PMC-680i

Advanced Power Quality Analyzer

User Manual

Version: V0.9A

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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.

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

1PPS	= 1 Pulse Per Second
CET	= Ceiec Electric Technology
DI	= Digital Input
DMD	= Present Demand
DO	= Digital Output
DR	= Data Recorder
DWR	= Disturbance Waveform Recorder
FIFO	= First In First Out
Fund.	= Fundamental
GB	= Giga Byte
GPS	= Global Positioning System
HS	= High-Speed
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
Hn	= nth order Harmonic in RMS
IHn	= nth order Interharmonic in RMS
LCD	= Liquid Crystal Display
MB	= Mega Byte
Pred_DMD	= Predicted Demand
Plt	= Long-term Flicker
Pst	= Short-term Flicker
PQ	= Power Quality
RO	= Relay Output
RTC	= Real Time Clock
SDR	= Statistical Data Recorder
SOE	= Sequence Of Events
SMTP	= Simple Mail Transfer Protocol
SYNC DI	= Demand Sync Input
TH	= Total Harmonic in RMS, excluding Fundamental
THD	= Total Harmonic Distortion

TOHD	= Total Odd Harmonic Distortion
TEHD	= Total Even Harmonic Distortion
U0 / I0	= Zero Sequence Voltage / Current
U1 / I1	= Positive Sequence Voltage / Current
U2 / I2	= Negative Sequence Voltage /Current
U0 / I0 Unb	= Zero Sequence Voltage / Current Unbalance
U2 / I2 Unb	= Negative Sequence Voltage / Current Unbalance
I5	=Ground Current
WF	= Waveform
WFR	= Waveform Recorder
Dip	= Used interchangbly with Sag
Sag	= Used interchangbly with Dip
Swell	= Temporary increases in RMS value of AC voltage
Transient	=Unidirectional impulse of either polarity or a damped oscillatory wave with the first peak occurring in either polarity
$U_{rms(1/2)}$	= Half-Cycle RMS Voltage
U_{din}	= Declared input voltage - Value obtained from the declared supply voltage by a transducer ratio
U_{sr}	= Sliding Reference Voltage
$I_{half\ cycle\ rms}$	= Value of the RMS Current measured over each half period
Dip Threshold	= Voltage magnitude specified for the purpose of detecting the start and end of a voltage dip
Flagged data	= For any measurement time interval in which interruptions, dips or swells occur, the measurement results of all other parameters made during this time interval are flagged

Chapter 1 Introduction

This manual explains how to use the PMC-680i Advanced Power Quality Analyzer.

This chapter provides an overview of the PMC-680i Analyzer and summarizes many of its key features.

1.1 Overview

The PMC-680i is CET's Advanced Utility PQ Analyzer designed for the compliance monitoring market as it offers un-surpassed functionality by combining Class 0.2S accuracy and advanced PQ features in a standard DIN 192 form factor with a high resolution, backlit, color TFT LCD display. The PMC-680i complies with IEC 62053-22 Class 0.2S, IEC 61000-4-30 Class A, IEC 61000-4-7, IEC-61000-4-15 and EN50160. Further, it offers a logging capacity with up to 8GB of on-board memory, extensive I/O with 8xDIs, 4xRO and 4xDOs, GPS Time Sync., dual Ethernet and two RS-485 ports. These features likely make the PMC-680i the most advanced PQ Analyzer for the Utility market today.

Typical Applications

- PQ monitoring at HV, MV and LV Utility Substations

- Data Centers, Semiconductor Fabs, Heavy Industries
- 7x24 Automated Manufacturing Facilities
- Dips/Swell, Transient, Flicker and Disturbance monitoring
- Mains and critical feeder monitoring
- Substation automation with IEC61850 protocol
- Retrofit applications with Clamp-on CTs

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

Basic Features

- Standard 512 samples/cycle sampling, optional 1024
- 4GB on-board log memory, optional 8GB
- Industrial-grade, high-resolution Color TFT LCD @ 640x480
- IEC 62053-22 Class 0.2S kWh metering with Multi-Tariff TOU
- Time Synch. via IRIG-B, SNTP or GPS 1PPS output
- 256 setpoints and 16 HS (High-Speed) Setpoints
- Dual 100Base T Ethernet and RS485 ports
- Up to 12 months of daily backup of PQ recordings in PQDIF format

Power Quality Features

- IEC 61000-4-30 Class A Certified by PSL
- IEC 61000-4-7, IEC 61000-4-15 and EN50160 Reporting
- Dips/Swells, Transient, Interruptions, Mains Signalling Voltage (MSV), Rapid Voltage Changes (RVC) and In-rush Current monitoring
- Disturbance Direction Indicator & Disturbance Waveform Recording
- Harmonic analysis up to 63^{rd} on-board and 511^{th} via software
- Fault Capture up to 2,000V peak to peak (400VAC Option)
- Real-time Waveform (WF) Capture, Trending and Statistical Reporting
- Waveform recording in PQDIF and COMTRADE file format that is compatible with the PQ View software

Front Panel Display

- Real-time, Harmonic Power and Energy measurements
- Real-time waveforms for 3-phase Voltages and Currents
- Harmonic histogram
- EN50160 Report
- Statistical Trending
- PQ Log with ITIC/SEMI F47 and waveform displays
- SOE Log
- I/O status
- Device configuration
- Diagnostics

Power Quality Metering

PQ Parameters as per IEC 61000-4-30

- Power Frequency
- Magnitude of the Supply Voltage
- Flicker
- Supply Voltage Dips and Swells
- Voltage Interruptions
- Transient Voltages
- Supply Voltage Unbalance
- Voltage Harmonics and Interharmonics
- Mains Signalling Voltage (MSV) on the Supply Voltage
- Rapid Voltage Changes (RVC)
- Measurement of Underdeviation and Overdeviation parameters

Harmonic and Interharmonic measurements

- K-Factor for Current, Crest Factor for Current and Voltage
- U and I THD, TOHD, TEHD
- U and I Phase and Magnitude (RMS and %HD[#]) from 2^{nd} to 63^{rd}

- U and I Interharmonics from 0 to 63rd
- Harmonic kW, kvar, kVA and PF from 2nd to 63rd
- Fundamental U, I, kW, kvar, kVA and Displacement PF
- Total harmonic kWh, kvarh Imp./Exp./Net/Total
- Harmonic kWh, kvarh Imp./Exp. from 2nd to 63rd
- Fundamental kWh, kvarh Imp./Exp./Net/Total

%HD can be configured as % of Fundamental, % of U/I nominal or % of RMS

Symmetrical Components and Unbalances

- Zero, Positive and Negative Sequence Components
- U and I Unbalance based on Zero and Negative Sequence Components

Transient and Dip/Swell Recording

- Transient recording as short as 40us at 512 samples or 20us at 1024 samples @ 50Hz
- Dip/Swell recording @ 10ms (½ cycle at 50Hz)
- Transient triggers WFR and DWR
- Dip/Swell trigger DO/RO, WFR, WDR, DR and HS DR
- On-board analysis of ITIC/SEMI F47 plot and the captured waveforms

Rapid Voltage Changes

- Programmable detection modes: voltage change between two steady-state or maximum voltage change

In-rush Current Monitoring

- Monitoring of the ½ cycle RMS Current and capturing of the Current waveforms associated with events such as motor starting and transformer being energized

Disturbance Direction Indicator

- Determine if a Dip Event is located upstream or downstream
- Pinpoint if the cause of the event is external or internal

Disturbance Waveform Recorder (DWR)

- Disturbance recording of all Voltage (Ua, Ub, Uc, U4 and U5) and Current (Ia, Ib, Ic, I4 and I5) Inputs
  - Initial Fault: Up to 35 cycles @ 512 samples/cycle
  - Extended Fault: 150 cycles @ 16 samples/cycle

- Steady State: 300 seconds of 1-cycle RMS recording @ 50Hz
- Post Fault: Up to 15 cycles @ 512 samples/cycle

Waveform Capture (WFC) and Waveform Recorder (WFR)

- Real-time WF Capture @ 128 samples/cycle via front panel display
- WF Recorder with 128~ entries each
- Simultaneous capture of 4-phase Voltage and 5-phase Current inputs
- # of Cycles x Samples/Cycles with programmable # of pre-fault cycles
    - 10x1024*, 20x512, 40x256
    - 80x128, 160x64, 320x32, 640x16
- Extended recording for a maximum of 7 consecutive captures
- COMTRADE file format, downloadable from the on-board FTP Server

~256 entries with the 8GB option, * only available for the 1024 sampling option

PQ Event Counters

- Transient, Dip, Swell, Interruption, Rapid Voltage Changes and Mains Signaling Voltage

Metering

Basic Measurements (1-second update)

- 3-phase Voltages (U1-U3) and U4
- 3-phase Currents (I1-I3), I4 and I5
- 3-phase Power, PF, Frequency and Phase Angles
- kWh, kvarh Imp./Exp./Net/Total and kVAh Total

High-speed Measurements

- 3-phase Voltage and Current, U4, I4, I5 @ ½ cycle
- Frequency @ 1 cycle

Demands

- 3-phase Voltage, Current, Power, PF, U4, I4, I5, Frequency
- Demand synchronization with DI
- Predicted Demands
- Peak Demands for This Month and Last Month, or Before the Last Reset and Since the Last Reset

- Max./Min. per Demand Period

Multi-Tariff TOU capability

- Two independent sets of TOU Schedules, each supporting
    - Up to 12 Seasons
    - 90 Holidays or Alternate Days and 3 Weekdays
    - 20 Daily Profiles, each with 12 Periods in 1-minute interval
    - 8 Tariffs, each providing the following information
        - kWh/kvarh Imp./Exp. and kVAh
        - kW/kvar Imp./Exp. Peak Demands
        - Register Rollover value at 99,999,999,999 k*X*h

Data, Waveform and Event Recording

Non-Volatile Log Memory

- Standard 4GB, optional 8GB

Interval Energy Recorder

- kWh, kvarh Imp./Exp. and kVAh Total
- Support FIFO

Statistical Data Recorder

- Recording of the Max., Min., Avg. and CP95 for real-time measurements including U, I, Freq., Flicker, Harmonics and Unbalances in 16 different recorders
- Recording interval from 1 minute to 60 minutes
- 30 days @ 1-minute, 300 days @ 10-minute, 450-day @ 15-minute
- On-board trending via Front Panel display
- PQDIF file format, downloadable from the on-board FTP Server

Data Recorder and HS Data Recorder

- 8 Data Recorders of 32 parameters and 4 HS DR of 16 parameters
- Recording interval from 1s to 40 days for Data Recorder
- Recording interval from ½ cycle to 60 cycles for HS Data Recorder
- Programmable sources
- Recording depth fixed at 65535

- DR supports FIFO or Stop-When-Full mode and HS DR supports Stop-When-Full mode

Max./Min. Log

- Logging of Max./Min. values for real-time measurements such as U, I, kW, kvar, kVA, PF, Freq., Unbalance, K-factor, THD

SOE Log

- 1024 FIFO events time-stamped to ±1ms resolution
- Setup changes, System events, Setpoint events and I/O operations

PQ Log

- 1024 FIFO entries time-stamped to ±1ms resolution
- Transient, Dip/Swell, Disturbance Location, Rapid Voltage Change, etc.
- Record the time and characteristic data of the captured PQ event

Setpoints

PQ Setpoints

- Transient trigger WFR or DWR
- Dip/Swell, Rapid Voltage Changes, Inrush Current and Harmonics trigger DO/RO, DR, HS DR, WFR or DWR

Control Setpoints

- 256 Control Setpoints and 16 HS Setpoints
- Extensive monitoring sources
- Configurable thresholds and time delays
- Trigger DO, DR, HS DR, WFR or DWR

Digital Input Setpoints

- Provides control output actions in response to changes in Digital Input status
- Demand Synchronization
- Trigger DO, DR, HS DR, WFR or DWR

Inputs and Outputs

Digital Inputs

- 8 channels, volts free dry contact, 24VDC internally wetted
- 1000Hz sampling

- External status monitoring with programmable debounce
- Pulse counting with programmable weight for each channel for collecting WAGES (Water, Air, Gas, Electricity, Steam) information
- Demand Synchronization
- Time-Sync via GPS's 1PPS output

Digital Outputs

- 8 channels for control, alarming and pulsing applications
- RO1-RO2: Form A Mechanical Relay
- RO3-RO4: Form C Mechanical Relay
- DO1-DO4: Optically Isolated Solid State Relay

Communications

Ethernet Ports (P1, P2)

- Dual 10/100BaseT TCP/IP Ethernet Ports with RJ45 connector
- Maximum of 10 simultaneous IP connections
- Optional 100BaseFX with ST connector
- Protocols
    - Modbus TCP
    - HTTP, SNTP, SMTP, FTP
    - Ethernet Gateway
    - IEC61850
- Firmware upgrade via Ethernet port

RS-485 (P3, P4)

- Optically isolated RS485 port with baudrate from 1.2 to 115.2 kbps
- Modbus RTU protocol
- Time Sync. via GPS’s 1PPS or IRIG-B outputs

Time Synchronization

- Battery-backed real-time clock @ 6ppm (≤ 0.5s/day)
- Time Sync. via SNTP, GPS’s 1PPS or IRIG-B outputs

System Integration

PecStar iEMS

The PMC-680i is supported by CET's PecStar iEMS software. In addition, the PMC-680i can be easily integrated into other 3rd party systems because of its support of multiple communications ports as well as different industry standard protocols

PMC Setup

- Free Setup configuration tool
- Real-time and log display
- Remote control

3rd Party System Integration

- Easy integration into Substation Automation or Utility SCADA systems via Modbus RTU, Modbus TCP or IEC61850
- 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 (Chrome) without the use of any proprietary software
- The on-board, password protected FTP Server allows logged data in PQDIF or COMTRADE format to be downloaded without any special software
- The downloaded files can be subsequently viewed using software that supports the industry standard PQDIF and COMTRADE file formats

1.3 PMC-680i' application in Power and Energy Management and Analyzer Systems

The PMC-680i can be used to monitor Wye or Delta connected power system. Modbus communications allow real-time data, events, DI status, Data Logs, Waveform and other information to be transmitted to an Integrated Energy Management System such as PecStar® iEMS.

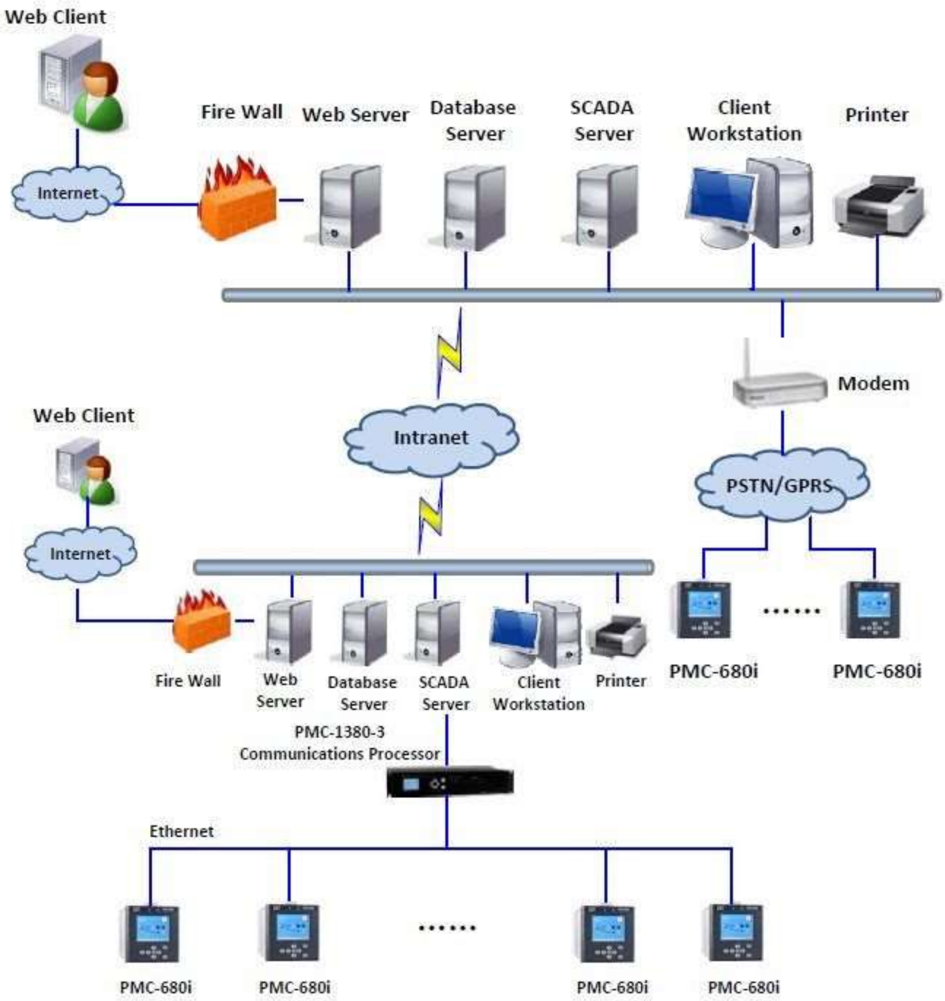


Figure 1-1 Typical Application

1.4 Getting more information

Additional information is available from CET via the following sources:

- Visit www.cet-global.com
- Contact your local representative
- Contact CET directly via email or telephone

Chapter 2 Installation

Caution

Installation of the PMC-680i should only be performed by qualified, competent personnel that have the appropriate training and experience with high voltage and current devices. The meter must be installed in accordance with all local and national electrical codes.

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

2.1 Appearance

Figure 2-1 Appearance

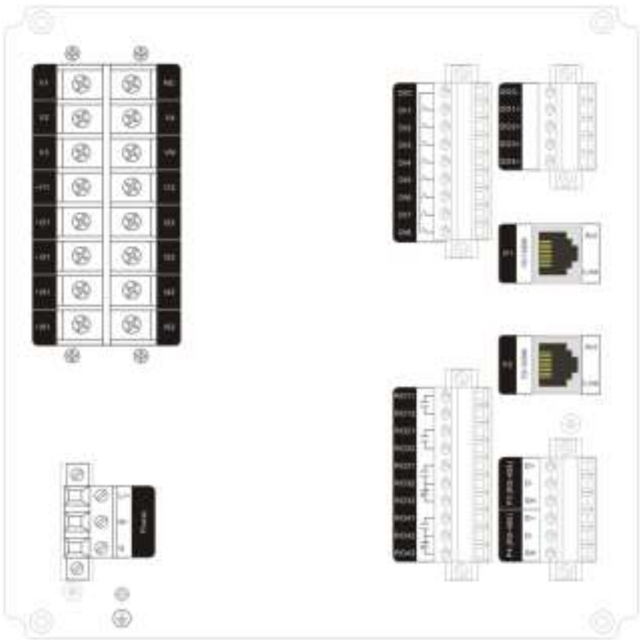
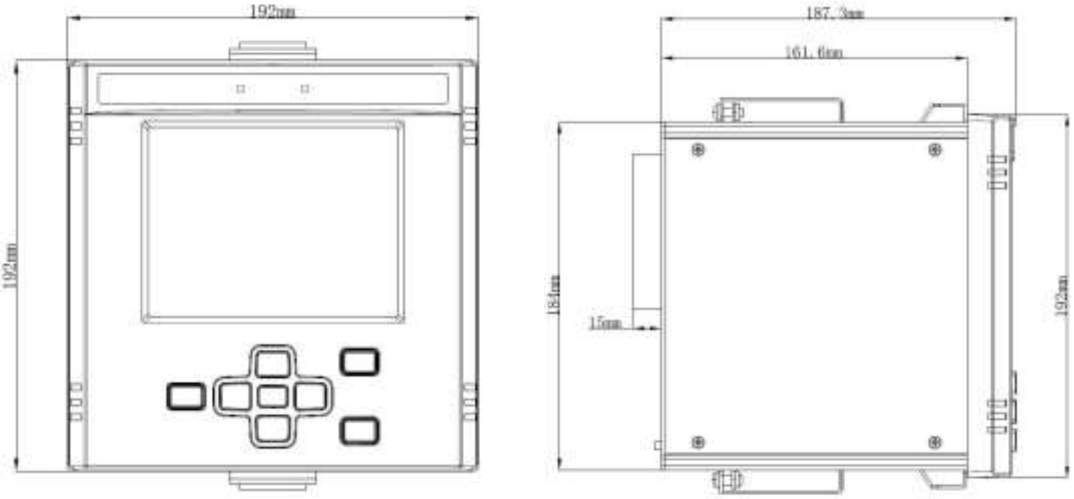


Figure 2-2 Rear Panel

2.2 Unit Dimensions



Front View **Side View**

Figure 2-3 Unit Dimensions

2.3 Mounting

The PMC-680i should be installed in a dry environment with no dust and kept away from heat, radiation and electrical noise sources.

Installation steps:

- Remove the mounting brackets from the meter
- Fit the meter through a 186mmx186mm cutout as shown in Figure 2-4
- Re-install and tighten the mounting brackets against the panel to secure the meter

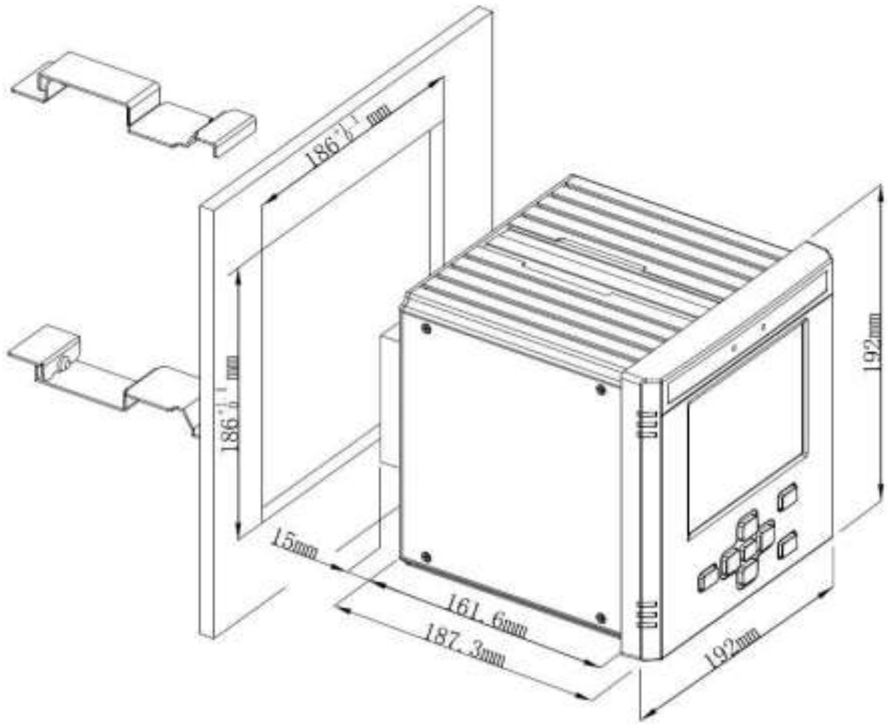


Figure 2-4 Panel Cutout

2.4 Wiring Connections

PMC-680i can satisfy almost any three or four phase power systems. Please read this section carefully before installation and choose the correct wiring method for your power system. The following wiring modes are supported:

- 3-phase 4-wire Wye Direct Connection
- 3-phase 4-wire Wye with 3PTs and 4CTs
- 3-phase 3-wire Grounded Wye Direct Connection
- 3-phase 3-wire Grounded Wye with 3PTs and 3CTs
- 3-phase 3-wire Grounded Delta Direct Connection
- 3-phase 3-wire Delta with 2PTs and 2CTs
- 3-phase 3-wire Delta with 2PTs and 2CTs

Caution

Under no circumstances should the PT secondary be shorted.

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

2.4.1 3-phase 4-wire Wye Direct Connection

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

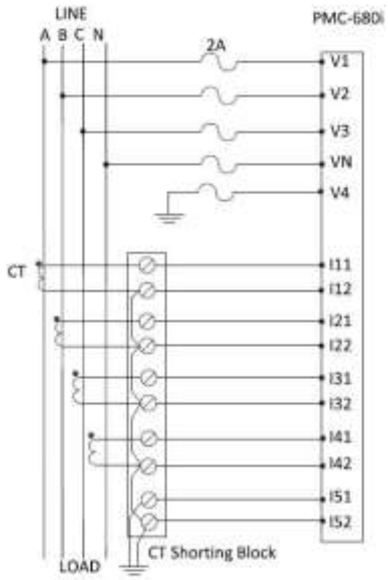


Figure 2-5 4-Wire Wye, no PTs, 4CTs

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

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

Set the **Wiring Mode** to Wye.

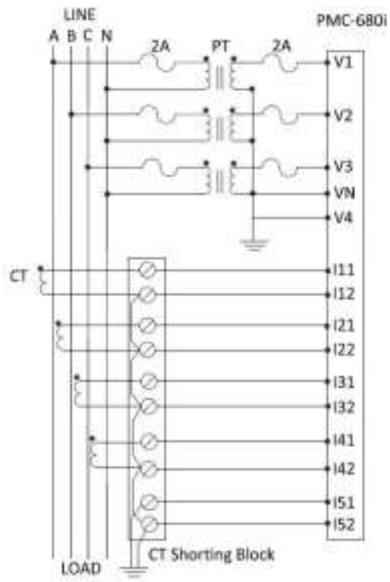


Figure 2-6 4-Wire Wye, 3PTs, 4CTs

2.4.3 3-phase 3-wire Grounded Wye Direct Connection

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

Set the **Wiring Mode** to Wye.

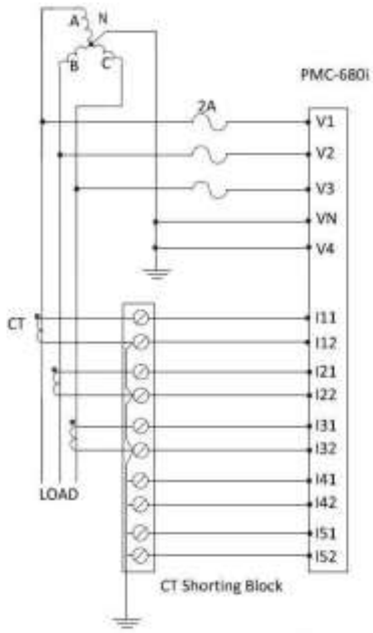


Figure 2-7 3-Wire Grounded Wye, Direct Connection

2.4.4 3-phase 3-wire Grounded Wye with 3PTs and 3CTs

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

Set the **Wiring Mode** to Wye.

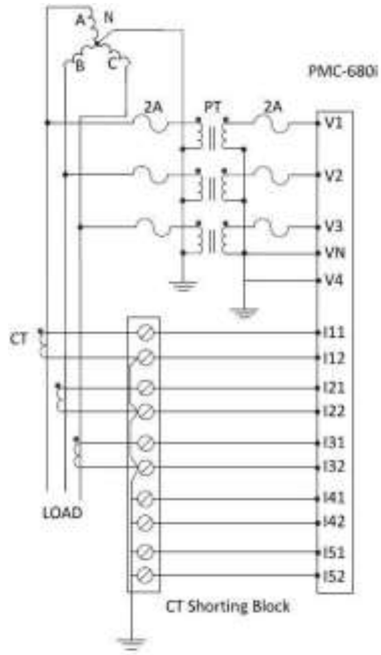


Figure 2-8 3-Wire Grounded Wye, 3PTs, 3CTs

2.4.5 3-phase 3-wire Grounded Delta Connection

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

Set the **Wiring Mode** to Delta.

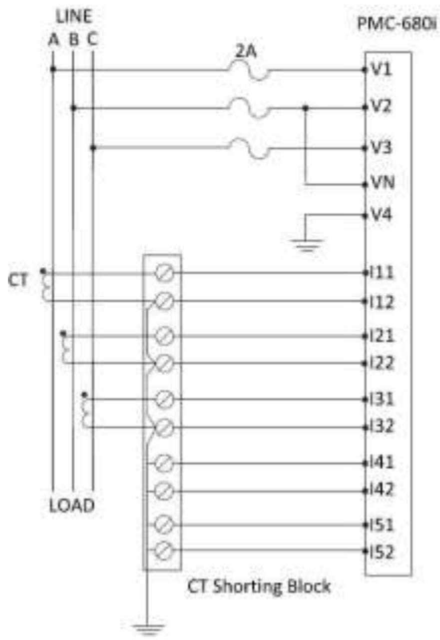


Figure 2-9 3-Wire Grounded Delta, no PTs, 4CTs

2.4.6 3-phase 3-wire Delta with 2PTs and 3CTs

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

Set the **Wiring Mode** to Delta.

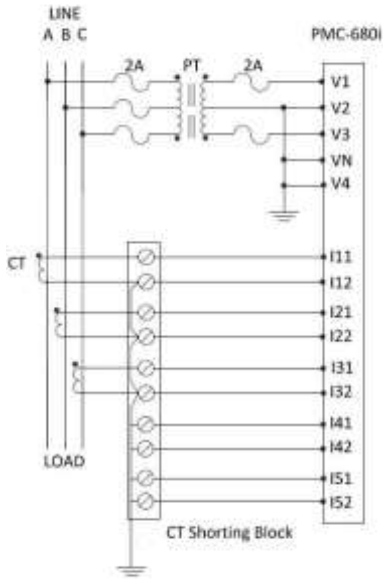


Figure 2-10 3-Wire Delta, 2PTs, 3CTs

2.4.7 3-phase 3-wire Delta with 2PTs and 2CTs

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

Set the **Wiring Mode** to Delta.

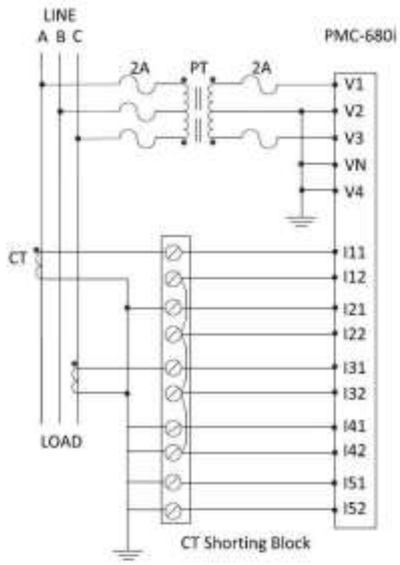


Figure 2-11 3-Wire Delta, 2PTs, 2CTs

2.5 Communications Wiring

2.5.1 Ethernet Port (10/100BaseT)

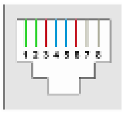
RJ45 Connector	Pin	Meaning
	1	Transmit Data+
	2	Transmit Data-
	3	Receive Data+
	4,5,7,8	NC
	6	Receive Data-

Table 2-1 RJ45 Connector Pin Description for 10/100BaseT Applications

2.5.2 RS485 Port

The PMC-680i provides up to two RS485 ports and supports the Modbus RTU protocol. Up to 32 devices can be connected on a RS485 bus. The overall length of the RS485 cable connecting all devices should not exceed 1200m.

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

The following figure illustrates the RS485 communications connections on the PMC-680i:

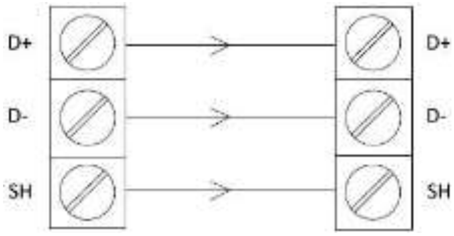


Figure 2-12 RS485 Communications Connections

2.6 Digital Input Wiring

The following figure illustrates the Digital Input connections on the PMC-680i:

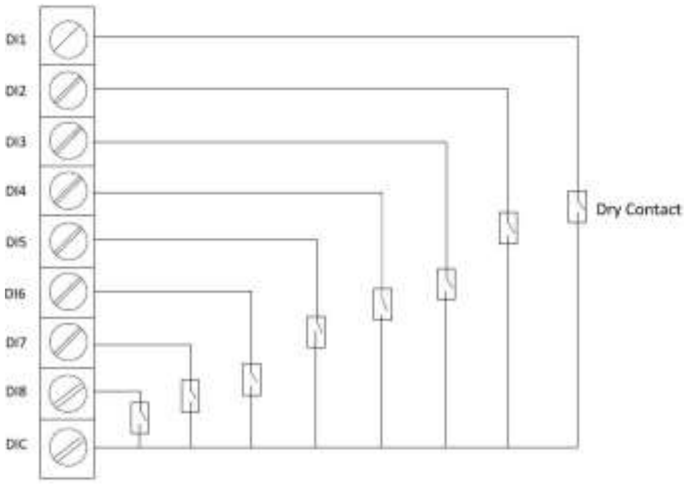


Figure 2-13 DI Connections

2.7 GPS 1PPS Input wiring

The Digital Input on the PMC-680i can be used for time synchronization with a GPS 1PPS output. The following figure illustrates the wiring connections:

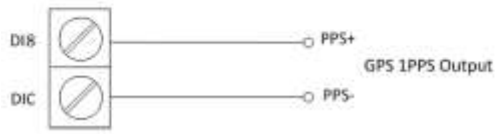


Figure 2-14 Time Sync. Connections

2.8 Digital Output Wiring

The following figure illustrates the Digital Output connections on the PMC-680i:

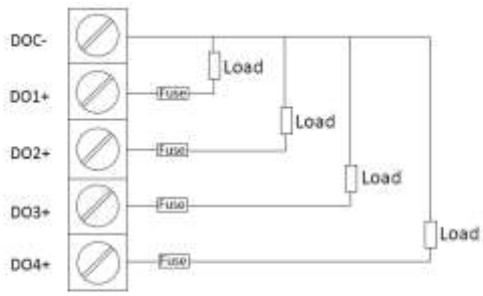


Figure 2-15 DO Connections

2.9 RO Wiring

The following figure illustrates the RO connections on the PMC-680i:

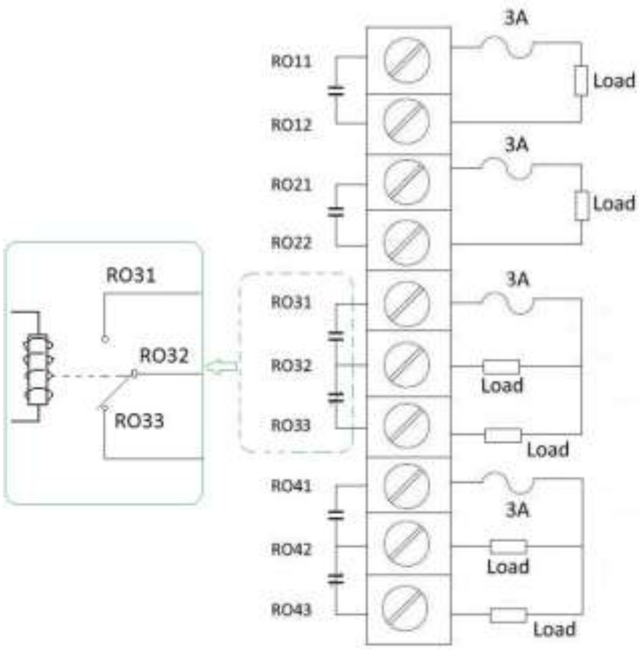


Figure 2-16 Pulse Output Connections

2.10 Pulse Output Wiring

The following figure illustrates the Pulse Output connections on the PMC-680i:

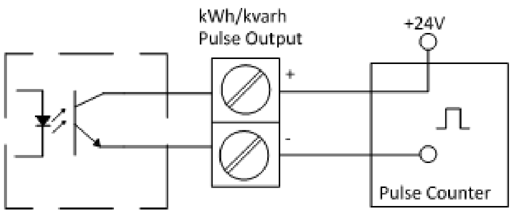


Figure 2-17 Pulse Output Connections

2.11 Power Supply Wiring

For AC supply, connect the live wire to the L/+ terminal and the neutral wire to the N/- terminal. For DC supply, connect the positive wire to the L/+ terminal and the negative wire to the N/- terminal.

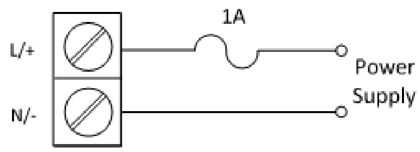


Figure 2-18 Power Supply Connections

2.12 Chassis Ground Wiring

Connect the G terminal to earth ground.

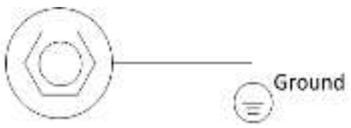


Figure 2-19 Chassis Ground connection

Chapter 3 User Interface

3.1 Front Panel Interface

The PMC-680i is equipped with a stunning, 640x480, TFT Color, LCD Display. The following figure illustrates PMC-680i's Main Display, which is the first screen shown upon device power up.

Figure 3-1 Main Display

3.1.1 Display Hierarchy and Menu Tree

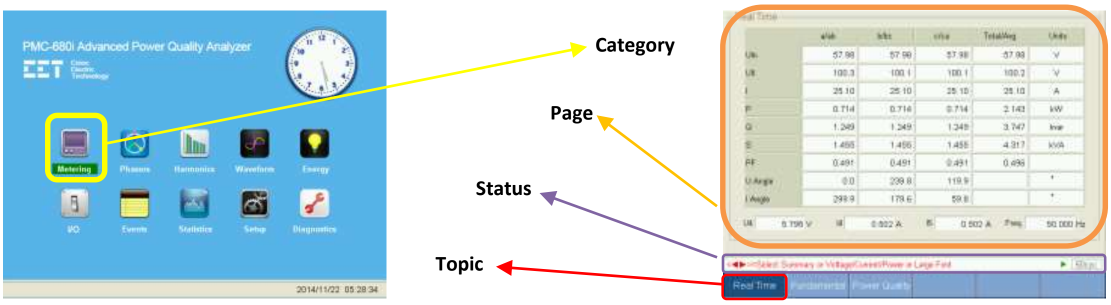


Figure 3-2 Hierarchy of Menu

For the PMC-680i, the display of the measurements 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. The **Status** area indicates if there are additional Pages of measurement under a particular Topic and how to get there.

The following figure illustrates menu tree of the Front Panel:

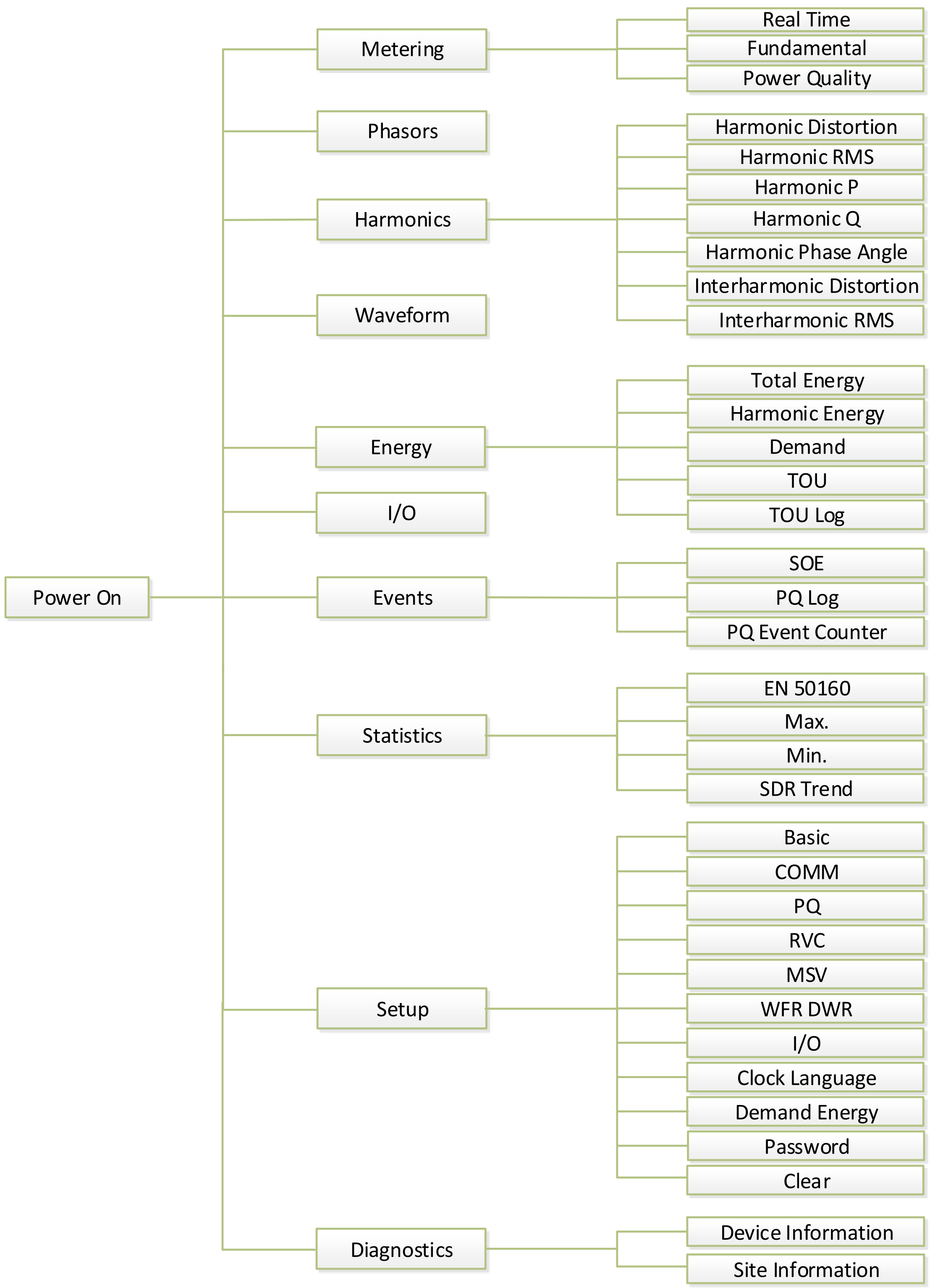


Figure 3-3 Menu Tree

3.1.2 Navigating the Front Panel User Interface

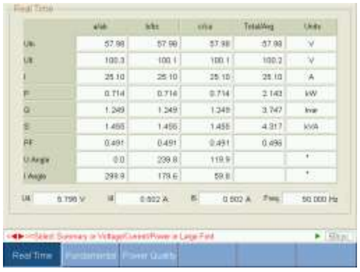
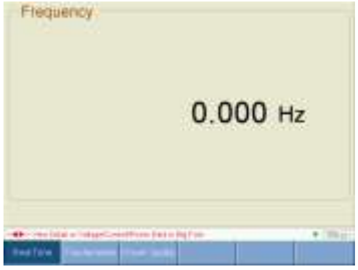
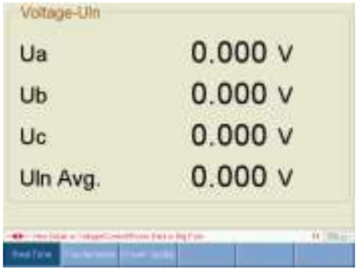
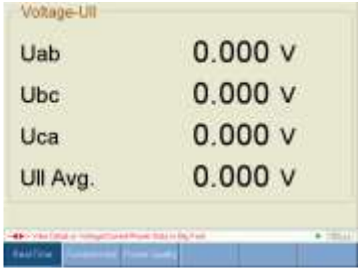
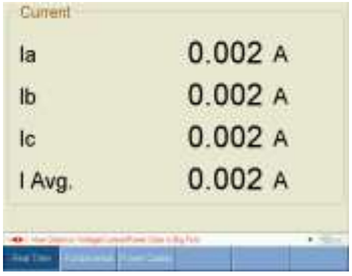
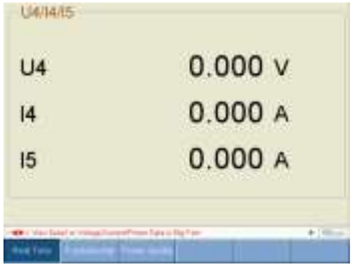
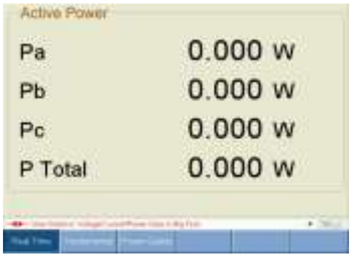
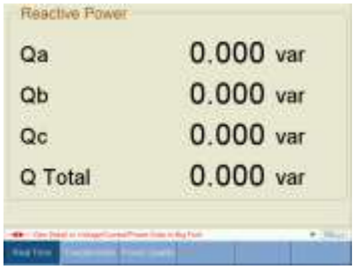
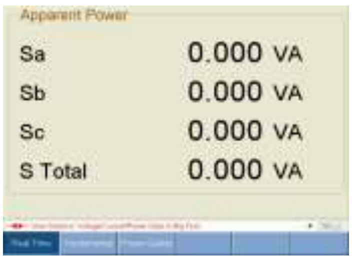
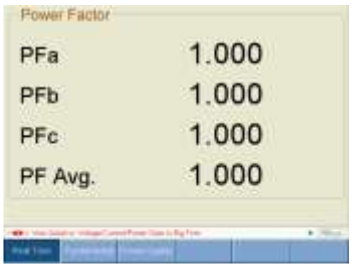
Figure 3-4 Front Panel User Interface

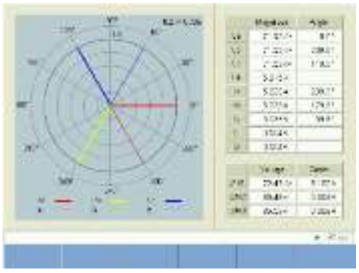
The PMC-680i features a stunning, high resolution, color LCD display with an intuitive graphical user interface that makes it extremely simple to operate. There are eight buttons located beneath the LCD display on the front panel: **<Enter>**, **<Tab>**, **<Fn>**, <▲>, <▼>, <◀>, <▶> and **<Esc>**.

Buttons	Description
<▲> <▼> <◀> <▶>	In the **Main Display**, the four arrow buttons are used to move the cursor between Categories, which are represented by the different icons. The current cursor position is indicated by the highlighted **Category's** description. While inside a **Category** and under a particular **Topic**, the arrow buttons are used to navigate between **Pages**. Use <▲> or <▼> to view more parameters, while use <◀> or <▶> to backward or forward.
<Enter>	Enter a **Category** when pressed.
<Tab>	Move between **Topics** from left to right.
<Esc>	Return to the previous level.
<Fn>	Press **<Fn>** and **<Enter>** to capture current interface.
<Fn> + <▲>/ <▼>	Press this key combination to jump to first or last page.
<Fn> + <◀>/ <▶>	Press this key combination to backward or forward ten pages.

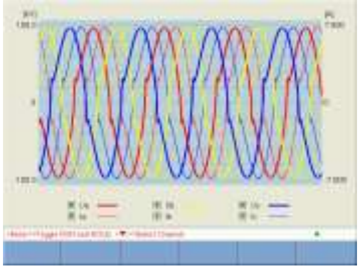
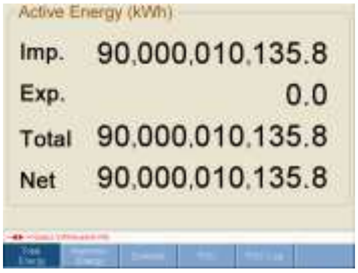
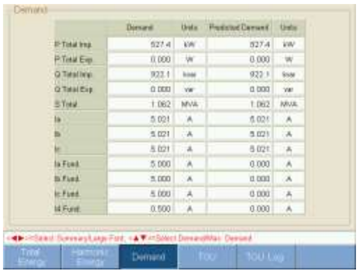
Table 3-1 Description of Button in Front Panel

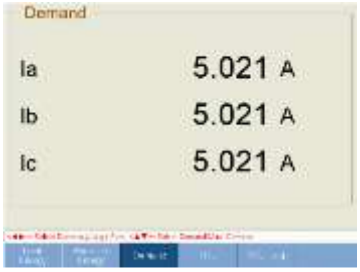
The following table gives a complete description of this information hierarchy.

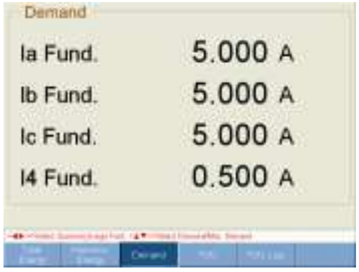
<table>
<tr><th>Category</th><th>Topics</th><th colspan="2">Pages</th></tr>
<tr><td rowspan="5">Metering</td><td rowspan="5">Real Time</td>
<td>
</td>
<td>
</td></tr>
<tr><td>
</td>
<td>
</td></tr>
<tr><td>
</td>
<td>
</td></tr>
<tr><td>
</td>
<td>
</td></tr>
<tr><td>
</td>
<td>
</td></tr>
</table>

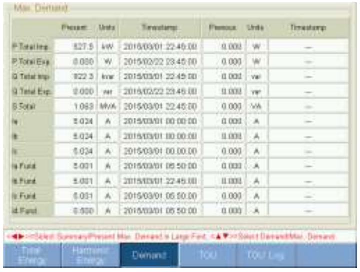
			
	Fundamental		
	Power Quality		
Phasors	-		
Harmonics	Ua Distortion Ia Distortion		

	Ua RMS Ia RMS		
	Harmonic Pa Harmonic Qa		
	Ua Harmonic Phase Angle Ia Harmonic Phase Angel		
	Ua Interharmonic Distortion Ia Interharmonic Distortion		
	Ua Interharmonic RMS Ia Interharmonic RMS		

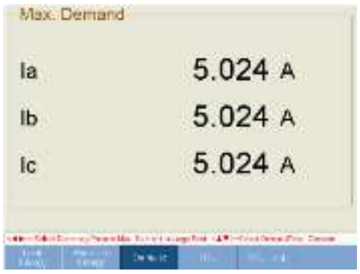
Waveform	-	
Energy	Total Energy	 
		
	Harmonic Energy	
	Demand	

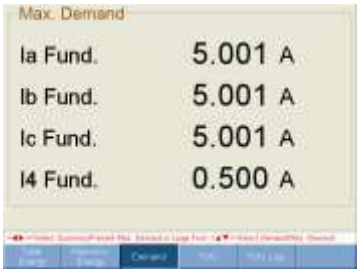


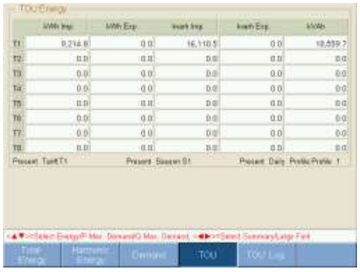


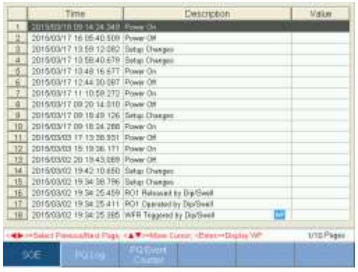
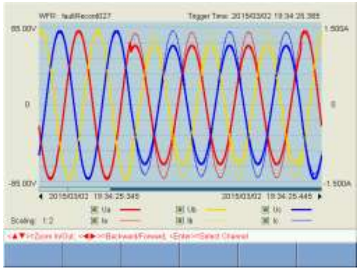
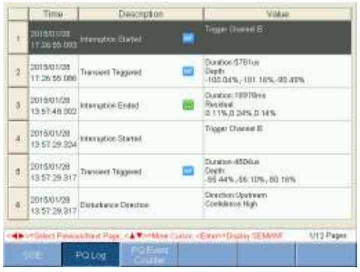
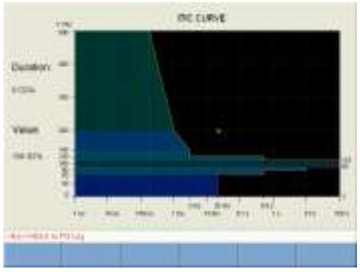


	Present	Units	Timestamp	Previous	Units	Timestamp
P Total Imp.	527.5	kW	2015/03/01 22:45:00	0.000	W	—
P Total Exp.	0.000	W	2015/02/22 23:45:00	0.000	W	—
Q Total Imp.	922.3	kvar	2015/03/01 22:45:00	0.000	var	—
Q Total Exp.	0.000	var	2015/02/22 23:45:00	0.000	var	—
S Total	1.063	MVA	2015/03/01 22:45:00	0.000	VA	—
Ia	5.024	A	2015/03/01 00:00:00	0.000	A	—
Ib	5.024	A	2015/03/01 00:00:00	0.000	A	—
Ic	5.024	A	2015/03/01 00:00:00	0.000	A	—
Ia Fund.	5.001	A	2015/03/01 05:50:00	0.000	A	—
Ib Fund.	5.001	A	2015/03/01 22:45:00	0.000	A	—
Ic Fund.	5.001	A	2015/03/01 05:50:00	0.000	A	—
I4 Fund.	0.500	A	2015/03/01 05:50:00	0.000	A	—

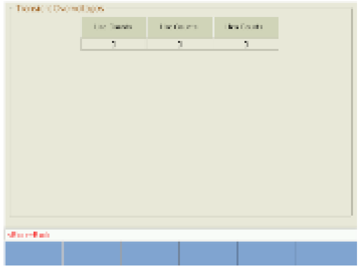
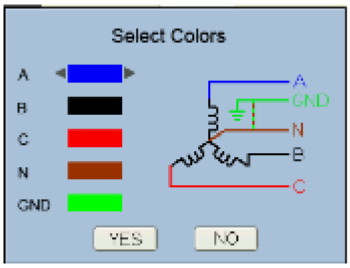
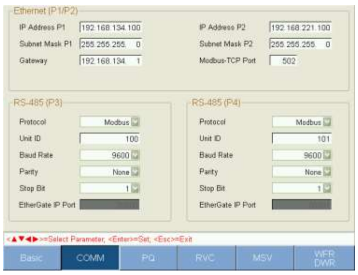




<table>
<tr><td rowspan="5"></td><td rowspan="3">TOU</td><td colspan="2"></td></tr>
<tr><td>
</td><td></td></tr>
<tr><td></td><td>
</td></tr>
<tr><td rowspan="2">TOU Log</td><td></td><td></td></tr>
<tr><td colspan="2"></td></tr>
</table>

I/O	-	
Events	SOE	 
	PQ Log	 
	PQ Event Counter	
Statistics	EN50160	

			
	Max. Min.		
	SDR Trend		
Setup	Basic		
	COMM PQ		

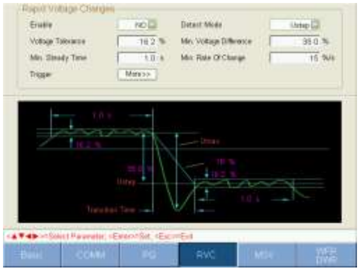
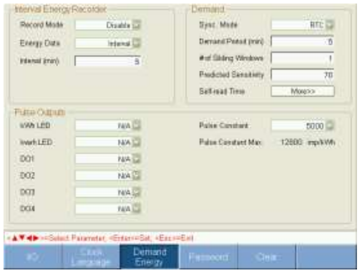
	RVC MSV		
	WFR/DWR I/O		
	Clock/Language Demand/Energy		
	Password Clear		
Diagnostics	Device Information Site Information		

Table 3-2 Description of each Hierarchy

3.2 Web Interface

The PMC-680i's web interface has been designed specifically to work with Google Chrome. Please use this link (https://www.google.com/intl/en/chrome/browser/) to download and install Google Chrome if it's not already installed on the PC.

The default IP Addresses of the PMC-680i's two Ethernet Ports are 192.168.0.100 for P1 and 192.168.1.100 for P2, respectively. Please make sure to configure the IP Addresses and Subnet Masks for the PMC-680i 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.

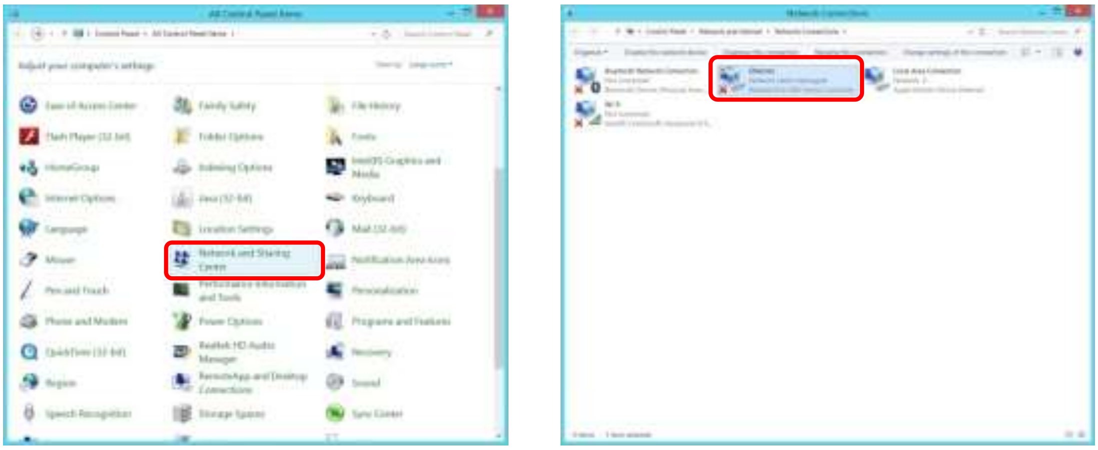


Figure 3-5 Control Panel and Network Connections

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.

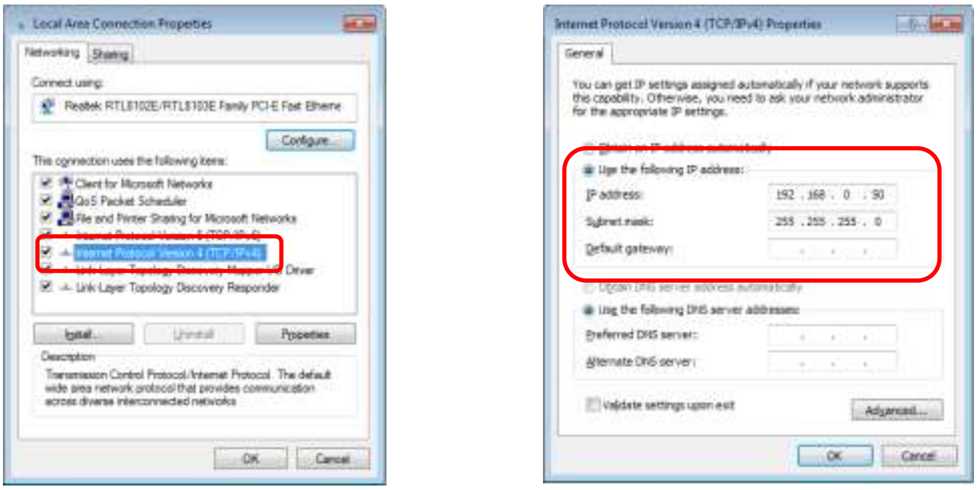


Figure 3-6 Setting PC's IP Address

3.2.2 Configure PMC-680i's IP Addresses

To configure the PMC-680i's IP Addresses, move the cursor to the **Setup** category, hit **<Enter>** and then the **Basic Setup** topic appears. Hit the **<Tab>** button to move from **Basic Setup** to **COMM Setup**. The IP Addresses can be modified by hitting **<Enter>** and going inside the page. Please note that P1 and P2 should not on the same network segment.

Figure 3-7 Configure PMC-680i's IP Address

3.2.3 Enabling Java Scripting in Google Chrome

1) Open **Google Chrome** with **Java scripting** enabled. To enable **Java Scripting**, move the mouse pointer to the upper right-hand corner of the **Google Chrome** interface and then click on this icon to open the **Settings** page.

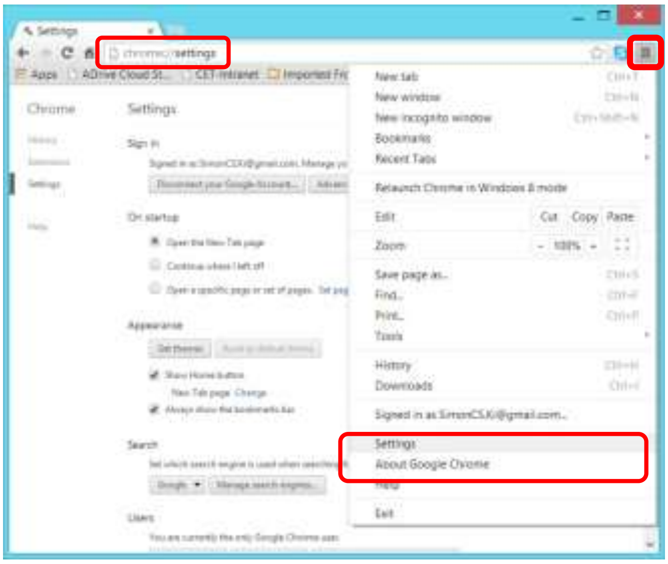


Figure 3-8 Open Setting page of Google Chrome

2) Double-click on the link **Show Advanced Settings** located at the bottom of the page to show the advanced settings.

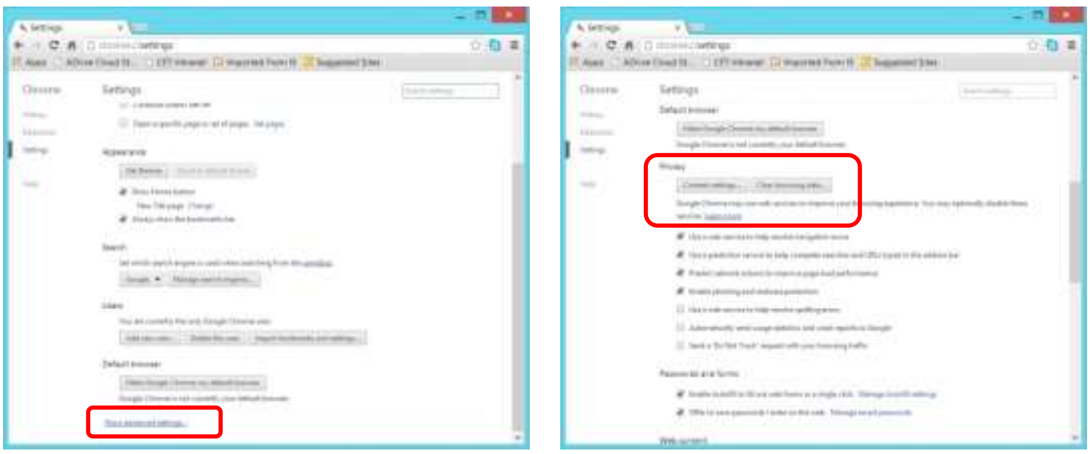


Figure 3-9 Advanced Setting page of Google Chrome

3) Double-click on the **Content Settings** and the following screen appears. Select the option **Allow all sites to run JavaScript (recommended)**.

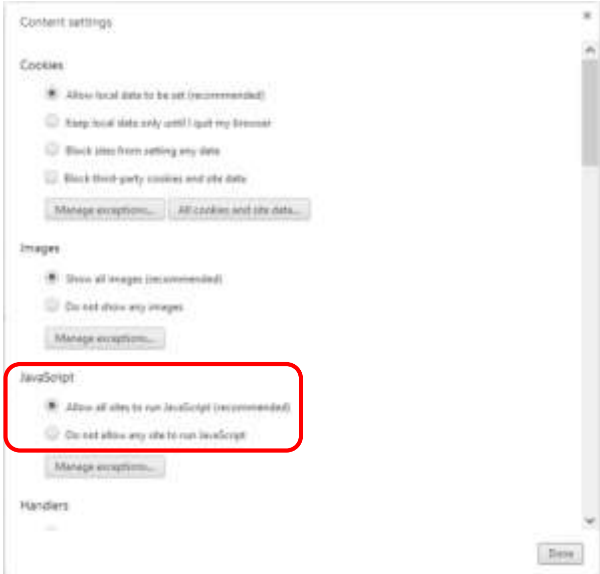


Figure 3-10 Set Content Setting for Google Chrome

3.2.4 Web Interface

1) Enter the IP Address of the PMC-680i in the Address area of **Google Chrome** and then press **<Enter>**.

2) The PMC-680i's Web Interface appears. There are four main menu items on the left-hand pane - **Metering**, **Statistics**, **Setup** and **Diagnostics**.

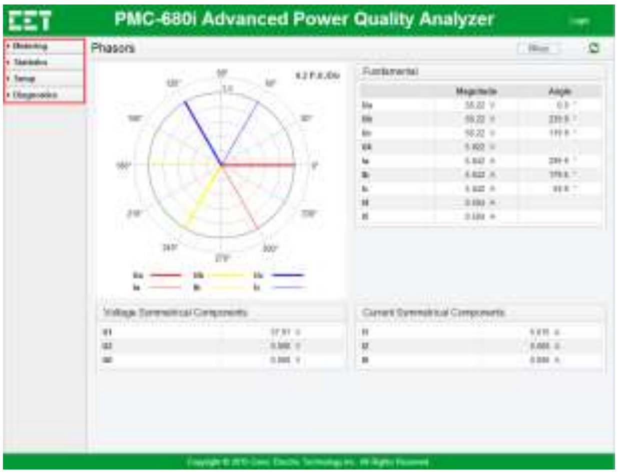


Figure 3-11 Web Interface

3.2.4.1 Metering

Click on the down arrow icon on the right of **Metering** to expand its sub-menu, which includes **Phasors**, **Real Time, Power Quality, Harmonics, Interharmonics, Demand, Energy, TOU, Waveform** and **I/O.** The following sections provide a quick overview of the web pages available under **Metering**.

3.2.4.1.1 Phasors

Click **Phasors** on the left-hand pane, the page displays following information:

- Phase and magnitude of Ua (WYE)/Uab (Delta), Ub (WYE)/Ubc (Delta), Uc (WYE)/Uca (Delta), Ia, Ib, Ic, U4, I4 and I5
- U1, U2 and U0
- I1, I2 and I0

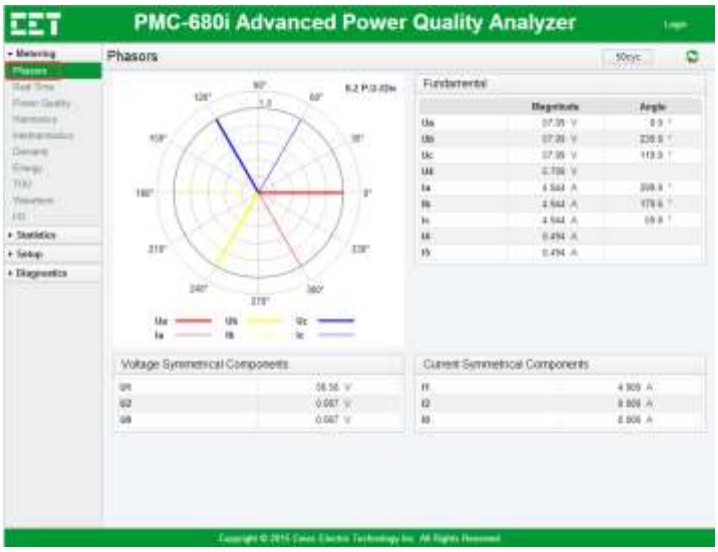


Figure 3-12 Phasors Interface

3.2.4.1.2 Real Time

Click **Real Time** on the left-hand pane, the available outputs are Voltage, Current, U/I Phase Angle, Power and Frequency.

Figure 3-13 Real Time Interface

3.2.4.1.3 Power Quality

Click **Power Quality** on the left-hand pane, the available outputs are Voltage Deviation, Frequency Deviation, Flicker, Symmetrical Components, Unbalance and PQ Event Counter.

Figure 3-14 Power Quality Interface

3.2.4.1.4 Harmonics

Click on the drop-down box beside **Harmonics** on the right-hand pane to select which input to display. The available inputs are Ua (WYE)/Uab (Delta), Ub (WYE)/Ubc (Delta), Uc (WYE)/Uca (Delta), U4, Ia, Ib, Ic, I4 and I5. Click **Harmonic Distortion (%), Harmonic RMS (V), Harmonic P (W), Harmonic Phase Angle (°)** and **Harmonic Q (var)** to view corresponding information.

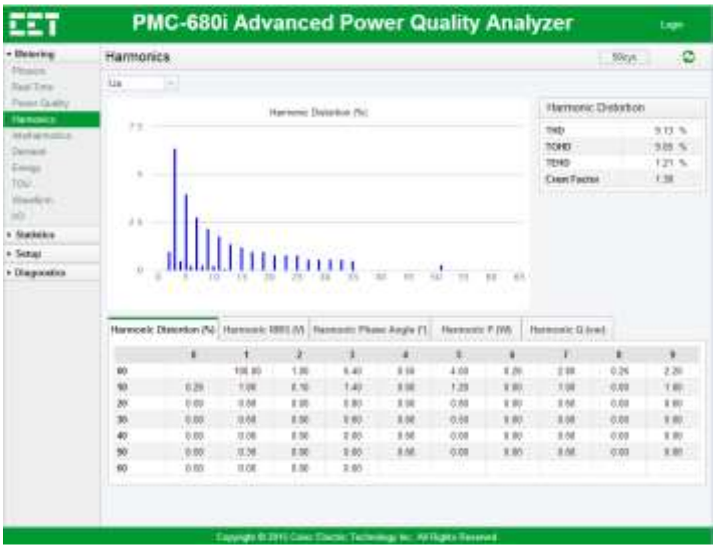


Figure 3-15 Harmonics Interface

3.2.4.1.5 Interharmonics

Click on the drop-down box beside **Inter-Harmonics** on the right-hand pane to select which input to display. The available inputs are Ua (WYE)/Uab (Delta), Ub (WYE)/Ubc (Delta), Uc (WYE)/Uca (Delta), U4, Ia, Ib, Ic, I4 and I5. Click **Interharmonic Distortion (%)** and **Interharmonic RMS (V)** to view corresponding information.

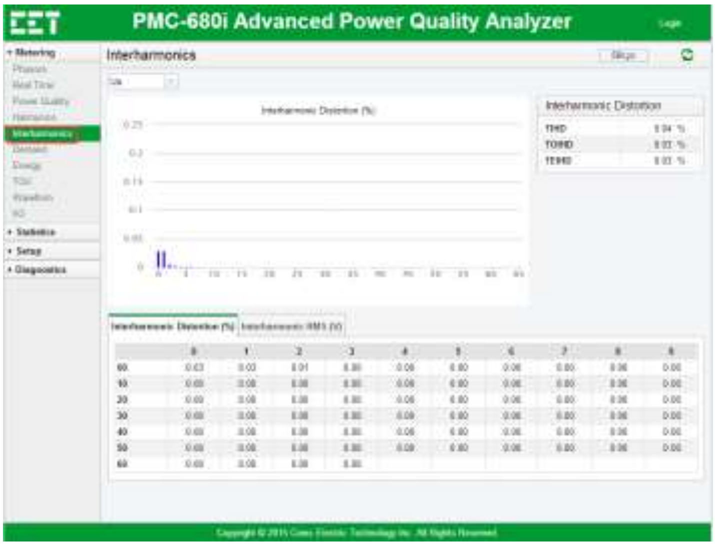


Figure 3-16 Interharmonics Interface

3.2.4.1.6 Demand

Click **Demand** on the left-hand pane, the **Demand** and **Max. Demand** will be shown on the right-hand pane. Depending on the setting of the **Self-Read Time** setup register, the **Max. Demand** web page may display the Max. Demand of This/Last Month or Max. Demand since/before Last Reset.

