

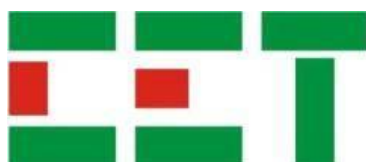
# **iMeter 8**

## **Advanced Power Quality Analyzer**

### **User Manual**

### **Version: 1.1**

May 19, 2025



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## Standards Compliance



**DANGER**

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



**CAUTION**

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



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

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

### **Limited warranty**

- 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 unsurpassed 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 2<sup>nd</sup> to 63<sup>rd</sup> #
  - U and I Individual Interharmonics (%IHD and RMS) from 1<sup>st</sup> to 63<sup>rd</sup> #
  - Total Harmonic P, Q, S and PF
  - Harmonic P, Q, S and PF from 2<sup>nd</sup> to 63<sup>rd</sup> in RMS
  - Harmonic Phase Angle from 2<sup>nd</sup> to 63<sup>rd</sup>
  - U and I DC Components
  - Total Harmonic kWh, kvarh Import/Export/Net/Total
  - Total Harmonic kWh, kvarh Import/Export from 2<sup>nd</sup> to 63<sup>rd</sup>
- # %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 ( $\frac{1}{2}$  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  $\frac{1}{2}$  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 kWh
- 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 99<sup>th</sup> percentile very short time (3s) values
- 52 Weekly Reports for statistical evaluations on Voltage Harmonics (95<sup>th</sup> percentile) and Current Harmonics (95<sup>th</sup> and 99<sup>th</sup> 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/SMTSP, 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 ( $\leq 0.5s/day$ )
- 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 3<sup>rd</sup> 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

#### 3<sup>rd</sup> 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.

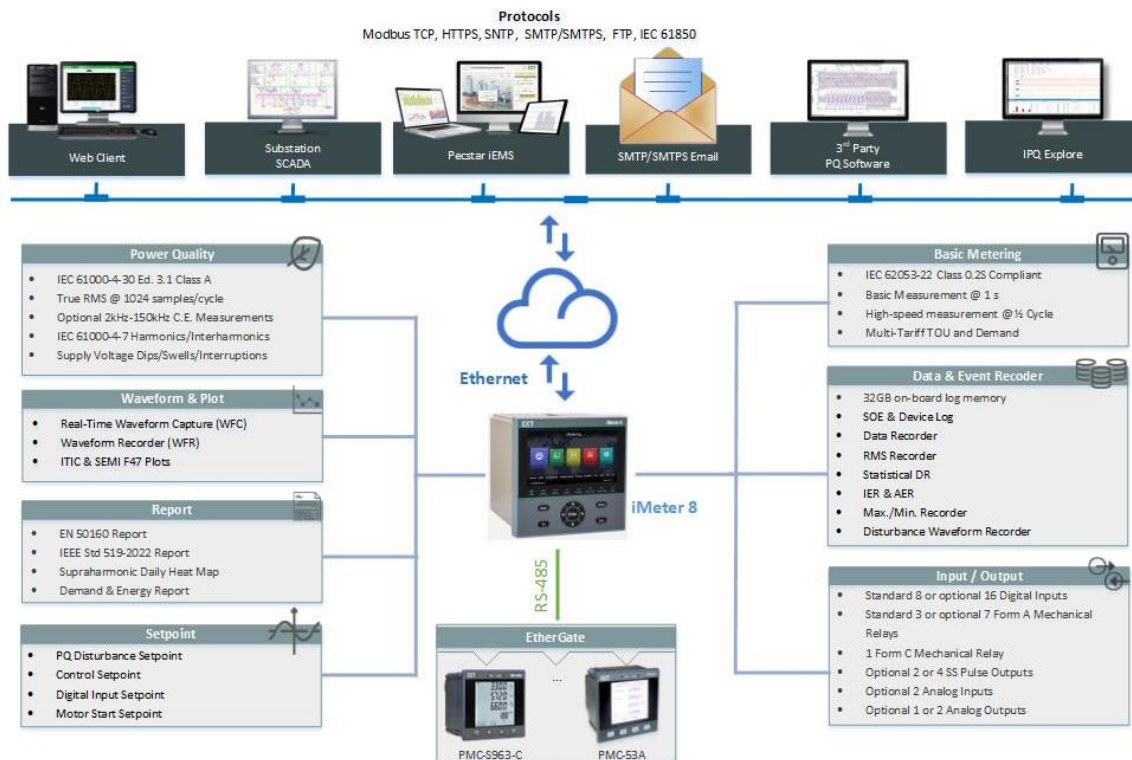


Figure 1-1 Typical Application

## 1.4 Getting more information

Additional information is available from CET via the following sources:

- Visit [www.cet-global.com](http://www.cet-global.com)
- Contact your local representative
- Contact CET directly via email at [support@cet-global.com](mailto: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



