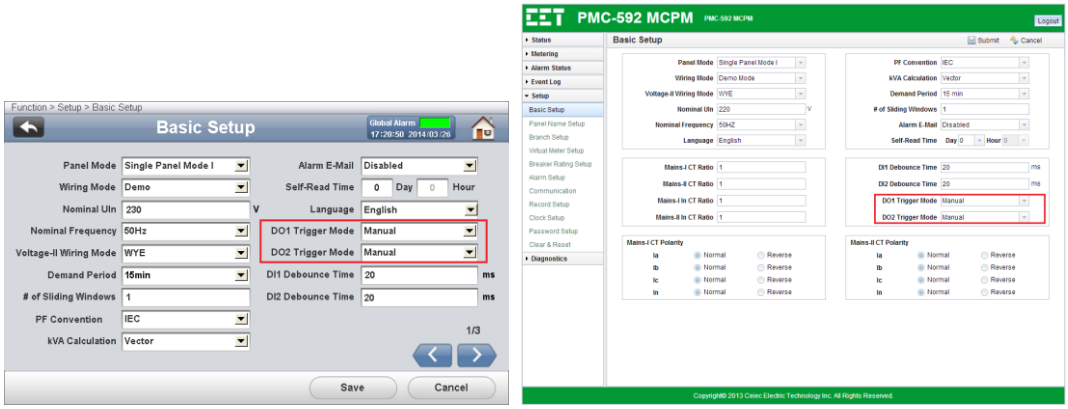


Figure 4-2 Programming DO via HMI and Web

4.2 Power, Energy and Demand

4.2.1 Basic Measurements

The PMC-592 provides the following basic measurements with 1 second update rate:

	Parameter	Phase A	Phase B	Phase C	Total	Average	Neutral
Mains-I/II	VLN	●	●	●	○	●	○
	VLL	●	●	●	○	●	○
	Current	●	●	●	○	●	●
	Loading Factor	●	●	●	○	○	○
	kW	●	●	●	●	○	○
	kvar	●	●	●	●	○	○
	kVA	●	●	●	●	○	○
	PF	●	●	●	●	○	○
	Frequency	●	○	○	○	○	○
TC1/TC2		●					
Branch	Current	●	●	●	○	○	○
	Loading Factor	●	●	●	○	○	○
	kW	●	●	●	●	○	○
	kvar	●	●	●	●	○	○
	kVA	●	●	●	●	○	○
	PF	●	●	●	●	○	○

Table 4-2 Basic Measurement

4.2.2 Energy Measurements

The PMC-592's Energy measurements include active energy (kWh), reactive energy (kvarh) and apparent energy (kVAh) with a resolution of 0.01 and a maximum value of 100,000,000. When the maximum value is reached, it will automatically roll over to zero.

The energy can be reset manually or preset to user-defined values through the HMI or via communications. The PMC-592 provides the following energy measurements:

	kWh Import	kWh Export	kvarh Import	kvarh Export	kVAh Total
Mains-I/II	●	●	●	●	●
Branch	●	○	●	○	●

Table 4-3 Energy Measurements

4.2.3 Demands

Demand is defined as the average power consumption over a fixed interval (usually 15 minutes).

The PMC-592 supports the sliding window demand calculation and has the following setup parameters:

Setup Parameter	Value or Description
# of Sliding Windows (Reg. # 6012)	1 to 15 (Default = 1)
Demand Period (Reg. # 6011)	1/2/3/5/10/15*/30/60(minutes). For example, if the **# of Sliding Windows** is set as 1 and the **Demand Period** is 15, the demand cycle will be 1×15 = 15min. (*Default = 15)
Self-Read Time (Reg. # 6021)	The **Self-Read Time** allows the user to specify the time and day of the month for the Demand Log Self-Read operation. The **Self-Read Time** supports three options: • A zero value means that the Self-Read will take place at 24:00 of the last day of each month. • A non-zero value means that the Self-Read will take place at a specific time and day based on the formula: Self-Read Time = Day * 100 + Hour where 0 ≤ Hour ≤ 23 and 1 ≤ Day ≤ 28. For example, the value 1512 means that the Self-Read will take place at 12:00pm on the 15th day of each month. • A 0xFFFF value will disable the Self-Read operation and replace it with manual operation. A manual reset will cause the Max/Min Log of **This Month** to be transferred to the Max/Min Log of **Last Month** and then reset. The terms **This Month** and **Last Month** will become **Since Last Reset** and **Before Last Reset**.

Table 4-4 Demand Setup Parameters

The PMC-592 provides the following Demand and Max Demand parameters:

Demand and Max Demand Parameters			
Mains-I Ia	Mains-I Ib	Mains-I Ic	-
Mains-I ∑kW	Mains-I ∑kvar	Mains-I ∑kVA	-
Mains-II Ia	Mains-II Ib	Mains-II Ic	-
Mains-II ∑kW	Mains-II ∑kvar	Mains-II ∑kVA	-
1-Ø SM1 I	1-Ø SM2 I	…	1-Ø SM84 I
2-Ø SM1 I	2-Ø SM2 I	…	2-Ø SM42 I
3-Ø SM1 I	3-Ø SM2 I	…	3-Ø SM28 I
1-Ø SM1 kW	1-Ø SM2 kW	…	1-Ø SM84 kW
2-Ø SM1 kW	2-Ø SM2 kW	…	2-Ø SM42 kW
3-Ø SM1 kW	3-Ø SM2 kW	…	3-Ø SM28 kW
1-Ø SM1 kvar	1-Ø SM2 kvar	…	1-Ø SM84 kvar
2-Ø SM1 kvar	2-Ø SM2 kvar	…	2-Ø SM42 kvar
3-Ø SM1 kvar	3-Ø SM2 kvar	…	3-Ø SM28 kvar
1-Ø SM1 kVA	1-Ø SM2 kVA	…	1-Ø SM84 kVA

2-Ø SM1 kVA	2-Ø SM2 kVA	…	2-Ø SM42 kVA
3-Ø SM1 kVA	3-Ø SM2 kVA	…	3-Ø SM28 kVA

Table 4-5 Demand Parameters

Notes:

1) The Mains or SMx Max Demands can be reset manually through communications, the built-in Web Interface or the optional HMI Display.

4.3 Alarm Setpoints

The PMC-592 provides powerful alarming functions for the Mains and Branch Inputs as well as for different parameters. Each Alarm Type has an independent enable switch, which allows the alarms for Mains-I, Mains-II and Branch to be enabled separately as needed. The alarms may also be disabled by setting alarm threshold to 0.

4.3.1 Alarm Status

The PMC-592 supports both the Instantaneous Alarm and Latched Alarm, which are defined below.

Instantaneous Alarm

The status of an Instantaneous Alarm becomes ALARM when the alarm condition is met and is automatically reset to NORMAL when the alarm condition is no longer met. Instantaneous Alarm cannot be reset manually.

Latched Alarm

On the other hand, the status of a Latched Alarm becomes ALARM when the alarm condition is met and will remain in the ALARM state even after the alarm condition is no longer met. The Latched Alarm must be reset manually. However, the Latched Alarm cannot be reset while the alarm condition remains.

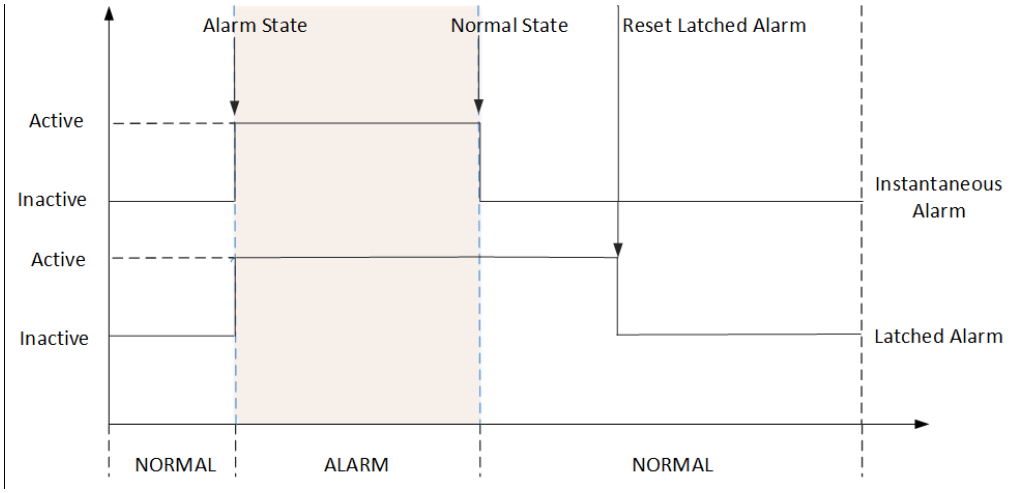


Figure 4-3 Alarm Status

4.3.2 Alarm Counters

Each SM or channel of PMC-592 is equipped with counters which will increment every time a specific alarm condition is met. In addition, the Mains and Global alarm counters are described as following:

Counter Name	Description
Global Alarm Counter	Increment by 1 when any measurement has an alarm

Mains-I Global Alarm Counter	Increment by 1 when any Mains-I measurement has an alarm
Mains-II Global Alarm Counter	Increment by 1 when any Mains-II measurement has an alarm
Current-I Alarm Counter	Increment by 1 when any of the following Mains-I parameters has an alarm: I, I Demand, I Harmonics, I Unbalance
Current-II Alarm Counter	Increment by 1 when any of the following Mains-II parameters has an alarm: I, I Demand, I Harmonics, I Unbalance
Voltage-I Alarm Counter	Increment by 1 when any of the following Mains-I parameters has an alarm: V, V Harmonics, V Unbalance
Voltage-II Alarm Counter	Increment by 1 when any of the following Mains-II parameters has an alarm: V, V Harmonics, V Unbalance
RTD1 Alarm Counter	Increment by 1 when RTD1 has an alarm
RTD2 Alarm Counter	Increment by 1 when RTD2 has an alarm
DI1 Alarm Counter	Increment by 1 when DI1 has an alarm
DI2 Alarm Counter	Increment by 1 when DI2 has an alarm

Table 4-6 Mains and Global Alarm Counter Calculations

4.3.3 Universal Hysteresis and Current ON/OFF Status

The Universal Hysteresis, Current ON Threshold, Current ON Delay and Current OFF Delay are global parameters that are valid for all relevant alarms.

Parameters	Description	Range	Default Value
Universal Hysteresis	The hysteresis rate for calculating the Return Threshold for all Alarms.	0 to 10%	2%
Current ON Threshold	The ON Threshold that applies to all Current channels for switching from the OFF to ON state.	0 to 10%	5%
Current ON Delay	The minimum duration that the Current of a particular channel must exceed the ON Threshold before the Status would switch from OFF to ON.	0 to 9999(s)	10s
Current OFF Delay	The minimum duration that the Current of a particular channel must fall below the OFF Threshold before the Status would switch from ON to OFF.	0 to 9999(s)	30s

Table 4-7 Global Parameters

The Universal Hysteresis is a global parameter that is used to prevent measurement fluctuation around the threshold point from causing an alarm to fluctuate between the Active and Inactive states.

*It should be noted that the **absolute value** of the Alarm Threshold is calculated based on the Breaker Rating parameters.* ***Therefore, it's critical to set the Breaker Rating correctly for each Current channel for the Current Alarms to work properly.***

| Channel Alarm Threshold | = Channel's Breaker Rating x Alarm Threshold (%)

For Current On, High and High-High Alarms, which are conceptually similar to Over Setpoint:

Return Threshold = Alarm Threshold x (1 – Universal Hysteresis)

For Low and Low-Low Alarms, which are conceptually similar to Under Setpoint:

Return Threshold = Alarm Threshold x (1 + Universal Hysteresis)

The PMC-592 provides the ON/OFF status for each Current channel to indicate whether the channel is ON (Loaded) or OFF (No Load). If the channel status is OFF, it means that the channel has no load and would prevent the Low and Low-Low alarms from activating.

The following figures illustrate the logic diagram of the Current ON/OFF status, respectively.

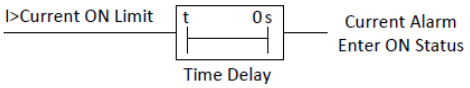


Figure 4-4 Current ON Logic Diagram

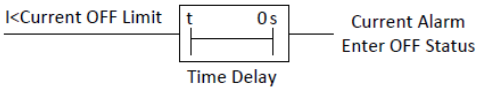


Figure 4-5 Current OFF Logic Diagram

Where

OFF Threshold = On Threshold X (1 – Universal Hysteresis)

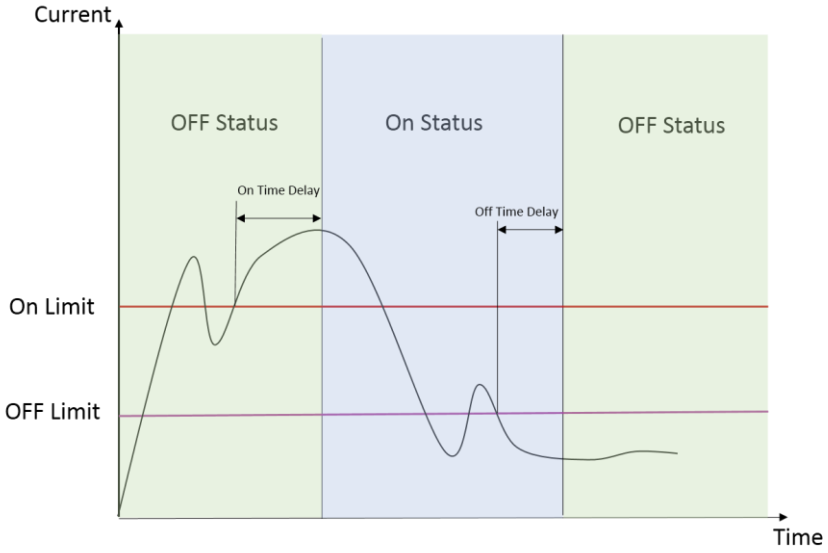


Figure 4-6 Current ON/OFF Status

4.3.4 Current Alarms

PMC-592 provides four Current alarm levels (High-High, High, Low, Low-Low) for the Mains and Branch Currents as well as the associated Current Demands with Time Delay parameters.

*It should be noted that the **absolute value** of the Alarm Threshold is calculated based on the Breaker Rating parameters.* ***Therefore, it's critical to set the Breaker Rating correctly for each Current channel for the Current Alarms to work properly.***

| Channel Alarm Threshold | = Channel's Breaker Rating x Alarm Threshold (%)

The following table illustrates the Current Alarm parameters.

Parameters	Description	Range/Option
Current Alarm Enable	Bit 0 = Mains-I Bit 1 = Mains-II Bit 2 = Branch Bits 3 - 15 = Reserved	0* = Disable 1 = Enable
Current HH Alarm Threshold (%)	Current HH Alarm Limit	0 to 100%, 80%*
Current HH Alarm Time Delay	Current HH Alarm Time Delay	0 to 9999(s), 10s*
Current H Alarm Threshold (%)	Current H Alarm Limit	0 to 100%, 60%*
Current H Alarm Time Delay	Current H Alarm Time Delay	0 to 9999(s), 10s*

Current L Alarm Threshold (%)	Current L Alarm Limit	0* to 100%
Current L Alarm Time Delay	Current L Alarm Time Delay	0* to 9999(s)
Current LL Alarm Threshold (%)	Current LL Alarm Limit	0* to 100%
Current LL Alarm Time Delay	Current LL Alarm Time Delay	0* to 9999(s)
Current Demand Alarm Enable	Bit 0 = Mains-I Bit 1 = Mains-II Bits 2 - 15 = Reserved	0* = Disable 1 = Enable
Current Demand HH Alarm Threshold (%)	Current Demand HH Alarm Limit	0* to 100%
Current Demand HH Alarm Time Delay	Current Demand HH Alarm Time Delay	0* to 9999(s)
Current Demand H Alarm Threshold (%)	Current Demand H Alarm Limit	0* to 100%
Current Demand H Alarm Time Delay	Current Demand H Alarm Time Delay	0* to 9999(s)
Current Demand L Alarm Threshold (%)	Current Demand L Alarm Limit	0* to 100%
Current Demand L Alarm Time Delay	Current Demand L Alarm Time Delay	0* to 9999(s)
Current Demand LL Alarm Threshold (%)	Demand LL Alarm Limit	0* to 100%
Current Demand LL Alarm Time Delay	Current Demand LL Alarm Time Delay	0* to 9999(s)

*default

Table 4-8 Current Alarm Parameters

The logic diagram of the Current HH Alarm is illustrated in Figure 4-7.

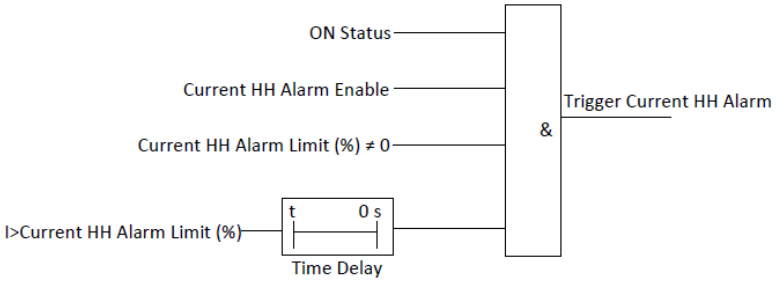


Figure 4-7 Current HH Alarm Logic Diagram

The logic diagram of the Current H Alarm is illustrated in Figure 4-8.

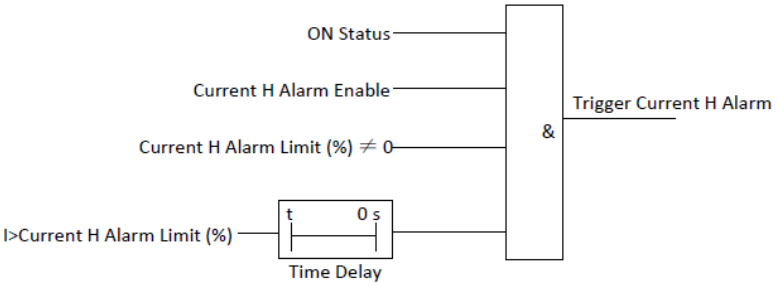


Figure 4-8 Current H Alarm Logic Diagram

The logic diagram of Current L Alarm is illustrated in Figure 4-9.

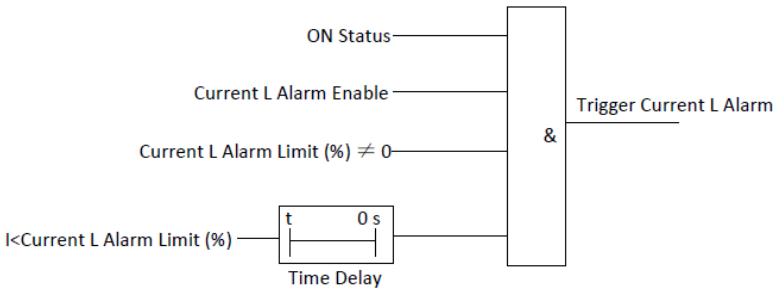


Figure 4-9 Current L Alarm Logic Diagram

The logic diagram of the Current LL Alarm is illustrated in Figure 4-10.

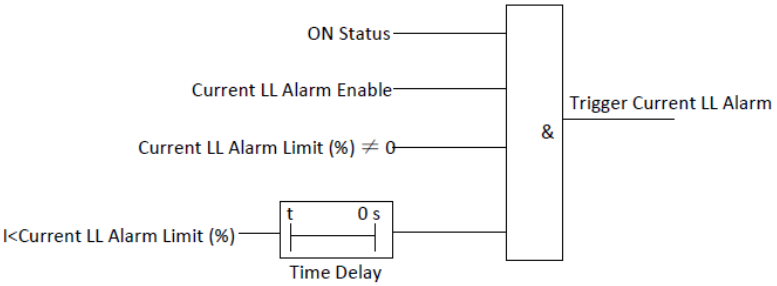


Figure 4-10 Current LL Alarm Logic Diagram

4.3.5 Voltage Alarm

PMC-592 provides the **Voltage Alarm On/OFF** status as well as two Voltage Alarm levels (High and Low) for the Mains VLN and VLL. The Voltage H/L Alarms will only be evaluated if it's determined that the **Voltage Alarm** status is ON.

*It should be noted that the **absolute value** of the **Voltage Alarm On/OFF Threshold** is calculated based on the **Nominal Uln Voltage** parameter.* ***Therefore, it's critical to set the Nominal Uln Voltage correctly for the Voltage Alarm ON/OFF to work properly.***

Voltage Alarm ON Threshold = Nominal Uln Voltage x 10%

Voltage Alarm OFF Threshold = Voltage ON Threshold x (1 – Universal Hysteresis)

The following table illustrates the Voltage Alarm parameters.

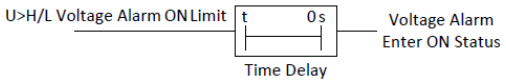
Parameters	Description	Range/Option
VLN Alarm Enable	Bit 0 = Mains-I Bit 1 = Mains-II Bits 2 - 15 = Reserved	0* = Disable 1 = Enable
VLN H Alarm Threshold	VLN H Alarm Limit	0* to 300V
VLN H Alarm Time Delay	VLN H Alarm Time Delay	0* to 9999(s)
VLN L Alarm Threshold	VLN L Alarm Limit	0* to 300V
VLN L Alarm Time Delay	VLN L Alarm Time Delay	0* to 9999(s)
VLL Alarm Enable	Bit 0 = Mains-I Bit 1 = Mains-II Bits 2 - 15 = Reserved	0* = Disable 1 = Enable
VLL H Alarm Threshold	VLL H Alarm Limit	0* to 500V
VLL H Alarm Time Delay	VLL H Alarm Time Delay	0* to 9999(s)
VLL L Alarm Threshold	VLL L Alarm Limit	0* to 500V

VLL L Alarm Time Delay	VLL L Alarm Time Delay	0* to 9999(s)

*default

Table 4-9 Voltage Alarm Parameters

The following figures illustrate the logic diagram of the Voltage Alarm ON/OFF status, respectively.



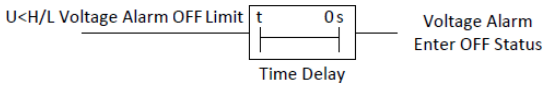


Figure 4-11 Voltage Alarm ON Logic Diagram **Figure 4-12 Voltage Alarm OFF Logic Diagram**

The logic diagram of Voltage H Alarm is illustrated in Figure 4-13.