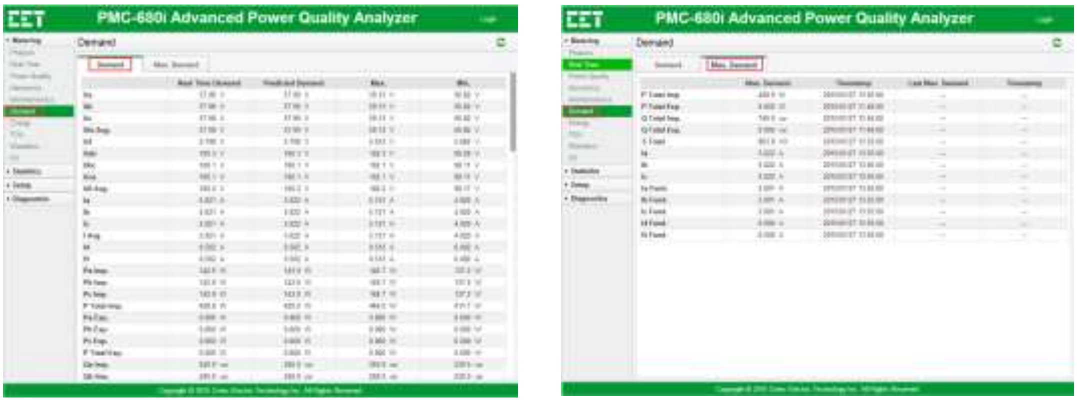


Figure 3-17 Demand Interfaces

3.2.4.1.7 Energy

Click **Energy** on the left-hand pane, the **Total Energy** and **Harmonic Energy** will be shown on the right-hand pane. Click **Total Energy** tab, the available outputs are Active/Reactive/Apparent Energy, while **Harmonic Energy** displays H01 to H63 kWh Imp./Exp., H01 to H63 kvarh Imp./Exp. measurements.

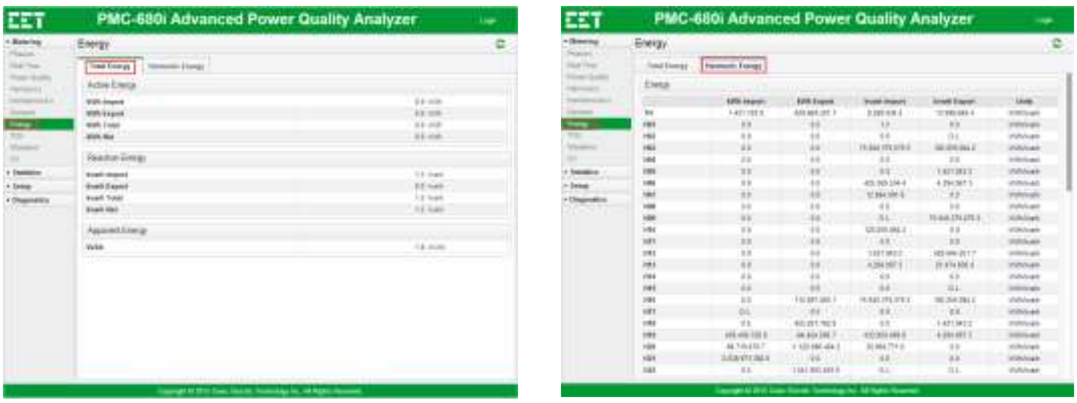


Figure 3-18 Energy Interfaces

3.2.4.1.8 TOU

Click **TOU** on the left-hand pane, the right-hand page displays TOU **Real Time** and **Log** information. Click **Real Time** to view present TOU schedule information, Energy and Max. Demand information. Click **Log** to view TOU data which includes historical Energy and Max. Demand information.

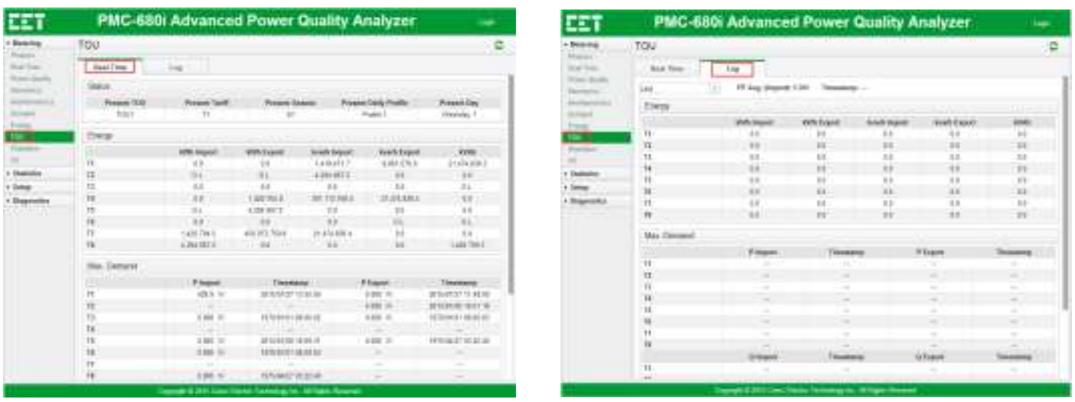


Figure 3-19 TOU Interfaces

3.2.4.1.9 Waveform

This web page displays the real-time waveform captured by the PMC-680i. A small fly-out comment showing the channel name and the measurement value is displayed when the mouse pointer is positioned to a particular point in a waveform.

Figure 3-20 Waveform Interface

3.2.4.1.10 I/O

Click **I/O** on the left-hand pane to display status of Digital Inputs, Relay Outputs and Digital Outputs.

Figure 3-21 I/O Interface

3.2.4.2 Statistics

Click on the down arrow icon beside **Statistics** on the right to expand its sub-menu, which includes **Counters, SOE, PQ Log, Max./Min., SDR Trend, PQDIF, COMTRADE** and **EN50160**. The following sections provide a quick overview of the web pages available under **Statistics**.

3.2.4.2.1 Counters

This web page displays counters for SOE, PQ log, Pst, Plt, TOU, IER, EN50160, WFR, DWR, MSV, DR, HSDR and SDR.

Figure 3-22 Counter Interface

3.2.4.2.2 SOE

This web page displays SOE Log starting with the most recent event (with a **Start Index** of 1). There is a text box near the lower right-hand corner of the page. By entering a specific value in the text box and the web page jump to particular page.

Also, you can query fixed period's SOE by specifying **Start Date** and **End Date.** By selecting event type from **Type** drop-down box to query specific type SOE. If a SOE has Waveform, the waveform column would display download link. Click **Detail** to download file, please see figures below. In the **Waveform** dialog box, click **view** to display waveform, while click **.cfg** or **.dat** to download waveform file.

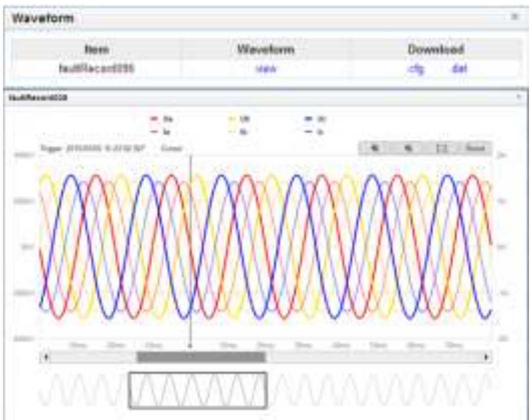


Figure 3-23 SOE Interface and Download Waveform file

3.2.4.2.3 PQ Log

This web page displays PQ Log starting with the most recent event (with a **Start Index** of 1). There is a text box near the lower right-hand corner of the page. By entering a specific value in the text box and the web page jump to particular page.

Also, you can query fixed period's PQ by specifying **Start Date** and **End Date.** By selecting event type from **Type** drop-down box to query specific type PQ log. If a PQ Log has corresponding Waveform, SEMI F47 or ITIC file, the waveform and Evaluate columns would display view link. Click **Detail, SEMI F47** or **ITIC** to view and download file, please see figures below.

Figure 3-24 PQ Log Interface

3.2.4.2.4 Max./Min. Log

Click **Max./Min.** on the left-hand pane and the following screens appear. This web page displays the Max./Min. Log information of this month (since last reset) and last month (before last reset).

Period Displays the Max. and Min. information for a specific period, which consists of **This Period** and **Last Period**.

Recorder Specifies one of four Groups of Max. and Min. information to display.

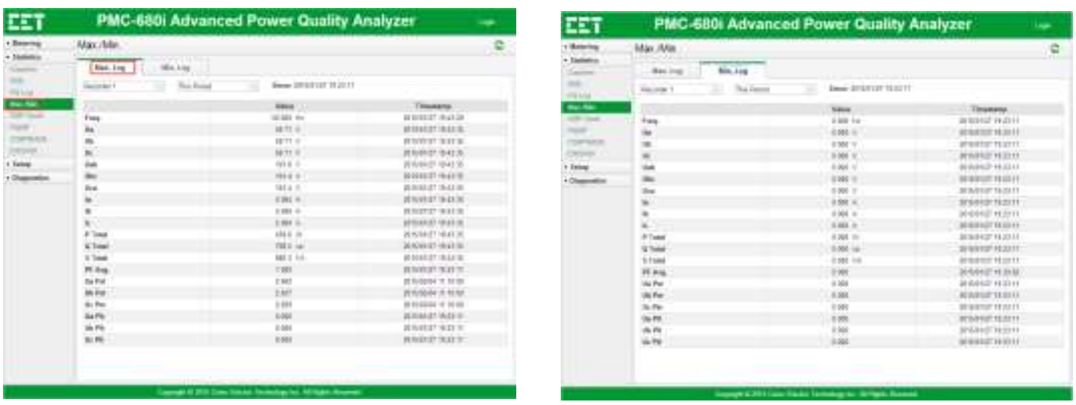


Figure 3-25 Max./Min. Interface

3.2.4.2.5 SDR Trend

Click **SDR Trend** on the left-hand pane and the following screen appears on the right-hand pane. This web page displays the Statistical Log in a trend curve. The available inputs are FREQ, Ua, Ub, Uc, U4, Ia, Ib, Ic, I4, I5, Ua ANG, Ub ANG which can be configured via communication, please refer to **5.9.20 Trend Log Setup**.

The color of the trend curve is highlighted and a small fly-out comment displayed showing the parameter name and the measurement when the mouse pointer is positioned to a particular point on a trend curve. Please note that the curve set log entries plot as horizontal axis and the page displays latest 200 logs.

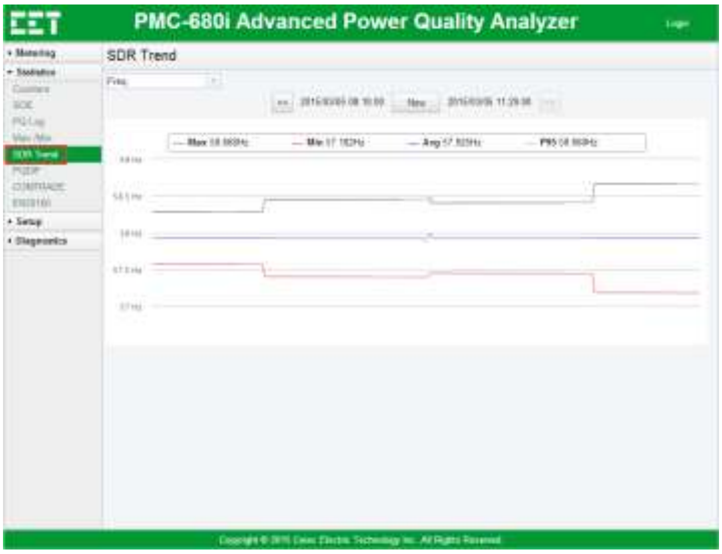


Figure 3-26 SDR Trend Interface

3.2.4.2.6 PQDIF

Click on **PQDIF** on the left-hand pane and the following screen appears on the right-hand pane. This web page displays the available **PQDIF** files in a Table format. Setting start date and end date allows the user to search for the PQDIF files for a specific date. The **Download** button on the right side of the Table allows the user to download a **PQDIF** file and store it locally on a PC where it can be viewed using a **PQDIF** viewer.

Figure 3-27 PQDIF Interface

3.2.4.2.7 COMTRADE

Click on **COMTRADE** on the left-hand pane and the following screen appears on the right-hand pane. This web page displays the available **COMTRADE** files in a Table format. The **view** button below **Waveform** column allows the user to view waveform of the COMTRADE file. The **.cfg** and **.dat** button on the right side of the Table allows the user to download a **COMTRADE** file and store it locally on a PC where it can then be viewed using a **COMTRADE** viewer.

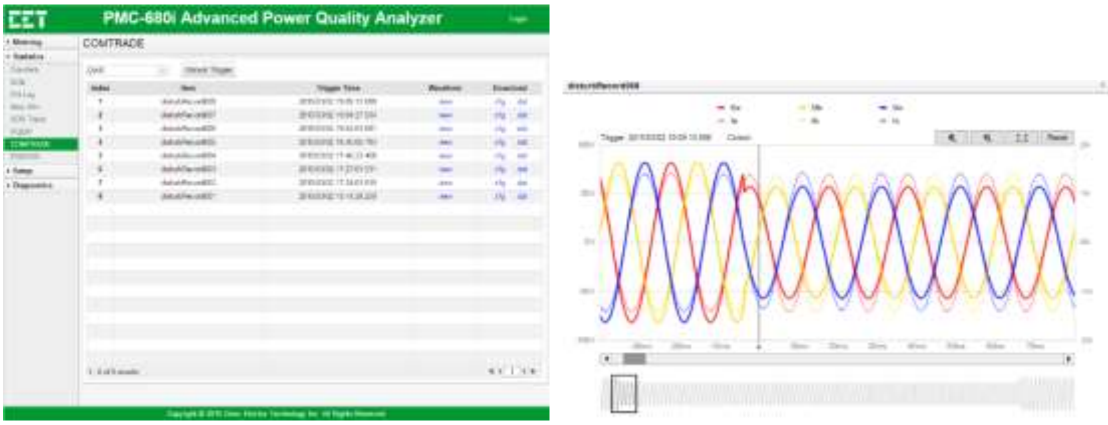


Figure 3-28 COMTRADE Interface

3.2.4.2.8 EN50160

Click **EN50160** on the left-hand pane and the following screen appears. This web page displays the **Summary of Results for EN50160 Compliance** in a Table format and click hyperlink such as **FAIL** to view detail information. **Export** button allows users to download EN50160 Compliance report, and the box near the **Export** button page allows the user to search for the EN50160 Compliance Report for a specific period.

Figure 3-29 EN50160 Interface

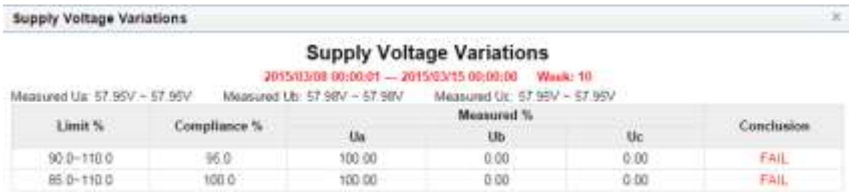


Figure 3-30 Detail Information Example

3.2.4.3 Setup

Click **Setup** on the left-hand pane to expand and the sub-menus, which includes **Basic Setup**, **PQ Setup, Demand Setup, Record Setup, I/O Setup, COMM Setup**, **Clock Setup**, **Password Setup** and **Clear**. Then click **Basic Setup** and the following screen appears. This web page displays **Basic Setup** information.

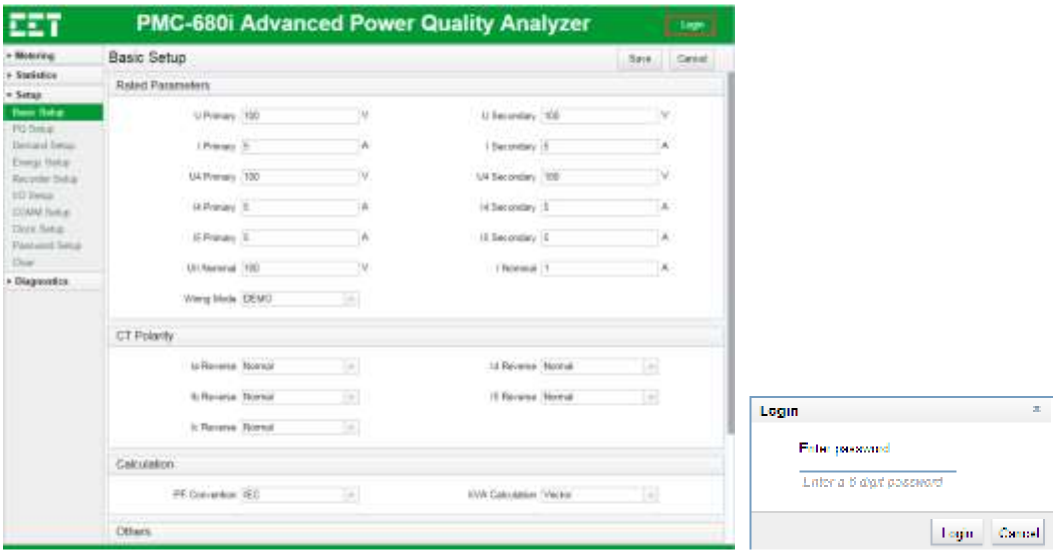


Figure 3-31 Setup Interface

In order to make changes, the user needs to first login to the web interface by clicking on the **Login** icon at the upper right-hand corner of the page. The user then enter the password (default password = 000000) at the **Login** dialog box. The user may now make the necessary setup changes for the PMC-680i.

3.2.4.3.1 Basic Setup

Click **Basic Setup** on the left-hand pane and the following screen appears on the right-hand pane.

Figure 3-32 Basic Setup Interface

The following table illustrates the range for each parameter:

Parameter	Range	Parameter	Range	Parameter	Range
Rated Parameters					
U Primary	1 to 1000000V	I Primary	1 to 30000A	U4 Primary	1 to 1000000V
U Secondary	1 to 1500V	I Secondary	1 to 50A	U4 Secondary	1 to 1500V
I4 Primary	1 to 30000A	I5 Primary	1 to 30000A	Ull Nominal	1 to 1500V
I4 Secondary	1 to 50A	I5 Secondary	1 to 50A	I Nominal	1 to 20A
Wiring Mode	4W-WYE, 3W-WYE, DEMO, DELTA				
CT Polarity					

<table>
<tr><td>Ia Reverse</td><td rowspan="2">Normal,
Reverse</td><td>Ib Reverse</td><td rowspan="2">Normal, Reverse</td><td rowspan="2">Ic Reverse</td><td rowspan="2">Normal, Reverse</td></tr>
<tr><td>I4 Reverse</td><td>I5 Reverse</td></tr>
<tr><td colspan="6">Calculation</td></tr>
<tr><td>PF Convention</td><td colspan="2">IEC, IEEE, -IEEE</td><td>kVA Calculation</td><td colspan="2">Vector, Scalar</td></tr>
<tr><td colspan="6">Others</td></tr>
<tr><td>Basic Agg.</td><td colspan="2">50cyc, 150cyc, 10min, 2</td><td>Freq. Agg</td><td colspan="2">1sec, 3sec, 10sec</td></tr>
<tr><td>PQ Plot</td><td colspan="2">ITIC, SEMI F47</td><td>Phase A Color</td><td colspan="2">Red*</td></tr>
<tr><td>Phase B Color</td><td colspan="2">Yellow*</td><td>Phase C Color</td><td colspan="2">Blue*</td></tr>
<tr><td>Phase N Color</td><td colspan="2">Black*</td><td>GND Color</td><td colspan="2">Green/Yellow striped*</td></tr>
</table>

*default

Table 3-3 Basic Setup Parameters Range

3.2.4.3.2 PQ Setup

Click **PQ Setup** on the left-hand pane and the following screen appears on the right-hand pane. Set power quality parameters as you need which consist of below categories and please refer to **5.9.6 PQ Setup** for detailed range.

- Harmonic
- Flicker
- Dip/Swell
- Transient
- RVC (Rapid Voltage Changes)
- Inrush Current
- MSV (Mains Signalling Voltage)
- Discard Flagged Data

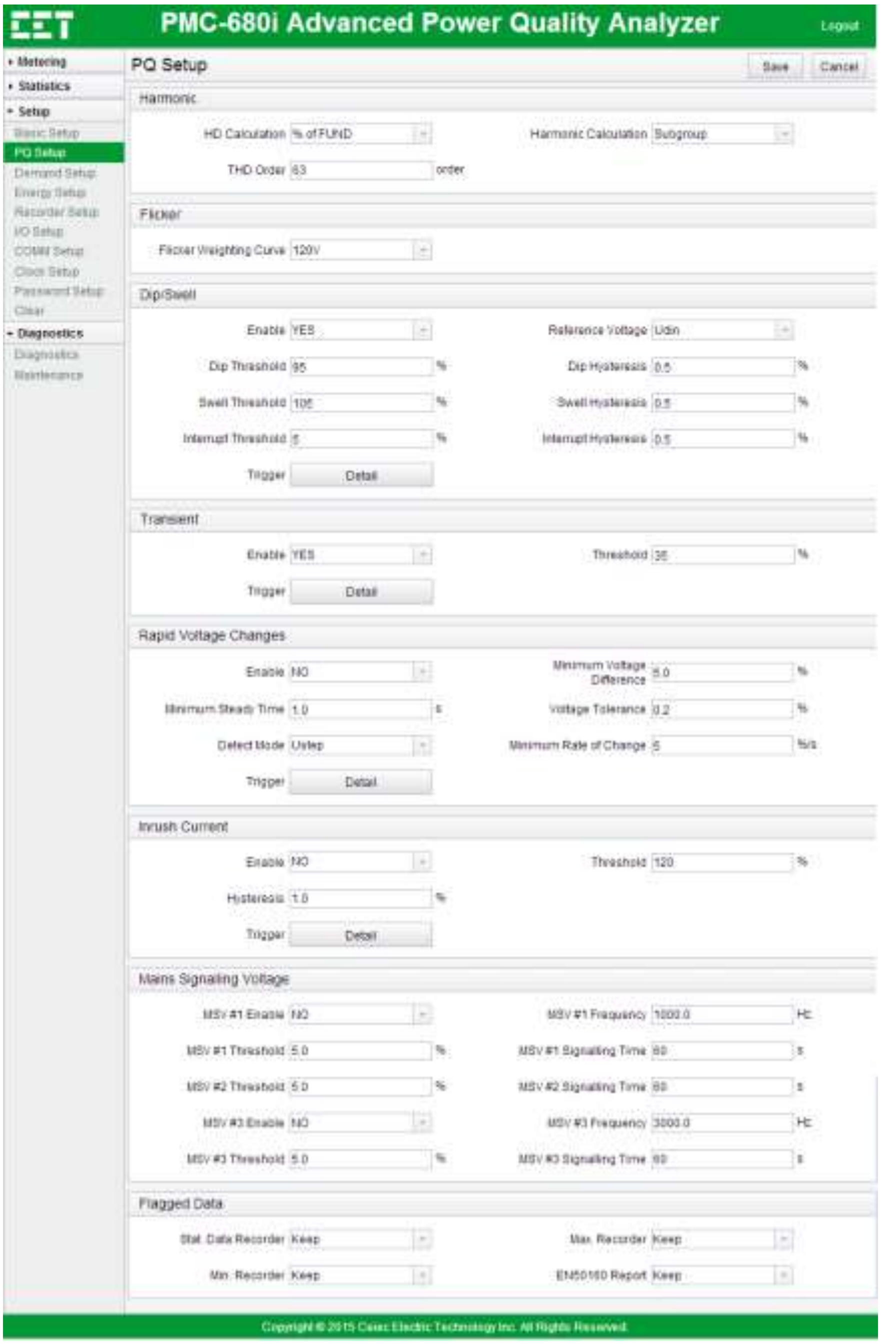


Figure 3-33 PQ Setup Interface

3.2.4.3.3 Demand Setup

Click **Demand Setup** on the left-hand pane and the following screen appears. Set demand parameters as you need, please refer to **5.9.8 Demand Setup**.

Figure 3-34 Demand Setup Interface

3.2.4.3.4 Energy Setup

Click **Energy Setup** on the left-hand pane and the following screen appears. Set energy parameters as you need, please refer to **5.9.17 Interval Energy Recorder (IER) Setup** and **5.9.10 Energy Pulse Setup**.

Figure 3-35 Energy Setup Interface

3.2.4.3.5 Recorder Setup

Click **Recorder Setup** on the left-hand pane and the following screen appears. Set various recorders' parameters as you need, please refer to **5.9.9 WFR Setup**.

Figure 3-36 Record Setup Interface

3.2.4.3.6 I/O Setup

Click **I/O Setup** on the left-hand pane and the following screen appears. Set I/O parameters as you need, please refer to **5.9.3 DI Setup** and **5.9.4 RO/DO Setup**.

Figure 3-37 I/O Setup Interface

3.2.4.3.7 COMM Setup

The PMC-680i comes standard with two Ethernet ports (P1&P2) which support Modbus TCP and two RS-485 ports (P3&P4) which support Modbus RTU. In addition, PMC-680i support sending alarm email via setting SMTP server. Click on **COMM Setup** on the left-hand pane and the following screen appears. Set COMM parameters as you need, please refer to **5.9.1 Communications Setup**. Please note that P1 and P2 should not on the same network segment.

Figure 3-38 COMM Setup Interface

3.2.4.3.8 Clock Setup

Click **Clock Setup** on the left-hand pane and the following screen appears. This web page shows four areas: **PC Clock, Device Clock, Clock** and **SNTP.** There is a quick access button that can be used to synchronize the PMC-680i's Clock to the PC Clock with just a simple click.

Figure 3-39 Clock Setup Interface

3.2.4.3.9 Password Setup

Click **Password Setup** on the left-hand pane and the following screen appears. This web page allows the user to change the **Login** password for the PMC-680i. It's highly recommended for the user to change the default **Login** password to something unique. After inputting passwords, click **Save** to save change.

Figure 3-40 Password Setup Interface

3.2.4.3.10 Clear

Click **Clear** on the left-hand pane and the following screen appears. This web page allows the user to perform the following Clear functions:

Button	Function
Clear Max. Demand	Clear Max. demand of this month
Clear All Max./Min. Log	Clear all Max./Min. Log of This Period (This Month or Since the Last Reset)
Clear SOE Log	Clear SOE Log
Clear PQ Log	Clear PQ Log
Clear PQ Event Counters	Clear PQ Event Counters
Clear All DI Counters	Clear all DI Counters
Clear TOU Log	Clear all TOU Log, including real-time log and historical log
Clear Energy	Clear energy record

Table 3-4 Clear Items

Figure 3-41 Clear Setup Interface

For example, if the user clicks on **Clear Max. Demand**, the following dialog box appears. Click **OK** to confirm to delete.

Figure 3-42 Confirm Page

3.2.4.5 Diagnostics

Click **Diagnostics** on the left-hand pane to expand its sub-menu, which includes **Diagnostics** and **Maintenance.**

3.2.4.5.1 Diagnostics

Click **Diagnostics** on the left-hand pane and the following screen appears. This web page displays the PMC-680i's diagnostics information in a table format, which includes **Version, Self Diagnostics, Memory** and **Site Information**.

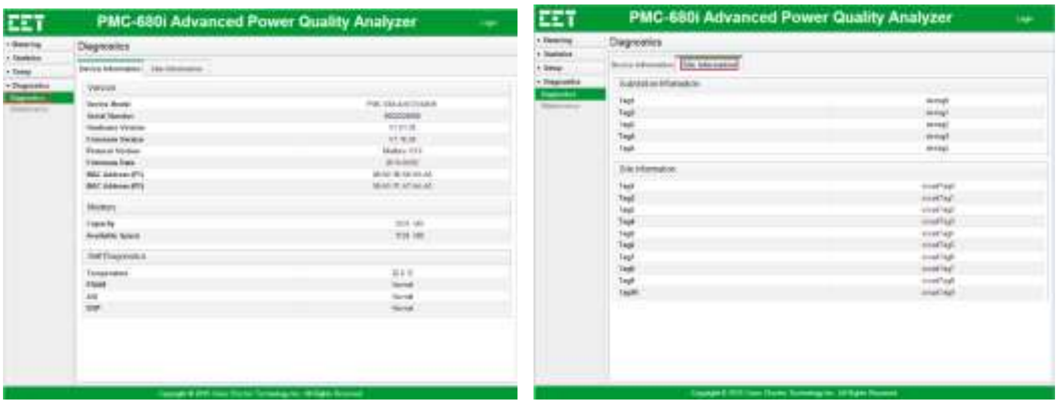


Figure 3-43 Diagnostics Interface

3.2.4.4.2 Maintenance

User login the PMC-680i Web with standard password, and click **Maintenance** on the left-hand pane and the following screen appears.

- **Backup & Restore** Save or restore all configuration to local
- **Alarm E-mail Test** Test Alarm Email which configured via communication

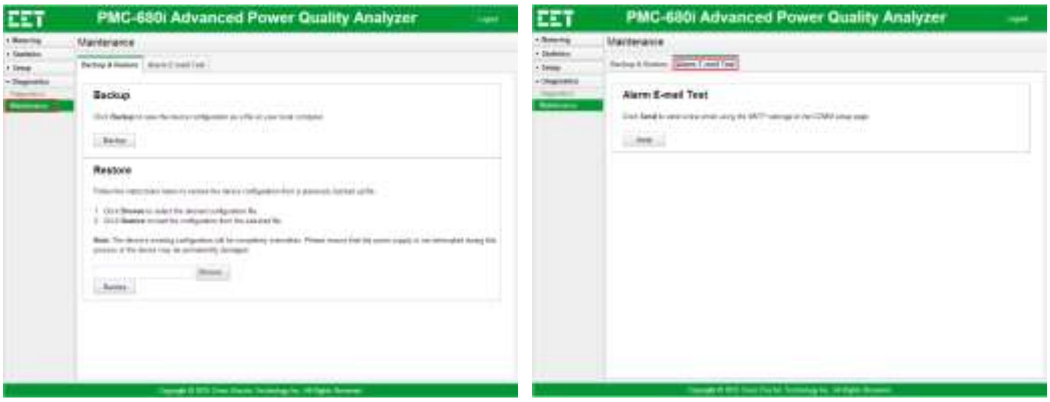


Figure 3-44 Maintenance Interface

3.2.4.6 Customization

PMC-680i provides web page to distributor which can be used to execute some customized information, such as Device Model, Web Page Banner, Logo on Front Panel and Logo on Web. Besides, you can reset to factory defaults and caution should be exercised when taking this action. Enter http://IP:Port/index.html#Customize in the Address area of **Google Chrome** and then press **<Enter>**. Follow the guidelines on the web to customize information as you need.

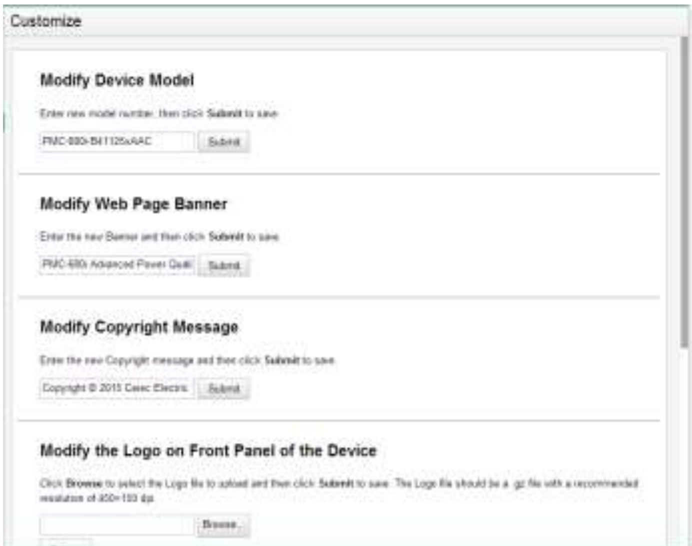


Figure 3-45 Customize Interface

Chapter 4 Applications

4.1 Inputs and Outputs

4.1.1 Digital Inputs

The PMC-680i is equipped with 8 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	Each **DI** can be configured as a Status Input, Pulse Counter Input. Only one **DI** should be programmed as a Demand Sync Input. If **Clock Source** is set to DI, DI8 is used by default for GPS 1PPS Time Sync.	0=Status Input* 1=Counter 2=DMD Sync
DIx Debounce	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 9999 (ms) (Default=20ms)
DIx Setpoint Type	Specifies the valid transition type, whether it's positive, negative or any, that a DI Setpoint looks for before triggering its output. DI Setpoint can only be used when a DI is configured as a Status Input.	0=Any Transition* 1= +ve Transition 2= -ve Transition
DIx Setpoint Trigger	Specifies what output action a DI Setpoint will take when it triggers. DI Setpoint can only be used when a DI is configured as a Status Input.	See Table 5-92
DIx Pulse Weight	Specifies the incremental value for each received pulse. This is only used when a DI is configured as a Pulse Counter Input.	1* to 1,000,000

Table 4-1 Definition for DI Parameters

The PMC-680i's DIs can be used in the following applications:

1) 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 Front Panel as well as through communications. Changes in DI status are stored as events in the SOE Log in 1 ms resolution. The following table illustrates how to program a particular DI for Status monitoring.

Setup Parameter	Value	Description
DIx Mode	0	Status Input
DIx Debounce	20	Default
DIx Setpoint Type	0, 1, 2	0=Any Transition* 1= +ve Transition

		2= -ve Transition
DIx Setpoint Trigger	See Table 5-92	See Table 5-92
DIx Pulse Weight	N/A	N/A

Table 4-2 DI Setup Parameters for Status Input

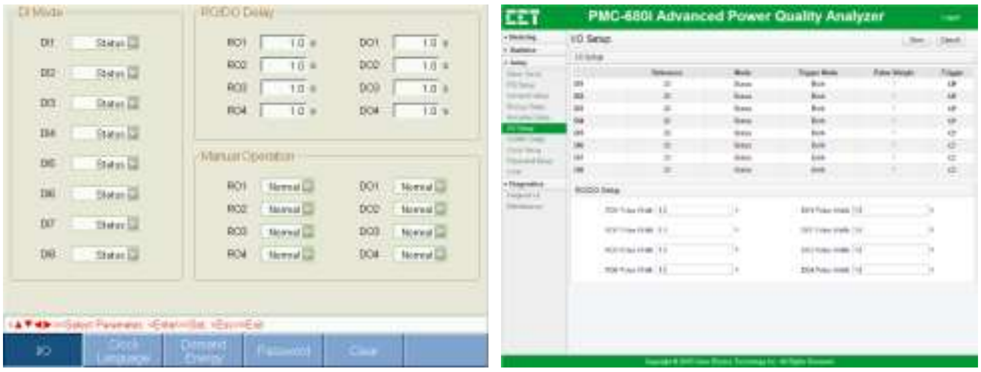


Figure 4-1 Program DI for Status Monitoring

2) A **DI** can be used for pulse counting to collect WAGES (Water, Air, Gas, Electricity and Steam) information. The **DI Pulse Counter** information is available via the Front Panel Interface or communications. The **DI Pulse Counters** can be reset from the front panel or via communications. The following table illustrates how to program a **DI** for pulse counting.

Setup Parameter	Value	Description
DIx Mode	1	Counter
DIx Debounce	20	Default
DIx Setpoint Type	N/A	N/A
DIx Setpoint Trigger	N/A	N/A
DIx Pulse Weight	1	Default

Table 4-3 DI Setup Parameters for Pulse Counting

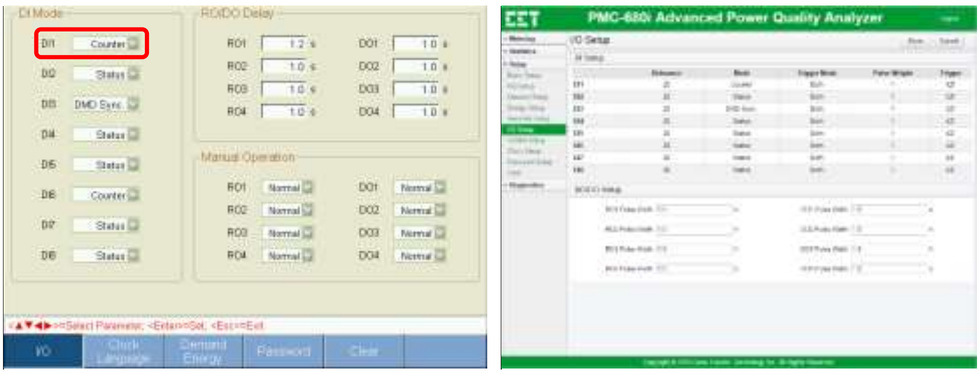


Figure 4-2 Pulse Counter Display on the Front Panel Interface

3) One of the **DIs** can be programmed to receive the Demand Sync Pulse by setting **DI Mode** to **DMD Sync**. The following table illustrates how to program a **DI** as a **Demand Sync Input**. Please refer to Section 4.2.3 for a detailed description.

Setup Parameter	Value	Description
DIx Mode	2	DMD Sync
DIx Debounce	20 (Default)	Default
DIx Setpoint Type	N/A	N/A
DIx Setpoint Trigger	N/A	N/A
DIx Pulse Weight	N/A	N/A

Table 4-4 DI Setup Parameters for Demand Sync Pulse

4) When the **Clock Source** parameter is set to **DI, DI8** is used by default to receive the 1PPS GPS Time Sync. Signal for synchronizing its internal RTC. All **DI8** setup parameters are disregarded except for the **DI8 Debounce**. Please refer to Section 4.7.3 for a detailed description.

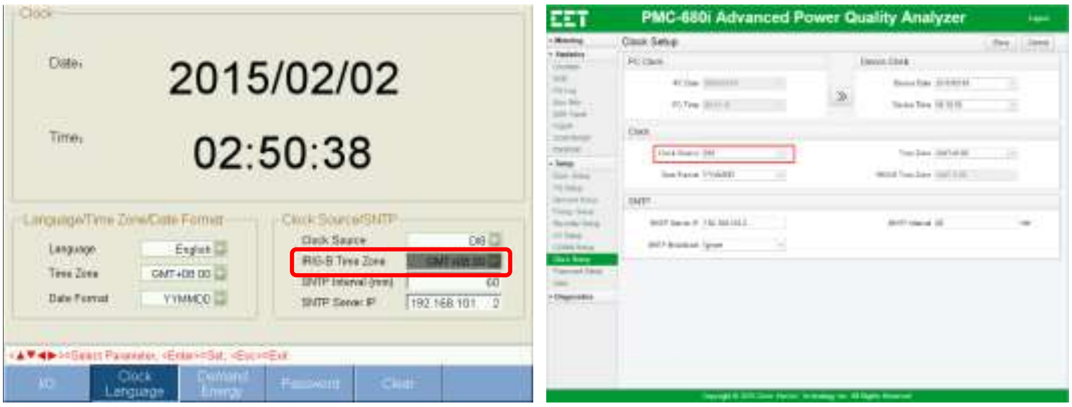


Figure 4-3 Set DI as Clock Source

4.1.2 Relay Outputs and Digital Outputs

The PMC-680i comes standard with 2 Form A and 2 Form C Mechanical Relay Outputs (RO) as well as 4 Solid State Relay Outputs (DO). RO and DO are normally used for setpoint alarming, load control, or remote control applications. RO and DO on the PMC-680i has the following setup parameters:

Setup Parameter	Definition	Options
RO / DO Alarm Enable Flag	Specifies if RO / DO alarm function is enabled.	0*=Disabled 1 ~ 4=RO1 to RO4 Enabled 5 ~ 8=DO1 to DO4 Enabled
Execute without Arm	Specifies if the relays needs to be armed before they can be operated on. Therefore, the user must first arm the relay first before operating a relay	0*=Disabled 1=Enabled

RO / DO Delay	As to remote aggregate command, and if the delay time is 0, the RO / DO will immediately take action when received the command and remain closed status until the next command come. On the contrary, RO / DO will take action and return after a certain time delay (x 0.1s). For remote open command, the delay time has no meaning and RO / DO will immediately return after receive the command. As to non-remote command, and it means that the RO / DO will return immediately after receive the return command when the time delay is 0; if the time value is not 0, RO / DO will return at a certain time delay (x 0.1s) after receive the return command.	0 to 6000 (x 0.1s), 10*

* Default

Table 4-5 DO/RO Setup Parameters

ROs and DOs on the PMC-680i can be used in the following applications:

Application	Description
Front Panel Control	Manual operation from the Front Panel, mainly used for relay testing.
Remote Control	Remotely operated over communications via our free PMC Setup software or PecStar® iEMS. Remote Control of RO and DO is not supported by the Web Interface.
Control Setpoint	Control Setpoints can be programmed to trigger RO/DO, WFR, DR, Alarm Email, etc, upon becoming active. Please refer to Section 4.3 for detailed description.
Dip/Swell Setpoint	Dip/Swell Setpoint can be programmed to trigger RO/DO, WFR, DR, Alarm Email, etc, upon becoming active. Please refer to Section 4.4.4 for detailed description.
Transient Setpoint	Transient setpoint can be programmed to trigger WFR and DWR, upon becoming active. Please refer to Section 4.4.5 for detailed description.
RVC Setpoint	RVC setpoint can be programmed to trigger WFR and DWR, upon becoming active. Please refer to Section 4.4.10 for detailed description.
Inrush Setpoint	Inrush Setpoint can be programmed to trigger RO/DO, WFR, DR, Alarm Email, etc. upon becoming active. Please refer to Section 4.4.11 for a detailed description.

Table 4-6 DO/RO Setup Applications

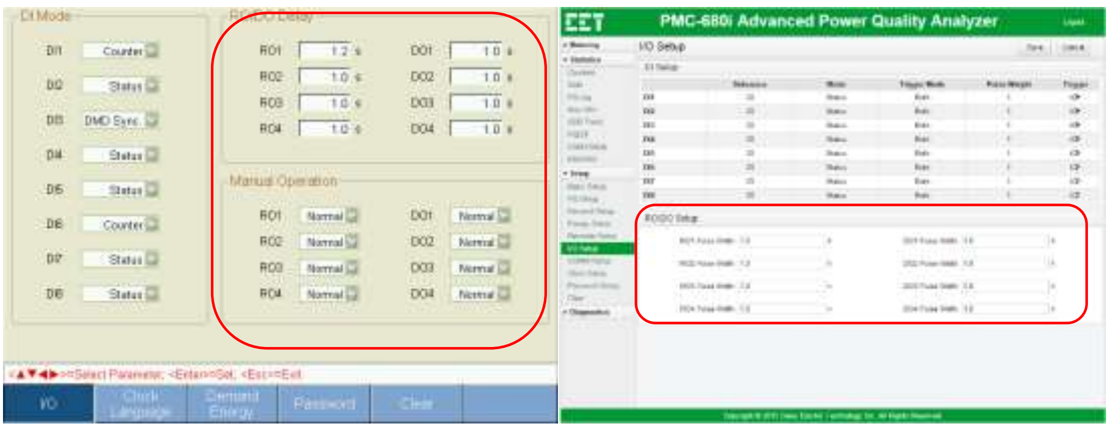


Figure 4-4 Manual Operation of RO/DO via the Front Panel Interface

Since there are so many ways to utilize the relay output on the PMC-680i, a prioritized scheme has been developed to avoid conflicts between different applications. In general, Front Panel Control has the highest priority and can override the other applications. Remote Control, Control, Dip/Swell, Transient, Inrush Current and RVC Setpoint share the same priority, meaning that they can all be programmed to control the same relay output. This scheme is equivalent to having an implicit Logical OR operation for the control of a Relay Output and may be useful in providing a generic alarm output signal. However, the sharing of a Relay Output is not recommended if the user intends to generate a control signal in response to a specific setpoint condition.

4.1.3 Energy Pulse Outputs

There are two common applications for Energy Pulsing:

- Accuracy Testing
- Providing energy consumption information to an external device such as a PLC or a Pulse Counter

The PMC-680i can be configured to generate kWh and/or kvarh energy pulsing via either the 2 Front Panel LED Pulse Outputs (kWh and kvarh) or the 4 Digital Outputs in the back. Energy pulsing can be enabled from the Front Panel or Web through the **Demand Energy** or **Energy Setup** screen.

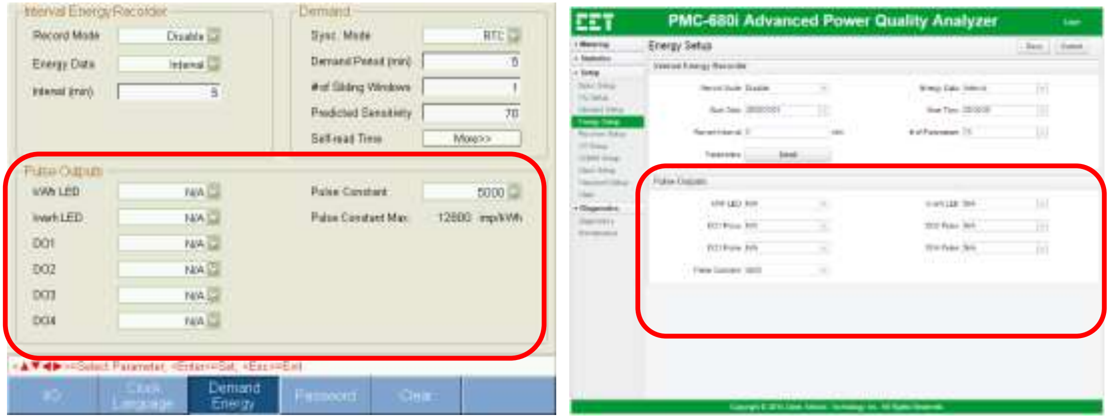


Figure 4-5 Enable Energy Pulse in the Front Panel and Web

PMC-680i's Energy Pulse Outputs have the following setup parameters:

Setup Parameters	Definition	Options	
kWh LED Energy Pulse Source		Disabled Fundamental kWh	Harmonic kWh Total kWh
kvarh LED Energy Pulse Source	Specify the source to which the energy pulse output is proportional.	Disabled Fundamental kvarh	Harmonic kvarh Total kvarh
DO Energy Pulse Source		See Table 4-8 DO Energy Pulse Source	
Energy Pulse Constant	Specify the rate of the energy pulse output. For example, 1000 means 1000 Impulses per kWh or 1 Impulse per 1Wh.	1000, 3200, 5000, 6400 or 12800 Impulses per kXh (imp/kXh)	

Table 4-7 Setup Parameters for Energy Pulse Output

Energy Pulse	Description	Energy Pulse	Description	Energy Pulse	Description

Source		Source		Source	
0	Disabled	7	kWh TH	14	kvarh Imp. H01
1	Real Time kWh Total	8	kWh Imp. TH	15	kvarh Exp. H01
2	kWh Imp.	9	kWh Exp. TH	16	kvarh TH
3	kWh Exp.	10	Real Time kvarh Total	17	kvarh Imp. TH
4	kWh Total Fundamental	11	kvarh Imp.	18	kvarh Exp. TH
5	kWh Imp. H01	12	kvarh Exp.		
6	kWh Exp. H01	13	kvarh Total Fundamental		

Table 4-8 DO Energy Pulse Source

It's important to understand that energy pulsing is always based on the secondary ratings (e.g. 230V and 5A) as it would be impossible to generate the required number or pulses based on the primary ratings. The following table illustrates the recommended settings for the **Energy Pulse Constant** based on **Z** = 2 x $V_{nominal}$ x $I_{nominal}$, where $V_{nominal}$ and $I_{nominal}$ are the secondary voltage and current nominal ratings. In general, one would use a higher **Pulse Constant** for a smaller **Z** value **(i.e.** a smaller $V_{nominal}$ and $I_{nominal}$**)** in an accuracy testing situation to reduce the test time.

Z	Energy Pulse Constant	Default	Min. Interval
≤1000	1000/3200/5000/6400/12800	1000	160ms
≤2000	1000/3200/5000/6400	1000	
≤2600	1000/3200/5000	1000	
≤4000	1000/3200	1000	
≤13000	1000	1000	

Table 4-9 Settings for Energy Pulse Constant

4.2 Power, Energy and Demand

4.2.1 Basic Measurements

The PMC-680i provides the following basic measurements with 1 second update rate:

- 3-phase Voltages and Currents
- 3-phase Powers, PFs and dPF
- U4, I4, I5 and Frequency
- Bi-directional Energy measurements
- Voltage and Current phase angles

- Real-time status for DIs, ROs and DOs
- Ia/Ib/Ic/I4/I5 K-Factor and Crest Factor, Ua/Ub/Uc/U4 Crest Factor

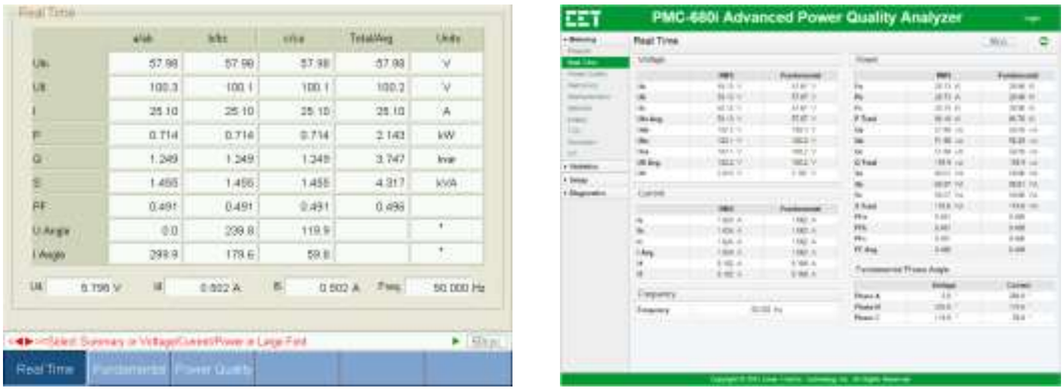


Figure 4-6 Displaying for Basic Measurements

4.2.2 Energy Measurements

The PMC-680i provides Energy measurements include fundamental energy as well as harmonic energy. The energy has a maximum value of 99,999,999,999.999 and will roll over to zero when it is reached. The energy can be reset manually or preset to user-defined values through the front panel or via communications. The PMC-680i provides the following energy measurements:

<table>
<tr><th>kWh</th><th>kvarh</th><th>kVAh</th></tr>
<tr><td>Imp. (Total RMS)</td><td>Imp. (Total RMS)</td><td rowspan="10">kVAh Total</td></tr>
<tr><td>Exp. (Total RMS)</td><td>Exp. (Total RMS)</td></tr>
<tr><td>Net (Total RMS)</td><td>Net (Total RMS)</td></tr>
<tr><td>Total (Total RMS)</td><td>Total (Total RMS)</td></tr>
<tr><td>Net Fundamental</td><td>Net Fundamental</td></tr>
<tr><td>Total Fundamental</td><td>Total Fundamental</td></tr>
<tr><td>Imp./Exp. TH</td><td>Imp./Exp. TH</td></tr>
<tr><td>Net TH</td><td>Net TH</td></tr>
<tr><td>Total TH</td><td>Total TH</td></tr>
<tr><td>Imp./Exp. H02 to H63</td><td>Imp./Exp. H02 to H63</td></tr>
</table>

Table 4-10 Energy Measurements

4.2.3 Demands

Demand is defined as the average power consumption over a fixed interval (usually 15 minutes), including present demand and predicted demand, and both of them have two calculations: SLD and DI

Sync. The predicted demand is typically used for pre-alarm and helps users reducing power consumption.

PMC-680i also provides recording of Max. Demand of this month and last month. The Max. Demand of this month can be transferred to be as Max. Demand of last month at the end of month, and the Max. Demand of this month will be reset.

The PMC-680i has the following setup parameters which can set via communication or through the Front Panel:

Setup Parameter	Definition	Options
Demand Sync. Mode	**SLD** - Internally synchronized to the meter clock **DI Sync** - Externally synchronized to a DI that has been programmed as a Demand Sync Input by setting the **DI Mode** setup parameter as **DMD Sync**.	0=SLD (default) 1=DI Sync
Demand Period	1 to 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.	1 to 60 minutes Default=15
# of Sliding Windows	The number of Sliding Windows.	1 to 15 Default=1
Self-Read Time	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**.	Default=0xFFFF
Predicted Response	The Predicated Response shows the speed of the predicted demand output. A value between 70 and 99 is recommended for a reasonably fast response. Specify a higher value for higher sensitivity.	70 to 99 Default=70

Table 4-11 Setup Parameters for Demand

The PMC-680i provides the following Present Demand and Predicted Demand parameters:

	Ua/Ub/Uc	ULN avg	Uab/Ubc/Uca	ULL avg	U4

Present Demand	Ia/Ib/Ic	I avg	I4	I5	∑kVA
	kWa/kWb/kWc Imp./Exp.	∑kW Imp./Exp.	kvara/kvarb/kvarc Imp./Exp.	∑kvar Imp./Exp.	kVAa/kVAb/kVAc
	P.F.a/P.F.b/P.F.c	∑P.F.	Frequency	Ua/Ub/Uc Deviation	Uab/Ubc/Uca Deviation
	Ua/Ub/Uc Over Deviation	Uab/Ubc/Uca Over Deviation	Ua/Ub/Uc Under Deviation	Uab/Ubc/Uca Under Deviation	Freq Deviation
	U2/U0 Unbalance	I2/I0 Unbalance	Ia/Ib/Ic K Factor	I4 K Factor	I5 K Factor
	Ua/Uab THD	Ub/Ubc THD	Uc/Uca THD	U4 THD	
	Ia/Ib/Ic THD	I4 THD	I5 THD		
	Ua/Uab TOHD	Ub/Ubc TOHD	Uc/Uca TOHD	U4 TOHD	
	Ia/Ib/Ic TOHD	I4 TOHD	I5 TOHD		
	Ua/Uab TEHD	Ub/Ubc TEHD	Uc/Uca TEHD	U4 TEHD	
	Ia/Ib/Ic TEHD	I4 TEHD	I5 TEHD		
	Ia Fund.	Ib Fund.	Ic Fund.	I4 Fund.	I5 Fund.
Predicted Demand	Ua/Ub/Uc	ULN avg	Uab/Ubc/Uca	ULL avg	U4
	Ia/Ib/Ic	I avg	I4	I5	
	kWa/kWb/kWc Imp./Exp.	∑kW Imp./Exp.	kvara/kvarb/kvarc Imp./Exp.	∑kvar Imp./Exp.	
	kVAa/kVAb/kVAc	∑kVA	P.F.a/P.F.b/P.F.c	∑P.F.	Frequency
Max. Demand	Ia/Ib/Ic	∑kW Imp./Exp.		∑kvar Imp./Exp.	
	∑kVA				

Table 4-12 Demand Parameters

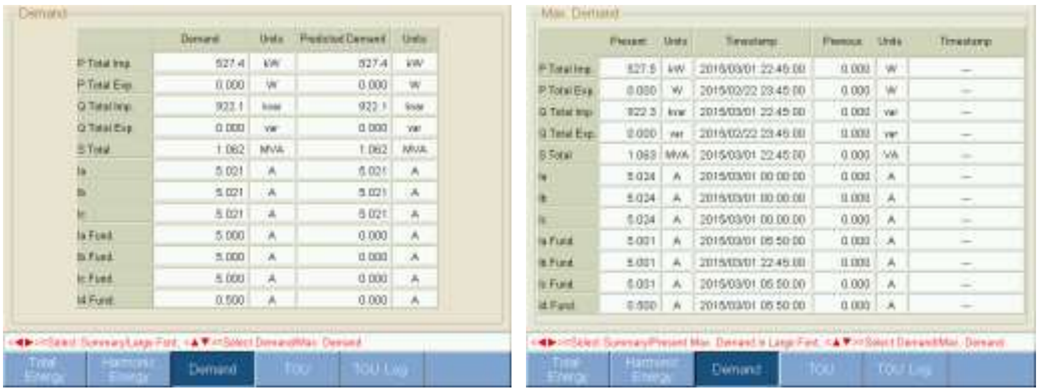


Figure 4-7 Display of Demand via Front Panel

The Max. Demand can be reset manually through the Front Panel or via communications.

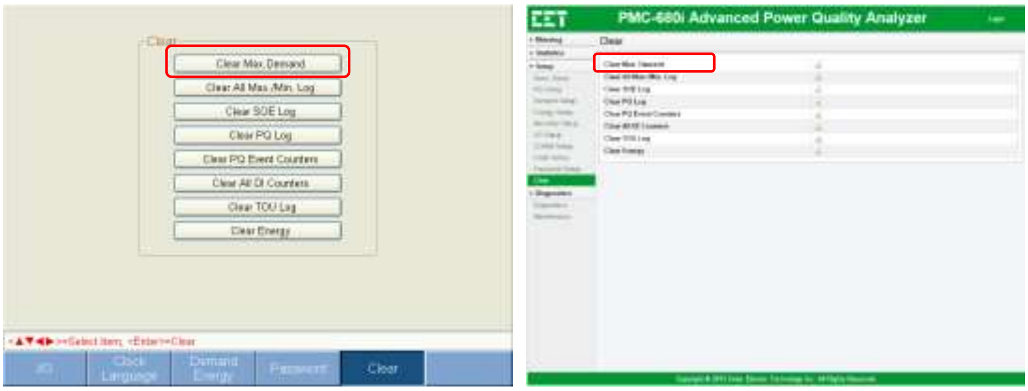


Figure 4-8 Clear Max. Demand through the front panel and Web

4.2.4 Time of Use (TOU)

TOU is used for electricity pricing that varies depending on the time of day, day of week, and the season. For power provider, TOU is typically used for billing application, as it consists of daily profiles for seasons, holidays, weekdays and weekends. For power consumers, understanding TOU may provide you with an opportunity to save money by using less electricity at times of peak demand.

The PMC-680i supports two TOU schedules, which can be switched at a pre-defined time. The switching between the two schedules is stored in the SOE log as an event. Up to twelve seasons can be applied and each season can be programmed with up to twenty daily profiles for alternative day, weekday1, weekday2 or weekday3.

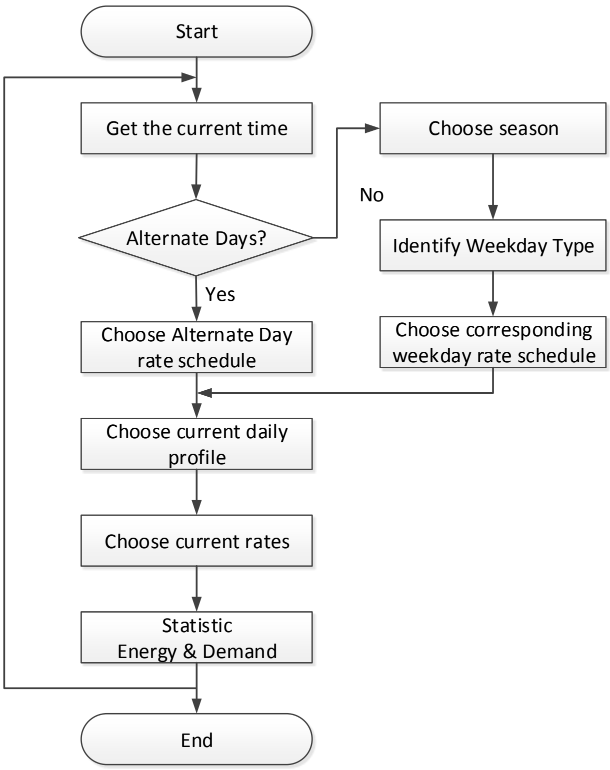


Figure 4-9 TOU Logic

Each TOU schedule has the following setup parameters and can only be programmed via communications:

Setup Parameters	Definition	Options
Daily Profile #	Specify a daily rate schedule which can be divided into a maximum of 12 periods in 1-min intervals. Up to 20 Daily Profiles can be programmed for each TOU schedule.	1 to 20, the first period start at 00:00 and the last period end at 24:00.
Season #	A year can be divided into a maximum of 12 seasons. Each season is specified a start date and end with the next season's start date.	1 to 12, , start from January 1st
Alternate Days #	A day can be defined as an alternate day, such as May 1st. Each alternate day uses a daily profile.	1 to 90.
Day Types	Specify the day types of the week. Each day of a week can be categorized as a day type which includes weekday1, weekday2, weekday3 and alternate days. The alternate day has the highest priority.	Weekday1, Weekday2, Wee kday3 and alternate days
Switch Time	Specify when to switch from one TOU schedule to another. Write 0xFFFFFFFF to this parameter (register 50107) if there is no need to switch or only one TOU schedule.	Format: YYYYMMDDHH
Self-Read time	Specify the day and time of each month to transfer TOU recorders. 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.	Format: DDHH

Table 4-13 TOU Setup Parameters

The TOU status and readings can be displayed through the Front Panel or via communications, see the below captures.

Figure 4-10 TOU Status

For each Tariff, the PMC-680i provides the following real-time Energy and Demand information: kWh/kvarh Imp./Exp., kVAh and kW/kvar Imp./Exp. Max. Demands. The register value will roll over to zero automatically when it reaches 99,999,999,999.999 kWh.

In addition, PMC-680i provides real-time datalog, historic datalog and transient datalog for TOU. Each datalog contains energy and demand information. The real-time datalog triggered by fixed time automatically and transient datalog triggered manually. The real-time datalog has a capacity of 3 entries organized in a FIFO basis, with the newest datalog replacing the oldest one. Historic datalog calculate Monthly Average Power Factor in statistic time while recording interval energy. All TOU datalogs can be retrieved or reset via the Front Panel or communications.

4.3 Setpoints

The PMC-680i comes standard with 272 user programmable setpoints which provide extensive control by allowing a user to initiate an action in response to a specific condition. There are 256 Standard Setpoints and 16 High-Speed Setpoints. Typical setpoint applications include alarming, fault detection and power quality monitoring.

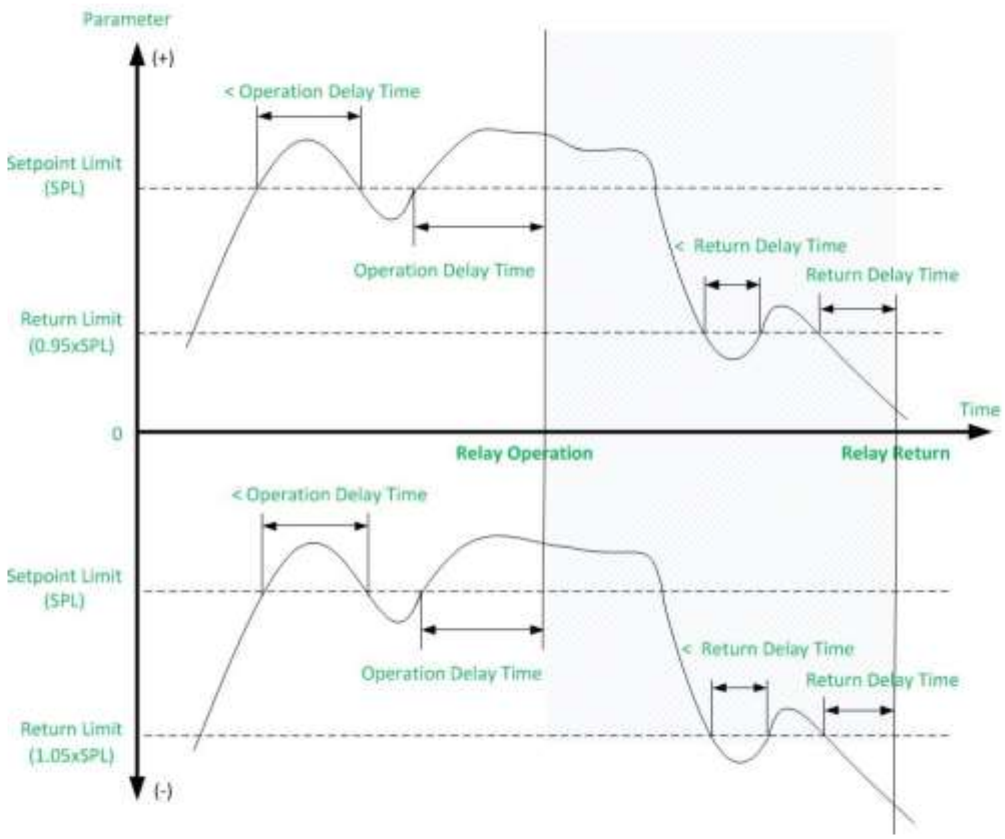


Figure 4-11 Over Setpoints

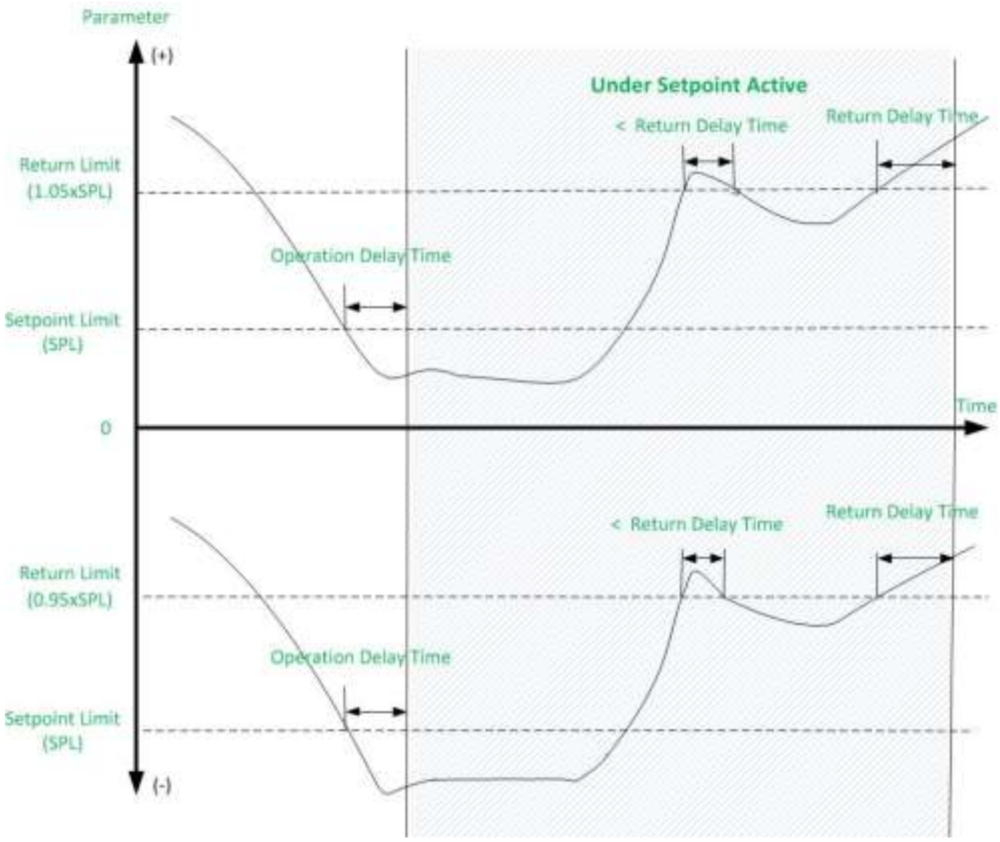


Figure 4-12 Under Setpoints

The Setpoints can be programmed over communications and have the following setup parameters:

Setup Parameter	Definition	Options
Setpoint Type	Specify the monitoring condition -- Over Setpoint, Under Setpoint.	0*=Over Setpoint 1=Under Setpoint
Setpoint Parameter	Specify the parameter to be monitored.	See table 4-15
Setpoint Active Limit	Specify the value that the setpoint parameter must exceed for Over Setpoint or go below for Under Setpoint for the setpoint to become active.	0*
Setpoint Inactive Limit	Specify the value that the setpoint parameter must go below for Over Setpoint or exceed for Under Setpoint for the setpoint to becomes inactive.	0*
Setpoint Active Delay	Specify the minimum duration that the setpoint condition must be met before the setpoint becomes active. An event will be generated and stored in the SOE Log. The range of the **Setpoint Active Delay** is between 0 and 9999 seconds for Standard Setpoints and between 0 and 9999 cycles for High Setpoints.	0* to 9999s
Setpoint Inactive Delay	Specify the minimum duration that the setpoint return condition must be met before the setpoint becomes inactive. An event will be generated and	0* to 9999

	stored in the SOE Log. The range of the **Setpoint Inactive Delay** is between 0 and 9999 seconds for Standard Setpoints and between 0 and 9999 cycles for High Setpoints.	
Setpoint Trigger	Specify what action a setpoint can take when it becomes active. Please refer to Table 4-16 below for a list of Setpoint Triggers.	0*

*Default

Table 4-14 Description for Setpoint Parameters

Setpoint Parameters			
Real-time*	**Demand**	**PQ**	**Harmonics & Interharmonics**
ULN	kW Total DMD	U0 Unb	U_THD, I_THD
ULL	kvar Total DMD	U2 Unb	U_TOHD, I_TOHD
U4	No kVA Total DMD	I0 Unb	U_TEHD, I_TEHD
Ia / Ib /Ic	P.F. Total DMD	I2 Unb	U_TIHD, I_TIHD
I4	kW Total Pred_DMD	U Fund.	U_TIOHD, I_TIOHD
I5	kvar Total Pred_DMD	I Fund.	U_TIEHD, I_TIEHD
Frequency	P.F. Total Pred_DMD	Volt. Fluctuation	U_HD02 to U_HD63
kW Total		Pst	U_IHD01 to U_IHD63
kvar Total		Plt	I_H02_RMS to I_H63_RMS
P.F. Total			I_IH01_RMS to I_IH63_RMS

* High-Speed Setpoint Parameters

Table 4-15 Setpoint Parameters

Bit	Action	Bit	Action	Bit	Action
Bit0	RO1 Closed	**Bit8~Bit10**	Reserved	**Bit21**	Standard DR #3
Bit1	RO2 Closed	**Bit11**	HS DR #1	**Bit22**	Standard DR #4
Bit2	RO3 Closed	**Bit12**	HS DR #2	**Bit23**	Standard DR #5
Bit3	RO4Closed	**Bit13**	HS DR #3	**Bit24**	Standard DR #6
Bit4	DO1 Closed	**Bit14**	HS DR #4	**Bit25**	Standard DR #7
Bit5	DO2 Closed	**Bit15~Bit18**	Reserved	**Bit26**	Standard DR #8

Bit6	DO3 Closed	**Bit19**	Standard DR #1	**Bit27**	DWR
Bit7	DO4 Closed	**Bit20**	Standard DR #2	**Bit28**	WFR

* Only can be triggered by DI and Standard Setpoints

Table 4-16 Setpoint Triggers

4.4 Power Quality Parameters

The PMC-680i has been certified as an IEC 61000-4-30 Class A performance instrument by PSL. Therefore, the **Measurement Aggregation Algorithm** used for the derivation of all IEC 61000-4-30 PQ parameters are in accordance to Section 4.5 of the IEC 61000-4-30 Standard. Please refer to Appendix E for a copy of the IEC 61000-4-30 Class A Certificate of Conformity.