Figure 2-1 Appearance

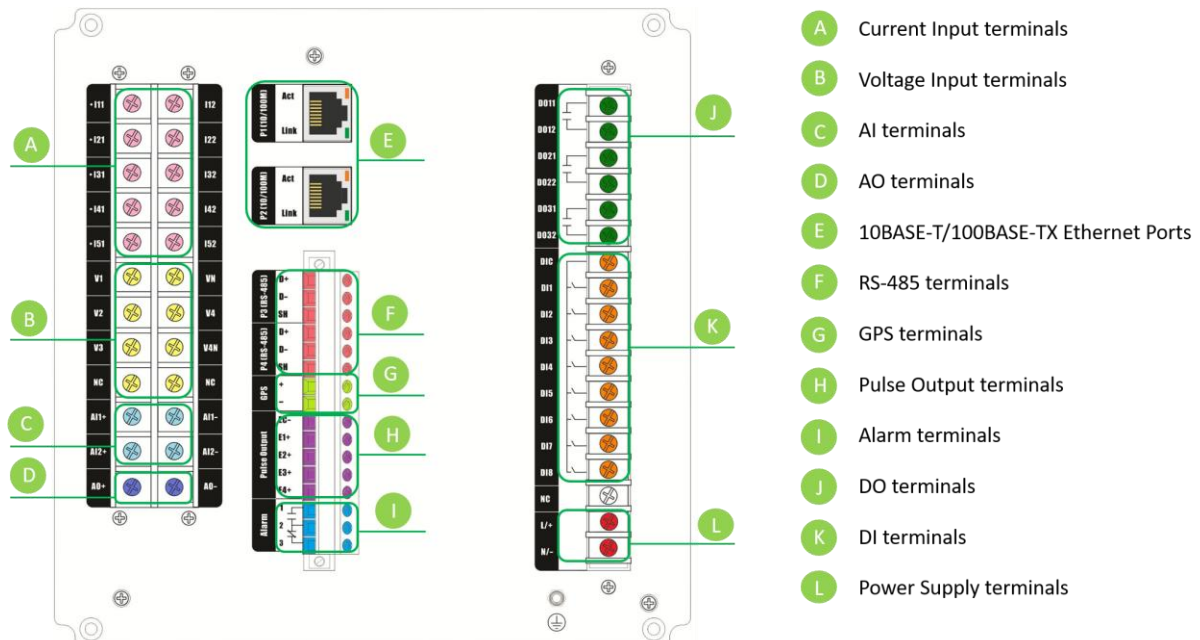


Figure 2-2 Rear Panel

## 2.2 Unit Dimensions

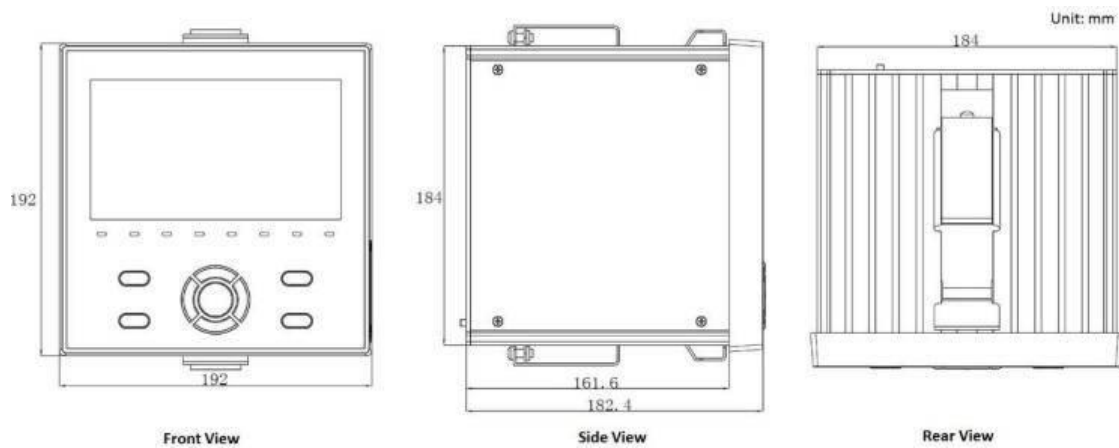


Figure 2-3 Unit Dimensions

## 2.3 Terminal Dimensions

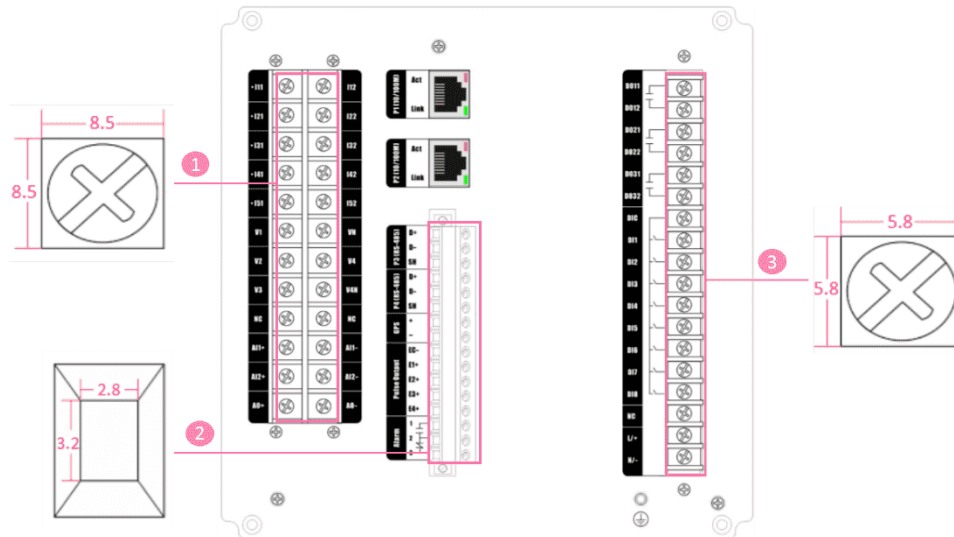


Figure 2-4 Terminal Dimensions

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

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



### 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**.

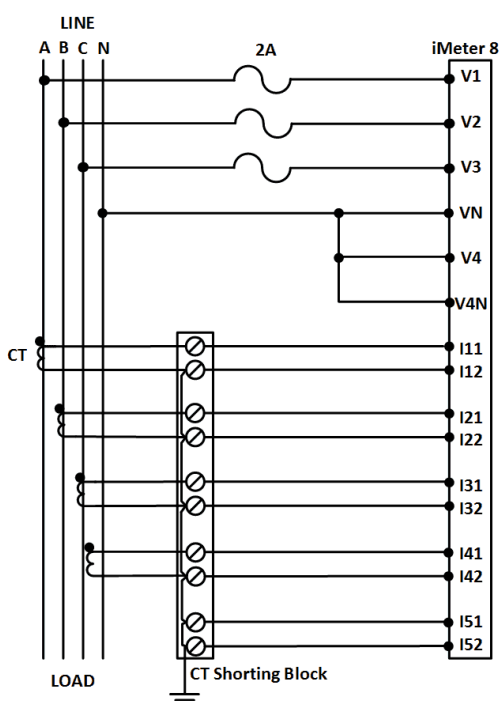


Figure 2-6 3-Phase 4-Wire Wye, no PTs, 4CTs

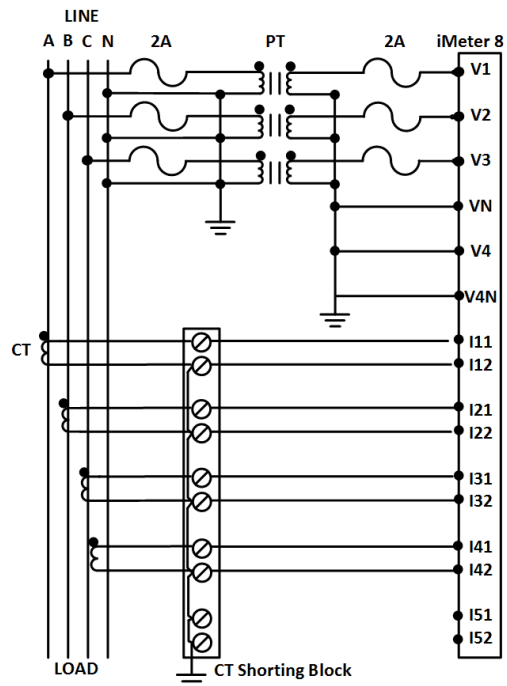


Figure 2-7 3-Phase 4-Wire Wye, 3PTs, 4CTs

### 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**.

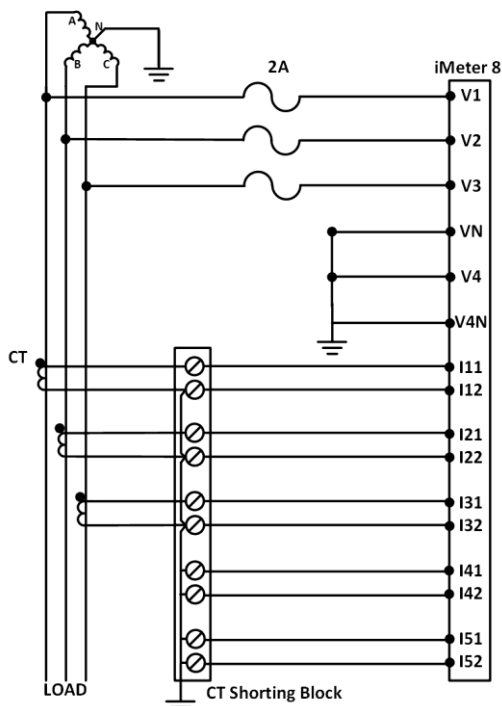


Figure 2-8 3P3W Grounded Wye, Direct Connection

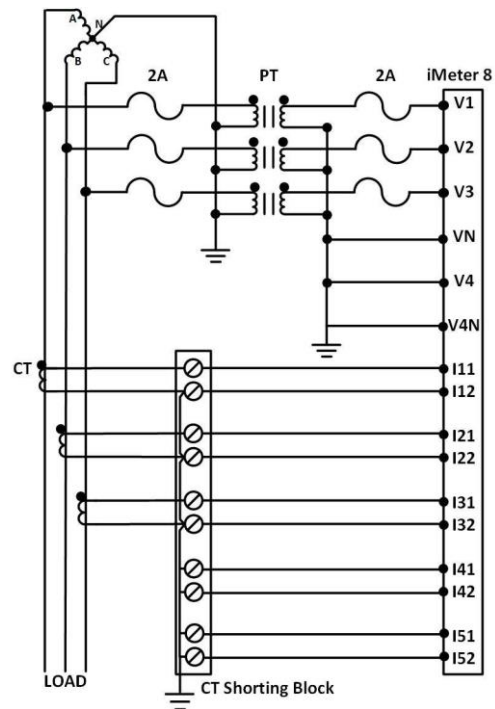


Figure 2-9 3P3W Grounded Wye, 3PTs, 3CTs

### 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**.

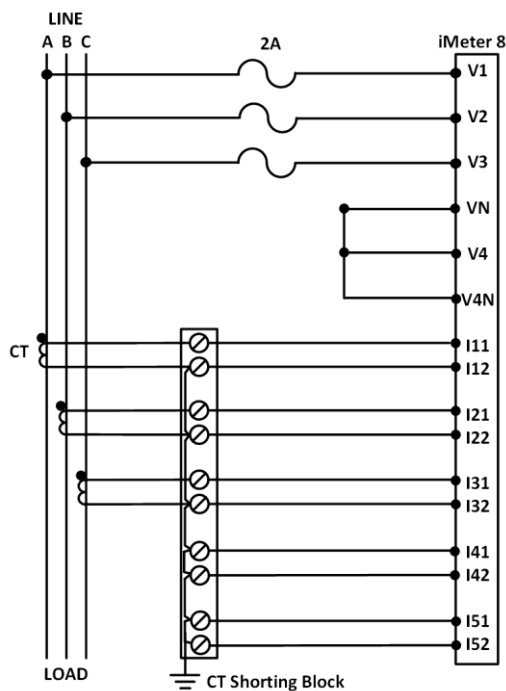


Figure 2-10 3P3W, no PTs, 3CTs

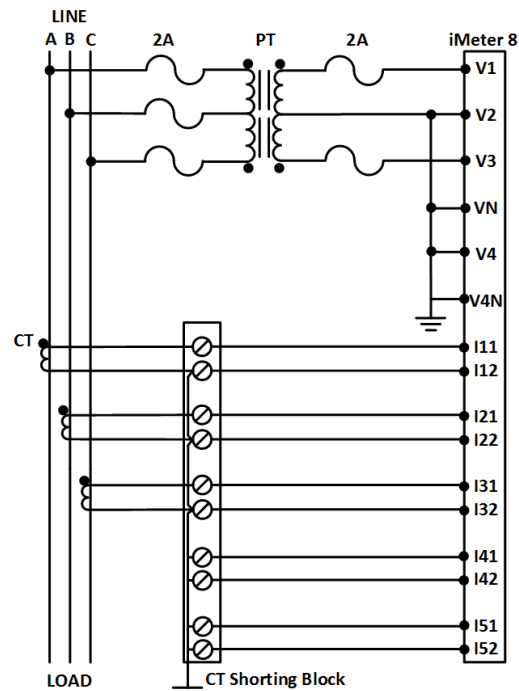


Figure 2-11 3P3W Delta, 2PTs, 3CTs

### 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**.

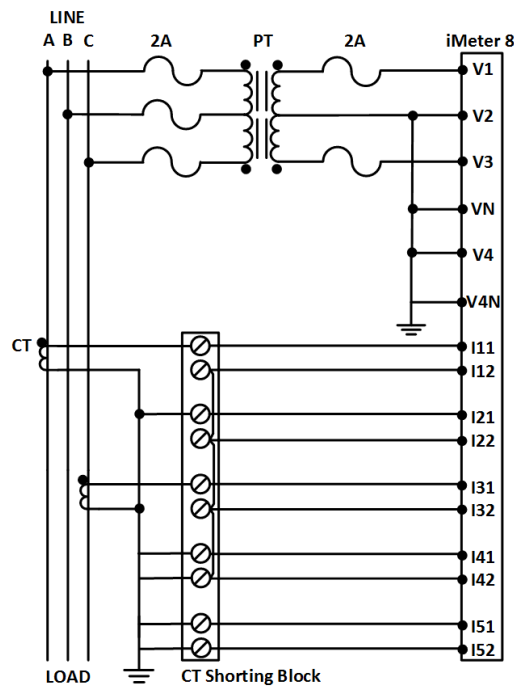


Figure 2-12 3-Phase 3-Wire Delta, 2PTs, 2CTs

### 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**.

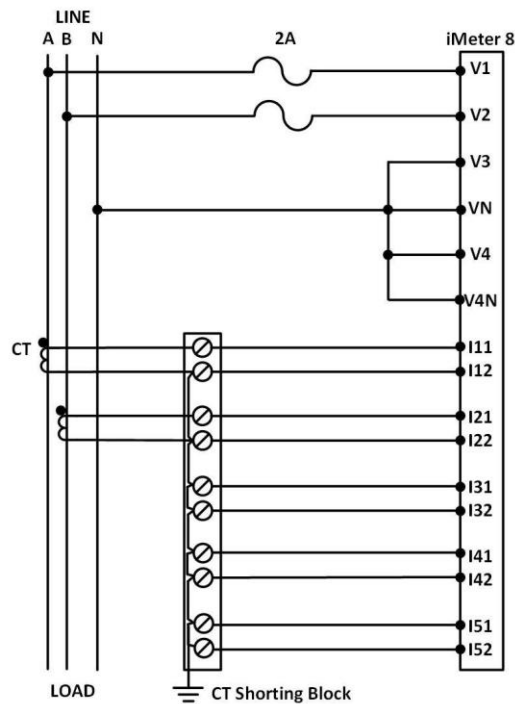


Figure 2-13 1-Phase 3-Wire Direct Connections with 2CTs

### 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**.

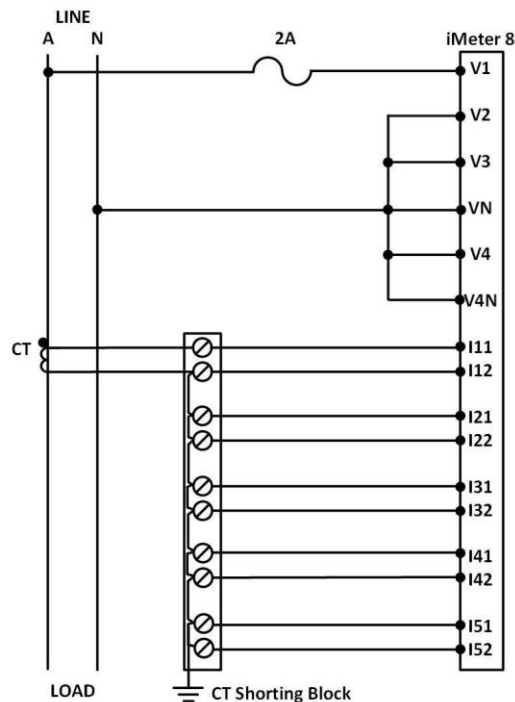


Figure 2-14 1-Phase 2-Wire L-N Direct Connections with 1CT

## 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**.

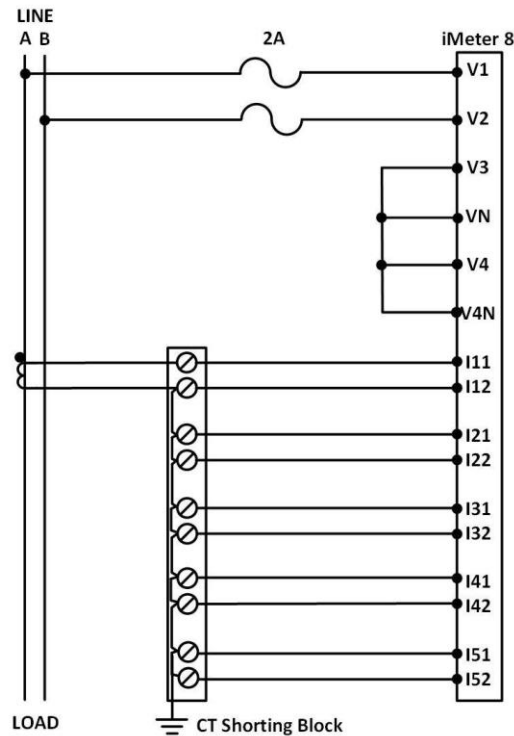


Figure 2-15 1-Phase 2-Wire L-L Direct Connections with 1CT

## 2.6 Communications Wiring

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

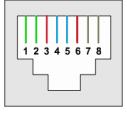
| RJ45 Connector                                                                      | Pin     | Meaning        |
|-------------------------------------------------------------------------------------|---------|----------------|
|  | 1       | Transmit Data+ |
|                                                                                     | 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:

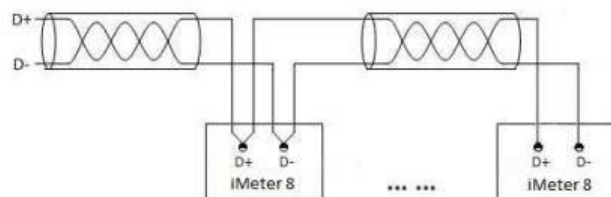


Figure 2-16 RS-485 Communications Connections

## 2.7 Digital Input Wiring

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

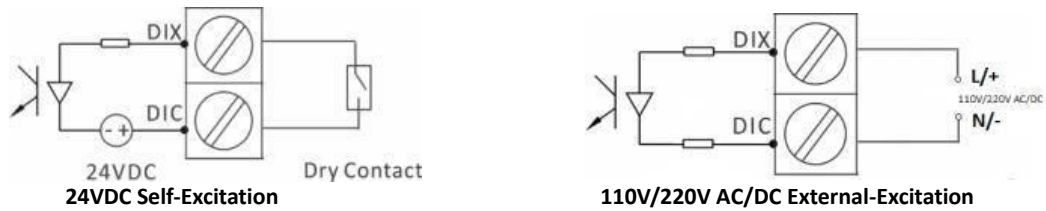


Figure 2-17 DI Connections

## 2.8 Digital Output Wiring

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

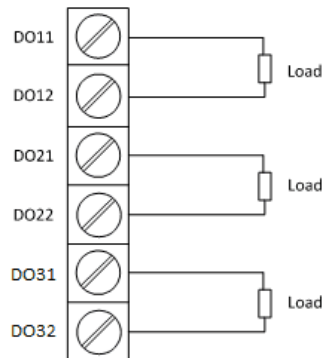


Figure 2-18 DO Connections

## 2.9 Pulse Output Wiring

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

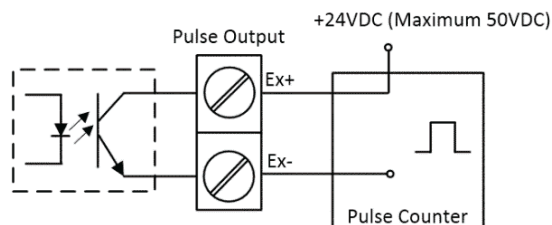


Figure 2-19 Pulse Output (Solid State Relay) Connections for Energy Pulsing

## 2.10 Analog Input Wiring

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

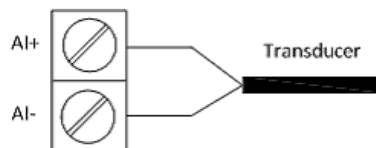


Figure 2-20 AI Connections

## 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:

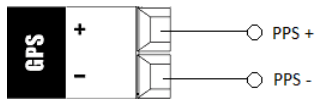


Figure 2-22 GPS 1PPS Time Sync.

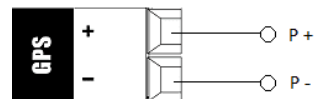


Figure 2-23 IRIG-B Time Sync.

## 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.

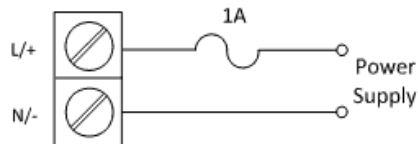


Figure 2-24 Power Supply Connections

## 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>&lt;▲&gt;<br/>&lt;▼&gt;<br/>&lt;◀&gt;<br/>&lt;▶&gt;</p> | <p>In the <b>Main Menu</b> page, &lt;◀&gt; and &lt;▶&gt; buttons are used to move the cursor between different icons (<b>Categories</b>). The current cursor position is indicated by the highlighted <b>Category</b>'s description.</p> <p>When inside a <b>Category</b> and under a particular <b>Sub-Menu</b>, the arrow buttons are used to navigate between <b>Pages</b>.</p> <ul style="list-style-type: none"> <li>Pressing &lt;▲&gt; or &lt;▼&gt; shifts the cursor up/down in the sub-menu column.</li> <li>Pressing &lt;◀&gt; or &lt;▶&gt; moves backward or forward to display different parameters.