iMeter 8

Advanced Power Quality Analyzer

User Manual

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Standards Compliance

CE



DANGER

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



CAUTION

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



DANGER

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

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

Limited warranty

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

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Chapter 1 Introduction

This manual explains how to use the iMeter 8 Advanced Power Quality Analyzer. Throughout the manual, the term “meter” generally refers to all models.

This chapter provides an overview of the iMeter 8 and summarizes many of its key features.

1.1 Overview

The iMeter 8 is CET’s Advanced 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 192x192x182.4mm housing with a High-Resolution, Color Dot-Matrix LCD display. The iMeter 8 complies with such standards as IEC 62053-22 Class 0.2S, IEC 61000-4-30 Ed. 3.1 Class A, IEC 61000-4-15, IEC 61000-4-7, EN50160, IEEE Std 519-2022 as well as IEC 61850 for Substation Automation. Further, it offers a large logging capacity with 32GB of on-board memory, extensive I/O, multiple Time Synchronization methods, 2x10BASE-T/100BASE-TX Ethernet and 2xRS-485 ports. In addition, it optionally provides 2xAO and 2xAI for different applications. These features likely make the iMeter 8 one of the most advanced PQ Analyzer for an intelligent Power Quality Monitoring System. Following is a list of typical applications for the iMeter 8:

- PQ monitoring at HV, MV and LV Utility Substations
- Data Centers, Semiconductor Fabs, Heavy Industries
- 7x24 Automated Manufacturing Facilities
- Dips, Swells, Interruptions, Transients, Flickers and Harmonics monitoring
- Mains and Critical feeder monitoring
- IEC 61850 support for Substation Automation and Smart Grid
- Retrofit applications with optional Class 0.5S Split-Core Current Probe (SCCP)

Contact CET Technical Support should you require further assistance with your application.

1.2 Features

Basic Features

- IEC 62053-22 Class 0.2S kWh metering with Multi-Tariff TOU
- True RMS @ 1024 samples/cycle sampling
- 32GB on-board log memory
- 7'' High-Resolution Color Dot-Matrix Display @ 800x480
- Time Sync. via SNTP, IEEE 1588 (PTP), IRIG-B or GPS 1PPS output
- 256 Standard Setpoints and 16 High-Speed Setpoint
- Dual 10BASE-T/100BASE-TX Ethernet and two RS-485 ports

Power Quality Features

- IEC 61000-4-30 Ed. 3.1 Class A Certified
- IEC 61000-4-15, IEC 61000-4-7 Compliance
- EN 50160 and IEEE Std 519 Reporting
- 2kHz to 150kHz Conducted Emission measurements
- Disturbance Direction Indicator
- Disturbance Waveform Recording and RMS Recording
- Fault Capture up to 2,000V peak to peak
- Waveform recording in COMTRADE and PQDIF file format (Compatible with the PQ View software)

Front Panel Display and Web Interface

- True RMS Real-time, Harmonics, Power and Energy measurements
- Demands and Multi-Tariff TOU
- Max. & Min. Logs
- Sequence & Unbalance
- Real-time WF Capture of 3-phase Voltages and Currents
- Event Waveforms, RMS Recording and ITIC/SEMI F47 Curves
- Harmonics & Interharmonics Histogram and Phasor Diagrams
- Device and SOE Logs, PQ Counters, Audit Logs and I/O status
- Device Configuration and Diagnostics

Power Quality Metering

PQ Parameters as per IEC 61000-4-30 Ed. 3.1 Class A Certified

- Power Frequency
- Magnitude of the Supply Voltage and Current
- Flicker
- Supply Voltage Dips, Swells and Interruptions
- Supply Voltage Unbalance and Current Unbalance
- Mains Signalling Voltage on the Supply Voltage
- Rapid Voltage Changes
- Measurement of Under Deviation and Over Deviation Parameters
- Harmonics and Interharmonics for Voltage and Current
- 2kHz to 150kHz Conducted Emission measurements

Harmonic and Interharmonic Measurements

- K-Factor for Current, Crest Factor for Current and Voltage
- U and I THD, TOHD, TEHD, TIHD, TOIHD, TEIHD and TH (RMS)
- U and I Individual Harmonics (%HD and RMS) from 2nd to 63$^{rd\,\#}$
- U and I Individual Interharmonics (%IHD and RMS) from 1st to 63$^{rd\,\#}$
- Total Harmonic P, Q, S and PF
- Harmonic P, Q, S and PF from 2nd to 63rd in RMS
- Harmonic Phase Angle from 2nd to 63rd
- U and I DC Components
- Total Harmonic kWh, kvarh Import/Export/Net/Total
- Total Harmonic kWh, kvarh Import/Export from 2nd to 63rd

$^{\#}$%HD and %IHD can be configured as % of Fundamental, % of U/I nominal or % of RMS

Conducted Emissions in the 2kHz to 150kHz Range (Optional)

- Real-time amplitude (150/180-Cycle) and the Max., Min., Avg. and CP95 values (in 1-min interval) for a total of 106 frequency segments for the 2kHz-9kHz (U_{rms} and I_{rms}) and 9kHz-150kHz (U_{rms}) range
- Daily Heat Map display on the Web Interface for the Max., Min., Avg. and CP95 values

Sequence and Unbalance

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

Dips, Swells and Interruptions Recording

- Dips, Swells & Interruptions detection @ 10ms (½ cycle at 50Hz)
- Trigger for DO, SOE Log, DR, WFR, DWR, RMSR, iTrigger and Alarm Email
- Display of Event specific WFR, DWR and/or RMSR as well as the associated ITIC/SEMI F47 plot on the Front Panel and Web Interface
- ITIC/SEMI F47 Alarm trigger for DO and iTrigger upon the detection of Dips, Swells and Interruptions that are outside of the respective tolerance curves

Transients Recording

- Transients capture as short as 20us @ 50Hz or 16.67us @ 60Hz at 1024 samples for sub-cycle disturbance such as capacitor switching and resonance phenomena
- Display of Event specific WFR, DWR and/or RMSR on the Front Panel and Web Interface

Rapid Voltage Changes (RVC)

- Detection of a quick transition in RMS voltage between two steady state Voltage conditions

Inrush 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/Swell/Interruption Event is located upstream or downstream
- Pinpoint if the cause of the event is external or internal

PQ Event Counters

- Dips, Swells, Interruptions, Transients, Rapid Voltage Changes, Inrush Currents, Mains Signalling Voltages and Total PQ Event Counters

Metering

Basic Measurements (1-second update)
- 3-phase U, I, P, Q, S and PF as well as U4, I4 and I5
- kWh, kvarh Import/Export/Net/Total and kVAh Total
- Frequency

High-speed Measurements
- 3-phase U, I, P, Q, S and PF as well as U4, I4 and I5 @ ½ cycle
- Frequency @ 1 cycle

Demands
- Present and Predicted Demand for 3-phase U, I, P, Q, S and PF as well as U4, I4, I5, Frequency
- Present Demand of 4-phase U & I THD/TOHD/TEHD, 4-phase Current K-Factor, U2/U0 & I2/I0 Unbalance, Over & Under Deviation of Voltage and Frequency, 4-phase Fundamental Current
- Max./Min. values per Demand Interval
- Maximum Demands for This Month & Last Month (or Since Last Reset & Before Last Reset)
- Demand Synchronization with DI

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 15-minute intervals
  - 8 Tariffs, each providing the following information:
    - kWh/kvarh Import/Export and kVAh
    - kW/kvar Import/Export Maximum Demands with timestamp
    - Register rollover at 100,000,000,000.000 or 1,000,000,000.000 kXh
- Switching between two TOU schedules manually or according to pre-programmed time
- 12 Historical Logs for Energy and Maximum Demand

Data and Event Recording

Non-Volatile Log Memory
- 32GB on-board Log Memory

Data Recorder (DR)
- 8 DR Logs capable of recording
- Recording Interval from 1s to 40 days
- Up to 64 Parameters for each DR Log with programmable sources such as Real-time measurements, Harmonics, Unbalance and Demand measurements
- Configurable Recording Offset
- Support FIFO or Stop-When-Full recording modes

Interval Energy Recorder (IER) and Accumulative Energy Recorder (AER)
- Both IER and AER support the recording of Total RMS kWh, kvarh Import/Export/Total/Net and kVAh, Total Fundamental and Total Harmonic kWh, kvarh Import/Export
- Recording Interval from 1 minute to 65535 minutes
- Maximum Recording Depth @ 65535 records
- Support FIFO and Stop-When-Full modes

Statistical Data Recorder (SDR)
- 16 SDR Logs of maximum 64 parameters each
- Recording of the Max., Min., Avg. and CP95 for Real-time measurements including U, I, P, Q, S, PF, Freq., Power, PF, Harmonics, Deviations and Unbalances
- Recording Interval from 0 to 60 minutes
- 30 days @ 1-minute, 300 days @ 10-minute, 450-day @ 15-minute
- PQDIF file format, downloadable from the on-board FTP Server
- Support FIFO or Stop-When-Full mode

Max./Min. Recorder (MMR)
- 4 Max./Min. Recorders of 20 parameters each
- RMS/Fundamental/Harmonic/Interharmonic measurements, Demands, Deviations, Unbalances and Flicker
- Two transfer modes:
  - Manual: Max./Min. Since Last Reset & Before Last Reset
  - Auto: Max./Min. of This Month & Last Month

Disturbance Waveform Recorder (DWR)
- 128 entries
- Simultaneous recording of all Voltage (U1-U4) and Current (I1-I4) Inputs
  - Initial Fault: 35 cycles @ 512 samples/cycle
  - Extended Fault: Up to 150 cycles @ 16 samples/cycle
  - Steady State: Up to 360s of 1-cycle absolute peak values
  - Post Fault: 15 cycles @ 512 samples/cycle

Real-Time Waveform Capture (WFC) and Waveform Recorder (WFR)
- Real-time WFC @ 128 samples/cycle x 4 cycles via Front Panel and Web Interface
- WFR with maximum 128 entries
- Simultaneous capture of 4-phase Voltage and Current Inputs
- No. of Cycles x Samples/Cycles with programmable pre-fault cycles: (40-400)x1024, (40-800)x512, (40-1600)x256, (40-3200)x128
- Scheduled WFR with maximum repetition of 10,000 times and programmable schedule from 1 to 1440 mins
- COMTRADE file format, downloadable from the on-board Web Server or FTP Server

IEEE Std 519-2022 Report
- 365 Daily Reports for statistical evaluations on Voltage and Current Harmonics based on 99th percentile very short time (3s) values
- 52 Weekly Reports for statistical evaluations on Voltage Harmonics (95th percentile) and Current Harmonics (95th and 99th percentile) short time (10 min) values
- Configurable Report Mode, PCC Voltage, Max. Short Circuit Current, etc.

RMS Recorder (RMSR)
- 128 entries
- 16 channels maximum, selectable U, I, P, Q, S, PF, Frequency, Freq. Deviation
- Recording Interval from 0.5 to 60 cycles
- Recording Width @ 7200 samples per parameter
- Configurable pre-fault samples from 100 to 500
- 72 seconds of ½ cycle RMS recording @ 50Hz or 60 seconds @ 60Hz
- Display of Ua/Ub/Uc/Uab/Ubc/Uca/Ia/Ib/Ic RMSR on the Web Interface

SOE Log
- 1024 FIFO events time-stamped to ±1ms resolution
- Setpoint events, I/O operations, Dips, Swells, Interruptions, Transients, Rapid Voltage Changes, Inrush Current, Mains Signalling Voltages, Motor Start, etc.
- Record the time and characteristic data of the Setpoint and PQ events

Device Log
- 1024 FIFO entries time-stamped to ±1ms resolution
- Power On/Off Records, Setup changes, Time Sync., Device Operations and Self-diagnostics

iTrigger
- Cross-trigger DO, SOE Log, WFR, DWR, RMSR and Alarm Email with other iMeter devices within the same local area network (LAN)
- Programmable via Web Interface or Communications

Audit Logs
- Display of Log In/Out events, View/Export/Clear Audit Logs events on the Web Interface for Auditor Account
- Store up to 2048 logs in non-volatile memory
- Support FIFO or Stop-When-Full recording modes

Setpoints

PQ Setpoints
- Transients
- Dips, Swells, Interruptions, ITIC Alarm and SEMI F47 Alarm
- Rapid Voltage Changes
- Inrush Current
- Trigger DO, DR, SOE Log, WFR, DWR, RMSR, iTrigger and Alarm Email

Control Setpoints
- 256 Standard and 16 High-Speed Setpoints
- Extensive monitoring sources including U, I, P, Q, S, Demand, Harmonics, Unbalances, Deviations, Flickers, Phase Reversal/Loss, etc.
- Configurable thresholds and time delays
- Trigger DO, DR, SOE Log, WFR, DWR, RMSR, iTrigger and Alarm Email

Digital Input Setpoints
- Provides control output actions in response to changes in Digital Input status
- Trigger DO, DR, SOE Log, WFR, DWR, RMSR, iTrigger and Alarm Email

Motor Start Setpoint
- Monitoring motor startup procedure with recording of Max. Starting Current, Minimum Voltage and Duration
- Trigger DO, SOE Log, WFR, DWR, RMSR, iTrigger and Alarm Email

Inputs and Outputs

Digital Inputs
- Standard 8 or optional 16 channels
- Standard volt free dry contact with 24VDC Internal Excitation
- Optional 110VAC/DC or 220VAC/DC External Excitation
- 1000Hz sampling for 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 and Tariff Switch based on DI Status

Digital Outputs
- Standard 3 or optional 7 channels Form A and 1 channel Form C Mechanical Relays for general purpose control or alarming
- Optional 2 or 4 Solid-State Relays for Energy Pulsing applications

Analog Inputs (Optional)
- Two channels 0/4-20mA DC input with programmable zero and full scales that can be used to measure external transducer signal

Analog Output (Optional)
- One or two Channels 0/4-20mA DC output with programmable zero and full scales

Communications

Ethernet Ports (P1, P2)
- Dual 10BASE-T/100BASE-TX Ethernet Ports with RJ45 connector
- Protocols supported: Modbus TCP, HTTPS, SNTP, SMTP/SMTPS, FTP and IEC 61850
- Built-in password protected Web Server with multiple user accounts and pre-defined roles for easy data viewing, setup configuration and firmware upgrade
- Simultaneous client connections for 12xModbus TCP & 12xIEC 61850

RS-485 (P3, P4)
- Dual optically isolated RS-485 port with baud rate from 1.2 to 38.4 kbps
- Support Modbus RTU and Ethernet Gateway

Time Synchronization

- Battery-backed Real-time clock @ 6ppm (≤ 0.5s/day)
- Time Sync. via Modbus RTU/TCP, SNTP, IEEE 1588 (PTP)
- Optional GPS/IRIG-B outputs

System Integration

PecStar® iEMS

- Supported by CET's PecStar iEMS
- Can be easily integrated into other 3rd party systems because of its support of multiple communications ports as well as different industry standard protocols such as Modbus and IEC 61850

iPQ Explore

- Compact, password protected free software for simultaneous connection with multiple iMeter series Analyzers
- Support configurations for all Setup parameters
- Display of Real-time Measurements, PQ Events and Waveforms
- Export of IER, AER, DR and SDR Logs as well as EN 50160 and IEEE Std 519-2022 Reports

3rd Party System Integration

- Easy integration into Substation Automation or Utility SCADA systems via Modbus RTU, Modbus TCP or IEC 61850
- The on-board, password-protected Web Server provides user-friendly access to its data and supports the configuration for most Setup parameters via a web browser without the use of proprietary software
- The on-board, password-protected FTP Server allows Excel files for the logged C.E. Measurement data, IEEE Std 519-2022 Daily and Weekly reports and the COMTRADE files for the waveform records 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 iMeter 8 Application in PQ Monitoring and Energy Management Systems

The iMeter 8 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.

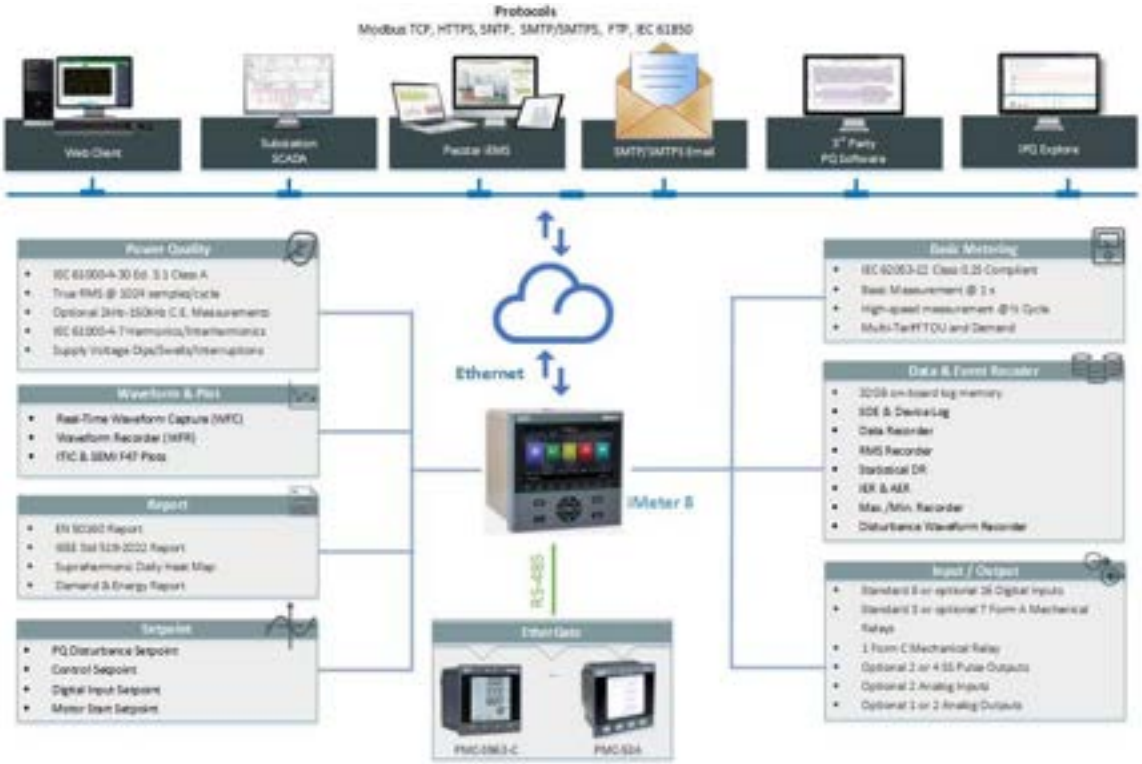


Figure 1-1 Typical Application

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 at support@cet-global.com

Chapter 2 Installation

Caution

Installation of the iMeter 8 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.

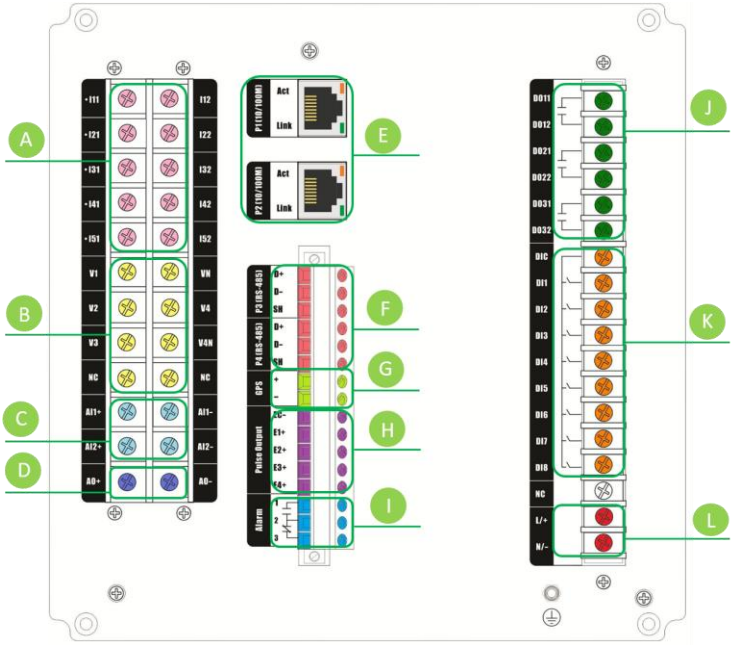
During the operation of the meter, hazardous voltages are present at the input terminals. Failure to observe precautions can result in serious or even fatal injury and equipment damage.

2.1 Appearance



1 Enclosure
2 7'' TFT Color LCD
3 LED Indicators
4 Buttons

Figure 2-1 Appearance



A Current Input terminals
B Voltage Input terminals
C AI terminals
D AO terminals
E 10BASE-T/100BASE-TX Ethernet Ports
F RS-485 terminals
G GPS terminals
H Pulse Output terminals
I Alarm terminals
J DO terminals
K DI terminals
L Power Supply terminals

Figure 2-2 Rear Panel

2.2 Unit Dimensions

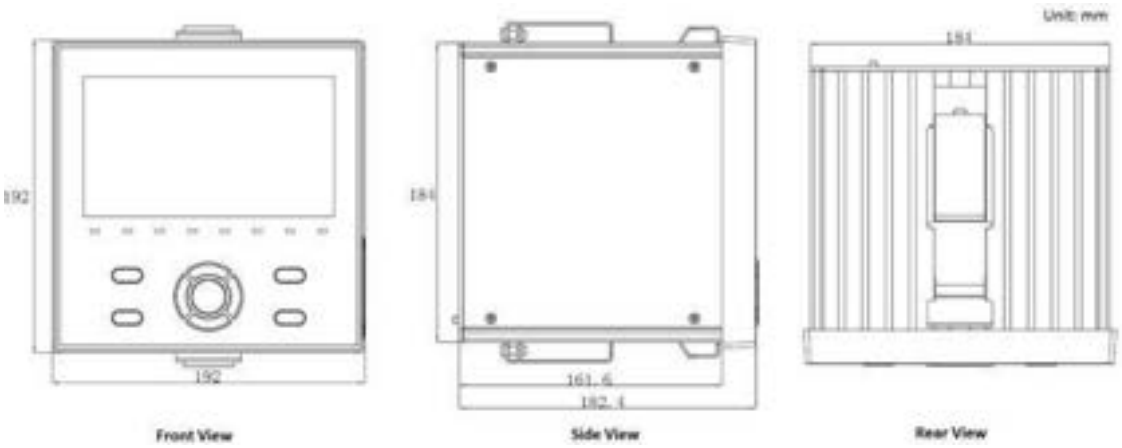


Figure 2-3 Unit Dimensions

2.3 Terminal Dimensions

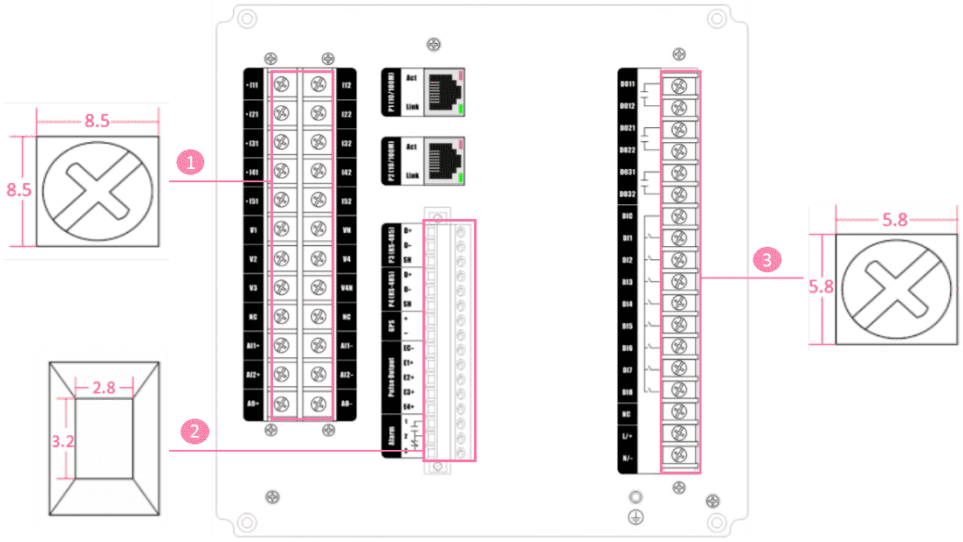


Figure 2-4 Terminal Dimensions

No.	Terminal	Terminal Dimensions	Wire Size	Max. Torque
1	Voltage/Current Input AI/AO	8.5mm x 8.5mm	1.0 mm^2 -2.5 mm^2 12-22AWG	18 kgf.cm/M4 (15.6 lb-in)
2	RS-485/GPS Pulse Output/Alarm	2.8mm x 3.2mm	1.5mm^2 12-26AWG	5 kgf.cm/M3 (4.3 lb-in)
3	DI/DO Power Supply	5.8mm x 5.8mm	1.0 mm^2 -2.5 mm^2 14-22AWG	8.0 kgf.cm/M3 (6.9 lb-in)

Table 2-1 Terminal Dimensions

2.4 Mounting

The iMeter 8 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 2-5 Panel Cutout**
- Re-install and tighten the mounting brackets against the panel to secure the meter

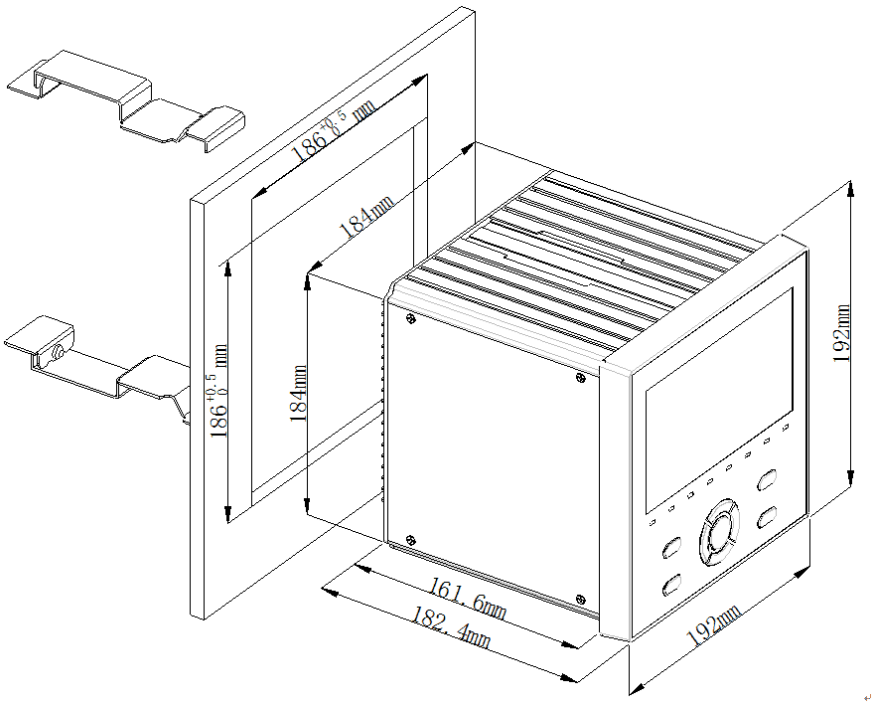


Figure 2-5 Panel Cutout

2.5 Wiring Connections

The iMeter 8 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 3CTs
- 3-phase 3-wire Delta with 2PTs and 2CTs
- 1-Phase 3-Wire Direct Connections with 2CTs*
- 1-Phase 2-Wire L-N Direct Connections with 1CT*
- 1-Phase 2-Wire L-L Direct Connections with 1CT*

* Available in the Firmware V2.51.50 or later

Caution

Under no circumstances should the PT secondary be shorted.

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

2.5.1 3-Phase 4-Wire Wye 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 **3P4W**.

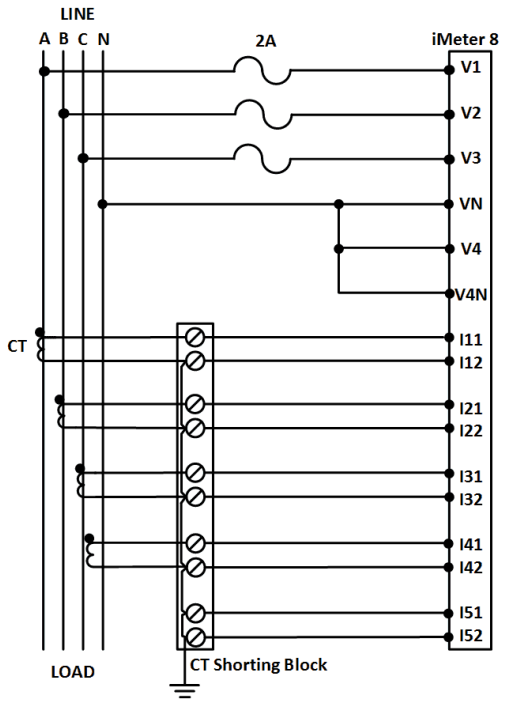


Figure 2-6 3-Phase 4-Wire Wye, no PTs, 4CTs

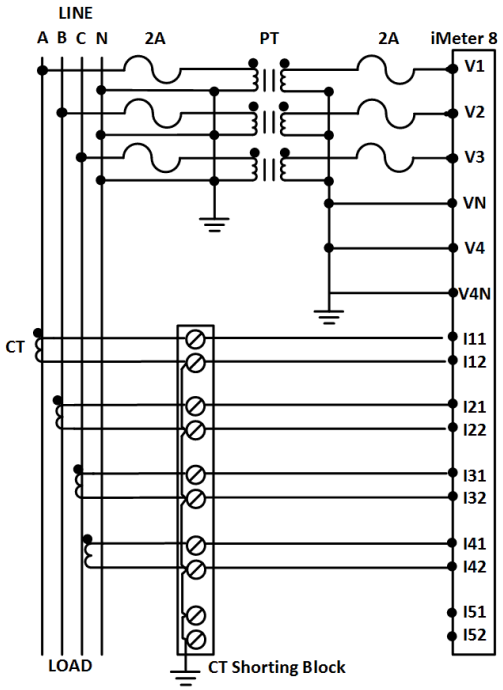


Figure 2-7 3-Phase 4-Wire Wye, 3PTs, 4CTs

2.5.2 3-Phase 3-Wire Grounded Wye 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 **3P3W**.

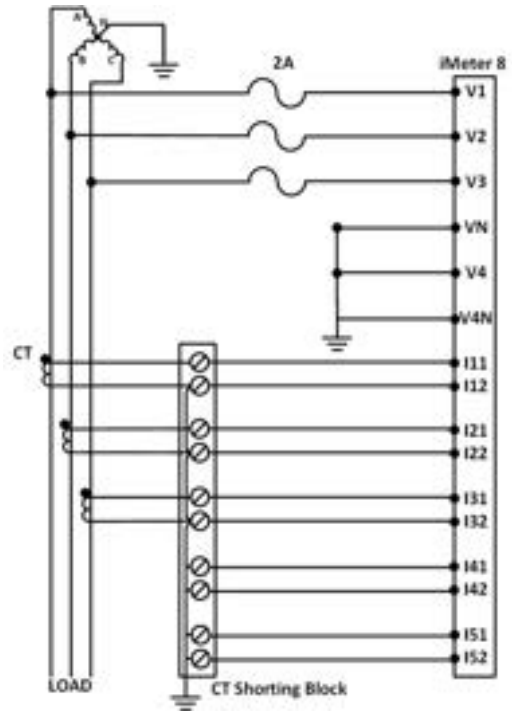


Figure 2-8 3P3W Grounded Wye, Direct Connection

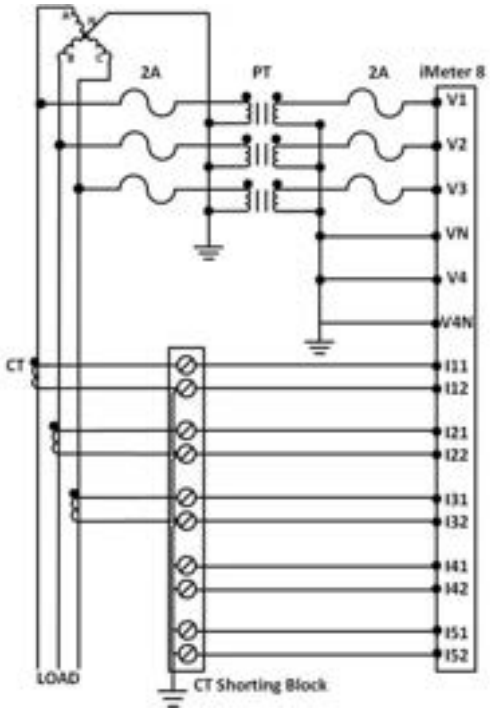


Figure 2-9 3P3W Grounded Wye, 3PTs, 3CTs

2.5.3 3-Phase 3-Wire 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 **3P3W**.

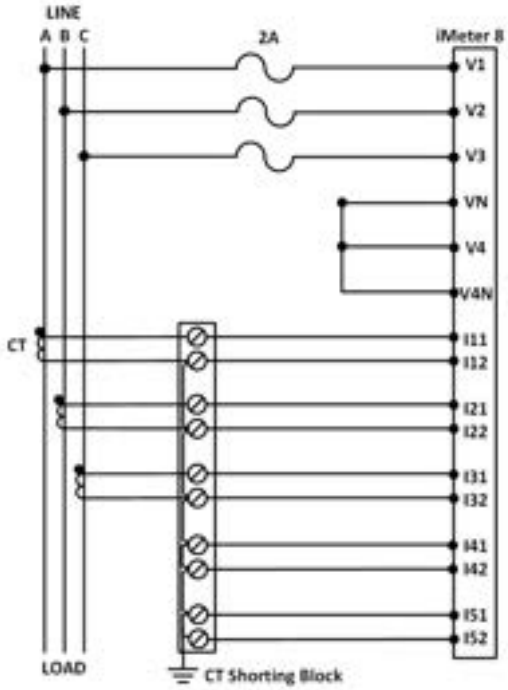


Figure 2-10 3P3W, no PTs, 3CTs

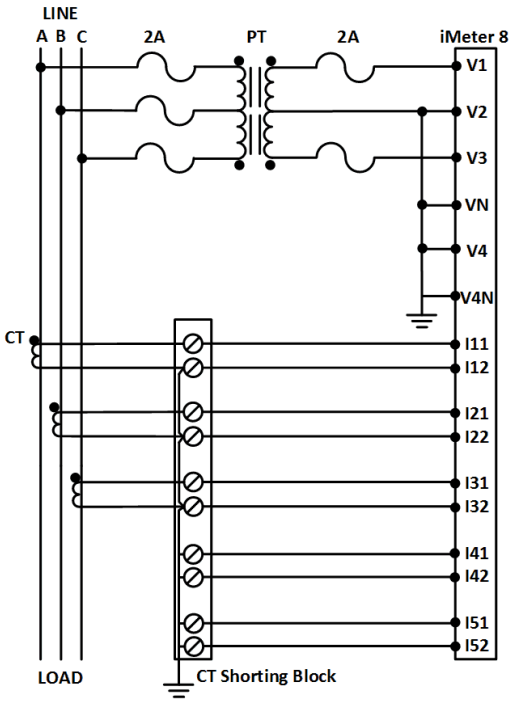


Figure 2-11 3P3W Delta, 2PTs, 3CTs

2.5.4 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 **3P3W**.

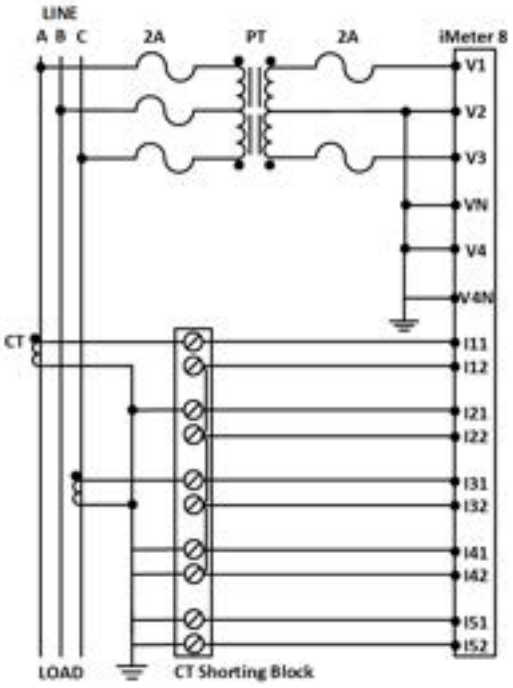


Figure 2-12 3-Phase 3-Wire Delta, 2PTs, 2CTs

2.5.5 1-Phase 3-Wire Direct Connections with 2CTs

The iMeter 8 with the firmware V2.51.50 or later supports **1P3W** wiring mode. Please consult the serial number label to ensure that the rated PT secondary voltage is less than or equal to the meter's rated **Phase** voltage input specification. Set the **Wiring Mode** to **1P3W**.

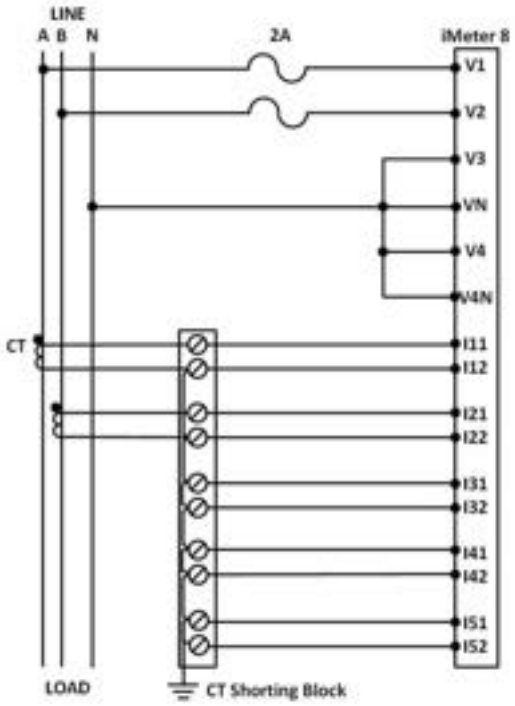


Figure 2-13 1-Phase 3-Wire Direct Connections with 2CTs

2.5.6 1-Phase 2-Wire L-N Direct Connections with 1CT

The iMeter 8 with the firmware V2.51.50 or later supports **1P2W L-N** wiring mode. Please consult the serial number label to ensure that the rated PT secondary voltage is less than or equal to the meter's rated **Phase** voltage input specification. Set the **Wiring Mode** to **1P2W L-N**.

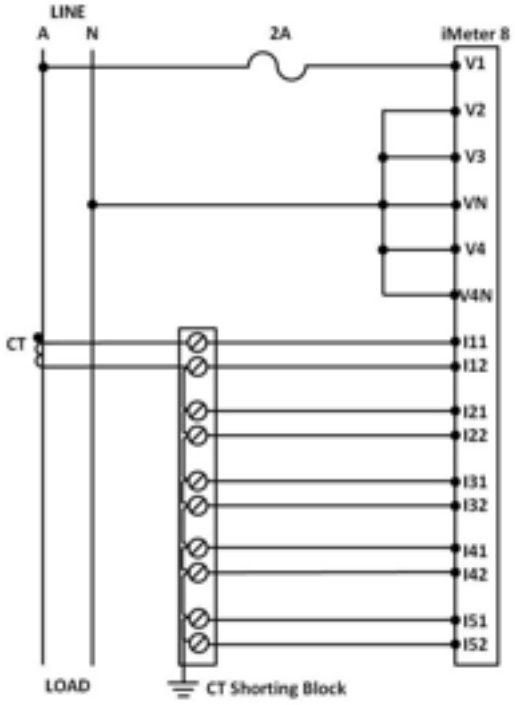


Figure 2-14 1-Phase 2-Wire L-N Direct Connections with 1CT

2.5.7 1-Phase 2-Wire L-L Direct Connections with 1CT

The iMeter 8 with the firmware V2.51.50 or later supports **1P2W L-L** wiring mode. Please consult the serial number label to ensure that the rated PT secondary voltage is less than or equal to the meter's rated **Phase** voltage input specification. Set the **Wiring Mode** to **1P2W L-L**.

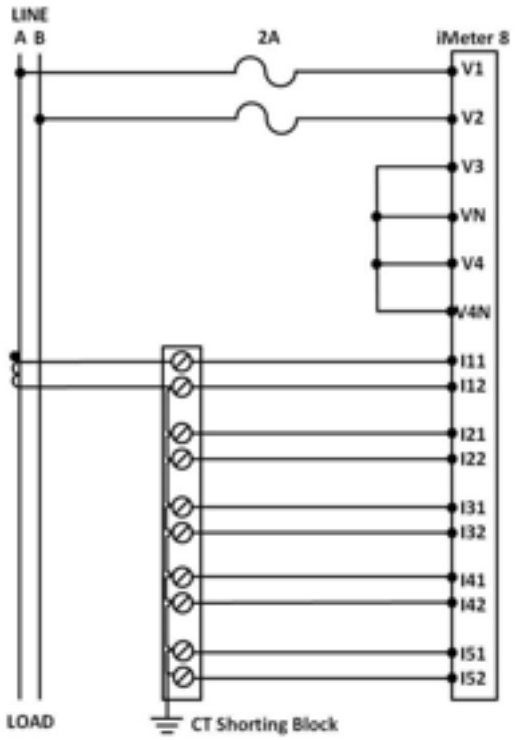


Figure 2-15 1-Phase 2-Wire L-L Direct Connections with 1CT

2.6 Communications Wiring

2.6.1 Ethernet Port (10BASE-T/100BASE-TX)

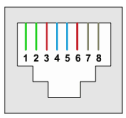
RJ45 Connector	Pin	Meaning
	1	Transmit Data+
	2	Transmit Data-
	3	Receive Data+
	4,5,7,8	NC
	6	Receive Data-

Table 2-2 RJ45 Connector Pin Description for 10BASE-T/100BASE-TX Applications

2.6.2 RS-485 Port

The iMeter 8 provides two RS-485 ports and supports the Modbus RTU protocol. Up to 32 devices can be connected on a RS-485 bus. The overall length of the RS-485 cable connecting all devices should not exceed 1200m.

If the master station does not have a RS-485 communications port, a USB/RS-485 converter or Ethernet to RS-485 gateway with optically isolated outputs and surge protection should be used.

The following figure illustrates the RS-485 communications connections on the iMeter 8:

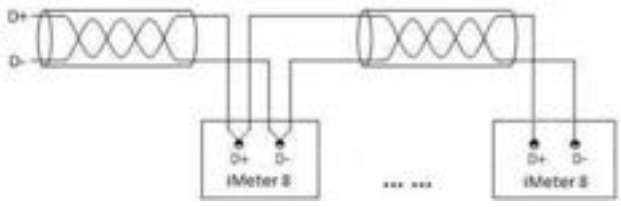


Figure 2-16 RS-485 Communications Connections

2.7 Digital Input Wiring

The following figures illustrate the Digital Input connections on the iMeter 8:



24VDC Self-Excitation **110V/220V AC/DC External-Excitation**

Figure 2-17 DI Connections

2.8 Digital Output Wiring

The following figure illustrates the Digital Output connections on the iMeter 8:

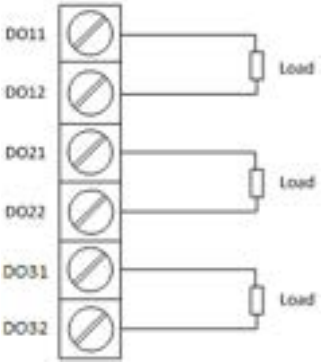


Figure 2-18 DO Connections

2.9 Pulse Output Wiring

The following figure illustrates the Pulse Output connections on the iMeter 8:

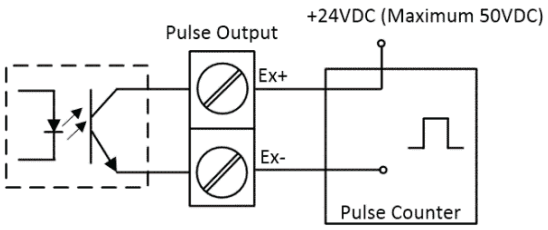


Figure 2-19 Pulse Output (Solid State Relay) Connections for Energy Pulsing

2.10 Analog Input Wiring

The following figure illustrates the Analog Input connections on the iMeter 8:

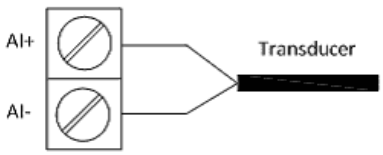


Figure 2-20 AI Connections

2.11 Analog Output Wiring

The following figure illustrates the Analog Output connections on the iMeter 8:



Figure 2-21 AO Connections

2.12 GPS Wiring

The GPS port on the iMeter 8 can be connected for GPS 1PPS Time Sync or IRIG-B Time Sync.

The following figures illustrate the GPS connections on the iMeter 8:

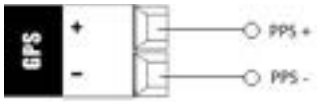


Figure 2-22 GPS 1PPS Time Sync.

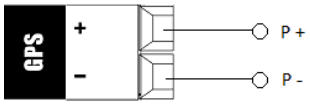


Figure 2-23 IRIG-B Time Sync.

2.13 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.

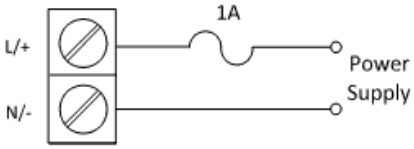


Figure 2-24 Power Supply Connections

2.14 Chassis Ground Wiring

Connect the G terminal to earth ground.

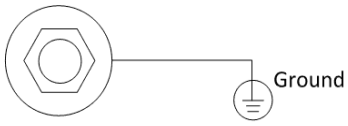


Figure 2-25 Chassis Ground connection

Chapter 3 User Interface

3.1 Front Panel Interface

The following screen capture shows the **Metering** display on the iMeter 8, which is equipped with a stunning, 800x480, TFT Color, LCD Display. There are eight LED indicators on the Front Panel for different parameters' status. The iMeter 8 also provides nine buttons for data display and setup configuration.



Figure 3-1 Main Display

3.1.1 Front Panel LED Indicators

There are eight LED indicators on the iMeter 8's Front Panel as described in the table below.

LED Indicator	Color	Status	Description
Run	Green	Blinking once per second	Device is running normally
		Off	Device is running abnormally
Comm.	Green	Blinking	Receiving or Transmitting data
		Off	No Communications
Alarm	Red	On	Hardware fault or Audit Log exceeds 90%
Harm.	Red	On	U THD/TIHD exceeds preset value
Flicker	Red	On	Plt or Pst exceeds preset value
Volt. Dev.	Red	On	Voltage Deviation exceeds preset value
Freq. Dev.	Red	On	Frequency Deviation exceeds preset value
Unb.	Red	On	U2/I2 Unbalance exceeds preset value

Table 3-1 Front Panel LED Indicators Description

3.1.2 Front Panel Buttons

The iMeter 8's Front Panel has been designed with a 9-button user-friendly interface that allows users to quickly scroll through most of the available measurements.

Buttons	Metering/Power Quality/PQ Insight/Event Menu	Setup Menu
<▲> <▼> <◀> <▶>	In the **Main Menu** page, <◀> and <▶> buttons are used to move the cursor between different icons (**Categories**). The current cursor position is indicated by the highlighted **Category**'s description.	
	When inside a **Category** and under a particular **Sub-Menu**, the arrow buttons are used to navigate between **Pages**. • Pressing <▲> or <▼> shifts the cursor up/down in the sub-menu column. • Pressing <◀> or <▶> moves backward or forward to display different parameters. • Pressing <▲> or <▼> scrolls the individual harmonic or Interharmonic measurements for 1st to 63rd in the **Power Quality > Harmonics** or **Interharmonic** sub-menu. • In the WFR page, using <◀> or <▶> to select the target area and then pressing the <▲> or <▼> buttons to zoom in or out of the waveform.	• Before a parameter is selected, use the <◀>, <▶>, <▲> and <▼> buttons to navigate around and select the desired parameter for modification. • If a numeric parameter is already selected, pressing <▲> or <▼> increments or decrements a numeric value. • If an enumerated parameter is already selected, pressing <▲> or <▼> goes back or advances to last or next enumerated value in the selection list.
<Reset>	Pressing this button reset the LED indicators.	
<Home>	Pressing this button return to the main page.	
<Enter>	• Before a **Category** > **Sub-menu** or operation is selected, pressing **<Enter>** enters the selected **Category** > **Sub-**	• After changing the parameter, pressing **<Enter>** saves the new

	menu or execute the chosen operation. • In the **Metering > RMS** summary page, press **<Enter>** to refresh the RMS data. • When in a record or event page, e.g. an EN50160 record page, press **<Enter>** to display the details page.	settings into memory.
<Fn>	• When inside a data display page, pressing **<Fn>** switches between the **Large Font** and **Summary** page. • In the **Metering > Max.** or **Min.** page, using the **<Fn>** button to scroll between different **Max.** or **Min.** measurements with timestamps.	N/A
<Esc>	• Pressing **<Esc>** returns to the previous level menu or page.	• Pressing **<Esc>** cancel the entered value.
<Fn> + <Enter>	Press this key combination to capture the current page.	

Table 3-2 Button Function

3.1.3 Front Panel Display



Figure 3-2 Hierarchy of Menu

The Front Panel Display allows users to view data and perform basic configuration.

- The main menu consists of 5 icons and each icon represents a **Category**: **Metering, Power Quality, PQ Insight, Events** and **Setup.**
- Each **Category** consists of **Topics** (sub-menus) for data viewing or setup configuration.
- Each **Topic** may provide one or more **Pages** of measurement information.
- The **Status** bar indicates if there are additional measurements under a particular **Page** and how to get there.

All data and setup parameters can be viewed without a password, but a valid **Front Panel Password** is required for making setup changes. The default **Front Panel Password** is 1.

The following figure provides an overview of the Front Panel User Interface.

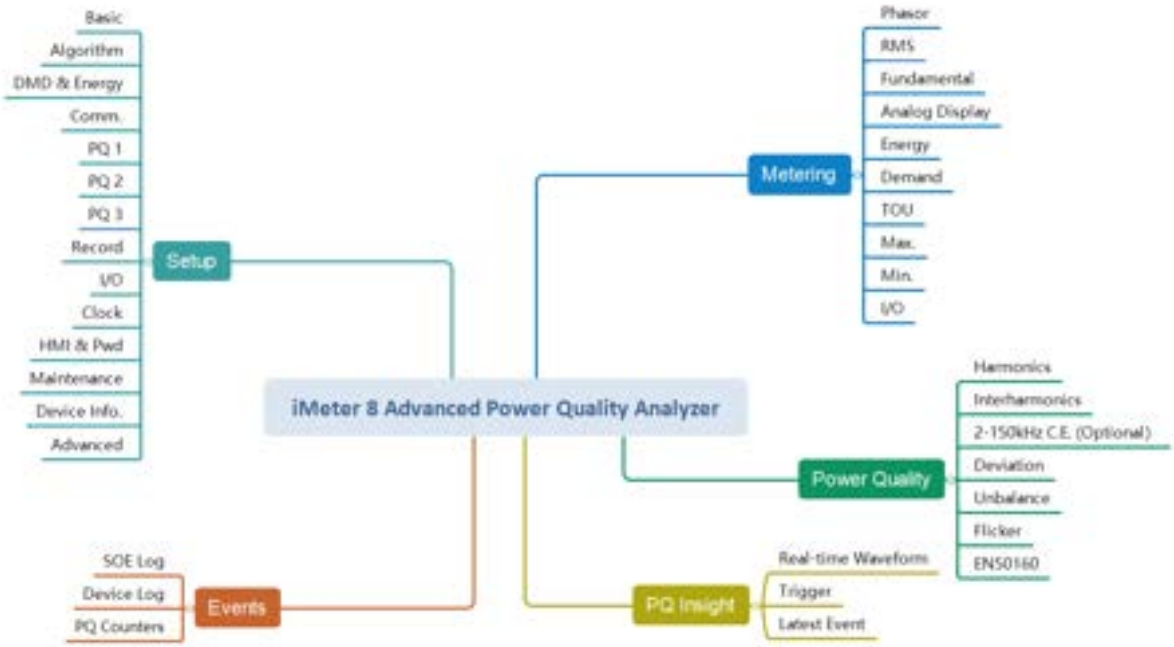


Figure 3-3 Overview of Front Panel Display

3.1.3.1 Metering

The **Metering** menu consists of **Phasor, RMS, Fundamental, Analog Display, Energy, Demand, TOU, Max., Min.** and **I/O.** The following sections provide an overview of those sub-menus.



Figure 3-4 Metering

3.1.3.1.1 Phasor

Enter the **Phasor** sub-menu and the following screen appears which displays the **Magnitude** and **Phase** information.



Figure 3-5 Phasor

3.1.3.1.2 RMS

Enter the **RMS** sub-menu and the following screen appears which displays the 3-Ø and Tot./Avg. RMS measurements updated @1s for ULN, ULL, I, P, Q, S and PF as well as 3-Ø U/I Angle, U4, I4, I5 and Frequency. Press <**Enter**> to pause or refresh the data.

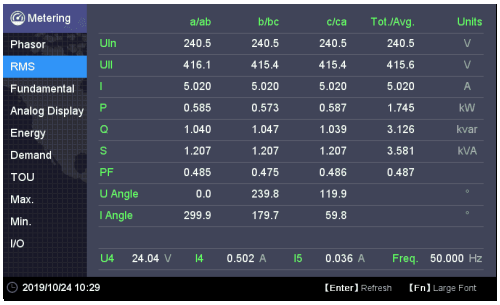


Figure 3-6 RMS

Press <**Fn**> to enter the Large Font screen and then use <◀> or <▶> to scroll among different screens. In the Large Font screen, press <**Enter**> to pause or refresh the data and press <**Fn**> again to return to the **RMS Summary** screen.

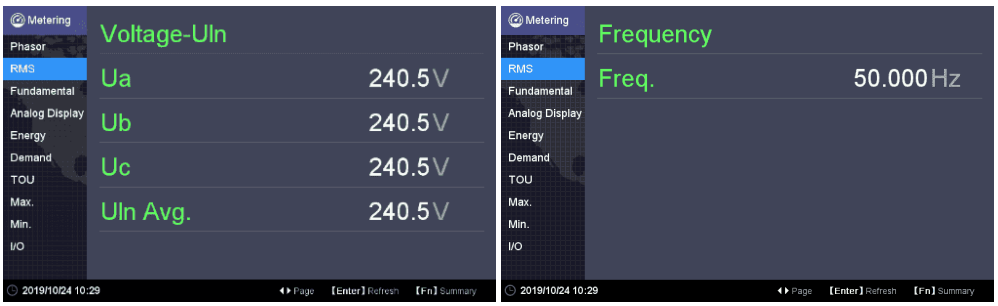


Figure 3-7 Large Font Display of RMS Measurements

3.1.3.1.3 Fundamental

Enter the **Fundamental** sub-menu and the following screen appears which displays the 3-Ø and Tot./Avg. Fundamental measurements updated @1s for ULN, ULL, I, P, Q, S and dPF as well as 3-Ø U/I Angle, U4 and I4. Press **<Enter>** to pause or refresh the data.

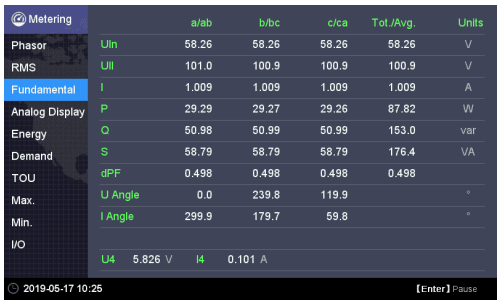


Figure 3-8 Fundamental Measurements

3.1.3.1.4 Analog Display

Enter the **Analog Display** sub-menu and the following screen appears which shows the Analog as well as the Trend Curves for per phase Voltage and Current. Use <◀> or <▶> to scroll among 3-Ø ULN, ULL and I measurements.



Figure 3-9 Analog Display

3.1.3.1.5 Energy

Enter the **Energy** sub-menu and the following screens are displayed which provides the measurements for kWh, kvarh Import/Export/Total/Net and kVAh Total. Use <◀> or <▶> to scroll among **RMS, Fund.** and **Tot. Harm.** measurements.

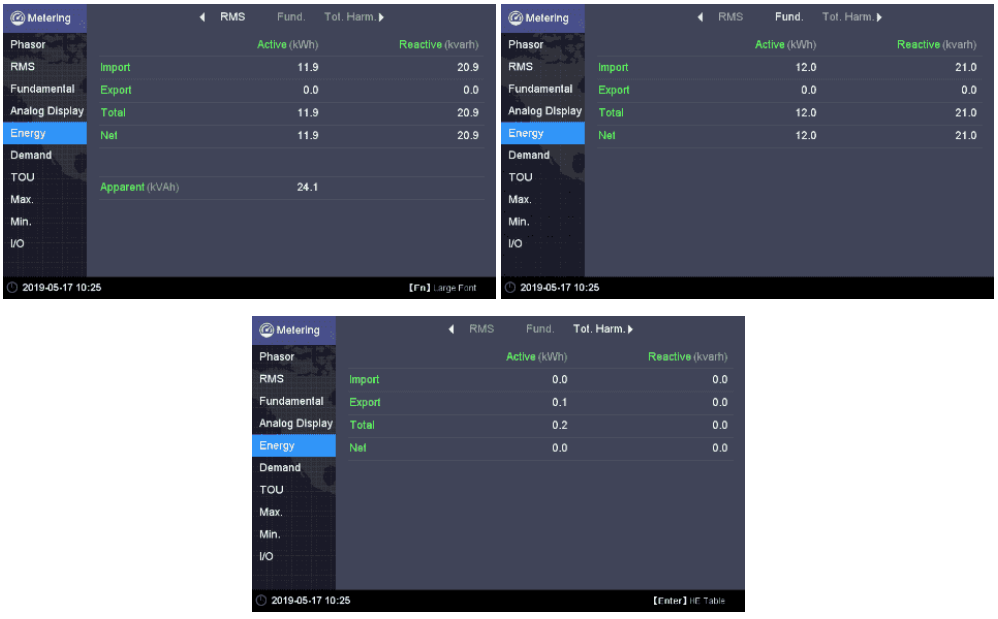


Figure 3-10 Energy Measurements

At the **RMS** Energy Summary screen, press <**Fn**> to enter the Large Font display and then use <◀> or <▶> to scroll among the different screens. Press <**Fn**> again to return to **RMS** Energy Summary screen.



Figure 3-11 Large Font Displays for RMS Energy Measurements

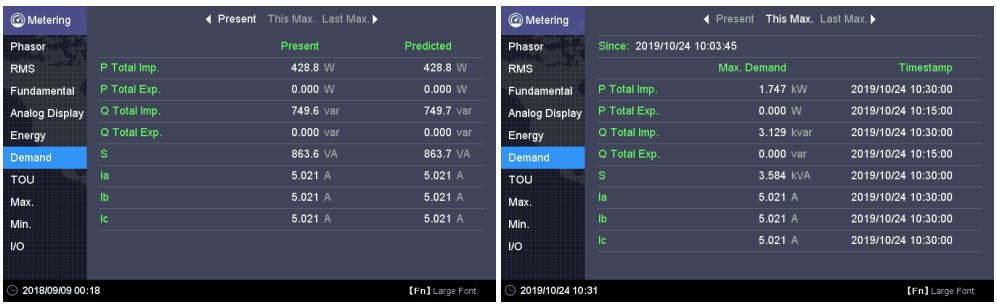
At the **Tot. Harm.** screen, press <**Enter**> to view the TH (Total Harmonic) and Individual Harmonic Energy (from H01 to H63) for kWh, kvarh Imp./Exp.. Press <▲> or <▼> to scroll among H01 to H63. Press <**Esc**> to return to the **Tot. Harm.** screen.



Figure 3-12 Individual Harmonic Energy Measurements

3.1.3.1.6 Demand

Enter the **Demand** sub-menu and the following screens are available which display the Present Demand, Predicted Demand, This Max. and Last Max. for P/Q Total Imp./Exp., S and 3-Ø Current. Use <◀> or <▶> to scroll among **Present** (including **Present & Predicted Demand**), **This Max.** and **Last Max.** with their timestamps. Depending on the setting of the **Self-Read Time**, **This Max.** and **Last Max.** could mean the Max. Demand of This Month/Last Month or Since/Before the Last Reset.



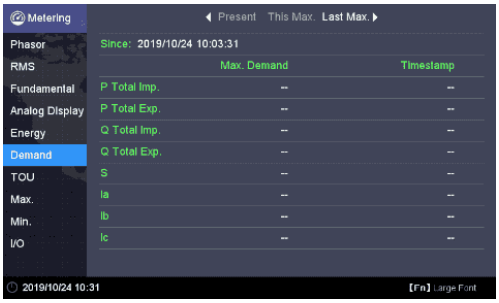


Figure 3-13 Demands Summary

At **Present**, **This Max.** and **Last Max.** screen, press <**Fn**> to enter the Large Font display and then use <◀> or <▶> to scroll among different screens and press <**Fn**> again to return to the Demand summary screen.

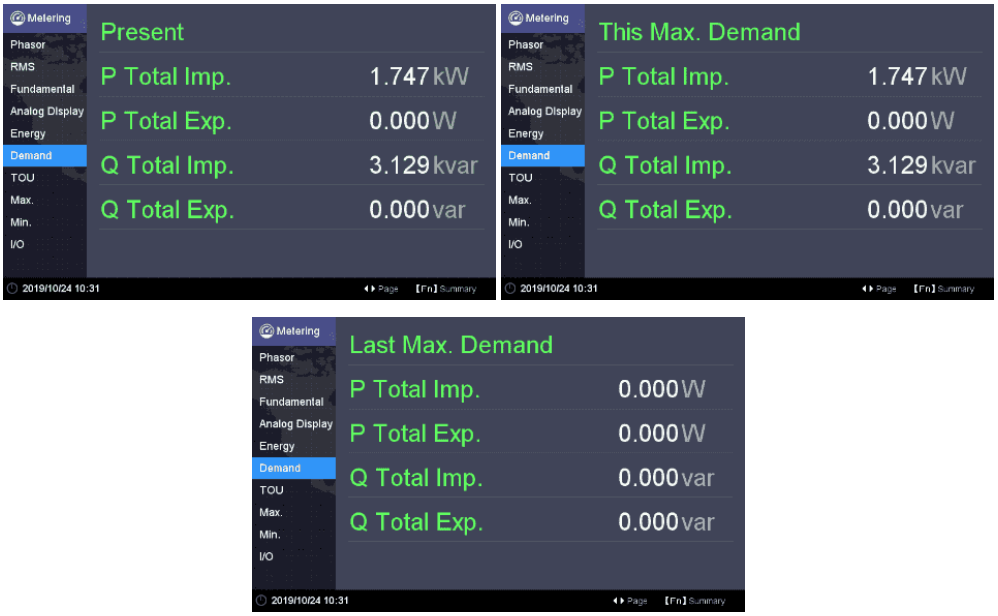


Figure 3-14 Present and Max. Demand Large Font Displays

3.1.3.1.7 TOU

Enter the **TOU** sub-menu and the following screens are available. Use <◀> or <▶> to scroll between **Present** and **Last** TOU screens.

- The **Present** TOU Summary screen displays the Present Tariff/Season/Daily Profile as well as the kWh/kvarh Imp./Exp. and kVAh for the different Tariffs.
- The **Last** TOU Summary screen displays the Self-Read Time for the Last TOU Log, kWh, kvarh Imp./Exp. and kVAh for the different Tariffs.

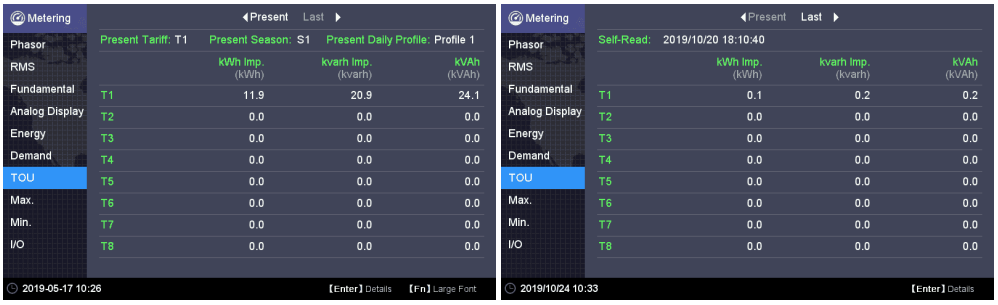


Figure 3-15 TOU Overview

At the **Present/Last** TOU Summary screens, press <**Enter**> to view the details of the **Present** and **Last** TOU Log. Press <▲> or <▼> to scroll among **TOU Energy**, **P Max. DMD** and **Q Max. DMD** for the different Tariffs. Press <**Esc**> to return to the **TOU Summary** screen.

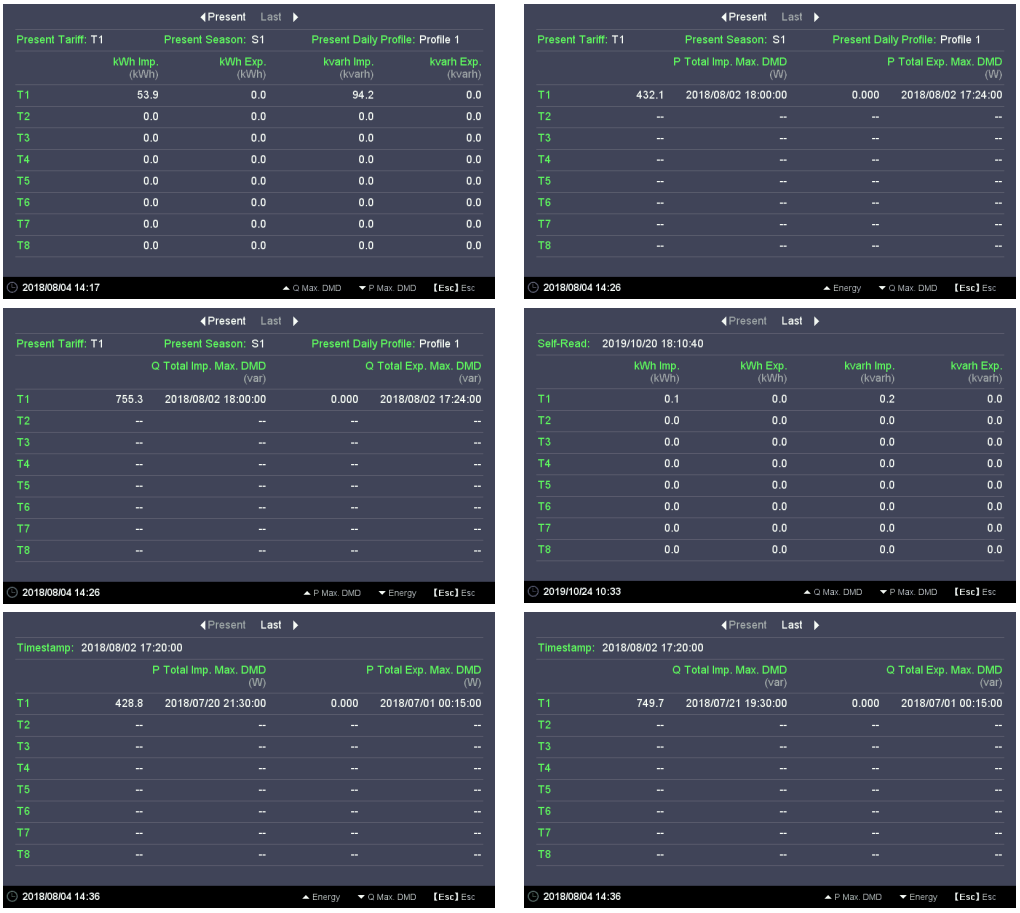


Figure 3-16 Present/Last TOU Details

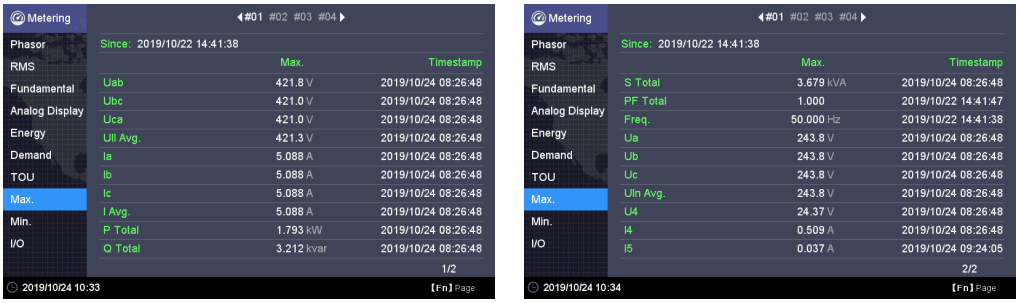
At the **Present/Last** TOU Summary screens, press <**Fn**> to enter to the Large Font page, use <◀> or <▶> to scroll between the different TOU parameters pages and press <**Fn**> again to return to the Summary page.



Figure 3-17 Large Font Display for TOU Measurement

3.1.3.1.8 Max./Min.

Enter the **Max.** or **Min.** sub-menu and the following screens are available which display the Max. or Min. measurements with timestamps. Press <**Fn**> to scroll among the different parameters of **Max.** or **Min.** measurements. Use <◀> or <▶> to scroll among the 4 groups of **Max**. or **Min**. Recorder.



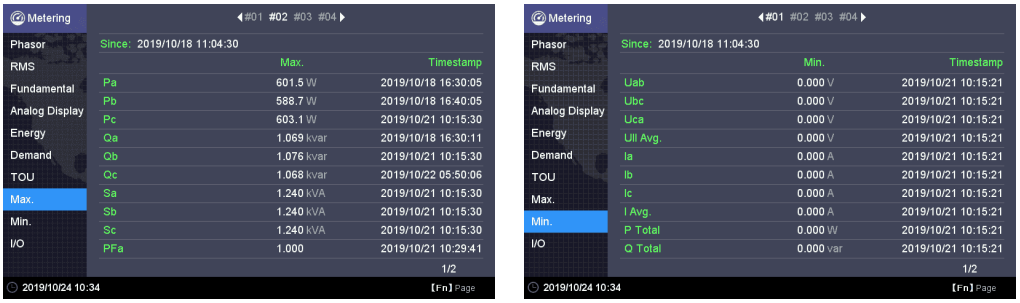


Figure 3-18 Max./Min. Measurements

3.1.3.1.9 I/O

Enter the **I/O** sub-menu and the following screens are available which display the I/O Statuses or measurements. The iMeter 8 can be optional equipped with 16 DIs and 8 DOs, the DI and DO pages will display corresponding information in that case.

Use <◀> or <▶> to scroll between **DI, DO** and **AI** pages. Please note that the **AI** page only available when the device is equipped with the AI option.

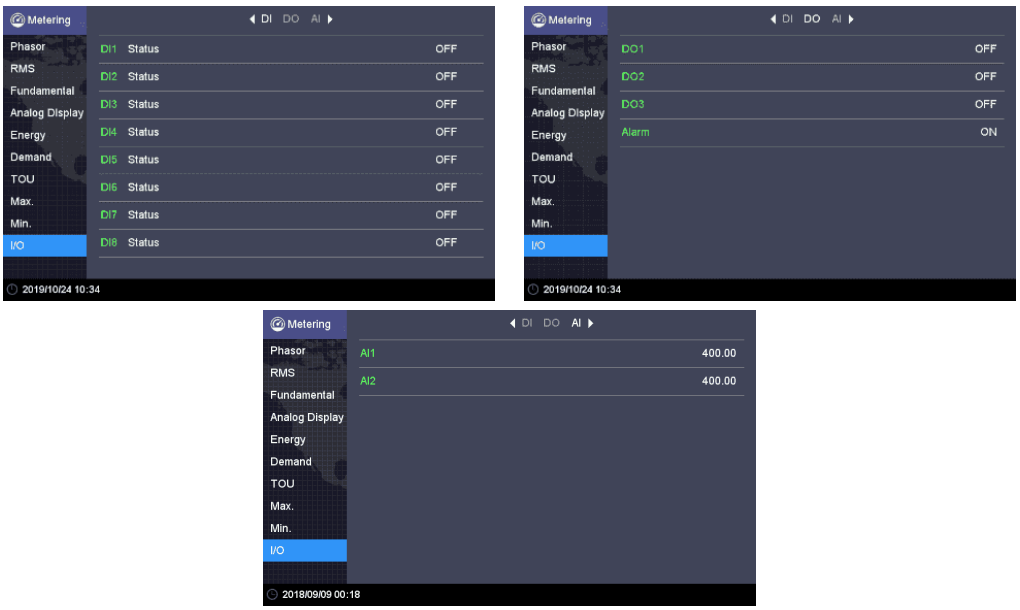


Figure 3-19 I/O Displays

3.1.3.2 Power Quality

The **Power Quality** menu includes **Harmonics, Interharmonics, 2-150kHz C.E.** (optional), **Deviation, Unbalance, Flicker** and **EN50160.** The following sections provide a quick overview of these sub-menus.



Figure 3-20 Power Quality

3.1.3.2.1 Harmonic

Enter the **Harmonics** sub-menu and the **Ua** harmonics screen shows.

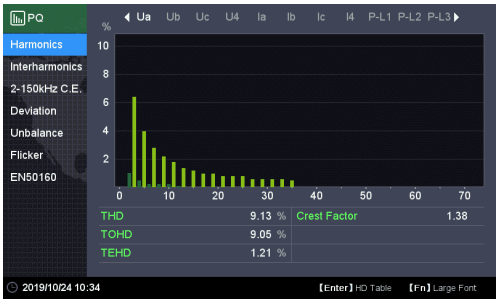


Figure 3-21 Harmonics Overview

Use <◀> or <▶> to scroll among the **Harmonics Overview** for the 4-Ø Voltages, 4-Ø Currents and 3-Ø Powers.



Figure 3-22 Harmonics Overview

The Voltage Harmonics screen shows the Voltage Harmonic Spectrum, THD, TOHD, TEHD and Crest Factor while the Current Harmonics screen shows the Current Harmonic Spectrum, THD, TOHD, TEHD, Crest Factor, TDD, TDD Odd, TDD Even, and K-Factor. The Power Harmonics screen shows the Total Harmonic measurements for P, Q, S and PF.

At the **Harmonic** page, press <**Enter**> to view the Individual Harmonics and use <▼> or <▲> to view the Individual Harmonic measurements for 1st to 63rd, press the <**Esc**> to exit the Individual Harmonic page.



Figure 3-23 Individual Harmonics Measurements

At the **Voltage** or **Current** Harmonics Overview screen, press **<Fn>** to enter the Large Font page and then use <◀> or <▶> to scroll among different screens and press <**Fn**> again to return to the previous level.



Figure 3-24 Large Font Display for Harmonic Measurement

3.1.3.2.2 Interharmonic

Enter the **Interharmonic** sub-menu and the following screens are available. Use <◀> or <▶> to scroll among the 4-Ø **Voltage** or **Current Harmonics**. Each screen provides the Interharmonic Spectrum, TIHD, TOIHD and TEIHD measurements.

At the **Voltage** or **Current** Interharmonic Overview screens, press <**Enter**> to view the %IHD and RMS measurements for 4-Ø Voltages and Currents from IH01 to IH63. Use <▼> or <▲> to view the Individual Interharmonic measurements for 1st to 63rd, press the <**Esc**> to exit the Individual Interharmonic page.

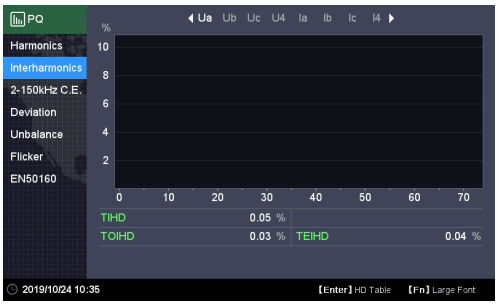


Figure 3-25 Interharmonics Overview

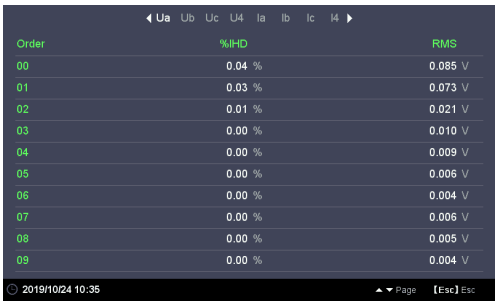


Figure 3-26 Individual Interharmonics

At the **Voltage** or **Current** Interharmonic Overview screens, press **<Fn>** to enter the Large Font page, use <◀> or <▶> to scroll among different screens and press <**Fn**> again to return to the previous level.

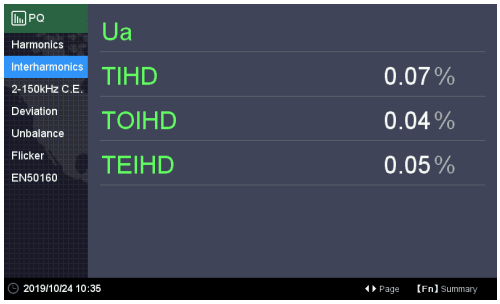
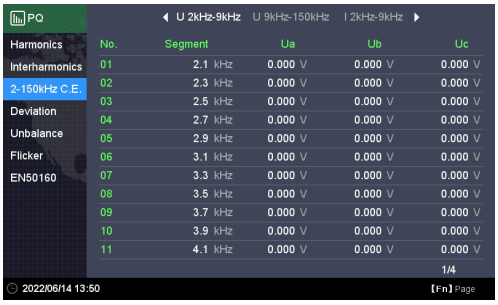


Figure 3-27 Interharmonics Large Font Displays

3.1.3.2.3 2-150kHz C.E. (Optional)

Enter the **2-150kHz C.E.** sub-menu and the following screens are available which display Ua/Ub/Uc for the 2kHz-9kHz and 9kHz-150kHz ranges, and Ia/Ib/Ic for the 2kHz-9kHz range. Use <◀> or <▶> to scroll among the Voltage and Current C.E. measurements and press <**Fn**> to scrolls among different pages.



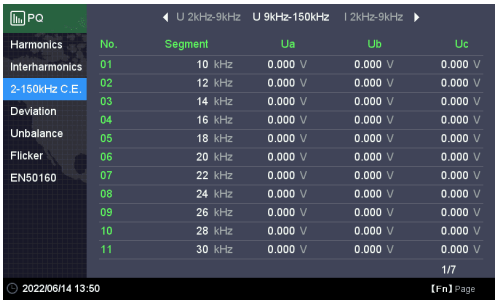




Figure 3-28 2-150kHz C.E.

3.1.3.2.4 Deviation

Enter the **Deviation** sub-menu and the following screen appears which displays the Over/Under Deviation measurements for 3-Ø ULN and ULL as well as the Frequency Deviation measurement.



Figure 3-29 Deviation

3.1.3.2.5 Unbalance

Enter the **Unbalance** sub-menu to display the Positive/Negative/Zero Sequence measurements for Voltage and Current as well as the U2/I2 and U0/I0 Unbalance measurements.

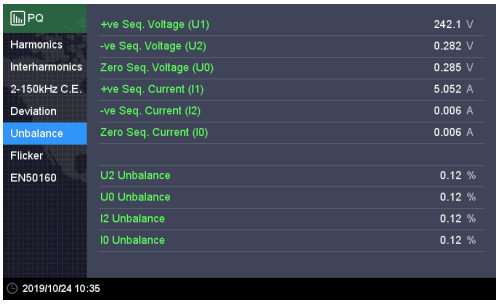


Figure 3-30 Unbalance

3.1.3.2.6 Flicker

Enter the **Flicker** sub-menu to display the Pst and Plt measurements for 3-Ø Voltages.

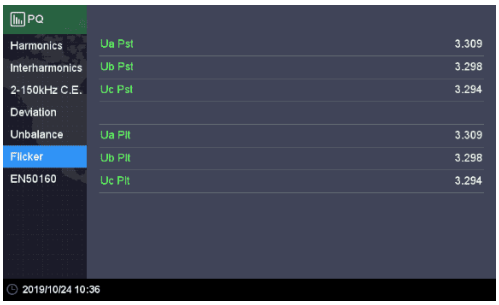


Figure 3-31 Flicker

3.1.3.2.7 EN50160

Enter the **EN50160** sub-menu to check the EN50160 Summary Report where ✅ indicates a positive conclusion while ❌ indicates a negative conclusion.

Press <◀> or <▶> to select different period for the EN50160 Report. Press <▲> or <▼> to scroll up or down to select a particular parameter, and press <**Enter**> to display a particular EN50160 Summary Report. The following screenshot provides an example of the details for Power Frequency.



Figure 3-32 Summary of EN50160 Report

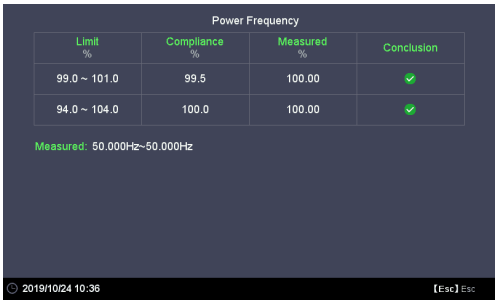


Figure 3-33 Power Frequency

3.1.3.3 PQ Insight

The **PQ Insight** menu mainly provides the Real-Time Waveform display.



Figure 3-34 PQ Insight Topic

Enter the **Real-Time Waveform** sub-menu, the screen shows the Real-Time WFC for 3-Ø Voltages and Currents at 128 samples/cycle for 4 cycles that is updated every second. Press <**Enter**> to enter the display and then use <▲>, <▼>, <◀>, <▶> and <**Enter**> to navigate around the screen. One can toggle the display of a particular Voltage or Current Channel, **Pause**/**Refresh** the WFC update, manually trigger a WFR, DWR, RMSR or check the details of the latest SOE event displayed at the left of the screen with ITIC/SEMI Curves and WFR/DWR waveforms.

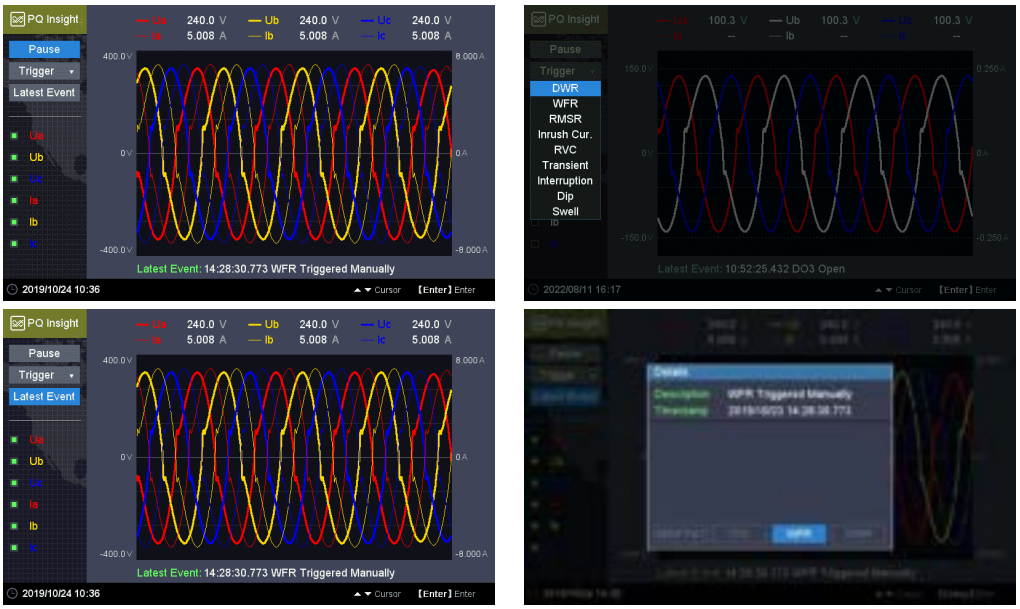


Figure 3-35 PQ Insight Pages

3.1.3.4 Events

The **Events** menu consists of **SOE Log, Device Log** and **PQ Counters.** The following section provides a quick overview of these screens.



Figure 3-36 Event Menu

3.1.3.4.1 SOE Log

Enter the **SOE Log** sub-menu and the following screen is available which displays up to 1024 events starting with the most recent events.

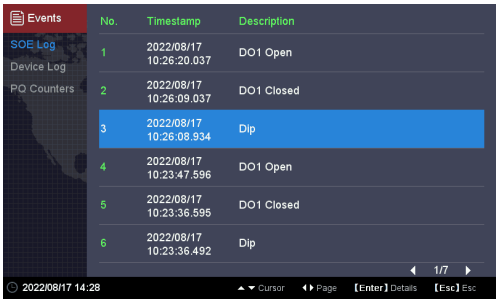


Figure 3-37 SOE Log

Use <◀> or <▶> to quickly move through the pages. Press <**Enter**> to enter the selected page, then use <▲> or <▼> to scroll through the events list. Press <**Enter**> to select and view the event details.

If the selected log is a PQ event, the **Details** dialog box may provide the options for displaying the SEMI F47/ITIC curves or the WFR, RMSR and/or DWR waveform display. Press <◀> or <▶> to select the option and press <**Enter**> to select and view the respective display.

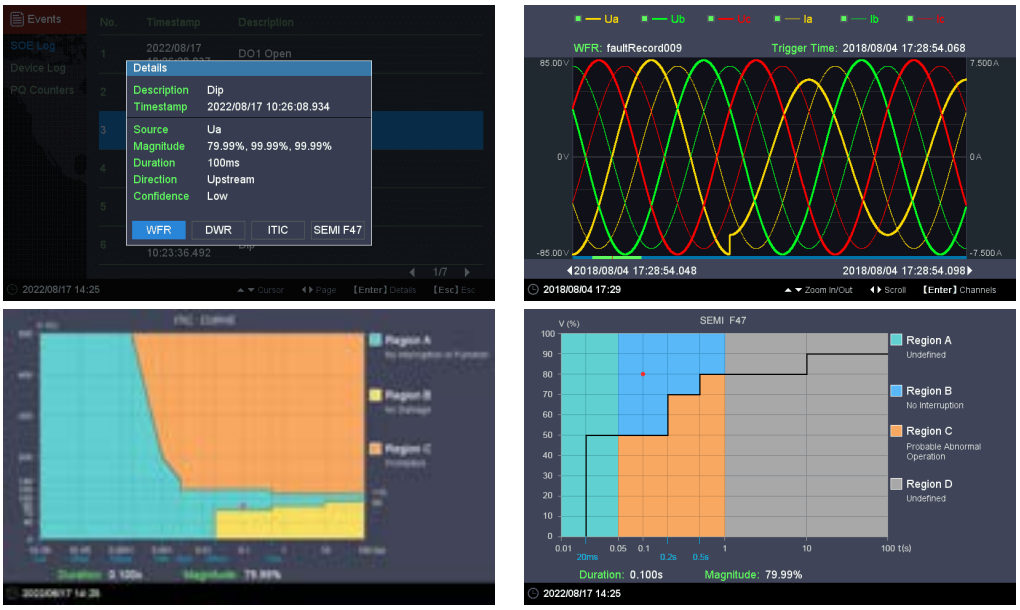


Figure 3-38 Event Detail and SEMI F47, ITIC & WFR

The WFR page shows the detailed event and the timestamp. Press <**Enter**> to select which channels would be displayed. Inside the waveform display, press <▲> or <▼> to zoom in/out of the waveform or press <◀> or <▶> to scroll backward/forward of the waveform on the time scale.

3.1.3.4.2 Device Log

Enter the **Device Log** sub-menu and the following screen appears which displays up to 1024 events starting with the most recent event. Use <◀> or <▶> to quickly move through the pages.

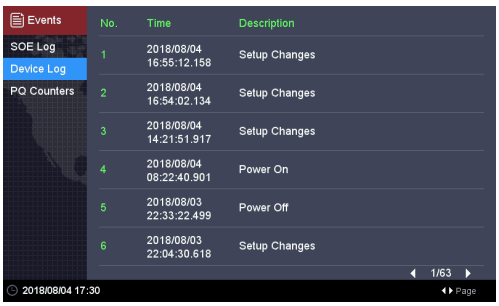


Figure 3-39 Device Log

3.1.3.4.3 PQ Counters

Enter the **PQ Counters** sub-menu to display the different PQ Event counters.

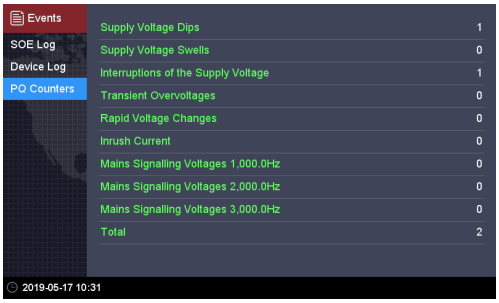


Figure 3-40 PQ Counters

3.1.3.5 Setup

The **Setup** menu consists of **Basic, Algorithm, DMD & Energy, Comm., PQ 1, PQ 2, PQ 3, Record, I/O, Clock, HMI & Pwd, Maintenance, Device Info.** and **Advanced** sub-menus. The following sections provide a quick overview of these sub-menus.



Figure 3-41 Setup Menu

3.1.3.5.1 Basic

Enter the **Basic** sub-menu and the following screen appears. Use <◀>, <▶>, <▲>, <▼> to scroll through the different parameters and then press <**Enter**> to select the desired parameter. The Front Panel Password is required for any setup changes. Please refer to **Section 3.2.4.5.1.1** for the setup range and the default values of the different parameters.



Figure 3-42 Basic Setup

3.1.3.5.2 Algorithm

Enter the **Algorithm** sub-menu and the following screen appears. Please refer to **Section 3.2.4.5.1.5** for the setup ranges and the default values. The **TDD Preset IL (Pri.)** and **I4 TDD Preset IL (Pri.)** are available in the firmware V2.50.51 or later.

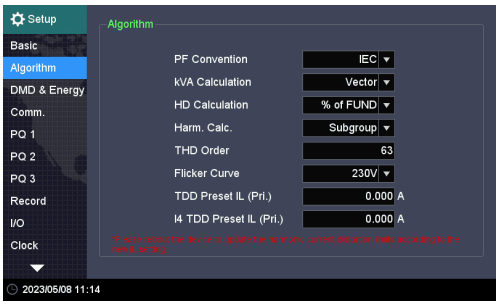


Figure 3-43 Algorithm Setup

3.1.3.5.3 DMD & Energy

Enter the **DMD & Energy** sub-menu and the following screen appears. Please refer to **Section 4.2.4** for demand details, **Section 4.1.3** and **4.6** for energy pulse and IER/AER information.



Figure 3-44 DMD & Energy Setup

3.1.3.5.4 Comm.

Enter the **Comm.** sub-menu and the following screen appears. Please refer to **Section 3.2.4.5.1.2** for parameters setup ranges and the default values.