4.4.1 Power Frequency

The PMC-680i is capable of measuring **Frequency** accurate to ±0.005Hz or 0.01%. The measurement range is ±15% of $f_{nominal}$, which is 42.5Hz to 57.5Hz for 50Hz system and 51 Hz to 69Hz for 60Hz system.

The measurement method of **Frequency** is in accordance with Section 5.1 of IEC 61000-4-30 Standard for Class A performance. The PMC-680i also computes **Freq. Deviation** as per below:

Freq. Deviation = $((f - f_{nominal})/f_{nominal}) \times 100\%$ where $f_{nominal}$ is the Nominal Frequency

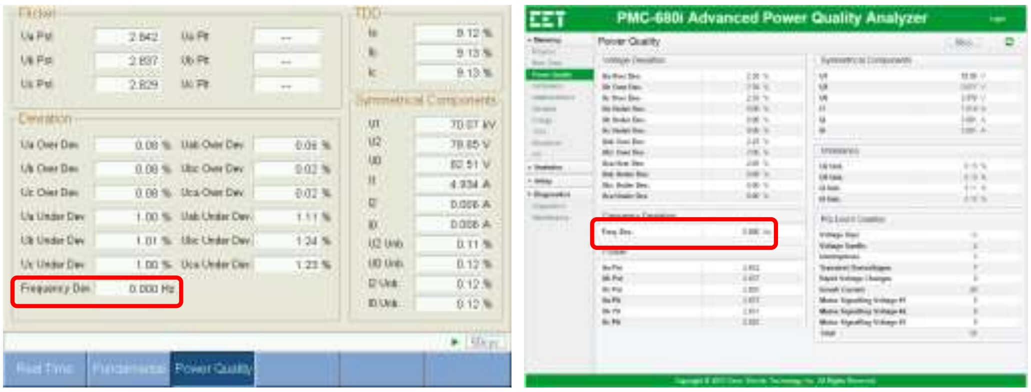


Figure 4-13 Displaying for Frequency Deviation

4.4.2 Magnitude of the Supply Voltage

The measurement method of the **Magnitude of the Supply Voltage** parameters is in accordance with Section 5.2 of IEC 61000-4-30 Standard for Class A performance. The measurement method is not intended for the detection and measurement of disturbances such as **Dips**, **Swells**, **Voltage Interruptions** and **Transients**. The RMS value includes voltage related measurements such as **Harmonics**, **Interharmonics**, **Mains Signaling**, etc.

4.4.3 Flicker

The PMC-680i provides the **Flicker** measurements in accordance with the IEC 61000-4-15 (2010) Standard for Class A performance using the recommended models for 120V and 230V, supporting both 50Hz and 60Hz for each model. Voltage Dips, Swells and Interruptions shall cause P_{st} and P_{lt} output values as well as "output 4 and 5 values" (see IEC 61000-4-15) to be **flagged**. Please refer to Section 4.4.12 Flagging Concept for a detailed description.

The PMC-680i is capable of storing Flicker measurements for 1 year with the standard 4GB model and 2 years with the 8GB option.

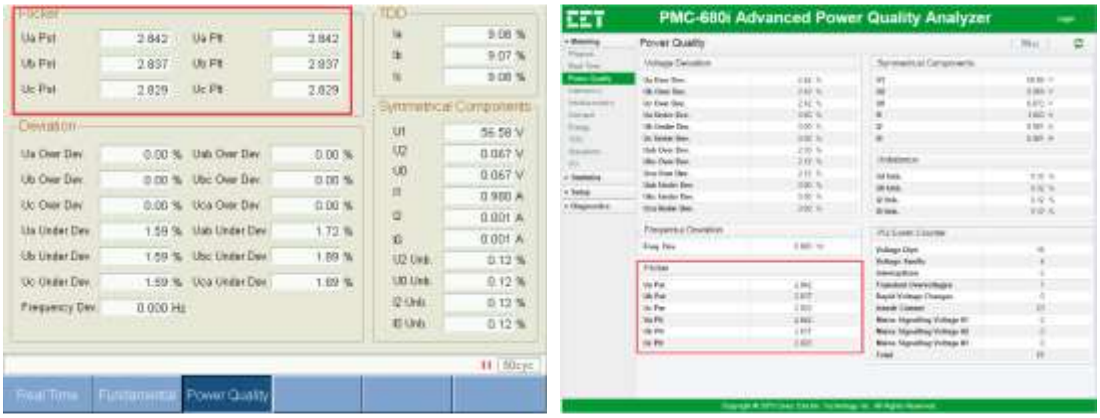


Figure 4-14 Displaying for Flicker

4.4.4 Supply Voltage Dips/Swells and Interruption

The PMC-680i supports the detection of the **Supply Voltage Dips/Swells** and **Interruption** using a method that is in accordance with Section 5.4 of IEC 61000-4-30 Standard for Class A performance.

The PMC-680i provides Dip/Swell and Interruption detection for voltage quality monitoring on a per phase basis and records an event in the **PQ Log**, which includes the event timestamp event type, event characteristics and ITIC/SEMI F47 curve. Moreover, Dip/Swell detection for each phase voltage would trigger WFR, DWR, HS DR, DR and RO/DO Alarm.

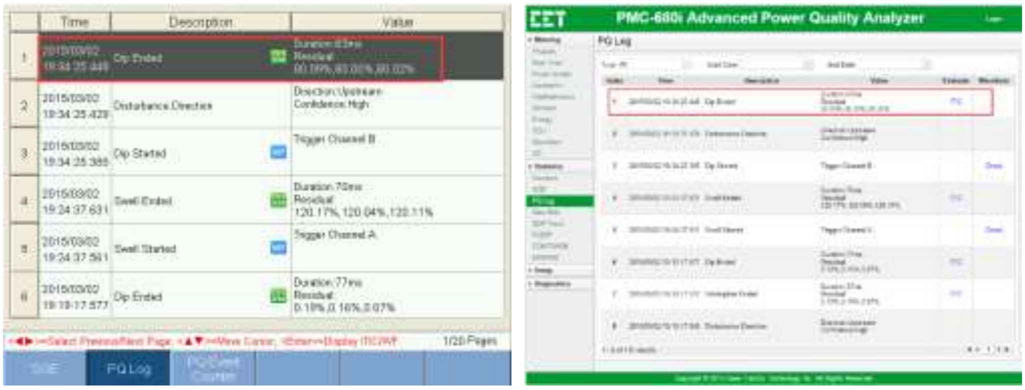


Figure 4-15 Displaying for Dip/Swell and Interruption

4.4.4.1 Voltage Dip Evaluation

A **Voltage Dip** is characterized by a pair of data, the **Residual Voltage** (*U_{res}*) or **Depth** and **Duration**:

Parameter	Definition
Residual Voltage	The lowest $U_{rms(1/2)}$ value measured on any channel during the **Dip**

Depth	The difference between the **Reference Voltage** (either U_{din} or U_{sr}) and the **Residual Voltage**. It's generally expressed in percentage of the **Reference Voltage**.
Duration	The time difference between the beginning and the end of the **Voltage Dip**.

Table 4-17 Dip Evaluation Parameter

4.4.4.2 Voltage Swell Evaluation

A **Voltage Swell** is characterized by a pair of data, the **Maximum Swell Voltage Magnitude** and **Duration**:

Parameter	**Definition**
Max. Voltage Swell Magnitude	The largest $U_{rms\,(1/2)}$ value measured on any channel during the **Swell**.
Duration	The time difference between the beginning and the end of the **Voltage Swell**.

Table 4-18 Swell Evaluation Parameter

4.4.4.3 Sliding Reference Voltage (U_{sr})

If a sliding reference is chosen for the detection of **Voltage Dip** or **Swell**, this shall be calculated using a first order filter with a 1-min time constant. This filter is given by

$$U_{sr(n)} = 0.9967 \times U_{sr(n-1)} + 0.0033 \times U_{(10/12)rms}$$

where

$U_{sr(n)}$ is the present value of the **Sliding Reference Voltage**

$U_{sr(n-1)}$ is the previous value of the **Sliding Reference Voltage**

$U_{(10/12)rms}$ is the most recent 10/12-cycle r.m.s. value

4.4.4.4 Dip/Swell Setpoint

As per IEC 41000-4-30:

Voltage Swell Detection

On polyphase systems a Swell begins when the Urms(1/2) voltage of one or more channels rises above the Swell Threshold and ends when the Urms(1/2) voltage on all measured channels is equal to or below the Swell Threshold minus the Hysteresis voltage.

Voltage Dip Detection

On polyphase systems a Dip begins when the Urms(1/2) voltage of one or more channels is below the Dip Threshold and ends when the Urms(1/2) voltage on all measured channels is equal to or above the Dip Threshold plus the Hysteresis voltage.

The Dip/Swell Threshold and the Hysteresis Voltage are both set by the user according to the actual situation. The Dip/Swell Setpoint provides the following setup parameters which can be programmed via the Front Panel or over communications:

Parameter	**Definition**	**Options/Value**
Dip/Swell Reference Voltage	Udin / Usr	0*= U_{din}, 1= U_{sr}
Dip/Swell Enable	Dip/Swell Enable.	0*=Disabled, 1=Enabled

Swell Limit	Specify the limit of Swell.	101 to 200(%) of reference voltage, Default=110%
Dip Limit	Specify the limit of Dip.	1 to 99(%) of reference voltage, Default=90%
Dip Return	Specify the return value of Dips.	1 to 1000 (x0.001 Ue), Default=5
Swell Return	Specify the return value of Swells.	1 to 1000 (x0.001 Ue), Default=5
Dip/Swell Trigger	Specify what action a setpoint can take when Dip / Swell become active	DO/RO Closed / DR / HS DR / WFR* / DWR

*default

Table 4-19 Description for Dip/Swell Parameter

The **Dip Limit**, **Swell Limit**, **Voltage Interruption Threshold** and **Dip/Swell Return** values should be configured to meet the following criteria:

a) The **Voltage Interruption Threshold** shall be set below **Dip Limit**.

b) The **Swell Limit** and **Dip Limit** should associate with Voltage Rapid Changes in the minimum difference between the two steady-states. The absolute value of the difference between the Dip /Swell Limits and 100% must always be greater than the **Voltage Rapid Changes** in the minimum pressure difference between the two steady-states (actual percentage).

c) The **Dip/Swell Return** value should associate with Swell limit and Dip Limit, Dip/Swell return value (actual value) must be less than the Dip/Swell limit (Dip, Swell of the absolute difference of the minimum value and 100%).

d) Regardless of whether **Dip/Swell** is enabled, the conditions for a), b) and c) must always be met.

4.4.4.5 WFR of Dips/Swells Events

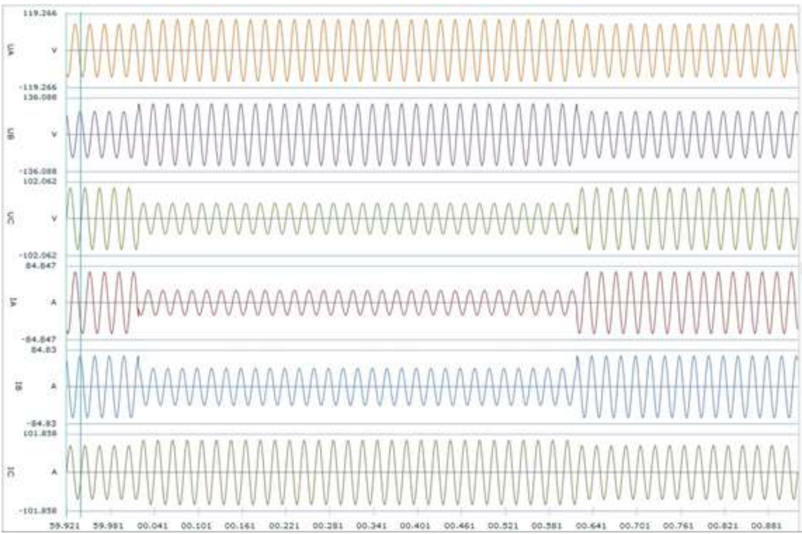


Figure 4-16 WFR of a Dip Event

Figure 4-17 RMS Plot of the same Dip Event

4.4.4.6 Voltage Interruption Evaluation

On polyphase systems, a Voltage Interruption begins when the $U_{rms\,(1/2)}$ voltages of all channels fall below the **Interruption Threshold** and ends when the $U_{rms\,(1/2)}$ voltage on any one channel is equal to, or greater than, the **Interruption Threshold** plus the **Hysteresis**.

The **Interruption Threshold** and **Hysteresis** are both set by the user according to the use. The **Interruption Threshold** shall not be set below the uncertainty of **Residual Voltage** measurement plus the value of **Hysteresis**. Typically, **Hysteresis** is equal to 2% of U_{din}. The **Interruption Threshold** can, for example, be set to 5% of U_{din}.

The **Duration** of a voltage interruption is the time difference between the beginning and the end of the **Voltage Interruption**.

4.4.4.7 Voltage Interruption Setpoint

The Voltage Interruption Setpoint provides the following setup parameters which can be programmed via the Front Panel or over communications:

Parameter	Definition	Options/Value
Interruption Reference Voltage	Udin / Usr	0*= U_{din}, 1= U_{sr}
Interruption Enable	Dip/Swell Enable.	0*=Disabled, 1=Enabled
Interruption Limit	Specify the limit of Interruption.	50 to 0(%) of reference voltage, Default=10%
Interruption Return	Specify the return value of Interruption.	1 to 1000 (x0.001 Ue), Default=5
Interruption Trigger	Specify what action a setpoint can take when Dip / Swell become active	DO/RO Closed / DR / HS-DR / WFR* / DWR

*default

Table 4-20 Description for Interruption Setpoint Parameter

4.4.5 Voltage Transients

The PMC-680i provides the capability for detecting voltage transient disturbances using the sliding-window method according to IEC 61000-4-30 with a maximum resolution of 40μs (@50Hz) for the standard PMC-680i and 20μs (@50Hz) with the optional 1024 samples/cycle sampling. The PMC-680i provides transient detection for voltage quality monitoring and records an event in the **PQ Log**, which includes the event timestamp event type, and event characteristics. In addition, transient would trigger WFR and DWR.

4.4.5.1 Transient Setpoint

The Transient Setpoint provides the following setup parameters which can be programmed via the Front Panel or over communications:

Setup Parameter	Definition	Options
Transient Enable	Transient enable or disable.	Disabled* / Enabled
Transient Limit	Specify the limit of Transient	5% to 500% Ue, 35*
Transient Trigger	Specify what action a setpoint can take when Transient become active	WFR* / DWR

*default

Table 4-21 Setup parameters for Transient Setpoint

4.4.5.2 WFR of Transient Events

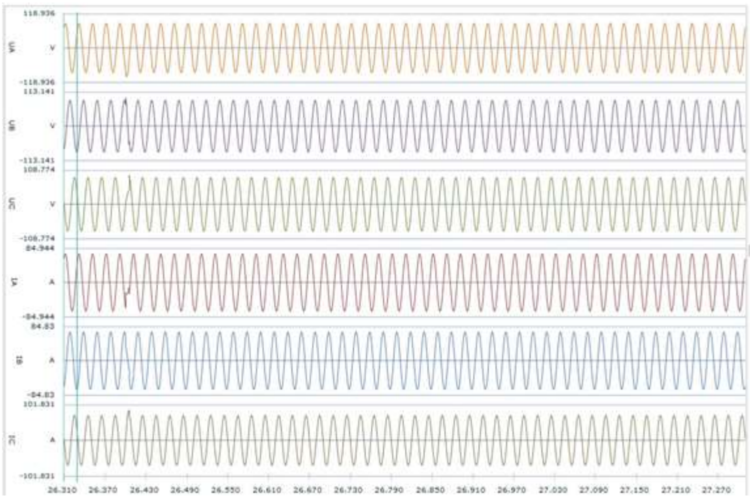


Figure 4-18 WFR of a Transient Event at 512 samples/cycle

4.4.6 Supply Voltage Unbalance

The PMC-680i provides both the Zero Sequence and Negative Sequence Voltage and Current Unbalance measurements using Symmetrical Components and in accordance with Section 5.7 of IEC 61000-4-30 Standard for Class A performance.

$$\mathrm{V2\ Unbalance} = \frac{V2}{V1} \mathrm{x100\%}, \quad \mathrm{I2\ Unbalance} = \frac{I2}{I1} \mathrm{x100\%} \quad \text{(Negative Sequence Unbalance)}$$

$$V0\ \text{Unbalance} = \frac{V0}{V1} x100\%, \quad I0\ \text{Unbalance} = \frac{I0}{I1} x100\% \quad \text{(Zero Sequence Unbalance)}$$

where

V0, V1, V2 are the Zero, Positive and Negative Sequence Components for Voltage, respectively.

and

I0, I1, I2 are the Zero, Positive and Negative Sequence Components for Current, respectively.

4.4.7 Harmonics and Interharmonics

The PMC-680i provides the Harmonics and Interharmonics measurements in accordance with Sections 5.8 and 5.9 of IEC 61000-4-30 Standard for Class A performance using a 10/12 cycle gapless centered harmonic sub-group measurement, denoted C_{ng} for Harmonics and $C_{n\text{-}200\text{-}ms}$ for Interhamonics, as per IEC 61000-4-7:2002.

There are three methods to calculate the Harmonic Distortion (HD):

a) Fundamental Method:

Voltage Kth Harmonic/Interharmonic Distortion= $\frac{U_k}{U_1}$X100% where U_1 is the Fundamental Voltage

Current Kth Harmonic/Interharmonic Distortion= $\frac{I_k}{I_1}X100\%$ where I_1 is the Fundamental Current

b) RMS Method:

Voltage Kth Harmonic /Interharmonic Distortion= $\frac{U_k}{\sqrt{\sum_{K=1}^{\infty} U_K{}^2}}$X100% where the denominator is the RMS

Current Kth Harmonic/Interharmonic Distortion= $\frac{I_k}{\sqrt{\sum_{K=1}^{\infty} I_K{}^2}}$X100% where the denominator is the RMS

c) Nominal Method:

Voltage Kth Harmonic /Interharmonic Distortion= $\frac{U_k}{U_{nom}}$X100% where U_{nom} is the Nominal Voltage

Current Kth Harmonic /Interharmonic Distortion= $\frac{I_k}{I_{nom}}$X100% where I_{nom} is the Nominal Current

The PMC-680i also provides, in addition to Voltage Harmonics, measurements for Current Harmonics, K-Factor, Crest Factor, Power Harmonics and Energy Harmonics.

K-Factor and Crest 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.

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

I_h = h_{th} Harmonic Current in RMS

h_{max} = Highest harmonic order

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

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

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

X_{rms} = RMS value

4.3.8.1 Voltage and Current Harmonics and Interharmonics

The following table illustrates the Voltage and Current Harmonics and Interharmonics measurements available on the PMC-680i:

	Ua	Ub	Uc	U4	Ia	Ib	Ic	I4	I5
THD, TOHD, TEHD (%)	▪	▪	▪	▪	▪	▪	▪	▪	▪
HD01 to HD63 (%)	▪	▪	▪	▪	▪	▪	▪	▪	▪
TH, H01 to H63 (RMS)	▪	▪	▪	▪	▪	▪	▪	▪	▪
TOH/THE/DC rms	▪	▪	▪	▪	▪	▪	▪	▪	▪
Current K-Factor	--	--	--	--	▪	▪	▪	▪	▪
Crest Factor	▪	▪	▪	▪	▪	▪	▪	▪	▪
IHD01 to IHD63 (%)	▪	▪	▪	▪	▪	▪	▪	▪	▪
IH01 to IH63 (RMS)	▪	▪	▪	▪	▪	▪	▪	▪	▪
TIHD, TOIHD, TEIHD (%)	▪	▪	▪	▪	▪	▪	▪	▪	▪
Phase Angle H01 to H63	▪	▪	▪	▪	▪	▪	▪	▪	▪

Table 4-22 Voltage and Current Harmonics and Interharmonics Measurements

4.4.8.2 Power Harmonics

The following table illustrates the Power Harmonic measurements available on the PMC-680i:

	Ua	Ub	Uc	U4	Ia	Ib	Ic	I4	I5

kW/kvar/kVA TH	▪	▪	▪	--	▪	▪	▪	--	--
PF TH	--	--	--	--	--	--	--	--	--
kW/kvar/kVA Fundamental	▪	▪	▪	--	▪	▪	▪	--	--
PF Fundamental	▪	▪	▪	--	▪	▪	▪	--	--
kW/kvar/kVA H02 to H63	▪	▪	▪	--	▪	▪	▪	--	--
PF H02 to H63	▪	▪	▪	--	▪	▪	▪	--	--

Table 4-23 Power Harmonics Measurements

4.4.8.3 Harmonic Setup Parameters

The Harmonic provides the following setup parameters which can be programmed via the Front Panel or over communications:

Setup Parameter	Definition	Options
Harmonics Calculation	Specifies the Harmonics calculation methods, please refer to above introduction.	0*=% of Fundamental 1=% of RMS 2=% of Nominal
Statistical Harmonic Calculation	Specifies the mode of calculating harmonic.	0*=Subgroup, 1=Group
Order of Harmonic Calculation	Specifies the order of harmonic statistic.	2 to 63 (Default=40)

*default

Table 4-24 Setup parameters for Harmonic

4.4.8.4 Screen Captures of Harmonics Measurements

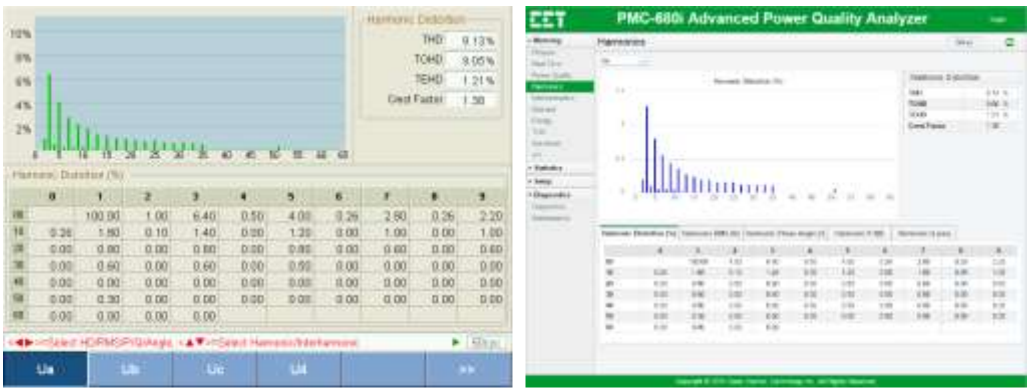


Figure 4-19 Harmonic Measurements on Front Panel Interface and Web Interface

Indicates the data is flagged and press **Enter** to select to refresh present page or select to stop refreshing data.

4.4.8 Mains Signalling Voltage (MSV)

As per 5.10 of IEC 61000-4-30:

Mains Signaling Voltage is RMS voltage of mains signal.

Mains signaling voltage measurement shall be based on

- *Either the corresponding 10/12-cycle r.m.s. value interharmonic bin*
- *Or the r.m.s. of the four nearest 10/12-cycle r.m.s. value interharmonic bins*

The beginning of a signaling emission shall be detected when the measured value of the concerned interharmonic exceeds a threshold. The measured values are recorded during a period of time specified by the user, in order to give the level and the sequence of the signal voltage.

The user must select a detection threshold above 0.1% U_{din} as well as the length of the recording period up to 120s.

The PMC-680i provides 3 groups of waveform recorder for MSV with 128 entries in accordance with Section 5.10 of IEC 61000-4-30 Standard for Class A performance. Each MSV WR will be recorded as PQ Log, SOE Log and EN50160 report.

The MSV provides the following setup parameters which can be programmed through the Front Panel, Web or communication:

Setup Parameter	Value
MSV #x Enable	0 = Enable, 1 = Disable, default=0
MSV #x Frequency	50 Hz: 600 to 30000 (x0.1Hz) 60 Hz: 700 to 30000 (x0.1Hz) Default=10000
MSV #x Limit	3 to 1000 (x0.001Ue), default=50 (x0.001Ue)
MSV #x Emission Time	1 to 120s, default=60s

Table 4-25 Mains Signal Voltage Setup Parameters

Table 4-20 Setup Mains Signal Voltage via Front Panel and Web

4.4.9 Voltage Deviation

As per Section 5.12 of IEC 61000-4-30:

The 10/12-cycle r.m.s value Urms can be used to assess the underdeviation and overdeviation parameters in per cent of Udin. The underdeviation Uunder and overdeviation Uover parameters are determined by the following equations. w:

Voltage Overdeviation (%)

$U_{over} = 0$ if $U_{rms} < U_{din}$

$U_{over} = ((U_{rms} - U_{din}) / U_{din}) \times 100\%$ if $U_{rms} \geq U_{din}$

Voltage Underdeviation (%)

$U_{under} = 0$ if $U_{rms} > U_{din}$

$U_{under} = ((U_{din} - U_{rms}) / U_{din}) \times 100\%$ if $U_{rms} \leq U_{din}$

The PMC-680i is capable of measuring Voltage accurate to 0.1% and monitoring Voltage deviation on line. In addition, the Voltage deviation can be set as setpoint. The following screen captures illustrates the display of the Deviation parameters in the Front Panel and built-in Web Interface.

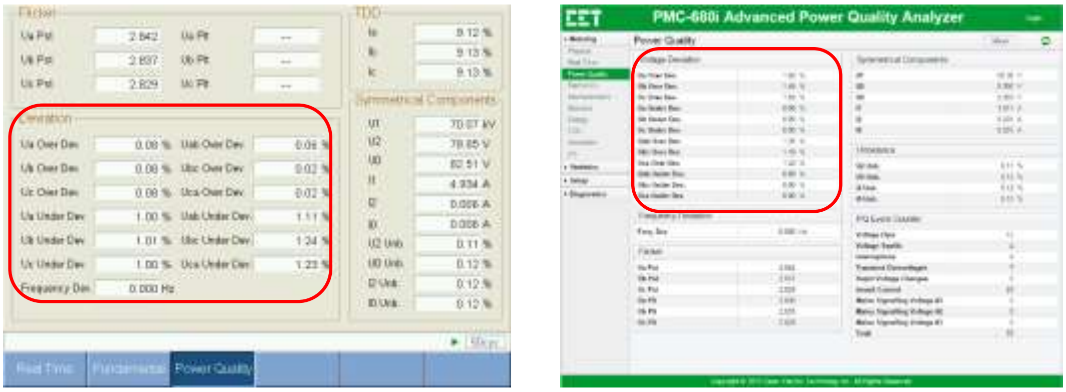


Figure 4-21 Voltage Deviation Display on Front Panel and Web

4.4.10 Rapid Voltage Changes (RVC)

As per IEC 61000-4-30:

A rapid voltage change is a quick transition in RMS voltage between two steady-state conditions.

To measure rapid voltage change, threshold must be defined for each of the following: the minimum rate of change, the minimum duration of the steady-state conditions, the minimum difference in voltage between the two steady-state conditions, and the steadiness of the steady-state conditions.

The voltage during a rapid voltage change must not exceed the voltage dip and/or the voltage swell threshold, as it would otherwise be considered as a voltage dip or swell.

The characteristic parameter of the rapid voltage change is the difference between the steady-state value reached after the change and the initial steady-state value.

The PMC-680i provides the ability to capture RVC in accordance with the IEC 61000-4-30 Standard and records in PQ Log and High-speed Recording with event timestamp, event type, and event characteristics.

4.4.10.1 RVC Setpoint

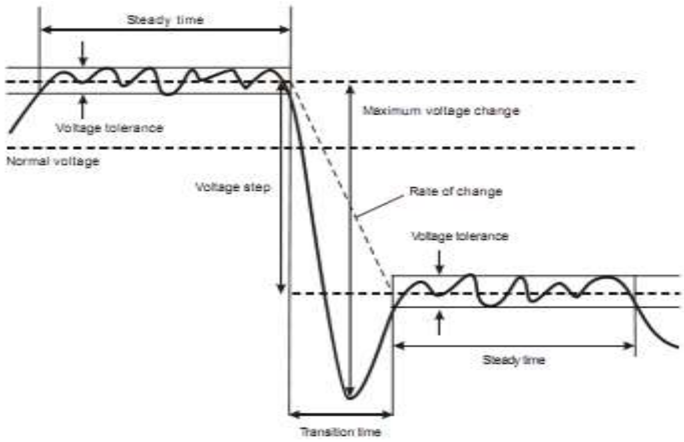


Figure 4-22 Rapid Voltage Changes

The RVC Setpoint provides the following setup parameters which can be programmed through the Front Panel, web or over communications:

Setup Parameters	Definition	Options
RVC Enable	Specifies if RVC Setpoint is enabled.	Disabled* / Enabled
Detection Mode	Specifies detection mode of the RVC.	0*= Steady-state Volt. Change 1= Maximum Volt. Change
RVC Voltage Tolerance	Maximum allowable fluctuation between the maximum and minimum voltage values during the steady state condition. For example, the voltage tolerance is 0.5% that is the allowable fluctuation max voltage is $0.005Vll_{nominal.}$	0.1% to 100% $ULL_{nominal}$
RVC SS Duration Min.	Minimum duration to reach the steady-state condition.	0.1 to 10 seconds
RVC VStep Min.	Minimum voltage step change between two steady-state conditions	0.1% to 100% $ULL_{nominal}$
RVC Rate Change Min.	Minimum rate of change between two steady-state conditions.	0.1%/second to 100%/second
RVC Trigger	Output Specify what action a setpoint can take when RVC become active.	WFR* / DWR

*default

Table 4-26 Setup Parameters for RVC Setpoint

To reach the steady-state condition, the voltage fluctuation (voltage difference in RMS between Max. and Min.) must be less than **RVC Voltage Tolerance** for a period longer than **RVC SS Duration Min.**

For the RVC Setpoint to trigger, the following conditions must be met:

a) The voltage step change between two steady-state conditions is greater than **RVC VStep Min.**

b) The rate of change between two steady-state conditions is greater than **RVC Rate Change Min.**

c) The voltage during a rapid voltage change must not exceed the voltage dip and/or the voltage swell threshold, as it would otherwise be considered as a voltage dip or swell.

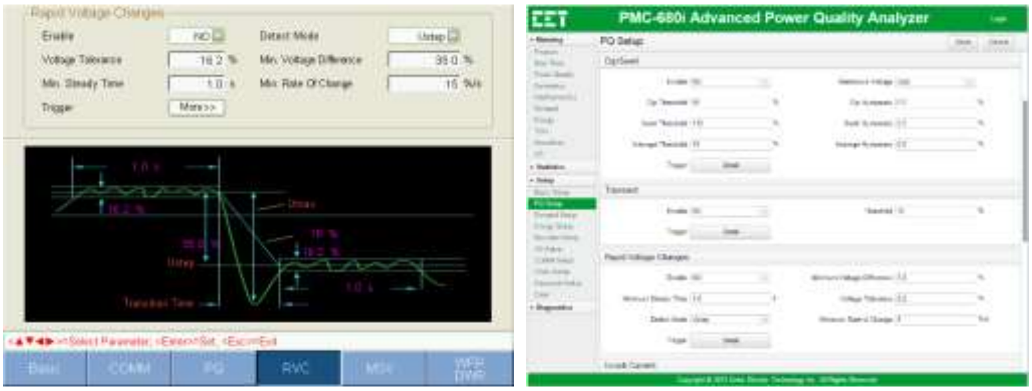


Figure 4-23 RVC Setup via Front Panel and Web

4.4.10.2 WFR of RVC Event

Figure 4-24 WFR of a RVC Event

Figure 4-25 RMS Plot of the same RVC Event

4.4.11 Inrush Current

As per IEC 61000-4-30:

The inrush current begins when the ***I*****half cycle rms** *current rises above the* ***Inrush Threshold****, and ends when the* ***I*****half cycle rms** *current is equal to or below the* ***Inrush Threshold*** *minus a user-selected* ***Inrush Hysteresis*** *value.*

The inrush current can be further characterized by

- *the time duration between the beginning and the end of the inrush current*
- *the maximum value of inrush current measured* ***I*****half cycle rms** *value*
- *the square root of the mean of the squared* ***I*****half cycle rms** *values measured during the inrush duration*

Inrush current refers to the maximum instantaneous current drawn by an electrical device, often several times their normal full-load current, when first energized such as the turning on of an AC electric motor or the energization of a transformer or a capacitor bank. The higher than normal inrush current typically only lasts for a few cycles before returning to their steady state condition.

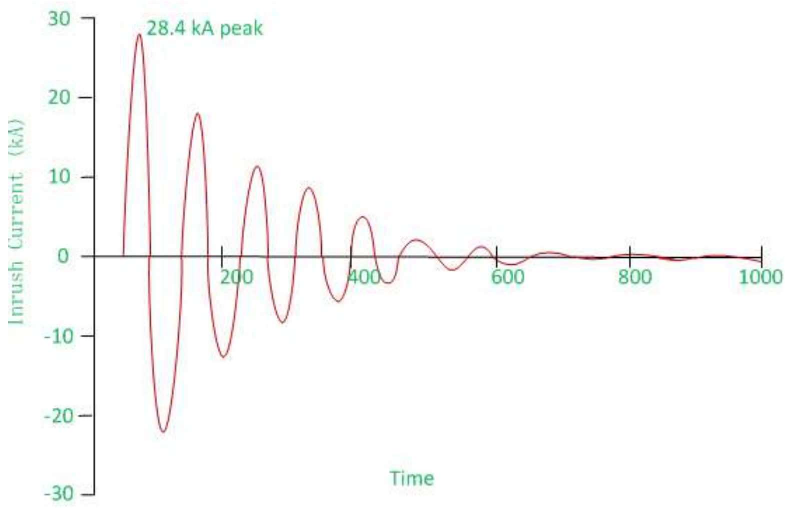


Figure 4-26 Inrush Current

The PMC-680i provides the capability for detecting and the capturing of the inrush current transient disturbance that is in accordance with the IEC 61000-4-30 Standard for Class A performance.

4.4.11.1 Inrush Current Setpoint

The PMC-680i provides following programmable parameters for Inrush Current Setpoint which can be set via the Front Panel or though communication.

Setup Parameters	Definition	Options
Inrush Current Enable	Specifies if inrush current setpoint is enabled.	0*=Disabled, 1=Enabled
Inrush Current Threshold	Defines the range that current must exceed for the Inrush Current becomes active.	100% to 500% (Default=120)
Inrush Current Hysteresis	Defines the limit, which is equal to Inrush Threshold - Inrush Hysteresis, for the ***I*****half cycle rms** *current below which the inrush transient end*	1-1000(x0.1%) (Default = 10)
Inrush Current Trigger	Specify what action a setpoint can take when Inrush Current become active	DO/RO Closed / DR / HS-DR / WFR* / DWR

*default

Table 4-27 Setup Parameters for Inrush Current Setpoint

Table 4-27 Setup Inrush Current Setpoint via Front Panel and Web

4.4.11.2 WFR of Inrush Current Event

Figure 4-28 WFR of an Inrush Current Event @ 128 samples/cycle

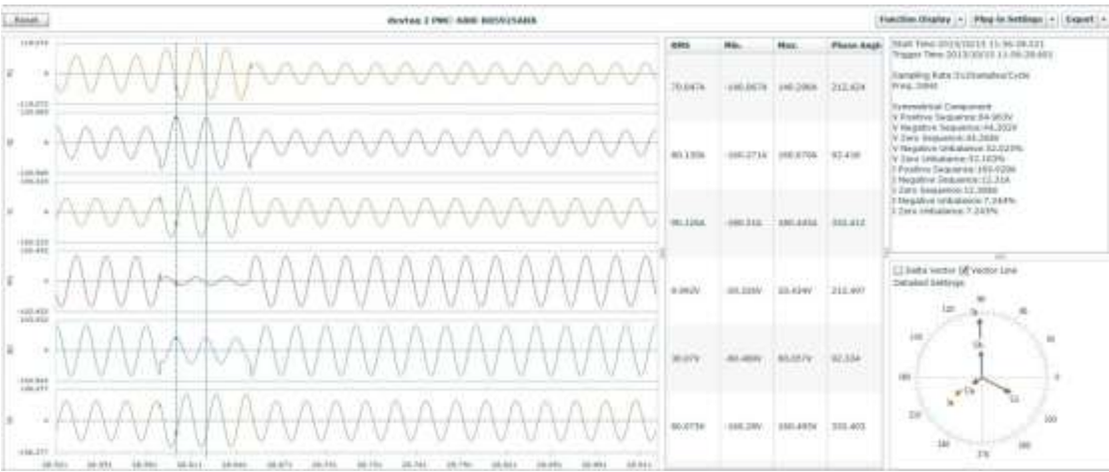


Figure 4-29 WFR of an Inrush Current Event @ 512 samples/cycle

4.4.12 Flagging Concept

As per Section 4.7 of IEC 61000-4-30:

During a dip, swell, or interruption, the measurement algorithm for other parameters (for example, frequency measurement) might produce an unreliable value. The flagging concept therefore avoids counting a single event more than once in different parameters (for example, counting a single dip as both a dip and a frequency variation) and indicates that an aggregated value might be unreliable.

Flagging is only triggered by dips, swells and interruptions. The detection of dips and swells is dependent on the threshold selected by the user, and this selection will influence which data are "flagged".

The flagging concept is applicable for Class A measurement performance during measurement of power frequency, voltage magnitude, flicker, supply voltage unbalance, voltage harmonics, voltage interharmonics, mains signalling and measurement of underdeviation and overdeviation parameters.

If during a given time interval any value is flagged, the aggregate value indicating that value shall also be flagged. The flagged value shall be stored and also included in the aggregation process, for example, if during a given time interval any value is flagged the aggregated value that includes this value shall also be flagged and stored.

The PMC-680i is a certified IEC 61000-4-30 Class A device so it supports the **Flagging Concept**.

Flagging Setup The **Flagging Setup** register (40825) defines if ***Flagging*** is enabled for a particular type of Statistical Log as illustrated in the following table, with a bit value of 1 meaning that ***Flagging*** is enabled for the corresponding Log type.

Bit 15~Bit 5	Bit 4	Bit 3	Bit 2	Bit1	Bit 0	Bit 0
Reserved	QR Log	EN50160	Min. Log	Max. Log	SDR Log	Disabled/Enabled

Table 4-28 Flagging Setup Register (40825)

Flagging Status This register indicates if a particular type of data has been ***flagged*** with a bit value of 1 meaning ***flagged*** and 0 meaning ***not flagged***. The following table illustrates the details of the **Flagging Status** register for real-time data.

Bit	Description		Bit	Description	
B0	Basic Measurement	Dip	B8	Pst.	Dip
B1		Swell	B9		Swell
B2		Interruption	B10		Interruption
B3		Over Current Limit	B11		Reserved
B4	Freq.	Dip	B12	Plt.	Dip
B5		Swell	B13		Swell
B6		Interruption	B14		Interruption
B7		Reserved	B15		Reserved

Table 4-29 Flagging Status Register (0080)

Statistical Log For any Statistical Log (such as SDR Log, Max. Log, Min. Log and/or EN50160 Log), its log entry will be discarded and will not be included in the statistical evaluation if any data within the log entry has been ***Flagged*** while the bit representing the particular Log type in the **Flagging Setup** register is enabled (set to 1).

Real-time Data Real-time data via Modbus communications will only refresh after the **Flagging Status** register has been read if Bit 15 of the **Flagging Setup** register is enabled (set to 1) and if ***Flagging*** is active. Conversely, real-time data via Modbus communications will automatically refresh if Bit 15 of the **Flagging Setup** register is disabled (set to 0) so there is no need to read the **Flagging Status** register before reading the real-time data.

Real-time data includes Frequency, Voltage, Current, Unbalance, Harmonics and Interharmonics measurements.

4.4.13 Disturbance Direction Location

The PMC-680i has disturbance direction detection capabilities to enable you to determine the location of a disturbance, whether it's upstream or downstream, from multiple meters in a power monitoring system more quickly and accurately. When the Dip starts, the PMC-680i start detect location automatically and provide confidence by calculating power characters, and the direction information and the confidence level are recorded as PQ Log.

Score	Level
0–29	Low
30–69	Medium
70–100	High

Table 4-30 Confidence Level

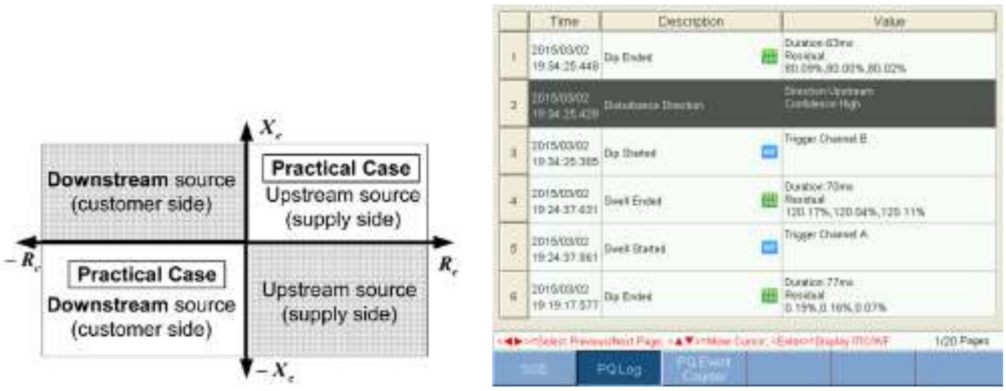


Figure 4-30 Disturbance Direction Location

4.4.14 EN50160 Compliance Report

The EN50160 Standard defines the ***Voltage Characteristics of Electricity Supplied by Public Distribution Systems***. It provides the limits within which any customer can expect voltage characteristics to remain. For a complete definition of the non-conformity level for each of the following EN50160 parameters, please consult the EN50160 Standard document.

The PMC-680i can measure, summarize data and statistics relevant data in accordance with the EN50160 standard. In addition, the device is capable of creating a report per week for the following PQ parameters and the report can be stored for one year.

- Power Frequency, including Maximum and Minimum
- Supply Voltage Variations, including Maximum and Minimum
- Flicker, including Max./Min. and CP95
- Voltage Unbalance, including Max./Min. and CP95
- Harmonic Voltage, including Max./Min., Avg. and CP95
- Mains Signal Voltage, including Max./Min. and CP95
- Rapid Voltage Changes
- Swell and Dips, statistic parameters classified according to characteristic voltage and duration
- Interruption, statistics parameters classified according to duration
- Transient

The programming of EN50160 Log only supports communications, please refer to section **5.9.18** to set parameters for each item. EN50160 Report can be accessed through the Front Panel or via communications. The PMC-680i can store up to 52 logs, if there are more than 52 logs, the newest log will replace the oldest on a FIFO basis.

The following screen captures illustrate the PMC-680i's EN50160 Compliance Report available on its Front Panel and Web Interface.

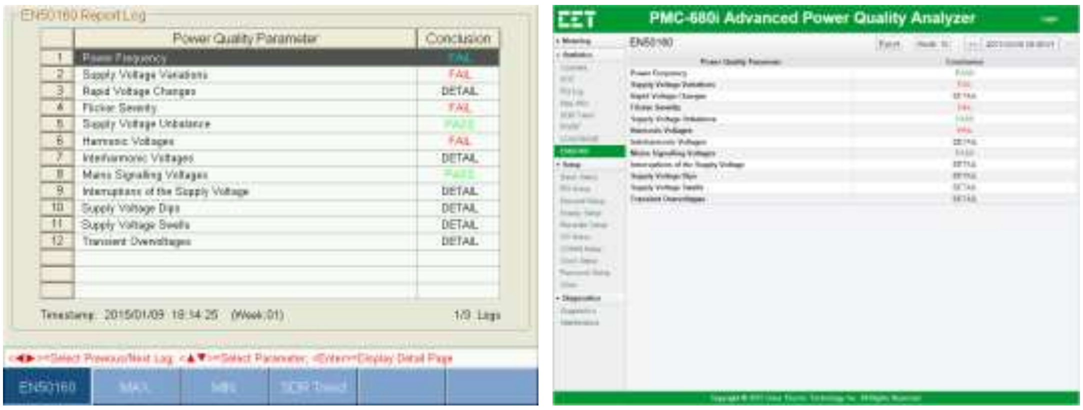


Figure 4-31 EN50160 Report Display via Front Panel and Web

4.4.15 Disturbance Waveform Recorder (DWR)

The PMC-680i provides disturbance waveform recording including Ua/Ub/Uc/U4 and Ia/Ib/Ic/I4/I5. The disturbance waveform recording can be triggered by dip, swell, transient, rapid voltage changes, setpoint event, DI status changes and communications. The Disturbance Waveform data is stored in the device's non-volatile memory with COMTRADE file format and will not suffer any loss in the event of power failure. The PMC-680i can store DWR logs up to 128 entries @4GB or 256 entries @8GB. Each disturbance waveform recording consists of the following stages.

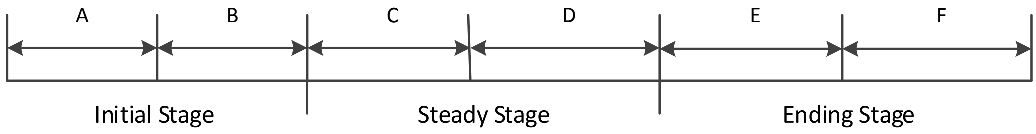


Figure 4-32 Disturbance Location

Stage	Description	Recording Length	Recording Frequency
A	Pre-Fault cycles for the Initial Stage	5 to 10 cycles	512 Samples/Cycle
B	Waveform Recording of the Initial Stage	25 to 35 cycles	512 Samples/Cycle
C	Waveform Recording during the Steady Stage	0 to 150 cycles	16 Samples/Cycle
D	RMS Recording during the Steady Stage	0 to 18,000 cycles	1 Sample/Cycle
E	Pre-Fault cycles of the Ending Stage	2 cycles	512 Samples/Cycle
F	Waveform Recording of the Ending Stage	13 cycles	512 Samples/Cycle

Table 4-31 Time frames of waveform

Notes:

1) For stages C and D:

If **C** < 150 cycles, the **D** would be 0.
If **C** = 150 cycles, the **D** stage data will be recorded.
If **D** = 18,000 cycles, the recording of **D** stage data end even if disturbance does not finish. After 10 minutes, the **E** and **F** stage data will be recorded**.**

3) The following figure shows an example of Disturbance Waveform Recording.

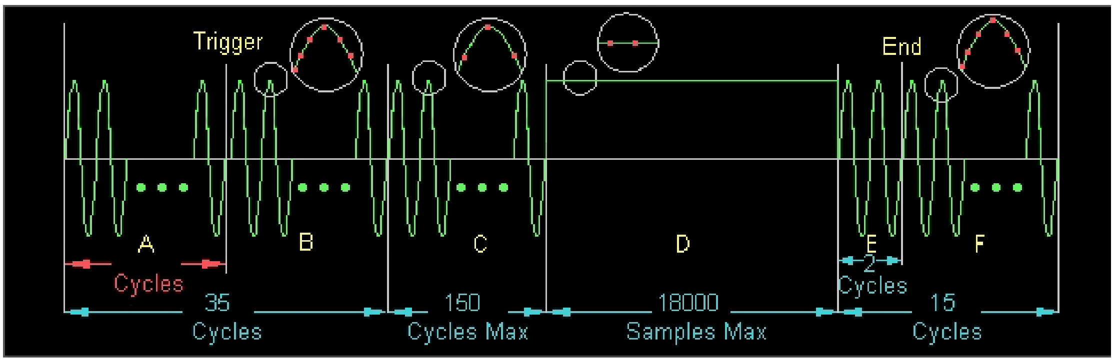


Figure 4-33 Disturbance Waveform Recorder

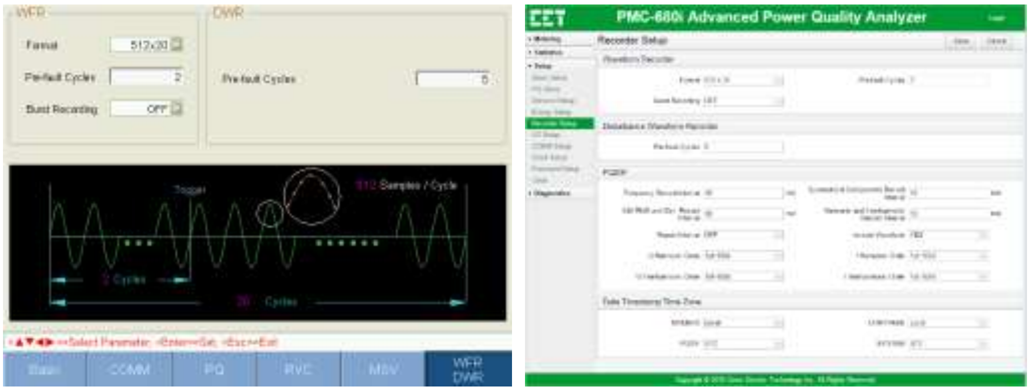
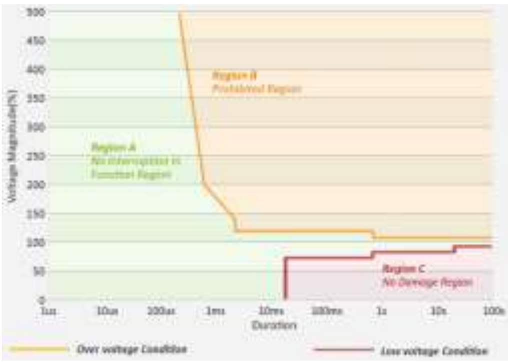


Figure 4-34 DWR Setup via Front Panel and Web

4.4.16 ITIC/SEMI F47 Curve

The ITIC Curve describes an AC input voltage which typically can be tolerated (no interruption in function) by most Information Technology Equipment (ITE), while SEMI F47 is specification for Semiconductor Processing Equipment Voltage Dip Immunity, which specifies the required voltage Dip tolerance for semiconductor fabrication equipment.



ITIC **SEMI F47**

Figure 4-35 ITIC and SEMI F47

PMC-680i's Front Panel or Web can display ITIC or SEMI F47 curve for PQ Events. Display ITIC or SEMI F47 can be set via the Web or communication.

Setup Parameters	Definition	Options
PQ Curve	Set display ITIC or SEMI F47 curve for PQ event. SEMI F47 only for Dip event.	0=ITIC (default) 1=SEMI F47

Table 4-32 ITIC/SEMI F47 Curve Setup Parameter

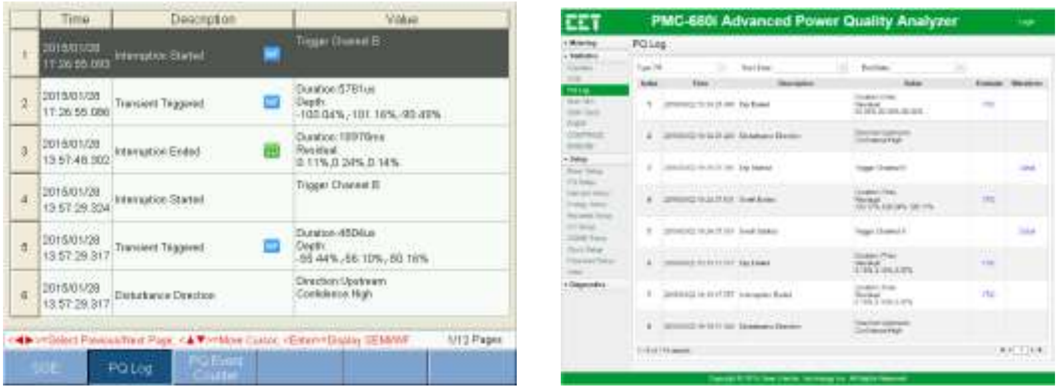


Figure 4-36 PQ Log with ITIC/SEMI F47 via Web

Navigate to PQ Log page in the Front Panel or Web, move cursor to curve in the Front Panel or click the curve on the web to display ITIC or SEMI F47 curve.

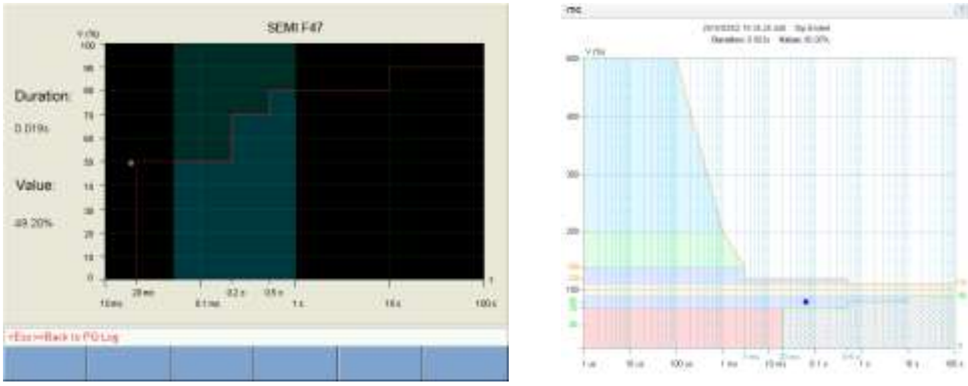


Figure 4-37 ITIC and SEMI F47 Curve via Front Panel and Web

4.5 Data Logging

4.5.1 SOE Log and PQ Log

The PMC-680i's **SOE Log** and **PQ Log** can store up to 1024 events. The **SOE Log** consists of such events as power-on, power-off, PQ events, Discrete Events, setpoint actions, WFR, Mains Signaling Voltages WFR, relay actions, DI status changes and setup changes in its non-volatile memory, while the **PQ Log** consists of such events as Dip/Swell, Transient, Inrush Current, Rapid Voltage Changes and Mains Signaling Voltages. For detailed event and log description, please refer to **Appendix B**. Each event record includes the event classification, its relevant parameter values and a timestamp in 1ms resolution.

All events can be displayed on the Front Panel interface or retrieved via communications. If there are more than 1024 events, the newest event will replace the oldest event on a FIFO basis.

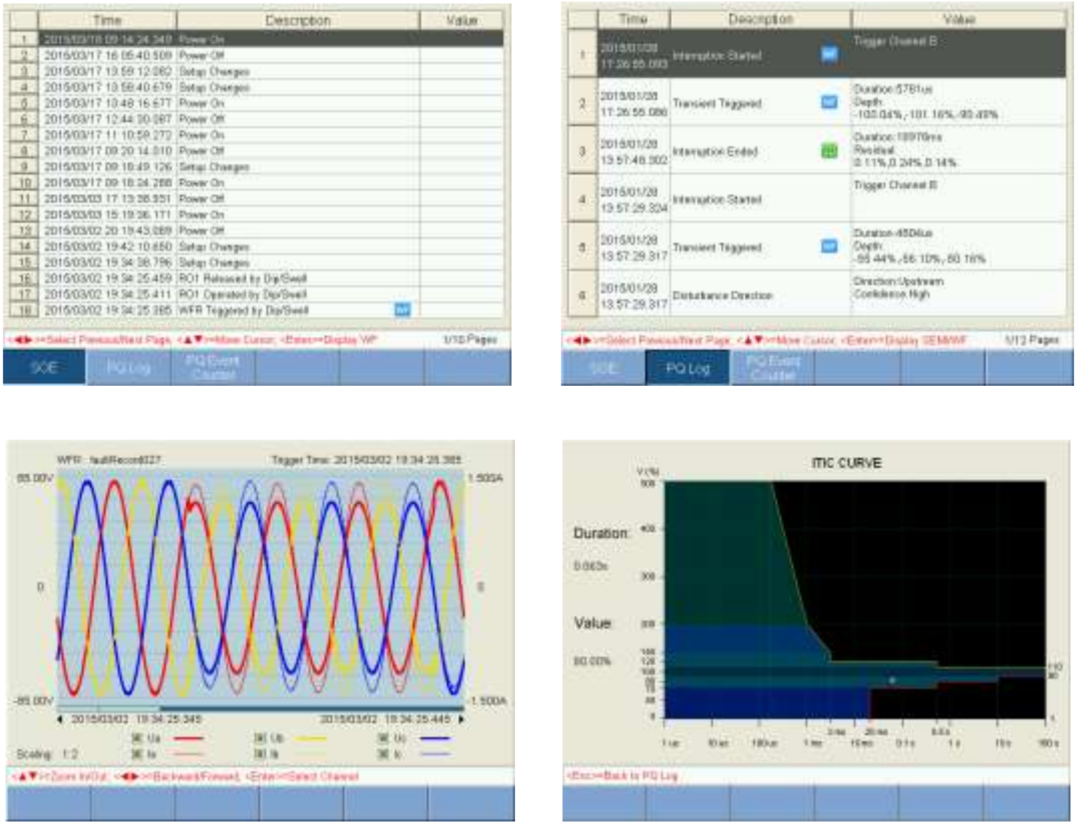


Figure 4-38 SOE/PQ Log, Waveform and ITIC Curve

Please follow guidelines below to open waveform or ITIC/SEMI F47 curve of the event.

1. On the **SOE/PQ Log** page, select SOE/PQ log page by pressing <◀> or <▶>.

2. On the one page, select an event by pressing <▲> or <▼>.

3. Press **<Enter>** to display waveform or ITIC/SEMI curve.

4. On the waveform page, press <◀> or <▶> to zoom in or zoom out waveform, while press <▲> or <▼> to backward or forward. To select channel, please press **<Enter>.**

The **SOE Log** and **PQ Log** can be reset from the front panel or via communications.

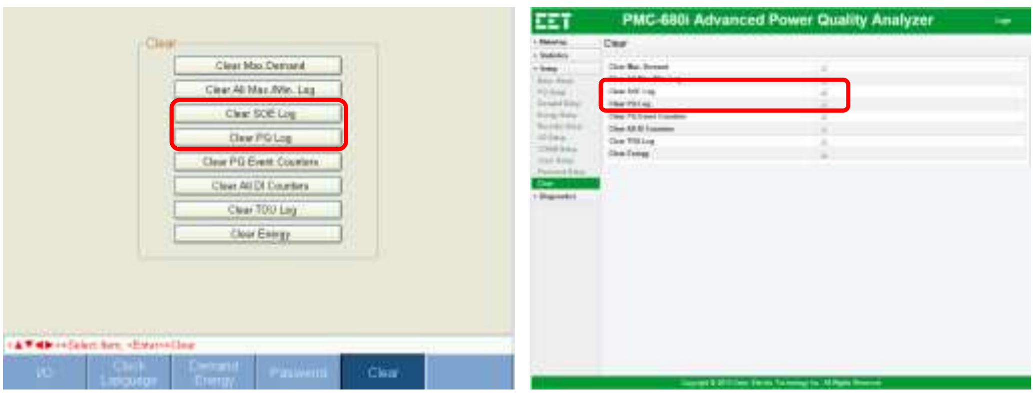


Figure 4-39 Clear PQ Log and SOE Log via Front Panel and Web

4.5.2 Statistical Data Recorder (SDR)

The PMC-680i provides a comprehensive **SDR** for IEC 61000-4-30 parameters that is un-matched by other PQ devices. The **SDR** records the Min., Max., Avg. (also known as Demand) and CP95 for each parameter. There are 16 **SDR**s of 64 parameters each that can be individually programmed to record different parameters at different time intervals, which may vary from 0 to 60 minutes. The PMC-680i with the standard 4GB option can retain the SDR Logs for 90 days when the recording interval is set to 3 minutes. The recorded data is stored in non-volatile memory and will not suffer any loss in the event of a power failure. If storage is full, the newest log will replace the oldest on a first-in-first-out basis.

The programming of the **SDR** is only supported over communications. Each SDR provides the following setup parameters:

Setup Parameters	Value/Option	Default
Recording Interval	0 to 60 minutes	15
Recording Mode	0=Stop-When-Full / 1=First-In-First-Out	1
Number of Parameters	0 to 64 (user defined)	64
Parameters 1 to 64	See **Section 5.9.13**	

Table 4-33 Setup Parameters for SDR

The **SDR Log** is only operational when the values of **Recording Interval** and **Number of Parameters** are all non-zero.

4.5.3 Data Recorder (DR)

The PMC-680i provides 8 Standard Data Recorders with recording interval from 1s to 40 days and 4 HS Data Recorders with recording interval from 0.5 to 60 cycles, each recorder supports 16 parameters. **DR Log** can be used to Trend or power supply unbalance analysis. The **DR Logs** are stored in non-volatile memory and will not suffer any loss in the event of a power failure.

The programming of the **DR** is only supported over communications. Each **DR** provides the following setup parameters:

Setup Parameters	Value/Option	Default
Triggered Mode	0=Disabled / 1=Triggered by Timer / 2=Triggered by Setpoint	DR=1, HS DR=2
Recording Mode	0=Stop-When-Full / 1=First-In-First-Out HS DR only be 0=Stop-when-Full.	DR=1 HS DR=0
Recording Interval	Standard DR: 1 second to 40 days HS DR: 0.5 cycle to 60 cycles	300s
Offset Time	0 to 43200 seconds, 0 indicates no offset.	0

	For DR, the offset time should be less than recording interval. For HS DR, the offset time indicates recording begins after specified time.	
Number of Parameters	For DR, 0 to 32 For HS DR, 0 to 16	DR=32 HS DR=16
Parameter 1 to 16	See **Section 5.9.14** and **5.9.15**	

Table 4-34 Setup Parameters for DR

The **DR** is only operational when the values of **Triggered Mode**, **Recording Interval**, and **Number of Parameters** are all non-zero.

Under **FIFO** mode, the newest log will replace the oldest on a first-in-first-out basis when the storage is full. Under **Stop-When-Full** mode, the record would be stop when the storage is full.

4.5.4 Max./Min. Log

The PMC-680i provides 4 Max. Logs and 4 Min. Logs capable of recording 20 parameters each since Last Reset (This Month) or before Last Reset (Last Month). Each record includes relevant parameter values and timestamp. The recorded data is stored in non-volatile memory and will not suffer any loss in the event of a power failure.

The PMC-680i's Max./Min. Log can record the following parameters:

Max./Min. Parameters					
Ia	Ib	Ic	I4	Iavg	I0
Ua	Ub	Uc	U4	ULN avg	U0
Uab	Ubc	Uca	ULL avg		
∑kW	∑kvar	∑kVA	∑P.F.	Freq.	
Ua THD	Ub THD	Uc THD	Uab THD	Ubc THD	Uca THD
Ia THD	Ib THD	Ic THD			
Ia K-Factor	Ib K-Factor	Ic K-Factor	I4 K-Factor	U Unbal.	I Unbal.

Table 4-35 Max./Min. Measurements

The programming of the Max./Min. Log is only supported over communications. Each Max./Min. Log provides the following setup parameters:

Parameters	**Value**
Self-Read time	▪ A zero value means that the Self-Read will take place at 24:00 of the last day of each month. (Default) ▪ 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**.
Number of Parameters	0 to 20
Parameter 1 to 20	All real-time data can be configured to parameters, see **section 5.9.16**

Table 4-36 Setup Parameters for Max./Min. Log

All Max./Min. Log can be accessed over communication and the Max./Min. Log can be reset over Front Panel or via communication.

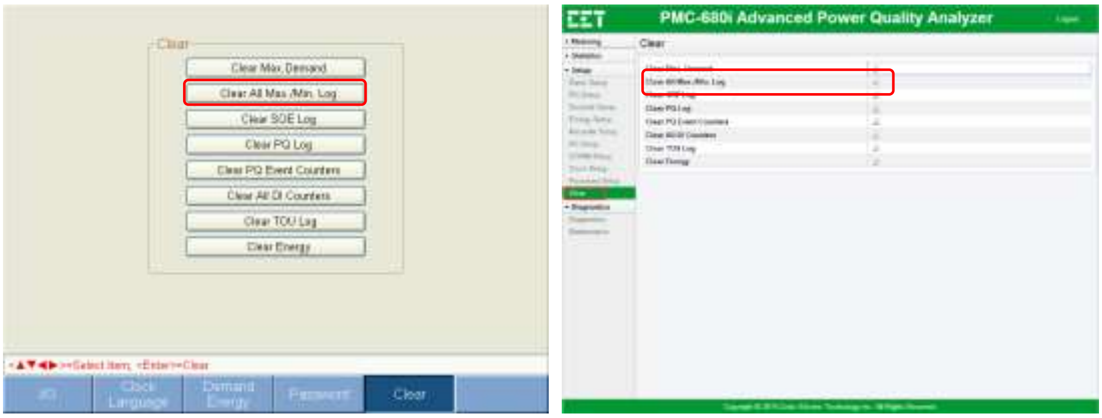


Figure 4-40 Clear All Max./Min. Log

4.5.5 Pst Log

The PMC-680i's Pst Log can store up to 52560 events per 10 minutes about voltage Pst in its non-volatile memory. Each event record includes the event classification, its relevant parameter values and a timestamp in 1ms resolution.

All events can be retrieved via communications for display. If there are more than 52560 events, the newest event will replace the oldest event on a first-in-first-out basis. The Pst Log can be reset from the front panel or via communications.

4.5.6 Plt Log

The PMC-680i's Plt Log can store up to 4380 events per 2 hours about voltage Plt in its non-volatile memory. Each event record includes the event classification, its relevant parameter values and a timestamp in 1ms resolution.

All events can be retrieved via communications for display. If there are more than 4380 events, the newest event will replace the oldest event on a first-in-first-out basis. The Plt Log can be reset from the front panel or via communications.

4.5.7 Interval Energy Recorder (IER)

The PMC-680i's **IER** can store up energy parameters which are illustrated in table below in its non-volatile memory. Each event record includes the event classification, its relevant parameter values and a timestamp.

No.	Parameters	No.	Parameters	No.	Parameters	No.	Parameters
0	None	4	kvarh Imp.	8	kWh Imp. Fund	12	kWh Imp. TH
1	kWh Imp.	5	kvarh Exp.	9	kWh Exp. Fund	13	kWh Exp. TH
2	kWh Exp.	6	∑kvarh	10	kvarh Imp. Fund	14	kvarh Imp. TH
3	∑kWh	7	∑kVA	11	kvarh Exp. Fund	15	kvarh Exp. TH

Table 4-37 IER Measurements

The PMC-680i with the standard 4GB option can can store 65535 records. If the storage is full, the newest event will replace the oldest event on a first-in-first-out basis. The **IER Logs** can be reset from the Front panel or via communications.

The programming of the **IER** is both supported over communications and via the front panel. **IER** provides the following setup parameters:

Setup Parameters	Value	Default
Recording Mode	0=Disabled / 1=Stop-When-Full / 2=First-In-First-Out	0
Recording Data Format	0 = Interval Energy, 1 = Real-time Energy	0
Recording Interval	1 to 65535 mins	5
Start Time	20YY/MM/DD, HH:MM:SS	
Number of Parameters	1 to 15	15
Parameter 1 to 15	Please see **Section 5.9.17**	

Table 4-38 Setup Parameters for IER

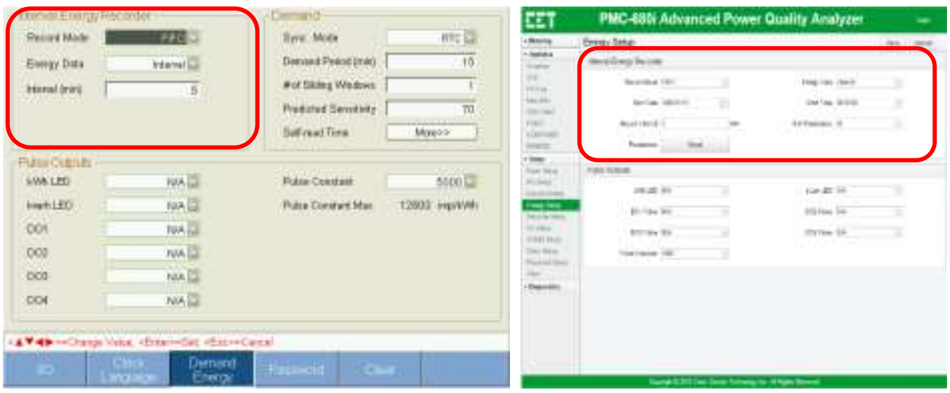


Figure 4-41 Set IER via Front Panel and Web

4.5.8 Qualification Rate Log

The PMC-680i provides qualification rate statistics for power quality, including Voltage Deviation, Frequency Deviation and Plt. The log can be stored for 1 year @ 4G which can be retrieved via communication. The Qualification Rate Log can be reset via communications (register 9296).

The programming of the **Qualification Rate Log** is supported over communications. **Qualification Rate Log** provides the following setup parameters:

Setup Parameters	**Value**	**Default**
U Over Dev. Limit	(0~100%)Un	0.07
U Under Dev. Limit	(-100%~0)Un	-0.07
Freq. Over Dev. Limit	0~7.5 Hz	0.2
Freq. Under Dev. Limit	-7.5~Hz	-0.2
Plt Limit	0~50	1

Table 4-39 Setup Parameters for Qualification Rate Log

4.5.9 Waveform Recorder (WFR)

The PMC-680i provides one group of **WFR** with a total of 128 entries @4GB or 256 entries @8GB. **WFR** Log can simultaneously capture 3-phase voltage and current signals at a maximum resolution of 128/256 samples per cycles.

WFR on the PMC-680i can be triggered by Dip/Swell, Transient, Inrush Current, Rapid Voltage Changes, Setpoints, DI changes, or manually through communications. The manual trigger command has the highest priority. When WFR is already in progress, other WFR commands will be ignored until the present recording has completed. The WFR has a capacity of 128/256 entries organized in a FIFO basis, with the newest waveform log replacing the oldest one. The WFR log is stored in the device's non-volatile memory with COMTRADE or PQDIF file format and will not suffer any loss in the event of power failure. The log can be accessed via communication.

The programming of the **WFR** is supported over the Front Panel, web or communications. The **WFR** provides the following setup parameters:

Setup Parameters	**Value/Option**
Consecutive Recording Depth	1 to 7, default = 1
# of Samples	0*=16 Samples/640 Cycles 2=64 Samples/160 Cycles 5=256 Samples/40 Cycles 1=32 Samples/320 Cycles 3=128 Samples/80 Cycles 6=512 Samples/20 Cycles 7=1024 Samples/10 Cycles, 7 is default for PMC-680i with 1024 samples per cycle sampling, and this value is only valid with the 1024 samples/cycle option
Pre-fault Cycle	2 to 384 Cycles (16 Samples/640 Cycles) 2 to 192 Cycles (32 Samples/640 Cycles)

	2 to 96 Cycles (64 Samples/160 Cycles) 2 to 24 Cycles (256 Samples/40 Cycles) 2 to 6 Cycles (1024 Samples/10 Cycles)	2 to 48 Cycles (128 Samples/80 Cycles) 2 to 12 Cycles (512 Samples/20 Cycles)
Pre-fault Cycles of DWR	5 to 10 Cycles	

Table 4-40 Setup Parameters for WFR

Table 4-42 Setup WFR via Front Panel and Web

All waveform recorder logs can be retrieved via communications by our PecStar® iEMS or our free PMC Setup Software for display.