</li> <li>Pressing &lt;▲&gt; or &lt;▼&gt; scrolls the individual harmonic or Interharmonic measurements for 1<sup>st</sup> to 63<sup>rd</sup> in the <b>Power Quality &gt; Harmonics</b> or <b>Interharmonic</b> sub-menu.</li> <li>In the WFR page, using &lt;◀&gt; or &lt;▶&gt; to select the target area and then pressing the &lt;▲&gt; or &lt;▼&gt; buttons to zoom in or out of the waveform.</li> </ul> | <ul style="list-style-type: none"> <li>Before a parameter is selected, use the &lt;◀&gt;, &lt;▶&gt;, &lt;▲&gt; and &lt;▼&gt; buttons to navigate around and select the desired parameter for modification.</li> <li>If a numeric parameter is already selected, pressing &lt;▲&gt; or &lt;▼&gt; increments or decrements a numeric value.</li> <li>If an enumerated parameter is already selected, pressing &lt;▲&gt; or &lt;▼&gt; goes back or advances to last or next enumerated value in the selection list.</li> </ul> |
| <Reset>                                                    | Pressing this button reset the LED indicators.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <Home>                                                     | Pressing this button return to the main page.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <Enter>                                                    | <ul style="list-style-type: none"> <li>Before a <b>Category &gt; Sub-menu</b> or operation is selected, pressing &lt;Enter&gt; enters the selected <b>Category &gt; Sub-</b></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>After changing the parameter, pressing &lt;Enter&gt; saves the new</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                        |

|                                   |                                                                                                                                                                                                                                                                                                                                                                      |                                                       |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
|                                   | <b>menu</b> or execute the chosen operation. <ul style="list-style-type: none"> <li>In the <b>Metering &gt; RMS</b> summary page, press <b>&lt;Enter&gt;</b> to refresh the RMS data.</li> <li>When in a record or event page, e.g. an EN50160 record page, press <b>&lt;Enter&gt;</b> to display the details page.</li> </ul>                                       | settings into memory.                                 |
| <b>&lt;Fn&gt;</b>                 | <ul style="list-style-type: none"> <li>When inside a data display page, pressing <b>&lt;Fn&gt;</b> switches between the <b>Large Font</b> and <b>Summary</b> page.</li> <li>In the <b>Metering &gt; Max.</b> or <b>Min.</b> page, using the <b>&lt;Fn&gt;</b> button to scroll between different <b>Max.</b> or <b>Min.</b> measurements with timestamps.</li> </ul> | N/A                                                   |
| <b>&lt;Esc&gt;</b>                | Pressing <b>&lt;Esc&gt;</b> returns to the previous level menu or page.                                                                                                                                                                                                                                                                                              | Pressing <b>&lt;Esc&gt;</b> cancel the entered value. |
| <b>&lt;Fn&gt; + &lt;Enter&gt;</b> | Press this key combination to capture the current page.                                                                                                                                                                                                                                                                                                              |                                                       |

Table 3-2 Button Function

### 3.1.3 Front Panel Display

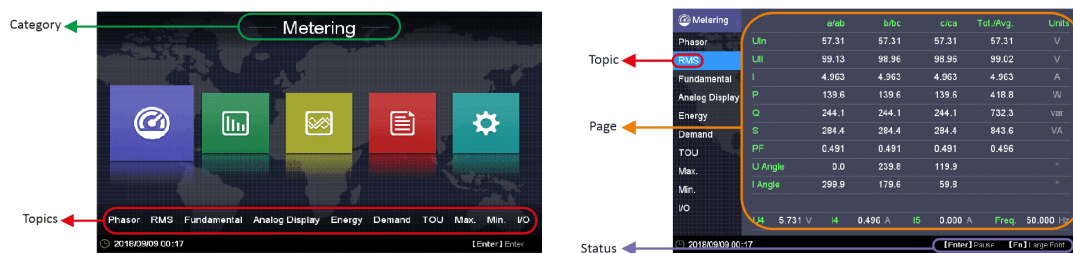


Figure 3-2 Hierarchy of Menu

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.