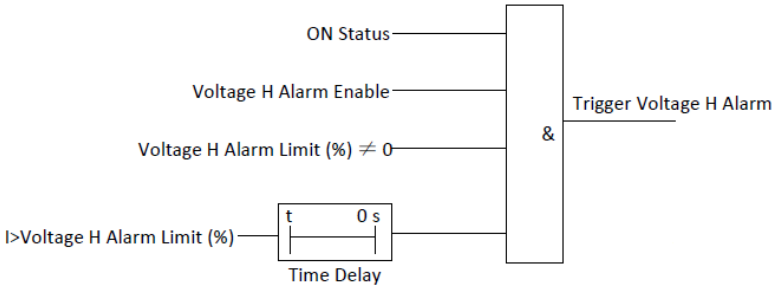


Figure 4-13 Voltage H Alarm Logic Diagram

The logic diagram of Voltage L Alarm is illustrated in Figure 4-14.

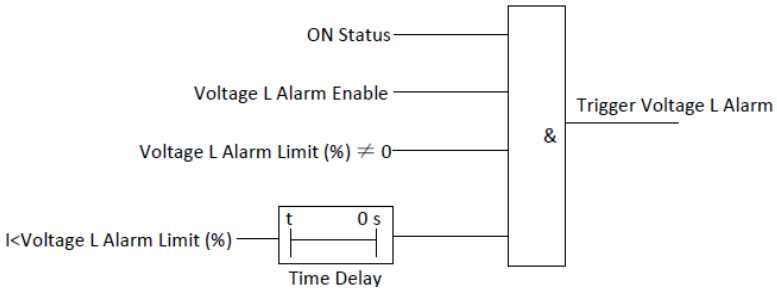


Figure 4-14 Voltage L Alarm Logic Diagram

4.3.6 Power and Power Factor Alarms

PMC-592 provides the **Power Alarm On/OFF** status as well as two Power Alarm levels (High and Low) for the Mains. The Power H/L Alarms will only be evaluated if it's determined that the **Power Alarm** status is ON. The Power and Power Factor Alarms only apply to the Mains Inputs.

*It should be noted that the **absolute value** of the **Power Alarm On/OFF Threshold** is calculated based on the **Nominal Uln Voltage** and **Breaker Rating** parameters.* ***Therefore, it's critical to set these parameters correctly for the Power Alarm ON/OFF and other Power Alarms to work properly.***

Power ON Threshold = (Breaker Rating x Nominal Uln Voltage x 3) x Current ON Threshold

Power OFF Threshold = Power ON Threshold x (1 – Universal Hysteresis)

Parameters	Description	Range/Option
Power Alarm Enable	Bit 0 = Mains-I Bit 1 = Mains-II	0* = Disable 1 = Enable

	Bits 2 - 15 = Reserved	
kW Total H Alarm Threshold (%)	kW Total H Alarm Limit	0* to 100%
kW Total H Alarm Time Delay	kW Total H Alarm Time Delay	0* to 9999(s)
kW Total L Alarm Threshold	kW Total L Alarm Limit	0* to 100%
kW Total L Alarm Time Delay	kW Total L Alarm Time Delay	0* to 9999(s)
kvar Total H Alarm Threshold (%)	kvar Total H Alarm Limit	0* to 100%
kvar Total H Alarm Time Delay	kvar Total H Alarm Time Delay	0* to 9999(s)
kvar Total L Alarm Threshold	kvar Total L Alarm Limit	0* to 100%
kvar Total L Alarm Time Delay	kvar Total L Alarm Time Delay	0* to 9999(s)
kVA Total H Alarm Threshold (%)	kVA Total H Alarm Limit	0* to 100%
kVA Total H Alarm Time Delay	kVA Total H Alarm Time Delay	0* to 9999(s)
kVA Total L Alarm Threshold	kVA Total L Alarm Limit	0* to 100%
kVA Total L Alarm Time Delay	kVA Total L Alarm Time Delay	0* to 9999(s)
PF Total Alarm Enable	Bit 0 = Mains-I Bit 1 = Mains-II Bits 2 - 15 = Reserved	0* = Disable 1 = Enable
PF Total H Alarm Threshold (%)	PF Total H Alarm Limit	0* to 100%
PF Total H Alarm Time Delay	PF Total H Alarm Time Delay	0* to 9999(s)
PF Total L Alarm Threshold	PF Total L Alarm Limit	0* to 100%
PF Total L Alarm Time Delay	PF Total L Alarm Time Delay	0* to 9999(s)
Power Demand Alarm Enable	Bit 0 = Mains-I Bit 1 = Mains-II Bits 2 - 15 = Reserved	0* = Disable 1 = Enable
kW Total Demand H Alarm Threshold (%)	kW Total Demand H Alarm Limit	0* to 100%
kW Total Demand H Alarm Time Delay	kW Total Demand H Alarm Time Delay	0* to 9999(s)
kW Total Demand L Alarm Threshold	trigger kW Total Demand L Alarm Limit	0* to 100%
kW Total Demand L Alarm Time Delay	kW Total Demand L Alarm Time Delay	0* to 9999(s)
kvar Total Demand H Alarm Threshold (%)	kvar Total Demand H Alarm Limit	0* to 100%
kvar Total Demand H Alarm Time Delay	kvar Total Demand H Alarm Time Delay	0* to 9999(s)
kvar Total Demand L Alarm Threshold	kvar Total Demand L Alarm Limit	0* to 100%
kvar Total Demand L Alarm Time Delay	kvar Total Demand L Alarm Time Delay	0* to 9999(s)
kVA Total Demand H Alarm Threshold (%)	kVA Total Demand H Alarm Limit	0* to 100%
kVA Total Demand H Alarm Time Delay	kVA Total Demand H Alarm Time Delay	0* to 9999(s)
kVA Total Demand L Alarm Threshold	kVA Total Demand L Alarm Limit	0* to 100%
kVA Total Demand L Alarm Time Delay	kVA Total Demand L Alarm Time Delay	0* to 9999(s)

*default

Table 4-10 Power Alarm Parameters

The following figures illustrate the logic diagrams of the Power Alarm On/OFF, respectively.

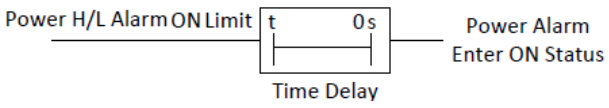


Figure 4-15 Power Alarm ON Logic Diagram

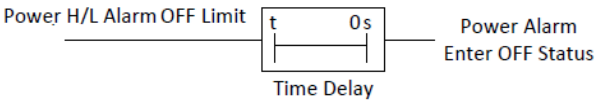


Figure 4-16 Power Alarm OFF Logic Diagram

The logic diagram of Power H Alarm is illustrated in Figure 4-17.

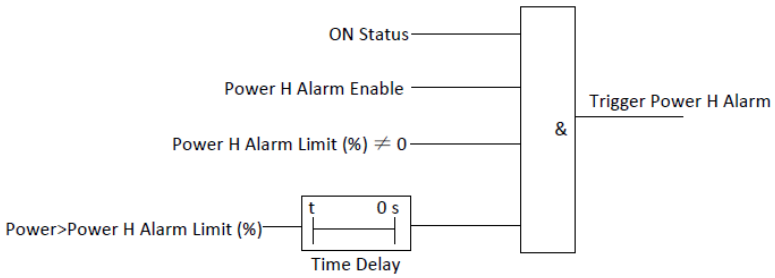


Figure 4-17 Power H Alarm Logic Diagram

The logic diagram of Power L Alarm is illustrated in Figure 4-18.

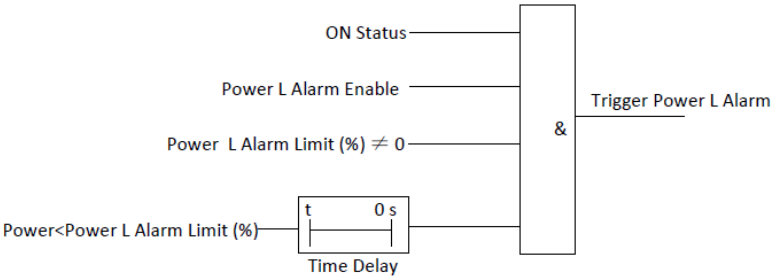


Figure 4-18 Power L Alarm Logic Diagram

The logic diagram of PF H Alarm is illustrated in Figure 4-19.

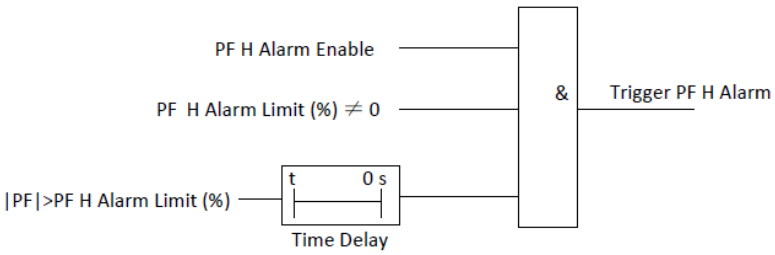


Figure 4-19 PF H Alarm Logic Diagram

The logic diagram of PF L Alarm is illustrated in Figure 4-20.

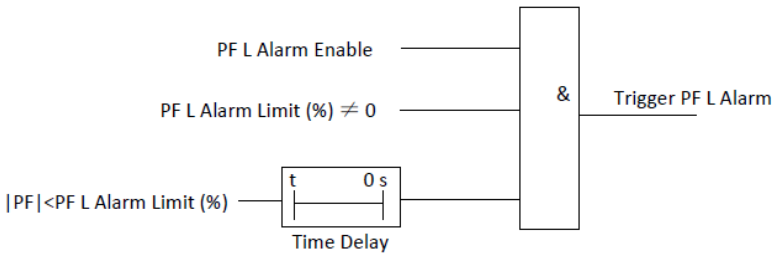


Figure 4-20 PF L Alarm Logic Diagram

4.3.7 Frequency Alarm

Since PMC-592 measures its frequency based on Va of Mains-I only, the Frequency Alarm is activated when Mains-I Phase A Voltage Alarm status is ON.

The FREQ H/L Alarm Return Thresholds are illustrated below:

FREQ H Alarm Return Threshold = FREQ H Alarm Threshold – 0.1Hz

FREQ L Alarm Return Threshold = FREQ L Alarm Threshold + 0.1Hz

The following table illustrates the Frequency Alarm parameters.

Parameters	Description	Range
FREQ H Alarm Threshold	FREQ H Alarm Limit	45 to 65Hz*
FREQ H Alarm D Time Delay	FREQ H Alarm Time Delay	0 to 9999(s), 10s*
FREQ L Alarm Threshold	FREQ L Alarm Limit	45* to 65Hz
FREQ L Alarm Time Delay	FREQ L Alarm Time Delay	0 to 9999(s), 10s*

*default

Table 4-11 Frequency Alarm Parameters

The logic diagram of FREQ H Alarm is illustrated in Figure 4-21.

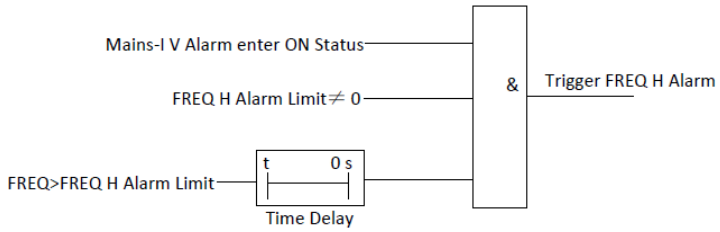


Figure 4-21 FREQ H Alarm Logic Diagram

The logic diagram of FREQ L Alarm is illustrated in Figure 4-22.

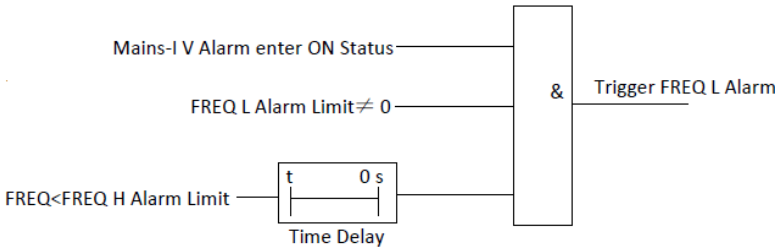


Figure 4-22 FREQ L Alarm Logic Diagram

4.3.8 Unbalance Alarm

The following table illustrates the Unbalance Alarm parameters.

Parameters	Description	Range
I Unb. Alarm Enable	Bit 0 = Current-I Bit 1 = Current-II Bits 2 - 15 = Reserved	0* = Disable 1 = Enable
I Unb. Alarm Threshold (%)	Current Unb. Alarm Limit	0* to 100%
I Unb. Alarm Time Delay	Current Unb. Alarm Time Delay	0* to 9999(s)
V Unb. Alarm Enable	Bit 0 = Voltage-I Bit 1 = Voltage-II	0* = Disable 1 = Enable

	Bits 2 - 15 = Reserved	
V Unb. Alarm Threshold (%)	Voltage Unb. Alarm Limit	0* to 100%
V Unb. Alarm Time Delay	Voltage Unb. Alarm Time Delay	0* to 9999(s)

*default

Table 4-12 Unbalance Alarm Parameters

The logic diagram of Unbalance Alarm is illustrated in Figure 4-23.

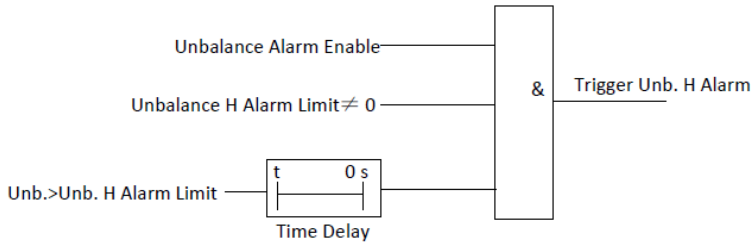


Figure 4-23 Unbalance Alarm Logic Diagram

4.3.9 Harmonic Distortion Alarm

The following table illustrates the Harmonic Distortion Alarm parameters.

Parameters	Description	Range
Harmonic Alarm Enable	Bit 0 = Current-I Bit 1 = Current-II Bit 2 = Voltage-I Bit 3 = Voltage –II Bits 4 - 15 = Reserved	0* = Disable 1 = Enable
THD Alarm Threshold (%)	THD Alarm Limit	0* to 100%
THD Alarm Time Delay	THD Alarm Time Delay	0* to 9999(s)
TOHD Alarm Threshold (%)	TOHD Alarm Limit	0* to 100%
TOHD Alarm Time Delay	TOHD Alarm Time Delay	0* to 9999(s)
TEHD Alarm Threshold (%)	TEHD Alarm Limit	0* to 100%
TEHD Alarm D Time delay	TEHD Alarm Time Delay	0* to 9999(s)

*default

Table 4-13 Harmonic Distortion Alarm Parameters

The logic diagram of Harmonic Distortion Alarm is illustrated in Figure 4-24.

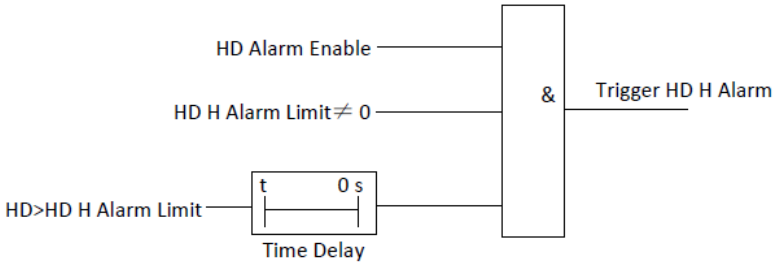


Figure 4-24 Harmonic Distortion Alarm Logic Diagram

4.3.10 Temperature Alarm

The following table illustrates the Temperature Alarm parameters.

Parameters	Description	Range
RTD1 HH Alarm Threshold	RTD1 Temp. HH Alarm Limit	0* to 200°C
RTD1 HH Alarm Time Delay	RTD1 HH Alarm Time Delay	0* to 9999(s)

RTD1 H Alarm Threshold	RTD1 Temp. H Alarm Limit	0* to 200°C
RTD1 H Alarm Time Delay	RTD1 H Alarm Time Delay	0* to 9999(s)
RTD2 HH Alarm Threshold	RTD2 Temp. HH Alarm Limit	0* to 200°C
RTD2 HH Alarm Time Delay	RTD2 HH Alarm Time Delay	0* to 9999(s)
RTD2 H Alarm Threshold	RTD2 Temp. H Alarm Limit	0* to 200°C
RTD2 H Alarm Time Delay	RTD2 H Alarm Time Delay	0* to 9999(s)

*default

Table 4-14 Temperature Alarm Parameters

The logic diagram of Temperature HH Alarm is illustrated in Figure 4-25.

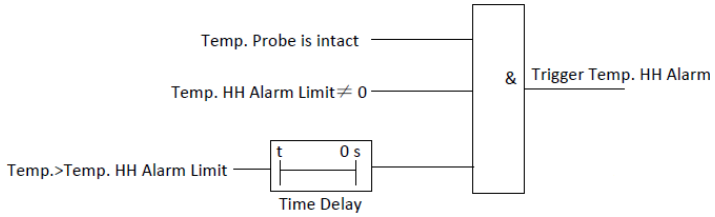


Figure 4-25 Temperature HH Alarm Logic Diagram

The logic diagram of Temperature H Alarm is illustrated in Figure 4-26.

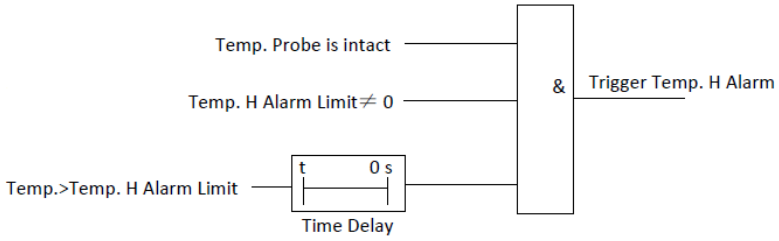


Figure 4-26 Temperature H Alarm Logic Diagram

4.3.11 DI Alarm

The following table illustrates the DI Alarm parameters.

Parameters	Description	Range/Option
DI1 Alarm Type	Disable / DI1 Closed Trigger / DI1 Open Trigger	Disable
DI1 Alarm Time Delay	DI1 Alarm Time Delay	0 to 9999(s)
DI2 Alarm Type	Disable / DI2 Closed Trigger / DI2 Open Trigger	Disable
DI2 Alarm Time Delay	DI2 Alarm Time Delay	0 to 9999(s)

Table 4-15 DI Alarm Parameters

The logic diagram of DI Closed Alarm is illustrated in Figure 4-27.

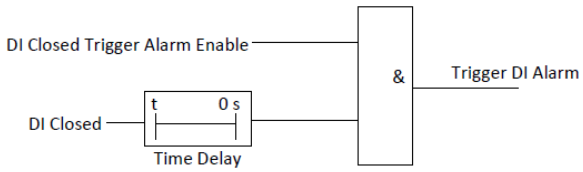


Figure 4-27 DI Closed Alarm Logic Diagram

The logic diagram of DI Open Alarm is illustrated in Figure 4-28.

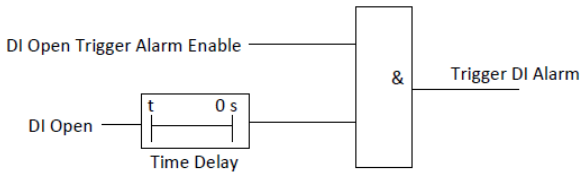


Figure 4-28 DI Open Alarm Logic Diagram

4.4 Power Quality Parameters

4.4.1 Unbalance

The PMC-592 measures the Voltage and Current Unbalances based on the following:

$$\text{Voltage Unbalance} = \frac{V_2}{V_1} \times 100\% \qquad \text{Current Unbalance} = \frac{I_2}{I_1} \times 100\%$$

Where

V_1 is Positive Sequence Voltage and V_2 is Negative Sequence Voltage.

And

I_1 is Positive Sequence Current and I_2 is Negative Sequence Current.

Under 1P3W wiring mode, the calculation method is listed below:

$$\text{Voltage Unbalance} = \frac{|Ua - Ub|}{(Ua + Ub)} \times 100\%$$

$$\text{Current Unbalance} = \frac{|Ia - Ib|}{(Ia + Ib)} \times 100\%$$

4.4.2 Harmonics

The PMC-592 provides the following Harmonic parameters: Mains-I/II THD, Mains-I/II TOHD, Mains-I/II TEHD, Mains-I/II K-factor, Mains-I/II Individual Harmonics up to the 31st order and THD only for each of the 84 Branch Currents. All Harmonic parameters are available through communications, the built-in Web Interface and the optional HMI Display.

The following equations illustrate how to calculate the individual harmonic distortion:

Fundamental Method:

$$\text{Voltage } K^{th} \text{ Harmonic Distortion} = \frac{V_K}{V_1} \times 100\% \qquad \text{Current } K^{th} \text{ Harmonic Distortion} = \frac{I_k}{I_1} \times 100\%$$

Where

V_1 / I_1 are the Fundamental Voltage/Current RMS and

V_k / I_k is the k_{th} Harmonic Voltage/Current RMS

The PMC-592 provides the following Harmonic measurements:

	Mains-I	Mains-II	Branch
Harmonics-Voltage	Va/Vb/Vc THD	Va/Vb/Vc THD (WYE)	SM1 to SM84 THD

		Vab/Vbc/Vca THD (Delta)	SM1 to SM84 THD
	Va/Vb/Vc TEHD	Va/Vb/Vc TEHD (WYE) Vab/Vbc/Vca TEHD (Delta)	
	Va/Vb/Vc TOHD	Va/Vb/Vc TOHD (WYE) Vab/Vbc/Vca TOHD (Delta)	
	Va/Vb/Vc HD02	Va/Vb/Vc HD02 (WYE) Vab/Vbc/Vca HD02 (Delta)	
	……		
	Va/Vb/Vc HD31	Va/Vb/Vc HD31 (WYE) Vab/Vbc/Vca HD31 (Delta)	
Harmonics-Current	Ia/Ib/Ic THD	Ia/Ib/Ic THD	
	Ia/Ib/Ic TEHD	Ia/Ib/Ic TEHD	
	Ia/Ib/Ic TOHD	Ia/Ib/Ic TOHD	
	Ia/Ib/Ic K-Factor	Ia/Ib/Ic K-Factor	
	Ia/Ib/Ic HD02	Ia/Ib/Ic HD02	
	……		
	Ia/Ib/Ic HD31	Ia/Ib/Ic HD31	

Table 4-16 Harmonics Measurements

K-Factor

K-factor is defined as the weighted sum of the harmonic load currents 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 effects.

The calculation method of K-Factor is listed below:

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

I_h = h_{th} Harmonic Current in RMS

h_{max} = Highest harmonic order

h = Harmonic order

4.5 Sub-Meters (SM)

The PMC-592 provides 1-Ø, 2-Ø and 3-Ø SMs automatically with no configuration requirements. The SM assignments are different between Sequential and Cross-Over Modes, as illustrated in Tables 4-17 and 4-18.