4.5.10 SDR Trend

The PMC-680i provides trend curve for Max./Min., Avg. and CP95 with up to 12 parameters including voltage, current, power, energy, etc. using SDR log. It's important to note that because data source of parameters are come from SDR Log, the parameter that used to draw trend curve should be configured in SDR. The programming of the **SDR Trend** is only supported over communications. The **SDR Trend** provides the following setup parameters:

Parameter	Value
Number of Parameters	0 to 12, default = 12
Parameters #x	Freq /Ua/Ub/Uc/U4/Ia/Ib/Ic RMS/∑kWh/∑kvarh/∑kVAh/kW Imp. DMD/kW Exp. DMD

Table 4-41 Setup Parameters for SDR Trend

The trend can be accessed through the Front Panel or Web. Please note that the trend curve is drawn by log entries dot as X-axis, with 200 and 100 dot in Web and the Front Panel, respectively. Both the Web and the Front Panel page display the latest 200 or 100 logs when you enter into pages.

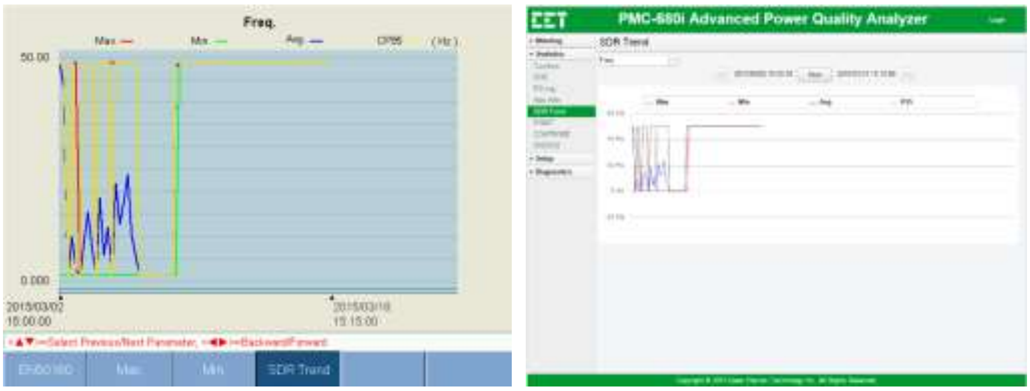


Figure 4-43 SDR Trend display via Front Panel and Web

4.5.11 PQDIF and COMTRADE Storage

The PMC-680i is capable of storing standard data with PQDIF format, WFR data with COMTRADE format in its non-volatile memory. All record can be stored for about half a year without communication and will not suffer any loss in the event of a power failure. The PMC-680i can store following standard data with PQDIF format.

Parameter	Description	Cycles
Freq.	Freq.	3s
Voltage RMS	Ua, Ub, Uc	150/180 cycles
	Uab, Ubc, Uca	150/180 cycles
Current RMS	Ia, Ib, Ic	150/180 cycles
Voltage Deviation	Ua/Ub/Uc Deviation	150/180 cycles
	Uab/Ubc/Uca Deviation	150/180 cycles
Fundamental RMS	Ua/Ub/Uc H01 RMS	150/180 cycles
	Ia/Ib/Ic H01 RMS	150/180 cycles
Unbalance	Ua/Ub/Uc Unbalance	150/180 cycles
	Ia/Ib/Ic H01 Unbalance	150/180 cycles
Sequence Components	U1, U2, U0	150/180 cycles
	I1, I2, I0	150/180 cycles
Harmonic Voltage	Ua/Ub/Uc_THD, Ua/Ub/Uc_TOHD, Ua/Ub/Uc_TEHD	150/180 cycles
	Ua/Ub/Uc_HD_01 ... Ua/Ub/Uc_HD_63	150/180 cycles
Harmonic Current	Ia/Ib/Ic_THD, Ia/Ib/Ic_TOHD, Ia/Ib/Ic_TEHD	150/180 cycles

	Ia/Ib/Ic_H01_RMS ... Ia/Ib/Ic_H63_RMS	150/180 cycles
Inter-Harmonic Voltage	Ua/Ub/Uc_TIHD, Ua/Ub/Uc_TOIHD, Ua/Ub/Uc_TEIHD	150/180 cycles
	Ua/Ub/Uc_IHD_01 ... Ua/Ub/Uc_IHD_63	150/180 cycles
Inter-Harmonic Current	Ia/Ib/Ic_TIHD, Ia/Ib/Ic_TOIHD, Ia/Ib/Ic_TEIHD	150/180 cycles
	Ia/Ib/Ic_IH01_RMS ... Ia/Ib/Ic_IH63_RMS	150/180 cycles
Flicker	Pst	10 mines
	Plt	2 hours
Fundamental Power	kWa/kWb/kWc, kvara/kvarb/kvarc, kVAa/kVAb/kVAc, DFa/DFb/DFc, ∑kW, ∑kvar, ∑kVA	150/180 cycles
Total Power	kWa/kWb/kWc, kvara/kvarb/kvarc, kVAa/kVAb/kVAc, PFa/PFb/PFc, ∑kW, ∑kvar, ∑kVA	150/180 cycles
Total Harmonic Power	kWa/kWb/kWc TH, kvara/kvarb/kvarc TH kVAa/kVAb/kVAc TH, kW/kvar/kVA TH	150/180 cycles
Energy	kWh Imp., kWh Exp., kvarh Imp., kvarh Exp., kWh Imp. H01, kWh Exp. H01, kvarh Imp. H01, kvarh Exp. H01	150/180 cycles
Event	PQ Event, DWR, WFR	-

Table 4-42 Normal Parameters for Daily Backup

The PQDIF and COMTRADE file can be retrieved via building web interface. In the **PQDIF** page, click **Download** to download PQDIF file. To download COMTRADE file, click **.cfg** or **.dat** in the **COMTRADE** page, also users can view waveform of COMTRADE by clicking **view**.

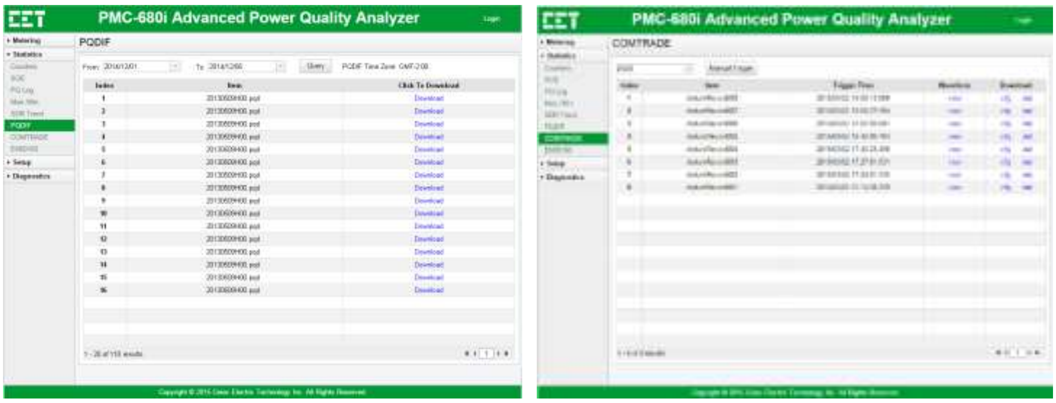


Figure 4-44 PQDIF/COMTRADE display via Web

4.5.12 PQ Counters

The PMC-680i Provides counting ability for PQ Events. When a new event generated, the register will add 1 and system will alarm. The Max. value of counter register is 2^{32} (4,294,967,296), the register will roll over to 0 when it reaches the maximum. The counter can be reset by Front Panel or via communications. The PMC-680i provides following PQ event counter.

No	Event	No	Event	No	Event
0	Dip	4	Rapid Voltage Changes	8	Signal Voltage#2
1	Swell	5	Inrush Current	9	Signal Voltage#3
2	Interruption	6	Reserved	10	Total
3	Transient	7	Signal Voltage#1		

Table 4-43 PQ Event Counter

All PQ Event Counters can be reset over the Front Panel, web or via communications:

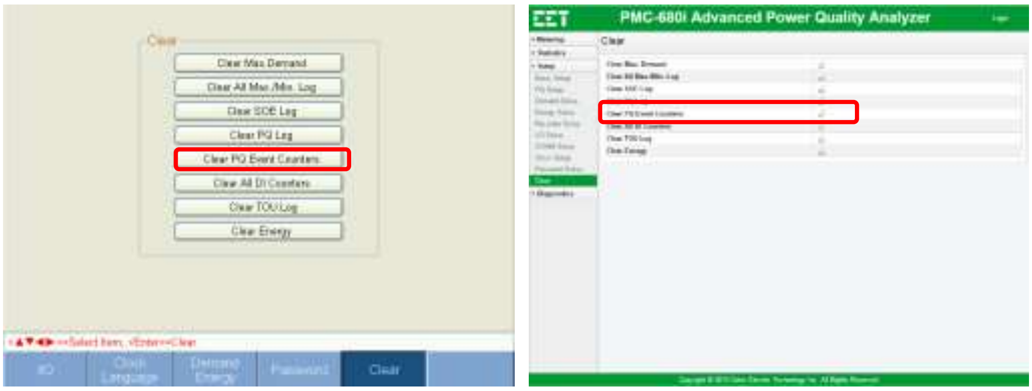


Figure 4-45 Clear PQ Event Counters through Front Panel and Web

4.6 SMTP (Simple Mail Transfer Protocol)

SMTP can be used to send PMC-680i's PQ or SOE email notification to specified mail address through the connected Ethernet port providing that the network and SMTP Sever has been properly configured. The programming of the **SMTP** setup parameters are supported via the communications which are listed in the following table:

Setup Parameters	Option	Default
SMTP Event Classification	Determines if a newly generated SOE/PQ log is sent out by email.	See Note 1)
SMTP IP Port	SMTP server's IP Port.	25
IP Address of SMTP Server	SMTP server's IP Address.	0.0.0.0
Source Email Address	Determines an email address will send out SOE/PQ log notification.	
Source User Name	The user name of the source Email Address.	

Login Password	The login password of the source Email Address.	
Destination Email Address	Determines an email address will receive SOE/PQ log notification.	

Table 4-44 SMTP Setup Parameters

Notes:

1) **SMTP Event Classification** register determines if a newly generated SOE/PQ LOG is sent out by email. The following table illustrates the Bitmap definition of this register. When a particular bit is set to 1, its corresponding events will be sent out by email.

Bit	Classification	Event Type	Bit	Classification	Event Type
Bit 0	1=System Events See Appendix B	SOE	Bit 16	0x81=Dip/Swell Disturbance	PQ Log
Bit 1	2=Standard Setpoints Events		Bit 17	0x82=Transient Disturbance	
Bit 2	3=High-speed Setpoints Events		Bit 18	0x83 = Inrush Current	
Bit 3	4=Discrete Events		Bit 19	0x84 = RVC	
Bit 4	5 =WFR		Bit 20	0x85 = MSV	
Bit 5	6 = DWR		Bit 21	0x86 = Relative RMS (Reserved)	
Bit 6	7 = MSV WFR				
Bit 7	8 = Standard DR				
Bit 8	9 = HS DR				

Table 4-45 SMTP Event Classification Register (40900)

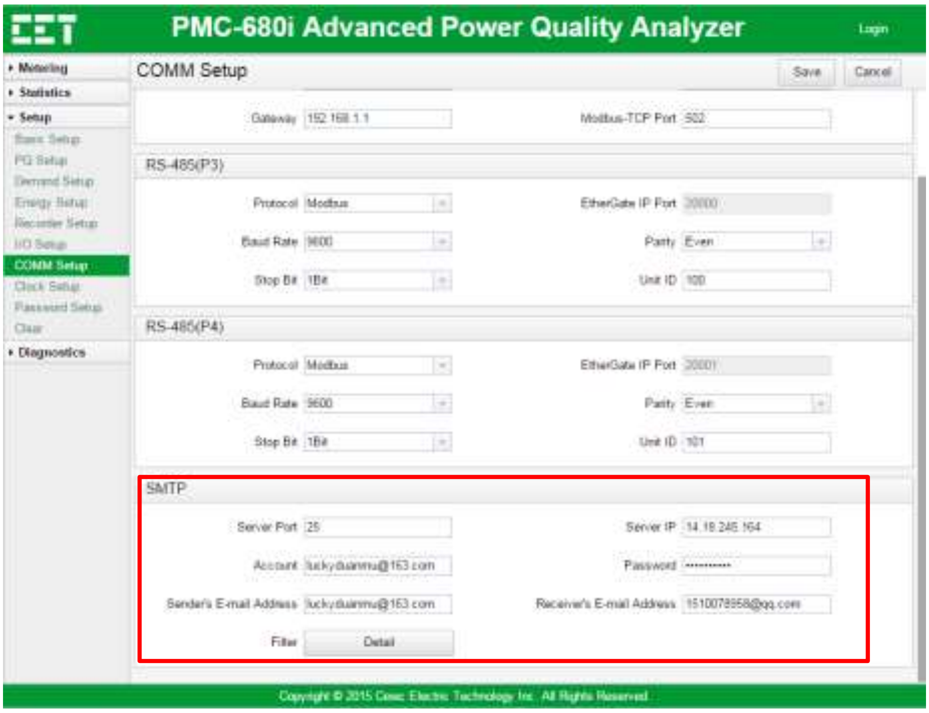


Figure 4-46 Setup SMTP via Web

Please follow guidelines below to use alarm email notification function of the PMC-680i:

1) Configure Ethernet via the Front Panel, make sure the Ethernet settings are correct and can access to the internet.

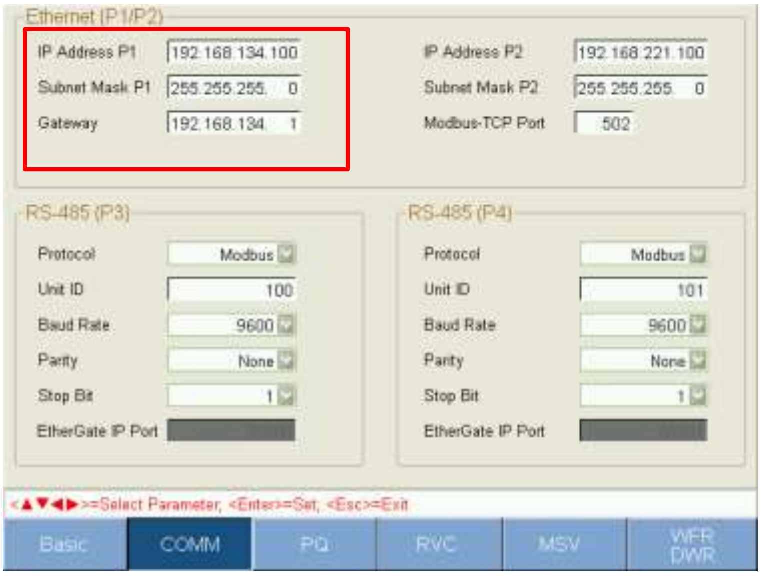


Figure 4-47 Setup SMTP via Web

2) Set SMTP Server via the web, please refer to table 4-45 and figure 4-46 above. Please note that only one receiver email address can be configured.

3) In **Setup > COMM Setup** web interface, click **Detail** after Filter to set **SMTP Event Classification.**

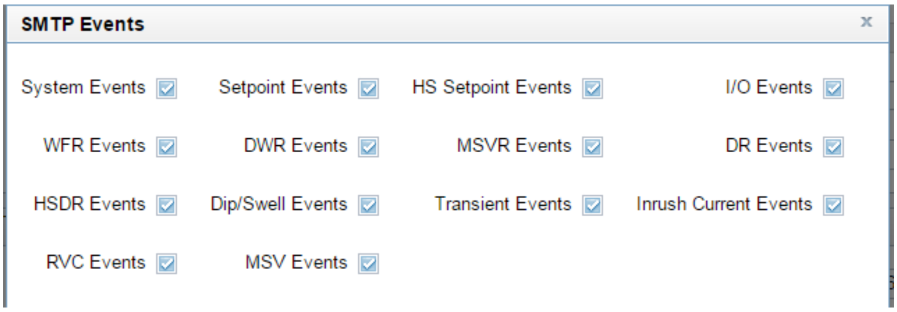


Figure 4-48 Filter SMTP Events

4) Test the email notification function.

Open the web and naviagate to **Diagnostics > Maintenance**, click **Alarm E-mail Test.**

Click **Send** and confirm to send the email.

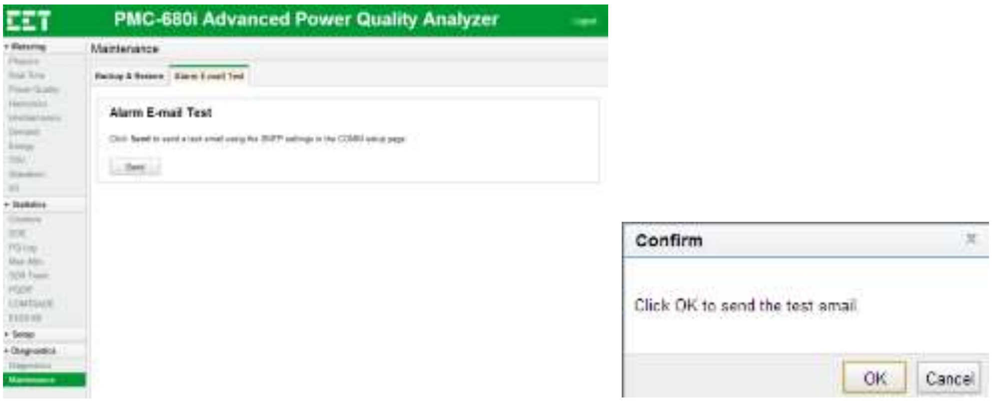


Figure 4-49 Test SMTP

5) When Events generated in PMC-680i and the SOE will be sent to Receiver's Email address automatically. The Email format is:

PMC-680i-XXXX(SN:XXXX): Event Details

YYYY/MM/DD HH:MM:SS.MMM

Notes:

1) Please remember to shut down anti-spam function in both Receiver and Sender Email sides.
2) The Email Format is fixed. Only device name and time format can be modified in PMC-680i Web interface.

4.7 Time Synchronization

The PMC-680i is equipped with a 6ppm, battery-backed real-time clock that has a maximum error of 0.5s per day. If the supply power is lost or removed, the internal back-up battery keeps the real-time clock running until power is restored.

The PMC-680i provides timestamps for all recorded data so it's extremely important for the clock to be properly configured to achieve precise events time stamping for energy and power quality analysis.

4.7.1 PMC Setup

PMC Setup can be used to manually set the time of an individual meter through the "Set Time" function under the **Manual Operate** menu using the computer's clock as the clock source. Please refer to the PMC Setup's User Manual for a complete description.

Figure 4-50 Set Time via PMC Setup

4.7.2 PecStar iEMS

PecStar® iEMS can be configured to provide regular time synchronization by broadcasting time-sync packets over the connected medium, whether it be RS485 or Ethernet. The default time synchronization interval of is 60 minutes. Please consult the PecStar iEMS's user manual for a complete description.

4.7.3 SNTP (Simple Network Time Protocol)

SNTP can be used to synchronize the PMC-680i's clock through the connected Ethernet port providing that the network has been properly configured for the PMC-680i to connect to the **SNTP Server**, wherever it resides. The programming of the **SNTP** setup parameters are supported via the Front Panel or communications. The SNTP server provides the following setup parameters:

Setup Parameters	Option	Default
Clock Source	0=RTC, 1=SNTP, 2=GPS, 3=IRIG-B, 4=DI. Set **Clock Source**=1	0
Time Zone	See **Section 5.9.22 System Setup**, register 40801	26
SNTP Sync. Interval	10 (default) to 1440 minutes	60
IP Address of SNTP Server	Set the IP address of the **SNTP Server**	192.168.101.2
Broadcast Synchronization		
SNTP Broadcast Flag	Enable or disable SNTP broadcast time sync. 0* = Disabled, 1 = Enabled	0

Table 4-51 SNTP Setup Parameters

4.7.4 Modbus

Modbus can be used to synchronize the PMC-680i's clock through the communication. Set the **Clock Source** as **RTC** via the Front Panel or communication, then set the register values of 60000 to 60005 or 9000 to 9005, please refer to **Section 5.12 Time Registers** for a detailed description**.**

4.7.5 GPS with Time Sync Pulse

The PMC-680i can be configured to synchronize its millisecond clock with a GPS's time sync pulse. The programming of the setup parameters is only supported over communications.

Setup Parameters	Option	Default
Clock Source	0=RTC, 1=SNTP, 2=GPS, 3=IRIG-B, 4=DI. Set **Clock Source**=2	0

Table 4-52 GPS's Time Sync. Setup Parameters

Note:

1) The **Com Port#2 Protocol** can be used as GPS or IRIGB time synchronization. When the **Clock Source** is set as GPS or IRIGB, the Port 2 shall be used as time synchronization, on a priority basis.

Please also refer to **Figure 2-14** for the time synchronization wiring diagram.

P4 (RS485 Port #2)	D+	D-	SH
GPS with Sync Pulse	PPS+	PPS+	--

Table 4-53 Relation with Terminal

4.7.6 IRIG-B

The PMC-680i can be configured to synchronize its clock with an IRIG-B input with P1 (RS485 Port #1). The IRIG-B can analysis from year to second information and synchronize clock to millisecond without other ways. The IRIG-B provides the following setup parameters:

Setup Parameters	Option	Default
Clock Source	0=RTC, 1=SNTP, 2=GPS, 3=IRIG-B, 4=DI. Set **Clock Source**=3	0
Time Zone	See **Section 5.9.22 System Setup**, register 40801	26
IRIG-B Time Zone	See **Section 5.9.22 System Setup**, register 40802	26

Table 4-54 Setup Parameters for IRIG-B

Note:

1) The **Com Port#2 Protocol** can be used as GPS or IRIGB time synchronization. When the **Clock Source** is set as GPS or IRIGB, the Port 2 shall be used as time synchronization, on a priority basis.

P4 (RS485 Port #2)	D+	D-	SH
IRIG-B	P+	P-	--

Table 4-55 Relation with Terminal

4.7.7 DI with PPS

The PMC-680i can be configured to synchronize its millisecond clock with 1PPS output via one of PMC-680i's **DI8**. The programming of the DI is only supported over communications. The time synchronization with DI provides the following setup parameters.

Setup Parameters	Option	Default
Clock Source	0=RTC, 1=SNTP, 2=GPS, 3=IRIG-B, 4=DI. Set **Clock Source**=4	0
DI8 Mode	0=Normal (Status Input), 1=Pulse Counter, 2=DMD Sync. Set **DI8 Mode**=1	0

Table 4-56 DI Setup for 1PPS GPS Time Sync Pulse

Chapter 5 Modbus Register Map

This chapter provides a complete description of the Modbus register map (**Protocol Version 3.0**) for the PMC-680i Advanced Utility Power Quality Analyzer to facilitate the development of 3rd party Modbus RTU communications driver for accessing information on the PMC-680i.

The PMC-680i 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)

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

5.1 Basic Measurements

Register Address	Property	Description	Format	Unit
0000	RO	Ua[1]	Float	V
0002	RO	Ub[1]	Float	V
0004	RO	Uc[1]	Float	V
0006	RO	ULN Avg.[1]	Float	V
0008	RO	Uab	Float	V
0010	RO	Ubc	Float	V
0012	RO	Uca	Float	V
0014	RO	ULL Avg.	Float	V
0016	RO	Ia	Float	A
0018	RO	Ib	Float	A
0020	RO	Ic	Float	A
0022	RO	I Avg.	Float	A
0024	RO	kWa[1]	Float	W
0026	RO	kWb[1]	Float	W
0028	RO	kWc[1]	Float	W
0030	RO	∑kW	Float	W
0032	RO	kvara[1]	Float	var

0034	RO	kvarb[1]	Float	var
0036	RO	kvarc[1]	Float	var
0038	RO	∑kvar	Float	var
0040	RO	kVAa[1]	Float	VA
0042	RO	kVAb[1]	Float	VA
0044	RO	kVAc[1]	Float	VA
0046	RO	∑kVA	Float	VA
0048	RO	P.F.a[1]	Float	--
0050	RO	P.F.b[1]	Float	--
0052	RO	P.F.c[1]	Float	--
0054	RO	∑P.F.	Float	--
0056	RO	FREQ	Float	Hz
0058	RO	U0	Float	V
0060	RO	I0	Float	A
0062	RO	I5	Float	A
0064	RO	Real-time Data Timestamp - UNIX Time	UINT32	s
0066	RO	Real-time Data - Millisecond	UINT32	ms
0068	RO	Freq. Timestamp - UNIX Time	UINT32	s
0070	RO	Freq. Timestamp - Millisecond	UINT32	ms
0072	RO	Pst. Timestamp - UNIX Time	UINT32	s
0074	RO	Pst. Timestamp - Millisecond	UINT32	ms
0076	RO	Plt. Timestamp - UNIX Time	UINT32	s
0078	RO	Plt. Timestamp - Millisecond	UINT32	ms
0080	RO	Flagging Status of Real-time Data[2]	Bitmap	
0081~0092		Reserved		
0093	RO	Standard Setpoint Status #1[3]	Bitmap	
0095	RO	Standard Setpoint Status #2[3]	Bitmap	

0097	RO	Standard Setpoint Status #3[3]	Bitmap	
0099	RO	Standard Setpoint Status #4[3]	Bitmap	
0101	RO	Standard Setpoint Status #5[3]	Bitmap	
0103	RO	Standard Setpoint Status #6[3]	Bitmap	
0105	RO	Standard Setpoint Status #7[3]	Bitmap	
0107	RO	Standard Setpoint Status #8[3]	Bitmap	
0109		Reserved		
0111	RO	HS Setpoint Status[5]	Bitmap	
0113		Reserved		
0115	RO	Dips Counter	UINT32	
0117	RO	Swells Counter	UINT32	
0119	RO	Interruption Counter	UINT32	
0121	RO	Transient Counter	UINT32	
0123	RO	RVC Counter	UINT32	
0125	RO	Inrush Current Counter	UINT32	
0127	RO	Relative RMS Counter	UINT32	
0129	RO	MSV (Mains Signalling Voltage) #1 Counter	UINT32	
0131	RO	MSV #2 Counter	UINT32	
0133	RO	MSV #3 Counter	UINT32	
0135	RO	Total PQ Event	UINT32	
0137	RO	SOE Pointer	UINT32	
0139	RO	PQ Log Pointer	UINT32	
0141	RO	WFR Log Pointer	UINT32	
0143		Reserved		
0145	RO	Disturbance Recorder Pointer	UINT32	
0147~0151		Reserved		
0153	RO	MSV WFR Pointer (Freq #1)	UINT32	

0155	RO	MSV WFR Pointer (Freq #2)	UINT32	
0157	RO	MSV WFR Pointer (Freq #3)	UINT32	
0159	RO	SDR Log #1 Pointer	UINT32	
0161	RO	SDR Log #2 Pointer	UINT32	
0163	RO	SDR Log #3 Pointer	UINT32	
0165	RO	SDR Log #4 Pointer	UINT32	
0167	RO	SDR Log #5 Pointer	UINT32	
0169	RO	SDR Log #6 Pointer	UINT32	
0171	RO	SDR Log #7 Pointer	UINT32	
0173	RO	SDR Log #8 Pointer	UINT32	
0175	RO	SDR Log #9 Pointer	UINT32	
0177	RO	SDR Log #10 Pointer	UINT32	
0179	RO	SDR Log #11 Pointer	UINT32	
0181	RO	SDR Log #12 Pointer	UINT32	
0183	RO	SDR Log #13 Pointer	UINT32	
0185	RO	SDR Log #14 Pointer	UINT32	
0187	RO	SDR Log #15 Pointer	UINT32	
0189	RO	SDR Log #16 Pointer	UINT32	
0191~0205		Reserved		
0207	RO	DR Log #1 Pointer	UINT32	
0209	RO	DR Log #2 Pointer	UINT32	
0211	RO	DR Log #3 Pointer	UINT32	
0213	RO	DR Log #4 Pointer	UINT32	
0215	RO	DR Log #5 Pointer	UINT32	
0217	RO	DR Log #6 Pointer	UINT32	
0219	RO	DR Log #7 Pointer	UINT32	
0221	RO	DR Log #8 Pointer	UINT32	

0223	RO	HS DR Log #1 Pointer	UINT32	
0225	RO	HS DR Log #2 Pointer	UINT32	
0227	RO	HS DR Log #3 Pointer	UINT32	
0229	RO	HS DR Log #4 Pointer	UINT32	
0231~0237		Reserved		
0239	RO	Pst Log Pointer	UINT32	
0241	RO	Plt Log Pointer	UINT32	
0243		Reserved		
0245	RO	IER Log Pointer	UINT32	
0247	RO	EN50160 Pointer	UINT32	
0249	RO	Qualification Rate Pointer	UINT32	
0251	RO	TOU Historical Log Pointer	UINT32	
0253~0306		Reserved		
0308	RO	DI Status[4]	Bitmap	
0309		Reserved		
0310	RO	RO/DO Status[5]	Bitmap	

Table 5-1 Basic Measurements

Notes:

1) When the **Wiring Mode** is **Delta**, the per phase line-to-neutral voltages, kWs, kvars, kVAs and P.F.s have no meaning, and their registers are reserved.
2) Please refer to **Section 4.4.12 Flagging Concept** for a detailed description of the **Flagging Status** register.

Bit	Description		Bit	Description	
B0	Basic Measurement	Dip	**B8**	Pst.	Dip
B1		Swell	**B9**		Swell
B2		Interruption	**B10**		Interruption
B3		Over Current Limit*	**B11**		Reserved
B4	Freq.	Dip	**B12**	Plt.	Dip
B5		Swell	**B13**		Swell
B6		Interruption	**B14**		Interruption

B7		Reserved	B15		Reserved

* 2xIn

Table 5-2 Flagging Status

3) The **Standard Setpoint Status #1 to #8** registers represent the states of Standard Setpoints #1 to #256 while the **HS Setpoint Status** register represents the states of HS Setpoints #1 to #16, with a bit value of 1 meaning active and 0 meaning inactive. **Standard Setpoint Status #9** register is reserved.

Bit	B0	B1	B2	...	B31
Standard Setpoint	Setpoint #1	Setpoint #2	Setpoint #3	...	Setpoint #32

Table 5-3 Standard Setpoint Status #1 (0093)

Bit	B0	B1	B2	...	B31
Standard Setpoint	Setpoint #33	Setpoint #34	Setpoint #35	...	Setpoint #64

Table 5-4 Standard Setpoint Status #2 (0095)

Bit	B0	B1	B2	...	B31
Standard Setpoint	Setpoint #65	Setpoint #66	Setpoint #67	...	Setpoint #96

Table 5-5 Standard Setpoint Status #3 (0097)

Bit	B0	B1	B2	...	B31
Standard Setpoint	Setpoint #97	Setpoint #98	Setpoint #99	...	Setpoint #128

Table 5-6 Standard Setpoint Status #4 (0099)

Bit	B0	B1	B2	...	B31
Standard Setpoint	Setpoint #129	Setpoint #130	Setpoint #131	...	Setpoint #160

Table 5-7 Standard Setpoint Status #5 (0101)

Bit	B0	B1	B2	...	B31
Standard Setpoint	Setpoint #161	Setpoint #162	Setpoint #163	...	Setpoint #192

Table 5-8 Standard Setpoint Status #6 (0103)

Bit	B0	B1	B2	...	B31
Standard Setpoint	Setpoint #193	Setpoint #194	Setpoint #195	...	Setpoint #224

Table 5-9 Standard Setpoint Status #7 (0105)

Bit	B0	B1	B2	...	B31

Standard Setpoint	Setpoint #225	Setpoint #226	Setpoint #227	...	Setpoint #256

Table 5-10 Standard Setpoint Status #8 (0107)

Bit	B0	B1	B2	...	B15	B16~B31
HS Setpoint	HS Setpoint #1	HS Setpoint #2	HS Setpoint #3	...	HS Setpoint #16	Reserved

Table 5-11 High-speed Setpoint Status (0111)

4) For the **DI Status** register, the bit values of B0 to B7 represent the states of DI1 to DI8, respectively, with "1" meaning active (closed) and "0" meaning inactive (open).

Bit	B0	B1	B2	...	B7	B8~B15
DI Status	DI1	DI2	DI3	...	DI8	Reserved

Table 5-12 DI Status

5) For the **RO/DO Status** register, the bit values of B0 to B3 represent the states of RO1 to RO4 while the bit values of B4 to B7 represent the states of DO1 to DO4, respectively, with "1" meaning active (closed) and "0" meaning inactive (open).

Bit	B0	B1	B2	B3	B4	B5	B6	B7	B8~B15
RO/DO Status	RO1	RO2	RO3	RO4	DO1	DO2	DO3	DO4	Reserved

Table 5-13 RO/DO Status

6) The range of the **SOE / PQ Log Pointer** is between 0 and 0xFFFFFFFF. The **SOE / PQ Log Pointer** is incremented by one for every **SOE / PQ log** generated and will roll over to 0 if its current value is 0xFFFFFFFF. Since the **SOE /PQ Log Pointer** is a 32-bit value and the **SOE / PQ Log** capacity is relatively small with only 1024 entries in the PMC-680i, an assumption has been made that the **SOE / PQ Log pointer** will never roll over. If a **Clear SOE / PQ Log** is performed from the front panel or via communications, the **SOE / PQ Log Pointer** will be reset to zero. Therefore, any 3rd party software should assume that a **Clear SOE / PQ Log** action has been performed if it sees the **SOE / PQ Log Pointer** rolling over to zero or to a value that is smaller than its own pointer. In this case, the new **SOE / PQ Log Pointer** also indicates the number of logs in the **SOE / PQ Log** if it is less than 1024. Otherwise, there will always be 1024 entries in the **SOE / PQ Log**.

7) The PMC-680i has 16 Statistical Data Recorder Logs (**SDR Log #1 to 16**). Each **SDR Log** has a pointer that indicates its present logging position. The range of the **SDR Log Pointer** is between 0 and 0xFFFFFFFF. The **SDR Log Pointer** is incremented by one for every **SDR Log** generated and will roll over to 0 if its current value is 0xFFFFFFFF. A value of zero indicates that the device does not contain any **SDR Log**. If a **Clear All SDR Log** is performed via communications, all **SDR Log Pointers** will be reset to zero.

   To determine the latest **SDR Log #X** location (X=1 to 16):

   SDR Log #X latest location = Modulo [**DR Pointer #X / DR #X Depth**]

8) The PMC-680i has 8 **Data Recorder Logs** (**DR Log #1 to 8**). Each **DR Log** has a pointer that indicates its present logging position. The range of the **DR Log Pointer** is between 0 and 0xFFFFFFFF. Since the **DR Log Pointer** is a 32-bit value and the DR Log capacity is relatively small with only 12800 entries (4GB) or 25600 entries (8GB) in the PMC-680i, an assumption has been made that the **DR Log Pointer** will never roll over. The **DR Log Pointer** is incremented by one for every real-time **DR Log** generated and will roll over to 0 if its current value is 0xFFFFFFFF. A value of zero indicates that the device does not contain any **DR Log**. If a **Clear All DR Log** is performed via communications, all **DR Log Pointers** will be reset to zero.

   To determine the latest **DR Log #X** location (X=1 to 8):

   DR Log #X latest log location = Modulo [**DR Log #X Pointer/DR Log #X Depth**]

9) **WFR Log** has a pointer that indicates its present logging position. The range of the **WFR Log Pointer** is between 0 and 0xFFFFFFFF. The **WFR Log Pointer** is incremented by one for every **WFR Log** generated and will roll over to 0 if its current value is 0xFFFFFFFF. A value of zero indicates that the device does not contain any **WFR Log**. The depth of **WFR Log** is 128 entries (4GB) or 256 entries (8GB). Since the **WFR Log Pointers** are 32-bit values, an assumption has been made that these pointers will never roll over. If a **Clear WFR** log is performed via communications, the **WFR Log Pointers** will be reset to zero.

   To determine the latest **WFR Log** location:

   WFR Log latest location = Modulo [**WFR Log Pointer** / **WFR Log Depth**]

10) HS DR Log records high-speed recording of $U_{rms(1/2)}$ and $I_{rms(1/2)}$

5.2 Energy Measurements

Register Address	Property	Description	Format	Unit
0500	RW	kWh Imp.	INT64	wh
0504	RW	kWh Exp.	INT64	wh
0508	RW	kvarh Imp.	INT64	varh
0512	RW	kvarh Exp.	INT64	varh
0516	RW	kVAh Total	INT64	VAh
0520	RO	kWh Net	INT64	wh
0524	RO	kWh Total	INT64	wh
0528	RO	kvarh Net	INT64	varh
0532	RO	kvarh Total	INT64	varh
0536	RO	Reserved	INT64	

Table 5-14 Energy Measurements

5.3 DI Pulse Counter

Register Address	Property	Description	Format	Unit
0650	RW	DI #1 Counter (Bottom Value)	INT32	
0652	RW	DI #2 Counter (Bottom Value)	INT32	
0654	RW	DI #3 Counter (Bottom Value)	INT32	
0656	RW	DI #4 Counter (Bottom Value)	INT32	
0658	RW	DI #5 Counter (Bottom Value)	INT32	
0660	RW	DI #6 Counter (Bottom Value)	INT32	
0662	RW	DI #7 Counter (Bottom Value)	INT32	
0664	RW	DI #8 Counter (Bottom Value)	INT32	
0666~0680		Reserved		

Table 5-15 Pulse Counter

Notes:

1) DI Counter = Pulse Number x DI Pulse Weight
2) The Counter registers have a maximum value of 999,999,999 and will roll over to zero automatically when it is reached. The roll over rule is: [Bottom Value + New Integrated Value- 1,000,000,000]

For example, Bottom Value is 999,999,995, New Integrated Value is 8, and then the value after rolling over is:

999,999,995 + 8 – 1,000,000,000 = 3

5.4 PQ Measurements

Register Address	Property	Description	Format	Unit
0700	RO	Ua Deviation[1]	Float	
0702	RO	Ub Deviation[1]	Float	
0704	RO	Uc Deviation[1]	Float	
0706	RO	Uab Deviation	Float	
0708	RO	Ubc Deviation	Float	
0710	RO	Uca Deviation	Float	
0712	RO	Over Ua Deviation[1]	Float	
0714	RO	Over Ub Deviation[1]	Float	
0716	RO	Over Uc Deviation[1]	Float	
0718	RO	Over Uab Deviation	Float	
0720	RO	Over Ubc Deviation	Float	
0722	RO	Over Uca Deviation	Float	
0724	RO	Under Ua Deviation[1]	Float	
0726	RO	Under Ub Deviation[1]	Float	
0728	RO	Under Uc Deviation[1]	Float	
0730	RO	Under Uab Deviation	Float	
0732	RO	Under Ubc Deviation	Float	
0734	RO	Under Uca Deviation	Float	
0736	RO	Freq. Deviation	Float	Hz
0738	RO	Ua (WYE) / Uab (Delta) Fluctuation	Float	
0740	RO	Ub (WYE) / Ubc (Delta) Fluctuation	Float	
0742	RO	Uc (WYE) / Uca (Delta) Fluctuation	Float	
0744	RO	Ua (WYE) / Uab (Delta) Fluctuation Freq.	Float	
0746	RO	Ub (WYE) / Ubc (Delta) Fluctuation Freq.	Float	

0748	RO	Uc (WYE) / Uca (Delta) Fluctuation Freq.	Float	
0750	RO	U0 Unbal.	Float	
0752	RO	U2 Unbal.	Float	
0754	RO	I0 Unbal.	Float	
0756	RO	I2 Unbal.	Float	
0758	RO	U0	Float	V
0760	RO	U1	Float	V
0762	RO	U2	Float	V
0764	RO	I0	Float	A
0766	RO	I1	Float	A
0768	RO	I2	Float	A
0770	RO	Ua (WYE) / Uab (Delta) Pst.	Float	
0772	RO	Ub (WYE) / Ubc (Delta) Pst.	Float	
0774	RO	Uc (WYE) / Uca (Delta) Pst.	Float	
0776	RO	Ua (WYE) / Uab (Delta) Plt.	Float	
0778	RO	Ub (WYE) / Ubc (Delta) Plt.	Float	
0780	RO	Uc (WYE) / Uca (Delta) Plt.	Float	
0782	RO	Reserved	Float	
0784	RO	Ia TDD (Total Harmonic Demand Deviation)	Float	
0786	RO	Ib TDD	Float	
0788	RO	Ic TDD	Float	
0790	RO	I4 TDD	Float	
0792	RO	I5 TDD	Float	
0794	RO	Ia TDD Odd	Float	
0796	RO	Ib TDD Odd	Float	
0798	RO	Ic TDD Odd	Float	
0800	RO	I4 TDD Odd	Float	

0802	RO	I5 TDD Odd	Float	
0804	RO	Ia TDD Even	Float	
0806	RO	Ib TDD Even	Float	
0808	RO	Ic TDD Even	Float	
0810	RO	I4 TDD Even	Float	
0812	RO	I5 TDD Even	Float	
0814	RO	Ia K-Factor	Float	
0816	RO	Ib K-Factor	Float	
0818	RO	Ic K-Factor	Float	
0820	RO	I4 K-Factor	Float	
0822	RO	I5 K-Factor	Float	
0824	RO	Ia Crest Factor	Float	
0826	RO	Ib Crest Factor	Float	
0828	RO	Ic Crest Factor	Float	
0830	RO	I4 Crest Factor	Float	
0832	RO	I5 Crest Factor	Float	
0834	RO	Ua Crest Factor	Float	
0836	RO	Ub Crest Factor	Float	
0838	RO	Uc Crest Factor	Float	
0840	RO	U4 Crest Factor	Float	
0842	RO	Ua (WYE) / Uab (Delta) MSV #1	Float	V
0844	RO	Ub (WYE) / Ubc (Delta) MSV #1	Float	V
0846	RO	Uc (WYE) / Uca (Delta) MSV #1	Float	V
0848	RO	Ua (WYE) / Uab (Delta) MSV #2	Float	V
0850	RO	Ub (WYE) / Ubc (Delta) MSV #2	Float	V
0852	RO	Uc (WYE) / Uca (Delta) MSV #2	Float	V
0854	RO	Ua (WYE) / Uab (Delta) MSV #3	Float	V

0856	RO	Ub (WYE) / Ubc (Delta) MSV #3	Float	V
0858	RO	Uc (WYE) / Uca (Delta) MSV #3	Float	V

Table 5-16 PQ Measurements

Notes:

1) When the **Wiring Mode** is **Delta**, the per phase line-to-neutral voltage deviations have no meaning, and their registers are reserved
2) Please refer to Section **4.4.9 Voltage Deviation** for a detailed description.
2) Please refer to Section **4.4.1 Power Frequency** for a detailed description.
3) Please refer to Section **4.4.6 Supply Voltage Unbalance** for a detailed description.

5.5 Harmonics & Interharmonic Measurements

5.5.1 Harmonic Distortion Measurements

Register Address	Property	Description	Format	Unit
1000	RO	Ua (WYE) / Uab (Delta) THD	Float	% / x100
1002	RO	Ub (WYE) / Ubc (Delta) THD	Float	% / x100
1004	RO	Uc (WYE) / Uca (Delta) THD	Float	% / x100
1006	RO	U4 THD	Float	% / x100
1008	RO	Ia THD	Float	% / x100
1010	RO	Ib THD	Float	% / x100
1012	RO	Ic THD	Float	% / x100
1014	RO	I4 THD	Float	% / x100
1016	RO	I5 THD	Float	% / x100
1018	RO	Ua (WYE) / Uab (Delta) TOHD	Float	% / x100
1020	RO	Ub (WYE) / Ubc (Delta) TOHD	Float	% / x100
1022	RO	Uc (WYE) / Uca (Delta) TOHD	Float	% / x100
1024	RO	U4 TOHD	Float	% / x100
1026	RO	Ia TOHD	Float	% / x100
1028	RO	Ib TOHD	Float	% / x100
1030	RO	Ic TOHD	Float	% / x100
1032	RO	I4 TOHD	Float	% / x100
1034	RO	I5 TOHD	Float	% / x100

1036	RO	Ua (WYE) / Uab (Delta) TEHD	Float	% / x100
1038	RO	Ub (WYE) / Ubc (Delta) TEHD	Float	% / x100
1040	RO	Uc (WYE) / Uca (Delta) TEHD	Float	% / x100
1042	RO	U4 TEHD	Float	% / x100
1044	RO	Ia TEHD	Float	% / x100
1046	RO	Ib TEHD	Float	% / x100
1048	RO	Ic TEHD	Float	% / x100
1050	RO	I4 TEHD	Float	% / x100
1052	RO	I5 TEHD	Float	% / x100
1054	RO	Ua (WYE) / Uab (Delta) DC Distortion	Float	% / x100
1056	RO	Ub (WYE) / Ubc (Delta) DC Distortion	Float	% / x100
1058	RO	Uc (WYE) / Uca (Delta) DC Distortion	Float	% / x100
1060	RO	U4 DC Distortion	Float	% / x100
1062	RO	Ia DC Distortion	Float	% / x100
1064	RO	Ib DC Distortion	Float	% / x100
1066	RO	Ic DC Distortion	Float	% / x100
1068	RO	I4 DC Distortion	Float	% / x100
1070	RO	I5 DC Distortion	Float	% / x100
1072	RO	Ua (WYE) / Uab (Delta) HD01	Float	% / x100
1074	RO	Ub (WYE) / Ubc (Delta) HD01	Float	% / x100
1076	RO	Uc (WYE) / Uca (Delta) HD01	Float	% / x100
1078	RO	U4 HD01	Float	% / x100
1080	RO	Ia HD01	Float	% / x100
1082	RO	Ib HD01	Float	% / x100
1084	RO	Ic HD01	Float	% / x100
1086	RO	I4 HD01	Float	% / x100
1088	RO	I5 HD01	Float	% / x100

	...	...	...	% / x100
2188	RO	Ua (WYE) / Uab (Delta) HD63	Float	% / x100
2190	RO	Ub (WYE) / Ubc (Delta) HD63	Float	% / x100
2192	RO	Uc (WYE) / Uca (Delta) HD63	Float	% / x100
2194	RO	U4 HD63	Float	% / x100
2196	RO	Ia HD63	Float	% / x100
2198	RO	Ib HD63	Float	% / x100
2200	RO	Ic HD63	Float	% / x100
2202	RO	I4 HD63	Float	% / x100
2204	RO	I5 HD63	Float	% / x100

Table 5-17 Harmonics Measurements

5.5.2 Harmonic Voltage & Current RMS

Register Address	Property	Description	Format	Unit
2300	RO	Ua (WYE) / Uab (Delta) TH* RMS	Float	V
2302	RO	Ub (WYE) / Ubc (Delta) TH* RMS	Float	V
2304	RO	Uc (WYE) / Uca (Delta) TH* RMS	Float	V
2306	RO	U4 TH* RMS	Float	V
2308	RO	Ia TH* RMS	Float	A
2310	RO	Ib TH* RMS	Float	A
2312	RO	Ic TH* RMS	Float	A
2314	RO	I4 TH* RMS	Float	A
2316	RO	I5 TH* RMS	Float	A
2318	RO	Ua (WYE) / Uab (Delta) TOH01 RMS	Float	V
2320	RO	Ub (WYE) / Ubc (Delta) TOH01 RMS	Float	V
2322	RO	Uc (WYE) / Uca (Delta) TOH01 RMS	Float	V
2324	RO	U4 TOH01 RMS	Float	V

2326	RO	Ia TOH01 RMS	Float	A
2328	RO	Ib TOH01 RMS	Float	A
2330	RO	Ic TOH01 RMS	Float	A
2332	RO	I4 TOH01 RMS	Float	A
2334	RO	I5 TOH01 RMS	Float	A
2336	RO	Ua (WYE) / Uab (Delta) TEH01 RMS	Float	V
2338	RO	Ub (WYE) / Ubc (Delta) TEH01 RMS	Float	V
2340	RO	Uc (WYE) / Uca (Delta) TEH01 RMS	Float	V
2342	RO	U4 TEH01 RMS	Float	V
2344	RO	Ia TEH01 RMS	Float	A
2346	RO	Ib TEH01 RMS	Float	A
2348	RO	Ic TEH01 RMS	Float	A
2350	RO	I4 TEH01 RMS	Float	A
2352	RO	I5 TEH01 RMS	Float	A
2354	RO	Ua (WYE) / Uab (Delta) DC RMS	Float	V
2356	RO	Ub (WYE) / Ubc (Delta) DC RMS	Float	V
2358	RO	Uc (WYE) / Uca (Delta) DC RMS	Float	V
2360	RO	U4 DC RMS	Float	V
2362	RO	Ia DC RMS	Float	A
2364	RO	Ib DC RMS	Float	A
2366	RO	Ic DC RMS	Float	A
2368	RO	I4 DC RMS	Float	A
2370	RO	I5 DC RMS	Float	A
2372	RO	Ua (WYE) / Uab (Delta) H01 RMS	Float	V
2374	RO	Ub (WYE) / Ubc (Delta) H01 RMS	Float	V
2376	RO	Uc (WYE) / Uca (Delta) H01 RMS	Float	V
2378	RO	U4 H01 RMS	Float	V

2380	RO	Ia H01 RMS	Float	A
2382	RO	Ib H01 RMS	Float	A
2384	RO	Ic H01 RMS	Float	A
2386	RO	I4 H01 RMS	Float	A
2388	RO	I5 H01 RMS	Float	A
…	RO	…	…	…
3488	RO	Ua (WYE) / Uab (Delta) H63 RMS	Float	V
3490	RO	Ub (WYE) / Ubc (Delta) H63 RMS	Float	V
3492	RO	Uc (WYE) / Uca (Delta) H63 RMS	Float	V
3494	RO	U4 H63 RMS	Float	V
3496	RO	Ia H63 RMS	Float	A
3498	RO	Ib H63 RMS	Float	A
3500	RO	Ic H63 RMS	Float	A
3502	RO	I4 H63 RMS	Float	A
3504	RO	I5 H63 RMS	Float	A

*TH=Total Harmonics

Table 5-18 Harmonics Voltage & Current RMS

5.5.3 Individual Total Harmonic

Register Address	Property	Description	Format	Unit
27000	RO	kW[1] TH01	Float	W
27002	RO	kvar[1] TH01	Float	var
27004	RO	kVA[1] TH01	Float	VA
27006	RO	P.F. TH01	Float	
27008	RO	kW[1] TH02	Float	W
27010	RO	kvar[1] TH02	Float	var
27012	RO	kVA[1] TH02	Float	VA
27014	RO	P.F. TH02	Float	
…		…		

27496	RO	kW[1] TH63	Float	W
27498	RO	kvar[1] TH63	Float	var
27500	RO	kVA[1] TH63	Float	VA
27502	RO	P.F. TH63	Float	

Table 5-19 Individual Total Harmonic

Notes:

1) When the **Wiring Mode** is **Delta**, the per-phase kW/kvar/kVA H01 to H63 have no meaning, and their registers are reserved.

5.5.4 Harmonic Power

Register Address	Property	Description	Format	Unit
28000	RO	kWa[1] TH*	Float	W
28002	RO	kWb[1] TH	Float	W
28004	RO	kWc[1] TH	Float	W
28006	RO	ΣkW TH	Float	W
28008	RO	kvara[1] TH	Float	
28010	RO	kvarb[1] TH	Float	
28012	RO	kvarc[1] TH	Float	
28014	RO	Σkvar TH	Float	
28016	RO	kVAa[1] TH	Float	
28018	RO	kVAb[1] TH	Float	
28020	RO	kVAc[1] TH	Float	
28022	RO	ΣkVA TH	Float	
28024~28028		Reserved	Float	
28030	RO	P.F. TH	Float	
28032~28038		Reserved	Float	
28040	RO	kWa H01	Float	W
28042	RO	kWb H01	Float	W
28044	RO	kWc H01	Float	W

28046	RO	kvara H01	Float	var
28048	RO	kvarb H01	Float	var
28050	RO	kvarc H01	Float	var
28052	RO	kVAa H01	Float	VA
28054	RO	kVAb H01	Float	VA
28056	RO	kVAc H01	Float	VA
28058	RO	P.F.a H01	Float	
28060	RO	P.F.b H01	Float	
28062	RO	P.F.c H01	Float	
…	RO	…	Float	
29528	RO	kWa H63	Float	W
29530	RO	kWb H63	Float	W
29532	…	kWc H63	Float	W
29534	RO	kvara H63	Float	var
29536	RO	kvarb H63	Float	var
29538	RO	kvarc H63	Float	var
29540	RO	kVAa H63	Float	VA
29542	RO	kVAb H63	Float	VA
29544	RO	kVAc H63	Float	VA
29546	RO	P.F.a H63	Float	
29548	RO	P.F.b H63	Float	
29550	RO	P.F.c H63	Float	

*TH=Total Harmonics

Table 5-20 Harmonic Power

Notes:

1) When the **Wiring Mode** is **Delta**, the per-phase kW/kvar/kVA have no meaning, and their registers are reserved.

5.5.5 Harmonic Angles

Register Address	Property	Description	Format	Unit

30000~30016	RO	Reserved	Float	
30018	RO	Ua(WYE) / Uab(Delta) Angle H01	Float	
30020	RO	Ub(WYE) / Ubc(Delta) Angle H01	Float	
30022	RO	Uc(WYE) / Uca(Delta) Angle H01	Float	
30024	RO	U4 Angle H01	Float	
30026	RO	Ia Angle H01	Float	
30028	RO	Ib Angle H01	Float	
30030	RO	Ic Angle H01	Float	
30032	RO	I4 Angle H01	Float	
30034	RO	I5 Angle H01	Float	
…	RO	….	Float	
31134	RO	Ua(WYE) / Uab(Delta) Angle H63	Float	
31136	RO	Ub(WYE) / Ubc(Delta) Angle H63	Float	
31138	RO	Uc(WYE) / Uca(Delta) Angle H63	Float	
31140	RO	U4 Angle H63	Float	
31142	RO	Ia Angle H63	Float	
31144	RO	Ib Angle H63	Float	
31146	RO	Ic Angle H63	Float	
31148	RO	I4 Angle H63	Float	
31150	RO	I5 Angle H63	Float	

Table 5-21 Harmonic Angle

5.5.6 Harmonic Energy

Register Address	Property	Description	Format	Unit
31500	RW	kWh Imp. TH[1]	Int64	wh
31504	RW	kWh Exp. TH[1]	Int64	wh
31508	RW	kavrh Imp. TH[1]	Int64	varh
31512	RW	kvarh Exp. TH[1]	Int64	varh

31516	RO	kWh Net TH	Int64	wh
31520	RO	kWh Total TH	Int64	wh
31524	RO	kvarh Net TH	Int64	varh
31528	RO	kvarh Total TH	Int64	varh
31532				
31600	RW	kWh Imp. H01[1]	Int64	wh
31604	RW	kWh Exp. H01[1]	Int64	wh
31608	RW	kvarh Imp. H01[1]	Int64	varh
31612	RW	kvarh Exp. H01[1]	Int64	varh
31616	RW	kWh Imp. H02[1]	Int64	wh
31620	RW	kWh Exp. H02[1]	Int64	wh
31624	RW	kvarh Imp. H02[1]	Int64	varh
31628	RW	kvarh Exp. H02[1]	Int64	varh
…	RW	…	Int64	
32592	RW	kWh Imp. H63[1]	Int64	wh
32596	RW	kWh Exp. H63[1]	Int64	wh
32600	RW	kvarh Imp. H63[1]	Int64	varh
32604	RW	kvarh Exp. H63[1]	Int64	varh

Table 5-22 Harmonic Energy

Notes:

1) The registers have a maximum value of 99,999,999,999,999 and will roll over to zero automatically when it is reached.

5.5.7 Interharmonics Distortion (IHD) Measurements

Register Address	Property	Description	Format	Unit
33100	RO	Ua / Uab TIHD[1]	Float	%, x100
33102	RO	Ub / Ubc TIHD[1]	Float	%, x100
33104	RO	Uc / Uca TIHD[1]	Float	%, x100
33106	RO	U4 TIHD	Float	%, x100
33108	RO	Ia TIHD	Float	%, x100

33110	RO	Ib TIHD	Float	%, x100
33112	RO	Ic TIHD	Float	%, x100
33114	RO	I4 TIHD	Float	%, x100
33116	RO	I5 TIHD	Float	%, x100
33118	RO	Ua / Uab TOIHD[1]	Float	%, x100
33120	RO	Ub / Ubc TOIHD[1]	Float	%, x100
33122	RO	Uc / Uca TOIHD[1]	Float	%, x100
33124	RO	U4 TOIHD	Float	%, x100
33126	RO	Ia TOIHD	Float	%, x100
33128	RO	Ib TOIHD	Float	%, x100
33130	RO	Ic TOIHD	Float	%, x100
33132	RO	I4 TOIHD	Float	%, x100
33134	RO	I5 TOIHD	Float	%, x100
33136	RO	Ua / Uab TEIHD[1]	Float	%, x100
33138	RO	Ub / Ubc TEIHD[1]	Float	%, x100
33140	RO	Uc / Uca TEIHD[1]	Float	%, x100
33142	RO	U4 TEIHD	Float	%, x100
33144	RO	Ia TEIHD	Float	%, x100
33146	RO	Ib TEIHD	Float	%, x100
33148	RO	Ic TEIHD	Float	%, x100
33150	RO	I4 TEIHD	Float	%, x100
33152	RO	I5 TEIHD	Float	%, x100
33154	RO	Ua / Uab[1] IHD01	Float	%, x100
33156	RO	Ub / Ubc[1] IHD01	Float	%, x100
33158	RO	Uc / Uca[1] IHD01	Float	%, x100
33160	RO	U4 IHD01	Float	%, x100
33162	RO	Ia IHD01	Float	%, x100

33164	RO	Ib IHD01	Float	%, x100
33166	RO	Ic IHD01	Float	%, x100
33168	RO	I4 IHD01	Float	%, x100
33170	RO	I5 IHD01	Float	%, x100
…	…	….	…	
34288	RO	Ua / Uab[1] IHD63	Float	%, x100
34290	RO	Ub / Ubc[1] IHD63	Float	%, x100
34292	RO	Uc / Uca[1] IHD63	Float	%, x100
34294	RO	U4 IHD63	Float	%, x100
34296	RO	Ia IHD63	Float	%, x100
34298	RO	Ib IHD63	Float	%, x100
34300	RO	Ic IHD63	Float	%, x100
34302	RO	I4 IHD63	Float	%, x100
34304	RO	I5 IHD63	Float	%, x100

Table 5-23 Interharmonics Measurements

Notes:

1) The voltage TIHD / TOIHD / TEIHD / 1st to 63rd Interharmonic are phase voltage measurements in WYE mode and they will be automatically changed to line voltage measurements in Delta mode.

5.5.8 Interharmonic Voltage & Current RMS

Register Address	Property	Description	Format	Unit
34500	RO	Ua (WYE) / Uab (Delta) TIH RMS	Float	V
34502	RO	Ub (WYE) / Ubc (Delta) TIH RMS	Float	V
34504	RO	Uc (WYE) / Uca (Delta) TIH RMS	Float	V
34506	RO	U4 TIH RMS	Float	V
34508	RO	Ia TIH RMS	Float	A
34510	RO	Ib TIH RMS	Float	A
34512	RO	Ic TIH RMS	Float	A
34514	RO	I4 TIH RMS	Float	A

34516	RO	I5 TIH RMS	Float	A
34518	RO	Ua (WYE) / Uab (Delta) TOIH RMS	Float	V
34520	RO	Ub (WYE) / Ubc (Delta) TOIH RMS	Float	V
34522	RO	Uc (WYE) / Uca (Delta) TOIH RMS	Float	V
34524	RO	U4 TOIH RMS	Float	V
34526	RO	Ia TOIH RMS	Float	A
34528	RO	Ib TOIH RMS	Float	A
34530	RO	Ic TOIH RMS	Float	A
34532	RO	I4 TOIH RMS	Float	A
34534	RO	I5 TOIH RMS	Float	A
35436	RO	Ua (WYE) / Uab (Delta) TEIH RMS	Float	V
34538	RO	Ub (WYE) / Ubc (Delta) TEIH RMS	Float	V
34540	RO	Uc (WYE) / Uca (Delta) TEIH RMS	Float	V
34542	RO	U4 TEIH RMS	Float	V
34544	RO	Ia TEIH RMS	Float	A
34546	RO	Ib TEIH RMS	Float	A
34548	RO	Ic TEIH RMS	Float	A
34550	RO	I4 TEIH RMS	Float	A
34552	RO	I5 TEIH RMS	Float	A
34554	RO	Ua (WYE) / Uab (Delta) IH00 RMS	Float	V
34556	RO	Ub (WYE) / Ubc (Delta) IH00 RMS	Float	V
34558	RO	Uc (WYE) / Uca (Delta) IH00 RMS	Float	V
34560	RO	U4 IH00 RMS	Float	V
34562	RO	Ia IH00 RMS	Float	A
34564	RO	Ib IH00 RMS	Float	A
34566	RO	Ic IH00 RMS	Float	A
34568	RO	I4 IH00 RMS	Float	A

34570	RO	I5 IH00 RMS	Float	A
34572	RO	Ua (WYE) / Uab (Delta) IH01 RMS	Float	V
34574	RO	Ub (WYE) / Ubc (Delta) IH01 RMS	Float	V
34576	RO	Uc (WYE) / Uca (Delta) IH01 RMS	Float	V
34578	RO	U4 IH01 RMS	Float	V
34580	RO	Ia IH01 RMS	Float	A
34582	RO	Ib IH01 RMS	Float	A
34584	RO	Ic IH01 RMS	Float	A
34586	RO	I4 IH01 RMS	Float	A
34588	RO	I5 IH01 RMS	Float	A
......	RO	...	Float	
35688	RO	Ua (WYE) / Uab (Delta) IH63 RMS	Float	V
35690	RO	Ub (WYE) / Ubc (Delta) IH63 RMS	Float	V
35692	RO	Uc (WYE) / Uca (Delta) IH63 RMS	Float	V
35694	RO	U4 IH63 RMS	Float	V
35696	RO	Ia IH63 RMS	Float	A
35698	RO	Ib IH63 RMS	Float	A
35700	RO	Ic IH63 RMS	Float	A
35702	RO	I4 IH63 RMS	Float	A
35704	RO	I5 IH63 RMS	Float	A

Table 5-24 Interharmonics Voltage & Current RMS

5.6 Demand

5.6.1 Present Demand

Register Address	Property	Description	Format	Unit
3600	RO	Ua[1]	Float	V
3602	RO	Ub[1]	Float	V
3604	RO	Uc[1]	Float	V

3606	RO	ULN Avg	Float	V
3608	RO	U4	Float	V
3610	RO	Uab	Float	V
3612	RO	Ubc	Float	V
3614	RO	Uca	Float	V
3616	RO	ULL Avg.	Float	V
3618	RO	Ia	Float	A
3620	RO	Ib	Float	A
3622	RO	Ic	Float	A
3624	RO	I Avg.	Float	A
3626	RO	I4	Float	A
3628	RO	I5	Float	A
3630	RO	kWa Imp.[1]	Float	W
3632	RO	kWb Imp.[1]	Float	W
3634	RO	kWc Imp.[1]	Float	W
3636	RO	∑kW Imp.	Float	W
3638	RO	kWa Exp.[1]	Float	
3640	RO	kWb Exp.[1]	Float	
3642	RO	kWc Exp.[1]	Float	
3644	RO	∑kW Exp.	Float	
3646	RO	kvara Imp.[1]	Float	var
3648	RO	kvarb Imp.[1]	Float	var
3640	RO	kvarc Imp.[1]	Float	var
3652	RO	∑kvar Imp.	Float	var
3654	RO	kvara Exp.[1]	Float	var
3656	RO	kvarb Exp.[1]	Float	var
3658	RO	kvarc Exp.[1]	Float	var

3660	RO	∑kvar Exp.	Float	var
3662	RO	kVAa[1]	Float	VA
3664	RO	kVAb[1]	Float	VA
3666	RO	kVAc[1]	Float	VA
3668	RO	∑kVA	Float	VA
3670	RO	P.F.a[1]	Float	--
3672	RO	P.F.b[1]	Float	--
3674	RO	P.F.c[1]	Float	--
3676	RO	∑P.F.	Float	--
3678	RO	Freq	Float	Hz
3680	RO	Ua Deviation[1]	Float	100%
3682	RO	Ub Deviation[1]	Float	100%
3684	RO	Uc Deviation[1]	Float	100%
3686	RO	Uab Deviation	Float	100%
3688	RO	Ubc Deviation	Float	100%
3690	RO	Uca Deviation	Float	100%
3692	RO	Ua Over Deviation[1]	Float	100%
3694	RO	Ub Over Deviation[1]	Float	100%
3696	RO	Uc Over Deviation[1]	Float	100%
3698	RO	Uab Over Deviation	Float	100%
3700	RO	Ubc Over Deviation	Float	100%
3702	RO	Uca Over Deviation	Float	100%
3704	RO	Ua Under Deviation[1]	Float	100%
3706	RO	Ub Under Deviation[1]	Float	100%
3708	RO	Uc Under Deviation[1]	Float	100%
3710	RO	Uab Under Deviation	Float	100%
3712	RO	Ubc Under Deviation	Float	100%

3714	RO	Uca Under Deviation	Float	100%
3716	RO	Freq. Deviation	Float	100%
3718	RO	U0 Unbal.	Float	
3720	RO	U2 Unbal.	Float	
3722	RO	I0 Unbal.	Float	
3724	RO	I2 Unbal.	Float	
3726	RO	Ia K-Factor	Float	
3728	RO	Ib K-Factor	Float	
3730	RO	Ic K-Factor	Float	
3732	RO	I4 K-Factor	Float	
3734	RO	I5 K-Factor	Float	
3736	RO	Ua (WYE) / Uab (Delta) THD	Float	
3738	RO	Ub (WYE) / Ubc (Delta) THD	Float	
3740	RO	Uc (WYE) / Uca (Delta) THD	Float	
3742	RO	U4 THD	Float	
3744	RO	Ia THD	Float	
3746	RO	Ib THD	Float	
3748	RO	Ic THD	Float	
3750	RO	I4 THD	Float	
3752	RO	I5 THD	Float	
3754	RO	Ua (WYE) / Uab (Delta) TOHD	Float	
3756	RO	Ub (WYE) / Ubc (Delta) TOHD	Float	
3758	RO	Uc (WYE) / Uca (Delta) TOHD	Float	
3760	RO	U4 TOHD	Float	
3762	RO	Ia TOHD	Float	
3764	RO	Ib TOHD	Float	
3766	RO	Ic TOHD	Float	

3768	RO	I4 TOHD	Float	
3770	RO	I5 TOHD	Float	
3772	RO	Ua (WYE) / Uab (Delta) TEHD	Float	
3774	RO	Ub (WYE) / Ubc (Delta) TEHD	Float	
3776	RO	Uc (WYE) / Uca (Delta) TEHD	Float	
3778	RO	U4 TEHD	Float	
3780	RO	Ia TEHD	Float	
3782	RO	Ib TEHD	Float	
3784	RO	Ic TEHD	Float	
3786	RO	I4 TEHD	Float	
3788	RO	I5 TEHD	Float	
3790	RO	Ia FUND.	Float	A
3792	RO	Ib FUND.	Float	A
3794	RO	Ic FUND.	Float	A
3796	RO	I4 FUND.	Float	A
3798	RO	I5 FUND.	Float	A
3800~3806		Reserved		

Table 5-25 Present Demand

Notes:

1) When the **Wiring Mode** is **Delta**, the phase voltages demand, kWs demand, kvars demand and kVAs demand have no meaning, and their registers are reserved.

5.6.2 Predicted Demand

Register Address	Property	Description	Format	Unit
3900	RO	Ua[1]	Float	V
3902	RO	Ub[1]	Float	V
3904	RO	Uc[1]	Float	V
3906	RO	ULN Avg.	Float	V
3908	RO	U4	Float	V

3910	RO	Uab	Float	V
3912	RO	Ubc	Float	V
3914	RO	Uca	Float	V
3916	RO	ULL Avg.	Float	V
3918	RO	Ia	Float	A
3920	RO	Ib	Float	A
3922	RO	Ic	Float	A
3924	RO	I Avg.	Float	A
3926	RO	I4	Float	A
3928	RO	I5	Float	A
3930	RO	kWa Imp.[1]	Float	W
3932	RO	kWb Imp.[1]	Float	W
3934	RO	kWc Imp.[1]	Float	W
3936	RO	∑kW Imp.	Float	W
3938	RO	kWa Exp.[1]	Float	W
3940	RO	kWb Exp.[1]	Float	W
3942	RO	kWc Exp.[1]	Float	W
3944	RO	∑kW Exp.	Float	W
3946	RO	kvara Imp.[1]	Float	var
3948	RO	kvarb Imp.[1]	Float	var
3940	RO	kvarc Imp.[1]	Float	var
3952	RO	∑kvar Imp.	Float	var
3954	RO	kvara Exp.[1]	Float	var
3956	RO	kvarb Exp.[1]	Float	var
3958	RO	kvarc Exp.[1]	Float	var
3960	RO	∑kvar Exp.	Float	var
3962	RO	kVAa[1]	Float	VA

3964	RO	kVAb[1]	Float	VA
3966	RO	kVAc[1]	Float	VA
3968	RO	∑kVA	Float	VA
3970	RO	P.F.a[1]	Float	--
3972	RO	P.F.b[1]	Float	--
3974	RO	P.F.c[1]	Float	--
3976	RO	∑P.F.	Float	--
3978	RO	Freq	Float	Hz

Table 5-26 Predicted Demand

Notes:

1) When the **Wiring Mode** is **Delta**, the per phase V/kW/kvar/kVA/PF Predicted demand have no meaning, and their registers are reserved.