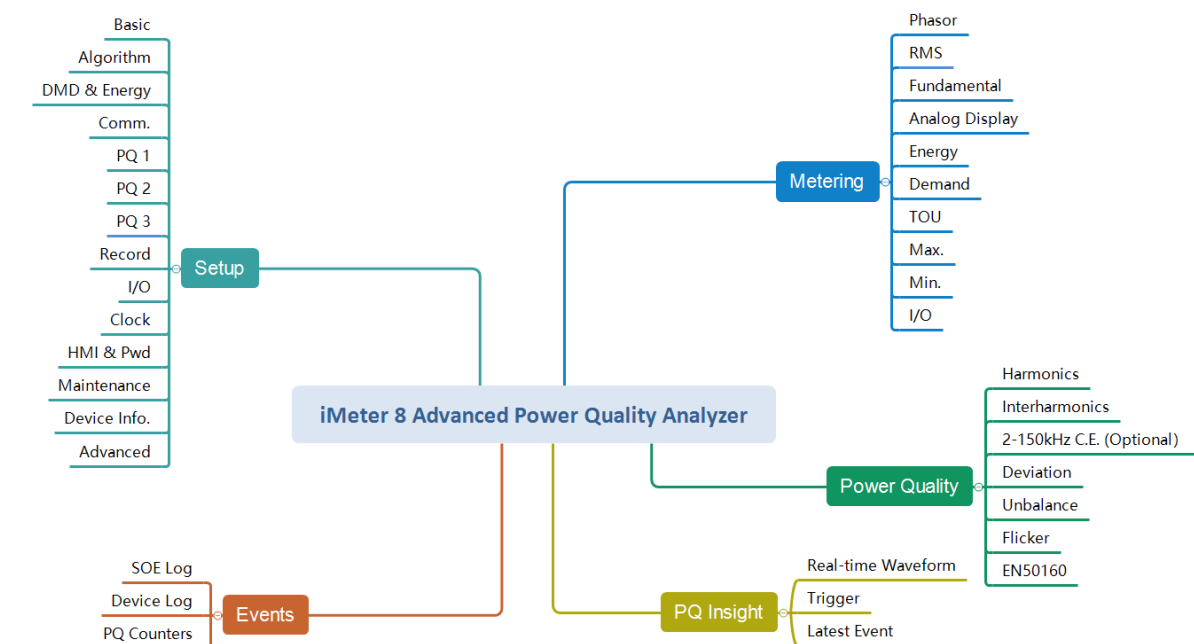


Figure 3-3 Overview of Front Panel Display

### 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.

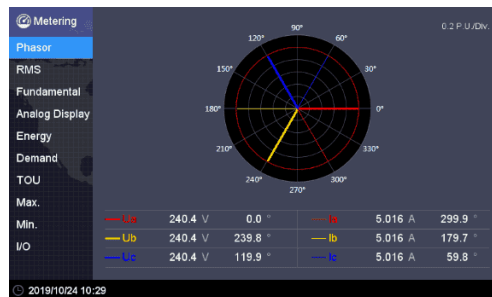


Figure 3-5 Phasor

#### 3.1.3.1.2 RMS

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

| Metering         |         | a/ab                            | b/bc  | c/ca    | Tot./Avg. | Units     |
|------------------|---------|---------------------------------|-------|---------|-----------|-----------|
| Phasor           | Uln     | 240.5                           | 240.5 | 240.5   | 240.5     | V         |
| RMS              | Ull     | 416.1                           | 415.4 | 415.4   | 415.6     | V         |
| Fundamental      | I       | 5.020                           | 5.020 | 5.020   | 5.020     | A         |
| Analog Display   | P       | 0.585                           | 0.573 | 0.587   | 1.745     | kW        |
| Energy           | Q       | 1.040                           | 1.047 | 1.039   | 3.126     | kvar      |
| Demand           | S       | 1.207                           | 1.207 | 1.207   | 3.581     | kVA       |
| TOU              | PF      | 0.485                           | 0.475 | 0.486   | 0.487     |           |
| Max.             | U Angle | 0.0                             | 239.8 | 119.9   |           | °         |
| Min.             | I Angle | 299.9                           | 179.7 | 59.8    |           | °         |
| I/O              |         |                                 |       |         |           |           |
|                  | U4      | 24.04 V                         | I4    | 0.502 A | I5        | 0.036 A   |
|                  |         |                                 |       |         | Freq.     | 50.000 Hz |
| 2019/10/24 10:29 |         | [Enter] Refresh [Fn] Large Font |       |         |           |           |

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.

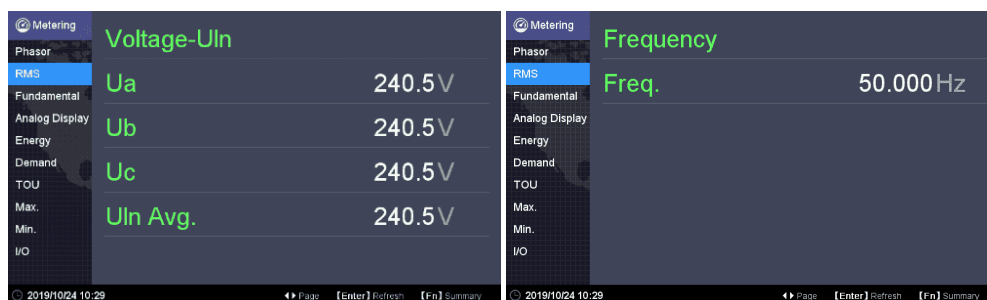


Figure 3-7 Large Font Display of RMS Measurements

### 3.1.3.1.3 Fundamental

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

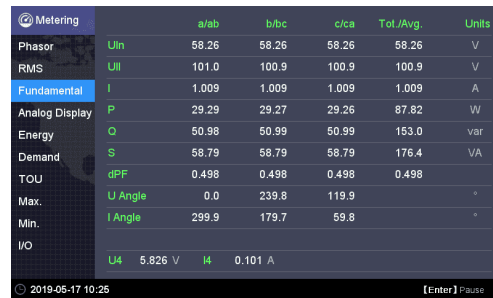


Figure 3-8 Fundamental Measurements

### 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- $\phi$  ULN, ULL and I measurements.

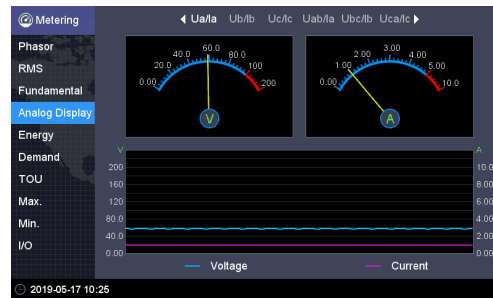


Figure 3-9 Analog Display

### 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.

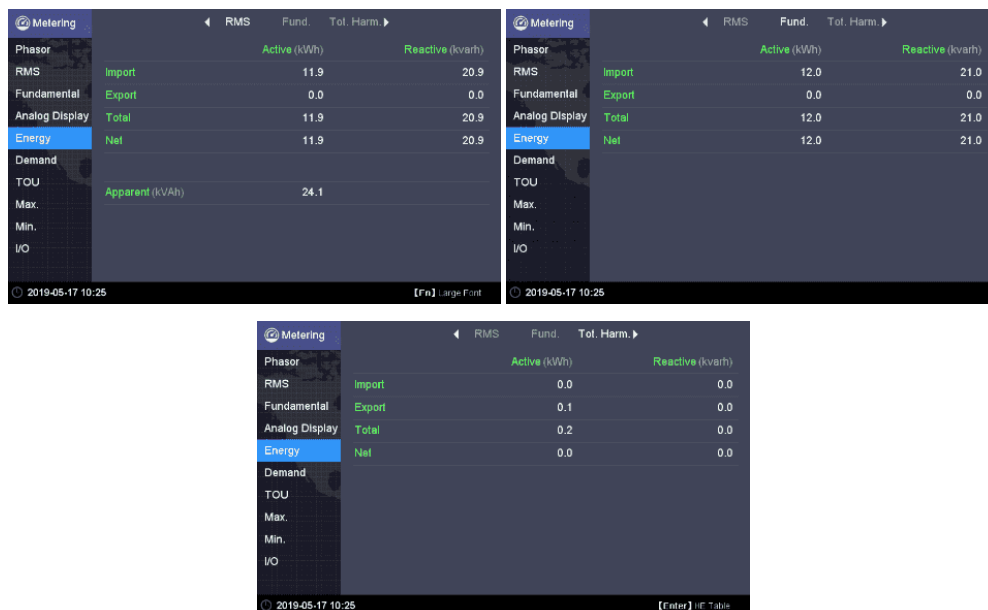


Figure 3-10 Energy Measurements

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.

| Harmonic Energy |                   |                   |                       |                       |
|-----------------|-------------------|-------------------|-----------------------|-----------------------|
|                 | kWh Imp.<br>(kWh) | kWh Exp.<br>(kWh) | kvarh Imp.<br>(kvarh) | kvarh Exp.<br>(kvarh) |
| TH              | 9.6               | 17.7              | 0.0                   | 2.0                   |
| H01             | 1,265.5           | 0.0               | 2,256.6               | 0.0                   |
| H02             | 0.0               | 0.1               | 0.2                   | 0.0                   |
| H03             | 0.0               | 10.5              | 0.0                   | 0.1                   |
| H04             | 0.0               | 0.0               | 0.0                   | 0.0                   |
| H05             | 2.1               | 0.0               | 0.0                   | 3.5                   |
| H06             | 0.0               | 0.0               | 0.0                   | 0.0                   |
| H07             | 0.9               | 0.0               | 1.7                   | 0.0                   |
|                 |                   |                   |                       | 1/8                   |

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- $\emptyset$  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.

| Metering       | ◀ Present This Max. Last Max. ▶ |           |           |
|----------------|---------------------------------|-----------|-----------|
|                | Present                         | Predicted |           |
| Phasor         |                                 |           |           |
| RMS            | P Total Imp.                    | 428.8 W   | 428.8 W   |
| Fundamental    | P Total Exp.                    | 0.000 W   | 0.000 W   |
| Analog Display | Q Total Imp.                    | 749.6 var | 749.7 var |
| Energy         | Q Total Exp.                    | 0.000 var | 0.000 var |
| Demand         | S                               | 863.6 VA  | 863.7 VA  |
| TOU            | Ia                              | 5.021 A   | 5.021 A   |
| Max.           | Ib                              | 5.021 A   | 5.021 A   |
| Min.           | Ic                              | 5.021 A   | 5.021 A   |
| I/O            |                                 |           |           |

| Metering       | ◀ Present This Max. Last Max. ▶ |             |                     |
|----------------|---------------------------------|-------------|---------------------|
|                | Since: 2019/10/24 10:03:45      | Max. Demand | Timestamp           |
| Phasor         |                                 |             |                     |
| RMS            | P Total Imp.                    | 1.747 kW    | 2019/10/24 10:30:00 |
| Fundamental    | P Total Exp.                    | 0.000 W     | 2019/10/24 10:15:00 |
| Analog Display | Q Total Imp.                    | 3.129 kvar  | 2019/10/24 10:30:00 |
| Energy         | Q Total Exp.                    | 0.000 var   | 2019/10/24 10:15:00 |
| Demand         | S                               | 3.584 kVA   | 2019/10/24 10:30:00 |
| TOU            | Ia                              | 5.021 A     | 2019/10/24 10:30:00 |
| Max.           | Ib                              | 5.021 A     | 2019/10/24 10:30:00 |
| Min.           | Ic                              | 5.021 A     | 2019/10/24 10:30:00 |
| I/O            |                                 |             |                     |

|              | Max. Demand | Timestamp |
|--------------|-------------|-----------|
| P Total Imp. | --          | --        |
| P Total Exp. | --          | --        |
| Q Total Imp. | --          | --        |
| Q Total Exp. | --          | --        |
| S            | --          | --        |
| Ia           | --          | --        |
| Ib           | --          | --        |
| Ic           | --          | --        |

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.

| Screen           | Metric       | Value      |
|------------------|--------------|------------|
| Present          | P Total Imp. | 1.747 kW   |
|                  | P Total Exp. | 0.000 W    |
|                  | Q Total Imp. | 3.129 kvar |
|                  | Q Total Exp. | 0.000 var  |
| This Max. Demand | P Total Imp. | 1.747 kW   |
|                  | P Total Exp. | 0.000 W    |
|                  | Q Total Imp. | 3.129 kvar |
|                  | Q Total Exp. | 0.000 var  |
| Last Max. Demand | P Total Imp. | 0.000 W    |
|                  | P Total Exp. | 0.000 W    |
|                  | Q Total Imp. | 0.000 var  |
|                  | Q Total Exp. | 0.000 var  |

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.