The assignment principle is not programmable. Therefore, it is extremely important to allocate the 1-Ø, 2-Ø and 3-Ø circuits during installation that meet this fixed assignment principle.

It's also important to note that the Alarming features only work with 1-Ø SMs for Branch circuits.

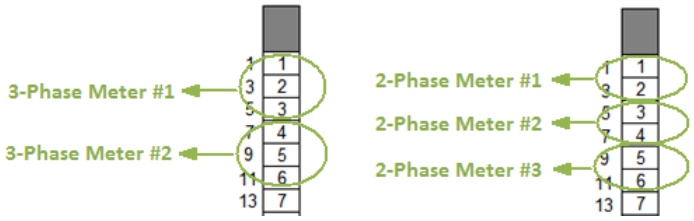


Figure 4-30 2-Ø and 3-Ø SM Examples

1-Ø SM	2-Ø SM	3-Ø SM	1-Ø SM	2-Ø SM	3-Ø SM	1-Ø SM	2-Ø SM	3-Ø SM	1-Ø SM	2-Ø SM	3-Ø SM
1	1	1	22	11	8	43	22	15	64	32	22
2			23			44			65		
3	2		24	12		45	23		66	33	
4		2	25		9	46		16	67		23
5	3		26	13		47	24		68	34	
6			27			48			69		
7	4	3	28	14	10	49	25	17	70	35	24
8			29			50			71		
9	5		30	15		51	26		72	36	
10		4	31		11	52		18	73		25
11	6		32	16		53	27		74	37	
12			33			54			75		
13	7	5	34	17	12	55	28	19	76	38	26
14			35			56			77		
15	8		36	18		57	29		78	39	
16		6	37		13	58		20	79		27
17	9		38	19		59	30		80	40	
18			39			60			81		
19	10	7	40	20	14	61	31	21	82	41	28
20			41			62			83		
21	21		42	21		63	42		84	42	

Table 4-17 SM Assignment in Sequential Mode

1-Ø SM	2-Ø SM	3-Ø SM	1-Ø SM	2-Ø SM	3-Ø SM	1-Ø SM	2-Ø SM	3-Ø SM	1-Ø SM	2-Ø SM	3-Ø SM
1	1	1	2	2	2	43	22	15	44	23	16
3			4			45			46		
5	3		6	4		47	24		48	25	
7		3	8		4	49		17	50		18
9	5		10	6		51	26		52	27	
11			12			53			54		
13	7	5	14	8	6	55	28	19	56	29	20
15			16			57			58		
17	9		18	10		59	30		60	31	
19		7	20		8	61		21	62		22
21	11		22	12		63	32		64	33	

23			24			65			66		
25	13	9	26	14	10	67	34	23	68	35	24
27			28			69			70		
29	15		30	16		71	36		72	37	
31		11	32		12	73		25	74		26
33	17		34	18		75	38		76	39	
35			36			77			78		
37	19	13	38	20	14	79	40	27	80	41	28
39			40			81			82		
41	21		42	21		83	42		84	42	

Table 4-18 SM Assignment in Cross-over Mode

The PMC-592 provides the following parameters for 1-Ø, 2-Ø and 3-Ø SMs:

Real-time: Current, kW, kvar, kVA, PF, Loading Factor, ON/OFF Status

Demands and Max Demands: Current, kW, kvar, kVA

Energy: kWh, kvarh, kVAh

4.6 Virtual Meters (VM)

The PMC-592 supports up to ten Virtual Meters, VM1 to VM10, which can be used to perform arbitrary aggregation from any of the 84 individual 1-Ø SMs, depending on the actual installation. The following figure is an example of 3 Virtual Meters:

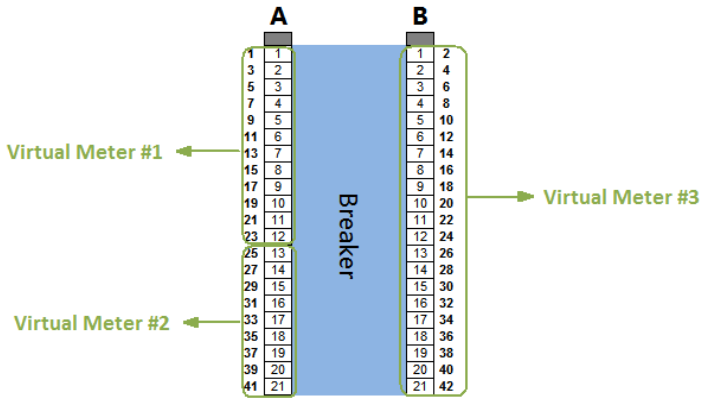


Figure 4-29 Virtual Meter Example

Each VM provides the following parameters as the aggregated values of the individual 1- Ø SMs: ∑kW, ∑kWh, ∑kvarh and ∑kVAh. VM energy measurements are separate from the SM energy measurements so clearing the energy measurements of one SM would not affect the energy measurements of the VM that consists of that particular SM.

4.7 Data Logging

4.7.1 SOE Recorder

The PMC-592's **SOE Log** can store up to 1000 events such as Power-On, Power-Off, Alarms, Relay actions, Digital Input status changes, Diagnostics and Setup changes in non-volatile memory. Each event includes a cause, its relevant parameter values and a timestamp in 1ms resolution.

All events can be retrieved via communications. If there are more than 1000 events, the newest event will replace the oldest event on a FIFO basis. The SOE Log can be reset through the built-in Web Interface, the optional HMI Display or via communications.

4.7.2 Max/Min Recorder

The PMC-592 records the Max. and Min. values for real-time and THD measurements for This Month, Last Month and Historical. The Max/Min Log is stored in non-volatile memory and will not suffer any loss in the event of a power failure.

The **Self-Read Time** allows the user to specify the time and day of the month for the Self-Read operation. At the specified time in each month, the Max/Min Log of **This Month** is transferred to the Max/Min Log of **Last Month** and then reset. The **Self-Read Time** supports three options:

- A zero value means that the Self-Read will take place at 24:00 of the last day of each month.
- A non-zero value means that the Self-Read will take place at a specific time and day based on the formula: Self-Read Time = Day * 100 + Hour where 0 ≤ Hour ≤ 23 and 1 ≤ Day ≤ 28. For example, the value 1512 means that the Self-Read will take place at 12:00pm on the 15th day of each month.
- A 0xFFFF value will disable the Self-Read operation and replace it with manual operation. A manual reset will cause the Max/Min Log of **This Month** to be transferred to the Max/Min Log of **Last Month** and then reset. The terms **This Month** and **Last Month** will become **Since Last Reset** and **Before Last Reset**.

The PMC-592 provides the Max/Min values for the parameters below for This Month, Last Month and Historical:

Mains-I and Mains-II Max./Min. Parameters		
Va/Vb/Vc/VLN Avg.	Vab/Vbc/Vca/VLL Avg.	Ia/Ib/Ic/I Avg./In
Ia/Ib/Ic Loading %	kWa/kWb/kWc/∑kW	kvara/kvarb/kvarc/∑kvar
kVAa/kVAb/kVAc/∑kVA	PFa/PFb/PFc/∑P.F.	FREQ
V/I Unbalance	RTD1/RTD2	--
Ia THD/TOHD/TEHD	Ib THD/TOHD/TEHD	Ic THD/TOHD/TEHD
Mains-I Va THD/TOHD/TEHD	Mains-I Vb THD/TOHD/TEHD	Mains-I Vc THD/TOHD/TEHD
Mains-II Va/Vab THD/TOHD/TEHD	Mains-II Vb/Vbc THD/TOHD/TEHD	Mains-II Vc/Vca THD/TOHD/TEHD
SM Max./Min. Parameters		
1-Ø SM1 to SM84 I	2-Ø SM1 to SM42 I	3- Ø SM1 to SM28 I
1- Ø SM1 to SM84 kW	2- Ø SM1 to SM42 kW	3- Ø SM1 to SM28 kW
1- Ø SM1 to SM84 kvar	2- Ø SM1 to SM42 kvar	3- Ø SM1 to SM28 kvar
1- Ø SM1 to SM84 kVA	2- Ø SM1 to SM42 kVA	3- Ø SM1 to SM28 kVA
1- Ø SM1 to SM84 PF	2- Ø SM1 to SM42 PF	3- Ø SM1 to SM28 PF
1- Ø SM1 to SM84 Loading %	2- Ø SM1 to SM42 Loading %	3- Ø SM1 to SM28 Loading %
SM1 to SM84 ITHD	--	--

Table 4-19 Max/Min Measurements

Max/Min data can be accessed and reset through communications, the built-in Web Interface and the optional HMI Display.

4.7.3 Interval Energy Recorder (IER)

The PMC-592 provides an IER which is capable of recording the following parameters.

- Mains-I kWh/kvarh Import/Export and kVAh

- Mains-II kWh/kvarh Import/Export and kVAh
- 1-ø SM1 to SM84 kWh/kvarh Import and kVAh
- 2- ø SM1 to SM42 kWh/kvarh Import and kVAh
- 3- ø SM1 to SM28 kWh/kvarh Import and kVAh
- VM1 to VM10 kWh/kvarh Import and kVAh

The programming of the IER Log is supported over communications or the built-in Web Interface.

The IER Log provides the following setup parameters:

Parameter	Range/Option
Recording Mode	0* = Disabled / 1 = Stop-When-Full / 2 = First-In-First-Out
Recording Depth	0* to 10000 (entry)
Recording Interval	0* = 5mins / 1 = 10mins / 2 = 15mins / 3 = 30mins / 4 = 60mins
Start Time	20YY/MM/DD, HH:MM:SS

*default

Table 4-20 Setup Parameters for IER

The IER is operational when the values of **Recording Mode** and **Recording Depth** are non-zero and the current time meets or exceeds the **Start Time**.

4.7.4 Waveform Recorder (WFR)

The PMC-592's WFR has a log capacity of 16 entries organized in a FIFO basis, with the newest log replacing the oldest one. The WFR Log is stored in non-volatile memory and will not suffer any loss in the event of power failure. Each Waveform Recorder can simultaneously capture 3-phase Voltage and Current signals at a maximum resolution of 64 samples per cycles. The WFR can be triggered manually via communications or by the following alarms if they are enabled: Mains Voltage, Mains Current, Mains V/I Unbalance, Harmonics, Frequency, Power and DI. WFR is triggered by any alarms going active, and there is no need to do any configuration. The manual trigger command has a higher priority. When a WFR is already in progress, all other WFR commands will be ignored until the present recording is completed.

The programming of the WFR is supported over communications, the built-in Web Interface and the optional HMI Display. The WFR provides the following setup parameters:

Parameter	Value
WFR Format	Samples/Cycles x # of Cycles: 0 = 16x600, 1 = 16x300, 2 = 32x300, 3 = 32x150, 4 = 64x150, 5 = 64x75
Pre-fault Cycle	0 to 10 (cycles)

Table 4-21 WFR Setup Parameters

All WFR Logs can be retrieved via communications by our PecStar® iEMS or the built-in Web Interface for display.

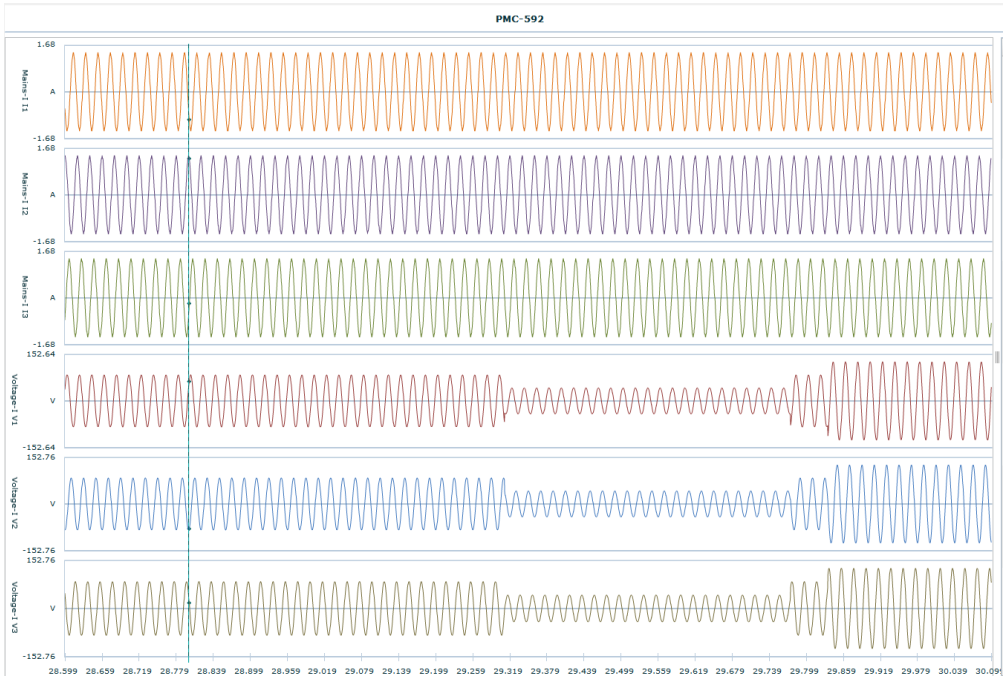


Figure 4-31 Waveform Recording displayed in PecStar®

4.8 Communications

The PMC-592 is equipped with one RS485 port, one RS-485/422 port as well as one Ethernet port and supports multiple protocols such as Modbus RTU and SNMP. Therefore, it can be easily and conveniently integrated into other systems.

4.8.1 SNMP (Simple Network Management Protocol)

SNMP is widely used for managing network devices on IP networks by Network Management Systems (NMS).

The PMC-592's basic measurements and alarm data can be sent via SNMP. In addition, event records can be sent to an NMS in Trap format. Please refer to Sections **3.2.3.5.7 Communication Setup** or **5.8.2 Communication Setup** for more information. The PMC-592 provides the following information via SNMP.

Parameter		
Information	Device Module, Device Serial Number, Firmware Version, Branch Number, Time of Power Up, PDU Name, Panel1 Name, Panel2 Name	
Diagnostics	Check NVRAM, Disk, ADC, CT Strip, Power, Check Battery, Check DSP, Check Setting	
Alarms	Global Alarm Mains-I/Mains-II Global Alarm Mains-I/Mains-II Ia/Ib/Ic/I4 Alarm Mains-I/Mains-II Ia/Ib/Ic Demand Alarm Voltage-I/Voltage-II Va/Vb/Vc/Vab/Vbc/Vca Alarm Frequency Alarm Mains-I/Mains-II kW/kvar/kVA Alarm	Mains-I/Mains-II kW/kvar/kVA Demand Alarm Mains-I/Mains-II PF Alarm Current-I/Current-II Unbalance Alarm Voltage-I/Voltage -II Unbalance Alarm Current-I/Current-II Ia/Ib/Ic Harmonic Alarm Voltage-I/Voltage-II Va/Vb/Vc Harmonic Alarm RTD1/RTD2 Alarm, Branch Alarm
Measurements	Please refer to Section **4.2 Power, Energy and Demand** for a detailed description of the	

	measurements provided.

Table 4-22 Data Provided by the PMC-592 via SNMP

Note:
The parameter list may be different for different firmware versions. Please refer to the MIB file, which can be downloaded from the Maintenance page of the built-in Web Interface of the device. Please refer to Section 3.2.3.6.2 for more information.

4.8.2 SNTP (Simple Network Time protocol)

PMC-592 provides timestamps for all recorded data so it is critical to maintain an accurate clock to achieve precise events and power quality analysis. The PMC-592 comes with a 6ppm, battery-backed RTC that has a maximum error of 0.5s per day. If the supply power is lost or removed, the internal battery keeps the real-time clock running until power is restored.

The PMC-592's SNTP client can be used to synchronize its internal clock with an external SNTP Server. The programming of the SNTP setup parameters is supported over communications, the built-in Web Interface and the optional HMI Display.

Setup Parameters	Option
SNTP Enable	Disabled*/Enable
Time Zone	GMT-12:00 / GMT-11:00 / GMT-10:00 / GMT-9:00 / GMT-8:00 / GMT-7:00 / GMT-6:00 / GMT-5:00 / GMT-4:00 / GMT-3:30 / GMT-3:00 / GMT-2:00 / GMT-1:00 / GMT-0:00 / GMT+1:00 / GMT+2:00 / GMT+3:00 / GMT+3:30 / GMT+4:00 / GMT+4:30/ GMT+5:00 / GMT+5:30 / GMT+5:45 / GMT+6:00 / GMT+6:30 / GMT+7:00 / GMT+8:00*/ GMT+9:00 / GMT+9:30 / GMT+10:00 / GMT+11:00 / GMT+12:00 / GMT+13:00
Time Sync. Interval	10 to 1440 minutes (Default = 60 minutes)
IP Address of Time Server	Set the IP address of your Time Server

Table 4-23 SNTP Setup Parameters

In addition, the PMC-592 can be time sync'ed via **PecStar®**iEMS, the built-in Web Interface and the optional HMI Display. Please refer to **Sections 3.3.2** and **3.2.3.5.9** for more information.

4.8.3 SMTP (Simple Mail Transfer Protocol)

The PMC-592 supports a SMTP Client which enables it to send an alarm Email to a Receiver e-mail address. The programming of the SMTP setup parameters is supported over communications, the built-in Web Interface and the optional HMI Display.

Setup Parameters	Option
SMTP Server IP	Set the IP address of your SMTP Server.
Sender Email	Set the Email address of sender.
Sender Email Password	Set the Email Password of Sender.
Receiver Email	Set the Email address of Receiver.

Table 4-24 SMTP Setup Parameters

Chapter 5 Modbus Register Map

This chapter provides a complete description of the Modbus register map (**Protocol Version 1.0**) for the PMC-592 to facilitate the development of 3rd party Modbus RTU communications driver for accessing information on the PMC-592.

The PMC-592 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)
4) Read Energy Files (Function Code 0x14)

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

5.1 Status Register

5.1.1 General Status

Register	Property	Description	Format	Note
0000	RO	DI Status[1]	Bitmap	
0001	RO	DO Status[2]	Bitmap	
0002	RO	Latest Alarm Channel	Bitmap	See Appendix A
0003	RO	Diagnostics[3]	Bitmap	
0005	RO	Run Time	UINT32	
0007	RO	SOE Pointer[4]	UINT32	
0009	RO	IER Log Pointer[5]	UINT32	
0011	RO	WFR Log Pointer[6]	UINT32	
0013	RO	WFR Status	UINT16	0 = WFR Disabled 1 = WFR

Table 5-1 General Status

Notes:

1) For the **DI Status** register, the bit values of Bit0 to Bit1 represent the states of DI1 to DI2, respectively, with "1" meaning active (closed) and "0" meaning inactive (open). The remaining bits are reserved.
2) For the **DO Status** register, the bit values of Bit0 to Bit1 represent the states of DO1 to DO2, respectively, with "1" meaning active (closed) and "0" meaning inactive (open). The remaining bits are reserved.
3) The **Diagnostics** register indicates the various system statuses with a bit value of 0 meaning normal and 1 meaning fault. The following table illustrates the details of the Diagnostics register.

Bit	Alarm Event	Bit	Alarm Event
Bit 0	NVRAM Fault	**Bit 9**	Communication Parameters Incorrect
Bit 1	Disk Fault	**Bit 10**	Breaker Parameters Incorrect
Bit 2	A/D Chips Fault	**Bit 11**	Alarm Parameters Incorrect
Bit 3	CT Strip not inserted	**Bit 12**	Branch Parameters Incorrect
Bit 4	Internal Power Supply Fault	**Bit 13**	VM Parameters Incorrect
Bit 5	Clock battery voltage is low	**Bit 14**	Calibration Parameters Error
Bit 6	DSP Fault	**Bit 15**	Internal Parameters Error
Bit 7	System Parameters Error	**Bits 16 - 31**	Reserved
Bit 8	SM Name Parameters Incorrect		

Table 5-2 Diagnostics Register (Reg. # 0003)

4) The range of the SOE Pointer is between 0 and 0xFFFFFFFF. The SOE Pointer is incremented by one for every event generated and will roll over to 0 if its current value is 0xFFFFFFFF. The SOE Log capacity is relatively small with only 1000 events in the PMC-592, and it can be reset to zero and then immediately incremented by one with a new "Clear SOE via Front Panel" or "Clear SOE via Communications" event. When the number of events is larger than 1000, only the latest 1000 events will be stored.
5) The range of the IER Pointer is between 0 and 0xFFFFFFFF. The pointers point to the current logging position and are incremented by one for every new record generated and will roll over to 0 if its current value is 0xFFFFFFFF.
6) The range of the WFR Pointer is between 0 and 0xFFFFFFFF. The pointers point to the current logging position and are incremented by one for every new record generated and will roll over to 0 if its current value is 0xFFFFFFFF.