5.6.3 Max. Value per Demand Period

Register Address	Property	Description	Format	Unit
4100	RO	Ua[1]	See Note 2)	V
4106	RO	Ub[1]		V
4112	RO	Uc[1]		V
4118	RO	ULN avg[1]		V
4124	RO	U4		V
4130	RO	Uab		V
4136	RO	Ubc		V
4142	RO	Uca		V
4148	RO	ULL avg		V
4154	RO	Ia		A
4160	RO	Ib		A
4166	RO	Ic		A
4172	RO	I avg		A
4178	RO	I4		A

4184	RO	I5		A
4190	RO	kWa Imp.[1]		W
4196	RO	kWb Imp.[1]		W
4202	RO	kWb Imp.[1]		W
4208	RO	∑kW Imp.		W
4214	RO	kWa Exp.[1]	Float	W
4220	RO	kWb Exp.[1]	Float	W
4226	RO	kWb Exp.[1]	Float	W
4232	RO	∑kW Exp.	Float	W
4238	RO	kvara Imp.[1]	See Note 2)	var
4244	RO	kvarb Imp.[1]		var
4250	RO	kvarb Imp.[1]		var
4256	RO	∑kvar Imp.		var
4262	RO	kvara Exp.[1]	Float	var
4268	RO	kvarb Exp.[1]	Float	var
4274	RO	kvarb Exp.[1]	Float	var
4280	RO	∑kvar Exp.	Float	var
4286	RO	kVAa[1]	See Note 2)	VA
4292	RO	kVAb[1]		VA
4298	RO	kVAc[1]		VA
4304	RO	∑kVA		VA
4310	RO	P.F.a[1]		
4316	RO	P.F.b[1]		
4322	RO	P.F.c[1]		
4328	RO	∑P.F.		
4334	RO	Freq.		Hz
4340	RO	Ua Deviation		100%

4346	RO	Ub Deviation		100%
4352	RO	Uc Deviation		100%
4358	RO	Uab Deviation		100%
4364	RO	Ubc Deviation		100%
4370	RO	Uca Deviation		100%
4376	RO	Ua Over Deviation		100%
4382	RO	Ub Over Deviation		100%
4388	RO	Uc Over Deviation		100%
4394	RO	Uab Over Deviation		100%
4400	RO	Ubc Over Deviation		100%
4406	RO	Uca Over Deviation		100%
4412	RO	Ua Under Deviation		100%
4418	RO	Ub Under Deviation		100%
4424	RO	Uc Under Deviation		100%
4430	RO	Uab Under Deviation		100%
4436	RO	Ubc Under Deviation		100%
4442	RO	Uca Under Deviation		100%
4448	RO	Freq Deviation		100%
4454	RO	U2 Unbalance		
4460	RO	U0 Unbalance		
4466	RO	I2 Unbalance		
4472	RO	I0 Unbalance		
4478	RO	Ia K Factor		
4484	RO	Ib K Factor		
4490	RO	Ic K Factor		
4496	RO	I4 K Factor		
4502	RO	I5 K Factor		

4508	RO	Ua (WYE) / Uab (Delta) THD		
4514	RO	Ub (WYE) / Ubc (Delta) THD		
4520	RO	Uc (WYE) / Uca (Delta) THD		
4526	RO	U4 THD		
4532	RO	Ia THD		
4538	RO	Ib THD		
4544	RO	Ic THD		
4550	RO	I4 THD		
4556	RO	I5 THD		
4562	RO	Ua (WYE) /Uab (Delta) TOHD		
4568	RO	Ub (WYE) / Ubc (Delta) TOHD		
4574	RO	Uc (WYE) / Uca (Delta) TOHD		
4580	RO	U4 TOHD		
4586	RO	Ia TOHD		
4592	RO	Ib TOHD		
4598	RO	Ic TOHD		
4604	RO	I4 TOHD		
4610	RO	I5 TOHD		
4616	RO	Ua (WYE) /Uab (Delta) TEHD		
4622	RO	Ub (WYE) / Ubc (Delta) TEHD		
4628	RO	Uc (WYE) / Uca (Delta) TEHD		
4634	RO	U4 TEHD		
4640	RO	Ia TEHD		
4646	RO	Ib TEHD		
4652	RO	Ic TEHD		
4658	RO	I4 TEHD		
4664	RO	I5 TEHD		

4670	RO	Ia H01		A
4676	RO	Ib H01		A
4682	RO	Ic H01		A
4688	RO	I4 H01		A
4694	RO	I5 H01		A
4700~4718	RO	Reserved		

Table 5-27 Peak Demand

Notes:

1) When the **Wiring Mode** is **Delta**, the per phase U/kW/kvar/kVA demand have no meaning, and their registers are reserved.
2) The following table illustrates Demand Data Structure:

Offset		Description
+0	High	Year (-2000)
	Low	Month
+1	High	Day
	Low	Hour
+2	High	Minute
	Low	Second
+3	-	Reserved
+4 ~ +5	-	Record Value

Table 5-28 Demand Data Structure

5.6.4 Min. Value per Demand Period

Register Address	Property	Description	Format	Unit
4800	RO	Ua[1]	See Note 2)	V
4806	RO	Ub[1]		V
4812	RO	Uc[1]		V
4818	RO	ULN avg[1]		V
4824	RO	U4		V
4830	RO	Uab		V

4836	RO	Ubc		V
4842	RO	Uca		V
4848	RO	ULL avg		V
4854	RO	Ia		A
4860	RO	Ib		A
4866	RO	Ic		A
4872	RO	I avg		A
4878	RO	I4		A
4884	RO	I5		A
4890	RO	kWa Imp.[1]		W
4896	RO	kWb Imp.[1]		W
4902	RO	kWb Imp.[1]		W
4908	RO	∑kW Imp.		W
4914	RO	kWa Exp.[1]	Float	W
4920	RO	kWb Exp.[1]	Float	W
4926	RO	kWb Exp.[1]	Float	W
4932	RO	∑kW Exp.	Float	W
4938	RO	kvara Imp.[1]		var
4944	RO	kvarb Imp.[1]	See	var
4950	RO	kvarb Imp.[1]	Note 2)	var
4956	RO	∑kvar Imp.		var
4962	RO	kvara Exp.[1]	Float	var
4968	RO	kvarb Exp.[1]	Float	var
4974	RO	kvarb Exp.[1]	Float	var
4980	RO	∑kvar Exp.	Float	var
4986	RO	kVAa[1]	See	VA
4992	RO	kVAb[1]	Note 2)	VA

4298	RO	kVAc1		VA
5004	RO	∑kVA		VA
5010	RO	P.F.a1		
5016	RO	P.F.b1		
5022	RO	P.F.c1		
5028	RO	∑P.F.		
5034	RO	Freq.		Hz
5040	RO	Ua Deviation		100%
5046	RO	Ub Deviation		100%
5052	RO	Uc Deviation		100%
5058	RO	Uab Deviation		100%
5064	RO	Ubc Deviation		100%
5070	RO	Uca Deviation		100%
5076	RO	Ua Over Deviation		100%
5082	RO	Ub Over Deviation		100%
5088	RO	Uc Over Deviation		100%
5094	RO	Uab Over Deviation		100%
5100	RO	Ubc Over Deviation		100%
5106	RO	Uca Over Deviation		100%
5112	RO	Ua Under Deviation		100%
5118	RO	Ub Under Deviation		100%
5124	RO	Uc Under Deviation		100%
5130	RO	Uab Under Deviation		100%
5136	RO	Ubc Under Deviation		100%
5142	RO	Uca Under Deviation		100%
5148	RO	Freq Deviation		100%
5154	RO	U2 Unbalance		

5160	RO	U0 Unbalance		
5166	RO	I2 Unbalance		
5172	RO	I0 Unbalance		
5178	RO	Ia K Factor		
5184	RO	Ib K Factor		
5190	RO	Ic K Factor		
5196	RO	I4 K Factor		
5202	RO	I5 K Factor		
5208	RO	Ua (WYE) / Uab (Delta) THD		
5214	RO	Ub (WYE) / Ubc (Delta) THD		
5220	RO	Uc (WYE) / Uca (Delta) THD		
5226	RO	U4 THD		
5232	RO	Ia THD		
5238	RO	Ib THD		
5244	RO	Ic THD		
5250	RO	I4 THD		
5256	RO	I5 THD		
5262	RO	Ua (WYE) /Uab (Delta) TOHD		
5268	RO	Ub (WYE) / Ubc (Delta) TOHD		
5274	RO	Uc (WYE) / Uca (Delta) TOHD		
5280	RO	U4 TOHD		
5286	RO	Ia TOHD		
5292	RO	Ib TOHD		
5298	RO	Ic TOHD		
5304	RO	I4 TOHD		
5310	RO	I5 TOHD		
5316	RO	Ua (WYE) /Uab (Delta) TEHD		

5322	RO	Ub (WYE) / Ubc (Delta) TEHD		
5328	RO	Uc (WYE) / Uca (Delta) TEHD		
5334	RO	U4 TEHD		
5340	RO	Ia TEHD		
5346	RO	Ib TEHD		
5352	RO	Ic TEHD		
5358	RO	I4 TEHD		
5364	RO	I5 TEHD		
5370	RO	Ia H01		A
5376	RO	Ib H01		A
5382	RO	Ic H01		A
5388	RO	I4 H01		A
5394	RO	I5 H01		A
5400	RO	Reserved		

Table 5-29 Min. Demand

Notes:

1) When the **Wiring Mode** is **Delta**, the per phase U/kW/kvar/kVA demand have no meaning, and their registers are reserved.
2) The following table illustrates Demand Data Structure:

Offset		Description
+0	High	Year (-2000)
	Low	Month
+1	High	Day
	Low	Hour
+2	High	Minute
	Low	Second
+3	-	Reserved
+4 ~ +5	-	Record Value

Table 5-30 Demand Data Structure

5.6.5 Present Max.

Register	Property	Description	Format	Unit
5500	RO	∑kW Imp.	See **Note 1)**	W
5506	RO	∑kW Exp.		W
5512	RO	∑kvar Imp.		var
5518	RO	∑kvar Exp.		var
5524	RO	∑kVA		VA
5530	RO	Ia		A
5536	RO	Ib		A
5542	RO	Ic		A
5548	RO	Ia H01		
5554	RO	Ib H01		
5560	RO	IC H01		
5566	RO	I4 H01		
5572	RO	I5 H01		

Table 5-31 Present Max. Demand

Notes:

1) The following table illustrates Demand Data Structure:

Offset		Description
+0	High	Year (-2000)
	Low	Month
+1	High	Day
	Low	Hour
+2	High	Minute
	Low	Second
+3	-	Reserved
+4~+5	-	Record Value

Table 5-32 Demand Data Structure

5.6.6 Max. of Last Time

Register	Property	Description	Format	Unit
5700	RO	∑kW Imp.	See **Note 1)**	W
5706	RO	∑kW Exp.		W
5712	RO	∑kvar Imp.		var
5718	RO	∑kvar Exp.		var
5724	RO	∑kVA		VA
5730	RO	Ia		A
5736	RO	Ib		A
5742	RO	Ic		A
5748	RO	Ia H01		
5754	RO	Ib H01		
5760	RO	Ic H01		
5766	RO	I4 H01		
5772	RO	I5 H01		

Table 5-33 Max. Demand of Last Time

Notes:

1) The following table illustrates Demand Data Structure:

Offset		Description
+0	High	Year (-2000)
	Low	Month
+1	High	Day
	Low	Hour
+2	High	Minute
	Low	Second
+3	-	Reserved
+4 ~ +5	-	Record Value

Table 5-34 Demand Data Structure

5.7 Log Register

5.7.1 SOE Log Buffer

Register Address	Property	Description	Format
10000	RW	SOE Log Pointer n*	UINT32
10002~10037	RO	SOE Log Event @ Pointer n	See Table 5-36 SOE Log Data Structure
10038~10073	RO	SOE Log Event @ Pointer n+1	
…		…	
10326~10361	RO	SOE Log Event @ Pointer n+9	

* Writing n to the SOE Log Pointer register will update the SOE Log Buffer with SOE Log Events from pointer positions from n to n+9.

Table 5-35 SOE Log Buffer

Note:

1) The PMC-680i's **SOE Log** can store up to 1024 events with the 4GB option (2048 events with the 8GB option). If there are more than 1024/2048 events, the newest event will replace the oldest event on a FIFO basis.

Offset	Property	Description	Format	Unit
+0	RO	High-order Byte: Event Classification	UINT16	-
	RO	Low-order Byte: Sub-Classification		
+1	RO	Record Time: Year	UINT16	0-99 (Year-2000)
	RO	Record Time: Month		1 to 12
+2	RO	Record Time: Day	UINT16	1 to 31
	RO	Record Time: Hour		0 to 23
+3	RO	Record Time: Minute	UINT16	0 to 59
	RO	Record Time: Second		0 to 59
+4	RO	Record Time: Millisecond	UINT16	0 to 999
+5	RO	Reserved		
+6 to +35	RO	Event Values	See Appendix B	-

Table 5-36 SOE Log Data Structure

5.7.2 PQ Log Buffer

Register Address	Property	Description	Format
10500	RW	PQ log Pointer n*	UINT32
10502~10537	RO	PQ Log Event @ Pointer n	See

10538~10573	RO	PQ Log Event @ Pointer n+1	Table 5-38 PQ Log Data Structure
…		…	
10826~10861	RO	PQ Log Event @ Pointer n+9	

* Writing n to the PQ Log Pointer register will update the PQ Log Buffer with PQ Log Events at pointer positions from n to n+9.

Table 5-37 PQ Log Buffer

Note:

1) The PMC-680i's **PQ Log** can store up to 1024 events with the 4GB option (2048 events with the 8GB option). If there are more than 1024/2048 events, the latest event will replace the oldest event on a FIFO basis.

Offset	Property	Description	Format	Unit
+0	RO	High-order Byte: Event Classification	UINT16	-
	RO	Low-order Byte: Sub-Classification		
+1	RO	Record Time: Year	UINT16	0-99 (Year-2000)
	RO	Record Time: Month		1 to 12
+2	RO	Record Time: Day	UINT16	1 to 31
	RO	Record Time: Hour		0 to 23
+3	RO	Record Time: Minute	UINT16	0 to 59
	RO	Record Time: Second		0 to 59
+4	RO	Record Time: Millisecond	UINT16	0 to 999
+5	RO	Reserved		
+6 to +35	RO	Event Values	See Appendix B	-

Table 5-38 PQ Log Data Structure

5.7.3 SDR Log

5.7.3.1 SDR Log Buffer

Register Address	Property	Description	Format	Unit
11000~11518	RO	SDR Log #1 Buffer	See Section 5.7.3.2 SDR Log Buffer Structure	-
11600~12118	RO	SDR Log #2 Buffer		-
12200~12718	RO	SDR Log #3 Buffer		-
12800~13318	RO	SDR Log #4 Buffer		-
13400~13918	RO	SDR Log #5 Buffer		-

14000~14518	RO	SDR Log #6 Buffer		-
14600~15118	RO	SDR Log #7 Buffer		-
15200~15718	RO	SDR Log #8 Buffer		-
15800~16318	RO	SDR Log # 9 Buffer		-
16400~16918	RO	SDR Log #10 Buffer		-
17000~17518	RO	SDR Log #11 Buffer		-
17600~18118	RO	SDR Log #12 Buffer		-
18200~18718	RO	SDR Log #13 Buffer		-
18800~19318	RO	SDR Log #14 Buffer		-
19400~19918	RO	SDR Log #15 Buffer		-
20000~20518	RO	SDR Log #16 Buffer		-

Table 5-39 SDR Log Buffer

5.7.3.2 SDR Log Buffer Structure

Offset	Property	Description	Format	Unit
+0	RW	SDR Log X Pointer n*	UINT32	--
+2~+4	RO	End Time of the Record [2]	Bitmap	--
+5	RO	Flagging Status	UINT16	0 = No Flag 1 = Flagged & Eliminated 2 = Flagged & Not Eliminated
+6~+13	RO	Data Item #1	See Section 5.7.3.3 SDR Data Item Structure	--
+14~+22	RO	Data Item #2		
…		…		
+510~+517	RO	Data Item #64		

* Writing n to the SDR Log X Pointer register will update the SDR Log X Buffer with the SDR Log X Record at pointer position n.

Table 5-40 SDR Log Buffer Structure

Notes:

1) The data items can be configured as any real-time data. Please see **Appendix A**.
2) Record Time data structure

Offset	Property	Description	Format	Unit

+0	RO	Year	UINT16	0-99 (Year-2000)
	RO	Month		1 to 12
+1	RO	Day	UINT16	1 to 31
	RO	Hour		0 to 23
+2	RO	Minute	UINT16	0 to 59
	RO	Second		0 to 59

Table 5-41 Record Time Data Structure

5.7.3.3 SDR Data Item Structure

Offset	Property	Description
+0	RO	Maximum
+2	RO	Minimum
+4	RO	Avg.
+6	RO	CP95

Table 5-42 SDR Data Item Structure

Notes:

1) The specific data formats of Max., Min., AVG and CP95 are defined by the section 5.9.13 SDR Setup. For example, the Parameter#1 number is set to 10001, the statistical records data item # 1's data type is automatically updated to 6, represents a 32-bit floating-point numbers.

5.7.4 DR (Data Recorder) Log

5.7.4.1 Standard DR Log Buffer

Register Address	Property	Description	Format	Unit
20600~20671	RO	DR Log #1 Buffer	See Section 5.7.4.2 Standard DR Log Buffer Structure	-
20700~20771	RO	DR Log #2 Buffer		-
20800~20871	RO	DR Log #3 Buffer		-
20900~20971	RO	DR Log #4 Buffer		-
21000~21071	RO	DR Log #5 Buffer		-
21100~21171	RO	DR Log #6 Buffer		-
21200~21271	RO	DR Log #7 Buffer		-
21300~21371	RO	DR Log #8 Buffer		-

Table 5-43 DR Log Buffer

5.7.4.2 Standard DR Log Buffer Structure

Offset	Property	Description	Format
+0	RW	DR Log X Pointer (n)*	UINT32
+2~+4	RO	Record Time[2]	Bitmap
+5	RO	Millisecond	UINT32
+6	RO	Flagging Status[3]	UINT32
+7		Data Item #1	Bitmap
…		…	
+69	RO	Data Item #32	

* Writing n to the DR Log X Pointer register will update the DR Log X Buffer with the DR Log X Record at pointer position n.

Table 5-44 DR Data Buffer Structure

Notes:

1) The data items can be configured as any real-time data. Please see **Appendix A**.
2) Record Time data structure

Offset	Property	Description	Format	Unit
+0	RO	Year	UINT16	0-99 (Year-2000)
	RO	Month		1 to 12
+1	RO	Day	UINT16	1 to 31
	RO	Hour		0 to 23
+2	RO	Minute	UINT16	0 to 59
	RO	Second		0 to 59

Table 5-45 Record Time Data Structure

3) The following table illustrates Flagging Status:

Offset	Description		Offset	Description	
Bit0	Basic Realtime Measurement	Dip	Bit8	Pst	Dip
Bit1		Swell	Bit9		Swell
Bit2		Interruption	Bit10		Interruption
Bit3		Current	Bit11		Reserved

Bit4	Freq.	Dip	Bit12	Plt	Dip
Bit5		Swell	Bit13		Swell
Bit6		Interruption	Bit14		Interruption
Bit7		Reserved	Bit15		Reserved

Table 5-46 Flagging Status

5.7.4.3 High-speed (HS) DR Log Buffer

Register Address	Property	Description	Format
21400~21439	RO	HS DR Log #1 Buffer	See Section 5.7.4.4 HS DR Log Buffer Structure
21500~21539	RO	HS DR Log #2 Buffer	
21600~21639	RO	HS DR Log #3 Buffer	
21700~21739	RO	HS DR Log #4 Buffer	

Table 5-47 HS DR Log Buffer

5.7.4.4 HS DR Log Buffer Structure

Offset	Property	Description	Format
+0	RW	HS DR Log X Pointer (n)*	UINT32
+2~+4	RO	Record Time[2]	Bitmap
+5	RO	Millisecond	UINT32
+6	RO	Flagging Status[3]	UINT32
+7	RO	Data Item #1	Bitmap
…		…	
+37	RO	Data Item #16	

* Writing n to the DR Log X Pointer register will update the DR Log X Buffer with the DR Log X Record at pointer position n.

Table 5-48 HS DR Log Buffer Structure

Notes:

1) The data items can be configured as any real-time data. Please see **Appendix A**.
2) Record Time data structure:

Offset	Property	Description	Format	Unit
+0	RO	Year	UINT16	0-99 (Year-2000)
	RO	Month		1 to 12

+1	RO	Day	UINT16	1 to 31
	RO	Hour		0 to 23
+2	RO	Minute	UINT16	0 to 59
	RO	Second		0 to 59

Table 5-49 Record Time Data Structure

3) The following table illustrates Flagging Status:

Offset	Description		Offset	Description	
Bit0	Basic Realtime Measurement	Dip	Bit8	Pst	Dip
Bit1		Swell	Bit9		Swell
Bit2		Interruption	Bit10		Interruption
Bit3		Current	Bit11		Reserved
Bit4	Freq.	Dip	Bit12	Plt	Dip
Bit5		Swell	Bit13		Swell
Bit6		Interruption	Bit14		Interruption
Bit7		Reserved	Bit15		Reserved

Table 5-50 Flagging Status

5.7.5 MM Log (Max./Min. Log)

5.7.5.1 MM Log Buffer

Register Address	Property	Description	Format
22200-22306	RW	Max. Log #1 Buffer	See Section 5.7.5.2 MM Log Buffer Structure
22350~22456	RW	Max. Log #2 Buffer	
22500~22606	RW	Max. Log #3 Buffer	
22650~22756	RW	Max. Log #4 Buffer	
22800~22906	RW	Min. Log #1 Buffer	
22950~23056	RW	Min. Log #2 Buffer	
23100~23206	RW	Min. Log #3 Buffer	
23250~23356	RW	Min. Log #4 Buffer	

Table 5-51 MM Log Buffer

5.7.5.2 MM Log Buffer Structure

Offset Address	Property	Description	Format	Range/Options
+0	RW	MM Log X Pointer (n)	UINT32	0 = Since Last Reset/This Month 1 = Before Last Reset/Last Month
+2	RO	Record Time	Bitmap	
+5	RO	Flagging Status		0 = No Flag 1 = Flagged & Eliminated 2 = Flagged & Not Eliminated
+6~+10		Data Item #1	See Section 5.7.5.3 MM Data Item Data Structure	
+11~+15	RO	Data Item #2		
…		…		
+101~+105	RO	Data Item #20		

* Writing n to the MM Log X Pointer register will update the MM Log X Buffer with the MM Log X Record at pointer position n.

Table 5-52 Max./Min. Log Data Structure

5.7.5.3 MM Data Item Data Structure

Offset	Property	Description		
+0	RO	Record Time	Hi	Year (-2000)
			Low	Month
+1	RO		Hi	Day
			Low	Hour
+2	RO		Hi	Minute
			Low	Second
+3~+4	RO	Max. or Min. Value		

Table5-53 MM Data Item Data Structure

Notes:

1) The formats of data Items are defined in Appendix A. For example, the Parameter#1 number is set to 10001, the statistical records data item # 1's data type (register address 35800) is automatically updated to 6, represents a 32-bit floating-point numbers.

5.7.6 Pst/Plt Log

5.7.6.1 Pst Log Buffer

Register Address	Property	Description	Format

23400	RW	Pst Log Pointer (n)*	UINT32
23402~23411	RO	Log n	See Section 5.7.6.3 Pst / Plt Log Data Structure
23412~23421	RO	Log n+1	
…		…	
23492~23501	RO	Log n+9	

* Writing n to the Pst Log Pointer register will update the Pst Log Buffer with Pst Log Records at pointer positions from n to n+9.

Table 5-54 Pst Log Buffer

5.7.6.2 Plt Log Buffer

Register Address	Property	Description	Format
23600	RW	Plt Log Pointer	UINT32
23602~23611	RO	Log n	See Section 5.7.6.3 Pst / Plt Log Data Structure
23612~23621	RO	Log n+1	
…		…	
23692~23701	RO	Log n+9	

* Writing n to the Plt Log Pointer register will update the Plt Log Buffer with Plt Log Records at pointer positions from n to n+9.

Table 5-55 Plt Log

5.7.6.3 Pst/Plt Log Data Structure

Offset	Property	Description	Format	Unit
+0~+2	RO	Record Time	Bitmap	--
+3	RO	Flagging Status	UINT16	
+4~+5	RO	Ua Pst/Plt	Float	V
+6~+7	RO	Ub Pst/Plt	Float	V
+8~+9	RO	Uc Pst/Plt	Float	V

Table 5-56 Pst/Plt Log Data Structure

Notes:

1) The following table illustrates Flagging Status:

Offset	Description		Offset	Description	
Bit0		Dip	Bit8	Pst	Dip

Bit1	Basic Realtime Measurement	Swell	Bit9		Swell
Bit2		Interruption	Bit10		Interruption
Bit3		Current	Bit11		Reserved
Bit4	Freq.	Dip	Bit12	Plt	Dip
Bit5		Swell	Bit13		Swell
Bit6		Interruption	Bit14		Interruption
Bit7		Reserved	Bit15		Reserved

Table 5-57 Flagging Status

5.7.7 IER (Interval Energy Recorder) Log

5.7.7.1 IER Log Buffer

Register Address	Property	Description	Format
23800	RW	IER Log Pointer (n)*	UINT32
23802~23875	RO	IER Log n	See Section 5.7.7.2 IER Log Buffer Structure
23876~23949	RO	IER Log n+1	
23950~24023	RO	IER Log n+2	
24024~24097	RO	IER Log n+3	

* Writing n to the IER Pointer register will update the IE Log Buffer with IER at pointer positions from n to n+3.

Table 5-58 IER Log Buffer

5.7.7.2 IER Log Buffer Structure

Offset	Property	Description	Format	Note
+0~+2	RO	Start Time	UINT32	
+3~+5	RO	End Time	UINT32	
+6~+9	RO	Data Item1	Int64	
+10~+13	RO	Data Item2	Int64	
+14~+17	RO	Data Item3	Int64	
+18~+21	RO	Data Item4	Int64	
+22~+25	RO	Data Item5	Int64	
+26~+29	RO	Data Item6	Int64	

+30~+33	RO	Data Item7	Int64	
+34~+37	RO	Data Item8	Int64	
+38~+41	RO	Data Item9	Int64	
+42~+45	RO	Data Item10	Int64	
+46~+49	RO	Data Item11	Int64	
+50~+53	RO	Data Item12	Int64	
+54~+57	RO	Data Item13	Int64	
+58~+61	RO	Data Item14	Int64	
+62~+65	RO	Data Item15	Int64	

*TH=Total Harmonic

Table 5-59 IER Data Buffer Structure

5.7.8 EN50160 Log

Register Address	Property	Description	Format	Note
24200	RW	EN50160 Log Pointer (n)	UINT32	
24202	RO	Start Time	UINT32	
24205	RO	End Time	UINT32	
24208	RO	Flagging Status	UINT32	
24210	RO	Freq. Conclusion	UINT32	0=Pass, 1=Failed
24212	RO	Freq N Valid	UINT32	Number of valid intervals
24214	RO	Freq N Invalid	UINT32	Number of invalid intervals
24216	RO	Freq Wide Conclusion	UINT32	0=Pass, 1=Failed
24218	RO	Freq N2	UINT32	Number of valid intervals in which the freq deviates from the nominal by more than user defined wide limit
24220	RO	Freq (1 - N2/N)	Float	
24222	RO	Freq Narrow Conclusion	UINT32	0=Pass, 1=Failed
24224	RO	Freq N1	UINT32	Number of valid intervals in which the freq deviates from the nominal by more than user defined narrow limit

24226	RO	Freq (1 - N1/N)	Float	
24228	RO	Freq Max.	UINT32	Hz, on OP - Observation Period, a week by default
24230	RO	Freq Min.	UINT32	Hz
24232	RO	U Magnitude Conclusion	UINT32	0=Pass, 1=Failed
24234	RO	U Mag N Valid	UINT32	--
24236	RO	U Mag Invalid N	UINT32	--
24238	RO	U Mag Wide Conclusion	UINT32	Note 1
24240	RO	Ua Mag N2	UINT32	Number of valid intervals in which the voltage on 3-phase deviates from nominal by more than user defined wide limit
24242	RO	Ub Mag N2	UINT32	
24244	RO	Uc Mag N2	UINT32	
24246	RO	Ua Mag (1 - N2/N)	Float	--
24248	RO	Ub Mag (1 - N2/N)	Float	--
24250	RO	Uc Mag (1 - N2/N)	Float	--
24252	RO	U Mag Narrow Conclusion	UINT32	0=Pass, 1=Failed
24254	RO	Ua Mag N1	UINT32	Number of valid intervals in which the voltage on 3-phase deviates from nominal by more than user defined narrow limit
24256	RO	Ub Mag N1	UINT32	
24258	RO	Uc Mag N1	UINT32	
24260	RO	Ua Mag (1 - N1/N)	Float	--
24262	RO	Ub Mag (1 - N1/N)	Float	
24264	RO	Uc Mag (1 - N1/N)	Float	--
24266	RO	Ua mean Max.	Float	Max. of average voltage Ua/Ub/Uc over 1 week
24268	RO	Ub mean Max.	Float	
24270	RO	Uc mean Max.	Float	
24272	RO	Ua mean Min.	Float	Min. of average voltage Ua/Ub/Uc over 1 week
24274	RO	Ub mean Min.	Float	
24276	RO	Uc mean Min.	Float	

24278	RO	Flicker Conclusion	UINT32	0=Pass, 1=Failed
24280	RO	Plt N Valid	UINT32	--
24282	RO	Plt N invalid	UINT32	--
24284	RO	Ua Plt N1	UINT32	Number of valid intervals in which Plt on 3-phase is greater than 1
24286	RO	Ub Plt N1	UINT32	
24288	RO	Uc Plt N1	UINT32	
24290	RO	Ua (1 - N1/N)	Float	
24292	RO	Ub (1 - N1/N)	Float	
24294	RO	Uc (1 - N1/N)	Float	
24296	RO	Ua Plt Max.	Float	Maximum Plt value for 3-phase over 1 week
24298	RO	Ub Plt Max.	Float	
24300	RO	Uc Plt Max.	Float	
24302	RO	Ua Plt Min.	Float	Minimum Plt value for 3-phase over 1 week
24304	RO	Ub Plt Min.	Float	
24306	RO	Uc Plt Min.	Float	
24308	RO	Ua Plt CP95	Float	CP95 of Plt value for 3-phase over 1 week
24300	RO	Ub Plt CP95	Float	
24312	RO	Uc Plt CP95	Float	
24314	RO	U Unbalance Conclusion	UINT32	0=Pass, 1=Failed
24316	RO	U Unbalance N valid	UINT32	
24318	RO	U Unbalance N invalid	UINT32	
24320	RO	U Unbalance N1	UINT32	Number of valid intervals in which the voltage unbalance exceeds user defined unbalance limit value
24322	RO	U Unbalance (1 - N1/N)	Float	
24324	RO	U Unbalance Max.	Float	Maximum/Minimum/CP95 voltage unbalance value over 1 week
24326	RO	U Unbalance Min.	Float	
24328	RO	U Unbalance CP95	Float	

24320	RO	Harmonic Conclusion	UINT32	0=Pass, 1=Failed
24332	RO	Harmonic N Valid	UINT32	
24334	RO	Harmonic N Invalid	UINT32	
24336	RO	THD Conclusion	UINT32	0=Pass, 1=Failed
24338	RO	Ua THD N1	UINT32	Number of intervals in which theTHD on3- phase exceed user defined limits
24340	RO	Ub THD N1	UINT32	
24342	RO	Uc THD N1	UINT32	
24344	…	Ua THD (1 - N1/N)	Float	
24346	RO	Ub THD (1 - N1/N)	Float	
24348	RO	Uc THD (1 - N1/N)	Float	
24350~24376	RO	Reserved	UINT32	
24378	RO	H02 Conclusion	UINT32	0=Pass, 1=Failed
24380	RO	Ua H02 N1	UINT32	
24382	RO	Ub H02 N1	UINT32	
24384	RO	Uc H02 N1	UINT32	
24386	RO	Ua H02 (1 - N1/N)	Float	
24388	RO	Ub H02 (1 - N1/N)	Float	
24400	RO	Uc H02 (1 - N1/N)	Float	
	RO	……	UINT32	
24700	RO	H25 Conclusion	UINT32	
24702	RO	Ua H25 N1	UINT32	
24704	RO	Ub H25 N1	UINT32	
24706	RO	Uc H25 N1	UINT32	
24708	RO	Ua H25 (1 - N1/N)	Float	
24710	RO	Ub H25 (1 - N1/N)	Float	
24712	RO	Uc H25 (1 - N1/N)	Float	
24714	RO	Ua THD Max.	Float	

24716	RO	Ub THD Max.	Float	
24718	RO	Uc THD Max.	Float	
24720	RO	Ua THD Min.	Float	
24722	RO	Ub THD Min.	Float	
24724	RO	Uc THD Min.	Float	
24726	…	Ua THD CP95	Float	
24728	RO	Ub THD CP95	Float	
24730	RO	Uc THD CP95	Float	
24732	RO	Ua THD Avg	Float	
24734	RO	Ub THD Avg	Float	
24736	RO	Uc THD Avg	Float	
24738~24748	RO	Reserved	Float	
24750	RO	Ua H02 Max.	Float	
24752	RO	Ub H02 Max.	Float	
24754	RO	Uc H02 Max.	Float	
	RO	……	Float	
24888	RO	Ua H25 Max.	Float	
24890	RO	Ub H25 Max.	Float	
24892	RO	Uc H25 Max.	Float	
24894~24904	RO	Reserved	Float	
24906	RO	Ua H02 Min.	Float	
24908	RO	Ub H02 Min.	Float	
24910	RO	Uc H02 Min.	Float	
	RO	……	Float	
25044	RO	Ua H25 Min.	Float	
25046	RO	Ub H25 Min.	Float	
25048	RO	Uc H25 Min.	Float	

25050~25054	RO	Reserved	Float	
25056	RO	Ua H02 CP95	Float	
25058	RO	Ub H02 CP95	Float	
25060	RO	Uc H02 CP95	Float	
	RO	……	Float	
25200	RO	Ua H25 CP95	Float	
25202	RO	Ub H25 CP95	Float	
25204	RO	Uc H25 CP95	Float	
25206~25216	RO	Reserved	Float	
25218	RO	Ua H02 Avg	Float	
25220	RO	Uc H02 Avg	Float	
25222	RO	Uc H02 Avg	Float	
	RO	……	Float	
25356	RO	Ua H25 Avg	Float	
25358	RO	Uc H25 Avg	Float	
25360	RO	Uc H25 Avg	UINT32	
25362	RO	Interharmonics N Valid	UINT32	
25364	RO	Interharmonics N Invalid	Float	
25366	RO	Ua TIHD Max.	Float	
25368	RO	Ub TIHD Max.	Float	
25370	RO	Uc TIHD Max.	Float	
25372	RO	Ua TIHD Min.	Float	
25374	RO	Ub TIHD Min.	Float	
25376	RO	Uc TIHD Min.	Float	
25378	RO	Ua TIHD CP95	Float	
25380	RO	Ub TIHD CP95	Float	
25382	RO	Uc TIHD CP95	Float	

25384	RO	Ua TIHD Avg	Float	
25386	RO	Ub TIHD Avg	Float	
25388	RO	Uc TIHD Avg	Float	
25390~25394	RO	Reserved	Float	
25396	RO	Ua IH01 Max.	Float	
25398	RO	Ub IH01 Max.	Float	
25400	RO	Uc IH01 Max.	Float	
	RO	……	Float	
25540	RO	Ua IH25 Max.	Float	
25542	RO	Ub IH25 Max.	Float	
25544	RO	Uc IH25 Max.	Float	
25546~25550	RO	Reserved	Float	
25552	RO	Ua IH01 Min.	Float	
25554	RO	Ub IH01 Min.	Float	
25556	RO	Uc IH01 Min.	Float	
	RO	……	Float	
25696	RO	Ua IH25 Min.	Float	
25698	RO	Ub IH25 Min.	Float	
25700	RO	Uc IH25 Min.	Float	
25702~25706	RO	Reserved	Float	
25708	RO	Ua IH01 CP95	Float	
25710	RO	Ub IH01 CP95	Float	
25712	RO	Uc IH01 CP95	Float	
	RO	……	Float	
25852	RO	Ua IH25 CP95	Float	
25854	RO	Ub IH25 CP95	Float	
25856	RO	Uc IH25 CP95	Float	

25858~25862	RO	Reserved		
25864	RO	Ua IH01 Avg	Float	
25866	RO	Ub IH01 Avg	Float	
25868	RO	Uc IH01 Avg	Float	
	RO	……	Float	
26008	RO	Ua IH25 Avg	Float	
26010	RO	Ub IH25 Avg	Float	
26012	RO	Uc IH25 Avg	Float	
26014	RO	MSV Conclusion	UINT32	
26016	RO	MSV N Valid	UINT32	
26018	RO	MSV N Invalid	UINT32	
26020	RO	MSV1 Conclusion	UINT32	
26062	RO	Ua MSV N1	UINT32	
26024	RO	Ub MSV N1	UINT32	
26026	RO	Uc MSV N1	UINT32	
26028	RO	Ua MSV1 (1 - N1/N)	Float	
26030	RO	Ub MSV1 (1 - N1/N)	Float	
26046	RO	Uc MSV1 (1 - N1/N)	Float	
	RO	……		
26048	RO	MSV3 Conclusion	UINT32	
26050	RO	Ua MSV3 N1	UINT32	
26052	RO	Ub MSV3 N1	UINT32	
26054	RO	Uc MSV3 N1	UINT32	
26056	RO	Ua MSV3 (1 - N1/N)	Float	
26058	RO	Ub MSV3 (1 - N1/N)	Float	
26060	RO	Uc MSV3 (1 - N1/N)	Float	
26062	RO	Ua MSV1 Max.	Float	

26064	RO	Ub MSV1 Max.	Float	
26066	RO	Uc MSV1 Max.	Float	
26068	RO	Ua MSV2 Max.	Float	
26070	RO	Ub MSV2 Max.	Float	
26072	RO	Uc MSV2 Max.	Float	
26074	RO	Ua MSV3 Max.	Float	
26076	RO	Ub MSV3 Max.	Float	
26078	RO	Uc MSV3 Max.	Float	
26080	RO	Ua MSV1 Min.	Float	
26082	RO	Ub MSV1 Min.	Float	
26084	RO	Uc MSV1 Min.	Float	
26086	RO	Ua MSV2 Min.	Float	
26088	RO	Ub MSV2 Min.	Float	
26090	RO	Uc MSV2 Min.	Float	
26092	RO	Ua MSV3 Min.	Float	
26094	RO	Ub MSV3 Min.	Float	
26096	RO	Uc MSV3 Min.	Float	
26098	RO	Ua MSV1 CP95	Float	
26100	RO	Ub MSV1 CP95	Float	
26102	RO	Uc MSV1 CP95	Float	
26104	RO	Ua MSV2 CP95	Float	
26106	RO	Ub MSV2 CP95	Float	
26108	RO	Uc MSV2 CP95	Float	
26110	RO	Ua MSV3 CP95	Float	
26112	RO	Ub MSV3 CP95	Float	
26114	RO	Uc MSV3 CP95	Float	
26116	RO	Ua RVC N1	Reserved	

26118	RO	Ub RVC N1	Reserved	RVC counter occurs on 3-phase within a week
26120	RO	Uc RVC N1	Reserved	
26122		Reserved		
26124		Reserved		
26126	RO	Swell N11	UINT32	See Note 1)
26128	RO	Swell N21	UINT32	
26130	RO	Swell N31	UINT32	
26132	RO	Swell N41	UINT32	
26134	RO	Swell N12	UINT32	
26136	RO	Swell N22	UINT32	
26138	RO	Swell N32	UINT32	
26140	RO	Swell N42	UINT32	
26142	RO	Swell N13	UINT32	
26144	RO	Swell N23	UINT32	
26146	RO	Swell N33	UINT32	
26148	RO	Swell N43	UINT32	
26150	RO	Swell N14	UINT32	
26152	RO	Swell N24	UINT32	
26154	RO	Swell N34	UINT32	
26156	RO	Swell N44	UINT32	
26158	RO	Swell N15	UINT32	
26160	RO	Swell N25	UINT32	
26162	RO	Swell N35	UINT32	
26164	RO	Swell N45	UINT32	
26166	RO	Dip N11	UINT32	
26168	RO	Dip N21	UINT32	
26170	RO	Dip N31	UINT32	

26172	RO	Dip N41	UINT32	
26174	RO	Dip N51	UINT32	
26176	RO	Dip N61	UINT32	
26178	RO	Dip N12	UINT32	
26180	RO	Dip N22	UINT32	
26182	RO	Dip N32	UINT32	
26184	RO	Dip N42	UINT32	
26186	RO	Dip N52	UINT32	
26188	RO	Dip N62	UINT32	
26190	RO	Dip N13	UINT32	
26192	RO	Dip N23	UINT32	
26194	RO	Dip N33	UINT32	
26196	RO	Dip N43	UINT32	
26198	RO	Dip N53	UINT32	
26200	RO	Dip N63	UINT32	
26202	RO	Dip N14	UINT32	
26204	RO	Dip N24	UINT32	
26206	RO	Dip N34	UINT32	
26208	RO	Dip N44	UINT32	
26210	RO	Dip N54	UINT32	
26212	RO	Dip N64	UINT32	
26214	RO	Dip N15	UINT32	
26216	RO	Dip N25	UINT32	
26218	RO	Dip N35	UINT32	
26220	RO	Dip N45	UINT32	
26222	RO	Dip N55	UINT32	
26224	RO	Dip N65	UINT32	

26226	RO	Interruptions N11	UINT32	
26228	RO	Interruption N21	UINT32	
26230	RO	Interruption N31	UINT32	
26232	RO	Ua Transient N1	UINT32	Transient counter occurs on 3-Phase over 1 week
26234	RO	Ub Transient N1	UINT32	
26236	RO	Uc Transient N1	UINT32	

* Writing n to the EN50160 Log Pointer register will update the EN50160 Log Buffer with a Log Record at the pointer position.

Table 5-60 EN50160 Log

Notes:

1) Nxx have following definitions:

Swell (t indicates Duration, while u indicates Residual Voltage)				
Counter	10ms <= *t* <= 500ms	500ms < t <= 5000ms	5000ms < t <= 60000ms	t > 60000ms
110% < u < 120%	N11	N21	N31	N41
120% <= u < 140%	N12	N22	N32	N42
140% <= u < 160%	N13	N23	N33	N43
160% <= u < 200%	N14	N24	N34	N44
u >= 200%	N15	N25	N35	N45

Table 5-61 Swell Counter Definition

Dip (t indicates Duration, while u indicates Residual Voltage)						
Counter	10ms < t <= 200ms	200ms < t <= 500ms	500ms < t <= 1000ms	1000ms < t <= 5000ms	5000ms < t <= 60000ms	t > 60000ms
u < 5%	N11	N21	N31	N41	N51	N61
5% <= u < 40%	N12	N22	N32	N42	N52	N62
40% <= u < 70%	N13	N23	N33	N43	N53	N63
70% <= u < 80%	N14	N24	N34	N44	N54	N64
80% <= u < 90%	N15	N25	N35	N45	N55	N65

Table 5-62 Dip Counter Definition

Interruption (t indicates Duration, while u indicates Residual Voltage)

Counter	t <= 1s	t <= 180000ms	t > 180000ms
	N11	N21	N31

Table 5-63 Interruption Counter Definition

5.7.9 QR (Qualification Rate) Log

5.7.9.1 QR Log Buffer

Register Address	Property	Description	Format
26400	RW	QR Log Pointer (n)*	UINT32
26402~26417	RO	QR Log n	See Section 5.7.9.2 QR Log Data Structure
26418~26433	RO	QR Log n+1	
…		…	
26514~26529	RO	QR Log n+7	

* Writing n to the QR Log Pointer register will update the QR Log Buffer with QR Log Records at pointer positions from n to N+7.

Table 5-64 QR Log Buffer

5.7.9.2 QR Log Data Structure

Offset	Property	Description	Format	Unit
+0~+2	RW	Record Time	Bitmap	
+3		Flagging Status[1]	Bitmap	
+4	RO	Voltage Deviation	Float	
+6	RO	Frequency Deviation	Float	
+8	RO	Plt	Float	
+10	RO	Voltage Deviation Total Evaluate Time	UINT32	min
+12	RO	Frequency Deviation Total Evaluate Time	UINT32	s
+14	RO	Plt Total Evaluate Time	UINT32	hour

Table 5-65 QR Log Data Structure

Notes:

1) The following table illustrates Flagging Status:

Offset	Description	Offset	Description

Bit0	Basic Realtime Measurement	Dip	Bit8	Pst	Dip
Bit1		Swell	Bit9		Swell
Bit2		Interruption	Bit10		Interruption
Bit3		Current	Bit11		Reserved
Bit4	Freq.	Dip	Bit12	Plt	Dip
Bit5		Swell	Bit13		Swell
Bit6		Interruption	Bit14		Interruption
Bit7		Reserved	Bit15		Reserved

Table 5-66 Flagging Status

5.7.10 TOU Log

All TOU Logs' timestamps are recorded according to local time.

5.7.10.1 TOU Realtime Status

Register	Property	Description	Format	Note/Range
36000	RO	Present Tariff Schedule	Unit16	0~7: T1~T8
36001	RO	Present Season Schedule	Unit16	0~11: Season1~12
36002	RO	Present Daily Profile	Unit16	0~11: Daily Profile 1~12
36003	RO	Present Daily Profile Index	Unit16	0~19: Daily Profile Index 1~20
36004	RO	Present Weekday Type	Unit16	0 = Weekday 1 1 = Weekday 2 2 = Weekday 3 3 = Special Day
36005	RO	Present TOU Schedule	Unit16	0~1
36006	RO	TOU Log Pointer	Unit32	

Table 5-67 TOU Real-time Status

5.7.10.2 TOU Real-time Log

Register	Description	Format
36100~36139	Tariff #1 Data	See 5.7.5.5 TOU Log Data Structure
36140~36179	Tariff #2 Data	
36180~36219	Tariff #3 Data	

36220~36259	Tariff #4 Data	
36260~36299	Tariff #5 Data	
36300~36339	Tariff #6 Data	
36340~36379	Tariff #7 Data	
36380~36419	Tariff #8 Data	

Table 5-68 TOU Real-time Log

5.7.10.3 TOU Historical Log

Register	Property	Description	Format
36500	RW	Recorder No.	UINT32
36502	RO	Record Time	Bitmap
36505	RO	Monthly Average PF (1)	Float
36507~36826	RO	Tariff #1 ~ Tariff #8 Data	See 5.7.5.5 TOU Log Data Structure

Table 5-69 TOU Historical Log

5.7.10.4 TOU Transient Log

Register	Property	Description	Format
36900	RO	Record Time	Bitmap
36903~37223	RO	Tariff #1 ~ Tariff #8 Data	See 5.7.5.5 TOU Log Data Structure

Table 5-70 TOU Transient Log

5.7.10.5 TOU Log Data Structure

Offset	Property	Description	Format	Note
0	RW	kWh Imp.	INT64	
4	RW	kWh Exp.	INT64	
8	RW	kvarh Imp.	INT64	
12	RW	kvarh Exp.	INT64	
16	RW	kVAh	INT64	
20	RW	kW Imp. Max. Demand	Float	
22	RW	kW Imp. Max. Demand Timestamp[1]		

25	RW	kW Exp. Max. Demand	Float	
27	RW	kW Exp. Max. Demand Timestamp[1]		
30	RW	kvar Imp. Max. Demand	Float	
32	RO	kvar Imp. Max. Demand Timestamp[1]		
35	RO	kvar Exp. Max. Demand	Float	
37	RO	kvar Exp. Max. Demand Timestamp[1]		

Table 5-71 TOU Log Data Structure

Notes:

1) The following table illustrates the register of timestamp:

Offset	Description
+0	High: Year (-2000)
	Low: Month
+1	High: Day
	Low: Hour
+2	High: Minute
	Low: Second

Table 5-72 Timestamp Format

5.8 Real-time WFR Register

Register	Property	Description	Format	Note/Range
53000	RO	Start Time	Bitmap	
53004	RO	Reserved	Unit16	
53005	RO	Reserved	Unit16	
53006	RO	Frequency	Float	
53008	RO	Ia 1st Sample	Float	
…	RO	…	Float	
54030	RO	Ia 512nd Sample	Float	
54032	RO	Ib 1st Sample	Float	
…	RO	…	Float	

55054	RO	Ib 512^{nd} Sample	Float	
55056	RO	Ic 1^{st} Sample	Float	
…	RO	…	Float	
56078	RO	Ic 512^{nd} Sample	Float	
56080	RO	Ua 1^{st} Sample	Float	
…	RO	…	Float	
57102	RO	Ua 512^{nd} Sample	Float	
57104	RO	Ub 1^{st} Sample	Float	
…	RO	…	Float	
58126	RO	Ub 512^{nd} Sample	Float	
58128	RO	Uc 1^{st} Sample	Float	
…	RO	…	Float	
59150	RO	Uc 512^{nd} Sample	Float	

Table 5-73 Real-time WFR Register

Notes:

1) Read real-time WFR by reading 53000, and when the register is read, it will refresh automatically to ensure WFR's integrity.

5.9 Device Setup Parameters

5.9.1 Communications Setup

Register Address	Property	Description		Format	Note
40000	RW	RS485 Port 1 (P3)	Unit ID	UINT16	1 to 247, (Default=100)
40001	RW		Baud rate[1]	UINT16	0 to 7, 3*
40002	RW		Parity	UINT16	0=None, 1=Odd, 2=Even*
40003	RW		Stop Bit	UINT16	1=1 Bit*, 2=2 Bits
40004	RW		Protocol[2]	UINT16	0=Modbus*, 1=Pass-through
40005	RW			UINT16	20000* to 60000
40006~40007	RW	Reserved		UINT16	
40008	RW	RS485 Port 2 (P4)[3]	Unit ID	UINT16	1 to 247, (Default=101)
40009	RW		Baud rate[1]	UINT16	0 to 7, 3*

40010	RW		Parity	UINT16	0=None, 1=Odd, 2=Even*
40011	RW		Stop Bit	UINT16	1=1 Bit*, 2=2 Bits
40012	RW		Protocol[2]	UINT16	0=Modbus*, 1=Pass-through
40013	RW		Pass-through Port	UINT16	20000 to 60000, 20001*
40014~40015	RW	Reserved		UINT16	
40016	RW	Ethernet 1 (P1)	IP Address[4]	UINT32	Default=192.168.0.100
40018	RW		Subnet Mask[4]	UINT32	Default=255.255.255.0
40020	RW		Default Gateway[4]	UINT32	Default=192.168.0.1
40022	RW	Reserved			
40024	RW	Ethernet 2 (P2)	IP Address[4]	UINT32	Default=192.168.1.100
40026	RW		Subnet Mask[4]	UINT32	Default=255.255.255.0
40028~40030	RW	Reserved		UINT32	
40032	RW	MODBUS TCP – IP Port #		UINT16	502 to 60000 (Default=502)
40033~40063	RW	Reserved		--	--
40065	RW	IP Address of SNTP Server		UINT32	Default=192.168.101.2
40067	RW	SNTP Sync. Interval		UINT16	10 to 1440 min, (Default=60)
40068	RW	SNTP Broadcast Flag		UINT16	0*=Disabled, 1=Enabled

*Default

Table 5-74 Communication Setup Parameters

Notes:

1) Baudrate options: 0=1200, 1=2400, 2=4800, 3=9600*, 4=19200, 5=38400, 6=57600, 7=115200
2) Protocol options: 0=Modbus RTU*, 1-1999=Invalid, >=2000=IP Port # when used as an Transparent Ethernet Gateway
3) When the **Clock Source** is **GPS** or **IRIG-B**, P4 (RS-485 Port 2) is used by default for GPS and IRIG-B Time Sync. Please refer to Section **4.6 Time Synchronization** for detailed description.
4) If the IP Address is 192.168.0.100, write "0xC0A00064" to the register. P1 and P2 should not on the same network segment.

5.9.2 Basic Setup Parameters

Register Address	Property	Description	Format	Range / Options
41000	RW	Wiring Mode	UINT16	1=4W-WYE*, 2=3W-WYE 3=Delta, 4=Demo
41001	RW	PT Primary (V)	UINT32	1 to 1,000,000, 100*
41003	RW	PT Secondary (V)	UINT32	1 to 1500, 100*

41005	RW	CT Primary (A)	UINT32	1 to 30000, 5*
41007	RW	CT Secondary (A)	UINT32	1 to 50, 5*
41009	RW	U4 Primary (V)	UINT32	1 to 1,000,000, 100*
41011	RW	U4 Secondary (V)	UINT32	1 to 1500, 100*
41013	RW	I4 Primary (A)	UINT32	1 to 30000, 5*
41015	RW	I4 Secondary (A)	UINT32	1 to 50, 5*
41017	RW	I5 Primary (A)	UINT32	1 to 30000, 5*
41019	RW	I5 Secondary (A)	UINT32	1 to 50, 5*
41021	RW	ULL Nominal ($Vll_{nominal}$)	UINT32	1 to 1500, 415*
41023	RW	Nominal Current ($I_{nominal}$)	UINT32	1 to 20 , 5*
41025	RW	CT Polarity[1]	Bitmap	0=Normal*, 1=Reverse
41026	RW	Reserved	UINT16	
41027	RW	Power Factor Convention[2]	UINT16	0=IEC*, 1=IEEE, 2=-IEEE
41028	RW	kVA Calculation[3]	UINT16	0=Vector*, 1=Scalar
41029	RW	Harmonics Calculation	UINT16	0=% of Fundamental* 1=% of RMS 2=% of Nominal
41030	RW	Statistical Harmonic Calculation	UINT16	0=Subgroup*, 1=Group
41031	RW	Order of Harmonic Calculation		2 to 63*

*Default

Table 5-75 Basic Setup Parameters

Notes:

1) The **CT Polarity** register defines the polarity for the Current Inputs as illustrated in the following table.

Bit 15~Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	I5	I4	Ic	Ib	Ia

Table 5-76 CT Polarity Register

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

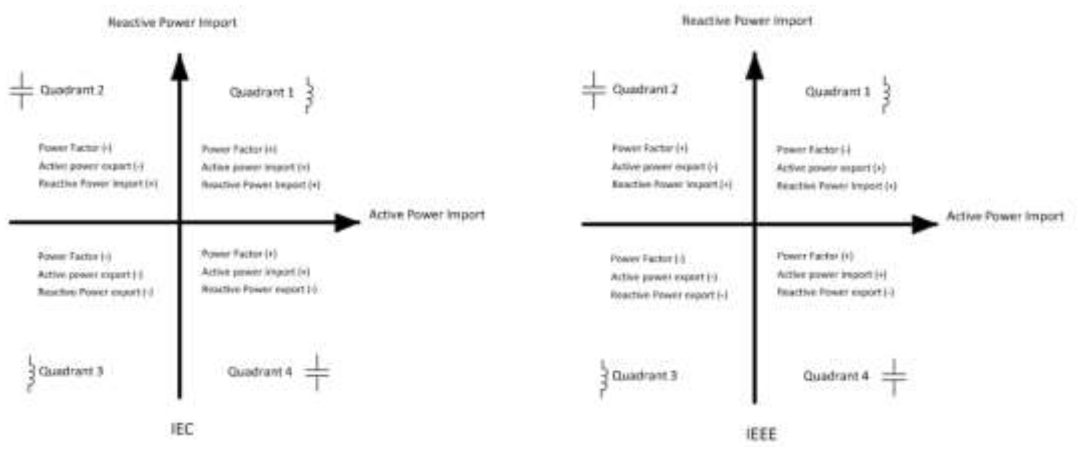


Figure 5-1 Power Factor Definitions

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)**:** $KVA_{total} = KVA_a + KVA_b + KVA_c$

5.9.3 DI Setup

Register Address	Property	Description	Format	Range/Options
40100	RW	DI1 Mode[1]	UINT16	0*=Normal (Status Input) 1=Pulse Counter 2=DMD Sync
40101	RW	DI1 Debounce	UINT16	1 to 9999 (ms) (Default=20ms)
40102	RW	DI1 Pulse Weight	UINT32	1~1,000,000
40104	RW	DI1 Setpoint Type[2]	UINT16	0=Any Change* 1=Positive Edge 2=Negative Edge
40105	RW	DI1 Setpoint Trigger	UINT32	See 4.3 Setpoints
40107~40108		Reserved	UINT16	
…		…	UINT16	…
40163	RW	DI8 Mode[1]	UINT16	0*=Normal (Status Input) 1=Counter 2=DMD Sync
40164	RW	DI8 Debounce	UINT16	1 to 9999 (ms) (Default=20ms)
40165	RW	DI8 Pulse Weight	UINT32	1~1,000,000

40167	RW	DI8 Setpoint Type	UINT16	0=Any Change 1=Positive Edge 2=Negative Edge
40168	RW	DI8 Setpoint Trigger	UINT32	See 4.3 Setpoints
40170~40171		Reserved	UINT16	

* Default

Table 5-77 DI Setup Parameter

Notes:

1) Only one **DI** should be programmed as the Demand Sync. Input. To use a different DI for Demand Sync., the existing **DI** must first be reset back to **Normal (Status Input)** before programming the new **DI** for Demand Sync. Otherwise the configuration will be unsuccessful. DI8 is used by default for GPS 1PPS Time Sync input if the Clock Source is programmed as DI.
2) **DIx Setpoint Type** is valid only DIs are under Normal (Status Input) mode and used trigger WFR and DWR, that means DIs which under **Pulse Counter** or **DMS Sync** mode will not be impacted by **DIx Setpoint Type.** In addition, all of the Setpoint Actives are triggered by Positive Edge, while Setpoint Returns are triggered by Negative Edge.

5.9.4 RO/DO Setup

Register Address	Property	Description	Format	Range/Options
40300	RW	RO / DO Alarm Enable Flag	UINT16	0*=Disabled, 1=RO1, 2=RO2, 3=RO3, 4=RO4, 5=DO1, 6=DO2, 7=DO3, 8=DO4 Only one RO or DO can be selected.
40301	RW	Execute without Arm[1]	UINT16	0=Disabled 1*=Enabled
40302	RW	RO1 Delay[2]	UINT16	0 to 6000 (x0.1s) (Default=10)
40303	RW	RO2 Delay[2]	UINT16	
40304	RW	RO3 Delay[2]	UINT16	
40305	RW	RO4 Delay[2]	UINT16	
40306~40309		Reserved		
40310	RW	DO1 Delay[2]	UINT16	0 to 6000 (x0.1s) (Default=10)
40311	RW	DO2 Delay[2]	UINT16	
40312	RW	DO3 Delay[2]	UINT16	
40313	RW	DO4 Delay[2]	UINT16	

*Default

Table 5-78 RO/DO Setup Parameters

Notes:

1) **Arm without Execute** setup register is used to specify if the relays needs to be armed before they can be operated on. The default setting is **Disabled**. Therefore, the user must arm the relay first before operating a relay.
2) **RO / DO Delay** is not the same as the effect of the different commands, as following:
   - As to remote aggregate command, and if the delay time is 0, the RO / DO will immediately take action when received the command and remain closed status until the next command come. On the contrary, RO / DO will take action and return after a certain time delay (x 0.1s). For remote open command, the delay time has no meaning and RO / DO will immediately return after receive the command.
   - As to non-remote command, it means that the RO / DO will return immediately after receive the return command when the time delay is 0; if the time value is not 0, RO / DO will return at a certain time delay (x 0.1s) after receive the return command.

5.9.5 SMTP Setup

Register Address	Property	Description	Format	Range/Options
40900	RW	SMTP Event Classification[1]	Bitmap	Note 1)
40902	RW	SMTP IP Port	UINT16	1 to 65535 (Default=25)
40903	RW	IP Address of SMTP Server[2]	UINT32	Default=0.0.0.0
40905	RW	Source Email Address[3]	CHAR	Note 2)
40915	RW	Source Username[4]	CHAR	
40920	RW	Login Password[5]	CHAR	Note 3)
40925	RW	Destination Email Address[6]	CHAR	Note 4)

*Default

Table 5-79 SMTP Setup Parameters

Notes:

1) **SMTP Event Classification** register determines if a newly generated SOE/PQ LOG is sent out by email. The following table illustrates the Bitmap definition of this register. When a particular bit is set to 1, its corresponding events will be sent out by email.

Bit	Classification	Event Type	Bit	Classification	Event Type
Bit 0	1=System Events See Appendix B	SOE	Bit 16	0x81=Dip/Swell Disturbance	PQ Log
Bit 1	2=Standard Setpoints Events		Bit 17	0x82=Transient Disturbance	
Bit 2	3=High-speed Setpoints Events		Bit 18	0x83 = Inrush Current	
Bit 3	4=Discrete Events		Bit 19	0x84 = RVC	
Bit 4	5 =WFR		Bit 20	0x85 = MSV	
Bit 5	6 = DWR		Bit 21	0x86 = Relative RMS (Reserved)	
Bit 6	7 = MSV WFR				
Bit 7	8 = Standard DR				
Bit 8	9 = HS DR				

Table 5-80 SMTP Event Classification Register (40900)

2) If the IP Address is 192.168.0.100, write “0xC0A00064” to the register.
3) This string parameter may be up to 20 characters long and specifies the source email address that appears in the “**From**” field of the email. For example, if the email address is PMC-680i@ceiec-electric.com, set the parameter as”70 6D 63 2D 36 38 30 69 40 63 65 69 65 63 2D 65 6C 65 63 74 72 69 63 2E 63 6F 6D 00 00” where the two zero characters “00 00” at the end of the string are the string terminator.
4) This string parameter may be up to 10 characters long and specifies the "**Source Username**" that appears in the email. For example, if the username is “abc”, set the parameter as “61 62 63 00 00” where the two zero characters “00 00” at the end of the string are the string terminator.
5) This string parameter may be up to 10 characters long and specifies the Logon Password to login the “**Source Email**” account. For example, if the password is “PMC-680i”, set the parameter as “50 4D 43 2D 36 38 30 69 00 00” where the two zero characters “00 00” at the end of the string are the string terminator.
6) This string parameter may be up to 20 characters long and specifies the destination email address that appears in the “**To**” field of the email. For example, if the email address is PMC-680i-a@ceiec-electric.com, so set the registers as”70 6D 63 2D 36 38 30 69 2D 61 40 63 65 69 65 63 2D 65 6C 65 63 74 72 69 63 2E 63 6F 6D 00 00” where the two zero characters “00 00” at the end of the string are the string terminator.

5.9.6 PQ Log Setup

Register	Property	Description	Format	Note
41100	RW	Dip/Swell Enable[1]	UINT16	0=Disabled, 1*=Enabled
41101	RW	Dip/Swell Voltage Reference	UINT16	0=Udin (Nominal) 1*=Usr (Slide Reference Voltage)
41102	RW	Swell Limit	UINT16	101 to 200 (x0.01Ue), 110*
41103	RW	Dip Limit[2]	UINT16	1 to 99 (x0.01Ue), 90*
41104	RW	Interruption Limit[2]	UINT16	0to 50 (x0.01Ue), 10*
41105	RW	Swell Hysteresis	UINT16	1 to 1000 (x0.001Ue), 5*
41106	RW	Dip Hysteresis	UINT16	
41107	RW	Interruption Hysteresis	UINT16	
41108	RW	Dip/Swell Trigger	UINT32	WFR
41110	RW	Reserved	UINT32	
41112	RW	Transient Enable	UINT16	0=Disabled, 1*=Enabled
41113	RW	Transient Limit	UINT16	5 to 500 (%), 20*
41114	RW	Transient Trigger[3]	UINT32	WFR
41116~41119	RW	Reserved	UINT16	
41120	RW	Inrush Current Enable	UINT16	0*=Disabled, 1=Enabled
41121	RW	Inrush Current Limit	UINT16	100 to 500 (%), 120*
41122	RW	Inrush Current Hysteresis	UINT16	1 to 1000 (0.1% to 100%), 10*

41123	RW	Inrush Current Trigger	UINT32	WFR
41125~41127	RW	Reserved	UINT16	
41128	RW	Rapid Voltage Changes (RVC) Enable	UINT16	0*=Disabled, 1=Enabled
41129	RW	Detection mode (Set Voltage Reference)	UINT16	0*=Steady-state 1=Maximum U change
41130	RW	Voltage Tolerance	UINT32	0 to 1000 (x0.001Ue), 10*
41132	RW	Steady-State Duration	UINT32	1 to 50 (x0.1s), 10*
41134	RW	Minimum Voltage Difference	UINT32	1 to 1000 (0.1% to 100%), 50*
41136	RW	Minimum Step Change	UINT32	0 to 100 (x0.001Ue), 10*
41138	RW	RVC Trigger[3]	UINT32	WFR, DWR
41140~41153	RW	Reserved		
41154	RW	MSV #1 Enable	UINT16	0*=Disabled, 1=Enabled
41155	RW	MSV #1 Frequency	UINT16	50 Hz: 600 to 30000 (x0.1Hz) 60 Hz: 700 to 30000 (x0.1Hz) Default=10000
41156	RW	MSV #1 Limit	UINT16	3 to 1000 (x0.001Ue) Default=50 (x0.001Ue)
41157	RW	MSV #1 Emission Time	UINT16	1 to 120s, Default=60s
41158~41159	RW	Reserved		
41160	RW	MSV #2 Enable	UINT16	0*=Disabled, 1=Enabled
41161	RW	MSV #2 Frequency	UINT16	50 Hz: 600 to 30000 (x0.1Hz) 60 Hz: 700 to 30000 (x0.1Hz) Default=20000
41162	RW	MSV #2 Limit	UINT16	3 to 1000 (x0.001Ue) Default=50 (x0.001Ue)
41163	RW	MSV #2 Emission Time	UINT16	1 to 120s, Default=60s

41164~41165	RW	Reserved		
41166	RW	MSV #3 Enable	UINT16	0*=Disabled, 1=Enabled
41167	RW	MSV #3 Frequency	UINT16	50 Hz: 600 to 30000 (x0.1Hz) Default=30000 60 Hz: 700 to 30000 (x0.1Hz) Default=30000
41168	RW	MSV #3 Limit	UINT16	3 to 1000 (x0.001Ue) Default=50 (x0.001Ue)
41169	RW	MSV #3 Emission Time	UINT16	1 to 120s, Default=60s
41170~41171		Reserved		
41172	RW	Flicker Mode	UINT16	0*=120V, 1=230V

*Default

Table 5-81 PQ Log Setup

Notes:

1) When the **Wiring Mode** is WYE, Dip/Swell Voltage is line to phase voltage. When the **Wiring Mode** is Delta, it will be line to line voltage.
2) The **Dip Limit**, **Swell Limit**, **Voltage Interruption Threshold** and **Dip/Swell Return** values should be configured to meet the following criteria:
    a) The **Voltage Interruption Threshold** shall not be set below **Dip Limit**.
    b) The **Swell Limit** and **Dip Limit** should associate with Voltage Rapid Changes in the minimum difference between the two steady-states. The absolute value of the minimum Dip/Swell limit (the differential between Dip/Swell and 100%) must be greater than the **Voltage Rapid Changes** in the minimum pressure difference between the two steady-states (actual percentage).
    c) Dip/Swell return value should associate with Swell limit and Dip Limit, Dip/Swell return value (actual value) must be less than the Dip/Swell limit (Dip, Swell of the absolute difference of the minimum value and 100%).
    d) Regardless of Dip/Swell enable, a), b) and c) must be complied.
3) Table 5-82 provides a list of Dip/Swell, Voltage Transient and Rapid Voltage Changes Triggers. Dip/Swell, Transient, Relative RMS and Rapid Change Voltage Trigger DO1/DO2 only be available under DO1/DO2 function is Digital Output. Transient and Rapid Change Voltage can only trigger DOs change, WFR and DWR.

Key	Action	Key	Action	Key	Action	Key	Action
0	RO1	**8**	Reserved	**16**	Reserved	**24**	DR #6
1	RO2	**9**	Reserved	**17**	Reserved	**25**	DR #7
2	RO3	**10**	Reserved	**18**	Reserved	**26**	DR #8
3	RO4	**11**	HS DR #1	**19**	DR #1	**27**	DWR
4	DO1	**12**	HS DR #2	**20**	DR #2	**28**	WFR
5	DO2	**13**	HS DR #3	**21**	DR #3	**29**	Reserved

6	DO3	**14**	HS DR #4	**22**	DR #4	**30**	Reserved
7	DO4	**15**	Reserved	**23**	DR #5	**31**	Reserved

Table 5-82 Dip/Swell and Rapid Voltage Change Triggers

4) Transient and Rapid Voltage Changes cannot trigger data recorder or DOs.

5.9.7 PQDIF Setup

Register Address	Property	Description	Format	Range / Options
41200	RW	Freq. Statistics Interval	UINT16	1 to 60 Mins, 10*
41201	RW	Symmetrical Components and Unb. Statistics Interval	UINT16	1 to 60 Mins, 10*
41202	RW	U & I RMS and Deviation Statistics Interval	UINT16	1 to 60 Mins, 10*
41203	RW	Harmonic & Inter-Harmonic Statistics Interval	UINT16	1 to 60 Mins, 10*
41204	RW	PQDIF Save Interval	UINT16	0* to 24 Hour 0 Indicates PQDIF is disabled
41205	RW	PQDIF Configration[1]	UINT32	

*Default

Table 5-83 PQDIF Setup

Notes:

1) Table 5-84 provides details of PQDIF's configuration word.

Bit	Description	Bit	Description
Bit0	1= Self-Read Event Enabled 0= Self-Read Event Disabled	**Bit1**	1= Self-Read Harmonic Angle Enabled 0= Self-Read Harmonic Angle Disabled
Bit2	1= Harmonic Order indicates Harmonic 2= Actual Freq. indicates Harmonic	**Bit3**	1= Actual Freq. indicates Inter-Harmonic 2= Inter-Harmonic Order indicates Inter-Harmonic
Bit4 to Bit 15	Reserved		
Bit16 to Bit19	Current Inter-harmonic Orders: 0 =None 1 = IH01 to IH09 2 = IH01 to IH19 3 = IH01 to IH29	**Bit20 to Bit23**	Voltage Inter-harmonic Orders: 0 =None 1 = IH01 to IH09 2 = IH01 to IH19 3 = IH01 to IH29

	4 = IH01 to IH39	5 = IH01 to IH49		4 = IH01 to IH39	5 = IH01 to IH49
	6 = IH01 to IH59	7 = IH01 to IH63		6 = IH01 to IH59	7 = IH01 to IH63
Bit24 to Bit27	Current Harmonic Orders:		**Bit28 to Bit31**	Voltage Harmonic Orders:	
	0 =None	1 = H01 to H09		0 =None	1 = H01 to H09
	2 = H01 to H19	3 = H01 to H29		2 = H01 to H19	3 = H01 to H29
	4 = H01 to H39	5 = H01 to H49		4 = H01 to H39	5 = H01 to H49
	6 = H01 to H59	7 = H01 to H63		6 = H01 to H59	7 = H01 to H63

Table 5-84 PQDIF Configuration

5.9.8 Demand Setup

Register Address	Property	Description	Format	Range / Options
41250	RW	Demand Sync.	UINT16	0=SLD*, 1=SYNC DI
41251	RW	Demand Period	UINT16	1 to 60minutes, 5*
41252	RW	Number of Sliding Windows	UINT16	1 to 15*
41253	RW	Self-read Time[1]	UINT16	Default = 0xFFFF
41254	RW	Predicated Response	UINT16	70* to 99

*Default

Table 5-85 PQDIF Setup

Notes:

1) Self-Read Time is applied to Max. Demand Log and Max./Min. Log, there are three types of Self-Read Time as following:
   - A zero value means that the Self-Read will take place at 00:00 of the end of the 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.
   - 0xFFFF means the log will be transferred manually.