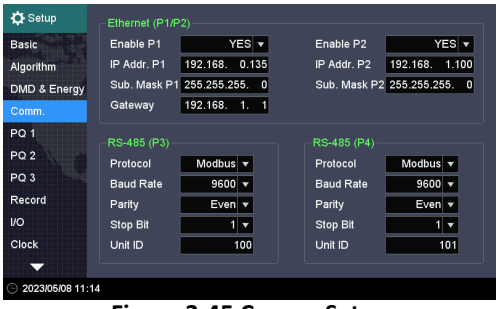


Figure 3-45 Comm. Setup

3.1.3.5.5 PQ 1 & PQ 2

Enter the **PQ 1** or **PQ 2** sub-menu and the following screen appears, which allow users to setup parameters for **PQ Disturbance, Transient, Rapid Voltage Changes, Inrush Current** as well as **2-150kHz C.E.** Please refer to **Section 5.10.9** for more information. Please note that the device should be rebooted to take effect after changing the **2-150kHz C.E.** parameter.

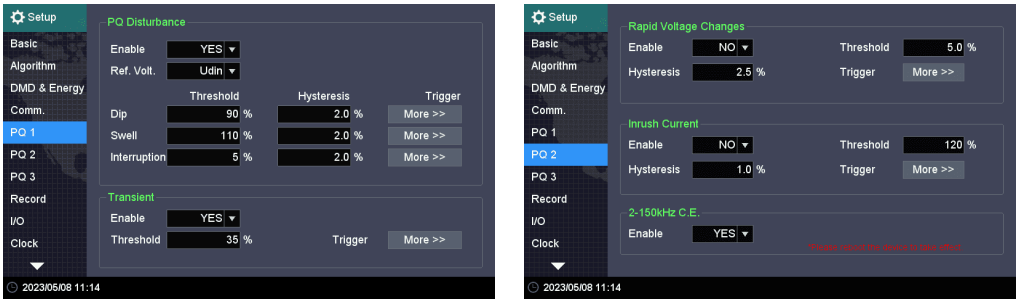


Figure 3-46 PQ 1 and PQ 2 Setup

3.1.3.5.6 PQ 3 (IEEE Std 519 Report)

The **PQ 3** sub-menu allow users to setup parameters for the IEEE Std 519 compliance reporting. Please refer to **Section 3.2.4.5.2.3** for more information.

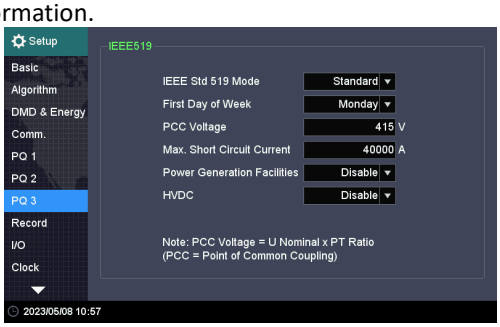


Figure 3-47 IEEE Std 519-2022 Compliance Report Setup

3.1.3.5.7 Record

Enter the **Record** sub-menu and the following screen appears. Please refer to **Section 4.6.2** and **4.6.4** for WFR, DWR and RMSR information, respectively.

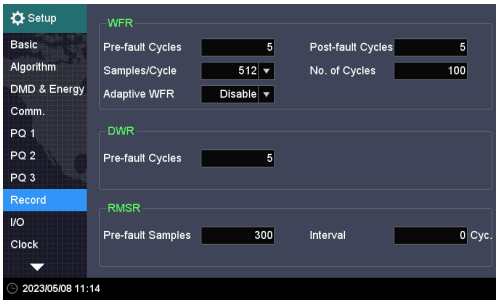


Figure 3-48 Record Setup

3.1.3.5.8 I/O

Enter the **I/O** sub-menu and the screen on the right appears. Please refer to **Section 5.10.2** and **5.10.3** for more information. This screen would display optional DIs, DOs, AI or AO setup information if the iMeter 8 is equipped with corresponding options.

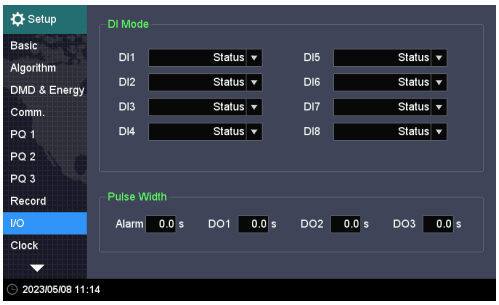


Figure 3-49 I/O Setup

3.1.3.5.9 Clock

Enter the **Clock** sub-menu to display the **Clock**, **Clock Source/SNTP** and **IEEE 1588 (PTP)** settings. Please refer to **Section 3.2.4.5.1.3** for the ranges and default values. Please note that the device should be rebooted to take effect after changing the **IEEE 1588 (PTP)** parameters.



Figure 3-50 Clock Setup

3.1.3.5.10 HMI & Pwd

Enter the **HMI & Pwd** sub-menu to display the settings for the **HMI & Language** and **Password**.

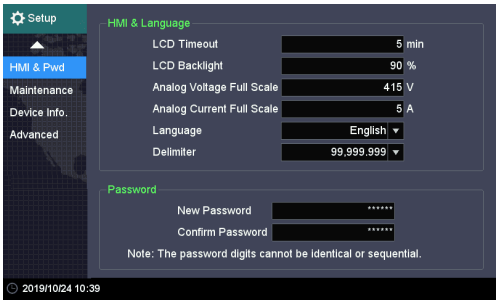


Figure 3-51 HMI & Pwd Setup

3.1.3.5.11 Maintenance

Enter the **Maintenance** sub-menu and the following screen appears which allows the manual control of DO and reset of the different groups of parameters.

Reset: Perform the following reset operations: All Events, EN50160 Log, All Demands, Present Max. Demand, All Max. & Min. Log, Present Max. & Min. Log, Energy, All DI Counters and PQ Counters.

DO Manual Operation: Force DOx On/Off or return DOx to Normal control.

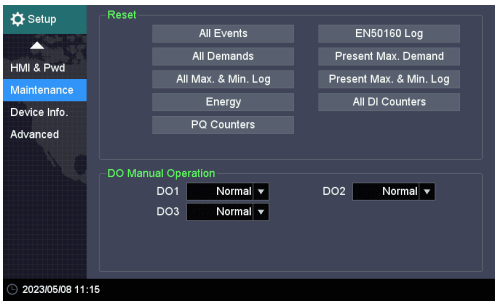


Figure 3-52 Maintenance

3.1.3.5.12 Device Info.

Enter the **Device Info.** sub-menu and the following screen appears, which displays device's **Basic**, **Version** and **Self Diagnostics** information.

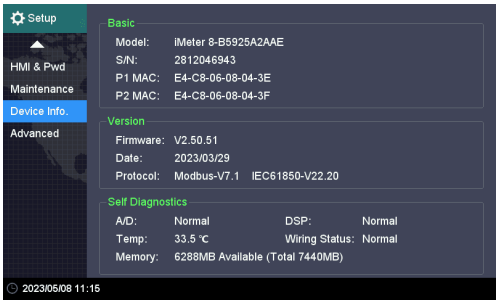


Figure 3-53 Device Info.

3.1.3.5.13 Advanced

Enter the **Advanced** sub-menu and the following screen appears. Please consult the qualified personnel before making changes to these settings and the device should be rebooted to take effect after changing the **Advanced** parameters.



Figure 3-54 Advanced Setup

3.2 On-board Web Interface

The iMeter 8's Web Interface is compatible with various Web Browsers which are listed in the table below.

Browser	Version
Google Chrome	V103.0.5060.134 and above
Microsoft Edge	V103.0.1264.71 and above
Firefox	V102.0.1 and above

Table 3-3 Supported Web Browsers

The default IP addresses of the iMeter 8's two Ethernet Ports are 192.168.0.100 and 192.168.1.100 for P1 and P2, respectively. Please make sure to configure the **IP Address**, **Subnet Mask** and **Default Gateway** such that it's on the same subnet as the PC that is being used to connect with the iMeter 8.

3.2.1 Setting PC's IP Address

1. To determine the PC's IP Address, click the Start icon , then the Settings button on Windows 10 (for other MS Windows systems, please refer to this link for more instructions).

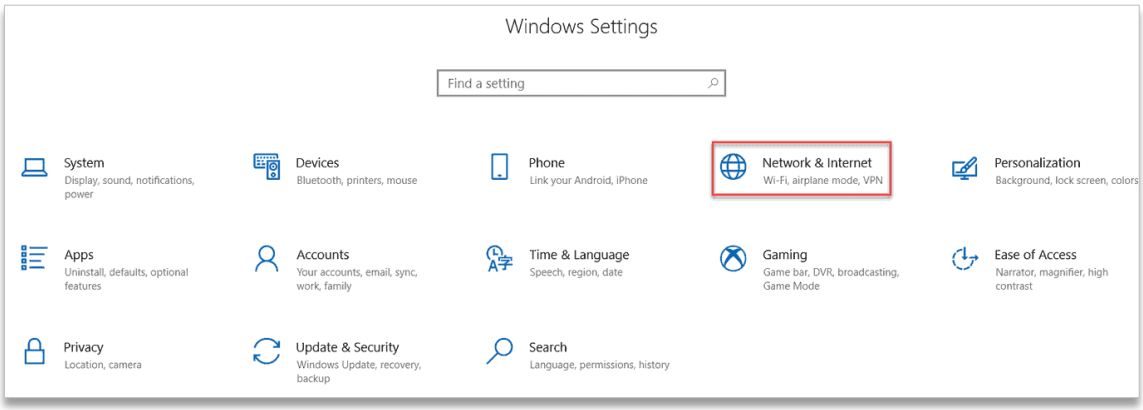


Figure 3-55 Settings > Network & Internet

2. Click **Network & Internet**, select **Change adapter options** and then find the appropriate Ethernet connection.

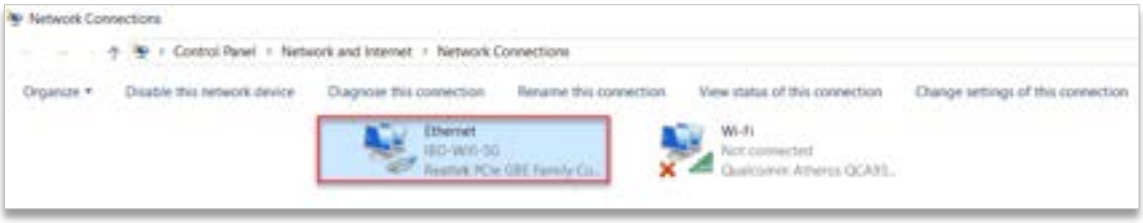


Figure 3-56 Network and Sharing Center

3. Right-click on it and select **Properties**. Then double-click on **Internet Protocol Version 4 (TCP/IPv4)** to show its IP configuration.

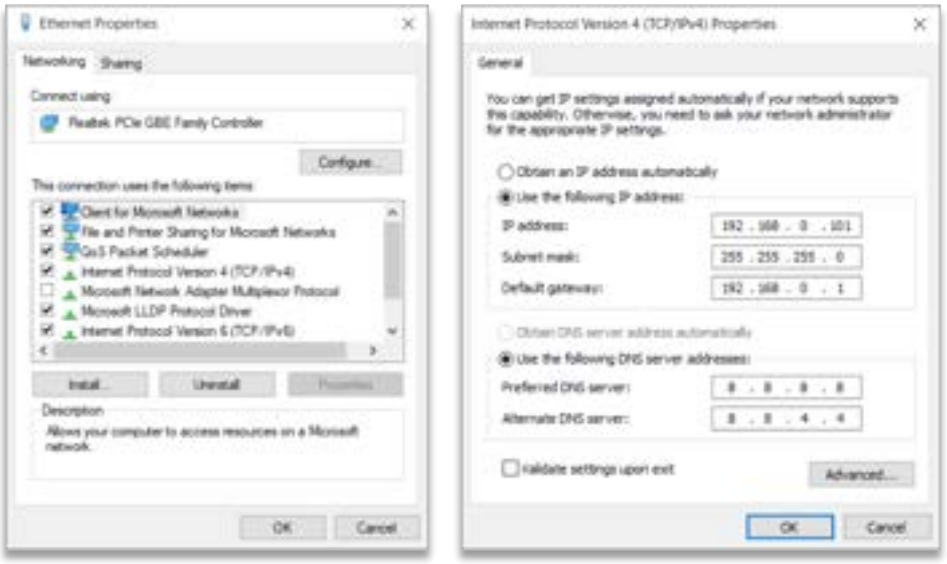


Figure 3-57 Setting PC's IP Address

3.2.2 Configure iMeter 8's IP Addresses

Please follow the steps below to configure the iMeter 8's IP Addresses:

1. Move the cursor to the **Setup** category, hit **<Enter>** and then the **Basic** topic appears.
2. Hit **<▼>** to move from **Basic** to **Comm.**
   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.

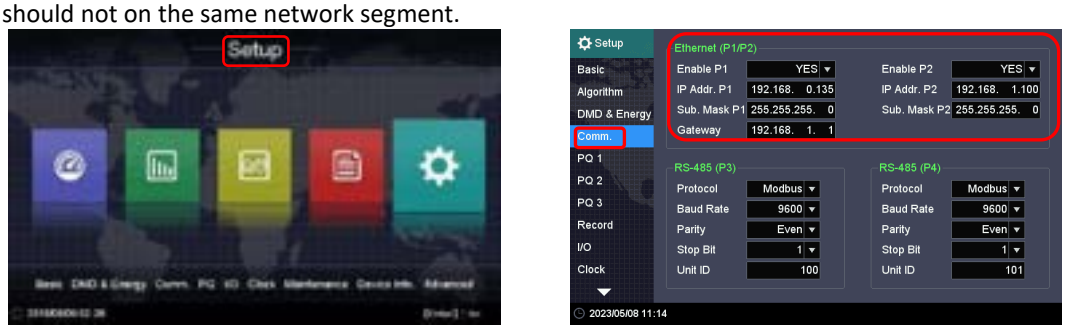


Figure 3-58 Configure iMeter 8's IP Address via Front Panel

3.2.3 Enabling Java Script in Google Chrome

Generally, the JavaScript in Google Chrome is enabled by default. Please refer to this section to turn on the JavaScript in Google Chrome if by any chance.

1) Click the **Menu** icon ⋮ on **Chrome** and then select **Settings**.

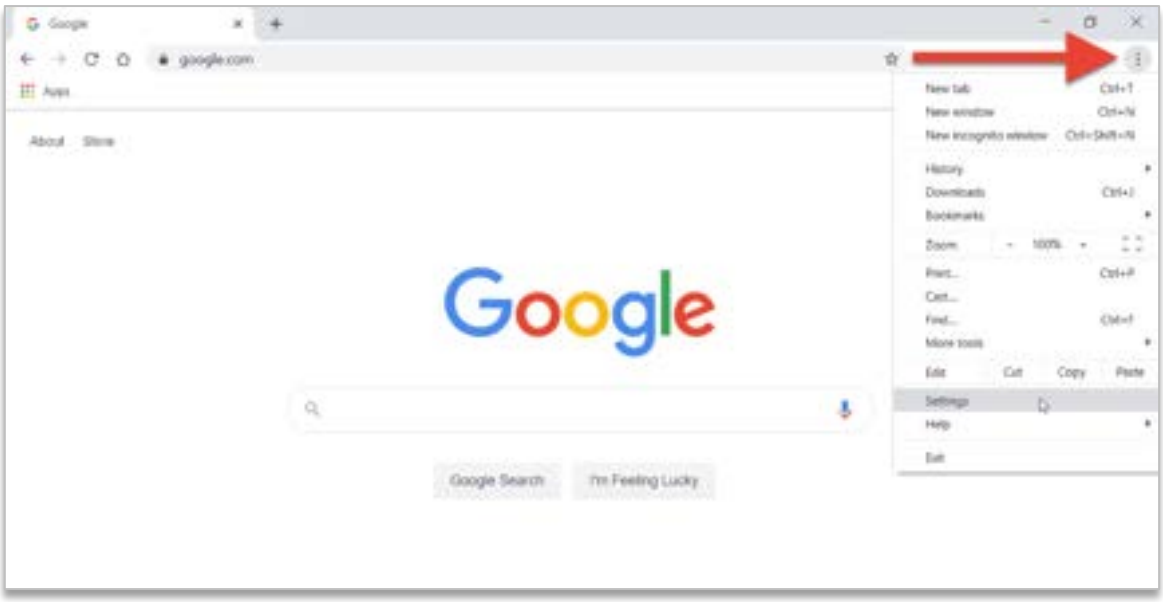
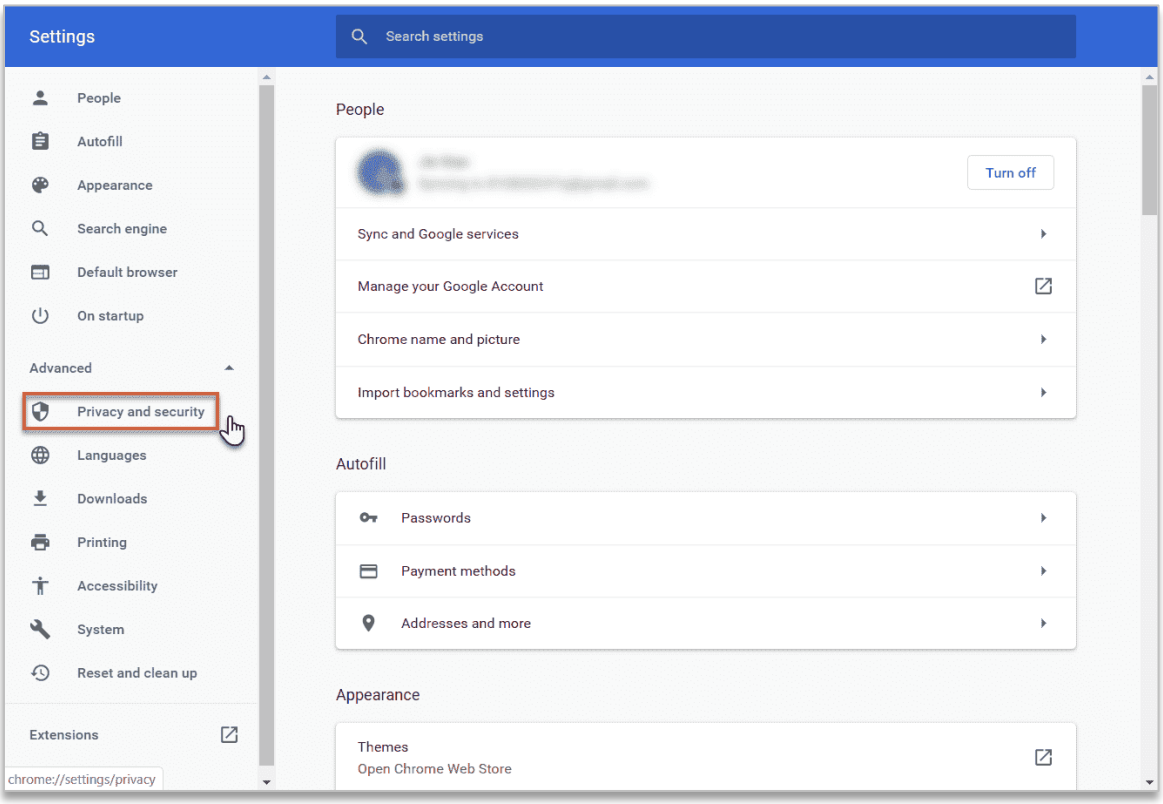


Figure 3-59 Open Setting page of Google Chrome

2) Expand the **Advanced** menu on left-hand side and go to **Privacy and Security**.



3) Choose **Manage certificates** and then click on **Import** on the **Certificates** dialog box.

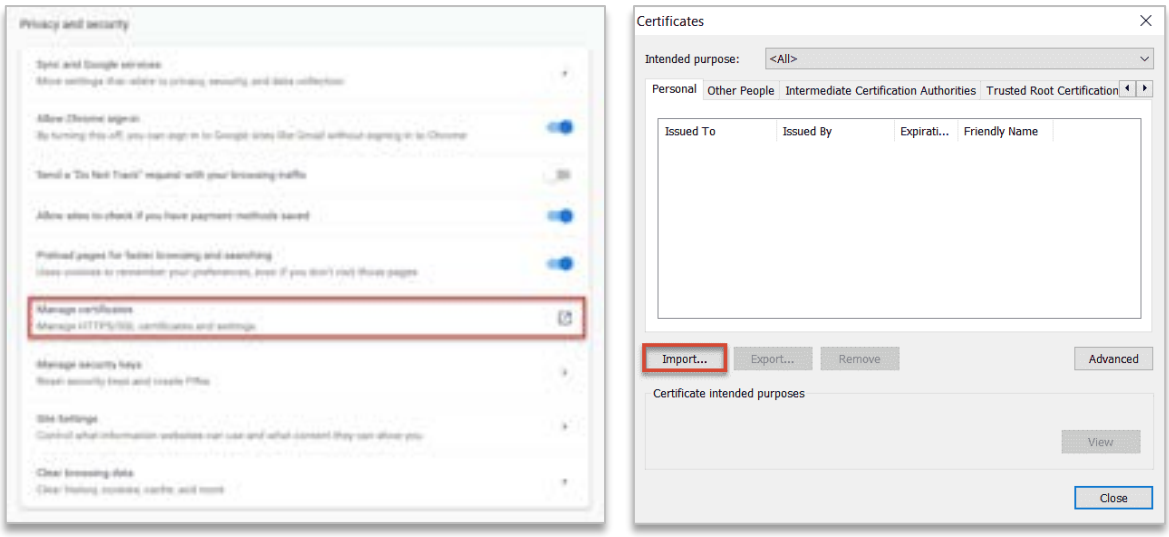


Figure 3-60 Manage certificates -> Import certificate

4) Follow the discrete steps wizard for importing the certificate. Choose the .pfx certificate and enter the password for the **private key** which is "**123456**". It's recommended to place the certificate in **Trusted Publishers** store in the next step.

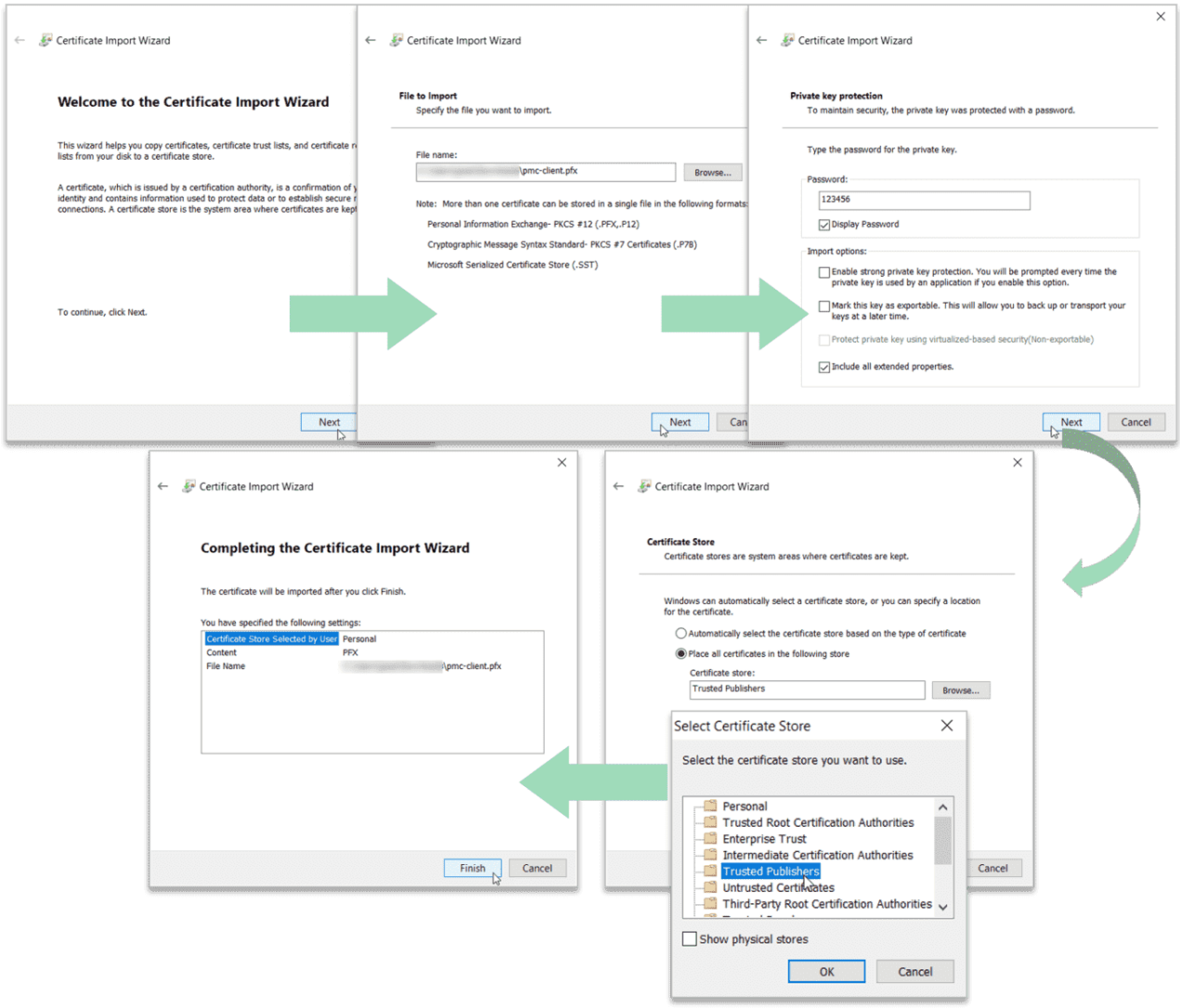


Figure 3-61 Import .pfx certificate

3.2.4 Accessing Web Interface

1) Restart **Chrome** and enter the complete IP address of the iMeter 8 (e.g.: https://192.168.0.100) in the Address area of **Google Chrome** and then press **<Enter>**.



Figure 3-62 Web IP Address

2) Select the **pmc-client** certificate as shown in the following figure and press **OK**.



Figure 3-63 Select a certificate

3) The following Privacy Error may appear since the certificate is untrusted for **Chrome**. Click on **Advanced** then **Proceed to localhost (unsafe)**.

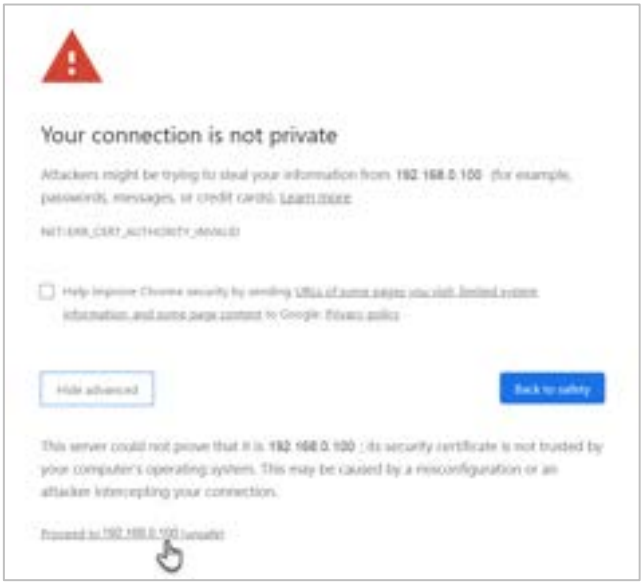


Figure 3-64 Privacy Error

4) The iMeter 8's Web Login Interface appears.

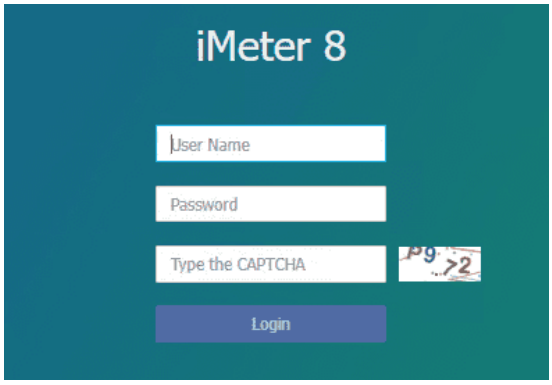


Figure 3-65 iMeter 8 Web Login Interface

An user with corresponding authority is required to login to the Web interface to view data or change setup parameters. The default **Login Info.** for the operator, user and auditor accounts are listed below. Please be noted that if the password is entered incorrectly for 5 times, the login access will be locked out for 5 minutes.

Account	Username	Default Password
Operator	operator	abcd1234-
User	user	abcd1234-
Auditor	auditor	abcd1234-

Table 3-4 Default Username and Password for Operator/User/Auditor account

The table below lists the web access authorities for each accounts:

<table>
<tr><th colspan="3">Web Operation</th><th>operator</th><th>user</th><th>auditor</th></tr>
<tr><td colspan="3">Modify Password</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="3">PQ Insight</td><td>✓</td><td rowspan="5">View Only</td><td>×</td></tr>
<tr><td colspan="3">Metering</td><td rowspan="3">✓
(View and Export)</td><td>×</td></tr>
<tr><td colspan="3">Power Quality</td><td>×</td></tr>
<tr><td rowspan="3">Events</td><td colspan="2">Device Log</td><td>×</td></tr>
<tr><td colspan="2">SOE Log</td><td rowspan="2">✓</td><td>×</td></tr>
<tr><td colspan="2">PQ Counter</td><td>×</td></tr>
<tr><td>Events</td><td colspan="2">Audit Log</td><td>×</td><td>×</td><td>✓</td></tr>
<tr><td rowspan="11">Setup</td><td colspan="2">Basic</td><td rowspan="11">✓
(View and Config.)</td><td rowspan="11">View Only</td><td>×</td></tr>
<tr><td colspan="2">PQ</td><td>×</td></tr>
<tr><td colspan="2">Dmd. & Energy</td><td>×</td></tr>
<tr><td colspan="2">Record</td><td>×</td></tr>
<tr><td colspan="2">Setpoint</td><td>×</td></tr>
<tr><td colspan="2">I/O</td><td>×</td></tr>
<tr><td rowspan="2">Others</td><td>Alarm Email</td><td>×</td></tr>
<tr><td>Advanced</td><td>×</td></tr>
<tr><td rowspan="3">Diagnostics</td><td>Device & Site Info.</td><td>×</td></tr>
<tr><td>User Management</td><td>✓ (only adding and deleting user account)</td><td>×</td><td>×</td></tr>
<tr><td>Maintenance</td><td>✓</td><td>×</td><td>×</td></tr>
</table>

Table 3-5 Accounts Authorities

5) The **PQ Insight** page (first page displayed upon user login) appears after login. There are five items at the **Title Bar** - **PQ Insight**, **Metering, Power Quality, Events** and **Setup.**



Figure 3-66 Title Bar

6) The Web Interface's login password can be changed by clicking on the down arrow at the upper right-hand corner of the page and then selecting **Change Password** as shown below.



Figure 3-67 Change Web Interface Login Password

3.2.4.1 PQ Insight

The **Waveform** under **PQ Insight** menu is the first page displayed upon user login and includes following information and operations:

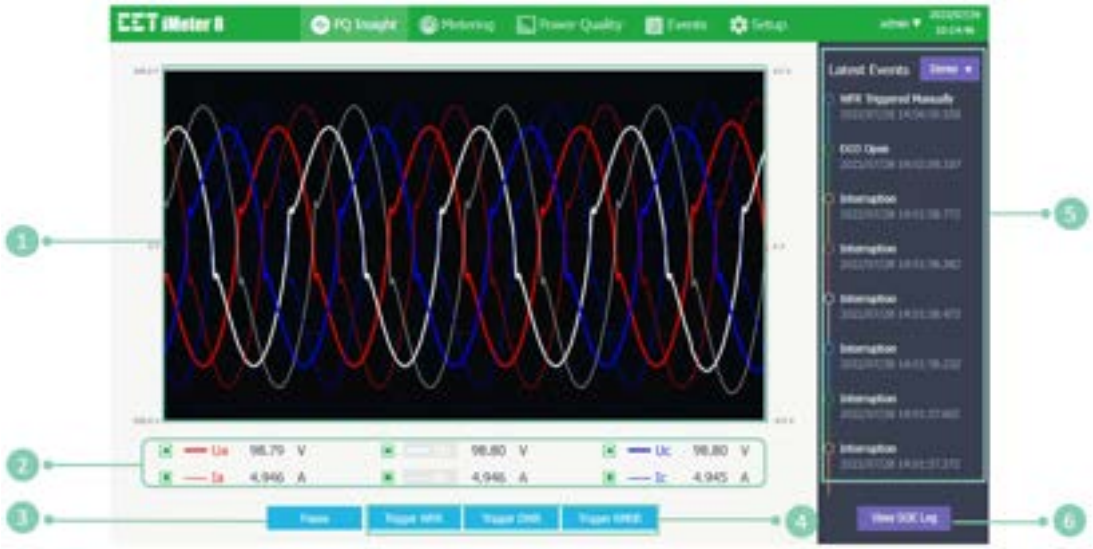


Figure 3-68 PQ Insight of Web Interface

1	Voltage & Current Waveforms
2	Select/De-select Voltage/Current Channels by clicking check box
3	Toggle between <**Pause**> & <**Refresh**> for waveform update
4	Manual Trigger WFR/DWR/RMSR/iTrigger 1/iTrigger 2/iTrigger 3
5	Latest 8 SOE Events
6	Enter **SOE Log** page (Display if there are 8 SOE Events in the **Latest Events** area)

Table 3-6 PQ Insight

3.2.4.2 Metering

Click **Metering** on the **Title Bar** and its sub-menus appear on the left-hand pane which includes **Phasor**, **Basic, Energy, Demand, TOU, Max./Min.** and **I/O.** The following sections provide a quick overview for these sub-menus.

3.2.4.2.1 Phasor

Click **Phasor** on the left-hand pane and the following screen appears which displays the Phasor diagram, Magnitude and Phase Angles for Ua/Ub/Uc (3P4W) or Uab/Ubc/Uca (3P3W) and Ia/Ib/Ic as well as Frequency. Click **Export** to save the Phasor data to a .csv file at the default download folder of the Web Browser.

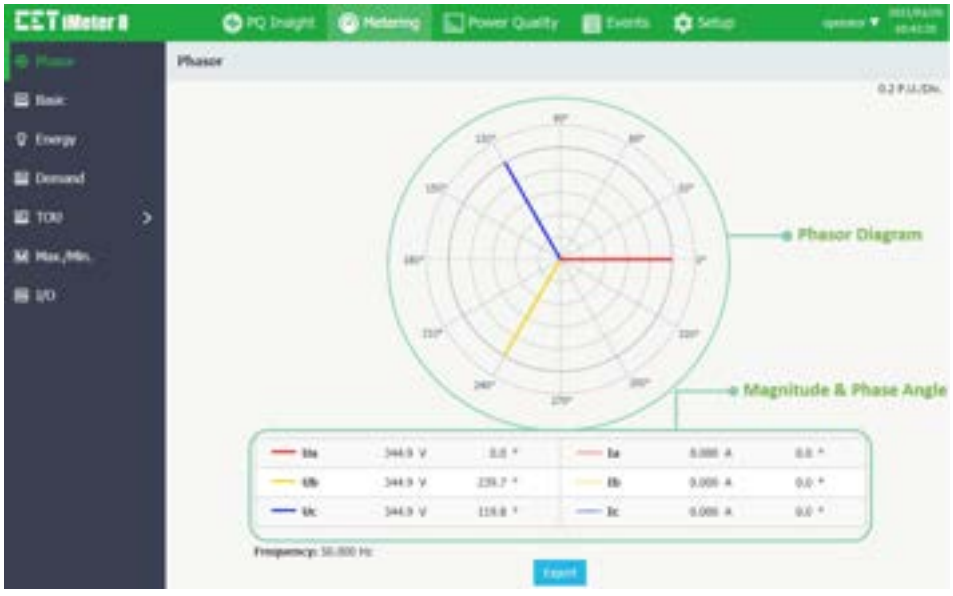


Figure 3-69 Phasor Interface

3.2.4.2.2 Basic

Click **Basic** on the left-hand pane and the following screen appears which shows the basic real-time readings for 3-Ø Voltages, Currents, Powers, Power Factors as well as U4, I4, I5 and Frequency. Click **Export** to save the data on this page to a .csv file at the default download folder of the Web Browser.

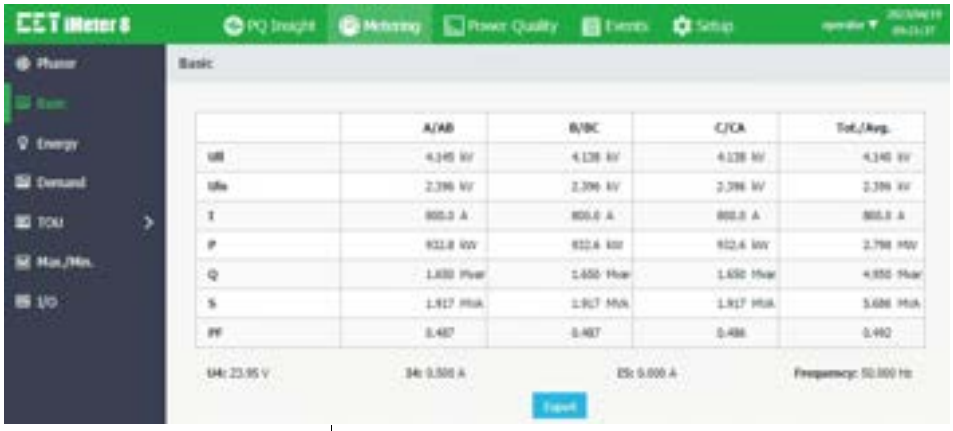


Figure 3-70 Basic Interface

3.2.4.2.3 Energy

Click **Energy** on the left-hand pane and the following screen appears which shows the **RMS, Fundamental** and **Harmonics** kWh/kvarh for **Import/Export/Net/Total** as well as **Apparent** Energy for the total of 3 Phases.

Click **Active** or **Reactive** from the drop-down list to switch between Active/Reactive Energy displays.

Click **Export** to save the Energy information to a .csv file at the default download folder.

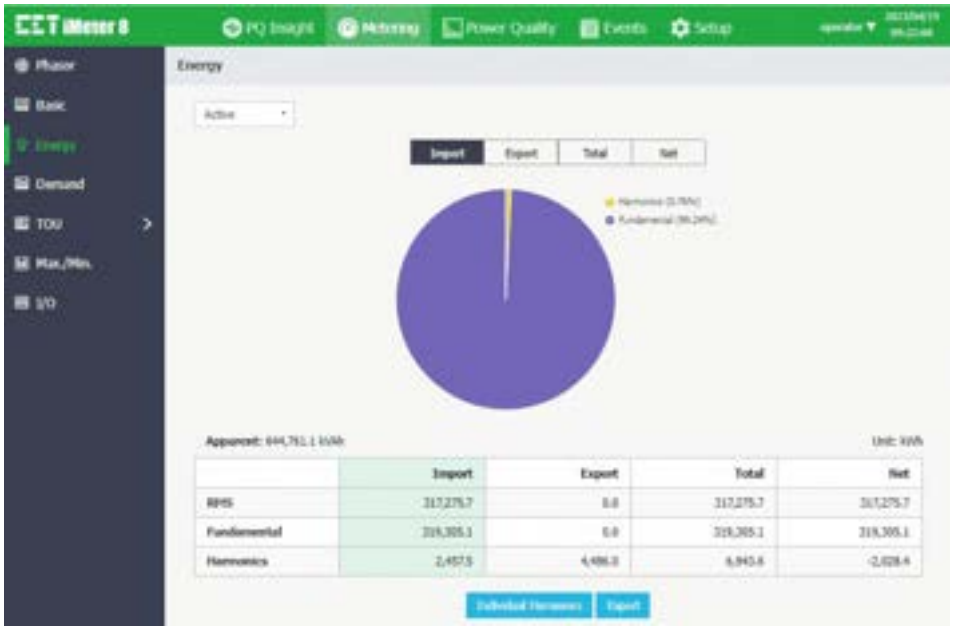


Figure 3-71 Energy Web Interface

Click **Individual Harmonics** and the following pages are available which display Harmonic Energy in spectrum or table format for kWh, kvarh Imp./Exp. by selecting **Spectrum** or **Table** from the top left drop-down list.

- **Spectrum** Move the mouse pointer over a particular histogram to show its harmonic order and value. Click on the **kWh Imp.**, **kWh Exp.**, **kvarh Imp.**, **kvarh Exp.** tab at the top to view the respective Harmonic Energy spectrums.

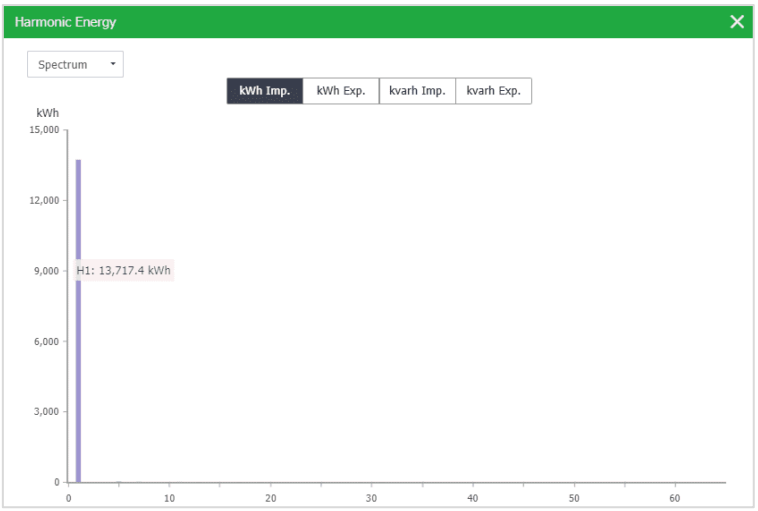
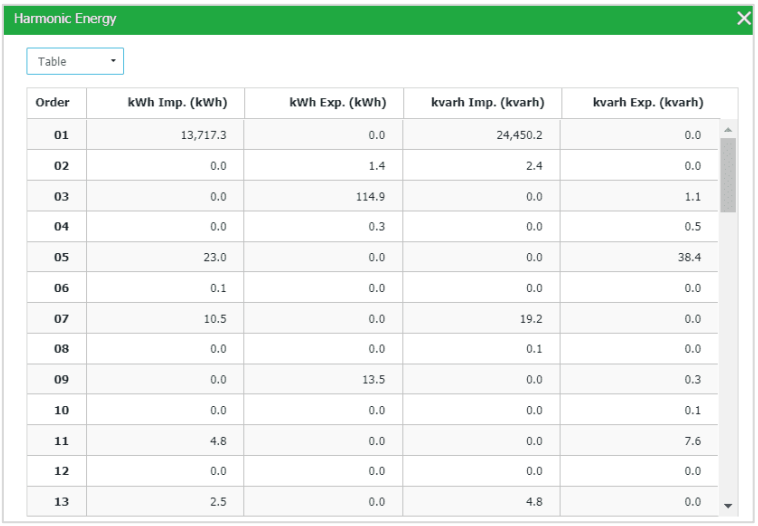


Figure 3-72 Individual Harmonics Spectrum Web Interface

- **Table**



Order	kWh Imp. (kWh)	kWh Exp. (kWh)	kvarh Imp. (kvarh)	kvarh Exp. (kvarh)
01	13,717.3	0.0	24,450.2	0.0
02	0.0	1.4	2.4	0.0
03	0.0	114.9	0.0	1.1
04	0.0	0.3	0.0	0.5
05	23.0	0.0	0.0	38.4
06	0.1	0.0	0.0	0.0
07	10.5	0.0	19.2	0.0
08	0.0	0.0	0.1	0.0
09	0.0	13.5	0.0	0.3
10	0.0	0.0	0.0	0.1
11	4.8	0.0	0.0	7.6
12	0.0	0.0	0.0	0.0
13	2.5	0.0	4.8	0.0

Figure 3-73 Individual Harmonics Table Web Interface

3.2.4.2.4 Demand

Click **Demand** on the left-hand pane and the following screen appears which shows the readings for **Present** (Present Demand), **Predicted** (Predicted Demand), **This Max.** and **Last Max.** Depending on the setting of the **Self-Read Time**, **This Max.** and **Last Max.** could mean the Max. Demand of This Month/Last Month or Since/Before Last Reset. Move the mouse pointer over the readings for **This Max.** and **Last Max.** to show the corresponding timestamp.

Click **Reset This Max.** (available for **Operator** only) to manually reset the Max. Demand of This Month or Since Last Reset. It should be noted that it's not possible to manually reset the **Last Max.**, which is the Max. Demand of Last Month or Before Last Reset.

Click **Export** to save the demand data on this page to a .csv file at the default download folder.

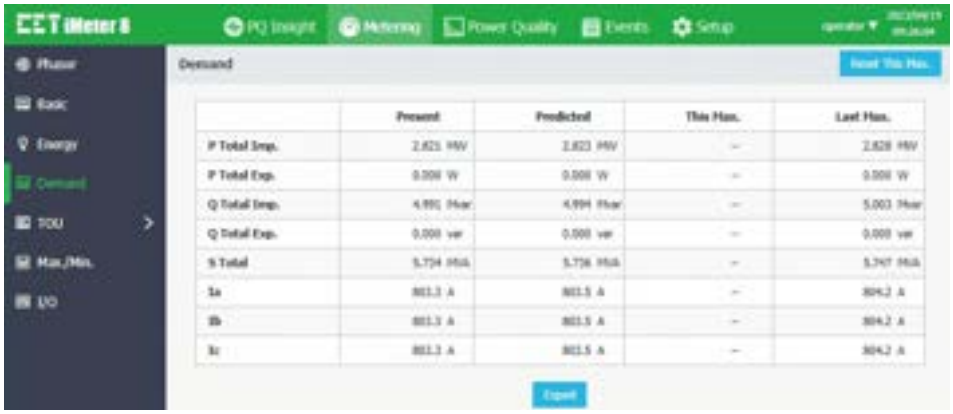


Figure 3-74 Demand Interface

3.2.4.2.5 TOU

Click **TOU** on the left-hand pane to view the **Real Time, Freeze Record** and **Historical Record** TOU information**.**

3.2.4.2.5.1 Real Time

The **TOU / Real Time** page displays the present TOU information, including **Energy** and **Max. Demand** for all 8 Tariffs. The **Present Schedule, Present Tariff, Present Season** and **Present Daily Profile** are displayed at the top of the page.

Click **Switch Schedule** to manually switch between Schedules of TOU1 and TOU2.

Click **Export** to save the Real Time TOU data to a .csv file at default download folder.

Click **Freeze** to take a momentary snapshot of the TOU Energy and Max. Demand, the freeze data can be viewed via **Freeze Record** sub-menu (see **3.2.4.2.5.2 Freeze Record**).

- **Energy** Select from the drop-down list underneath Present Tariff to display the respective Tariff information for **kWh Imp.**, **kWh Exp.**, **kvarh Imp.**, **kvarh Exp.** and **kVAh**.

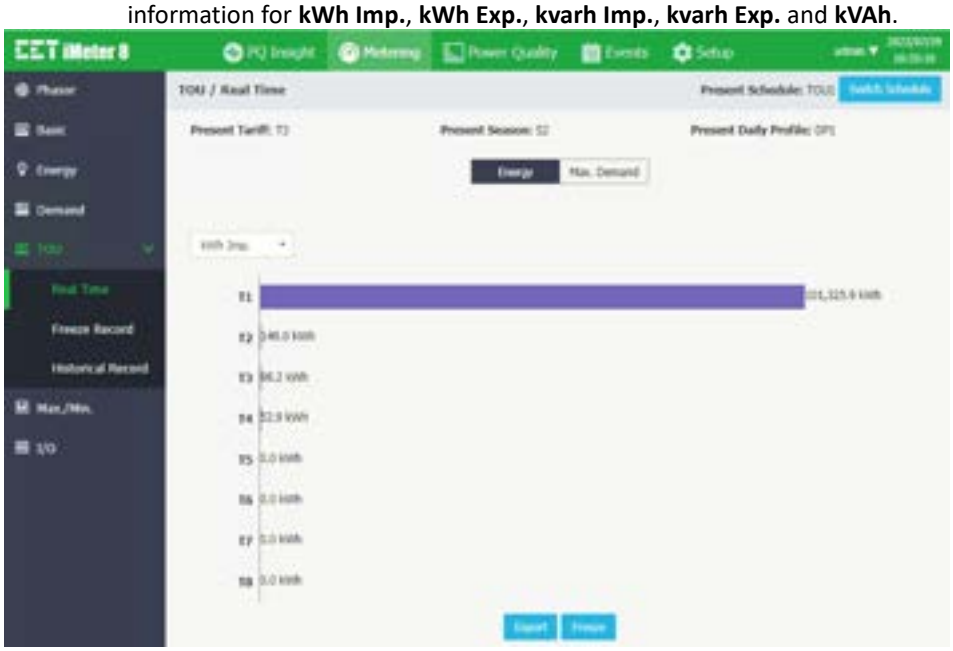


Figure 3-75 Real Time TOU Interfaces

- **Max. Demand** Select from the drop-down list underneath Present Tariff to display the respective Tariff information for **P Imp.**, **P Exp.**, **Q Imp**. and **Q Exp**.



Figure 3-76 Real Time TOU Max. Demand

3.2.4.2.5.2 Freeze Record

The iMeter 8 provides a **Freeze Record** with timestamp for the Energy and Max. Demand generated momentarily after the manual **Freeze** operation from the **TOU > Real Time** interface.

Click **Export** to save the **Freeze Record** data to a .csv file at the default download folder.



Figure 3-77 Freeze TOU Record Interfaces

3.2.4.2.5.3 Historical Record

The iMeter 8 can restore up to 12 Historical Records with timestamp based on the FIFO principle. The **Historical Record** includes PF Total, TOU Energy and Max. Demand for the 8 Tariffs. When the **TOU Record Self-Read Time** is set to **Auto**, the **Historical Record** is generated monthly at the pre-defined **Self-Read Time.** It can also be manually generated by clicking on the **Trigger TOU Recording** button at the top right. Click **Export** to save the currently displayed **Historical Record** to a .csv file at the default download folder.



Figure 3-78 Historical Record TOU Record Interfaces

3.2.4.2.6 Max./Min.

Click **Max./Min.** on the left-hand pane and the following screen appears which displays the 4 groups of Max./Min. Recorder with timestamps.

Select **Max. Log/Min. Log** and Log #1 to Log #4 from the drop-down list to display Max./Min. Recorders of configured parameters.

Click **Export** to save the specific group of **Max.** or **Min.** data displayed on the current page to a .csv file at the default download folder.

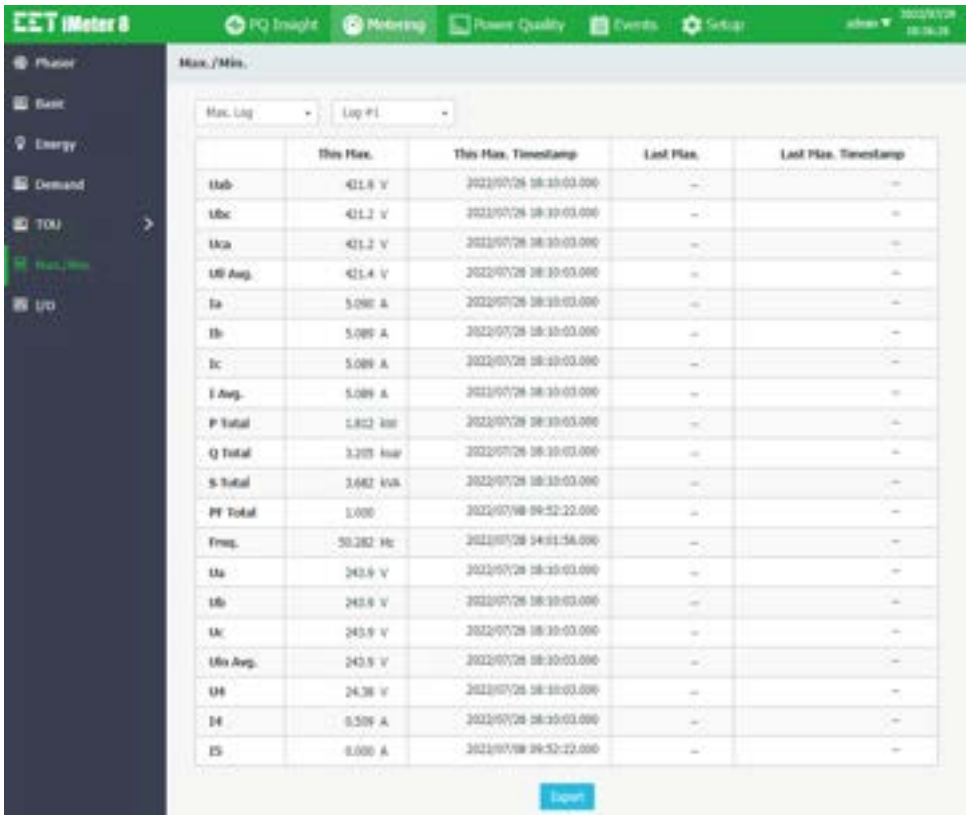


Figure 3-79 Max./Min. Interface

3.2.4.2.7 I/O

Click **I/O** on the left-hand pane and following screen appears which displays the I/O function and status.

The iMeter 8 can be equipped optional with 16 DIs, 8 DOs and 2 AIs, the I/O page will display corresponding information accordingly.

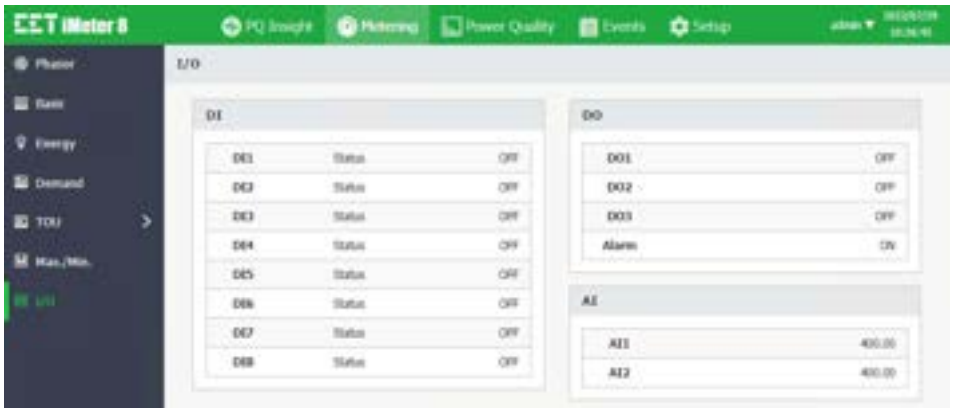


Figure 3-80 I/O Interface

3.2.4.3 Power Quality

Click **Power Quality** at the **Title Bar** and its sub-menus appear on the left-hand pane which includes **Harmonics, Interhamonics, 2kHz-150kHz C.E.** (optional), **Deviation, Seq. & Unb., Flicker, EN50160** and **IEEE Std 519**. The following sections provide a quick overview of these web pages.

3.2.4.3.1 Harmonics

Click **Harmonics** on the left-hand pane and the following screen appears which displays up to 63rd harmonic Spectrum for the following parameter: **THD, TOHD, TEHD, Crest Factor, K-Factor, TDD, TDD Odd** and **TDD Even**.

Click **Ua**, **Ub**, **Uc**, **U4**, **Ia**, **Ib**, **Ic** and **I4** tabs to view respective Harmonics data. Move the mouse pointer over a particular histogram to show its harmonic order and value.

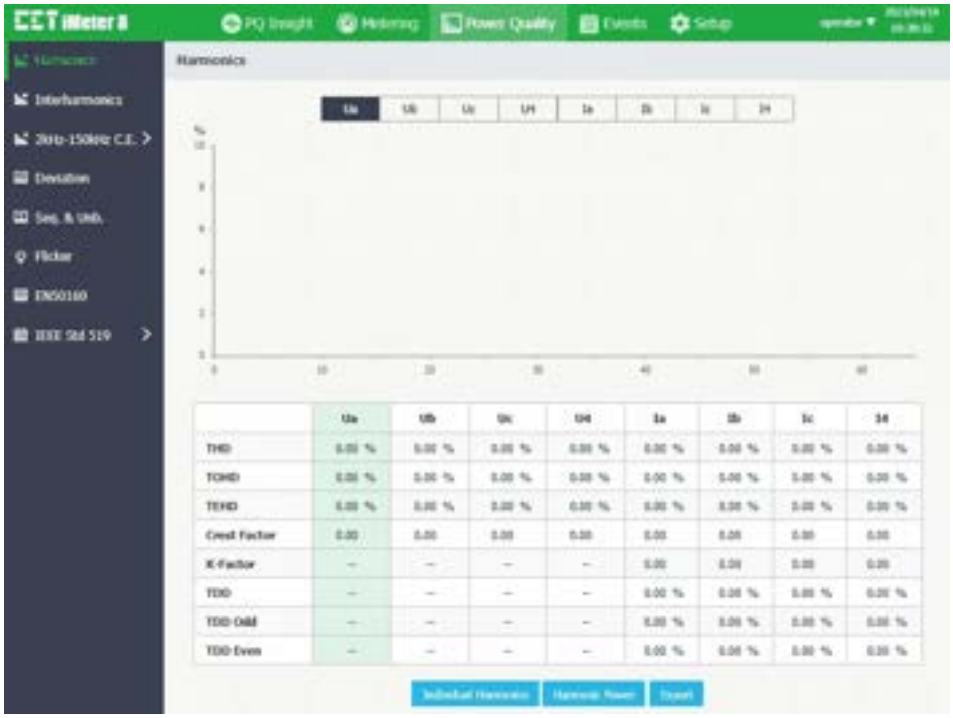


Figure 3-81 Harmonics Interface

- Click **Individual Harmonics** at the bottom of the page to view the **%HD**, **RMS** and **Angle** for 4-phase Voltages and Currents in a table format.
  Click **Harmonic Power** at the bottom of the page to display the individual harmonic measurements for

3-phase P, Q, S and PF in a table format.

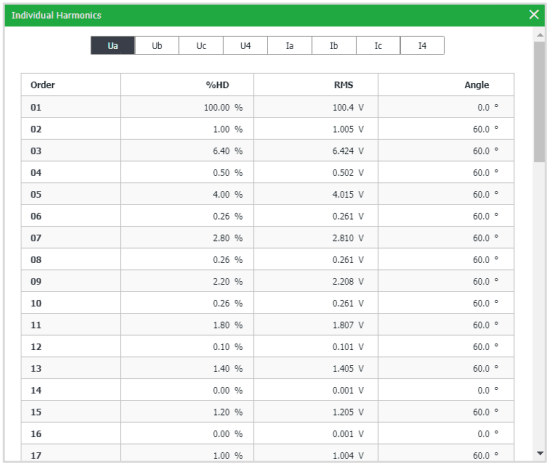


Figure 3-82 %HD, RMS and Angle Interface



Figure 3-83 Harmonic Power Interface

Click **Export** to export all the harmonic data to a .csv file at the default download folder.

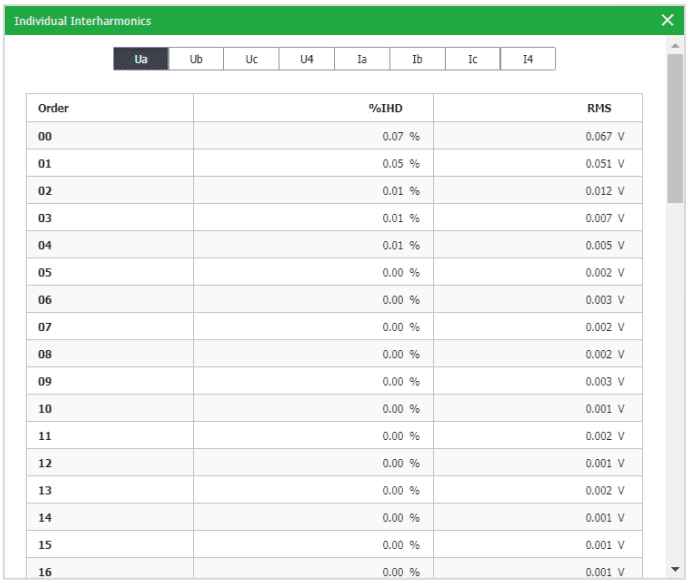
3.2.4.3.2 Interharmonics

Click **Interharmonics** on the left-hand pane and the following screen appears which displays up to 63rd interharmonics Spectrum for 4-phase Voltages and Currents **TIHD/TOIHD/TEIHD**. Move the mouse pointer over a particular histogram to show its interharmonic order and value.



Figure 3-84 Interharmonic Interface

Click **Individual Interharmonics** at the bottom of the page to view the data in a table format.



Order	%IHD	RMS
00	0.07 %	0.067 V
01	0.05 %	0.051 V
02	0.01 %	0.012 V
03	0.01 %	0.007 V
04	0.01 %	0.005 V
05	0.00 %	0.002 V
06	0.00 %	0.003 V
07	0.00 %	0.002 V
08	0.00 %	0.002 V
09	0.00 %	0.003 V
10	0.00 %	0.001 V
11	0.00 %	0.002 V
12	0.00 %	0.001 V
13	0.00 %	0.002 V
14	0.00 %	0.001 V
15	0.00 %	0.001 V
16	0.00 %	0.001 V

Figure 3-85 Individual Interharmonics

Click **Export** to export all the Interharmonic data to a .csv file at the default download folder.

3.2.4.3.3 (Optional) 2kHz-150kHz C.E.

Click **2kHz-150kHz C.E.** on the left-hand pane to expand its sub-menu – **Real Time** and **Daily Heat Map.**

3.2.4.3.3.1 Real Time

Click Real Time on the left-hand pane and the following screen appears which displays 3-phase U_{rms} C.E. at 3s resolution for 2kHz~9kHz & 9kHz~150kHz frequency ranges. The iMeter 8 with firmware V2.50.51 or later provides I_{rms} C.E. at 3s resolution for 2kHz~9kHz frequency range.

Click **Export** to export data displayed on the current page to a .csv file at the default download folder.



Figure 3-86 2kHz-150kHz Real Time Interface

3.2.4.3.3.2 Daily Heat Map

Click **Daily Heat Map** on the left-hand pane and the following screen appears which displays the Max., Min., Avg. and CP95 values of 3-phase U_{rms} and I_{rms} (only 2kHz~9kHz range) with timestamps in a specific day.

Click **Max.**, **Min.**, **Avg**. and **CP95** tabs at the top of the page to view respective data.

Click **Export** to save the currently displayed U_{rms} value and 24-hour C.E. with an interval of 1-minute to a .csv file at the default download folder.

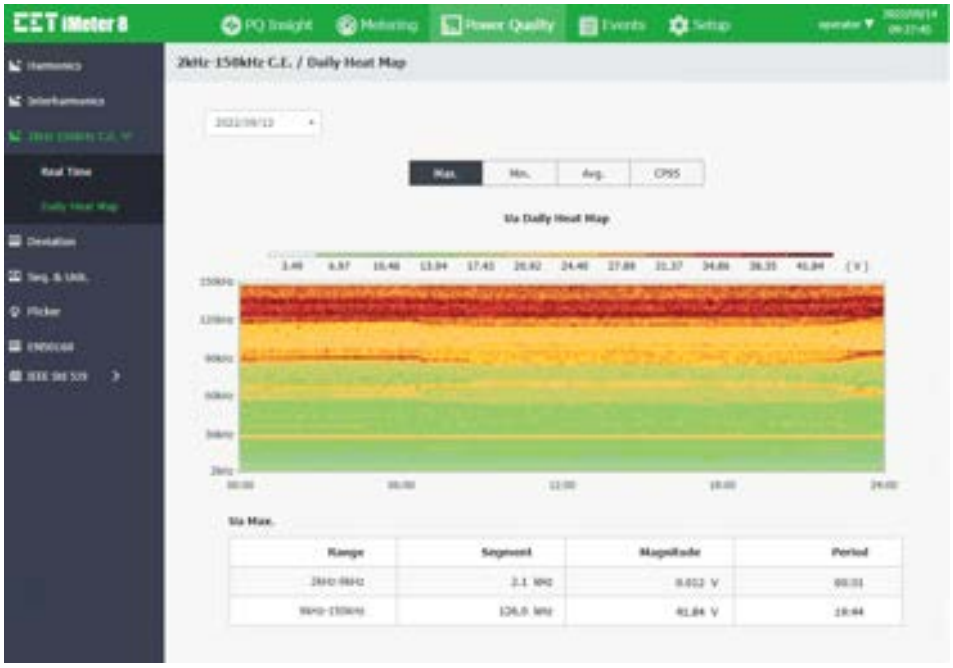


Figure 3-87 Ua Daily Heat Map Interface



Figure 3-88 Ia Daily Heat Map Interface

3.2.4.3.4 Deviation

Click **Deviation** on the left-hand pane to display **Over/Under Deviation** measurements for 3-phase ULL and ULN as well as **Frequency Deviation**.

Click **Export** to save the data to a .csv file at the default download folder.

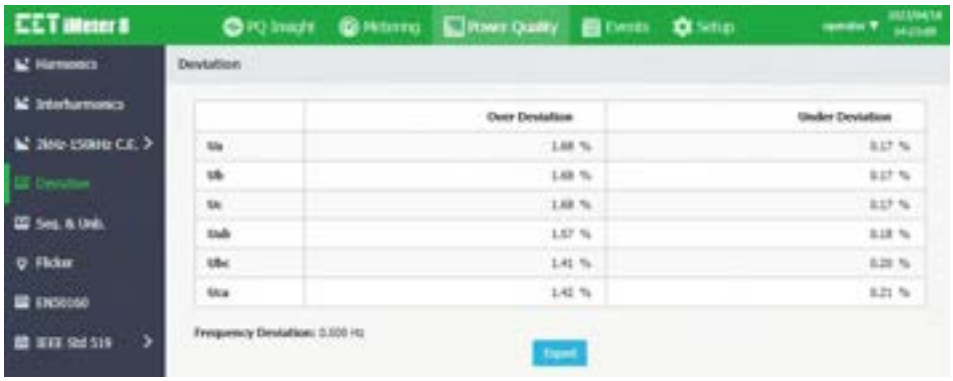


Figure 3-89 Deviation Interface

3.2.4.3.5 Seq. & Unb.

Click **Seq. & Unb.** on the left-hand pane to display Negative and Zero Sequence Unbalance as well as the Positive, Negative and Zero Sequence measurements for Voltage and Current.

Click **Export** to save the data to a .csv file at the default download Folder.

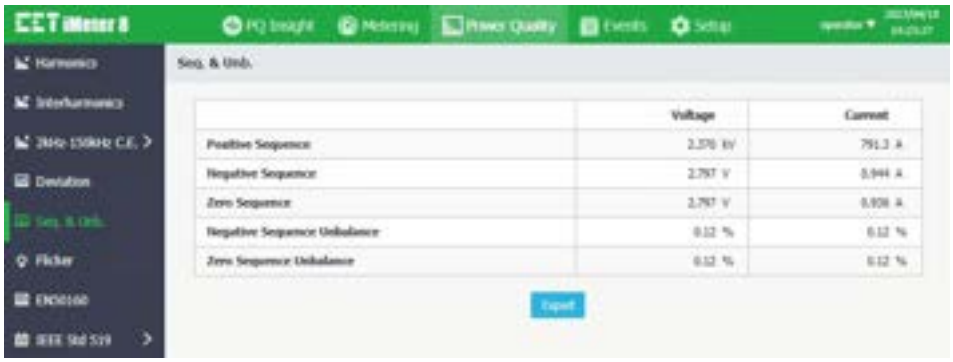


Figure 3-90 Seq. & Unb. Interface

3.2.4.3.6 Flicker

Click **Flicker** on the left-hand pane to display the **Pst/Plt** measurements for 3-phase Voltages. Click **Export** to save the data to a .csv file at the default download folder.

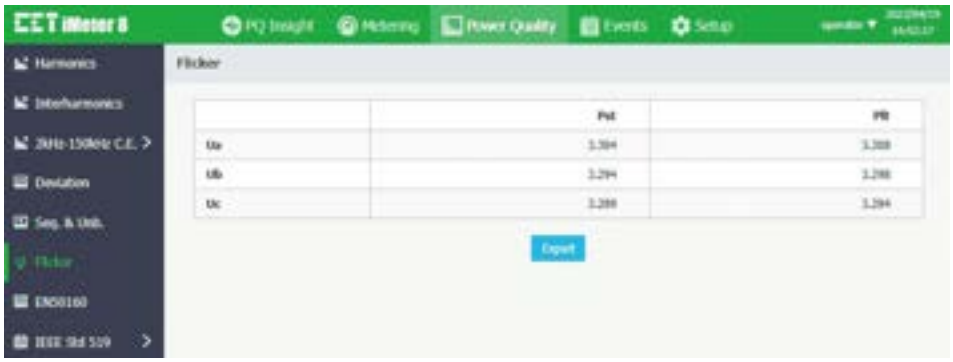


Figure 3-91 Flicker Interfaces

3.2.4.3.7 EN50160

Click **EN50160** on the left-hand pane and the following screen appears. Click on the drop-down list on the top left to select the period for the desired EN50160 Summary Report. As shown in **Figure 3-92**, ✓ denotes the positive evaluation while ✗ denotes the negative evaluation for the parameter. Click on a particular parameter to view the report details. Click **Export** to download the EN50160 Report file for the currently selected period.

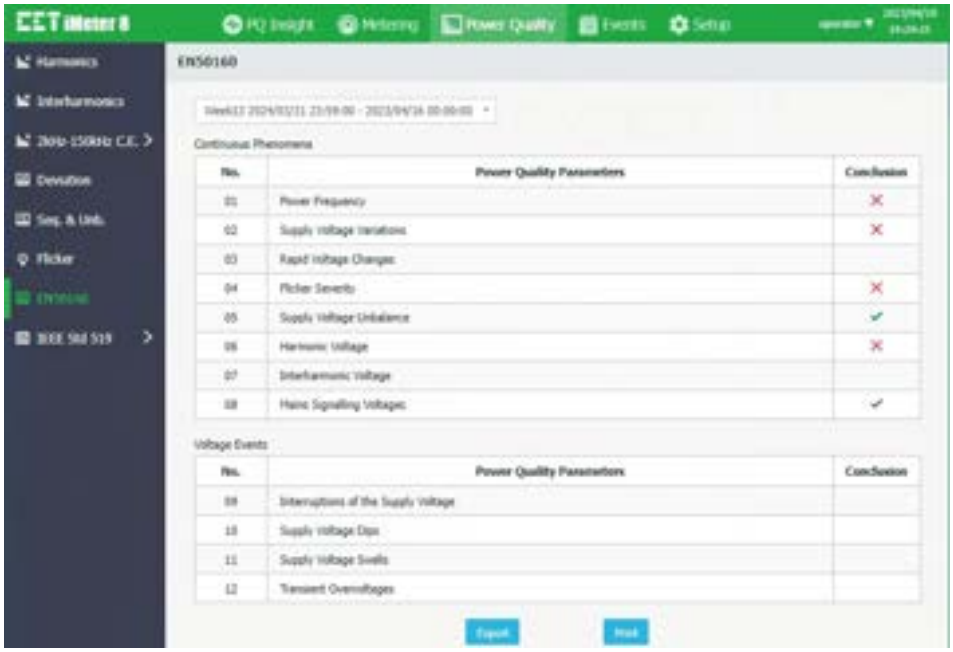


Figure 3-92 EN50160 Interfaces and Parameters' Details

The following screenshots provide a quick overview of the summary details for each parameter.

- **Power Frequency**



Figure 3-93 Power Frequency

- **Supply Voltage Variations**



Figure 3-94 Supply Voltage Variations

- **Rapid Voltage Changes**



Figure 3-95 Rapid Voltage Changes

- **Flicker Severity**



Figure 3-96 Flicker Severity

- **Supply Voltage Unbalance**



Figure 3-97 Supply Voltage Unbalance

- **Harmonic/Interharmonic Voltage**

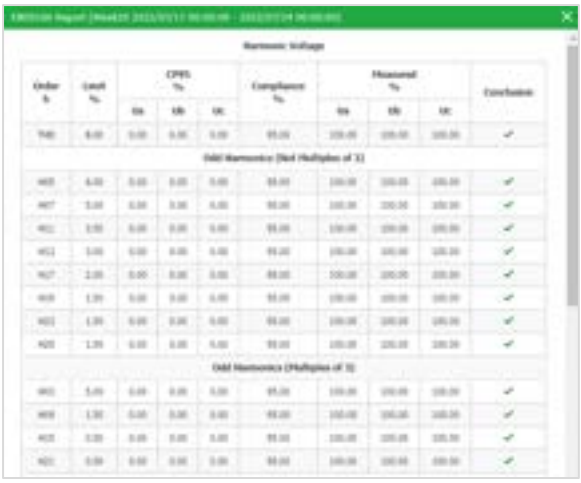


Figure 3-98 Harmonic Voltage

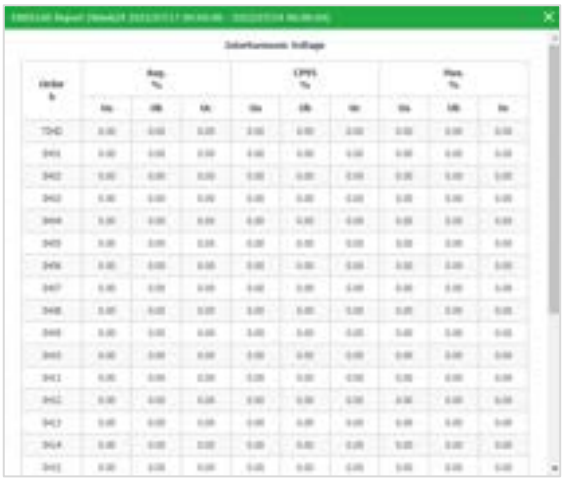


Figure 3-99 Interharmonic Voltage

- **Mains Signalling Voltages**



Figure 3-100 Mains Signalling Voltages

- **Interruptions of the Supply Voltage**



Figure 3-101 Interruptions of the Supply Voltage

- **Supply Voltage Dips**

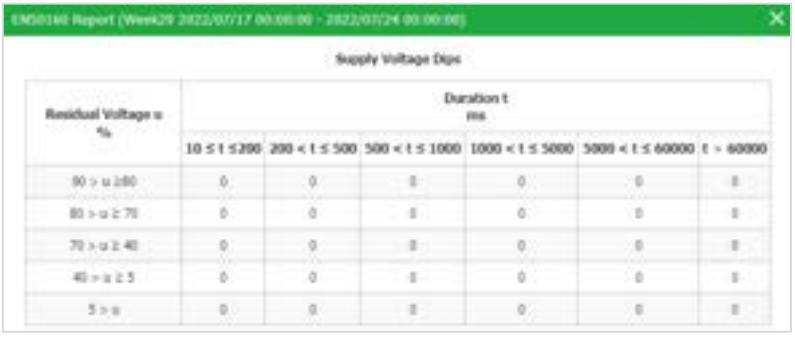


Figure 3-102 Supply Voltage Dips

- **Supply Voltage Swells**



Figure 3-103 Supply Voltage Swells

- **Transient Overvoltages**



Figure 3-104 Transient Overvoltages

Click **Print** to open the preview window. Then click **Print** at the top of the window to confirm the printing of the report, which includes the conclusion page and the details page for each item.



Figure 3-105 Preview for Printing EN50160 Report

3.2.4.3.8 IEEE Std 519

Click **IEEE Std 519** on the left-hand pane and the **Weekly Report** screen appears. Click on the drop-down list on the top left to select the period for the desired IEEE Std 519 Report. As shown in figure below, ✓ denotes the positive evaluation while ✗ denotes the negative evaluation for the parameter. Click on a particular parameter to view the report details Click **Export** to download the IEEE Std 519-2022 Weekly Report_Weekxx.xls or IEEE Std 519-2022 Daily Report_YYYYMMDD.xls file for the currently selected period.

3.2.4.3.8.1 Weekly Report



Figure 3-106 Voltage Harmonics IEEE Std 519 Weekly Report

3.2.4.3.8.2 Daily Report

Click on **Daily Report** under **IEEE Std 519**, and the Voltage Harmonics report for a specified date will be displayed**.** Click the **Current Harmonics** tab to show Current Harmonics report.

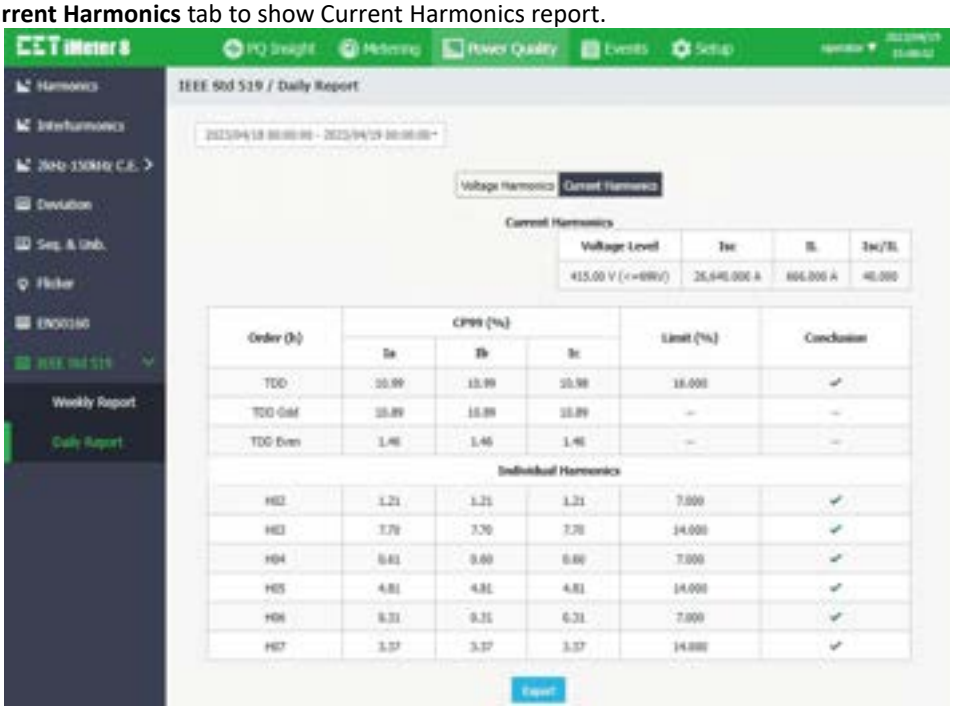


Figure 3-107 Current Harmonics IEEE Std 519 Daily Report

3.2.4.4 Events

Click **Events** at the **Title Bar** and its sub-menu appear on the left-hand pane which includes **SOE Log, Device Log** and **PQ Counters**. The following sections provide a quick overview of these web pages.

3.2.4.4.1 SOE Log

Click **SOE Log** on the left-hand pane to display the SOE Log on the right-hand pane starting with the most recent events. The interface supports the following filtering mechanism.

Search Period: Use the drop-down box on the left to select a specific period.
Event Type: Use the drop-down box in the middle to select a particular event type, including Dip/Swell, Transient, RVC, MSV, Inrush Current, Motor Start, Setpoint, I/O, DR and Waveform.
Keyword: Enter a keyword in the text box on the right to search for events that contain the keyword.

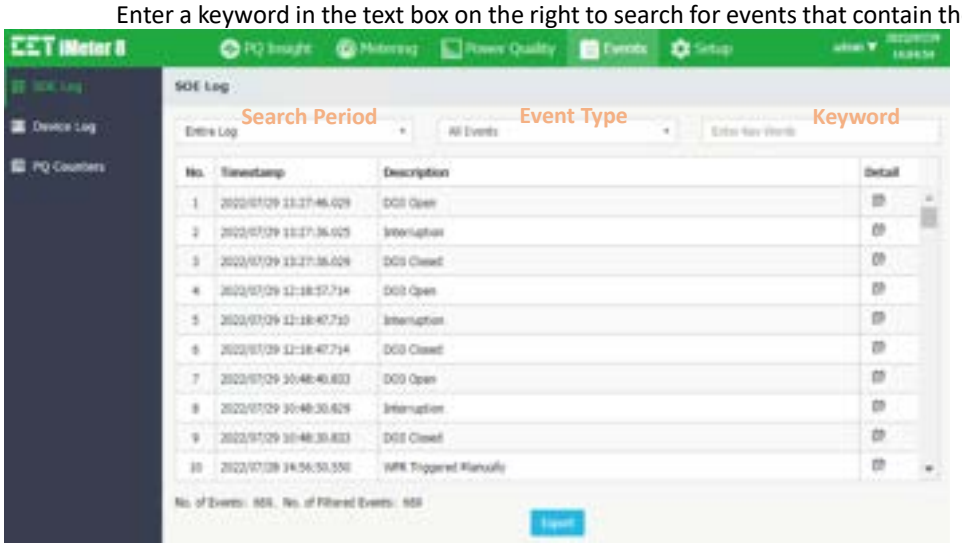


Figure 3-108 SOE Log Interfaces

Click on a specific event to display the event details.

Click **Export** to save all SOE events to a .csv file at the default download folder.

Here are several examples for SOE Log details:

1) DOx Closed



Figure 3-109 DOx Operated by an Interruption Event

2) Setpoint



Figure 3-110 Setpoint

3) Transient



Figure 3-111 Transient

Inside the waveform display, there are four control icons: .

These two icons are used to zoom in and out of the waveforms based on the time scale.

This icon is used to reset the waveform display back to its default resolution.

This icon is used to export the waveform CFG (Configuration) and DAT (Data) file in COMTRADE format to a compressed folder.

There is also a scroll bar at the bottom that allows the waveform to be scrolled forward and backward.

4) When Dips/Swells are configured to trigger WFR/DWR and/or RMSR, the recorded Swell events will have the option of showing the ITIC plot while the Dips/Interruptions events will have the option of showing both the ITIC and SEMI F47 plots, along with the WFR/DWR/RMSR waveform.

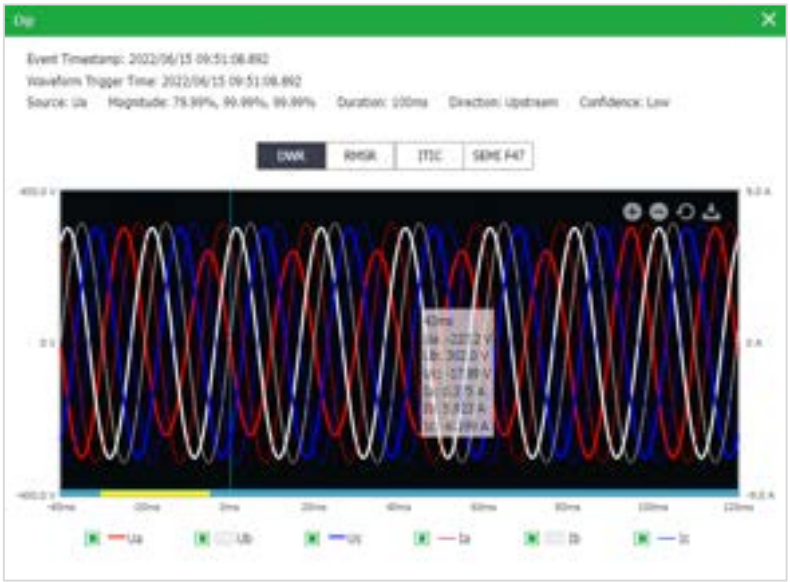


Figure 3-112 Dip Event Interface



Figure 3-113 Dip on ITIC and SEMI F47 Interface

3.2.4.4.2 Device Log

Click **Device Log** on the left-hand pane to display the Device Log on the right-hand pane starting with the most recent events. Also, the interface supports the following filtering mechanism.

Search Period: Use the drop-down box on the left to select a specific period.
Keyword: Enter a keyword in the text box on the right to search for events that contain the keyword.
Click **Export** to save all device logs to a .csv file at the default download folder.

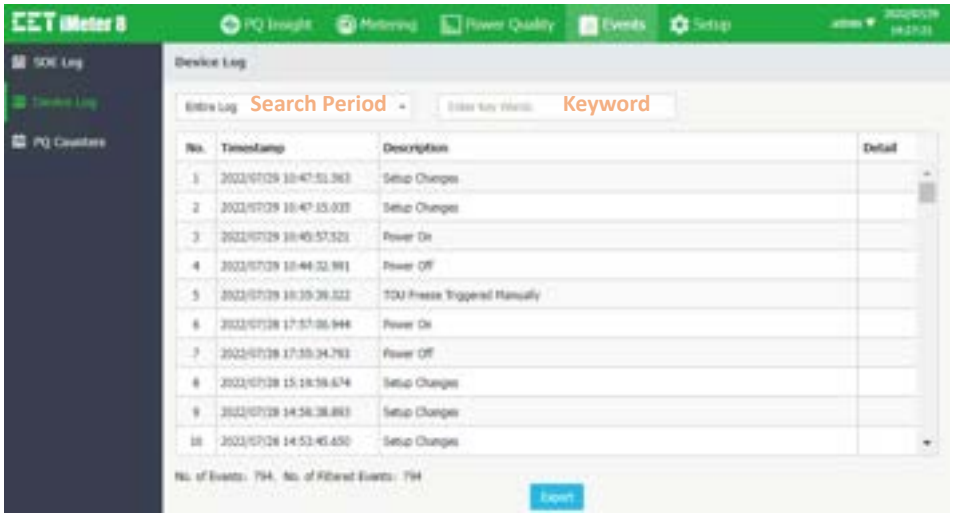


Figure 3-114 Device Log Interface

3.2.4.4.3 PQ Counters

Click **PQ Counters** on the left-hand pane to display different PQ Counters including **Dips, Swells, Interruptions, Transients, RVC, Inrush Current** and 3-levels' **MSV** on the right-hand pane.



Figure 3-115 PQ Counter Interface

3.2.4.4.4 Audit Log

Login the Web Sever as the auditor and the **Audit Log** page display.

Click **Export** to save all Audit Log to a .csv file at the default download folder.

Click **Refresh** to load the latest audit log and click **Clear** to reset the current page.

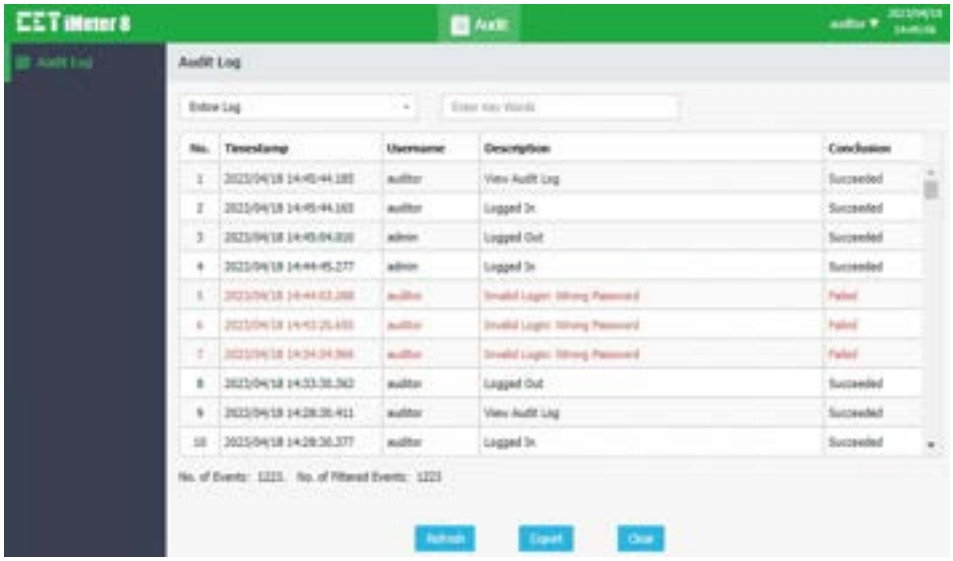


Figure 3-116 Audit Log Interface

3.2.4.5 Setup

Click **Setup** at the **Title Bar** and the web server displays the **Setup Wizard** to guide users to setup the meter quickly.

- **Start**. The user may select **Manual** to setup the meter step-by-step and then click **Next** or choose **Import Template** to restore a previously saved configuration.
  If choose **Import Template**, click **Browse** to select the Setup Template and then click **Next.**



Figure 3-117 Wizard-Start-Manual

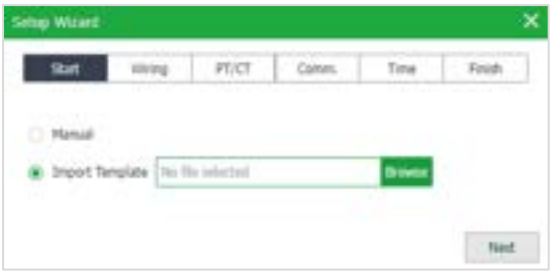


Figure 3-118 Wizard-Start-Import Template

- **Wiring**. Please refer to **Section 3.2.4.5.1.1** to set the wiring mode. Please note that the wiring modes of **1P2W-LL**, **1P2W-LN** and **1P3W** are available only in the iMeter 8 with the Firmware V2.51.50 or later.

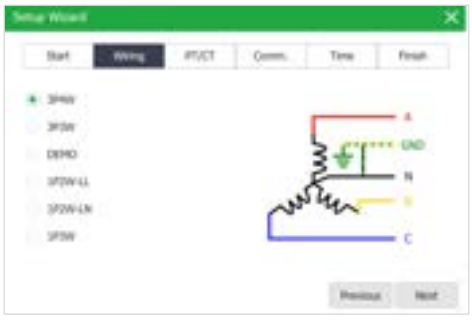


Figure 3-119 Wizard-Wiring

- **PT/CT**. Please refer to **Section 3.2.4.5.1.1** for more information.



Figure 3-120 Wizard-PT/CT

- **Comm.** Please refer to **Section 3.2.4.5.1.2** for more information.



Figure 3-121 Wizard-Comm.

- **Time**. This step provides two methods to set time: manual configuration or synchronization with PC.

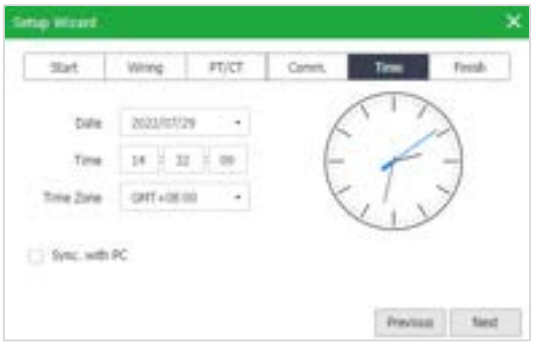


Figure 3-122 Wizard-Time

- **Finish**. Click **Previous** to return to the previous pages or **Finish** to apply the changes and exit the Setup Wizard. Check the **Do not show this Wizard again** box, the **Setup Wizard** won't appear next time.



Figure 3-123 Wizard-Finish

The following sections describe the **Setup** sub-menus which include **Basic**, **PQ**, **Dmd. & Energy**, **Record**, **Setpoint**, **I/O**, **Others** and **Diagnostics**.