5.1.2 Instantaneous Alarm

Register	Property	Description	Format	Note
0020	RO	Global Total Alarm Status	Bitmap	Bit 0 = Alarm Bits 1 - 15 = Reserved
0021	RO	Mains-I Total Alarm Status		
0022	RO	Mains-II Total Alarm Status		
0023	RO	Mains-I Ia Alarm	Bitmap	Bit 0 = HH Alarm Bit 1 = H Alarm Bit 2 = L Alarm Bit 3 = LL Alarm Bits 4 - 15 = Reserved
0024	RO	Mains-I Ib Alarm		
0025	RO	Mains-I Ic Alarm		
0026	RO	Mains-I I4 Alarm		
0027	RO	Mains-I Ia Demand Alarm		
0028	RO	Mains-I Ib Demand Alarm		
0029	RO	Mains-I Ic Demand Alarm		
0030	RO	Mains-II Ia Alarm		
0031	RO	Mains-II Ib Alarm		
0032	RO	Mains-II Ic Alarm		
0033	RO	Mains-II I4 Alarm		
0034	RO	Mains-II Ia Demand Alarm		
0035	RO	Mains-II Ib Demand Alarm		
0036	RO	Mains-II Ic Demand Alarm		
0037	RO	Mains-I Va Alarm	Bitmap	Bit 0 = H Alarm Bit 1 = L Alarm Bits 2 - 15 = Reserved
0038	RO	Mains-I Vb Alarm		
0039	RO	Mains-I Vc Alarm		
0040	RO	Mains-I Vab Alarm		
0041	RO	Mains-I Vbc Alarm		
0042	RO	Mains-I Vca Alarm		
0043	RO	Mains-II Va Alarm		
0044	RO	Mains-II Vb Alarm		
0045	RO	Mains-II Vc Alarm		
0046	RO	Mains-II Vab Alarm		
0047	RO	Mains-II Vbc Alarm		
0048	RO	Mains-II Vca Alarm		
0049	RO	FREQ Alarm		
0050	RO	Mains-I kW Alarm		
0051	RO	Mains-I kvar Alarm		
0052	RO	Mains-I kVA Alarm		
0053	RO	Mains-I PF Alarm		
0054	RO	Mains-I kW Demand Alarm		

0055	RO	Mains-I kvar Demand Alarm		
0056	RO	Mains-I kVA Demand Alarm		
0057	RO	Mains-II kW Alarm		
0058	RO	Mains-II kvar Alarm		
0059	RO	Mains-II kVA Alarm		
0060	RO	Mains-II PF Alarm		
0061	RO	Mains-II kW Demand Alarm		
0062	RO	Mains-II kvar Demand Alarm		
0063	RO	Mains-II kVA Demand Alarm		
0064	RO	Mains-I V Unbalance Alarm	Bitmap	Bit 0 = Alarm Bits 1 - 15 = Reserved
0065	RO	Mains-II V Unbalance Alarm		
0066	RO	Mains-I I Unbalance Alarm		
0067	RO	Mains-II I Unbalance Alarm		
0068	RO	Mains-I Va Harmonic Alarm	Bitmap	Bit 0 = THD Alarm Bit 1 = TOHD Alarm Bit 2 = TEHD Alarm Bits 3 - 15 = Reserved
0069	RO	Mains-I Vb Harmonic Alarm		
0070	RO	Mains-I Vc Harmonic Alarm		
0071	RO	Mains-II Va Harmonic Alarm		
0072	RO	Mains-II Vb Harmonic Alarm		
0073	RO	Mains-II Vc Harmonic Alarm		
0074	RO	Mains-I Ia Harmonic Alarm		
0075	RO	Mains-I Ib Harmonic Alarm		
0076	RO	Mains-I Ic Harmonic Alarm		
0077	RO	Mains-II Ia Harmonic Alarm		
0078	RO	Mains-II Ib Harmonic Alarm		
0079	RO	Mains-II Ic Harmonic Alarm		
0080	RO	RTD1 Alarm	Bitmap	Bit 0 = HH Alarm Bit 1 = H Alarm Bits 2 - 15 = Reserved
0081	RO	RTD2 Alarm		
0082	RO	DI1 Alarm	Bitmap	Bit 0 = Alarm Bits 1 - 15 = Reserved
0083	RO	DI2 Alarm		
0084	RO	SM1 Alarm	Bitmap	Bit 0 = HH Alarm Bit 1 = H Alarm Bit 2 = L Alarm Bit 3 = LL Alarm Bits 4 - 15 = Reserved
0085	RO	SM2 Alarm		
0086	RO	SM3 Alarm		
0087	RO	SM4 Alarm		
....		....		
0167	RO	SM84 Alarm		

Table 5-3 Instantaneous Alarm

5.1.3 Latched Alarm

Register	Property	Description	Format	Note
0180	RO	Global Total Alarm Status	Bitmap	Bit 0 = Alarm Bits 1 - 15 = Reserved
0181	RO	Mains-I Total Alarm Status		
0182	RO	Mains-II Total Alarm Status		
0183	RO	Mains-I Ia Alarm	UINT16	Bit 0 = HH Alarm

0184	RO	Mains-I Ib Alarm	Bitmap	Bit 1 = H Alarm Bit 2 = L Alarm Bit 3 = LL Alarm Bits 4 - 15 = Reserved
0185	RO	Mains-I Ic Alarm		
0186	RO	Mains-I I4 Alarm		
0187	RO	Mains-I Ia Demand Alarm		
0188	RO	Mains-I Ib Demand Alarm		
0189	RO	Mains-I Ic Demand Alarm		
0190	RO	Mains-II Ia Alarm		
0191	RO	Mains-II Ib Alarm		
0192	RO	Mains-II Ic Alarm		
0193	RO	Mains-II I4 Alarm		
0194	RO	Mains-II Ia Demand Alarm		
0195	RO	Mains-II Ib Demand Alarm		
0196	RO	Mains-II Ic Demand Alarm		
0197	RO	Mains-I Va Alarm	Bitmap	Bit 0 = H Alarm Bit 1 = L Alarm Bits 2 - 15 = Reserved
0198	RO	Mains-I Vb Alarm		
0199	RO	Mains-I Vc Alarm		
0200	RO	Mains-I Vab Alarm		
0201	RO	Mains-I Vbc Alarm		
0202	RO	Mains-I Vca Alarm		
0203	RO	Mains-II Va Alarm		
0204	RO	Mains-II Vb Alarm		
0205	RO	Mains-II Vc Alarm		
0206	RO	Mains-II Vab Alarm		
0207	RO	Mains-II Vbc Alarm		
0208	RO	Mains-II Vca Alarm		
0209	RO	FREQ Alarm		
0210	RO	Mains-I kW Alarm		
0211	RO	Mains-I kvar Alarm		
0212	RO	Mains-I kVA Alarm		
0213	RO	Mains-I PF Alarm		
0214	RO	Mains-I kW Demand Alarm		
0215	RO	Mains-I kvar Demand Alarm		
0216	RO	Mains-I kVA Demand Alarm		
0217	RO	Mains-II kW Alarm		
0218	RO	Mains-II kvar Alarm		
0219	RO	Mains-II kVA Alarm		
0220	RO	Mains-II PF Alarm		
0221	RO	Mains-II kW Demand Alarm		
0222	RO	Mains-II kvar Demand Alarm		
0223	RO	Mains-II kVA Demand Alarm		
0224	RO	Mains-I V Unbalance Alarm	Bitmap	Bit 0 = Alarm Bits 1 - 15 = Reserved
0225	RO	Mains-II V Unbalance Alarm		
0226	RO	Mains-I I Unbalance Alarm		

0227	RO	Mains-II I Unbalance Alarm		
0228	RO	Mains-I Va Harmonic Alarm	Bitmap	Bit 0 = THD Alarm Bit 1 = TOHD Alarm Bit 2 = TEHD Alarm Bits 3 - 15 = Reserved
0229	RO	Mains-I Vb Harmonic Alarm		
0230	RO	Mains-I Vc Harmonic Alarm		
0231	RO	Mains-II Va Harmonic Alarm		
0232	RO	Mains-II Vb Harmonic Alarm		
0233	RO	Mains-II Vc Harmonic Alarm		
0234	RO	Mains-I Ia Harmonic Alarm		
0235	RO	Mains-I Ib Harmonic Alarm		
0236	RO	Mains-I Ic Harmonic Alarm		
0237	RO	Mains-II Ia Harmonic Alarm		
0238	RO	Mains-II Ib Harmonic Alarm		
0239	RO	Mains-II Ic Harmonic Alarm		
0240	RO	RTD1 Alarm	Bitmap	Bit 0 = HH Alarm Bit 1 = H Alarm Bits 2 - 15 = Reserved
0241	RO	RTD2 Alarm		
0242	RO	DI1 Alarm	Bitmap	Bit 0 = Alarm Bits 1 - 15 = Reserved
0243	RO	DI2 Alarm		
0244	RO	SM1 Alarm	Bitmap	Bit 0 = HH Alarm Bit 1 = H Alarm Bit 2 = L Alarm Bit 3 = LL Alarm Bits 4 - 15 = Reserved
0245	RO	SM2 Alarm		
….		….		
0327	RO	SM84 Alarm		

Table 5-4 Latch Alarm

5.1.4 Alarm Counter

Register	Property	Description	Format
0340	RW	Global Alarm Counter[1]	UINT16
0341	RW	Mains-I Alarm Counter[1]	UINT16
0342	RW	Mains-II Alarm Counter[1]	UINT16
0343	RW	Voltage-I Alarm Counter[1]	UINT16
0344	RW	Voltage-II Alarm Counter[1]	UINT16
0345	RW	Current-I Alarm Counter[1]	UINT16
0346	RW	Current-II Alarm Counter[1]	UINT16
0347	RW	RTD1 Alarm Counter[1]	UINT16
0348	RW	RTD2 Alarm Counter[1]	UINT16
0349	RW	DI1 Alarm Counter[1]	UINT16
0350	RW	DI2 Alarm Counter[1]	UINT16
0351	RW	SM1 Alarm Counter[1]	UINT16
0352	RW	SM2 Alarm Counter[1]	UINT16
….		….	
0434	RW	SM84 Alarm Counter[1]	UINT16

Table 5-5 Alarm Counter

Notes:

1) Writing "0" to the register clear the counter. It is invalid to write any value other than 0 to the register. The register value is non-volatile.

5.2 Basic Measurements

5.2.1 Mains Measurements

Register	Property	Description	Format	Scale/Unit
0500	RO	Mains-I Va	UINT32	x100[1], V
0502	RO	Mains-I Vb	UINT32	x100, V
0504	RO	Mains-I Vc	UINT32	x100, V
0506	RO	Mains-I VLN average	UINT32	x100, V
0508	RO	Mains-I Vab	UINT32	x100, V
0510	RO	Mains-I Vbc	UINT32	x100, V
0512	RO	Mains-I Vca	UINT32	x100, V
0514	RO	Mains-I VLL average	UINT32	x100, V
0516	RO	Mains-II Va[2]	UINT32	x100, V
0518	RO	Mains-II Vb[2]	UINT32	x100, V
0520	RO	Mains-II Vc[2]	UINT32	x100, V
0522	RO	Mains-II VLN average[2]	UINT32	x100, V
0524	RO	Mains-II Vab	UINT32	x100, V
0526	RO	Mains-II Vbc	UINT32	x100, V
0528	RO	Mains-II Vca	UINT32	x100, V
0530	RO	Mains-II VLL average	UINT32	x100, V
0532	RO	System FREQ	UINT32	x100, Hz
0534	RO	Mains-I Ia	UINT32	x1000, A
0536	RO	Mains-I Ib	UINT32	x1000, A
0538	RO	Mains-I Ic	UINT32	x1000, A
0540	RO	Mains-I I4[3]	UINT32	x1000, A
0542	RO	Reserved		
0544	RO	Mains-I I average	UINT32	x1000, A
0546	RO	Mains-I Ia Loading Factor[4]	UINT32	x10, %
0548	RO	Mains-I Ib Loading Factor[4]	UINT32	x10, %
0550	RO	Mains-I Ic Loading Factor[4]	UINT32	x10, %
0552	RO	Mains-I kWa	INT32	x1000, kW
0554	RO	Mains-I kWb	INT32	x1000, kW
0556	RO	Mains-I kWc	INT32	x1000, kW
0558	RO	Mains-I ∑kW	INT32	x1000, kW
0560	RO	Mains-I kvara	INT32	x1000, kvar
0562	RO	Mains-I kvarb	INT32	x1000, kvar
0564	RO	Mains-I kvarc	INT32	x1000, kvar
0566	RO	Mains-I ∑kvar	INT32	x1000, kvar
0568	RO	Mains-I kVAa	INT32	x1000, kVA
0570	RO	Mains-I kVAb	INT32	x1000, kVA
0572	RO	Mains-I kVAc	INT32	x1000, kVA
0574	RO	Mains-I ∑kVA	INT32	x1000, kVA
0576	RO	Mains-I PFa	INT32	x1000

0578	RO	Mains-I PFb	INT32	x1000
0580	RO	Mains-I PFc	INT32	x1000
0582	RO	Mains-I ∑PF	INT32	x1000
0584	RO	Mains-II Ia	UINT32	x1000, A
0586	RO	Mains-II Ib	UINT32	x1000, A
0588	RO	Mains-II Ic	UINT32	x1000, A
0590	RO	Mains-II I4	UINT32	x1000, A
0592	RO	Reserved	UINT32	x1000, A
0594	RO	Mains-II I average	UINT32	x1000, A
0596	RO	Mains-II Ia Loading Factor[3]	UINT32	x10, %
0598	RO	Mains-II Ib Loading Factor[3]	UINT32	x10, %
0600	RO	Mains-II Ic Loading Factor[3]	UINT32	x10, %
0602	RO	Mains-II kWa	INT32	x1000, kW
0604	RO	Mains-II kWb	INT32	x1000, kW
0606	RO	Mains-II kWc	INT32	x1000, kW
0608	RO	Mains-II ∑kW	INT32	x1000, kW
0610	RO	Mains-II kvara	INT32	x1000, kvar
0612	RO	Mains-II kvarb	INT32	x1000, kvar
0614	RO	Mains-II kvarc	INT32	x1000, kvar
0616	RO	Mains-II ∑kvar	INT32	x1000, kvar
0618	RO	Mains-II kVAa	INT32	x1000, kVA
0620	RO	Mains-II kVAb	INT32	x1000, kVA
0622	RO	Mains-II kVAc	INT32	x1000, kVA
0624	RO	Mains-II ∑kVA	INT32	x1000, kVA
0626	RO	Mains-II PFa	INT32	x1000
0628	RO	Mains-II PFb	INT32	x1000
0630	RO	Mains-II PFc	INT32	x1000
0632	RO	Mains-II ∑PF	INT32	x1000
0634	RO	Mains-I Voltage Unbalance	UINT32	x100, %
0636	RO	Mains-II Voltage Unbalance	UINT32	x100, %
0638	RO	Mains-I Current Unbalance	UINT32	x100, %
0640	RO	Mains-II Current Unbalance	UINT32	x100, %
0642	RO	RTD1 Temp.	UINT16	x10, ℃
0643	RO	RTD2 Temp.	UINT16	x10, ℃
0644	RO	TC1 Resistance Value	UINT16	Ω
0645	RO	TC2 Resistance Value	UINT16	Ω

Table 5-6 Mains Measurements

Notes:

1) "×100, V" indicates the value returned in the register is 100 times the actual engineering value with the unit V (voltage). For example, if a register contains a value 22003, the actual value is 22003/100 = 220.03V.
2) When the **Wiring Mode** is Delta, the per phase line-to-neutral voltages have no meaning, and their registers are reserved.
3) The calculation method of Ia/Ib/Ic Loading Factor is listed below:

$$\text{Ia/Ib/Ic Loading Factor} = \frac{\text{Ia/Ib/Ic}}{\text{Breaker Rating}} \times 100\%$$

5.2.2 SM Measurements

Register	Property	Description	Format	Scale/Unit
0650	RO	1-Ø SM1 Current	UINT32	x1000, A
0652	RO	1-Ø SM2 Current	UINT32	x1000, A
….		….		
0816	RO	1-Ø SM84 Current	UINT32	x1000, A
0818	RO	2-Ø SM1 Current Average	UINT32	x1000, A
0820	RO	2-Ø SM2 Current Average	UINT32	x1000, A
….		….		
0900	RO	2-Ø SM42 Current Average	UINT32	x1000, A
0902	RO	3-Ø SM1 Current Average	UINT32	x1000, A
0904	RO	3-Ø SM2 Current Average	UINT32	x1000, A
….		….		
0956	RO	3-Ø SM28 Current Average	UINT32	x1000, A
0958	RO	1-Ø SM1 kW	INT32	x1000, kW
0960	RO	1-Ø SM2 kW	INT32	x1000, kW
….		….		
1124	RO	1-Ø SM84 kW	INT32	x1000, kW
1126	RO	2-Ø SM1 kW Total	INT32	x1000, kW
1128	RO	2-Ø SM2 kW Total	INT32	x1000, kW
….		….		
1208	RO	2-Ø SM42 kW Total	INT32	x1000, kW
1210	RO	3-Ø SM1 kW Total	INT32	x1000, kW
1212	RO	3-Ø SM2 kW Total	INT32	x1000, kW
….		….		
1264	RO	3-Ø SM28 kW Total	INT32	x1000, kW
1266	RO	1-Ø SM1 kvar	INT32	x1000,kvar
1268	RO	1-Ø SM2 kvar	INT32	x1000, kvar
….		….		
1432	RO	1-Ø SM84 kvar	INT32	x1000, kvar
1434	RO	2-Ø SM1 kvar Total	INT32	x1000, kvar
1436	RO	2-Ø SM2 kvar Total	INT32	x1000, kvar
….		….		
1516	RO	2-Ø SM42 kvar Total	INT32	x1000, kvar
1518	RO	3-Ø SM1 kvar Total	INT32	x1000, kvar
1520	RO	3-Ø SM2 kvar Total	INT32	x1000, kvar
….		….		
1572	RO	3-Ø SM28 kvar Total	INT32	x1000, kvar
1574	RO	1-Ø SM1 kVA	INT32	x1000, kVA

1576	RO	1-Ø SM2 kVA	INT32	x1000, kVA
….		….		
1740	RO	1-Ø SM84 kVA	INT32	x1000, kVA
1742	RO	2-Ø SM1 kVA Total	INT32	x1000, kVA
1744	RO	2-Ø SM2 kVA Total	INT32	x1000, kVA
….		….		
1824	RO	2-Ø SM42 kVA Total	INT32	x1000, kVA
1826	RO	3-Ø SM1 kVA Total	INT32	x1000, kVA
1828	RO	3-Ø SM2 kVA Total	INT32	x1000, kVA
….		….		
1880	RO	3-Ø SM28 kVA Total	INT32	x1000, kVA
1882	RO	1-Ø SM1 PF	INT32	x1000
1884	RO	1-Ø SM2 PF	INT32	x1000
….		….		
2048	RO	1-Ø SM84 PF	INT32	x1000
2050	RO	2-Ø SM1 PF Total	INT32	x1000
2052	RO	2-Ø SM2 PF Total	INT32	x1000
….		….		
2132	RO	2-Ø SM42 PF Total	INT32	x1000
2134	RO	3-Ø SM1 PF Total	INT32	x1000
2136	RO	3-Ø SM2 PF Total	INT32	x1000
….		….		
2188	RO	3-Ø SM28 PF Total	INT32	x1000
2190	RO	1-Ø SM1 Loading Factor	UINT32	x10, %
2192	RO	1-Ø SM2 Loading Factor	UINT32	x10, %
….		….		
2356	RO	1-Ø SM84 Loading Factor	UINT32	x10, %
2358	RO	2-Ø SM1 Loading Factor	UINT32	x10, %
2360	RO	2-Ø SM2 Loading Factor	UINT32	x10, %
….		….		
2440	RO	2-Ø SM42 Loading Factor	UINT32	x10, %
2442	RO	3-Ø SM1 Loading Factor	UINT32	x10, %
2444	RO	3-Ø SM2 Loading Factor	UINT32	x10, %
….		….		
2496	RO	3-Ø SM28 Loading Factor	UINT32	x10, %
8000	RO	SM1 Loading Status[1]	UINT32	0 = OFF 1 = ON
8002	RO	SM2 Loading Status[1]	UINT32	
….		….		
8166	RO	SM84 Loading Status[1]	UINT32	

Table 5-7 SM Measurements

Notes:

1) When SMx current > Current Alarm ON Threshold (Reg. # 6391), the SMx Loading Status is ON, otherwise it's OFF.

5.3 Energy Measurements

5.3.1 Mains Energy

Register	Property	Description	Format	Scale/Unit
2500	RO	Mains-I kWh Import	UINT32	x10, kWh
2502	RO	Mains-I kWh Export	UINT32	x10, kWh
2504	RO	Mains-I kvarh Import	UINT32	x10, kvarh
2506	RO	Mains-I kvarh Export	UINT32	x10, kvarh
2508	RO	Mains-I kVAh	UINT32	x10, kVAh
2510	RO	Mains-II kWh Import	UINT32	x10, kWh
2512	RO	Mains-II kWh Export	UINT32	x10, kWh
2514	RO	Mains-II kvarh Import	UINT32	x10, kvarh
2516	RO	Mains-II kvarh Export	UINT32	x10, kvarh
2518	RW	Mains-II kVAh	UINT32	x10, kVAh

Table 5-8 Mains Energy

5.3.2 SM Energy

Register	Property	Description	Format	Scale/Unit
2520	RO	1-Ø SM1 kWh	UINT32	x10, kWh
2522	RO	1-Ø SM2 kWh	UINT32	x10, kWh
….		….		
2686	RO	1-Ø SM84 kWh	UINT32	x10, kWh
2688	RO	2-Ø SM1 kWh	UINT32	x10, kWh
2690	RO	2-Ø SM2 kWh	UINT32	x10, kWh
….		….		
2770	RO	2-Ø SM42 kWh	UINT32	x10, kWh
2772	RO	3-Ø SM1 kWh	UINT32	x10, kWh
2774	RO	3-Ø SM2 kWh	UINT32	x10, kWh
….		….		
2826	RO	3-Ø SM28 kWh	UINT32	x10, kWh
2828	RO	1-Ø SM1 kvarh	UINT32	x10, kvarh
2830	RO	1-Ø SM2 kvarh	UINT32	x10, kvarh
….		….		
2994	RO	1-Ø SM84 kvarh	UINT32	x10, kvarh
2996	RO	2-Ø SM1 kvarh	UINT32	x10, kvarh
2998	RO	2-Ø SM2 kvarh	UINT32	x10, kvarh
….		….		
3078	RO	2-Ø SM42 kvarh	UINT32	x10, kvarh
3080	RO	3-Ø SM1 kvarh	UINT32	x10, kvarh
3082	RO	3-Ø SM2 kvarh	UINT32	x10, kvarh
….		….		
3134	RO	3-Ø SM28 kvarh	UINT32	x10, kvarh
3136	RW	1-Ø SM1 kVAh	UINT32	x10, kVAh

3138	RW	1-Ø SM2 kVAh	UINT32	x10, kVAh
….		….		
3302	RW	1-Ø SM84 kVAh	UINT32	x10, kVAh
3304	RW	2-Ø SM1 kVAh	UINT32	x10, kVAh
3306	RW	2-Ø SM2 kVAh	UINT32	x10, kVAh
….		….		
3386	RW	2-Ø SM42 kVAh	UINT32	x10, kVAh
3388	RW	3-Ø SM1 kVAh	UINT32	x10, kVAh
3390	RW	3-Ø SM2 kVAh	UINT32	x10, kVAh
….		….		
3442	RW	3-Ø SM28 kVAh	UINT32	x10, kVAh

Table 5-9 Branch Energy

5.4 Demand

5.4.1 Real-time Demand

5.4.1.1 Mains Present Demand

Register	Property	Description	Format	Scale/Unit
3450	RO	Mains-I Ia Demand	UINT32	x1000, A
3452	RO	Mains-I Ib Demand	UINT32	x1000, A
3454	RO	Mains-I Ic Demand	UINT32	x1000, A
3456	RO	Mains-I ∑kW Demand	INT32	x1000, kW
3458	RO	Mains-I ∑kvar Demand	INT32	x1000, kvar
3460	RO	Mains-I ∑kVA Demand	INT32	x1000, kVA
3462	RO	Mains-II Ia Demand	UINT32	x1000, A
3464	RO	Mains-II Ib Demand	UINT32	x1000, A
3466	RO	Mains-II Ic Demand	UINT32	x1000, A
3468	RO	Mains-II ∑kW Demand	INT32	x1000, kW
3470	RO	Mains-II ∑kvar Demand	INT32	x1000, kvar
3472	RO	Mains-II ∑kVA Demand	INT32	x1000, kVA