5.9.9 WFR Setup

Register	Property	Description	Format	Range/Option
41300	RW	Pre-fault Cycles[1]	UINT16	2 to 384 (16 Samples/640 Cycles), 4* 2 to 192 (32 Samples/320 Cycles), 4* 2 to 96 (64 Samples/160 Cycles), 4* 2 to 48 (128 Samples/80 Cycles), 4* 2 to 24 (256 Samples/40 Cycles), 4* 2 to 12 (512 Samples/20 Cycles), 4* 2 to 6 (1024 Samples/10 Cycles), 4*

41301	RW	Consecutive Recording Depth	UINT16	0 to 7, 1*
41302	RW	# of Samples[2]	UINT16	0=16 Samples/640 Cycles 1=32 Samples/320 Cycles 2=64 Samples/160 Cycles 3=128 Samples/80 Cycles 4*=256 Samples/40 Cycles 5=512 Samples/20 Cycles 6=1024 Samples/10 Cycles
41303~41305	RW	Reserved	UNIT16	
41306	RW	Pre-fault Cycles of DWR		5* to 10 Cycles

*Default

Table 5-86 WFR Log Setup

Notes:

1) 1024 Samples/10 Cycles is default for PMC-680i with 1024 samples per cycle sampling. This value is only valid with the 1024 samples/cycle option.
2) For PMC-680i with 1024 samples per cycle sampling, the maximum sampling frequency is 1024, default of WFR Format is 1024 Samples/10 Cycles, and pre-fault cycles is 2.

5.9.10 Energy Pulse Setup

Register	Property	Description	Format	Range/Option
41350	RW	Energy Pulse Constant[1]	UINT16	0=1000 Pulse/kWh 1=3200 Pulse/kWh 2*=5000 Pulse/kWh 3=6400 Pulse/kWh 4=12800 Pulse/kWh
41351	RW	kWh LED Pulse Output	UINT16	0= Disabled 1*= Total kWh 2= Fund. kWh 3= Harmonic kWh
41352	RW	kvarh LED Pulse Output	UINT16	0= Disabled 1*= Total kvarh 2= Fund. kvarh 3= Harmonic kvarh
41353	RW	DO1 Energy Pulse Source[2]	UNIT16	0 to 18, 0*
41354	RW	Reserved	UNIT16	
41355	RW	DO2 Energy Pulse Source[2]	UNIT16	0 to 18, 0*

41356	RW	Reserved	UNIT16	
41357	RW	DO3 Energy Pulse Source[2]	UNIT16	0 to 18, 0*
41358	RW	Reserved	UNIT16	
41359	RW	DO4 Energy Pulse Source[2]	UNIT16	0 to 18, 0*
41360	RW	Reserved	UNIT16	

*Default

Table 5-87 Energy Pulse Setup

Notes:

1) The **Energy Pulse Constant** should be set according to secondary current value, please refer to table below:

Secondary Voltage *Current (V*A*2)	Energy Pulse Constant	Minimum Interval (ms)
≤1000	1000/3200/5000/6400/12800	160
≤2000	1000/3200/5000/6400	
≤2600	1000/3200/5000	
≤4000	1000/3200	
≤13000	1000	

Table 5-88 Energy Pulse Constant Range

For example, if secondary current = 100V, secondary voltage = 1A, then the maximum of **Energy Pulse Constant** can be set as 12800.

2) The following table illustrates the valid options for the Energy Pulse Source setup register:

Energy Pulse Source	Description	Energy Pulse Source	Description
0	Disabled	10	Real Time kvarh Total
1	Real Time kWh Total	11	kvarh Imp.
2	kWh Imp.	12	kvarh Exp.
3	kWh Exp.	13	kvarh Total Fundamental
4	kWh Total Fundamental	14	kvarh Imp. H01
5	kWh Imp. H01	15	kvarh Exp. H01
6	kWh Exp. H01	16	kvarh TH
7	kWh TH	17	kvarh Imp. TH
8	kWh Imp. TH	18	kvarh Exp. TH
9	kWh Exp. TH		

Table 5-89 Energy Pulse Source Setup Register

5.9.11 Standard Setpoints Setup

Register Address	Property	Description		Format	Range/Options
41400	RW	Setpoint #1	Parameter [1]	UINT32	0*
41402	RW		Type	UINT16	0*=Disabled 1=Over Setpoint 2=Under Setpoint
41403	RW		Active Limit	Float	999,999*
41405	RW		Inactive Limit	Float	999,999*
41407	RW		Active Delay	UINT16	0 to 9999 s, 10*
41408	RW		Inactive Delay	UINT16	0 to 9999 s, 10*
41409	RW		Trigger[2]	UINT32	0*=Disabled
41411	RW		Reserved		
…		…			…
44715	RW	Setpoint #256	Parameter[1]	UINT32	0*
44717	RW		Type	UINT16	0*=Disabled 1=Over Setpoint 2=Under Setpoint
44718	RW		Active Limit	Float	999,999*
44720	RW		Inactive Limit	Float	999,999*
44722	RW		Active Delay	UINT16	0 to 9999 s, 10*
44723	RW		Inactive Delay	UINT16	0 to 9999 s, 10*
44724	RW		Trigger[2]	UINT32	0*=Disabled
44726	RW		Reserved		

*Default

Table 5-90 Setpoint Setup Parameters

Notes:

1) The PMC-680i provides the following setpoint parameters:

Key	Parameter	Key	Parameter	Key	Parameter
1	ULN	25	U TEHD	49	∑kvar Imp. Demand
2	ULL	26	I THD	50	∑kvar Exp. Demand
3	U4	27	I TOHD	51	∑kVA Demand

4	Ia/Ib/Ic	28	I TEHD	52	∑P.F. Demand
5	I4	29	U TIHD	53	∑kW Imp. Pred. DMD
6	I5	30	U TOIHD	54	∑kW Exp. Pred. DMD
7	∑kW	31	U TEIHD	55	∑kvar Imp. Pred. DMD
8	∑kvar	32	I TIHD	56	∑kvar Exp. Pred. DMD
9	∑kVA	33	I TOIHD	57	∑kVA Pred. DMD
10	∑P.F.	34	I TEIHD	58	∑P.F. Pred. DMD
11	U0 Unbalance	35	U TH RMS	59	Pst
12	U2 Unbalance	36	U TOH RMS	60	Plt
13	I0 Unbalance	37	U TEH RMS	61	Voltage Fluct.
14	I2 Unbalance	38	I TH RMS	0x0002xxxx	U HD02
15	U Fundamental	39	I TOH RMS	…	U HD03~HD62
16	I Fundamental	40	I TEH RMS	0x003fxxxx	U HD63
17	U Deviation	41	U TIH RMS	0x0081xxxx	U IHD01
18	U Over Deviation	42	U TOIH RMS	…	U IHD02~IHD62
19	U Under Deviation	43	U TEIH RMS	0x00bfxxxx	U IHD063
20	Frequency	44	I TIH RMS	0x02xxxxxx	I HD02
21	Frequency Deviation	45	I TOIH RMS	…	I HD03~HD62
22	Phase Reversal	46	I TEIH RMS	0x3fxxxxxx	I HD63
23	U THD	47	∑kW Imp. Demand	0x81xxxxxx	I IHD01
24	U TOHD	48	∑kW Exp. Demand	…	I IHD02~IHD62
				0xbfxxxxxx	I IHD063

Table 5-91 Setpoint Parameters

2) The PMC-680i provides the following Setpoint Triggers:

Bit	Action	Bit	Action
Bit0	RO1 Closed	**Bit14**	HS DR #4
Bit1	RO2 Closed	**Bit15~ Bit18**	Reserved
Bit2	RO3 Closed	**Bit19**	Standard DR #1

Bit3	RO4 Closed	**Bit20**	Standard DR #2
Bit4	DO1 Closed	**Bit21**	Standard DR #3
Bit5	DO2 Closed	**Bit22**	Standard DR #4
Bit6	DO3 Closed	**Bit23**	Standard DR #5
Bit7	DO4 Closed	**Bit24**	Standard DR #6
Bit8~Bit10	Reserved	**Bit25**	Standard DR #7
Bit11	HS DR #1	**Bit26**	Standard DR #8
Bit12	HS DR #2	**Bit27**	DWR
Bit13	HS DR #3	**Bit28**	WFR

Table 5-92 Setpoint Triggers

5.9.12 HS (High-speed) Setpoints Setup

Register Address	Property	Description		Format	Range/Options
45400	RW	HS Setpoint #1	Parameter	UINT32	See Table 5-91 above
45402	RW		Type	UINT16	0*=Disabled 1=Over Setpoint 2=Under Setpoint
45403	RW		Active Limit	Float	Default=0
45405	RW		Inactive Limit	Float	Default=0
45407	RW		Active Delay	UINT16	0* to 9999 cycle
45408	RW		Inactive Delay	UINT16	0* to 9999 cycle
45409	RW		Trigger	UINT32	See Table 5-92 (Default=0)
45411			Reserved	UINT32	
…		…			…
45595	RW	HS Setpoint #16	Parameter[1]	UINT32	See Table 5-91 above
45597	RW		Type	UINT16	0*=Disabled 1=Over Setpoint 2=Under Setpoint
45598	RW		Active Limit	Float	Default=0
45600	RW		Inactive Limit	Float	Default=0

45602	RW		Active Delay	UINT16	0* to 9999 cycle
45603	RW		Inactive Delay	UINT16	0* to 9999 cycle
45604	RW		Trigger	UINT32	See Table 5-92 (Default=0)
45606			Reserved	UINT32	

*Default

Table 5-93 Setpoint Setup Parameters

5.9.13 SDR Setup

5.9.13.1 SDR #1 Setup

Register Address	Property	Description	Format	Range/Options	Default
45700	RW	Recording Interval	UINT16	0 to 60 min	15
45701	RW	Recording Mode	UINT16	0=Stop-When-Full 1=First-In-First-Out	1
45702	RW	Number of Parameters	UINT16	0 to 64	64
45703	RW	Parameter #1	UINT16	Freq.	10001*
45704	RW	Parameter #2	UINT16	Ua RMS	10002
45705	RW	Parameter #3	UINT16	Ub RMS	10003
45706	RW	Parameter #4	UINT16	Uc RMS	10004
45707	RW	Parameter #5	UINT16	U4 RMS	10005
45708	RW	Parameter #6	UINT16	ULN RMS Avg	10006
45709	RW	Parameter #7	UINT16	Uab RMS	10007
45710	RW	Parameter #8	UINT16	Ubc RMS	10008
45711	RW	Parameter #9	UINT16	Uca RMS	10009
45712	RW	Parameter #10	UINT16	ULL RMS Avg	10010
45713	RW	Parameter #11	UINT16	Ia RMS	10011
45714	RW	Parameter #12	UINT16	Ib RMS	10012
45715	RW	Parameter #13	UINT16	Ic RMS	10013
45716	RW	Parameter #14	UINT16	I4 RMS	10014
45717	RW	Parameter #15	UINT16	I5 RMS	10015

45718	RW	Parameter #16	UINT16	Current RMS Avg	10016
45719	RW	Parameter #17	UINT16	∑kWa	10017
45720	RW	Parameter #18	UINT16	∑kWb	10018
45721	RW	Parameter #19	UINT16	∑kWc	10019
45722	RW	Parameter #20	UINT16	∑kW	10020
45723	RW	Parameter #21	UINT16	∑kvara	10021
45724	RW	Parameter #22	UINT16	∑kvarb	10022
45725	RW	Parameter #23	UINT16	∑kvarc	10023
45726	RW	Parameter #24	UINT16	∑kvar	10024
45727	RW	Parameter #25	UINT16	∑kVAa	10025
45728	RW	Parameter #26	UINT16	∑kVAb	10026
45729	RW	Parameter #27	UINT16	∑kVAc	10027
45730	RW	Parameter #28	UINT16	∑kVAh	10028
45731	RW	Parameter #29	UINT16	∑P.F.a	10029
45732	RW	Parameter #30	UINT16	∑P.F.b	10030
45733	RW	Parameter #31	UINT16	∑P.F.c	10031
45734	RW	Parameter #32	UINT16	∑P.F.	10032
45735	RW	Parameter #33	UINT16	Ua Deviation	10033
45736	RW	Parameter #34	UINT16	Ub Deviation	10034
45737	RW	Parameter #35	UINT16	Uc Deviation	10035
45738	RW	Parameter #36	UINT16	Uab Deviation	10036
45739	RW	Parameter #37	UINT16	Ubc Deviation	10037
45740	RW	Parameter #38	UINT16	Uca Deviation	10038
45741	RW	Parameter #39	UINT16	Ua Over Deviation	10039
45742	RW	Parameter #40	UINT16	Ub Over Deviation	10040
45743	RW	Parameter #41	UINT16	Uc Over Deviation	10041
45744	RW	Parameter #42	UINT16	Uab Over Deviation	10042

45745	RW	Parameter #43	UINT16	Ubc Over Deviation	10043
45746	RW	Parameter #44	UINT16	Uca Over Deviation	10044
45747	RW	Parameter #45	UINT16	Ua Under Deviation	10045
45748	RW	Parameter #46	UINT16	Ub Under Deviation	10046
45749	RW	Parameter #47	UINT16	Uc Under Deviation	10047
45750	RW	Parameter #48	UINT16	Uab Under Deviation	10048
45751	RW	Parameter #49	UINT16	Ubc Under Deviation	10049
45752	RW	Parameter #50	UINT16	Uca Under Deviation	10050
45753	RW	Parameter #51	UINT16	Freq. Deviation	10051
45754	RW	Parameter #52	UINT16	Ua Fluct.	10052
45755	RW	Parameter #53	UINT16	Ub Fluct.	10053
45756	RW	Parameter #54	UINT16	Uc Fluct.	10054
45757	RW	Parameter #55	UINT16	U0 Unbal.	10055
45758	RW	Parameter #56	UINT16	U2 Unbal.	10056
45759	RW	Parameter #57	UINT16	I0 Unbal.	10057
45760	RW	Parameter #58	UINT16	I2 Unbal.	10058
45761	RW	Parameter #59	UINT16	U0	10059
45762	RW	Parameter #60	UINT16	U2	10060
45763	RW	Parameter #61	UINT16	U1	10061
45764	RW	Parameter #62	UINT16	I0	10062
45765	RW	Parameter #63	UINT16	I2	10063
45766	RW	Parameter #64	UINT16	I1	10064

*Default for 150 cycles

Table 5-94 SDR #1 Setup

5.9.13.2 SDR #2 Setup

Register Address	Property	Description	Format	Range/Options	Default
45800	RW	Recording Interval	UINT16	0 to 60 min	15
45801	RW	Recording Mode	UINT16	0=Stop-When-Full	1

				1=First-In-First-Out	
45802	RW	Number of Parameters	UINT16	0 to 64	64
45803	RW	Parameter #1	UINT16	Ua Fund. RMS	11107*
45804	RW	Parameter #2	UINT16	Ub Fund. RMS	11108
45805	RW	Parameter #3	UINT16	Uc Fund. RMS	11109
45806	RW	Parameter #4	UINT16	U4 Fund. RMS	11110
45807	RW	Parameter #5	UINT16	Ia Fund. RMS	11088
45808	RW	Parameter #6	UINT16	Ib Fund. RMS	11089
45809	RW	Parameter #7	UINT16	Ic Fund. RMS	11090
45810	RW	Parameter #8	UINT16	I4 Fund. RMS	11091
45811	RW	Parameter #9	UINT16	∑kWa H01	11971
45812	RW	Parameter #10	UINT16	∑kWb H01	11972
45813	RW	Parameter #11	UINT16	∑kWc H01	11973
45814	RW	Parameter #12	UINT16	∑kW H01	11719
45815	RW	Parameter #13	UINT16	∑kvara H01	11974
45816	RW	Parameter #14	UINT16	∑kvarb H01	11975
45817	RW	Parameter #15	UINT16	∑kvarc H01	11976
45818	RW	Parameter #16	UINT16	∑kvar H01	11720
45819	RW	Parameter #17	UINT16	∑kVAa H01	11977
45820	RW	Parameter #18	UINT16	∑kVAb H01	11978
45821	RW	Parameter #19	UINT16	∑kVAc H01	11979
45822	RW	Parameter #20	UINT16	∑kVA H01	11721
45823	RW	Parameter #21	UINT16	∑P.F.a H01	11980
45824	RW	Parameter #22	UINT16	∑P.F.b H01	11981
45825	RW	Parameter #23	UINT16	∑P.F.c H01	11982
45826	RW	Parameter #24	UINT16	∑P.F. H01	11722
45827	RW	Parameter #25	UINT16	∑kWa TH	11679

45828	RW	Parameter #26	UINT16	∑kWb TH	11680
45829	RW	Parameter #27	UINT16	∑kWc TH	11681
45830	RW	Parameter #28	UINT16	∑kW TH	11715
45831	RW	Parameter #29	UINT16	∑kvara TH	11682
45832	RW	Parameter #30	UINT16	∑kvarb TH	11683
45833	RW	Parameter #31	UINT16	∑kvarc TH	11684
45834	RW	Parameter #32	UINT16	∑kvar TH	11716
45835	RW	Parameter #33	UINT16	∑kVAa TH	11685
45836	RW	Parameter #34	UINT16	∑kVAb TH	11686
45837	RW	Parameter #35	UINT16	∑kVAc TH	11687
45838	RW	Parameter #36	UINT16	∑kVA TH	11717
45839	RW	Parameter #37	UINT16	∑P.F.a TH	11688
45840	RW	Parameter #38	UINT16	∑P.F.b TH	11689
45841	RW	Parameter #39	UINT16	∑P.F.c TH	11690
45842	RW	Parameter #40	UINT16	∑P.F. TH	11718
45843	RW	Parameter #41	UINT16	Ua THD	10103
45844	RW	Parameter #42	UINT16	Ub THD	10104
45845	RW	Parameter #43	UINT16	Uc THD	10105
45846	RW	Parameter #44	UINT16	U4 THD	10106
45847	RW	Parameter #45	UINT16	Ia THD	10115
45848	RW	Parameter #46	UINT16	Ib THD	10116
45849	RW	Parameter #47	UINT16	Ic THD	10117
45850	RW	Parameter #48	UINT16	I4 THD	10118
45851	RW	Parameter #49	UINT16	Ua TOHD	10107
45852	RW	Parameter #50	UINT16	Ub TOHD	10108
45853	RW	Parameter #51	UINT16	Uc TOHD	10109
45854	RW	Parameter #52	UINT16	U4 TOHD	10110

45855	RW	Parameter #53	UINT16	Ia TOHD	10120
45856	RW	Parameter #54	UINT16	Ib TOHD	10121
45857	RW	Parameter #55	UINT16	Ic TOHD	10122
45858	RW	Parameter #56	UINT16	I4 TOHD	10123
45859	RW	Parameter #57	UINT16	Ua TEHD	10111
45860	RW	Parameter #58	UINT16	Ub TEHD	10112
45861	RW	Parameter #59	UINT16	Uc TEHD	10113
45862	RW	Parameter #60	UINT16	U4 TEHD	10114
45863	RW	Parameter #61	UINT16	Ia TEHD	10125
45864	RW	Parameter #62	UINT16	Ib TEHD	10126
45865	RW	Parameter #63	UINT16	Ic TEHD	10127
45866	RW	Parameter #64	UINT16	I4 TEHD	10128

*Default for 150 cycles

Table 5-95 SDR #2 Setup

5.9.13.3 SDR #3 Setup

Register Address	Property	Description	Format	Range/Options	Default
45900	RW	Recording Interval	UINT16	0 to 60 min	15
45901	RW	Recording Mode	UINT16	0=Stop-When-Full 1=First-In-First-Out	1
45902	RW	Number of Parameters	UINT16	0 to 64	64
45903	RW	Parameter #1	UINT16	Uab Fund. RMS	10130*
45904	RW	Parameter #2	UINT16	Ubc Fund. RMS	10131
45905	RW	Parameter #3	UINT16	Uca Fund. RMS	10132
45906	RW	Parameter #4	UINT16	Ua/Uab TIHD	12727
45907	RW	Parameter #5	UINT16	Ub/Ubc TIHD	12728
45908	RW	Parameter #6	UINT16	Uc/Uca TIHD	12729
45909	RW	Parameter #7	UINT16	U4 TIHD	12730
45910	RW	Parameter #8	UINT16	Ia TIHD	12739

45911	RW	Parameter #9	UINT16	Ib TIHD	12740
45912	RW	Parameter #10	UINT16	Ic TIHD	12741
45913	RW	Parameter #11	UINT16	I4 TIHD	12742
45914	RW	Parameter #12	UINT16	Ua/Uab TOIHD	12731
45915	RW	Parameter #13	UINT16	Ub/Ubc TOIHD	12732
45916	RW	Parameter #14	UINT16	Uc/Uca TOIHD	12733
45917	RW	Parameter #15	UINT16	U4 TOIHD	12734
45918	RW	Parameter #16	UINT16	Ia TOIHD	12744
45919	RW	Parameter #17	UINT16	Ib TOIHD	12745
45920	RW	Parameter #18	UINT16	Ic TOIHD	12746
45921	RW	Parameter #19	UINT16	I4 TOIHD	12747
45922	RW	Parameter #20	UINT16	Ua/Uab TEIHD	12735
45923	RW	Parameter #21	UINT16	Ub/Ubc TEIHD	12736
45924	RW	Parameter #22	UINT16	Uc/Uca TEIHD	12737
45925	RW	Parameter #23	UINT16	U4 TEIHD	12738
45926	RW	Parameter #24	UINT16	Ia TEIHD	12749
45927	RW	Parameter #25	UINT16	Ib TEIHD	12750
45928	RW	Parameter #26	UINT16	Ic TEIHD	12751
45929	RW	Parameter #27	UINT16	I4 TEIHD	12752
45930	RW	Parameter #28	UINT16	Ia THD DMD	51073
45931	RW	Parameter #29	UINT16	Ib THD DMD	51074
45932	RW	Parameter #30	UINT16	Ic THD DMD	51075
45933	RW	Parameter #31	UINT16	I4 THD DMD	51076
45934	RW	Parameter #32	UINT16	kW Imp. DMD	51019
45935	RW	Parameter #33	UINT16	kW Imp. Max. DMD	53001
45936	RW	Parameter #34	UINT16	Ua Pst	50001
45937	RW	Parameter #35	UINT16	Ub Pst	50002

45938	RW	Parameter #36	UINT16	Uc Pst	50003
45939	RW	Parameter #37	UINT16	Ua Plt	50004
45940	RW	Parameter #38	UINT16	Ub Plt	50005
45941	RW	Parameter #39	UINT16	Uc Plt	50006
45942~45966	RW	Parameter #40~ Parameter #64	UINT16	Reserved	0

*Default for 150 cycles

Table 5-96 SDR #3 Setup

5.9.13.4 SDR #4 Setup

Register Address	Property	Description	Format	Range/Options	Default
46000	RW	Recording Interval	UINT16	0 to 60 min	15
46001	RW	Recording Mode	UINT16	0=Stop-When-Full 1=First-In-First-Out	1
46002	RW	Number of Parameters	UINT16	0 to 64	64
46003	RW	Parameter #1	UINT16	Ua HD00	10500
46004	RW	Parameter #2	UINT16	Ub HD00	10501
46005	RW	Parameter #3	UINT16	Uc HD00	10502
46006	RW	Parameter #4	UINT16	U4 HD00	10503
46007	RW	Parameter #5	UINT16	Ua HD01	10504
46008	RW	Parameter #6	UINT16	Ub HD01	10505
46009	RW	Parameter #7	UINT16	Uc HD01	10506
46010	RW	Parameter #8	UINT16	U4 HD01	10507
46011	RW	Parameter #9	UINT16	Ua HD02	10508
46012	RW	Parameter #10	UINT16	Ub HD02	10509
46013	RW	Parameter #11	UINT16	Uc HD02	10510
46014	RW	Parameter #12	UINT16	U4 HD02	10511
46015	RW	Parameter #13	UINT16	Ua HD03	10512
46016	RW	Parameter #14	UINT16	Ub HD03	10513
46017	RW	Parameter #15	UINT16	Uc HD03	10514

46018	RW	Parameter #16	UINT16	U4 HD03	10515
46019	RW	Parameter #17	UINT16	Ua HD04	10516
46020	RW	Parameter #18	UINT16	Ub HD04	10517
46021	RW	Parameter #19	UINT16	Uc HD04	10518
46022	RW	Parameter #20	UINT16	U4 HD04	10519
46023	RW	Parameter #21	UINT16	Ua HD05	10520
46024	RW	Parameter #22	UINT16	Ub HD05	10521
46025	RW	Parameter #23	UINT16	Uc HD05	10522
46026	RW	Parameter #24	UINT16	U4 HD05	10523
46027	RW	Parameter #25	UINT16	Ua HD06	10524
46028	RW	Parameter #26	UINT16	Ub HD06	10525
46029	RW	Parameter #27	UINT16	Uc HD06	10526
46030	RW	Parameter #28	UINT16	U4 HD06	10527
46031	RW	Parameter #29	UINT16	Ua HD07	10528
46032	RW	Parameter #30	UINT16	Ub HD07	10529
46033	RW	Parameter #31	UINT16	Uc HD07	10530
46034	RW	Parameter #32	UINT16	U4 HD07	10531
46035	RW	Parameter #33	UINT16	Ua HD08	10532
46036	RW	Parameter #34	UINT16	Ub HD08	10533
46037	RW	Parameter #35	UINT16	Uc HD08	10534
46038	RW	Parameter #36	UINT16	U4 HD08	10535
46039	RW	Parameter #37	UINT16	Ua HD09	10536
46040	RW	Parameter #38	UINT16	Ub HD09	10537
46041	RW	Parameter #39	UINT16	Uc HD09	10538
46042	RW	Parameter #40	UINT16	U4 HD09	10539
46043	RW	Parameter #41	UINT16	Ua HD10	10540
46044	RW	Parameter #42	UINT16	Ub HD10	10541

46045	RW	Parameter #43	UINT16	Uc HD10	10542
46046	RW	Parameter #44	UINT16	U4 HD10	10543
46047	RW	Parameter #45	UINT16	Ua HD10	10544
46048	RW	Parameter #46	UINT16	Ub HD11	10545
46049	RW	Parameter #47	UINT16	Uc HD11	10546
46050	RW	Parameter #48	UINT16	U4 HD11	10547
46051	RW	Parameter #49	UINT16	Ua HD11	10548
46052	RW	Parameter #50	UINT16	Ub HD12	10549
46053	RW	Parameter #51	UINT16	Uc HD12	10550
46054	RW	Parameter #52	UINT16	U4 HD12	10551
46055	RW	Parameter #53	UINT16	Ua HD13	10552
46056	RW	Parameter #54	UINT16	Ub HD13	10553
46057	RW	Parameter #55	UINT16	Uc HD13	10554
46058	RW	Parameter #56	UINT16	U4 HD13	10555
46059	RW	Parameter #57	UINT16	Ua HD14	10556
46060	RW	Parameter #58	UINT16	Ub HD14	10557
46061	RW	Parameter #59	UINT16	Uc HD14	10558
46062	RW	Parameter #60	UINT16	U4 HD14	10559
46063	RW	Parameter #61	UINT16	Ua HD15	10560
46064	RW	Parameter #62	UINT16	Ub HD15	10561
46065	RW	Parameter #63	UINT16	Uc HD15	10562
46066	RW	Parameter #64	UINT16	U4 HD15	10563

Table 5-97 SDR #4 Setup

5.9.13.5 SDR #5 Setup

Register Address	Property	Description	Format	Range/Options	Default
46100	RW	Recording Interval	UINT16	0 to 60 min	15
46101	RW	Recording Mode	UINT16	0=Stop-When-Full	1

				1=First-In-First-Out	
46102	RW	Number of Parameters	UINT16	0 to 64	64
46103	RW	Parameter #1	UINT16	Ua HD16	10564
46104	RW	Parameter #2	UINT16	Ub HD16	10565
46105	RW	Parameter #3	UINT16	Uc HD16	10566
46106	RW	Parameter #4	UINT16	U4 HD16	10567
46107	RW	Parameter #5	UINT16	Ua HD17	10568
46108	RW	Parameter #6	UINT16	Ub HD17	10569
46109	RW	Parameter #7	UINT16	Uc HD17	10570
46110	RW	Parameter #8	UINT16	U4 HD17	10571
46111	RW	Parameter #9	UINT16	Ua HD18	10572
46112	RW	Parameter #10	UINT16	Ub HD18	10573
46113	RW	Parameter #11	UINT16	Uc HD18	10574
46114	RW	Parameter #12	UINT16	U4 HD18	10575
46115	RW	Parameter #13	UINT16	Ua HD19	10576
46116	RW	Parameter #14	UINT16	Ub HD19	10577
46117	RW	Parameter #15	UINT16	Uc HD19	10578
46118	RW	Parameter #16	UINT16	U4 HD19	10579
46119	RW	Parameter #17	UINT16	Ua HD20	10580
46120	RW	Parameter #18	UINT16	Ub HD20	10581
46121	RW	Parameter #19	UINT16	Uc HD20	10582
46122	RW	Parameter #20	UINT16	U4 HD20	10583
46123	RW	Parameter #21	UINT16	Ua HD21	10584
46124	RW	Parameter #22	UINT16	Ub HD21	10585
46125	RW	Parameter #23	UINT16	Uc HD21	10586
46126	RW	Parameter #24	UINT16	U4 HD21	10587
46127	RW	Parameter #25	UINT16	Ua HD22	10588

46128	RW	Parameter #26	UINT16	Ub HD22	10589
46129	RW	Parameter #27	UINT16	Uc HD22	10590
46130	RW	Parameter #28	UINT16	U4 HD22	10591
46131	RW	Parameter #29	UINT16	Ua HD23	10592
46132	RW	Parameter #30	UINT16	Ub HD23	10593
46133	RW	Parameter #31	UINT16	Uc HD23	10594
46134	RW	Parameter #32	UINT16	U4 HD23	10595
46135	RW	Parameter #33	UINT16	Ua HD24	10596
46136	RW	Parameter #34	UINT16	Ub HD24	10597
46137	RW	Parameter #35	UINT16	Uc HD24	10598
46138	RW	Parameter #36	UINT16	U4 HD24	10599
46139	RW	Parameter #37	UINT16	Ua HD25	10600
46140	RW	Parameter #38	UINT16	Ub HD25	10601
46141	RW	Parameter #39	UINT16	Uc HD25	10602
46142	RW	Parameter #40	UINT16	U4 HD25	10603
46143	RW	Parameter #41	UINT16	Ua HD26	10604
46144	RW	Parameter #42	UINT16	Ub HD26	10605
46145	RW	Parameter #43	UINT16	Uc HD26	10606
46146	RW	Parameter #44	UINT16	U4 HD26	10607
46147	RW	Parameter #45	UINT16	Ua HD27	10608
46148	RW	Parameter #46	UINT16	Ub HD27	10609
46149	RW	Parameter #47	UINT16	Uc HD27	10610
46150	RW	Parameter #48	UINT16	U4 HD27	10611
46151	RW	Parameter #49	UINT16	Ua HD28	10612
46152	RW	Parameter #50	UINT16	Ub HD28	10613
46153	RW	Parameter #51	UINT16	Uc HD28	10614
46154	RW	Parameter #52	UINT16	U4 HD28	10615

46155	RW	Parameter #53	UINT16	Ua HD29	10616
46156	RW	Parameter #54	UINT16	Ub HD29	10617
46157	RW	Parameter #55	UINT16	Uc HD29	10618
46158	RW	Parameter #56	UINT16	U4 HD29	10619
46159	RW	Parameter #57	UINT16	Ua HD30	10620
46160	RW	Parameter #58	UINT16	Ub HD30	10621
46161	RW	Parameter #59	UINT16	Uc HD30	10622
46162	RW	Parameter #60	UINT16	U4 HD30	10623
46163	RW	Parameter #61	UINT16	Ua HD31	10624
46164	RW	Parameter #62	UINT16	Ub HD31	10625
46165	RW	Parameter #63	UINT16	Uc HD31	10626
46166	RW	Parameter #64	UINT16	U4 HD31	10627

Table 5-98 SDR #5 Setup

5.9.13.6 SDR #6 Setup

Register Address	Property	Description	Format	Range/Options	Default
46200	RW	Recording Interval	UINT16	0 to 60 min	15
46201	RW	Recording Mode	UINT16	0=Stop-When-Full 1=First-In-First-Out	1
46202	RW	Number of Parameters	UINT16	0 to 64	64
46203	RW	Parameter #1	UINT16	Ua HD32	10628
46204	RW	Parameter #2	UINT16	Ub HD32	10629
46205	RW	Parameter #3	UINT16	Uc HD32	10630
46206	RW	Parameter #4	UINT16	U4 HD32	10631
46207	RW	Parameter #5	UINT16	Ua HD33	10632
46208	RW	Parameter #6	UINT16	Ub HD33	10633
46209	RW	Parameter #7	UINT16	Uc HD33	10634
46210	RW	Parameter #8	UINT16	U4 HD33	10635

46211	RW	Parameter #9	UINT16	Ua HD34	10636
46212	RW	Parameter #10	UINT16	Ub HD34	10637
46213	RW	Parameter #11	UINT16	Uc HD34	10638
46214	RW	Parameter #12	UINT16	U4 HD34	10639
46215	RW	Parameter #13	UINT16	Ua HD35	10640
46216	RW	Parameter #14	UINT16	Ub HD35	10641
46217	RW	Parameter #15	UINT16	Uc HD35	10642
46218	RW	Parameter #16	UINT16	U4 HD35	10643
46219	RW	Parameter #17	UINT16	Ua HD36	10644
46220	RW	Parameter #18	UINT16	Ub HD36	10645
46221	RW	Parameter #19	UINT16	Uc HD36	10646
46222	RW	Parameter #20	UINT16	U4 HD36	10647
46223	RW	Parameter #21	UINT16	Ua HD37	10648
46224	RW	Parameter #22	UINT16	Ub HD37	10649
46225	RW	Parameter #23	UINT16	Uc HD37	10650
46226	RW	Parameter #24	UINT16	U4 HD37	10651
46227	RW	Parameter #25	UINT16	Ua HD38	10652
46228	RW	Parameter #26	UINT16	Ub HD38	10653
46229	RW	Parameter #27	UINT16	Uc HD38	10654
46230	RW	Parameter #28	UINT16	U4 HD38	10655
46231	RW	Parameter #29	UINT16	Ua HD39	10656
46232	RW	Parameter #30	UINT16	Ub HD39	10657
46233	RW	Parameter #31	UINT16	Uc HD39	10658
46234	RW	Parameter #32	UINT16	U4 HD39	10659
46235	RW	Parameter #33	UINT16	Ua HD40	10660
46236	RW	Parameter #34	UINT16	Ub HD40	10661
46237	RW	Parameter #35	UINT16	Uc HD40	10662

46238	RW	Parameter #36	UINT16	U4 HD40	10663
46239	RW	Parameter #37	UINT16	Ua HD41	10664
46240	RW	Parameter #38	UINT16	Ub HD41	10665
46241	RW	Parameter #39	UINT16	Uc HD41	10666
46242	RW	Parameter #40	UINT16	U4 HD41	10667
46243	RW	Parameter #41	UINT16	Ua HD42	10668
46244	RW	Parameter #42	UINT16	Ub HD42	10669
46245	RW	Parameter #43	UINT16	Uc HD42	10670
46246	RW	Parameter #44	UINT16	U4 HD42	10671
46247	RW	Parameter #45	UINT16	Ua HD43	10672
46248	RW	Parameter #46	UINT16	Ub HD43	10673
46249	RW	Parameter #47	UINT16	Uc HD43	10674
46250	RW	Parameter #48	UINT16	U4 HD43	10675
46251	RW	Parameter #49	UINT16	Ua HD44	10676
46252	RW	Parameter #50	UINT16	Ub HD44	10677
46253	RW	Parameter #51	UINT16	Uc HD44	10678
46254	RW	Parameter #52	UINT16	U4 HD44	10679
46255	RW	Parameter #53	UINT16	Ua HD45	10680
46256	RW	Parameter #54	UINT16	Ub HD45	10681
46257	RW	Parameter #55	UINT16	Uc HD45	10682
46258	RW	Parameter #56	UINT16	U4 HD45	10683
46259	RW	Parameter #57	UINT16	Ua HD46	10684
46260	RW	Parameter #58	UINT16	Ub HD46	10685
46261	RW	Parameter #59	UINT16	Uc HD46	10686
46262	RW	Parameter #60	UINT16	U4 HD46	10687
46263	RW	Parameter #61	UINT16	Ua HD47	10688
46264	RW	Parameter #62	UINT16	Ub HD47	10689

46265	RW	Parameter #63	UINT16	Uc HD47	10690
46266	RW	Parameter #64	UINT16	U4 HD47	10691

Table 5-99 SDR #6 Setup

5.9.13.7 SDR #7 Setup

Register Address	Property	Description	Format	Range/Options	Default
46300	RW	Recording Interval	UINT16	0 to 60 min	15
46301	RW	Recording Mode	UINT16	0=Stop-When-Full 1=First-In-First-Out	1
46302	RW	Number of Parameters	UINT16	0 to 64	64
46303	RW	Parameter #1	UINT16	Ua HD48	10692
46304	RW	Parameter #2	UINT16	Ub HD48	10693
46305	RW	Parameter #3	UINT16	Uc HD48	10694
46306	RW	Parameter #4	UINT16	U4 HD48	10695
46307	RW	Parameter #5	UINT16	Ua HD49	10696
46308	RW	Parameter #6	UINT16	Ub HD49	10697
46309	RW	Parameter #7	UINT16	Uc HD49	10698
46310	RW	Parameter #8	UINT16	U4 HD49	10699
46311	RW	Parameter #9	UINT16	Ua HD50	10700
46312	RW	Parameter #10	UINT16	Ub HD50	10701
46313	RW	Parameter #11	UINT16	Uc HD50	10702
46314	RW	Parameter #12	UINT16	U4 HD50	10703
46315	RW	Parameter #13	UINT16	Ia DC RMS	11359
46316	RW	Parameter #14	UINT16	Ib DC RMS	11360
46317	RW	Parameter #15	UINT16	Ic DC RMS	11361
46318	RW	Parameter #16	UINT16	I4 DC RMS	11362
46319	RW	Parameter #17	UINT16	Ia H01 RMS	11364
46320	RW	Parameter #18	UINT16	Ib H01 RMS	11365

46321	RW	Parameter #19	UINT16	Ic H01 RMS	11366
46322	RW	Parameter #20	UINT16	I4 H01 RMS	11367
46323	RW	Parameter #21	UINT16	Ia H02 RMS	11369
46324	RW	Parameter #22	UINT16	Ib H02 RMS	11370
46325	RW	Parameter #23	UINT16	Ic H02 RMS	11371
46326	RW	Parameter #24	UINT16	I4 H02 RMS	11372
46327	RW	Parameter #25	UINT16	Ia H03 RMS	11374
46328	RW	Parameter #26	UINT16	Ib H03 RMS	11375
46329	RW	Parameter #27	UINT16	Ic H03 RMS	11376
46330	RW	Parameter #28	UINT16	I4 H03 RMS	11377
46331	RW	Parameter #29	UINT16	Ia H04 RMS	11379
46332	RW	Parameter #30	UINT16	Ib H04 RMS	11380
46333	RW	Parameter #31	UINT16	Ic H04 RMS	11381
46334	RW	Parameter #32	UINT16	I4 H04 RMS	11382
46335	RW	Parameter #33	UINT16	Ia H05 RMS	11384
46336	RW	Parameter #34	UINT16	Ib H05 RMS	11385
46337	RW	Parameter #35	UINT16	Ic H05 RMS	11386
46338	RW	Parameter #36	UINT16	I4 H05 RMS	11387
46339	RW	Parameter #37	UINT16	Ia H06 RMS	11389
46340	RW	Parameter #38	UINT16	Ib H06 RMS	11390
46341	RW	Parameter #39	UINT16	Ic H06 RMS	11391
46342	RW	Parameter #40	UINT16	I4 H06 RMS	11392
46343	RW	Parameter #41	UINT16	Ia H07 RMS	11394
46344	RW	Parameter #42	UINT16	Ib H07 RMS	11395
46345	RW	Parameter #43	UINT16	Ic H07 RMS	11396
46346	RW	Parameter #44	UINT16	I4 H07 RMS	11397
46347	RW	Parameter #45	UINT16	Ia H08 RMS	11399

46348	RW	Parameter #46	UINT16	Ib H08 RMS	11400
46349	RW	Parameter #47	UINT16	Ic H08 RMS	11401
46350	RW	Parameter #48	UINT16	I4 H08 RMS	11402
46351	RW	Parameter #49	UINT16	Ia H09 RMS	11404
46352	RW	Parameter #50	UINT16	Ib H09 RMS	11405
46353	RW	Parameter #51	UINT16	Ic H09 RMS	11406
46354	RW	Parameter #52	UINT16	I4 H09 RMS	11407
46355	RW	Parameter #53	UINT16	Ia H10 RMS	11409
46356	RW	Parameter #54	UINT16	Ib H10 RMS	11410
46357	RW	Parameter #55	UINT16	Ic H10 RMS	11411
46358	RW	Parameter #56	UINT16	I4 H10 RMS	11412
46359	RW	Parameter #57	UINT16	Ia H11 RMS	11414
46360	RW	Parameter #58	UINT16	Ib H11 RMS	11415
46361	RW	Parameter #59	UINT16	Ic H11 RMS	11416
46362	RW	Parameter #60	UINT16	I4 H11 RMS	11417
46363	RW	Parameter #61	UINT16	Ia H12 RMS	11419
46364	RW	Parameter #62	UINT16	Ib H12 RMS	11420
46365	RW	Parameter #63	UINT16	Ic H12 RMS	11421
46366	RW	Parameter #64	UINT16	I4 H12 RMS	11422

Table 5-100 SDR #7 Setup

5.9.13.8 SDR #8 Setup

Register Address	Property	Description	Format	Range/Options	Default
46400	RW	Recording Interval	UINT16	0 to 60 min	15
46401	RW	Recording Mode	UINT16	0=Stop-When-Full 1=First-In-First-Out	1
46402	RW	Number of Parameters	UINT16	0 to 64	64
46403	RW	Parameter #1	UINT16	Ia H13 RMS	11424

46404	RW	Parameter #2	UINT16	Ib H13 RMS	11425
46405	RW	Parameter #3	UINT16	Ic H13 RMS	11426
46406	RW	Parameter #4	UINT16	I4 H13 RMS	11427
46407	RW	Parameter #5	UINT16	Ia H14 RMS	11429
46408	RW	Parameter #6	UINT16	Ib H14 RMS	11430
46409	RW	Parameter #7	UINT16	Ic H14 RMS	11431
46410	RW	Parameter #8	UINT16	I4 H14 RMS	11432
46411	RW	Parameter #9	UINT16	Ia H15 RMS	11434
46412	RW	Parameter #10	UINT16	Ib H15 RMS	11435
46413	RW	Parameter #11	UINT16	Ic H15 RMS	11436
46414	RW	Parameter #12	UINT16	I4 H15 RMS	11437
46415	RW	Parameter #13	UINT16	Ia H16 RMS	11439
46416	RW	Parameter #14	UINT16	Ib H16 RMS	11440
46417	RW	Parameter #15	UINT16	Ic H16 RMS	11441
46418	RW	Parameter #16	UINT16	I4 H16 RMS	11442
46419	RW	Parameter #17	UINT16	Ia H17 RMS	11444
46420	RW	Parameter #18	UINT16	Ib H17 RMS	11445
46421	RW	Parameter #19	UINT16	Ic H17 RMS	11446
46422	RW	Parameter #20	UINT16	I4 H17 RMS	11447
46423	RW	Parameter #21	UINT16	Ia H18 RMS	11449
46424	RW	Parameter #22	UINT16	Ib H18 RMS	11450
46425	RW	Parameter #23	UINT16	Ic H18 RMS	11451
46426	RW	Parameter #24	UINT16	I4 H18 RMS	11452
46427	RW	Parameter #25	UINT16	Ia H19 RMS	11454
46428	RW	Parameter #26	UINT16	Ib H19 RMS	11455
46429	RW	Parameter #27	UINT16	Ic H19 RMS	11456
46430	RW	Parameter #28	UINT16	I4 H19 RMS	11457

46431	RW	Parameter #29	UINT16	Ia H20 RMS	11459
46432	RW	Parameter #30	UINT16	Ib H20 RMS	11460
46433	RW	Parameter #31	UINT16	Ic H20 RMS	11461
46434	RW	Parameter #32	UINT16	I4 H20 RMS	11462
46435	RW	Parameter #33	UINT16	Ia H21 RMS	11464
46436	RW	Parameter #34	UINT16	Ib H21 RMS	11465
46437	RW	Parameter #35	UINT16	Ic H21 RMS	11466
46438	RW	Parameter #36	UINT16	I4 H21 RMS	11467
46439	RW	Parameter #37	UINT16	Ia H22 RMS	11469
46440	RW	Parameter #38	UINT16	Ib H22 RMS	11470
46441	RW	Parameter #39	UINT16	Ic H22 RMS	11471
46442	RW	Parameter #40	UINT16	I4 H22 RMS	11472
46443	RW	Parameter #41	UINT16	Ia H23 RMS	11474
46444	RW	Parameter #42	UINT16	Ib H23 RMS	11475
46445	RW	Parameter #43	UINT16	Ic H23 RMS	11476
46446	RW	Parameter #44	UINT16	I4 H23 RMS	11477
46447	RW	Parameter #45	UINT16	Ia H24 RMS	11479
46448	RW	Parameter #46	UINT16	Ib H24 RMS	11480
46449	RW	Parameter #47	UINT16	Ic H24 RMS	11481
46450	RW	Parameter #48	UINT16	I4 H24 RMS	11482
46451	RW	Parameter #49	UINT16	Ia H25 RMS	11484
46452	RW	Parameter #50	UINT16	Ib H25 RMS	11485
46453	RW	Parameter #51	UINT16	Ic H25 RMS	11486
46454	RW	Parameter #52	UINT16	I4 H25 RMS	11487
46455	RW	Parameter #53	UINT16	Ia H26 RMS	11489
46456	RW	Parameter #54	UINT16	Ib H26 RMS	11490
46457	RW	Parameter #55	UINT16	Ic H26 RMS	11491

46458	RW	Parameter #56	UINT16	I4 H26 RMS	11492
46459	RW	Parameter #57	UINT16	Ia H27 RMS	11494
46460	RW	Parameter #58	UINT16	Ib H27 RMS	11495
46461	RW	Parameter #59	UINT16	Ic H27 RMS	11496
46462	RW	Parameter #60	UINT16	I4 H27 RMS	11497
46463	RW	Parameter #61	UINT16	Ia H28 RMS	11499
46464	RW	Parameter #62	UINT16	Ib H28 RMS	11500
46465	RW	Parameter #63	UINT16	Ic H28 RMS	11501
46466	RW	Parameter #64	UINT16	I4 H28 RMS	11502

Table 5-101 SDR #8 Setup

5.9.13.9 SDR #9 Setup

Register Address	Property	Description	Format	Range/Options	Default
46500	RW	Recording Interval	UINT16	0 to 60 min	15
46501	RW	Recording Mode	UINT16	0=Stop-When-Full 1=First-In-First-Out	1
46502	RW	Number of Parameters	UINT16	0 to 64	64
46503	RW	Parameter #1	UINT16	Ia H29 RMS	11504
46504	RW	Parameter #2	UINT16	Ib H29 RMS	11505
46505	RW	Parameter #3	UINT16	Ic H29 RMS	11506
46506	RW	Parameter #4	UINT16	I4 H29 RMS	11507
46507	RW	Parameter #5	UINT16	Ia H30 RMS	11509
46508	RW	Parameter #6	UINT16	Ib H30 RMS	11510
46509	RW	Parameter #7	UINT16	Ic H30 RMS	11511
46510	RW	Parameter #8	UINT16	I4 H30 RMS	11512
46511	RW	Parameter #9	UINT16	Ia H31 RMS	11514
46512	RW	Parameter #10	UINT16	Ib H31 RMS	11515
46513	RW	Parameter #11	UINT16	Ic H31 RMS	11516

46514	RW	Parameter #12	UINT16	I4 H31 RMS	11517
46515	RW	Parameter #13	UINT16	Ia H32 RMS	11519
46516	RW	Parameter #14	UINT16	Ib H32 RMS	11520
46517	RW	Parameter #15	UINT16	Ic H32 RMS	11521
46518	RW	Parameter #16	UINT16	I4 H32 RMS	11522
46519	RW	Parameter #17	UINT16	Ia H33 RMS	11524
46520	RW	Parameter #18	UINT16	Ib H33 RMS	11525
46521	RW	Parameter #19	UINT16	Ic H33 RMS	11526
46522	RW	Parameter #20	UINT16	I4 H33 RMS	11527
46523	RW	Parameter #21	UINT16	Ia H34 RMS	11529
46524	RW	Parameter #22	UINT16	Ib H34 RMS	11530
46525	RW	Parameter #23	UINT16	Ic H34 RMS	11531
46526	RW	Parameter #24	UINT16	I4 H34 RMS	11532
46527	RW	Parameter #25	UINT16	Ia H35 RMS	11534
46528	RW	Parameter #26	UINT16	Ib H35 RMS	11535
46529	RW	Parameter #27	UINT16	Ic H35 RMS	11536
46530	RW	Parameter #28	UINT16	I4 H35 RMS	11537
46531	RW	Parameter #29	UINT16	Ia H36 RMS	11539
46532	RW	Parameter #30	UINT16	Ib H36 RMS	11540
46533	RW	Parameter #31	UINT16	Ic H36 RMS	11541
46534	RW	Parameter #32	UINT16	I4 H36 RMS	11542
46535	RW	Parameter #33	UINT16	Ia H37 RMS	11544
46536	RW	Parameter #34	UINT16	Ib H37 RMS	11545
46537	RW	Parameter #35	UINT16	Ic H37 RMS	11546
46538	RW	Parameter #36	UINT16	I4 H37 RMS	11547
46539	RW	Parameter #37	UINT16	Ia H38 RMS	11549
46540	RW	Parameter #38	UINT16	Ib H38 RMS	11550

46541	RW	Parameter #39	UINT16	Ic H38 RMS	11551
46542	RW	Parameter #40	UINT16	I4 H38 RMS	11552
46543	RW	Parameter #41	UINT16	Ia H39 RMS	11554
46544	RW	Parameter #42	UINT16	Ib H39 RMS	11555
46545	RW	Parameter #43	UINT16	Ic H39 RMS	11556
46546	RW	Parameter #44	UINT16	I4 H39 RMS	11557
46547	RW	Parameter #45	UINT16	Ia H40 RMS	11559
46548	RW	Parameter #46	UINT16	Ib H40 RMS	11560
46549	RW	Parameter #47	UINT16	Ic H40 RMS	11561
46550	RW	Parameter #48	UINT16	I4 H40 RMS	11562
46551	RW	Parameter #49	UINT16	Ia H41 RMS	11564
46552	RW	Parameter #50	UINT16	Ib H41 RMS	11565
46553	RW	Parameter #51	UINT16	Ic H41 RMS	11566
46554	RW	Parameter #52	UINT16	I4 H41 RMS	11567
46555	RW	Parameter #53	UINT16	Ia H42 RMS	11569
46556	RW	Parameter #54	UINT16	Ib H42 RMS	11570
46557	RW	Parameter #55	UINT16	Ic H42 RMS	11571
46558	RW	Parameter #56	UINT16	I4 H42 RMS	11572
46559	RW	Parameter #57	UINT16	Ia H43 RMS	11574
46560	RW	Parameter #58	UINT16	Ib H43 RMS	11575
46561	RW	Parameter #59	UINT16	Ic H43 RMS	11576
46562	RW	Parameter #60	UINT16	I4 H43 RMS	11577
46563	RW	Parameter #61	UINT16	Ia H44 RMS	11579
46564	RW	Parameter #62	UINT16	Ib H44 RMS	11580
46565	RW	Parameter #63	UINT16	Ic H44 RMS	11581
46566	RW	Parameter #64	UINT16	I4 H44 RMS	11582

Table 5-102 SDR #9 Setup

5.9.13.10 SDR #10 Setup

Register Address	Property	Description	Format	Range/Options	Default
46600	RW	Recording Interval	UINT16	0 to 60 min	15
46601	RW	Recording Mode	UINT16	0=Stop-When-Full 1=First-In-First-Out	1
46602	RW	Number of Parameters	UINT16	0 to 64	64
46603	RW	Parameter #1	UINT16	Ia H45 RMS	11584
46604	RW	Parameter #2	UINT16	Ib H45 RMS	11585
46605	RW	Parameter #3	UINT16	Ic H45 RMS	11586
46606	RW	Parameter #4	UINT16	I4 H45 RMS	11587
46607	RW	Parameter #5	UINT16	Ia H46 RMS	11589
46608	RW	Parameter #6	UINT16	Ib H46 RMS	11590
46609	RW	Parameter #7	UINT16	Ic H46 RMS	11591
46610	RW	Parameter #8	UINT16	I4 H46 RMS	11592
46611	RW	Parameter #9	UINT16	Ia H47 RMS	11594
46612	RW	Parameter #10	UINT16	Ib H47 RMS	11595
46613	RW	Parameter #11	UINT16	Ic H47 RMS	11596
46614	RW	Parameter #12	UINT16	I4 H47 RMS	11597
46615	RW	Parameter #13	UINT16	Ia H48 RMS	11599
46616	RW	Parameter #14	UINT16	Ib H48 RMS	11600
46617	RW	Parameter #15	UINT16	Ic H48 RMS	11601
46618	RW	Parameter #16	UINT16	I4 H48 RMS	11602
46619	RW	Parameter #17	UINT16	Ia H49 RMS	11604
46620	RW	Parameter #18	UINT16	Ib H49 RMS	11605
46621	RW	Parameter #19	UINT16	Ic H49 RMS	11606
46622	RW	Parameter #20	UINT16	I4 H49 RMS	11607
46623	RW	Parameter #21	UINT16	Ia H50 RMS	11609
46624	RW	Parameter #22	UINT16	Ib H50 RMS	11610

46625	RW	Parameter #23	UINT16	Ic H50 RMS	11611
46626	RW	Parameter #24	UINT16	I4 H50 RMS	11612
46627	RW	Parameter #25	UINT16	Ua IHD00	12754
46628	RW	Parameter #26	UINT16	Ub IHD00	12755
46629	RW	Parameter #27	UINT16	Uc IHD00	12756
46630	RW	Parameter #28	UINT16	U4 IHD00	12757
46631	RW	Parameter #29	UINT16	Ua IHD01	12758
46632	RW	Parameter #30	UINT16	Ub IHD01	12759
46633	RW	Parameter #31	UINT16	Uc IHD01	12760
46634	RW	Parameter #32	UINT16	U4 IHD01	12761
46635	RW	Parameter #33	UINT16	Ua IHD02	12762
46636	RW	Parameter #34	UINT16	Ub IHD02	12763
46637	RW	Parameter #35	UINT16	Uc IHD02	12764
46638	RW	Parameter #36	UINT16	U4 IHD02	12765
46639	RW	Parameter #37	UINT16	Ua IHD03	12766
46640	RW	Parameter #38	UINT16	Ub IHD03	12767
46641	RW	Parameter #39	UINT16	Uc IHD03	12768
46642	RW	Parameter #40	UINT16	U4 IHD03	12769
46643	RW	Parameter #41	UINT16	Ua IHD04	12770
46644	RW	Parameter #42	UINT16	Ub IHD04	12771
46645	RW	Parameter #43	UINT16	Uc IHD04	12772
46646	RW	Parameter #44	UINT16	U4 IHD04	12773
46647	RW	Parameter #45	UINT16	Ua IHD05	12774
46648	RW	Parameter #46	UINT16	Ub IHD05	12775
46649	RW	Parameter #47	UINT16	Uc IHD05	12776
46650	RW	Parameter #48	UINT16	U4 IHD05	12777
46651	RW	Parameter #49	UINT16	Ua IHD06	12778

46652	RW	Parameter #50	UINT16	Ub IHD06	12779
46653	RW	Parameter #51	UINT16	Uc IHD06	12780
46654	RW	Parameter #52	UINT16	U4 IHD06	12781
46655	RW	Parameter #53	UINT16	Ua IHD07	12782
46656	RW	Parameter #54	UINT16	Ub IHD07	12783
46657	RW	Parameter #55	UINT16	Uc IHD07	12784
46658	RW	Parameter #56	UINT16	U4 IHD07	12785
46659	RW	Parameter #57	UINT16	Ua IHD08	12786
46660	RW	Parameter #58	UINT16	Ub IHD08	12787
46661	RW	Parameter #59	UINT16	Uc IHD08	12788
46662	RW	Parameter #60	UINT16	U4 IHD08	12789
46663	RW	Parameter #61	UINT16	Ua IHD09	12790
46664	RW	Parameter #62	UINT16	Ub IHD09	12791
46665	RW	Parameter #63	UINT16	Uc IHD09	12792
46666	RW	Parameter #64	UINT16	U4 IHD09	12793

Table 5-103 SDR #10 Setup

5.9.13.11 SDR #11 Setup

Register Address	Property	Description	Format	Range/Options	Default
46700	RW	Recording Interval	UINT16	0 to 60 min	15
46701	RW	Recording Mode	UINT16	0=Stop-When-Full 1=First-In-First-Out	1
46702	RW	Number of Parameters	UINT16	0 to 64	64
46703	RW	Parameter #1	UINT16	Ua IHD10	12794
46704	RW	Parameter #2	UINT16	Ub IHD10	12795
46705	RW	Parameter #3	UINT16	Uc IHD10	12796
46706	RW	Parameter #4	UINT16	U4 IHD10	12797
46707	RW	Parameter #5	UINT16	Ua IHD11	12798

46708	RW	Parameter #6	UINT16	Ub IHD11	12799
46709	RW	Parameter #7	UINT16	Uc IHD11	12800
46710	RW	Parameter #8	UINT16	U4 IHD11	12801
46711	RW	Parameter #9	UINT16	Ua IHD12	12802
46712	RW	Parameter #10	UINT16	Ub IHD12	12803
46713	RW	Parameter #11	UINT16	Uc IHD12	12804
46714	RW	Parameter #12	UINT16	U4 IHD12	12805
46715	RW	Parameter #13	UINT16	Ua IHD13	12806
46716	RW	Parameter #14	UINT16	Ub IHD13	12807
46717	RW	Parameter #15	UINT16	Uc IHD13	12808
46718	RW	Parameter #16	UINT16	U4 IHD13	12809
46719	RW	Parameter #17	UINT16	Ua IHD14	12810
46720	RW	Parameter #18	UINT16	Ub IHD14	12811
46721	RW	Parameter #19	UINT16	Uc IHD14	12812
46722	RW	Parameter #20	UINT16	U4 IHD14	12813
46723	RW	Parameter #21	UINT16	Ua IHD15	12814
46724	RW	Parameter #22	UINT16	Ub IHD15	12815
46725	RW	Parameter #23	UINT16	Uc IHD15	12816
46726	RW	Parameter #24	UINT16	U4 IHD15	12817
46727	RW	Parameter #25	UINT16	Ua IHD16	12818
46728	RW	Parameter #26	UINT16	Ub IHD16	12819
46729	RW	Parameter #27	UINT16	Uc IHD16	12820
46730	RW	Parameter #28	UINT16	U4 IHD16	12821
46731	RW	Parameter #29	UINT16	Ua IHD17	12822
46732	RW	Parameter #30	UINT16	Ub IHD17	12823
46733	RW	Parameter #31	UINT16	Uc IHD17	12824
46734	RW	Parameter #32	UINT16	U4 IHD17	12825

46735	RW	Parameter #33	UINT16	Ua IHD18	12826
46736	RW	Parameter #34	UINT16	Ub IHD18	12827
46737	RW	Parameter #35	UINT16	Uc IHD18	12828
46738	RW	Parameter #36	UINT16	U4 IHD18	12829
46739	RW	Parameter #37	UINT16	Ua IHD19	12830
46740	RW	Parameter #38	UINT16	Ub IHD19	12831
46741	RW	Parameter #39	UINT16	Uc IHD19	12832
46742	RW	Parameter #40	UINT16	U4 IHD19	12833
46743	RW	Parameter #41	UINT16	Ua IHD20	12834
46744	RW	Parameter #42	UINT16	Ub IHD20	12835
46745	RW	Parameter #43	UINT16	Uc IHD20	12836
46746	RW	Parameter #44	UINT16	U4 IHD20	12837
46747	RW	Parameter #45	UINT16	Ua IHD21	12838
46748	RW	Parameter #46	UINT16	Ub IHD21	12839
46749	RW	Parameter #47	UINT16	Uc IHD21	12840
46750	RW	Parameter #48	UINT16	U4 IHD21	12841
46751	RW	Parameter #49	UINT16	Ua IHD22	12842
46752	RW	Parameter #50	UINT16	Ub IHD22	12843
46753	RW	Parameter #51	UINT16	Uc IHD22	12844
46754	RW	Parameter #52	UINT16	U4 IHD22	12845
46755	RW	Parameter #53	UINT16	Ua IHD23	12846
46756	RW	Parameter #54	UINT16	Ub IHD23	12847
46757	RW	Parameter #55	UINT16	Uc IHD23	12848
46758	RW	Parameter #56	UINT16	U4 IHD23	12849
46759	RW	Parameter #57	UINT16	Ua IHD24	12850
46760	RW	Parameter #58	UINT16	Ub IHD24	12851
46761	RW	Parameter #59	UINT16	Uc IHD24	12852

46762	RW	Parameter #60	UINT16	U4 IHD24	12853
46763	RW	Parameter #61	UINT16	Ua IHD25	12854
46764	RW	Parameter #62	UINT16	Ub IHD25	12855
46765	RW	Parameter #63	UINT16	Uc IHD25	12856
46766	RW	Parameter #64	UINT16	U4 IHD25	12857

Table 5-104 SDR #11 Setup

5.9.13.12 SDR #12 Setup

Register Address	Property	Description	Format	Range/Options	Default
46800	RW	Recording Interval	UINT16	0 to 60 min	15
46801	RW	Recording Mode	UINT16	0=Stop-When-Full 1=First-In-First-Out	1
46802	RW	Number of Parameters	UINT16	0 to 64	64
46803	RW	Parameter #1	UINT16	Ua IHD26	12858
46804	RW	Parameter #2	UINT16	Ub IHD26	12859
46805	RW	Parameter #3	UINT16	Uc IHD26	12860
46806	RW	Parameter #4	UINT16	U4 IHD26	12861
46807	RW	Parameter #5	UINT16	Ua IHD27	12862
46808	RW	Parameter #6	UINT16	Ub IHD27	12863
46809	RW	Parameter #7	UINT16	Uc IHD27	12864
46810	RW	Parameter #8	UINT16	U4 IHD27	12865
46811	RW	Parameter #9	UINT16	Ua IHD28	12866
46812	RW	Parameter #10	UINT16	Ub IHD28	12867
46813	RW	Parameter #11	UINT16	Uc IHD28	12868
46814	RW	Parameter #12	UINT16	U4 IHD28	12869
46815	RW	Parameter #13	UINT16	Ua IHD29	12870
46816	RW	Parameter #14	UINT16	Ub IHD29	12871
46817	RW	Parameter #15	UINT16	Uc IHD29	12872

46818	RW	Parameter #16	UINT16	U4 IHD29	12873
46819	RW	Parameter #17	UINT16	Ua IHD30	12874
46820	RW	Parameter #18	UINT16	Ub IHD30	12875
46821	RW	Parameter #19	UINT16	Uc IHD30	12876
46822	RW	Parameter #20	UINT16	U4 IHD30	12877
46823	RW	Parameter #21	UINT16	Ua IHD31	12878
46824	RW	Parameter #22	UINT16	Ub IHD31	12879
46825	RW	Parameter #23	UINT16	Uc IHD31	12880
46826	RW	Parameter #24	UINT16	U4 IHD31	12881
46827	RW	Parameter #25	UINT16	Ua IHD32	12882
46828	RW	Parameter #26	UINT16	Ub IHD32	12883
46829	RW	Parameter #27	UINT16	Uc IHD32	12884
46830	RW	Parameter #28	UINT16	U4 IHD32	12885
46831	RW	Parameter #29	UINT16	Ua IHD33	12886
46832	RW	Parameter #30	UINT16	Ub IHD33	12887
46833	RW	Parameter #31	UINT16	Uc IHD33	12888
46834	RW	Parameter #32	UINT16	U4 IHD33	12889
46835	RW	Parameter #33	UINT16	Ua IHD34	12890
46836	RW	Parameter #34	UINT16	Ub IHD34	12891
46837	RW	Parameter #35	UINT16	Uc IHD34	12892
46838	RW	Parameter #36	UINT16	U4 IHD34	12893
46839	RW	Parameter #37	UINT16	Ua IHD35	12894
46840	RW	Parameter #38	UINT16	Ub IHD35	12895
46841	RW	Parameter #39	UINT16	Uc IHD35	12896
46842	RW	Parameter #40	UINT16	U4 IHD35	12897
46843	RW	Parameter #41	UINT16	Ua IHD36	12898
46844	RW	Parameter #42	UINT16	Ub IHD36	12899

46845	RW	Parameter #43	UINT16	Uc IHD36	12900
46846	RW	Parameter #44	UINT16	U4 IHD36	12901
46847	RW	Parameter #45	UINT16	Ua IHD37	12902
46848	RW	Parameter #46	UINT16	Ub IHD37	12903
46849	RW	Parameter #47	UINT16	Uc IHD37	12904
46850	RW	Parameter #48	UINT16	U4 IHD37	12905
46851	RW	Parameter #49	UINT16	Ua IHD38	12906
46852	RW	Parameter #50	UINT16	Ub IHD38	12907
46853	RW	Parameter #51	UINT16	Uc IHD38	12908
46854	RW	Parameter #52	UINT16	U4 IHD38	12909
46855	RW	Parameter #53	UINT16	Ua IHD39	12910
46856	RW	Parameter #54	UINT16	Ub IHD39	12911
46857	RW	Parameter #55	UINT16	Uc IHD39	12912
46858	RW	Parameter #56	UINT16	U4 IHD39	12913
46859	RW	Parameter #57	UINT16	Ua IHD40	12914
46860	RW	Parameter #58	UINT16	Ub IHD40	12915
46861	RW	Parameter #59	UINT16	Uc IHD40	12916
46862	RW	Parameter #60	UINT16	U4 IHD40	12917
46863	RW	Parameter #61	UINT16	Ua IHD41	12918
46864	RW	Parameter #62	UINT16	Ub IHD41	12919
46865	RW	Parameter #63	UINT16	Uc IHD41	12920
46866	RW	Parameter #64	UINT16	U4 IHD41	12921

Table 5-105 SDR #12 Setup

5.9.13.13 SDR #13 Setup

Register Address	Property	Description	Format	Range/Options	Default
46900	RW	Recording Interval	UINT16	0 to 60 min	15
46901	RW	Recording Mode	UINT16	0=Stop-When-Full	1

				1=First-In-First-Out	
46902	RW	Number of Parameters	UINT16	0 to 64	64
46903	RW	Parameter #1	UINT16	Ua IHD42	12922
46904	RW	Parameter #2	UINT16	Ub IHD42	12923
46905	RW	Parameter #3	UINT16	Uc IHD42	12924
46906	RW	Parameter #4	UINT16	U4 IHD42	12925
46907	RW	Parameter #5	UINT16	Ua IHD43	12926
46908	RW	Parameter #6	UINT16	Ub IHD43	12927
46909	RW	Parameter #7	UINT16	Uc IHD43	12928
46910	RW	Parameter #8	UINT16	U4 IHD43	12929
46911	RW	Parameter #9	UINT16	Ua IHD44	12930
46912	RW	Parameter #10	UINT16	Ub IHD44	12931
46913	RW	Parameter #11	UINT16	Uc IHD44	12932
46914	RW	Parameter #12	UINT16	U4 IHD44	12933
46915	RW	Parameter #13	UINT16	Ua IHD45	12934
46916	RW	Parameter #14	UINT16	Ub IHD45	12935
46917	RW	Parameter #15	UINT16	Uc IHD45	12936
46918	RW	Parameter #16	UINT16	U4 IHD45	12937
46919	RW	Parameter #17	UINT16	Ua IHD46	12938
46920	RW	Parameter #18	UINT16	Ub IHD46	12939
46921	RW	Parameter #19	UINT16	Uc IHD46	12940
46922	RW	Parameter #20	UINT16	U4 IHD46	12941
46923	RW	Parameter #21	UINT16	Ua IHD47	12942
46924	RW	Parameter #22	UINT16	Ub IHD47	12943
46925	RW	Parameter #23	UINT16	Uc IHD47	12944
46926	RW	Parameter #24	UINT16	U4 IHD47	12945
46927	RW	Parameter #25	UINT16	Ua IHD48	12946

46928	RW	Parameter #26	UINT16	Ub IHD48	12947
46929	RW	Parameter #27	UINT16	Uc IHD48	12948
46930	RW	Parameter #28	UINT16	U4 IHD48	12949
46931	RW	Parameter #29	UINT16	Ua IHD49	12950
46932	RW	Parameter #30	UINT16	Ub IHD49	12951
46933	RW	Parameter #31	UINT16	Uc IHD49	12952
46934	RW	Parameter #32	UINT16	U4 IHD49	12953
46935	RW	Parameter #33	UINT16	Ua IHD50	12954
46936	RW	Parameter #34	UINT16	Ub IHD50	12955
46937	RW	Parameter #35	UINT16	Uc IHD50	12956
46938	RW	Parameter #36	UINT16	U4 IHD50	12957
46939	RW	Parameter #37	UINT16	Ia IHD00	13613
46940	RW	Parameter #38	UINT16	Ib IHD00	13614
46941	RW	Parameter #39	UINT16	Ic IHD00	13615
46942	RW	Parameter #40	UINT16	I4 IHD00	13616
46943	RW	Parameter #41	UINT16	Ia IHD01	13618
46944	RW	Parameter #42	UINT16	Ib IHD01	13619
46945	RW	Parameter #43	UINT16	Ic IHD01	13620
46946	RW	Parameter #44	UINT16	I4 IHD01	13621
46947	RW	Parameter #45	UINT16	Ia IHD02	13623
46948	RW	Parameter #46	UINT16	Ib IHD02	13624
46949	RW	Parameter #47	UINT16	Ic IHD02	13625
46950	RW	Parameter #48	UINT16	I4 IHD02	13626
46951	RW	Parameter #49	UINT16	Ia IHD03	13628
46952	RW	Parameter #50	UINT16	Ib IHD03	13629
46953	RW	Parameter #51	UINT16	Ic IHD03	13630
46954	RW	Parameter #52	UINT16	I4 IHD03	13631

46955	RW	Parameter #53	UINT16	Ia IHD04	13633
46956	RW	Parameter #54	UINT16	Ib IHD04	13634
46957	RW	Parameter #55	UINT16	Ic IHD04	13635
46958	RW	Parameter #56	UINT16	I4 IHD04	13636
46959	RW	Parameter #57	UINT16	Ia IHD05	13638
46960	RW	Parameter #58	UINT16	Ib IHD05	13639
46961	RW	Parameter #59	UINT16	Ic IHD05	13640
46962	RW	Parameter #60	UINT16	I4 IHD05	13641
46963	RW	Parameter #61	UINT16	Ia IHD06	13643
46964	RW	Parameter #62	UINT16	Ib IHD06	13644
46965	RW	Parameter #63	UINT16	Ic IHD06	13645
46966	RW	Parameter #64	UINT16	I4 IHD06	13646