3.2.4.5.1 Basic

Click **Basic** on the left-hand pane and the following screen appears which has the four tabs: **Basic, Comm., Time, Fault Monitoring** and **Others**.

3.2.4.5.1.1 Basic

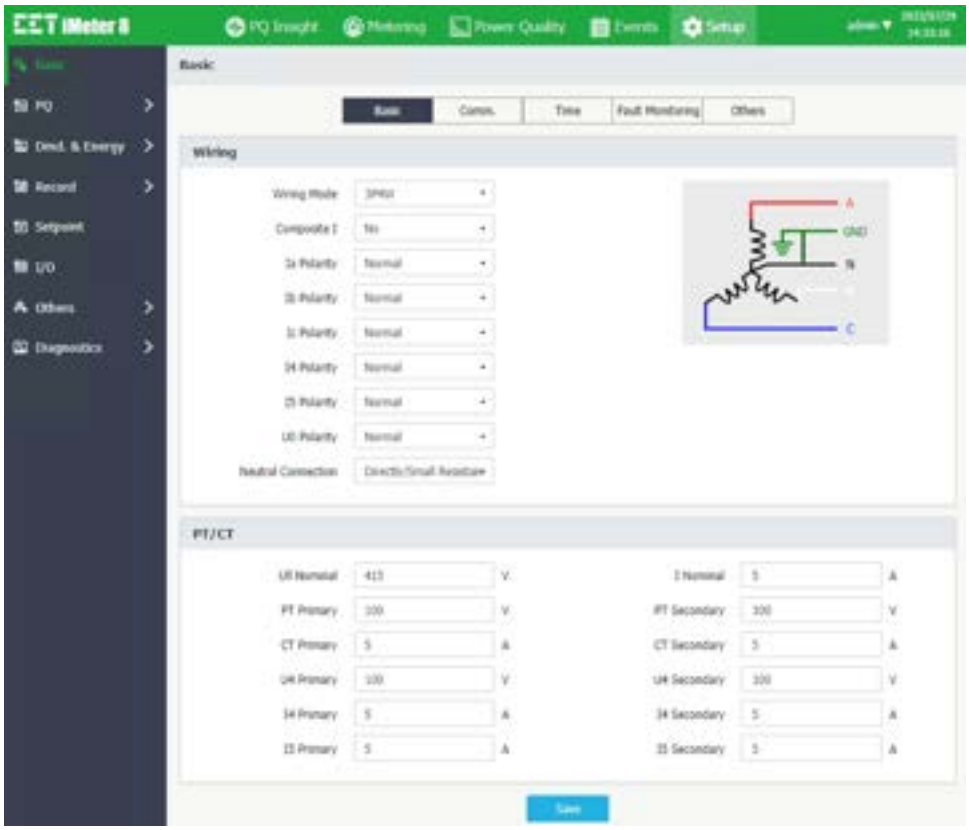


Figure 3-124 Channels Color Settings

The following table illustrates the ranges and default values for each basic setup parameters:

Parameter	Range, Default*	Parameter	Range, Default*
Wiring (Click on the wiring graphics on the right-hand side to set the Channels Color.)			
Wring Mode	3P4W*, 3P3W, DEMO, 1P2W-LL~, 1P2W-LN~, 1P3W~	Composite I	No*, Ia, Ib, Ic
SCCP (Display when the corresponding options are equipped)	5A (50A) @ 10mV/A* 20A @ 10mV/A 200A @ 1mV/A 500A @ 1mV/A 500A (550A) @ 1mV/A 5kA @ 0.1mV/A	Ia/Ib/Ic/I4/I5 Polarity	Normal*, Reverse
U0 Polarity	Normal*, Reverse	Neutral Connection	• Directly/Small Resistance/Reactance* • Ungrounded/High Resistance • Arc Suppression Coil
PT/CT			
ULL Nominal	1 to 1500V, 415*	I Nominal	1 to 10,000A, 5*
PT Primary	1 to 1,000,000V, 100*	PT Secondary	1 to 1500V, 100*
CT Primary	1 to 30,000A, 5*	CT Secondary	1 to 50A, 5*
U4 Primary	1 to 1,000,000V, 100*	U4 Secondary	1 to 1500V, 100*
I4 Primary	1 to 30,000A, 5*	I4 Secondary	1 to 50A, 5*
I5 Primary	1 to 30,000A, 5*	I5 Secondary	1 to 50A, 5*

~ Available in the Firmware V2.51.50 or later

Table 3-7 Basic Parameters Description

3.2.4.5.1.2 Comm.

The iMeter 8 comes standard with two Ethernet ports (P1&P2) and two RS-485 ports (P3&P4).

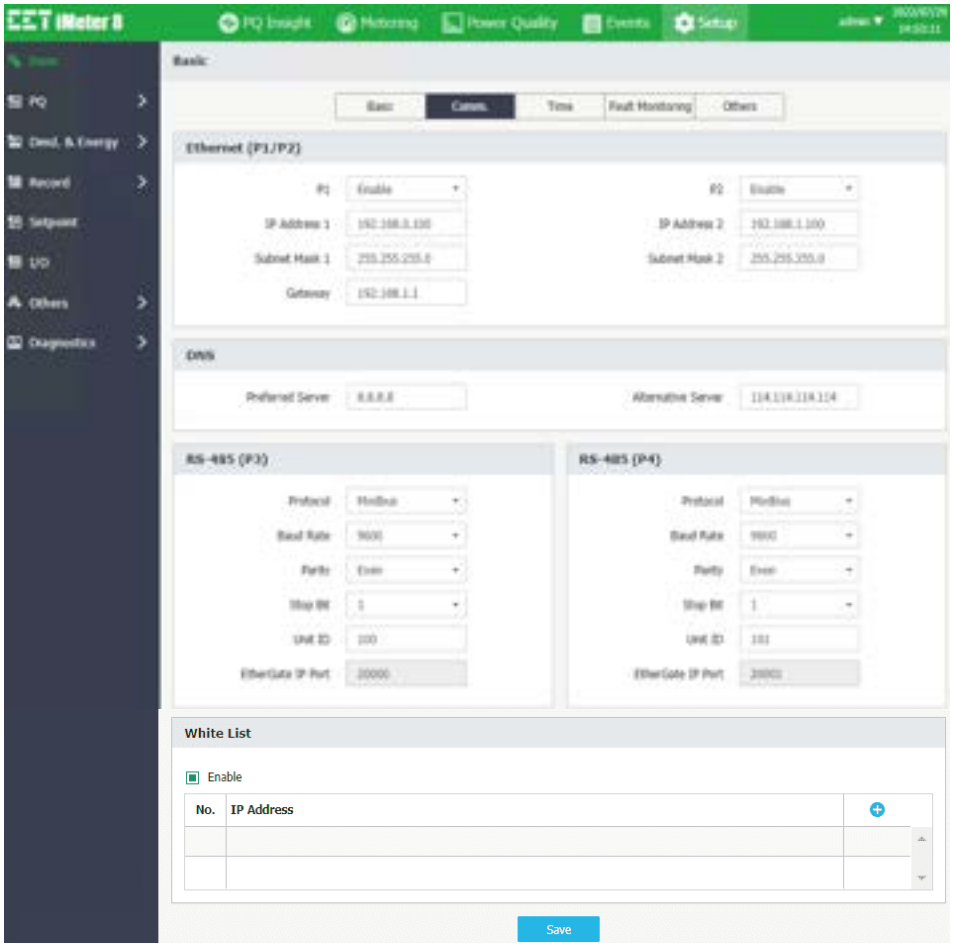


Figure 3-125 Comm. Setup Interface

The following table illustrates the ranges and default values for the Comm. parameter:

Parameter	Range, Default*	Parameter	Range, Default*
Ethernet (P1/P2) Please note that P1 and P2 should not on the same network segment.			
P1	Enable*, Disable	P2	Enable*, Disable
IP Address 1	192.168.0.100*	IP Address 2	192.168.1.100*
Subnet Mask 1	255.255.255.0*	Subnet Mask 2	255.255.255.0*
Gateway	192.168.0.1*		
DNS			
Preferred Server	Specifies the primary DNS Server. 8.8.8.8*	Alternative Server	Specifies the secondary DNS Server. 114.114.114.114*
RS-485 (P3)			
Protocol	Modbus*, EtherGate, Disable	Baud Rate	1200, 2400, 4800, 9600*, 19200, 38400
Parity	None, Odd, Even*	Stop Bit	1*, 2
Unit ID	1 to 247, 100*	EtherGate IP Port	20000~60000, 20000*
RS-485 (P4)			
Protocol	Modbus*, EtherGate, Disable	Baud Rate	1200, 2400, 4800, 9600*, 19200, 38400
Parity	None, Odd, Even*	Stop Bit	1*, 2
Unit ID	1 to 247, 101*	EtherGate IP Port	20000~60000, 20001*
White List			
Enable	Enable access white list, click ⊕ to add an IP Address to the white list and click 🗑 to delete an IP address from the white list.		
IP Address	The IP Address has been added to the white list.		

Table 3-8 Comm. Setup Parameters

3.2.4.5.1.3 Time

The web page shows two areas: **Date** and **Time Sync**. The date and time can be updated manually or synchronized with a local PC by simply checking the **Sync. With PC** box.

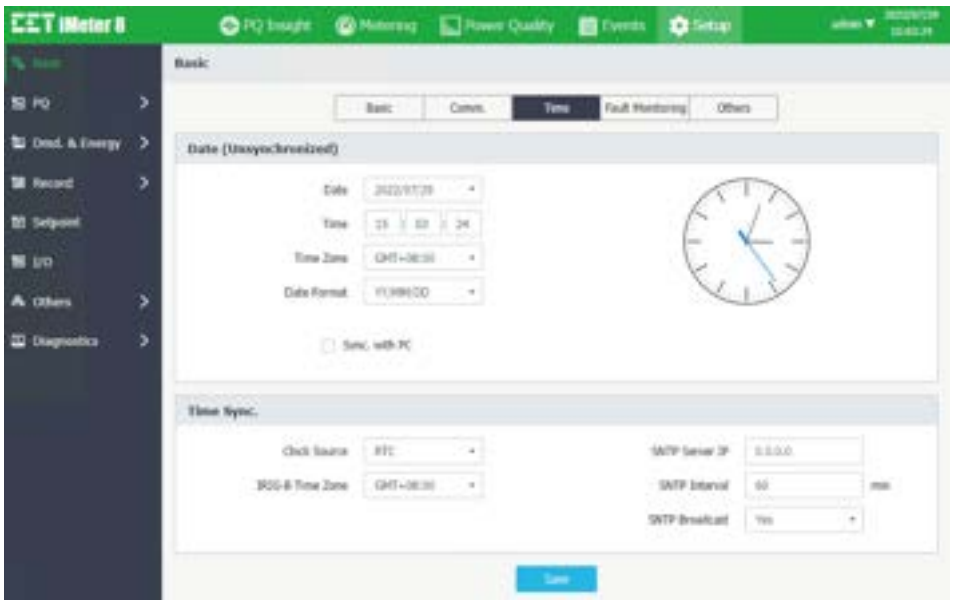


Figure 3-126 Time Setup Interface

The following table illustrates the range for Time parameters where * indicates the default value.

Parameter	Range, Default*	Parameter	Range, Default*
Date		**Time Sync.**	
Date	2000-01-01 to 2037-12-31	Clock Source	RTC*, SNTP, GPS, IRIG-B, 1588 (PTP)-P1, 1588 (PTP)-P2
Time	00:00:00 to 23:59:59	SNTP Server IP	192.168.101.2*
Time Zone	GMT-12:00 to GMT+13:00; GMT+8:00*	IRIG-B Time Zone	GMT-12 to GMT+13; GMT+8*
Date Format	YY/MM/DD, MM/DD/YY, DD/MM/YY, YY-MM-DD*, MM-DD-YY, DD-MM-YY	SNTP Interval	1 to 1440 min, 60 min*
		SNTP Broadcast	Yes*, No

Table 3-9 Date and Time Parameters

3.2.4.5.1.4 Fault Monitoring

This web page allows the users to setup motor start monitoring parameters under **Fault Monitoring**.

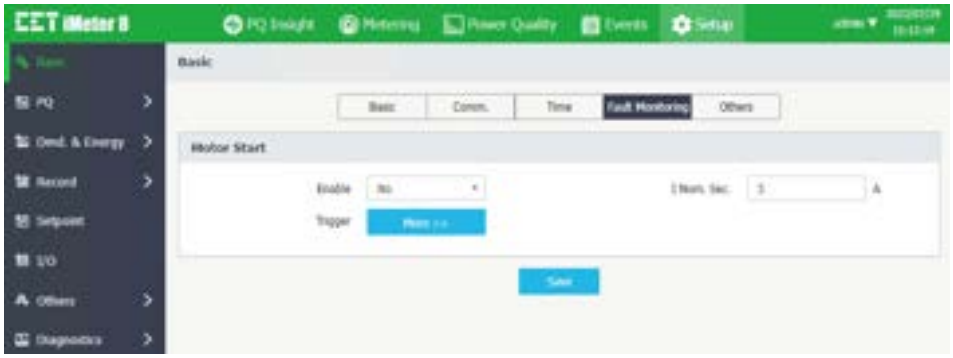


Figure 3-127 Fault Monitoring Parameters Setup Interface

The following table illustrates the range for Motor Start monitoring parameters where * indicates the default value.

Parameter	Range, Default*
Enable	Enable Motor Start monitoring. No*, Yes.
I Nom. Sec.	0.01A~6.00A, 5A*
Trigger	WFR, DWR, RMSR, DOs, iTrigger 1/2/3, DWR & RMSR*

Table 3-10 Fault Monitoring Parameters

3.2.4.5.1.5 Others Setup

This web page allows the users to setup Language, Delimiter and the different parameters under **Algorithm**.



Figure 3-128 Other Parameters Setup Interface

The following table illustrates the setup range for different parameters.

Parameter	Range, Default*
Others	
Language	English*, Simplified Chinese, Traditional Chinese
Delimiter	• 99,999.999*: "," is used as the x1000 delimiter and "." as the decimal point. • 99 999,999: " " is used as the x1000 delimiter and "," as the decimal point.
Algorithm	
PF Convention	IEC*, IEEE, -IEEE
kVA Calculation	Vector*, Scalar
HD Calculation	% of FUND*, % of RMS, % of UN
Harm. Calc. Method	Subgroup*, Group
THD Order	2~63*
TDD Preset IL (Pri.)	0*~30000A (x0.001)
I4 TDD Preset IL (Pri.)	• 0: represents to use the TDD calculation method compatible with the standard TDD calc. in IEEE_519 • non-zero value: it is the preset IL for TDD Calculation As per the IEEE Std 519-2022, *IL = maximum demand load current the PCC (point of common coupling) under normal load operating conditions*

Table 3-11 Other Parameters Setup Range

3.2.4.5.2 PQ Setup

Click **PQ** on the left-hand pane to expand its sub-menus to show **Settings**, **EN50160** and **IEEE Std 519**.

3.2.4.5.2.1 Settings

This web page has six tabs: **PQ Disturbance**, **Transient**, **RVC**, **MSV**, **Inrush Current** and **Flicker**.

- **PQ Disturbance** For more information, please refer to **Section 4.5.6 4.5.6.2**

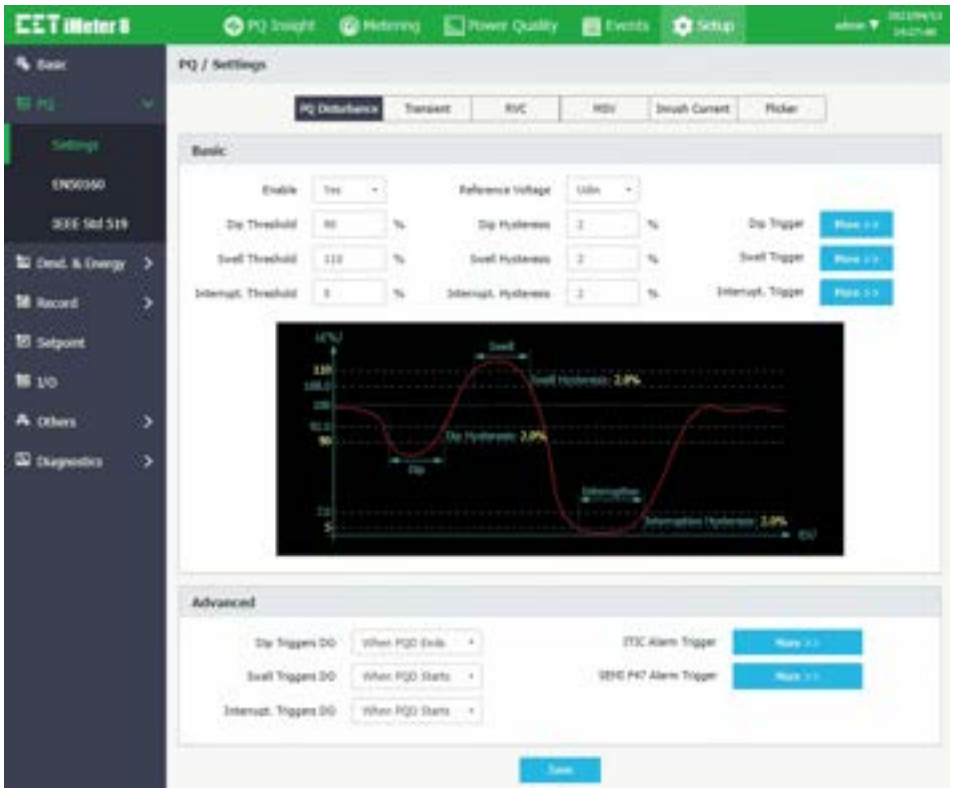


Figure 3-129 PQ Disturbance Setup Interface

- **Transient** For more information, please refer to **Section 4.5.7 .**



Figure 3-130 Transient Setup Interface

- **RVC** For more information, please refer to **Section 4.5.11 .**



Figure 3-131 RVC Setup Interface

- **MSV** For more information, please refer to **Section 4.5.10 .**

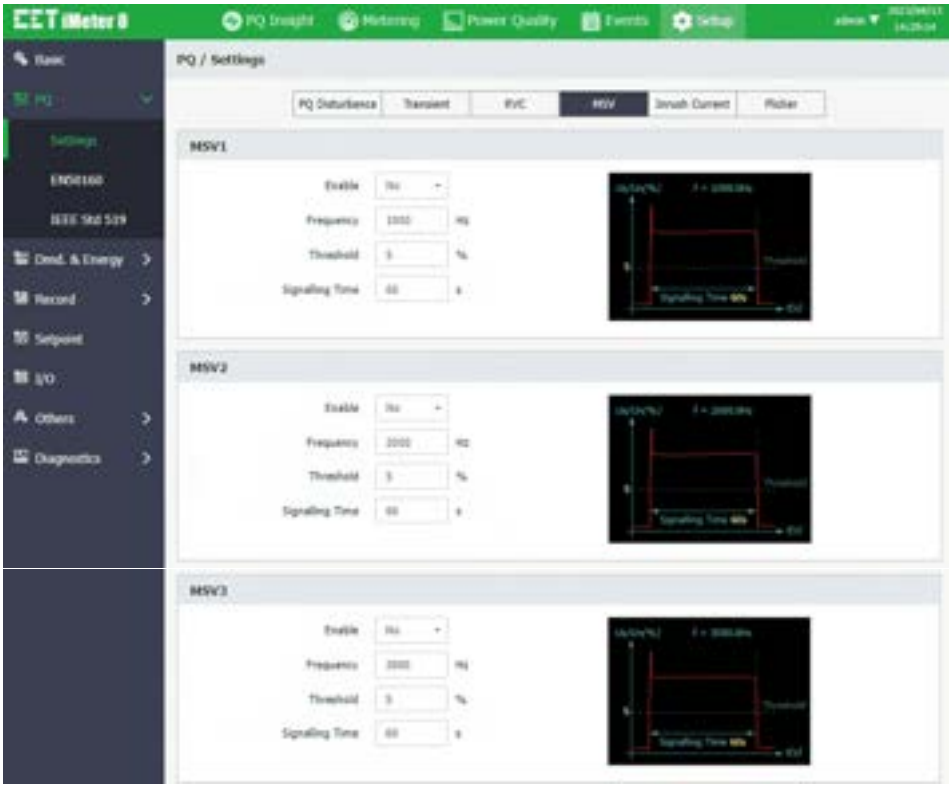


Figure 3-132 MSV Setup Interface

- **Inrush Current** For more information, please refer to **Section 4.5.14 .**

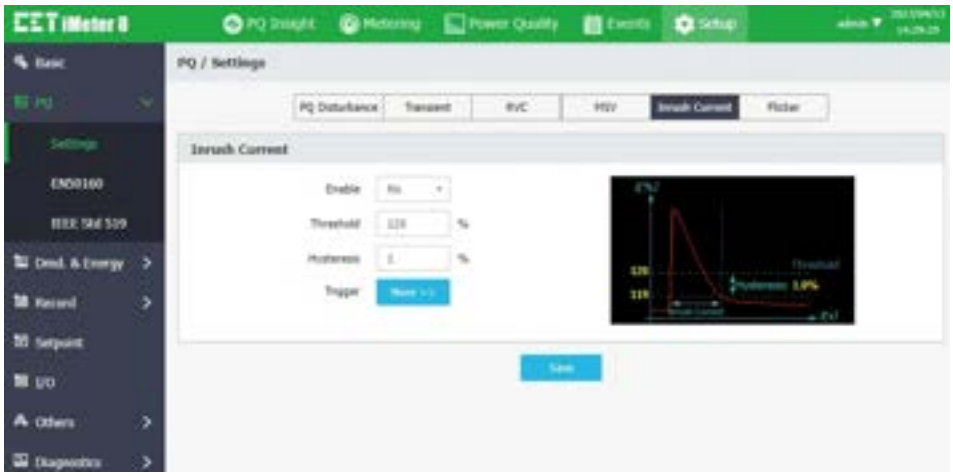


Figure 3-133 Inrush Current Setup Interface

- **Flicker** The options for **Flicker Curve** are 120V and 230V (default). For more information, please refer to **Section 4.5.4 .**



Figure 3-134 Flicker Setup Interface

3.2.4.5.2.2 EN50160

This page allows the users to setup the **Voltage Level** and **First Day of Week** for the EN50160 report.

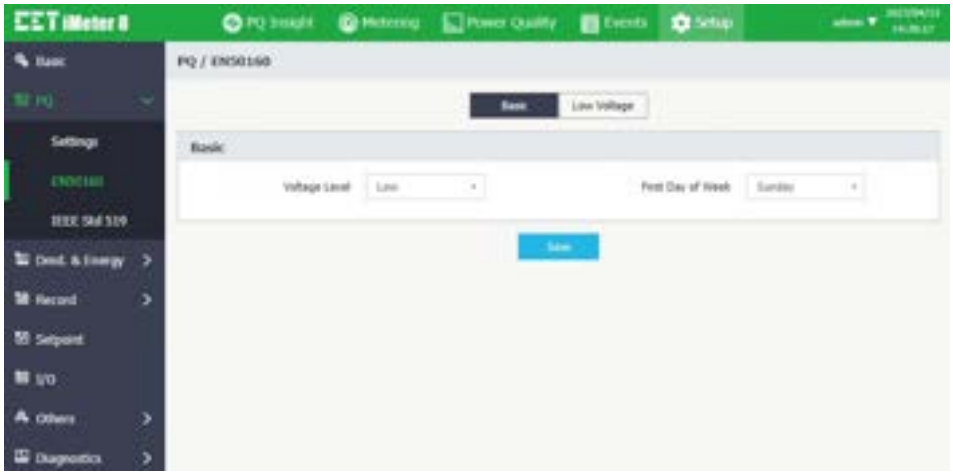


Figure 3-135 Basic EN50160 Setup Interface

The figure below illustrates the default limits of the EN50160 parameters according to the Voltage Level setting, which is Low in this instance. For more information, please refer to **Section 4.5.15 .**

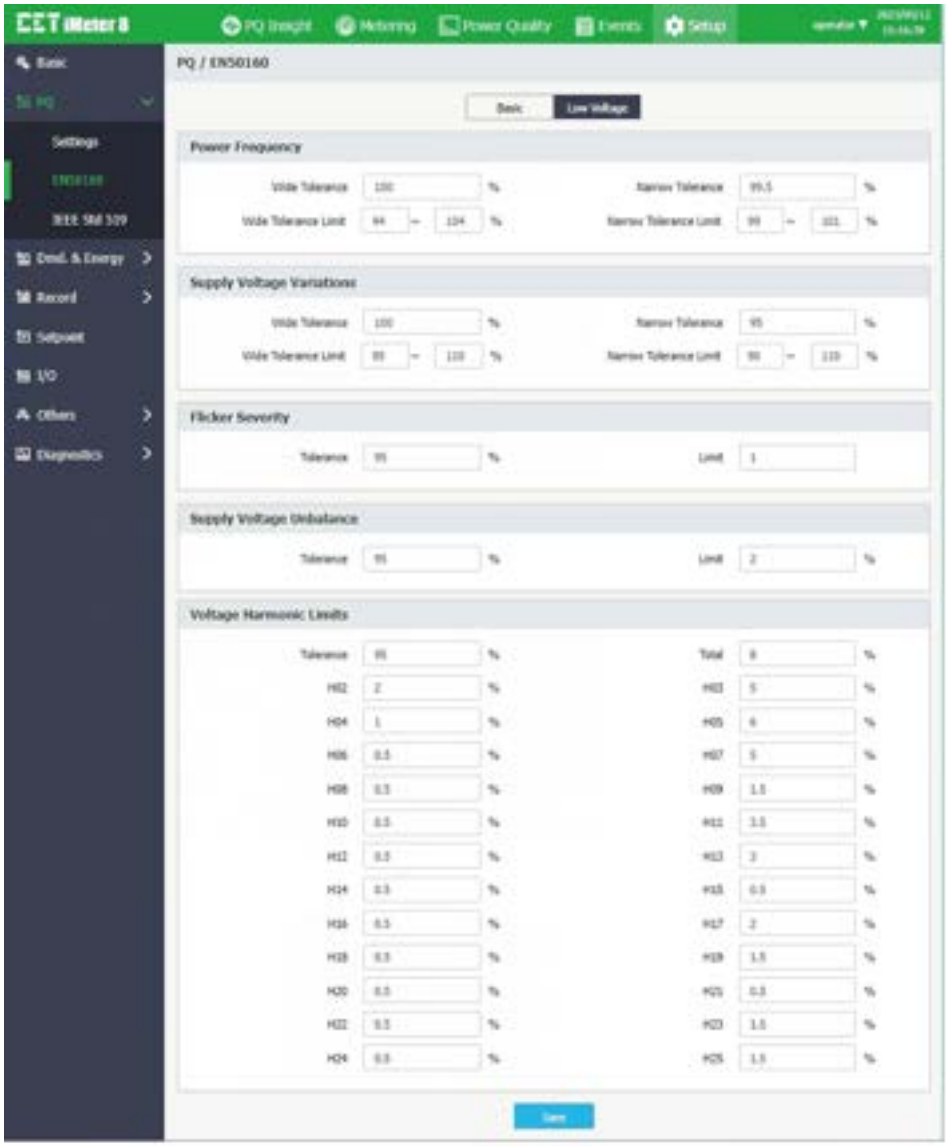


Figure 3-136 Detailed EN50160 Setup Interface

3.2.4.5.2.3 IEEE Std 519

This page allows the users to configure the IEEE Std 519 report related parameters. For more information, please refer to **Table 4-36**.

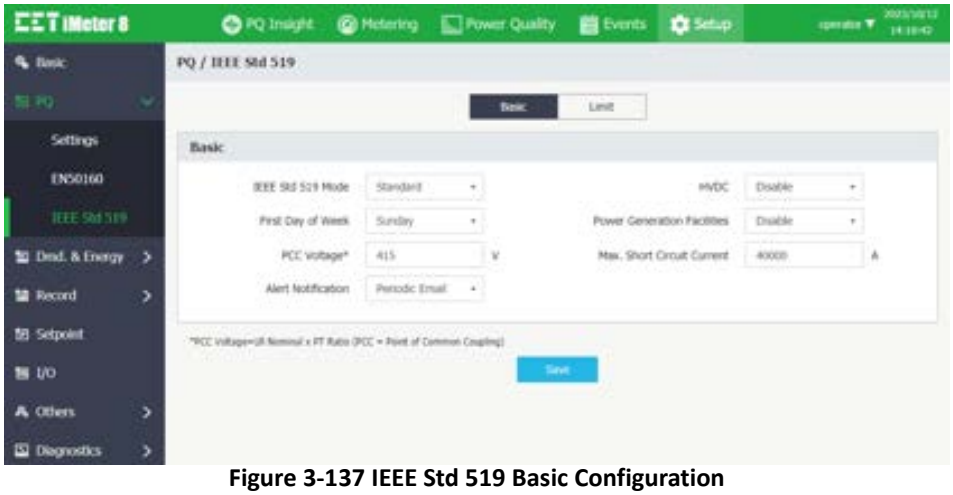


Figure 3-137 IEEE Std 519 Basic Configuration

Figure 3-138 illustrates the default voltage harmonic limits of the IEEE Std 519-2022 according to the PCC Voltage

setting, which is at **> 161kV** level in this instance. For more information, please refer to **Section 4.5.18** .



Figure 3-138 Default Voltage Harmonic Limits of IEEE Std 519-2022 for Above 161kV Systems

Figure 3-139 illustrates the default current harmonic limits of the IEEE Std 519-2022 according to the SCR Ratio (<25), and PCC Voltage setting, which is at > 161kV in this instance. For more information, please refer to **Section 4.5.18** .

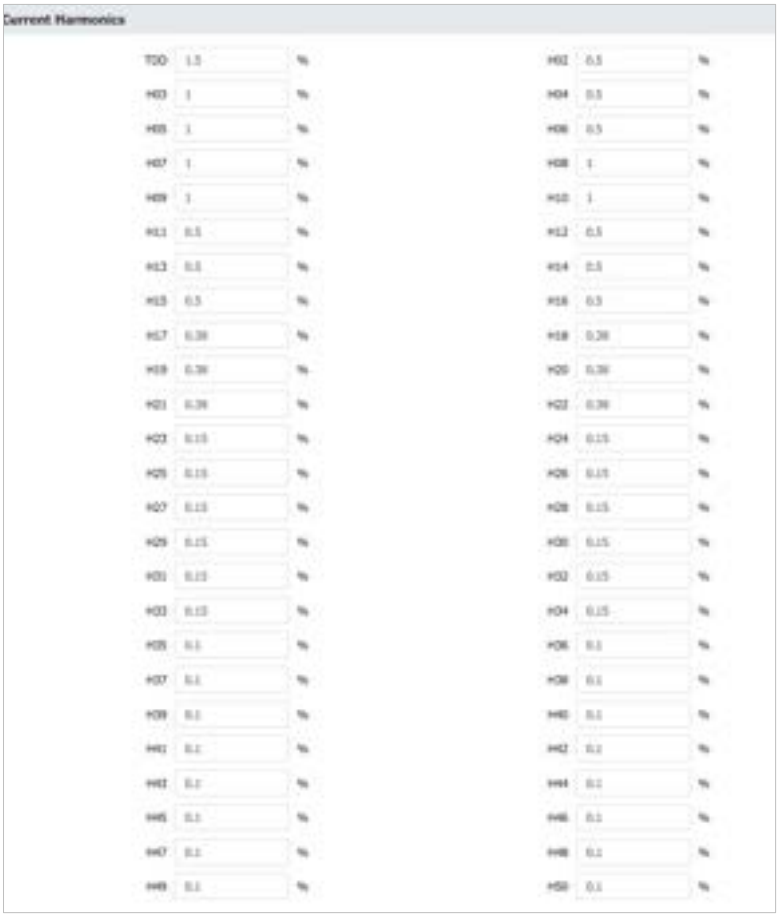


Figure 3-139 Default Current Harmonic Limits for SCR Ratio < 25, Above 161kV Power Systems

3.2.4.5.3 Demand & Energy

Click **Dmd. & Energy** on the left-hand pane to expand its sub-menu to show **Demand, Energy** and **TOU**.

3.2.4.5.3.1 Demand

Please refer to **Section 4.2.4** for more information.

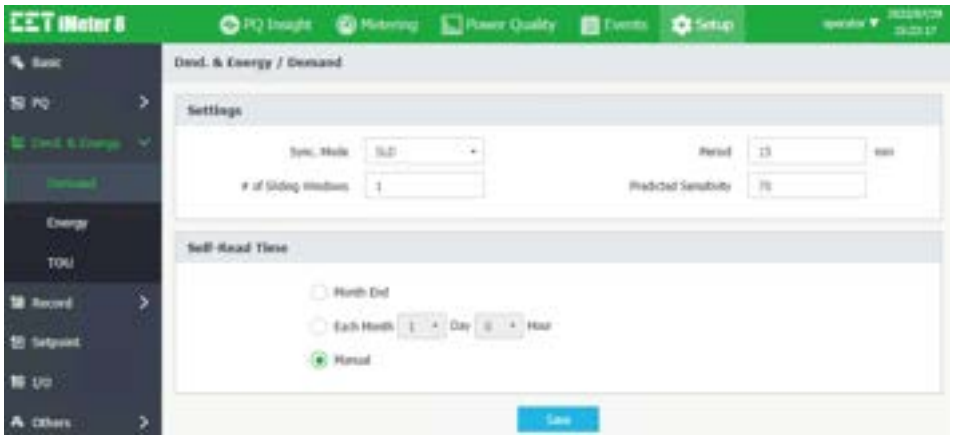


Figure 3-140 Demand Setup Interface

3.2.4.5.3.2 Energy

Click **Energy** on the left-pane of the page to access **Energy Preset**, **Energy Pulse** and **Energy Log** configuration.

- **Energy Preset** Supports the presetting of kWh Import/Export, kvarh Import/Export and kVAh Total. The valid range for the pre-defined energy should be between 0 and 99,999,999,999.999 or 999,999,999.999 (depending on **Energy Rollover** setup). See **Figure 3-141 Energy Setup Interface**.

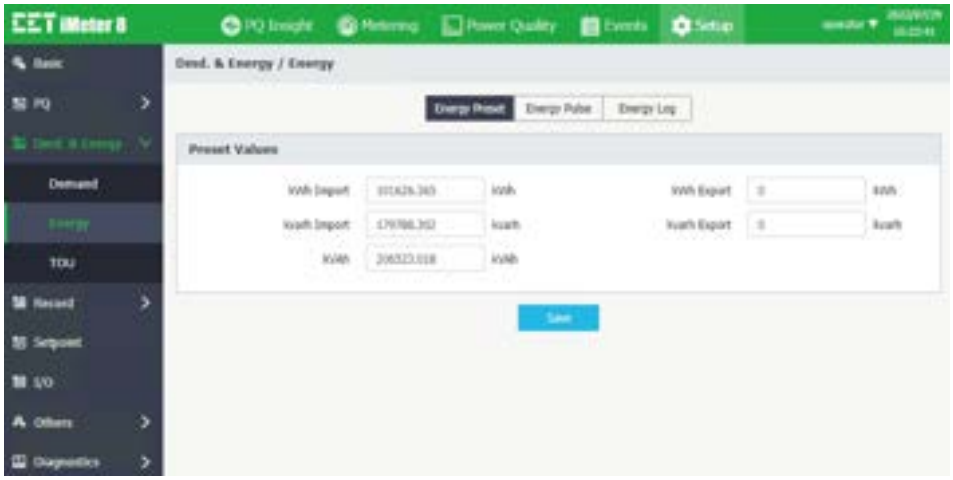


Figure 3-141 Energy Setup Interface

- **Energy Pulse** Supports the configuration of the Pulse Constant and DO Energy Pulse setup parameters. For more information, please refer to **Section 4.1.3 .**

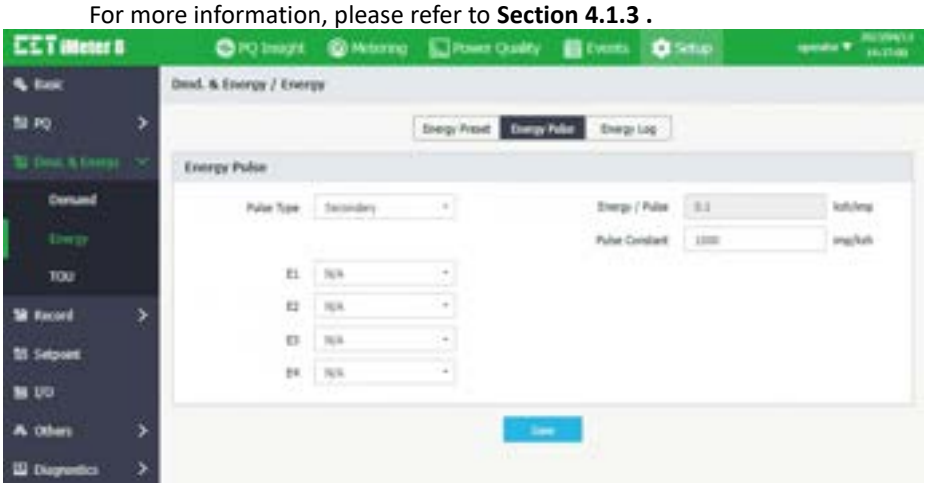


Figure 3-142 Energy Pulse Setup Interface

- **Energy Log** Setup IER and AER. Please refer to **Section 4.6** for details.

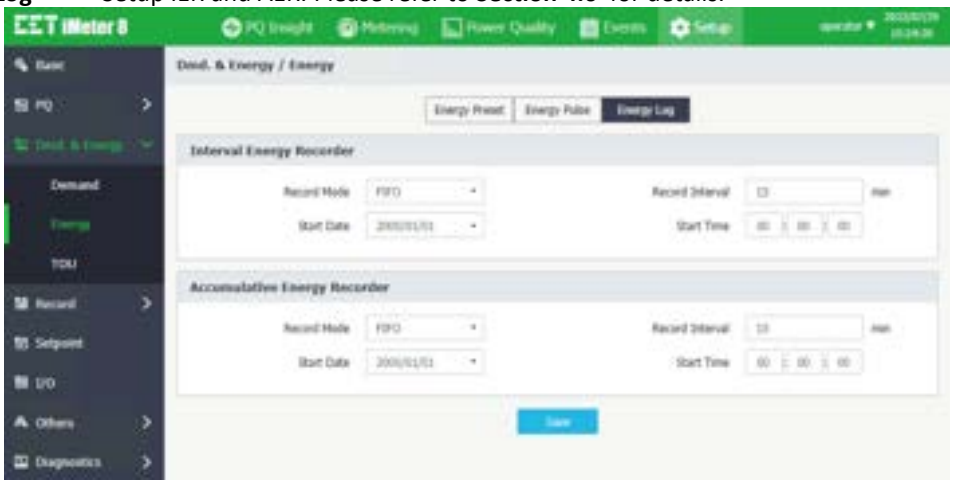


Figure 3-143 Energy Log Setup Interface

3.2.4.5.3.3 TOU

Click **TOU** to access **Labels**, **Basic**, **Daily Profiles**, **Seasons** and **Alternate Days** configurations.

- **Labels**

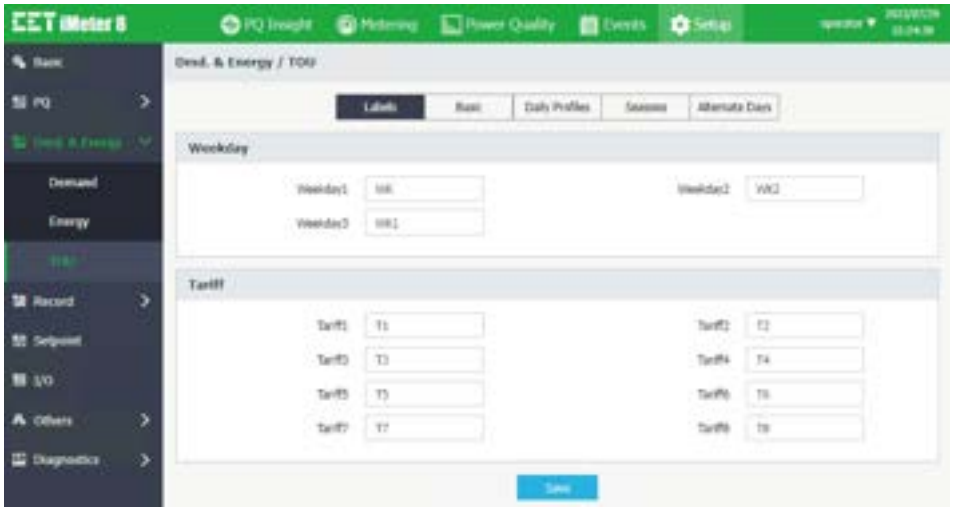


Figure 3-144 Labels Setup Interface

- **Basic**

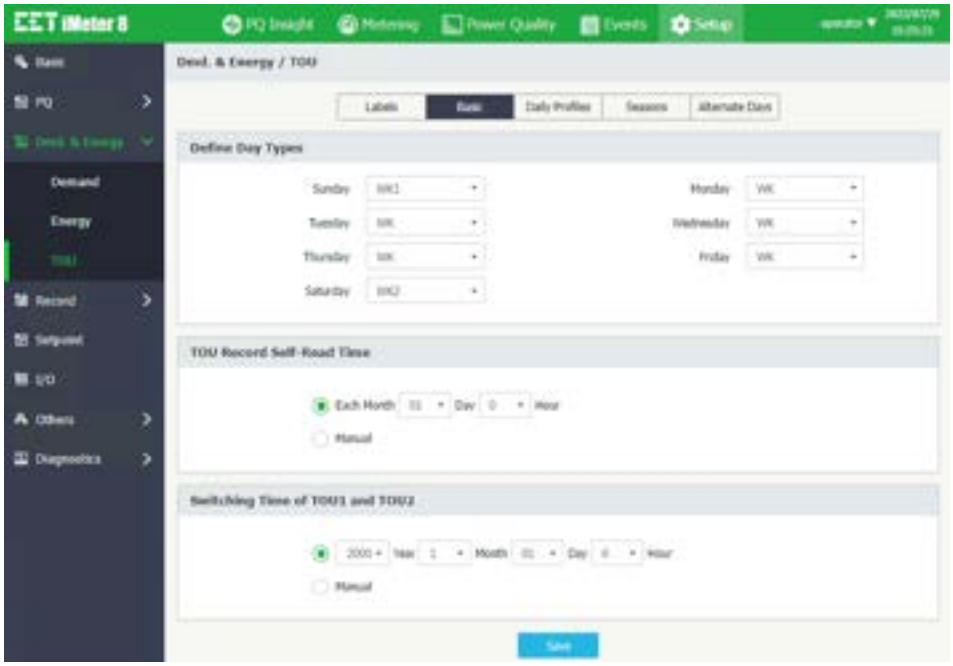


Figure 3-145 Basic Setup Interface

- **Daily Profiles**

  Click on a particular **Daily Profile** and the **Profile x** dialog box appears which allows the **Daily Profile Name**, **Start Time** and **Tariff** for each **Period** to be defined until the entire day has been filled.

  As figure below shown, the **Start Time** for the first **Period** is fixed at 00:00 and cannot be modified. Each **Daily Profile** supports a maximum of 20 **Periods** in 15-minute resolution. The **Start Time** of the next **Period** defines the end time of the previous **Period**.

  Click ⊕ to add a new **Period** or 🗑 to clear the current **Period**'s settings. The last defined **Period** will end at 24:00.

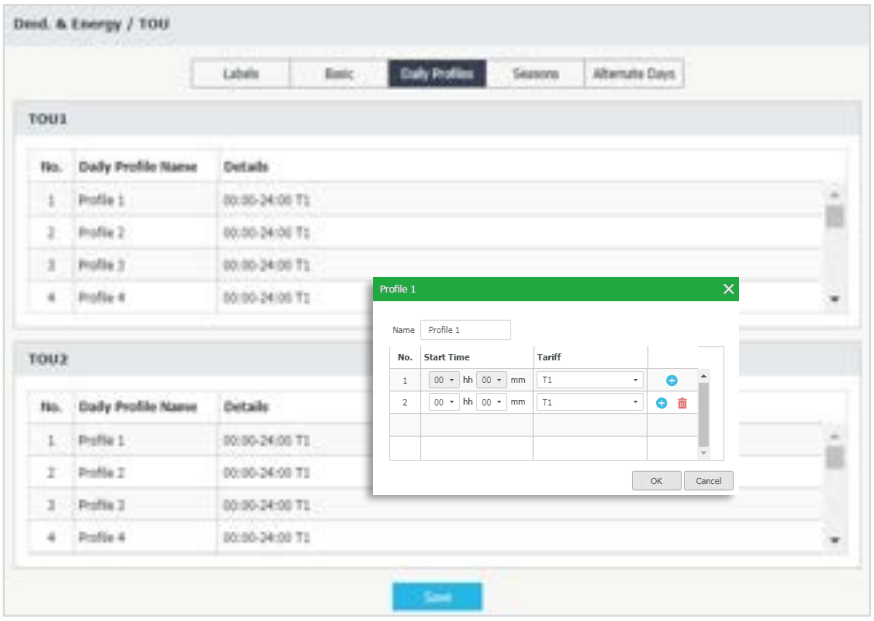


Figure 3-146 Daily Profiles Setup Interface

- **Seasons**

  Click **Seasons** and the screen below appears which allows to define **Start Date, WKDAY Daily Profile, WKEND1 Daily Profile** and **WKEND2 Daily Profile** for each **Season** until the entire year has been filled.

  Up to 12 seasons can be defined for each TOU. The **Start Date** for the first **Season** is fixed at 01/01 and cannot be modified. The **Start Date** of the next **Season** defines the end date of the previous **Season**.

  Click ⊕ to add a new **Season** or 🗑 to clear the current **Season's** settings. The last defined **Season** will end at 12/31.

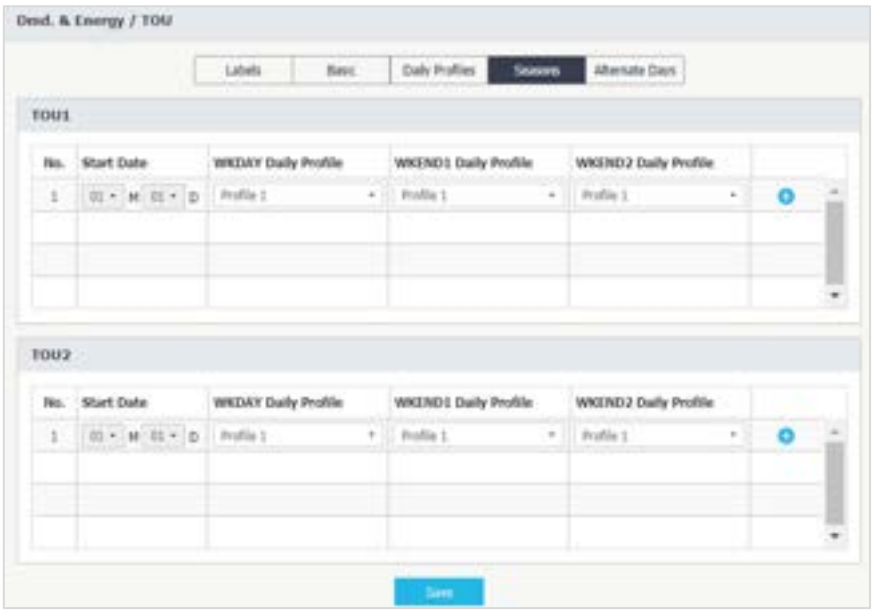


Figure 3-147 Seasons Setup Interface

- **Alternate Days**
  Click on **Alternate Days** and the following screen appears which allows up to 90 Alternate Days to be defined for each TOU. Click the **Add** button to start the configuration.

  Click ⊕ to add a new Alternate Day or 🗑 to clear the setting for the current Alternate Day.

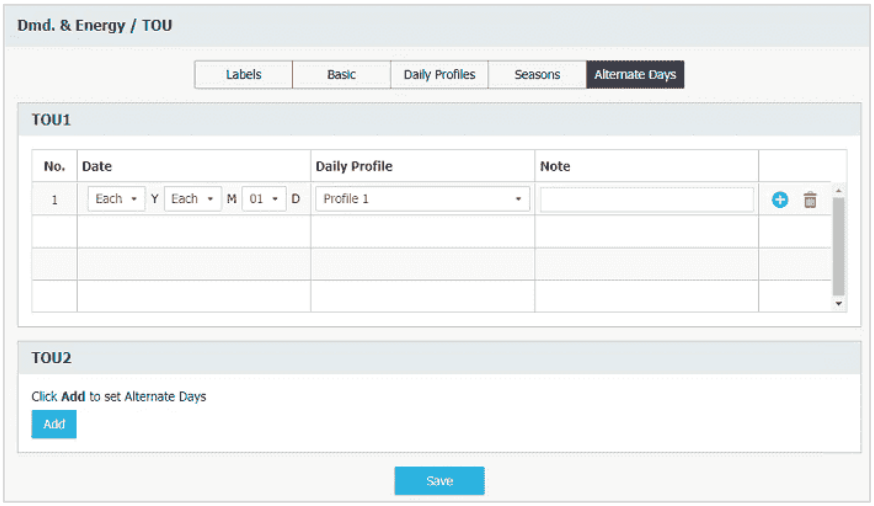


Figure 3-148 Alternate Days Setup Interface

3.2.4.5.4 Record

Click **Record** on the left-hand pane to expand its sub-menus which includes **Waveform, SDR, DR, Max./Min** and **PQDIF & IEC61850.**

3.2.4.5.4.1 Waveform

Click **Waveform** on the left-hand pane and the following page appears which has five tabs: **WFR, DWR, RMSR, Sche. WFR** and **iTrigger.**

- **WFR** For more information, please refer to **Section 4.6.2 .**



Figure 3-149 WFR Setup Interface

- **DWR** Click **DWR** near the top of the page and the following page appears which provides the **Pre-fault Cycles** settings. The range of **Pre-fault Cycles** is 5 to 10 with 5 being the default, for more information, please refer to **Section 4.6.3 .**



Figure 3-150 DWR Setup Interface

- **RMSR** Click "Add" to add a batch of parameters by selecting desired parameters from the **Parameters** Dialog Box or " De-select All" to remove all existing parameters. Click on the right-hand column to edit an existing parameter or to remove a particular parameter. For more information, please refer to **Section 4.6.4 .**

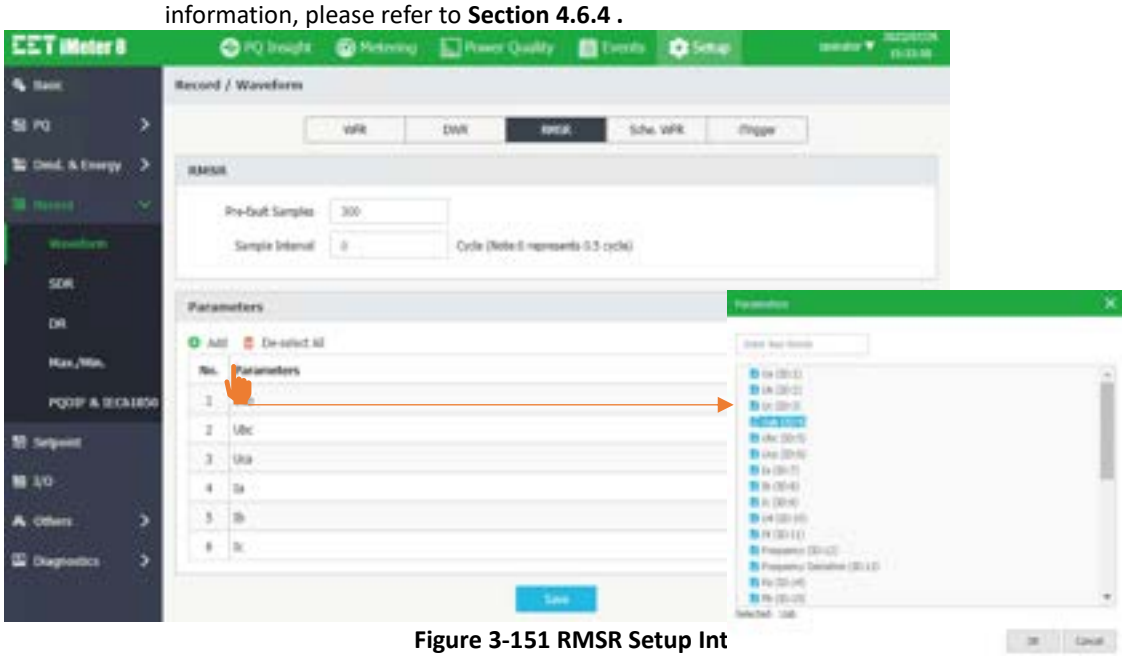


Figure 3-151 RMSR Setup Int

- **Sche. WFR (Scheduled WFR)** For more information, please refer to **Section 4.6.2 .**

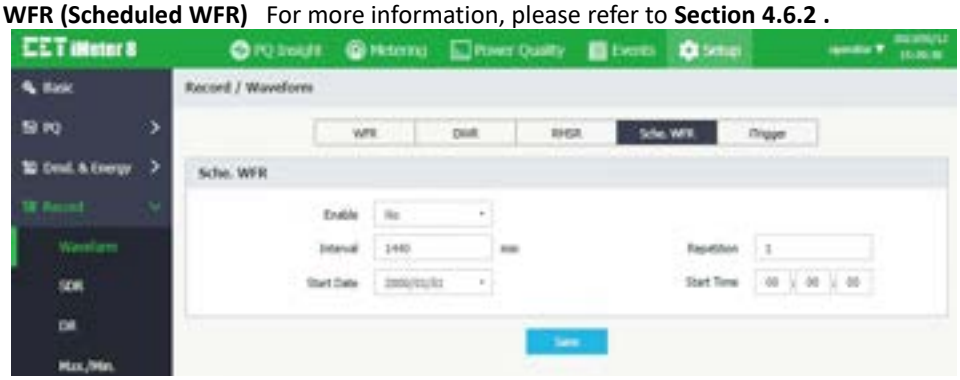


Figure 3-152 Sche. WFR Setup Interface

- **iTrigger** For more information, please refer to **Section 4.7**

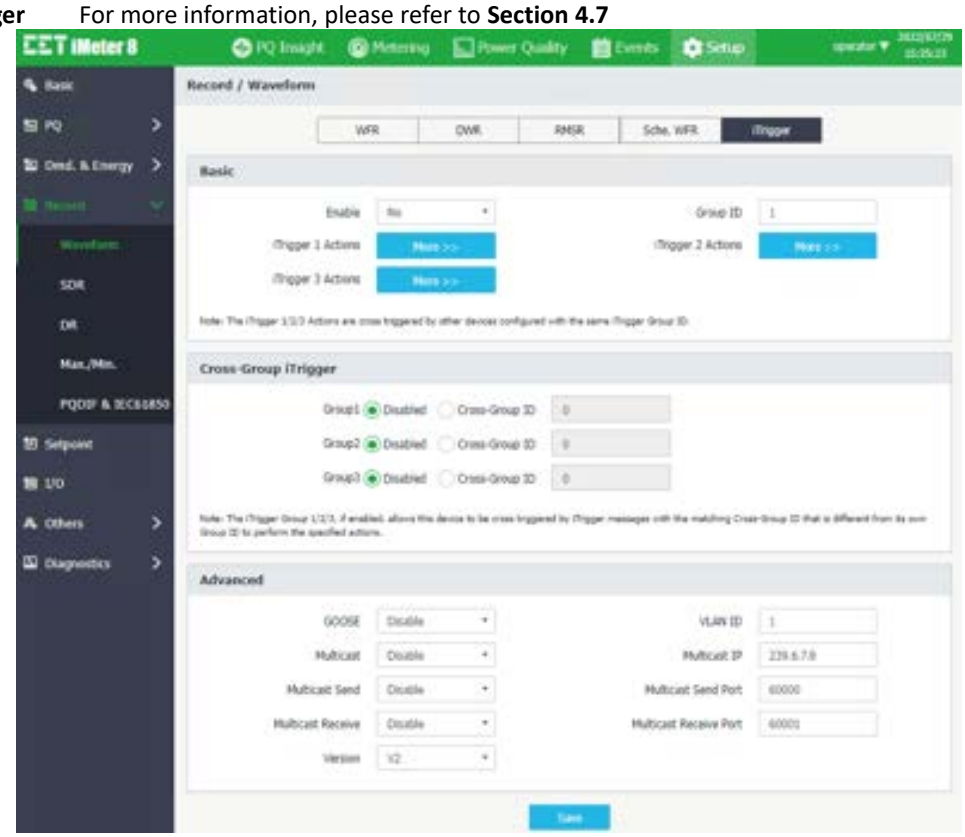


Figure 3-153 iTrigger Setup Interface

3.2.4.5.4.2 SDR

The iMeter 8 comes standard with 16 Statistical Data Recorders of 64 parameters each. Please refer to **4.6.8** for more information.

Click "Add" to add a batch of parameters or "De-select All" to remove all existing parameters.

Click on the right-hand column to edit an existing parameter or to remove a particular parameter.

Please refer to **Appendix A** for the available parameters for SDR.

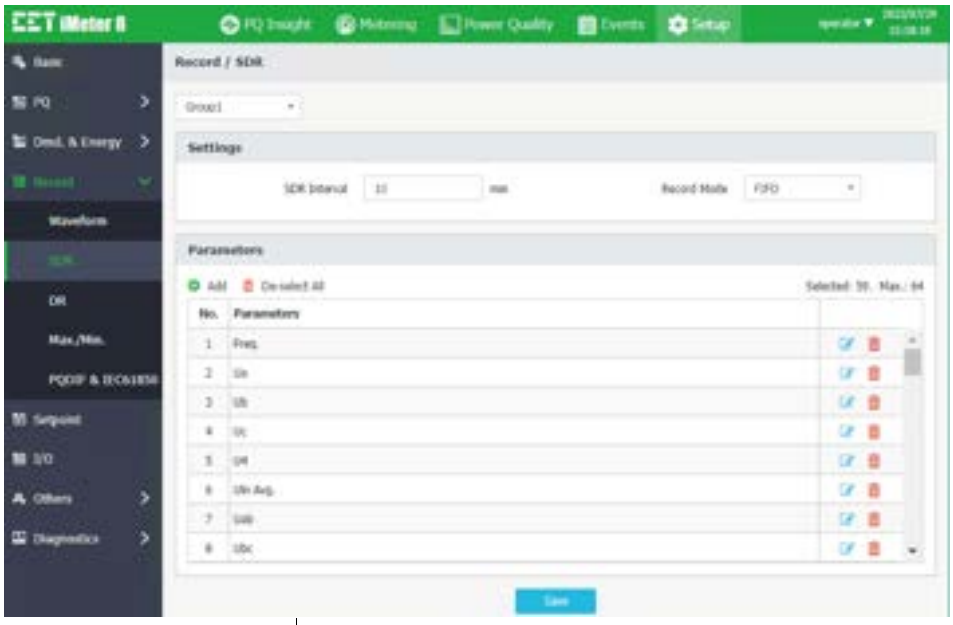


Figure 3-154 SDR Setup Interface

3.2.4.5.4.3 DR

The iMeter 8 supports 8 Data Recorders. Please refer to **Section 4.6.7** for more information.
Click "Add" to add a batch of parameters or "De-select All" to remove all existing parameters.
Click on the right-hand column to edit an existing parameter or to remove a particular parameter.
Please refer to **Appendix A** for the available parameters for Data Recorders.

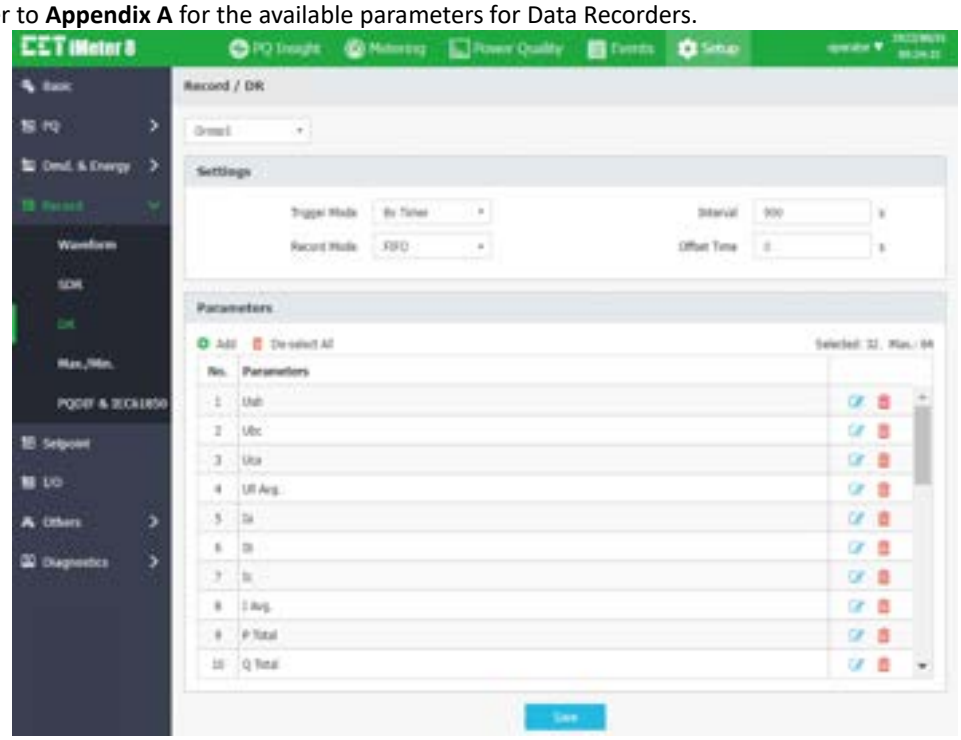


Figure 3-155 DR Setup Interface

3.2.4.5.4.4 Max./Min.

The iMeter 8 supports 4 Max./Min. Recorders of 20 parameters each. Please refer to **Section 4.6.9** for more information.

Click "Add" to add a batch of parameters or "De-select All" to remove all existing parameters.
Click on the right-hand column to edit an existing parameter or to remove a particular parameter.
Please refer to **Appendix A** for the available parameters for Max./Min. Recorders.

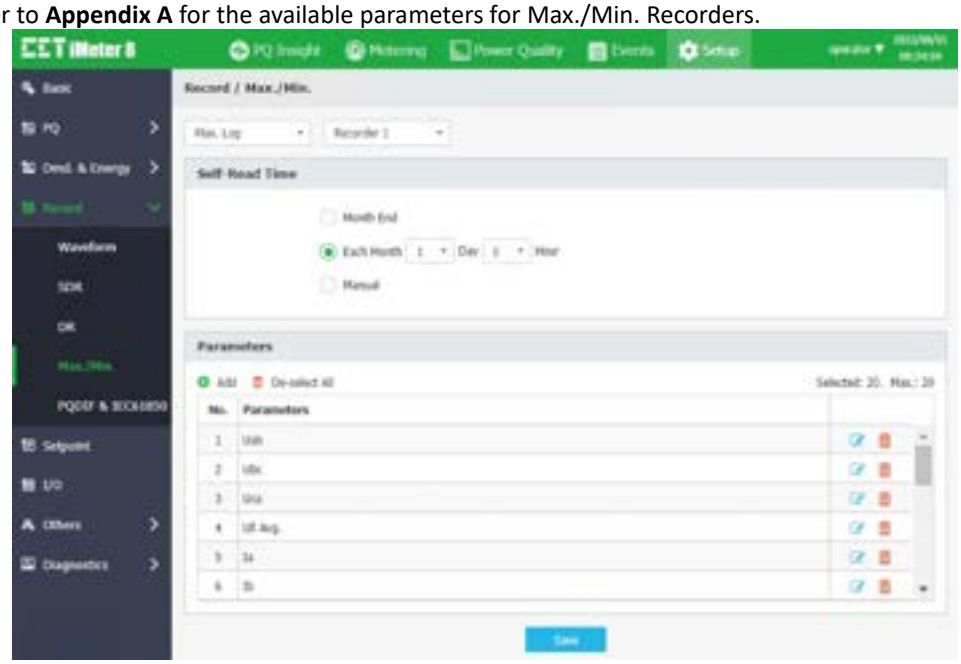


Figure 3-156 Setup Max./Min. Interface

3.2.4.5.4.5 PQDIF & IEC61850

The iMeter 8 supports setup the PQDIF and IEC61850 via the following interface. Please refer to registers 41203 and 41204 for details.

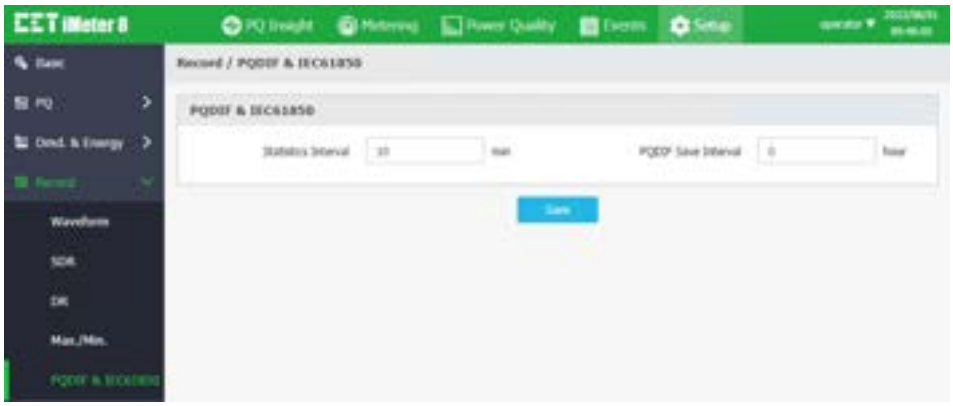


Figure 3-157 Setup PQDIF & IEC61850 Interface

3.2.4.5.5 Setpoint

Click **Setpoint** on the left-hand pane to configure the setup parameters for **Setpoint** (Standard Setpoint) and **HSSP** (High-speed Setpoint).

- **Standard Setpoint:** Click a particular Setpoint and the **Setpoint Settings** dialog box appears, please refer to **Section 4.3** for detailed description.

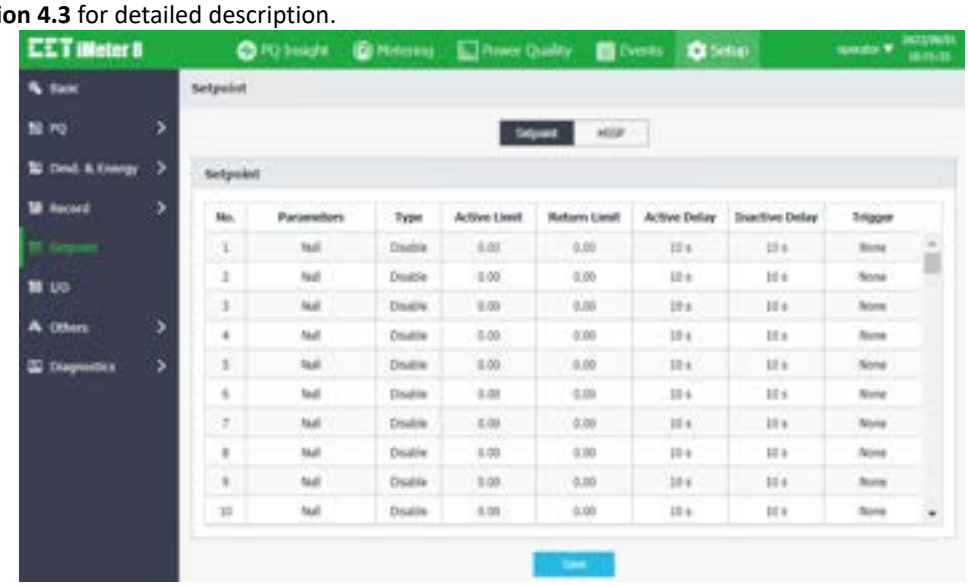


Figure 3-158 Standard Setpoint Setup Interface

- **HS Setpoint Setup**

  1) Click **HSSP** tab on the top pane and the following screen appears.

  2) Click a particular HS Setpoint and the **HSSP Settings** dialog box appears, please refer to **Section 5.10.15** for detailed description.

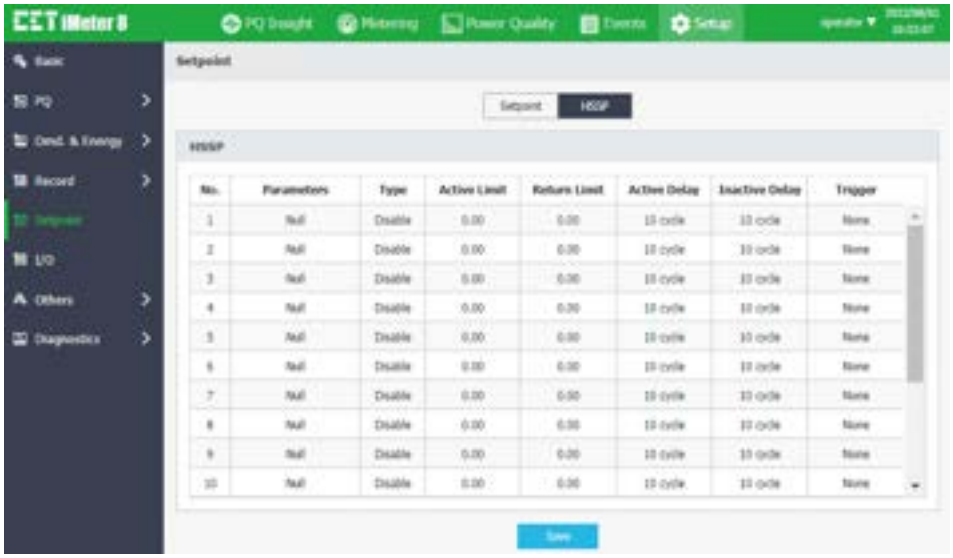


Figure 3-159 HS Setpoint Setup Interface

3.2.4.5.6 I/O Setup

Click **I/O** on the left-hand pane to configure I/O parameters.

- **DI Setup**

  Click on a particular DI and the **DI Settings** dialog box appears. Please refer to **Section Chapter 4** for more information.

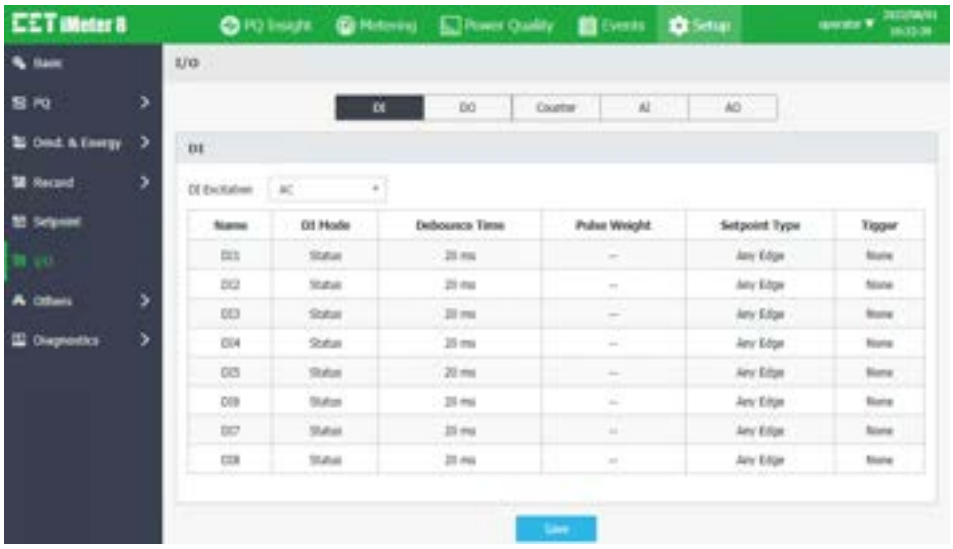


Figure 3-160 DI Setup Interface

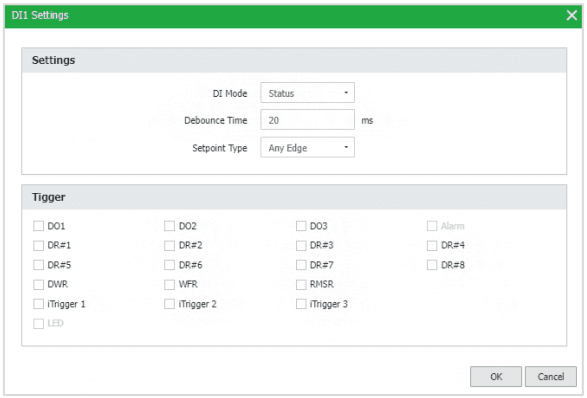


Figure 3-161 DIx Setup Interface

- **DO Setup**

Click the **DO** tab at the top of the page and the following screen appears, please refer to **Section 5.10.3** for more information.



Figure 3-162 DO Setup Interface

- **Counter**

Click the **Counter** tab at the top of the page and the following screen appears, please refer to **Section 5.3** for more information.



Figure 3-163 Counters Setup Interface

- **AI (Optional)**

Click the **AI** tab at the top of the page and the following screen appears, please refer to **Section 4.1.4** for more information. Please note that the AI tab only appears when the iMeter 8 is equipped with the corresponding option.

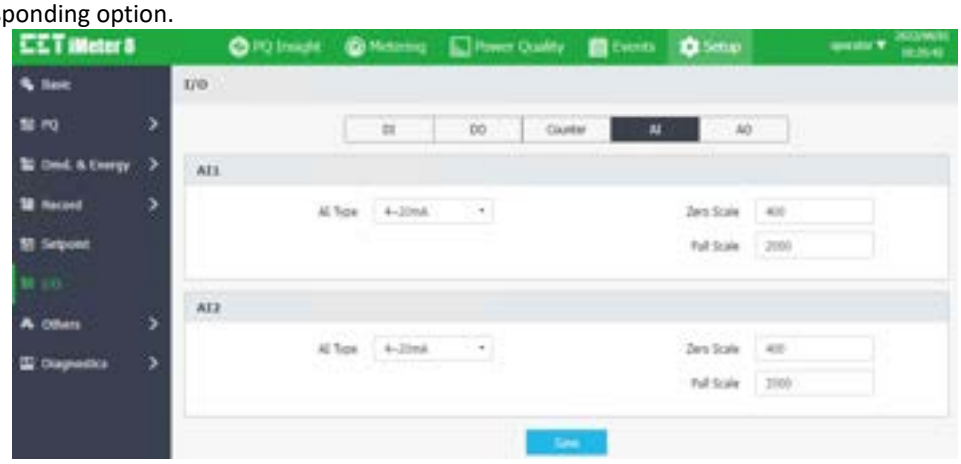


Figure 3-164 AI Setup Interface

- **AO (Optional)**

Click the **AO** tab at the top of the page and the following screen appears, please refer to **Section 4.1.5** for more information. Please note that the AO tab only appears when the iMeter 8 is equipped with the corresponding option.

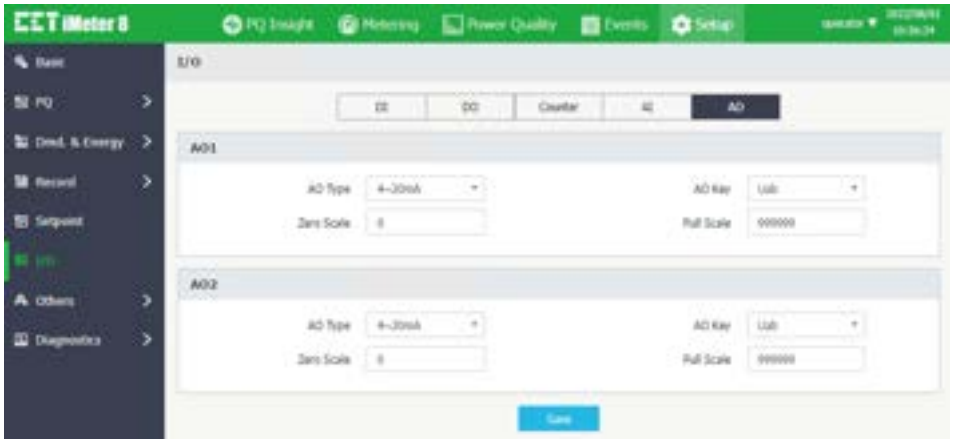


Figure 3-165 AO Setup Interface

3.2.4.5.7 Others

Click **Others** on the left-hand pane to expand its sub-menus which includes **Alarm Email** and **Advanced.**

3.2.4.5.7.1 Alarm Email

- **Settings** Please refer to **Section 4.9** for more information.



Figure 3-166 Alarm Email Setting Interface

Click **More >>** to open the Trigger Source dialog box and then select the event type that would trigger an alarm email.



Figure 3-167 Trigger Source Dialog Box

- **Alarm Email** Click **Test** to send a test email to check the correctness of the **Alarm Email** configuration

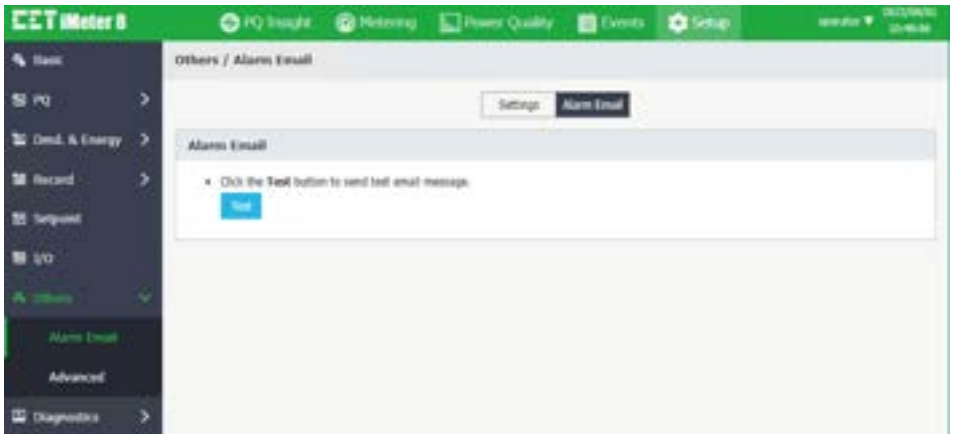
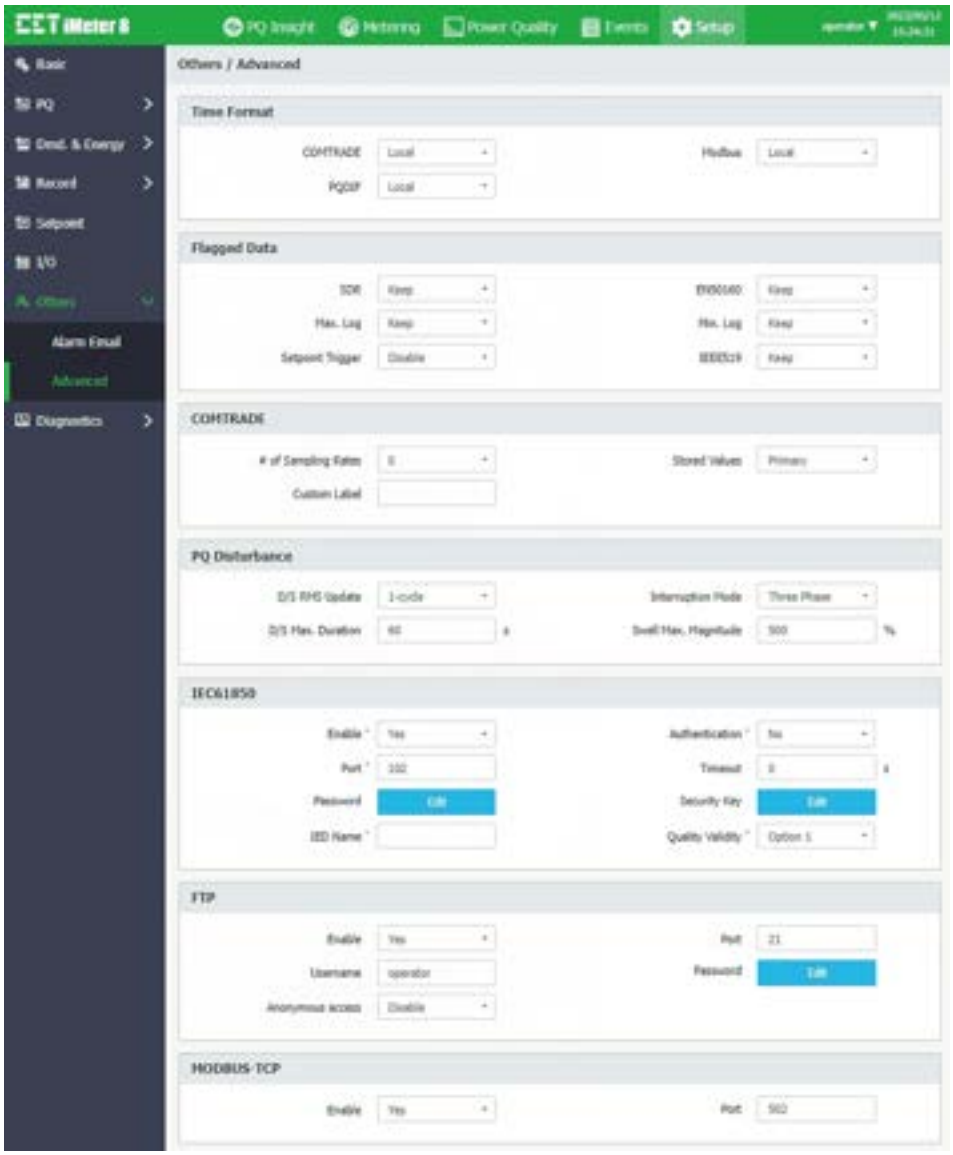


Figure 3-168 Test Alarm Email Interface

3.2.4.5.7.2 Advanced

Click **Advanced** on the left-hand pane and the following page appears which allows the **Advanced** parameters to be configured. Please consult with the qualified personnel before configuring these advanced parameters.



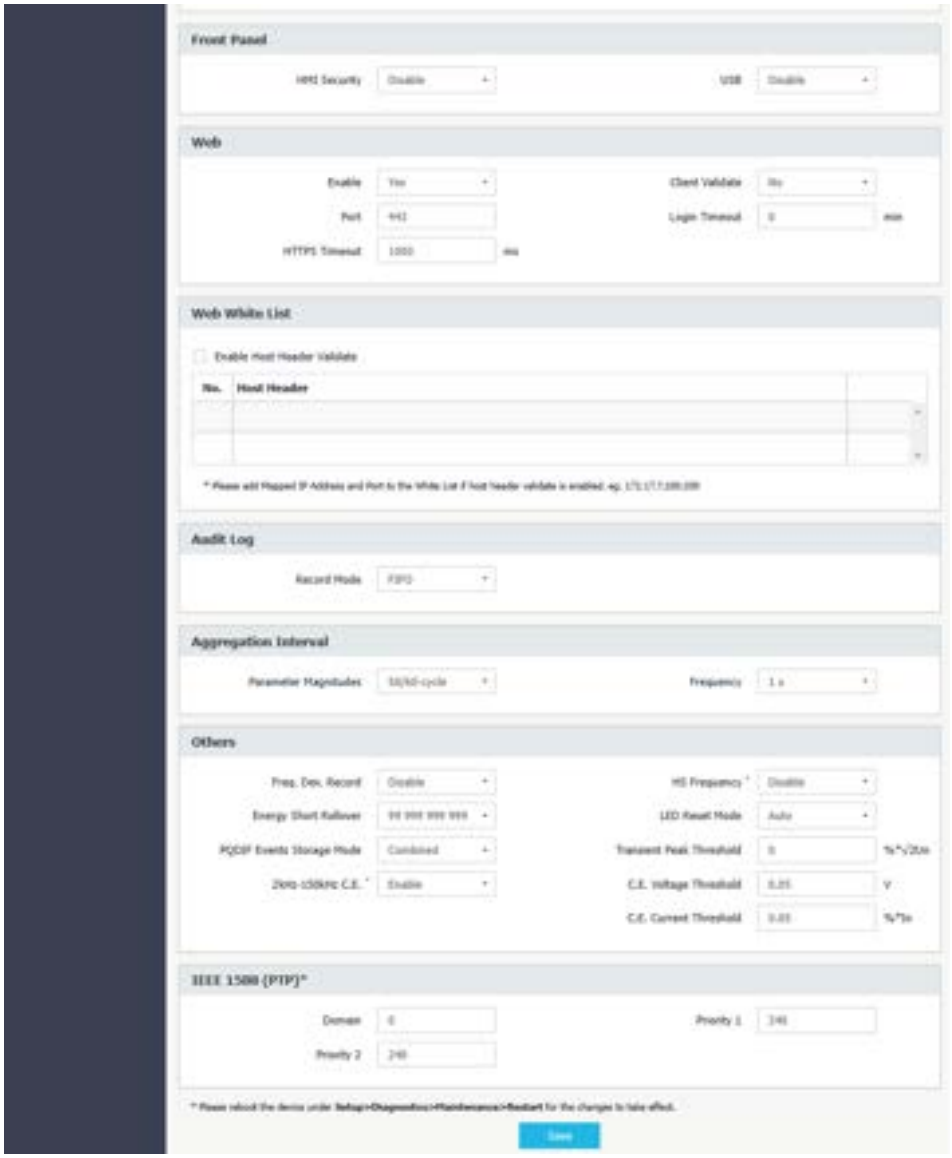


Figure 3-169 Advanced Interface

The following table illustrated the range and default values of the **Advanced** parameters.

Parameter	Description	Range/Default*
Time Format		
COMTRADE	Specifies time format of the COMTRADE, PQDIF and Modbus.	• Local* • UTC
Modbus		
PQDIF		
Flagged Data		
SDR	Specifies to keep or remove the flagged data from the SDR, EN50160, Max./Min., as well as IEEE Std 519 report, and whether the flagged data will trigger Setpoint Alarm.	• Keep* • Remove
EN50160		
Max. Log		
Min. Log		
IEEE519		
Setpoint Trigger		• Disable* • Enable
COMTRADE: Specifies format for WF COMTRADE file		
# of Sampling Rates	Specifies the number of Sampling Rates	• 0* • No. of Sampling Rates
Stored Values	Specifies the stored COMTRADE is primary value or secondary value.	• Primary* • Secondary
Custom Label	Specifies the custom label of the COMTRADE file.	
PQ Disturbance		
D/S RMS Update	U_{rms} for Dips/Swells/Interruptions evaluation. • Computed every cycle and shifted by 1/2 cycle	• 1 cycle* • ½-cycle

	• Computed every 1/2 cycle and shifted by 1/2 cycle	
Interruption Mode	Specifies the trigger mode of the interruption. • The U_{rms} of any phase is lower than the Interruption Threshold, the Interruptions will be triggered. • All 3 phase U_{rms} are lower than the Interruption Threshold, the Interruptions will be triggered.	• Single Phase • Three Phase*
D/S Max. Duration	Specifies the Maximum duration of Dips/Swells.	1-600s, 60*
Swell Max. Magnitude	Specifies the Maximum magnitude of Swells.	101-500 (%), 500*
IEC61850		
Enable	Enable IEC61850 or not.	• No • Yes*
Authentication	Specifies enable Client Authentication or not	• No* • Yes
Port	Specifies the port of the IEC61850 Server	1 to 65535, 102*
Timeout	Specifies deviation range of the timestamp.	0s*
Password	Specifies password of the Client Authentication.	
Security Key	Specifies security key of the Client Authentication.	6365742D656C65637472 69632E636F6D*
IED Name	Specifies IED (Intelligent Electronic Device) name.	
Quality Validity	Specifies IEC 61850 Validity Mode.	0 = Option 1 (all good) *
FTP		
Enable	Enable FTP or not.	• No • Yes*
Port	Specifies the port of the FTP Server	1 to 65535, 21*
Username	Specifies the login user name of the FTP Server	operator*
Password	Specifies the login user password of the FTP Server	abcd1234-*
Anonymous access	Enable anonymous login the FTP Server.	• Disable* • Enable
MODBUS-TCP		
Enable	Enable Modbus TCP or not.	• Disable • Enable*
Port	Specifies the port of the Modbus TCP	1 to 65535, 502*
Front Panel		
HMI Security	Enable Front Panel's security protection or not.	• Disable* • Enable
USB	Enable USB Function or not	• Disable* • Enable
Web		
Enable	Enable Web login or not.	• Disable • Enable*
Client Validate	Enable Web Client validation or not.	• Disable* • Enable
Port	Specifies Web server port.	1 to 65535, 443*
Login Timeout	Specifies timeout of login web server.	0 to 1440min, 5*
HTTPS Timeout	Specifies timeout of login https.	100 to 5000ms, 1000*
Web White List~		
Enable Host Header Validate	Enable Web Host Header validation or not.	• Disable* • Enable
Host Header White list	Added mapped IP Address and port to the white list after enabling **Enable Host Header Validate.**	Eg: 172.17.7.100:200
Audit Log		
Record Mode	Specifies record mode for audit log.	• FIFO* • Stop When Full
Aggregation Interval		
Parameter Magnitudes	Specifies the interval for the basic measurement shall be aggregated	• 50/60-cycle* • 150/180-cycle • 10-min • 2-hour
Frequency	Specifies the interval for the Freq. shall be aggregated	• 1s* • 3s • 10s
Others		
Freq. Dev. Record	Enable Frequency deviation recorder or not	• Disable* • Enable
HS Frequency	Enable High-speed Frequency measurement.	
Energy Short Rollover	Specifies the maximum value of Energy register.	• 0=99,999,999,999 (kWh/kvarh/kVAh)* • 1=999,999,999

		(kWh/kvarh/kVAh)
LED Reset Mode	Reset Mode of LED Indicators.	• Auto* • Manual
PQDIF Event Storage Mode	Specifies if the PQDIF event is stored separately or not.	• Combined • Separated
Transient Peak Threshold	Specifies the peak threshold for the Transient Evaluation method.	0* to 500 (%Un* √ 2)
2kHz-150kHz C.E.	Enable 2kHz-150kHz C.E. function.	• Disable • Enable*
C.E. Voltage Threshold	Specifies Voltage threshold for 2kHz-150kHz C.E.	0.05* (x100V)
C.E. Current Threshold	Specifies Current threshold for 2kHz-150kHz C.E.	0.05* (%*In) 0.05 means 0.05%*In
IEEE 1588 (PTP)		
Domain	PTP Domain identifies a group of devices that talk together.	0* to 255
Priority 1	Specifies the clock priority.	0 to 255, 240*
Priority 2	Specifies the finer-grained clock priority.	0 to 255, 240*

~Available in the Firmware V2.51.52 or later.