Table 5-10 Mains Present Demand

5.4.1.2 SM Present Demand

Register	Property	Description	Format	Scale/Unit
3474	RO	1-Ø SM1 Current Demand	UINT32	x1000, A
3476	RO	1-Ø SM2 Current Demand	UINT32	x1000, A
…		…		
3640	RO	1-Ø SM84 Current Demand	UINT32	x1000, A
3642	RO	2-Ø SM1 Current Demand	UINT32	x1000, A
3644	RO	2-Ø SM2 Current Demand	UINT32	x1000, A
…		…		
3724	RO	2-Ø SM42 Current Demand	UINT32	x1000, A
3726	RO	3-Ø SM1 Current Demand	UINT32	x1000, A
3728	RO	3-Ø SM2 Current Demand	UINT32	x1000, A

...		...		
3780	RO	3-Ø SM28 Current Demand	UINT32	x1000, A
3782	RO	1-Ø SM1 kW Demand	INT32	x1000, kW
3784	RO	1-Ø SM2 kW Demand	INT32	x1000, kW
...		...		
3948	RO	1-Ø SM84 kW Demand	INT32	x1000, kW
3950	RO	2-Ø SM1 kW Demand	INT32	x1000, kW
3952	RO	2-Ø SM2 kW Demand	INT32	x1000, kW
....		....		
4032	RO	2-Ø SM42 kW Demand	INT32	x1000, kW
4034	RO	3-Ø SM1 kW Demand	INT32	x1000, kW
4036	RO	3-Ø SM2 kW Demand	INT32	x1000, kW
....		....		
4088	RO	3-Ø SM28 kW Demand	INT32	x1000, kW
4090	RO	1-Ø SM1 kvar Demand	INT32	x1000, kvar
4092	RO	1-Ø SM2 kvar Demand	INT32	x1000, kvar
....		....		
4256	RO	1-Ø SM84 kvar Demand	INT32	x1000, kvar
4258	RO	2-Ø SM1 kvar Demand	INT32	x1000, kvar
4260	RO	2-Ø SM2 kvar Demand	INT32	x1000, kvar
....		....		
4340	RO	2-Ø SM42 kvar Demand	INT32	x1000, kvar
4342	RO	3-Ø SM1 kvar Demand	INT32	x1000, kvar
4344	RO	3-Ø SM2 kvar Demand	INT32	x1000, kvar
....		....		
4396	RO	3-Ø SM28 kvar Demand	INT32	x1000, kvar
4398	RO	1-Ø SM1 kVA Demand	INT32	x1000, kVA
4400	RO	1-Ø SM2 kVA Demand	INT32	x1000, kVA
....		....		
4564	RO	1-Ø SM84 kVA Demand	INT32	x1000, kVA
4566	RO	2-Ø SM1 kVA Demand	INT32	x1000, kVA
4568	RO	2-Ø SM2 kVA Demand	INT32	x1000, kVA
....		....		
4648	RO	2-Ø SM42 kVA Demand	INT32	x1000, kVA
4650	RO	3-Ø SM1 kVA Demand	INT32	x1000, kVA
4652	RO	3-Ø SM2 kVA Demand	INT32	x1000, kVA
....		....		
4704	RO	3-Ø SM28 kVA Demand	INT32	x1000, kVA

Table 5-11 SM Present Demand

5.4.2 Max Demand Log

5.4.2.1 Mains Max Demand

Register	Property	Description	Format

20000-20047	RO	Historical Max Demand	See Section 5.4.2.2 Mains Max Demand Data Structure
20048-20095	RO	Max Demand of This Month (Since Last Reset)	
20096-20143	RO	Max Demand of Last Month (Before Last Reset)	

Table 5-12 Mains Max Demand

5.4.2.2 Mains Max Demand Data Structure

Offset	Property	Description	Format	Scale/Range
+0	RO	Mains-I Ia Max Demand	MAX32U[1]	x1000, A
+4	RO	Mains-I Ib Max Demand		x1000, A
+8	RO	Mains-I Ic Max Demand		x1000, A
+12	RO	Mains-I ∑kW Max Demand	MAX32[2]	x1000, kW
+16	RO	Mains-I ∑kvar Max Demand		x1000, kvar
+20	RO	Mains-I ∑kVA Max Demand		x1000, kVA
+24	RO	Mains-II Ia Max Demand	MAX32U[1]	x1000, A
+28	RO	Mains-II Ib Max Demand		x1000, A
+32	RO	Mains-II Ic Max Demand		x1000, A
+36	RO	Mains-II ∑kW Max Demand	MAX32[2]	x1000, kW
+40	RO	Mains-II ∑kvar Max Demand		x1000, kvar
+44	RO	Mains-II ∑kVA Max Demand		x1000, kVA

Table 5-13 Mains Max Demand Data Structure

Notes:

1) **MAX32U** means an unsigned 32-bit Max Demand Log, the log data structure is illustrated in the following table.

Offset	Property	Description	Format
+0	RO	Record Value	UINT32
+2	RO	Record Time	UNIX Time

Table 5-14 MAX32U Max Demand Log Data Structure

2) **MAX32** means a signed 32-bit Max Demand Log, the log data structure is illustrated in the following table.

Offset	Property	Description	Format
+0	RO	Record Value	INT32
+2	RO	Record Time	UNIX Time

Table 5-15 MAX32 Max Demand Log Data Structure

5.4.2.3 SM Max Demand

Register	Property	Description	Format
20144-22607	RO	Historical Max Demand	See Section 5.4.2.4 SM Max Demand Data Structure
22608-25071	RO	Max Demand of This Month (Since Last Reset)	
25072-27535	RO	Max Demand of Last Month (Before Last Reset)	

Table 5-16 SM Max Demand

5.4.2.4 SM Max Demand Data Structure

Offset	Property	Description	Format	Scale/Range
+0	RO	1-ø SM1 Current Max Demand	MAX32U[1]	x1000, A
+4	RO	1-ø SM2 Current Max Demand		x1000, A

....		....		
+332	RO	1-ø SM84 Current Max Demand		x1000, A
+336	RO	2-ø SM1 Current Max Demand		x1000, A
+340	RO	2-ø SM2 Current Max Demand		x1000, A
....		....		
+500	RO	2-ø SM42 Current Max Demand		x1000, A
+504	RO	3-ø SM1 Current Max Demand		x1000, A
+508	RO	3-ø SM2 Current Max Demand		x1000, A
....		....		
+612	RO	3-ø SM28 Current Max Demand		x1000, A
+616	RO	1-ø SM1 kW Max Demand		x1000, kW
+620	RO	1-ø SM2 kW Max Demand		x1000, kW
....		....		
+948	RO	1-ø SM84 kW Max Demand		x1000, kW
+952	RO	2-ø SM1 kW Max Demand		x1000, kW
+956	RO	2-ø SM2 kW Max Demand		x1000, kW
....		....		
+1116	RO	2-ø SM42 kW Max Demand		x1000, kW
+1120	RO	3-ø SM1 kW Max Demand		x1000, kW
+1124	RO	3-ø SM2 kW Max Demand		x1000, kW
....		....		
+1228	RO	3-ø SM28 kW Max Demand		x1000, kW
+1232	RO	1-ø SM1 kvar Max Demand		x1000, kvar
+1236	RO	1-ø SM2 kvar Max Demand		x1000, kvar
....		....		
+1564	RO	1-ø SM84 kvar Max Demand		x1000, kvar
+1568	RO	2-ø SM1 kvar Max Demand	MAX32[2]	x1000, kvar
+1572	RO	2-ø SM2 kvar Max Demand		x1000, kvar
....		....		
+1732	RO	2-ø SM42 kvar Max Demand		x1000, kvar
+1736	RO	3-ø SM1 kvar Max Demand		x1000, kvar
+1740	RO	3-ø SM2 kvar Max Demand		x1000, kvar
....		....		
+1844	RO	3-ø SM28 kvar Max Demand		x1000, kvar
+1848	RO	1-ø SM1 kVA Max Demand		x1000, kVA
+1852	RO	1-ø SM2 kVA Max Demand		x1000, kVA
....		....		
+2180		1-ø SM84 kVA Max Demand		x1000, kVA
+2184	RO	2-ø SM1 kVA Max Demand		x1000, kVA
+2188	RO	2-ø SM2 kVA Max Demand		x1000, kVA
....		....		
+2348		2-ø SM42 kVA Max Demand		x1000, kVA
+2352	RO	3-ø SM1 kVA Max Demand		x1000, kVA

+2356	RO	3-ø SM2 kVA Max Demand		x1000, kVA
....		....		
+2460	RO	3-ø SM28 kVA Max Demand		x1000, kVA

Table 5-17 SM Max Demand Data Structure

Notes:

1) **MAX32U** means an unsigned 32-bit Max Demand Log, the log data structure is illustrated in the following table.

Offset	Property	Description	Format
+0	RO	Record Value	UINT32
+2	RO	Record Time	UNIX Time

Table 5-18 MAX32U Max Demand Log Data Structure

2) **MAX32** means a signed 32-bit Max Demand Log, the log data structure is illustrated in the following table.

Offset	Property	Description	Format
+0	RO	Record Value	INT32
+2	RO	Record Time	UNIX Time

Table 5-19 MAX32 Max Demand Log Data Structure

5.5 Harmonics Measurements

5.5.1 Mains Harmonic Measurements

Register	Property	Description	Format	Scale/Unit
4710	RO	Mains-I Ia THD	UINT16	x100, %
4711	RO	Mains-I Ia TOHD	UINT16	x100, %
4712	RO	Mains-I Ia TEHD	UINT16	x100, %
4713	RO	Mains-I Ib THD	UINT16	x100, %
4714	RO	Mains-I Ib TOHD	UINT16	x100, %
4715	RO	Mains-I Ib TEHD	UINT16	x100, %
4716	RO	Mains-I Ic THD	UINT16	x100, %
4717	RO	Mains-I Ic TOHD	UINT16	x100, %
4718	RO	Mains-I Ic TEHD	UINT16	x100, %
4719	RO	Mains-II Ia THD	UINT16	x100, %
4720	RO	Mains-II Ia TOHD	UINT16	x100, %
4721	RO	Mains-II Ia TEHD	UINT16	x100, %
4722	RO	Mains-II Ib THD	UINT16	x100, %
4723	RO	Mains-II Ib TOHD	UINT16	x100, %
4724	RO	Mains-II Ib TEHD	UINT16	x100, %
4725	RO	Mains-II Ic THD	UINT16	x100, %
4726	RO	Mains-II Ic TOHD	UINT16	x100, %
4727	RO	Mains-II Ic TEHD	UINT16	x100, %
4728	RO	Mains-I Va THD	UINT16	x100, %
4729	RO	Mains-I Va TOHD	UINT16	x100, %
4730	RO	Mains-I Va TEHD	UINT16	x100, %
4731	RO	Mains-I Vb THD	UINT16	x100, %

4732	RO	Mains-I Vb TOHD	UINT16	x100,%
4733	RO	Mains-I Vb TEHD	UINT16	x100, %
4734	RO	Mains-I Vc THD	UINT16	x100, %
4735	RO	Mains-I Vc TOHD	UINT16	x100, %
4736	RO	Mains-I Vc TEHD	UINT16	x100, %
4737	RO	Mains-II Va/Vab THD[1]	UINT16	x100, %
4738	RO	Mains-II Va/Vab TOHD[1]	UINT16	x100, %
4739	RO	Mains-II Va/Vab TEHD[1]	UINT16	x100, %
4740	RO	Mains-II Vb/Vbc THD[1]	UINT16	x100, %
4741	RO	Mains-II Vb/Vbc TOHD[1]	UINT16	x100, %
4742	RO	Mains-II Vb/Vbc TEHD[1]	UINT16	x100, %
4743	RO	Mains-II Vc/Vca THD[1]	UINT16	x100, %
4744	RO	Mains-II Vc/Vca TOHD[1]	UINT16	x100, %
4745	RO	Mains-II Vc/Vca TEHD[1]	UINT16	x100, %
4746-4775	RO	Mains-I Ia Individual Harmonic Distortion	See Table 5-21 HD Data Structure	
4776-4805	RO	Mains-I Ib Individual Harmonic Distortion		
4806-4835	RO	Mains-I Ic Individual Harmonic Distortion		
4836-4865	RO	Mains-II Ia Individual Harmonic Distortion		
4866-4895	RO	Mains-II Ib Individual Harmonic Distortion		
4896-4925	RO	Mains-II Ic Individual Harmonic Distortion		
4926-4955	RO	Mains-I Va Individual Harmonic Distortion		
4956-4985	RO	Mains-I Vb Individual Harmonic Distortion		
4986-5015	RO	Mains-I Vc Individual Harmonic Distortion		
5016-5045	RO	Mains-II Va/Vab Individual Harmonic Distortion[1]		
5046-5075	RO	Mains-II Vb/Vbc Individual Harmonic Distortion[1]		
5076-5105	RO	Mains-II Vc/Vca Individual Harmonic Distortion[1]		

Table 5-20 Mains Harmonic Measurements

Notes:

1) Mains-II Line-to-neutral voltages THD/TOHD/TEHD Max/Min and line-to-line voltages THD/TOHD/TEHD Max/Min share the same register as these two options are mutually exclusive.
2) The following table illustrates the detail individual harmonics distortion.

Offset	Property	Description	Format	Scale/Unit
+0	RO	HD02	UINT16	x100, %
+1	RO	HD03	UINT16	x100, %
+2	RO	HD04	UINT16	x100, %
+3	RO	HD05	UINT16	x100, %
…	…	…	…	…
+27	RO	HD29	UINT16	x100, %
+28	RO	HD30	UINT16	x100, %
+29	RO	HD31	UINT16	x100, %

Table 5-21 HD Data Structure

5.5.2 Branch THD Measurements

Register	Property	Description	Format	Scale/Unit
5106	RO	SM1 Current THD	UINT16	x100,%
5107	RO	SM2 Current THD	UINT16	x100,%
….		….		
5189	RO	SM84 Current THD	UINT16	x100,%

Table 5-22 Branch Harmonic Measurements

5.5.3 Mains K Factor

Register	Property	Description	Format	Scale
5200	RO	Mains-I Ia K Factor	UINT16	x100
5201	RO	Mains-I Ib K Factor	UINT16	x100
5202	RO	Mains-I Ic K Factor	UINT16	x100
5203	RO	Mains-II Ia K Factor	UINT16	x100
5204	RO	Mains-II Ib K Factor	UINT16	x100
5205	RO	Mains-II Ic K Factor	UINT16	x100

Table 5-23 Mains K Factor

5.6 Log Register

5.6.1 SOE Recorder Log

Register	Property	Description	Format
10000-10008	RO	Event 1	See Table 5-25 SOE Log Data Structure
10009-10017	RO	Event 2	
10018-10026	RO	Event 3	
10027-10035	RO	Event 4	
….		….	
18991-18999	RO	Event 1000	

Table 5-24 SOE Log

Offset	Property	Description	Format	Range/Note
+0	RO	Reserved	UINT16	-
+1	RO	High-order Byte: Event Classification	UINT16	See Appendix A
		Low-order Byte: Sub-Classification		See Appendix A
+2	RO	High-order Byte: Year	UINT16	0-99 (Year-2000)
		Low-order Byte: Month		1 to 12
+3	RO	High-order Byte: Day	UINT16	1 to 31
		Low-order Byte: Hour		0 to 23
+4	RO	High-order Byte: Minute	UINT16	0 to 59
		Low-order Byte: Second		0 to 59
+5	RO	Millisecond	UINT16	0 to 999
+6	RO	Event Value High Word	INT16	-
+7	RO	Event Value Low Word	INT16	

+8	RO	Channel No.	UINT16	

Table 5-25 SOE Log Data Structure

5.6.2 Max/Min Recorder Log (MMR Log)

5.6.2.1 Mains MMR Log

Register	Property	Description	Format
30000-30397	RO	Mains Max Historical	See Table 5-27 Mains MMR Log Data Structure
30398-30795	RO	Mains Min Historical	
30796-31193	RO	Mains Max of This Month (Since Last Reset)	
31194-31591	RO	Mains Min of This Month (Since Last Reset)	
31592-31989	RO	Mains Max of Last Month (Before Last Reset)	
31990-32387	RO	Mains Min of Last Month (Before Last Reset)	

Table 5-26 Mains Max/Min Log

Notes:

The following table illustrates the Mains MMR Log Data Structure

Offset	Property	Description	Format	Scale/Unit
+0	RO	Mains-I Va	MM32U[1]	x100, V
+4	RO	Mains-I Vb		x100, V
+8	RO	Mains-I Vc		x100, V
+12	RO	Mains-I VLN Average		x100, V
+16	RO	Mains-I Vab		x100, V
+20	RO	Mains-I Vbc		x100, V
+24	RO	Mains-I Vca		x100, V
+28	RO	Mains-I VLL Average		x100, V
+32	RO	Mains-II Va		x100, V
+36	RO	Mains-II Vb		x100, V
+40	RO	Mains-II Vc		x100, V
+44	RO	Mains-II VLN Average		x100, V
+48	RO	Mains-II Vab		x100, V
+52	RO	Mains-II Vbc		x100, V
+56	RO	Mains-II Vca		x100, V
+60	RO	Mains-II VLL Average		x100, V
+64	RO	System FREQ		x100, Hz
+68	RO	Mains-I Ia		x1000, A
+72	RO	Mains-I Ib		x1000, A
+76	RO	Mains-I Ic		x1000, A
+80	RO	Mains-I I4		x1000, A
+84	RO	Reserved		
+88	RO	Mains-I I Average		x1000, A
+92	RO	Mains-I Ia Loading Factor		x10, %
+96	RO	Mains-I Ib Loading Factor		x10, %
+100	RO	Mains-I Ic Loading Factor		x10, %

+104	RO	Mains-I kWa		x1000, kW
+108	RO	Mains-I kWb		x1000, kW
+112	RO	Mains-I kWc		x1000, kW
+116	RO	Mains-I ∑kW		x1000, kW
+120	RO	Mains-I kvara		x1000, kvar
+124	RO	Mains-I kvarb		x1000, kvar
+128	RO	Mains-I kvarc		x1000, kvar
+132	RO	Mains-I ∑kvar		x1000, kvar
+136	RO	Mains-I kVAa		x1000, kVA
+140	RO	Mains-I kVAb		x1000, kVA
+144	RO	Mains-I kVAc		x1000, kVA
+148	RO	Mains-I ∑kVA		x1000, kVA
+152	RO	Mains-I PFa		x000
+156	RO	Mains-I PFb		x000
+160	RO	Mains-I PFc		x000
+164	RO	Mains-I ∑P.F.		x000
+168	RO	Mains-II Ia		x1000, A
+172	RO	Mains-II Ib		x1000, A
+176	RO	Mains-II Ic		x1000, A
+180	RO	Mains-II I4		x1000, A
+184	RO	Reserved	MM32[2]	
+188	RO	Mains-II I Average		x1000, A
+192	RO	Mains-II Ia Loading Factor		x10, %
+196	RO	Mains-II Ib Loading Factor		x10, %
+200	RO	Mains-II Ic Loading Factor		x10, %
+204	RO	Mains-II kWa		x1000, kW
+208	RO	Mains-II kWb		x1000, kW
+212	RO	Mains-II kWc		x1000, kW
+216	RO	Mains-II ∑kW		x1000, kW
+220	RO	Mains-II kvara		x1000, kvar
+224	RO	Mains-II kvarb		x1000, kvar
+228	RO	Mains-II kvarc		x1000, kvar
+232	RO	Mains-II ∑kvar		x1000, kvar
+236	RO	Mains-II kVAa		x1000, kVA
+240	RO	Mains-II kVAb		x1000, kVA
+244	RO	Mains-II kVAc		x1000, kVA
+248	RO	Mains-II ∑kVA		x1000, kVA
+252	RO	Mains-II PFa		x1000
+256	RO	Mains-II PFb		x1000
+260	RO	Mains-II PFc		x1000
+264	RO	Mains-II ∑P.F.		x000
+268	RO	Mains-I I Unbalance	MM32U[1]	x100, %
+272	RO	Mains-II I Unbalance		x100, %

+276	RO	Mains-I V Unbalance		x100, %
+280	RO	Mains-II V Unbalance		x100, %
+284	RO	RTD1 Temp.	MM16U[3]	x10, ℃
+287	RO	RTD2 Temp.		x10, ℃
+290	RO	Mains-I Ia THD		x100, %
+293	RO	Mains-I Ia TOHD		x100, %
+296	RO	Mains-I Ia TEHD		x100, %
+299	RO	Mains-I Ib THD		x100, %
+302	RO	Mains-I Ib TOHD		x100, %
+305	RO	Mains-I Ib TEHD		x100, %
+308	RO	Mains-I Ic THD		x100, %
+311	RO	Mains-I Ic TOHD		x100, %
+314	RO	Mains-I Ic TEHD		x100, %
+317	RO	Mains-II Ia THD		x100, %
+320	RO	Mains-II Ia TOHD		x100, %
+323	RO	Mains-II Ia TEHD		x100, %
+326	RO	Mains-II Ib THD		x100, %
+329	RO	Mains-II Ib TOHD		x100, %
+332	RO	Mains-II Ib TEHD		x100, %
+335	RO	Mains-II Ic THD		x100, %
+338	RO	Mains-II Ic TOHD		x100, %
+341	RO	Mains-II Ic TEHD		x100, %
+344	RO	Mains-I Va THD		x100, %
+347	RO	Mains-I Va TOHD		x100, %
+350	RO	Mains-I Va TEHD		x100, %
+353	RO	Mains-I Vb THD		x100, %
+356	RO	Mains-I Vb TOHD		x100, %
+359	RO	Mains-I Vb TEHD		x100, %
+362	RO	Mains-I Vc THD		x100, %
+365	RO	Mains-I Vc TOHD		x100, %
+368	RO	Mains-I Vc TEHD		x100, %
+371	RO	Mains-II Va/Vab THD[4]		x100, %
+374	RO	Mains-II Va/Vab TOHD[4]		x100, %
+377	RO	Mains-II Va/Vab TEHD[4]		x100, %
+380	RO	Mains-II Vb/Vbc THD[4]		x100, %
+383	RO	Mains-II Vb/Vbc TOHD[4]		x100, %
+386	RO	Mains-II Vb/Vbc TEHD[4]		x100, %
+389	RO	Mains-II Vc/Vca THD[4]		x100, %
+392	RO	Mains-II Vc/Vca TOHD[4]		x100, %
+395	RO	Mains-II Vc/Vca TEHD[4]		x100, %

Table 5-27 Mains MMR Log Data Structure

1) The **MM32U** data structure is illustrated in the following table.