Table 5-106 SDR #13 Setup

5.9.13.14 SDR #14 Setup

Register Address	Property	Description	Format	Range/Options	Default
47000	RW	Recording Interval	UINT16	0 to 60 min	15
47001	RW	Recording Mode	UINT16	0=Stop-When-Full 1=First-In-First-Out	1
47002	RW	Number of Parameters	UINT16	0 to 64	64
47003	RW	Parameter #1	UINT16	Ia IHD07	13648
47004	RW	Parameter #2	UINT16	Ib IHD07	13649
47005	RW	Parameter #3	UINT16	Ic IHD07	13650
47006	RW	Parameter #4	UINT16	I4 IHD07	13651
47007	RW	Parameter #5	UINT16	Ia IHD08	13653
47008	RW	Parameter #6	UINT16	Ib IHD08	13654
47009	RW	Parameter #7	UINT16	Ic IHD08	13655
47010	RW	Parameter #8	UINT16	I4 IHD08	13656

47011	RW	Parameter #9	UINT16	Ia IHD09	13658
47012	RW	Parameter #10	UINT16	Ib IHD09	13659
47013	RW	Parameter #11	UINT16	Ic IHD09	13660
47014	RW	Parameter #12	UINT16	I4 IHD09	13661
47015	RW	Parameter #13	UINT16	Ia IHD10	13663
47016	RW	Parameter #14	UINT16	Ib IHD10	13664
47017	RW	Parameter #15	UINT16	Ic IHD10	13665
47018	RW	Parameter #16	UINT16	I4 IHD10	13666
47019	RW	Parameter #17	UINT16	Ia IHD11	13668
47020	RW	Parameter #18	UINT16	Ib IHD11	13669
47021	RW	Parameter #19	UINT16	Ic IHD11	13670
47022	RW	Parameter #20	UINT16	I4 IHD11	13671
47023	RW	Parameter #21	UINT16	Ia IHD12	13673
47024	RW	Parameter #22	UINT16	Ib IHD12	13674
47025	RW	Parameter #23	UINT16	Ic IHD12	13675
47026	RW	Parameter #24	UINT16	I4 IHD12	13676
47027	RW	Parameter #25	UINT16	Ia IHD13	13678
47028	RW	Parameter #26	UINT16	Ib IHD13	13679
47029	RW	Parameter #27	UINT16	Ic IHD13	13680
47030	RW	Parameter #28	UINT16	I4 IHD13	13681
47031	RW	Parameter #29	UINT16	Ia IHD14	13683
47032	RW	Parameter #30	UINT16	Ib IHD14	13684
47033	RW	Parameter #31	UINT16	Ic IHD14	13685
47034	RW	Parameter #32	UINT16	I4 IHD14	13686
47035	RW	Parameter #33	UINT16	Ia IHD15	13688
47036	RW	Parameter #34	UINT16	Ib IHD15	13689
47037	RW	Parameter #35	UINT16	Ic IHD15	13690

47038	RW	Parameter #36	UINT16	I4 IHD15	13691
47039	RW	Parameter #37	UINT16	Ia IHD16	13693
47040	RW	Parameter #38	UINT16	Ib IHD16	13694
47041	RW	Parameter #39	UINT16	Ic IHD16	13695
47042	RW	Parameter #40	UINT16	I4 IHD16	13696
47043	RW	Parameter #41	UINT16	Ia IHD17	13698
47044	RW	Parameter #42	UINT16	Ib IHD17	13699
47045	RW	Parameter #43	UINT16	Ic IHD17	13700
47046	RW	Parameter #44	UINT16	I4 IHD17	13701
47047	RW	Parameter #45	UINT16	Ia IHD18	13703
47048	RW	Parameter #46	UINT16	Ib IHD18	13704
47049	RW	Parameter #47	UINT16	Ic IHD18	13705
47050	RW	Parameter #48	UINT16	I4 IHD18	13706
47051	RW	Parameter #49	UINT16	Ia IHD19	13708
47052	RW	Parameter #50	UINT16	Ib IHD19	13709
47053	RW	Parameter #51	UINT16	Ic IHD19	13710
47054	RW	Parameter #52	UINT16	I4 IHD19	13711
47055	RW	Parameter #53	UINT16	Ia IHD20	13713
47056	RW	Parameter #54	UINT16	Ib IHD20	13714
47057	RW	Parameter #55	UINT16	Ic IHD20	13715
47058	RW	Parameter #56	UINT16	I4 IHD20	13716
47059	RW	Parameter #57	UINT16	Ia IHD21	13718
47060	RW	Parameter #58	UINT16	Ib IHD21	13719
47061	RW	Parameter #59	UINT16	Ic IHD21	13720
47062	RW	Parameter #60	UINT16	I4 IHD21	13721
47063	RW	Parameter #61	UINT16	Ia IHD22	13723
47064	RW	Parameter #62	UINT16	Ib IHD22	13724

47065	RW	Parameter #63	UINT16	Ic IHD22	13725
47066	RW	Parameter #64	UINT16	I4 IHD22	13726

Table 5-107 SDR #14 Setup

5.9.13.15 SDR #15 Setup

Register Address	Property	Description	Format	Range/Options	Default
47100	RW	Recording Interval	UINT16	0 to 60 min	15
47101	RW	Recording Mode	UINT16	0=Stop-When-Full 1=First-In-First-Out	1
47102	RW	Number of Parameters	UINT16	0 to 64	64
47103	RW	Parameter #1	UINT16	Ia IHD23	13728
47104	RW	Parameter #2	UINT16	Ib IHD23	13729
47105	RW	Parameter #3	UINT16	Ic IHD23	13730
47106	RW	Parameter #4	UINT16	I4 IHD23	13731
47107	RW	Parameter #5	UINT16	Ia IHD24	13733
47108	RW	Parameter #6	UINT16	Ib IHD24	13734
47109	RW	Parameter #7	UINT16	Ic IHD24	13735
47110	RW	Parameter #8	UINT16	I4 IHD24	13736
47111	RW	Parameter #9	UINT16	Ia IHD25	13738
47112	RW	Parameter #10	UINT16	Ib IHD25	13739
47113	RW	Parameter #11	UINT16	Ic IHD25	13740
47114	RW	Parameter #12	UINT16	I4 IHD25	13741
47115	RW	Parameter #13	UINT16	Ia IHD26	13743
47116	RW	Parameter #14	UINT16	Ib IHD26	13744
47117	RW	Parameter #15	UINT16	Ic IHD26	13745
47118	RW	Parameter #16	UINT16	I4 IHD26	13746
47119	RW	Parameter #17	UINT16	Ia IHD27	13748
47120	RW	Parameter #18	UINT16	Ib IHD27	13749

47121	RW	Parameter #19	UINT16	Ic IHD27	13750
47122	RW	Parameter #20	UINT16	I4 IHD27	13751
47123	RW	Parameter #21	UINT16	Ia IHD28	13753
47124	RW	Parameter #22	UINT16	Ib IHD28	13754
47125	RW	Parameter #23	UINT16	Ic IHD28	13755
47126	RW	Parameter #24	UINT16	I4 IHD28	13756
47127	RW	Parameter #25	UINT16	Ia IHD29	13758
47128	RW	Parameter #26	UINT16	Ib IHD29	13759
47129	RW	Parameter #27	UINT16	Ic IHD29	13760
47130	RW	Parameter #28	UINT16	I4 IHD29	13761
47131	RW	Parameter #29	UINT16	Ia IHD30	13763
47132	RW	Parameter #30	UINT16	Ib IHD30	13764
47133	RW	Parameter #31	UINT16	Ic IHD30	13765
47134	RW	Parameter #32	UINT16	I4 IHD30	13766
47135	RW	Parameter #33	UINT16	Ia IHD31	13768
47136	RW	Parameter #34	UINT16	Ib IHD31	13769
47137	RW	Parameter #35	UINT16	Ic IHD31	13770
47138	RW	Parameter #36	UINT16	I4 IHD31	13771
47139	RW	Parameter #37	UINT16	Ia IHD32	13773
47140	RW	Parameter #38	UINT16	Ib IHD32	13774
47141	RW	Parameter #39	UINT16	Ic IHD32	13775
47142	RW	Parameter #40	UINT16	I4 IHD32	13776
47143	RW	Parameter #41	UINT16	Ia IHD33	13778
47144	RW	Parameter #42	UINT16	Ib IHD33	13779
47145	RW	Parameter #43	UINT16	Ic IHD33	13780
47146	RW	Parameter #44	UINT16	I4 IHD33	13781
47147	RW	Parameter #45	UINT16	Ia IHD34	13783

47148	RW	Parameter #46	UINT16	Ib IHD34	13784
47149	RW	Parameter #47	UINT16	Ic IHD34	13785
47150	RW	Parameter #48	UINT16	I4 IHD34	13786
47151	RW	Parameter #49	UINT16	Ia IHD35	13788
47152	RW	Parameter #50	UINT16	Ib IHD35	13789
47153	RW	Parameter #51	UINT16	Ic IHD35	13790
47154	RW	Parameter #52	UINT16	I4 IHD35	13791
47155	RW	Parameter #53	UINT16	Ia IHD36	13793
47156	RW	Parameter #54	UINT16	Ib IHD36	13794
47157	RW	Parameter #55	UINT16	Ic IHD36	13795
47158	RW	Parameter #56	UINT16	I4 IHD36	13796
47159	RW	Parameter #57	UINT16	Ia IHD37	13798
47160	RW	Parameter #58	UINT16	Ib IHD37	13799
47161	RW	Parameter #59	UINT16	Ic IHD37	13800
47162	RW	Parameter #60	UINT16	I4 IHD37	13801
47163	RW	Parameter #61	UINT16	Ia IHD38	13803
47164	RW	Parameter #62	UINT16	Ib IHD38	13804
47165	RW	Parameter #63	UINT16	Ic IHD38	13805
47166	RW	Parameter #64	UINT16	I4 IHD38	13806

Table 5-108 SDR #15 Setup

5.9.13.16 SDR #16 Setup

Register Address	Property	Description	Format	Range/Options	Default
47200	RW	Recording Interval	UINT16	0 to 60 min	15
47201	RW	Recording Mode	UINT16	0=Stop-When-Full 1=First-In-First-Out	1
47202	RW	Number of Parameters	UINT16	0 to 64	64
47203	RW	Parameter #1	UINT16	Ia IHD39	13808

47204	RW	Parameter #2	UINT16	Ib IHD39	13809
47205	RW	Parameter #3	UINT16	Ic IHD39	13810
47206	RW	Parameter #4	UINT16	I4 IHD39	13811
47207	RW	Parameter #5	UINT16	Ia IHD40	13813
47208	RW	Parameter #6	UINT16	Ib IHD40	13814
47209	RW	Parameter #7	UINT16	Ic IHD40	13815
47210	RW	Parameter #8	UINT16	I4 IHD40	13816
47211	RW	Parameter #9	UINT16	Ia IHD41	13818
47212	RW	Parameter #10	UINT16	Ib IHD41	13819
47213	RW	Parameter #11	UINT16	Ic IHD41	13820
47214	RW	Parameter #12	UINT16	I4 IHD41	13821
47215	RW	Parameter #13	UINT16	Ia IHD42	13823
47216	RW	Parameter #14	UINT16	Ib IHD42	13824
47217	RW	Parameter #15	UINT16	Ic IHD42	13825
47218	RW	Parameter #16	UINT16	I4 IHD42	13826
47219	RW	Parameter #17	UINT16	Ia IHD43	13828
47220	RW	Parameter #18	UINT16	Ib IHD43	13829
47221	RW	Parameter #19	UINT16	Ic IHD43	13830
47222	RW	Parameter #20	UINT16	I4 IHD43	13831
47223	RW	Parameter #21	UINT16	Ia IHD44	13833
47224	RW	Parameter #22	UINT16	Ib IHD44	13834
47225	RW	Parameter #23	UINT16	Ic IHD44	13835
47226	RW	Parameter #24	UINT16	I4 IHD44	13736
47227	RW	Parameter #25	UINT16	Ia IHD45	13738
47228	RW	Parameter #26	UINT16	Ib IHD45	13739
47229	RW	Parameter #27	UINT16	Ic IHD45	13740
47230	RW	Parameter #28	UINT16	I4 IHD45	13841

47231	RW	Parameter #29	UINT16	Ia IHD46	13843
47232	RW	Parameter #30	UINT16	Ib IHD46	13844
47233	RW	Parameter #31	UINT16	Ic IHD46	13845
47234	RW	Parameter #32	UINT16	I4 IHD46	13846
47235	RW	Parameter #33	UINT16	Ia IHD47	13848
47236	RW	Parameter #34	UINT16	Ib IHD47	13849
47237	RW	Parameter #35	UINT16	Ic IHD47	13850
47238	RW	Parameter #36	UINT16	I4 IHD47	13851
47239	RW	Parameter #37	UINT16	Ia IHD48	13853
47240	RW	Parameter #38	UINT16	Ib IHD48	13854
47241	RW	Parameter #39	UINT16	Ic IHD48	13855
47242	RW	Parameter #40	UINT16	I4 IHD48	13856
47243	RW	Parameter #41	UINT16	Ia IHD49	13858
47244	RW	Parameter #42	UINT16	Ib IHD49	13859
47245	RW	Parameter #43	UINT16	Ic IHD49	13860
47246	RW	Parameter #44	UINT16	I4 IHD49	13861
47247	RW	Parameter #45	UINT16	Ia IHD50	13863
47248	RW	Parameter #46	UINT16	Ib IHD50	13864
47249	RW	Parameter #47	UINT16	Ic IHD50	13865
47250	RW	Parameter #48	UINT16	I4 IHD50	13866
47251	RW	Parameter #49	UINT16	Reserved	0
47252	RW	Parameter #50	UINT16	Reserved	0
47253	RW	Parameter #51	UINT16	Reserved	0
47254	RW	Parameter #52	UINT16	Reserved	0
47255	RW	Parameter #53	UINT16	Reserved	0
47256	RW	Parameter #54	UINT16	Reserved	0
47257	RW	Parameter #55	UINT16	Reserved	0

47258	RW	Parameter #56	UINT16	Reserved	0
47259	RW	Parameter #57	UINT16	Reserved	0
47260	RW	Parameter #58	UINT16	Reserved	0
47261	RW	Parameter #59	UINT16	Reserved	0
47262	RW	Parameter #60	UINT16	Reserved	0
47263	RW	Parameter #61	UINT16	Reserved	0
47264	RW	Parameter #62	UINT16	Reserved	0
47265	RW	Parameter #63	UINT16	Reserved	0
47266	RW	Parameter #64	UINT16	Reserved	0

Table 5-109 SDR #16 Setup

5.9.14 Data Recorder (DR) Setup

5.9.14.1 DR #1 Setup

Register Address	Property	Description	Format	Range/Options	Default
47300	RW	Triggered Mode	UINT16	0=Disabled 1=Triggered by Timer 2=Triggered by Setpoint	1
47301	RW	Recording Mode	UINT16	0=Stop-When-Full 1=First-In-First-Out	1
47302	RW	Reserved	UINT16		
47303	RW	Recording Interval	UINT32	1s to 40 days	300
47305	RW	Offset Time	UINT16	0 to 43200s	0
47306	RW	Number of Parameters	UINT32	0 to 32	32
47307	RW	Parameter #1	UINT16	Freq.	1
47308	RW	Parameter #2	UINT16	Ua RMS	2
47309	RW	Parameter #3	UINT16	Ub RMS	3
47310	RW	Parameter #4	UINT16	Uc RMS	4
47311	RW	Parameter #5	UINT16	U4 RMS	5
47312	RW	Parameter #6	UINT16	ULN RMS Avg	6

47313	RW	Parameter #7	UINT16	Uab RMS	7
47314	RW	Parameter #8	UINT16	Ubc RMS	8
47315	RW	Parameter #9	UINT16	Uca RMS	9
47316	RW	Parameter #10	UINT16	ULL RMS Avg	10
47317	RW	Parameter #11	UINT16	Ia RMS	11
47318	RW	Parameter #12	UINT16	Ib RMS	12
47319	RW	Parameter #13	UINT16	Ic RMS	13
47320	RW	Parameter #14	UINT16	I4 RMS	14
47321	RW	Parameter #15	UINT16	Current RMS Avg	16
47322	RW	Parameter #16	UINT16	∑kWa	17
47323	RW	Parameter #17	UINT16	∑kWb	18
47324	RW	Parameter #18	UINT16	∑kWc	19
47325	RW	Parameter #19	UINT16	∑kW	20
47326	RW	Parameter #20	UINT16	∑kvara	21
47357	RW	Parameter #21	UINT16	∑kvarb	22
47358	RW	Parameter #22	UINT16	∑kvarc	23
47359	RW	Parameter #23	UINT16	∑kvar	24
47330	RW	Parameter #24	UINT16	∑kVAa	25
47331	RW	Parameter #25	UINT16	∑kVAb	26
47332	RW	Parameter #26	UINT16	∑kVAc	27
47333	RW	Parameter #27	UINT16	∑kVAh	28
47334	RW	Parameter #28	UINT16	∑P.F.a	29
47335	RW	Parameter #29	UINT16	∑P.F.b	30
47336	RW	Parameter #30	UINT16	∑P.F.c	31
47337	RW	Parameter #31	UINT16	∑P.F.	32
47338	RW	Parameter #32	UINT16	∑kW Imp. DMD	51019

Table 5-110 DR #1 Setup

Notes:

1) Only Data IDs of 50-cycle can be set as DR's parameters.

5.9.14.2 DR #2 Setup

Register Address	Property	Description	Format	Range/Options	Default
47400	RW	Triggered Mode	UINT16	0=Disabled 1=Triggered by Timer 2=Triggered by Setpoint	1
47401	RW	Recording Mode	UINT16	0=Stop-When-Full 1=First-In-First-Out	1
47402	RW	Reserved	UINT16		
47403	RW	Recording Interval	UINT32	1s to 40 days	300
47405	RW	Offset Time	UINT16	0 to 43200s	0
47406	RW	Number of Parameters	UINT16	0 to 32	32
47407	RW	Parameter #1	UINT16	Ua Deviation	33
47408	RW	Parameter #2	UINT16	Ub Deviation	34
47409	RW	Parameter #3	UINT16	Uc Deviation	35
47410	RW	Parameter #4	UINT16	Uab Deviation	36
47411	RW	Parameter #5	UINT16	Ubc Deviation	37
47412	RW	Parameter #6	UINT16	Uca Deviation	38
47413	RW	Parameter #7	UINT16	Ua Over Deviation	39
47414	RW	Parameter #8	UINT16	Ub Over Deviation	40
47415	RW	Parameter #9	UINT16	Uc Over Deviation	41
47416	RW	Parameter #10	UINT16	Uab Over Deviation	42
47417	RW	Parameter #11	UINT16	Ubc Over Deviation	43
47418	RW	Parameter #12	UINT16	Uca Over Deviation	44
47419	RW	Parameter #13	UINT16	Ua Under Deviation	45
47420	RW	Parameter #14	UINT16	Ub Under Deviation	46
47421	RW	Parameter #15	UINT16	Uc Under Deviation	47
47422	RW	Parameter #16	UINT16	Uab Under Deviation	48

47423	RW	Parameter #17	UINT16	Ubc Under Deviation	49
47424	RW	Parameter #18	UINT16	Uca Under Deviation	50
47425	RW	Parameter #19	UINT16	Freq. Deviation	51
47426	RW	Parameter #20	UINT16	Ua Fluct.	52
47427	RW	Parameter #21	UINT16	Ub Fluct.	53
47428	RW	Parameter #22	UINT16	Uc Fluct.	54
47429	RW	Parameter #23	UINT16	U2 Unbal.	56
47430	RW	Parameter #24	UINT16	U0 Unbal.	55
47431	RW	Parameter #25	UINT16	I2 Unbal.	58
47432	RW	Parameter #26	UINT16	I0 Unbal.	57
47433	RW	Parameter #27	UINT16	U1	61
47434	RW	Parameter #28	UINT16	U2	60
47435	RW	Parameter #29	UINT16	U0	59
47436	RW	Parameter #30	UINT16	I1	64
47437	RW	Parameter #31	UINT16	I2	63
47438	RW	Parameter #32	UINT16	I0	62

Table 5-111 DR #2 Setup

Notes:

1) Only Data IDs of 50-cycle can be set as DR's parameters.

5.9.14.3 DR #3 Setup

Register Address	Property	Description	Format	Range/Options	Default
47500	RW	Triggered Mode	UINT16	0=Disabled 1=Triggered by Timer 2=Triggered by Setpoint	1
47501	RW	Recording Mode	UINT16	0=Stop-When-Full 1=First-In-First-Out	1
47502	RW	Reserved	UINT16		
47503	RW	Recording Interval	UINT32	1s to 40 days	300

47505	RW	Offset Time	UINT16	0 to 43200s	0
47506	RW	Number of Parameters	UINT16	0 to 32	32
47507	RW	Parameter #1	UINT16	Ia TDD	65
47508	RW	Parameter #2	UINT16	Ib TDD	66
47509	RW	Parameter #3	UINT16	Ic TDD	67
47510	RW	Parameter #4	UINT16	I4 TDD	68
47511	RW	Parameter #5	UINT16	Ia TDD ODD	70
47512	RW	Parameter #6	UINT16	Ib TDD ODD	71
47513	RW	Parameter #7	UINT16	Ic TDD ODD	72
47514	RW	Parameter #8	UINT16	I4 TDD ODD	73
47515	RW	Parameter #9	UINT16	Ia TDD EVEN	75
47516	RW	Parameter #10	UINT16	Ib TDD EVEN	76
47517	RW	Parameter #11	UINT16	Ic TDD EVEN	77
47518	RW	Parameter #12	UINT16	I4 TDD EVEN	78
47519	RW	Parameter #13	UINT16	Ia K-Factor	80
47520	RW	Parameter #14	UINT16	Ib K-Factor	81
47521	RW	Parameter #15	UINT16	Ic K-Factor	82
47522	RW	Parameter #16	UINT16	I4 K-Factor	83
47523	RW	Parameter #17	UINT16	Ia Crest Factor	85
47524	RW	Parameter #18	UINT16	Ib Crest Factor	86
47525	RW	Parameter #19	UINT16	Ic Crest Factor	87
47526	RW	Parameter #20	UINT16	I4 Crest Factor	88
47527	RW	Parameter #21	UINT16	Ua Crest Factor	90
47528	RW	Parameter #22	UINT16	Ub Crest Factor	91
47529	RW	Parameter #23	UINT16	Uc Crest Factor	92
47530	RW	Parameter #24	UINT16	U4 Crest Factor	93
47531	RW	Parameter #25	UINT16	Ua THD	103

47532	RW	Parameter #26	UINT16	Ub THD	104
47533	RW	Parameter #27	UINT16	Uc THD	105
47534	RW	Parameter #28	UINT16	U4 THD	106
47535	RW	Parameter #29	UINT16	Ua TOHD	107
47536	RW	Parameter #30	UINT16	Ub TOHD	108
47537	RW	Parameter #31	UINT16	Uc TOHD	109
47538	RW	Parameter #32	UINT16	U4 TOHD	110

Table 5-112 DR #3 Setup

Notes:

1) Only Data IDs of 50-cycle can be set as DR's parameters.

5.9.14.4 DR #4 Setup

Register Address	Property	Description	Format	Range/Options	Default
47600	RW	Triggered Mode	UINT16	0=Disabled 1=Triggered by Timer 2=Triggered by Setpoint	1
47601	RW	Recording Mode	UINT16	0=Stop-When-Full 1=First-In-First-Out	1
47602	RW	Reserved	UINT16		
47603	RW	Recording Interval	UINT32	1s to 40 days	300
47605	RW	Offset Time	UINT16	0 to 43200s	0
47606	RW	Number of Parameters	UINT16	0 to 32	32
47607	RW	Parameter #1	UINT16	Ua TEHD	111
47608	RW	Parameter #2	UINT16	Ub TEHD	112
47609	RW	Parameter #3	UINT16	Uc TEHD	113
47610	RW	Parameter #4	UINT16	U4 TEHD	114
47611	RW	Parameter #5	UINT16	Ua HDH0	500
47612	RW	Parameter #6	UINT16	Ub HDH0	501
47613	RW	Parameter #7	UINT16	Uc HDH0	502

47614	RW	Parameter #8	UINT16	U4 HDH0	503
47615	RW	Parameter #9	UINT16	Ua HDH1	504
47616	RW	Parameter #10	UINT16	Ub HDH1	505
47617	RW	Parameter #11	UINT16	Uc HDH1	506
47618	RW	Parameter #12	UINT16	U4 HDH1	507
47619	RW	Parameter #13	UINT16	Ia TH RMS	1088
47620	RW	Parameter #14	UINT16	Ib TH RMS	1089
47621	RW	Parameter #15	UINT16	Ic TH RMS	1090
47622	RW	Parameter #16	UINT16	I4 TH RMS	1091
47623	RW	Parameter #17	UINT16	Ia TOH RMS	1093
47624	RW	Parameter #18	UINT16	Ib TOH RMS	1094
47625	RW	Parameter #19	UINT16	Ic TOH RMS	1095
47626	RW	Parameter #20	UINT16	I4 TOH RMS	1096
47627	RW	Parameter #21	UINT16	Ia TEH RMS	1098
47628	RW	Parameter #22	UINT16	Ib TEH RMS	1099
47629	RW	Parameter #23	UINT16	Ic TEH RMS	1100
47630	RW	Parameter #24	UINT16	I4 TEH RMS	1101
47631	RW	Parameter #25	UINT16	Ua H0 RMS	1359
47632	RW	Parameter #26	UINT16	Ub H0 RMS	1360
47633	RW	Parameter #27	UINT16	Uc H0 RMS	1361
47634	RW	Parameter #28	UINT16	U4 H0 RMS	1362
47635	RW	Parameter #29	UINT16	Ua H01 RMS	1364
47636	RW	Parameter #30	UINT16	Ub H01 RMS	1365
47637	RW	Parameter #31	UINT16	Uc H01 RMS	1366
47638	RW	Parameter #32	UINT16	U4 H01 RMS	1367

Table 5-113 DR #4 Setup

Notes:

1) Only Data IDs of 50-cycle can be set as DR's parameters.

5.9.14.5 DR #5 Setup

Register Address	Property	Description	Format	Range/Options	Default
47700	RW	Triggered Mode	UINT16	0=Disabled 1=Triggered by Timer 2=Triggered by Setpoint	1
47701	RW	Recording Mode	UINT16	0=Stop-When-Full 1=First-In-First-Out	1
47702	RW	Reserved	UINT16		
47703	RW	Recording Interval	UINT32	1s to 40 days	300
47705	RW	Offset Time	UINT16	0 to 43200s	0
47706	RW	Number of Parameters	UINT16	0 to 32	32
47707	RW	Parameter #1	UINT16	∑kWa TH	1679
47708	RW	Parameter #2	UINT16	∑kWb TH	1680
47709	RW	Parameter #3	UINT16	∑kWc TH	1681
47710	RW	Parameter #4	UINT16	∑kW TH	1715
47711	RW	Parameter #5	UINT16	∑kWa H01	1971
47712	RW	Parameter #6	UINT16	∑kWb H01	1972
47713	RW	Parameter #7	UINT16	∑kWc H01	1973
47714	RW	Parameter #8	UINT16	∑kW H01	1719
47715	RW	Parameter #9	UINT16	∑kvara H01	1974
47716	RW	Parameter #10	UINT16	∑kvarb H01	1975
47717	RW	Parameter #11	UINT16	∑kvarc H01	1976
47718	RW	Parameter #12	UINT16	∑kvar H01	1720
47719	RW	Parameter #13	UINT16	∑kVAa H01	1977
47720	RW	Parameter #14	UINT16	∑kVAb H01	1978
47721	RW	Parameter #15	UINT16	∑kVAc H01	1979
47722	RW	Parameter #16	UINT16	∑kVA H01	1721
47723	RW	Parameter #17	UINT16	∑P.F.a H01	1980

47724	RW	Parameter #18	UINT16	∑P.F.b H01	1981
47725	RW	Parameter #19	UINT16	∑P.F.c H01	1982
47726	RW	Parameter #20	UINT16	∑P.F. H01	1722
47727	RW	Parameter #21	UINT16	Ua TIHD	2727
47728	RW	Parameter #22	UINT16	Ub TIHD	2728
47729	RW	Parameter #23	UINT16	Uc TIHD	2729
47730	RW	Parameter #24	UINT16	U4 TIHD	2730
47731	RW	Parameter #25	UINT16	Ua TOIHD	2731
47732	RW	Parameter #26	UINT16	Ub TOIHD	2732
47733	RW	Parameter #27	UINT16	Uc TOIHD	2733
47734	RW	Parameter #28	UINT16	U4 TOIHD	2734
47735	RW	Parameter #29	UINT16	Ua TEIHD	2735
47736	RW	Parameter #30	UINT16	Ub TEIHD	2736
47737	RW	Parameter #31	UINT16	Uc TEIHD	2737
47738	RW	Parameter #32	UINT16	U4 TEIHD	2738

Table 5-114 DR #5 Setup

Notes:

1) Only Data IDs of 50-cycle can be set as DR's parameters.

5.9.14.6 DR #6 Setup

Register Address	Property	Description	Format	Range/Options	Default
47800	RW	Triggered Mode	UINT16	0=Disabled 1=Triggered by Timer 2=Triggered by Setpoint	2
47801	RW	Recording Mode	UINT16	0=Stop-When-Full 1=First-In-First-Out	1
47802	RW	Reserved			
47803	RW	Recording Interval	UINT32	1s to 40 days	300
47805	RW	Offset Time	UINT16	0 to 43200s	0

47806	RW	Number of Parameters	UINT16	0 to 32	32
47807	RW	Parameter #1	UINT16	Freq.	1
47808	RW	Parameter #2	UINT16	Ua RMS	2
47809	RW	Parameter #3	UINT16	Ub RMS	3
47810	RW	Parameter #4	UINT16	Uc RMS	4
47811	RW	Parameter #5	UINT16	U4 RMS	5
47812	RW	Parameter #6	UINT16	ULN RMS Avg	6
47813	RW	Parameter #7	UINT16	Uab RMS	7
47814	RW	Parameter #8	UINT16	Ubc RMS	8
47815	RW	Parameter #9	UINT16	Uca RMS	9
47816	RW	Parameter #10	UINT16	ULL RMS Avg	10
47817	RW	Parameter #11	UINT16	Ia RMS	11
47818	RW	Parameter #12	UINT16	Ib RMS	12
47819	RW	Parameter #13	UINT16	Ic RMS	13
47820	RW	Parameter #14	UINT16	I4 RMS	14
47821	RW	Parameter #15	UINT16	Current RMS Avg	16
47822	RW	Parameter #16	UINT16	∑kWa	17
47823	RW	Parameter #17	UINT16	∑kWb	18
47824	RW	Parameter #18	UINT16	∑kWc	19
47825	RW	Parameter #19	UINT16	∑kW	20
47826	RW	Parameter #20	UINT16	∑kvara	21
47827	RW	Parameter #21	UINT16	∑kvarb	22
47828	RW	Parameter #22	UINT16	∑kvarc	23
47829	RW	Parameter #23	UINT16	∑kvar	24
47830	RW	Parameter #24	UINT16	∑kVAa	25
47831	RW	Parameter #25	UINT16	∑kVAb	26
47832	RW	Parameter #26	UINT16	∑kVAc	27

47833	RW	Parameter #27	UINT16	∑kVAh	28
47834	RW	Parameter #28	UINT16	∑P.F.a	29
47835	RW	Parameter #29	UINT16	∑P.F.b	30
47836	RW	Parameter #30	UINT16	∑P.F.c	31
47837	RW	Parameter #31	UINT16	∑P.F.	32
47838	RW	Parameter #32	UINT16	∑kW Imp. DMD	51019

Table 5-115 DR #6 Setup

Notes:

1) Only Data IDs of 50-cycle can be set as DR's parameters.

5.9.14.7 DR #7 Setup

Register Address	Property	Description	Format	Range/Options	Default
47900	RW	Triggered Mode	UINT16	0=Disabled 1=Triggered by Timer 2=Triggered by Setpoint	2
47901	RW	Recording Mode	UINT16	0=Stop-When-Full 1=First-In-First-Out	1
47902	RW	Reserved	UINT16		
47903	RW	Recording Interval	UINT32	1s to 40 days	300
47905	RW	Offset Time	UINT16	0 to 43200s	0
47906	RW	Number of Parameters	UINT16	0 to 32	32
47907	RW	Parameter #1	UINT16	Ua Deviation	33
47908	RW	Parameter #2	UINT16	Ub Deviation	34
47909	RW	Parameter #3	UINT16	Uc Deviation	35
47910	RW	Parameter #4	UINT16	Uab Deviation	36
47911	RW	Parameter #5	UINT16	Ubc Deviation	37
47912	RW	Parameter #6	UINT16	Uca Deviation	38
47913	RW	Parameter #7	UINT16	Ua Over Deviation	39
47914	RW	Parameter #8	UINT16	Ub Over Deviation	40

47915	RW	Parameter #9	UINT16	Uc Over Deviation	41
47916	RW	Parameter #10	UINT16	Uab Over Deviation	42
47917	RW	Parameter #11	UINT16	Ubc Over Deviation	43
47918	RW	Parameter #12	UINT16	Uca Over Deviation	44
47919	RW	Parameter #13	UINT16	Ua Under Deviation	45
47920	RW	Parameter #14	UINT16	Ub Under Deviation	46
47921	RW	Parameter #15	UINT16	Uc Under Deviation	47
47922	RW	Parameter #16	UINT16	Uab Under Deviation	48
47923	RW	Parameter #17	UINT16	Ubc Under Deviation	49
47924	RW	Parameter #18	UINT16	Uca Under Deviation	50
47925	RW	Parameter #19	UINT16	Freq. Deviation	51
47926	RW	Parameter #20	UINT16	Ua Fluct.	52
47927	RW	Parameter #21	UINT16	Ub Fluct.	53
47928	RW	Parameter #22	UINT16	Uc Fluct.	54
47929	RW	Parameter #23	UINT16	U2 Unbal.	56
47930	RW	Parameter #24	UINT16	U0 Unbal.	55
47931	RW	Parameter #25	UINT16	I2 Unbal.	58
47932	RW	Parameter #26	UINT16	I0 Unbal.	57
47933	RW	Parameter #27	UINT16	U1	61
47934	RW	Parameter #28	UINT16	U2	60
47935	RW	Parameter #29	UINT16	U0	59
47936	RW	Parameter #30	UINT16	I1	64
47937	RW	Parameter #31	UINT16	I2	63
47938	RW	Parameter #32	UINT16	I0	62

Table 5-116 DR #7 Setup

Notes:

1) Only Data IDs of 50-cycle can be set as DR's parameters.

5.9.14.8 DR #8 Setup

Register Address	Property	Description	Format	Range/Options	Default
48000	RW	Triggered Mode	UINT16	0=Disabled 1=Triggered by Timer 2=Triggered by Setpoint	0
48001	RW	Recording Mode	UINT16	0=Stop-When-Full 1=First-In-First-Out	1
48002	RW	Reserved	UINT16		
48003	RW	Recording Interval	UINT32	1s to 40 days	300
48005	RW	Offset Time	UINT16	0 to 43200s	0
48006	RW	Number of Parameters	UINT16	0 to 32	32
48007~48038	RW	Parameter #1~ Parameter #32	UINT16	Reserved	0

Table 5-117 DR #8 Setup

Notes:

1) Only Data IDs of 50-cycle can be set as DR's parameters.

5.9.15 High-speed (HS) DR Setup

5.9.15.1 HS DR #1 Setup

Register Address	Property	Description	Format	Range/Options	Default
48100	RW	Triggered Mode	UINT16	0=Disabled 1=Triggered by Timer 2=Triggered by Setpoint	2
48101	RW	Reserved	UINT16		
48102	RW	Reserved	UINT16		
48103	RW	Recording Interval	UINT32	1 to 120 (x ½cycle)	1
48105	RW	Offset Time	UINT16	0 to 43200s	0
48106	RW	Number of Parameters	UINT16	0 to 16	16
48107	RW	Parameter #1	UINT16	Ua RMS	1
48108	RW	Parameter #2	UINT16	Ub RMS	2
48109	RW	Parameter #3	UINT16	Uc RMS	3
48110	RW	Parameter #4	UINT16	U4 RMS	13

48111	RW	Parameter #5	UINT16	ULN RMS Avg	4
48112	RW	Parameter #6	UINT16	Uab RMS	5
48113	RW	Parameter #7	UINT16	Ubc RMS	6
48114	RW	Parameter #8	UINT16	Uca RMS	7
48115	RW	Parameter #9	UINT16	ULL RMS Avg	8
48116	RW	Parameter #10	UINT16	Ia RMS	9
48117	RW	Parameter #11	UINT16	Ib RMS	10
48118	RW	Parameter #12	UINT16	Ic RMS	11
48119	RW	Parameter #13	UINT16	I4 RMS	14
48120	RW	Parameter #14	UINT16	Current RMS Avg	12
48121	RW	Parameter #15	UINT16	Reserved	0
48122	RW	Parameter #16	UINT16	Reserved	0

Table 5-118 HSDR #1 Setup

5.9.15.2 HS DR #2 Setup

Register Address	Property	Description	Format	Range/Options	Default
48200	RW	Triggered Mode	UINT16	0=Disabled 1=Triggered by Timer 2=Triggered by Setpoint	2
48201	RW	Reserved	UINT16		
48202	RW	Reserved	UINT16		
48203	RW	Recording Interval	UINT32	1 to 120 (x ½cycle)	1
48205	RW	Offset Time	UINT16	0 to 43200s	0
48206	RW	Number of Parameters	UINT16	0 to 16	16
48207	RW	Parameter #1	UINT16	∑kWa	16
48208	RW	Parameter #2	UINT16	∑kWb	17
48209	RW	Parameter #3	UINT16	∑kWc	18
48210	RW	Parameter #4	UINT16	∑kW	19
48211	RW	Parameter #5	UINT16	∑kvara	20

48212	RW	Parameter #6	UINT16	∑kvarb	21
48213	RW	Parameter #7	UINT16	∑kvarc	22
48214	RW	Parameter #8	UINT16	∑kvar	23
48215	RW	Parameter #9	UINT16	∑kVAa	24
48216	RW	Parameter #10	UINT16	∑kVAb	25
48217	RW	Parameter #11	UINT16	∑kVAc	26
48218	RW	Parameter #12	UINT16	∑kVAh	27
48219	RW	Parameter #13	UINT16	∑P.F.a	28
48220	RW	Parameter #14	UINT16	∑P.F.b	29
48221	RW	Parameter #15	UINT16	∑P.F.c	30
48222	RW	Parameter #16	UINT16	∑P.F.	31

Table 5-119 HSDR #2 Setup

5.9.15.3 HS DR #3 Setup

Register Address	Property	Description	Format	Range/Options	Default
48300	RW	Triggered Mode	UINT16	0=Disabled 1=Triggered by Timer 2=Triggered by Setpoint	0
48301	RW	Reserved	UINT16		
48302	RW	Reserved	UINT16		
48303	RW	Recording Interval	UINT32	1 to 120 (x ½cycle)	1
48305	RW	Offset Time	UINT16	0 to 43200s	0
48306	RW	Number of Parameters	UINT16	0 to 16	16
48307	RW	Parameter #1	UINT16	Ua RMS	1
48308	RW	Parameter #2	UINT16	Ub RMS	2
48309	RW	Parameter #3	UINT16	Uc RMS	3
48310	RW	Parameter #4	UINT16	U4 RMS	13
48311	RW	Parameter #5	UINT16	ULN RMS Avg	4
48312	RW	Parameter #6	UINT16	Uab RMS	5

48313	RW	Parameter #7	UINT16	Ubc RMS	6
48314	RW	Parameter #8	UINT16	Uca RMS	7
48315	RW	Parameter #9	UINT16	ULL RMS Avg	8
48316	RW	Parameter #10	UINT16	Ia RMS	9
48317	RW	Parameter #11	UINT16	Ib RMS	10
48318	RW	Parameter #12	UINT16	Ic RMS	11
48319	RW	Parameter #13	UINT16	I4 RMS	14
48320	RW	Parameter #14	UINT16	Current RMS Avg	12
48321	RW	Parameter #15	UINT16	Reserved	0
48322	RW	Parameter #16	UINT16	Reserved	

Table 5-120 HSDR #3 Setup

5.9.15.4 HS DR #4 Setup

Register Address	Property	Description	Format	Range/Options	Default
48400	RW	Triggered Mode	UINT16	0=Disabled 1=Triggered by Timer 2=Triggered by Setpoint	0
48401	RW	Reserved	UINT16		
48402	RW	Reserved	UINT16		
48403	RW	Recording Interval	UINT32	1 to 120 (x ½cycle)	1
48405	RW	Offset Time	UINT16	0 to 43200s	0
48406	RW	Number of Parameters	UINT16	0 to 16	16
48407	RW	Parameter #1	UINT16	∑kWa	16
48408	RW	Parameter #2	UINT16	∑kWb	17
48409	RW	Parameter #3	UINT16	∑kWc	18
48410	RW	Parameter #4	UINT16	∑kW	19
48411	RW	Parameter #5	UINT16	∑kvara	20
48412	RW	Parameter #6	UINT16	∑kvarb	21
48413	RW	Parameter #7	UINT16	∑kvarc	22

48414	RW	Parameter #8	UINT16	∑kvar	23
48415	RW	Parameter #9	UINT16	∑kVAa	24
48416	RW	Parameter #10	UINT16	∑kVAb	25
48417	RW	Parameter #11	UINT16	∑kVAc	26
48418	RW	Parameter #12	UINT16	∑kVAh	27
48419	RW	Parameter #13	UINT16	∑P.F.a	28
48420	RW	Parameter #14	UINT16	∑P.F.b	29
48421	RW	Parameter #15	UINT16	∑P.F.c	30
48422	RW	Parameter #16	UINT16	∑P.F.	31

Table 5-121 HSDR #4 Setup

5.9.16 Max./Min. Recorder (MMR) Setup

5.9.16.1 Max./Min. Recorder #1 Setup

Register Address		Property	Description	Format	Range/Options	Default
Max.	Min.					
48900	49301	RW	Self-read Time	UINT16		0
48901	49302		Number of Parameters	UINT16	0 to 20	20
48902	49303	RW	Parameter #1	UINT16	Freq.	10001
48903	49304	RW	Parameter #2	UINT16	Ua RMS	10002
48904	49305	RW	Parameter #3	UINT16	Ub RMS	10003
48905	49306	RW	Parameter #4	UINT16	Uc RMS	10004
48906	49307	RW	Parameter #5	UINT16	Uab RMS	10007
48907	49308	RW	Parameter #6	UINT16	Ubc RMS	10008
48908	49309	RW	Parameter #7	UINT16	Uca RMS	10009
48909	49310	RW	Parameter #8	UINT16	Ia RMS	10011
48910	49311	RW	Parameter #9	UINT16	Ib RMS	10012
48911	49312	RW	Parameter #10	UINT16	Ic RMS	10013
48912	49313	RW	Parameter #11	UINT16	∑kW	10020

48913	49314	RW	Parameter #12	UINT16	∑kvar	10024
48914	49315	RW	Parameter #13	UINT16	∑kVA	10028
48915	49316	RW	Parameter #14	UINT16	∑P.F.	10032
48916	49317	RW	Parameter #15	UINT16	Ua Pst	50001
48917	49318	RW	Parameter #16	UINT16	Ub Pst	50002
48918	49319	RW	Parameter #17	UINT16	Uc Pst	50003
48919	49320	RW	Parameter #18	UINT16	Ua Plt	50004
48920	49321	RW	Parameter #19	UINT16	Ub Plt	50005
48921	49301	RW	Parameter #20	UINT16	Uc Plt	50006

Table 5-122 Max./Min. Recorder #1 Setup

5.9.16.2 Max./Min. Recorder #2 Setup

Register Address		Property	Description	Format	Range/Options	Default
Max.	Min.					
49000	49400	RW	Self-read Time	UINT16		0
49001	49401	RW	Number of Parameters	UINT16	0 to 20	20
49002	49402	RW	Parameter #1	UINT16	Ua Over Deviation	10039
49003	49403	RW	Parameter #2	UINT16	Ub Over Deviation	10040
49004	49404	RW	Parameter #3	UINT16	Uc Over Deviation	10041
49005	49405	RW	Parameter #4	UINT16	Uab Over Deviation	10042
49006	49406	RW	Parameter #5	UINT16	Ubc Over Deviation	10043
49007	49407	RW	Parameter #6	UINT16	Uca Over Deviation	10044
49008	49408	RW	Parameter #7	UINT16	Ua Under Deviation	10045
49009	49409	RW	Parameter #8	UINT16	Ub Under Deviation	10046
49010	49410	RW	Parameter #9	UINT16	Uc Under Deviation	10047
49011	49411	RW	Parameter #10	UINT16	Uab Under Deviation	10048
49012	49412	RW	Parameter #11	UINT16	Ubc Under Deviation	10049
49013	49413	RW	Parameter #12	UINT16	Uca Under Deviation	10050

49014	49414	RW	Parameter #13	UINT16	Freq. Deviation	10051
49015	49415	RW	Parameter #14	UINT16	U0 Unbal.	10055
49016	49416	RW	Parameter #15	UINT16	U2 Unbal.	10056
49017	49417	RW	Parameter #16	UINT16	I0 Unbal.	10057
49018	49418	RW	Parameter #17	UINT16	I2 Unbal.	10058
49019	49419	RW	Parameter #18	UINT16	U4 RMS	10005
49020	49420	RW	Parameter #19	UINT16	I4 RMS	10014
49021	49421	RW	Parameter #20	UINT16	I5 RMS	10015

Table 5-123 Max. Recorder #2 Setup

5.9.16.3 Max./Min. Recorder #3 Setup

Register Address		Property	Description	Format	Range/Options	Default
Max.	Min.					
49100	49500	RW	Self-read Time	UINT16		0
49101	49501	RW	Number of Parameters	UINT16	0 to 20	20
49102	49502	RW	Parameter #1	UINT16	U1	10061
49103	49503	RW	Parameter #2	UINT16	U2	10060
49104	49504	RW	Parameter #3	UINT16	U0	10059
49105	49505	RW	Parameter #4	UINT16	I1	10064
49106	49506	RW	Parameter #5	UINT16	I2	10063
49107	49507	RW	Parameter #6	UINT16	I0	10062
49108	49508	RW	Parameter #7	UINT16	Ua THD	10103
49109	49509	RW	Parameter #8	UINT16	Ub THD	10104
49110	49510	RW	Parameter #9	UINT16	Uc THD	10105
49111	49511	RW	Parameter #10	UINT16	Ia THD	10115
49112	49512	RW	Parameter #11	UINT16	Ib THD	10116
49113	49513	RW	Parameter #12	UINT16	Ic THD	10117
49114	49514	RW	Parameter #13	UINT16	∑kW TH	11715

49115	49515	RW	Parameter #14	UINT16	∑kvar TH	11716
49116	49516	RW	Parameter #15	UINT16	∑kVA TH	11717
49117	49517	RW	Parameter #16	UINT16	∑P.F. TH	11718
49118	49518	RW	Parameter #17	UINT16	∑kW H01	11719
49119	49519	RW	Parameter #18	UINT16	∑kvar H01	11720
49120	49520	RW	Parameter #19	UINT16	∑kVA H01	11721
49121	49521	RW	Parameter #20	UINT16	∑P.F. H01	11722

Table 5-124 Max./Min. Recorder #3 Setup

5.9.16.4 Max./Min. Recorder #4 Setup

Register Address		Property	Description	Format	Range/Options	Default
Max.	Min.					
49200	49600	RW	Self-read Time	UINT16		0
49201	49601	RW	Number of Parameters	UINT16	0 to 20	20
49202~49221	49602~49621	RW	Parameter #1~20	UINT16	Reserved	0

Table 5-125 Max./Min. Recorder #4 Setup

5.9.17 Interval Energy Recorder (IER) Setup

Register	Property	Description		Format	Range/Option
49700	RW	Recording Mode		UINT16	0*=Disabled 1=Stop-When-Full 2=First-In-First-Out
49701	RW	Recording Data Format			0 = Interval Energy, 1 = Real-time Energy
49702	RW	Reserved			
49703	RW	Recording Interval		UINT16	1 to 65535min, 5*
49704~ 49706	RW	Start Time[2]	High-order Byte: Year	UINT16	0-99 (Year-2000)
			Low-order Byte: Month		1 to 12
			High-order Byte: Day	UINT16	1 to 31
			Low-order Byte: Hour		0 to 23

			High-order Byte: Minute	UINT16	0 to 59
			Low-order Byte: Second		0 to 59
49707	RW	Number of Parameters		UINT16	1* to N, 15*
49708	RW	Parameter 1		UINT16	See Note 1)
49709	RW	Parameter 2		UINT16	
...	RW	...		UINT16	
49722	RW	Parameter 15		UINT16	

* Default

Table 5-126 IER Setup

Notes:

1) The following table illustrates the parameters of IER:

Key	Parameter	Key	Parameter
0	None	8	kWh Imp. H01
1	kWh Imp.	9	kWh Exp. H01
2	kWh Exp.	10	kvarh Imp. H01
3	kWh Total	11	kvarh Exp. H01
4	kvarh Imp.	12	kWh Imp. TH
5	kvarh Exp.	13	kWh Exp. TH
6	kvarh Total	14	kvarh Imp. TH
7	kVAh	15	kvarh Exp. TH

Table 5-127 IER Parameter

5.9.18 EN50160 Setup

Register Address	Property	Description	Format	Range/Value
49790	RW	Voltage Level	UNIT16	0*=LV, 1=MV, 2=HV
49791	RW	Start Week	UNIT16	0*=Sunday 1~6=Monday to Saturday
49792~49799	RW	Reserved		
49800	RW	Freq Wide Tolerance	Float	1.0
49802	RW	Freq positive deviation wide limit	Float	1.04
49804	RW	Freq negative deviation wide limit	Float	0.94
49806	RW	Freq narrow tolerance	Float	0.995
49808	RW	Freq positive deviation narrow limit	Float	1.01

49810	RW	Freq negative deviation narrow limit	Float	0.99
49812	RW	Voltage wide tolerance	Float	1.0
49814	RW	Voltage positive deviation wide limit	Float	LV: 1.1 MV/LV: 1.15
49816	RW	Voltage negative deviation wide limit	Float	0.85
49818	RW	Voltage narrow tolerance	Float	LV: 0.95 MV/HV: 0.99
49820	RW	Voltage positive deviation narrow limit	Float	1.1
49822	RW	Voltage negative deviation narrow limit	Float	0.9
49824	RW	Flicker tolerance	Float	0.95
49826	RW	Flicker limit	Float	1
49828	RW	Voltage Unbalance tolerance	Float	0.95
49830	RW	Voltage Unbalance limit	Float	0.02
49832	RW	Harmonic Voltage tolerance	Float	0.95
49834	RW	THD limit	Float	0.08
49836	RW	Reserved	Float	
49838	RW	Reserved	Float	
49840	RW	H02 Voltage limit	Float	LV/MV: 0.02 HV: 0.019
49842	RW	H03 Voltage limit	Float	LV/MV: 0.05 HV: 0.03
49844	RW	H04 Voltage limit		0.01
49846	RW	H05 Voltage limit	Float	LV/MV: 0.06 HV: 0.05
49848	RW	H06 Voltage limit	Float	0.005
49850	RW	H07 Voltage limit	Float	LV/MV: 0.05 HV: 0.04

49852	RW	H08 Voltage limit	Float	0.005
49854	RW	H09 Voltage limit	Float	LV/MV:0.015 HV: 0.013
49856	RW	H10 Voltage limit	Float	0.005
49858	RW	H11 Voltage limit	Float	LV/MV:0.035 HV: 0.03
49860	RW	H12 Voltage limit	Float	0.005
49862	RW	H13 Voltage limit	Float	LV/MV:0.03 HV: 0.025
49864	RW	H14 Voltage limit	Float	0.005
49866	RW	H15 Voltage limit	Float	0.005
49868	RW	H16 Voltage limit	Float	0.005
49870	RW	H17 Voltage limit	Float	0.02
49872	RW	H18 Voltage limit	Float	0.005
49874	RW	H19 Voltage limit	Float	0.015
49876	RW	H20 Voltage limit	Float	0.005
49878	RW	H21 Voltage limit	Float	0.005
49880	RW	H22 Voltage limit	Float	0.005
49882	RW	H23 Voltage limit	Float	0.015
49884	RW	H24 Voltage limit	Float	0.005
49886	RW	H25 Voltage limit	Float	0.015
49888	RW	Reserved	Float	0

Table 5-128 EN50160 Parameters Setup

5.9.19 QR (Qualification Rate) Log

Register Address	Property	Description	Format	Scale	Default
50000	RW	Reserved	UINT16		
50001	RO	Reserved	UINT16		

50002	RO	U Over Dev. Limit	Float	(0~100%) Un	0.07
50004	RO	U Under Dev. Limit	Float	(-100%~0) Un	-0.07
50006	RO	Freq. Over Dev. Limit	Float	0~7.5 Hz	0.2
50008	RO	Freq. Under Dev. Limit	Float	-7.5~0 Hz	-0.2
50010	RO	Plt Limit	Float	0~50	1

Table 5-129 QR Log Data Structure

5.9.20 Trend Log Setup

The Trend Log is displayed on the PMC-680i's Front Panel Interface or web. Up to 12 parameters can be displayed at the same time. The Trend Log parameters must be part of the SDR Log.

Register Address	Property	Description	Format	Range/Option
50050	RW	Number of Parameters	UINT16	0 to12 (Default=12)
50051	RW	Parameter #1: Freq.	UINT16	
50052	RW	Parameter #2: Ua RMS	UINT16	
50053	RW	Parameter #3: Ub RMS	UINT16	
50054	RW	Parameter #4: Uc RMS	UINT16	
50055	RW	Parameter #5: Ia RMS	UINT16	
50056	RW	Parameter #6: Ib RMS	UINT16	
50057	RW	Parameter #7: Ic RMS	UINT16	
50058	RW	Parameter #8: ∑kWh	UINT16	
50059	RW	Parameter #9: ∑kvarh	UINT16	
50060	RW	Parameter #10: ∑kVAh	UINT16	
50061	RW	Parameter #11: kW Imp. DMD	UINT16	
50062	RW	Parameter #12: kW Exp. DMD	UINT16	

Table 5-130 Trend Log Setup

5.9.21 TOU Setup

5.9.21.1 Basic Setup

Register	Property	Description	Format	Range/Option

50100	RW	Sunday Setup	UINT16	0=Weekday1 1=Weekday2 2=Weekday3
50101	RW	Monday Setup	UINT16	
50102	RW	Tuesday Setup	UINT16	
50103	RW	Wednesday Setup	UINT16	
50104	RW	Thursday Setup	UINT16	
50105	RW	Friday Setup	UINT16	
50106	RW	Saturday Setup	UINT16	
50107	RW	Switch Time Between Two TOU Schedules	UINT32	YYYYMMDDHH
50109	RW	TOU Self-read Time	UINT16	DDHH

Table 5-131 TOU Basic Setup

5.9.21.2 Season Setup

The PMC-680i has two sets of Season setup parameters. The base addresses for two sets are 50200 and 50300 respectively. Register Address = Base Address + Register Offset, for example, the season #2's start date of second schedule is 50300+4 = 50304.

Offset	Property	Description	Format	Range/Note
0	RW	Season #1: Start Date[1]	UINT16	0x0101
1	RW	Season #1: Weekday#1 Daily Profile	UINT16	0 to 19
2	RW	Season #1: Weekday#2 Daily Profile	UINT16	
3	RW	Season #1: Weekday#3 Daily Profile	UINT16	
4	RW	Season #2: Start Date High-order Byte: Month Low-order Byte: Day	UINT16	
5	RW	Season #2: Weekday#1 Daily Profile	UINT16	0 to 19
6	RW	Season #2: Weekday#2 Daily Profile	UINT16	
7	RW	Season #2: Weekday#3 Daily Profile	UINT16	
8	RW	Season #3: Start Date	UINT16	See Season #2: Start Date
9	RW	Season #3: Weekday#1 Daily Profile	UINT16	0 to 19
10	RW	Season #3: Weekday#2 Daily Profile	UINT16	
11	RW	Season #3: Weekday#3 Daily Profile	UINT16	

12	RW	Season #4: Start Date	UINT16	See Season #2: Start Date
13	RW	Season #4: Weekday#1 Daily Profile	UINT16	0 to 19
14	RW	Season #4: Weekday#2 Daily Profile	UINT16	
15	RW	Season #4: Weekday#3 Daily Profile	UINT16	
16	RW	Season #5: Start Date	UINT16	See Season #2: Start Date
17	RW	Season #5: Weekday#1 Daily Profile	UINT16	0 to 19
18	RW	Season #5: Weekday#2 Daily Profile	UINT16	
19	RW	Season #5: Weekday#3 Daily Profile	UINT16	
20	RW	Season #6: Start Date	UINT16	See Season #2: Start Date
21	RW	Season #6: Weekday#1 Daily Profile	UINT16	0 to 19
22	RW	Season #6: Weekday#2 Daily Profile	UINT16	
23	RW	Season #6: Weekday#3 Daily Profile	UINT16	
24	RW	Season #7: Start Date	UINT16	See Season #2: Start Date
25	RW	Season #7: Weekday#1 Daily Profile	UINT16	0 to 19
26	RW	Season #7: Weekday#2 Daily Profile	UINT16	
27	RW	Season #7: Weekday#3 Daily Profile	UINT16	
28	RW	Season #8: Start Date	UINT16	See Season #2: Start Date
29	RW	Season #8: Weekday#1 Daily Profile	UINT16	0 to 19
30	RW	Season #8: Weekday#2 Daily Profile	UINT16	
31	RW	Season #8: Weekday#3 Daily Profile	UINT16	
32	RW	Season #9: Start Date	UINT16	See Season #2: Start Date
33	RW	Season #9: Weekday#1 Daily Profile	UINT16	0 to 19
34	RW	Season #9: Weekday#2 Daily Profile	UINT16	
35	RW	Season #9: Weekday#3 Daily Profile	UINT16	
36	RW	Season #10: Start Date	UINT16	See Season #2: Start Date
37	RW	Season #10: Weekday#1 Daily Profile	UINT16	0 to 19
38	RW	Season #10: Weekday#2 Daily Profile	UINT16	

39	RW	Season #10: Weekday#3 Daily Profile	UINT16	
40	RW	Season #11: Start Date	UINT16	See Season #2: Start Date
41	RW	Season #11: Weekday#1 Daily Profile	UINT16	0 to 19
42	RW	Season #11: Weekday#2 Daily Profile	UINT16	
43	RW	Season #11: Weekday#3 Daily Profile	UINT16	
44	RW	Season #12: Start Date	UINT16	See Season #2: Start Date
45	RW	Season #12: Weekday#1 Daily Profile	UINT16	0 to 19
46	RW	Season #12: Weekday#2 Daily Profile	UINT16	
47	RW	Season #12: Weekday#3 Daily Profile	UINT16	

Table 5-132 Season Setup

Notes:

1) **Start Date** for Season#1 is Jan. 1st and cannot be modified.
2) It is invalid when set **Start Date** as 0xFFFF. If one of season's start time is set as 0xFFFF, then all the later seasons' **Start Date** must be 0xFFFF which means the valid period of last season is from **Start Date** to the end of this year.
3) The previous season must be earlier than the later season.

5.9.21.3 Daily Profile Setup

Register Address	Property	Description	Format
50400~50423	RW	Daily Profile #1	See Table 5-135 Daily Profile Data Structure Setup
50424~50447	RW	Daily Profile #2	
50448~50471	RW	Daily Profile #3	
50472~50495	RW	Daily Profile #4	
50496~50519	RW	Daily Profile #5	
50520~50543	RW	Daily Profile #6	
50544~50567	RW	Daily Profile #7	
50568~50591	RW	Daily Profile #8	
50592~50615	RW	Daily Profile #9	
50616~50639	RW	Daily Profile #10	
50640~50663	RW	Daily Profile #11	
50664~50687	RW	Daily Profile #12	
50688~50711	RW	Daily Profile #13	

50712~50735	RW	Daily Profile #14	
50736~50760	RW	Daily Profile #15	
50760~50783	RW	Daily Profile #16	
50784~50807	RW	Daily Profile #17	
50808~50831	RW	Daily Profile #18	
50832~50855	RW	Daily Profile #19	
50856~50879	RW	Daily Profile #20	

Table 5-133 Daily Profile#1 Setup

Register Address	Property	Description	Format
50900~50923	RW	Daily Profile #1	See Table 5-135 Daily Profile Data Structure Setup
50924~50947	RW	Daily Profile #2	
50948~50971	RW	Daily Profile #3	
50972~50995	RW	Daily Profile #4	
50996~51019	RW	Daily Profile #5	
51020~51043	RW	Daily Profile #6	
51044~51067	RW	Daily Profile #7	
51068~51091	RW	Daily Profile #8	
51092~50615	RW	Daily Profile #9	
51116~51139	RW	Daily Profile #10	
51140~51163	RW	Daily Profile #11	
51164~51187	RW	Daily Profile #12	
51188~51211	RW	Daily Profile #13	
51212~51235	RW	Daily Profile #14	
51236~51260	RW	Daily Profile #15	
51260~51283	RW	Daily Profile #16	
51284~51307	RW	Daily Profile #17	
51308~51331	RW	Daily Profile #18	

51332~51355	RW	Daily Profile #19	
51356~51379	RW	Daily Profile #20	

Table 5-134 Daily Profile#2 Setup

Offset	Property	Description	Format	Note
+0	RW	Daily Profile #*x* Period #1 Start Time	UINT16	0x0000
+1	RW	Daily Profile #*x* Period #1 Tariff	UINT16	0 to 7 0=T1, 7=T8
+2	RW	Daily Profile #*x* Period #2 Start Time	UINT16	
+3	RW	Daily Profile #*x* Period #2 Tariff	UINT16	0 to 7 0=T1, 7=T8
+4	RW	Daily Profile #*x* Period #3 Start Time	UINT16	
+5	RW	Daily Profile #*x* Period #3 Tariff	UINT16	0 to 7 0=T1, 7=T8
+6	RW	Daily Profile #*x* Period #4 Start Time	UINT16	
+7	RW	Daily Profile #*x* Period #4 Tariff	UINT16	0 to 7 0=T1, 7=T8
+8	RW	Daily Profile #*x* Period #5 Start Time	UINT16	
+9	RW	Daily Profile #*x* Period #5 Tariff	UINT16	0 to 7 0=T1, 7=T8
+10	RW	Daily Profile #*x* Period #6 Start Time	UINT16	
+11	RW	Daily Profile #*x* Period #6 Tariff	UINT16	0 to 7 0=T1, 7=T8
+12	RW	Daily Profile #*x* Period #7 Start Time	UINT16	
+13	RW	Daily Profile #*x* Period #7 Tariff	UINT16	0 to 7 0=T1, 7=T8
+14	RW	Daily Profile #*x* Period #8 Start Time	UINT16	
+15	RW	Daily Profile #*x* Period #8 Tariff	UINT16	0 to 7 0=T1, 7=T8
+16	RW	Daily Profile #*x* Period #9 Start Time	UINT16	
+17	RW	Daily Profile #*x* Period #9 Tariff	UINT16	0 to 7 0=T1, 7=T8
+18	RW	Daily Profile #*x* Period #10 Start Time	UINT16	

+19	RW	Daily Profile #*x* Period #10 Tariff	UINT16	0 to 7 0=T1, 7=T8
+20	RW	Daily Profile #*x* Period #11 Start Time	UINT16	
+21	RW	Daily Profile #*x* Period #11 Tariff	UINT16	0 to 7 0=T1, 7=T8
+22	RW	Daily Profile #*x* Period #12 Start Time	UINT16	
+23	RW	Daily Profile #*x* Period #12 Tariff	UINT16	0 to 7 0=T1, 7=T8

x indicates Daily Profile number.

Table 5-135 Daily Profile Data Structure Setup

Notes:

1) **Daily Profile#1 Period #1 Start Time** should be 00:00 and cannot be modified.
2) It is invalid when set **Start Time** as 0xFFFF. If one of daily profile's **Start Time** is set as 0xFFFF, then all the later daily profiles' **Start Time** must be 0xFFFF which means the valid period of last daily profile is from **Start Time** to the end of the year.
3) The minimum interval of period is 15mins.
4) The previous period must be earlier than the later period.

5.9.21.4 Alternate Days Setup

The Alternate Days has higher priority than season, which means if one day is set as alternate day, then this day's rate distribution will according to Alternate Days schedule.

The PMC-680i has two sets of Alternate Days setup parameter. The base addresses for two sets are 51400 and 51700 respectively. Register Address = Base Address + Register Offset.

Offset	Property	Description	Format	Note
0	RW	Alternate Day #1 Date[1]	UINT32	
2	RW	Alternate Day #1 Daily Profile	UINT16	0 to 19
3	RW	Alternate Day #2 Date[1]	UINT32	
5	RW	Alternate Day #2 Daily Profile	UINT16	0 to 19
6	RW	Alternate Day #3 Date[1]	UINT32	
8	RW	Alternate Day #3 Daily Profile	UINT16	0 to 19
9	RW	Alternate Day #4 Date[1]	UINT32	
11	RW	Alternate Day #4 Daily Profile	UINT16	0 to 19
12	RW	Alternate Day #5 Date[1]	UINT32	
14	RW	Alternate Day #5 Daily Profile	UINT16	0 to 19

15	RW	Alternate Day #6 Date[1]	UINT32	
17	RW	Alternate Day #6 Daily Profile	UINT16	0 to 19
18	RW	Alternate Day #7 Date[1]	UINT32	
19	RW	Alternate Day #7 Daily Profile	UINT16	0 to 19
21	RW	Alternate Day #8 Date[1]	UINT32	
22	RW	Alternate Day #8 Daily Profile	UINT16	0 to 19
24	RW	Alternate Day #9 Date[1]	UINT32	
25	RW	Alternate Day #9 Daily Profile	UINT16	0 to 19
27	RW	Alternate Day #10 Date[1]	UINT32	
29	RW	Alternate Day #10 Daily Profile	UINT16	0 to 19
…		…		
…		…		
240	RW	Alternate Day #81 Date[1]	UINT32	
162	RW	Alternate Day #81 Daily Profile	UINT16	0 to 19
243	RW	Alternate Day #82 Date[1]	UINT32	
245	RW	Alternate Day #82 Daily Profile	UINT16	0 to 19
246	RW	Alternate Day #83 Date[1]	UINT32	
248	RW	Alternate Day #83 Daily Profile	UINT16	0 to 19
249	RW	Alternate Day #84 Date[1]	UINT32	
251	RW	Alternate Day #84 Daily Profile	UINT16	0 to 19
252	RW	Alternate Day #85 Date[1]	UINT32	
254	RW	Alternate Day #85 Daily Profile	UINT16	0 to 19
255	RW	Alternate Day #86 Date[1]	UINT32	
256	RW	Alternate Day #86 Daily Profile	UINT16	0 to 19
258	RW	Alternate Day #87 Date[1]	UINT32	
260	RW	Alternate Day #87 Daily Profile	UINT16	0 to 19
261	RW	Alternate Day #88 Date[1]	UINT32	

263	RW	Alternate Day #88 Daily Profile	UINT16	0 to 19
264	RW	Alternate Day #89 Date[1]	UINT32	
266	RW	Alternate Day #89 Daily Profile	UINT16	0 to 19
267	RW	Alternate Day #90 Date[1]	UINT32	
269	RW	Alternate Day #90 Daily Profile	UINT16	0 to 19

Table 5-136 Alternate Days Setup

Notes:

1) The following table illustrates the register of date:

Byte3	Byte2	Byte1	Byte0
Reserved	Year	Month	Day

Table 5-137 Date Format

The Year and Month can be set as **0xFF** which means the alternate day is repeated by year or month, that is the day of every year or every month is alternate day.

5.9.22 System Setup

Register Address	Property	Description	Format	Range / Options	Default
40800	RW	Clock Source[1]	UINT16	0=RTC, 1=SNTP, 2=GPS, 3=IRIG-B, 4=DI	0
40801		Time Zone[2]	UINT16	0 to 32	26
40802	RW	IRIG-B Time Zone [2]	UINT16	0 to 32	13
40803	RW	Language	UINT16	0*=English	0
40804	RW	Date Format	UINT16	0*=YYMMDD 1=MMDDYY 2=DDMMYY	0
40805	RW	Reserved			
40806	RW	Backlight Timeout	UINT16	0 to 60 min	3
40807	RW	LCD Contrast (%)	UINT16	50 to 100	90
40808	RW	Phase A Color	UINT16	0=Brown 1=Red 2=Pink 3=Orange 4=Yellow 5=Yellow-green 7=Light-blue	1
40809	RW	Phase B Color	UINT16		4
40810	RW	Phase C Color	UINT16		8

40811	RW	Phase N Color	UINT16	6=Green 9=Violet 8=Dark-blue 11=Natural Gray 10=Gray 12=White 13=Black	13
40812	RW	Earth Wire Color	UINT16		1
40813	RW	Set Password	UINT32	0~999999	0
40815~40817	RW	Reserved	UINT32		
40819	RW	Time Zone of data timestamp[3]	UINT16		0x0C
40820	RW	PQ Curve	UINT16	0=ITIC, 1=SEMI F47	0
40821	RW	Set Interval	UINT16	0=50/60cycles 1=150/180cycles 2=10min 3=2hour	0
40822	RW	Freq. Interval	UINT16	0=1s, 1=3s, 2=10s	0
40823	RW	Reserved	UINT16		
40824	RW	Sampling Section of DWR .cfg File[4]	UINT16	0=0 1=Actual Sampling	0
40825	RW	Eliminate Flagged Data	UINT16	0=Disabled, 1=Enabled BIT0: SDR Log BIT1: Max. Log BIT2: Min. Log BIT3: EN50160 BIT4: QR Log Others: Reserved	0

Table 5-138 System Setup Parameters

Notes:

1) When **Clock Source** is set to GPS or IRIG-B, P4 (RS485 Port 2) will be automatically used for the respective Time Sync signal. Please refer to Section **4.6 Time Synchronization** for detailed description.

   When **Clock Source** is set to DI, DI8 will be used by default for the 1PPS GPS Time Sync input.

2) The following table lists the Codes for different Time Zones. The IRIG-B Time Zone parameter should be configured when **Clock Source** is set to IRIG-B.