Table 3-12 Advanced Setup Interface

3.2.4.5.8 Diagnostics

Click **Diagnostics** on the left-hand pane to expand its sub-menus which consist of **Device & Site Info., User Management** and **Maintenance.**

3.2.4.5.8.1 Device & Site Info.

- **Device**

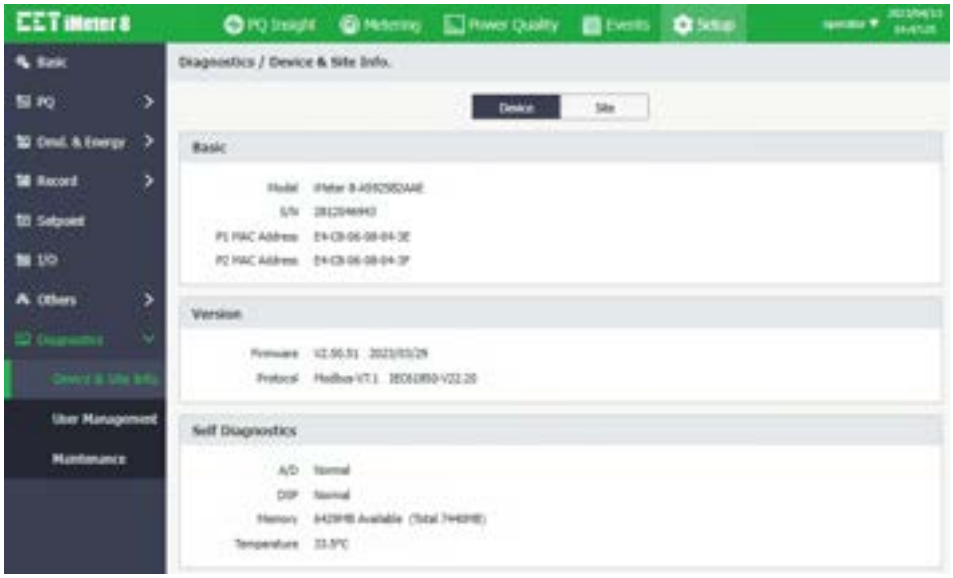


Figure 3-170 Device Interface

- **Site**

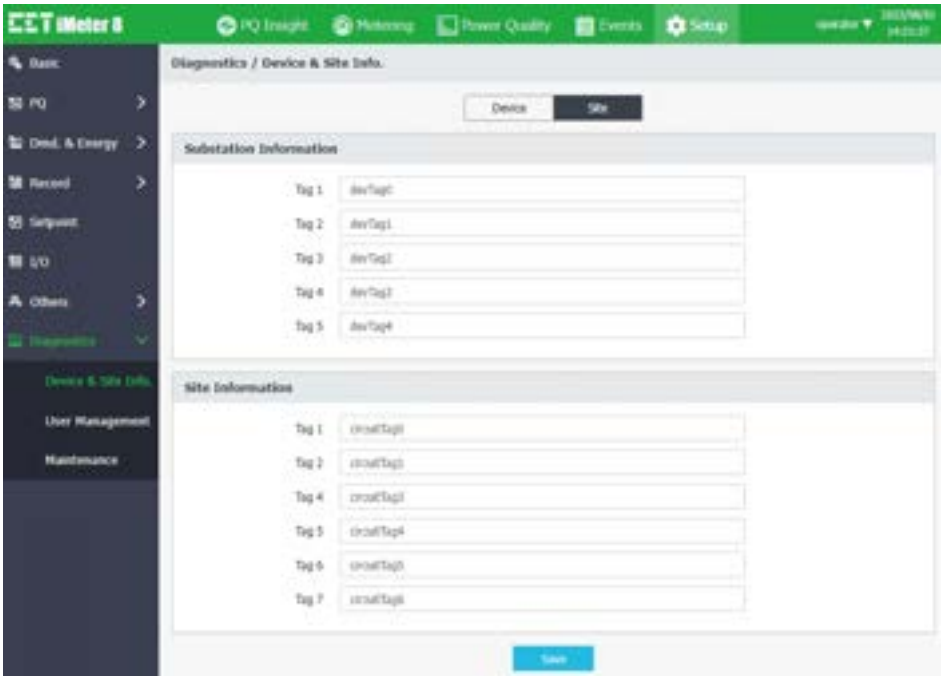


Figure 3-171 Site Interface

3.2.4.5.8.2 User Management

Click **User Management** on the left-hand pane and the following screen appears on the right-hand pane.

The user with Operator authority can click ⊕ to add a new user account or click 🗑 to remove an existing user account.

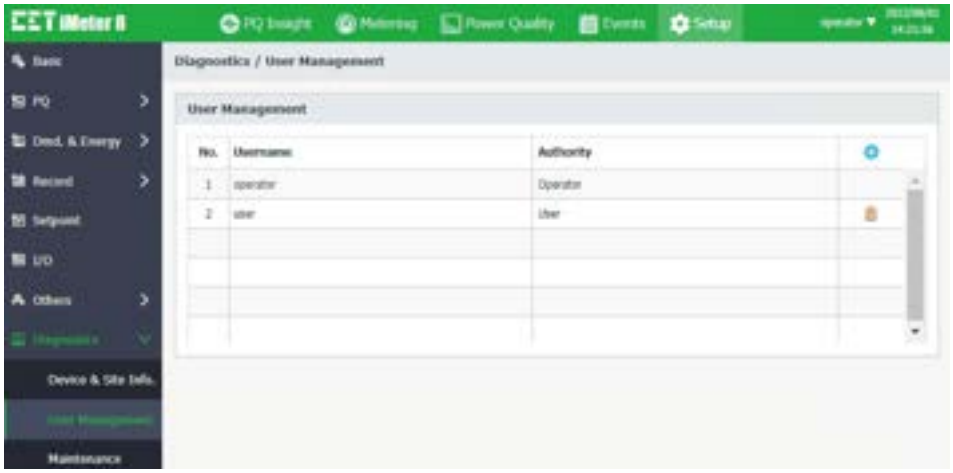


Figure 3-172 User Management Interface

3.2.4.5.8.3 Maintenance

Click **Maintenance** on the left-hand pane and the following screen appears which provides the options for **LED Reset, DO Control, Clear**, **Imp. /Exp.**, **Upgrade** and **Restart**.

- **LED Reset** Perform manual SP LED Reset operation**.**

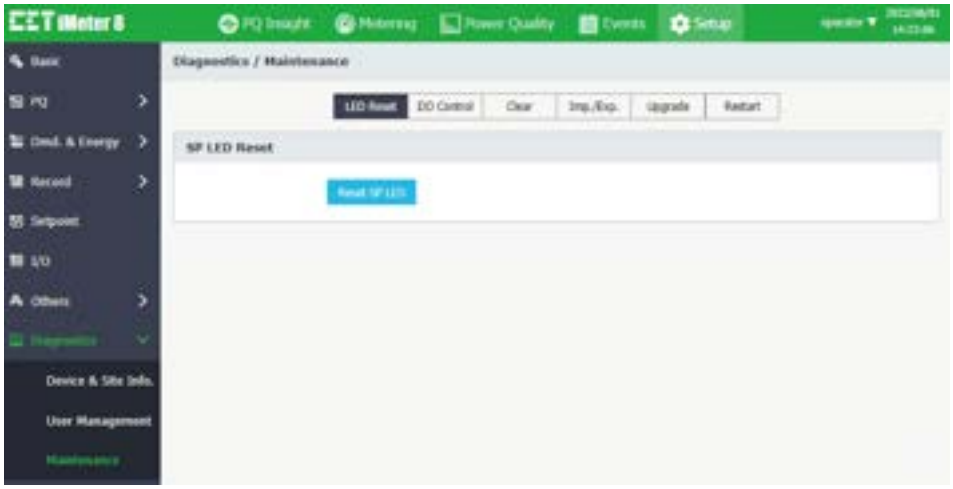


Figure 3-173 LED Reset Interface

- **DO Control** Perform manual **DO Control** or **Reset All DOs to Normal**.

  Depending on the **DO Pulse Width** setting, the DO may behave differently when it is operated manually via the Web Interface. A zero **Pulse Width** means **Latched** operation while non-zero means **Pulsed** operation.

  - For **Latched** operation, the DO will remain in the **Active** state when it's manually operated and will only return to the **Inactive** state when it's manually released.
  - For **Pulsed** operation, the DO will return automatically from the **Active** state to the **Inactive** state after a duration that is equal to the non-zero **Pulse Width** setting, without requiring a manual **Release** operation.

  In addition, if a DO is already in a **Released** state, the manual **DO Release** command would fail and generate an error message *DOx Released Failed* would be appeared.

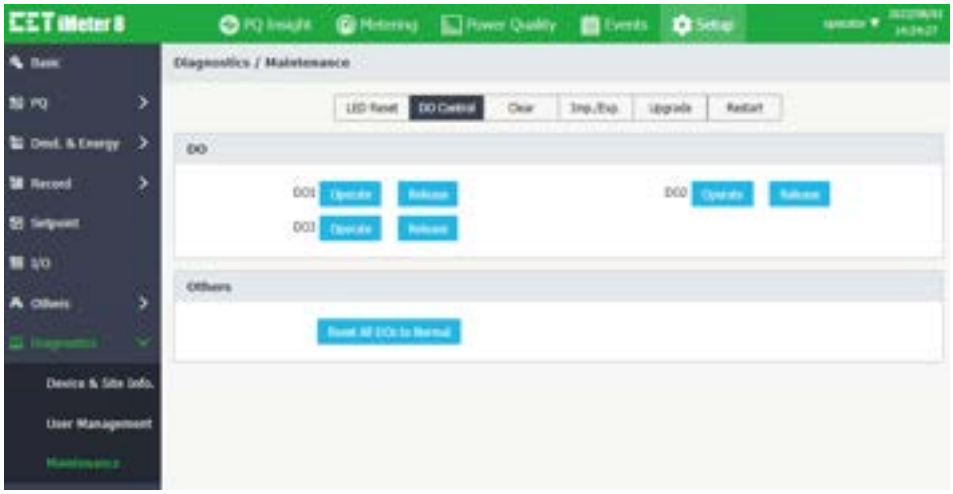


Figure 3-174 DO Control Interface

- **Clear** Perform the various **Clear** operations by groups or individually

  - **Clear Groups**



Figure 3-175 Clear Groups

- **Clear Individuals**



Figure 3-176 Clear Individuals Interface

- **Imp./Exp.**
  - Export all metering data, PQ data, Events log and device setup parameters configuration.
  - Import or Export Setup parameters, Comm. Parameters and Users Configuration via **Setup Parameters,**

Comm. Parameters and **User Configuration,** respectively.

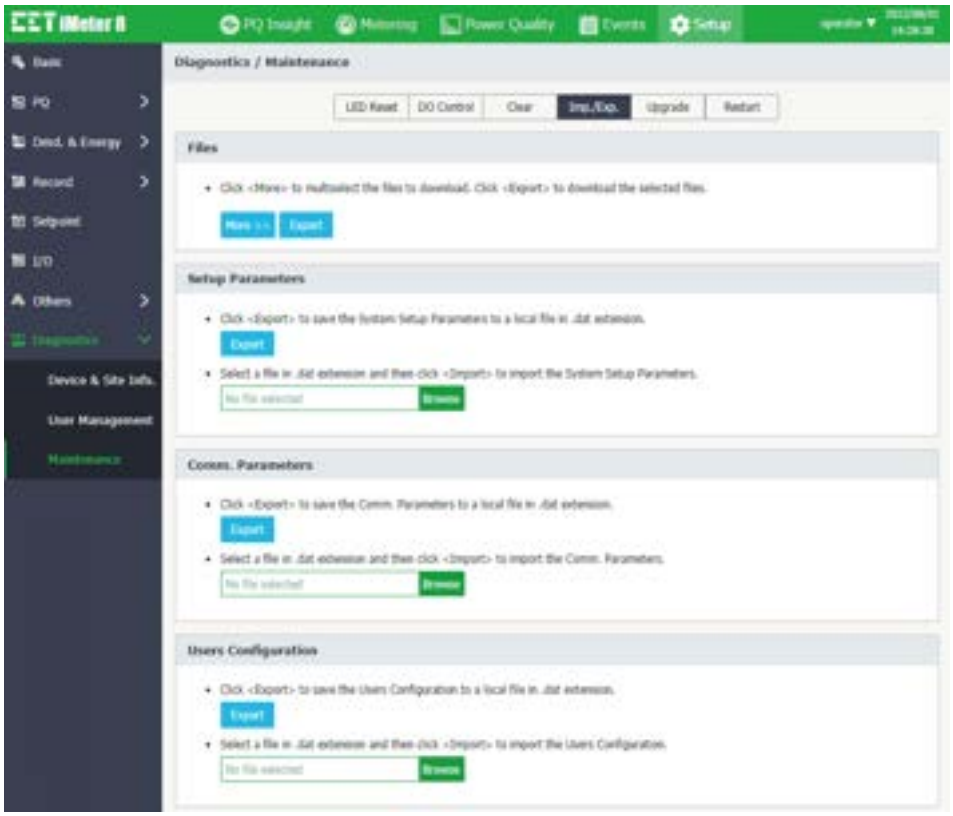


Figure 3-177 Imp./Exp. Interface

- **Upgrade** Only a user with **Operator** authority can import an IEC61850 SCL file or perform the Firmware Upgrade for iMeter 8.

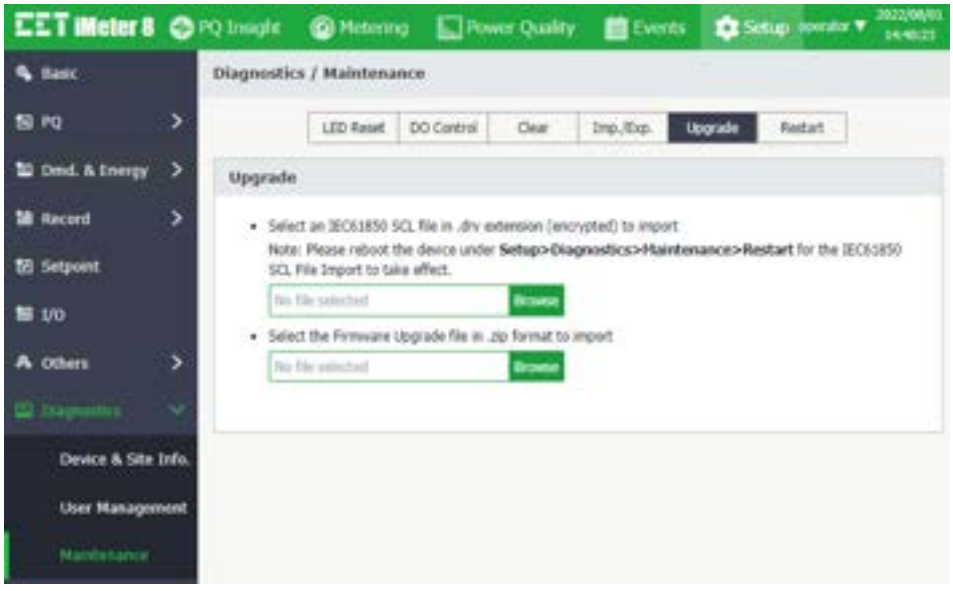


Figure 3-178 Upgrade Interface

Please be noted that you may have to clear the browser cache after upgrading the device to ensure the screen can be displayed normally. In most browsers, you can clear the cache in either the settings or options menu. The keyboard combinations **Ctrl+Shift+Del** (Windows) or **Command**+**Shift**+**Delete** (Mac) bring up the necessary deletion screen in most browsers as well.

- **Restart** Click the **Restart** tab at the top of the page and the following screen appears which allows the meter to be restarted via the Web Interface.

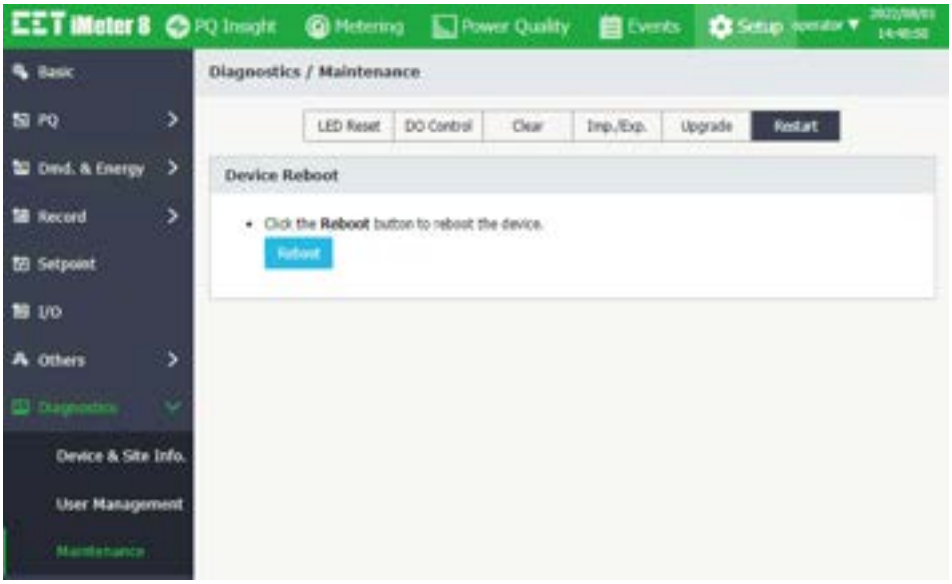


Figure 3-179 Restart Interface

Chapter 4 Applications

4.1 Inputs and Outputs

4.1.1 Digital Inputs

The iMeter 8 comes standard with 8 or optionally with 16 Digital Inputs (DIs) with a sampling frequency of 1000Hz, programmable Excitation Mode and Debounce. The iMeter 8 provides the following programmable functions for its Digital Inputs:

1) **Status Input** — Status Input are typically used for status monitoring which can help prevent equipment damage, improve maintenance, and track security breaches. The real-time statuses of the Digital Inputs are available on the Front Panel Display, Web Interface as well as through communications. Changes in Digital Input status are stored as events in the SOE Log in 1 ms resolution.

2) **Pulse Counting** — Pulse counting is supported with programmable Pulse Weight and facilitates WAGES (Water, Air, Gas, Electricity and Steam) information collection.

3) **Demand Sync Pulse** — One of DIs can be programmed to receive the Demand Sync Pulse. Only one DI can be programmed as **DMD Sync**. For example, to set DI7 as Demand Sync Input, DI1 to DI6 must not be programmed as **DMD Sync** input.

4) **Tariff Switching** — Up to 3 DIs may be used to select to which of the 8 Tariffs the energy consumption should be accumulated. The 3 DIs (DI1 to DI3) represent 3 binary digits where Tariff 1=000, Tariff 2=001, …, Tariff 8=111 where DI1 represents the least significant digit and DI3 represents the most significant digit. The **DI1 Function** setup register must first be programmed as a **Tariff Switch** before configuring DI2 with the same function. In other words, if DI1 is configured as a **Status Input** or **Pulse Counter** and DI2 is configured as a **Tariff Switch**, the TOU will continue to function based on the TOU Schedule.

The table below describes the DI's setup parameters:

Parameter	Definition	Options/Range, Default*
DIx Function	**DI** can be configured as a Status Input, Pulse Counter or DMD Sync. Only one **DI** should be programmed as **DMD Sync**. Only DI1 to DI3 can be configured as **Tariff Switch**.	0=Status Input* 1=Pulse Counter 2=DMD Sync 3=Tariff Switch
DIx Debounce	Specifies the minimum duration the **DI** must remain in the Active or Inactive state before a state change is considered to be valid.	1 to 9999 (ms), 20*
DIx Setpoint Type	Specifies the valid transition type, whether it's positive, negative or any edge, for a DI Setpoint to become active. The **DIx Setpoint Type** is only used when a DI is configured as a **Status Input** and only affects which edge would trigger the Waveform Recorder if configured.	0=Any Edge* 1=Positive 2=Negative
DIx Trigger[1]	Specifies what output action a DI Setpoint will take when it becomes active. DI Setpoint is only valid when a DI is configured as a Status Input.	See **Table 4-2**
DIx Pulse Weight	Specifies the incremental value for each received pulse. This is only used when a DI is configured as a **Pulse Counter**.	1* to 1,000,000
DI Excitation Mode	Specifies the excited mode for each DI.	0=DC*, 1=AC

Table 4-1 DI Setup Parameters

The table below provides a list of DIx's Setpoint Trigger. The DO4 to DO7 only functions when the meter is equipped with corresponding modules.

Bit	Action	Bit	Action	Bit	Action	Bit	Action
0	Alarm	**7**	DO7 Closed	**19**	DR #1	**26**	DR #8
1	DO1 Closed	**8**	Reserved	**20**	DR #2	**27**	DWR
2	DO2 Closed	**9-14**	Reserved	**21**	DR #3	**28**	WFR
3	DO3 Closed	**15**	iTrigger 1	**22**	DR #4	**29**	RMSR
4	DO4 Closed	**16**	iTrigger 2	**23**	DR #5	**30~31**	Reserved
5	DO5 Closed	**17**	iTrigger 3	**24**	DR #6		
6	DO6 Closed	**18**	Reserved	**25**	DR #7		

Table 4-2 DI Setpoint Trigger Actions

The DI setup parameters can be programmed via Front Panel, Web or through communications.

4.1.2 Digital Outputs and Alarm

The iMeter 8 comes standard with 3 or optionally with 7 Form A Electrometrical Digital Outputs (DO), and 1 Form C Relay Output can be used for Power Failure Alarm Output by enabling LOP Alarm.

The Digital Outputs on the iMeter 8 can be used in the following applications:

1) Front Panel Control Manually operated from the Front Panel, mainly used for relay testing. Please refer to **Section 3.1.3.5.11** for a detailed description.

2) Remote Control Remotely operated over communications via the on-board Web Server or the PecStar® iEMS Integrated Energy Management System.

3) Control Setpoint Control setpoints can be programmed to trigger DO, DR, WFR, DWR, RMSR, Alarm Email, LED Alarm (only parts of standard Setpoints) or iTriggers upon becoming active. Please refer to **Section 4.3** for a detailed description.

4) PQ Disturbance Setpoint PQ Disturbance setpoint can be programmed to trigger DO, DR, WFR, DWR, RMSR, iTriggers or Alarm Email upon becoming active. Please refer to **Section 4.5.6** for a detailed description.

5) Transient Setpoint Transient setpoint can be programmed to trigger DO, WFR, DWR, RMSR, iTriggers or Alarm Email upon becoming active. Please refer to **Section 4.5.7** for a detailed description.

6) Inrush Setpoint Inrush Setpoint can be programmed to trigger DO, DR, WFR, DWR, RMSR, iTriggers or Alarm Email upon becoming active. Please refer to **Section 4.5.14** for a detailed description.

7) RVC Setpoint RVC setpoint can be programmed to trigger DO, WFR, DWR, RMSR, iTriggers or Alarm Email upon becoming active. Please refer to **Section 4.5.11** for a detailed description.

8) Motor Start Setpoint Motor Start Setpoint can be programmed to trigger DO, WFR, DWR, RMSR, iTriggers or Alarm Email upon detection.

9) ITIC/SEMI F47 Setpoint ITIC or SEMI F47 Setpoint can be programmed to trigger DO or iTriggers upon the detection of PQ disturbances that are outside of the respective tolerance curves.

10) iTrigger (optional) The DO, SOE Log, WFR, DWR, RMSR or Alarm Email can be cross-triggered by iMeter devices within the same local area network.

DOs on the iMeter 8 have the following setup parameters:

Parameter	Definition	Options/Range, Default*
LOP Alarm	Specifies if the Power Failure Alarm function is enabled. If the Output isn't programmed as LOP, it can be used as normal DO (Alarm).	0=Disabled, 1=Enabled*
Arm before Execute	Enable or disable the **Arm Before Execute** feature for the DO.	0=Enabled*, 1=Disabled
Alarm/DOx Pulse Width (x=1 to 7)	Specifies if the duration for which the relay output will be active when a Remote Operate or Setpoint Trigger command is received to operate it.	0* to 6000 (x 0.1s) 0 (Latch Mode)

Table 4-3 DO Setup Parameters

The DO setup parameters can be programmed via Front Panel, Web or through communications.

Since there are multiple ways to trigger the relay output on the iMeter 8, 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 Setpoint, PQ Disturbance Setpoint, Transient Setpoint, Inrush Current Setpoint, RVC Setpoint, Motor Start Setpoint, ITIC/SEMI F47 Alarm and iTrigger 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 Digital Output and may be useful in providing a generic alarm output signal. However, the sharing of a DI 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

The iMeter 8 comes optionally with 2 or 4 Solid State Relay Outputs for energy pulsing. Energy Pulse Outputs are typically used for accuracy testing. Energy pulsing can be configured from the Front Panel, Web Interface or through communications. The table below illustrates the ranges and default values for the Energy Pulse Outputs

parameters:

Parameters	Definition	Options/Range, Default*
Ex Source (x=1 to 4)	Specify the source to which the energy pulse output is proportional.	See **Table 4-5 Ex Source**
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, 12800 (imp/kWh), and any value between 0 and 65535^
Energy / Pulse~	Specify required energy to trigger 1 energy pulse.	1* to 65535 (x0.1)kxh/imp
Energy Pulse Type~	Specify the energy pulse mode. • 0: apply to the setting of the **Pulse Constant** (register 41350), which means energy pulse is based on the secondary value. • 1: apply to the setting of the **Energy / Pulse** (register 41351), which means energy pulsing is based on the primary value.	0

~ Available in the firmware V2.50.51 or later. ^ Available in the firmware V2.51.51 or later

Table 4-4 Setup Parameters for Energy Pulse Output

Source	Description	Source	Description	Source	Description
1	kWh Total	**7**	kWh Total TH	**13**	kvarh Total Fund.
2	kWh Imp.	**8**	kWh Imp. TH	**14**	kvarh Imp. Fund.
3	kWh Exp.	**9**	kWh Exp. TH	**15**	kvarh Exp. Fund.
4	kWh Total Fund.	**10**	kvarh Total	**16**	kvarh Total TH
5	kWh Imp. Fund.	**11**	kvarh Imp.	**17**	kvarh Imp. TH
6	kWh Exp. Fund.	**12**	kvarh Exp.	**18**	kvarh Exp. TH

Table 4-5 Ex Source

The **Pulse Constant** can be configured as 1000/3200/5000/6400/12800 impulses per kWh. It's important to understand that Energy Pulsing is always based on the secondary ratings 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 **Pulse Constant** based on **Z** = 2 x $V_{nominal}$ x $I_{nominal}$, where $V_{nominal}$ and $I_{nominal}$ are the secondary nominal Voltage and Current 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 4-6 Recommended Settings for Energy Pulse Constant

4.1.4 Analog Inputs (Optional)

The iMeter 8 comes optionally with two Analog Inputs which can be programmed as 0mA to 20mA or 4mA to 20mA input. There are 3 setup parameters for each AI:

Parameters	Definition	Options/Range, Default*
Type	Select between 0-20mA or 4-20mA input	4~20mA*, 0~20mA
Zero Scale	This value corresponds to the minimum Analog Input of 0 mA (for 0-20mA Input) or 4 mA (for 4-20mA input).	-999,999 ~+999,999, 400*
Full Scale	This value corresponds to the maximum Analog Input of 20 mA.	-999,999 ~ +999,999, 2000*

Table 4-7 AI Setup Parameters

For example, to measure the oil temperature of a transformer, connect the outputs of the temperature sensor to the AI terminals of the iMeter 8. The temperature sensor outputs 4mA when the temperature is -25°C and 20mA when the temperature is 100°C. As such, the **Type** parameter should be programmed as **4-20mA**. The **AI FULL** parameter should be programmed with the value 100, and the **AI ZERO** parameter should be programmed with the value -25. Therefore, when the output of the sensor is 20mA, the reading will be 100.00°C. When the output is 4mA, the reading will be -25.00°C. When the output is 12mA, the reading will be (100°C - (-25°C)) x (12mA-4mA) / (20mA-4mA) + (-25°C) = 37.50°C.

4.1.5 Analog Outputs (Optional)

The iMeter 8 comes optionally with one or two Analog Outputs which can be programmed as 0mA to 20mA or 4mA to 20mA output. There are 4 setup parameters for each AO:

Parameters	Definition	Options/Range, Default*
AOx Type	Select between 0-20mA or 4-20mA input	4~20mA*, 0~20mA
AOx Key	Defines the parameter to which the Analog Output is proportional. see **Analog Output Parameters** table	0* to 15
Zero Scale	Defines the zero scale value of the parameter when the Analog Output is 0 or 4 mA according to the AO Type.	-999,999 ~ +999,999, 0*
Full Scale	Defines the full scale value of the parameter when the Analog Output is 20 mA.	-999,999 ~ +999,999*

Table 4-8 AO Setup Parameters

The table below lists the Analog Output Parameters.

Key	Parameter	Scale	Unit	Key	Parameter	Scale	Unit
0	Uab	x1	V	**8**	P Total	x1	kW
1	Ubc		V	**9**	Q Total		kvar
2	Uca		V	**10**	S Total		kVA
3	ULL Average		V	**11**	PF Total	x0.001	-
4	Ia		A	**12**	Frequency	x0.01	Hz
5	Ib		A	**13**	P Total Present Demand	x1	kW
6	Ic		A	**14**	Q Total Present Demand		kvar
7	I Average		A	**15**	S Total Present Demand		kVA

Table 4-9 Analog Output Parameters

For example, an AO of 4-20mA is required to be proportional to Phase A current. The maximum value of phase A current is 2000A, and the minimum value is 500A. As such, the **Type** parameter should be programmed as **4-20mA**. The **Key** parameter should be programmed with Ia (Phase A Current). The **AO FULL** parameter should be programmed with the value 2000. The **AO ZERO** parameter should be programmed with the value 500. Therefore, when Phase A Current is 500A or below, the AO output is 4mA. When Phase A Current is 2000A, the AO output is 20mA. When Phase A Current is 1250A, the AO is (1250A-500A) x (20mA-4mA) / (2000A-500A) + 4mA = 12.00 (mA).

4.2 Power, Energy and Demand

4.2.1 Basic Measurements

The iMeter 8 provides the following basic measurements (@ 1-second update rate) which are available through the Front Panel, Web Interface or communications.

- 3-phase U, I, P, Q, S and PF as well U4, I4, I5
- kWh, kvarh Import/Export/Net/Total and kVAh Total
- Frequency

4.2.2 High-speed Measurements

The iMeter 8 provides the following high-speed measurements which are available through the communications.

- 3-phase U, I, P, Q, S and PF as well as U4, I4 and I5 @ ½ cycle
- Frequency @ 1 cycle

4.2.3 Energy Measurements

The iMeter 8 provides Energy parameters for active energy (kWh), reactive energy (kvarh) and apparent energy (kVAh), as well as harmonic energy with a maximum value of 100,000,000,000.000 or 1,000,000,000.000 (if **Energy Rollover** is set to **1**). When the maximum value is reached, the energy registers will automatically roll over to zero. The energy can be reset manually through the Front Panel, on-board Web or via communications. Besides, the energy can be preset to user-defined values through the Web Interface or via communications. The iMeter 8 provides the following energy measurements:

kWh	kvarh	kVAh
Imp. (Total RMS)	Imp. (Total RMS)	kVAh Total
Exp. (Total RMS)	Exp. (Total RMS)	
Net (Total RMS)	Net (Total RMS)	

Total (Total RMS)	Total (Total RMS)	
Imp./Exp./Net/Total Fundamental	Imp./ Exp./Net/Total Fundamental	
Imp./Exp./Net/Total TH	Imp./Exp./Net/Total TH	
Imp./Exp. H02 to H63	Imp./Exp. H02 to H63	

Table 4-10 Energy Measurements

4.2.4 Demand Measurements

4.2.4.1 Present and Predicted Demand

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

iMeter 8 provides the predicted demand for pre-alarming and helps users to reduce demand consumption by predicting the demand at the end of the present period based on the current real-time power consumption.

The iMeter 8 provides the following Present Demand and Predicted Demand parameters:

	Present Demand	Predicted Demand
Voltage	Ua, Ub, Uc, ULN Avg, Uab, Ubc, Uca, ULL Avg, U4	Ua, Ub, Uc, ULN Avg, Uab, Ubc, Uca, ULL Avg, U4
Current	Ia, Ib, Ic, I Avg, I4, I5	Ia, Ib, Ic, I Avg, I4, I5
Frequency	Frequency	Frequency
Power	Pa/Pb/Pc Import/Export, Total P Import/Export Qa/Qb/Qc Import/Export, Total Q Import/Export Sa/Sb/Sc, S Total	Pa/Pb/Pc Import/Export, P Total Import/Export Qa/Qb/Qc Import/Export, Q Total Import/Export Sa/Sb/Sc, S Total
PF	PFa, PFb, PFc, PF Total	PFa, PFb, PFc, PF Total
Harmonics	Ua (Uab) THD/TOHD/TEHD Ub (Ubc) THD/TOHD/TEHD Uc (Uca) THD/TOHD/TEHD U4 THD/TOHD/TEHD Ia Fund./THD/TOHD/TEHD/K-Factor Ib Fund./THD/TOHD/TEHD/K-Factor Ic Fund./THD/TOHD/TEHD/K-Factor I4 Fund./THD/TOHD/TEHD/K-Factor	-
Unbalance	U0/U2 Unbalance, I0/I2 Unbalance	-
Deviation	Ua Deviation/Over Deviation/Under Deviation Ub Deviation/Over Deviation/Under Deviation Uc Deviation/Over Deviation/Under Deviation Uab Deviation/Over Deviation/Under Deviation Ubc Deviation/Over Deviation/Under Deviation Uca Deviation/Over Deviation/Under Deviation Frequency Deviation	-

Table 4-11 Present and Predicted Demand Parameters

4.2.4.2 Max. Demand

The iMeter 8 also provides the Max. Demand of This/Last Month or Since/Before Last Reset according to the **Self-Read Time** setup parameter. The Max. Demand of This Month (or Since Last Reset) is transferred to the Max. Demand of Last Month (or Before Last Reset) and then reset each month at the **Self-Read Time** or after a manual reset. The iMeter 8 provides the following Max. Demand parameters:

	Max. Demand Measurements (with Timestamp)
Power	Total P Import/Export, Total Q Import/Export
Current	Ia, Ib, Ic, Ia Fund., Ib Fund., Ic Fund, I4 Fund.

Table 4-12 Max. Demand Measurements

This Max. Demand can be reset manually through the Front Panel, Web Interface or through communications.

4.2.4.3 Max./Min. Value per Demand Period

The iMeter 8 calculates the Max./Min. value per demand period for the parameters as shown in table below and all the measurements can be accessed through communications.

	Max./Min. Parameters per Demand Period
Voltage	Ua, Ub, Uc, ULN Avg, Uab, Ubc, Uca, ULL Avg, U4
Current	Ia, Ib, Ic, I Avg, I4, I5
Frequency	Frequency
Power	Pa/Pb/Pc Import/Export, Total P Import/Export Qa/Qb/Qc Import/Export, Total Q Import/Export Sa/Sb/Sc, S Total

PF	PFa, PFb, PFc, PF Total
Harmonics	Ua (Uab) THD/TOHD/TEHD Ub (Ubc) THD/TOHD/TEHD Uc (Uca) THD/TOHD/TEHD U4 THD/TOHD/TEHD Ia Fund./THD/TOHD/TEHD/K-Factor Ib Fund./THD/TOHD/TEHD/K-Factor Ic Fund./THD/TOHD/TEHD/K-Factor I4 Fund./THD/TOHD/TEHD/K-Factor
Unbalance	U0/U2 Unbalance, I0/I2 Unbalance
Deviation	Ua Deviation/Over Deviation/Under Deviation Ub Deviation/Over Deviation/Under Deviation Uc Deviation/Over Deviation/Under Deviation Uab Deviation/Over Deviation/Under Deviation Ubc Deviation/Over Deviation/Under Deviation Uca Deviation/Over Deviation/Under Deviation Frequency Deviation

Table 4-13 Max./Min. Parameters per Demand Period

4.2.4.4 Demand Setup Parameters

The iMeter 8 provides the following Demand setup parameters which can set through Front Panel, Web Interface or via communication:

Parameter	Definition	Options/Range, Default*
Demand Sync. Mode	**SLD** - Internally synchronized to the meter clock **Sync. DI** - 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* 1=Sync. DI
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 15*
# of Sliding Windows	Number of Sliding Windows.	1* to 15
Self-Read Time	The **Self-Read Time** allows the user to specify the time and day of the month for the Max. Demand Self-Read operation. The **Self-Read Time** supports three options: • A zero value means that the Self-Read will take place at 00:00 of the first 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. Demand of **This Month** to be transferred to the Max. Demand of **Last Month** and then reset. The terms **This Month** and **Last Month** will become **Since Last Reset** and **Before Last Reset**.	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

Table 4-14 Demand Setup Parameters

4.3 Setpoints

The iMeter 8 comes standard with 256 Standard Setpoints and 16 High-speed Setpoints which provide extensive control by allowing users to initiate an action in response to a specific condition. Typical setpoint applications include alarming, control and power quality monitoring.

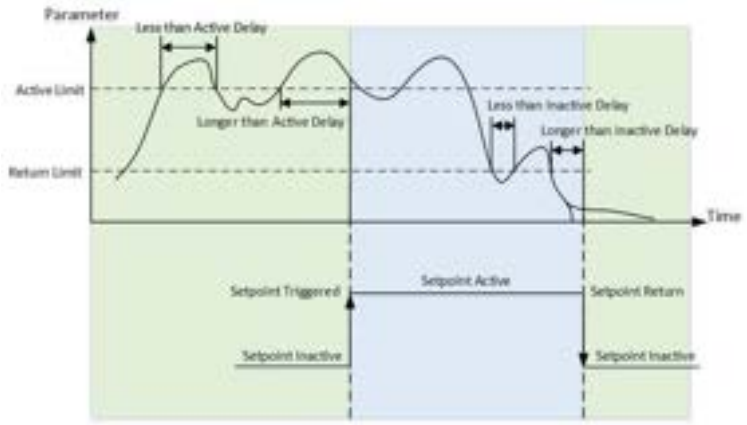


Figure 4-1 Over Setpoints

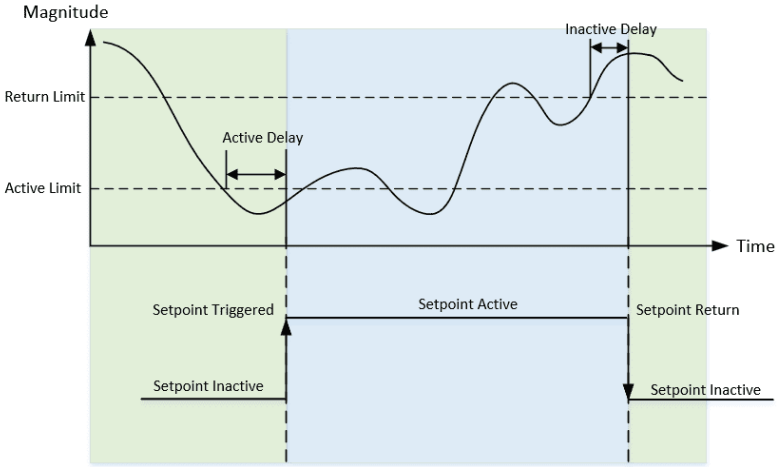


Figure 4-2 Under Setpoints

The Setpoints can be programmed via the Web Interface or communications. The table below lists the Setpoint setup parameters:

Parameter	Definition	Options/Range, Default*
Type	Disabled, Over or Under Setpoint.	0=Disabled* 1=Over SP, 2=Under SP
Parameter	Specify the parameter to be monitored.	See Table 4-16
Active Limit	Specify the value that the setpoint parameter must exceed for Over Setpoint to become active or for Under Setpoint to become inactive.	0*
Return Limit	Specify the value that the setpoint parameter must go below for Over Setpoint to become inactive or for Under Setpoint to become active.	0*
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 **Active Delay** is 0 to 9999 seconds for Standard Setpoints and 0 to 9999 cycles for HS Setpoints.	0 to 9999, 10*
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 stored in the SOE Log. The range of the **Inactive Delay** is 0 to 9999 seconds for Standard Setpoints and 0 to 9999 cycles for HS Setpoints.	0 to 9999, 10*
Setpoint Trigger	Specify what action a setpoint would take when it becomes active.	See **Table 4-17**, 0*

Table 4-15 Description for Setpoint Parameters

The iMeter 8 provides the following Setpoint parameters, Standard Setpoint can monitor all parameters while the HS Setpoint only can monitor parameters 1 to 10.

Key	Parameter	Key	Parameter	Key	Parameter
1	ULN	28	I TEHD	55	∑kW Exp. Pred. DMD
2	ULL	29	U TIHD	56	∑kvar Exp. Pred. DMD
3	U4	30	U TOIHD	57	∑kVA Pred. DMD
4	I	31	U TEIHD	58	PF Total Pred. DMD
5	I4	32	I TIHD	59	Pst

6	I5	33	I TOIHD	60	Plt
7	P Total	34	I TEIHD	61	Reserved
8	Q Total	35	U TH RMS	62	Phase Loss
9	S Total	36	U TOH RMS	0x20000	U HD02
10	PF Total	37	U TEH RMS	…	U HD03~HD62
11	U0 Unbalance	38	I TH RMS	0x3f0000	U HD63
12	U2 Unbalance	39	I TOH RMS	0x400000	U H02 RMS
13	I0 Unbalance	40	I TEH RMS	…	U H03 RMS~U H62 RMS
14	I2 Unbalance	41	U TIH RMS	0x7D0000	U H63 RMS
15	U Fundamental	42	U TOIH RMS	0x810000	U IHD01
16	I Fundamental	43	U TEIH RMS	…	U IHD02~IHD62
17	U Deviation	44	I TIH RMS	0xBF0000	U IHD63
18	U Over Deviation	45	I TOIH RMS	0x02000000	I H02 RMS
19	U Under Deviation	46	I TEIH RMS	…	I H03 RMS~I H62 RMS
20	Frequency	47	∑kW Imp. DMD	0x3F000000	I H63 RMS
21	Frequency Deviation	48	∑kvar Imp. DMD	0x40000000	I HD02
22	Phase Reversal	49	∑kW Exp. DMD	…	I HD03~I HD62
23	U THD	50	∑kvar Exp. DMD	0x7D000000	I HD63
24	U TOHD	51	∑kVA DMD	0x81000000	I IH01 RMS
25	U TEHD	52	PF Total DMD	…	I IH02 RMS~I IH62 RMS
26	I THD	53	∑kW Imp. Pred. DMD	0xBF000000	I IH63 RMS
27	I TOHD	54	∑kvar Imp. Pred. DMD		

Table 4-16 Setpoint Parameters

Bit	Action	Bit	Action	Bit	Action	Bit	Action
0	Alarm[1]	**7**	DO7 Closed [2]	**19**	DR #1	**26**	DR #8
1	DO1 Closed	**8**	LED Alarm[3]	**20**	DR #2	**27**	DWR
2	DO2 Closed	**9-14**	Reserved	**21**	DR #3	**28**	WFR
3	DO3 Closed	**15**	iTrigger 1	**22**	DR #4	**29**	RMSR
4	DO4 Closed [2]	**16**	iTrigger 2	**23**	DR #5	**30~31**	Reserved
5	DO5 Closed [2]	**17**	iTrigger 3	**24**	DR #6		
6	DO6 Closed [2]	**18**	Reserved	**25**	DR #7		

Table 4-17 Setpoint Triggers

Notes:

1) Function when a DO's **LOP Alarm** is programmed as **Disable**.

2) Valid only when the iMeter 8 is equipped with corresponding options.

3) Only parts of standard setpoints can trigger the LED Alarm, including U Deviation, U Over/Under Deviation, Frequency Deviation, U/I THD, U0/U2/I0/I2 Unbalance and Pst/Plt.

4.4 Motor Start Monitoring

The iMeter 8 can monitor the **Motor Start** procedure with the recording of the characteristic information such as I_{max}, U_{min} and Duration in the SOE Log as well as triggering DO, SOE Log, WFR, DWR, RMSR, iTrigger and Alarm Email.

- I_{max} – Maximum start current
- U_{min} – Minimum start voltage
- Duration – Time differences between the motor start detection and motor running/stop state detection.

The iMeter 8 considers 4 conditions for the monitored motor: Start, Running, Stop and Non-supervision.

- **Motor Start**

  The initial state of a motor is stop. The iMeter 8 considers the motor started from stop based on any of the following criteria:

  1) The maximum value of the 3-phase RMS current, Imax, exceeds the motor starting current threshold (1.2Ie)
  2) The Imax exceeds 0.004In (In stands for nominal current of iMeter 8) with a preset delay of 0.1s.

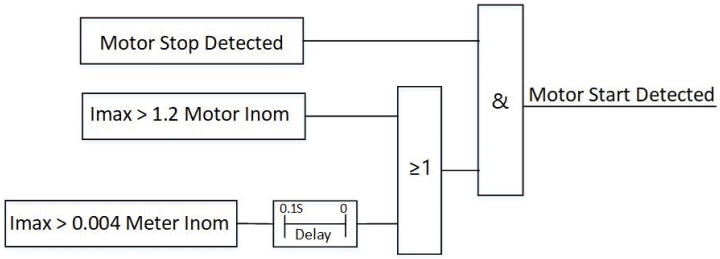


Figure 4-3 Motor Start Detected

The following table illustrates the ranges and default values for **Motor Startup** parameters.

Parameter	Options/Range, Default*	Parameter	Options/Range, Default*
Enable	Yes, No*	**I Nom. Sec.**	0.01~6.00A, 5.00A*
Trigger	N/A*, DO, SOE Log, DWR, WFR, RMSR, iTrigger and Alarm Email		

Table 4-18 Motor Startup Parameters

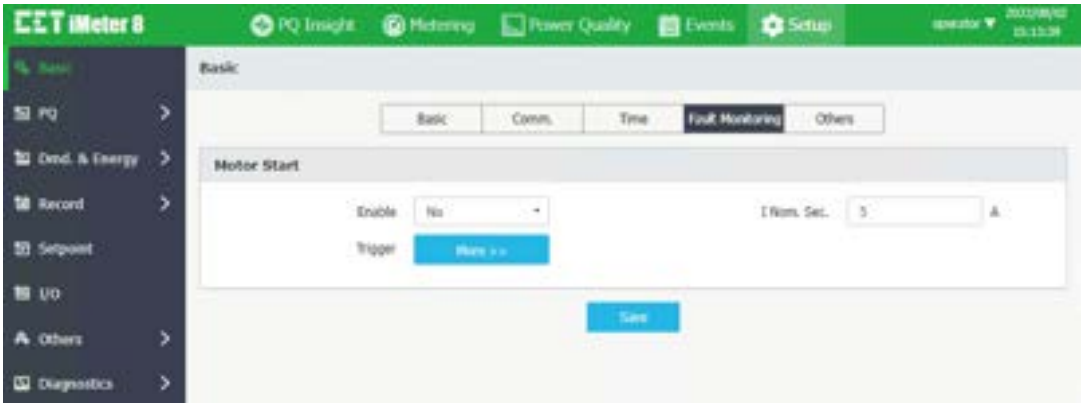


Figure 4-4 Motor Setup via the Web Interface

- **Motor Running**

  The iMeter 8 considers the motor has gone into running mode when it detects the Imax is in the range of 1.2Ie to 0.02In for at least 60ms.

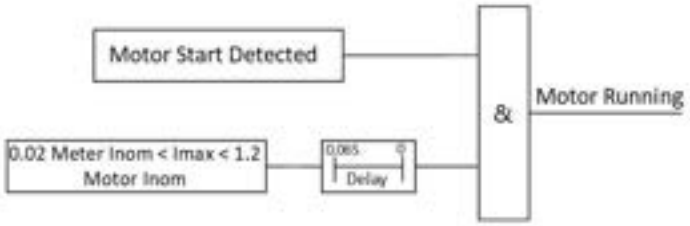


Figure 4-5 Motor Running

- **Motor Stop**

  The iMeter 8 considers the motor stopped based on the detection of Imax < 0.02In with a preset delay of 0.1s.

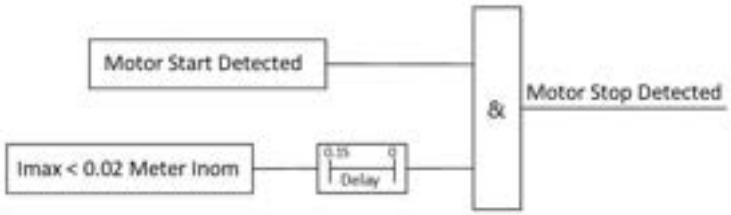


Figure 4-6 Motor Stop Detected

- **Non-supervision State**

  The iMeter 8 considers the motor as Non-supervised when the meter is restarted or the Motor Start Monitoring is disabled.

4.5 Power Quality Parameters

4.5.1 Phase Angles

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

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

4.5.2 Power Frequency and Freq. Deviation

The iMeter 8 is capable of measuring **Frequency** accurate to ±0.003Hz. The measurement range is ±10% of $f_{nominal}$, which is 40Hz to 60Hz for 50Hz system and 48Hz to 72Hz for 60Hz system.

The measurement method of **Frequency** is in accordance with **Section 5.1** of **IEC 61000-4-30 Ed. 3 Standard** for Class A performance. The iMeter 8 also computes **Freq. Deviation** as per below:

$$\textbf{Freq. Deviation} = [(f - f_{nominal})/f_{nominal}] \times 100\%$$

where $f_{nominal}$ is the Nominal Frequency

The **Freq. Deviation** measurement can be accessed through Front Panel, On-board Web Server or through communications.

4.5.3 Magnitude of the Supply Voltage

The measurement method of the **Magnitude of the Supply Voltage** is in accordance with **Section 5.2** of **IEC 61000-4-30 Ed. 3 Standard** for Class A performance. The measurement method is not intended for the detection and measurement of disturbances such as **Dips**, **Swells**, **Interruptions** and **Transients**. The RMS value includes voltage related measurements such as **Harmonics**, **Interharmonics**, **Mains Signaling**, etc.

4.5.4 Magnitude of Current

As per **IEC 61000-4-30 Ed. 3 Standard** for Class A performance, the current measurements (waveform, harmonic and interharmonic) are useful as a supplement to voltage measurements.

- *The basic measurement shall be the RMS value of the current magnitude over a 10/12-cycle time interval for a 50/60 Hz power system.*
- *The boundaries of any current measurement interval shall be determined by, and identical to, the boundaries of the interval for the corresponding voltage channel.*

4.5.5 Flicker

Flicker is a recurrent variation of light intensity of lamps caused by load change which produces a voltage drop across a system's impedance.
The iMeter 8 provides the Flicker measurements in accordance with **Section 5.3** of **IEC 61000-4-30 Ed. 3** for Class A performance (where **IEC 61000-4-15 Standard** applies). The Nominal Frequency (50Hz or 60Hz) and the **Flicker Curve** (120V or 230V) setup parameters, programmable via the Web Server or Communications, determine which model would be used for the following Flicker measurements.

- *Short-term flicker severity (Pst) measured over a 10-minute interval*
- *Long-term flicker severity (Plt) calculated from a sequence of 12 Pst according to the following formula:*

$$Plt = \sqrt[3]{\sum_{i=1}^{12} \frac{Pst_i^3}{12}}$$

After two hours measuring, the first Plt will be calculated. As from two hours Plt is calculated every 10 minutes.

The Flicker measurement can be accessed through Front Panel, On-board Web Server or through communications.

Pst/Plt values above 1.00 are generally considered as a potential issue. During the development and testing phase, 1.00 was established as the value where half of all people tested indicated that the flicker level was annoying.

4.5.6 PQ Disturbance - Dips, Swells and Interruption

The iMeter 8 supports the detection of the **Supply Voltage Dips** and **Swells** using a method that is in accordance with **Section 5.4** of **IEC 61000-4-30 Ed. 3 Standard** for Class A performance.

The iMeter 8 provides Dips/Swells detection for Voltage quality monitoring on a per phase basis, which support multiple triggers at the same time, including **DR, SOE Log, WFR, DWR, RMSR, DO, iTrigger** and **Alarm Email** (function if **LOP Alarm Enable** is set to **Disable**). The timestamp, duration and Magnitudes of per phase voltage of each Dip/Swell would be recorded by the iMeter 8. In addition, iMeter 8 also supports display of Dip/Swell event specific WFR, DWR and/or RMSR as well as the associated ITIC/SEMI F47 plot on the Front Panel and Web Interface.

4.5.6.1 Swells, Dips and Interruption Detection

As per IEC 61000-4-30 Ed.3:

☞ ***Voltage Swell Detection***

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

☞ ***Voltage Interruption Detection***

On polyphase systems, a voltage interruptions begins when the $U_{rms(1/2)}$ voltage of all channels fall below the voltage interruption threshold, and ends when the $U_{rms(1/2)}$ voltage on any one channel is equal to, or greater than, the voltage interruption threshold plus the hysteresis.

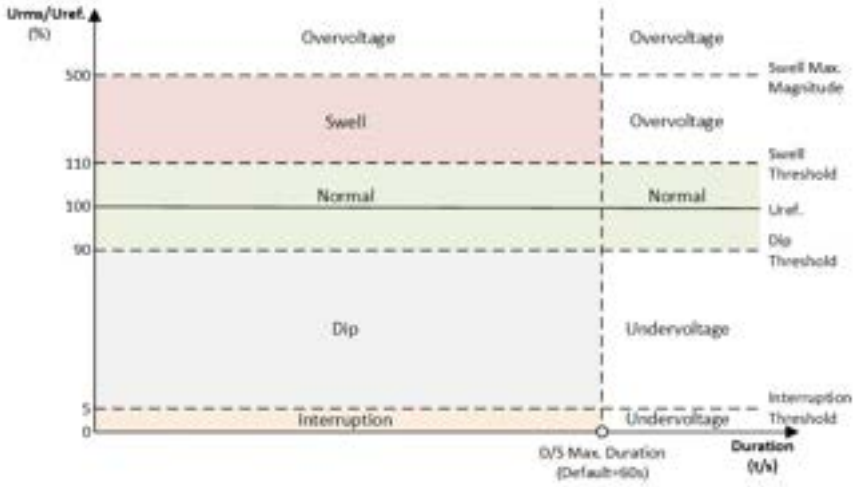


Figure 4-7 PQ Disturbance Detections

Swells and Dips are described as short duration variations, under and over voltages are described as long duration variation. When the voltage drops below a specified percentage of the nominal voltage (usually 5% or less), it is defined as an interruption.

- **Swell**

Swell detection starts when the following criteria are satisfied simultaneously:

1. The U_{rms} voltage of one or more channels rise above the [**Swell Threshold** (Default: 110%) **x Uref**)
2. All 3 channels U_{rms} are below the [**Swell Max. Magnitude** (Default: 500%) **x Uref**)
3. **Duration** is shorter than **D/S Max. Duration** (Default: 60s)

Swell detection ends when all 3 channels U_{rms} fall below the value of [**Swell (Threshold** - **Swell Hysteresis) x Uref**].

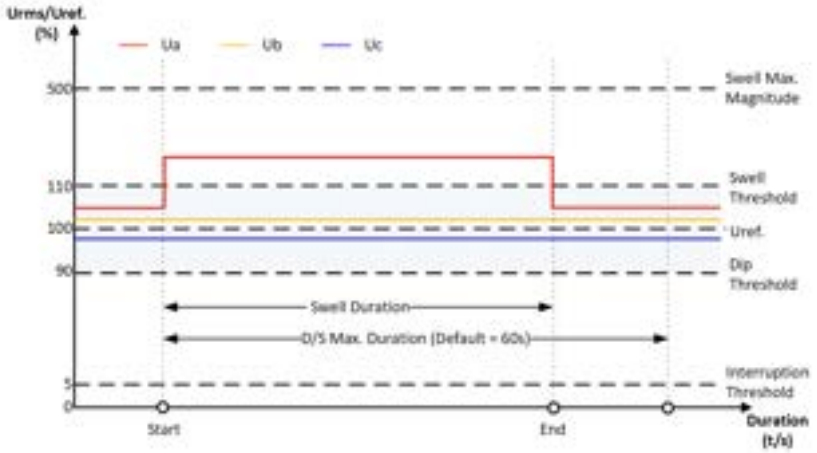


Figure 4-8 Swells Detection Criteria

- **Overvoltage**

Overvoltage will be detected when any of the following criteria is satisfied:

1. One or more channels **U_{rms}** rises above the [**Swell Max. Magnitude** (Default: 500%) **x Uref**].

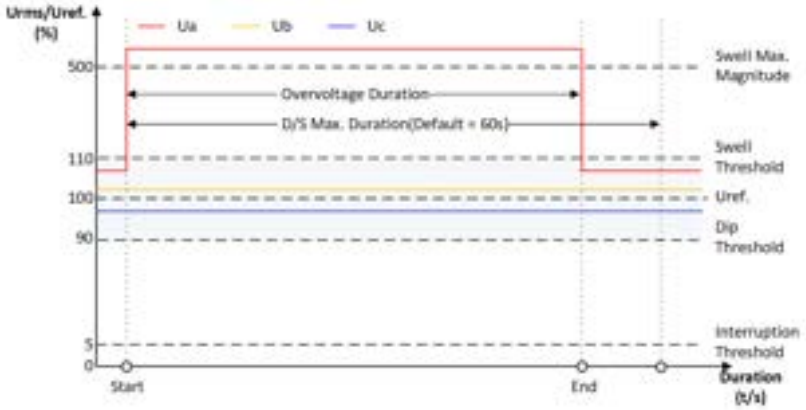


Figure 4-9 Overvoltage Detection Criteria 1

2. The **U_{rms}** of one or more channels is above the value of [**Swell Threshold x Uref]** and duration is longer than the **D/S Max. Duration** (Default: 60s)

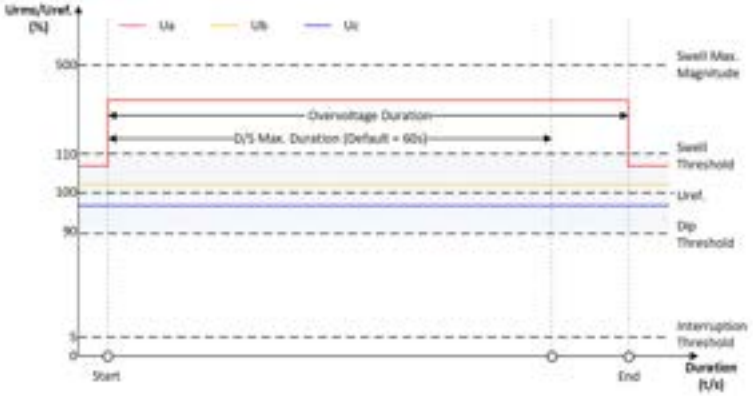


Figure 4-10 Overvoltage Detection Criteria 2

Overvoltage detection ends when all 3 channels voltage falls below the value of [**Swell (Threshold** – **Hysteresis) x Uref.].**

- **Dip**

Dip detection starts when the following criteria are satisfied simultaneously:

1. The U_{rms} of one or more channels falls below the value fo [**Dip Threshold** (Default: 90%) x Uref] but exceeds the [**Interruption Threshold** (Default: 5%) x Uref].

2. **Duration** is shorter than **D/S Max. Duration** (Default: 60s).



Figure 4-11 Dip

Dip detection ends when all 3 channels voltage exceed [**Dip (Threshold** + **Dip Hysteresis) x Uref.]**

- **Undervoltage**

Undervoltage detection starts when any of the following criteria is satisfied:

1. The U_{rms} voltage of one or more channels falls below the [**Dip Limit** (Default: 90%) x **Uref**].
2. **Duration** is longer than **D/S Max. Duration** (Default: 60s).

Undervoltage will return when all 3 channels voltage exceed [**Dip (Threshold** + **Hysteresis)** x **Uref**].

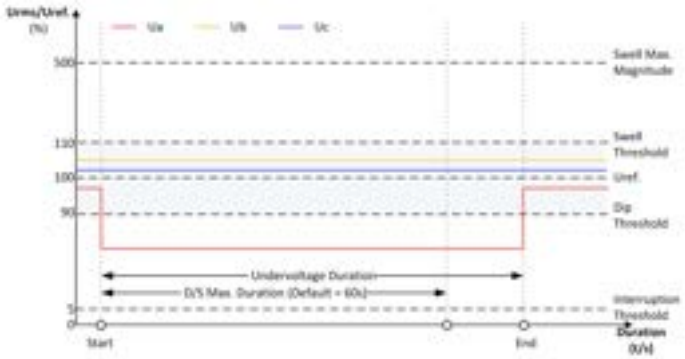


Figure 4-12 Undervoltage

- **Interruption**

Interruption detection starts when the following criteria are satisfied simultaneously:

1. All 3 channels voltage falls below the value of [**Interruption Threshold** (Default: 5%) x Uref]
2. **Duration** is shorter than **D/S Max. Duration** (Default: 60s)

If any channel's voltage is equal to or greater than the [**Interruption (Threshold** – **Hysteresis) x Uref.],** the Interruption detection ends.

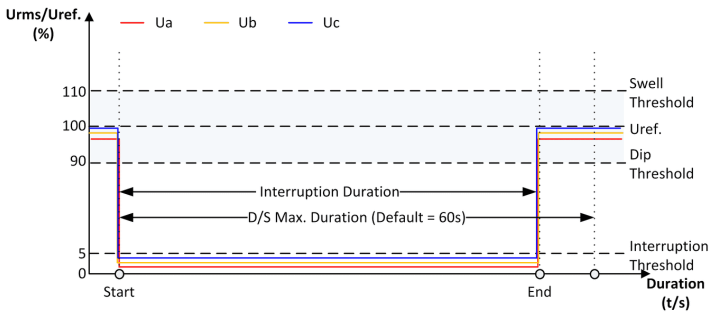


Figure 4-13 Interruption

4.5.6.2 PQ Disturbance Settings

The **PQ Disturbance** setup parameters can be programmed over the Front Panel, Web Interface or via communications. The **Dip Threshold**, **Swell Threshold**, **Voltage Interruption Threshold** and **Dip/Swell Hysteresis**

should be configured to meet the following criteria:

a) The **Voltage Interruption Threshold** shall be set below the **Dip Threshold**.
b) The **Dip/Swell Hysteresis** must be less than the **Dip/Swell Thresholds**.
c) The **Rapid Voltage Changes (RVC) Threshold** must be less than the **Dip and Swell Thresholds**.
d) Regardless of whether **Dip/Swell** is enabled, the conditions for a), b) and c) must always be met.

The following table illustrates the ranges and default values for the PQ Disturbance parameters on the iMeter 8.

Parameter	Options/Range	Default
Basic		
Enable	Dip/Swell/Interruption Enable, 0=No, 1=Yes	1
Reference Voltage (U_{ref})[1]	Udin (Nominal Voltage), Usr (Sliding Reference Voltage)	Udin
Swell Threshold (Limit)	101 to 200 (x0.01 Uref.)	110
Dip Threshold (Limit)	1 to 99 (x0.01 Uref)	90
Interruption Threshold (Limit)	0 to 50 (x0.01 Uref)	5
Swell Hysteresis	1 to 1000 (x0.001 Uref)	20
Dip Hysteresis		
Interruption Hysteresis		
Swell Trigger Action	See Note 2	DWR, RMSR
Dip Trigger Action		
Interruption Trigger Action		
Advanced		
Dip Triggers DO[3]	• When PQD Starts • When PQD Ends	When PQD Ends
Swell Triggers DO[3]		When PQD Starts
Interrupt. Triggers DO[3]		When PQD Starts
D/S RMS Update[4]	• 0 = Magnitude RMS for Dips/Swells/Interruptions computed by every 1 cycle and shifted by 1/2 cycle. • 1 = computed by every 1/2 cycle and shifted by 1/2 cycle.	0
Interruption Mode[5]	• 0 = The voltage of any phase is lower than the Interruption Threshold, the Interruptions will be triggered. • 1 = All 3 phase voltages are lower than the Interruption Threshold, the Interruptions will be triggered.	1
D/S Max. Duration	1-600s	60
Swell Max. Magnitude	101-500 (%)	500

Table 4-19 PQ Disturbance Parameters

Notes:

1. If a Sliding Reference Voltage uses measured values filtered with a 1-minute 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

   Generally, the Sliding Reference Voltage Usr is not used in LV systems.

2. The following table illustrates the details of the **Swell/Dip/Interruption Trigger Action** register with a bit value of "1" meaning Active while "0" meaning Inactive.

Bit	Trigger	Bit	Trigger	Bit	Trigger
0	Alarm (when LOP Alarm Enable = Disable)	9~14	Reserved	23	DR #5
1	DO1 Closed	15	iTrigger 1	24	DR #6
2	DO2 Closed	16	iTrigger 2	25	DR #7
3	DO3 Closed	17	iTrigger 3	26	DR #8
4	DO4 Closed	18	Reserved	27	DWR
5	DO5 Closed	19	DR #1	28	WFR
6	DO6 Closed	20	DR #2	29	RMSR
7	DO7 Closed	21	DR #3	30~31	Reserved
8	Reserved	22	DR #4		

Table 4-20 Trigger Actions

3. PQD Trigger DO modes:

DO Action Modes	DO Close When	DO Release When
When PQD Starts	Swell Starts	• Pulse Width = 0, DO will be released when PQD ends or PQD becomes invalid. If there is a new event trigger the DO, the DO will remain in the Closed state and be released until all the trigger sources return. • Pulse Width ≠ 0, DO will release after the pulse width. If there is a new event trigger the DO, the DO's pulse width will be recalculated. PQD becomes invalid when: • Swell turns to Overvoltage • Dip turns to Undervoltage • Dip turns to Interruption • Interruption turns to Undervoltage
	Dip Starts	
	Interruption Starts	
When PQD Ends	Swell Event Ends	• DO Pulse Width = 0, release after 1s • DO Pulse Width ≠ 0, release after *[the event ends + Pulse Width]*
	Dip Event Ends	
	Interruption Event Ends	

Table 4-21 PQD Trigger DO modes

4. The **Dip/Swell RMS Update** determines if the U_{rms} is computed every cycle and then shifted by ½ cycle (register value = 0) or if the U_{rms} is computed every ½ cycle and then shifted by ½ cycle (register value = 1).

5. The **Interruption Mode** determines if an Interruption event should start when the U_{rms} of all 3 phases (register value = 1) or when the U_{rms} of any phase (register value = 0) is lower than the **Interruption Threshold**.

4.5.6.3 Disturbance Direction Indicator

The iMeter 8 provides the Disturbance Direction Indicator as an educated guess with confidence level for the disturbance direction of a Dip/Swell/Interruption event, whether Upstream or Downstream, and records the information in the SOE Log.

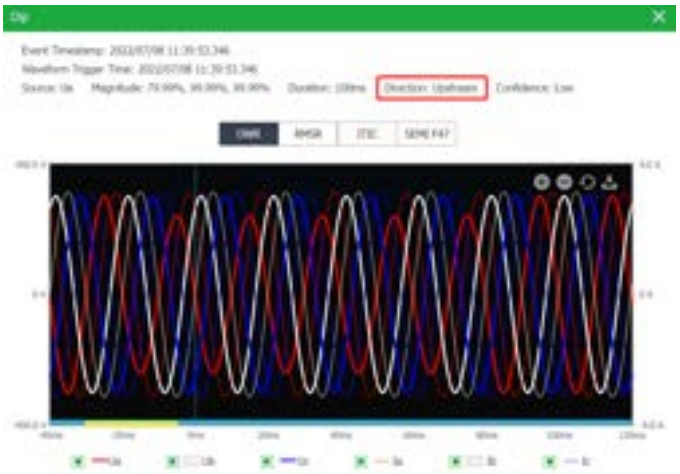


Figure 4-14 Disturbance Direction Location

4.5.6.4 DWR for PQ Disturbance

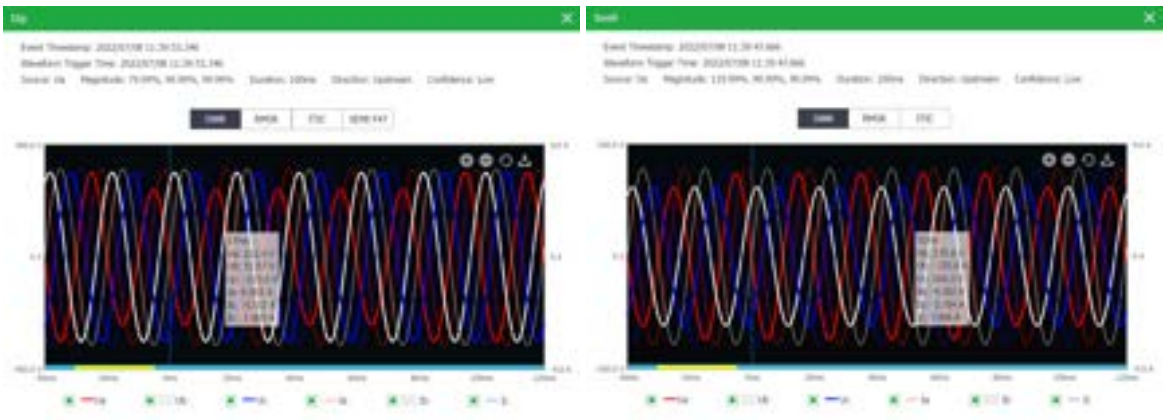


Figure 4-15 DWR of Dips and Swells Event



Figure 4-16 DWR of Interruption Event DWR

4.5.7 Transients Voltage

The iMeter 8 provides the capability for detecting Transient Voltages using the sliding-window method which compares the instantaneous value with the corresponding value on the previous cycle at a maximum resolution of 20μs (@50Hz) and in accordance with **Section 5.6** of **IEC 61000-4-30 Ed. 3 Standard**.

The iMeter 8 provides the following setup parameters for Transient Voltages which can be programmed via the Front Panel, Web Interface or Communications:

Parameter	Options/Range, Default*
Enable	Yes, No*
Threshold	5% to 500% of Udin, 35%*
Trigger	WFR*, DWR, RMSR, DO, Alarm Email

Table 4-22 Transient Setup Parameters

The figure below shows a WFR of a Voltage Transient event.

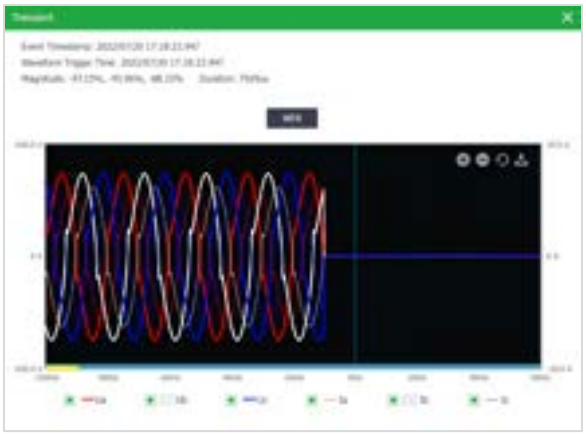


Figure 4-17 Transient Event WFR

4.5.8 Supply Voltage and Current Unbalance

The iMeter 8 provides both the Zero-Sequence and Negative-Sequence Unbalance measurements for Voltage and Current, using Symmetrical Components and in accordance with **Section 5.7**, **Section 5.13.6** of **IEC 61000-4-30 Ed. 3 Standard** for Class A performance, respectively.

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

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

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.

4.5.9 Harmonics and Interharmonics

4.5.9.1 HD/IHD Calculation Methods

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

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

4.5.9.2 Voltage Harmonic/Interharmonic

The basic measurement of voltage harmonics complies with **IEC 61000-4-7 Class I**. The standard allows three different ways to calculate the harmonics in a 0.2s fixed data window, see figure below. The user shall select either by a 10/12-cycle **Harmonic Group**, designated as $Y_{g,h}$, or a 10/12-cycle **Subgroup**, designated as $Y_{sg,h}$. When **Subgroup** is selected, the **Total Harmonic Distortion** (THD) calculated shall be the **Subgroup Total Harmonic Distortion** (THDS).

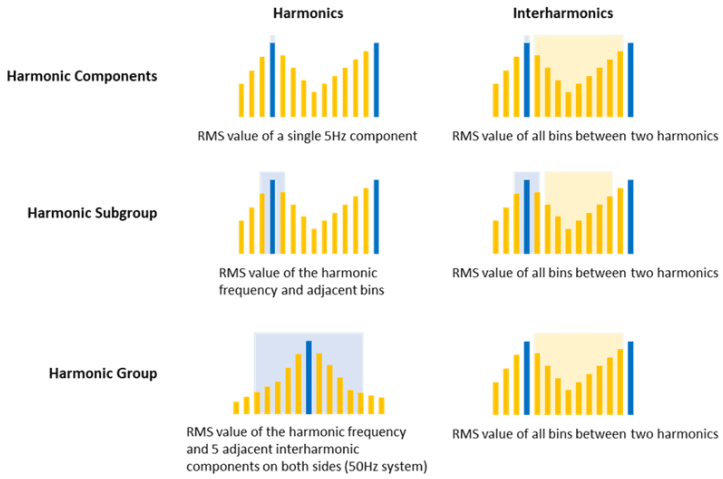


Figure 4-18 Harmonic Calculation Method

4.5.9.3 THD

For the assessment of harmonic distortion, three harmonic distortion indices are introduced in IEC 61000-4-7, named as: THD, THDS and THDG.

Total harmonic distortion (THD):

$$THD_Y = \sqrt{\sum_{h=2}^{h_{max}} \left(\frac{Y_{H,h}}{Y_{H,1}}\right)^2}$$

where
h= harmonic order (1, 2, 3, 4, … up to 63)
$Y_{H,h}$=RMS value of h^{th} harmonic component

Group total harmonic distortion (THDG):

$$THDG_Y = \sqrt{\sum_{h=h_{min}}^{h_{max}} \left(\frac{Y_{g,h}}{Y_{g,1}}\right)^2}$$

where
$Y_{g,h}$=RMS value of h^{th} harmonic group

Subgroup total harmonic distortion (THDS):

$$THDGS_Y = \sqrt{\sum_{h=h_{min}}^{h_{max}} \left(\frac{Y_{sg,h}}{Y_{sg,1}}\right)^2}$$

where
$Y_{sg,h}$=RMS value of a harmonic subgroup

On the iMeter 8, the **THD** will be calculated using **THDG** or **THDS** depending on the harmonic calculation method (**Group** or **Subgroup**).

4.5.9.4 Total Demand Distortion (TDD)

TDD is defined as the ratio of the RMS (Root-Mean-Square) of the harmonic content, considering harmonic components up to **63rd** order and specifically excluding interharmonics, expressed as a percent of the **Maximum Demand Load Current** (**I_L**).

TDD of Current is calculated by the formula below:

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

where
I_L = Maximum Demand Load Current
h = Harmonic Order (1, 2, 3, 4, etc.)
I_h = RMS Load Current at the n^{th} Harmonic

The **Maximum Demand Load Current** (**I_L**) can be user-predefined via **TDD Preset IL** parameter or computed automatically with the following algorithm (When **TDD Preset IL = 0**) as per IEEE Std 519-2022.

- If more than 12 (M≥12) month's running time data is available, the last 12 month's data will be used for I_L calculation by the following formula:

$$I_L = \frac{1}{12} \sum_{i=\text{M-12}}^{M} I_i$$

Where
M denotes the device running time in month
I_i denotes the maximum current demand in each month

- If 1 to 12 (1≤M<12) months of running time data is available, the IL shall be calculated by the following formula:

$$I_L = \frac{1}{M} \sum_{i=1}^{M} Ii$$

Where
M denotes the device running time in month
I_i denotes the monthly maximum current demand for the i^{th} month

- If less than 1 month's data is available. For example, a new installation, the Maximum Demand Load Current is not available and the meter will set IL = **This Max Current Demand**.

The Harmonics Calculation Method, THD Order and HD Calculation, as well as TDD Preset IL and I4 TDD Preset IL (supported in the firmware V2.50.00 or later) can be set through the Front Panel, Web Interface, or via Communications.

Parameter	Description	Options/Range, Default*
HD Calculation	Specifies the Harmonics calculation methods.	0=% of Fundamental* 1=% of RMS 2=% of Nominal
Harmonic Calculation Method	Specifies the mode of calculating harmonic.	0=Subgroup* 1=Group
THD Order	Specifies the order of harmonic statistic.	2 to 63*
TDD Preset IL Primary	Specifies if the TDD calculation method compatible with the standard TDD calc. in IEEE_519 • 0: represents to use the TDD calculation method compatible with the standard TDD calc. in IEEE Std 519-2022 • non-zero value: it is the preset IL for TDD Calculation As per IEEE Std 519-2022: *IL = maximum demand load current at the PCC (point of common coupling) under normal load operating conditions*	0*~30,000A (x0.001)
I4 TDD Preset IL Primary		

Table 4-23 Setup parameters for Harmonic

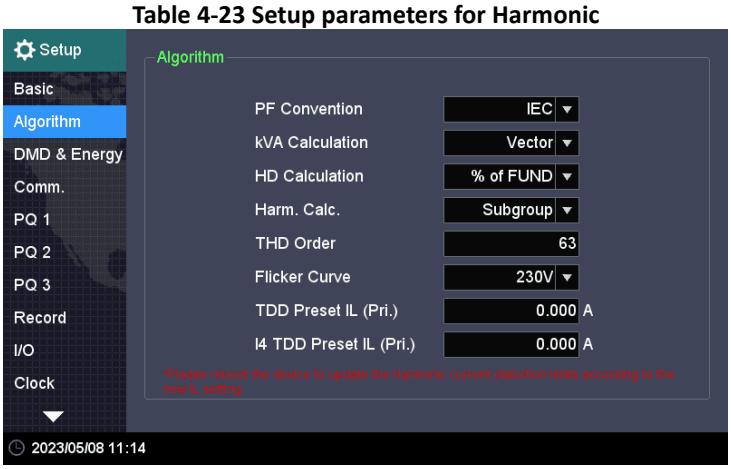


Figure 4-19 PQ-Harmonics Setup Interface

4.5.9.5 Harmonics Power

The iMeter 8 provides Individual Harmonic to the 63rd order and the TH (Total Harmonic) P, Q, S and PF for 3-Ø and Total. The Total 3-Ø Harmonic Powers are only available via communications while the Individual Harmonic and TH (Total Harmonic) Powers for Phase A/B/C are available via both the Web Interface and communications.

4.5.9.6 Harmonic Energy

The iMeter 8 provides the Total Harmonic Energy Measurements for kWh, kvarh Import/Export/Net/Total and kVAh as well as the Individual Harmonic Energy Measurements to the 63rd order for kWh, kvarh Import/Export. The Harmonic Energy can be retrieved via the Front Panel, Web Interface and Communications.

4.5.9.7 K-Factor

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

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

Where

I_h = h_{th} Harmonic Current in RMS

h_{max} = Highest harmonic order

4.5.9.8 Crest Factor

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

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

where

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

X_{rms} = RMS value

4.5.9.9 Harmonics/Interharmonics Voltage and Current

The iMeter 8 provides the following Harmonic/Interharmonic Voltage and Current measurements:

Measurements	Ua	Ub	Uc	U4	Ia	Ib	Ic	I4
THD, TOHD, TEHD (%)	▪	▪	▪	▪	▪	▪	▪	▪
HD01 to HD63 (%)	▪	▪	▪	▪	▪	▪	▪	▪
H01 to H63 (RMS)	▪	▪	▪	▪	▪	▪	▪	▪
TH/TOH/TEH	▪	▪	▪	▪	▪	▪	▪	▪
Current K-Factor	-	-	-	-	▪	▪	▪	▪
Crest Factor	▪	▪	▪	▪	▪	▪	▪	▪
IHD00 to IHD63 (%)	▪	▪	▪	▪	▪	▪	▪	▪
IH00 to IH63 (RMS)	▪	▪	▪	▪	▪	▪	▪	▪
TIHD, TOIHD, TEIHD (%)	▪	▪	▪	▪	▪	▪	▪	▪
TIH, TIEH, TIOH (RMS)	▪	▪	▪	▪	▪	▪	▪	▪
Phase Angle H01 to H63	▪	▪	▪	▪	▪	▪	▪	▪

Table 4-24 Voltage and Current Harmonics and Interharmonics Measurements

4.5.10 MSV (Mains Signalling Voltage)

Mains signalling voltage, called “ripple control signal” in certain applications, is a burst of signals, often applied at a non-harmonic frequency, that remotely control industrial equipment, revenue meters and other devices.

The iMeter 8 provides the Mains Signalling Voltage measurements in accordance with **Section 5.10** of **IEC 61000-4- 30 Ed. 3 Standard** for Class A performance.

- ☞ *Mains Signalling Voltage is RMS voltage of mains signal.*
- ☞ *Mains signalling 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 signalling 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 0.3% U_{din} as well as the length of the recording period up to 120s.*

The iMeter 8 can simultaneously detect three different frequencies for Mains Signalling Voltage. The emission signalling will trigger an event in SOE, recording the Trigger Channel and Max. Volt. of the three-phase voltages.

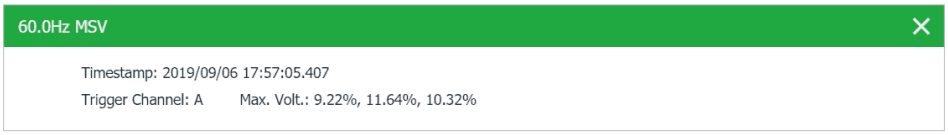


Figure 4-20 Event for 60.0Hz MSV in SOE

The iMeter 8 provides following MSV setup parameters which can be programmed through Front Panel, Web Interface or Communications:

Parameter	Options/Range, Default*	Parameter	Options/Range, Default*
Enable	Yes, No*	Frequency	60 to 3k Hz, 1k(MSV1)*, 2k(MSV2)*, 3k(MSV3)*
Threshold	0.3% to 100% of Udin, 5%*	Signalling Time	1 to 120s, 60s*

Table 4-25 Mains Signal Voltage Setup Parameters

4.5.11 RVC (Rapid Voltage Change)

The iMeter 8 provides the ability to capture RVC in accordance with **Section 5.11** & **A.5** of the **IEC 61000-4-30 Ed. 3 Standard** for Class A performance.

As per 5.11 of IEC 61000-4-30 Ed. 3:

- ☞ *A rapid voltage change is a quick transition in RMS voltage occurring between two steady-state conditions and during which the RMS voltage does not exceed the dip/swell thresholds*
- ☞ *An RMS voltage is in a steady-state condition if all the immediately preceding 100/120 $U_{rms\ (1/2)}$ values remain within an RVC threshold from the arithmetic mean of those 100/120 $U_{rms\ (1/2)}$ values.*
- ☞ *The RVC threshold and hysteresis are set by the user according to the application, as percentage of Udin and the hysteresis should be less than the threshold.*

4.5.11.1 Rapid Voltage Change Evaluation

A Rapid Voltage Change event is characterized by 4 parameters: **Start time**, **Duration**, ΔU_{max} and ΔU_{ss}.

- Start Time — When the "Voltage-is-Steady-State" logic signal becomes False and initiates the RVC event.
- Duration — 100/120 half-cycle prior to the "Voltage-is-Steady-State" logic signal returns to True from False.
- ΔU_{max} — The absolute maximum difference between any of the $U_{rms\ (1/2)}$ values during the RVC event and the final arithmetic mean 100/120 $U_{rms\ (1/2)}$ value just prior to the RVC event.
- ΔU_{ss} — The absolute difference between the final arithmetic mean 100/120 $U_{rms\ (1/2)}$) value just prior to the RVC event and the first arithmetic mean 100/120 $U_{rms\ (1/2)}$ value after the RVC event.

The iMeter 8 provides the following RVC setup parameters which can be programmed via the Front Panel, Web Interface or Communications:

Parameter	Options/Range, Default*	Parameter	Options/Range, Default*
Enable	Yes, No*	Threshold	0.2% to 10% of Udin, 5%*
Hysteresis	0.1 to 5 (%) of Udin, 2.5%*	Trigger	WFR, DWR, RMSR*, DO, iTrigger

Table 4-26 RVC Setup Parameters

4.5.11.2 RMSR for an RVC Event

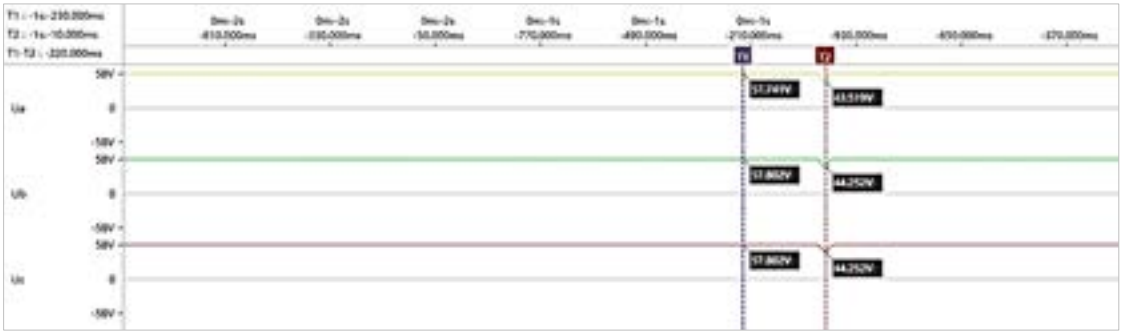


Figure 4-21 RMSR for an RVC Event

4.5.12 Voltage Underdeviation and Overdeviation

The iMeter 8 provides the ability to capture **Voltage Deviation** in accordance with the **IEC 61000-4-30 Ed. 3 Standard**.

As per Section 5.12 or Annex D (Informative) of IEC 61000-4-30 Ed. 3

- ☞ *The 10/12-cycle r.m.s value, $U_{rms\ (10/12),\ i}$, should be used to assess the underdeviation and overdeviation parameters in percent of Udin. The underdeviation $U_{rms\text{-}under}$ and overdeviation $U_{rms\text{-}over}$ parameters are determined by the following equations:*

Calculation of $U_{rms\text{-}under,\ i}$:

If $U_{rms\ (10/12),\ i} > U_{din}$ then $U_{rms\text{-}under,\ i} = U_{din}$

If $U_{rms\ (10/12),\ i} \leq U_{din}$ then $U_{rms\text{-}under,\ i} = U_{rms\ (10/12),\ i}$

Calculation of $U_{rms\text{-}over,\ i}$:

If $U_{rms\ (10/12),\ i} < U_{din}$ then $U_{rms\text{-}over,\ i} = U_{din}$

If $U_{rms\ (10/12),\ i} \geq U_{din}$ then $U_{rms\text{-}over,\ i} = U_{rms\ (10/12),\ i}$

And the Underdeviation/Overdeviation should be calculated based on the following:

Underdeviation:

$$U_{under} = \frac{U_{din} - \sqrt{\frac{\sum_{i=1}^{n} U_{rms-under,i}^2}{n}}}{U_{din}}$$

Overdeviation:

$$U_{over} = \frac{\sqrt{\frac{\sum_{i=1}^{n} u_{rms-over,i}^2}{n}} - U_{din}}{U_{din}}$$

Where

n = the number of 10/12 cycle RMS values for under or overdeviation

and

$U_{rms\text{-}under,\ i}$ /$U_{rms\text{-}over,\ i}$ *is the* i^{th} *10/12-cycle RMS value.*

The iMeter 8 is capable of measuring Voltage with an accuracy of 0.1% and monitoring Voltage Deviation online. In addition, the Voltage Deviation is supported by the Setpoint function. Please refer to **Chapter 3 User Interface** for the Deviation parameters on the Front Panel and Web Interface.

4.5.13 Flagging Concept

The iMeter 8 supports the Flagging Concept as per ***Section 4.7*** of the ***IEC 61000-4-30 Ed. 3 Standard:***

- *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 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.*

Besides, flagging will be triggered by the detection of I > 2In on iMeter 8.

The **Flagging Status** register (0080) indicates if a certain group of data has been ***flagged*** because of Dip/Swell/Interruption or Over Current Limit detected, with a bit value of 1 meaning ***flagged*** and 0 meaning ***not flagged*** for the corresponding event.

Bit	Description		Bit	Description	
B0	Basic Measurements	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 4-27 Flagging Status Register (0080)

For real-time Voltage, Frequency, Pst and Plt, as well as Pst and Plt Log, a value of “1” indicates that a particular group of data has been flagged due to Dip (BIT0), Swell (BIT1), or Interruption (BIT2) is detected. And in the Flagging Status register for real-time Current measurements, a value of “1” indicates that a certain group of data has been flagged due to overcurrent.

For any Statistical Log, the **Eliminate Flagged Data** register (40825) defines if the flagging data should be kept or removed in a particular type of statistical log as illustrated in the following table. If the corresponding Flagged Data Setup is set to **Remove**, 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. And in the Flagging Status registers, a value of “0” indicates no flagged data, and “1” indicates that a particular group of data has been flagged and removed while “2” (only for SDR Log and Max./Min. Log) indicates the flagged data has been kept.

Bit7~Bit15	Bit 6	Bit4~Bit15	Bit3	Bit2	Bit1	Bit0
Reserved	IEEE Std 519 Report	Reserved	EN50160 Log	Min. Log	Max. Log	SDR Log

Table 4-28 Flagging Setup Register (40825)

4.5.14 Inrush Current

Inrush current refers to the maximum instantaneous current drawn by a power supply or electrical device at turn-on, 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.

As per **Section A6.4** of **IEC 61000-4-30 Ed. 2 Standard**, the iMeter 8 supports the detection of Inrush Current as a supplement to voltage measurements, especially when trying to determine the causes of events such as voltage dip.

☞ *The inrush current begins when the* $I_{half_cyc_rms}$ *current rises above the* ***Inrush Threshold*** *and ends when the* $I_{half_cycle\text{-}rms}$ *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 the measurement inrush current* $I_{half_cyc_rms}$
- *the square root of the mean of the squared* $I_{half\ cyc\ rms}$ *values measured during the inrush duration*

The $I_{half_cyc_rms}$ is calculated by the following equation:

$$I_{half_cyc_rms} = \sqrt{\frac{1}{T/2}\int_0^{T/2} i^2(t)dt}$$



Figure 4-22 Inrush Current

The following table illustrates the ranges and default values for the Inrush Current parameters:

Parameter	Options/Range, Default*	Parameter	Options/Range, Default*
Enable	Yes, No*	**Threshold**	10% to 500% of In, 120%*
Hysteresis	0.1% to 100% of In, 1%*	**Trigger**	DR, WFR*, DWR, RMSR, DO, iTrigger

Table 4-29 Inrush Current Parameters

4.5.15 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 iMeter 8 can measure, summarize data and statistical relevant data in accordance with the EN50160

standard. Further, the device will create a report per week for the following PQ parameters and store the report for one year.

- Power Frequency, including Maximum and Minimum
- Supply Voltage Variations, including Maximum and Minimum
- Flickers, including Max./Min. and CP95
- Voltage Unbalance, including Max./Min. and CP95
- Harmonic and Interharmonic Voltage, including Max./Min., average and CP95
- Mains Signalling Voltage, including Max./Min. and CP95
- Rapid Voltage Changes
- Dips and Swells with statistical parameters classified according to characteristic Voltage and duration
- Interruptions with statistical parameters classified according to the duration
- Transient

The following table illustrates the default limits for the EN50160 parameters. The users can modify the default values via the Web Server or Communications.