⌕ Metering

◀ Present Last ▶

Phasor

Present Tariff: T1 Present Season: S1 Present Daily Profile: Profile 1

RMS

kWh Imp. (kWh) kvarh Imp. (kvarh) kVAh (kVAh)

Fundamental

T111.920.924.1

Analog Display

T20.00.00.0

Energy

T30.00.00.0

Demand

T40.00.00.0

TOU

T50.00.00.0

Max.

T60.00.00.0

Min.

T70.00.00.0

I/O

T80.00.00.0

○ 2019-05-17 10:26

[Enter] Details [Fn] Large Font

⌕ Metering

◀ Present Last ▶

Phasor

Self-Read: 2019/10/20 18:10:40

RMS

kWh Imp. (kWh) kvarh Imp. (kvarh) kVAh (kVAh)

Fundamental

T10.10.20.2

Analog Display

T20.00.00.0

Energy

T30.00.00.0

Demand

T40.00.00.0

TOU

T50.00.00.0

Max.

T60.00.00.0

Min.

T70.00.00.0

I/O

T80.00.00.0

○ 2019/10/24 10:33

[Enter] Details

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.

| Present Last       |                    |                |                                  |                    |
|--------------------|--------------------|----------------|----------------------------------|--------------------|
| Present Tariff: T1 | Present Season: S1 |                | Present Daily Profile: Profile 1 |                    |
|                    | kWh Imp. (kWh)     | kWh Exp. (kWh) | kvarh Imp. (kvarh)               | kvarh Exp. (kvarh) |
| T1                 | 53.9               | 0.0            | 94.2                             | 0.0                |
| T2                 | 0.0                | 0.0            | 0.0                              | 0.0                |
| T3                 | 0.0                | 0.0            | 0.0                              | 0.0                |
| T4                 | 0.0                | 0.0            | 0.0                              | 0.0                |
| T5                 | 0.0                | 0.0            | 0.0                              | 0.0                |
| T6                 | 0.0                | 0.0            | 0.0                              | 0.0                |
| T7                 | 0.0                | 0.0            | 0.0                              | 0.0                |
| T8                 | 0.0                | 0.0            | 0.0                              | 0.0                |
| 2018/08/04 14:17   |                    |                |                                  |                    |

| Present Last       |                             |                     |                                  |                     |
|--------------------|-----------------------------|---------------------|----------------------------------|---------------------|
| Present Tariff: T1 | Present Season: S1          |                     | Present Daily Profile: Profile 1 |                     |
|                    | Q Total Imp. Max. DMD (var) |                     | Q Total Exp. Max. DMD (var)      |                     |
| T1                 | 755.3                       | 2018/08/02 18:00:00 | 0.000                            | 2018/08/02 17:24:00 |
| T2                 | --                          | --                  | --                               | --                  |
| T3                 | --                          | --                  | --                               | --                  |
| T4                 | --                          | --                  | --                               | --                  |
| T5                 | --                          | --                  | --                               | --                  |
| T6                 | --                          | --                  | --                               | --                  |
| T7                 | --                          | --                  | --                               | --                  |
| T8                 | --                          | --                  | --                               | --                  |
| 2018/08/04 14:26   |                             |                     |                                  |                     |

| Present Last       |                            |                     |                                  |                     |
|--------------------|----------------------------|---------------------|----------------------------------|---------------------|
| Present Tariff: T1 | Present Season: S1         |                     | Present Daily Profile: Profile 1 |                     |
|                    | Q Total Imp. Max. DMD (VW) |                     | P Total Exp. Max. DMD (VW)       |                     |
| T1                 | 428.8                      | 2018/07/20 21:30:00 | 0.000                            | 2018/07/01 00:15:00 |
| T2                 | --                         | --                  | --                               | --                  |
| T3                 | --                         | --                  | --                               | --                  |
| T4                 | --                         | --                  | --                               | --                  |
| T5                 | --                         | --                  | --                               | --                  |
| T6                 | --                         | --                  | --                               | --                  |
| T7                 | --                         | --                  | --                               | --                  |
| T8                 | --                         | --                  | --                               | --                  |
| 2018/08/04 14:36   |                            |                     |                                  |                     |

| Present Last       |                            |                     |                                  |                     |
|--------------------|----------------------------|---------------------|----------------------------------|---------------------|
| Present Tariff: T1 | Present Season: S1         |                     | Present Daily Profile: Profile 1 |                     |
|                    | P Total Imp. Max. DMD (VW) |                     | P Total Exp. Max. DMD (VW)       |                     |
| T1                 | 432.1                      | 2018/08/02 18:00:00 | 0.000                            | 2018/08/02 17:24:00 |
| T2                 | --                         | --                  | --                               | --                  |
| T3                 | --                         | --                  | --                               | --                  |
| T4                 | --                         | --                  | --                               | --                  |
| T5                 | --                         | --                  | --                               | --                  |
| T6                 | --                         | --                  | --                               | --                  |
| T7                 | --                         | --                  | --                               | --                  |
| T8                 | --                         | --                  | --                               | --                  |
| 2018/08/04 14:26   |                            |                     |                                  |                     |

| Self-Read: 2019/10/20 18:10:40 |                |                |                    |                    |
|--------------------------------|----------------|----------------|--------------------|--------------------|
|                                | kWh Imp. (kWh) | kWh Exp. (kWh) | kvarh Imp. (kvarh) | kvarh Exp. (kvarh) |
| T1                             | 0.1            | 0.0            | 0.2                | 0.0                |
| T2                             | 0.0            | 0.0            | 0.0                | 0.0                |
| T3                             | 0.0            | 0.0            | 0.0                | 0.0                |
| T4                             | 0.0            | 0.0            | 0.0                | 0.0                |
| T5                             | 0.0            | 0.0            | 0.0                | 0.0                |
| T6                             | 0.0            | 0.0            | 0.0                | 0.0                |
| T7                             | 0.0            | 0.0            | 0.0                | 0.0                |
| T8                             | 0.0            | 0.0            | 0.0                | 0.0                |
| 2019/10/24 10:33               |                |                |                    |                    |

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.

| Metering         |                |
|------------------|----------------|
| Phasor           | T1 Energy      |
| RMS              | kWh Imp. 1.2   |
| Fundamental      | kWh Exp. 0.0   |
| Analog Display   | kvarh Imp. 2.1 |
| Energy           | kvarh Exp. 0.0 |
| Demand           | kVAh 2.4       |
| TOU              |                |
| Max.             |                |
| Min.             |                |
| I/O              |                |
| 2018/09/09 09:33 |                |

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.

| Metering                   |          |            |                     |
|----------------------------|----------|------------|---------------------|
| Since: 2019/10/22 14:41:38 |          |            |                     |
| Phasor                     |          |            |                     |
| RMS                        | Uab      | 421.8 V    | 2019/10/24 08:26:48 |
| Fundamental                | Ubc      | 421.0 V    | 2019/10/24 08:26:48 |
| Analog Display             | Uca      | 421.0 V    | 2019/10/24 08:26:48 |
| Energy                     | Ull Avg. | 421.3 V    | 2019/10/24 08:26:48 |
| Demand                     | Ia       | 5.088 A    | 2019/10/24 08:26:48 |
| TOU                        | Ib       | 5.088 A    | 2019/10/24 08:26:48 |
| Max.                       | Ic       | 5.088 A    | 2019/10/24 08:26:48 |
| Min.                       | I Avg.   | 5.088 A    | 2019/10/24 08:26:48 |
| I/O                        | P Total  | 1.793 kW   | 2019/10/24 08:26:48 |
|                            | Q Total  | 3.212 kvar | 2019/10/24 08:26:48 |
| 2019/10/24 10:33           |          |            |                     |

| Metering                   |          |           |                     |
|----------------------------|----------|-----------|---------------------|
| Since: 2019/10/22 14:41:38 |          |           |                     |
| Phasor                     |          |           |                     |
| RMS                        | S Total  | 3.679 kVA | 2019/10/24 08:26:48 |
| Fundamental                | PF Total | 1.000     | 2019/10/22 14:41:38 |
| Analog Display             | Freq.    | 50.000 Hz | 2019/10/22 14:41:38 |
| Energy                     | Ua       | 243.8 V   | 2019/10/24 08:26:48 |
| Demand                     | Ub       | 243.8 V   | 2019/10/24 08:26:48 |
| TOU                        | Uc       | 243.8 V   | 2019/10/24 08:26:48 |
| Max.                       | Ull Avg. | 243.8 V   | 2019/10/24 08:26:48 |
| Min.                       | U4       | 24.37 V   | 2019/10/24 08:26:48 |
| I/O                        | I4       | 0.509 A   | 2019/10/24 08:26:48 |
|                            | I5       | 0.037 A   | 2019/10/24 09:24:05 |
| 2019/10/24 10:34           |          |           |                     |