Offset	Property	Description	Format
+0	RO	Record Value	UINT32
+2	RO	Record Time	UNIX Time

Table 5-28 MM32U Data Structure

2) The **MM32** data structure is illustrated in the following table.

Offset	Property	Description	Format
+0	RO	Record Value	INT32
+2	RO	Record Time	UNIX Time

Table 5-29 MM32 Data Structure

3) The **MM16U** data structure is illustrated in the following table.

Offset	Property	Description	Format
+0	RO	Record Value	UINT16
+2	RO	Record Time	UNIX Time

Table 5-30 MM16U Data Structure

4) Mains-II VLN THD/TOHD/TEHD Max/Min and VLL THD/TOHD/TEHD Max/Min share the same register as these two options are mutually exclusive.

5.6.2.2 Branch Max Recorder (MXR) Log

Register	Property	Description	Format
35000-38947	RO	Historical Max	See Table 5-32 Branch MXR Log Data Structure
38948-42895	RO	Max of This Month (Since Last Reset)	
42896-46843	RO	Max of Last Month (Before Last Reset)	

Table 5-31 Branch MXR Log

Offset	Property	Description	Format	Scale/Unit
+0	RO	1-Ø SM1 Current	MAX32U[1]	x1000, A
+4	RO	1-Ø SM2 Current		x1000, A
....		....		
+332	RO	1-Ø SM84 Current		x1000, A
+336	RO	2-Ø SM1 Current		x1000, A
+340	RO	2-Ø SM2 Current		x1000, A
....		....		
+500	RO	2-Ø SM42 Current		x1000, A
+504	RO	3-Ø SM1 Current		x1000, A
+508	RO	3-Ø SM2 Current		x1000, A
....		....		
+612	RO	3-Ø SM28 Current		x1000, A
+616	RO	1-Ø SM1 kW	MAX32[2]	x1000, kW
+620	RO	1-Ø SM2 kW		x1000, kW
....		....		
+948	RO	1-Ø SM84 kW		x1000, kW
+952	RO	2-Ø SM1 kW		x1000, kW
+956	RO	2-Ø SM2 kW		x1000, kW

....		....		
+1116	RO	2-Ø SM42 kW		x1000, kW
+1120	RO	3-Ø SM1 kW		x1000, kW
+1124	RO	3-Ø SM2 kW		x1000, kW
....		....		
+1228	RO	3-Ø SM28 kW		x1000, kW
+1232	RO	1-Ø SM1 kvar		x1000, kvar
+1236	RO	1-Ø SM2 kvar		x1000, kvar
....		....		
+1564	RO	1-Ø SM84 kvar		x1000, kvar
+1568	RO	2-Ø SM1 kvar		x1000, kvar
+1572	RO	2-Ø SM2 kvar		x1000, kvar
....		....		
+1732	RO	2-Ø SM42 kvar		x1000, kvar
+1736	RO	3-Ø SM1 kvar		x1000, kvar
+1740	RO	3-Ø SM2 kvar		x1000, kvar
....		....		
+1844	RO	3-Ø SM28 kvar		x1000, kvar
+1848	RO	1-Ø SM1 kVA	MAX32U[1]	x1000, kVA
+1852	RO	1-Ø SM2 kVA		x1000, kVA
....		....		
+2180	RO	1-Ø SM84 kVA		x1000, kVA
+2184	RO	2-Ø SM1 kVA		x1000, kVA
+2188	RO	2-Ø SM2 kVA		x1000, kVA
....		....		
+2348	RO	2-Ø SM42 kVA		x1000, kVA
+2352	RO	3-Ø SM1 kVA		x1000, kVA
+2356	RO	3-Ø SM2 kVA		x1000, kVA
....		....		
+2460	RO	3-Ø SM28 kVA		x1000, kVA
+2464	RO	1-Ø SM1 PF	MAX32[2]	x1000
+2468	RO	1-Ø SM2 PF		x1000
....		....		x1000
+2796	RO	1-Ø SM84 PF		x1000
+2800	RO	2-Ø SM1 PF		x1000
+2804	RO	2-Ø SM2 PF		x1000
....		....		x1000
+2964	RO	2-Ø SM42 PF		x1000
+2968	RO	3-Ø SM1 PF		x1000
+2972	RO	3-Ø SM2 PF		x1000
....		....		x1000
+3076	RO	3-Ø SM28 PF		x1000
+3080	RO	1-Ø SM1 Loading Factor	MAX32U[1]	x10, %

+3084	RO	1-Ø SM2 Loading Factor		x10, %
....		....		
+3412	RO	1-Ø SM84 Loading Factor		x10, %
+3416	RO	2-Ø SM1 Loading Factor		x10, %
+3420	RO	2-Ø SM2 Loading Factor		x10, %
....		....		
+3580	RO	2-Ø SM42 Loading Factor		x10, %
+3584	RO	3-Ø SM1 Loading Factor		x10, %
+3588	RO	3-Ø SM2 Loading Factor		x10, %
....		....		
+3692	RO	3-Ø SM28 Loading Factor		x10, %
+3696	RO	SM1 THD	MAX16U[3]	x100, %
+3699	RO	SM2 THD		x100, %
....		....		
+3945	RO	SM84 THD		x100, %

Table 5-32 Branch Max Log Data Structure

Notes:

1) **MAX32U** means an unsigned 32-bit Max Demand Log, the log data structure is illustrated in the following table.

Offset	Property	Description	Format
+0	RO	Record Value	UINT32
+2	RO	Record Time	UNIX Time

Table 5-33 MAX32U Branch Max Log Data Structure

2) **MAX32** means a signed 32-bit Max Demand Log, the log data structure is illustrated in the following table.

Offset	Property	Description	Format
+0	RO	Record Value	INT32
+2	RO	Record Time	UNIX Time

Table 5-34 MAX32 Branch Max Log Data Structure

3) **MAX16U** means an unsigned 16-bit Max/Min Log, the log data structure is illustrated in the following table.

Offset	Property	Description	Format
+0	RO	Record Value	UINT16
+2	RO	Record Time	UNIX Time

Table 5-35 MAX16U Branch Max Log Data Structure

5.7 VM Data

5.7.1 VM kW Measurements

Register	Property	Description	Format	Scale/Unit
5300	RO	VM1 kW	INT32	x1000, kW
5302	RO	VM2 kW	INT32	x1000, kW
5304	RO	VM3 kW	INT32	x1000, kW
5306	RO	VM4 kW	INT32	x1000, kW
5308	RO	VM5 kW	INT32	x1000, kW
5310	RO	VM6 kW	INT32	x1000, kW

5312	RO	VM7 kW	INT32	x1000, kW
5314	RO	VM8 kW	INT32	x1000, kW
5316	RO	VM9 kW	INT32	x1000, kW
5318	RO	VM10 kW	INT32	x1000, kW

Table 5-36 VM Measurement

5.7.2 VM Energy Measurements

Register	Property	Description	Format	Scale/Unit
5350	RO	VM1 kWh	UINT32	x10, kWh
5352	RO	VM1 kvarh	UINT32	x10, karh
5354	RO	VM1 kVAh	UINT32	x10, kVAh
5356	RO	VM2 kWh	UINT32	x10, kWh
5358	RO	VM2 kvarh	UINT32	x10, karh
5360	RO	VM2 kVAh	UINT32	x10, kVAh
5362	RO	VM3 kWh	UINT32	x10, kWh
5364	RO	VM3 kvarh	UINT32	x10, karh
5366	RO	VM3 kVAh	UINT32	x10, kVAh
5368	RO	VM4 kWh	UINT32	x10, kWh
5370	RO	VM4 kvarh	UINT32	x10, karh
5372	RO	VM4 kVAh	UINT32	x10, kVAh
5374	RO	VM5 kWh	UINT32	x10, kWh
5376	RO	VM5 kvarh	UINT32	x10, karh
5378	RO	VM5 kVAh	UINT32	x10, kVAh
5380	RO	VM6 kWh	UINT32	x10, kWh
5382	RO	VM6 kvarh	UINT32	x10, karh
5384	RO	VM6 kVAh	UINT32	x10, kVAh
5386	RO	VM7 kWh	UINT32	x10, kWh
5388	RO	VM7 kvarh	UINT32	x10, karh
5390	RO	VM7 kVAh	UINT32	x10, kVAh
5392	RO	VM8 kWh	UINT32	x10, kWh
5394	RO	VM8 kvarh	UINT32	x10, karh
5396	RO	VM8 kVAh	UINT32	x10, kVAh
5398	RO	VM9 kWh	UINT32	x10, kWh
5400	RO	VM9 kvarh	UINT32	x10, karh
5402	RO	VM9 kVAh	UINT32	x10, kVAh
5404	RO	VM10 kWh	UINT32	x10, kWh
5406	RO	VM10 kvarh	UINT32	x10, karh
5408	RO	VM10 kVAh	UINT32	x10, kVAh

Table 5-37 VM Energy Measurements

5.8 Setup Parameters

5.8.1 System Parameters

Register	Property	Description	Format	Range/Note

6000	RW	Panel Mode	UINT16	0 = Single Panel Mode I* 1 = Single Panel Mode II 2 = Dual Panel Mode I 3 = Dual Panel Mode II
6001	RW	Nominal Uln Voltage	UINT16	90V to 277V, 230*
6002	RW	Nominal Frequency	UINT16	0 = 50Hz* 1 = 60Hz
6003	RW	Mains-II Wiring Mode	UINT16	0 = WYE* 1 = Delta 2 = 1P3W
6004	RW	Mains-I CT Ratio.	UINT16	1A: 1* to 30000 5A: 1* to 6000
6005	RW	Mains-I I4 CT Ratio	UINT16	1* to 10000
6006	RW	Mains-II CT Ratio	UINT16	1A: 1* to 30000 5A: 1* to 6000
6007	RW	Mains-II I4 CT Ratio	UINT16	1* to 10000
6008	RW	Mains CT Ploarity[1]	Bitmap	
6009	RW	Power Factor Convention[2]	UINT16	0 = IEC* 1 = IEEE 2 = -IEEE
6010	RW	kVA Calculation[3]	UINT16	0 = Vector* 1 = Scalar
6011	RW	Demand Period	UINT16	1/2/3/5/10/15*/30/60 (min)
6012	RW	Number of Sliding Windows	UINT16	1* to 15
6013	RW	SMTP Alarm Email Enable	UINT16	0 = Disabled* 1 = Enabled
6014	RW	Time Zone[4]	UINT16	0 to 32, 26*
6015	RW	System Language	UINT16	0 = Simplified Chinese 1 = English* 2 = Traditional Chinese
6016	RW	DI1 Debounce	UINT16	1 to 1000 (ms), 20*
6017	RW	DI2 Debounce	UINT16	
6018	RW	DO1 Control Mode	UINT16	0 = Manual 1 = Mains-I Instantaneous Alarm 2 = Mains-II Instantaneous Alarm 4 = Mains-I Latched Alarm 5 = Mains-II Latched Alarm 6 = Global Latched Alarm
6019	RW	DO2 Control Mode	UINT16	
6020	RW	Mains-I Wiring Mode	UINT16	0 = WYE* 1 = 1P3W 2 = Demo
6021	RW	Self-Read Time[5]	UINT16	0* to 2823, 0xFFFF
6022	RW	Date Format	UINT16	0 = YYYY/MM/DD* 1 = MM/DD/YYYY 2 = DD/MM/YYYY

*Default

Table 5-38 Basic Setup Parameters

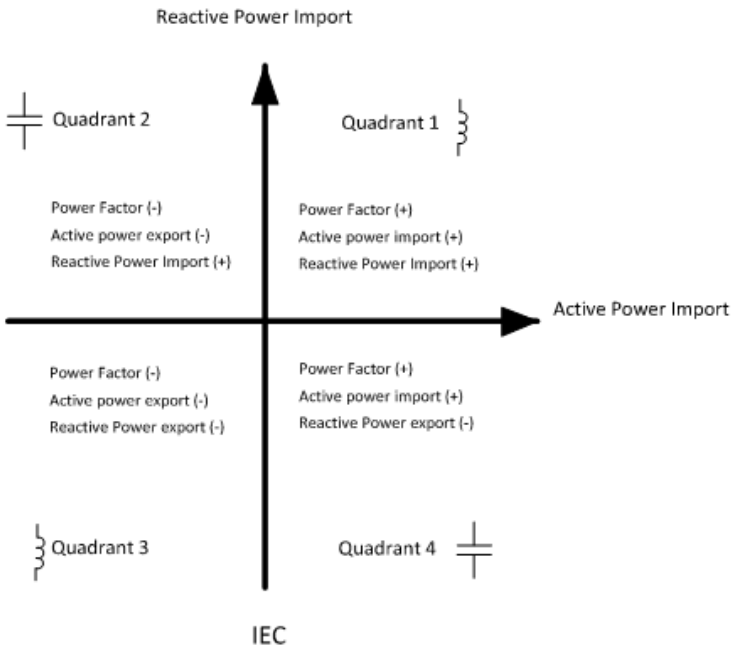
Notes:

1) The **Mains CT Polarity** register indicates the various Mains current polarities with a bit value of 0 meaning normal and 1 meaning reverse. The following table illustrates the details of the **Mains CT Polarity** register.

Bit	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Mains-I Current Polarity	Mains-I Ia	Mains-I Ib	Mains-I Ic	Mains-I I4
Bit	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**
Mains-II Current Polarity	Mains-II Ia	Mains-II Ib	Mains-II Ic	Mains-II I4
Bit	**Bits 8 - 15**			
	Reserved			

Table 5-39 Mains CT Polarity Register (Reg. # 6008)

2) P.F. Convention: -IEEE is the same as IEEE but with the opposite sign.



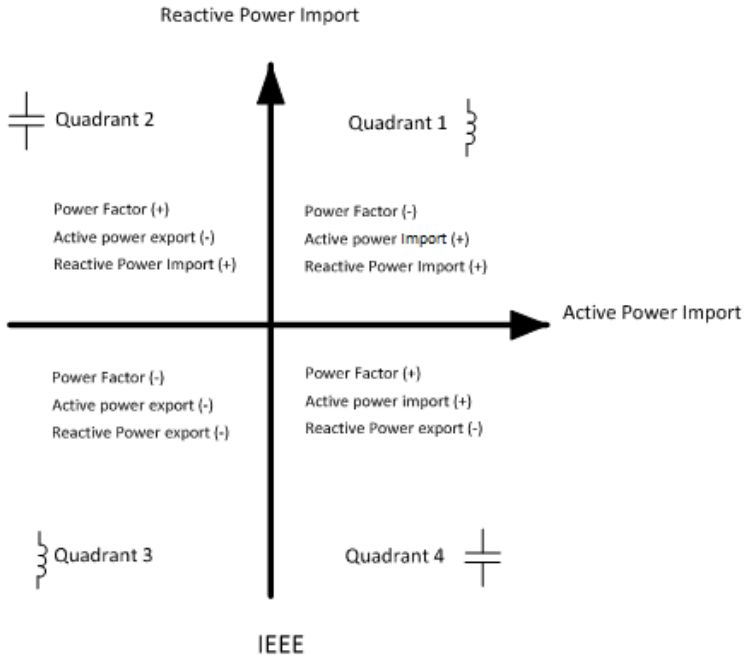


Figure 5-1 Power Factor Definitions

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 = kVAa + kVAb + kVAc**

4) The following table lists the supported Time Zones:

Code	Time Zone	Code	Time Zone	Code	Time Zone
0	GMT-12:00	**11**	GMT-2:00	**22**	GMT+5:45
1	GMT-11:00	**12**	GMT-1:00	**23**	GMT+6:00
2	GMT-10:00	**13**	GMT-0:00	**24**	GMT+6:30
3	GMT-9:00	**14**	GMT+1:00	**25**	GMT+7:00
4	GMT-8:00	**15**	GMT+2:00	**26**	GMT+8:00
5	GMT-7:00	**16**	GMT+3:00	**27**	GMT+9:00
6	GMT-6:00	**17**	GMT+3:30	**28**	GMT+9:30
7	GMT-5:00	**18**	GMT+4:00	**29**	GMT+10:00
8	GMT-4:00	**19**	GMT+4:30	**30**	GMT+11:00
9	GMT-3:30	**20**	GMT+5:00	**31**	GMT+12:00
10	GMT-3:00	**21**	GMT+5:30	**32**	GMT+13:00

Table 5-40 Time Zones

5) **Self-Read Time** is applied to Max Demand Log and Max/Min Log.

There are three types of **Self-Read Time**.

A zero value indicates that the transfer will happen at 24:00 of the last day of every month.

A non-zero value indicates that the transfer will happen at a specific time based on the formula [Hour+Day*100] where 0≤Hour≤23 and 1≤Day≤28. For example, the value 2812 means that the Max Demand of Current Month will be transferred to the Max Demand of Last Month register at 12:00pm on the 28th day of each month.

A 0xFFFF value will disable the Self-Read operation and replace it with manual operation. A manual reset will cause the Max/Min Log of **This Month** to be transferred to the Max/Min Log of **Last Month** and then reset. The terms **This Month** and **Last Month** will become **Since Last Reset** and **Before Last Reset**.

5.8.2 Communications Setup

Register	Property	Description	Format	Range/Note
6240	RW	Port 1 unit ID	UINT16	1 to 247, 100*
6241	RW	Port 1 Baud rate	UINT16	0 = 1200, 1 = 2400, 2 = 4800, 3 = 9600, 4 = 19200, 5 = 38400*
6242	RW	Port 1 Configuration	UINT16	0 = 8N2, 1 = 8O1, 2 = 8E1* 3 = 8N1, 4 = 8O2, 5 = 8E2
6243	RW	Port 2 unit ID	UINT16	1 to 247, 101*
6244	RW	Port 2 Baud rate	UINT16	0 = 1200, 1 = 2400, 2 = 4800 3 = 9600, 4 = 19200, 5 = 38400*
6245	RW	Port 2 Configuration	UINT16	0 = 8N2, 1 = 8O1, 2 = 8E1* 3 = 8N1, 4 = 8O2, 5 = 8E2
6246	RW	IP Address(H)	UINT16	If the IP Address is 192.168.0.100, write “0xC0A80064” to this register. (Default = 192.168.0.100)
6247	RW	IP Address(L)	UINT16	
6248	RW	Subnet mask(H)	UINT16	If the Subnet Mask is 255.255.255.0, write “0xFFFFFF00” to this register. (Default = 255.255.255.0)
6249	RW	Subnet mask(L)	UINT16	
6250	RW	Gateway Address(H)	UINT16	If the IP Address is 192.168.0.1, write “0xC0A80201” to this register. (Default = 192.168.2.1)
6251	RW	Gateway Address(L)	UINT16	
6252	RW	SNTP Enable	UINT16	0 = Disabled* 1 = Enabled
6253	RW	SNTP Time Sync. Interval[1]	UINT16	10 to 1440 (min), 60*
6254	RW	SNTP Server IP Address (H)	UINT16	If address is 192.168.0.100, write “0xC0A80064” to this register (Default = 192.168.0.100)
6255	RW	SNTP Server IP Address (L)	UINT16	

6256	RW	SMTP Server IP Address (H)	UINT16	If address is 191.0.0.6, write "0XBF000006" to this register (Default = 191.0.0.6)
6257	RW	SMTP Server IP Address (L)	UINT16	
6258-6297	RW	Sender Email Address[2]	UINT16X40	See Note (2)
6298-6337	RW	Login Password[3]	UINT16X40	See Note (3)
6338-6377	RW	Receiver Email Address[4]	UINT16X40	See Note (4)
6378	RW	SNMP Event Subscription	Bitmap	0* to 31
6379	RW	SNMP Event Subscriber IP Address (H)	UINT16	0*
6380	RW	SNMP Event Subscriber IP Address (L)	UINT16	

*Default

Table 5-41 Communication Setup

Notes:

1) The synchronization Interval should be set between 10 and 1440 minutes.

2) This string register specifies the source email address that appears in the "From" field of the email. This string may be up to 40 characters long. Please add the value zero "0000" at the end of the string as the string terminator. For example, if the email address is sender@example.com, set the registers as"00 73 00 65 00 6E 00 64 00 65 00 72 00 40 00 65 00 78 00 61 00 6D 00 70 00 6C 00 65 00 2E 00 63 00 6F 00 6D 00 00 00 00".

3) This string register specifies the Password to login the "**Sender Email**" account. This string may be up to 40 characters long. Please add the value zero "0000" at the end of the string as the string terminator. For example, if the password is "example", set the registers as "00 65 00 78 00 61 00 6D 00 70 00 6C 00 65 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00".

4) This string register specifies the destination email address that appears in the "To" field of the email. This string may be up to 40 characters long. Please add the value zero "0000" at the end of the string as the string terminator. For example, if the email address is receiver@example.com, so set the registers as"00 72 00 65 00 63 00 65 00 69 00 76 00 65 00 72 00 40 00 65 00 78 00 61 00 6D 00 70 00 6C 00 65 00 2E 00 63 00 6F 00 6D".

5) The **SNMP Event Subscription** register indicates which SOE will be send out by Trap format with a bit value of 1 meaning send out by trap.

Bit	Bits 5 - 15	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
SOE	Reserved	Self-test Events	Operation Events	Setpoint Events	DO Events	DI Events

Table 5-42 SNMP Event Subscription (Reg. # 6378)

5.8.3 SM Name Setup

Register	Property	Description	Format	Note
6050-6069	RW	Meter Model[1]	UINT16x20	ASCII
6070-6089	RW	Mains-I Name	UINT16x20	
6090-6109	RW	Mains-II Name	UINT16x20	
50000-50019	RW	SM1 Name	UINT16x20	
50020-50039	RW	SM2 Name	UINT16x20	
….		….		
51660-51679	RW	SM84 Name	UINT16x20	

Table 5-43 SM Name Register

Notes:

1) The Meter Model appears in registers 6050 to 6069 and contains the ASCII encoding of the string "PMC-592" as shown in the following table.