EN50160 Parameter	Setting / Voltage Level	Low	Medium	High
Power Frequency	Wide Tolerance (%)	100	100	100
	Wide Tolerance Limit (%)	94~104	94~104	94~104
	Narrow Tolerance (%)	99.5	99.5	99.5
	Narrow Tolerance Limit (%)	99~101	99~101	99~101
Supply Voltage Variations	Wide Tolerance (%)	100	100	100
	Wide Tolerance Limit (%)	85~110	85~115	85~115
	Narrow Tolerance (%)	95	99	99
	Narrow Tolerance Limit (%)	90~110	90~110	90~110
Flicker Severity	Tolerance (%)	95	95	95
	Limit	1	1	1
Supply Voltage Unbalance	Tolerance (%)	95	95	95
	Limit (%)	2	2	2
Voltage Harmonic Limits	Tolerance (%)	95	95	95
	Total (%)	8	8	8
	H02 (%)	2	2	1.9
	H03 (%)	5	5	3
	H04 (%)	1	1	1
	H05 (%)	6	6	5
	H07 (%)	5	5	4
	H09 (%)	1.5	1.5	1.3
	H11 (%)	3.5	3.5	3
	H13 (%)	3	3	2.5
	H17 (%)	2	2	2
	H19/H23/H25 (%)	1.5	1.5	1.5
	H06/H08/H10/H12/H14/H15/ H16/H18/H20/H21/H22/H24 (%)	0.5	0.5	0.5

Table 4-30 Default Values for EN50160 Settings

The programming of the EN50160 reporting is supported via the Web interface and communications. The EN50160 Report can be accessed through the Front Panel, Web Interface or via Communications. The iMeter 8 can store up to 52 weekly reports. If there are more than 52 reports, the newest report will replace the oldest on a FIFO basis. Please refer to **Section 3.1.3.2.7** and **Section 3.2.4.3.7** for an EN50160 sample report from the Front Panel and the Web Interface, respectively.

4.5.16 ITIC/SEMI F47 Plot and Alarm

ITIC curve provides an AC voltage boundary that most information technology equipment (ITE) can tolerate or ride through without experiencing unexpected shutdowns or malfunctions.

No Interruption in Function (Region A): Equipment is expected to operate properly.

No Damage Region (Region B): Voltage dips, dropouts, and steady state voltages in this region are not expected to damage the ITE equipment. Normal functioning of ITE equipment is also not expected in region.

Prohibited Region (Region C): Any surges or swells in this region could result in damage to the ITE.

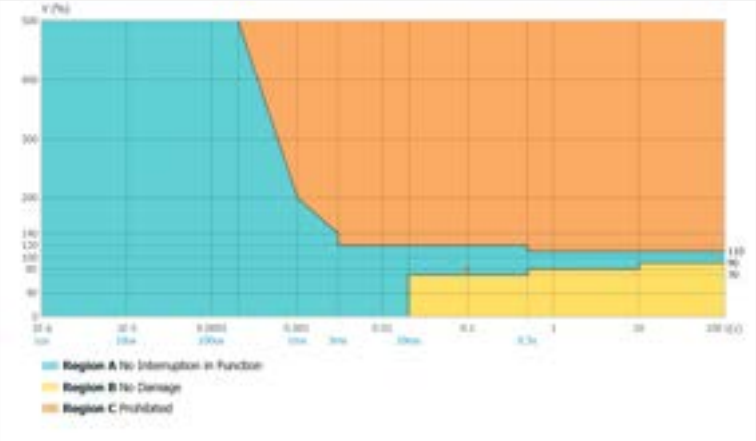


Figure 4-31 ITIC Curve

SEMI F47 sets out limits of voltage Dip that the equipment needs to tolerate without creating any process upsets or shutdowns.

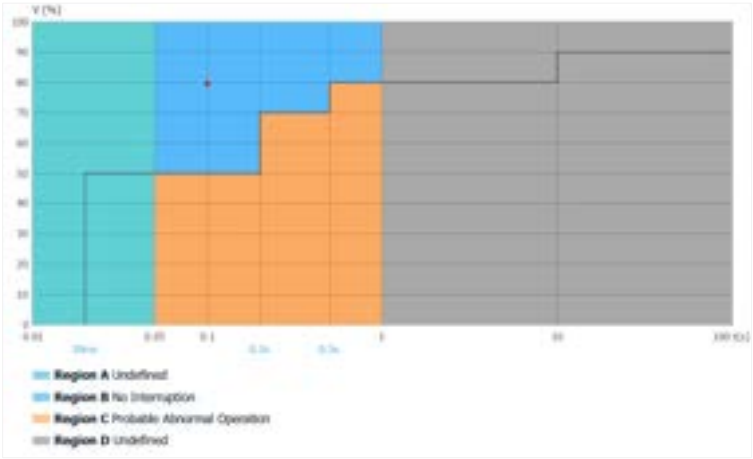


Figure 4-32 SEMI F47 Curve

The iMeter 8's Front Panel and Web Page can display the ITIC plot for Dip, Swell and Interruption events but only SEMI F47 plot for Dip and Interruption events. In addition, ITIC/SEMI F47 Alarm can trigger DO or/and iTrigger upon the detection of PQ disturbances that are outside of the respective tolerance curves:

- ITIC Alarm: When the voltage is in the **No Damage Region B** or **Prohibited Region,** which means the voltage exceeds Dip/Swell or Interruption limits and the latest voltage exceeds the tolerate limit, the DO or/and iTrigger would be triggered.
- SEMI F47 Alarm: When the voltage exceeds the Dip limits and the latest voltage exceeds the tolerate limit, the DO or/and iTrigger would be triggered.

The following table lists the setup parameters for the ITIC/SEMI F47 alarm:

Parameter	Definition	Default
ITIC Alarm Trigger	DOs and iTrigger 1/2/3 If Pulse Width=0, the DO will be released after 1s. If Pulse Width≠0, the DO will be released after the configured Pulse width. If the DO is closed when the SEMI F47 Alarm becomes active, the DO keeps the Closed state.	None
SEMI F47 Alarm Trigger		

Table 4-33 ITIC/SEMI F47 Alarm Settings

4.5.17 Conducted Emissions in the 2kHz to 150kHz range(Optional)

The iMeter 8 is capable of providing an overview of conducted voltage emissions in the supraharmoics 2kHz-150kHz range in a power quality context, as per **Annex C (Informative)** of **IEC 61000-4-30 Ed. 3 Standard.**

- *These emissions are presumed to be quasi-steady-state levels, although they may have amplitude modulation.*

☞ *Useful Information about measurement in the 2 kHz to 150 kHz range can be found in **IEC 61000-4-7: 2002**, **Annex B** (2 kHz to 9 kHz), and **CISPR 16** (9 kHz to 150 kHz).*

4.5.17.1 2kHz to 9kHz Measurement Method

As per IEC 61000-4-7: 2002 Annex B

☞ *The measurement of these components (2kHz to 9kHz) does not require a high resolution in the frequency domain. Instead, it is customary to group the energy of the signal to be analysed into predefined frequency bands, the bandwidth for the grouping of these emissions should be fixed at 200Hz. The center frequency of the first possible group is 2.1kHz.*

☞ *For the frequency analysis, the DFT method and for the grouping procedure a method similar to that described in 5.5.1, are under consideration. The DFT method is suitable for voltage and current measurements whereas CISPR 16 considers only voltages.*

4.5.17.2 9kHz to 150kHz Measurement Method

As per IEC 61000-4-30 Ed. 3.1 Annex C

☞ *The frequency range of 9kHz to 150kHz could be divided into equal-width segments. The segment width could be an integer multiple of 200Hz, preferably either 200Hz or 2kHz). For the purpose of this measurement method, it is acceptable to process a frequency range beyond 9kHz to 150kHz, for example processing the range 8kHz to 150kHz if a 2kHz segment width is selected.*

☞ *The minimum, average, and maximum magnitude of the RMS voltage in each frequency segment in the 9kHz to 150kHz range could be recorded during each 10/12-cycle interval. In addition, the single maximum value in any segment, on any channel, could be recorded.*

4.5.17.3 Real-Time RMS Data

The iMeter 8 provides the real-time 3-Ø U_{rms} and I_{rms} (I_{rms} is available in firmware V2.50.51 or later) for 2kHz to 9kHz which is divided into 35 equal-width segments.

- Frequency band resolution - 200Hz bins
- Aggregation interval - 3s

And for 9kHz to 150kHz frequency range which is divided into 71 equal-width segments, the iMeter 8 also provides the real-time 3-Ø average U_{rms}.

- Frequency band resolution - 2kHz bins
- Aggregation interval - 3s

All the real time measurements are retrievable via the Front Panel, Web Interface or Communications if the **2-150kHz C.E. Enable** (Register 41032) is Enabled.



Figure 4-23 2-9kHz Real Time C.E. on Web Interface

4.5.17.4 Daily Heat Map

The iMeter 8 continually records the Max./Min./Avg./CP95 values of Conducted Emissions in each frequency segment in 1-min interval. It also records the peak values of Max./Min./Avg./CP95 in a day and their located frequency segment with timestamp.

As shown in the following figure, the horizontal axis of the graph represents the hours in one day. The vertical axis of the graph represents the emission frequency spectrum for Ia from 2kHz to 9kHz. The color map shows the peak amplitude in 1-min interval and at a given frequency. It is expressed in Amps. The table at the bottom displays the peak value of Ia Max. in the 2kHz to 9kHz range, the related frequency segment and time of occurrence.

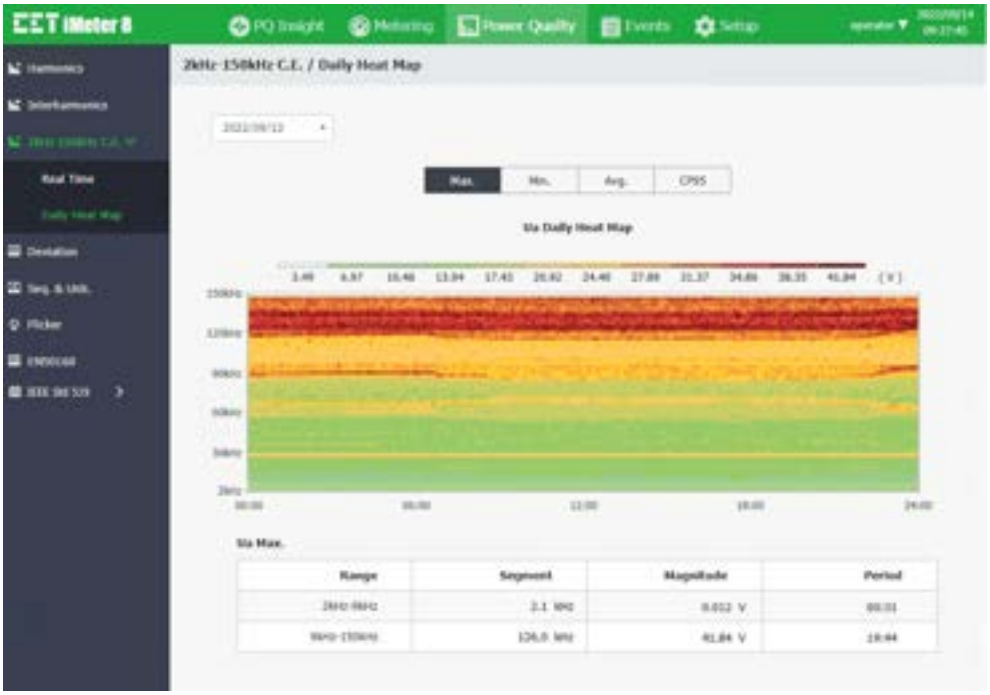


Figure 4-24 Ua Daily Heat Map Interface



Figure 4-25 Ia Daily Heat Map Interface

The iMeter 8 can store up to 30 daily records based on a First-in-First-out principle. All the records can be downloaded from the Web Server or FTP Server. The historical daily records can be reset via Web Server or Communications.

4.5.18 IEEE Std 519-2022 Compliance Report

The IEEE 519 standard defines the voltage and current harmonic distortion measurements, analysis methods and practice limits for harmonics control applied at the point of common coupling (PCC). The iMeter 8 with the firmware V2.50.51 or later provides a solution to generate IEEE Std 519-2022 compliance Daily and Weekly

reports with easy configurations.

The IEEE Std 519-2022 standard defines four sets of limits for the individual voltage harmonics up to 50th and Total Harmonic Distortion (THD), depending on the PCC voltage level. And it also defines the limits of individual current harmonics divided into 5 groups (2nd - 10th, 11th - 16th, 17th - 22nd, 23rd - 34th and 35th - 50th) as well as Total Demand Distortion (TDD).

4.5.18.1 Terms Definition

The definition of the following terms applied to this section are described in this section. The IEEE Standards Dictionary Online should be consulted for other terms not mentioned below.

- **Point of Common Coupling** (**PCC**) – Point on a public power supply system, electrically nearest to a particular load, at which other loads are, or could be, connected. The PCC is a point located upstream of the considered installation.
- **Maximum Demand Load Current** (I_L) – This current value is enacted at the PCC and calculated as the average of the currents corresponding to the peak demand during the previous 12 months.
- **Short Circuit Ratio** (**SCR**) – At a particular location, the ratio of the available short circuit current, in amperes, to the maximum demand load current, in amperes.

4.5.18.2 Harmonics Evaluation

The IEEE Std 519-2022 standard requires the harmonic data to the 50th on aggregation of 150/180 cycles (3s) and 10min for the statistical assessments.

As per IEEE Std 519-2022, the Voltage Harmonic compliance criteria are:

- Daily 99th percentile 3s values should be less than 1.5 times the values given in the table below.
- Weekly 95th percentile 10-min values should be less than the values given in the table below.

Bus Voltage *V* at PCC	Individual Harmonic (%)	THD (%)
$V \leq 1.0$ kV	5.0	8.0
1 kV < $V \leq 69$ kV	3.0	5.0
69 kV < $V \leq 161$ kV	1.5	2.5
161 kV < V	1.0	1.5*

Table 4-34 Voltage Harmonic Compliance Limit

*High-voltage systems are allowed to have up to 2% THD where the cause is an HVDC terminal whose effects are found to be attenuated at points in the network where future users may be connected.

And the Current Harmonic compliance criteria are:

- Daily 99th percentile 3s values should be less than 2.0 times the values given in the table below.
- Weekly 99th percentile 10-min values should be less than 1.5 times the values given in the table below.
- Weekly 95th percentile 10-min values should be less than the values given in the table below.

120V – 69kV system						
I_{sc}/I_L	**2 ≤ h < 11***	**11 ≤ h <17**	**17 ≤ h < 23**	**23 ≤ h < 35**	**35 ≤ h ≤ 50**	**TDD**
< 20~	4.0	2.0	1.5	0.6	0.3	5.0
20 < 50	7.0	3.5	2.5	1.0	0.5	8.0
50 < 100	10.0	4.5	4.0	1.5	0.7	12.0
100 < 1000	12.0	5.5	5.0	2.0	1.0	15.0
> 1000	15.0	7.0	6.0	2.5	1.4	20.0
69kV – 161kV system						
I_{sc}/I_L	**2 ≤ h < 11***	**11 ≤ h <17**	**17 ≤ h < 23**	**23 ≤ h < 35**	**35 ≤ h ≤ 50**	**TDD**
< 20~	2.0	1.0	0.75	0.3	0.15	2.5
20 < 50	3.5	1.75	1.25	0.5	0.25	4.0
50 < 100	5.0	2.25	2.0	0.75	0.35	6.0
100 < 1000	6.0	2.75	2.5	1.0	0.5	7.5
> 1000	7.5	3.5	3.0	1.25	0.7	10.0
Above 161kV system						
I_{sc}/I_L	**2 ≤ h < 11***	**11 ≤ h <17**	**17 ≤ h < 23**	**23 ≤ h < 35**	**35 ≤ h ≤ 50**	**TDD**
< 25~	1.0	0.5	0.38	0.15	0.1	1.5
25 < 50	2.0	1.0	0.75	0.3	0.15	2.5
≥ 50	3.0	1.5	1.15	0.45	0.22	3.75

Table 4-35 Current Harmonic Compliance Limit

* For h ≤ 6, even harmonics are limited to 50% of the Harmonic limits shown in the table.
~ Power generation facilities are limited to these values of current distortion, regardless of actual Isc/IL unless covered by other standards with applicable scope.

Where

I_{SC} = Maximum short-circuit current at PCC

I_L = Maximum demand load current at PCC under normal load operating conditions.

h = Individual harmonic order

4.5.18.3 Setup

To generate IEEE Std 519-2022 Daily/Weekly reports, the iMeter 8 automatically switches the applicable voltage and current harmonic limits according to the IEEE Std 519-2022 standard based on the following IEEE Std 519-2022 basic parameters configuration.

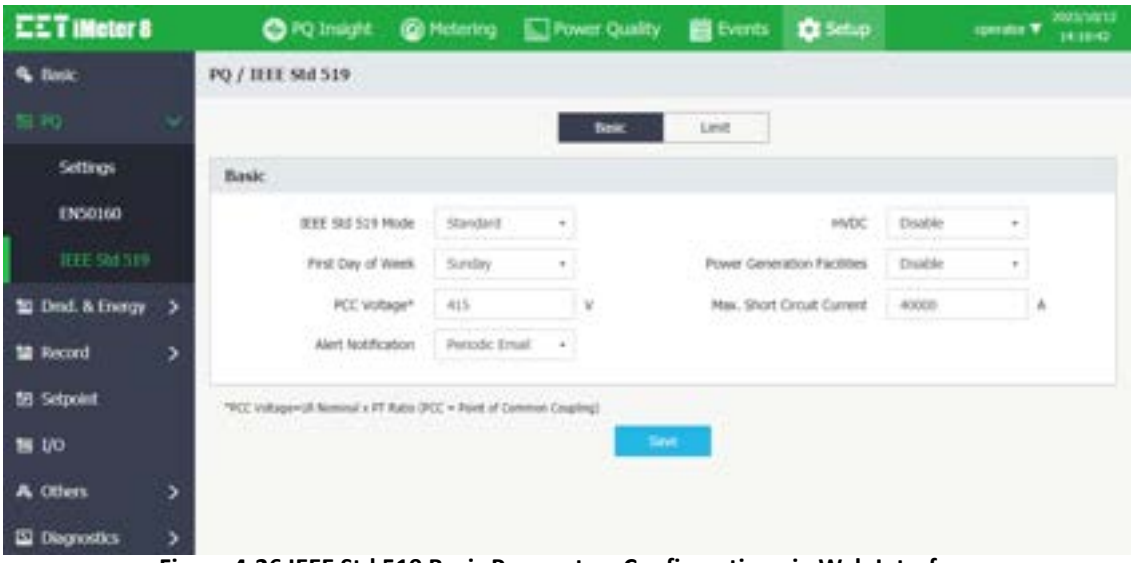


Figure 4-26 IEEE Std 519 Basic Parameters Configuration via Web Interface

The following table illustrates the setting range and default values for these parameters.

Parameter	Options/Range, Default*	Description
IEEE Std 519 Mode	Disable*/Standard/Custom	**Standard**[1] – Use measured IL for **SCR** calculation and determining the limits according to IEEE Std 519-2022 for report generation. **Custom** – Use custom **TDD Preset IL** for **SCR** calculation. Users may customize the harmonic limits for report generation.
HVDC	Enable / Disable*	High-voltage systems (> 161kV) are allowed to have a higher voltage THD where the cause is an HVDC terminal. In this condition, enable the **HVDC** parameter to increase the voltage THD tolerance to 2% (see Table 4-34)
First Day of Week	Sunday* to Monday	--
Power Generation Facilities	Disable* / Enable	For power generation equipment, enable this parameter to limit the current distortion to those value in row for < 20 or < 25 group in table 4-32, regardless of actual Isc/IL
PCC Voltage	1 to 9,999,000 (V), 415V*	PCC Voltage = ULL Nominal x PT Ratio
Max. Short Circuit Current	1 to 9,999,000 (A), 40000A*	This is the maximum short circuit current could be produced at PCC according to the **PCC voltage** and the supply impedance at PCC, rather than the maximum MCCB rating.
Alert Notification	Alarm Email*, Periodic Email	Alarm Email – Send an email when the report is generated. Periodic Email – Send an email if an evaluation result in the report is fail.

Table 4-36 IEEE Std 519 Report Parameters Configuration

Notes:

1. In **Standard** mode, for a new installation, the monthly maximum current demand is not available.
   - If Preset IL ≠ 0: the meter will use Preset IL for SCR calculation and determining the current harmonic distortion limits in the first month (M <1),
   - If Preset IL = 0: the meter will use the greater of **This Max. Current Demand** and **I Nominal*CT Ratio** for SCR cal. and for determining the current harmonic distortion in the first month (M<1).
2. It is necessary to reboot the device to allow the new changes of **Preset IL** to take effect. The harmonic current distortion limits will be updated accordingly after reboot.
3. Modification of the **Short Circuit Current** (Isc) may change the SCR (Isc/IL) ratio and result in a change in the harmonic

current distortion limits.

4. Before a new round commissioning test after installation, it is recommended to perform the **Clear All Demands** and **Reset IL** to clear the historical demand and IL record for generating a report for verification purpose.

4.5.18.4 Report Generation

The iMeter 8 generates the IEEE Std 519-2022 Daily Report and the Weekly Report on the basis of the 3-second interval data measured in one day and the 10-min interval data measured in one week, respectively. Each of the daily/weekly reports consists of a voltage compliance report and a current compliance report. The iMeter 8 can store up to 356 daily reports and 52 weekly reports on a first-in-first-out basis.

4.5.18.4.1 Daily Report Displayed on Web Server

- **Voltage Harmonic Compliance Report**

  As shown in the figure below, the IEEE Std 519-2022 Daily Voltage Harmonic Compliance Report begins with the **Voltage Level**, then the **99th percentile** values for **THD** and **Individual Harmonics** from 2nd to 7th, along with the IEEE Std 519 specified limits and a pass/fail conclusion where ✔ denotes the positive evaluation while ✘ denotes the negative evaluation.

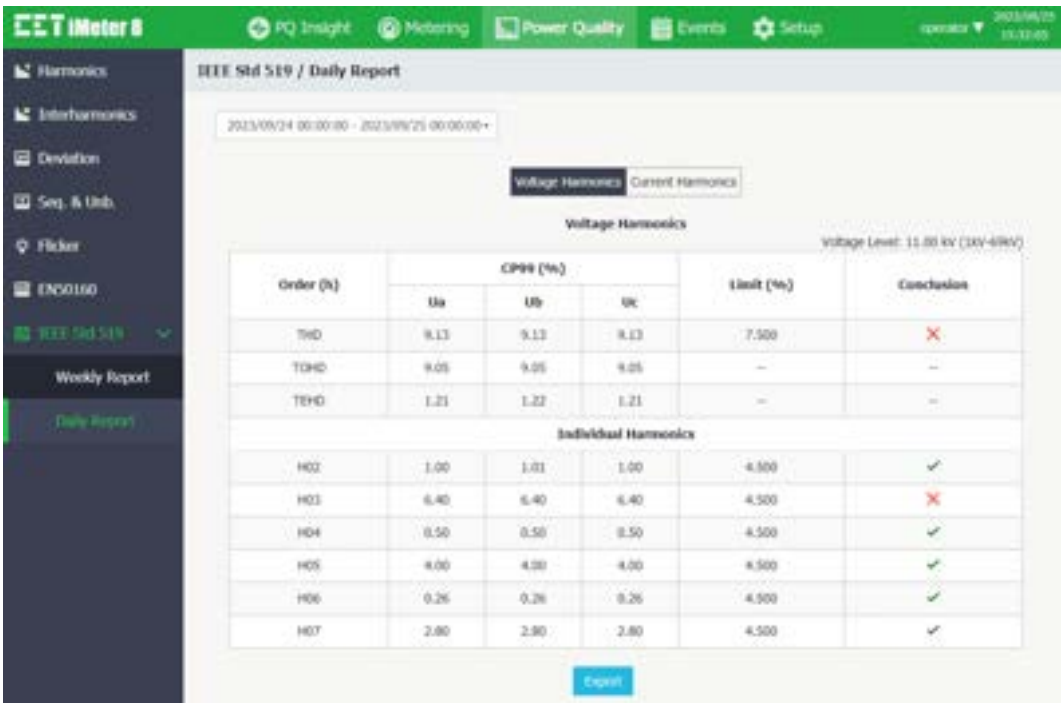


Figure 4-27 IEEE Std 519 Daily Voltage Harmonics Compliance Report

- **Current Harmonic Compliance Report**

  As shown in the following figure, the IEEE Std 519 Daily Current Harmonic Compliance Report begins with the Voltage Level, Isc, IL and Isc/IL, then the **99th percentile** values for the **TDD**, and **Individual Harmonics** from 2nd to 7th, along with the IEEE Std 519 specified limits and a pass/fail conclusion where ✔ denotes the positive evaluation while ✘ denotes the negative evaluation.

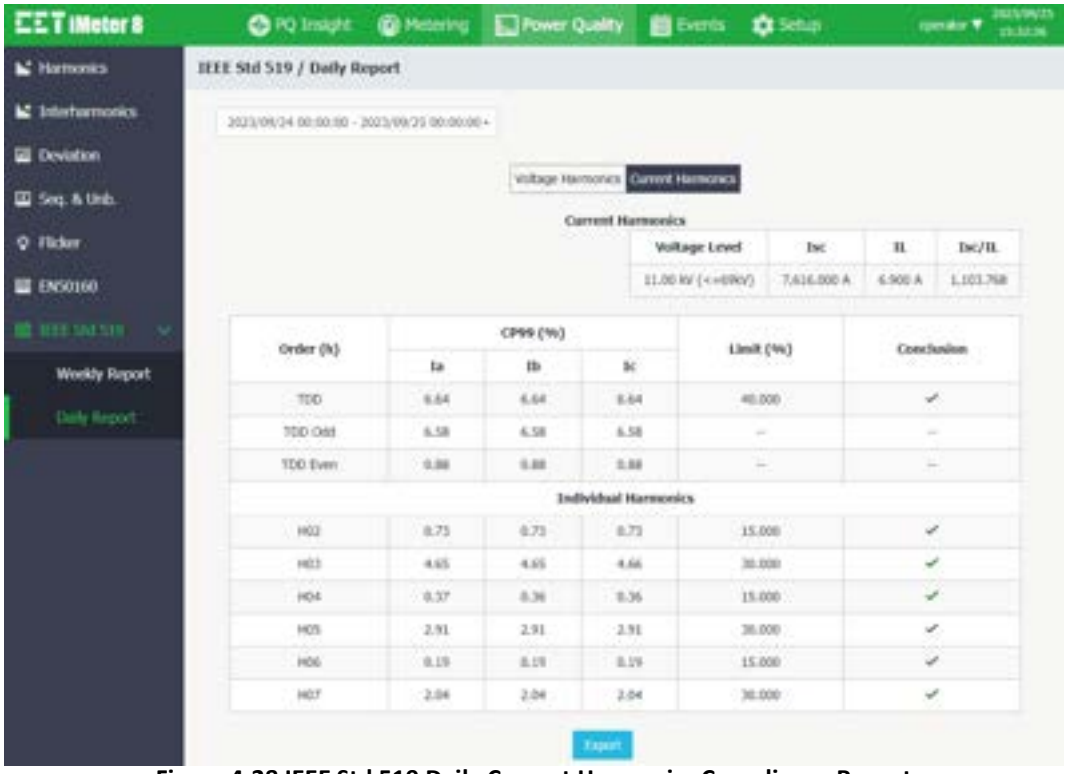


Figure 4-28 IEEE Std 519 Daily Current Harmonics Compliance Report

4.5.18.4.2 Weekly Report Displayed on Web Server

- **Voltage Harmonic Compliance Report**

  Similar to the Daily Report, the Weekly Voltage Harmonic Compliance Report provides the **Voltage Level**, the **95th** percentile values for **THD** and **Individual Harmonics** from 2nd to 7th, along with the IEEE Std 519 specified limits and a pass/fail conclusion.



Figure 4-29 IEEE Std 519 Weekly Voltage Harmonics Compliance Report

- **Current Harmonic Compliance Report**

  The IEEE Std 519 Weekly Current Harmonic Compliance Report provides the Voltage Level, Isc, IL and Isc/IL, then the **95th** and **99th percentile** values for the **TDD** and **Individual Harmonics** from 2nd to 7th, along with the IEEE Std 519 specified limits and a pass/fail conclusion

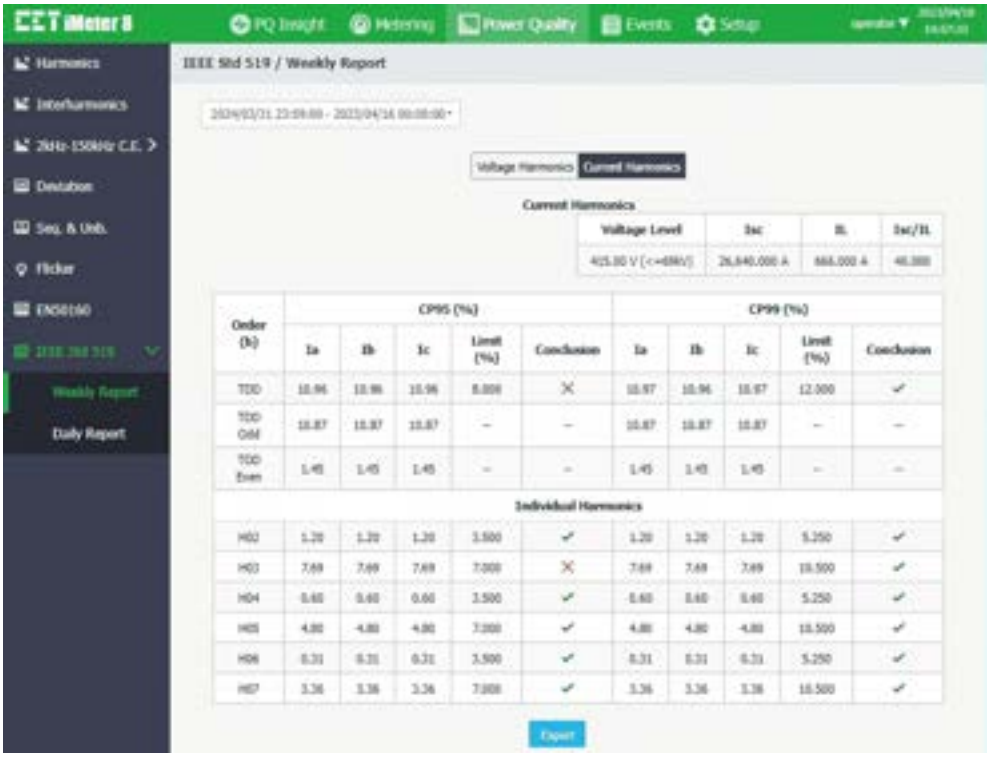


Figure 4-30 IEEE Std 519 Weekly Current Harmonics Compliance Report

The entire IEEE Std 519 Daily/Weekly Compliance Report provided by iMeter 8 includes the **Min.**, **Max.**, **Avg.** and percentile values for voltage **THD** and **Individual Harmonics** from 2nd to 50th, as well as current **TDD** and **Individual Harmonics** from 2nd to 50th. The user may obtain the entire report for a given date by exporting it from the Web/FTP server or by communication or receive it by e-mail via the SMTPS service as soon as it is generated or if the evaluation result of any item in the report is fail.

4.6 Data Logging

4.6.1 IER/AER

The iMeter 8 provides a fixed capacity of 65535 entries for both IER (Interval Energy Recorder) and AER (Accumulative Energy Recorder) Logs for the parameter specified in table below. The IER records the amount of energy consumed during the last completed interval while the AER records a snapshot of the accumulated energy at the time of recording. The IER/AER Logs can only be retrieved through communications.

kWh		kvarh		kVAh
Imp. (Total RMS)	Imp. Fundamental	Imp. (Total RMS)	Imp. Fundamental	kVAh Total
Exp. (Total RMS)	Exp. Fundamental	Exp. (Total RMS)	Exp. Fundamental	
Net (Total RMS)	Imp. Harmonics	Net (Total RMS)	Imp. Harmonics	
Total (Total RMS)	Exp. Harmonics	Total (Total RMS)	Exp. Harmonics	

Table 4-37 IER/AER Parameters

The IER/AER setup parameters, which include **Recording Mode, Recording Interval** and **Start Time**, can be programmed from the Front Panel, Web Interface or communications. Please note that changing any of the setup parameters would reset the IER/AER Logs. The following table illustrates the range of the Energy Log parameter.

Parameter	Options/Range, Default*	Parameter	Options/Range, Default*
Record Mode	Disable, Stop When Full, FIFO*	Interval	1 to 65535 min, 15 min*
Start Date	2000-01-01*	Start Time	00:00:00*

Table 4-38 IER/AER Setup Parameters

4.6.2 WFR (Waveform Recorder)

The iMeter 8 supports the waveform recording of 4-phase Voltages and Currents at a maximum resolution of 1024 samples/cycle. WFR on the iMeter 8 can be triggered by PQ Disturbance (Dips/Swells/Interruptions), Transients, Rapid Voltage Changes, Inrush Current, Setpoints, DI Status Changes or even manually triggered through the Front Panel, Web Interface and communications. The manual trigger command has a higher priority.

When a WFR is already in progress, other WFR commands will be ignored until the present recording has completed. The WFR has a capacity of 128 entries organized in a FIFO basis, with the newest WFR log replacing the oldest one. The WFR log is stored in the device's non-volatile memory in COMTRADE file format and will not suffer any loss in the event of power failure.

The WFR log can be viewed directly on the Front Panel and Web Interface as well as downloaded from the on-board FTP/Web Server or via communications. The programming of the WFR is supported via the Front Panel, Web Interface or Communications. The following table illustrates the ranges and default values of the WFR parameters.

Parameter	Options/Range, Default*	Parameter	Options/Range, Default*
Pre-Fault Cycles Post-Fault Cycles	2~16 Cycles, 5*	No. of Cycles	Range of Cycles @ Samples/Cycle, 100* • (40-3200) @128 • (40-800) @ 512 • (40-1600) @ 256 • (40-400) @ 1024
Samples/Cycle	128, 256, 512*, 1024		
Adaptive WFR	0=Enabled, 1=Disabled*		

Table 4-39 WFR Setup Parameters



Figure 4-31 Set WFR via Web Interface

The iMeter 8 also provides the following settings for Scheduled WFR to trigger the WFR on the hour as pre-configured. The programming of the Scheduled WFR is supported via the Web Interface or Communications.

Parameter	Options/Range, Default*	Parameter	Options/Range, Default*
Enable	Yes, No*	Interval	1 to 1440 min, 1440*
Recording Depth (Repetition)	0 to 1000, 1*	Start Date	2000-01-01*
		Start Time	00:00:00*

Table 4-40 Scheduled WFR Setup Parameters

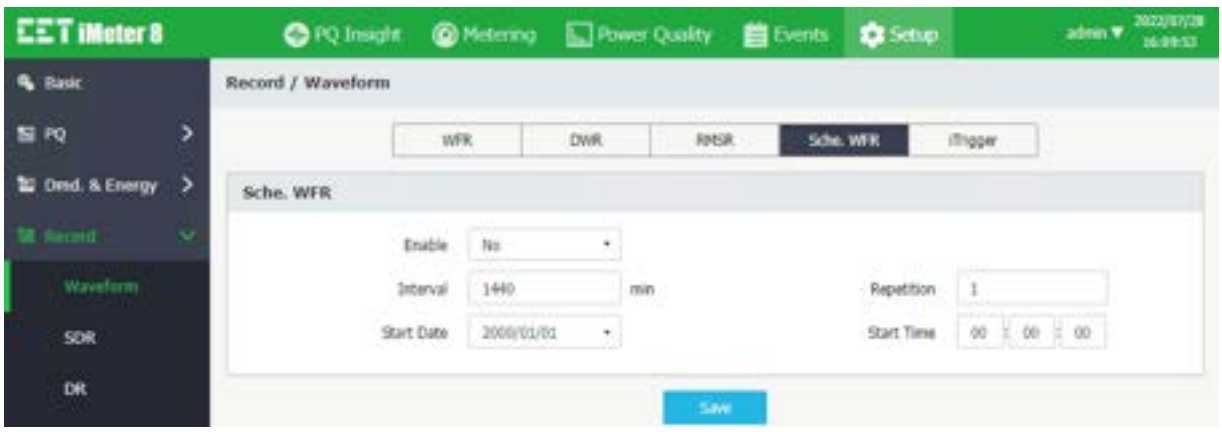


Figure 4-32 Set Sche. WFR via Web Interface

4.6.3 Disturbance Waveform Recorder (DWR)

The iMeter 8 supports the Disturbance Waveform Recording of 4-phase Voltage and 4-phase Current at a maximum resolution of 512 samples/cycle. The DWR can be triggered by Dips, Swells, Interruptions, Transients, RVC, Inrush Current, Setpoint, DI Status Changes or even manually triggered via the Web Interface and communications. The DWR log is stored in the device's non-volatile memory in COMTRADE file format and will not suffer any loss in the event of power failure. The DWR has a capacity of 128 entries organized in a FIFO basis, with the newest DWR log replacing the oldest one. Each DWR log consists of the following stages.

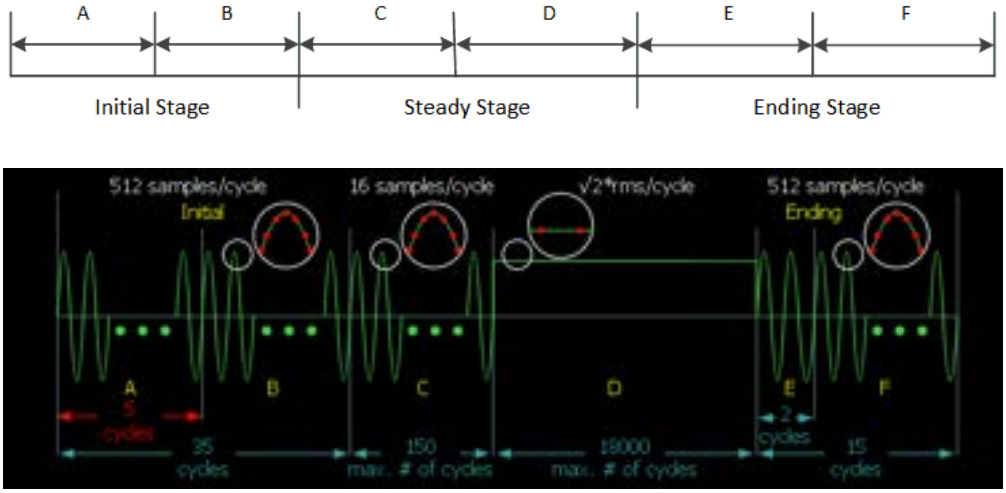


Figure 4-33 Disturbance Location

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 30 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 4-41 Detailed Description of the DWR Stages

Notes:

1) The data for Stages A, B, E and F are always recorded.
2) For stages C and D:
   If **C** < 150 cycles, the **D** would be 0.
   If **C** = 150 cycles, the **D** stage's 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 for a Dip event.

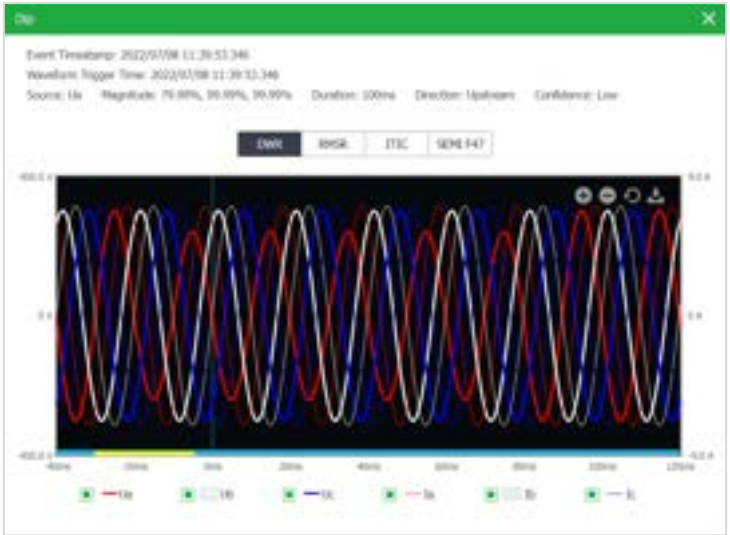


Figure 4-34 An Example of DWR

4.6.4 RMS Recorder (RMSR)

The iMeter 8 provides high-speed RMS Recording which can be triggered by Dips, Swells, Interruption, Transients, RVC, Inrush Current, Setpoints, DI Status Changes, or manually via communications. The RMSR Logs are stored in the device' non-volatile memory in COMTRADE file format and will not suffer any loss in the event of power failure. The RMSR has a capacity of 128 entries organized in a FIFO basis, with the newest RMSR log replacing the oldest one.

All RMSR can be accessible via the on-board FTP Server or communications by our PecStar® iEMS. The programming of the RMSR is supported over the Front Panel, Web Server or via Communications.

The **Recording Width** for RMSR is fixed at 7200 samples per parameter. The following table illustrates the ranges and default values for the RMSR parameters.

Parameter	Options/Range, Default*	Parameter	Options/Range, Default*
Pre-fault Samples	100 to 500, 300*	Sample Interval	0* to 60 (0 represents 0.5 cycle)

Table 4-42 RMSR Setup Parameters

The table below illustrates the available source parameters for RMSR recording.

Key	Parameter	Key	Parameter	Key	Parameter
0	Disabled	**11**	I4	**22**	Sc
1	Ua	**12**	Frequency	**23**	PFa
2	Ub	**13**	Freq. Deviation	**24**	PFb
3	Uc	**14**	Pa	**25**	PFc
4	Uab	**15**	Pb	**26**	ULN Avg.
5	Ubc	**16**	Pc	**27**	ULL Avg.
6	Uca	**17**	Qa	**28**	I Avg.
7	Ia	**18**	Qb	**29**	P Total
8	Ib	**19**	Qc	**30**	Q Total
9	Ic	**20**	Sa	**31**	S Total
10	U4	**21**	Sb	**32**	PF Total

Table 4-43 Available Parameters for RMSR

4.6.5 Pst Log

The iMeter 8's Pst Log can store up to 52560 entries (i.e. 1-year: 365x24x6) about Voltage Pst in its non-volatile memory. Each record includes the timestamp in 1ms resolution, flagging status and 3-phase Voltage Pst measurements.

The Pst Log can be retrieved via communications for display. If there are more than 52560 events, the newest event will replace the oldest event on a FIFO basis. The Pst Log can be reset from Web Server or via communications.

4.6.6 Plt Log

The iMeter 8's Plt Log can store up to 4380 entries (i.e. 1-year: 365x12) about Voltage Plt in its non-volatile memory. Each record includes the timestamp in 1ms resolution, flagging status and 3-phase Voltage Plt measurements.

The Plt Log can be retrieved via communications for display. If there are more than 4380 events, the newest event will replace the oldest event on a FIFO basis. The Plt Log can be reset from the Web Server via communications.

4.6.7 DR (Data Recorder)

The iMeter 8 provides 8 Data Recorders (**DR**) capable of recording 64 parameters each. The recorded data is stored in non-volatile memory and will not suffer any loss in the event of a power failure.

The Data Recorder can be programmed via the Web Interface or over communications. Each Data Recorder provides the following setup parameters:

Parameter	Options/Range, Default*	Parameter	Options/Range, Default*
Triggered Mode	Disabled, By Timer*, By Setpoint	Recording Mode	Stop-When-Full, First-In-First-Out*
Interval	0 to 3,456,000 seconds, 900*	Number of Parameters	0 to 64*
Offset Time	0* (no offset) to 43200 If the **Trigger Mode** is set to	Parameters	Please refer to **Appendices A** and **C** for a complete list of the Data Recorder

	Triggered by Setpoint, the **Offset Time** will be disregarded.		Parameters and the default configuration for each DR, respectively.

Table 4-44 Setup Parameters for DR

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

Data Recorder #X can be triggered by clearing the Data Recorder #X when it is full in Stop-When-Full mode.

The **Recording Offset** parameter can be used to delay the recording by a fixed time from the **Recording Interval**. For example, if the **Recording Interval** parameter is set to 3600 (hourly) and the **Recording Offset** parameter is set to 300 (5 minutes), the recording will take place at 5 minutes after the hour every hour, i.e. 00:05, 01:05, 02:05…etc. The programmed value of the **Recording Offset** parameter should be less than that of the **Recording Interval** parameter.

4.6.8 SDR (Statistical Data Recorder)

The iMeter 8 provides 16 groups of SDRs of 64 parameters each to record Max., Min., Average, and CP95 measurements with a recording depth of 43200 and configurable recording interval from 0 (disabled) to 60 mins. The SDR Logs are stored in non-volatile memory and will not suffer any loss in the event of a power failure.

The programming of the **SDR** is supported via Web interface or through communications. Each **SDR** provides the following setup parameters:

Parameter	Options/Range, Default*
Recording Interval	0 to 60 minutes, 10 min*
Recording Mode	Stop-When-Full, First-In-First-Out*
Number of Parameters	0 (SDR is disabled) to 64*
Parameters 1 to 64	Please refer to **Appendix A** and **B** for a complete list of the SDR Parameters and default configuration for each SDR, respectively.

Table 4-45 Setup Parameters for SDR

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

4.6.9 Max./Min. Recorder

The iMeter 8 provides 4 Max./Min. Recorders of 20 parameters each for This Month (Since Last Reset) and Last Month (Before Last Reset). Each log includes the relevant max./min. 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 programming of the Max./Min. recorders is supported via Web Interface or through communications. Each Max./Min. Log recorder provides the following setup parameters:

Parameters	Description
Self-Read time	The same **Self-Read Time** for the **Max. Demand Log** is used to specify the time and day of the month for the **Max./Min.** Self-Read operation. Please refer to **Section 4.2.4** for a complete description of the **Self-Read Time** and its operation.
Number of Parameters	0 to 20
Parameter 1 to 20	See **Appendix A**

Table 4-46 Max./Min. Log Setup Parameters

The Front Panel supports the display for This Max./Min. logs Since the Last Reset.

Both This Max./Min. logs and the Last Max./Min. logs can be accessed via Web Interface or through communications. The Max./Min. Log can be reset manually from the Front Panel, Web Interface or via communications.

4.6.10 SOE Log & Device Log

4.6.10.1 SOE Log

The SOE Log can store up to 1024 events such as Setpoint, Digital Input status changes, Relay actions, Dips, Swells, Interruptions, Transient, Inrush Current, Rapid Voltage Changes and Motor Start based on a FIFO principle. Each event record includes the event classification, its relevant parameter values and a timestamp in 1ms resolution.

4.6.10.2 Device Log

The Device Log can store up to 1024 events such as Power-on, Power-off, Setup changes, Clear actions and TOU Schedule Switch in its non-volatile memory on a FIFO basis. Each event record includes the event classification,

its relevant parameter values and a timestamp in 1ms resolution.

Please refer to the **Appendix D** for the SOE Classification and Device Log Classification.

The SOE and Device Logs can be retrieved or reset via the Front Panel, Web Interface or communications.

4.6.11 Audit Logs

The Audit Log can store up to 2048 login events, including login, logout, log fail, check/export/clear audit log. The auditor has access of the 10 latest audit logs through the web server.
The recording mode can be programmable as FIFO or Stop-When-Full via the web server: **Setup > Others > Advanced > Audit Log.**

4.6.12 PQ Counters

The iMeter 8 supports the counting of the different PQ Events as illustrated in table below. When a particular event is detected, the corresponding counter will increment. The maximum value of the PQ Counter is 2^{32} (4,294,967,296), and it will automatically roll over to 0 when the maximum value has been reached. The counter can be reset from the Front Panel, Web Interface or via communications.

No	Event	No	Event	No	Event
1	Dip	**5**	Rapid Voltage Change	**9**	Mains Signal Voltage#3
2	Swell	**6**	Inrush Current	**10**	Total
3	Interruption	**7**	Mains Signal Voltage#1		
4	Transient	**8**	Mains Signal Voltage#2		

Table 4-47 PQ Event Counter

4.6.13 PQDIF

The iMeter 8 comes equipped with 32GB of memory and can store 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 iMeter 8 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	
Current RMS	Ia, Ib, Ic	
Voltage Deviation	Ua/Ub/Uc Deviation	
	Uab/Ubc/Uca Deviation	
Fundamental RMS	Ua/Ub/Uc H01 RMS	
	Ia/Ib/Ic H01 RMS	
Unbalance	U2/U0 Unbalance	
	I2/I0 Unbalance	
Sequence Components	U1, U2, U0	
	I1, I2, I0	
Harmonic Voltage	Ua/Ub/Uc THD	
	Ua/Ub/Uc TOHD	
	Ua/Ub/Uc TEHD	
	Ua/Ub/Uc HD01	
	...	
	Ua/Ub/Uc HD63	
Harmonic Current	Ia/Ib/Ic THD	
	Ia/Ib/Ic TOHD	
	Ia/Ib/Ic TEHD	
	Ia/Ib/Ic H01 RMS	
	...	
	Ia/Ib/Ic H63 RMS	
Inter-Harmonic Voltage	Ua/Ub/Uc THD	
	Ua/Ub/Uc TOHD	
	Ua/Ub/Uc TEHD	
	Ua/Ub/Uc HD01	
	...	
	Ua/Ub/Uc HD63	
Inter-Harmonic Current	Ia/Ib/Ic THD	
	Ia/Ib/Ic TOHD	

	Ia/Ib/Ic TEHD	
	Ia/Ib/Ic H01 RMS	
	...	
	Ia/Ib/Ic H63 RMS	
Flicker	Pst	10 mins
	Plt	2 hours
Fundamental Power	kWa/kWb/kWc, kvara/kvarb/kvarc, kVAa/kVAb/kVAc, PFa/PFb/PFc, kW Total, kvar Total, kVA Total	150/180 cycles
Total Power	kWa/kWb/kWc, kvara/kvarb/kvarc, kVAa/kVAb/kVAc, PFa/PFb/PFc, kW Total, kvar Total, kVA Total	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	SOE Log, DWR, WFR	-

Table 4-48 PQDIF Data

The users can retrieve PQDIF files from the on-board FTP server and open them with other tools. The PQDIF provides following setup parameters which can be programmed through Web Server (See **Section 3.2.4.5.7.2**) or via communications.

Parameters	Options/Range	Default
PQDIF & IEC 61850 Statistics Interval	1 to 60 mins	10
Save Interval	0 (PQDIF is disabled) to 24 Hour	0

Table 4-49 PQDIF Setup Parameters

4.7 iTrigger

The WFR/DWR/RMSR/DO of iMeter 8 can be cross triggered (available in Firmware V2.50.51 or later) by other iTrigger-enabled devices residing on the same subnet of the LAN (Local Area Network) and configured with the same **iTrigger Group ID**. In addition, enabling the **iTrigger Group x** will allow the iMeter 8 to be cross-triggered by iTrigger message with the matching Cross-Group ID that is different from its own Group ID to perform the specified actions. The iTrigger can be programmed via the Web Interface or through communications.

Parameters	Options/Range	Default
iTrigger Enable	Disabled, Enabled	Disabled
Group ID	0 to 16383	1
iTrigger x Actions (x=1, 2, 3)	Alarm Email, DO, DWR, WFR, RMSR	iTrigger 1: DWR* iTrigger 2: WFR* iTrigger 3: RMSR*
iTrigger Group x	-1 to 16383 -1 represents for Cross-Group iTrigger disabled	-1
GOOSE Enable	Disabled, Enabled	Disabled
GOOSE VLAN ID	0 to 4095	1
Multicast Enable	Disabled, Enabled	Disabled
Multicast IP	0xE0000100~0xEFFFFFFF	0xEF060708 (239.6.7.8)
Multicast Send Enable	Disabled, Enabled	Disabled
Multicast Send Port	0 to 65535	60000
Multicast Receive Enable	Disabled, Enabled	Disabled
Multicast Receive Port	0 to 65535	60001
Version	0=V1, 1=V2	V2

Table 4-50 iTrigger Setup Parameters

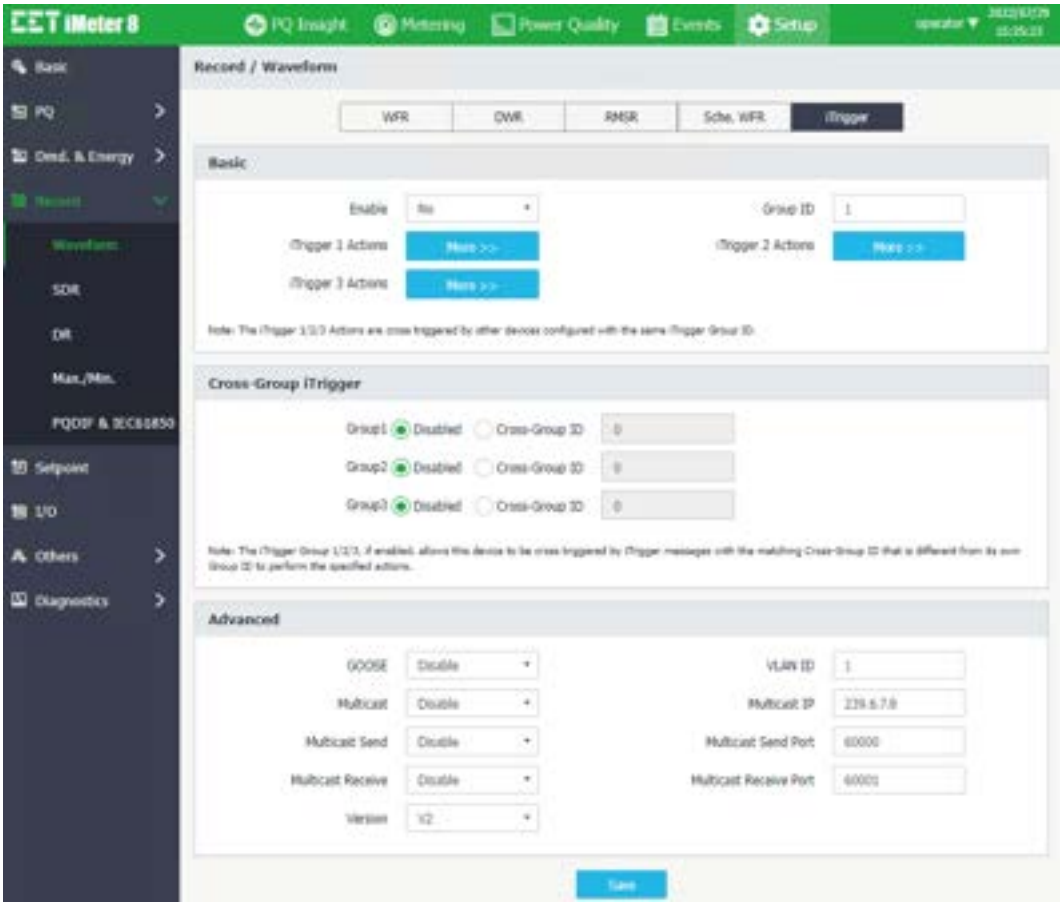


Figure 4-35 Setup iTrigger Parameters via the Web Interface

4.8 Time of Use (TOU)

TOU is used for electricity pricing that varies depending on the time of day, day of week, and season. The TOU system allows the user to configure an electricity price schedule with accumulated energy consumption into different TOU tariffs based on the time of consumption.

The TOU feature on the iMeter 8 supports two TOU schedules, which can be switched at a pre-defined time. Each TOU schedule supports:

- Up to 12 seasons
- 90 Holidays or Alternate Days
- 20 Daily Profiles, each with 12 Periods in 15-minute interval
- 8 Tariffs

Instead of using the TOU schedule to switch between Tariffs, the iMeter 8 supports Tariff switching based on the status of DI1 to DI3.

The 3 Digital Inputs (DI1, DI2 and DI3) represent 3 binary digits where Tariff 1=000, Tariff 2=001, Tariff 3= 010, …Tariff 7=110 and Tariff 8=111 where DI1 represents the least significant digit and DI3 represents the most significant digit. As soon as DI1, DI2 and/or DI3 are configured as **Tariff Switches**, the current **TOU Tariff** will be determined by the status of the DIs, and the TOU Schedule will be ignored. The **DI1 Function** setup register must first be programmed as a **Tariff Switch** before configuring DI2 and DI3 with the same function. In other words, if DI1 is configured as a **Digital Input** or **Pulse Counter**, and DI2 is configured as a **Tariff Switch**, the TOU will continue to function based on the TOU Schedule. The number of Tariffs supported depends on how many DIs are programmed as a Tariff Switch as indicated in the following table.

Tariff	DI Function		
	DI1 = Tariff Switch	DI2 & DI1 = Tariff Switch	DI3, DI2 & DI1 = Tariff Switch
T1	DI1 (0=T1)	DI2 + DI1 (00=T1)	DI3 + DI2 + DI1 (000=T1)
T2	DI1 (1=T2)	DI2 + DI1 (01=T2)	DI3 + DI2 + DI1 (001=T2)
T3	Not Available	DI2 + DI1 (10=T3)	DI3 + DI2 + DI1 (010=T3)
T4	Not Available	DI2 + DI1 (11=T4)	DI3 + DI2 + DI1 (011=T4)
T5	Not Available	Not Available	DI3 + DI2 + DI1 (100=T5)

T6	Not Available	Not Available	DI3 + DI2 + DI1 (101=T6)
T7	Not Available	Not Available	DI3 + DI2 + DI1 (110=T7)
T8	Not Available	Not Available	DI3 + DI2 + DI1 (111=T8)

Table 4-51 DIs and the Number of Tariffs Setup

Each TOU schedule has the following setup parameters and can only be programmed via the Web Interface (See **Section 3.2.4.5.3.3**) or through communications:

Parameters	Description	Options/Range
Daily Profile #	Specify a daily rate schedule which can be divided into a maximum of 12 periods in 15-min intervals. Up to 20 Daily Profiles can be programmed for each TOU schedule.	1 to 20, the first period starts at 00:00 and the last period ends at 24:00.
Season #	A year can be divided into a maximum of 12 seasons. Each season is specified with a Start Date and ends with the next season's Start Date.	1 to 12, starts from January 1st
Alternate Days #	A day can be defined as an Alternate Day, such as May 1st. Each Alternate Day is assigned a Daily Profile.	1 to 90.
Day Types	Specify the day type of the week. Each day of a week can be assigned a day type such as Weekday1, Weekday2, Weekday3 and Alternate Days. The Alternate Day has the highest priority.	Weekday1, Weekday2, Weekday3 and Alternate Days
Switching Time	Specify when to switch from one TOU schedule to another. Writing 0xFFFFFFFF to this parameter disables switching between TOU schedules.	Format: YYYYMMDDHH Default=0xFFFFFFFF

Table 4-52 TOU Setup Parameters

For each of the 8 Tariff Rates, the iMeter 8 provides the following measurements:

- Energy: kWh Import/Export, kvarh Import/Export, kVAh - Per Phase and Total
- Max. Demand: kW/kvar/kVA of This Month (Since Last Reset) and Last Month (Before Last Reset).

All these data above are available via the Front Panel, Web Interface and communications.

In addition, the iMeter 8 provides 12 Historical TOU Logs for Energy and Max. Demand. All TOU log can be reset via the Web Server or communications.

4.9 Alarm Email (SMTP)

The iMeter 8 can be configured to send Alarm Emails based on the Simple Mail Transfer Protocol (SMTP), which may be triggered by Setpoints, Dips, Swells, Interruptions, Transients, etc.

The Alarm Email provides the following information in a text format:

1) iMeter 8's serial number
2) Event description
3) Event timestamp

The programming of the Alarm Email is supported through Web interface or via the communications.

Parameters	Description	Options/Range, Default*
Server IP	IP/domain name of the SMTP Server, e.g., smtp.gmail.com (up to 31 characters long).	0.0.0.0*
Port	The IP Port No. for the SMTP Server	0 to 65535, 25*
Username	SMTP Server's logon username for Sender's email address	See Note 1), N/A*
Password	SMTP Server's logon password for Sender's email address	See Note 2), N/A*
Sender E-mail	Sender's email address	See Note 3), N/A*
Receiver E-mail	Receiver's email address	See Note 4), N/A*
Trigger Source	Specify When the alarm email will send out	System event, Setpoint, HS Setpoint, I/O, Dip/Swell, Interruption, Transient, Inrush Current, RVC, MSV, Record, Motor Start, EN 50160, IEEE Std 519, N/A*
SSL Enable	Enable SSL (Secure Socket Layer) for SMTP server or not. If set **Enable SSL for SMTP** as **Yes,** the iMeter 8 will support SMTPS.	Yes, No*

Table 4-53 SMTP Setup Parameters

Notes:

1. The **Username** should not exceed 40 ASCII Characters.
2. The **Password** should not exceed 20 ASCII Characters.
3. The **Sender E-mail** setup parameters should not exceed 40 ASCII characters.
4. The **Receiver E-mail** setup parameters should not exceed 90 ASCII characters, different receivers should be separated by ";" symbol.

Take setting setpoint to trigger the Alarm Email as an example, and the following are the detailed steps:

1) Click **Setup -> Setpoint -> Setpoint (Standard Setpoint)** as shown below. Select a particular Setpoint (e.g. No.1) under Standard Setpoint to open the Setpoint 1 Settings dialog box and configure the **Parameters** (select ULN) and **Settings** as required.

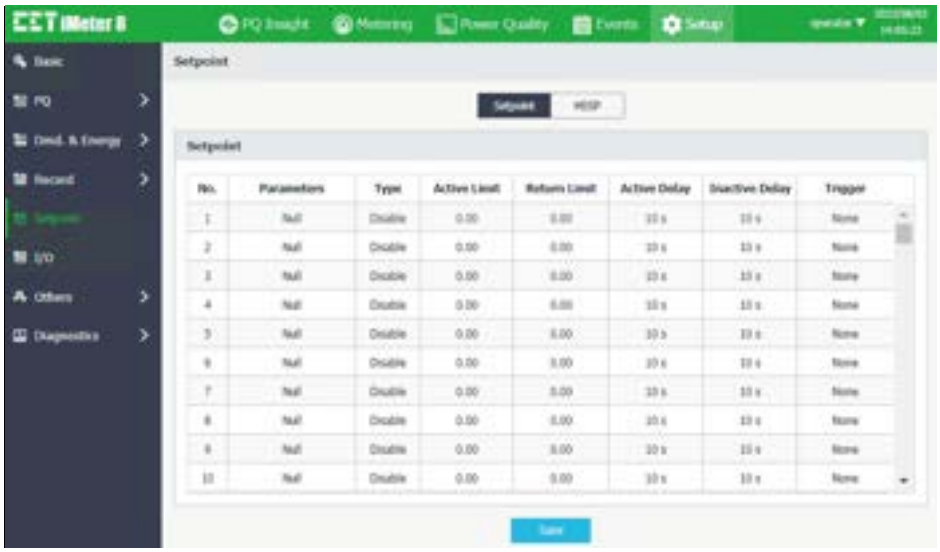


Figure 4-36 Setpoint Settings

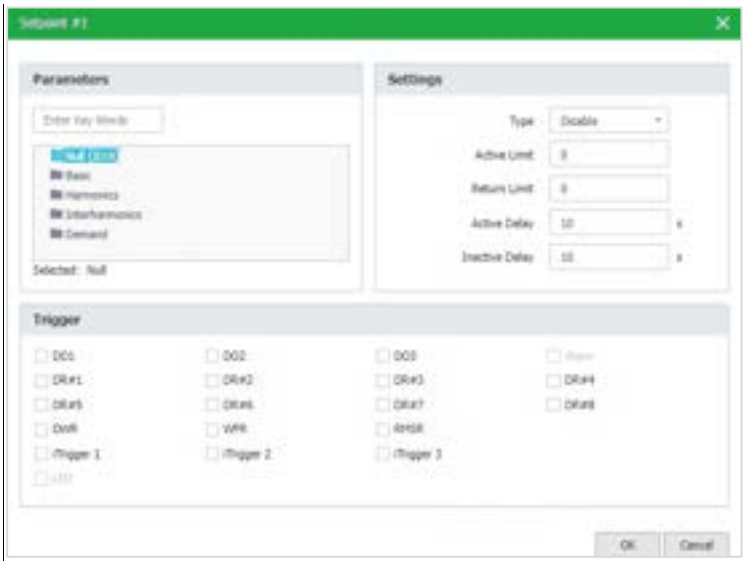


Figure 4-37 Sepoint#1 Settings Dialog

2) Click **Setup > Others > Alarm Email > Settings**. Enter the App Password created from the Google or Microsoft account into the Password setting. Click **Save** after the configuration is completed, and the message "**Operate Succeeded**" will appear if the configuration is accepted by the meter.



Figure 4-38 Alarm Email Settings via Web

Please note that all the SMTP information should be entered correctly (please log into the Sender Email account to confirm the SMTP settings).

Here are two examples for the SMTP configuration for Gmail and Outlook.

For Gmail:

- SMTP Server – smtp.gmail.com
- SMTP IP Port – 465
- Sender E-mail – example@gmail.com
- Receiver Email – ****@***.com
- SSL Enable – Yes
- Password – Please see the following guide (the Google account password could not work due to the verification mechanism of Google).

a. Please log into **Google Account** and under **Security** settings, ensure the 2-Step Verification is turned on as Google suggested.



Figure 4-39 2-Step Verification on Google Account

b. Since iMeter 8 doesn't support **2-Step Verification** with web direction to Gmail, please create an item under **App passwords** (under **2-Step Verification** in the above figure), and Google will provide you with a 16-character app password. Please use this app password in the SMTP configuration of iMeter 8.

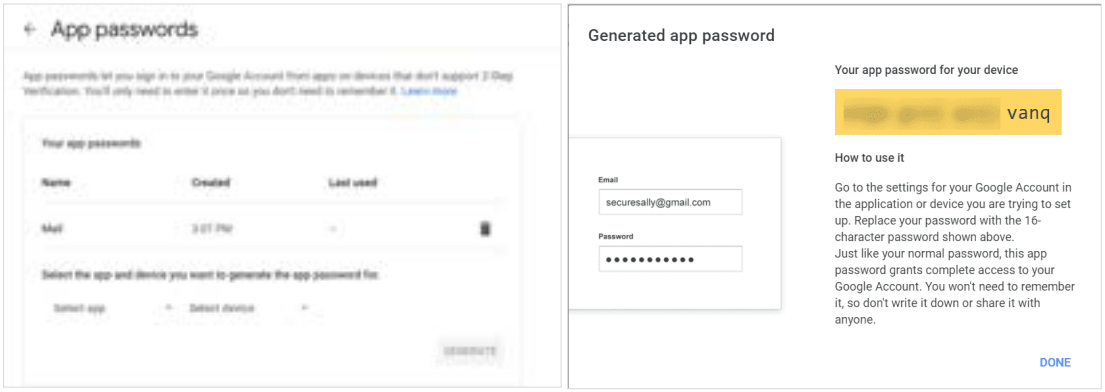


Figure 4-40 Retrieve App Password for Google Account

For Outlook:

- SMTP Server – smtp.office365.com
- SMTP IP Port – 587
- Sender E-mail – example@outlook.com
- Receiver E-mail – ****@***.com
- SSL Enable: No (Outlook uses STARTTLS for SMTP service so there is no need to enable SSL).
- Password: Please see the following guide (Similarly, the password of Outlook account could not work due to the Verification mechanism of Microsoft).

a. Please log into **Microsoft account** and go to **Advanced security options** under **Security** tab.

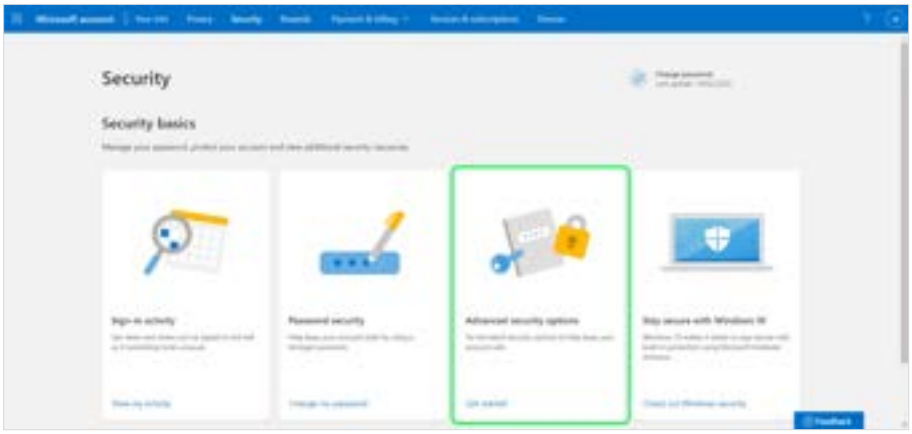


Figure 4-41 Security Setting for Microsoft Account

b. Ensure the **Two-step verification** is turned on as Microsoft suggested. Create a new app password under **App passwords**. Please use this provided App password in the SMTP configuration of iMeter 8.



Figure 4-42 Retrieve App Password for Microsoft Account

3) Click **Alarm Email** tab to send a Test Email by clicking on **Test**. The message "**E-mail has been sent to the specified address!**" will appear if a test email has been successfully sent to the Receiver. However, if the receiver didn't receive the test email, the Alarm Email settings should be verified to make sure that they are correct and the iMeter 8 should be checked that it is connected to the Internet.

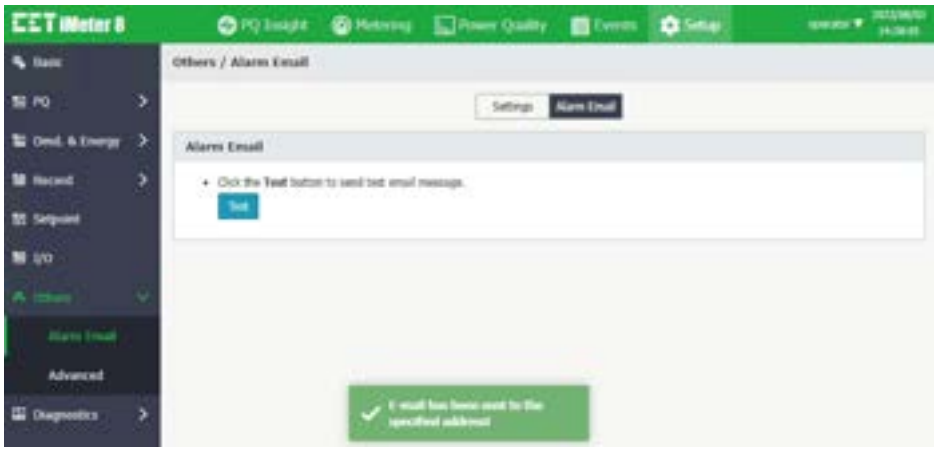


Figure 4-43 Send Test Email

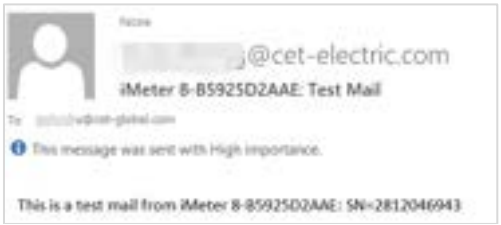


Figure 4-44 An Example of Test Email

4) If the Receiver receives the test email successfully, please return to **Alarm Email Settings** (Step 2) and click on **More >>** to open the **Trigger Source** dialog box. Check the Setpoint selection box and click **OK** to confirm the changes. Click **Save** to keep the changes.



Figure 4-45 Trigger Source Dialog

5) When the Setpoint is activated, an alarm email will be sent to the Receiver by the iMeter 8.



Figure 4-46 Alarm Email Sample

4.10 Time Synchronization

The iMeter 8 provides timestamps for all recorded data so it's extremely important for the clock to be properly configured to achieve precise time-stamping for Energy, Power Quality and Event analysis. The different time sync. methods are discussed in the following sections.

4.10.1 RTC

The iMeter 8 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 **Clock Source Register (40800)** is set to **RTC** by default. This can be changed via the Front Panel, Web Server or communications.

4.10.2 SNTP

SNTP (Simple Network Time Protocol) can be used to synchronize the iMeter 8's clock with an external **SNTP Server** through its Ethernet port providing that the network has been properly configured. The programming of the **SNTP** setup parameters is supported via the Front Panel, Web Interface or communications.

Setup Parameters	Options/Range	Setting
Clock Source	0=RTC, 1=SNTP, 2=GPS, 3=IRIGB, 4=Reserved, 5=1588-P1, 6=1588-P2	1
Time Zone	GMT-12:00 / GMT-11:00 / GMT-10:00 / GMT-9:00 / GMT-8:00 / GMT-7:00 / GMT-6:00 / GMT-5:00 / GMT-4:00 / GMT-3:30 / GMT-3:00 / GMT-2:00 / GMT-1:00 / GMT-0:00 / GMT+1:00 / GMT+2:00 / GMT+3:00 / GMT+3:30 / GMT+4:00 / GMT+4:30/ GMT+5:00 / GMT+5:30 / GMT+5:45 / GMT+6:00 / GMT+6:30 / GMT+7:00 / GMT+8:00 (default)/ GMT+9:00 / GMT+9:30 / GMT+10:00 / GMT+11:00 / GMT+12:00 / GMT+13:00	GMT+8:00
SNTP Sync. Interval	10 to 1440 minutes	60
SNTP Server IP	Set the IP address of the **SNTP Server**	0.0.0.0
Broadcast Synchronization		
SNTP Broadcast Flag	Enable or disable SNTP broadcast time sync. 0=Disabled, 1=Enabled	1

Table 4-54 SNTP Setup Parameters

4.10.3 GPS or IRIG-B

The iMeter 8 comes standard with a **GPS** port which can be used as GPS or IRIG-B time synchronization. The following table lists the terminal relations for two Time Sync ways. Please also refer to **Section 2.12 GPS Wiring** for the time synchronization wiring diagram.

GPS Port	GPS+	GPS-
GPS	PPS+	PPS-
IRIG-B	P+	P-

Table 4-55 Relation with Terminal

- **GPS**

  GPS receivers often provide 1PPS (1 Pulse per Second) timing output which the iMeter 8 can be connected to synchronize its millisecond clock via its Clock Input terminals. An incoming PPS signal on an input time synchronization connector can be repeated to one or two output time synchronization. Set the **Clock Source Register (40800)** to **GPS** through the Front Panel, Web Server or via communications.

- **IRIG-B**

  The IRIG-B time codes, originally developed by the Inter-Range Instrumentation Group (IRIG), is a standard format for transferring serial timing information once a second. IRIG-B has a pulse rate of 100 pulse per second.

  The iMeter 8 accepts an IRIG-B signal as time source to provide a precision time reference. The iMeter 8 can automatically detect the RS-485 differential signal carrying the IRIG-B full date/time information via its Clock Input terminals. Please refer to Figure 2-20 for the wiring. The IRIG-B time source (i.e., GPS receiver/clock) shall support **IEEE C37.118** (also called **IEEE 1344 Extensions**) for time code.

  Since the UTC time is transported by the IRIG-B frame, the **IRIG-B Time Zone** can be used to determine the Local Time for the iMeter 8 providing the meter and the time source are in the same time zone. The programming of the IRIG-B Time Zone is supported via the Front Panel, Web Interface or through Communications.

The iMeter 8 can be configured to synchronize its clock with the IRIG-B input via its GPS port by having the **Clock Source Register (40800)** set to **IRIG-B**.

Parameters	Options/Range	Setting
Clock Source	0=RTC, 1=SNTP, 2=GPS, 3=IRIGB, 4=Reserved, 5=1588-P1, 6=1588-P2	3
IRIG-B Time Zone	See **Section 5.10.6 System Setup**, register 40802	26

Table 4-56 Setup Parameters for IRIG-B

4.10.4 IEEE 1588 - PTP

IEEE 1588v2 Precision Time Protocol (PTP) depends on time-stamped frames exchanged between a timing master clock and a timing slave clock, with intermediate boundary and/or transparent clocks to maintain the time accuracy in the sub-microsecond range.

The iMeter 8 supports the PTP time synchronization over its dual Ethernet ports, P1 and/or P2 with a maximum error of 80us.

The related terms and parameter definitions are described as following:

- **Master** - Clocks are typically synchronized to a master clock whose time is accurate, stable and traceable to a known standard (usually GPS).
- **Slave** - Slave devices are remote from the Master and is synchronizing to it.
- **Domain Number** - PTP provides for scalability by allowing each PTP clock group to be assigned to a logical group called a domain. The domain number is an integer from 0 to 127, with a default value of 0.
- **Protocol** - PTP supports network transport over Layer 2 (802.3), or Layer 3 (UDP/IPv4).
- **PTP Priority 1** - A configurable clock priority for the Master-Slave Hierarchy. A clock with a lower value has a higher priority. 255 for Slave-only clock.
- **PTP Priority 2** - A configurable second order clock priority.
- **PTP Delay** - The iMeter 8 only supports peer-to-peer mechanism.

Parameters	Description	Options/Range, Default*
Clock Source	0=RTC, 1=SNTP, 2=GPS, 3=IRIGB, 4=Reserved, 5=1588-P1, 6=1588-P2	5 or 6
PTP Domain	PTP Domain identifies a group of devices that talk together.	0* to 255
PTP Priority 1	Specifies the clock priority.	0 to 255, 240*
PTP Priority 2	Specifies the finer-grained clock priority.	0 to 255, 240*

Table 4-57 Setup Parameters for IEEE 1588

The programming of the **IEEE 1588** setup parameters is supported via the Front Panel, Web Server or communications.

4.10.5 Modbus RTU

The iMeter 8's clock can be synchronized through communications using the Modbus RTU protocol, please refer to **Section 5.14** for a detailed description.

4.10.6 PecStar iEMS

PecStar® iEMS can be configured to provide regular time synchronization by broadcasting time-sync packets over the connected medium, whether it is RS-485 or Ethernet. The default time synchronization interval of is 60 minutes. Please consult the PecStar iEMS's user manual for a complete description.

4.11 Ethernet Gateway

The iMeter 8's **Ethernet Gateway** feature supports the gateway function for Modbus communications between the Master Software (e.g. PecStar iEMS) on a Local Area Network and other RS-485-enabled devices (e.g. PMC-53A) via the iMeter 8's Ethernet (P1/P2) and RS-485 ports (P3/P4). This eliminates the need for an additional, external Ethernet-to-RS-485 Gateway, simplifies the overall network design and save cost.

- ☞ The Master Software sends a "Modbus RTU over TCP/IP" packet (Modbus RTU packet, i.e. the payload, encapsulated in a TCP/IP frame) to the iMeter 8's Ethernet port at its IP Address and the default IP Port No. 20000.
- ☞ The iMeter 8 receives this "Modbus RTU over TCP/IP" packet at its Ethernet port, extracts the "encapsulated" Modbus RTU packet, i.e. the payload, from the TCP/IP frame and then in turn forwards it to its RS-485 port (such as P3).
- ☞ The RS-485-enabled device receives the Modbus RTU packet and sends its response back to the iMeter 8, which in turn encapsulates the Modbus RTU response packet in a TCP/IP frame and then sends it back to the Master Software over Ethernet to complete the transaction.

The following illustrates the steps of configuration the iMeter 8's Ethernet Gateway via P3:

1) Go to **Setup -> Basic -> Comm. -> RS-485 (P3)** to change the **Protocol** setup parameter from the default setting of **Modbus** to **Gateway,** either via the Front Panel or Web Interface.

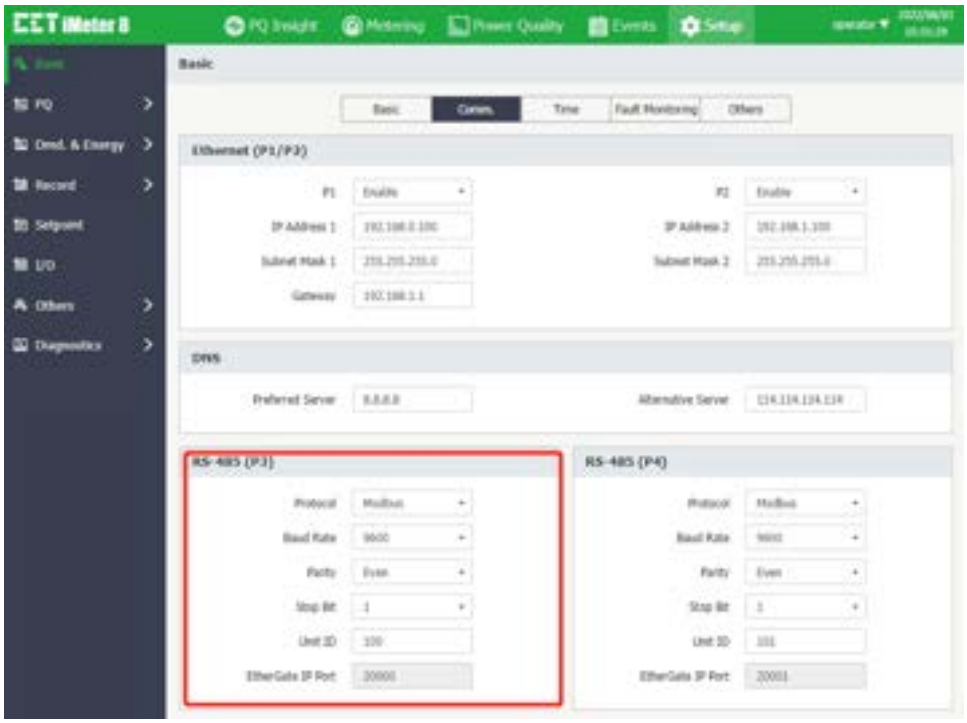


Figure 4-47 Select "EtherGate" Mode via the Web Interface

2) Connect the RS-485-enabled devices (i.e. PMC-53A) to the RS-485 port (P3) of the iMeter 8.



Figure 4-48 Typical Application for Ethernet Gateway

3) Configure the Master Software (e.g. PecStar iEMS) on the WorkStation to communicate with the RS-485-enabled devices via iMeter 8's Ethernet port at IP port No. 20000. It should be noted that the Master Software must support the **Modbus RTU** over **TCP/IP** protocol for this to work.

4) Make sure the serial port settings such as Baud Rate and Data Format are identical between iMeter 8's RS-485 port and the RS-485-enabled devices.

5) The Master Software should be able to communicate with the RS-485-enabled devices via the iMeter 8's Ethernet Gateway, providing that all the necessary configuration is correct.

4.12 On-board FTP Server

The iMeter 8 provides access to its COMTRADE file, such as Waveform Log and RMS plot via the on-board FTP Server.

4.12.1 Access the FTP Server

The following illustrates the steps for accessing the iMeter 8's FTP Server.

1) Configure the FTP settings at **Setup -> Others -> Advanced** on the Web Server of the iMeter 8. It's recommended that the FTP settings be kept at the default values in case they are forgotten.

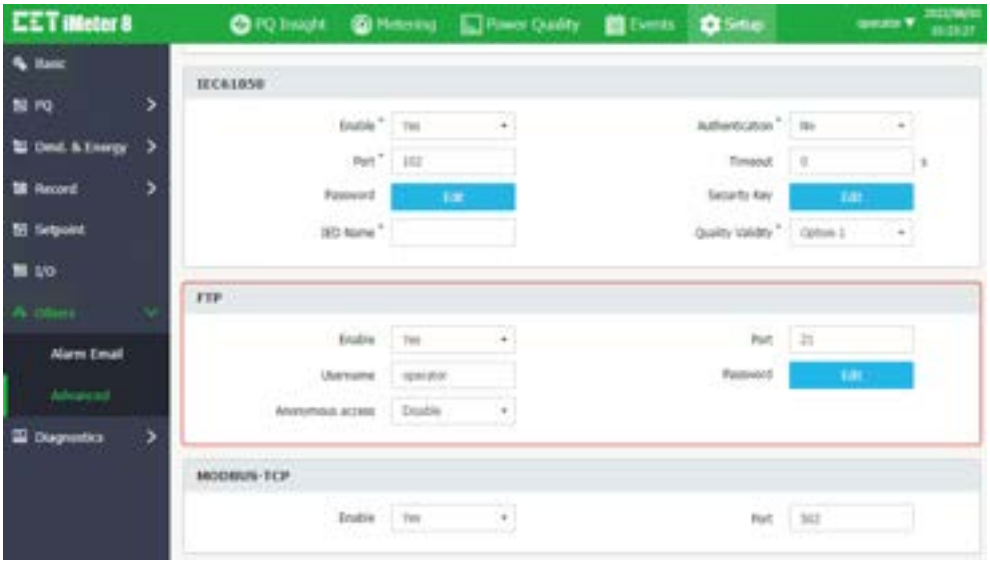


Figure 4-49 FTP Settings on Web

2) Connect to the FTP Server. Both the Windows OS and Mac OS provide multiple methods to connect to the FTP Server. Here is an example on Windows 10.

   a) Press ⊞ + **E** key together to open the **File Explorer** and then type in the FTP address, for example:

ftp://192.168.1.100/.

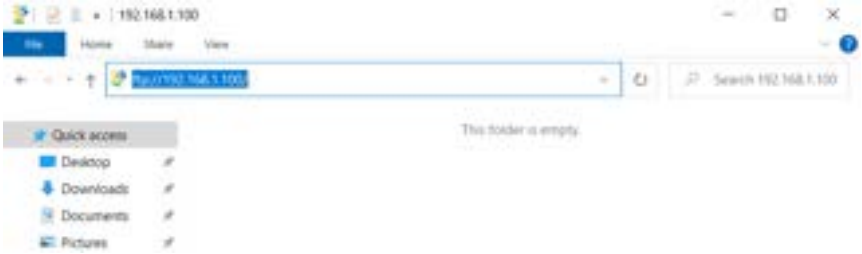


Figure 4-50 Windows File Explorer

b) In the **Log On As** dialog box, enter the username and password which are confirmed by Step 1 and then click **Log On**. The default username and password are “operator” and “abcd1234-”, respectively.

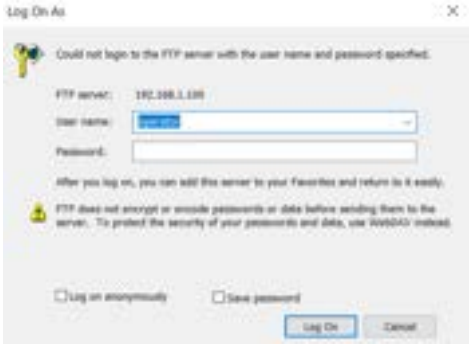


Figure 4-51 Log On As dialog

3) If the FTP Server is connected successfully, the following screen capture with the listed folders appear.

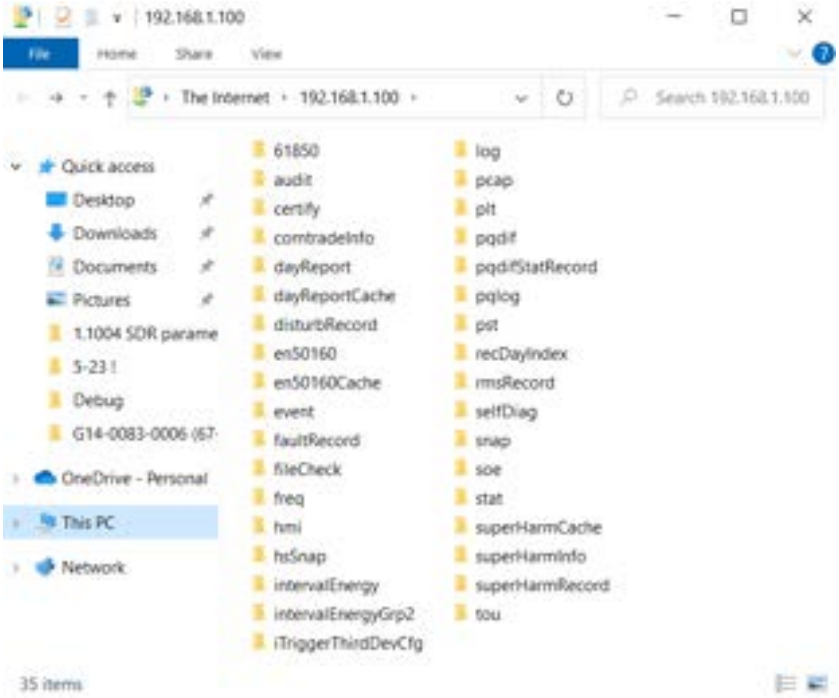


Figure 4-52 iMeter 8’s FTP Server

4.12.2 Quick Overview for FTP Files

The following provides a quick overview for the disturbRecord, faultRecord, rmsRecord and superHarmRecord. Please copy the required files to your local computer before opening them using the appropriate application.

- **disturbRecord** stores the **Disturbance Waveform Records** in COMTRADE format based on a First-In-First-Out Principle. Each DWR will generate 3 files which are disturbRecordXXX.cfg, disturbRecordXXX.dat and disturbRecordXXX.hdr where XXX stands for the logging sequence.

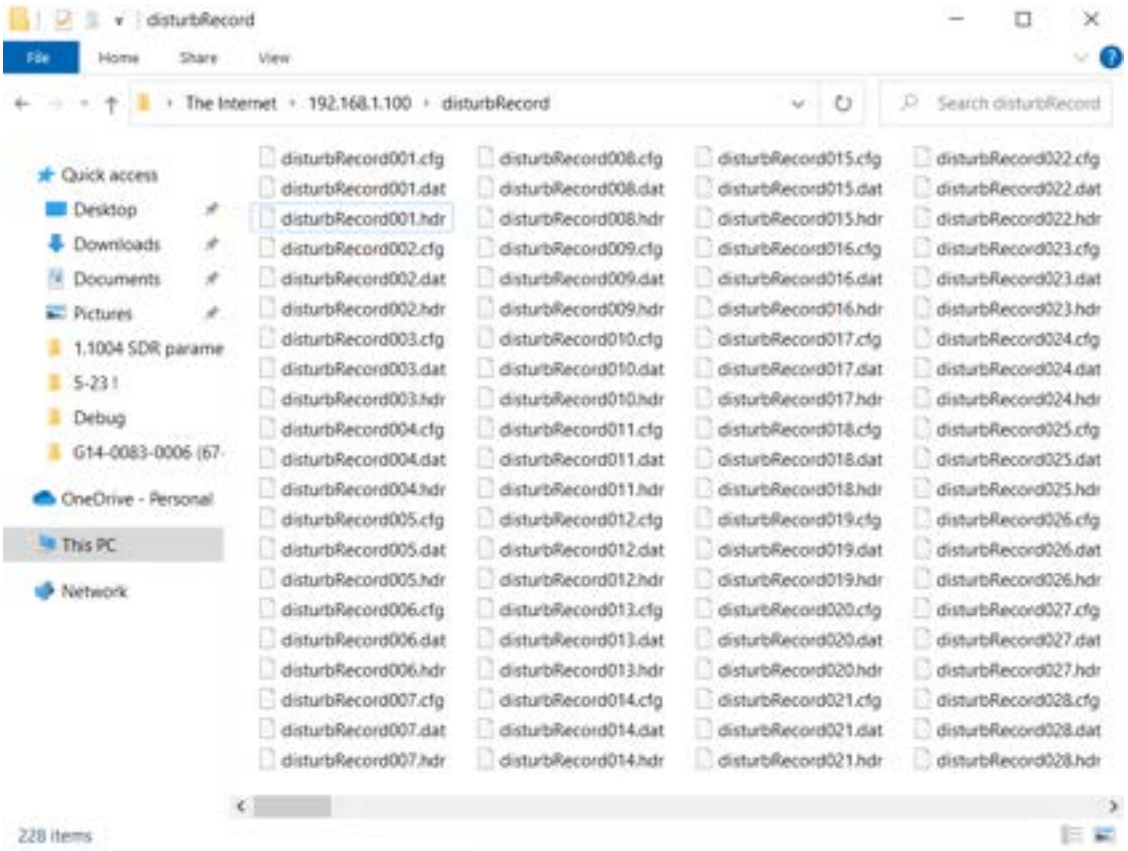


Figure 4-53 disturbRecord Files

faultRecord stores the **Waveform Records** in COMTRADE format based on a First-In-First-Out principle. Each WFR will generate 3 files which are faultRecordXXX.cfg, faultRecordXXX.hdr and faultRecordXXX.dat where XXX stands for the logging sequence.