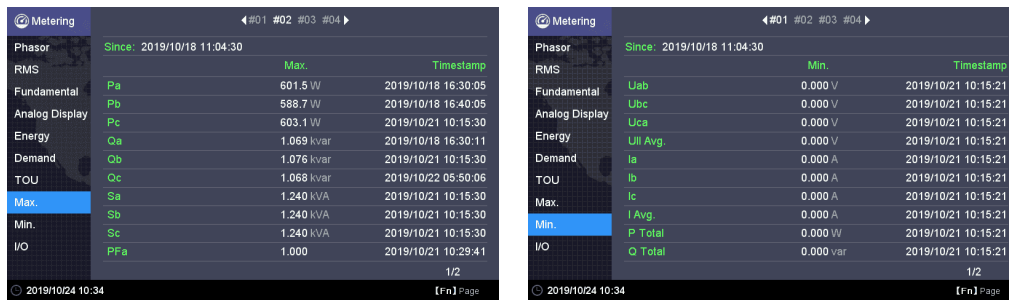


Figure 3-18 Max./Min. Measurements

### 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.

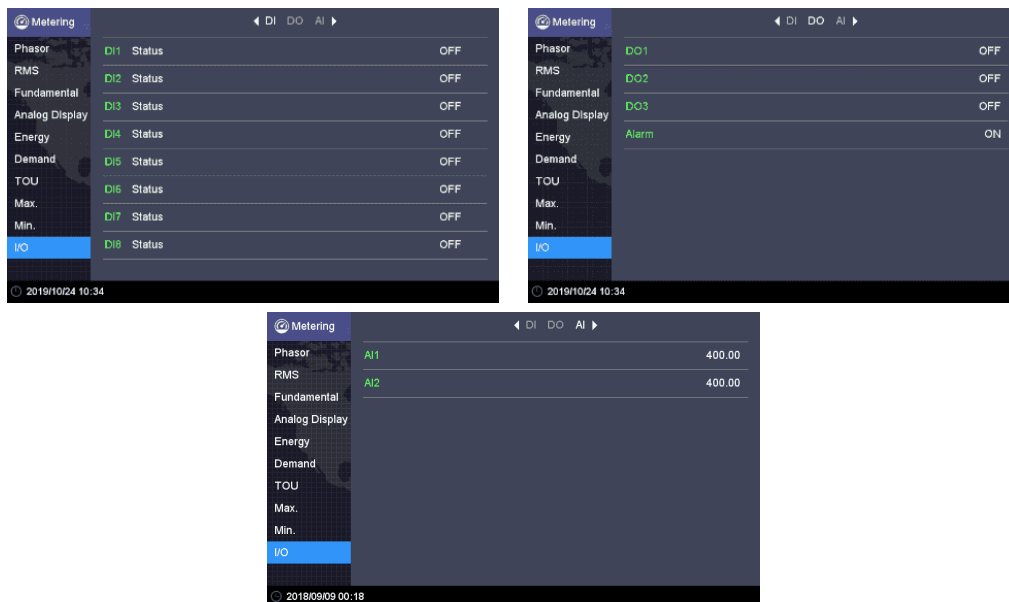


Figure 3-19 I/O Displays

### 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.

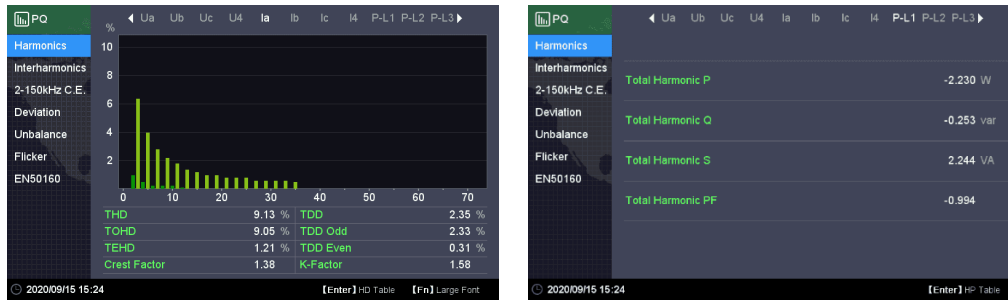


Figure 3-22 Harmonics Overview

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 1<sup>st</sup> to 63<sup>rd</sup>, press the <Esc> to exit the Individual Harmonic page.

| Order | %HD      | RMS     | Angle  |
|-------|----------|---------|--------|
| 01    | 100.00 % | 58.11 V | 0.0 °  |
| 02    | 1.00 %   | 0.582 V | 60.2 ° |
| 03    | 6.40 %   | 3.719 V | 60.3 ° |
| 04    | 0.50 %   | 0.291 V | 60.4 ° |
| 05    | 4.00 %   | 2.325 V | 60.5 ° |
| 06    | 0.26 %   | 0.151 V | 60.6 ° |
| 07    | 2.80 %   | 1.627 V | 60.7 ° |
| 08    | 0.26 %   | 0.151 V | 60.8 ° |
| 09    | 2.20 %   | 1.279 V | 60.9 ° |
| 10    | 0.26 %   | 0.151 V | 61.0 ° |

Navigation options at the bottom include <◀> Page and [Esc] Esc.

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 1<sup>st</sup> to 63<sup>rd</sup>, press the <Esc> to exit the Individual Interharmonic page.



Figure 3-25 Interharmonics Overview

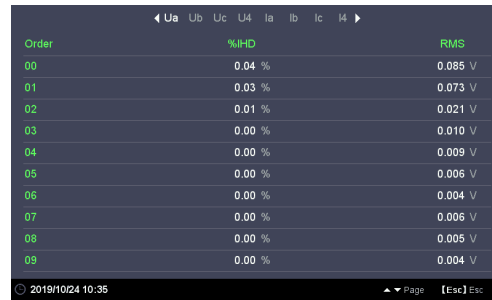


Figure 3-26 Individual Interharmonics

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.

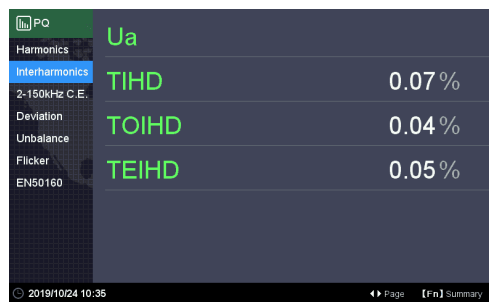


Figure 3-27 Interharmonics Large Font Displays

### 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.

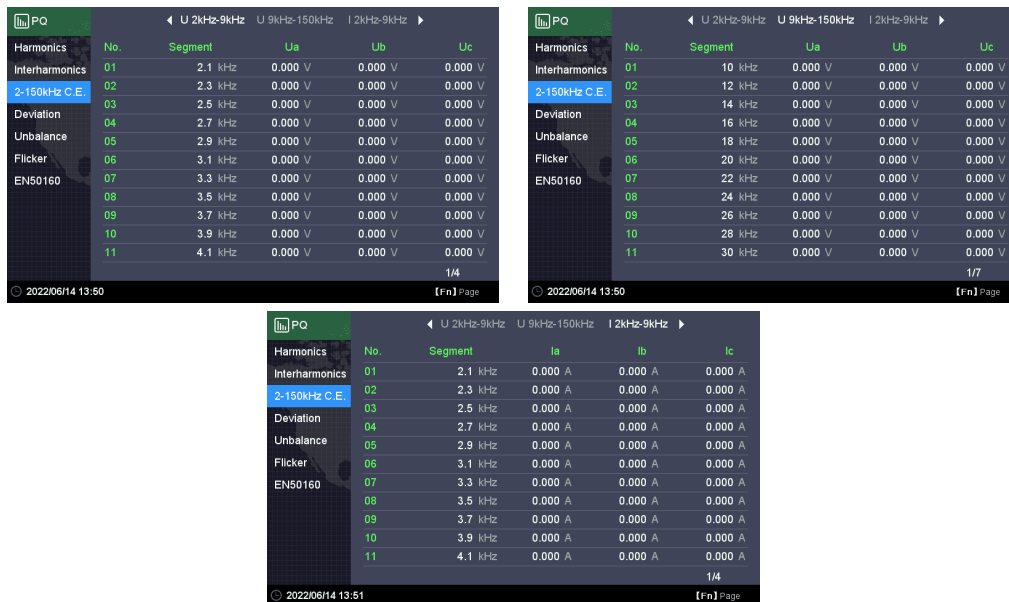


Figure 3-28 2-150kHz C.E.

### 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.

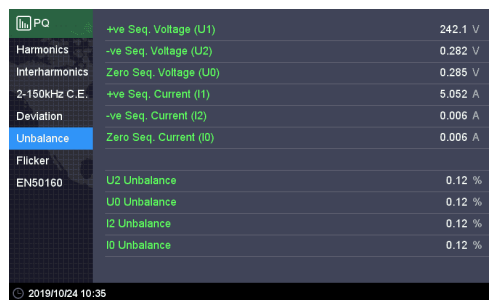


| Category       | Parameter     | Value  |
|----------------|---------------|--------|
| Harmonics      | Ua Over Dev.  | 0.16 % |
|                | Ub Over Dev.  | 0.16 % |
|                | Uc Over Dev.  | 0.16 % |
| Interharmonics | Ua Over Dev.  | 0.12 % |
|                | Ub Over Dev.  | 0.04 % |
|                | Uc Over Dev.  | 0.04 % |
| 2-150kHz C.E.  | Ua Over Dev.  | 0.16 % |
|                | Ub Over Dev.  | 0.04 % |
|                | Uc Over Dev.  | 0.04 % |
| Unbalance      | Ua Under Dev. | 0.72 % |
|                | Ub Under Dev. | 0.72 % |
|                | Uc Under Dev. | 0.72 % |
| Flicker        | Ua Under Dev. | 0.79 % |
|                | Ub Under Dev. | 0.90 % |
|                | Uc Under Dev. | 0.89 % |
| EN50160        | Ua Under Dev. | 0.89 % |
|                | Ub Under Dev. | 0.89 % |
|                | Uc Under Dev. | 0.89 % |
| Freq. Dev.     | 0.000 Hz      |        |

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.