Register	Value(Hex)	ANSCII
6050	0x50	P
6051	0x4D	M
6052	0x43	C

6053	0x2D	-
6054	0x35	5
6055	0x39	9
6056	0x32	2
6057-6569	0x20	<Null>

Table 5-44 ASCII Encoding of "PMC-592"

5.8.4 Breakers Rating Setup

Register	Property	Description	Format	Range/Default
6150	RW	Mains-I Breaker Rating	UINT16	1 to 2000A, (Default = 500A)
6151	RW	Mains-I I4 Current Rating	UINT16	1 to 2000A, (Default = 500A)
6152	RW	Mains-II Breaker Rating	UINT16	
6153	RW	Mains-II I4 Current Rating	UINT16	
6154	RW	SM1 Breaker Rating	UINT16	1 to 300A, (Default = 60A)
6155	RW	SM2 Breaker Rating	UINT16	
....		....		
6237	RW	SM84 Breaker Rating	UINT16	

Table 5-45 Breaker Rating Setup Register

5.8.5 Alarm Setup

Register	Property	Description	Format	Range/Options
6390	RW	Universal Hysteresis[1]	UINT16	0 to 100 (x0.1%), 20*
6391	RW	Current Alarm ON Threshold[2]	UINT16	0 to 100 (x0.1%), 50*
6392	RW	Current Alarm ON Time Delay	UINT16	0 to 9999 (s), 10s*
6393	RW	Current Alarm OFF Time Delay	UINT16	0 to 9999 (s), 30s*
6403	RW	Current Alarm Enable[3]	Bitmap	Note 3
6404	RW	Current HH Alarm Threshold	UINT16	0 to 1000, 800*
6405	RW	Current HH Alarm Time Delay	UINT16	0 to 9999 (s), 10s*
6406	RW	Current H Alarm Threshold	UINT16	0 to 1000, 600*
6407	RW	Current H Alarm Time Delay	UINT16	0 to 9999 (s), 10s*
6408	RW	Current L Alarm Threshold	UINT16	0* to 1000
6409	RW	Current L Alarm Time Delay	UINT16	0* to 9999 (s)
6410	RW	Current LL Alarm Threshold	UINT16	0* to 1000
6411	RW	Current LL Alarm Time Delay	UINT16	0* to 9999 (s)
6412	RW	Vln Alarm Enable[4]	Bitmap	0 = Disable* 1 = Enable
6413	RW	Vln H Alarm Threshold	UINT16	0* to 3000 (x0.1)
6414	RW	Vln H Alarm Time Delay	UINT16	0* to 9999 (s)
6415	RW	Vln L Alarm Threshold	UINT16	0* to 3000 (x0.1)
6416	RW	Vln L Alarm Time Delay	UINT16	0* to 9999 (s)
6417	RW	Vll Alarm Enable[5]	Bitmap	0 = Disabled* 1 = Enabled
6418	RW	Vll H Alarm Threshold	UINT16	0* to 5000 (x0.1)
6419	RW	Vll H Alarm Time Delay	UINT16	0* to 9999 (s)
6420	RW	Vll L Alarm Threshold	UINT16	0* to 5000 (x0.1)

6421	RW	Vll L Alarm Time Delay	UINT16	0* to 9999 (s)
6422	RW	Power Alarm Enable[6]	Bitmap	0 = Disabled* 1 = Enabled
6423	RW	kW Total H Alarm Threshold[7]	UINT16	0* to 1000(x0.1)
6424	RW	kW Total H Alarm Time Delay	UINT16	0* to 9999(s)
6425	RW	kW Total L Alarm Threshold	UINT16	0* to 1000(x0.1)
6426	RW	kW Total L Alarm Time Delay	UINT16	0* to 9999(s)
6427	RW	kvar Total H Alarm Threshold	UINT16	0* to 1000(x0.1)
6428	RW	kvar Total H Alarm Time Delay	UINT16	0* to 9999(s)
6429	RW	kvar Total L Alarm Threshold	UINT16	0* to 1000(x0.1)
6430	RW	kvar Total L Alarm Time Delay	UINT16	0* to 9999(s)
6431	RW	kVA Total H Alarm Threshold	UINT16	0* to 1000(x0.1)
6432	RW	kVA Total H Alarm Time Delay	UINT16	0* to 9999(s)
6433	RW	kVA Total L Alarm Threshold	UINT16	0* to 1000(x0.1)
6434	RW	kVA Total L Alarm Time Delay	UINT16	0* to 9999(s)
6435	RW	PF Total Alarm Enable[6]	Bitmap	0 = Disable* 1 = Enable
6436	RW	PF Total H Alarm Threshold	UINT16	0* to 1000(x0.001)
6437	RW	PF Total H Alarm Time Delay	UINT16	0* to 9999(s)
6438	RW	PF Total L Alarm Threshold	UINT16	0* to 1000(x0.001)
6439	RW	PF Total L Alarm Time Delay	UINT16	0* to 9999(s)
6440	RW	Frequency H Alarm Threshold	UINT16	4500 to 6500*(x0.01)
6441	RW	Frequency H Alarm Time Delay	UINT16	0 to 9999(s), 10*
6442	RW	Frequency L Alarm Threshold	UINT16	4500* to 6500 (x0.01)
6443	RW	Frequency L Alarm Time Delay	UINT16	0 to 9999 (s), 10s*
6444	RW	I Demand Alarm Enable[6]	Bitmap	0 = Disabled* 1 = Enabled
6445	RW	I Demand HH Alarm Threshold	UINT16	0* to 1000 (x0.1)
6446	RW	I Demand HH Alarm Time Delay	UINT16	0* to 9999 (s)
6447	RW	I Demand H Alarm Threshold	UINT16	0* to 1000 (x0.1)
6448	RW	I Demand H Alarm Time Delay	UINT16	0* to 9999 (s)
6449	RW	I Demand L Alarm Threshold	UINT16	0* to 1000 (x0.1)
6450	RW	I Demand L Alarm Time Delay	UINT16	0* to 9999 (s)
6451	RW	I Demand LL Alarm Threshold	UINT16	0* to 1000 (x0.1)
6452	RW	I Demand LL Alarm Time Delay	UINT16	0* to 9999 (s)
6453	RW	Power Demand Alarm Enable6	Bitmap	0 = Disabled* 1 = Enabled
6454	RW	kW Total Demand H Alarm Threshold	UINT16	0* to 1000 (x0.1)
6455	RW	kW Total Demand H Alarm Time Delay	UINT16	0* to 9999 (s)
6456	RW	kW Total Demand L Alarm Threshold	UINT16	0* to 1000 (x0.1)
6457	RW	kW Total Demand L Alarm Time Delay	UINT16	0* to 9999 (s)
6458	RW	kvar Total Demand H Alarm Threshold	UINT16	0* to 1000 (x0.1)
6459	RW	kvar Total Demand H Alarm Time Delay	UINT16	0* to 9999 (s)
6460	RW	kvar Total Demand L Alarm Threshold	UINT16	0* to 1000 (x0.1)
6461	RW	kvar Total Demand L Alarm Time Delay	UINT16	0* to 9999 (s)
6462	RW	kVA Total Demand H Alarm Threshold	UINT16	0* to 1000 (x0.1)

6463	RW	kVA Total Demand H Alarm Time Delay	UINT16	0* to 9999 (s)
6464	RW	kVA Total Demand L Alarm Threshold	UINT16	0* to 1000(x0.1)
6465	RW	kVA Total Demand L Alarm Time Delay	UINT16	0* to 9999 (s)
6466	RW	RTD1 HH Alarm Threshold	UINT16	0* to 200
6467	RW	RTD1 HH Alarm Time Delay	UINT16	0* to 9999 (s)
6468	RW	RTD1 H Alarm Threshold	UINT16	0* to 200
6469	RW	RTD1 H Alarm Time Delay	UINT16	0* to 9999 (s)
6470	RW	RTD2 HH Alarm Threshold	UINT16	0* to 200
6471	RW	RTD2 HH Alarm Time Delay	UINT16	0* to 9999 (s)
6472	RW	RTD2 H Alarm Threshold	UINT16	0* to 200
6473	RW	RTD2 H Alarm Time Delay	UINT16	0* to 9999 (s)
6474	RW	I Unbalance Alarm Enable[8]	Bitmap	0 = Disabled* 1 = Enabled
6475	RW	I Unbalance Alarm Threshold	UINT16	0* to 1000 (x0.1%)
6476	RW	I Unbalance Alarm Time Delay	UINT16	0* to 9999 (s)
6477	RW	V Unbalance Alarm Enable[8]	Bitmap	0 = Disabled* 1 = Enabled
6478	RW	V Unbalance Alarm Threshold	UINT16	0* to 1000 (x0.1%)
6479	RW	V Unbalance Alarm Time Delay	UINT16	0* to 9999 (s)
6480	RW	Harmonic Distortion Alarm Enable[9]	Bitmap	0 = Disabled* 1 = Enabled
6481	RW	THD Alarm Threshold	UINT16	0* to 1000 (x0.1%)
6482	RW	THD Alarm Time Delay	UINT16	0* to 9999 (s)
6483	RW	TOHD Alarm Threshold	UINT16	0* to 1000 (x0.1%)
6484	RW	TOHD Alarm Time Delay	UINT16	0* to 9999 (s)
6485	RW	TEHD Alarm Threshold	UINT16	0* to 1000 (x0.1%)
6486	RW	TEHD Alarm Time Delay	UINT16	0* to 9999 (s)
6487	RW	DI1 Alarm Configuration	UINT16	0 = Disable 1 = DI1 Open Trigger 2 = DI1 Closed Trigger
6488	RW	DI1 Alarm Time Delay	UINT16	0* to 9999 (s)
6489	RW	DI2 Alarm Configuration	UINT16	0* = Disable 1 = DI2 Open Trigger 2 = DI2 Closed Trigger
6490	RW	DI2 Alarm Time Delay	UINT16	0* to 9999 (s)

*Default

Table 5-46 Alarm Setup Parameters

Notes:

1) The calculation method **Universal Hysteresis** is listed below:

$$\text{Universal Hysteresis} = \frac{\left|\text{Alarm Threshold - Alarm Return Threshold}\right|}{\text{Alarm Threshold}} \times 100\%$$

2) Current Alarm ON value = Breaker Rating x **Current Alarm ON Threshold**
3) The following table illustrates the details of the **Current Alarm Enable** register with a bit value of 1 meaning enabled and 0 meaning disabled.

	Bits 3 - 15	Bit 2	Bit 1	Bit 0
Current Alarm Enable	Reserved	Branch Current	Mains-II Current	Mains-I Current

Table 5-47 Current Alarm Enabled Register (Reg. # 6403)

4) The following table illustrates the details of the **VLN Alarm Enable** register with a bit value of 1 meaning enabled and 0 meaning disabled.

	Bits 2 - 15	Bit 1	Bit 0
VLN Alarm Enable	Reserved	Mains-II Vln	Mains-I Vln

Table 5-48 VLN Alarm Enabled Register (Reg. # 6412)

5) The following table illustrates the details of the **VLL Alarm Enable** register with a bit value of 1 meaning enabled and 0 meaning disabled.

	Bits 2 - 15	Bit 1	Bit 0
VLL Alarm Enable	Reserved	Mains-II Vll	Mains-I Vll

Table 5-49 VLL Alarm Enabled Register (Reg. # 6417)

6) The following table illustrates the details of the **Power/PF/I Demand and Power Demand Alarm Enable** register with a bit value of 1 meaning enabled and 0 meaning disabled.

	Bits 2 - 15	Bit 1	Bit 0
Power/PF/I Demand/Power Demand Alarm Enable	Reserved	Mains-II	Mains-I

Table 5-50 Power/PF/I Demand and Power Demand Alarm Enabled

7) kW H Alarm Threshold is a percentage of the 3-ø Power rating. If the H Alarm Threshold is 10%, the rated voltage is 220V and the Breaker Rating is 100A, then the kW H Alarm setting = 220 * 100 * 3 * 10% = 6600W = 6.6kW

8) The following table illustrates the details of the **V/I Unbalance Alarm Enable** register with a bit value of 1 meaning enabled and 0 meaning disabled.

	Bits 2 - 15	Bit 1	Bit 0
V/I Unbalance Alarm Enable	**Reserved**	**Mains-II V/I Unbalance**	**Mains-I V/I Unbalance**

Table 5-51 V/I Unbalance Alarm Enabled

9) The following table illustrates the details of the **Harmonic Distortion Alarm Enable** register with a bit value of 1 meaning enabled and 0 meaning disabled.

	Bits 4 - 15	Bit 3	Bit 2	Bit 1	Bit 0
THD/TOHD/TEHD Alarm Enable	Reserved	Mains-II V	Mains-II	Mains-I V	Mains-I I

Table 5-52 Harmonic Distortion Alarm Enabled (Reg. # 6480)

5.8.6 Branch Setup Parameters

Register	Property	Description	Format	Range/Options
6520	RW	CT Strip Mode	UINT16	0 = Sequential Mode* 1 = Cross-over Mode
6521	RW	CT Strip A Polarity	UINT16	0 = Normal* 1 = Reversed
6522	RW	CT Strip B Polarity	UINT16	
6523	RW	CT Strip C Polarity	UINT16	
6524	RW	CT Strip D Polarity	UINT16	
6525	RW	CT Strip A Installation Direction	UINT16	0 = Top* 1 = Bottom
6526	RW	CT Strip B Installation Direction	UINT16	
6527	RW	CT Strip C Installation Direction	UINT16	
6528	RW	CT Strip D Installation Direction	UINT16	
6529	RW	SM1 Voltage Phase	UINT16	0 = Not Use 1 = A Phase* 2 = B Phase 3 = C Phase
6530	RW	SM2 Voltage Phase	UINT16	
6531	RW	SM3 Voltage Phase	UINT16	
6532	RW	SM4 Voltage Phase	UINT16	
6533	RW	SM5 Voltage Phase	UINT16	

6534	RW	SM6 Voltage Phase	UINT16	
….		….		
6549	RW	SM21 Voltage Phase	UINT16	
6550	RW	SM22 Voltage Phase	UINT16	
….		….		
6570	RW	SM42 Voltage Phase	UINT16	
6571	RW	SM43 Voltage Phase	UINT16	
….		….		
6591	RW	SM63 Voltage Phase	UINT16	
6592	RW	SM64 Voltage Phase	UINT16	
….		….		
6612	RW	SM84 Voltage Phase	UINT16	

* Default

Table 5-53 Branch Parameters Setup

5.8.7 VM (Virtual Meter) Setup

5.8.7.1 VM Configuration

Register	Property	Description	Format	Range/Options
6700-6705	RW	VM1 Configuration	UINT16	See section 5.8.7.2 VM Configuration Data Structure
6706-6711	RW	VM2 Configuration	UINT16	
6712-6717	RW	VM3 Configuration	UINT16	
6718-6723	RW	VM4 Configuration	UINT16	
6724-6729	RW	VM5 Configuration	UINT16	
6730-6735	RW	VM6 Configuration	UINT16	
6736-6741	RW	VM7 Configuration	UINT16	
6742-6747	RW	VM8 Configuration	UINT16	
6748-6753	RW	VM9 Configuration	UINT16	
6754-6759	RW	VM10 Configuration	UINT16	

Table 5-54 Total VM Configuration Group

5.8.7.2 VM Configuration Data Structure

Offset	Property	Description	Format	Range/Options
+0	RW	VM Configuration 1[1]	Bitmap	0* to 65535
+1	RW	VM Configuration 2[1]	Bitmap	
+2	RW	VM Configuration 3[1]	Bitmap	
+3	RW	VM Configuration 4[1]	Bitmap	
+4	RW	VM Configuration 5[1]	Bitmap	
+5	RW	VM Configuration 6[1]	Bitmap	0* to 15

*Default

Table 5-55 Total VM Configurations

Notes:

1) Each Bit indicates if a particular SM is included in a VM's aggregation. Setting a bit to 1 includes a SM or to 0 excludes it in the VM's aggregation. The Virtual Meter configuration is supported through communications, the built-in Web Interface and the optional HMI Display.

Bit	Bit 15	Bit 14	Bit 13	…	Bit 2	Bit 1	Bit 0
SMs	SM16	SM15	SM14	…	SM3	SM2	SM1

Table 5-56 VM Configuration 1

Bit	Bit 15	Bit 14	Bit 13	…	Bit 2	Bit 1	Bit 0
SMs	SM32	SM31	SM30	…	SM19	SM18	SM17

Table 5-57 VM Configuration 2

Bit	Bit 15	Bit 14	Bit 13	…	Bit 2	Bit 1	Bit 0
SMs	SM48	SM47	SM46	…	SM35	SM34	SM33

Table 5-58 VM Configuration 3

Bit	Bit 15	Bit 14	Bit 13	…	Bit 2	Bit 1	Bit 0
SMs	SM64	SM63	SM62	…	SM51	SM50	SM49

Table 5-59 VM Configuration 4

Bit	Bit 15	Bit 14	Bit 13	…	Bit 2	Bit 1	Bit 0
SMs	SM80	SM79	SM78	…	SM67	SM66	SM65

Table 5-60 VM Configuration 5

Bit	Bit 4 to Bit 15	Bit 3	Bit 2	Bit 1	Bit 0
SMs	Reserved	SM84	SM83	SM82	SM81

Table 5-61 VM Configuration 6

5.8.8 WFR Setup

5.8.8.1 WFR Setup Parameters

Register	Property	Description	Format	Range/Options
7000	RW	WFR Format (# of Samples/Cycles x #of Cycles)	UINT16	0 = 16x600* 3 = 32x150 1 = 16x300 4 = 64x150 2 = 32x300 5 = 64x75
7001	RW	Pre-fault Cycles[3]	UINT16	1 to 10, 5*

* Default

Table 5-62 WFR Log

Notes:

1) Modifying the Setup Parameters of WFRx will clear the WFRx Log and reset WFRx Pointer will be reset to “0”.

5.8.8.2 WFR File Structure

Register	Property	Description	Format
7500-7519	RW	File Name[1]	Char
7520	RO	File Size	UINT32
7522	RW	File Offset[2]	UINT32
7524	RO	Valid Byte Count[3]	UINT16
7525	RO	File Data Buffer 1[4]	Char
……	RO	……	Char
7646	RO	File Data Buffer 244[4]	Char

Table 5-63 WFR Log Structure

Notes:

1) You must read out register 7500 to register 7519 for a time to get the whole **File Name**.

Writing the path strings what you want to read in **File Name** register, and there are the following strings and XXX represents the file number:

WFR configuration file: COMTRADE/WXXX.cfg

WFR data file: COMTRADE/WXXX.dat

If the WFR **File Name** are WAVE/W001.cfg and WAVE/W001.dat, and their string codes are 0x57,0x41,0x56,0x45,0x2F,0x57,0x30,0x30,0x31,0x2E,0x63,0x66,0x67 and 0x57,0x41,0x56,0x45,0x2F,0x57,0x30,0x30,0x31,0x2E,0x64,0x61,0x74 respectively.

2) **File Offset** register defines the offset of the first byte in the data buffer of the current file, it will automatically adjust the file offset when read the **File Offset** register and it also can adjust to the specific offset by writing a relative number to **File Offset** register.

3) It means that the file transfer completed when the **Valid Byte Count** is 0 and **File Offset** is equivalent to the file size.

4) **File Data Buffer 1** to **File Data Buffer 244** can be up to transfer 244 bytes data every time. And you also need to read out all data buffer for a time to get the whole data.

5.8.9 Interval Energy Recorder Setup

5.8.9.1 IER Setup

Register	Property	Description		Format	Note
7100	RW	Recording Mode		UINT16	0 = Disabled* 1 = Stop-When-Full 2 = First-In-First-Out
7101	RW	Recording Depth[1]		UINT16	0* to 10000
7102	RW	Recording Interval		UINT16	0 = 5mins* 1 = 10mins 2 = 15mins 3 = 30mins 4 = 60mins
7103	RW	Start Time[2]	High-order Byte: Year	UINT16	0-99 (Year-2000)
			Low-order Byte: Month		1 to 12
7104	RW		High-order Byte: Day	UINT16	1 to 31
			Low-order Byte: Hour		0 to 23
7105	RW		High-order Byte: Minute	UINT16	0 to 59
			Low-order Byte: Second		0 to 59

* Default

Table 5-64 IER Log

Notes:
1) If "**Recording Depth**" is set to "**0**, the IER is disabled.
2) When the current time meets or exceeds the **Start Time**, the IER starts to record.

5.8.9.2 IER Log Data Structure

Register	Property	Description	Format	Note
7120	RW	High Order - IER Log Meter Type	UINT16	See Note 1)
		Low Order - IER Log Meter Number		

Table 5-65 IER Log Data Structure

Note:

1) As to the 16 bit unsigned value (0xXXXX) which be written to the register, different values have different meanings, the following table illustrates the details.

Key	IER Log Meter Type	IER Log Meter Number	Description
1	0x01 (Mains)	0x01	Mains-I IER Logs(0x0101)
		0x02	Mains-II IER Logs(0x0102)
2	0x02	0x01	1-Ø SM1 IER Logs (0x0201)

	(1-Ø SM)	0x02	1-Ø SM2 IER Logs (0x0202)
		0x03	1-Ø SM3 IER Logs (0x0203)
		….	….
		0x54	1-Ø SM84 IER Logs (0x0254)
3	0x03 (2-Ø SM)	0x01	2-Ø SM1 IER Logs (0x0301)
		0x02	2-Ø SM2 IER Logs (0x0302)
		0x03	2-Ø SM3 IER Logs (0x0303)
		….	….
		0x2A	2-Ø SM42 IER Logs (0x032A)
4	0x04 (3-Ø SM)	0x01	3-Ø SM1 IER Logs (0x0401)
		0x02	3-Ø SM2 IER Logs (0x0402)
		0x03	3-Ø SM3 IER Logs (0x0403)
		….	….
		0x1C	3-Ø SM28 IER Logs (0x041C)
5	0x05 (Total VMx)	0x01	Total VM1 IER Logs (0x0501)
		0x02	Total VM2 IER Logs (0x0502)
		….	….
		0x0A	Total VM10 IER (0x020A)

Table 5-66 IER Log

5.8.10 Control Setup

5.8.10.1 DO Control

The PMC-592 adopts the ARM before EXECUTE operation for the remote control of its Digital Outputs. Before executing an OPEN or CLOSE command on a Digital Output, it must be “Armed” first. This is achieved by writing the value 0xFF00 to the appropriate register to “Arm” a particular RO/DO operation. The DO will be “Disarmed” automatically if an “Execute” command is not received within 15 seconds after it has been “Armed”. If an “Execute” command is received without first having received an “Arm” command, the meter ignores the “Execute” command and returns the 0x04 exception code.