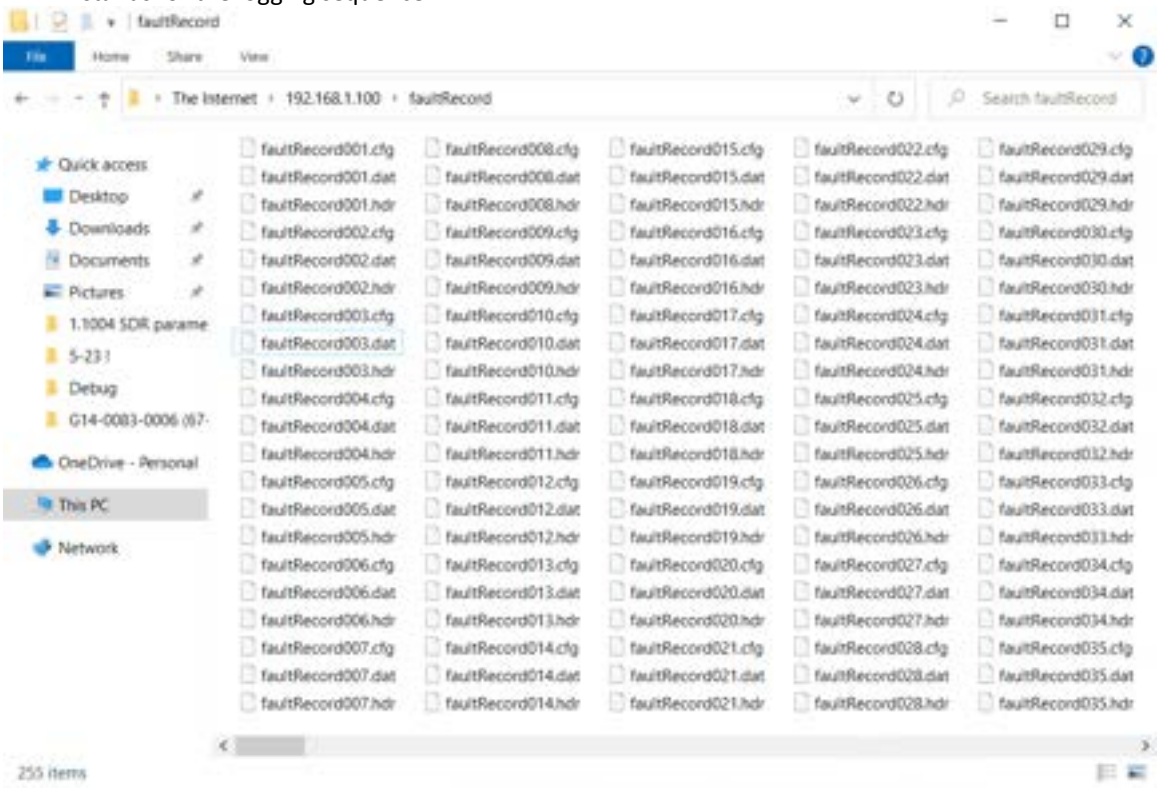


Figure 4-54 faultRecord Files

rmsRecord stores the **RMS Records** in COMTRADE format based on a First-In-First-Out principle. Each RMS Recorder will generate 3 files which are rmsRecordXXX.hdr and rmsRecordXXX.dat and rmsRecordXXX.cfg

where XXX stands for the logging sequence.

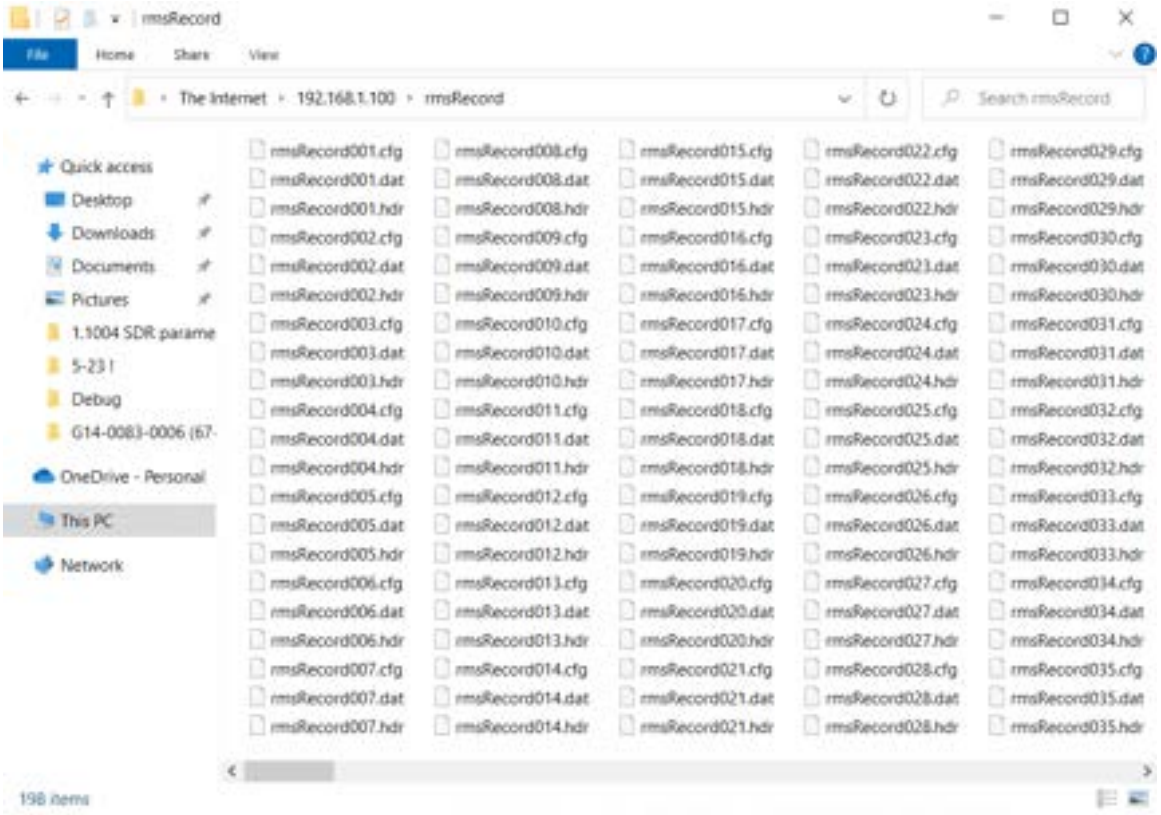


Figure 4-55 rmsRecord Files

superHarmRecord (Optional) stores 4 files in .gz format for the **Daily Amplitudes** reports of Max./Min./Average/CP95 values in **2-150 kHz** every day. The .csv spreadsheets can be open in Excel after downloading and then decompressing the .gz files.

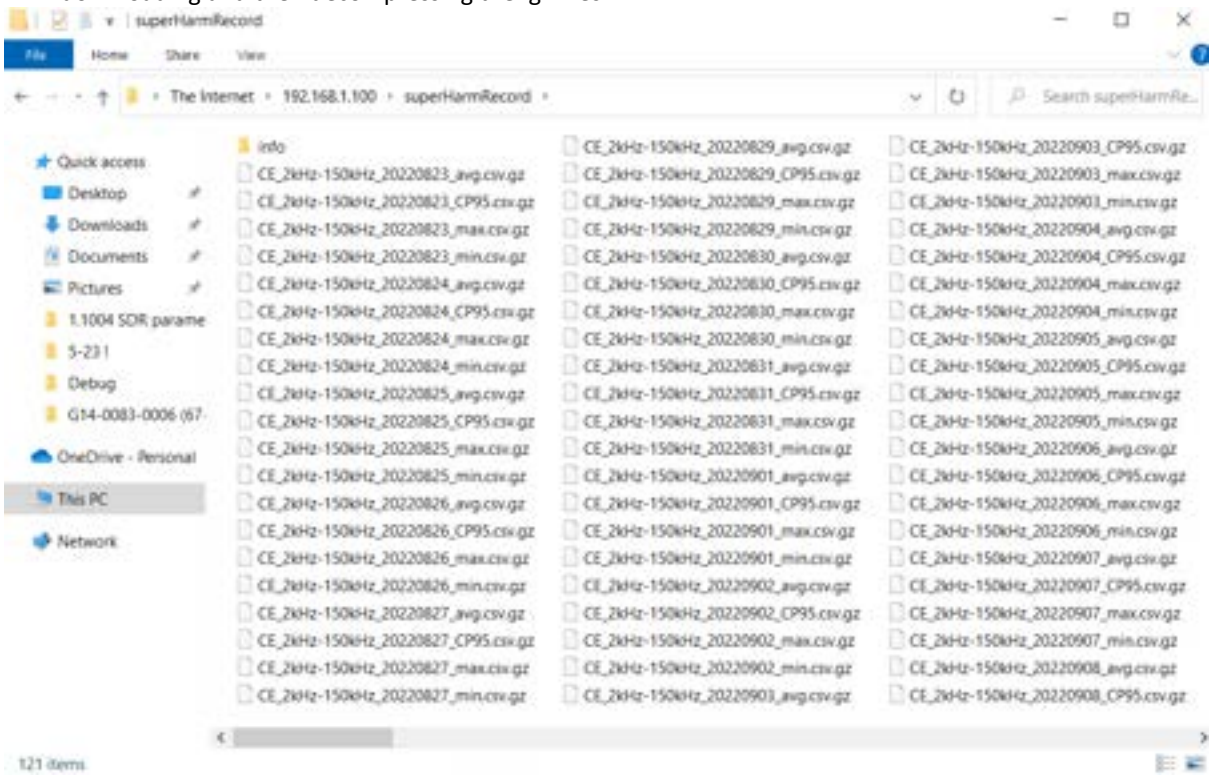


Figure 4-56 superHarmRecord Files

Chapter 5 Modbus Register Map

This chapter provides a complete description of the Modbus register map (**Protocol Version 7.4**) for the iMeter 8 Advanced Utility Power Quality Analyzer to facilitate the development of 3rd party Modbus RTU communications driver for accessing information on the iMeter 8. For a complete Modbus Protocol Specification, please visit http://www.modbus.org.

The iMeter 8 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)

5.1 Basic Measurements

Register	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	Pa[1]	Float	W
0026	RO	Pb[1]	Float	W
0028	RO	Pc[1]	Float	W
0030	RO	P Total	Float	W
0032	RO	Qa[1]	Float	var
0034	RO	Qb[1]	Float	var
0036	RO	Qc[1]	Float	var
0038	RO	Q Total	Float	var
0040	RO	Sa[1]	Float	VA
0042	RO	Sb[1]	Float	VA
0044	RO	Sc[1]	Float	VA
0046	RO	S Total	Float	VA
0048	RO	PFa[1]	Float	--
0050	RO	PFb[1]	Float	--
0052	RO	PFc[1]	Float	--
0054	RO	PF Total	Float	--
0056	RO	Frequency	Float	Hz
0058	RO	U4	Float	V
0060	RO	I4	Float	A
0062	RO	I5	Float	A
0064	RO	Real-time Data Timestamp - Second (UNIX Time)	UINT32	s
0066	RO	Real-time Data Timestamp - Millisecond (UNIX Time)	UINT32	ms
0068	RO	Frequency Timestamp - Second (UNIX Time)	UINT32	s
0070	RO	Frequency Timestamp - Millisecond (UNIX Time)	UINT32	ms
0072	RO	Pst Timestamp - Second (UNIX Time)	UINT32	s
0074	RO	Pst Timestamp - Millisecond (UNIX Time)	UINT32	ms
0076	RO	Plt Timestamp - Second (UNIX Time)	UINT32	s
0078	RO	Plt Timestamp - Millisecond (UNIX Time)	UINT32	ms
0080	RO	Flagging Status of Real-time Data[2]	UINT16	
0081~0092		Reserved	Float	
0093	RO	Standard Setpoint Status #1[3]	UINT32	
0095	RO	Standard Setpoint Status #2[3]	UINT32	
0097	RO	Standard Setpoint Status #3[3]	UINT32	
0099	RO	Standard Setpoint Status #4[3]	UINT32	
0101	RO	Standard Setpoint Status #5[3]	UINT32	
0103	RO	Standard Setpoint Status #6[3]	UINT32	
0105	RO	Standard Setpoint Status #7[3]	UINT32	
0107	RO	Standard Setpoint Status #8[3]	UINT32	
0109	RO	Standard Setpoint Status #9[3]	UINT32	
0111	RO	HS Setpoint Status[3]	UINT32	

0113	RO	Reserved	UINT32	
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	Reserved	UINT32	
0129	RO	Mains Signalling Voltage #1 Event Counter	UINT32	
0131	RO	Mains Signalling Voltage #2 Event Counter	UINT32	
0133	RO	Mains Signalling Voltage #3 Event Counter	UINT32	
0135	RO	Total PQ Event Counter	UINT32	
0137	RO	Device Log Pointer[4]	UINT32	
0139	RO	SOE Log Pointer[4]	UINT32	
0141	RO	WFR Log Pointer[4]	UINT32	
0143	RO	RMSR Log Pointer[4]	UINT32	
0145	RO	DWR Log Pointer[4]	UINT32	
0147~0157	RO	Reserved	UINT32	
0159	RO	SDR Log #1 Pointer[4]	UINT32	
0161	RO	SDR Log #2 Pointer[4]	UINT32	
0163	RO	SDR Log #3 Pointer[4]	UINT32	
0165	RO	SDR Log #4 Pointer[4]	UINT32	
0167	RO	SDR Log #5 Pointer[4]	UINT32	
0169	RO	SDR Log #6 Pointer[4]	UINT32	
0171	RO	SDR Log #7 Pointer[4]	UINT32	
0173	RO	SDR Log #8 Pointer[4]	UINT32	
0175	RO	SDR Log #9 Pointer[4]	UINT32	
0177	RO	SDR Log #10 Pointer[4]	UINT32	
0179	RO	SDR Log #11 Pointer[4]	UINT32	
0181	RO	SDR Log #12 Pointer[4]	UINT32	
0183	RO	SDR Log #13 Pointer[4]	UINT32	
0185	RO	SDR Log #14 Pointer[4]	UINT32	
0187	RO	SDR Log #15 Pointer[4]	UINT32	
0189	RO	SDR Log #16 Pointer[4]	UINT32	
0191~0205	RO	Reserved	UINT32	
0207	RO	DR Log #1 Pointer[4]	UINT32	
0209	RO	DR Log #2 Pointer[4]	UINT32	
0211	RO	DR Log #3 Pointer[4]	UINT32	
0213	RO	DR Log #4 Pointer[4]	UINT32	
0215	RO	DR Log #5 Pointer[4]	UINT32	
0217	RO	DR Log #6 Pointer[4]	UINT32	
0219	RO	DR Log #7 Pointer[4]	UINT32	
0221	RO	DR Log #8 Pointer[4]	UINT32	
0223~0237	RO	Reserved	UINT32	
0239	RO	Pst Log Pointer[4]	UINT32	
0241	RO	Plt Log Pointer[4]	UINT32	
0243	RO	Reserved	UINT32	
0245	RO	IER Log Pointer[4]	UINT32	
0247	RO	EN50160 Report Pointer[4]	UINT32	
0249	RO	Reserved	UINT32	
0251	RO	Historical TOU Log Pointer[4]	UINT32	
0253	RO	Reserved	UINT32	
0255	RO	Frequency Deviation Log Pointer	UINT32	
0257	RO	AER Log Pointer[4]	UINT32	
0259	RO	Reserved	UINT32	
0261	RO	2kHz-150kHz C.E. Log Pointer	UINT32	
0263	RO	Reserved	UINT32	
0265	RO	IEEE Std 519 Daily Report Pointer[4]	UINT32	
0267	RO	IEEE Std 519 Weekly Report Pointer[4]	UINT32	
0269	RO	Max. Demand Log Pointer[4]	UINT32	
0271~0279	RO	Reserved	UINT32	
0280	RO	ILa	Float	
0282	RO	ILb	Float	
0284	RO	ILc	Float	
0286	RO	ILavg	Float	
0288	RO	IL4	Float	
0290~0293	RO	Reserved	UINT32	
0294	RO	HS Frequency	Float	
0300	RO	AI1	Float	

0302	RO	AI2	Float	
0304~0307		Reserved	UINT16	
0308	RO	DI Status[5]	UINT16	
0309		Reserved	UINT16	
0310	RO	DO Status[6]	UINT16	
0311~0312		Reserved	UINT32	
0314	RO	Audit Log Pointer[4]	UINT32	

Table 5-1 Basic Measurements

Notes:

1) When the **Wiring Mode** is **3P3W**, the per phase ULN, P (kW), Q (kvar), S (kVA) and PF have no meaning, and their registers are reserved.
2) Please refer to **Section 4.5.13** 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 (2xIn)	**B11**		Reserved
B4	Frequency	Dip	**B12**	Plt.	Dip
B5		Swell	**B13**		Swell
B6		Interruption	**B14**		Interruption
B7		Reserved	**B15**		Reserved

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. The **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~B31
Standard Setpoint	Reserved

Table 5-11 Standard Setpoint Status #9 (0109)

Bit	HS Setpoint	Bit	HS Setpoint	Bit	HS Setpoint	Bit	HS Setpoint

B0	HS Setpoint #1	**B4**	HS Setpoint #5	**B8**	HS Setpoint #9	**B12**	HS Setpoint #13
B1	HS Setpoint #2	**B5**	HS Setpoint #6	**B9**	HS Setpoint #10	**B13**	HS Setpoint #14
B2	HS Setpoint #3	**B6**	HS Setpoint #7	**B10**	HS Setpoint #11	**B14**	HS Setpoint #15
B3	HS Setpoint #4	**B7**	HS Setpoint #8	**B11**	HS Setpoint #12	**B15**	HS Setpoint #16

Table 5-12 High-speed Setpoint Status (0111)

4) The **Log Pointer** indicates its current logging position with a range of 0 and 0xFFFFFFFF, and it is incremented by one for every new log generated and will roll over to 0 if its current value is 0xFFFFFFFF. If a **Clear xxx Log** is performed from the Front Panel, Web Page or via communications, its corresponding **Log Pointer** will be reset to zero, which will be recorded into SOE Log and the SOE Log Pointer will be immediately incremented by one. When the Log Pointer is larger than the respective Log Depth, the latest logs are stored on a FIFO (if Record Mode = FIFO). The following table lists the Log Depth for each Log Recorder:

Recorder	Depth	Recorder	Depth	Recorder	Depth
SOE Log	1024	**Device Log**	1024	**DR**	65535
SDR (1-16)	43200	**RMSR**	128	**IER**	65535
AER	65535	**WFR**	128	**DWR**	128
Plt	4380	**Pst**	52560	**EN50160**	52
Audit Log	2048	**Historical TOU**	12	**Max. Demand Log**	1
IEEE Std 519 Daily	365	**IEEE Std 519 Weekly**	52	**Frequency Deviation Log**	777600

Table 5-13 Log Depth

5) For the **DI Status** register, the bit values of B0 to B15 represent the states of DI1 to DI16, respectively, with “1” meaning Active (Closed) and “0” meaning Inactive (Open).
6) For the **DO Status** register, the bit value of B0 represents the Alarm state while the bit values of B1 to B7 represent the states of DO1 to DO7, respectively, with “1” meaning Operated (Closed) and “0” meaning Released (Open).

5.2 Energy Measurements

5.2.1 INT64 Energy Measurement

The Energy registers will roll over to zero automatically when it is reached to the maximum value, which depends on the **Energy Rollover**’s (Register 40758) setting:

- 0: maximum value of 100,000,000,000,000 (Default)
- 1: maximum value of 1,000,000,000,000

Register	Property	Description	Format	Scale	Unit
0500	RW	∑kWh Imp.	INT64	1	wh
0504	RW	∑kWh Exp.	INT64	1	wh
0508	RW	∑kvarh Imp.	INT64	1	varh
0512	RW	∑kvarh Exp.	INT64	1	varh
0516	RW	∑kVAh	INT64	1	VAh
0520	RO	∑kWh Net	INT64	1	wh
0524	RO	∑kWh Total	INT64	1	wh
0528	RO	∑kvarh Net	INT64	1	varh
0532	RO	∑kvarh Total	INT64	1	varh

Table 5-14 Energy Measurements (INT64)

5.2.2 INT32 Energy Measurement

The INT32 Energy measurement should be calculated based on E1 & E2:

∑kxh (Import/Export/Net/Total)
= E1x100 Gxh + E2x0.1 kxh
= E1x10^8 kxh + E2x0.1 kxh

The E1 and E2 registers have a maximum value of 100 and 1,000,000,000, respectively, and will roll over to zero automatically when it is reached. The E1 register will be incremented by 1 when the E2 register rolls over. The calculated Total kXh (Import/Export/Net/Total) has a maximum value of 1x10^{11}kxh. The E1 and E2 registers must be written simultaneously.

Register	Property	Description	Format	Scale	Unit
0550	RW	∑kWh Import E1	INT32	1	100 GWh
0552	RW	∑kWh Import E2	INT32	0.1	kWh
0554	RW	∑kWh Export E1	INT32	1	100 GWh
0556	RW	∑kWh Export E2	INT32	0.1	kWh

0558	RW	∑kvarh Import E1	INT32	1	100 Gvarh
0560	RW	∑kvarh Import E2	INT32	0.1	kvarh
0562	RW	∑kvarh Export E1	INT32	1	100 Gvarh
0564	RW	∑kvarh Export E2	INT32	0.1	kvarh
0566	RW	∑kVAh E1	INT32	1	100 GVAh
0568	RW	∑kVAh E2	INT32	0.1	kVAh
0570	RO	∑kWh Net E1	INT32	1	100 GWh
0572	RO	∑kWh Net E2	INT32	0.1	kWh
0574	RO	∑kWh Total E1	INT32	1	100 GWh
0576	RO	∑kWh Total E2	INT32	0.1	kWh
0578	RO	∑kvarh Net E1	INT32	1	100 Gvarh
0580	RO	∑kvarh Net E2	INT32	0.1	kvarh
0582	RO	∑kvarh Total E1	INT32	1	100 Gvarh
0584	RO	∑kvarh Total E2	INT32	0.1	kvarh

Table 5-15 32-bits Energy Measurements

5.3 DI Pulse Counter

The DI Counters have a maximum value of 999,999,999 and will roll over to zero automatically when it is reached.

Register	Property	Description	Format	Range
0650	RW	DI1 Counter	INT32	0 to 999,999,999
0652	RW	DI2 Counter	INT32	
0654	RW	DI3 Counter	INT32	
0656	RW	DI4 Counter	INT32	
0658	RW	DI5 Counter	INT32	
0660	RW	DI6 Counter	INT32	
0662	RW	DI7 Counter	INT32	
0664	RW	DI8 Counter	INT32	
0666	RW	DI9 Counter[1]	INT32	
0668	RW	DI10 Counter[1]	INT32	
0670	RW	DI11 Counter[1]	INT32	
0672	RW	DI12 Counter[1]	INT32	
0674	RW	DI13 Counter[1]	INT32	
0676	RW	DI14 Counter[1]	INT32	
0678	RW	DI15 Counter[1]	INT32	
0680	RW	DI16 Counter[1]	INT32	

Table 5-16 Pulse Counter

Notes:

1) DI9 Counter to DI16 Counter are only available when the iMeter 8 is equipped with corresponding options.

5.4 PQ Measurements

Register	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	Ua Over Deviation[1]	Float	
0714	RO	Ub Over Deviation[1]	Float	
0716	RO	Uc Over Deviation[1]	Float	
0718	RO	Uab Over Deviation	Float	
0720	RO	Ubc Over Deviation	Float	
0722	RO	Uca Over Deviation	Float	
0724	RO	Ua Under Deviation[1]	Float	
0726	RO	Ub Under Deviation[1]	Float	
0728	RO	Uc Under Deviation[1]	Float	
0730	RO	Uab Under Deviation	Float	
0732	RO	Ubc Under Deviation	Float	
0734	RO	Uca Under Deviation	Float	
0736	RO	Freq. Deviation	Float	Hz
0738~0748	RO	Reserved		
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/Uab Pst[2]	Float	
0772	RO	Ub/Ubc Pst[2]	Float	
0774	RO	Uc/Uca Pst[2]	Float	
0776	RO	Ua/Uab Plt[2]	Float	
0778	RO	Ub/Ubc Plt[2]	Float	
0780	RO	Uc/Uca Plt[2]	Float	
0782	RO	Reserved	Float	
0784	RO	Ia TDD	Float	
0786	RO	Ib TDD	Float	
0788	RO	Ic TDD	Float	
0790	RO	I4 TDD	Float	
0792	RO	Reserved	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	Reserved	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	Reserved	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	Reserved	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	Reserved	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/Uab MSV #1[2]	Float	V
0844	RO	Ub/Ubc MSV #1[2]	Float	V
0846	RO	Uc/Uca MSV #1[2]	Float	V
0848	RO	Ua/Uab MSV #2[2]	Float	V
0850	RO	Ub/Ubc MSV #2[2]	Float	V
0852	RO	Uc/Uca MSV #2[2]	Float	V
0854	RO	Ua/Uab MSV #3[2]	Float	V
0856	RO	Ub/Ubc MSV #3[2]	Float	V
0858	RO	Uc/Uca MSV #3[2]	Float	V

Table 5-17 PQ Measurements

Notes:

1. When the **Wiring Mode** is **3P3W**, the 3-Ø ULN Deviations have no meaning and their registers are reserved.
2. When the **Wiring Mode** is **3P3W** or **1P2W L-L**, the phase A/B/C Voltage Pst/Plt/MSV mean phase AB/BC/CA Voltage Pst/Plt/MSV.

5.5 Harmonics & Interharmonic Measurements

5.5.1 Harmonic Distortion

Register	Property	Description	Format	Unit/Scale
1000	RO	Ua/Uab THD[1]	Float	%/x100
1002	RO	Ub/Ubc THD[1]	Float	%/x100
1004	RO	Uc/Uca THD[1]	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	Reserved	Float	
1018	RO	Ua/Uab TOHD[1]	Float	%/x100
1020	RO	Ub/Ubc TOHD[1]	Float	%/x100
1022	RO	Uc/Uca TOHD[1]	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	Reserved	Float	
1036	RO	Ua/Uab TEHD[1]	Float	%/x100
1038	RO	Ub/Ubc TEHD[1]	Float	%/x100
1040	RO	Uc/Uca TEHD[1]	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	Reserved	Float	
1054	RO	Ua/Uab DC Component[1]	Float	%/x100
1056	RO	Ub/Ubc DC Component[1]	Float	%/x100
1058	RO	Uc/Uca DC Component[1]	Float	%/x100
1060	RO	U4 DC Component	Float	%/x100
1062	RO	Ia DC Component	Float	%/x100
1064	RO	Ib DC Component	Float	%/x100
1066	RO	Ic DC Component	Float	%/x100
1068	RO	I4 DC Component	Float	%/x100
1070	RO	Reserved	Float	
1072	RO	Ua/Uab HD01[1]	Float	%/x100
1074	RO	Ub/Ubc HD01[1]	Float	%/x100
1076	RO	Uc/Uca HD01[1]	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	Reserved	Float	
	…	…	…	%/x100
2188	RO	Ua/Uab HD63[1]	Float	%/x100
2190	RO	Ub/Ubc HD63[1]	Float	%/x100
2192	RO	Uc/Uca HD63[1]	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

Table 5-18 Harmonics Distortion Measurements

Note:

1. When the **Wiring Mode** is **3P3W** or **1P2W L-L**, the Ua/Ub/Uc THD, TOHD, TEHD and Individual Harmonics mean Uab/Ubc/Uca THD, TOHD, TEHD and Individual Harmonics, respectively.
2. When the **Wiring Mode** is **1P2W L-N** or **1P2W L-L**, the B and C phase voltages THD/TOHD/TEHD/HD*xx* have no meaning, and their registers are reserved. When the **Wiring Mode** is **1P3W L-N,** the C phase voltages THD/TOHD/TEHD/HD*xx* have no meaning, and their registers are reserved.

5.5.2 Harmonic RMS Measurements

Register	Property	Description	Format	Unit
2300	RO	Ua/Uab TH RMS[1]	Float	V
2302	RO	Ub/Ubc TH RMS[1]	Float	V
2304	RO	Uc/Uca TH RMS[1]	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	Reserved	Float	

2318	RO	Ua/Uab TOH RMS[1]	Float	V
2320	RO	Ub/Ubc TOH RMS[1]	Float	V
2322	RO	Uc/Uca TOH RMS[1]	Float	V
2324	RO	U4 TOH RMS	Float	V
2326	RO	Ia TOH RMS	Float	A
2328	RO	Ib TOH RMS	Float	A
2330	RO	Ic TOH RMS	Float	A
2332	RO	I4 TOH RMS	Float	A
2334	RO	Reserved	Float	
2336	RO	Ua/Uab TEH RMS[1]	Float	V
2338	RO	Ub/Ubc TEH RMS[1]	Float	V
2340	RO	Uc/Uca TEH RMS[1]	Float	V
2342	RO	U4 TEH RMS	Float	V
2344	RO	Ia TEH RMS	Float	A
2346	RO	Ib TEH RMS	Float	A
2348	RO	Ic TEH RMS	Float	A
2350	RO	I4 TEH RMS	Float	A
2352	RO	Reserved	Float	
2354	RO	Ua/Uab DC Component RMS[1]	Float	V
2356	RO	Ub/Ubc DC Component RMS[1]	Float	V
2358	RO	Uc/Uca DC Component RMS[1]	Float	V
2360	RO	U4 DC Component RMS	Float	V
2362	RO	Ia DC Component RMS	Float	A
2364	RO	Ib DC Component RMS	Float	A
2366	RO	Ic DC Component RMS	Float	A
2368	RO	I4 DC Component RMS	Float	A
2370	RO	Reserved	Float	
2372	RO	Ua/Uab H01 RMS[1]	Float	V
2374	RO	Ub/Ubc H01 RMS[1]	Float	V
2376	RO	Uc/Uca H01 RMS[1]	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	Reserved	Float	
…	RO	…	…	…
3488	RO	Ua/Uab H63 RMS[1]	Float	V
3490	RO	Ub/Ubc H63 RMS[1]	Float	V
3492	RO	Uc/Uca H63 RMS[1]	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	Reserved	Float	

Table 5-19 Harmonics RMS Measurements

Note:

1. When the **Wiring Mode** is **3P3W**, the TH/TOH/TEH RMS and Individual Harmonic RMS for Ua/Ub/Uc mean the TH/TOH/TEH RMS and Individual Harmonic RMS for Uab/Ubc/Uca.
2. When the **Wiring Mode** is **1P2W L-N** or **1P2W L-L**, the B and C phase voltages harmonic measurements have no meaning, and their registers are reserved. When the **Wiring Mode** is **1P3W L-N,** the C phase voltages harmonic measurements have no meaning, and their registers are reserved.

5.5.3 Individual Total Harmonic Power

Register	Property	Description	Format	Unit
27000	RO	∑kW Fund.	Float	W
27002	RO	∑kvar Fund.	Float	var
27004	RO	∑kVA Fund.	Float	VA
27006	RO	dPF	Float	
27008	RO	∑kW H02	Float	W
27010	RO	∑kvar H02	Float	var
27012	RO	∑kVA H02	Float	VA
27014	RO	PF H02	Float	
…		…		
27496	RO	∑kW H63	Float	W
27498	RO	∑kvar H63	Float	var

27500	RO	∑kVA H63	Float	VA
27502	RO	PF H63	Float	

Table 5-20 Individual Total Harmonic Power

5.5.4 Harmonic Power

Register	Property	Description	Format	Unit
28000	RO	Pa TH[1]	Float	W
28002	RO	Pb TH[1]	Float	W
28004	RO	Pc TH[1]	Float	W
28006	RO	P TH	Float	W
28008	RO	Qa TH[1]	Float	var
28010	RO	Qb TH[1]	Float	var
28012	RO	Qc TH[1]	Float	var
28014	RO	Q TH	Float	var
28016	RO	Sa TH[1]	Float	VA
28018	RO	Sb TH[1]	Float	VA
28020	RO	Sc TH[1]	Float	VA
28022	RO	S TH	Float	VA
28024	RO	PFa TH[1]	Float	
28026	RO	PFb TH[1]	Float	
28028	RO	PFc TH[1]	Float	
28030	RO	PF TH	Float	
28032~28038		Reserved	Float	
28040	RO	Pa H01[1]	Float	W
28042	RO	Pb H01[1]	Float	W
28044	RO	Pc H01[1]	Float	W
28046	RO	Qa H01[1]	Float	var
28048	RO	Qb H01[1]	Float	var
28050	RO	Qc H01[1]	Float	var
28052	RO	Sa H01[1]	Float	VA
28054	RO	Sb H01[1]	Float	VA
28056	RO	Sc H01[1]	Float	VA
28058	RO	PFa H01[1]	Float	
28060	RO	PFb H01[1]	Float	
28062	RO	PFc H01[1]	Float	
…	RO	…	Float	
29528	RO	Pa H63[1]	Float	W
29530	RO	Pb H63[1]	Float	W
29532	…	Pc H63[1]	Float	W
29534	RO	Qa H63[1]	Float	var
29536	RO	Qb H63[1]	Float	var
29538	RO	Qc H63[1]	Float	var
29540	RO	Sa H63[1]	Float	VA
29542	RO	Sb H63[1]	Float	VA
29544	RO	Sc H63[1]	Float	VA
29546	RO	PFa H63[1]	Float	
29548	RO	PFb H63[1]	Float	
29550	RO	PFc H63[1]	Float	

Table 5-21 Harmonic Power

Notes:

1. When the **Wiring Mode** is **3P3W** or **1P3W**, the Total Harmonics and Individual Harmonics for Phase A/B/C P, Q, S and PF have no meaning and their registers are reserved.
2. When the **Wiring Mode** is **1P2W L-N** or **1P2W L-L**, the B and C phase Individual Harmonics have no meaning, and their registers are reserved. When the **Wiring Mode** is **1P3W L-N,** the C phase Individual Harmonics have no meaning, and their registers are reserved.

5.5.5 Harmonic Angles

Register	Property	Description	Format	Unit
30018	RO	Ua/Uab H01 Angle[1]	Float	°
30020	RO	Ub/Ubc H01 Angle[1]	Float	
30022	RO	Uc/Uca H01 Angle[1]	Float	
30024	RO	U4 H01 Angle	Float	
30026	RO	Ia H01 Angle	Float	
30028	RO	Ib H01 Angle	Float	
30030	RO	Ic H01 Angle	Float	
30032	RO	I4 H01 Angle	Float	

30034	RO	Reserved	Float	
…	RO	…	Float	
31134	RO	Ua/Uab H63 Angle[1]	Float	
31136	RO	Ub/Ubc H63 Angle[1]	Float	
31138	RO	Uc/Uca H63 Angle[1]	Float	
31140	RO	U4 H63 Angle	Float	
31142	RO	Ia H63 Angle	Float	
31144	RO	Ib H63 Angle	Float	
31146	RO	Ic H63 Angle	Float	
31148	RO	I4 H63 Angle	Float	
31150	RO	Reserved	Float	

Table 5-22 Harmonic Angle

Notes:

1. When the **Wiring Mode** is **3P3W** or **1P3W**, the Phase A/B/C Voltage Individual Angles mean Phase AB/BC/CA Voltage Individual Angles, Respectively.
2. When the **Wiring Mode** is **1P2W L-N** or **1P2W L-L**, the B and C phase Voltage Individual Angles have no meaning, and their registers are reserved. When the **Wiring Mode** is **1P3W L-N,** the C phase Voltage Individual Angles have no meaning, and their registers are reserved.

5.5.6 Harmonic Energy

Register	Property	Description	Format	Unit
31500	RW	Total Harmonic kWh Import[1]	INT64	wh
31504	RW	Total Harmonic kWh Export	INT64	wh
31508	RW	Total Harmonic kvarh Import[1]	INT64	varh
31512	RW	Total Harmonic kvarh Export[1]	INT64	varh
31516	RO	Total Harmonic kWh Net	INT64	wh
31520	RO	Total Harmonic kWh Total	INT64	wh
31524	RO	Total Harmonic kvarh Net	INT64	varh
31528	RO	Total Harmonic kvarh Total	INT64	varh
31532~31598		Reserved	INT64	
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
…		Reserved	INT64	
33000	RO	kWh Net TH	INT64	Wh
33004	RO	kWh Total TH	INT64	Wh
33008	RO	kvarh Net TH	INT64	varh
33012	RO	kvarh Total TH	INT64	varh

Table 5-23 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 Measurements

Register	Property	Description	Format	Unit/Scale
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	Reserved	Float	
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	Reserved	Float	
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	Reserved	Float	
33154	RO	Ua/Uab IHD00[1]	Float	%, x100
33156	RO	Ub/Ubc IHD00[1]	Float	%, x100
33158	RO	Uc/Uca IHD00[1]	Float	%, x100
33160	RO	U4 IHD00	Float	%, x100
33162	RO	Ia IHD00	Float	%, x100
33164	RO	Ib IHD00	Float	%, x100
33166	RO	Ic IHD00	Float	%, x100
33168	RO	I4 IHD00	Float	%, x100
33170	RO	Reserved	Float	
33172	RO	Ua/Uab IHD01[1]	Float	%, x100
33174	RO	Ub/Ubc IHD01[1]	Float	%, x100
33176	RO	Uc/Uca IHD01[1]	Float	%, x100
33178	RO	U4 IHD01	Float	%, x100
33180	RO	Ia IHD01	Float	%, x100
33182	RO	Ib IHD01	Float	%, x100
33184	RO	Ic IHD01	Float	%, x100
33186	RO	I4 IHD01	Float	%, x100
33188	RO	Reserved	Float	
…	…	….	…	
34288	RO	Ua/Uab IHD63[1]	Float	%, x100
34290	RO	Ub/Ubc IHD63[1]	Float	%, x100
34292	RO	Uc/Uca IHD63[1]	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

Table 5-24 Interharmonics Measurements

Note:

1. When the **Wiring Mode** is **3P3W** or **1P3W**, the Ua/Ub/Uc TIHD, TOIHD, TEIHD and Individual IHDs mean Uab/Ubc/Uca TIHD, TOIHD, TEIHD and Individual IHDs, respectively.
2. When the **Wiring Mode** is **1P2W L-N** or **1P2W L-L**, the B and C phase Voltage Individual IHDs have no meaning, and their registers are reserved. When the **Wiring Mode** is **1P3W L-N,** the C phase Voltage Individual IHDs have no meaning, and their registers are reserved.

5.5.8 Interharmonic RMS Measurements

Register	Property	Description	Format	Unit
34500	RO	Ua/Uab TIH RMS[1]	Float	V
34502	RO	Ub/Ubc TIH RMS[1]	Float	V
34504	RO	Uc/Uca TIH RMS[1]	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	Reserved	Float	
34518	RO	Ua/Uab TOIH RMS[1]	Float	V
34520	RO	Ub/Ubc TOIH RMS[1]	Float	V
34522	RO	Uc/Uca TOIH RMS[1]	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	Reserved	Float	
34536	RO	Ua/Uab TEIH RMS[1]	Float	V
34538	RO	Ub/Ubc TEIH RMS[1]	Float	V
34540	RO	Uc/Uca TEIH RMS[1]	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	Reserved	Float	
34554	RO	Ua/Uab IH00 RMS[1]	Float	V
34556	RO	Ub/Ubc IH00 RMS[1]	Float	V
34558	RO	Uc/Uca IH00 RMS[1]	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	Reserved	Float	
34572	RO	Ua/Uab IH01 RMS[1]	Float	V
34574	RO	Ub/Ubc IH01 RMS[1]	Float	V
34576	RO	Uc/Uca IH01 RMS[1]	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	Reserved	Float	
...	RO	...	Float	
35688	RO	Ua/Uab IH63 RMS[1]	Float	V
35690	RO	Ub/Ubc IH63 RMS[1]	Float	V
35692	RO	Uc/Uca IH63 RMS[1]	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	Reserved	Float	

Table 5-25 Interharmonics Voltage & Current RMS

Note:

1. When the **Wiring Mode** is **3P3W** or **1P3W**, the TIH/TOIH/TEIH RMS and Individual IH RMS for Ua/Ub/Uc mean TIH/TOIH/TEIH RMS and Individual IH RMS for Uab/Ubc/Uca, respectively.

2. When the **Wiring Mode** is **1P2W L-N** or **1P2W L-L**, the B and C phase RMS and Individual IH RMS have no meaning, and their registers are reserved. When the **Wiring Mode** is **1P3W L-N,** the C phase RMS and Individual IH RMS have no meaning, and their registers are reserved.

5.6 Conducted Emissions in the 2-150kHz Range

Register	Property	Description	Format	Unit
6200	RO	Timestamp-sec (UNIX)	UINT32	s
6202	RO	Timestamp-ms (UNIX)	UINT32	ms
6204	RO	Ua 2.1kHz Amplitude	Float	
6206	RO	Ub 2.1kHz Amplitude	Float	
6208	RO	Uc 2.1kHz Amplitude	Float	
6210	RO	Ua 2.3kHz Amplitude	Float	
6212	RO	Ub 2.3kHz Amplitude	Float	
6214	RO	Uc 2.3kHz Amplitude	Float	
6216	RO	Ua 2.5kHz Amplitude	Float	
6218	RO	Ub 2.5kHz Amplitude	Float	
6220	RO	Uc 2.5kHz Amplitude	Float	
...	RO	...	Float	
6408	RO	Ua 8.9kHz Amplitude	Float	
6410	RO	Ub 8.9kHz Amplitude	Float	
6412	RO	Uc 8.9kHz Amplitude	Float	

6414	RO	Ua 10kHz Amplitude	Float	
6416	RO	Ub 10kHz Amplitude	Float	
6418	RO	Uc 10kHz Amplitude	Float	
6420	RO	Ua 12kHz Amplitude	Float	
6422	RO	Ub 12kHz Amplitude	Float	
6424	RO	Uc 12kHz Amplitude	Float	
6426	RO	Ua 14kHz Amplitude	Float	
6428	RO	Ub 14kHz Amplitude	Float	
6430	RO	Uc 14kHz Amplitude	Float	
…	RO	…	Float	
6834	RO	Ua 150kHz Amplitude	Float	
6836	RO	Ub 150kHz Amplitude	Float	
6838	RO	Uc 150kHz Amplitude	Float	
6840	RO	Ia 2.1kHz Amplitude	Float	
6842	RO	Ib 2.1kHz Amplitude	Float	
6844	RO	Ic 2.1kHz Amplitude	Float	
…	RO	…	Float	
7044	RO	Ia 8.9kHz Amplitude	Float	
7046	RO	Ib 8.9kHz Amplitude	Float	
7048	RO	Ic 8.9kHz Amplitude	Float	

Table 5-26 Conducted Emissions in the 2-150kHz Range

5.7 Demand

5.7.1 Present Demand

Register	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	Pa Imp.[1]	Float	W
3632	RO	Pb Imp.[1]	Float	W
3634	RO	Pc Imp.[1]	Float	W
3636	RO	P Total Imp.	Float	W
3638	RO	Pa Exp.[1]	Float	W
3640	RO	Pb Exp.[1]	Float	W
3642	RO	Pc Exp.[1]	Float	W
3644	RO	P Total Exp.	Float	W
3646	RO	Qa Imp.[1]	Float	var
3648	RO	Qb Imp.[1]	Float	var
3650	RO	Qc Imp.[1]	Float	var
3652	RO	Q Total Imp.	Float	var
3654	RO	Qa Exp.[1]	Float	var
3656	RO	Qb Exp.[1]	Float	var
3658	RO	Qc Exp.[1]	Float	var
3660	RO	Q Total Exp.	Float	var
3662	RO	Sa[1]	Float	VA
3664	RO	Sb[1]	Float	VA
3666	RO	Sc[1]	Float	VA
3668	RO	S Total	Float	VA
3670	RO	PFa[1]	Float	--
3672	RO	PFb[1]	Float	--
3674	RO	PFc[1]	Float	--
3676	RO	PF Total	Float	--
3678	RO	Frequency	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	Frequency 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	Reserved	Float	
3736	RO	Ua/Uab THD[2]	Float	
3738	RO	Ub/Ubc THD[2]	Float	
3740	RO	Uc/Uca THD[2]	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	Reserved	Float	
3754	RO	Ua/Uab TOHD[2]	Float	
3756	RO	Ub/Ubc TOHD[2]	Float	
3758	RO	Uc/Uca TOHD[2]	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	Reserved	Float	
3772	RO	Ua/Uab TEHD[2]	Float	
3774	RO	Ub/Ubc TEHD[2]	Float	
3776	RO	Uc/Uca TEHD[2]	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	Reserved	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

Table 5-27 Present Demand

Notes:

1. When the **Wiring Mode** is **3P3W** or **1P3W**, the Present Demands for Ua/Ub/Uc, ULN Average, P Import/Export, Q Import/Export, S, PF, Voltage Deviation, have no meaning and their registers are reserved.
2. When the **Wiring Mode** is **3P3W** or **1P3W**, the Present Demands for Ua/Ub/Uc THD, TOHD and TEHD mean the Demands for Uab/Ubc/Uca THD, TOHD and TEHD.

5.7.2 Predicted Demand

Register	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	Pa Imp.[1]	Float	W
3932	RO	Pb Imp.[1]	Float	W
3934	RO	Pc Imp.[1]	Float	W
3936	RO	P Total Imp.	Float	W
3938	RO	Pa Exp.[1]	Float	W
3940	RO	Pb Exp.[1]	Float	W
3942	RO	Pc Exp.[1]	Float	W
3944	RO	P Total Exp.	Float	W
3946	RO	Qa Imp.[1]	Float	var
3948	RO	Qb Imp.[1]	Float	var
3950	RO	Qc Imp.[1]	Float	var
3952	RO	Q Total Imp.	Float	var
3954	RO	Qa Exp.[1]	Float	var
3956	RO	Qb Exp.[1]	Float	var
3958	RO	Qc Exp.[1]	Float	var
3960	RO	Q Total Exp.	Float	var
3962	RO	Sa[1]	Float	VA
3964	RO	Sb[1]	Float	VA
3966	RO	Sc[1]	Float	VA
3968	RO	S Total	Float	VA
3970	RO	PFa[1]	Float	-
3972	RO	PFb[1]	Float	-
3974	RO	PFc[1]	Float	-
3976	RO	PF Total	Float	-
3978	RO	Frequency	Float	Hz

Table 5-28 Predicted Demand

Notes:

1) When the **Wiring Mode** is **3P3W** or **1P3W**, the Predicted Demands for Ua/Ub/Uc, ULN Average, P Import/Export, Q Import/Export, S and PF, have no meaning and their registers are reserved.

5.7.3 Max. / Min. Value per Demand Period

Register		Property	Description	Format	Unit
Max.	Min.				
4100	4800	RO	Ua[1]	**See Section 5.7.5 Demand Data Structure**	V
4106	4806	RO	Ub[1]		
4112	4812	RO	Uc[1]		
4118	4818	RO	ULN Avg[1]		
4124	4824	RO	U4		
4130	4830	RO	Uab		
4136	4836	RO	Ubc		
4142	4842	RO	Uca		
4148	4848	RO	ULL Avg		
4154	4854	RO	Ia		A
4160	4860	RO	Ib		
4166	4866	RO	Ic		
4172	4872	RO	I Avg		
4178	4878	RO	I4		
4184	4884	RO	I5		

4190	4890	RO	Pa Imp.[1]		W
4196	4896	RO	Pb Imp.[1]		
4202	4902	RO	Pc Imp.[1]		
4208	4908	RO	P Imp. Total		
4214	4914	RO	Pa Exp.[1]		W
4220	4920	RO	Pb Exp.[1]		
4226	4926	RO	Pc Exp.[1]		
4232	4932	RO	P Exp. Total		
4238	4938	RO	Qa Imp.[1]		var
4244	4944	RO	Qb Imp.[1]		
4250	4950	RO	Qc Imp.[1]		
4256	4956	RO	Q Imp. Total		
4262	4962	RO	Qa Exp.[1]		
4268	4968	RO	Qb Exp.[1]		
4274	4974	RO	Qc Exp.[1]		
4280	4980	RO	Q Exp. Total		
4286	4986	RO	Sa[1]		VA
4292	4992	RO	Sb[1]		
4298	4298	RO	Sc[1]		
4304	5004	RO	S Total		
4310	5010	RO	PFa[1]		
4316	5016	RO	PFb[1]		
4322	5022	RO	PFc[1]		
4328	5028	RO	PF Total		
4334	5034	RO	Frequency		Hz
4340	5040	RO	Ua Deviation[1]		100%
4346	5046	RO	Ub Deviation[1]		
4352	5052	RO	Uc Deviation[1]		
4358	5058	RO	Uab Deviation		
4364	5064	RO	Ubc Deviation		
4370	5070	RO	Uca Deviation		
4376	5076	RO	Ua Over Deviation[1]		
4382	5082	RO	Ub Over Deviation[1]		
4388	5088	RO	Uc Over Deviation[1]		
4394	5094	RO	Uab Over Deviation		
4400	5100	RO	Ubc Over Deviation		
4406	5106	RO	Uca Over Deviation		
4412	5112	RO	Ua Under Deviation[1]		
4418	5118	RO	Ub Under Deviation[1]		
4424	5124	RO	Uc Under Deviation[1]		
4430	5130	RO	Uab Under Deviation		
4436	5136	RO	Ubc Under Deviation		
4442	5142	RO	Uca Under Deviation		
4448	5148	RO	Frequency Deviation		
4454	5154	RO	U0 Unbalance		
4460	5160	RO	U2 Unbalance		
4466	5166	RO	I0 Unbalance		
4472	5172	RO	I2 Unbalance		
4478	5178	RO	Ia K Factor		
4484	5184	RO	Ib K Factor		
4490	5190	RO	Ic K Factor		
4496	5196	RO	I4 K Factor		
4502	5202	RO	Reserved		
4508	5208	RO	Ua/Uab THD[2]		
4514	5214	RO	Ub/Ubc THD[2]		
4520	5220	RO	Uc/Uca THD[2]		
4526	5226	RO	U4 THD		
4532	5232	RO	Ia THD		
4538	5238	RO	Ib THD		
4544	5244	RO	Ic THD		
4550	5250	RO	I4 THD		
4556	5256	RO	Reserved		
4562	5262	RO	Ua/Uab TOHD[2]		
4568	5268	RO	Ub/Ubc TOHD[2]		
4574	5274	RO	Uc/Uca TOHD[2]		
4580	5280	RO	U4 TOHD		
4586	5286	RO	Ia TOHD		

4592	5292	RO	Ib TOHD		
4598	5298	RO	Ic TOHD		
4604	5304	RO	I4 TOHD		
4610	5310	RO	Reserved		
4616	5316	RO	Ua/Uab TEHD^2		
4622	5322	RO	Ub/Ubc TEHD^2		
4628	5328	RO	Uc/Uca TEHD^2		
4634	5334	RO	U4 TEHD		
4640	5340	RO	Ia TEHD		
4646	5346	RO	Ib TEHD		
4652	5352	RO	Ic TEHD		
4658	5358	RO	I4 TEHD		
4664	5364	RO	Reserved		
4670	5370	RO	Ia Fund.		A
4676	5376	RO	Ib Fund.		A
4682	5382	RO	Ic Fund.		A
4688	5388	RO	I4 Fund.		A

Table 5-29 Max./Min. Value per Demand Period

Notes:

1) When the **Wiring Mode** is **3P3W** or **1P3W**, the Max./Min. Value per Demands for Ua/Ub/Uc, ULN Average, P Import/Export, Q Import/Export, S, PF, Voltage Deviation, have no meaning and their registers are reserved.
2) When the **Wiring Mode** is **3P3W** or **1P3W**, the Max./Min. Value per Demands for Ua/Ub/Uc THD, TOHD and TEHD mean the Demands for Uab/Ubc/Uca THD, TOHD and TEHD.

5.7.4 This/Last Max. Demand Log

Register		Property	Description	Format	Unit
This Max.	Last Max.				
5500	5700	RO	P Imp. Total	**See Section 5.7.5 Demand Data Structure**	W
5506	5706	RO	P Exp. Total		W
5512	5712	RO	Q Imp. Total		var
5518	5718	RO	Q Exp. Total		var
5524	5724	RO	S Total		VA
5530	5730	RO	Ia		A
5536	5736	RO	Ib		A
5542	5742	RO	Ic		A
5548	5748	RO	Ia Fund.		A
5554	5754	RO	Ib Fund.		A
5560	5760	RO	Ic Fund.		A
5566	5766	RO	I4 Fund.		A

Table 5-30 Present Max. Demand

5.7.5 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 (Float)

Table 5-31 Demand Data Structure

5.8 Real-time IER & AER

5.8.1 Real-time IER & AER (INT64)

Register		Property	Description	Format	Unit
IER	AER				
6000	6100	RO	kWh Import	INT64	wh
6004	6104	RO	kWh Export	INT64	wh
6008	6108	RO	kWh Total	INT64	wh
6012	6112	RO	kvarh Import	INT64	varh
6016	6116	RO	kvarh Export	INT64	varh
6020	6120	RO	kvarh Total	INT64	varh

6024	6124	RO	kVAh	INT64	VAh
6028	6128	RO	Fundamental kWh Import	INT64	wh
6032	6132	RO	Fundamental kWh Export	INT64	wh
6036	6136	RO	Fundamental kvarh Import	INT64	varh
6040	6140	RO	Fundamental kvarh Export	INT64	varh
6044	6144	RO	Total Harmonic kWh Import	INT64	wh
6048	6148	RO	Total Harmonic kWh Export	INT64	wh
6052	6152	RO	Total Harmonic kvarh Import	INT64	varh
6056	6156	RO	Total Harmonic kvarh Export	INT64	varh
6060	6160	RO	kWh Net	INT64	wh
6064	6164	RO	kvarh Net	INT64	varh

Table 5-32 IER & AER Real-time Measurements (INT64)

5.8.2 Real-time IER & AER (INT32)

The INT32 Energy measurement should be calculated based on E1 & E2:

∑kxh (Import/Export/Net/Total)
= E1x100 Gxh + E2x0.1 kxh
= E1x10^8 kxh + E2x0.1 kxh

The E1 and E2 registers have a maximum value of 100 and 1,000,000,000, respectively, and will roll over to zero automatically when it is reached. The E1 register will be incremented by 1 when the E2 register rolls over. The calculated Total kXh (Import/Export/Net/Total) has a maximum value of 1x10^{11}kxh. The E1 and E2 registers must be written simultaneously.

Register		Property	Description	Format	Unit
IER	AER				
7100	7200	RO	kWh Import 1	INT32	100,000,000 kWh
7102	7202	RO	kWh Import 2	INT32	0.1kWh
7104	7204	RO	kWh Export 1	INT32	100,000,000 kWh
7106	7206	RO	kWh Export 2	INT32	0.1kWh
7108	7208	RO	kWh Total 1	INT32	100,000,000 kWh
7110	7210	RO	kWh Total 2	INT32	0.1kWh
7112	7212	RO	kvarh Import 1	INT32	100,000,000 kvarh
7114	7214	RO	kvarh Import 2	INT32	0. kvarh
7116	7216	RO	kvarh Export 1	INT32	100,000,000 kvarh
7118	7218	RO	kvarh Export 2	INT32	0. kvarh
7120	7220	RO	kvarh Total 1	INT32	100,000,000 kvarh
7122	7222	RO	kvarh Total 2	INT32	0. kvarh
7124	7224	RO	kVAh Import 1	INT32	100,000,000 kVAh
7126	7226	RO	kVAh Import 2	INT32	0. kVAh
7128	7228	RO	Fundamental kWh Import 1	INT32	100,000,000 kWh
7130	7230	RO	Fundamental kWh Import 2	INT32	0.1kWh
7132	7232	RO	Fundamental kWh Export 1	INT32	100,000,000 kWh
7134	7234	RO	Fundamental kWh Export 2	INT32	0.1kWh
7136	7236	RO	Fundamental kvarh Import 1	INT32	100,000,000 kvarh
7138	7238	RO	Fundamental kvarh Import 2	INT32	0. kvarh
7140	7240	RO	Fundamental kvarh Export 1	INT32	100,000,000 kvarh
7142	7242	RO	Fundamental kvarh Export 2	INT32	0. kvarh
7144	7244	RO	Total Harmonic kWh Import 1	INT32	100,000,000 kWh
7146	7246	RO	Total Harmonic kWh Import 2	INT32	0.1kWh
7147	7247	RO	Total Harmonic kWh Export 1	INT32	100,000,000 kWh
7150	7250	RO	Total Harmonic kWh Export 2	INT32	0.1kWh
7152	7252	RO	Total Harmonic kvarh Import 1	INT32	100,000,000 kvarh
7154	7254	RO	Total Harmonic kvarh Import 2	INT32	0. kvarh
7156	7256	RO	Total Harmonic kvarh Export 1	INT32	100,000,000 kvarh
7158	7258	RO	Total Harmonic kvarh Export 2	INT32	0. kvarh
7160	7260	RO	kWh Net 1	INT32	100,000,000 kWh
7162	7262	RO	kWh Net 2	INT32	0.1kWh
7164	7264	RO	kvarh Net 1	INT32	100,000,000 kvarh
7166	7266	RO	kvarh Net 2	INT32	0. kvarh

Table 5-33 IER & AER Real-time Measurements (INT32)

5.9 Data Logging

5.9.1 Device Log Buffer

The iMeter 8 can store up to 1024 entries Device Logs. Writing N to the **Device Log Index** register will update the #N to #N+9 Device Log Buffer with Device Log Events. For example, if the **Device Log Pointer (Register 0137)** =

2000, writing 1991 to register 10000 will update the log buffer with the latest 10 logs and writing 977 will load the oldest 10 logs.

Register	Property	Description	Format
10000	RW	Device Log Pointer N*	UINT32
10002~10037	RO	Event #N	See **Table 5-35**
10038~10073	RO	Event #N+1	
…		…	
10326~10361	RO	Event #N+9	

Table 5-34 Device Log Buffer

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	0-37 (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 D**	-

Table 5-35 Device Log Data Structure

5.9.2 SOE Log Buffer

The iMeter 8 can store up to 1024 entries SOE Logs. Writing N to the **SOE Log Index** register will update the #N to #N+9 SOE Log Buffer with SOE Log Events. For example, if the **SOE Log Pointer (Register 0139)** = 2000, writing 1991 to register 10500 will update the log buffer with the latest 10 logs and writing 977 will load the oldest 10 logs.

Register	Property	Description	Format
10500	RW	SOE log Pointer N	UINT32
10502~10537	RO	Event #N	See **Table 5-37**
10538~10573	RO	Event #N+1	
…		…	
10826~10861	RO	Event #N+9	

Table 5-36 SOE Log Buffer

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	0-37 (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 D**	-

Table 5-37 SOE Log Data Structure

5.9.3 PQD Log

5.9.3.1 PQD Log Buffer

Register	Property	Description	Format
22000~22035	RO	The Latest Swell Event	See **PQD Log Data Structure** table
22036~22071	RO	The Latest Dip Event	
22072~22107	RO	The Latest Interruption Event	

Table 5-38 POD Log Buffer

5.9.3.2 PQD Log Data Structure

Offset	Property	Description		Format	Range
+0	RO	Record Time	High Order - Year	UINT16	0-37 (Year-2000)
	RO		Low Order - Month		1 to 12

+1	RO		High Order - Day	UINT16	1 to 31
	RO		Low Order - Hour		0 to 23
+2	RO		High Order - Minute	UINT16	0 to 59
	RO		Low Order - Second		0 to 59
+3	RO		Millisecond	UINT16	0 to 999
+4 to +5	--	Reserved		--	-
+6	RO	Source		UINT32	1=Ua, 2=Ub, 3=Uc, 4=Uab, 5=Ubc, 6=Uca
+8	RO	Peak Residual Voltage (%)		FLOAT	-
+10	RO	Duration (ms)		UINT32	-
+12	RO	Ua Residual Voltage (%)		FLOAT	-
+14	RO	Ub Residual Voltage (%)		FLOAT	-
+16	RO	Uc Residual Voltage (%)		FLOAT	-
+18	RO	Disturbance Direction		UINT32	1=Upstream, 2=Downstream
+20	RO	Confidence		UINT32	1=Low, 2=Middle, 3=High
+22	RO	Ua Benchmark (Primary)		FLOAT	-
+24	RO	Ub Benchmark (Primary)		FLOAT	-
+26	RO	Uc Benchmark (Primary)		FLOAT	-
+28	--	Reserved		--	
+30	RO	Location in SEMI F47 Plot		UINT32	0=Reserved 1=Region A (undefined), 2=Region B (no interruption), 3=Region C (probable abnormal operation), 4=Region D (undefined)
+32	RO	Location in ITIC Plot		UINT32	0=Reserved 1=Region A (no interruption in function) 2=Region B (no damage) 3=Region C (Prohibited)
+34	--	Reserved		--	

Table 5-39 PQD Log Data Structure

5.9.4 SDR Log

5.9.4.1 SDR Log Buffer

Register	Property	Description	Format
11000~11518	RO	SDR Log #1	See **Section 5.9.4.2**
11600~12118	RO	SDR Log #2	
12200~12718	RO	SDR Log #3	
12800~13318	RO	SDR Log #4	
13400~13918	RO	SDR Log #5	
14000~14518	RO	SDR Log #6	
14600~15118	RO	SDR Log #7	
15200~15718	RO	SDR Log #8	
15800~16318	RO	SDR Log # 9	
16400~16918	RO	SDR Log #10	
17000~17518	RO	SDR Log #11	
17600~18118	RO	SDR Log #12	
18200~18718	RO	SDR Log #13	
18800~19318	RO	SDR Log #14	
19400~19918	RO	SDR Log #15	
20000~20518	RO	SDR Log #16	

Table 5-40 SDR Log Buffer

5.9.4.2 SDR Log Structure

The iMeter 8 provides 16 groups of SDR with each recording depth of 43200. Writing N to the **SDR Log #X Index** register will update the #N to #N+63 Data Item of SDR #X Log Buffer. For example, if the **SDR Log #1 Pointer (Register 0159)** = 50000 (providing the recording mode = First-In-First-Out), writing 50000 to register 11000 will load the latest 64 Data Items and writing 6801 will load the oldest 64 Data Items to the SDR #1 Log Buffer.

Offset	Property	Description	Format	Note
+0	RW	SDR Log # X Index N (1≤X≤16)	UINT32	-
+2~+4	RO	Record Time[2]	See Note 1)	
+5	RO	Flagging Data Status	UINT16	0=Not Flagged 1=Flagged & Removed 2=Flagged & Kept
+6~+13	RO	Data Item #N	See **Note 2)**	-

+14~+21	RO	Data Item #N+1		
…		…		
+510~+517	RO	Data Item #N+63		

Table 5-41 SDR Log Buffer Structure

Notes:

1) Record Time data structure

Offset	Property	Description	Format	Unit
+0	RO	Year	UINT16	0-37 (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 5-42 Record Time Data Structure

2) SDR Data Item Structure

Offset	Property	Description	Format
+0	RO	Maximum	Float
+2	RO	Minimum	Float
+4	RO	Average	Float
+6	RO	CP95	Float

Table 5-43 SDR Data Item Structure

5.9.5 DR (Data Recorder) Log

The iMeter 8 provides 8 groups of DR with each recording depth of 65535. Writing N to the **DR #X Log Index** register will update the #N to #N+63 Data Item of DR #X Log Buffer. For example, if the **DR #1 Log Pointer (Register 0207)** = 50000 (providing the recording mode = First-In-First-Out), writing 50000 to register 37500 will load the latest 64 Data Items and writing 1 will load the oldest 64 Data Items to the DR #1 Log Buffer.

Register	Property	Description	Format
37500~37635	RO	Data Recorder Log #1 Buffer	See **Table 5-44**
37650~37785	RO	Data Recorder Log #2 Buffer	
37800~37935	RO	Data Recorder Log #3 Buffer	
37950~38085	RO	Data Recorder Log #4 Buffer	
38100~38235	RO	Data Recorder Log #5 Buffer	
38250~38385	RO	Data Recorder Log #6 Buffer	
38400~38535	RO	Data Recorder Log #7 Buffer	
38550~38685	RO	Data Recorder Log #8 Buffer	

Table 5-44 DR Log Buffer

Offset	Properties	Format	Description	
+0	RW	UINT32	Data Recorder Log #X Pointer (N)	
+2	RO	Timestamp	High-order: Year (-2000)	Low-order: Month (1 to 12)
+3	RO		High-order: Day (1 to 31)	Low-order: Hour (0 to 23)
+4	RO		High-order: Minute (0 to 59)	Low-order: Second (0 to 59)
+5	RO		Millisecond (0 to 999)	
+6	RO	UINT16	0=Not Flagged, 1=Flagged	
+7	RO	Float	DR	Parameter 1
…	RO	Float		…
+37	RO	Float		Parameter 16
+38	RO	Float		Parameter 17
…	RO	Float		…
+133	RO	Float		Parameter 64

Table 5-45 Data Recorder Log Structure

5.9.6 MM Log (Max./Min. Log)

5.9.6.1 MM Log Buffer

Register	Description	Format
22200-22306	Max. #1 Log Buffer	See **Section 5.9.6.2**
22350~22456	Max. #2 Log Buffer	
22500~22606	Max. #3 Log Buffer	
22650~22756	Max. #4 Log Buffer	
22800~22906	Min. #1 Log Buffer	
22950~23056	Min. #2 Log Buffer	

23100~23206	Min. #3 Log Buffer	
23250~23356	Min. #4 Log Buffer	

Table 5-46 MM Log Buffer

5.9.6.2 MM Log Buffer Structure

Offset	Property	Description	Format	Range/Options
+0	RW	Max./Min. #X Log Index N	UINT32	0=Since Last Reset/This Month 1=Before Last Reset/Last Month
+2	RO	Recording Time[2]	Bitmap	
+5	RO	Flagging Data Status	UINT16	0=Not Flagged 1=Flagged & Removed 2=Flagged & kept
+6~+10	RO	Data Item #1	Bitmap	See **Table 5-49**
+11~+15	RO	Data Item #2		
…	RO	…		
+101~+105	RO	Data Item #20		

Table 5-47 Max./Min. Log Data Structure

Notes:

1. Please refer to Table 5-48 for the Recording Time data structure. Please note that the Recording Time means the Start Time of a Max. Recorder while the End Time of a Min. Recorder.

Offset	Property	Description	Format	Unit
+0	RO	Year	UINT16	0-37 (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 5-48 Time Structure

2. The following table illustrates the data structure of the MM Log.

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

Table 5-49 MM Data Structure

5.9.7 Pst/Plt Log

5.9.7.1 Pst Log Buffer

The iMeter 8 can store up to 52560 Pst Log based on a First-In-First-Out principle. Writing N to **Pst Log Index** register will update the #N to #N+9 log of the Log Buffer. For example, if the **Pst Log Pointer (Register 0239)** = 60000, writing 59991 to register 23400 will load the latest 10 log buffers and writing 7441 will load the oldest 10 log buffers.

Register	Property	Description	Format
23400	RW	Pst Log Index (N)	UINT32
23402~23411	RO	Log N	See **Section 5.9.7.3**
23412~23421	RO	Log N+1	
…		…	
23492~23501	RO	Log N+9	

Table 5-50 Pst Log Buffer

5.9.7.2 Plt Log Buffer

The iMeter 8 can store up to 4380 Plt Log based on a First-In-First-Out principle. Writing N to Plt Log Index register will update the #N to #N+9 log of the Log Buffer. For example, if the Plt Log Pointer (Register 0241) = 5000, writing 4991 to register 23600 will load the latest 10 log buffers and writing 621 will load the oldest 10 log buffers.

Register	Property	Description	Format
23600	RW	Plt Log Index (N)	UINT32
23602~23611	RO	Log N	See **Section 5.9.7.3**

23612~23621	RO	Log N+1	
…		…	
23692~23701	RO	Log N+9	

Table 5-51 Plt Log

5.9.7.3 Pst/Plt Log Data Structure

Offset	Property	Description		Format	Note/Unit
+0	RO	Record Time	High-Year (-2000)	Bitmap	
			Low- Month		
+1	RO		High- Day		
			Low- Hour		
+2	RO		High- Minute		
			Low- Second		
+3	RO	Flagging Status[1]		Bit 0=Dip, Bit 1=Swell Bit 2=Interruption	0=Not Flagged 1=Flagged
+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 5-52 Pst/Plt Log Data Structure

5.9.8 IER & AER Log

The iMeter 8 can store up to 65535 IER and AER Logs independently. Writing N to the **IER/AER Log Index** will update the #N to #N+1 Log Buffer. For example, if the IER Log Pointer (Register 0245) = 65530, writing 65529 to register 23800 to update the log buffer with the latest 2 logs and writing 1 to load the oldest 2 logs. If the IER Log pointer exceeds 65530, take 65540 as an example, writing 65539 (65540-1=65539) to the register 23800 to update the log buffer with the latest 2 logs and writing 6 (65540-65535+1=6) to load the oldest 2 logs.

5.9.8.1 IER/AER Log (INT64)

Register		Property	Description	Format
IER	AER			
23800	24000	RW	IER/AER Log Index N	UINT32
23802~23875	24002~24075	RO	Log #N	See **Table 5-54**
23876~23949	24076~24149	RO	Log #N+1	
23950	24150	RO	Reserved	

Table 5-53 IER/AER Log Buffer

5.9.8.2 IER & AER Log Data Structure (INT64)

Offset	Property	Description	Format	Note
+0~+2	RO	Start Time[1]	UINT32	
+3~+5	RO	End Time	UINT32	
+6~+9	RO	kWh Imp.	INT64	
+10~+13	RO	kWh Exp.	INT64	
+14~+17	RO	kWh Total	INT64	
+18~+21	RO	kvarh Imp.	INT64	
+22~+25	RO	kvarh Exp.	INT64	
+26~+29	RO	kvarh Total	INT64	
+30~+33	RO	kVAh Total	INT64	
+34~+37	RO	Fundamental kWh Import	INT64	
+38~+41	RO	Fundamental kWh Export	INT64	
+42~+45	RO	Fundamental kvarh Import	INT64	
+46~+49	RO	Fundamental kvarh Export	INT64	
+50~+53	RO	Total Harmonic kWh Import	INT64	
+54~+57	RO	Total Harmonic kWh Export	INT64	
+58~+61	RO	Total Harmonic kvarh Import	INT64	
+62~+65	RO	Total Harmonic kvarh Export	INT64	
+66~+69	RO	kWh Net	INT64	
+70~+73	RO	kvarh Net	INT64	

Table 5-54 IER & AER Log Data Structure

Note:

1. The following table illustrates the Data Structure of the Start/End Time.

Offset	Property	Description	Format	Unit
+0	RO	Year	UINT16	0-37 (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 5-55 Time Structure

5.9.8.3 IER/AER Log (INT32)

Register		Property	Description	Format
IER	AER			
26700	26850	RW	IER/AER Log Index N	UINT32
26702~26775	26852~26925	RO	Log #N	See **Section 5.9.8.4**
26776~26894	26926~26999	RO	Log #N+1	
26700	26850	RO	Reserved	

Table 5-56 IER & AER Log Buffer (INT32)

5.9.8.4 IER & AER Log Data Structure (INT32)

Offset	Property	Description	Format	Note
+0~+2	RO	Start Time[1]	UINT32	
+3~+5	RO	End Time	UINT32	
+6~+7	RO	kWh Import E1	INT32	
+8~+9	RO	kWh Import E2	INT32	
+10~+11	RO	kWh Export E1	INT32	
+12~+13	RO	kWh Export E2	INT32	
+14~+15	RO	kWh Total E1	INT32	
+16~+17	RO	kWh Total E2	INT32	
+18~+19	RO	kvarh Import E1	INT32	
+20~+21	RO	kvarh Import E2	INT32	
+22~+23	RO	kvarh Export E1	INT32	
+24~+25	RO	kvarh Export E2	INT32	
+26~+27	RO	kvarh Total E1	INT32	
+28~+29	RO	kvarh Total E2	INT32	
+30~+31	RO	kVAh Total E1	INT32	
+32~+33	RO	kVAh Total E2	INT32	
+34~+35	RO	Fundamental kWh Import E1	INT32	
+36~+37	RO	Fundamental kWh Import E2	INT32	
+38~+39	RO	Fundamental kWh Export E1	INT32	
+40~+41	RO	Fundamental kWh Export E2	INT32	
+42~+43	RO	Fundamental kvarh Import E1	INT32	
+44~+45	RO	Fundamental kvarh Import E2	INT32	
+46~+47	RO	Fundamental kvarh Export E1	INT32	
+48~+49	RO	Fundamental kvarh Export E2	INT32	
+50~+51	RO	Total Harmonic kWh Import E1	INT32	
+52~+53	RO	Total Harmonic kWh Import E2	INT32	
+54~+55	RO	Total Harmonic kWh Export E1	INT32	
+56~+57	RO	Total Harmonic kWh Export E2	INT32	
+58~+59	RO	Total Harmonic kvarh Import E1	INT32	
+60~+61	RO	Total Harmonic kvarh Import E2	INT32	
+62~+63	RO	Total Harmonic kvarh Export E1	INT32	
+64~+65	RO	Total Harmonic kvarh Export E2	INT32	
+66~+67	RO	kWh Net E1	INT32	
+68~+69	RO	kWh Net E2	INT32	
+70~+71	RO	kvarh Net E1	INT32	
+72~+73	RO	kvarh Net E2	INT32	

Table 5-57 IER & AER Log Data Structure (INT32)

Note:

1. The following table illustrates the Data Structure of the Start/End Time.

Offset	Property	Description	Format	Unit
+0	RO	Year	UINT16	0-37 (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 5-58 Time Structure

5.9.9 EN50160 Log

The iMeter 8 can store up to 52 entries EN50160 Log for a year. Retrieve the newest 52 entries EN50160 logs through writing entry number which you can get from **EN50160 Report Pointer** (Register 0247) into **EN50160 Log Index X** (Register 24200). For example, if the value for **EN50160 Report Pointer** is 100, then you can write 100 to 49 into **24200** register where 100 means the newest logs, and 49 means the oldest logs.

Register	Property	Description	Format	Note
24200	RW	EN50160 Log Index X	UINT32	
24202	RO	Start Time	Bitmap	
24205	RO	End Time	Bitmap	
24208	RO	Reserved	UINT32	
24210	RO	Freq. Evaluation Result	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 Limit Result	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	1 - N2/N ratio
24222	RO	Freq Narrow Limit Result	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	1 - N1/N ratio
24228	RO	Freq Max-op	Float	Hz, maximum mean Frequency (Freq mean-ep) over 1week
24230	RO	Freq Min-op	Float	Hz, minimum mean Frequency (Freq mean-ep) over 1week
24232	RO	U Magnitude Conclusion	UINT32	0=Pass, 1=Failed
24234	RO	U Magnitude Valid N	UINT32	Number of valid intervals
24236	RO	U Magnitude Invalid N	UINT32	Number of invalid intervals
24238	RO	U-Mag Wide Conclusion	UINT32	0=Pass, 1=Failed
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 Evaluation Conclusion	UINT32	0=Pass, 1=Failed
24280	RO	Plt N Valid	UINT32	Number of valid intervals
24282	RO	Plt N Invalid	UINT32	Number of invalid intervals
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 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 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 for 3-phase over 1 week
24310	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	Number of valid intervals
24318	RO	U Unbalance N Invalid	UINT32	Number of invalid intervals
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	
24330	RO	Harmonic Conclusion	UINT32	0=Pass, 1=Failed
24332	RO	Harmonic N Valid	UINT32	Number of valid intervals
24334	RO	Harmonic N Invalid	UINT32	Number of invalid intervals
24336	RO	THD Conclusion	UINT32	0=Pass, 1=Failed
24338	RO	Ua THD N1	UINT32	Number of intervals in which the THD on 3-phase exceed user defined limits
24340	RO	Ub THD N1	UINT32	
24342	RO	Uc THD N1	UINT32	
24344	RO	Ua THD (1 - N1/N)	Float	
24346	RO	Ub THD (1 - N1/N)	Float	
24348	RO	Uc THD (1 - N1/N)	Float	
24350~24376		Reserved		
24378	RO	H02 Harm Conclusion	UINT32	0=Pass, 1=Failed
24380	RO	Ua H02 N1	UINT32	Number of intervals in which the 2nd Harmonics on 3-phase exceed user defined limits
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	0=Pass, 1=Failed
24702	RO	Ua H25 N1	UINT32	Number of intervals in which the 25th Harmonics on 3-phase exceed user defined limits
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	Max. THD on 3-phase over 1 week
24716	RO	Ub THD Max.	Float	
24718	RO	Uc THD Max.	Float	
24720	RO	Ua THD Min.	Float	Min. THD on 3-phase over 1 week
24722	RO	Ub THD Min.	Float	
24724	RO	Uc THD Min.	Float	
24726	RO	Ua THD CP95	Float	CP95 average THD on 3-phase over 1 week
24728	RO	Ub THD CP95	Float	
24730	RO	Uc THD CP95	Float	
24732	RO	Ua THD Avg	Float	Average THD on 3-phase over 1 week
24734	RO	Ub THD Avg	Float	
24736	RO	Uc THD Avg	Float	
24738~24748		Reserved		
24750	RO	Ua H02 Max.	Float	Maximum 2nd harmonics on 3-phase over 1 week
24752	RO	Ub H02 Max.	Float	
24754	RO	Uc H02 Max.	Float	
24756~24886	RO	...	Float	...
24888	RO	Ua H25 Max.	Float	Maximum 25th harmonics on 3-phase over 1 week
24890	RO	Ub H25 Max.	Float	
24892	RO	Uc H25 Max.	Float	
24894~24904	--	Reserved	--	--
24906	RO	Ua H02 Min.	Float	Minimum 2nd harmonics on 3-phase over 1 week
24908	RO	Ub H02 Min.	Float	
24910	RO	Uc H02 Min.	Float	
24912~25042	RO	...	Float	...
25044	RO	Ua H25 Min.	Float	Minimum 25th harmonics on 3-phase over 1 week
25046	RO	Ub H25 Min.	Float	

25048	RO	Uc H25 Min.	Float	
25050~25060		Reserved		
25062	RO	Ua H02 CP95	Float	CP95 2nd harmonics on 3-phase over 1 week
25064	RO	Ub H02 CP95	Float	
25066	RO	Uc H02 CP95	Float	
25068~25198	RO	...	Float	...
25200	RO	Ua H25 CP95	Float	CP95 25th harmonics on 3-phase over 1 week
25202	RO	Ub H25 CP95	Float	
25204	RO	Uc H25 CP95	Float	
25206~25216		Reserved		
25218	RO	Ua H02 Avg	Float	Average 2nd harmonics on 3-phase over 1 week
25220	RO	Uc H02 Avg	Float	
25222	RO	Uc H02 Avg	Float	
25224~25354	RO	...	Float	...
25356	RO	Ua H25 Avg	Float	Average 25th harmonics on 3-phase over 1 week
25358	RO	Uc H25 Avg	Float	
25360	RO	Uc H25 Avg	Float	
25362	RO	Interharmonics N Valid	UINT32	Number of valid intervals
25364	RO	Interharmonics N Invalid	UINT32	Number of invalid intervals
25366	RO	Ua TIHD Max.	Float	Maximum TIHD on 3-phase over 1 week
25368	RO	Ub TIHD Max.	Float	
25370	RO	Uc TIHD Max.	Float	
25372	RO	Ua TIHD Min.	Float	Minimum TIHD on 3-phase over 1 week
25374	RO	Ub TIHD Min.	Float	
25376	RO	Uc TIHD Min.	Float	
25378	RO	Ua TIHD CP95	Float	CP95 of TIHD on 3-phase over 1 week
25380	RO	Ub TIHD CP95	Float	
25382	RO	Uc TIHD CP95	Float	
25384	RO	Ua TIHD Avg	Float	Average TIHD on 3-phase over 1 week
25386	RO	Ub TIHD Avg	Float	
25388	RO	Uc TIHD Avg	Float	
25390~25394		Reserved		
25396	RO	Ua IH01 Max.	Float	Maximum 1st Interharmonics on 3-phase over 1 week
25398	RO	Ub IH01 Max.	Float	
25400	RO	Uc IH01 Max.	Float	
25402~25538	RO	...	Float	...
25540	RO	Ua IH25 Max.	Float	Maximum 25th Interharmonics on 3-phase over 1 week
25542	RO	Ub IH25 Max.	Float	
25544	RO	Uc IH25 Max.	Float	
25546~25550	RO	Reserved	Float	
25552	RO	Ua IH01 Min.	Float	Minimum 1st Interharmonics on 3-phase over 1 week
25554	RO	Ub IH01 Min.	Float	
25556	RO	Uc IH01 Min.	Float	
	RO	...	Float	...
25696	RO	Ua IH25 Min.	Float	Minimum 25th Interharmonics on 3-phase over 1 week
25698	RO	Ub IH25 Min.	Float	
25700	RO	Uc IH25 Min.	Float	
25702~25706	RO	Reserved	Float	
25708	RO	Ua IH01 CP95	Float	CP95 1st Interharmonics on 3-phase over 1 week
25710	RO	Ub IH01 CP95	Float	
25712	RO	Uc IH01 CP95	Float	
	RO	...	Float	...
25852	RO	Ua IH25 CP95	Float	CP95 25th Interharmonics on 3-phase over 1 week
25854	RO	Ub IH25 CP95	Float	
25856	RO	Uc IH25 CP95	Float	
25858~25862	--	Reserved	--	--
25864	RO	Ua IH01 Avg	Float	Average 1st Interharmonics on 3-phase over 1 week
25866	RO	Ub IH01 Avg	Float	
25868	RO	Uc IH01 Avg	Float	
25870~26006	RO	...	Float	...
26008	RO	Ua IH25 Avg	Float	Average 25th Interharmonics on 3-phase over 1 week
26010	RO	Ub IH25 Avg	Float	
26012	RO	Uc IH25 Avg	Float	
26014	RO	MSV Conclusion	UINT32	0=Pass, 1=Failed
26016	RO	MSV N Valid	UINT32	Number of valid intervals
26018	RO	MSV N Invalid	UINT32	Number of invalid intervals
26020	RO	MSV1 Conclusion	UINT32	0=Pass, 1=Failed

26022	RO	Ua MSV1 N1	UINT32	# of valid intervals in which the Signalling voltage of Freq. #1 on 3-phase exceeds user-defined limit
26024	RO	Ub MSV1 N1	UINT32	
26026	RO	Uc MSV1 N1	UINT32	
26028	RO	Ua MSV1 (1 - N1/N)	Float	
26030	RO	Ub MSV1 (1 - N1/N)	Float	
26032	RO	Uc MSV1 (1 - N1/N)	Float	
26034~26046	RO	...		...
26048	RO	MSV3 Conclusion	UINT32	0=Pass, 1=Failed
26050	RO	Ua MSV3 N1	UINT32	# of valid intervals in which the Signalling voltage of Freq. #3 on 3-phase exceeds the user-defined limit
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	Maximum Mains Signalling value of Freq. #1 on 3-phase over 1 week
26064	RO	Ub MSV1 Max.	Float	
26066	RO	Uc MSV1 Max.	Float	
26068	RO	Ua MSV2 Max.	Float	Maximum Mains Signalling value of Freq. #2 on 3-phase over 1 week
26070	RO	Ub MSV2 Max.	Float	
26072	RO	Uc MSV2 Max.	Float	
26074	RO	Ua MSV3 Max.	Float	Maximum Mains Signalling value of Freq. #3 on 3-phase over 1 week
26076	RO	Ub MSV3 Max.	Float	
26078	RO	Uc MSV3 Max.	Float	
26080	RO	Ua MSV1 Min.	Float	Minimum Mains Signalling value of Freq. #1 on 3-phase over 1 week
26082	RO	Ub MSV1 Min.	Float	
26084	RO	Uc MSV1 Min.	Float	
26086	RO	Ua MSV2 Min.	Float	Minimum Mains Signalling value of Freq. #2 on 3-phase over 1 week
26088	RO	Ub MSV2 Min.	Float	
26090	RO	Uc MSV2 Min.	Float	
26092	RO	Ua MSV3 Min.	Float	Minimum Mains Signalling value of Freq. #3 on 3-phase over 1 week
26094	RO	Ub MSV3 Min.	Float	
26096	RO	Uc MSV3 Min.	Float	
26098	RO	Ua MSV1 CP95	Float	CP95 Mains Signalling value of Freq. #1 on 3-phase over 1 week
26100	RO	Ub MSV1 CP95	Float	
26102	RO	Uc MSV1 CP95	Float	
26104	RO	Ua MSV2 CP95	Float	CP95 Mains Signalling value of Freq. #2 on 3-phase over 1 week
26106	RO	Ub MSV2 CP95	Float	
26108	RO	Uc MSV2 CP95	Float	
26110	RO	Ua MSV3 CP95	Float	CP95 Mains Signalling value of Freq. #3 on 3-phase over 1 week
26112	RO	Ub MSV3 CP95	Float	
26114	RO	Uc MSV3 CP95	Float	
26116	RO	Ua RVC N1	UINT32	RVC counter occurs on 3-phase within a week
26118	RO	Ub RVC N1	UINT32	
26120	RO	Uc RVC N1	UINT32	
26122~26124		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	Transients occur on 3-Phase over 1 week
26234	RO	Ub Transient N1	UINT32	
26236	RO	Uc Transient N1	UINT32	

Table 5-59 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 5-60 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 5-61 Dip Counter Definition

Interruption (t indicates Duration, while u indicates Residual Voltage)			
Counter	t ≤ 1000ms	1000ms < t ≤ 180000ms	t > 180000ms
	N11	N21	N31

Table 5-61 Interruption Counter Definition

5.9.10 Frequency Deviation Log

5.9.10.1 Frequency Deviation Log Buffer

The iMeter 8 can store up to 777600 (90*24*60*6 with 10s interval) Frequency Deviation Log based on a First-In-First-Out principle. Writing N to **Frequency Deviation Log Index** register will update the #N to #N+9 log of the Log Buffer. For example, if the **Frequency Deviation Log Pointer (Register 0255)** = 800000, writing 799990 to

register 26600 will load the latest 10 log buffers and writing 22401 will load the oldest 10 log buffers.

Register	Property	Description	Format
26600	RW	Frequency Deviation Log Index (N)	UINT32
26602~26606	RO	Log N	See **Section 5.9.10.2**
26607~26611	RO	Log N+1	
…		…	
26647~26651	RO	Log N+9	

Table 5-62 Frequency Deviation Log Buffer

5.9.10.2 Frequency Deviation Log Data Structure

Offset	Property	Description		Format
+0	RO	Record Time	High: Year (-2000)	
			Low: Month	
+1	RO		High: Day	
			Low: Hour	
+2	RO		High: Minute	
			Low: Second	
+3~+4	RO	Frequency Value		Float

Table 5-63 Frequency Deviation Log Data Structure

5.9.11 TOU Log

5.9.11.1 Present TOU Status

Register	Property	Description	Format	Note/Range
36000	RO	Present Tariff Schedule	UINT16	0~7: T1~T8
36001	RO	Present Season Schedule	UINT16	0~11: Season 1~12
36002	RO	Present Daily Profile Period	UINT16	0~11: Daily Profile Period 1~12
36003	RO	Present Daily Profile Index	UINT16	0~19: Daily Profile Index 1~20
36004	RO	Present Weekday Type	UINT16	0=Weekday 1, 1=Weekday 2 2=Weekday 3, 3=Special Day
36005	RO	Present TOU Schedule	UINT16	0~1
36006	RO	TOU Log Pointer	UINT32	

Table 5-64 TOU Real-time Status

5.9.11.2 Real-time TOU Log

Register	Description	Format
36100~36139	Tariff #1 Data	See **Section 5.9.11.5**
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 5-65 TOU Real-time Log

5.9.11.3 TOU Historical Log

The iMeter 8 can store up to 12 months of TOU Historical Log. Retrieve the newest 12 entries TOU logs through writing entry number which you can get from **Historical TOU Data Record Pointer** (Register 0251) into **Log Index X** (Register 36500). For example, if the value for **Historical TOU Data Record Pointer** is 100, then you can write 100 to 89 into **36500** register where 100 means the newest logs, and 89 means the oldest logs.

Register	Property	Description	Format
36500	RW	Log Index N	UINT32
36502	RO	Record Time	
36505	RO	Period PF Avg. (Avg. PF over the Period)	Float
36507~36546	RO	Tariff #1 Data	See **Section 5.9.11.5**
36547~36586	RO	Tariff #2 Data	
36587~36626	RO	Tariff #3 Data	
36627~36666	RO	Tariff #4 Data	
36667~36706	RO	Tariff #5 Data	
36707~36746	RO	Tariff #6 Data	
36747~36786	RO	Tariff #7 Data	
36787~36826	RO	Tariff #8 Data	

Table 5-66 TOU Historical Log

5.9.11.4 TOU Freeze Log

Register	Property	Description	Format
36900	RO	Record Time	
36903~36942	RO	Tariff #1 Data	See **Section 5.9.11.5**
36943~36982	RO	Tariff #2 Data	
36983~37022	RO	Tariff #3 Data	
37023~37062	RO	Tariff #4 Data	
37063~37102	RO	Tariff #5 Data	
37103~37142	RO	Tariff #6 Data	
37143~37182	RO	Tariff #7 Data	
37183~37222	RO	Tariff #8 Data	

Table 5-67 TOU Freeze Log

5.9.11.5 TOU Log Data Structure

Offset	Property	Description	Format
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	RO	kW Imp. Max. Demand	Float
22	RO	kW Imp. Max. Demand Timestamp[1]	
25	RO	kW Exp. Max. Demand	Float
27	RO	kW Exp. Max. Demand Timestamp[1]	
30	RO	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 5-68 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 5-69 Timestamp Format

5.9.12 IEEE Std 519-2022 Compliance Report

The iMeter 8 can independently store up to 365 IEEE Std 519-2022 daily reports and 53 weekly reports. Writing N to the **Log Index** will update the daily report / weekly report Log Buffer. For example, if the **IEEE Std 519-2022 Daily Report Log Pointer (Register 0265**) = 366, writing 366 to register 38700 will update the log buffer with the latest daily report.