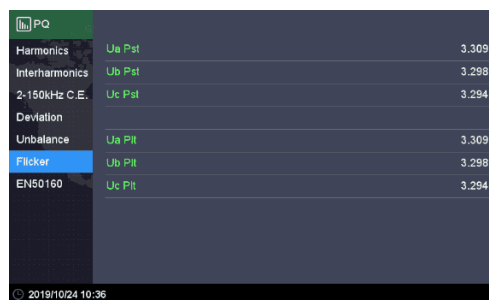


| Category       | Parameter              | Value   |
|----------------|------------------------|---------|
| Harmonics      | +ve Seq. Voltage (U1)  | 242.1 V |
|                | -ve Seq. Voltage (U2)  | 0.282 V |
|                | Zero Seq. Voltage (U0) | 0.285 V |
| Interharmonics | +ve Seq. Current (I1)  | 5.052 A |
|                | -ve Seq. Current (I2)  | 0.006 A |
|                | Zero Seq. Current (I0) | 0.006 A |
| 2-150kHz C.E.  | U2 Unbalance           | 0.12 %  |
|                | U0 Unbalance           | 0.12 %  |
|                | I2 Unbalance           | 0.12 %  |
| Deviation      | I0 Unbalance           | 0.12 %  |
|                | U2 Unbalance           | 0.12 %  |
|                | U0 Unbalance           | 0.12 %  |
| Unbalance      | I2 Unbalance           | 0.12 %  |
|                | I0 Unbalance           | 0.12 %  |
|                | U2 Unbalance           | 0.12 %  |
| Flicker        | U0 Unbalance           | 0.12 %  |
|                | I2 Unbalance           | 0.12 %  |
|                | I0 Unbalance           | 0.12 %  |
| EN50160        | I2 Unbalance           | 0.12 %  |
|                | I0 Unbalance           | 0.12 %  |
|                | U2 Unbalance           | 0.12 %  |

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.



| Category       | Parameter | Value |
|----------------|-----------|-------|
| Harmonics      | Ua Pst    | 3.309 |
|                | Ub Pst    | 3.298 |
|                | Uc Pst    | 3.294 |
| Interharmonics | Ua Pst    | 3.309 |
|                | Ub Pst    | 3.298 |
|                | Uc Pst    | 3.294 |
| 2-150kHz C.E.  | Ua Pst    | 3.309 |
|                | Ub Pst    | 3.298 |
|                | Uc Pst    | 3.294 |
| Deviation      | Ua Pst    | 3.309 |
|                | Ub Pst    | 3.298 |
|                | Uc Pst    | 3.294 |
| Unbalance      | Ua Pst    | 3.309 |
|                | Ub Pst    | 3.298 |
|                | Uc Pst    | 3.294 |
| Flicker        | Ua Pst    | 3.309 |
|                | Ub Pst    | 3.298 |
|                | Uc Pst    | 3.294 |
| EN50160        | Ua Pst    | 3.309 |
|                | Ub Pst    | 3.298 |
|                | Uc Pst    | 3.294 |

Figure 3-31 Flicker

### 3.1.3.2.7 EN50160

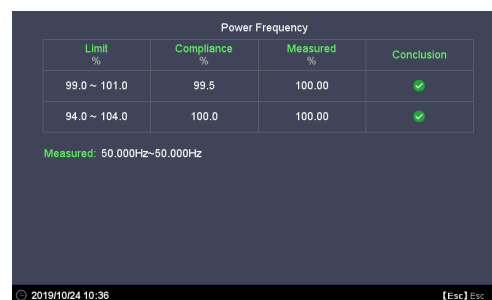
Enter the **EN50160** sub-menu to check the EN50160 Summary Report where  indicates a positive conclusion while  indicates a negative conclusion.

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.



| No. | Power Quality Parameters            | Conclusion |
|-----|-------------------------------------|------------|
| 01  | Power Frequency                     | ✓          |
| 02  | Supply Voltage Variations           | ✓          |
| 03  | Rapid Voltage Changes               | ✓          |
| 04  | Flicker Severity                    | ✗          |
| 05  | Supply Voltage Unbalance            | ✓          |
| 06  | Harmonic Voltages                   | ✓          |
| 07  | Interharmonic Voltages              | ✓          |
| 08  | Mains Signalling Voltages           | ✓          |
| 09  | Interruptions of the Supply Voltage | ✓          |
| 10  | Supply Voltage Dips                 | ✓          |
| 11  | Supply Voltage Swells               | ✓          |
| 12  | Transient Overvoltages              | ✓          |

Figure 3-32 Summary of EN50160 Report



| Limit %      | Compliance % | Measured % | Conclusion |
|--------------|--------------|------------|------------|
| 99.0 ~ 101.0 | 99.5         | 100.00     | ✓          |
| 94.0 ~ 104.0 | 100.0        | 100.00     | ✓          |

Measured: 50.000Hz~50.000Hz

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- $\phi$  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.

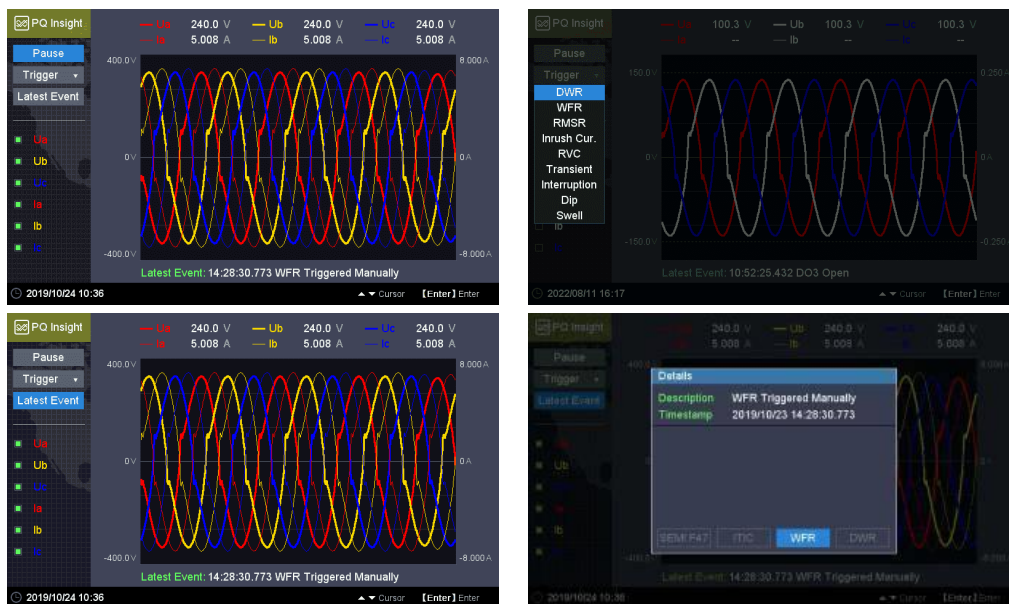


Figure 3-35 PQ Insight Pages

### 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.

| Events      | No. | Timestamp               | Description |
|-------------|-----|-------------------------|-------------|
| SOE Log     | 1   | 2022/08/17 10:26:20.037 | DO1 Open    |
| Device Log  | 2   | 2022/08/17 10:26:09.037 | DO1 Closed  |
| PQ Counters | 3   | 2022/08/17 10:26:08.934 | Dip         |
|             | 4   | 2022/08/17 10:23:47.596 | DO1 Open    |
|             | 5   | 2022/08/17 10:23:36.596 | DO1 Closed  |
|             | 6   | 2022/08/17 10:23:36.492 | Dip         |

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 &amp; 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

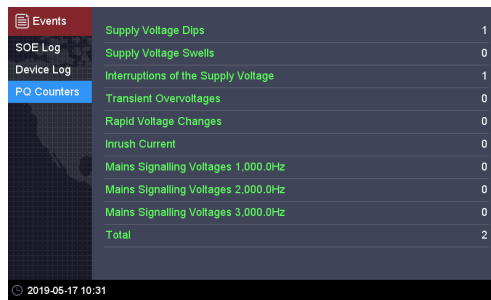
Enter the **Device Log** sub-menu and the following screen appears which displays up to 1024 events starting with the most recent event. Use <◀> or <▶> to quickly move through the pages.

| Events      | No. | Time                    | Description   |
|-------------|-----|-------------------------|---------------|
| SOE Log     | 1   | 2018/08/04 16:55:12.158 | Setup Changes |
| Device Log  | 2   | 2018/08/04 16:54:02.134 | Setup Changes |
| PQ Counters | 3   | 2018/08/04 14:21:51.917 | Setup Changes |
|             | 4   | 2018/08/04 08:22:40.901 | Power On      |
|             | 5   | 2018/08/03 22:33:22.499 | Power Off     |
|             | 6   | 2018/08/03 22:04:30.618 | Setup Changes |

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.



| Events                              | Count |
|-------------------------------------|-------|
| Supply Voltage Dips                 | 1     |
| Supply Voltage Swells               | 0     |
| Interruptions of the Supply Voltage | 1     |
| Transient Overvoltages              | 0     |
| Rapid Voltage Changes               | 0     |
| Inrush Current                      | 0     |
| Mains Signalling Voltages 1,000.0Hz | 0     |
| Mains Signalling Voltages 2,000.0Hz | 0     |
| Mains Signalling Voltages 3,000.0Hz | 0     |
| Total                               | 2     |

2019-05-17 10:31

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.