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 5-139 Time Zones

3) The timestamp of historical data is programmable which is illustrates below:
   0: local time
   1: UTC time

BIT	Description	Note
BIT0	MODBUS	Timestamp of retrived Data log via Modbus: Real-time measurement, SOE/PQLOG, DR, SDR, Max./Min. log, Plt/Pst, IER, Qualification Rate Log
BIT1	COMTRADE	Timestamp of COMTRADE file and the first/trigger point in .cfg file
BIT2	PQDIF	Timestamp of PQDIF file, file name and store directory.
BIT3	IEC61850	IEC61850 Log

Table 5-140 Timestamp of Historical Data

4) 0 means the DWR file doesn't involve sampling section information.

5.10 File Transfer Register

5.10.1 File Name

- **WFR file**

WFR files are stored in PMC-680i with COMTRADE format. Each WFR will generate three files: faultRecordXXX.cfg, faultRecordXXX.dat and faultRecordXXX.hdr. Short file names for the three files are WFR_xxx.cfg, WFR_xxx.dat and WFR_XXX.hdr where xxx is WFR file index.

- **DWR file**

DWR files are stored in PMC-680i with COMTRADE format. Each DWR will generate three files: disturbRecodXXX.cfg, disturbRecodXXX.dat and disturbRecodXXX.hdr. Short file names for the three files are DWR_xxx.cfg, DWR_xxx.dat and DWR_xxx.cfg where xxx is DWR file index.

- **MSV WFR file**

MSV WFR files are stored in PMC-680i with COMTRADE format. Each MSV WFR will generate three files: mainSignalRecordXXX.cfg, mainSignalRecordXXX.dat and mainSignalRecordXXX.hdr.

Short file names for the three files are MSVR#y_xxx.cfg, MSVR#y__xxx.dat and MSVR#y_.hdr where xxx is MSV WFR file index.

5.10.2 Reading File

The file can be read via file transfer register, the following shows how to read file.

1. Write short file name into **File Name** register, for example: MSVR#1_129.cfg. If the file doesn't exist or failed to open, the device will respond with abnormal node: **03**.
2. Write specified offset address in **File Offset** register if specific file need to be read, otherwise set the register blank and the file will be read from the beginning.

   When read file sequentially, the **File Offset** register will be adjusted automatically as long as **File Data Buffer** and **File Offset** are read simultaneously. Otherwise, the device will respond with abnormal node **03** after writing invalid file offset into the register.
3. It is recommend to read 125 registers at a time, including **File Offset, Valid Number of Data Bytes in the Frame** and **File Data Buffer.** If you want to re-read one specific data, do not write file offset and File Data Buffer will keep existing data.
4. Repeat step 3 until the valid data of this frame is 0 or file offset equals to file size and the file has been transferred.
5. Write a new short file name to start a new reading task.

Notes:

1) When reading file the connection is broken and then reconnected, all of the data of **File Bata Buffer** are oxff. A newly reading task should be started. However, writing file offset to the interruption register can accelerate reading.
2) Using short file name to read waveform file and DWR file.
3) When file size is invalid value: 0xFFFFFFFF, please rewrite the file name to start a newly reading file task.

5.10.3 Register Address

Register	Property	Description	Format	Range/Note
59400~59499	RW	File Name[1]	UINT16	Writing relative path of file in a frame, make up the end with \0.
59500	RO	File Size[2]	UINT32	File size of currently being transferred
59502	RW	File Offset	UINT32	Writing indicates should adjust offset
59504	RO	Valid Number of Data Bytes in the Frame	UINT16	
59505~59626	RO	File Data Buffer	Char	0~244

Table 5-141 File Transfer Register

5.11 Control Setup

5.11.1 RO/DO Control

The **RO/DO Control** registers are implemented as "Write-Only" Modbus Coil Registers (0XXXXX) and can be controlled with the Force Single Coil command (Function Code 0x05). Firmware Va.b.c.d and later also allows the RO/DO to be controlled with the Preset Multiple Registers command (Function Code 0x10). The PMC-680i does not support the Read Coils command (Function Code 0x01) or the Read Holding Registers command (Function Code 0x03) for these registers because **RO/DO Control** registers are "Write-Only". Register 0070 (**RO/DO Status**) should be read instead to determine the current RO/DO status.

The PMC-680i adopts the **Execute without Arm** operation for the remote control of its relays. By default, a relay must be "Armed" first before it can be operated on. This is achieved by writing the value 0xFF00 to the appropriate register to "Arm" a particular relay. The relay 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.

The **Execute without Arm** operation can be bypassed by setting the **Execute without Arm** (register 40301) setup register to **Disabled**. When this is done, it's no longer necessary to arm the relay before operating it.

Register Address	Property	Description	Format	Note
9100	WO	Arm RO1/DO1 Close	UINT16	Writing "0xFF00" to a particular register will perform the specified function.
9101	WO	Execute RO1/DO1 Close	UINT16	
9102	WO	Arm RO1/DO1 Open	UINT16	
9103	WO	Execute RO1/DO1 Open	UINT16	
9104	WO	Arm RO2/DO2 Close	UINT16	
9105	WO	Execute RO2/DO2 Close	UINT16	
9106	WO	Arm RO2/DO2 Open	UINT16	
9107	WO	Execute RO2/DO2 Open	UINT16	
9108	WO	Arm RO3/DO3 Close	UINT16	
9109	WO	Execute RO3/DO3 Close	UINT16	
9110	WO	Arm RO3/DO3 Open	UINT16	
9111	WO	Execute RO3/DO3 Open	UINT16	
9112	WO	Arm RO4/DO4 Close	UINT16	
9113	WO	Execute RO4/DO4 Close	UINT16	
9114	WO	Arm RO4/DO4 Open	UINT16	

9115	WO	Execute RO4/DO4 Open	UINT16	
9116	WO	Arm RO5/DO5 Close	UINT16	
9117	WO	Execute RO5/DO5 Close	UINT16	
9118	WO	Arm RO5/DO5 Open	UINT16	
9119	WO	Execute RO5/DO5 Open	UINT16	
9120	WO	Arm RO6/DO6 Close	UINT16	
9121	WO	Execute RO6/DO6 Close	UINT16	
9122	WO	Arm RO6/DO6 Open	UINT16	
9123	WO	Execute RO6/DO6 Open	UINT16	
9124	WO	Arm RO7/DO7 Close	UINT16	
9125	WO	Execute RO7/DO7 Close	UINT16	
9126	WO	Arm RO7/DO7 Open	UINT16	
9127	WO	Execute RO7/DO7 Open	UINT16	
9128	WO	Arm RO8/DO8 Close	UINT16	
9129	WO	Execute RO8/DO8 Close	UINT16	
9130	WO	Arm RO8/DO8 Open	UINT16	
9131	WO	Execute RO8/DO8 Open	UINT16	

Table 5-142 DO Control

5.11.2 Clear DI/DO

Register Address	Property	Description	Format	Note
9200	WO	Send Test Email	UINT16	Writing "0xFF00" to a particular register will perform the specified function.
9201	WO	Clear DI1	UINT16	
9202	WO	Clear DI2	UINT16	
9203	WO	Clear DI3	UINT16	
9204	WO	Clear DI4	UINT16	
9205	WO	Clear DI5	UINT16	
9206	WO	Clear DI6	UINT16	

9207	WO	Clear DI7	UINT16	
9208	WO	Clear DI8	UINT16	
9209~9216	WO	Reserved	UINT16	
9217	WO	Clear All DIs		
9218	WO	Disable DO Operate/Release by Front Panel	UINT16	
9219	WO	Clear All Historical Data[1]	UINT16	

Table 5-143 DO Control

Notes:

1) After sending **Clear All Historical Data** command, the PMC-680i will be restart, and ferroelectric data and CF card's data will be cleared.

5.11.3 Clear/Reset Control

Register Address	Property	Description	Format	Note
9250~9252	WO	Reserved	UINT16	
9253	WO	WFR Manual Trigger	UINT16	Fixed as 0xFF00
9254	WO	Reserved	UINT16	
9255	WO	DWR Manual Trigger	UINT16	Fixed as 0xFF00
9256	WO	TOU Transient Log Manual Trigger	UINT16	Fixed as 0xFF00
9257	WO	TOU Log Manual Trigger	UINT16	Fixed as 0xFF00
9258	WO	Switch TOU Schedules Manually	UINT16	Fixed as 0xFF00
9259	WO	Reserved	UINT16	
9260	WO	Reserved	UINT16	
9261	WO	Clear SOE Log	UINT16	Fixed as 0xFF00
9262	WO	Clear PQ Log	UINT16	Fixed as 0xFF00
9263	WO	Clear Energy Registers	UINT16	Fixed as 0xFF00
9264	WO	Clear Interval Energy Log	UINT16	Fixed as 0xFF00
9265~9274	WO	Reserved	UINT16	
9275	WO	Clear Plt Log	UINT16	Fixed as 0xFF00
9276	WO	Clear Pst Log	UINT16	Fixed as 0xFF00
9277	WO	Clear WFR	UINT16	Fixed as 0xFF00

9278	WO	Clear DWR	UINT16	Fixed as 0xFF00
9279	WO	Clear MSV#1 WFR	UINT16	Fixed as 0xFF00
9280	WO	Clear MSV#2 WFR	UINT16	Fixed as 0xFF00
9281	WO	Clear MSV#3 WFR	UINT16	Fixed as 0xFF00
9282	WO	Clear All Max./Min. Log	UINT16	Fixed as 0xFF00
9283	WO	Clear Max. Log#1		Fixed as 0xFF00
9284	WO	Clear Max. Log#2	UINT16	Fixed as 0xFF00
9285	WO	Clear Max. Log#3	UINT16	Fixed as 0xFF00
9286	WO	Clear Max. Log#4	UINT16	Fixed as 0xFF00
9287	WO	Reserved	UINT16	
9288	WO	Clear Min. Log#1	UINT16	Fixed as 0xFF00
9289	WO	Clear Min. Log#2	UINT16	Fixed as 0xFF00
9290	WO	Clear Min. Log#3	UINT16	Fixed as 0xFF00
9291	WO	Clear Min. Log#4	UINT16	Fixed as 0xFF00
9292	WO	Reserved	UINT16	
9293	WO	Clear All Demand[2]	UINT16	Fixed as 0xFF00
9294	WO	Clear Peak Demand of This Month or Since the Last Reset[3]	UINT16	Fixed as 0xFF00
9295	WO	Clear EN50160 Log	UINT16	Fixed as 0xFF00
9296	WO	Clear Qualification Rate Log	UINT16	Fixed as 0xFF00
9297	WO	Clear SDR Log #1	UINT16	Fixed as 0xFF00
9298	WO	Clear SDR Log #2	UINT16	Fixed as 0xFF00
9299	WO	Clear SDR Log #3	UINT16	Fixed as 0xFF00
9300	WO	Clear SDR Log #4	UINT16	Fixed as 0xFF00
9301	WO	Clear SDR Log #5	UINT16	Fixed as 0xFF00
9302	WO	Clear SDR Log #6	UINT16	Fixed as 0xFF00
9303	WO	Clear SDR Log #7	UINT16	Fixed as 0xFF00
9304	WO	Clear SDR Log #8	UINT16	Fixed as 0xFF00

9305	WO	Clear SDR Log #9	UINT16	Fixed as 0xFF00
9306	WO	Clear SDR Log #10	UINT16	Fixed as 0xFF00
9307	WO	Clear SDR Log #11	UINT16	Fixed as 0xFF00
9308	WO	Clear SDR Log #12	UINT16	Fixed as 0xFF00
9309	WO	Clear SDR Log #13	UINT16	Fixed as 0xFF00
9310	WO	Clear SDR Log #14	UINT16	Fixed as 0xFF00
9311	WO	Clear SDR Log #15	UINT16	Fixed as 0xFF00
9312	WO	Clear SDR Log #16	UINT16	Fixed as 0xFF00
9313	WO	Clear All SDR Logs	UINT16	Fixed as 0xFF00
9314	WO	Clear DR Log #1	UINT16	Fixed as 0xFF00
9315	WO	Clear DR Log #2	UINT16	Fixed as 0xFF00
9316	WO	Clear DR Log #3	UINT16	Fixed as 0xFF00
9317	WO	Clear DR Log #4	UINT16	Fixed as 0xFF00
9318	WO	Clear DR Log #5	UINT16	Fixed as 0xFF00
9319	WO	Clear DR Log #6	UINT16	Fixed as 0xFF00
9320	WO	Clear DR Log #7	UINT16	Fixed as 0xFF00
9321	WO	Clear DR Log #8	UINT16	Fixed as 0xFF00
9322	WO	Clear All DR Logs	UINT16	Fixed as 0xFF00
9327~9330	WO	Reserved	UINT16	
9331	WO	Clear All HS DR Logs	UINT16	Fixed as 0xFF00
9332	WO	Clear Swell Counter	UINT16	Fixed as 0xFF00
9333	WO	Clear Dips Counter	UINT16	Fixed as 0xFF00
9334	WO	Clear Interruption Counter	UINT16	Fixed as 0xFF00
9335	WO	Clear Transient Counter	UINT16	Fixed as 0xFF00
9336	WO	Clear RVC Counter	UINT16	Fixed as 0xFF00
9337	WO	Clear Inrush Current Counter	UINT16	Fixed as 0xFF00
9338	WO	Clear Relative RMS Counter	UINT16	Fixed as 0xFF00

9339	WO	Clear MSV#1 Counter	UINT16	Fixed as 0xFF00
9340	WO	Clear MSV#2 Counter	UINT16	Fixed as 0xFF00
9341	WO	Clear MSV#3 Counter	UINT16	Fixed as 0xFF00
9342	WO	Clear All PQ Counter	UINT16	Fixed as 0xFF00
9343	WO	Clear All TOU Data	UINT16	Fixed as 0xFF00

Table 5-144 Clear/Reset Control Register

Notes:

1) The command must be “0xFF00”.
2) Executing this command means the following demand will be cleared: present demand, predicted demand, Max./Min. demand per period, and peak demand of this month and last month.
3) When **Self-read Time** (41253) is 0x0000 or *XXXX,* executing this command means only clear present Max./Min. log, while **Self-read Time** (41253) is 0xFFFF, the present Max./Min. log will be transferred to since Last Reset.

5.12 Time Registers

There are two sets of **Time** registers supported by the PMC-680i - Year / Month / Day / Hour / Minute / Second (Registers # 60000 to 60002 for 6-digit addressing and Registers # 9000 to 9002 for 5-digit addressing) and UNIX Time (Registers # 60004 to 600005 for 6-digit addressing and Registers # 9004 to 9005 for 5-digit addressing). When sending time to the PMC-680i 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 (or 9000 to 9004 for 5-digit addressing) are being written to at the same time, both Time register sets will be updated to reflect the new time specified in the UNIX Time register set 60004 (9004) where the time specified in registers 60000 to 60003 (9000-9003 for 5-digit addressing) will be ignored. Writing to the Millisecond register 60003 (9003 for 5-digit addressing) 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 Address		Property	Description	Format	Note
6-digit	5-digit				
60000	9000	RW	High-order Byte: Year	UINT16	0-37 (Year-2000)
			Low-order Byte: Month		1 to 12
60001	9001	RW	High-order Byte: Day	UINT16	1 to 31
			Low-order Byte: Hour		0 to 23
60002	9002	RW	High-order Byte: Minute	UINT16	0 to 59
			Low-order Byte: Second		0 to 59
60003	9003	RW	Millisecond	UINT16	0 to 999

60004-60005	9004-9005	RW	UNIX Time	UINT32	(0 to 2145916799) This time shows the number of seconds since 00:00:00 January 1, 2000

Table 5-145 Time Registers

5.13 Information

5.13.1 Meter Information

Register Address		Property	Description	Format	Note
60200~60219	9800~9819	RO	Meter Model[1]	Char	See Note 1
60220	9820	RO	Firmware Version	UINT16	e.g. 10000 shows the version is V1.00.00
60221	9821	RO	Modbus Version	UINT16	e.g. 10 shows the version is V1.0
60222	9822	RO	IEC 61850 Version	UINT16	e.g. 0100 means the version is V01.00 e.g. 0000 means no 61850 support or 61850 version number error
60223	9823	RO	Hardware Version	UINT16	e.g. 10 shows the version is V1.0
60224	9824	RO	PPC Firmware Update Date: Year-2000	UINT16	e.g. 130709 means July 9,2013
60225	9825	RO	PPC Firmware Update Date: Month	UINT16	
60226	9826	RO	PPC Firmware Update Date: Day	UINT16	
60227	9827		Serial Number: AA(Year-2000) - BB(Month) - CC(Lot Number) - DDDD(Meter Number)	UINT32	
60229	9829	RO	Reserved		
60230	9830	RO	Feature Code[2]	UINT32	
60232	9832	RO	Reserved		
60233	9833	RO	Device Temperature (°C)	Float	
60235	9835	RO	Self-Diagnostics - PPC	UNIT32	Bit0: System Parameters Error Bit1: Secret Parameters Error

					Bit2: DSP Error Bit3: Memory Configuration Error
60237	9837		Self-Diagnostics - DSP	UNIT32	Bit0: AD Error
60239	9839	RO	Reserved	UNIT32	
60241	9841	RO	Reserved	UNIT32	
60243	9843	RO	MAC 1 Address-01	UNIT16	0x00A0
60244	9844	RO	MAC 1 Address-23	UNIT16	0x1EA0
60245	9845	RO	MAC 1 Address-45	UNIT16	0xAAA0
60246	9846	RO	MAC 2 Address-01	UNIT16	0x00A0
60247	9847	RO	MAC 1 Address-23	UNIT16	0x1EA1
60248	9848	RO	MAC 2 Address-45	UNIT16	0xAAA0
60249	9849	RO	Memory Capacity	UNIT16	Units: MB
60250	9850	RO	Remaining Memory	UNIT16	Units: MB

Table 5-146 Meter Information

Notes:

1) The **Meter Model** appears in registers 60200 to 60219 and contains the ASCII encoding of the string “PMC-680i” as shown in the following table.

Offset Address	Value(Hex)	ANSCII
60200	0x50	P
60201	0x4D	M
60202	0x43	C
60203	0x2D	-
60204	0x36	6
60205	0x38	8
60206	0x30	0
60207	0x69	i
60208-60219	0x20	<Null>

Table 5-147 ASCII Encoding of “PMC-680i”

2) The following table illustrates the PMC-680i's Feature Code:

BIT	Description	Value	Meaning	Model
0	Samples/Cycles	0	512 samples/cycle	A
		1	1024 samples/cycle	B
1	Memory	0	4G	4
		1	8G	8
2,3	Current Input	00	5A	5
		01	1A	1
		10	Clamp-On Current Probe	C
4,5	Voltage Input	01	57-347V	3
		10	400-830V	9
6	Power Supply	0	95-250VDC/AC±10%, 47-440Hz	2
		1	20~60VDC	
7	System Frequency	0	50Hz	5
		1	60Hz	6
8,9	I/O	00	8DI+4RO+4DO	A
10,11	Communications Port	00	2xEthernet Port	A
		01	2x100BaseT + 2xRS485	B
		10	1x100BaseT + 1x100BaseFX + 2xRS485	C
12	Reserved			
13	Support IEC61850	0	No	X
		1	Yes	A

Table 5-148 Feature Code

5.13.2 Device Tag Information

Register Address	Property	Description	Format	Note
40600	RW	Supply Company Tag 1[1]	Char	Devtag 0
40630	RW	Supply Company Tag 2	Char	Devtag 1
40660	RW	Substation Name	Char	Devtag 2

40690	RW	Voltage Level	Char	Devtag 3

Table 5-149 Device Tag Information

Notes:

1) However, the PMC-680i's Front Panel Interface supports the display of up to 39 characters only.

5.13.2 Circuit Tag Information

Register Address	Property	Description	Format	Note
52000	RW	Circuit Name	Char	60 characters
52008	RW	Bus Name	Char	60 characters
52038	RW	Monitoring Name	Char	60 characters
52068	RW	Monitoring Voltage Level	Char	60 characters
52098	RW	Assets Management ID	Char	60 characters
52128	RW	Monitoring Network ID	Char	60 characters
52158	RW	Commissioning Date	Char	60 characters
52188	RW	Exclusive Use (Yes/No)	Char	60 characters
52218	RW	Minimum Short Circuit Capacity	Char	60 characters
52248	RW	Power Supply Capacity	Char	60 characters
52278	RW	Customer Usage Agreement	Char	60 characters
52308	RW	Comtrade Tag	Char	60 characters

Table 5-150 Circuit Tag Information

Appendix A - Data ID

DR and SDR Data ID

Key ID				Parameters
50-cycle	150-cycle	10-min	2-hour	
1	10001	20001	30001	FREQ
2	10002	20002	30002	Ua
3	10003	20003	30003	Ub
4	10004	20004	30004	Uc
5	10005	20005	30005	U4
6	10006	20006	30006	Uln Avg.
7	10007	20007	30007	Uab
8	10008	20008	30008	Ubc
9	10009	20009	30009	Uca
10	10010	20010	30010	Ull Avg.
11	10011	20011	30011	Ia
12	10012	20012	30012	Ib
13	10013	20013	30013	Ic
14	10014	20014	30014	I4
15	10015	20015	30015	I5
16	10016	20016	30016	I Avg.
17	10017	20017	30017	∑kWa
18	10018	20018	30018	∑kWb
19	10019	20019	30019	∑kWc
20	10020	20020	30020	∑kW
21	10021	20021	30021	∑kvara
22	10022	20022	30022	∑kvarb
23	10023	20023	30023	∑kvarc

24	10024	20024	30024	∑kvar
25	10025	20025	30025	∑kVAa
26	10026	20026	30026	∑kVAb
27	10027	20027	30027	∑kVAc
28	10028	20028	30028	∑kVA
29	10029	20029	30029	PFa
30	10030	20030	30030	PFb
31	10031	20031	30031	PFc
32	10032	20032	30032	PF Avg.
33	10033	20033	30033	Ua Dev.
34	10034	20034	30034	Ub Dev.
35	10035	20035	30035	Uc Dev.
36	10036	20036	30036	Uab Dev.
37	10037	20037	30037	Ubc Dev.
38	10038	20038	30038	Uca Dev.
39	10039	20039	30039	Ua Over Dev.
40	10040	20040	30040	Ub Over Dev.
41	10041	20041	30041	Uc Over Dev.
42	10042	20042	30042	Uab Over Dev.
43	10043	20043	30043	Ubc Over Dev.
44	10044	20044	30044	Uca Over Dev.
45	10045	20045	30045	Ua Under Dev.
46	10046	20046	30046	Ub Under Dev.
47	10047	20047	30047	Uc Under Dev.
48	10048	20048	30048	Uab Under Dev.
49	10049	20049	30049	Ubc Under Dev.
50	10050	20050	30050	Uca Under Dev.

51	10051	20051	30051	Freq. Dev.
52	10052	20052	30052	Ua Fluctuation
53	10053	20053	30053	Ub Fluctuation
54	10054	20054	30054	Uc Fluctuation
55	10055	20055	30055	U0 Unb.
56	10056	20056	30056	U2 Unb.
57	10057	20057	30057	I0 Unb.
58	10058	20058	30058	I2 Unb.
59	10059	20059	30059	U0
60	10060	20060	30060	U2
61	10061	20061	30061	U1
62	10062	20062	30062	I0
63	10063	20063	30063	I2
64	10064	20064	30064	I1
65	10065	20065	30065	Ia TDD
66	10066	20066	30066	Ib TDD
67	10067	20067	30067	Ic TDD
68	10068	20068	30068	I4 TDD
69	10069	20069	30069	I5 TDD
70	10070	20070	30070	Ia TDD Odd
71	10071	20071	30071	Ib TDD Odd
72	10072	20072	30072	Ic TDD Odd
73	10073	20073	30073	I4 TDD Odd
74	10074	20074	30074	I5 TDD Odd
75	10075	20075	30075	Ia TDD Even
76	10076	20076	30076	Ib TDD Even
77	10077	20077	30077	Ic TDD Even

78	10078	20078	30078	I4 TDD Even
79	10079	20079	30079	I5 TDD Even
80	10080	20080	30080	Ia K-Factor
81	10081	20081	30081	Ib K-Factor
82	10082	20082	30082	Ic K-Factor
83	10083	20083	30083	I4 K-Factor
84	10084	20084	30084	I5 K-Factor
85	10085	20085	30085	Ia Crest Factor
86	10086	20086	30086	Ib Crest Factor
87	10087	20087	30087	Ic Crest Factor
88	10088	20088	30088	I4 Crest Factor
89	10089	20089	30089	I5 Crest Factor
90	10090	20090	30090	Ua Crest Factor
91	10091	20091	30091	Ub Crest Factor
92	10092	20092	30092	Uc Crest Factor
93	10093	20093	30093	U4 Crest Factor
94	10094	20094	30094	Ua MSV #1
95	10095	20095	30095	Ub MSV #1
96	10096	20096	30096	Uc MSV #1
97	10097	20097	30097	Ua MSV #2
98	10098	20098	30098	Ub MSV #2
99	10099	20099	30099	Uc MSV #2
100	10100	20100	30100	Ua MSV #3
101	10101	20101	30101	Ub MSV #3
102	10102	20102	30102	Uc MSV #3
103	10103	20103	30103	Ua THD
104	10104	20104	30104	Ub THD

105	10105	20105	30105	Uc THD
106	10106	20106	30106	U4 THD
107	10107	20107	30107	Ua TOHD
108	10108	20108	30108	Ub TOHD
109	10109	20109	30109	Uc TOHD
110	10110	20110	30110	U4 TOHD
111	10111	20111	30111	Ua TEHD
112	10112	20112	30112	Ub TEHD
113	10113	20113	30113	Uc TEHD
114	10114	20114	30114	U4 TEHD
115	10115	20115	30115	Ia THD
116	10116	20116	30116	Ib THD
117	10117	20117	30117	Ic THD
118	10118	20118	30118	I4 THD
119	10119	20119	30119	I5 THD
120	10120	20120	30120	Ia TOHD
121	10121	20121	30121	Ib TOHD
122	10122	20122	30122	Ic TOHD
123	10123	20123	30123	I4 TOHD
124	10124	20124	30124	I5 TOHD
125	10125	20125	30125	Ia TEHD
126	10126	20126	30126	Ib TEHD
127	10127	20127	30127	Ic TEHD
128	10128	20128	30128	I4 TEHD
129	10129	20129	30129	I5 TEHD
130	10130	20130	30130	Uab Fund.
131	10131	20131	30131	Ubc Fund.

132	10132	20132	30132	Uca Fund.
133	10133	20133	30133	Ua Fluct. CPM
134	10134	20134	30134	Ub Fluct. CPM
135	10135	20135	30135	Uc Fluct. CPM
				Reserved
500	10500	20500	30500	Ua HD00
501	10501	20501	30501	Ub HD00
502	10502	20502	30502	Uc HD00
503	10503	20503	30503	U4 HD00
504	10504	20504	30504	Ua HD01
505	10505	20505	30505	Ub HD01
506	10506	20506	30506	Uc HD01
507	10507	20507	30507	U4 HD01
...	...			...
748	10748	20748	30748	Ua HD62
749	10749	20749	30749	Ub HD62
750	10750	20750	30750	Uc HD62
751	10751	20751	30751	U4 HD62
752	10752	20752	30752	Ua HD63
753	10753	20753	30753	Ub HD63
754	10754	20754	30754	Uc HD63
755	10755	20755	30755	U4 HD63
756	10756	20756	30756	Ia HD00
757	10757	20757	30757	Ib HD00
758	10758	20758	30758	Ic HD00
759	10759	20759	30759	I4 HD00
760	10760	20760	30760	I5 HD00

761	10761	20761	30761	Ia HD01
762	10762	20762	30762	Ib HD01
763	10763	20763	30763	Ic HD01
764	10764	20764	30764	I4 HD01
765	10765	20765	30765	I5 HD01
				…
1066	11066	21066	31066	Ia HD62
1067	11067	21067	31067	Ib HD62
1068	11068	21068	31068	Ic HD62
1069	11069	21069	31069	I4 HD62
1070	11070	21070	31070	I5 HD62
1071	11071	21071	31071	Ia HD63
1072	11072	21072	31072	Ib HD63
1073	11073	21073	31073	Ic HD63
1074	11074	21074	31074	I4 HD63
1075	11075	21075	31075	I5 HD63
1076	11076	21076	31076	Ua TH RMS
1077	11077	21077	31077	Ub TH RMS
1078	11078	21078	31078	Uc TH RMS
1079	11079	21079	31079	U4 TH RMS
1080	11080	21080	31080	Ua TOH RMS
1081	11081	21081	31081	Ub TOH RMS
1082	11082	21082	31082	Uc TOH RMS
1083	11083	21083	31083	U4 TOH RMS
1084	11084	21084	31084	Ua TEH RMS
1085	11085	21085	31085	Ub TEH RMS
1086	11086	21086	31086	Uc TEH RMS

1087	11087	21087	31087	U4 TEH RMS
1088	11088	21088	31088	Ia TH RMS
1089	11089	21089	31089	Ib TH RMS
1090	11090	21090	31090	Ic TH RMS
1091	11091	21091	31091	I4 TH RMS
1092	11092	21092	31092	I5 TH RMS
1093	11093	21093	31093	Ia TOH RMS
1094	11094	21094	31094	Ib TOH RMS
1095	11095	21095	31095	Ic TOH RMS
1096	11096	21096	31096	I4 TOH RMS
1097	11097	21097	31097	I5 TOH RMS
1098	11098	21098	31098	Ia TEH RMS
1099	11099	21099	31099	Ib TEH RMS
1100	11100	21100	31100	Ic TEH RMS
1101	11101	21101	31101	I4 TEH RMS
1102	11102	21102	31102	I5 TEH RMS
1103	11103	21103	31103	Ua DC Component
1104	11104	21104	31104	Ub DC Component
1105	11105	21105	31105	Uc DC Component
1106	11106	21106	31106	U4 DC Component
1111	11111	21111	31111	Ua H02 RMS
1112	11112	21112	31112	Ub H02 RMS
1113	11113	21113	31113	Uc H02 RMS
1114	11114	21114	31114	U4 H02 RMS
1115	11115	21115	31115	Ua H03 RMS
1116	11116	21116	31116	Ub H03 RMS
1117	11117	21117	31117	Uc H03 RMS

1118	11118	21118	31118	U4 H03 RMS
				…
1351	11351	21351	31351	Ua H62 RMS
1352	11352	21352	31352	Ub H62 RMS
1353	11353	21353	31353	Uc H62 RMS
1354	11354	21354	31354	U4 H62 RMS
1355	11355	21355	31355	Ua H63 RMS
1356	11356	21356	31356	Ub H63 RMS
1357	11357	21357	31357	Uc H63 RMS
1358	11358	21358	31358	U4 H63 RMS
1359	11359	21359	31359	Ia DC Component
1360	11360	21360	31360	Ib DC Component
1361	11361	21361	31361	Ic DC Component
1362	11362	21362	31362	I4 DC Component
1363	11363	21363	31363	I5 DC Component
1364	11364	21364	31364	Ia Fund.
1365	11365	21365	31365	Ib Fund.
1366	11366	21366	31366	Ic Fund.
1367	11367	21367	31367	I4 Fund.
1368	11368	21368	31368	I5 Fund.
1369	11369	21369	31369	Ia H02 RMS
1370	11370	21370	31370	Ib H02 RMS
1371	11371	21371	31371	Ic H02 RMS
1372	11372	21372	31372	I4 H02 RMS
1373	11373	21373	31373	I5 H02 RMS
1374	11374	21374	31374	Ia H03 RMS
1375	11375	21375	31375	Ib H03 RMS

1376	11376	21376	31376	Ic H03 RMS
1377	11377	21377	31377	I4 H03 RMS
1378	11378	21378	31378	I5 H03 RMS
				…
1669	11669	21669	31669	Ia H62 RMS
1670	11670	21670	31670	Ib H62 RMS
1671	11671	21671	31671	Ic H62 RMS
1672	11672	21672	31672	I4 H62 RMS
1673	11673	21673	31673	I5 H62 RMS
1674	11674	21674	31674	Ia H63 RMS
1675	11675	21675	31675	Ib H63 RMS
1676	11676	21676	31676	Ic H63 RMS
1677	11677	21677	31677	I4 H63 RMS
1678	11678	21678	31678	I5 H63 RMS
1679	11679	21679	31679	∑kWa TH
1680	11680	21680	31680	∑kWb TH
1681	11681	21681	31681	∑kWc TH
1682	11682	21682	31682	∑kvara TH
1683	11683	21683	31683	∑kvarb TH
1684	11684	21684	31684	∑kvarc TH
1685	11685	21685	31685	∑kVAa TH
1686	11686	21686	31686	∑kVAb TH
1687	11687	21687	31687	∑kVAc TH
1688	11688	21688	31688	PFa TH
1689	11689	21689	31689	PFb TH
1690	11690	21690	31690	PFc TH
1691	11691	21691	31691	∑kWa TH SUM

1692	11692	21692	31692	∑kWb TH SUM
1693	11693	21693	31693	∑kWc TH SUM
1694	11694	21694	31694	∑kvara TH SUM
1695	11695	21695	31695	∑kvarb TH SUM
1696	11696	21696	31696	∑kvarc TH SUM
1697	11697	21697	31697	∑kVAa TH SUM
1698	11698	21698	31698	∑kVAb TH SUM
1699	11699	21699	31699	∑kVAc TH SUM
1703	11703	21703	31703	∑kWa TH ABS
1704	11704	21704	31704	∑kWb TH ABS
1705	11705	21705	31705	∑kWc TH ABS
1706	11706	21706	31706	∑kvara TH ABS
1707	11707	21707	31707	∑kvarb TH ABS
1708	11708	21708	31708	∑kvarc TH ABS
1709	11709	21709	31709	∑kVAa TH ABS
1710	11710	21710	31710	∑kVAb TH ABS
1711	11711	21711	31711	∑kVAc TH ABS
1715	11715	21715	31715	∑kW TH
1716	11716	21716	31716	∑kvar TH
1717	11717	21717	31717	∑kVA TH
1718	11718	21718	31718	PF Avg. TH
1719	11719	21719	31719	∑kW Fund.
1720	11720	21720	31720	∑kvar Fund.
1721	11721	21721	31721	∑kVA Fund.
1722	11722	21722	31722	dPF
1723	11723	21723	31723	∑kW H02
1724	11724	21724	31724	∑kvar H02

1725	11725	21725	31725	∑kVA H02
1726	11726	21726	31726	PF H02
1727	11727	21727	31727	∑kW H03
1728	11728	21728	31728	∑kvar H03
1729	11729	21729	31729	∑kVA H03
1730	11730	21730	31730	PF H03
				…
1963	11963	21963	31963	∑kW H62
1964	11964	21964	31964	∑kvar H62
1965	11965	21965	31965	∑kVA H62
1966	11966	21966	31966	PF H62
1967	11967	21967	31967	∑kW H63
1968	11968	21968	31968	∑kvar H63
1969	11969	21969	31969	∑kVA H63
1970	11970	21970	31970	PF H63
1971	11971	21971	31971	∑kWa Fund.
1972	11972	21972	31972	∑kWb Fund.
1973	11973	21973	31973	∑kWc Fund.
1974	11974	21974	31974	∑kvara Fund.
1975	11975	21975	31975	∑kvarb Fund.
1976	11976	21976	31976	∑kvarc Fund.
1977	11977	21977	31977	∑kVAa Fund.
1978	11978	21978	31978	∑kVAb Fund.
1979	11979	21979	31979	∑kVAc Fund.
1980	11980	21980	31980	dPFa
1981	11981	21981	31981	dPFb
1982	11982	21982	31982	dPFc

1983	11983	21983	31983	∑kWa H02
1984	11984	21984	31984	∑kWb H02
1985	11985	21985	31985	∑kWc H02
1986	11986	21986	31986	∑kvara H02
1987	11987	21987	31987	∑kvarb H02
1988	11988	21988	31988	∑kvarc H02
1989	11989	21989	31989	∑kVAa H02
1990	11990	21990	31990	∑kVAb H02
1991	11991	21991	31991	∑kVAc H02
1992	11992	21992	31992	PFa H02
1993	11993	21993	31993	PFb H02
1994	11994	21994	31994	PFc H02
				…
2715	12715	22715	32715	∑kWa H63
2716	12716	22716	32716	∑kWb H63
2717	12717	22717	32717	∑kWc H63
2718	12718	22718	32718	∑kvara H63
2719	12719	22719	32719	∑kvarb H63
2720	12720	22720	32720	∑kvarc H63
2721	12721	22721	32721	∑kVAa H63
2722	12722	22722	32722	∑kVAb H63
2723	12723	22723	32723	∑kVAc H63
2724	12724	22724	32724	PFa H63
2725	12725	22725	32725	PFb H63
2726	12726	22726	32726	PFc H63
2727	12727	22727	32727	Ua TIHD
2728	12728	22728	32728	Ub TIHD

2729	12729	22729	32729	Uc TIHD
2730	12730	22730	32730	U4 TIHD
2731	12731	22731	32731	Ua TOIHD
2732	12732	22732	32732	Ub TOIHD
2733	12733	22733	32733	Uc TOIHD
2734	12734	22734	32734	U4 TOIHD
2735	12735	22735	32735	Ua TEIHD
2736	12736	22736	32736	Ub TEIHD
2737	12737	22737	32737	Uc TEIHD
2738	12738	22738	32738	U4 TEIHD
2739	12739	22739	32739	Ia TIHD
2740	12740	22740	32740	Ib TIHD
2741	12741	22741	32741	Ic TIHD
2742	12742	22742	32742	I4 TIHD
2743	12743	22743	32743	I5 TIHD
2744	12744	22744	32744	Ia TOIHD
2745	12745	22745	32745	Ib TOIHD
2746	12746	22746	32746	Ic TOIHD
2747	12747	22747	32747	I4 TOIHD
2748	12748	22748	32748	I5 TOIHD
2749	12749	22749	32749	Ia TEIHD
2750	12750	22750	32750	Ib TEIHD
2751	12751	22751	32751	Ic TEIHD
2752	12752	22752	32752	I4 TEIHD
2753	12753	22753	32753	I5 TEIHD
2754	12754	22754	32754	Ua IHD00
2755	12755	22755	32755	Ub IHD00

2756	12756	22756	32756	Uc IHD00
2757	12757	22757	32757	U4 IHD00
2758	12758	22758	32758	Ua IHD01
2759	12759	22759	32759	Ub IHD01
2760	12760	22760	32760	Uc IHD01
2761	12761	22761	32761	U4 IHD01
...	...			...
3006	13006	23006	33006	Ua IHD63
3007	13007	23007	33007	Ub IHD63
3008	13008	23008	33008	Uc IHD63
3009	13009	23009	33009	U4 IHD63
3010	13010	23010	33010	Ia IHD00
3011	13011	23011	33011	Ib IHD00
3012	13012	23012	33012	Ic IHD00
3013	13013	23013	33013	I4 IHD00
3014	13014	23014	33014	I5 IHD00
3015	13015	23015	33015	Ia IHD01
3016	13016	23016	33016	Ib IHD01
3017	13017	23017	33017	Ic IHD01
3018	13018	23018	33018	I4 IHD01
3019	13019	23019	33019	I5 IHD01
...	...			...
3325	13325	23325	33325	Ia IHD63
3326	13326	23326	33326	Ib IHD63
3327	13327	23327	33327	Ic IHD63
3328	13328	23328	33328	I4 IHD63
3329	13329	23329	33329	I5 IHD63

3330	13330	23330	33330	Ua TIH RMS
3331	13331	23331	33331	Ub TIH RMS
3332	13332	23332	33332	Uc TIH RMS
3333	13333	23333	33333	U4 TIH RMS
3334	13334	23334	33334	Ua TOIH RMS
3335	13335	23335	33335	Ub TOIH RMS
3336	13336	23336	33336	Uc TOIH RMS
3337	13337	23337	33337	U4 TOIH RMS
3338	13338	23338	33338	Ua TEIH RMS
3339	13339	23339	33339	Ub TEIH RMS
3340	13340	23340	33340	Uc TEIH RMS
3341	13341	23341	33341	U4 TEIH RMS
3342	13342	23342	33342	Ia TIH RMS
3343	13343	23343	33343	Ib TIH RMS
3344	13344	23344	33344	Ic TIH RMS
3345	13345	23345	33345	I4 TIH RMS
3346	13346	23346	33346	I5 TIH RMS
3347	13347	23347	33347	Ia TOIH RMS
3348	13348	23348	33348	Ib TOIH RMS
3349	13349	23349	33349	Ic TOIH RMS
3350	13350	23350	33350	I4 TOIH RMS
3351	13351	23351	33351	I5 TOIH RMS
3352	13352	23352	33352	Ia TEIH RMS
3353	13353	23353	33353	Ib TEIH RMS
3354	13354	23354	33354	Ic TEIH RMS
3355	13355	23355	33355	I4 TEIH RMS
3356	13356	23356	33356	I5 TEIH RMS

3357	13357	23357	33357	Ua IH00 RMS
3358	13358	23358	33358	Ub IH00 RMS
3359	13359	23359	33359	Uc IH00 RMS
3360	13360	23360	33360	U4 IH00 RMS
3361	13361	23361	33361	Ua IH01 RMS
3362	13362	23362	33362	Ub IH01 RMS
3363	13363	23363	33363	Uc IH01 RMS
3364	13364	23364	33364	U4 IH01 RMS
...	...			...
3609	13609	23609	33609	Ua IH63 RMS
3610	13610	23610	33610	Ub IH63 RMS
3611	13611	23611	33611	Uc IH63 RMS
3612	13612	23612	33612	U4 IH63 RMS
3613	13613	23613	33613	Ia IH00 RMS
3614	13614	23614	33614	Ib IH00 RMS
3615	13615	23615	33615	Ic IH00 RMS
3616	13616	23616	33616	I4 IH00 RMS
3617	13617	23617	33617	I5 IH00 RMS
3618	13618	23618	33618	Ia IH01 RMS
3619	13619	23619	33619	Ib IH01 RMS
3620	13620	23620	33620	Ic IH01 RMS
3621	13621	23621	33621	I4 IH01 RMS
3622	13622	23622	33622	I5 IH01 RMS
...	...			...
3928	13928	23928	33928	Ia IH63 RMS
3929	13929	23929	33929	Ib IH63 RMS
3930	13930	23930	33930	Ic IH63 RMS

3931	13931	23931	33931	I4 IH63 RMS
3932	13932	23932	33932	I5 IH63 RMS
3933	13933	23933	33933	Ua Angle
3934	13934	23934	33934	Ub Angle
3935	13935	23935	33935	Uc Angle
3936	13936	23936	33936	U4 Angle
3937	13937	23937	33937	Ia Angle
3938	13938	23938	33938	Ib Angle
3939	13939	23939	33939	Ic Angle
3940	13940	23940	33940	I4 Angle
3941	13941	23941	33941	I5 Angle
3942	13942	23942	33942	Ua Fund. Angle
3943	13943	23943	33943	Ub Fund. Angle
3944	13944	23944	33944	Uc Fund. Angle
3945	13945	23945	33945	U4 Fund. Angle
3946	13946	23946	33946	Ua H02 Angle
3947	13947	23947	33947	Ub H02 Angle
3948	13948	23948	33948	Uc H02 Angle
3949	13949	23949	33949	U4 H02 Angle
…	…			…
4190	14190	24190	34190	Ua H63 Angle
4191	14191	24191	34191	Ub H63 Angle
4192	14192	24192	34192	Uc H63 Angle
4193	14193	24193	34193	U4 H63 Angle
4194	14194	24194	34194	Ia Fund. Angle
4195	14195	24195	34195	Ib Fund. Angle
4196	14196	24196	34196	Ic Fund. Angle

4197	14197	24197	34197	I4 Fund. Angle
4198	14198	24198	34198	I5 Fund. Angle
4199	14199	24199	34199	Ia H02 Angle
4200	14200	24200	34200	Ib H02 Angle
4201	14201	24201	34201	Ic H02 Angle
4202	14202	24202	34202	I4 H02 Angle
4203	14203	24203	34203	I5 H02 Angle
…	…			…
4504	14504	24504	34504	Ia H63 Angle
4505	14505	24505	34505	Ib H63 Angle
4506	14506	24506	34506	Ic H63 Angle
4507	14507	24507	34507	I4 H63 Angle
4508	14508	24508	34508	I5 H63 Angle

Key ID	Parameters	Key ID	Parameters	Key ID	Parameters
50001	Ua Pst	55004	DI	55014	DI9 Pulse Count
50002	Ub Pst	55005	DO	55015	DI10 Pulse Count
50003	Uc Pst	55006	DI1 Pulse Count	55016	DI11 Pulse Count
50004	Ua Plt	55007	DI2 Pulse Count	55017	DI12 Pulse Count
50005	Ub Plt	55008	DI3 Pulse Count	55018	DI13 Pulse Count
50006	Uc Plt	55009	DI4 Pulse Count	55019	DI14 Pulse Count
55000	AI1	55010	DI5 Pulse Count	55020	DI15 Pulse Count
55001	AI2	55011	DI6 Pulse Count	55021	DI16 Pulse Count
55002	AI3	55012	DI7 Pulse Count		
55003	AI4	55013	DI8 Pulse Count		

High-speed DR Data ID

Key ID	Parameters	Key ID	Parameters	Key ID	Parameters

0	None	11	Ic	22	kvarc
1	Ua	12	I Avg.	23	kvar Total
2	Ub	13	U4	24	kVAa
3	Uc	14	I4	25	kVAb
4	Uln Avg.	15	I5	26	kVAc
5	Uab	16	kWa	27	kVA Total
6	Ubc	17	kWb	28	PFa
7	Uca	18	kWc	29	PFb
8	Ull Avg.	19	kW Total	30	PFc
9	Ia	20	kvara	31	PF Total.
10	Ib	21	kvarb	32	Freq.

Demand Data ID

Key ID	Parameters	Key ID	Parameters	Key ID	Parameters
Present Demand					
51001	Ua	51036	PFa	51071	Uc THD
51002	Ub	51037	PFb	51072	U4 THD
51003	Uc	51038	PFc	51073	Ia THD
51004	Uln	51039	PF Avg.	51074	Ib THD
51005	U4	51040	Freq.	51075	Ic THD
51006	Uab	51041	Ua Dev.	51076	I4 THD
51007	Ubc	51042	Ub Dev.	51077	I5 THD
51008	Uca	51043	Uc Dev.	51078	Ua TOHD
51009	Ull Avg.	51044	Uab Dev.	51079	Ub TOHD
51010	Ia	51045	Ubc Dev.	51080	Uc TOHD
51011	Ib	51046	Uca Dev.	51081	U4 TOHD
51012	Ic	51047	Ua Over Dev.	51082	Ia TOHD
51013	I Avg.	51048	Ub Over Dev.	51083	Ib TOHD

51014	I4	51049	Uc Over Dev.	51084	Ic TOHD
51015	I5	51050	Uab Over Dev.	51085	I4 TOHD
51016	kWa Imp.	51051	Ubc Over Dev.	51086	I5 TOHD
51017	kWb Imp.	51052	Uca Over Dev.	51087	Ua TEHD
51018	kWc Imp.	51053	Ua Under Dev.	51088	Ub TEHD
51019	kW Total Imp.	51054	Ub Under Dev.	51089	Uc TEHD
51020	kWa Exp.	51055	Uc Under Dev.	51090	U4 TEHD
51021	kWb Exp.	51056	Uab Under Dev.	51091	Ia TEHD
51022	kWc Exp.	51057	Ubc Under Dev.	51092	Ib TEHD
51023	kW Total Exp.	51058	Uca Under Dev.	51093	Ic TEHD
51024	kvara Imp.	51059	Freq. Dev.	51094	I4 TEHD
51025	kvarb Imp.	51060	U0 Unb.	51095	I5 TEHD
51026	kvarc Imp.	51061	U2 Unb.	51096	Ia Fund.
51027	kvar Total Imp.	51062	I0 Unb.	51097	Ib Fund.
51028	kvara Exp.	51063	I2 Unb.	51098	Ic Fund.
51029	kvarb Exp.	51064	Ia K-Factor	51099	I4 Fund.
51030	kvar c Exp.	51065	Ib K-Factor	51100	I5 Fund.
51031	kvar Total Exp.	51066	Ic K-Factor	51101	AI1
51032	kVAa	51067	I4 K-Factor	51102	AI2
51033	kVAb	51068	I5 K-Factor	51103	AI3
51034	kVAc	51069	Ua THD	51104	AI4
51035	kVA Total	51070	Ub THD	51071	
Predicted Demand					
52001	Ua Pred.	52015	I5 Pred.	52029	kvarb Exp. Pred.
52002	Ub Pred.	52016	kWa Imp. Pred.	52030	kvarc Exp. Pred.
52003	Uc Pred.	52017	kWb Imp. Pred.	52031	kvar Total Exp. Pred.
52004	Uln Pred.	52018	kWc Imp. Pred.	52032	kVAa Pred.

52005	U4 Pred.	52019	kW Total Imp. Pred.	52033	kVAb Pred.
52006	Uab Pred.	52020	kWa Exp. Pred.	52034	kVAc Pred.
52007	Ubc Pred.	52021	kWb Exp. Pred.	52035	kVA Total Pred.
52008	Uca Pred.	52022	kWc Exp. Pred.	52036	PFa Pred.
52009	Ull Avg. Pred.	52023	kW Total Exp. Pred.	52037	PFb Pred.
52010	Ia Pred.	52024	kvara Imp. Pred.	52038	PFc Pred.
52011	Ib Pred.	52025	kvarb Imp. Pred.	52039	PF Avg. Pred.
52012	Ic Pred.	52026	kvarc Imp. Pred.	52040	Freq. Pred.
52013	I Avg. Pred.	52027	kvar Total Imp. Pred.		
52014	I4 Pred.	52028	kvara Exp. Pred.		
Max./Min. Demand					
53001	kW Total Imp. Max.	53010	Ib Fund. Max.	54006	Ia Last Max.
53002	kW Total Exp. Max.	53011	Ic Fund. Max.	54007	Ib Last Max.
53003	kvar Total Imp. Max.	53012	I4 Fund. Max.	54008	Ic Last Max.
53004	kvar Total Exp. Max.	53013	I5 Fund. Max.	54009	Ia Fund. Last Max.
53005	kVA Total Max.	54001	kW Total Imp. Last Max.	54010	Ib Fund. Last Max.
53006	Ia Max.	54002	kW Total Exp. Last Max.	54011	Ic Fund. Last Max.
53007	Ib Max.	54003	kvar Total Imp. Last Max.	54012	I4 Fund. Last Max.
53008	Ic Max.	54004	kvar Total Exp. Last Max.	54013	I5 Fund. Last Max.
53009	Ia Fund. Max.	54005	kVA Total Last Max.	54006	

Appendix B – Event Classification

SOE Event Classification

Event Classification	Sub-Classification	Description	SOE
1=System	0	Power On	None
	1	Power Off	None
	2	Change System Parameters	None
	3	Change Secret Parameters	None
	4	Set Clock	0= Set Clock via Front Panel 1= Set Clock via Communication
	5	Clear All Historical Data	None
	6	Restore Factory Defaults	None
	7	Format Device	
	8	Clear System Parameters	None
	9	Clear Secret Parameters	None
	10	Clear SOE Log	None
	11	Clear PQ Log	
	12	Clear SDR	0~15=SDR#1~SDR#16, writing 0xFFFFFFFF to clear all SDR
	13	Clear Standard DR	0~7=DR#1~DR#8, writing 0xFFFFFFFF to clear all DR
	14	Clear HS DR	0~3=HS DR#1~HS DR#4, writing 0xFFFFFFFF to clear all HS DR
	15	Clear Energy	None
	16	Clear IER	
	17	Clear DI Counter	0~7=DI#1~DI#8, writing 0xFFFFFFFF to clear all DI Counter
	18	Clear Flicker Log	None
	19	Clear Waveform Recorder	None

	20	Clear Disturbance Recorder	
	21	Clear MSV Log	1=MSV#1, 2=MSV#2, 3=MSV#3,
	22	Clear All Max./Min. Log	
	23	Clear Max. Log	0-3=Max. Log #1-4
	24	Clear Min. Log	0-3=Min. Log #1-4
	25	Clear Demand	0=Clear Demand of This Month 1= Clear All Demand
	26	Clear EN50160	None
	27	Clear Qualification Rate	None
	28	Clear PQ Counter	0=Dips, 1=Swell, 2=Interruption, 3=Transient, 4=RVC, 5=Inrush Current 7~9=MSV#1~MSV#3 10=All PQ Counter
	29	Clear TOU Log	
	30	TOU Transient Trigger Record	
	31	Set TOU Energy Bottom Value	None
	32	TOU Log Triggerred Manually	None
	33	Switch TOU Schedule	1=Man. #1 to #2 2=Man. #2 to #1 3=Auto. #1 to #2 4=Auto. #2 to #1
	34	Hardware Alarm	Device self-test PPC Device self-test DSP
	35	Hardware is working normally	None
	36	Upgraded DSP succeeded	Multi-circuit: 0~x= DSP1 ~ DSP(x+1) Single-circuit: Invalid
2=Standard Setpoint	0	Over Setpoint Active	UINT32: Setpoint Parameters FP32: The Setpoint Active/ Inactive limit (be consistent with real-time-limit) UINT32: Setpoint #X (0-255)
	1	Over Setpoint Return	UINT32: Setpoint Parameters

			FP32: The Setpoint Active/ Inactive limit (be consistent with real-time-limit) UINT32: Setpoint #X (0-15) FP32: Max. during Setpoint UINT32: Duration
	128	Under Setpoint Active	See Over Setpoint Active
	129	Under Setpoint Return	See Over Setpoin Return
3=HS Setpoint	0	Over Setpoint Active	UINT32: Setpoint Parameters FP32: The Setpoint Active/ Inactive limit (be consistent with real-time-limit) UINT32: Setpoint #X (0-255)
	1	Over Setpoint Return	UINT32: Setpoint Parameters FP32: The Setpoint Active/ Inactive limit (be consistent with real-time-limit) UINT32: Setpoint #X (0-15) FP32: Max. during Setpoint UINT32: Duration
	128	Under Setpoint Active	See Over Setpoint Active
	129	Under Setpoint Return	See Over Setpoin Return
4=Discrete Quantities	0	DI Close	UINT32: Number of activated DI 0 indicates DI1
	1	DI Open	
	2	DO Operated triggered by standard Setpoint	UINT32: Number of activated DO 0 indicates DO1
	3	DO Released triggered by standard Setpoint	
	4	DO Operated triggered by High-speed Setpoint	
	5	DO Released triggered by High-speed Setpoint	
	6	DO Operated by Remote Control	
	7	DO Released by Remote Control	
	8	DO Released by DI Pulse	UINT32: Number of Activated DO, 0 indicates DO1

			UINT32: Pulse Vaule, unit: 0.1s
	9	DI Co-movement Operated	uint32: Comovement Source-DI Number, 0 indicates DI1 uint32: Comovement Result 1 uint32: Comovement Result 2
	10	DI Co-movement Released	
	11	DO Co-movement Operated	UINT32: Number of activated DO 0 indicates DO1
	12	DO Co-movement Released	
	13	Reserved	
	14	Reserved	
	15	Dips/Swell trigger DO Operated	
	16	Dips/Swell trigger DO Released	
	17	Transient trigger DO Operated	
	18	Transient trigger DO Released	
	19	RVC trigger DO Operated	
	20	RVC trigger DO Released	
	21	Inrush Current trigger DO Operated	
	22	Inrush Current trigger DO Released	
	23	Hardware Alarm trigger DO Operated	
	24	Hardware Alarm trigger DO Released	
	25	DO Operated by Front Panel	
	26	DO Released by Front Panel	
5=WFR	0	WFR Triggered by Relative RMS	UNIT32: 0~7=Sub Relative RMS Event Number
	1	WFR Triggered by Dip/Swell	None
	2	WFR Triggered by Transient	
	3	WFR Triggered by Standard Setpoint	UNIT32: Standard Setpoint Number
	4	WFR Triggered by High-speed Setpoint	UNIT32: HS Setpoint Number
	5	WFR Triggered by DI Setpoint	UNIT32: DI Number

	6	WFR Triggered by Rapid Voltage Changes	
	7	WFR Triggered by Inrush Current	
	8	Triggered WFR Manually	
6=DWR	0	DWR Triggered by Relative RMS	UNIT32: 0~7=Sub Relative RMS Event Number
	1	DWR Triggered by Dip/Swell	
	2	DWR Triggered by Transient	
	3	DWR Triggered by Standard Setpoint	UNIT32: Standard Setpoint Number
	4	DWR Triggered by High-speed Setpoint	UNIT32: HS Setpoint Number
	5	DWR Triggered by DI Setpoint	UNIT32: DI Number
	6	DWR Triggered by Rapid Voltage Changes	
	7	DWR Triggered by Inrush Current	
	8	DWR Triggered Manually	
	9	DWR End	
7=MSV Recorder	0	MSV Recorder Triggered by Detected Signalling Voltage	UNIT32:0~2=MSV#1~MSV#3
8=Standard DR	0	DR Triggered by DI Operated	UNIT32: 0~7=Standard DR#1~Standard DR#8
	1	DR Ended by DI Released	
	2	DR Ended by DI Parameters changes	
	3	DR Triggered by Standard Setpoint Active	
	4	DR Ended by Standard Setpoint Return	
	5	DR Ended by Standard Setpoint Parameters Change	
	6	DR Triggered by HS Setpoint Active	
	7	DR Ended by HS Setpoint Return	
	8	DR Ended by HS Setpoint Parameters Change	
	9	DR Triggered by Dip/Swell Active	
	10	DR Ended by Dip/Swell Return	
	11	DR Ended by Inrush Current Parameters Change	

	12	DR Triggered by Inrush Current Active	
	13	DR Ended by Inrush Current Return	
	14	DR Ended by Inrush Current Parameters Change	
9=HS DR	0	HS DR Triggered by DI Operated	UNIT32: 0~3=HS DR#1~ HS DR#4
	1	HS DR Ended by DI Released	
	2	HS DR Ended by DI Parameters change	
	3	HS DR Triggered by Standard Setpoint Active	
	4	HS DR Ended by Standard Setpoint Return	
	5	HS DR Ended by Standard Setpoint Parameters Change	
	6	HS DR Triggered by HS Setpoint Active	
	7	HS DR Ended by HS Setpoint Return	
	8	HS DR Ended by HS Setpoint Parameters Change	
	9	HS DR Triggered by Dip/Swell Active	
	10	HS DR Ended by Dip/Swell Return	
	11	HS DR Ended by Inrush Current Parameters Change	
	12	HS DR Triggered by Inrush Current Active	
	13	HS DR Ended by Inrush Current Return	
	14	HS DR Ended by Inrush Current Parameters Change	

PQ Log Classification

PQ Log Classification	Sub-Classification	Description	PQ Value Scale/Option
0X81: Dip/Swell	0	Voltage Swell Active	UINT32 Bit0: A Phase, Bit1: B Phase, Bit2: C Phase
	1	Voltage Swell Inactive	FP32: Residual Voltage Max. (%) UINT32: Duration (ms) FP32: Ua Residual FP32: Ub Residual FP32: Uc Residual FP32: Ua Benchmark

			FP32: Ub Benchmark FP32: Uc Benchmark
	2	Voltage Dips Active	UINT32 Bit0: A Phase, Bit1: B Phase, Bit2: C Phase
	3	Voltage Dips Swell Inactive	FP32: Residual Voltage Min. (%) UINT32: Duration (ms) FP32: Ua Residual FP32: Ub Residual FP32: Uc Residual FP32: Ua Benchmark FP32: Ub Benchmark FP32: Uc Benchmark
	4	Voltage Interruption Active	UINT32 Bit0: A Phase, Bit1: B Phase, Bit2: C Phase
	5	Voltage Interruption Inactive	FP32: Residual Voltage Min. (%) UINT32: Duration (ms) FP32: Ua Residual FP32: Ub Residual FP32: Uc Residual FP32: Ua Benchmark FP32: Ub Benchmark FP32: Uc Benchmark
	6	Dips Location Detective	UINT32: Location 0=UpStream, 1=DownStream UINT32: Reliability 0=Low, 1=Middle, 2=High
0X82: Transient	0	Voltage Transient	FP32: Disturbance Max./Min. (%) UINT32: Duration (µs) FP32: Ua Disturbance (%) FP32: Ub Disturbance (%) FP32: Uc Disturbance (%)
0X83: Inrush Current	0	Inrush Ia Active	None
	1	Inrush Ib Active	
	2	Inrush Ic Active	
	3	Inrush Ia Inactive	UINT32: Duration (µs) FP32: Phase Current Disturbance (%) FP32: I_{rms} during Disturbance UINT32: Start Time (s) UINT32: Start Time (ms)
	4	Inrush Ib Inactive	
	5	Inrush Ic Inactive	

0X84:RVC	0	Rapid Ua Change	FP32: Voltage Change Rate UINT32: Voltage Change Time (ms) FP32: Direction (0=Down, 1=Up) UINT32: Max. Voltage Change Rate
	1	Rapid Ub Change	
	2	Rapid Uc Change	
0X85:MSV	0	MSV #1 Active	FP32: Frequency (Hz) uint32: Phase Bit0=Phase A, Bit1= Phase B, Bit2= Phase C
	1	MSV #1 Inactive	FP32: Frequency (Hz) FP32: Ua MSV Max. (%) FP32: Ub MSV Max. (%) FP32: Uc MSV Max. (%)
	2	MSV #2 Active	FP32: Frequency (Hz) uint32: Phase Bit0=Phase A, Bit1= Phase B, Bit2= Phase C
	3	MSV #2 Inactive	FP32: Frequency (Hz) FP32: Ua MSV Max. (%) FP32: Ub MSV Max. (%) FP32: Uc MSV Max. (%)
	4	MSV #3 Active	FP32: Frequency (Hz) uint32: Phase Bit0=Phase A, Bit1= Phase B, Bit2= Phase C
	5	MSV #3 Inactive	FP32: Frequency (Hz) FP32: Ua MSV Max. (%) FP32: Ub MSV Max. (%) FP32: Uc MSV Max. (%)
0X86: Relative RMS	0	Ua Relative RMS Active	FP32: Ua Diff.
	1	Ub Relative RMS Active	FP32: Ub Diff.
	2	Uc Relative RMS Active	FP32: Uc Diff.
	3	U0 Relative RMS Active	FP32: U0 Diff.
	4	Ia Relative RMS Active	FP32: Ia Diff.
	5	Ib Relative RMS Active	FP32: Ib Diff.
	6	Ic Relative RMS Active	FP32: Ic Diff.
	7	I0 Relative RMS Active	FP32: I0 Diff.

Appendix C - Technical Specifications

Voltage Inputs (U1, U2, U3, U4, VN)	
Standard (Un)	400ULN/690ULL
Optional (Un)	69ULN/120ULL
Range	10% to 120% Un
PT Ratio	
Primary	1-1000000V
Secondary	100-690V
U4 Primary	1-1000000V
U4 Secondary	100-690V
Overload	2xUn continuous, 4xUn for 1s
Burden	<0.5VA per phase
Frequency	45-65Hz
Current Inputs (I11, I12, I21, I22, I31, I32, I41, I42, I51, I52)	
Standard (In)	5A
Optional (In)	1A
Range	1% to 200% In
Starting Current	0.1% In
CT Ratio	
Primary	1-30000A
Secondary	1-5A
I4 Primary	1-30000A
I4 Secondary	1-5A
Overload	1.2xIn continuous, 10xIn for 1s
Burden	<0.5VA per phase
Power Supply (L+, N-, G)	
Standard	95-250VAC/VDC ± 10%, 47-440 Hz 20-60VDC

Burden	<14W
Digital Inputs (COM, DI1, DI2, …DI7, DI8)	
Standard	Dry contact, 24VDC internally wetted
Sampling	1000Hz
Hysteresis	1ms minimum
Relay Outputs (RO11, RO12, RO21,R O22)	
Type	Form A Mechanical Relay
Loading	5A @ 250VAC / 30VDC
Relay Outputs (RO31, RO32, RO33, RO41, RO42, RO43)	
Type	Form C Mechanical Relay
Loading	8A @ 250VAC / 30VDC
Digital Outputs (COM, DO1, DO2, DO3, DO4)	
Type	Form A Solid State Relay
Isolation	Optical
Max. Load Voltage	80V
Max. Forward Current	50mA
GPS (I+, I-, SH)	
Hardware Interface	IRIG-B
LCD Display	
Type	Color TFT LCD, Industrial Grade
Resolution	640x480
View Area	115x86 mm
Environmental Conditions	
Operating Temp.	-25°C to 70°C
Storage Temp.	-40°C to 85°C
Humidity	5% to 95% non-condensing
Atmospheric Pressure	80 kPa to 110 kPa

Pollution Degree	2
Measurement Category	CAT III
Mechanical Characteristics	
Panel Cutout	186x186 mm
Unit Dimensions	192x192x187 mm
IP Rating	52

Appendix D - Accuracy Specifications

Parameters	Accuracy	Resolution
Voltage	±0.1% reading	0.01V
Current	±0.1% reading + 0.05% F.S.	0.001A
I4 Measured	±0.1% reading + 0.05% F.S.	0.001A
I4 Calculated	0.5% F.S.	0.001A
kW, KVA	IEC 62053-22 Class 0.2S	0.001k
kWh, kVAh	IEC 62053-22 Class 0.2S	0.01kXh
kvar, kvarh	IEC 62053-23 Class 2	0.001k / 0.01kvarh
P.F.	IEC 62053-22 Class 0.2S	0.001
Frequency	±0.01 Hz	0.01Hz
Harmonics	IEC 61000-4-7 Class A	0.01%
K-Factor	IEC 61000-4-7 Class A	0.1
Phase angles	±1°	0.1°

Appendix E - IEC61000-4-30 Class A Certificate

PSL
Power Standards Lab
2020 Challenger Drive #100
Alameda, CA 94501 USA
TEL ++1-510-522-4400
FAX ++1-510-522-4455
www.PowerStandards.com

Certificate of Conformity
IEC 61000-4-30 Class A

CET iMeter 8 / PMC-680i
with PMC-2000 and GPS Antenna
(or other GPS receiver with equivalent accuracy and functionality)

IEC 61000-4-30 Ed. 2
230V, 50/60 Hz, L-N U_{din} for all parameters

61000-4-30 Section	Power Quality Parameter	Class A Compliance	Class S Compliance	Class B Compliance	Remarks
5.1	Power frequency	Yes	Yes	Yes	
5.2	Magnitude of the supply voltage	Yes	Yes	Yes	
5.3	Flicker	Yes	Yes	(N/A)	
5.4	Supply voltage dips and swells	Yes	Yes	Yes	
5.5	Voltage interruptions	Yes	Yes	Yes	
5.7	Supply voltage unbalance	Yes	Yes	Yes	
5.8	Voltage harmonics	Yes	Yes	Yes	
5.9	Voltage interharmonics	Yes	Yes	Yes	
5.10	Mains signaling voltage	Yes	Yes	Yes	
5.12	Underdeviation and overdeviation	Yes	(N/A)	(N/A)	
4.4	Measurement aggregation intervals	Yes	Yes	Yes	
4.6	Time-clock uncertainty	Yes	Yes	Yes	
4.7	Flagging	Yes	Yes	(N/A)	
6.1	Transient influence quantities	Yes	(N/A)	(N/A)	

(N/A) – Not Applicable. There is no requirement in the Standard.

This certificate summarizes the results of the PSL IEC 61000-4-30 Power Quality Measurement Methods Compliance Report, document #PSL 61000-4-30 Ed 2 Test Report – iMeter 8 – PMC-680i, dated 21 May 2013. PSL tested two samples, S/N 1206340015 and 1206340011, at 230VAC, 50/60 Hz. Manufacturer states that these samples are representative of the iMeter 8 / PMC-680i series.

iMeter 8 / PMC-680i

Alex McEachern 21 May 2013
Alex@PowerStandards.com

Statement of IEC 61000-4-30 Compliance

Appendix F - Standards Compliance

Safety Requirements	
LVD Directive 2006/95/EC	EN61010-1-1-2001
Insulation	IEC 60255-5-2000
Dielectric test	
Between Power, AC circuits, and GND	2kV @ 1 minute
Between I/O, GPS and GND	500V @ 1 minute
Insulation resistance	
Between Power, AC Circuits, and GND	>100MΩ
Between GPS and GND	>10MΩ
Impulse voltage	
Rated input voltage > 60V	6kV, 1.2/50µs
Rated input voltage ≤ 60V	1kV, 1.2/50µs
EMC Compatibility **EMC Directive 2004/108/EC (EN 61326: 2006)**	
Immunity Tests	
Electrostatic discharge	IEC 61000-4-2: 2008 Level IV
Radiated fields	IEC 61000-4-3: 2008 (10 V/m)
Fast transients	IEC 61000-4-4: 2004 Level III
Surges	IEC 61000-4-5: 2005 Level III
Conducted disturbances	IEC 61000-4-6: 2008 Level III
Magnetic Fields	IEC 61000-4-8: 2009 Level IV
Oscillatory waves	IEC 61000-4-12: 2006 Level III
Electromagnetic Emission	IEC 60255-25: 2000
Emission Tests	
Limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment	EN 55011: 2009 (CISPR 11)

Limits and methods of measurement of radio disturbance characteristics of information technology equipment		EN 55022: 2006+A1: 2007 (CISPR 22)
Limits for harmonic current emissions for equipment with rated current ≤16 A		EN 61000-3-2: 2006+A1: 2009
Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current ≤16 A		EN 61000-3-3: 2006
Emission standard for residential, commercial and light-industrial environments		EN 61000-6-3: 2007
Electromagnetic Emission Tests for Measuring Relays and Protection Equipment		IEC 60255-25: 2000
Mechanical Tests		
Vibration Test	Response	IEC 60255-21-1:1998 Level 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

Appendix F - Ordering Guide

Ceiec Electric Technology

Version 20150819

Product Code	Description
PMC-680i Advanced Power Quality Analyzer	
Sample/Cycle	
A	512 samples per cycle
B*	1024 samples per cycle
On-board Memory	
4	4GB
Input Current	
5	5A
1	1A
SCCP50*	50A Split-Core Current Probe Option Include 3x50A Split Core Current Probes
Input Voltage	
3	240VLN/415VLL
9*	400VLN/690VLL
Power Supply	
2	95-250VAC/DC, 47-440Hz
3	20-60VDC
System Frequency	
5	50Hz
6#	60Hz
I/O	
A	8 DI + 4 RO + 4 DO
Communications	
A	2 Ethernet ports
B*	2 Ethernet ports + 2 RS-485 ports
C*	1 Ethernet port + 1 Fiber port + 2 RS-485 ports
IEC61850	
X	None
A*	IEC61850 Protocol Support
Display Language	
E	English

PMC-680i	-	A	4	5	3	2	5	A	A	X	E	PMC-680i-A45325AAXE (Standard Model)

* Additional charges apply

\# Please consult Factory for availability

Contact us

Ceiec Electric Technology Headquarters

8/F, Westside, Building 201, Terra Industrial & Tradepark, Che Gong Miao, Shenzhen, Guangdong, P.R.China 518040

Tel: +86.755.8341.5187

Fax: +86.755.8341.0291

Email: sales@cet-global.com

Web: www.cet-global.com