Register	Property	Description	Format	Unit/Scale	Note
38700	RW	Report Type[1]	UINT32		0=Weekly Report* 1=Daily Report
38702	RW	Report Index N[1]	UINT32		
38705	RO	Start Time[2]	UINT32		
38708	RO	End Time[2]	UINT32		
38710	RO	Harmonic Voltage Total Result	UINT32		
38712	RO	Harmonic Voltage N	UINT32		Number of valid intervals
38714	RO	Harmonic Voltage invalid N	UINT32		Number of invalid intervals
38716	RO	THD Evaluation Result	UINT32		0=Pass, 1=Failed
38718	RO	Harmonic Current Total Result	UINT32		0=Pass, 1=Failed
38720	RO	Harmonic Current N	UINT32		
38722	RO	Harmonic Current invalid N	UINT32		
38724	RO	TDD Evaluation Result	UINT32		0=Pass, 1=Failed
38726	RO	Ua/Uab THD (CP95)	Float	% / x100	
38728	RO	Ua/Uab THD (CP99)	Float	% / x100	
38730	RO	Ub/Ubc THD (CP95)	Float	% / x100	
38732	RO	Ub/Ubc THD (CP99)	Float	% / x100	

38734	RO	Uc/Uca THD (CP95)	Float	% / x100	
38736	RO	Uc/Uca THD (CP99)	Float	% / x100	
38738	RO	Ua/Uab TOHD (CP95)	Float	% / x100	
38740	RO	Ua/Uab TOHD (CP99)	Float	% / x100	
38742	RO	Ub/Ubc TOHD (CP95)	Float	% / x100	
38744	RO	Ub/Ubc TOHD (CP99)	Float	% / x100	
38746	RO	Uc/Uca TOHD (CP95)	Float	% / x100	
38748	RO	Uc/Uca TOHD (CP99)	Float	% / x100	
38750	RO	Ua/Uab TEHD (CP95)	Float	% / x100	
38752	RO	Ua/Uab TEHD (CP99)	Float	% / x100	
38754	RO	Ub/Ubc TEHD (CP95)	Float	% / x100	
38756	RO	Ub/Ubc TEHD (CP99)	Float	% / x100	
38758	RO	Uc/Uca TEHD (CP95)	Float	% / x100	
38760	RO	Uc/Uca TEHD (CP99)	Float	% / x100	
38762	RO	Ua/Uab H02 (CP95)	Float	% / x100	
38764	RO	Ua/Uab H02 (CP95)	Float	% / x100	
38766	RO	Ub/Ubc H02 (CP95)	Float	% / x100	
38768	RO	Ub/Ubc H02 (CP99)	Float	% / x100	
38770	RO	Uc/Uca H02 (CP99)	Float	% / x100	
38772	RO	Uc/Uca H02 (CP99)	Float	% / x100	
		…			
39346	RO	Uc/Uca H50 (CP95)	Float	% / x100	
39348	RO	Uc/Uca H50 (CP99)	Float	% / x100	
39350	RO	Ia TDD (CP95)	Float	% / x100	
39352	RO	Ia TDD (CP99)	Float	% / x100	
39354	RO	Ib TDD (CP95)	Float	% / x100	
39358	RO	Ib TDD (CP99)	Float	% / x100	
39360	RO	Ic TDD (CP95)	Float	% / x100	
39362	RO	Ic TDD (CP99)	Float	% / x100	
39364	RO	Ia TDD Odd (CP95)	Float	% / x100	
39366	RO	Ia TDD Odd (CP99)	Float	% / x100	
39368	RO	Ib TDD Odd (CP95)	Float	% / x100	
39370	RO	Ib TDD Odd (CP99)	Float	% / x100	
39372	RO	Ic TDD Odd (CP95)	Float	% / x100	
39374	RO	Ic TDD Odd (CP99)	Float	% / x100	
39376	RO	Ia TDD Even (CP95)	Float	% / x100	
39378	RO	Ia TDD Even (CP99)	Float	% / x100	
39380	RO	Ib TDD Even (CP95)	Float	% / x100	
39382	RO	Ib TDD Even (CP99)	Float	% / x100	
39384	RO	Ic TDD Even (CP95)	Float	% / x100	
39386	RO	Ic TDD Even (CP99)	Float	% / x100	
39388	RO	Ia H02 (CP95)	Float	% / x100	
39390	RO	Ia H02 (CP99)	Float	% / x100	
39392	RO	Ib H02 (CP95)	Float	% / x100	
39394	RO	Ib H02 (CP99)	Float	% / x100	
39396	RO	Ic H02 (CP95)	Float	% / x100	
39398	RO	Ic H02(CP99)	Float	% / x100	
……					
39964	RO	Ia H50 (CP95)	Float	% / x100	
39966	RO	Ia H50 (CP99)	Float	% / x100	
39968	RO	Ib H50 (CP95)	Float	% / x100	
39970	RO	Ib H50 (CP99)	Float	% / x100	
39972	RO	Ic H50 (CP95)	Float	% / x100	
39974	RO	Ic H50 (CP99)	Float	% / x100	

Table 5-70 IEEE Std 519 Compliance Report

Note:

1. The registers 38700 and 38702 should be written simultaneously.
2. The following table illustrates the Data Structure of the Start/End Time.

Offset	Property	Description	Format	Unit
+0	RO	Year	UINT16	0-37 (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 5-71 Time Structure

3. When the Wiring Mode is **3P3W**, the Ua/Ub/Uc TDD, TDD Odd and TDD Even mean Uab/Ubc/Uca TDD, TDD Odd and TDD Even, respectively.

5.9.13 Real-time WFR Register

Register	Property	Description	Format	Note/Range
53000	RO	Start Time		
53004~53005	RO	Reserved	UINT16	
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 512nd Sample	Float	
55056	RO	Ic 1st Sample	Float	
…	RO	…	Float	
56078	RO	Ic 512nd Sample	Float	
56080	RO	Ua 1st Sample	Float	
…	RO	…	Float	
57102	RO	Ua 512nd Sample	Float	
57104	RO	Ub 1st Sample	Float	
…	RO	…	Float	
58126	RO	Ub 512nd Sample	Float	
58128	RO	Uc 1st Sample	Float	
…	RO	…	Float	
59150	RO	Uc 512nd Sample	Float	

Table 5-72 Real-time WFR Register

Notes:

1) The real-time WFR can be retrieved by reading 53000 and it will be refreshed automatically to ensure WFR's integrity. The following table illustrates the register of the start time.

Offset	Description
1	High: Year (-2000)
	Low: Month
2	High: Day
	Low: Hour
3	High: Minute
	Low: Second
4	Millisecond

Table 5-73 Time Structure

5.10 Device Setup Parameters

5.10.1 Communications Setup

Register	Property	Description		Format	Range/Option, Default*
40000	RW	RS-485 Port 1 (P3)	Unit ID	UINT16	1 to 247, 100*
40001	RW		Baud rate[1]	UINT16	0 to 5, 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	UINT16	0=Modbus RTU* 1=EtherGate, 2=Disabled
40005	RW		EtherGate Port	UINT16	20000* to 60000
40006~40007	RW	Reserved		UINT16	
40008	RW	RS-485 Port 2 (P4)	Unit ID	UINT16	1 to 247, 101*
40009	RW		Baud rate[1]	UINT16	0 to 5, 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	UINT16	0=Modbus RTU* 1=EtherGate, 2=Disabled
40013	RW		EtherGate Port	UINT16	20000 to 60000, 20001*
40014~40015	RW	Reserved		UINT16	
40016	RW	Ethernet 1 (P1)	IP Address[2]	UINT32	0xC0A80064 (192.168.0.100)
40018	RW		Subnet Mask[2]	UINT32	0xFFFFFF00 (255.255.255.0)
40020	RW		Default Gateway[2]	UINT32	0xC0A80001 (192.168.0.1)
40022	RW	Reserved			
40024	RW	Ethernet 2	IP Address[2]	UINT32	0xC0A80164 (192.168.1.100)

40026	RW	(P2)	Subnet Mask[2]	UINT32	0xFFFFFF00 (255.255.255.0)
40028~40030	RW	Reserved		UINT32	
40032	RW	Access Control		UINT16	0=Disabled*, 1=Enabled
40033	RW	White List IP1		UINT32	0*
40035	RW	White List IP2		UINT32	
…	RW	…		UINT32	
40063	RW	White List IP16		UINT32	
40065	RW	IP Address of SNTP Server		UINT32	0x00000000 (0.0.0.0)
40067	RW	SNTP Time Sync. Interval		UINT16	1 to 1440 min, 60*
40068	RW	SNTP Broadcast		UINT16	0=Disabled, 1=Enabled*
40069	RW	Preferred DNS Server IP		UINT32	0x8080808 (8.8.8.8)*
40071	RW	Alternative DNS Server IP		UINT32	0x72727272 (114.114.114.114)*

Table 5-74 Communication Setup Parameters

Notes:

1. Baudrate options: 0=1200, 1=2400, 2=4800, 3=9600, 4=19200, 5=38400
2. The last Octet of the **IP Address, Subnet Mask** and **Default Gateway** can neither be "0000 0000" nor "1111 1111". The default values for the **IP Address, Subnet Mask** and **Default Gateway Address** are 192.168.0.100, 255.255.255.0 and 192.168.0.1, respectively. P1 and P2 should not on the same network segment.

5.10.2 DI Setup

Register	Property	Description	Format	Range/Option, Default*
40100	RW	DI1 Mode[1]	UINT16	0=Status Input*, 1=Pulse Counter 2=DMD Sync, 3= Tariff Switch
40101	RW	DI1 Debounce	UINT16	1 to 9999 (ms), 20ms*
40102	RW	DI1 Pulse Weight	UINT32	1*~1,000,000
40104	RW	DI1 Setpoint Type[2]	UINT16	0=Any Edge*, 1=Positive, 2=Negative
40105	RW	DI1 Setpoint Trigger	UINT32	0*
40107~40108	RW	Reserved	UINT16	
…		…	UINT16	…
40163	RW	DI8 Mode[1]	UINT16	0=Status Input*, 1=Pulse Counter, 2=DMD Sync
40164	RW	DI8 Debounce	UINT16	1 to 9999 (ms), 20ms*
40165	RW	DI8 Pulse Weight	UINT32	1*~1,000,000
40167	RW	DI8 Setpoint Type[2]	UINT16	0=Any Edge*, 1=Positive, 2=Negative
40168	RW	DI8 Setpoint Trigger	UINT32	0*
40170~40171	RW	Reserved	UINT16	
40172	RW	DI9 Mode[1,4]	UINT16	0=Status Input*, 1=Pulse Counter, 2=DMD Sync
40173	RW	DI9 Debounce[4]	UINT16	1 to 9999 (ms), 20ms*
40174	RW	DI9 Pulse Weight[4]	UINT32	1*~1,000,000
40176	RW	DI9 Setpoint Type[2, 4]	UINT16	0=Any Edge*, 1=Positive, 2=Negative
40177	RW	DI9 Setpoint Trigger[3,4]	UINT32	0*
40179~40180	RW	Reserved	UINT16	
…		…	UINT16	…
40235	RW	DI16 Mode[1, 4]	UINT16	0=Status Input*, 1=Pulse Counter, 2=DMD Sync
40236	RW	DI16 Debounce[4]	UINT16	1 to 9999 (ms), 20ms*
40237	RW	DI16 Pulse Weight[4]	UINT32	1*~1,000,000
40239	RW	DI16 Setpoint Type[2, 4]	UINT16	0=Any Edge*, 1=Positive, 2=Negative
40240	RW	DI16 Setpoint Trigger[3, 4]	UINT32	0*
40242~40243	RW	Reserved	UINT16	
40244	RW	DI Excitation Type	UINT16	0=DC*, 1=AC

Table 5-75 DI Setup Parameter

Notes:

1. Only one DI should be programmed as the **DMD Sync**.. To use a different DI for DMD Sync., the existing DI must first be reset back to **Normal (Status Input)** before programming the new DI for **DMD Sync**., otherwise the configuration will be unsuccessful.

   Only DI1 to DI3 can be set as **Tariff Switch**.
2. The DIx Setpoint Type only affects which edge would trigger the Waveform Recorder, RMS Recorder and iTrigger, if configured.
3. The table below provides a list of DIx's Setpoint Trigger, with a value of "1" meaning Active and "0" meaning Inactive.

Bit	Action	Bit	Action	Bit	Action	Bit	Action
0	Alarm	**7**	DO7 Closed	**19**	DR #1	**26**	DR #8
1	DO1 Closed	**8**	Reserved	**20**	DR #2	**27**	DWR
2	DO2 Closed	**9~14**	Reserved	**21**	DR #3	**28**	WFR
3	DO3 Closed	**15**	iTrigger 1	**22**	DR #4	**29**	RMSR
4	DO4 Closed	**16**	iTrigger 2	**23**	DR #5	**30~31**	Reserved
5	DO5 Closed	**17**	iTrigger 3	**24**	DR #6		

6	DO6 Closed	**18**	Reserved	**25**	DR #7		

Table 5-76 DIx's Setpoint Triggers

4. DI9 ~ DI16 setup registers are valid only when the device is equipped with corresponding options.

5.10.3 DO Setup

Register	Property	Description	Format	Range/Option, Default*
40300	RW	LOP Alarm Enable	UINT16	0=Disabled, 1=Enabled*
40301	RW	Arm Before Execute[1]	UINT16	0=Enabled*, 1=Disabled
40302	RW	Alarm Pulse Width	UINT16	0* (Latch Mode) to 6000 (x0.1s)
40303	RW	DO1 Pulse Width[2]	UINT16	
40304	RW	DO2 Pulse Width[2]	UINT16	
40305	RW	DO3 Pulse Width[2]	UINT16	
40306	RW	DO4 Pulse Width[2,3]	UINT16	
40307	RW	DO5 Pulse Width[2,3]	UINT16	
40308	RW	DO6 Pulse Width[2,3]	UINT16	
40309	RW	DO7 Pulse Width[2,3]	UINT16	

Table 5-77 DO Setup Parameters

Notes:

1. **Arm Before Execute** setup register is used to specify if the relays need to be armed before they can be operated on.
2. **DO Pulse Width** specifies the duration for which the relay output will be active when a Remote Operate or Setpoint Trigger command is received to operate it.
3. DO4 ~ DO7 Pulse Width registers are valid only when the iMeter 8 is equipped with corresponding options.

5.10.4 AI/AO Setup

Register	Property	Description	Format	Range/Option, Default*
40400	RW	AI1 Type	UINT16	0=4~20mA*, 1=0~20mA
40401	RW	AI1 Zero Scale	INT32	-999,999 to +999,999, 400*
40403	RW	AI1 Full Scale	INT32	-999,999 to +999,999, 2000*
40405	RW	AI2 Type	UINT16	0=4~20mA*, 1=0~20mA
40406	RW	AI2 Zero Scale	INT32	-999,999 to +999,999, 400*
40408	RW	AI2 Full Scale	INT32	-999,999 to +999,999, 2000*
40410~40422	RW	Reserved	UINT16	-
40424	RW	AO1 Type	UINT16	0=4~20mA*, 1=0~20mA
40425	RW	AO1 Key[1]	UINT16	0* to 15
40426	RW	AO1 Zero Scale	INT32	-999,999 to +999,999, 0*
40428	RW	AO1 Full Scale	INT32	-999,999 to +999,999*
40430	RW	AO2 Type	UINT16	0=4~20mA*, 1=0~20mA
40431	RW	AO2 Key[1]	UINT16	0* to 15
40432	RW	AO2 Zero Scale	INT32	-999,999 to +999,999, 0*
40434	RW	AO2 Full Scale	INT32	-999,999 to +999,999*

Table 5-78 AI/AO Setup Parameters

Notes:

1) The table below lists the Analog Output Parameters.

Key	Parameter	Scale	Unit	Key	Parameter	Scale	Unit
0	Uab	x1	V	**8**	kW Total	x1	kW
1	Ubc		V	**9**	kvar Total		kvar
2	Uca		V	**10**	kVA Total		kVA
3	ULL Average		V	**11**	PF Total	x0.001	-
4	Ia		A	**12**	Frequency	x0.01	Hz
5	Ib		A	**13**	kW Total Present Demand	x1	kW
6	Ic		A	**14**	kvar Total Present Demand		kvar
7	I Average		A	**15**	kVA Total Present Demand		kVA

Table 5-79 Analog Output Parameters

2) AI/AO setup parameters are available only when the iMeter 8 is equipped with corresponding options.

5.10.5 iTrigger Setup

Register	Property	Description	Format	Range/Option, Default*
40725	RW	iTrigger Enable	UINT16	0=Disabled*, 1=Enabled
40726	RW	GOOSE VLAN ID	UINT16	0 ~ 4095, 1*
40727	RW	Group ID	UINT16	0 ~ 16383, 1*
40728	RW	iTrigger Group 1	INT16	-1* ~ 16383, -1 represents Cross-Group Trigger disabled
40729	RW	iTrigger Group 2	INT16	
40730	RW	iTrigger Group 3	INT16	

40731	RW	iTrigger 1 Actions[1]	UINT32	DWR*
40733	RW	Reserved	UINT16	
40734	RW	iTrigger 2 Actions[1]	UINT32	WFR*
40736	RW	Reserved	UINT16	
40737	RW	iTrigger 3 Actions[1]	UINT32	RMSR*
40739	RW	Reserved	UINT16	
40740	RW	Version of Sending Messages	UINT16	0=V1, 1=V2*
40741	RW	GOOSE Enable	UINT16	BIT0=GOOSE Enable (0*) BIT1=Multicast (0*) BIT2= Multicast Receive (0*) BIT3=Multicast Send (0*) 0=Disabled, 1=Enabled
40742	RW	Multicast IP	UINT32	0xE0000100 ~ 0xEFFFFFFF, 0xEF060708 (239.6.7.8)*
40744	RW	Multicast Send Port	UINT16	0 ~ 65535, 60000*
40745	RW	Multicast Received Port	UINT16	0 ~ 65535, 60001*

Table 5-80 iTrigger Setup Parameters

Notes:

1) The table below lists the iTrigger Actions.

Bit	Action	Bit	Action
0	Alarm	**7**	DO7 Closed
1	DO1 Closed	**8**	Reserved
2	DO2 Closed	**9-26**	Reserved
3	DO3 Closed	**27**	DWR
4	DO4 Closed	**28**	WFR
5	DO5 Closed	**29**	RMSR
6	DO6 Closed	**30~31**	Reserved

Table 5-81 iTrigger Trigger Actions

5.10.6 System Setup

Register	Property	Description	Format	Range/Option, Default*
40751	RW	Dip/Swell RMS Update[1]	UINT16	0*, 1
40752	RW	Interruption Mode[2]	UINT16	0, 1*
40753	RW	Reserved	UINT16	
40754	RW	Dip/Swell Max. Duration	UINT16	1 to 600s, 60s*
40755	RW	Swell Max. Magnitude	UINT16	101~500* (%)
40756	RW	Enable Audit Log Alarm[11]	UINT16	0=No*, 1=Yes
40757	RW	PQD Triggers DO	UINT16	BIT0=Swell triggers DO (0*) BIT1=Dip triggers DO (1*) BIT2=Interruption triggers DO (0*) 0=When PQD Starts, 1=When PQD Ends
40758	RW	Energy Rollover	UINT16	0=99,999,999,999 (kWh/kvarh/kVAh)* 1=999,999,999 (kWh/kvarh/kVAh)
40759	RW	Enable SSL for SMTP	UINT16	0=Disabled*, 1=Enabled
40760~40779	RW	SMTP Server Domain or IP	Char	Example: Format 1: 192.168.0.100 Format 2: smtp.163.com
40780	RW	1588 Time Sync. PTP Domain[11]	UINT16	0* to 255
40781	RW	1588 Time Sync. PTP Primary 1[11]	UINT16	0 to 255, 240*
40782	RW	1588 Time Sync. PTP Primary 2[11]	UINT16	0 to 255, 240*
40783~40792	RW	61850 IED Name[11]	Char	Null*
40793	RW	IEC 61850 Validity Mode[11]	UINT16	0 = Option 1 (all good)*
40794~40795		Reserved		
40796	RW	HS Frequency Enable[11]	UINT16	0=Disabled*, 1=Enabled
40797	RW	SSH Enable	UINT16	0=Disabled*, 1=Enabled
40798	RW	Reserved	UINT16	
40799	RW	Delimiter[3]	UINT16	0=Option 1*, 1=Option 2
40800	RW	Clock Source	UINT16	0=RTC*, 1=SNTP, 2=GPS, 3=IRIG-B, 4=Reserved, 5=1588-P1, 6=1588-P2
40801	RW	Time Zone[4]	UINT16	0 to 32, 26*
40802	RW	IRIG-B Time Zone[4]	UINT16	0 to 32, 26*
40803	RW	Language	UINT16	0=English*, 1= Simplified Chinese 2=Traditional Chinese
40804	RW	Date Format	UINT16	0=YYMMDD*, 1=MMDDYY 2=DDMMYY, 3=YYYY-MM-DD 4=MM-DD-YYYY, 5=DD-MM-YYYY
40805	RW	Reserved		

40806	RW	LCD Backlight Timeout	UINT16	0 to 60 min (0 means disabled), 5*	
40807	RW	LCD Contrast (%)	UINT16	50 to 100 (%), 90*	
40808	RW	Phase A Color	UINT16	See Note 5), 1*	
40809	RW	Phase B Color	UINT16	See Note 5), 4*	
40810	RW	Phase C Color	UINT16	See Note 5), 8*	
40811	RW	Phase N Color	UINT16	See Note 5), 13*	
40812	RW	Earth Wire Color	UINT16	0=Green, 1=Yellow-Green*	
40813	RW	Set Device Password	UINT32	0~999999, 000001*	
40815	RW	Reserved	UINT32		
40817	RW	Flagged Data Trigger Setpoint	UINT32	0=Enabled, 1=Disabled*	
40819	RW	Time Zone of data timestamp[6]	UINT16	0x00	
40820	RW	Reserved	UINT16		
40821	RW	Aggregation Interval (Refresh Rate)[7]	UINT16	0=50/60cycles* 1=150/180cycles 2=10-min 3=2-hour	
40822	RW	Freq. Interval	UINT16	0=1s*, 1=3s, 2=10s	
40823	RW	Reset Mode of LED Indicators	UINT16	0=Auto*, 1=Manual	
40824	RW	Sampling Rates in CFG File[8]	UINT16	0=0*, 1=Actual Sampling	
40825	RW	Eliminate Flagged Data[9]	UINT16	0=Disabled*, 1=Enabled	
40826~40833	RW	FTP User Name[10]	Char	operator*	
40834~40841	RW	FTP User Password[10]	Char	abcd1234-*	
40842	RW	FTP Anonymous Login Enable	UINT16	0=Enabled, 1=Disabled*	
40843	RW	FTP Enable	UINT16	0=Enabled*, 1=Disabled	
40844	RW	Telnet Enable	UINT16	0=Enabled, 1=Disabled*	
40845	RW	Reserved	UINT32		
40847	RW	Reserved	UINT16		
40848~40856	RW	Reserved	UINT32		
40857	RW	Web Enable	UINT16	0= Disabled, 1= Enabled*	
40858	RW	Web Client Certificate Validated	UINT16	0= Disabled*, 1= Enabled	
40859	RW	Web Port No.	UINT16	1 to 65535	443*
40860	RW	FTP Port No.	UINT16		21*
40861	RW	Telnet Port No.	UINT16		23*
40862~40863	RW	Reserved	UINT16		
40864	RW	Modbus TCP Enable	UINT16	0=Disabled, 1=Enabled*	
40865	RW	Modbus TCP Port No.	UINT16	1 to 65535, 502*	
40866	RW	HMI Security	UINT16	0=Disabled*, 1=Enabled	
40867	RW	IEC61850 Enable	UINT16	0=Disabled, 1=Enabled*	
40868	RW	Comm. Port 1 Enable	UINT16	0=Disabled, 1=Enabled*	
40869	RW	Comm. Port 2 Enable	UINT16	0=Disabled, 1=Enabled*	
40870	RW	Reserved	UINT16		
40871	RW	Web multi-connections under same IP	UINT16	3 to 30, 8*	
40872	RW	Audit Log Record Mode	UINT16	0=FIFO*, 1=Stop When Full	
40873	RW	Operation Port Config.	UINT16	0=All Ethernet Ports*, 1=P1, 2=P2	
40874	RW	Management Port Config.	UINT16	0=All Ethernet Ports*, 1=P1, 2=P2	
40875	RW	Cyber Security Test Mode	UINT16	0=Disabled*, 1=Enabled	
40876	RW	Reserved	UINT16		
40877	RW	USB Enable	UINT16	0=Disabled*, 1=Enabled	
40878	RW	IEC 61850 Client Certificate Validated[11]	UINT16	0=Disabled*, 1=Enabled	
40879~40886	RW	IEC 61850 Client Authentication Key	CHAR	ASCII (Must occupy 16 bytes) 6365742D656C6563747269632E636F6D	
40887~40892	RW	IEC 61850 Authentication Code[12]	UINT16	Null*	
40893	RW	IEC 61850 Timestamp Offset	UINT16	0*~65535s, "0" means time difference is not examined.	
40894	RW	Value Type in COMTRADE files	UINT16	0=Primary*, 1=Secondary	
40895	RW	Web Timeout	UINT16	0 to 1440 mins, 5*	
40896	RW	IEC 61850 Port No.[11]	UINT16	1 to 65535, 102*	
40897	RW	Reserved	UINT16		
40898	RW	HTTPS Timeout	UINT16	100 to 5000ms, 1000*	
40899	RW	Freq. Dev. Record Enable	UINT16	0=Disabled*, 1=Enabled	

Table 5-82 System Setup Parameters

Notes:

1) The **Dip/Swell RMS Update** register determines if the U_{rms} is computed every cycle and then shifted by ½ cycle (register value = 0) or if the U_{rms} is computed every ½ cycle and then shifted by ½ cycle (register value = 1).
2) The **Interruption Mode** register determines if an Interruption event should start when the U_{rms} of all 3 phases (register

value = 1) or when the U_{rms} of any phase (register value = 0) is lower than the **Interruption Threshold**.

3) The **Delimiter** setup register supports two options, 1 and 2:
Option 1: "," is used as the x1000 delimiter and "." as the decimal point (e.g. 123,456,789.0).
Option 2: " " is used as the x1000 delimiter and "," as the decimal point (e.g. 123 456 789,0).

4) 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 5-83 Time Zones

5) The following table lists the Color options for different wires.

No.	Color (R,G,B)	No.	Color (R,G,B)	No.	Color (R,G,B)
0	Brown (153,51,0)	5	Turquoise (0,162,132)	10	Grey (159,159,159)
1	Red (255,0,0)	6	Green (0,255,36)	11	Neutral Grey (193,193,193)
2	Pink (255,173,177)	7	Light blue (79,204,246)	12	White (255,255,255)
3	Orange (255,102,0)	8	Blue (0,0,255)	13	Black (0,0,0)
4	Yellow (255,216,0)	9	Violet (112,48,160)		

Table 5-84 Wire Color Options

6) The timestamp for different data is programmable by writing the "Time Format" register, with the bit value of "0" meaning LOCAL time, while "1" meaning UTC time. The following table illustrates the details of this register.

BIT	Description	Note
BIT0	MODBUS	Timestamp of retrieved Data logs via Modbus: Real-time measurement, SOE Log, Device Log, SDR, Max./Min. Log, DR, Plt/Pst, EN50160 Log, TOU Log, IER and AER Log.
BIT1	COMTRADE	Timestamp of COMTRADE file including the first/trigger point in .cfg file
BIT2	PQDIF	Timestamp of PQDIF file, file name and store directory.

Table 5-85 Timestamp of Historical Data

7) The basic measurement interval shall be a 10-cycle period for 50 Hz power system and a 12-cycle period for 60 Hz power system. The 10/12-cycle measurement are then aggregated over 4 additional intervals: 50/60-cycle, 150/180-cycle, 10 min, and 2-hour.

8) "0" means the DWR file in COMTRADE format doesn't include any sampling section information.

9) For **Eliminate Flagged Data** register, the bit value of "0" means Keep the Flagged Data in the log while "1" means Remove the Flagged Data. The following table illustrates the details of this register.

Bit7~Bit15	Bit 6	Bit4~Bit5	Bit3	Bit2	Bit1	Bit0
Reserved	IEEE Std 519 Report	Reserved	EN50160 Log	Min. Log	Max. Log	SDR Log

Table 5-86 Keep/Remove Flagged Data Register

10) The FTP Username and Password should not exceed 16 characters.

11) Modification written to this register requires a Device Reboot to take effect.

12) The **IEC 61850 Authentication Code** can be set up to 12 characters. If the code is less than 12 characters, statement terminator "\0" should be used. If the Code is default to be null, the code is 01+SN.

5.10.7 SMTP Setup

Register	Property	Description	Format	Range/Option, Default*
40900	RW	SMTP Trigger Event Classification	Bitmap	Note 1)
40902	RW	SMTP IP Port	UINT16	1 to 65535, 25*
40903	RW	IP Address of SMTP Server	UINT32	Default=0.0.0.0
40905	RW	Source Email Address[2]	CHAR	40 characters, Null*
40925	RW	Source User Name[3]	CHAR	40 characters, Null*
40945	RW	Login Password[4]	CHAR	20 characters, Null*
40955	RW	Destination Email Address[5]	CHAR	90 characters, Null*

Table 5-87 SMTP Setup Parameters

Notes:

1) **SMTP Trigger Event Classification** register determines if a newly generated Device/SOE 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
0	System Events	Device Log	19	RVC	SOE Log
1-7	Reserved		20	MSV	
8-12	Reserved	SOE Log	21	Reserved	
13	Setpoint		22	Motor Start	
14	HS Setpoint		23	Reserved	
15	I/O		24	Record (WFR, DWR, RMSR, DR, etc.)	
16	Dip/Swell		25	EN50160	EN50160
17	Transient		26	Reserved	
18	Inrush Current		27	IEEE Std 519-2022 Compliance Report	IEEE519

Table 5-88 SMTP Trigger Event Register (40900)

2) This string parameter may be up to 40 characters long and specifies the source email address that appears in the "**From**" field of the email. For example, if the email address is iMeter 8@cet-electric.com, set the parameter as"69 4D 65 74 65 72 20 38 40 63 65 74 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.
3) This string parameter may be up to 40 characters long and specifies the "**Source Email 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.
4) This string parameter may be up to 20 characters long and specifies the Logon Password to login the "**Source Email Address**" account. For example, if the password is "iMeter 8", set the parameter as "69 4D 65 74 65 72 20 38 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 90 characters long and specifies the receiver email address that appears in the "**To**" field of the email. For example, if the email address is iMeter 8@cet-electric.com, so set the registers as" 69 4D 65 74 65 72 20 38 40 63 65 74 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.

5.10.8 Basic Setup Parameters

Register	Property	Description	Format	Range/Option, Default*
41000	RW	Wiring Mode	UINT16	1= 3P4W*, 3=3P3W, 4=Demo 5=1P2W-LL~, 6=1P2W-LN~, 7=1P3W~
41001	RW	PT Primary (V)	UINT32	1 to 1,000,000V, 100*
41003	RW	PT Secondary (V)	UINT32	1 to 1500V, 100*
41005	RW	CT Primary (A)	UINT32	1 to 30000A, 5*
41007	RW	CT Secondary (A)	UINT32	1 to 50A, 5*
41009	RW	U4 Primary (V)	UINT32	1 to 1,000,000V, 100*
41011	RW	U4 Secondary (V)	UINT32	1 to 1500V, 100*
41013	RW	I4 Primary (A)	UINT32	1 to 30000A, 5*
41015	RW	I4 Secondary (A)	UINT32	1 to 50A, 5*
41017	RW	I5 Primary (A)	UINT32	1 to 30000A, 5*
41019	RW	I5 Secondary (A)	UINT32	1 to 50A, 5*
41021	RW	ULL Nominal	UINT32	1 to 1500V, 415*
41023	RW	I Nominal	UINT32	1 to 10,000A, 5*
41025	RW	CT Polarity[1]	Bitmap	0=Normal*, 1=Reverse
41026	RW	Composite I	UINT16	0= No Composite*, 1=Phase A 2=Phase B, 3=Phase C
41027	RW	Power Factor Convention[2]	UINT16	0=IEC*, 1=IEEE, 2=-IEEE
41028	RW	kVA Calculation[3]	UINT16	0=Vector*, 1=Standard
41029	RW	HD Calculation	UINT16	0=% of FUND*, 1=% of RMS 2=% of nom
41030	RW	Harmonic Calculation Method	UINT16	0=Subgroup*, 1=Group
41031	RW	THD Order	UINT16	2~63, 63*
41032	RW	2kHz-150kHz C.E. Enable[4]		0=Disabled, 1=Enabled*
41033	RW	U0 Polarity	UINT16	0=Normal*, 1=Reverse
41034	RW	Neutral Connection	UINT16	0=Directly/Small Resistance/Reactance* 1=Ungrounded/High Resistance 2= Arc Suppression Coil
41035	RW	SCCP Option	UINT16	• 0=5A (50A) @10mV/A* • 1=20A@10mV/A

				• 2=200A@1mV/A • 3=500A @1mV/A • 4=500A(550A) @1mV/A • 5=5kA @0.1mV/A
41036	RW	Reserved	UINT16	
41037	RW	TDD Preset IL Primary[5]	UINT32	0*~30,000A (x0.001A)
41039	RW	I4 TDD Preset IL Primary[5]	UINT32	

~Available in the Firmware V2.51.50 or later

Table 5-89 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 5-90 CT Polarity Register

2. PF Convention: -IEEE is the same as IEEE but with the opposite sign.

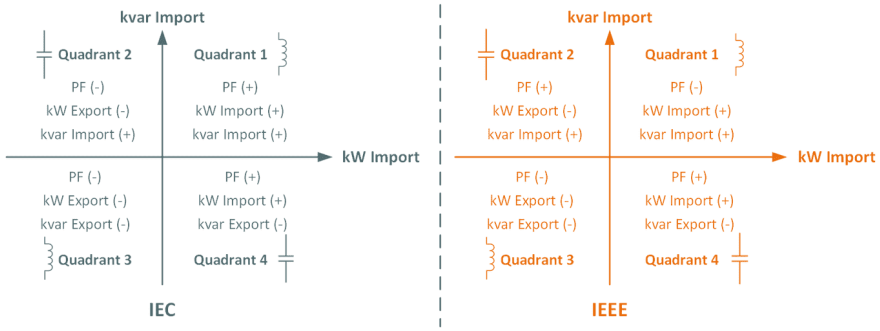


Figure 5-1 Power Factor Definitions

3. There are two ways to calculate kVA:

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

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

4. Modification written to this register requires a Device Reboot to take effect.
5. For the **TDD Preset IL Pri.** or **I4 TDD Preset IL Pri.**:
   - 0: represents to use the TDD calculation method compatible with the standard TDD calc. in IEEE Std 519-2022
   - non-zero value: the unit is A and it is the preset IL for TDD Calculation

   Besides, according to the IEEE Std 519-2022

   IL = maximum demand load current at the PCC (point of common coupling) under normal load operating conditions

5.10.9 PQ Setup

Register	Property	Description	Format	Range/Option, Default*
41085	RW	Swell Trigger Actions[2]	UINT32	DWR & RMSR*
41087	RW	Reserved	UINT16	
41088	RW	Dip Trigger Actions[2]	UINT32	DWR & RMSR*
41090	RW	Reserved	UINT16	
41091	RW	Interruption Trigger Actions[2]	UINT32	DWR & RMSR*
41093	RW	Reserved	UINT16	
41094	RW	ITIC Alarm Trigger Actions [3]	UINT32	DO, iTrigger
41096	RW	SEMI F47 Alarm Trigger Actions [3]	UINT32	0 (None)*
41098~41099	RW	Reserved	UINT16	
41100	RW	Dip/Swell Enable	UINT16	0=Disabled, 1=Enabled*
41101	RW	Dip/Swell Voltage Reference	UINT16	0=Udin(Nominal Voltage)* 1=Usr (Sliding Reference Voltage)
41102	RW	Swell Threshold[1]	UINT16	101 to 200 (x0.01Udin/Usr), 110*
41103	RW	Dip Threshold[1]	UINT16	1 to 99 (x0.01 Udin/Usr), 90*
41104	RW	Interruption Threshold[1]	UINT16	0 to 50 (x0.01 Udin/Usr), 5*
41105	RW	Swell Hysteresis[1]	UINT16	1 to 1000 (x0.001 Udin/Usr), 20*
41106	RW	Dip Hysteresis[1]	UINT16	
41107	RW	Interruption Hysteresis[1]	UINT16	
41108~41110	RW	Reserved	UINT32	
41112	RW	Transient Enable	UINT16	0=Disabled, 1=Enabled*
41113	RW	Transient Threshold[1]	UINT16	5 to 500 (%), 35*
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 Threshold[1]	UINT16	10 to 500 (%), 120*
41122	RW	Inrush Current Hysteresis	UINT16	1 to 1000 (0.1% to 100%), 10*
41123	RW	Inrush Current Trigger Action[4]	UINT32	WFR*
41125~41127	RW	Reserved	UINT16	
41128	RW	RVC Enable	UINT16	0=Disabled*, 1=Enabled
41129	RW	RVC Threshold	UINT32	2 to 100 (0.2% to 10%Un), 50*
41131	RW	RVC Hysteresis	UINT32	1 to 50 (0.1% to 5%Un), 25*
41133	RW	RVC Trigger[4]	UINT32	RMSR*
41135~41153	RW	Reserved	UINT32	
41154	RW	MSV #1 Enable	UINT16	0=Disabled*, 1=Enabled
41155	RW	MSV #1 Frequency	UINT16	600 to 30000 (x0.1Hz), 10000*
41156	RW	MSV #1 Threshold	UINT16	3 to 1000 (x0.001 Udin/Usr), 50*
41157	RW	MSV #1 Signalling Time	UINT16	1 to 120s, 60*
41158~41159	RW	Reserved		
41160	RW	MSV #2 Enable	UINT16	0=Disabled*, 1=Enabled
41161	RW	MSV #2 Frequency	UINT16	600 to 30000 (x0.1Hz), 20000*
41162	RW	MSV #2 Threshold	UINT16	3 to 1000 (x0.001 Udin/Usr), 50*
41163	RW	MSV #2 Signalling Time	UINT16	1 to 120s, 60*
41164~41165	RW	Reserved		
41166	RW	MSV #3 Enable	UINT16	0=Disabled*, 1=Enabled
41167	RW	MSV #3 Frequency	UINT16	600 to 30000* (x0.1Hz)
41168	RW	MSV #3 Threshold	UINT16	3 to 1000 (x0.001 Udin/Usr), 50*
41169	RW	MSV #3 Signalling Time	UINT16	1 to 120s, 60*
41170~41171		Reserved		
41172	RW	Flicker Mode	UINT16	0=120V, 1=230V*
41173~41176		Reserved		
41177	RW	U0 Active Limit	UINT16	1 to 200V, 20V*
41178	RW	Reserved	UINT16	
41179	RW	Zero Sequence PT/CT Polarity Reliability Factor	UINT16	0 to 10 (x0.1), 5*
41180~41184	RW	Reserved		
41185	RW	Motor Start Enable	UINT16	0=Disabled*, 1=Enabled
41186	RW	Motor Start I Nom. Sec.	UINT16	1 to 600 (x0.01), 500*
41187	RW	Motor Start Trigger Actions[2]	UINT32	WFR & RMSR*

Table 5-91 PQ Log Setup

Notes:

1. The values for the **Dip Threshold**, **Swell Threshold**, **Voltage Interruption Threshold** and **Dip/Swell Hysteresis** should be configured to meet the following criteria:
   a) The **Voltage Interruption Threshold** shall be set below **Dip Threshold**.
   b) The **Dip/Swell Hysteresis** must be less than the **Dip/Swell Threshold**.
   c) The **RVC Threshold** must be less than the **Dip and Swell Thresholds**.
   d) Regardless of whether **Dip/Swell** is enabled, the conditions for a), b) and c) must always be met.
2. The following table illustrates the details of the **XXX Trigger Action** register with a bit value of "1" meaning Active while "0" meaning Inactive.
   Please be noted that the ITIC/SEMI F47 only can trigger DOs and iTriggers, and the Transient/RVC cannot trigger DRs.

Bit	Action	Bit	Action	Bit	Action	Bit	Action
0	Alarm	**7**	DO7 Closed	**19**	DR #1	**26**	DR #8
1	DO1 Closed	**8**	Reserved	**20**	DR #2	**27**	DWR
2	DO2 Closed	**9~14**	Reserved	**21**	DR #3	**28**	WFR
3	DO3 Closed	**15**	iTrigger 1	**22**	DR #4	**29**	RMSR
4	DO4 Closed	**16**	iTrigger 2	**23**	DR #5	**30~31**	Reserved
5	DO5 Closed	**17**	iTrigger 3	**24**	DR #6		
6	DO6 Closed	**18**	Reserved	**25**	DR #7		

Table 5-92 DIx's Setpoint Triggers

5.10.10 PQDIF Setup

Register	Property	Description	Format	Range/Option, Default*
41200~41202	RW	Reserved	UINT16	
41203	RW	PQDIF & IEC 61850 Statistics Interval	UINT16	0 to 60 minutes, 10*
41204	RW	PQDIF Save Interval	UINT16	0 (Disabled)* to 24 Hour

Table 5-93 PQDIF Setup

5.10.11 Demand Setup

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

Table 5-94 Demand Setup

Notes:

1. The **Self-Read Time** allows the user to specify the time and day of the month for the Max. Demand Self-Read operation. The **Self-Read Time** supports three options:
   - A zero value means that the Self-Read will take place at 00:00 of the first 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. Demand of **This Month** to be transferred to the Max. Demand of **Last Month** and then reset. The terms **This Month** and **Last Month** will become **Since Last Reset** and **Before Last Reset**.

5.10.12 WFR Setup

Register	Property	Description	Format	Range/Option, Default*
41300	RW	Pre-fault Cycles of WFR	UINT16	2 to 16, 5*
41301	RW	Post-fault Cycles of WFR	UINT16	
41302	RW	Max. No. of Cycles	UINT16	Range of Cycles @ Samples/Cycle, 100* • (40-3200) @128 • (40-1600) @ 256 • (40-800) @ 512 • (40-400) @ 1024
41303	RW	Sampling Rates	UINT16	0=128 Samples/Cycles 1=256 Samples/Cycles 2=512 Samples/Cycles* 3=1024 Samples/Cycles
41304	RW	Adaptive WFR[1]	UINT16	0=Enabled, 1=Disabled*
41305	RW	Reserved		
41306	RW	Pre-fault Cycles of DWR	UINT16	5* to 10 Cycles
41307	RW	Scheduled WFR Enable	UINT16	0=Disabled*, 1=Enabled
41308	RW	Scheduled WFR Start Time	UINT16	See Note 2)
41311	RW	Scheduled WFR Interval	UINT16	1 to 1440* minutes
41312	RW	Repetitions	UINT16	0 to 10000, 1* 0 indicates recording continuously
41313	RW	Pre-fault Samples of RMSR	UINT16	100 to 500 samples, 300*
41314	RW	RMSR Sampling Interval	UINT16	0* to 60 cycles, 0=1/2 cycle
41315	RW	Channel 1	UINT16	See Note 3), 4*
41316	RW	Channel 2	UINT16	See Note 3), 5*
41317	RW	Channel 3	UINT16	See Note 3), 6*
41318	RW	Channel 4	UINT16	See Note 3), 7*
41319	RW	Channel 5	UINT16	See Note 3, 8*
41320	RW	Channel 6	UINT16	See Note 3), 9*
41321	RW	Channel 7	UINT16	See Note 3), 12*
41322	RW	Channel 8	UINT16	See Note 3), 13*
41323	RW	Channel 9	UINT16	See Note 3), 1*
41324	RW	Channel 10	UINT16	See Note 3), 2*
41325	RW	Channel 11	UINT16	See Note 3), 3*
41326	RW	Channel 12	UINT16	See Note 3), 0*
41327	RW	Channel 13	UINT16	See Note 3), 0*
41328	RW	Channel 14	UINT16	See Note 3), 0*
41329	RW	Channel 15	UINT16	See Note 3), 0*
41330	RW	Channel 16	UINT16	See Note 3), 0*

Table 5-95 WFR Log Setup

Notes:

1. If the **Adaptive WFR** is **disabled**, the **WFR** on the iMeter 8 is always recording the **Max. No. of Cycles.**

2. The following table illustrates the **Scheduled WFR Start Time** structure.

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

Table 5-96 Scheduled WFR Start Time Structure

3. The table below lists the available parameters for each channel, please note that the channel should be configured continually from the Channel 1.

Key	Parameter	Key	Parameter	Key	Parameter
0	Disabled	**11**	I4	**22**	Sc
1	Ua	**12**	Frequency	**23**	PFa
2	Ub	**13**	Freq. Deviation	**24**	PFb
3	Uc	**14**	Pa	**25**	PFc
4	Uab	**15**	Pb	**26**	ULN Avg.
5	Ubc	**16**	Pc	**27**	ULL Avg.
6	Uca	**17**	Qa	**28**	I Avg.
7	Ia	**18**	Qb	**29**	P Total
8	Ib	**19**	Qc	**30**	Q Total
9	Ic	**20**	Sa	**31**	S Total
10	U4	**21**	Sb	**32**	PF Total

Table 5-97 Available RMSR Channel

5.10.13 Energy Pulse Setup

Register	Property	Description	Format	Range/Option, Default*
41350	RW	Energy Pulse Constant[1]	UINT16	0=1000*, 1=3200, 2=5000 3=6400, 4=12800 (imp/kWh) 5=a value between 0 and 65535
41351	RW	Energy / Pulse[2]	UINT16	1* to 65535, x0.1 kxh/imp
41352	RW	Energy Pulse Type	UINT16	See note 3), 0*
41353	RW	Energy Pulse Output #1[4]	UINT16	0* to 18
41354	RW	Reserved	UINT16	
41355	RW	Energy Pulse Output #2[4]	UINT16	0* to 18
41356	RW	Reserved	UINT16	
41357	RW	Energy Pulse Output #3[4]	UINT16	0* to 18
41358	RW	Reserved	UINT16	
41359	RW	Energy Pulse Output #4[4]	UINT16	0* to 18
41360	RW	Reserved	UINT16	

Table 5-98 Energy Pulse Setup

Notes:

1) It's important to understand that energy pulsing is always based on the secondary ratings (e.g. 100V 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** = $V_{nominal}$ x $I_{nominal}$ x 2, where $V_{nominal}$ and $I_{nominal}$ are the secondary voltage and current nominal ratings, respectively. 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	Min. Interval (ms)	Default
≤1000	1000/3200/5000/6400/12800	160	1000
≤2000	1000/3200/5000/6400		
≤2600	1000/3200/5000		
≤4000	1000/3200		
≤13000	1000		

Table 5-99 Energy Pulse Constant Range

2) The **Energy / Pulse** specifies the required energy to trigger an energy pulse.

3) The **Energy Pulse Type** parameter has the following options:

- 0: apply to the register 41350 setting, which means energy pulsing is based on the secondary value.
- 1: apply to the register 41351 setting, which means energy pulsing is based on the primary value.

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

Value	Source	Value	Source	Value	Source	Value	Source
0	Disabled	**5**	kWh Imp. H01	**10**	kvarh Total RMS	**15**	kvarh Exp. H01
1	kWh Total RMS	**6**	kWh Exp. H01	**11**	kvarh Imp.	**16**	kvarh TH
2	kWh Imp.	**7**	kWh TH	**12**	kvarh Exp.	**17**	kvarh Imp. TH
3	kWh Exp.	**8**	kWh Imp. TH	**13**	kvarh Total Fund.	**18**	kvarh Exp. TH

4	kWh Total Fund.	**9**	kWh Exp. TH	**14**	kvarh Imp. H01		

Table 5-100 Energy Pulse Source Setup Register

5.10.14 Standard Setpoints Setup

Register	Property	Description		Format	Range/Option, Default*
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	0*
41405	RW		Return Limit	Float	0*
41407	RW		Active Delay	UINT16	0 to 9999 s, 10*
41408	RW		Inactive Delay	UINT16	0 to 9999 s, 10*
41409	RW		Trigger Action[2]	UINT32	0=Disabled*
41411	RW		Reserved	UINT32	
…		…			…
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	0*
44720	RW		Inactive Limit	Float	0*
44722	RW		Active Delay	UINT16	0 to 9999 s, 10*
44723	RW		Inactive Delay	UINT16	0 to 9999 s, 10*
44724	RW		Trigger Action[2]	UINT32	0=Disabled*
44726	RW		Reserved	UINT32	

Table 5-101 Setpoint Setup Parameters

Notes:

1) The iMeter 8 provides the following setpoint parameters:

Key	Parameter	Key	Parameter	Key	Parameter
1	ULN*	28	I TEHD	55	Total P Exp. Pred. DMD
2	ULL*	29	U TIHD	56	Total Q Exp. Pred. DMD
3	U4*	30	U TOIHD	57	Total S Pred. DMD
4	I*	31	U TEIHD	58	PF Total Pred. DMD
5	I4*	32	I TIHD	59	Pst
6	I5*	33	I TOIHD	60	Plt
7	P Total*	34	I TEIHD	61	Reserved
8	Q Total*	35	U TH RMS	62	Phase Loss
9	S Total*	36	U TOH RMS	0x20000	U HD02
10	PF Total*	37	U TEH RMS	…	U HD03~HD62
11	U0 Unbalance	38	I TH RMS	0x3f0000	U HD63
12	U2 Unbalance	39	I TOH RMS	0x400000	U H02 RMS
13	I0 Unbalance	40	I TEH RMS	…	U H03 RMS~U H62 RMS
14	I2 Unbalance	41	U TIH RMS	0x7D0000	U H63 RMS
15	U Fundamental	42	U TOIH RMS	0x810000	U IHD01
16	I Fundamental	43	U TEIH RMS	…	U IHD02~IHD62
17	U Deviation	44	I TIH RMS	0xBF0000	U IHD63
18	U Over Deviation	45	I TOIH RMS	0x02000000	I H02 RMS
19	U Under Deviation	46	I TEIH RMS	…	I H03 RMS~I H62 RMS
20	Frequency	47	Total P Imp. DMD	0x3F000000	I H63 RMS
21	Frequency Deviation	48	Total Q Imp. DMD	0x40000000	I HD02
22	Phase Reversal	49	Total P Exp. DMD	…	I HD03~I HD62
23	U THD	50	Total Q Exp. DMD	0x7D000000	I HD63
24	U TOHD	51	Total S DMD	0x81000000	I IH01 RMS
25	U TEHD	52	PF Total DMD	…	I IH02 RMS~I IH62 RMS
26	I THD	53	Total P Imp. Pred. DMD	0xBF000000	I IH63 RMS
27	I TOHD	54	Total Q Imp. Pred. DMD		

* High-Speed Setpoint Parameters

Table 5-102 Setpoint Parameters

2) The iMeter 8 provides the following Setpoint Triggers:

Bit	Trigger	Bit	Trigger	Bit	Trigger
0	Alarm	9~14	Reserved	23	DR #5
1	DO1 Closed	15	iTrigger 1	24	DR #6
2	DO2 Closed	16	iTrigger 2	25	DR #7
3	DO3 Closed	17	iTrigger 3	26	DR #8
4	DO4 Closed	18	Reserved	27	DWR

5	DO5 Closed	19	DR #1	28	WFR
6	DO6 Closed	20	DR #2	29	RMSR
7	DO7 Closed	21	DR #3	30~31	Reserved
8	LED Alarm[3]	22	DR #4		

Table 5-103 Setpoint Triggers

3) Only the following parameters' Standard Setpoint can trigger the LED Alarm: U/ Frequency Deviation, U THD, U TH RMS, U0/U2/I0/I2 Unbalance, Pst and Plt.

5.10.15 HS (High-speed) Setpoints Setup

Register	Property	Description		Format	Range/Option, Default*
45400	RW	HS Setpoint #1	Parameter	UINT32	See **Table 5-102** above
45402	RW		Type	UINT16	0=Disabled* 1=Over Setpoint, 2=Under Setpoint
45403	RW		Active Limit	Float	0*
45405	RW		Inactive Limit	Float	0*
45407	RW		Active Delay	UINT16	0 to 9999 cycle, 10*
45408	RW		Inactive Delay	UINT16	0 to 9999 cycle, 10*
45409	RW		Trigger Action	UINT32	See **Table 5-103,** Default=0
45411	RW		Reserved	UINT32	
…		…			…
45595	RW	HS Setpoint #16	Parameter	UINT32	See **Table 5-102** above
45597	RW		Type	UINT16	0=Disabled* 1=Over Setpoint, 2=Under Setpoint
45598	RW		Active Limit	Float	0*
45600	RW		Inactive Limit	Float	0*
45602	RW		Active Delay	UINT16	0 to 9999 cycle, 10*
45603	RW		Inactive Delay	UINT16	0 to 9999 cycle, 10*
45604	RW		Trigger Action	UINT32	See **Table 5-103,** Default=0
45606	RW		Reserved	UINT32	

Table 5-104 Setpoint Setup Parameters

5.10.16 SDR Setup

5.10.16.1 SDR Setup Registers

Register	Property	Description	Format
45700~45766	RW	SDR #1	See **Section 5.10.16.2 SDR Setup Data Structure**
45800~45866	RW	SDR #2	
45900~45966	RW	SDR #3	
46000~46066	RW	SDR #4	
46100~46166	RW	SDR #5	
46200~46266	RW	SDR #6	
46300~46366	RW	SDR #7	
46400~46466	RW	SDR #8	
46500~46566	RW	SDR #9	
46600~46666	RW	SDR #10	
46700~46766	RW	SDR #11	
46800~46866	RW	SDR #12	
46900~46966	RW	SDR #13	
47000~47066	RW	SDR #14	
47100~47166	RW	SDR #15	
47200~47266	RW	SDR #16	

Table 5-105 SDR Setup Registers

5.10.16.2 SDR Setup Data Structure

Offset	Property	Description	Format	Range/Option
+0	RW	Recording Interval	UINT32	1 to 60 (min)
+1	RW	Recording Mode	UINT16	0=Stop-When-Full, 1=First-In-First-Out
+2	RW	Number of Parameters	UINT16	0 to 64
+3	RW	Parameter 1	UINT16	Please refer to **Appendix A** and **B** for a complete list of the SDR Parameters and default configuration for each SDR, respectively.
+4	RW	Parameter 2	UINT16	
…	RW	…	UINT16	
+66	RW	Parameter 64	UINT16	

Table 5-106 SDR Setup Data Structure

5.10.17 Data Recorder (DR) Setup

5.10.17.1 Data Recorder Setup Registers

Register	Property	Description	Format
47300~47370	RW	Data Recorder #1	See **Section 5.10.17.2 Data Recorder Setup Data Structure**
47400~47470	RW	Data Recorder #2	
47500~47570	RW	Data Recorder #3	
47600~47670	RW	Data Recorder #4	
47700~47770	RW	Data Recorder #5	
47800~47870	RW	Data Recorder #6	
47900~47970	RW	Data Recorder #7	
48000~48070	RW	Data Recorder #8	

Table 5-107 Data Recorder Setup Registers

5.10.17.2 Data Recorder Setup Data Structure

Offset	Property	Description	Format	Range/Option
+0	RW	Triggered Mode [1]	UINT16	0=Disabled, 1=Triggered by Timer 2=Triggered by Setpoint
+1	RW	Recording Mode	UINT16	0=Stop-When-Full, 1=First-In-Frist-Out
+2	RW	Reserved	UINT16	
+3	RW	Recording Interval	UINT32	1 to 3,456,000 (s)
+5	RW	Recording Offset[2]	UINT16	0 to 43200 (s)
+6	RW	Number of Parameters[3]	UINT16	0 to 64
+7	RW	Parameter 1	UINT16	Please refer to **Appendices A** and **C** for a complete list of the Data Recorder Parameters and the default configuration for each DR, respectively.
+8	RW	Parameter 2	UINT16	
+9	RW	Parameter 3	UINT16	
+10	RW	Parameter 4	UINT16	
+11	RW	Parameter 5	UINT16	
+12	RW	Parameter 6	UINT16	
+13	RW	Parameter 7	UINT16	
+14	RW	Parameter 8	UINT16	
+15	RW	Parameter 9	UINT16	
+16	RW	Parameter 10	UINT16	
+17	RW	Parameter 11	UINT16	
+18	RW	Parameter 12	UINT16	
+19	RW	Parameter 13	UINT16	
+20	RW	Parameter 14	UINT16	
+21	RW	Parameter 15	UINT16	
+22	RW	Parameter 16	UINT16	
+23	RW	Parameter 17	UINT16	
+24	RW	Parameter 18	UINT16	
+25	RW	Parameter 19	UINT16	
+26	RW	Parameter 20	UINT16	
+27	RW	Parameter 21	UINT16	
+28	RW	Parameter 22	UINT16	
+29	RW	Parameter 23	UINT16	
+30	RW	Parameter 24	UINT16	
+31	RW	Parameter 25	UINT16	
+32	RW	Parameter 26	UINT16	
+33	RW	Parameter 27	UINT16	
+34	RW	Parameter 28	UINT16	
+35	RW	Parameter 29	UINT16	
+36	RW	Parameter 30	UINT16	
+37	RW	Parameter 31	UINT16	
+38	RW	Parameter 32	UINT16	
…				
+70	RW	Parameter 64	UINT16	

Table 5-108 DR Setup Data Structure

Notes:

1) The Data Recorder can be triggered by Setpoint (**Triggered by Setpoint**) or on a time basis using the meter clock (**Triggered by Timer**). For **Triggered by Setpoint**, when the Setpoint goes active, the Data Recorder starts to record, and when the Setpoint becomes inactive, the Data Recorder stops.
2) **Recording Offset** can be used to delay the recording by a fixed time from the **Recording Interval**. For example, if **Recording Interval** is set to 3600 (hourly) and **Recording Offset** is set to 300 (5 minutes), the recording will take place at 5 minutes after the hour every hour, i.e. 00:05, 01:05, 02:05…etc. The programmed value of **Recording Offset** should be less than

that of **Recording Interval**.

3) **Appendix A** provides a list of available parameters for data recording. All parameters are available for standard data recording. If **Number of parameters** is set to **0**, the Data Recorder is disabled.

5.10.18 Max./Min. Recorder (MMR) Setup

The **Self-Read Time** allows the user to specify the time and day of the month for the Max./Min. Log Self-Read operation. The **Self-Read Time** supports three options:

- A zero value means that the Self-Read will take place at 00:00 of the first 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. Demand of **This Month** to be transferred to the Max. Demand of **Last Month** and then reset. The terms **This Month** and **Last Month** will become **Since Last Reset** and **Before Last Reset**.

5.10.18.1 Max./Min. Recorder #1 Setup

Register		Property	Description	Format	Range/Option, Default*
Max.	Min.				
48900	49300	RW	Self-read Time	UINT16	0*
48901	49301	RW	Number of Parameters	UINT16	0 to 20*
48902	49302	RW	Parameter #1	UINT16	Uab*
48903	49303	RW	Parameter #2	UINT16	Ubc*
48904	49304	RW	Parameter #3	UINT16	Uca*
48905	49305	RW	Parameter #4	UINT16	ULL avg*
48906	49306	RW	Parameter #5	UINT16	Ia*
48907	49307	RW	Parameter #6	UINT16	Ib*
48908	49308	RW	Parameter #7	UINT16	Ic*
48909	49309	RW	Parameter #8	UINT16	I avg*
48910	49310	RW	Parameter #9	UINT16	P Total*
48911	49311	RW	Parameter #10	UINT16	Q Total*
48912	49312	RW	Parameter #11	UINT16	S Total*
48913	49313	RW	Parameter #12	UINT16	PF Total*
48914	49314	RW	Parameter #13	UINT16	Freq*
48915	49315	RW	Parameter #14	UINT16	Ua*
48916	49316	RW	Parameter #15	UINT16	Ub*
48917	49317	RW	Parameter #16	UINT16	Uc*
48918	49318	RW	Parameter #17	UINT16	ULN avg*
48919	49319	RW	Parameter #18	UINT16	U4*
48920	49320	RW	Parameter #19	UINT16	I4*
48921	49321	RW	Parameter #20	UINT16	I5*

Table 5-109 Max./Min. Recorder #1 Setup

5.10.18.2 Max./Min. Recorder #2 Setup

Register		Property	Description	Format	Range/Option, Default*
Max.	Min.				
49000	49400	RW	Self-read Time	UINT16	0*
49001	49401	RW	Number of Parameters	UINT16	0 to 20, 19*
49002	49402	RW	Parameter #1	UINT16	Pa*
49003	49403	RW	Parameter #2	UINT16	Pb*
49004	49404	RW	Parameter #3	UINT16	Pc*
49005	49405	RW	Parameter #4	UINT16	Qa*
49006	49406	RW	Parameter #5	UINT16	Qb*
49007	49407	RW	Parameter #6	UINT16	Qc*
49008	49408	RW	Parameter #7	UINT16	Sa*
49009	49409	RW	Parameter #8	UINT16	Sb*
49010	49410	RW	Parameter #9	UINT16	Sc*
49011	49411	RW	Parameter #10	UINT16	PFa*
49012	49412	RW	Parameter #11	UINT16	PFb*
49013	49413	RW	Parameter #12	UINT16	PFc*
49014	49414	RW	Parameter #13	UINT16	U0 Unb.*
49015	49415	RW	Parameter #14	UINT16	I0 Unb.*
49016	49416	RW	Parameter #15	UINT16	U2 Unb.*
49017	49417	RW	Parameter #16	UINT16	I2 Unb.*
49018	49418	RW	Parameter #17	UINT16	Uab THD

49019	49419	RW	Parameter #18	UINT16	Ubc THD
49020	49420	RW	Parameter #19	UINT16	Uca THD
49021	49421	RW	Parameter #20	UINT16	

Table 5-5-110 Max. Recorder #2 Setup

5.10.18.3 Max./Min. Recorder #3 Setup

Register		Property	Description	Format	Range/Option, Default*
Max.	Min.				
49100	49500	RW	Self-read Time	UINT16	0*
49101	49501	RW	Number of Parameters	UINT16	0 to 20, 18*
49102	49502	RW	Parameter #1	UINT16	Ua THD*
49103	49503	RW	Parameter #2	UINT16	Ub THD*
49104	49504	RW	Parameter #3	UINT16	Uc THD*
49105	49505	RW	Parameter #4	UINT16	Ia THD*
49106	49506	RW	Parameter #5	UINT16	Ib THD*
49107	49507	RW	Parameter #6	UINT16	Ic THD*
49108	49508	RW	Parameter #7	UINT16	Ia TDD*
49109	49509	RW	Parameter #8	UINT16	Ib TDD*
49110	49510	RW	Parameter #9	UINT16	Ic TDD*
49111	49511	RW	Parameter #10	UINT16	Ia K-Factor*
49112	49512	RW	Parameter #11	UINT16	Ib K-Factor*
49113	49513	RW	Parameter #12	UINT16	Ic K-Factor*
49114	49514	RW	Parameter #13	UINT16	Ua Crest Factor*
49115	49515	RW	Parameter #14	UINT16	Ub Crest Factor*
49116	49516	RW	Parameter #15	UINT16	Uc Crest Factor*
49117	49517	RW	Parameter #16	UINT16	Ia Crest Factor*
49118	49518	RW	Parameter #17	UINT16	Ib Crest Factor*
49119	49519	RW	Parameter #18	UINT16	Ic Crest Factor*
49120	49520	RW	Parameter #19	UINT16	
49121	49521	RW	Parameter #20	UINT16	

Table 5-111 Max./Min. Recorder #3 Setup

5.10.18.4 Max./Min. Recorder #4 Setup

Register		Property	Description	Format	Range/Option, Default*
Max.	Min.				
49200	49600	RW	Self-read Time	UINT16	0*
49201	49601	RW	Number of Parameters	UINT16	0 to 20, 19*
49202	49602	RW	Parameter #1	UINT16	U0 (Zero Sequence)*
49203	49603	RW	Parameter #2	UINT16	U1 (+ve Sequence)*
49204	49604	RW	Parameter #3	UINT16	U2 (-ve Sequence)*
49205	49605	RW	Parameter #4	UINT16	I0 (Zero Sequence)*
49206	49606	RW	Parameter #5	UINT16	I1 (+ve Sequence)*
49207	49607	RW	Parameter #6	UINT16	I2 (-ve Sequence)*
49208	49608	RW	Parameter #7	UINT16	Ua Pst*
49209	49609	RW	Parameter #8	UINT16	Ub Pst*
49210	49610	RW	Parameter #9	UINT16	Uc Pst*
49211	49611	RW	Parameter #10	UINT16	Ua Plt*
49212	49612	RW	Parameter #11	UINT16	Ub Plt*
49213	49613	RW	Parameter #12	UINT16	Uc Plt*
49214	49614	RW	Parameter #13	UINT16	Uab Deviation*
49215	49615	RW	Parameter #14	UINT16	Ubc Deviation*
49216	49616	RW	Parameter #15	UINT16	Uca Deviation*
49217	49617	RW	Parameter #16	UINT16	Ua Deviation*
49218	49618	RW	Parameter #17	UINT16	Ub Deviation*
49219	49619	RW	Parameter #18	UINT16	Uc Deviation*
49220	49620	RW	Parameter #19	UINT16	Freq. Dev.*
49221	49621	RW	Parameter #20	UINT16	

Table 5-112 Max./Min. Recorder #4 Setup

5.10.19 IER & AER Setup

Register		Property	Description	Format	Range/Option, Default*
IER	AER				
49700	49730	RW	Recording Mode	UINT16	0=Disabled 1=Stop-When-Full 2=First-In-First-Out*
49701	49731	RW	Reserved	UINT16	

49702	49732	RW	Reserved		UINT16	
49703	49733	RW	Recording Interval		UINT16	1 to 65535min, 15*
49704 ~ 49706	49734 ~ 49736	RW	Start Time[2]	High-order Byte: Year	UINT16	0-37 (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

Table 5-113 IER &AER Setup

5.10.20 EN50160 Setup

The default values in **Section 5.10.20.2** may be different for LV, MV and HV levels such that it's required to set Register 49790 **Voltage Level** first.

5.10.20.1 Basic

Register	Property	Description	Format	Range/Option, Default*
49790	RW	Voltage Level	UINT16	0=LV*, 1=MV, 2=HV
49791	RW	First Day of the Week	UINT16	0=Sunday* 1~6=Monday to Saturday

Table 5-114 EN50160 Basic Setup

5.10.20.2 EN 50160 Parameters

Register	Property	Description	Format	Range/Option, Default*
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

Table 5-115 EN50160 Parameters Setup

5.10.21 IEEE Std 519-2022 Report Setup

5.10.21.1 Basic

Register	Property	Description	Format	Range/Option, Default*
44800	RW	IEEE Std 519 Mode[1]	UINT16	0=Disabled*, 1=Standard 2=Custom
44801	RW	HVDC Enable[2]	UINT16	0=No*, 1=Yes
44802	RW	Enable Power Generation Facilities[3]	UINT16	0=No*, 1=Yes
44803	RW	PCC Voltage	UINT32	1~9999000V, 415* PCC Voltage = $Ull_{Nominal}$ x PT Ratio
44805	RW	Max. Short-Circuit Current (SCR)[4]	UINT32	1~9999000A, 40000*
44807	RW	First Day of Week[5]	UINT16	0=Sunday* 1~0=Monday to Saturday
44808	RW	Alert Notification	UINT16	0=Alarm Email* 1=Periodic Email

Table 5-116 IEEE Std 519-2022 Report Basic Parameters Setup

Notes:

1. For the IEEE Std 519 Mode:
   - **Standard**: Use measured IL for **SCR** calculation and determining the limits according to IEEE Std 519-2022 for report generation.
   - **Custom**: Use custom **TDD Preset IL** for **SCR** calculation. Users may customize the harmonic limits for report generation.

   In **Standard** mode, for a new installation, the monthly maximum current demand is not available.
   - If Preset IL ≠ 0: the meter will use Preset IL for SCR calculation and determining the current harmonic distortion limits in the first month (M <1).
   - If Preset IL = 0: the meter will use the greater of **This Max. Current Demand** and **I Nominal*CT Ratio** for SCR cal. and for determining the current harmonic distortion in the first month (M<1).
2. The **HVDC** is used for High-voltage systems (> 161kV) that may have a higher voltage THD caused by a HVDC terminal. In this condition, enable the **HVDC** parameter to increase the voltage THD tolerance to 2%.
3. For power generation equipment, enable **Power Generation Facilities** to limit the current distortion to those value in row for < 20 or < 25 group, regardless of actual Isc/IL
4. Modification of the **Max. Short Circuit Current** (Isc) may change the SCR (Isc/IL) ratio and result in a change in the harmonic current distortion limits.
   This is the maximum short circuit current could be produced at PCC according to the PCC voltage and the supply impedance at PCC, rather than the maximum MCCB rating.
5. The First Day of Week should be consistent with EN50160's (register 49791).

5.10.21.2 IEEE Std 519-2022 Report Parameter

The default values in table below may be various as per different setup in **Section 5.10.21.1**.

Register	Property	Description	Format	Unit	Default Value
44810	RW	VTHD limit	Float	%	800* (x0.01, %)
44812	RW	2nd Harmonic Voltage limit	Float	%	500* (x0.01, %)
44816	RW	3rd Harmonic Voltage limit	Float	%	500* (x0.01, %)
…	RW	…	Float	%	500* (x0.01, %)
44908	RW	50th Harmonic Voltage limit	Float	%	500* (x0.01, %)
44910~44914	RW	Reserved	Float	%	
44916	RW	TDD limit	Float	%	2000* (x0.01, %)
44918	RW	2nd Harmonic Current limit	Float	%	1500* (x0.01, %)
44920	RW	3rd Harmonic Current limit	Float	%	1500* (x0.01, %)
…	RW	…	Float	%	
45014	RW	50th Harmonic Current limit	Float	%	140* (x0.01, %)

Table 5-117 IEEE519 Limit Parameters Setup

5.10.22 TOU Setup

5.10.22.1 Basic Setup

Register	Property	Description	Format	Range/Option, Default*
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	TOU Switch Time	UINT32	See Note 2)
50109	RW	TOU Self-read Time	UINT16	DDHH, 0x0100*

Table 5-118 TOU Basic Setup

Notes:

1) If DI1 is not programmed as a **Tariff Switch**, the TOU will function based on the TOU Schedule. If at least one DI (DI1) is programmed as a **Tariff Switch**, the TOU Schedule will no longer be used and the Tariff switching will be based on the status of the DIs.
2) The following table illustrates the data structure for the TOU Switch Time. For example, 0x1003140C indicates a switch time of 12:00pm on March 20th, 2016. Writing 0xFFFFFFFF to this register disables the switching between TOU Schedule.

Byte 3	Byte 2	Byte 1	Byte 0
Year-2000 (0-37)	Month (1-12)	Day (1-31)	Hour (00-23)

Table 5-119 TOU Switch Time Format

5.10.22.2 Season Setup

The iMeter 8 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/Option, Default*
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 5-120 Season Setup

Notes:

1. **Start Date** for Season#1 is Jan. 1st and cannot be modified.
2. Setting a Season's **Start Date** as 0xFFFF terminates the TOU's Season settings. All subsequent Seasons' setup parameters will be ignored since the previous Season's duration is from its **Start Date** to the end of the year.
3. The **Start Date** of a particular Season must be later than the previous Season's.

5.10.22.3 Daily Profile Setup

The iMeter 8 has two sets of Daily Profile setup parameters, one for each TOU.

Register		Property	Description	Format
DP Set #1	DP Set #2			
50400~50423	50900~50923	RW	Daily Profile #1	See **Table 5-122**
50424~50447	50924~50947	RW	Daily Profile #2	
50448~50471	50948~50971	RW	Daily Profile #3	
50472~50495	50972~50995	RW	Daily Profile #4	
50496~50519	50996~51019	RW	Daily Profile #5	
50520~50543	51020~51043	RW	Daily Profile #6	
50544~50567	51044~51067	RW	Daily Profile #7	
50568~50591	51068~51091	RW	Daily Profile #8	
50592~50615	51092~50615	RW	Daily Profile #9	
50616~50639	51116~51139	RW	Daily Profile #10	
50640~50663	51140~51163	RW	Daily Profile #11	
50664~50687	51164~51187	RW	Daily Profile #12	
50688~50711	51188~51211	RW	Daily Profile #13	
50712~50735	51212~51235	RW	Daily Profile #14	
50736~50760	51236~51260	RW	Daily Profile #15	
50760~50783	51260~51283	RW	Daily Profile #16	
50784~50807	51284~51307	RW	Daily Profile #17	
50808~50831	51308~51331	RW	Daily Profile #18	
50832~50855	51332~51355	RW	Daily Profile #19	
50856~50879	51356~51379	RW	Daily Profile #20	

Table 5-121 Daily Profile#1 & #2 Setup

Offset	Property	Description		Format	Note
+0	RW	Period #1 Start Time		UINT16	0x0000
+1	RW	Period #1 Tariff		UINT16	0=T1, …, 7=T8
+2	RW	Period #2 Start Time	High-order Byte: Hour	UINT16	0 ≤ Hour < 24
			Low-order Byte: Min		Min=0, 15, 30, 45
+3	RW	Period #2 Tariff		UINT16	0=T1, …, 7=T8
+4	RW	Period #3 Start Time		UINT16	See Period #2 Start Time
+5	RW	Period #3 Tariff		UINT16	0=T1, …, 7=T8
+6	RW	Period #4 Start Time		UINT16	See Period #2 Start Time
+7	RW	Period #4 Tariff		UINT16	0=T1, …, 7=T8
+8	RW	Period #5 Start Time		UINT16	See Period #2 Start Time
+9	RW	Period #5 Tariff		UINT16	0=T1, …, 7=T8
+10	RW	Period #6 Start Time		UINT16	See Period #2 Start Time
+11	RW	Period #6 Tariff		UINT16	0=T1, …, 7=T8
+12	RW	Period #7 Start Time		UINT16	See Period #2 Start Time
+13	RW	Period #7 Tariff		UINT16	0=T1, …, 7=T8
+14	RW	Period #8 Start Time		UINT16	See Period #2 Start Time
+15	RW	Period #8 Tariff		UINT16	0=T1, …, 7=T8
+16	RW	Period #9 Start Time		UINT16	See Period #2 Start Time
+17	RW	Period #9 Tariff		UINT16	0=T1, …, 7=T8
+18	RW	Period #10 Start Time		UINT16	See Period #2 Start Time
+19	RW	Period #10 Tariff		UINT16	0=T1, …, 7=T8
+20	RW	Period #11 Start Time		UINT16	See Period #2 Start Time
+21	RW	Period #11 Tariff		UINT16	0=T1, …, 7=T8
+22	RW	Period #12 Start Time		UINT16	See Period #2 Start Time

+23	RW	Period #12 Tariff	UINT16	0=T1, …, 7=T8

Table 5-122 Daily Profile Data Structure Setup

Notes:

1. **Daily Profile #1's Period #1 Start Time** is always 00:00 and cannot be modified.
2. Setting a Period's **Start Time** as 0xFFFF terminates the Daily Profile's settings. All later Daily Profile' setup parameters will be ignored, and the previous Period's duration is from its **Start Time** to the end of the day.
3. The minimum interval of a period is 15 minutes.
4. The **Start Time** of a particular Period must be later than the previous Period's.

5.10.22.4 Alternate Days Setup

The Alternate Days has higher priority than the season, which means if one day is set as alternate day, then this day's rate distribution will according to Alternate Days schedule. The iMeter 8 has two sets of Alternate Days setup parameters, one for each TOU. The Base Addresses for the two sets are 51400 and 51700, respectively, where the Register Address = Base Address + Offset. For example, the register address for TOU #2's Alternative Day #2's Date is: 51700+3 = 51703.

Offset	Property	Description	Format	Note, Default*
0	RW	Alternate Day #1 Date[1]	UINT32	See Notes 1)
2	RW	Alternate Day #1 Daily Profile	UINT16	0* to 19
3	RW	Alternate Day #2 Date[1]	UINT32	See Notes 1)
5	RW	Alternate Day #2 Daily Profile	UINT16	0* to 19
6	RW	Alternate Day #3 Date[1]	UINT32	See Notes 1)
8	RW	Alternate Day #3 Daily Profile	UINT16	0* to 19
9	RW	Alternate Day #4 Date[1]	UINT32	See Notes 1)
11	RW	Alternate Day #4 Daily Profile	UINT16	0* to 19
12	RW	Alternate Day #5 Date[1]	UINT32	See Notes 1)
14	RW	Alternate Day #5 Daily Profile	UINT16	0* to 19
15	RW	Alternate Day #6 Date[1]	UINT32	See Notes 1)
17	RW	Alternate Day #6 Daily Profile	UINT16	0* to 19
18	RW	Alternate Day #7 Date[1]	UINT32	See Notes 1)
19	RW	Alternate Day #7 Daily Profile	UINT16	0* to 19
21	RW	Alternate Day #8 Date[1]	UINT32	See Notes 1)
22	RW	Alternate Day #8 Daily Profile	UINT16	0* to 19
24	RW	Alternate Day #9 Date[1]	UINT32	See Notes 1)
25	RW	Alternate Day #9 Daily Profile	UINT16	0* to 19
27	RW	Alternate Day #10 Date[1]	UINT32	See Notes 1)
29	RW	Alternate Day #10 Daily Profile	UINT16	0* to 19
…		…		
240	RW	Alternate Day #81 Date[1]	UINT32	See Notes 1)
242	RW	Alternate Day #81 Daily Profile	UINT16	0* to 19
243	RW	Alternate Day #82 Date[1]	UINT32	See Notes 1)
245	RW	Alternate Day #82 Daily Profile	UINT16	0* to 19
246	RW	Alternate Day #83 Date[1]	UINT32	See Notes 1)
248	RW	Alternate Day #83 Daily Profile	UINT16	0* to 19
249	RW	Alternate Day #84 Date[1]	UINT32	See Notes 1)
251	RW	Alternate Day #84 Daily Profile	UINT16	0* to 19
252	RW	Alternate Day #85 Date[1]	UINT32	See Notes 1)
254	RW	Alternate Day #85 Daily Profile	UINT16	0* to 19
255	RW	Alternate Day #86 Date[1]	UINT32	See Notes 1)
256	RW	Alternate Day #86 Daily Profile	UINT16	0* to 19
258	RW	Alternate Day #87 Date[1]	UINT32	See Notes 1)
260	RW	Alternate Day #87 Daily Profile	UINT16	0* to 19
261	RW	Alternate Day #88 Date[1]	UINT32	See Notes 1)
263	RW	Alternate Day #88 Daily Profile	UINT16	0* to 19
264	RW	Alternate Day #89 Date[1]	UINT32	See Notes 1)
266	RW	Alternate Day #89 Daily Profile	UINT16	0* to 19
267	RW	Alternate Day #90 Date[1]	UINT32	See Notes 1)
269	RW	Alternate Day #90 Daily Profile	UINT16	0* to 19

Table 5-123 Alternate Days Setup

Notes:

1) The following table illustrates the data structure of the Date register:

Byte 3	Byte 2	Byte 1	Byte 0
Reserved	Year-2000 (0-37)	Month (1-12)	Day (1-31)

Table 5-124 Date Format

When the Year and/or Month are set as **0xFF**, it means the Alternate Day is repetitive by year and/or month, i.e. the same day of every year or every month is an Alternate Day.

5.11 Web Host Setup

The Web Host Setup parameters are available in the in the Firmware V2.51.52 or later.

Register	Property	Description	Format	Range/Option, Default*
40565	RW	Web Host Verification	UINT16	0=Disabled*, 1=Enabled
40566~40581	RW	Web Host White List 1	Char	See Note 1)
40582~40597	RW	Web Host White List 2	Char	See Note 1)

Table 5-125 Web Host Setup

Notes:

1) Support the following characters: uppercase letters, lowercase letters, number 0 to 9, underscore '_', hyphen '-', dot '.', '[]', and colon ':'.
The **Web Host White List** statement is up to 32 characters long and should be ended with '\0', if there is no terminator, all contents of the register are considered valid values.

5.12 File Transfer Register

To read the waveform files in COMTRADE format (cfg., dat. and hdr. files) via Modbus connection, please execute the following operations.

1. Initiate Modbus connection to the device.
2. Read the specific Log Pointer register (Address 0141 for WFR, 0143 for RMSR, 0145 for DWR) and confirm that there is at least one record available.
3. File Buffer Refresh: Abbreviated Filename Specification

   To refresh the file buffer (register 59505-59626), write the abbreviated filename of the file into register 59400 to 59499. Each byte in these registers (59400-59499) represents a single character of the filename.

   The filename consists of three components:

   a. **Recorder type**: Indicates the type of recorder (i.e., **WFR** for Waveform Recorder, **DWR** for Disturbance Recorder, **RMSR** for RMS Recorder).

   b. **Logging Index**: A numerical value representing the specific log file.

   c. **File Extension**: Specified the file type (i.e., cfg., dat., hdr.).

   The device stores the most recent 128 WFR logs in its non-volatile memory based on a First-in-first-out principle. The valid range for the **Logging Index** is determined by the current value of the **Log Pointer**. Specifically, the valid index range is:

   (Logging Pointer Value - 128) +1 to **Logging Pointer Value**.

   Example:
   If the value of register 0141 (WFR Log Pointer) is 1000, the available WFR files range from **WFR_873.cfg** to **WFR_1000.cfg**.

   Termination:
   The filename must be terminated with a null character (**\0** or **0x00**) to indicate the end of the string.

   For Example:
   [Slave]: 57 46 52 5F 30 30 31 2E 64 61 74 00 00

Register	Value
59400	0x5746
59401	0x525F
59402	0x3030
59403	0x312E
59404	0x6461
59405	0x7400
59406-59499	0x0000

   The slave sends the above request to retrieve the "WFR_001.dat" file.

If the file does not exist or fails to open, the device will respond with exception code 0x03.

4. If the request is accepted by the master, read the value of register 59500 to retrieve the total number of bytes in the requested COMTRADE file. If the number of bytes is larger than 244, it will take several transactions to read the integrated file.

5. There are two methods to read the file: Auto and Manual.
   a. Auto: When the offset (59502) is read alongside the data buffer (59505-59626), the device automatically adjusts the file offset and updates the data buffer continually. This process continues until the file offset equals the total number of bytes in the COMTRADE file, or until the valid bytes in the current file frame reach 0, indicating that the file transfer is complete.

   b. Manual: If the user needs to read the file starting from a specific offset, write the desired offset into register 59502 to update the subsequent data buffer. If no offset is specified, the reading will begin from the start of the file. Repeat this process by manually increasing the offset to obtain the updated data buffer until either the valid bytes equal 0 or the offset equals the file size. Writing an invalid offset will result in an exception code 0x03.

6. Writing the filename in any state will restart a new reading process.

Register	Property	Description	Format	Notes
59400-59499	RW	Filename	CHAR	
59500	RO	No. of bytes in COMTRADE file	UINT32	
59502	RW	Offset in COMTRADE file	UINT32	
59504	RO	Valid Bytes	UINT16	
59505-59626	RO	Data Buffer	CHAR	Max. number of bytes transferred each time is 244.

Table 5-126 Read COMTRADE File Registers

Notes:

1. If the Modbus TCP connection is interrupted during file transfer due to network issues (for example, connection timeout, sever/client closing the connection, etc.) and is subsequently restored, the data buffer will be filled with an invalid value (0xFF). In this case, the file retrieval request must be resent. To optimize the process, it is recommended to manually resume reading the file from the point of interruption by specifying the appropriate offset (register 59502).
2. If the **Valid Bytes** register returns an invalid value (0xFFFFFFFF), restart the file reading process.

5.13 Control Setup

5.13.1 Alarm/DO Control

The Alarm/DO Control registers are implemented as both “Write-Only” Modbus Coil Registers (0XXXXX) and Modbus Holding Registers (4XXXXX), which can be controlled with the Force Single Coil command (Function Code 0x05) or the Preset Multiple Hold Registers (Function Code 0x10). The iMeter 8 does not support the Read Coils command (Function Code 0x01) because Alarm/DO Control registers are “Write-Only”. The DO Status register 0310 should be read instead to determine the current DO status.

The iMeter 8 adopts the ARM before EXECUTE operation for the remote control of its Digital Outputs if this function is enabled through the **Arm Before Execute Enable** Setup register (40301), which is enabled by default. Before executing an OPEN or CLOSE command on a Relay Output, it must be “Armed” first. This is achieved by writing the value 0xFF00 to the appropriate register to “Arm” a particular DO operation. The DO will be “Disarmed” automatically if an “Execute” command is not received within 15 seconds after it has been “Armed”. If an “Execute” command is received without first having received an “Arm” command, the meter ignores the “Execute” command and returns the 0x04 exception code.

Register	Property	Description	Format	Note
9100	WO	Arm Alarm Close	UINT16	Writing “0xFF00”
9101	WO	Execute Alarm Close	UINT16	
9102	WO	Arm Alarm Open	UINT16	
9103	WO	Execute Alarm Open	UINT16	
9104	WO	Arm DO1 Close	UINT16	
9105	WO	Execute DO1 Close	UINT16	
9106	WO	Arm DO1 Open	UINT16	
9107	WO	Execute DO1 Open	UINT16	
9108	WO	Arm DO2 Close	UINT16	
9109	WO	Execute DO2 Close	UINT16	

9110	WO	Arm DO2 Open	UINT16	
9111	WO	Execute DO2 Open	UINT16	
9112	WO	Arm DO3 Close	UINT16	
9113	WO	Execute DO3 Close	UINT16	
9114	WO	Arm DO3 Open	UINT16	
9115	WO	Execute DO3 Open	UINT16	
9116	WO	Arm DO4 Close	UINT16	
9117	WO	Execute DO4 Close	UINT16	
9118	WO	Arm DO4 Open	UINT16	
9119	WO	Execute DO4 Open	UINT16	
9120	WO	Arm DO5 Close	UINT16	
9121	WO	Execute DO5 Close	UINT16	
9122	WO	Arm DO5 Open	UINT16	
9123	WO	Execute DO5 Open	UINT16	
9124	WO	Arm DO6 Close	UINT16	
9125	WO	Execute DO6 Close	UINT16	
9126	WO	Arm DO6 Open	UINT16	
9127	WO	Execute DO6 Open	UINT16	
9128	WO	Arm DO7 Close	UINT16	
9129	WO	Execute DO7 Close	UINT16	
9130	WO	Arm DO7 Open	UINT16	
9131	WO	Execute DO7 Open	UINT16	

Table 5-127 DO Control

5.13.2 Clear/Reset Control

Register	Property	Description	Format	Note
9200	WO	Send Test Email[1]	UINT16	Writing "0xFF00" to the register to execute the described action.
9201	WO	Clear DI1 Counter	UINT16	
9202	WO	Clear DI2 Counter	UINT16	
9203	WO	Clear DI3 Counter	UINT16	
9204	WO	Clear DI4 Counter	UINT16	
9205	WO	Clear DI5 Counter	UINT16	
9206	WO	Clear DI6 Counter	UINT16	
9207	WO	Clear DI7 Counter	UINT16	
9208	WO	Clear DI8 Counter	UINT16	
9209	WO	Clear DI9 Counter[2]	UINT16	
9210	WO	Clear DI10 Counter[2]	UINT16	
9211	WO	Clear DI11 Counter[2]	UINT16	
9212	WO	Clear DI12 Counter[2]	UINT16	
9213	WO	Clear DI13 Counter[2]	UINT16	
9214	WO	Clear DI14 Counter[2]	UINT16	
9215	WO	Clear DI15 Counter[2]	UINT16	
9216	WO	Clear DI16 Counter[2]	UINT16	
9217	WO	Clear All DI Counters	UINT16	
9218	WO	Disable DO Operate/Release by Front Panel (Reset All DOs to Normal)	UINT16	
9219	WO	Reserved	UINT16	
9220~9221	WO	Reserved		
9222	WO	Clear Device Self-diagnosis Event	UINT16	
9223	WO	Manually trigger iTrigger 1	UINT16	
9224	WO	Manually trigger iTrigger 2	UINT16	
9225	WO	Manually trigger iTrigger 3	UINT16	
9226	WO	Setpoint LED Reset	UINT16	
9250~9252	WO	Reserved	UINT16	
9253	WO	Manual Trigger WFR	UINT16	
9254	WO	Manual Trigger RMSR	UINT16	
9255	WO	Manual Trigger DWR	UINT16	
9256	WO	Manual Freeze TOU Log	UINT16	
9257	WO	Manual Trigger TOU Recording	UINT16	
9258	WO	Manual Switch TOU Schedules	UINT16	
9259~9260	WO	Reserved	UINT16	
9261	WO	Clear Device Log	UINT16	
9262	WO	Clear SOE Log	UINT16	
9263	WO	Clear Energy Registers[3]	UINT16	
9264	WO	Clear IER	UINT16	
9265	WO	Clear AER	UINT16	
9266~9274	WO	Reserved	UINT16	

9275	WO	Clear Plt Log	UINT16	
9276	WO	Clear Pst Log	UINT16	
9277	WO	Clear WFR	UINT16	
9278	WO	Clear DWR	UINT16	
9279~9281	WO	Reserved	UINT16	
9282	WO	Clear All MM Log[4]	UINT16	
9283	WO	Clear Max. Log#1[5]	UINT16	
9284	WO	Clear Max. Log#2[5]	UINT16	
9285	WO	Clear Max. Log#3[5]	UINT16	
9286	WO	Clear Max. Log#4[5]	UINT16	
9287	WO	Reset IL	UINT16	
9288	WO	Clear Min. Log#1[5]	UINT16	
9289	WO	Clear Min. Log#2[5]	UINT16	
9290	WO	Clear Min. Log#3[5]	UINT16	
9291	WO	Clear Min. Log#4[5]	UINT16	
9292	WO	Clear IEEE Std 519 Report	UINT16	
9293	WO	Clear All Demand[6]	UINT16	
9294	WO	Clear This Max. Demand Log[7]	UINT16	
9295	WO	Clear EN 50160 Log	UINT16	
9296	WO	Reserved	UINT16	
9297	WO	Clear SDR Log #1	UINT16	
9298	WO	Clear SDR Log #2	UINT16	
9299	WO	Clear SDR Log #3	UINT16	
9300	WO	Clear SDR Log #4	UINT16	
9301	WO	Clear SDR Log #5	UINT16	
9302	WO	Clear SDR Log #6	UINT16	
9303	WO	Clear SDR Log #7	UINT16	
9304	WO	Clear SDR Log #8	UINT16	
9305	WO	Clear SDR Log #9	UINT16	
9306	WO	Clear SDR Log #10	UINT16	
9307	WO	Clear SDR Log #11	UINT16	
9308	WO	Clear SDR Log #12	UINT16	
9309	WO	Clear SDR Log #13	UINT16	
9310	WO	Clear SDR Log #14	UINT16	
9311	WO	Clear SDR Log #15	UINT16	
9312	WO	Clear SDR Log #16	UINT16	
9313	WO	Clear All SDR Logs	UINT16	
9314	WO	Clear DR Log #1	UINT16	
9315	WO	Clear DR Log #2	UINT16	
9316	WO	Clear DR Log #3	UINT16	
9317	WO	Clear DR Log #4	UINT16	
9318	WO	Clear DR Log #5	UINT16	
9319	WO	Clear DR Log #6	UINT16	
9320	WO	Clear DR Log #7	UINT16	
9321	WO	Clear DR Log #8	UINT16	
9322	WO	Clear All DR Logs	UINT16	
9323~9331	WO	Reserved	UINT16	
9332	WO	Clear Dip Counter	UINT16	
9333	WO	Clear Swell Counter	UINT16	
9334	WO	Clear Interruption Counter	UINT16	
9335	WO	Clear Transient Counter	UINT16	
9336	WO	Clear RVC Counter	UINT16	
9337	WO	Clear Inrush Current Counter	UINT16	
9338	WO	Reserved	UINT16	
9339	WO	Clear MSV#1 Counter	UINT16	
9340	WO	Clear MSV#2 Counter	UINT16	
9341	WO	Clear MSV#3 Counter	UINT16	
9342	WO	Clear All PQ Counter	UINT16	
9343	WO	Clear All TOU Data	UINT16	
9344	WO	Trigger Demo Swell Event	UINT16	
9345	WO	Trigger Demo Dip Event	UINT16	
9346	WO	Trigger Demo Interruption Event	UINT16	
9347	WO	Trigger Demo Transient Event	UINT16	
9348	WO	Trigger Demo Inrush Current Event	UINT16	
9349	WO	Trigger Demo RVC Event	UINT16	
9350	WO	Trigger Demo Motor Start Event	UINT16	
9351	WO	Clear RMSR Log	UINT16	

9352	WO	Clear All Events	UINT16	
9353~9354	WO	Reserved	UINT16	
9355	WO	Clear 2K-150kHz C.E. Records	UINT16	
9356	WO	Clear Frequency Deviation Records	UINT16	

Table 5-128 Clear/Reset Control Register

Notes:

1) The **Send Test Email** register can verify if the SMTP functions normally providing the SMTP configurations are correct.
2) Clear DI9 to DI16 registers are valid only when the iMeter 8 is equipped with corresponding options.
3) Writing 0xFF00 to the **Clear Energy Register** will clear all INT32, INT64 Energy and Harmonic Energy measurements.
4) Writing 0xFF00 to the **Clear All MM Log** register will clear all Max./Min. Logs (Max Demand Logs are excluded).
5) Writing 0xFF00 to the **Clear Max./Min. Log #X** register to clear the Max./Min. log of This Month (Since Last Reset) when the **Self-Read Time** register is set for automatic Self-Read operation. The Max./Min. log of Last Month will not be cleared. If the **Self-Read Time** register is set for manual operation with a register value of 0xFFFF, the Max./Min. log of This Month (Since Last Reset) will be transferred to the Max./Min. log of Last Month (Before Last Reset) and then cleared.
6) Writing 0xFF00 to the **Clear All Demand** register to clear the Present/Predicated Demand, as well as This/Last Max. Demand.
7) Writing 0xFF00 to the **Clear This Max. Demand Log** register to clear Max. Demand Log of This Month (Since Last Reset) when the **Self-Read Time** register is set for automatic Self-Read operation. The Max. Demand of Last Month will not be cleared. If the **Self-Read Time** register is set for manual operation with a register value of 0xFFFF, the Max. Demand of This Month (Since Last Reset) will be transferred to the Max. Demand of Last Month (Before Last Reset) and then be cleared.