Register	Property	Description	Format	Note
9100	WO	Arm DO1 Close	UINT16	Writing “0xFF00”
9101	WO	Execute DO1 Close	UINT16	Writing “0xFF00”
9102	WO	Arm DO1 Open	UINT16	Writing “0xFF00”
9103	WO	Execute DO1 Open	UINT16	Writing “0xFF00”
9104	WO	Arm DO2 Close	UINT16	Writing “0xFF00”
9105	WO	Execute DO2 Close	UINT16	Writing “0xFF00”
9106	WO	Arm DO2 Open	UINT16	Writing “0xFF00”
9107	WO	Execute DO2 Open	UINT16	Writing “0xFF00”

Table 5-67 DO Control

5.8.10.2 Clear/Reset Control

Register	Property	Description	Format	Note

7200	WO	Clear All Latched Alarms	UINT16	Writing "0xFF00" to the register clears all the Latched Alarms
7201	WO	Clear All Alarm Counters	UINT16	Writing "0xFF00" to the register clears all the Alarm Counters
7202	WO	Clear SOE	UINT16	Writing "0xFF00" to the register clears the SOE Log
7203	WO	Clear Energy[1]	UINT16	1) Writing "0xFFFF" to the register clears all the Energy registers 2) Writing "0x00FF" to the register clears all Mains Energy registers 3) Writing "0x01FF" to the register clears all SM Energy registers 4) Writing "0x02FF" to the register clears all VM Energy registers
7204	WO	Clear Max Demand Logs[2]	UINT16	1) Writing "0xFFFF" to the register clears all the Max Demand Logs 2) Writing "0x00FF" to the register clears all Mains Max Demand Logs 3) Writing "0x01FF" to the register clears all SMx Max Demand Logs
7205	WO	Clear Max/Min Recorder Logs	UINT16	Writing "0xFF00" to the register clears all the Max/Min Logs
7206	WO	Clear WFR Log	UINT16	Writing "0xFF00" to the register clears all the WFR
7207	WO	Clear IER Logs	UINT16	Writing "0xFF00" to the register clears all the energy logs
7208	WO	Trigger WFR	UINT16	Writing "0xFF00" to the register trigger WFR
7209	WO	Voltage Phase for Sequential Mode	UINT16	Writing "0xFF00" to the register configures the Voltage Phase for Sequential Mode
7210	WO	Voltage Phase for Cross-over Mode	UINT16	Writing "0xFF00" to the register configures the Voltage Phase for Cross-over Mode
7211	WO	Voltage Phase 1P3W Mode	UINT16	Writing "0xFF00" to the register configures the Voltage Phase for 1P3W Mode
7212	WO	Test Sending Email[3]	UINT16	Writing "0xFF00" to the Register sends a test Email to the specified Destination Email address.
7220	WO	Clear All[4]	UINT16	Writing "0xFF00" to the register clears all of the above

Table 5-68 Clear/Reset Control Setup

Notes:

1) The following table provides a detailed description of the different values that can be written to the **Clear Energy** register to clear the different Energy registers such as Mains-I, Mains-II, SMx and VMx.

Key	Clear Energy Register Values		Description
	High Order	Low Order	
1	0x00 (Mains)	0x00	Clear Main-I Energy (0x0000)
		0x01	Clear Main-II Energy (0x0001)
2	0x01 (SMx)	0x00	Clear 1-ø SM1 Energy (0x0100)
		0x01	Clear 1-ø SM2 Energy (0x0101)
		0x02	Clear 1-ø SM3 Energy (0x0102)
		….	….
		0x53	Clear 1-ø SM84 Energy (0x0153)
		0x54	Clear 2-ø SM1 Energy (0x0154)
		0x55	Clear 2-ø SM2 Energy (0x0155)
		0x56	Clear 2-ø SM3 Energy (0x0156)
		….	….
		0x7D	Clear 2-ø SM42 Energy (0x017D)
		0x7E	Clear 3-ø SM1 Energy (0x017E)

		0x7F	Clear 3-ø SM2 Energy (0x017F)
		0x80	Clear 3-ø SM3 Energy (0x0180)
		….	….
		0x99	Clear 3-ø SM28 Energy (0x0199)
3	0x02 (Total VMx)	0x00	Clear VM1 Energy (0x0200)
		0x01	Clear VM2 Energy (0x0201)
		0x02	Clear VM3 Energy (0x0202)
		….	….
		0x09	Clear VM10 Energy (0x0209)

Table 5-69 Clear Energy Register Values

2) The following table provides a detailed description of the different values that can be written to the **Clear Max Demand Logs** register to clear the different Max Demand Logs such as Mains-I, Mains-II, SMx and VMx.

Key	Clear Max Demand Logs Register Values		Description
	High Order	Low Order	
1	0x00 (Mains)	0x00	Clear Mains-I Max Demand Logs (0x0000)
		0x01	Clear Mains-II Max Demand Logs (0x0001)
2	0x01 (SMx)	0x00	Clear 1-Ø SM1 Max Demand Logs (0x0100)
		0x01	Clear 1-Ø SM2 Max Demand Logs (0x0101)
		0x02	Clear 1-Ø SM3 Max Demand Logs (0x0102)
		….	….
		0x53	Clear 1-Ø SM84 Max Demand Logs (0x0153)
		0x54	Clear 2-Ø SM1 Max Demand Logs (0x0154)
		0x55	Clear 2-Ø SM2 Max Demand Logs (0x0155)
		0x56	Clear 2-Ø SM3 Max Demand Logs (0x0156)
		….	….
		0x7D	Clear 2-Ø SM42 Max Demand Logs (0x017D)
		0x7E	Clear 3-Ø SM1 Max Demand Logs (0x017E)
		0x7F	Clear 3-Ø SM2 Max Demand Logs (0x017F)
		0x80	Clear 3-Ø SM3 Max Demand Logs (0x0180)
		….	….
		0x99	Clear 3-Ø SM28 Max Demand Logs (0x0199)

Table 5-70 Clear Max Demand Logs Register Values

3) The **Test Sending Email** register is used to test whether the SMTP setup is correct. PMC-592 device will send a test email to the specified receiver email address when the value 0xFF00 is written to this register.

4) Writing "0xff00" to the register clears all logs, including Latched Alarm, Alarm counter, IER Log, SOE Log, Max/Min Log of This Month, Max/Min Log of Last Month, This Max Demand, Last Max Demand, Waveform Recorder and Energy.

5.9 Time Registers

There are two sets of Time registers supported by the PMC-592 - Year/Month/Day/Hour/Minute/Second (Register # 60000 to 60004) and UTC Time (Reg. # 9000 to 9004). When sending time to the PMC-592 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 UTC Time register

set (60004) and the time specified in registers 60000-60002 will be ignored. Writing to the Millisecond register (60003) is optional during a Time Set operation. When broadcasting time, the function code must be set to 0x10 (Pre-set Multiple Registers). Incorrect date or time values will be rejected by the meter.

Register		Property	Description	Format	Note
60000	9000	RW	High-order Byte: Year	UINT16	0-38 (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	UTC Time	UINT32	0x386D4380 to 0x7FE8177F means 2000.01.01, 00:00:00 to 2037.12.31, 23:59:59

Table 5-71 Time Registers

5.10 Meter Information

Register		Property	Description	Format	Note
60200-60219	9800-9819	RO	Meter Model[1]	UINT16x20	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.120709 means July 9,2012
60223	9823	RO	Firmware Update Date: Month	UINT16	
60224	9824	RO	Firmware Update Date: Day	UINT16	
60225-60226	9825-9826	RO	Serial Number: XX(Year-2000) - XX(Month) - XX(Lot Number) - XXXX(Meter Number)	UINT16	e.g. 1208471895 means that this meter was the 1895th meter manufactured in Lot 47 of August 2012
60227-60228	9827-9828		Reserved	UINT16	
60229	9829	RO	Feature Code[2]	UINT16	See Note 2)
60230	9830	RO	Branch CT Nominal Primary	UINT16	1 to 2000 (Default = 5A)
60231	9831	RO	Branch CT Nominal Secondary	UINT16	1 to 2000 (Default = 20mA)
60232	9832	RO	Mains CT Nominal Secondary	UINT16	1 to 2000 (Default = 40mA)
60233	9833	RO	MAC Address	UINT16	
60234	9834	RO		UINT16	
60235	9835	RO		UINT16	
60236	9836	RO	DSP Firmware Version	UINT16	e.g. 10000 shows the version is V1.00.00
60237	9837	RO	CPU Firmware Version	UINT16	e.g. 10000 shows the version is V1.00.00
60238	9838	RO	Hardware Version	UINT16	e.g. 10000 shows the version is V1.00.00

60239	9839	RO	Web Version	UINT16	e.g. 10000 shows the version is V1.00.00

Table 5-72 Meter Information

Notes:

1) The Meter Model appears in registers 9800 to 9819 (60200 to 60219) and contains the ASCII encoding of the string "PMC-592" as shown in the following table.

Register		Value (Hex)	ASCII
60200	9800	0x50	P
60201	9801	0x4D	M
60202	9802	0x43	C
60203	9803	0x2D	-
60204	9804	0x35	5
60205	9805	0x39	9
60206	9806	0x32	2
60207	9807	0x20	<Null>
60208-60219	9808-9819	0x20	<Null>

Table 5-73 ASCII Encoding of "PMC-592"

2) The PMC-592 provides the following feature code:

Bit	Description	Value	Meaning
Bit 0	Max Demand Enable	0	Disabled
		1	Enabled
Bit 1	Max/Min Enable	0	Disabled
		1	Enabled
Bit 2	Power Quality Enable	0	Disabled
		1	Enabled
Bit 3	WFR Enable	0	Disabled
		1	Enabled
Bit 4	IER Enable	0	Disabled
		1	Enabled
Bit 5	Alarm Email Enable	0	Disabled
		1	Enabled
Bit 6	SNMP Enable	0	Disabled
		1	Enabled
Bits 7 - 8	Reserved		
Bit 9	SCCT Adapter or CT Strip	0	SCCT Adapter
		1	CT Strip
Bits 10 - 11	Mains CT Type	1	1A CT
		2	5A CT
Bit 12	Branch Circuits	1	One CT Strip or Adapter Board
Bit 13		2	Two CT Strips or Adapter Boards
Bit 14		3	Three CT Strips or Adapter Boards
Bit 15		4	Four CT Strips or Adapter Boards

Table 5-74 Feature Code

Appendix A - SOE Event Classification

Event Classification	Sub-Classification	Channel	Event Value Range/Option/Scale	Description
0	1	0	1/0	DI1 Close/DI1 Open
	2	0	1/0	DI2 Close/DI2 Open
1	1	0	1/0	DO1 Operated/Released by Remote Control
	2	0	1/0	DO2 Operated/Released by Remote Control
	3	0	1/0	DO1 Operated/Released by Set point
	4	0	1/0	DO2 Operated/Released by Set point
2	1	Alarm Channel[1]	Trigger Value (x1000)	Current HH Alarm Active
	2		Trigger Value (x1000)	Current H Alarm Active
	3		Trigger Value (x1000)	Current L Alarm Active
	4		Trigger Value (x1000)	Current LL Alarm Active
	5		Trigger Value (x100)	Voltage H Alarm Active
	6		Trigger Value (x100)	Voltage L Alarm Active
	7		Trigger Value (x1000)	Mains ∑kW H Alarm Active
	8		Trigger Value (x1000)	Mains ∑kW L Alarm Active
	9		Trigger Value (x1000)	Mains ∑kvar H Alarm Active
	10		Trigger Value (x1000)	Mains ∑kvar L Alarm Active
	11		Trigger Value (x1000)	Mains ∑kVA H Alarm Active
	12		Trigger Value (x1000)	Mains ∑kVA L Alarm Active
	13		Trigger Value (x1000)	Mains ∑P.F. H Alarm Active
	14		Trigger Value (x1000)	Mains ∑P.F. L Alarm Active
	15		Trigger Value (x1000)	Current Demand HH Alarm Active
	16		Trigger Value (x1000)	Current Demand H Alarm Active
	17		Trigger Value (x1000)	Current Demand L Alarm Active
	18		Trigger Value (x1000)	Current Demand LL Alarm Active
	19		Trigger Value (x1000)	Mains ∑kW Demand H Alarm Active
	20		Trigger Value (x1000)	Mains ∑kW Demand L Alarm Active
	21		Trigger Value (x1000)	Mains ∑kvar Demand H Alarm Active
	22		Trigger Value (x1000)	Mains ∑kvar Demand L Alarm Active
	23		Trigger Value (x1000)	Mains ∑kVA Demand H Alarm Active
	24		Trigger Value (x1000)	Mains ∑kVA Demand L Alarm Active
	25		Trigger Value (x100)	Frequency H Alarm Active
	26		Trigger Value (x100)	Frequency L Alarm Active
	27		Trigger Value (x100)	Voltage Unbalance Alarm Active
	28		Trigger Value (x100)	Voltage Unbalance Alarm Active
	29		Trigger Value (x100)	Mains THD Alarm Active
	30		Trigger Value (x100)	Mains TOHD Alarm Active
	31		Trigger Value (x100)	Mains TEHD Alarm Active
	32		Trigger Value (x10)	Temperature HH Alarm Active
	33		Trigger Value (x10)	Temperature H Alarm Active

	34		Trigger Value	DI Status Change Alarm Active
	35-100		Reserved	
	101	Alarm Channel[1]	Return Value (x1000)	Current HH Alarm Return
	102		Return Value (x1000)	Current H Alarm Return
	103		Return Value (x1000)	Current L Alarm Return
	104		Return Value (x1000)	Current LL Alarm Return
	105		Return Value (x100)	Voltage H Alarm Return
	106		Return Value (x100)	Voltage L Alarm Return
	107		Return Value (x1000)	Mains ∑kW H Alarm Return
	108		Return Value (x1000)	Mains ∑kW L Alarm Return
	109		Return Value (x1000)	Mains ∑kvar H Alarm Return
	110		Return Value (x1000)	Mains ∑kvar L Alarm Return
	111		Return Value (x1000)	Mains ∑kVA H Alarm Return
	112		Return Value (x1000)	Mains ∑kVA L Alarm Return
	113		Return Value (x1000)	Mains ∑P.F. H Alarm Return
	114		Return Value (x1000)	Mains ∑P.F. L Alarm Return
	115		Return Value (x1000)	Current Demand HH Alarm Return
	116		Return Value (x1000)	Current Demand H Alarm Return
	117		Return Value (x1000)	Current Demand L Alarm Return
	118		Return Value (x1000)	Current Demand LL Alarm Return
	119		Return Value (x1000)	Mains ∑kW Demand H Alarm Return
	120		Return Value (x1000)	Mains ∑kW Demand L Alarm Return
	121		Return Value (x1000)	Mains ∑kvar Demand H Alarm Return
	122		Return Value (x1000)	Mains ∑kvar Demand L Alarm Return
	123		Return Value (x1000)	Mains ∑kVA Demand H Alarm Return
	124		Return Value (x1000)	Mains ∑kVA Demand L Alarm Return
	125		Return Value (x100)	Frequency H Alarm Return
	126		Return Value (x100)	Frequency L Alarm Return
	127		Return Value (x100)	Voltage Unbalance Alarm Return
	128		Return Value (x100)	Voltage Unbalance Alarm Return
	129		Return Value (x100)	Mains THD Alarm Return
	130		Return Value (x100)	Mains TOHD Alarm Return
	131		Return Value (x100)	Mains TEHD Alarm Return
	132		Return Value (x10)	Temperature HH Alarm Return
	133		Return Value (x10)	Temperature H Alarm Return
	134		Return Value	DI Status Change Alarm Return
3	1	0	Method 0: Modbus 1: Web 2: Reset Button	Power On
	2	0		Power Off
	3	0		Set Time
	4	0		Set System Parameters
	5	0		Set Panel Name
	6	0		Set Communication Parameters
	7	0		Set Breaker Ratings

	8	0		Set Alarm Parameters
	9	0		Set Calibration Parameters
	10	0		Set Factory Parameters
	11	0		Set Branch Parameters
	12	0		Set Total VM Parameters
	13-14			Reserved
	15	0		Reset Alarm
	16	0		Clear Alarm Counter
	17	0		Clear Energy
	18	0		Clear Max Demand Logs
	19	0		Clear SOE
	20	0		Clear Max/Min Logs
	21	0		Clear WFR
	22	0		Clear IER Logs
	23	0		Manually Trigger WFR
	24	0		Preset Energy
	25-29			Reserved
	30	Parameter Type[2]		Load Factory Default Configuration
	31	0		Clear All Recorder
	32	0		Formatting Ferroelectric
	33	0		Formatting the Disk
	34	0		Importing Configuration Files
	35	0		Exporting the Ferroelectric Memory
	36	0		Importing the Ferroelectric Memory
4	1	0	0	NVRM Fault
	2	0	0	Disk Fault
	3	0	0	A/D Fault
	4	0	0	CT Strip Installation Fault
	5	0	0	Internal Power Fault
	6			Reserved
	7	0	0	DSP Fault
	8	0	0	System Parameters Fault
	9	0	0	SM Name Parameters Fault
	10	0	0	Communication Parameters Fault
	11	0	0	Breaker Parameters Fault
	12	0	0	Alarm Parameters Fault
	13	0	0	Branch Parameters Fault
	14	0	0	Total VM Parameters Fault
	15	0	0	Calibration Parameters Fault
	16	0	0	Internal Parameters Fault

Note:

1) The following table provides a detailed description of the Channel Number.

Channel Number	Description	Channel Number	Description
0	Mains-I Power	19	Mains-II Vab
1	Mains-II Power	20	Mains-II Vbc
2	Mains-I Ia	21	Mains-II Vca
3	Mains-I Ib	22	System Frequency
4	Mains-I Ic	23	RTD1
5	Mains-I I4	24	RTD2
6	Mains-II Ia	25	DI1
7	Mains-II Ib	26	DI2
8	Mains-II Ic	27	Mains-I Voltage Unbalance
9	Mains-II I4	28	Mains- II Voltage Unbalance
10	Mains-I Va	29	Mains-I Current Unbalance
11	Mains-I Vb	30	Mains- II Current Unbalance
12	Mains-I Vc	31-34	Reserved
13	Mains-I Vab	35	SM1
14	Mains-I Vbc	36	SM2
15	Mains-I Vca	….	….
16	Mains-II Va	34+n	SMn
17	Mains-II Vb	117	SM83
18	Mains-II Vc	118	SM84

2) The following table provides a detailed description of the Parameter Type for loading the Factory Default Configuration.

Parameter Type	Description
0	System parameter
1	SM name parameter
2	Communication parameter
3	Breaker capacity parameter
4	Alarm parameter
5	Branch take power parameter
6	Total VM Parameters
7	Calibration Parameters
8	Internal parameter
9	All parameter

Appendix B - Technical Specifications

Mains Voltage Inputs (V1, V2, V3, VN)	
Standard (Un)	277VLN/480VLL
Range	10% to 120% Un
PT Ratio	Not Supported
Overload	2xUn continuous, 4xUn for 1s
Burden	<0.05VA per phase @ 220V
Frequency	50Hz / 60Hz
Mains Current Inputs	
Nominal Current (In)	
Fixed-Core CT	5A / 1A
Split-Core CT	400A / 600A / 800A / 1000A
Range	0.3% to 100% In
CT Ratio	
Primary	1A: 1-30000, 5A: 1-6000
Secondary	1A: 1-30000, 5A: 1-6000
I4 Primary	1-10000
I4 Secondary	1-10000
Overload	1.2xIn continuous, 2xIn for 10s, 10xIn for 1s
Burden	<0.3VA per phase @ In
Branch Current Inputs	
Continuous Load (Imax)	100A maximum
Burden	<0.3VA per phase @ In
Power Supply	
Standard	
Main	95-277VAC/VDC ± 10%, 47-440 Hz
HMI	24VDC ± 20%
Burden	
Main	<5W
HMI	<10W
Digital Inputs	
Standard	Dry contact, 24VDC internally wetted
Sampling	1000Hz
Hysteresis	1-1,000ms programmable
Digital Outputs	
Contact Type	Normally-open
Contact Rating	5A @ 250VAC/30VDC
RTD Input	
Type	PT100
Range	-40 to 200 °C
Environmental Conditions	
Operating Temp.	
Main	-25°C to 70°C
HMI	0°C to 45°C
Storage Temp.	
Main	-40°C to 85°C
HMI	-20°C to 60°C
Humidity	
Main	5% to 95% non-condensing
HMI	10% to 90% non-condensing
Atmospheric Pressure	70 kPa to 106 kPa
Pollution Degree	II
Measurement Category	CAT III
Mechanical Characteristics	
Enclosure	Galvanized Steel
Unit Dimensions	260.5*154*55.5
Shipping Dimensions	TBD
Shipping Weight	TBD
IP Rating	20

Appendix C - Accuracy Specifications

Parameters		Accuracy	Resolution
Mains	Voltage	±0.5%	0.01V
	Current	±0.5%	0.001A
	kW, kvar, kVA	±0.5%	0.001k
	kWh	IEC 62053-22 Class 1	0.1kXh
	kvarh	IEC 62053-23 Class 2	0.1kvarh
	P.F.	±1.0%	0.001
	Frequency	±0.02 Hz	0.01Hz
	Harmonics	IEC 61000-4-7 / 30 Class B	0.01%
	V Unbalance	±0.2%	0.01%
	I Unbalance	±1.0%	0.01%
Branch	Current	±0.5%	0.001A
	kW, kvar, kVA	±1.0%	0.001k
	P.F.	±1.0%	0.001
	kWh	IEC 62053-22 Class 1	0.01kXh
	kvarh	IEC 62053-23 Class 2	0.1kvarh
	Harmonics	IEC 61000-4-7 / 30 Class B	0.01%
RTD		±1°	0.1°

Appendix D - Standards Compliance

Safety Requirements		
LVD Directive 2006 / 95 / EC Insulation Dielectric test Insulation resistance Impulse voltage		EN61010-1-1-2001 IEC 60255-5-2000 2kV @ 1 minute, 50/60Hz >100MΩ 5kV, 1.2/50μs
EMC Compatibility **EMC Directive 2004/108/EC (EN 61326: 2006)**		
Immunity Tests		
Electrostatic discharge		IEC 61000-4-2: 2001 Level III
Fast transients		IEC 61000-4-4: 2004 Level III
Surges		IEC 61000-4-5: 2005 Level III
Conducted disturbances		IEC 61000-4-6: 2006 Level III
Magnetic Fields		IEC 61000-4-3: 2002 Level III
Oscillatory waves		IEC 61000-4-12: 1995 Level III
Electromagnetic Emission		IEC 61000-4-8: 2001 Level IV
Emission Tests		
Limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment		EN 55011: 2009 (CISPR 11)
Limits and methods of measurement of radio disturbance characteristics of information technology equipment		EN 55022: 2006+A1: 2007 (CISPR 22)
Limits for harmonic current emissions for equipment with rated current ≤16 A		EN 61000-3-2: 2006+A1: 2009
Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current ≤16 A		EN 61000-3-3: 2006
Emission standard for residential, commercial and light-industrial environments		EN 61000-6-3: 2007
Electromagnetic Emission Tests for Measuring Relays and Protection Equipment		IEC 60255-25: 2000
Mechanical Tests		
Vibration Test	Response	IEC 60255-21-1:1998 Level II
	Endurance	IEC 60255-21-1:1998 Level I
Shock Test	Response	IEC 60255-21-2:1998 Level I
	Endurance	IEC 60255-21-2:1998 Level I
Bump Test		IEC 60255-21-2:1998 Level I

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