5.14 Time Registers

There are two sets of Time registers supported by the iMeter 8 - 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 iMeter 8 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		Property	Description	Format	Note
60000	9000	RW	High-order Byte: Year	UINT16	0-37 (Year-2000)
			Low-order Byte: Month		1 to 12
60001	9001	RW	High-order Byte: Day	UINT16	1 to 31
			Low-order Byte: Hour		0 to 23
60002	9002	RW	High-order Byte: Minute	UINT16	0 to 59
			Low-order Byte: Second		0 to 59
60003	9003	RW	Millisecond	UINT16	0 to 999
60004 ~ 60005	9004 ~ 9005	RW	UNIX Time	UINT32	0x386D4380 to 0x7FE8177F The corresponding time is 2000.01.01 00:00:00 to 2037.12.31 23:59:59 (GMT 0:00 Time Zone)
60006	9006	RO	Time Sync. Symbol	UINT16	0=Unsync., 1=Sync.

Table 5-129 Time Registers

5.15 Information

5.15.1 Meter Information

Register		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 0x0000 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	Firmware Date: Year-2000	UINT16	e.g. 130709 means July 9, 2013
60225	9825	RO	Firmware Date: Month	UINT16	
60226	9826	RO	Firmware Date: Day	UINT16	
60227	9827	RO	Serial 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	PPC Diagnostics Info.	UINT32	Bit0: System Parameters Error Bit1: Secret Parameters Error Bit2: DSP Error Bit3: Memory Configuration Error
60237	9837	RO	DSP Diagnostics Info.	UINT32	Bit0: AD Error
60239	9839	RO	Reserved	UINT32	
60241	9841	RO	Reserved	UINT32	
60243	9843	RO	MAC 1 Address-01	UINT16	0x00A0
60244	9844	RO	MAC 1 Address-23	UINT16	0x1EA0
60245	9845	RO	MAC 1 Address-45	UINT16	0xAAA0
60246	9846	RO	MAC 2 Address-01	UINT16	0x00A0
60247	9847	RO	MAC 2 Address-23	UINT16	0x1EA1
60248	9848	RO	MAC 2 Address-45	UINT16	0xAAA0
60249	9849	RO	Memory Capacity	UINT16	Units: MB
60250	9850	RO	Remaining Memory	UINT16	Units: MB

Table 5-130 Meter Information

Notes:

1) The **Meter Model** appears in registers 60200 to 60219 and contains the ASCII encoding of the string "iMeter 8-A5925ANAAE" as shown in the following table.

Register		Value(Hex)	ANSCII
60200	9800	0x69	i
60201	9801	0x4D	M
60202	9802	0x65	e
60203	9803	0x74	t
60204	9804	0x65	e
60205	9805	0x72	r
60206	9806	0x20	Null
60207	9807	0x38	8
60208	9808	0x2D	-
60209	9809	0x41	A
60210	9810	0x35	5
60211	9811	0x39	9
60212	9812	0x32	2
60213	9813	0x35	5
60214	9814	0x41	A
60215	9815	0x4E	N
60216	9816	0x41	A
60217	9817	0x41	A
60218	9818	0x45	E
60219	9819	0x20	Null

Table 5-131 ASCII Encoding of "iMeter 8-A5925ANAAE"

2) The iMeter 8 provides the following feature code:

Bit	Description	Value	Meaning	Option Code
Bit 29/28	Basic Feature	00	IEC 61000-4-30 Ed. 3.1 Class A Compliant	A
		01	IEC 61000-4-30 Ed. 3.1 Class A Compliant with 2-150kHz C.E. Measurement	B
Bit 3/2	Input Current	00	5A	5
		01	1A	1
		10	SCCP Option for use with CT Clamps	SCCPA
Bit 5/4	Input Voltage	10	400VLN/690VLL + 20%	9
Bit 6	Power Supply	0	95-250VAC/DC ± 10%, 47-440Hz	2
		1	20-60VDC	3
Bit 8/7	System Frequency	00	50Hz	5
		01	60Hz	6
Bit 10/9	I/O	00	8xDI + 4xDO + 4xSS Pulse Outputs	A
		01	8xDI + 4xDO + 2xAI + 1xAO + 4xSS Pulse Outputs	B

		10	16xDI + 8xDO + 4xSS Pulse Outputs	C
		11	8xDI + 4xDO + 2xAI + 2xAO + 2xSS Pulse Outputs	D
Bit 12/11	DI Excitation	00	Dry Contact (@24VDC Self-Excitation)	N
		01	110V AC/DC External Excitation	1
		10	220V AC/DC External Excitation	2
Bit 14/13	Communications	00	2x10BASE-T/100BASE-TX + 2xRS-485	A
Bit 16/15	GPS	00	GPS, IRIG-B	A
Bit 17	Language	0	English	E
		1	Chinese	C
Bit 30	Model	1	iMeter 8	N/A
Others	Reserved			

Table 5-132 Feature Code

5.15.2 Device Tag Information

Register	Property	Description	Format	Default
40600	RW	Substation Information Tag 1[1]	Char	DevTag 0
40630	RW	Substation Information Tag 2	Char	DevTag 1
40660	RW	Substation Information Tag 3	Char	DevTag 2
40690	RW	Substation Information Tag 4	Char	DevTag 3
40720	RW	Substation Information Tag 5	Char	DevTag 4

Table 5-133 Device Tag Information

Notes:

1) However, the iMeter 8's Front Panel Interface supports the display of up to 39 characters only.

5.15.3 Circuit Tag Information

Register	Property	Description	Format	Note	Default
52000	RW	Site Information Tag 1	Char	16 characters	circuitTag 0
52008	RW	Site Information Tag 2	Char		circuitTag 1
52038	RW	Site Information Tag 3	Char		circuitTag 2
52068	RW	Reserved	Char		
52098	RW	Site Information Tag 4	Char	16 characters	circuitTag 3
52128	RW	Site Information Tag 5	Char		circuitTag 4
52158	RW	Site Information Tag 6	Char		circuitTag 5
52188	RW	Site Information Tag 7	Char		circuitTag 6
52218~52278	RW	Reserved	Char		
52308	RW	Comtrade Tag	Char	60 characters	

Table 5-134 Circuit Tag Information

Appendix A - Source Parameters for DR, SDR and Max./Min. Recorder

Real-Time Parameters Data ID

Key ID				Parameters	Key ID				Parameters
50-cycle	150-cycle	10-min	2-hour		50-cycle	150-cycle	10-min	2-hour	
1	10001	20001	30001	FREQ	1723	11723	21723	31723	∑kW H02
2	10002	20002	30002	Ua	1724	11724	21724	31724	∑kvar H02
3	10003	20003	30003	Ub	1725	11725	21725	31725	∑kVA H02
4	10004	20004	30004	Uc	1726	11726	21726	31726	PF Avg. 02
5	10005	20005	30005	U4	1727	11727	21727	31727	∑kW H03
6	10006	20006	30006	ULN Avg.	1728	11728	21728	31728	∑kvar H03
7	10007	20007	30007	Uab	1729	11729	21729	31729	∑kVA H03
8	10008	20008	30008	Ubc	1730	11730	21730	31730	PF Avg. H03
9	10009	20009	30009	Uca	...	...	...	...	...
10	10010	20010	30010	ULL Avg.	1963	11963	21963	31963	∑kW H62
11	10011	20011	30011	Ia	1964	11964	21964	31964	∑kvar H62
12	10012	20012	30012	Ib	1965	11965	21965	31965	∑kVA H62
13	10013	20013	30013	Ic	1966	11966	21966	31966	PF Avg. H62
14	10014	20014	30014	I4	1967	11967	21967	31967	∑kW H63
15	10015	20015	30015	I5	1968	11968	21968	31968	∑kvar H63
16	10016	20016	30016	I Avg.	1969	11969	21969	31969	∑kVA H63
17	10017	20017	30017	∑kWa	1970	11970	21970	31970	PF Avg. H63
18	10018	20018	30018	∑kWb	1971	11971	21971	31971	∑kWa Fund.
19	10019	20019	30019	∑kWc	1972	11972	21972	31972	∑kWb Fund.
20	10020	20020	30020	∑kW	1973	11973	21973	31973	∑kWc Fund.
21	10021	20021	30021	∑kvara	1974	11974	21974	31974	∑kvara Fund.
22	10022	20022	30022	∑kvarb	1975	11975	21975	31975	∑kvarb Fund.
23	10023	20023	30023	∑kvarc	1976	11976	21976	31976	∑kvarc Fund.
24	10024	20024	30024	∑kvar	1977	11977	21977	31977	∑kVAa Fund.
25	10025	20025	30025	∑kVAa	1978	11978	21978	31978	∑kVAb Fund.
26	10026	20026	30026	∑kVAb	1979	11979	21979	31979	∑kVAc Fund.
27	10027	20027	30027	∑kVAc	1980	11980	21980	31980	dPFa
28	10028	20028	30028	∑kVA	1981	11981	21981	31981	dPFb
29	10029	20029	30029	PFa	1982	11982	21982	31982	dPFc
30	10030	20030	30030	PFb	1983	11983	21983	31983	∑kWa H02
31	10031	20031	30031	PFc	1984	11984	21984	31984	∑kWb H02
32	10032	20032	30032	PF Avg.	1985	11985	21985	31985	∑kWc H02
33	10033	20033	30033	Ua Dev.	1986	11986	21986	31986	∑kvara H02
34	10034	20034	30034	Ub Dev.	1987	11987	21987	31987	∑kvarb H02
35	10035	20035	30035	Uc Dev.	1988	11988	21988	31988	∑kvarc H02
36	10036	20036	30036	Uab Dev.	1989	11989	21989	31989	∑kVAa H02
37	10037	20037	30037	Ubc Dev.	1990	11990	21990	31990	∑kVAb H02
38	10038	20038	30038	Uca Dev.	1991	11991	21991	31991	∑kVAc H02
39	10039	20039	30039	Ua Over Dev.	1992	11992	21992	31992	PFa H02
40	10040	20040	30040	Ub Over Dev.	1993	11993	21993	31993	PFb H02
41	10041	20041	30041	Uc Over Dev.	1994	11994	21994	31994	PFc H02
42	10042	20042	30042	Uab Over Dev.	...	...	...	...	...
43	10043	20043	30043	Ubc Over Dev.	2715	12715	22715	32715	∑kWa H63
44	10044	20044	30044	Uca Over Dev.	2716	12716	22716	32716	∑kWb H63
45	10045	20045	30045	Ua Under Dev.	2717	12717	22717	32717	∑kWc H63
46	10046	20046	30046	Ub Under Dev.	2718	12718	22718	32718	∑kvara H63
47	10047	20047	30047	Uc Under Dev.	2719	12719	22719	32719	∑kvarb H63
48	10048	20048	30048	Uab Under Dev.	2720	12720	22720	32720	∑kvarc H63
49	10049	20049	30049	Ubc Under Dev.	2721	12721	22721	32721	∑kVAa H63
50	10050	20050	30050	Uca Under Dev.	2722	12722	22722	32722	∑kVAb H63
51	10051	20051	30051	Freq. Dev.	2723	12723	22723	32723	∑kVAc H63
52	10052	20052	30052	Reserved	2724	12724	22724	32724	PFa H63
53	10053	20053	30053	Reserved	2725	12725	22725	32725	PFb H63
54	10054	20054	30054	Reserved	2726	12726	22726	32726	PFc H63
55	10055	20055	30055	U0 Unb.	2727	12727	22727	32727	Ua TIHD
56	10056	20056	30056	U2 Unb.	2728	12728	22728	32728	Ub TIHD
57	10057	20057	30057	I0 Unb.	2729	12729	22729	32729	Uc TIHD
58	10058	20058	30058	I2 Unb.	2730	12730	22730	32730	U4 TIHD
59	10059	20059	30059	U0	2731	12731	22731	32731	Ua TOIHD
60	10060	20060	30060	U2	2732	12732	22732	32732	Ub TOIHD
61	10061	20061	30061	U1	2733	12733	22733	32733	Uc TOIHD

62	10062	20062	30062	I0	2734	12734	22734	32734	U4 TOIHD
63	10063	20063	30063	I2	2735	12735	22735	32735	Ua TEIHD
64	10064	20064	30064	I1	2736	12736	22736	32736	Ub TEIHD
65	10065	20065	30065	Ia TDD	2737	12737	22737	32737	Uc TEIHD
66	10066	20066	30066	Ib TDD	2738	12738	22738	32738	U4 TEIHD
67	10067	20067	30067	Ic TDD	2739	12739	22739	32739	Ia TIHD
68	10068	20068	30068	I4 TDD	2740	12740	22740	32740	Ib TIHD
69	10069	20069	30069	Reserved	2741	12741	22741	32741	Ic TIHD
70	10070	20070	30070	Ia TDD Odd	2742	12742	22742	32742	I4 TIHD
71	10071	20071	30071	Ib TDD Odd	2743	12743	22743	32743	Reserved
72	10072	20072	30072	Ic TDD Odd	2744	12744	22744	32744	Ia TOIHD
73	10073	20073	30073	I4 TDD Odd	2745	12745	22745	32745	Ib TOIHD
74	10074	20074	30074	Reserved	2746	12746	22746	32746	Ic TOIHD
75	10075	20075	30075	Ia TDD Even	2747	12747	22747	32747	I4 TOIHD
76	10076	20076	30076	Ib TDD Even	2748	12748	22748	32748	Reserved
77	10077	20077	30077	Ic TDD Even	2749	12749	22749	32749	Ia TEIHD
78	10078	20078	30078	I4 TDD Even	2750	12750	22750	32750	Ib TEIHD
79	10079	20079	30079	Reserved	2751	12751	22751	32751	Ic TEIHD
80	10080	20080	30080	Ia K-Factor	2752	12752	22752	32752	I4 TEIHD
81	10081	20081	30081	Ib K-Factor	2753	12753	22753	32753	Reserved
82	10082	20082	30082	Ic K-Factor	2754	12754	22754	32754	Ua IHD00
83	10083	20083	30083	I4 K-Factor	2755	12755	22755	32755	Ub IHD00
84	10084	20084	30084	Reserved	2756	12756	22756	32756	Uc IHD00
85	10085	20085	30085	Ia Crest Factor	2757	12757	22757	32757	U4 IHD00
86	10086	20086	30086	Ib Crest Factor	2758	12758	22758	32758	Ua IHD01
87	10087	20087	30087	Ic Crest Factor	2759	12759	22759	32759	Ub IHD01
88	10088	20088	30088	I4 Crest Factor	2760	12760	22760	32760	Uc IHD01
89	10089	20089	30089	Reserved	2761	12761	22761	32761	U4 IHD01
90	10090	20090	30090	Ua Crest Factor	…	…	…	…	…
91	10091	20091	30091	Ub Crest Factor	3006	13006	23006	33006	Ua IHD63
92	10092	20092	30092	Uc Crest Factor	3007	13007	23007	33007	Ub IHD63
93	10093	20093	30093	U4 Crest Factor	3008	13008	23008	33008	Uc IHD63
94	10094	20094	30094	Ua MSV #1	3009	13009	23009	33009	U4 IHD63
95	10095	20095	30095	Ub MSV #1	3010	13010	23010	33010	Ia IHD00
96	10096	20096	30096	Uc MSV #1	3011	13011	23011	33011	Ib IHD00
97	10097	20097	30097	Ua MSV #2	3012	13012	23012	33012	Ic IHD00
98	10098	20098	30098	Ub MSV #2	3013	13013	23013	33013	I4 IHD00
99	10099	20099	30099	Uc MSV #2	3014	13014	23014	33014	Reserved
100	10100	20100	30100	Ua MSV #3	3015	13015	23015	33015	Ia IHD01
101	10101	20101	30101	Ub MSV #3	3016	13016	23016	33016	Ib IHD01
102	10102	20102	30102	Uc MSV #3	3017	13017	23017	33017	Ic IHD01
103	10103	20103	30103	Ua THD	3018	13018	23018	33018	I4 IHD01
104	10104	20104	30104	Ub THD	3019	13019	23019	33019	Reserved
105	10105	20105	30105	Uc THD	…	…	…	…	…
106	10106	20106	30106	U4 THD	3325	13325	23325	33325	Ia IHD63
107	10107	20107	30107	Ua TOHD	3326	13326	23326	33326	Ib IHD63
108	10108	20108	30108	Ub TOHD	3327	13327	23327	33327	Ic IHD63
109	10109	20109	30109	Uc TOHD	3328	13328	23328	33328	I4 IHD63
110	10110	20110	30110	U4 TOHD	3329	13329	23329	33329	Reserved
111	10111	20111	30111	Ua TEHD	3330	13330	23330	33330	Ua TIH RMS
112	10112	20112	30112	Ub TEHD	3331	13331	23331	33331	Ub TIH RMS
113	10113	20113	30113	Uc TEHD	3332	13332	23332	33332	Uc TIH RMS
114	10114	20114	30114	U4 TEHD	3333	13333	23333	33333	U4 TIH RMS
115	10115	20115	30115	Ia THD	3334	13334	23334	33334	Ua TOIH RMS
116	10116	20116	30116	Ib THD	3335	13335	23335	33335	Ub TOIH RMS
117	10117	20117	30117	Ic THD	3336	13336	23336	33336	Uc TOIH RMS
118	10118	20118	30118	I4 THD	3337	13337	23337	33337	U4 TOIH RMS
119	10119	20119	30119	Reserved	3338	13338	23338	33338	Ua TEIH RMS
120	10120	20120	30120	Ia TOHD	3339	13339	23339	33339	Ub TEIH RMS
121	10121	20121	30121	Ib TOHD	3340	13340	23340	33340	Uc TEIH RMS
122	10122	20122	30122	Ic TOHD	3341	13341	23341	33341	U4 TEIH RMS
123	10123	20123	30123	I4 TOHD	3342	13342	23342	33342	Ia TIH RMS
124	10124	20124	30124	Reserved	3343	13343	23343	33343	Ib TIH RMS
125	10125	20125	30125	Ia TEHD	3344	13344	23344	33344	Ic TIH RMS
126	10126	20126	30126	Ib TEHD	3345	13345	23345	33345	I4 TIH RMS
127	10127	20127	30127	Ic TEHD	3346	13346	23346	33346	Reserved
128	10128	20128	30128	I4 TEHD	3347	13347	23347	33347	Ia TOIH RMS

129	10129	20129	30129	Reserved	3348	13348	23348	33348	Ib TOIH RMS
130	10130	20130	30130	Uab Fund.	3349	13349	23349	33349	Ic TOIH RMS
131	10131	20131	30131	Ubc Fund.	3350	13350	23350	33350	I4 TOIH RMS
132	10132	20132	30132	Uca Fund.	3351	13351	23351	33351	Reserved
133	10133	20133	30133	Reserved	3352	13352	23352	33352	Ia TEIH RMS
134	10134	20134	30134	Reserved	3353	13353	23353	33353	Ib TEIH RMS
135	10135	20135	30135	Reserved	3354	13354	23354	33354	Ic TEIH RMS
…	…	…	…		3355	13355	23355	33355	I4 TEIH RMS
500	10500	20500	30500	Ua HD00	3356	13356	23356	33356	Reserved
501	10501	20501	30501	Ub HD00	3357	13357	23357	33357	Ua IH00 RMS
502	10502	20502	30502	Uc HD00	3358	13358	23358	33358	Ub IH00 RMS
503	10503	20503	30503	U4 HD00	3359	13359	23359	33359	Uc IH00 RMS
504	10504	20504	30504	Ua HD01	3360	13360	23360	33360	U4 IH00 RMS
505	10505	20505	30505	Ub HD01	3361	13361	23361	33361	Ua IH01 RMS
506	10506	20506	30506	Uc HD01	3362	13362	23362	33362	Ub IH01 RMS
507	10507	20507	30507	U4 HD01	3363	13363	23363	33363	Uc IH01 RMS
…	…	…	…	…	3364	13364	23364	33364	U4 IH01 RMS
748	10748	20748	30748	Ua HD62	…	…	…	…	…
749	10749	20749	30749	Ub HD62	3609	13609	23609	33609	Ua IH63 RMS
750	10750	20750	30750	Uc HD62	3610	13610	23610	33610	Ub IH63 RMS
751	10751	20751	30751	U4 HD62	3611	13611	23611	33611	Uc IH63 RMS
752	10752	20752	30752	Ua HD63	3612	13612	23612	33612	U4 IH63 RMS
753	10753	20753	30753	Ub HD63	3613	13613	23613	33613	Ia IH00 RMS
754	10754	20754	30754	Uc HD63	3614	13614	23614	33614	Ib IH00 RMS
755	10755	20755	30755	U4 HD63	3615	13615	23615	33615	Ic IH00 RMS
756	10756	20756	30756	Ia HD00	3616	13616	23616	33616	I4 IH00 RMS
757	10757	20757	30757	Ib HD00	3617	13617	23617	33617	Reserved
758	10758	20758	30758	Ic HD00	3618	13618	23618	33618	Ia IH01 RMS
759	10759	20759	30759	I4 HD00	3619	13619	23619	33619	Ib IH01 RMS
760	10760	20760	30760	Reserved	3620	13620	23620	33620	Ic IH01 RMS
761	10761	20761	30761	Ia HD01	3621	13621	23621	33621	I4 IH01 RMS
762	10762	20762	30762	Ib HD01	3622	13622	23622	33622	Reserved
763	10763	20763	30763	Ic HD01	…	…	…	…	…
764	10764	20764	30764	I4 HD01	3928	13928	23928	33928	Ia IH63 RMS
765	10765	20765	30765	Reserved	3929	13929	23929	33929	Ib IH63 RMS
…	…	…	…	…	3930	13930	23930	33930	Ic IH63 RMS
1066	11066	21066	31066	Ia HD62	3931	13931	23931	33931	I4 IH63 RMS
1067	11067	21067	31067	Ib HD62	3932	13932	23932	33932	Reserved
1068	11068	21068	31068	Ic HD62	3933	13933	23933	33933	Ua Angle
1069	11069	21069	31069	I4 HD62	3934	13934	23934	33934	Ub Angle
1070	11070	21070	31070	Reserved	3935	13935	23935	33935	Uc Angle
1071	11071	21071	31071	Ia HD63	3936	13936	23936	33936	U4 Angle
1072	11072	21072	31072	Ib HD63	3937	13937	23937	33937	Ia Angle
1073	11073	21073	31073	Ic HD63	3938	13938	23938	33938	Ib Angle
1074	11074	21074	31074	I4 HD63	3939	13939	23939	33939	Ic Angle
1075	11075	21075	31075	Reserved	3940	13940	23940	33940	I4 Angle
1076	11076	21076	31076	Ua TH RMS	3941	13941	23941	33941	Reserved
1077	11077	21077	31077	Ub TH RMS	3942	13942	23942	33942	Ua Fund. Angle
1078	11078	21078	31078	Uc TH RMS	3943	13943	23943	33943	Ub Fund. Angle
1079	11079	21079	31079	U4 TH RMS	3944	13944	23944	33944	Uc Fund. Angle
1080	11080	21080	31080	Ua TOH RMS	3945	13945	23945	33945	U4 Fund. Angle
1081	11081	21081	31081	Ub TOH RMS	3946	13946	23946	33946	Ua H02 Angle
1082	11082	21082	31082	Uc TOH RMS	3947	13947	23947	33947	Ub H02 Angle
1083	11083	21083	31083	U4 TOH RMS	3948	13948	23948	33948	Uc H02 Angle
1084	11084	21084	31084	Ua TEH RMS	3949	13949	23949	33949	U4 H02 Angle
1085	11085	21085	31085	Ub TEH RMS	…	…	…	…	…
1086	11086	21086	31086	Uc TEH RMS	4190	14190	24190	34190	Ua H63 Angle
1087	11087	21087	31087	U4 TEH RMS	4191	14191	24191	34191	Ub H63 Angle
1088	11088	21088	31088	Ia TH RMS	4192	14192	24192	34192	Uc H63 Angle
1089	11089	21089	31089	Ib TH RMS	4193	14193	24193	34193	U4 H63 Angle
1090	11090	21090	31090	Ic TH RMS	4194	14194	24194	34194	Ia Fund. Angle
1091	11091	21091	31091	I4 TH RMS	4195	14195	24195	34195	Ib Fund. Angle
1092	11092	21092	31092	Reserved	4196	14196	24196	34196	Ic Fund. Angle
1093	11093	21093	31093	Ia TOH RMS	4197	14197	24197	34197	I4 Fund. Angle
1094	11094	21094	31094	Ib TOH RMS	4198	14198	24198	34198	Reserved
1095	11095	21095	31095	Ic TOH RMS	4199	14199	24199	34199	Ia H02 Angle
1096	11096	21096	31096	I4 TOH RMS	4200	14200	24200	34200	Ib H02 Angle

1097	11097	21097	31097	Reserved	4201	14201	24201	34201	Ic H02 Angle
1098	11098	21098	31098	Ia TEH RMS	4202	14202	24202	34202	I4 H02 Angle
1099	11099	21099	31099	Ib TEH RMS	4203	14203	24203	34203	Reserved
1100	11100	21100	31100	Ic TEH RMS	…	…	…	…	…
1101	11101	21101	31101	I4 TEH RMS	4504	14504	24504	34504	Ia H63 Angle
1102	11102	21102	31102	Reserved	4505	14505	24505	34505	Ib H63 Angle
1103	11103	21103	31103	Ua DC Component	4506	14506	24506	34506	Ic H63 Angle
1104	11104	21104	31104	Ub DC Component	4507	14507	24507	34507	I4 H63 Angle
1105	11105	21105	31105	Uc DC Component	4508	14508	24508	34508	Reserved
1106	11106	21106	31106	U4 DC Component	…	…	…	…	…
1107	11107	21107	31107	Ua Fund.	5000	15000	25000	35000	Uab DC Component
1108	11108	21108	31108	Ub Fund.	5001	15001	25001	35001	Ubc DC Component
1109	11109	21109	31109	Uc Fund.	5002	15002	25002	35002	Uca DC Component
1110	11110	21110	31110	U4 Fund.	5003	15003	25003	35003	Uab Fund. RMS
1111	11111	21111	31111	Ua H02 RMS	5004	15004	25004	35004	Ubc Fund. RMS
1112	11112	21112	31112	Ub H02 RMS	5005	15005	25005	35005	Uca Fund. RMS
1113	11113	21113	31113	Uc H02 RMS	5006	15006	25006	35006	Uab H02 RMS
1114	11114	21114	31114	U4 H02 RMS	5007	15007	25007	35007	Ubc H02 RMS
1115	11115	21115	31115	Ua H03 RMS	5008	15008	25008	35008	Uca H02 RMS
1116	11116	21116	31116	Ub H03 RMS	…	…	…	…	…
1117	11117	21117	31117	Uc H03 RMS	5189	15189	25189	35189	Uab H63 RMS
1118	11118	21118	31118	U4 H03 RMS	5190	15190	25190	35190	Ubc H63 RMS
					5191	15191	25191	35191	Uca H63 RMS
1351	11351	21351	31351	Ua H62 RMS	5192	15192	25192	35192	Uab DC Component
1352	11352	21352	31352	Ub H62 RMS	5193	15193	25193	35193	Ubc DC Component
1353	11353	21353	31353	Uc H62 RMS	5194	15194	25194	35194	Uca DC Component
1354	11354	21354	31354	U4 H62 RMS	5195	15195	25195	35195	Uab H01 HD
1355	11355	21355	31355	Ua H63 RMS	5196	15196	25196	35196	Ubc H01 HD
1356	11356	21356	31356	Ub H63 RMS	5197	15197	25197	35197	Uca H01 HD
1357	11357	21357	31357	Uc H63 RMS	5198	15198	25198	35198	Uab H02 HD
1358	11358	21358	31358	U4 H63 RMS	5199	15199	25199	35199	Ubc H02 HD
1359	11359	21359	31359	Ia DC Component	5200	15200	25200	35200	Uca H02 HD
1360	11360	21360	31360	Ib DC Component	…	…	…	…	…
1361	11361	21361	31361	Ic DC Component	5381	15381	25381	35381	Uab H63 HD
1362	11362	21362	31362	I4 DC Component	5382	15382	25382	35382	Ubc H63 HD
1363	11363	21363	31363	Reserved	5383	15383	25383	35383	Uca H63 HD
1364	11364	21364	31364	Ia Fund.					
1365	11365	21365	31365	Ib Fund.	5390	15390	25390	35390	Uab IH02 RMS
1366	11366	21366	31366	Ic Fund.	5391	15391	25391	35391	Ubc IH02 RMS
1367	11367	21367	31367	I4 Fund.	5392	15392	25392	35392	Uca IH02 RMS
1368	11368	21368	31368	Reserved					
1369	11369	21369	31369	Ia H02 RMS	5573	15573	25573	35573	Uab IH63 RMS
1370	11370	21370	31370	Ib H02 RMS	5574	15574	25574	35574	Ubc IH63 RMS
1371	11371	21371	31371	Ic H02 RMS	5575	15575	25575	35575	Uca IH63 RMS
1372	11372	21372	31372	I4 H02 RMS	5576	15576	25576	35576	Uab IH00 HD
1373	11373	21373	31373	Reserved	5577	15577	25577	35577	Ubc IH00 HD
1374	11374	21374	31374	Ia H03 RMS	5578	15578	25578	35578	Uca IH00 HD
1375	11375	21375	31375	Ib H03 RMS					
1376	11376	21376	31376	Ic H03 RMS	5765	15765	25765	35765	Uab IH63 HD
1377	11377	21377	31377	I4 H03 RMS	5766	15766	25766	35766	Ubc IH63 HD
1378	11378	21378	31378	Reserved	5767	15767	25767	35767	Uca IH63 HD
…	…	…	…	…	5768	15768	25768	35768	Uab THD
1669	11669	21669	31669	Ia H62 RMS	5769	15769	25769	35769	Ubc THD
1670	11670	21670	31670	Ib H62 RMS	5770	15770	25770	35770	Uca THD
1671	11671	21671	31671	Ic H62 RMS	5771	15771	25771	35771	Uab TOHD
1672	11672	21672	31672	I4 H62 RMS	5772	15772	25772	35772	Ubc TOHD
1673	11673	21673	31673	Reserved	5773	15773	25773	35773	Uca TOHD
1674	11674	21674	31674	Ia H63 RMS	5774	15774	25774	35774	Uab TEHD
1675	11675	21675	31675	Ib H63 RMS	5775	15775	25775	35775	Ubc TEHD
1676	11676	21676	31676	Ic H63 RMS	5776	15776	25776	35776	Uca TEHD
1677	11677	21677	31677	I4 H63 RMS	5777	15777	25777	35777	Uab Angle
1678	11678	21678	31678	Reserved	5778	15778	25778	35778	Ubc Angle
1679	11679	21679	31679	∑kWa TH	5779	15779	25779	35779	Uca Angle
1680	11680	21680	31680	∑kWb TH	5780	15780	25780	35780	Uab Fund. Angle
1681	11681	21681	31681	∑kWc TH	5781	15781	25781	35781	Ubc Fund. Angle
1682	11682	21682	31682	∑kvara TH	5782	15782	25782	35782	Uca Fund. Angle
1683	11683	21683	31683	∑kvarb TH	5783	15783	25783	35783	Uab H02 Angle

1684	11684	21684	31684	∑kvarc TH	5784	15784	25784	35784	Ubc H02 Angle
1685	11685	21685	31685	∑kVAa TH	5785	15785	25785	35785	Uca H02 Angle
1686	11686	21686	31686	∑kVAb TH					
1687	11687	21687	31687	∑kVAc TH	5966	15966	25966	35966	Uab H63 Angle
1688	11688	21688	31688	PFa TH	5967	15967	25967	35967	Ubc H63 Angle
1689	11689	21689	31689	PFb TH	5968	15968	25968	35968	Uca H63 Angle
1690	11690	21690	31690	PFc TH	5969	15969	25969	35969	Uab TIHD
1691	11691	21691	31691	∑kWa TH SUM	5970	15970	25970	35970	Ubc TIHD
1692	11692	21692	31692	∑kWb TH SUM	5971	15971	25971	35971	Uca TIHD
1693	11693	21693	31693	∑kWc TH SUM	5972	15972	25972	35972	Uab TOIHD
1694	11694	21694	31694	∑kvara TH SUM	5973	15973	25973	35973	Ubc TOIHD
1695	11695	21695	31695	∑kvarb TH SUM	5974	15974	25974	35974	Uca TOIHD
1696	11696	21696	31696	∑kvarc TH SUM	5975	15975	25975	35975	Uab TEIHD
1697	11697	21697	31697	∑kVAa TH SUM	5976	15976	25976	35976	Ubc TEIHD
1698	11698	21698	31698	∑kVAb TH SUM	5977	15977	25977	35977	Uca TEIHD
1699	11699	21699	31699	∑kVAc TH SUM	5978	15978	25978	35978	Uab TH RMS
1703	11703	21703	31703	∑kWa TH ABS	5979	15979	25979	35979	Ubc TH RMS
1704	11704	21704	31704	∑kWb TH ABS	5980	15980	25980	35980	Uca TH RMS
1705	11705	21705	31705	∑kWc TH ABS	5981	15981	25981	35981	Uab TOH RMS
1706	11706	21706	31706	∑kvara TH ABS	5982	15982	25982	35982	Ubc TOH RMS
1707	11707	21707	31707	∑kvarb TH ABS	5983	15983	25983	35983	Uca TOH RMS
1708	11708	21708	31708	∑kvarc TH ABS	5984	15984	25984	35984	Uab TEH RMS
1709	11709	21709	31709	∑kVAa TH ABS	5985	15985	25985	35985	Ubc TEH RMS
1710	11710	21710	31710	∑kVAb TH ABS	5986	15986	25986	35986	Uca TEH RMS
1711	11711	21711	31711	∑kVAc TH ABS	5987	15987	25987	35987	Uab TIH RMS
1715	11715	21715	31715	∑kW TH	5988	15988	25988	35988	Ubc TIH RMS
1716	11716	21716	31716	∑kvar TH	5989	15989	25989	35989	Uca TIH RMS
1717	11717	21717	31717	∑kVA TH	5990	15990	25990	35990	Uab TOIH RMS
1718	11718	21718	31718	PF Avg. TH	5991	15991	25991	35991	Ubc TOIH RMS
1719	11719	21719	31719	∑kW Fund.	5992	15992	25992	35992	Uca TOIH RMS
1720	11720	21720	31720	∑kvar Fund.	5993	15993	25993	35993	Uab TEIH RMS
1721	11721	21721	31721	∑kVA Fund.	5994	15994	25994	35994	Ubc TEIH RMS
1722	11722	21722	31722	dPF	5995	15995	25995	35995	Uca TEIH RMS

Flicker

Key ID	Parameters	Key ID	Parameters	Key ID	Parameters
50001	Ua Pst	50003	Uc Pst	50005	Ub Plt
50002	Ub Pst	50004	Ua Plt	50006	Uc Plt

Demand Parameters Data ID

Key ID	Parameters	Key ID	Parameters	Key ID	Parameters
Present Demand					
51001	Ua Pres.	51036	PFa Pres.	51071	Uc THD Pres.
51002	Ub Pres.	51037	PFb Pres.	51072	U4 THD Pres.
51003	Uc Pres.	51038	PFc Pres.	51073	Ia THD Pres.
51004	ULN Avg. Pres.	51039	PF Total Pres.	51074	Ib THD Pres.
51005	U4 Pres.	51040	Freq. Pres.	51075	Ic THD Pres.
51006	Uab Pres.	51041	Ua Dev. Pres.	51076	I4 THD Pres.
51007	Ubc Pres.	51042	Ub Dev. Pres.	51077	Reserved
51008	Uca Pres.	51043	Uc Dev. Pres.	51078	Ua TOHD Pres.
51009	ULL Avg. Pres.	51044	Uab Dev. Pres.	51079	Ub TOHD Pres.
51010	Ia Pres.	51045	Ubc Dev. Pres.	51080	Uc TOHD Pres.
51011	Ib Pres.	51046	Uca Dev. Pres.	51081	U4 TOHD Pres.
51012	Ic Pres.	51047	Ua Over Dev. Pres.	51082	Ia TOHD Pres.
51013	I Avg. Pres.	51048	Ub Over Dev. Pres.	51083	Ib TOHD Pres.
51014	I4 Pres.	51049	Uc Over Dev. Pres.	51084	Ic TOHD Pres.
51015	I5 Pres.	51050	Uab Over Dev. Pres.	51085	I4 TOHD Pres.
51016	kWa Imp. Pres.	51051	Ubc Over Dev. Pres.	51086	Reserved
51017	kWb Imp. Pres.	51052	Uca Over Dev. Pres.	51087	Ua TEHD Pres.
51018	kWc Imp. Pres.	51053	Ua Under Dev. Pres.	51088	Ub TEHD Pres.
51019	kW Total Imp. Pres.	51054	Ub Under Dev. Pres.	51089	Uc TEHD Pres.
51020	kWa Exp. Pres.	51055	Uc Under Dev. Pres.	51090	U4 TEHD Pres.
51021	kWb Exp. Pres.	51056	Uab Under Dev. Pres.	51091	Ia TEHD Pres.
51022	kWc Exp. Pres.	51057	Ubc Under Dev. Pres.	51092	Ib TEHD Pres.
51023	kW Total Exp. Pres.	51058	Uca Under Dev. Pres.	51093	Ic TEHD Pres.
51024	kvara Imp. Pres.	51059	Freq. Dev. Pres.	51094	I4 TEHD Pres.
51025	kvarb Imp. Pres.	51060	U0 Unb. Pres.	51095	Reserved Pres.
51026	kvarc Imp. Pres.	51061	U2 Unb. Pres.	51096	Ia Fund. Pres.

51027	kvar Total Imp. Pres.	51062	I0 Unb. Pres.	51097	Ib Fund. Pres.
51028	kvara Exp. Pres.	51063	I2 Unb. Pres.	51098	Ic Fund. Pres.
51029	kvarb Exp. Pres.	51064	Ia K-Factor Pres.	51099	I4 Fund. Pres.
51030	kvar c Exp. Pres.	51065	Ib K-Factor Pres.		
51031	kvar Total Exp. Pres.	51066	Ic K-Factor Pres.		
51032	kVAa Pres.	51067	I4 K-Factor Pres.		
51033	kVAb Pres.	51068	Reserved		
51034	kVAc Pres.	51069	Ua THD Pres.		
51035	kVA Total Pres.	51070	Ub THD Pres.		
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 Total 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	Reserved	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	Reserved
53009	Ia Fund. Max.	54005	kVA Total Last Max.	54006	

Appendix B - SDR Default Setting

Parameter	SDR 1	SDR 2	SDR 3	SDR 4
Recording Interval	10	10	10	10
Recording Mode[2]	1=FIFO	1=FIFO	1=FIFO	1=FIFO
Number of Parameters[5]	59	62	61	63
Parameter 1	Freq.	Ua Angle	Ua THD	Ua TH RMS
Parameter 2	Ua RMS	Ub Angle	Ub THD	Ub TH RMS
Parameter 3	Ub RMS	Uc Angle	Uc THD	Uc TH RMS
Parameter 4	Uc RMS	U4 Angle	U4 THD	U4 TH RMS
Parameter 5	U4 RMS	Uab Angle	Ia THD	Ia TH RMS
Parameter 6	ULN RMS Avg	Ubc Angle	Ib THD	Ib TH RMS
Parameter 7	Uab RMS	Uca Angle	Ic THD	Ic TH RMS
Parameter 8	Ubc RMS	Ia Angle	I4 THD	I4 TH RMS
Parameter 9	Uca RMS	Ib Angle	Reserved	Pa TH
Parameter 10	ULL RMS Avg	Ic Angle	Ua TOHD	Pb TH
Parameter 11	Ia RMS	I4 Angle	Ub TOHD	Pc TH
Parameter 12	Ib RMS	Reserved	Uc TOHD	P Total TH
Parameter 13	Ic RMS	Ua Fund. Angle	U4 TOHD	Qa TH
Parameter 14	I4 RMS	Ub Fund. Angle	Ia TOHD	Qb TH
Parameter 15	Reserved	Uc Fund. Angle	Ib TOHD	Qc TH
Parameter 16	Current RMS Avg	U4 Fund. Angle	Ic TOHD	Q Total TH
Parameter 17	Pa	Uab Fund. Angle	I4 TOHD	Sa TH
Parameter 18	Pb	Ubc Fund. Angle	Reserved	Sb TH
Parameter 19	Pc	Uca Fund. Angle	Ua TEHD	Sc TH
Parameter 20	P Total	Ia Fund. Angle	Ub TEHD	S Total TH
Parameter 21	Qa	Ib Fund. Angle	Uc TEHD	PFa TH
Parameter 22	Qb	Ic Fund. Angle	U4 TEHD	PFb TH
Parameter 23	Qc	I4 Fund. Angle	Ia TEHD	PFc TH
Parameter 24	Q Total	Reserved	Ib TEHD	PF TH
Parameter 25	Sa	U0	Ic TEHD	Ua DC Component
Parameter 26	Sb	U2	I4 TEHD	Ub DC Component
Parameter 27	Sc	U1	Reserved	Uc DC Component
Parameter 28	S Total	I0	Ia K-Factor	U4 DC Component
Parameter 29	PFa	I2	Ib K-Factor	Uab DC Component
Parameter 30	PFb	I1	Ic K-Factor	Ubc DC Component
Parameter 31	PFc	U2 Unbalance	I4 K-Factor	Uca DC Component
Parameter 32	PF Total	I2 Unbalance	Reserved	Ia DC RMS
Parameter 33	Ua Fund. RMS	U0 Unbalance	Ia TDD	Ib DC RMS
Parameter 34	Ub Fund. RMS	I0 Unbalance	Ib TDD	Ic DC RMS
Parameter 35	Uc Fund. RMS	Ua Deviation	Ic TDD	I4 DC RMS
Parameter 36	U4 Fund. RMS	Ub Deviation	I4 TDD	Ua HD01
Parameter 37	Uab Fund. RMS	Uc Deviation	Reserved	Ub HD01
Parameter 38	Ubc Fund. RMS	Uab Deviation	Ua TIHD	Uc HD01
Parameter 39	Uca Fund. RMS	Ubc Deviation	Ub TIHD	U4 HD01
Parameter 40	Ia Fund. RMS	Uca Deviation	Uc TIHD	Ua HD02
Parameter 41	Ib Fund. RMS	Ua Over Deviation	U4 TIHD	Ub HD02
Parameter 42	Ic Fund. RMS	Ub Over Deviation	Ia TIHD	Uc HD02
Parameter 43	I4 Fund. RMS	Uc Over Deviation	Ib TIHD	U4 HD02
Parameter 44	Pa Fund.	Uab Over Deviation	Ic TIHD	Ua HD03
Parameter 45	Pb Fund.	Ubc Over Deviation	I4 TIHD	Ub HD03
Parameter 46	Pc Fund.	Uca Over Deviation	Ua TOIHD	Uc HD03
Parameter 47	P Total Fund.	Ua Under Deviation	Ub TOIHD	U4 HD03
Parameter 48	Qa Fund.	Ub Under Deviation	Uc TOIHD	Ua HD04
Parameter 49	Qb Fund.	Uc Under Deviation	U4 TOIHD	Ub HD04
Parameter 50	Qc Fund.	Uab Under Deviation	Ia TOIHD	Uc HD04
Parameter 51	Q Total Fund.	Ubc Under Deviation	Ib TOIHD	U4 HD04
Parameter 52	Sa Fund.	Uca Under Deviation	Ic TOIHD	Ua HD05
Parameter 53	Sb Fund.	Freq. Deviation	I4 TOIHD	Ub HD05
Parameter 54	Sc Fund.	Uab THD	Ua TEIHD	Uc HD05
Parameter 55	S Total Fund.	Ubc THD	Ub TEIHD	U4 HD05
Parameter 56	dPFa	Uca THD	Uc TEIHD	Ua HD06
Parameter 57	dPFb	Uab TOHD	U4 TEIHD	Ub HD06
Parameter 58	dPFc	Ubc TOHD	Ia TEIHD	Uc HD06
Parameter 59	dPF Total	Uca TOHD	Ib TEIHD	U4 HD06
Parameter 60		Uab TEHD	Ic TEIHD	Ua HD07
Parameter 61		Ubc TEHD	I4 TEIHD	Ub HD07

Parameter 62		Uca TEHD		Uc HD07
Parameter 63				U4 HD07
Parameter 64				
Parameter	**SDR 5**	**SDR 6**	**SDR 7**	**SDR 8**
Recording Interval	10	10	10	10
Recording Mode[2]	1=FIFO	1=FIFO	1=FIFO	1=FIFO
Number of Parameters[5]	64	64	62	63
Parameter 1	Ua HD08	Ua HD24	Ua HD40	Ia HD08
Parameter 2	Ub HD08	Ub HD24	Ub HD40	Ib HD08
Parameter 3	Uc HD08	Uc HD24	Uc HD40	Ic HD08
Parameter 4	U4 HD08	U4 HD24	U4 HD40	Ia HD09
Parameter 5	Ua HD09	Ua HD25	Ua HD41	Ib HD09
Parameter 6	Ub HD09	Ub HD25	Ub HD41	Ic HD09
Parameter 7	Uc HD09	Uc HD25	Uc HD41	Ia HD10
Parameter 8	U4 HD09	U4 HD25	U4 HD41	Ib HD10
Parameter 9	Ua HD10	Ua HD26	Ua HD42	Ic HD10
Parameter 10	Ub HD10	Ub HD26	Ub HD42	Ia HD11
Parameter 11	Uc HD10	Uc HD26	Uc HD42	Ib HD11
Parameter 12	U4 HD10	U4 HD26	U4 HD42	Ic HD11
Parameter 13	Ua HD11	Ua HD27	Ua HD43	Ia HD12
Parameter 14	Ub HD11	Ub HD27	Ub HD43	Ib HD12
Parameter 15	Uc HD11	Uc HD27	Uc HD43	Ic HD12
Parameter 16	U4 HD11	U4 HD27	U4 HD43	Ia HD13
Parameter 17	Ua HD12	Ua HD28	Ua HD44	Ib HD13
Parameter 18	Ub HD12	Ub HD28	Ub HD44	Ic HD13
Parameter 19	Uc HD12	Uc HD28	Uc HD44	Ia HD14
Parameter 20	U4 HD12	U4 HD28	U4 HD44	Ib HD14
Parameter 21	Ua HD13	Ua HD29	Ua HD45	Ic HD14
Parameter 22	Ub HD13	Ub HD29	Ub HD45	Ia HD15
Parameter 23	Uc HD13	Uc HD29	Uc HD45	Ib HD15
Parameter 24	U4 HD13	U4 HD29	U4 HD45	Ic HD15
Parameter 25	Ua HD14	Ua HD30	Ua HD46	Ia HD16
Parameter 26	Ub HD14	Ub HD30	Ub HD46	Ib HD16
Parameter 27	Uc HD14	Uc HD30	Uc HD46	Ic HD16
Parameter 28	U4 HD14	U4 HD30	U4 HD46	Ia HD17
Parameter 29	Ua HD15	Ua HD31	Ua HD47	Ib HD17
Parameter 30	Ub HD15	Ub HD31	Ub HD47	Ic HD17
Parameter 31	Uc HD15	Uc HD31	Uc HD47	Ia HD18
Parameter 32	U4 HD15	U4 HD31	U4 HD47	Ib HD18
Parameter 33	Ua HD16	Ua HD32	Ua HD48	Ic HD18
Parameter 34	Ub HD16	Ub HD32	Ub HD48	Ia HD19
Parameter 35	Uc HD16	Uc HD32	Uc HD48	Ib HD19
Parameter 36	U4 HD16	U4 HD32	U4 HD48	Ic HD19
Parameter 37	Ua HD17	Ua HD33	Ua HD49	Ia HD20
Parameter 38	Ub HD17	Ub HD33	Ub HD49	Ib HD20
Parameter 39	Uc HD17	Uc HD33	Uc HD49	Ic HD20
Parameter 40	U4 HD17	U4 HD33	U4 HD49	Ia HD21
Parameter 41	Ua HD18	Ua HD34	Ua HD50	Ib HD21
Parameter 42	Ub HD18	Ub HD34	Ub HD50	Ic HD21
Parameter 43	Uc HD18	Uc HD34	Uc HD50	Ia HD22
Parameter 44	U4 HD18	U4 HD34	U4 HD50	Ib HD22
Parameter 45	Ua HD19	Ua HD35	Ia HD02	Ic HD22
Parameter 46	Ub HD19	Ub HD35	Ib HD02	Ia HD23
Parameter 47	Uc HD19	Uc HD35	Ic HD02	Ib HD23
Parameter 48	U4 HD19	U4 HD35	Ia HD03	Ic HD23
Parameter 49	Ua HD20	Ua HD36	Ib HD03	Ia HD24
Parameter 50	Ub HD20	Ub HD36	Ic HD03	Ib HD24
Parameter 51	Uc HD20	Uc HD36	Ia HD04	Ic HD24
Parameter 52	U4 HD20	U4 HD36	Ib HD04	Ia HD25
Parameter 53	Ua HD21	Ua HD37	Ic HD04	Ib HD25
Parameter 54	Ub HD21	Ub HD37	Ia HD05	Ic HD25
Parameter 55	Uc HD21	Uc HD37	Ib HD05	Ia HD26
Parameter 56	U4 HD21	U4 HD37	Ic HD05	Ib HD26
Parameter 57	Ua HD22	Ua HD38	Ia HD06	Ic HD26
Parameter 58	Ub HD22	Ub HD38	Ib HD06	Ia HD27
Parameter 59	Uc HD22	Uc HD38	Ic HD06	Ib HD27
Parameter 60	U4 HD22	U4 HD38	Ia HD07	Ic HD27

Parameter 61	Ua HD23	Ua HD39	Ib HD07	Ia HD28
Parameter 62	Ub HD23	Ub HD39	Ic HD07	Ib HD28
Parameter 63	Uc HD23	Uc HD39		Ic HD28
Parameter 64	U4 HD23	U4 HD39		
Parameter	**SDR 9**	**SDR 10**	**SDR 11**	**SDR 12**
Recording Interval	10	10	10	10
Recording Mode[2]	1=FIFO	1=FIFO	1=FIFO	1=FIFO
Number of Parameters[5]	63	63	60	64
Parameter 1	Ia HD29	Ia HD50	Ia H17 RMS	Ia H32 RMS
Parameter 2	Ib HD29	Ib HD50	Ib H17 RMS	Ib H32 RMS
Parameter 3	Ic HD29	Ic HD50	Ic H17 RMS	Ic H32 RMS
Parameter 4	Ia HD30	Ia H02 RMS	I4 H17 RMS	I4 H32 RMS
Parameter 5	Ib HD30	Ib H02 RMS	Ia H18 RMS	Ia H33 RMS
Parameter 6	Ic HD30	Ic H02 RMS	Ib H18 RMS	Ib H33 RMS
Parameter 7	Ia HD31	I4 H02 RMS	Ic H18 RMS	Ic H33 RMS
Parameter 8	Ib HD31	Ia H03 RMS	I4 H18 RMS	I4 H33 RMS
Parameter 9	Ic HD31	Ib H03 RMS	Ia H19 RMS	Ia H34 RMS
Parameter 10	Ia HD32	Ic H03 RMS	Ib H19 RMS	Ib H34 RMS
Parameter 11	Ib HD32	I4 H03 RMS	Ic H19 RMS	Ic H34 RMS
Parameter 12	Ic HD32	Ia H04 RMS	I4 H19 RMS	I4 H34 RMS
Parameter 13	Ia HD33	Ib H04 RMS	Ia H20 RMS	Ia H35 RMS
Parameter 14	Ib HD33	Ic H04 RMS	Ib H20 RMS	Ib H35 RMS
Parameter 15	Ic HD33	I4 H04 RMS	Ic H20 RMS	Ic H35 RMS
Parameter 16	Ia HD34	Ia H05 RMS	I4 H20 RMS	I4 H35 RMS
Parameter 17	Ib HD34	Ib H05 RMS	Ia H21 RMS	Ia H36 RMS
Parameter 18	Ic HD34	Ic H05 RMS	Ib H21 RMS	Ib H36 RMS
Parameter 19	Ia HD35	I4 H05 RMS	Ic H21 RMS	Ic H36 RMS
Parameter 20	Ib HD35	Ia H06 RMS	I4 H21 RMS	I4 H36 RMS
Parameter 21	Ic HD35	Ib H06 RMS	Ia H22 RMS	Ia H37 RMS
Parameter 22	Ia HD36	Ic H06 RMS	Ib H22 RMS	Ib H37 RMS
Parameter 23	Ib HD36	I4 H06 RMS	Ic H22 RMS	Ic H37 RMS
Parameter 24	Ic HD36	Ia H07 RMS	I4 H22 RMS	I4 H37 RMS
Parameter 25	Ia HD37	Ib H07 RMS	Ia H23 RMS	Ia H38 RMS
Parameter 26	Ib HD37	Ic H07 RMS	Ib H23 RMS	Ib H38 RMS
Parameter 27	Ic HD37	I4 H07 RMS	Ic H23 RMS	Ic H38 RMS
Parameter 28	Ia HD38	Ia H08 RMS	I4 H23 RMS	I4 H38 RMS
Parameter 29	Ib HD38	Ib H08 RMS	Ia H24 RMS	Ia H39 RMS
Parameter 30	Ic HD38	Ic H08 RMS	Ib H24 RMS	Ib H39 RMS
Parameter 31	Ia HD39	I4 H08 RMS	Ic H24 RMS	Ic H39 RMS
Parameter 32	Ib HD39	Ia H09 RMS	I4 H24 RMS	I4 H39 RMS
Parameter 33	Ic HD39	Ib H09 RMS	Ia H25 RMS	Ia H40 RMS
Parameter 34	Ia HD40	Ic H09 RMS	Ib H25 RMS	Ib H40 RMS
Parameter 35	Ib HD40	I4 H09 RMS	Ic H25 RMS	Ic H40 RMS
Parameter 36	Ic HD40	Ia H10 RMS	I4 H25 RMS	I4 H40 RMS
Parameter 37	Ia HD41	Ib H10 RMS	Ia H26 RMS	Ia H41 RMS
Parameter 38	Ib HD41	Ic H10 RMS	Ib H26 RMS	Ib H41 RMS
Parameter 39	Ic HD41	I4 H10 RMS	Ic H26 RMS	Ic H41 RMS
Parameter 40	Ia HD42	Ia H11 RMS	I4 H26 RMS	I4 H41 RMS
Parameter 41	Ib HD42	Ib H11 RMS	Ia H27 RMS	Ia H42 RMS
Parameter 42	Ic HD42	Ic H11 RMS	Ib H27 RMS	Ib H42 RMS
Parameter 43	Ia HD43	I4 H11 RMS	Ic H27 RMS	Ic H42 RMS
Parameter 44	Ib HD43	Ia H12 RMS	I4 H27 RMS	I4 H42 RMS
Parameter 45	Ic HD43	Ib H12 RMS	Ia H28 RMS	Ia H43 RMS
Parameter 46	Ia HD44	Ic H12 RMS	Ib H28 RMS	Ib H43 RMS
Parameter 47	Ib HD44	I4 H12 RMS	Ic H28 RMS	Ic H43 RMS
Parameter 48	Ic HD44	Ia H13 RMS	I4 H28 RMS	I4 H43 RMS
Parameter 49	Ia HD45	Ib H13 RMS	Ia H29 RMS	Ia H44 RMS
Parameter 50	Ib HD45	Ic H13 RMS	Ib H29 RMS	Ib H44 RMS
Parameter 51	Ic HD45	I4 H13 RMS	Ic H29 RMS	Ic H44 RMS
Parameter 52	Ia HD46	Ia H14 RMS	I4 H29 RMS	I4 H44 RMS
Parameter 53	Ib HD46	Ib H14 RMS	Ia H30 RMS	Ia H45 RMS
Parameter 54	Ic HD46	Ic H14 RMS	Ib H30 RMS	Ib H45 RMS
Parameter 55	Ia HD47	I4 H14 RMS	Ic H30 RMS	Ic H45 RMS
Parameter 56	Ib HD47	Ia H15 RMS	I4 H30 RMS	I4 H45 RMS
Parameter 57	Ic HD47	Ib H15 RMS	Ia H31 RMS	Ia H46 RMS
Parameter 58	Ia HD48	Ic H15 RMS	Ib H31 RMS	Ib H46 RMS
Parameter 59	Ib HD48	I4 H15 RMS	Ic H31 RMS	Ic H46 RMS

Parameter 60	Ic HD48	Ia H16 RMS	I4 H31 RMS	I4 H46 RMS
Parameter 61	Ia HD49	Ib H16 RMS		Ia H47 RMS
Parameter 62	Ib HD49	Ic H16 RMS		Ib H47 RMS
Parameter 63	Ic HD49	I4 H16 RMS		Ic H47 RMS
Parameter 64				I4 H47 RMS
Parameter	**SDR 13**	**SDR 14**	**SDR 15**	**SDR 16**
Recording Interval	10	10	10	10
Recording Mode[2]	1=FIFO	1=FIFO	1=FIFO	1=FIFO
Number of Parameters[5]	64	64	64	58
Parameter 1	Ia H48 RMS	Ua IHD13	Ua IHD29	Ua IHD45
Parameter 2	Ib H48 RMS	Ub IHD13	Ub IHD29	Ub IHD45
Parameter 3	Ic H48 RMS	Uc IHD13	Uc IHD29	Uc IHD45
Parameter 4	I4 H48 RMS	U4 IHD13	U4 IHD29	U4 IHD45
Parameter 5	Ia H49 RMS	Ua IHD14	Ua IHD30	Ua IHD46
Parameter 6	Ib H49 RMS	Ub IHD14	Ub IHD30	Ub IHD46
Parameter 7	Ic H49 RMS	Uc IHD14	Uc IHD30	Uc IHD46
Parameter 8	I4 H49 RMS	U4 IHD14	U4 IHD30	U4 IHD46
Parameter 9	Ia H50 RMS	Ua IHD15	Ua IHD31	Ua IHD47
Parameter 10	Ib H50 RMS	Ub IHD15	Ub IHD31	Ub IHD47
Parameter 11	Ic H50 RMS	Uc IHD15	Uc IHD31	Uc IHD47
Parameter 12	I4 H50 RMS	U4 IHD15	U4 IHD31	U4 IHD47
Parameter 13	Ua IHD00	Ua IHD16	Ua IHD32	Ua IHD48
Parameter 14	Ub IHD00	Ub IHD16	Ub IHD32	Ub IHD48
Parameter 15	Uc IHD00	Uc IHD16	Uc IHD32	Uc IHD48
Parameter 16	U4 IHD00	U4 IHD16	U4 IHD32	U4 IHD48
Parameter 17	Ua IHD01	Ua IHD17	Ua IHD33	Ua IHD49
Parameter 18	Ub IHD01	Ub IHD17	Ub IHD33	Ub IHD49
Parameter 19	Uc IHD01	Uc IHD17	Uc IHD33	Uc IHD49
Parameter 20	U4 IHD01	U4 IHD17	U4 IHD33	U4 IHD49
Parameter 21	Ua IHD02	Ua IHD18	Ua IHD34	Ua IHD50
Parameter 22	Ub IHD02	Ub IHD18	Ub IHD34	Ub IHD50
Parameter 23	Uc IHD02	Uc IHD18	Uc IHD34	Uc IHD50
Parameter 24	U4 IHD02	U4 IHD18	U4 IHD34	U4 IHD50
Parameter 25	Ua IHD03	Ua IHD19	Ua IHD35	Ia IHD00 RMS
Parameter 26	Ub IHD03	Ub IHD19	Ub IHD35	Ib IHD00 RMS
Parameter 27	Uc IHD03	Uc IHD19	Uc IHD35	Ic IHD00 RMS
Parameter 28	U4 IHD03	U4 IHD19	U4 IHD35	I4 IHD00 RMS
Parameter 29	Ua IHD04	Ua IHD20	Ua IHD36	Ia IHD01 RMS
Parameter 30	Ub IHD04	Ub IHD20	Ub IHD36	Ib IHD01 RMS
Parameter 31	Uc IHD04	Uc IHD20	Uc IHD36	Ic IHD01 RMS
Parameter 32	U4 IHD04	U4 IHD20	U4 IHD36	I4 IHD01 RMS
Parameter 33	Ua IHD05	Ua IHD21	Ua IHD37	Ia IHD02 RMS
Parameter 34	Ub IHD05	Ub IHD21	Ub IHD37	Ib IHD02 RMS
Parameter 35	Uc IHD05	Uc IHD21	Uc IHD37	Ic IHD02 RMS
Parameter 36	U4 IHD05	U4 IHD21	U4 IHD37	I4 IHD02 RMS
Parameter 37	Ua IHD06	Ua IHD22	Ua IHD38	Ia IHD03 RMS
Parameter 38	Ub IHD06	Ub IHD22	Ub IHD38	Ib IHD03 RMS
Parameter 39	Uc IHD06	Uc IHD22	Uc IHD38	Ic IHD03 RMS
Parameter 40	U4 IHD06	U4 IHD22	U4 IHD38	I4 IHD03 RMS
Parameter 41	Ua IHD07	Ua IHD23	Ua IHD39	Ia IHD04 RMS
Parameter 42	Ub IHD07	Ub IHD23	Ub IHD39	Ib IHD04 RMS
Parameter 43	Uc IHD07	Uc IHD23	Uc IHD39	Ic IHD04 RMS
Parameter 44	U4 IHD07	U4 IHD23	U4 IHD39	I4 IHD04 RMS
Parameter 45	Ua IHD08	Ua IHD24	Ua IHD40	Ia IHD05 RMS
Parameter 46	Ub IHD08	Ub IHD24	Ub IHD40	Ib IHD05 RMS
Parameter 47	Uc IHD08	Uc IHD24	Uc IHD40	Ic IHD05 RMS
Parameter 48	U4 IHD08	U4 IHD24	U4 IHD40	I4 IHD05 RMS
Parameter 49	Ua IHD09	Ua IHD25	Ua IHD41	Ia IHD06 RMS
Parameter 50	Ub IHD09	Ub IHD25	Ub IHD41	Ib IHD06 RMS
Parameter 51	Uc IHD09	Uc IHD25	Uc IHD41	Ic IHD06 RMS
Parameter 52	U4 IHD09	U4 IHD25	U4 IHD41	I4 IHD06 RMS
Parameter 53	Ua IHD10	Ua IHD26	Ua IHD42	Ua Pst
Parameter 54	Ub IHD10	Ub IHD26	Ub IHD42	Ub Pst
Parameter 55	Uc IHD10	Uc IHD26	Uc IHD42	Uc Pst
Parameter 56	U4 IHD10	U4 IHD26	U4 IHD42	Ua Plt
Parameter 57	Ua IHD11	Ua IHD27	Ua IHD43	Ub Plt
Parameter 58	Ub IHD11	Ub IHD27	Ub IHD43	Uc Plt

Parameter 59	Uc IHD11	Uc IHD27	Uc IHD43	
Parameter 60	U4 IHD11	U4 IHD27	U4 IHD43	
Parameter 61	Ua IHD12	Ua IHD28	Ua IHD44	
Parameter 62	Ub IHD12	Ub IHD28	Ub IHD44	
Parameter 63	Uc IHD12	Uc IHD28	Uc IHD44	
Parameter 64	U4 IHD12	U4 IHD28	U4 IHD44	

Appendix C - DR Default Setting

Parameter	DR 1	DR 2	DR 3	DR 4
Trigger Mode	1=Triggered by Timer	1=Triggered by Timer	1=Triggered by Timer	1=Triggered by Timer
Recording Mode	1=FIFO	1=FIFO	1=FIFO	1=FIFO
Recording Interval	900	900	900	900
Offset Time	0	0	0	0
Number of Parameters	32	32	29	27
Parameter 1	Uab	Uab Demand	Uab Deviation	Ua THD
Parameter 2	Ubc	Ubc Demand	Ubc Deviation	Ub THD
Parameter 3	Uca	Uca Demand	Uca Deviation	Uc THD
Parameter 4	ULL avg	ULL avg Demand	Ua Deviation	Uab THD
Parameter 5	Ia	Ia Demand	Ub Deviation	Ubc THD
Parameter 6	Ib	Ib Demand	Uc Deviation	Uca THD
Parameter 7	Ic	Ic Demand	Uab Over Deviation	Ia THD
Parameter 8	I avg	I avg Demand	Ubc Over Deviation	Ib THD
Parameter 9	P Total	P Total Imp Demand	Uca Over Deviation	Ic THD
Parameter 10	Q Total	Q Total Imp Demand	Ua Over Deviation	Ia TDD
Parameter 11	S Total	S Total Demand	Ub Over Deviation	Ib TDD
Parameter 12	PF Total	PF Total Demand	Uc Over Deviation	Ic TDD
Parameter 13	Freq	Freq Demand	Uab Under Deviation	Ia K-Factor
Parameter 14	Ua	Ua Demand	Ubc Under Deviation	Ib K-Factor
Parameter 15	Ub	Ub Demand	Uca Under Deviation	Ic K-Factor
Parameter 16	Uc	Uc Demand	Ua Under Deviation	Ua Crest Factor
Parameter 17	ULN avg	ULN avg Demand	Ub Under Deviation	Ub Crest Factor
Parameter 18	Pa	Pa Imp. Demand	Uc Under Deviation	Uc Crest Factor
Parameter 19	Pb	Pb Imp. Demand	Freq. Deviation	Ia Crest Factor
Parameter 20	Pc	Pc Imp. Demand	U0 Unbalance	Ib Crest Factor
Parameter 21	Qa	Qa Imp. Demand	I0 Unbalance	Ic Crest Factor
Parameter 22	Qb	Qb Imp. Demand	U2 Unbalance	Ua Pst
Parameter 23	Qc	Qc Imp. Demand	I2 Unbalance	Ub Pst
Parameter 24	Sa	Sa Demand	U0 (Zero Sequence)	Uc Pst
Parameter 25	Sb	Sb Demand	U1 (+ve Sequence)	Ua Plt
Parameter 26	Sc	Sc Demand	U2 (-ve Sequence)	Ub Plt
Parameter 27	PFa	PFa Demand	I0 (Zero Sequence)	Uc Plt
Parameter 28	PFb	PFb Demand	I1 (+ve Sequence)	
Parameter 29	PFc	PFc Demand	I2 (-ve Sequence)	
Parameter 30	U4	U4 Demand		
Parameter 31	I4	I4 Demand		
Parameter 32	I5	I5 Demand		
Parameter	**DR 5**	**DR 6**	**DR 7**	**DR 8**
Trigger Mode	0=Disable	0=Disable	0=Disable	0=Disable
Recording Mode	1=FIFO	1=FIFO	1=FIFO	1=FIFO
Recording Interval	900	900	900	900
Recording Offset	0	0	0	0
No. of Parameters	0	0	0	0
Parameter 1				
…				
Parameter 32				

Appendix D - Event Classification

SOE Event Classification

SOE Log Classification	Sub-Classification	Description	SOE Value Scale/Option
0xA1: PQ Disturbance	0	Voltage Swells	**UINT32:** Source Bit0: Ua, Bit1: Ub, Bit2: Uc Bit3: Uab, Bit4: Ubc, Bit5: Uca **FP32:** Max./Min. Residual Voltage **UINT32:** Duration (ms) **FP32:** Ua Residual **FP32:** Ub Residual **FP32:** Uc Residual **UINT32:** Disturbance Direction Location: 1=UpStream, 2=DownStream **UINT32:** Confidence: 1=Low, 2=Middle, 3=High **FP32:** Ua Benchmark (Primary) **FP32:** Ub Benchmark (Primary) **FP32:** Uc Benchmark (Primary) **UINT32:** Reserved
	1	Voltage Dips	Refer to **Voltage Swells**
	2	Voltage Interruption	Refer to **Voltage Swells**
	3	Over-Voltage Start	**UINT32:** Source Bit0: Ua, Bit1: Ub, Bit2: Uc Bit3: Uab, Bit4: Ubc, Bit5: Uca **FP32:** Ua Residual **FP32:** Ub Residual **FP32:** Uc Residual **UINT32:** Disturbance Direction Location: 1=UpStream, 2=DownStream **UINT32:** Confidence: 1=Low, 2=Middle, 3=High **FP32:** Ua Benchmark (Primary) **FP32:** Ub Benchmark (Primary) **FP32:** Uc Benchmark (Primary) **UINT32:** Reserved
	4	Over-Voltage Return	**UINT32:** Duration (ms) **FP32:** Ua Residual **FP32:** Ub Residual **FP32:** Uc Residual **FP32:** Ua Benchmark (Primary) **FP32:** Ub Benchmark (Primary) **FP32:** Uc Benchmark (Primary) **UINT32:** Reserved
	5	Under-Voltage Start	Refer to **Over-Voltage Start**
	6	Under -Voltage Return	Refer to **Over-Voltage Return**
0xA2: Transient	0	Transient Voltage	**FP32:** Max./Min. Disturbance **UINT32:** Duration (μs) **FP32:** Ua Disturbance **FP32:** Ub Disturbance **FP32:** Uc Disturbance
0xA3: Inrush Current	0	Inrush Current Start	**UINT32:** Source Bit0: Ua, Bit1: Ub, Bit2: Uc
	1	Inrush Current Return	**UINT32:** Duration (ms) **FP32:** Ia Disturbance Max. (A) **FP32:** Ib Disturbance Max. (A) **FP32:** Ic Disturbance Max. (A) **FP32:** Ia RMS during Disturbance (A) **FP32:** Ib RMS during Disturbance (A) **FP32:** Ic RMS during Disturbance (A)
0xA4: RVC	0	Rapid Voltage Change	**UINT32:** Start Time (s) **UINT32:** Start Time (ms) **UINT32:** Duration (ms) **FP32:** Max. Voltage Change Rate

			FP32: Steady Voltage Change Rate **UINT32:** Source Bit0: Ua, Bit1: Ub, Bit2: Uc Bit3: Uab, Bit4: Ubc, Bit5: Uca
0xA5: MSV	0	MSV #1 Start	**FP32:** Frequency (Hz) **UINT32:** Phase Bit0: Ua, Bit1: Ub, Bit2: Uc Bit3: Uab, Bit4: Ubc, Bit5: Uca
	1	MSV #1 End	**FP32:** Frequency (Hz) **FP32:** Ua MSV Max. **FP32:** Ub MSV Max. **FP32:** Uc MSV Max.
	2	MSV #2 Start	Please refer to MSV #1 Start
	3	MSV #2 End	Please refer to MSV #1 End
	4	MSV #3 Start	Please refer to MSV #1 Start
	5	MSV #3 End	Please refer to MSV #1 End
0xA6: Reserved			
0xA7: Motor Start	0	Motor Start	None
	1	Motor Start End	**FP32:** Imax **FP32:** Umin **UINT32:** Duration (ms)
0xA8: Reserved			
0xA9: Setpoint	0	Over Setpoint Active	**UINT32:** Setpoint Parameter **FP32:** Active Value **UINT32:** Setpoint Number (0-255)
	1	Over Setpoint Inactive	**UINT32:** Setpoint Parameter **FP32:** Inactive Value **UINT32:** Setpoint Number (0-255) **FP32:** Maximum during the setpoint active **UINT32:** Duration (ms)
	128	Under Setpoint Active	**UINT32:** Setpoint Parameter **FP32:** Active Value **UINT32:** Setpoint Number (0-255)
	129	Under Setpoint Inactive	**UINT32:** Setpoint Parameter **FP32:** Inactive Value **UINT32:** Setpoint Number (0-255) **FP32:** Maximum during the setpoint active **UINT32:** Duration (ms)
0xAA: High-Speed Setpoint	0	OverSetpoint Active	**UINT32:** Setpoint Parameter **FP32:** Active Value **UINT32:** Setpoint Number (0-15)
	1	OverSetpoint Inactive	**UINT32:** Setpoint Parameter **FP32:** Inactive Value **UINT32:** Setpoint Number (0-15) **FP32:** Maximum during the setpoint active **UINT32:** Duration (ms)
	128	UnderSetpoint Active	**UINT32:** Setpoint Parameter **FP32:** Active Value **UINT32:** Setpoint Number (0-15)
	129	UnderSetpoint Inactive	**UINT32:** Setpoint Parameter **FP32:** Inactive Value **UINT32:** Setpoint Group Number (0-15) **FP32:** Maximum during the setpoint active **UINT32:** Duration (ms)
0xAB: I/O Changes	0	DIx Closed	**UINT32:** DI Number, Bit0 to Bit7 stands for DI1 to DI8
	1	DIx Opened	
	2	DOx Operated	**UINT32:** DO Number: 0=Alarm, 1=DO1 **UINT32:** Trigger Source 0=DI 10=Front Panel 1=Setpoint 11=Reserved 2=HS Setpoint 12=Swells 3=Reserved 13=Dips 4=Transient 14=Interruptions

			5=Rapid Voltage Change 15=ITIC Curve Alarm 6=Inrush Current 16=SEMI F47 Curve Alarm 7=Reserved 17=Motor Start 8=Remote Control 18=iTrigger 9=Pulse Width 19= Reserved
			UINT32: Source MAC Address **UINT32:** Source Group ID
	3	DO Released	**UINT 32:** DO Number: 0=Alarm, 1=DO1 **UINT32:** Trigger Source 0=DI 10=Front Panel 1=Setpoint 11=Reserved 2=HS Setpoint 12=Swells 3=Reserved 13=Dips 4=Transient 14=Interruptions 5=Rapid Voltage Change 15=ITIC Curve Alarm 6=Inrush Current 16=SEMI F47 Curve Alarm 7=Reserved 17=Motor Start 8=Remote Control 18=iTrigger 9=Pulse Width 19= Reserved
0xAC: Recorders	0	WFR	**UINT32:** Trigger Source: 0=Manual, 1=iTrigger, 2= Schedule WFR
	1	DWR	
	2	RMSR	(Only for Trigger Source = iTrigger) **UINT32:** iTrigger Group **UINT64:** iTrigger Source MAC Address (Last 6 ASCII Digits)
	3	DR Start	**UINT32:** DR Number BIT0 to BIT7 stands for DR1 to DR8 **UINT32:** Trigger Source 0=DI Change, 1=Setpoint, 2=Reserved, 3=PQ Disturbance, 4=Inrush Current
	4	DR End	**UINT32:** DR Number BIT0 to BIT7 stands for DR1 to DR8 **UINT32:** Trigger Source 0=DI Change 1=Setpoint 2=Reserved, 3=PQ Disturbance 4=Inrush Current 5=DI Settings Changed 6=Setpoint Settings Changed 7=Reserved 8=PQ Disturbance Settings Changed 9=Inrush Current Settings Changed 10=Stop When Full

Device Log Classification

Event Classification	Sub-Classification	Description	Event Value
1=System	0	Power On	None
	1	Power Off	None
	2	Device Setup Changes	None
	3	Factory Setup Changes	None
	4	Set Clock	None
	5	Clear All Data	None
	6	Restore Factory Defaults	None
	7	Initialize Device	None
	8	Clear Device Setup Parameters	None
	9	Clear Factory Setup Parameters	None
	10	Clear IEEE Std 519 Compliance Report	None
	11	IL Reset	None
	12	Clear SDR	0~15=SDR# 1~SDR# 16 Writing 0xFFFFFFFF to clear all SDR Logs
	13	Clear DR	0~7= DR# 1~ DR# 8 Writing 0xFFFFFFFF to clear all DR Logs
	14	Reserved	
	15	Clear Energy	None
	16	Clear IER Log	
	17	Clear DI Counter	0~7=DI# 1~DI# 8 Writing 0xFFFFFFFF to clear all DI Counters
	18	Clear Flicker Log	0=Pst, 1=Plt
	19	Clear Waveform Recorder	
	20	Clear Disturbance Recorder	
	21	Reserved	
	22	Clear All Max./Min. Log	
	23	Clear Max. Log	0-3=Max./Min. Log# 1 ~ Max./Min. Log# 4
	24	Clear Min. Log	
	25	Clear Demand	0=Clear This Max. Demand Log 1= Clear All Demand
	26	Clear EN 50160 Log	
	27	Reserved	
	28	Clear PQ Counter	0=Dips 1=Swells 2=Interruptions 3=Transient 4=RVC 5=Inrush Current 6=Reserved 7~9=MSV# 1~MSV# 3 10=All PQ Counters
	29	Clear TOU Log	
	30	Manual Freeze TOU Log	
	31	Preset TOU Energy	None
	32	Manual Triggered TOU Log	None
	33	Switch TOU Schedule	0=Manual #1 to #2 1= Manual. #2 to #1 2=Auto. #1 to #2 3=Auto. #2 to #1
	34	Hardware Alarm	Device Self Diagnostics PPC Device Self Diagnostics DSP
	35	Hardware is working normally	None
	36	DSP Bootloader Upgrade Successfully	
	37	AI Calibration	
	38	Clear RMSR Log	
	39	Format Memory	
	40	Tariff Switched by DI from Tx to Ty	UINT32: Tx before switching UINT32: Ty after switching
	41	Tariff Switch by DI Enabled	UINT32: Tariff No.
	42	Tariff Switch by DI Disabled	UINT32: Tariff No.
	43	SD Card is not inserted	None
	44	Auditing Log exceeds 90% memory	None
	45	Auditing Log process exit abnormally	None

	46	Clear Device Logs	
	47	Clear SOE Logs	
	48	Clear Device Self-diagnostic Logs	None
	49	Clear Frequency Deviation Logs	
	50	Clear AER Log	
	51	Clear All Events	
	52-58	Reserved	
	59	Clear 2-150kHz C.E. Log	None
	60~61	Reserved	
	62	Reset LED Indicators Manually	

Appendix E - Technical Specifications

Voltage Inputs (V1, V2, V3, VN, V4, V4N)	
Standard (Un)	400ULN/690ULL +20%
Range	1% to 200% Un for 400ULN nominal
Overload	2xUn continuous, 4xUn for 1s
Burden	< 0.5VA/per phase
PT Ratio	
Primary	1-1,000,000V
Secondary	1-1,500V
V4 Primary	1-1,000,000V
V4 Secondary	1-1,500V
Measurement Category	CAT III 1000V
Frequency	40Hz-60Hz @ 50Hz, 48Hz-72Hz @ 60Hz
Current Inputs (I11, I12, I21, I22, I31, I32, I41, I42, I51, I52)	
Standard (In)	5A (Standard), 1A (Optional)
Range	1% to 400% In
Starting Current	0.1% In
Overload	4xIn continuous, 20xIn for 1s
Burden	< 0.5VA/per phase @ 5A < 0.1VA/per phase @ 1A
Optional SCCP Options	Split-Core Current Probe Input @ 500mV
SCCP-50A-500mV	5A/50A (In/Imax), max. 500mV Output
SCCP-200A-200mV	20A/200A (In/Imax), max. 200mV Output
SCCP-500A-500mV	500A Imax, max. 500mV Output
SCCP-5000A-500mV	Selectable 500A/5000A (Imax) Rogowski Coil, max. 500mV Output
CT Ratio	
Primary	1-30,000A
Secondary	1-50A
I4 Primary	1-30,000A
I4 Secondary	1-50A
Power Supply (L/+, N/-)	
Standard	95-250VAC/VDC ± 10%, 47-440 Hz
Optional	20-60VDC
Burden	< 12W
Overvoltage Category	OVC III 300V
Digital Inputs (DIC, DI1 to DI8 or DI16)	
Standard	Dry contact, 24VDC internally wetted
Optional	110V/220V AC/DC externally wetted
Sampling	1000Hz
Hysteresis	1ms minimum
Form A Relay Outputs (DO1 to DO3 or optional DO1 to DO7)	
Type	Form A Mechanical Relay
Loading	5A @ 250VAC/30VDC
Form C Relay Output (Alarm 1, 2, 3)	
Type	Form C Mechanical Relay
Loading	8A @ 250VAC/24VDC
Pulse Outputs (E1+, E1-, E2+, E2-, E3+, E3-, E4+, E4-)	
Type	Form A Solid State Relay
Isolation	Optical
Max. Load Voltage	30VDC
Max. Forward Current	4mA
Optional Analog Input (AI1+, AI1-, AI2+, AI2-)	
Type	0-20/4-20 mA DC
Overload	24 mA maximum
Optional Analog Output (AO1+, AO1-, AO2+, AO2-)	
Type	0-20/4-20 mA
Loading	500Ω maximum
Overload	24 mA maximum
Environmental Conditions	
Operating Temperature	-25°C to 70°C
Storage Temperature	-40°C to 85°C
Humidity	5% to 95% non-condensing
Atmospheric Pressure	63 kPa to 110 kPa
Pollution Degree	2
Mechanical Characteristics	
Panel Cutout	186x186 mm
Unit Dimensions	192x192x182.4 mm
IP Rating	52

Accuracy

Parameters	Accuracy	Resolution
Voltage (U)	±0.1%	0.001V
I1, I2, I3	±0.1%	0.001A
	SCCPA Option: ±0.1% + Error of SCCP	
I4	±0.1%	
I5	±0.5%	
P, Q, S	±0.2%	0.001kX
	SCCPA Option: ±0.5%	
kWh, kVAh	IEC 62053-22 Class 0.2S	0.1kXh
	SCCPA Option: IEC 62053-22 Class 0.5	
kvarh	IEC 62053-24 Class 0.5S IEC 62053-23 Class 2	0.1kvarh
	SCCPA Option: IEC 62053-24 Class 1	
PF	±0.2%	0.001
	SCCPA Option: ±0.5%	
Frequency	±0.003 Hz	0.001Hz
Harmonics	IEC 61000-4-7 Class I	0.001
Phase Angles	±0.2°	0.1°
	SCCPA Option: ±0.2° + Phase Error of SCCP	
U Unbalance	±0.1 %	0.01%
I Unbalance	±0.5%	0.01%
Pst, Plt	IEC 61000-4-15 Class F1	0.01%

Appendix F - Standard of Compliance

Safety Requirements	
CE LVD 2014 / 35 / EU	EN61010-1: 2010 + A1: 2019 EN IEC 61010-2-030: 2021 + A11: 2021
Electrical Safety in Low Voltage Distribution Systems up to 1000Vac and 1500 Vdc	IEC 61557-12: 2018 (PMD)
Insulation AC Voltage: 2kV @ 1 minute Insulation Resistance: >100MΩ Impulse Voltage: 6kV, 1.2/50µs	IEC 62052-11: 2003 IEC 62053-22: 2003 EN 61010-1: 2010 + A1: 2019
EMC Compatibility CE EMC Directive 2014 / 30 / EU (EN IEC 61326: 2021)	
Immunity (EN50082-2)	
Electrostatic Discharge	EN 61000-4-2: 2009
Radiated Fields	EN IEC 61000-4-3: 2020
Fast Transients	EN 61000-4-4: 2012
Surges	EN 61000-4-5: 2014 + A1: 2017
Conducted Disturbances	EN 61000-4-6: 2014
Magnetic Fields	EN 61000-4-8: 2010
Voltage Dips and Interruptions	EN IEC 61000-4-11: 2020
Ring Wave	EN 61000-4-12: 2017
Emission (EN50081-2)	
Limits and Methods of Measurement of Electromagnetic Disturbance Characteristics of Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment	EN 55011: 2016 + A1: 2017 + A2: 2021
Electromagnetic Compatibility of Multimedia Equipment - Emission Requirements	EN 55032: 2015 + AC: 2016 + A11: 2020
Limits for Harmonic Current Emissions for Equipment with Rated Current ≤16 A	EN IEC 61000-3-2: 2019 + A1: 2021
Limitation of Voltage Fluctuations and Flicker in Low-Voltage Supply Systems for Equipment With Rated Current ≤16 A	EN 61000-3-3: 2013 + A1: 2019 + A2: 2021
Emission Standard for Industrial Environments	EN 61000-6-4: 2019
Mechanical Tests	
Spring Hammer Test	IEC 62052-11: 2003
Vibration Test	IEC 62052-11: 2003
Shock Test	IEC 62052-11: 2003
Power Quality	
Voltage Characteristics of Electricity Supplied by Public Distribution Systems	EN 50160: 2010
General Guide on Harmonic and Interharmonic Measurements and Instrumentation, for Power Supply Systems and Equipment Connected Thereto	IEC 61000-4-7: 2009
Flicker Meter - Functional and Design Specifications	IEC 61000-4-15: 2010
Testing and Measurement Techniques - Power Quality Measurement Methods	IEC 61000-4-30: 2021 Ed. 3.1 Class A Certified
Power Quality Measurement in Power Supply Systems-Part 2: Functional Tests and Uncertainty Requirements	IEC 62586-2: 2021 Ed.2.1
Harmonic Control in Electrical Power systems	IEEE Std 519-2022

Appendix G - Ordering Guide

CET Electric Technology

Version 20230508

Product Code	Description
iMeter 8 Advanced Power Quality Analyzer	
Basic Feature	
A	1024 samples/cycle, 8GB On-Board Memory IEC 61000-4-30 Ed. 3.1 Class A Certified
B*~	1024 samples/cycle, 8GB On-Board Memory IEC 61000-4-30 Ed. 3.1 Class A Certified with 2kHz-150kHz C.E. Measurement
Input Current	
5	5A
1	1A
SCCPA^	SCCP Option for use with CT Clamps with max. 500mV output.
Input Voltage	
9	400VLN/690VLL + 20%
Power Supply	
2	95-250VAC/DC ± 10%, 47-440Hz
3*'	20-60VDC
System Frequency	
5	50Hz
6	60Hz
I/O	
A	8xDI + 4xDO + 4xSS Pulse Outputs
B*~	8xDI + 4xDO + 2xAI + 1xAO + 4xSS Pulse Outputs
C*	16xDI + 8xDO + 4xSS Pulse Outputs
D*~	8xDI + 4xDO + 2xAI + 2xAO + 2xSS Pulse Outputs
DI Excitation	
N	Dry Contact (@24VDC Self-Excitation)
1'	110V AC/DC External Excitation
2'	220V AC/DC External Excitation
Communications	
A	2x100BaseT + 2xRS-485
Time Sync.	
A	GPS, IRIG-B
Display Language	
E	English

iMeter 8	-	A	5	9	2	5	A	N	A	A	E	iMeter 8-A5925ANAAE (Standard Model)

*Additional charges apply

~ The I/O options "B" and "D" are not supported when the Basic Feature option "B" is selected.

^ The SCCPA option is compatible with the SCCP models listed in the "SCCP Option" sheet. This option does not come with any Current Clamp. Please refer to the "SCCP Option" sheet for more information and order the desired model and quantity as a separate item.

' The DI Excitation options "1" and "2" are not supported when the Power Supply option "3" with 20-60VDC is selected.

Contact us

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