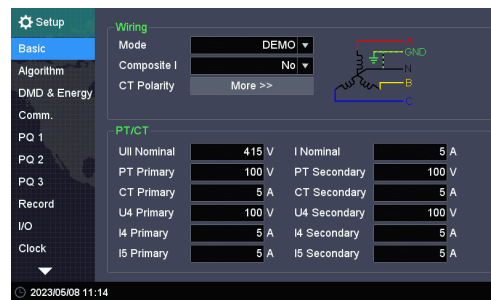


Figure 3-42 Basic Setup

#### 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.

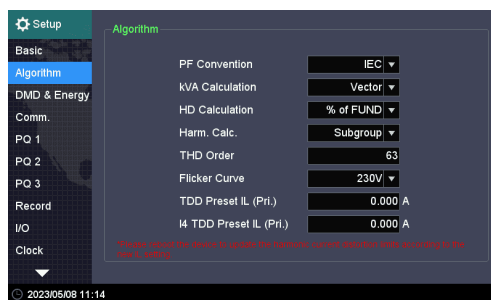


Figure 3-43 Algorithm Setup

### 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.

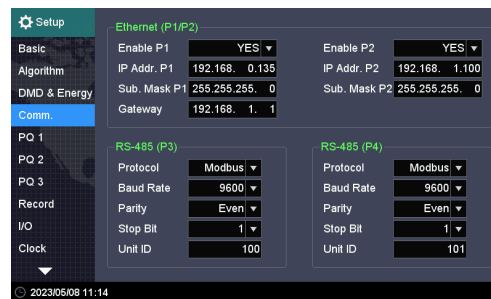


Figure 3-45 Comm. Setup

### 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.

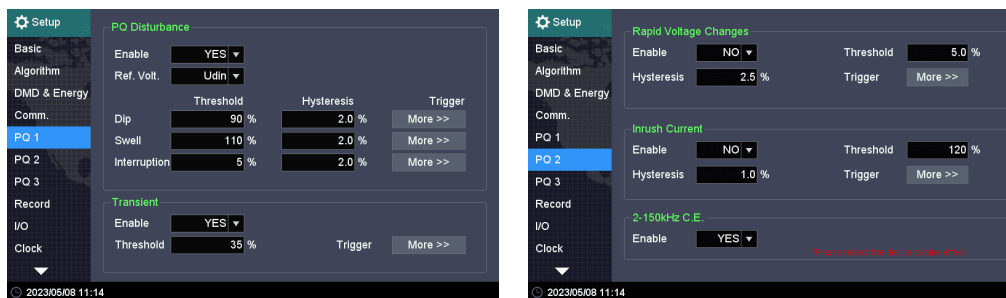


Figure 3-46 PQ 1 and PQ 2 Setup

### 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.

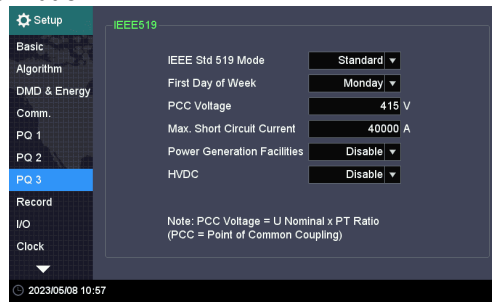


Figure 3-47 IEEE Std 519-2022 Compliance Report Setup

### 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.

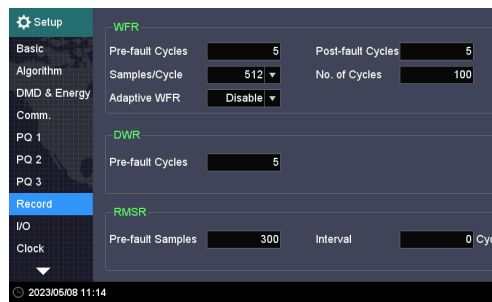


Figure 3-48 Record Setup

### 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.

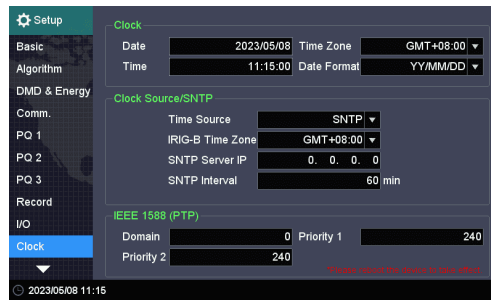


Figure 3-50 Clock Setup

### 3.1.3.5.10 HMI & Pwd

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

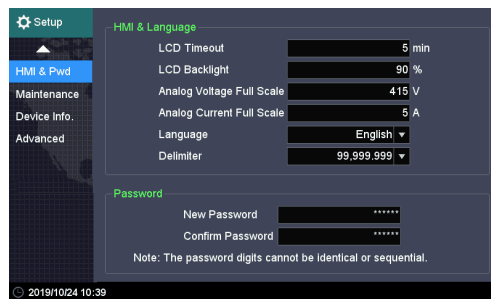


Figure 3-51 HMI & Pwd Setup

### 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.

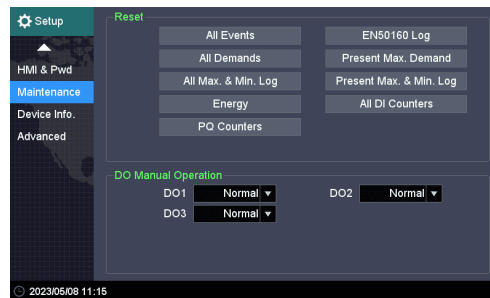


Figure 3-52 Maintenance

### 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.

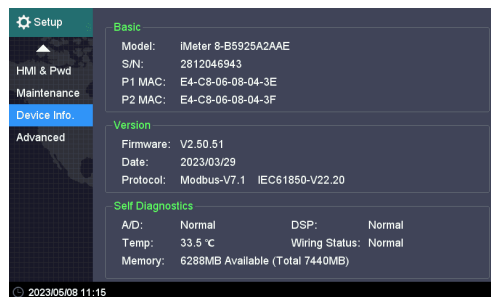


Figure 3-53 Device Info.

### 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.

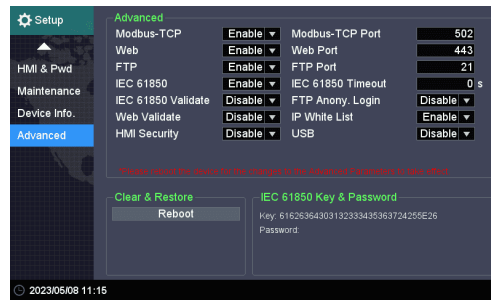


Figure 3-54 Advanced Setup

## 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

- 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).

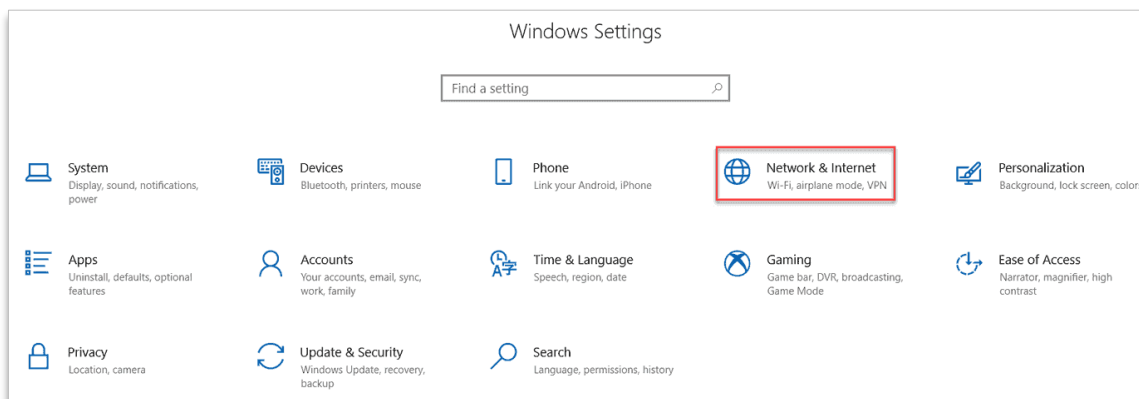


Figure 3-55 Settings > Network & Internet

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



Figure 3-56 Network and Sharing Center

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

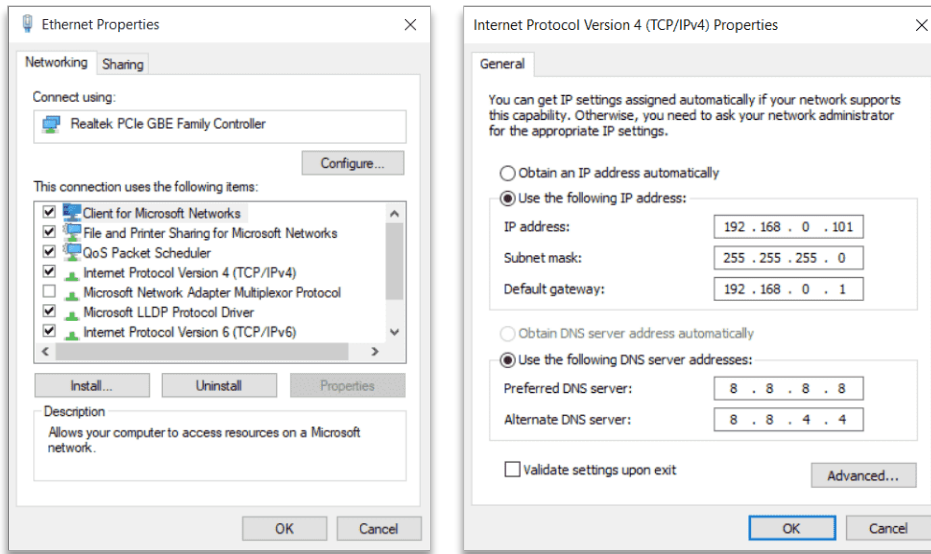


Figure 3-57 Setting PC's IP Address

### 3.2.2 Configure iMeter 8's IP Addresses

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

- Move the cursor to the **Setup** category, hit <Enter> and then the **Basic** topic appears.
- 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.

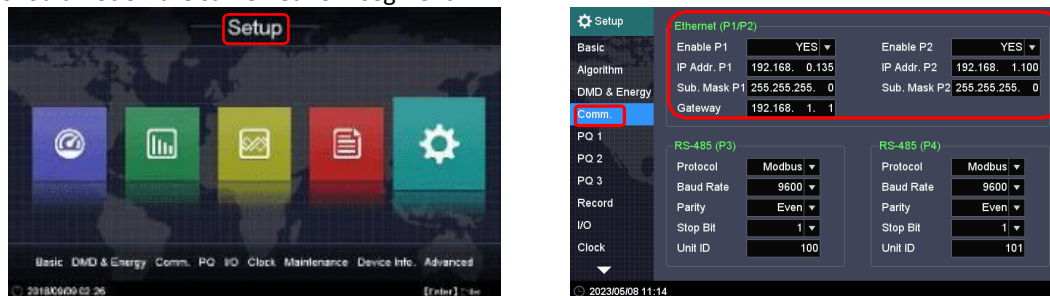


Figure 3-58 Configure iMeter 8's IP Address via Front Panel

### 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.

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

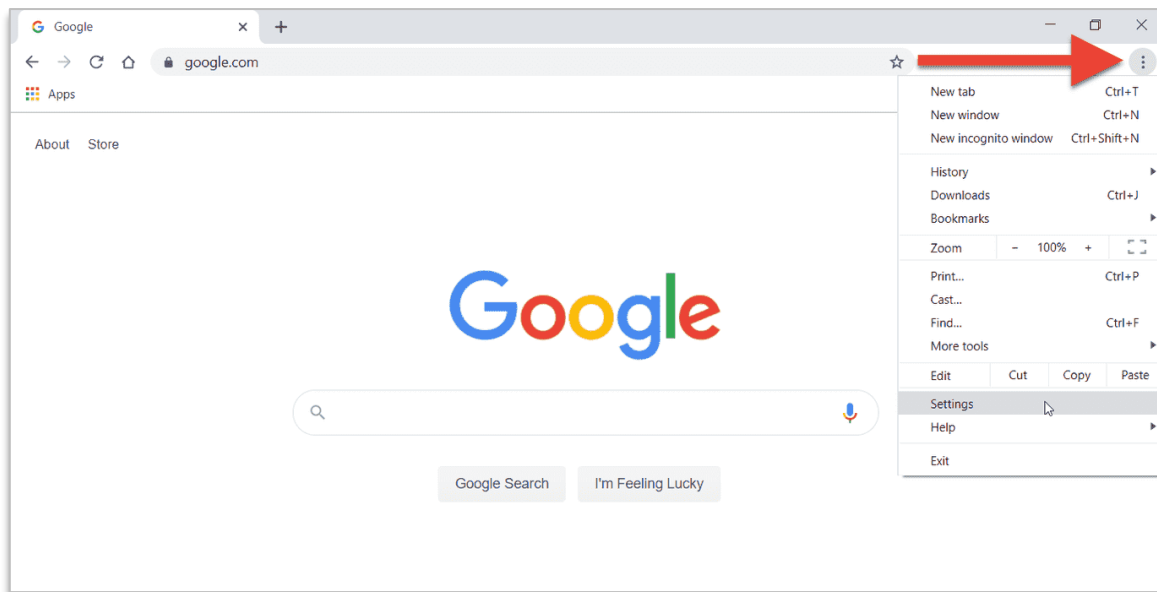
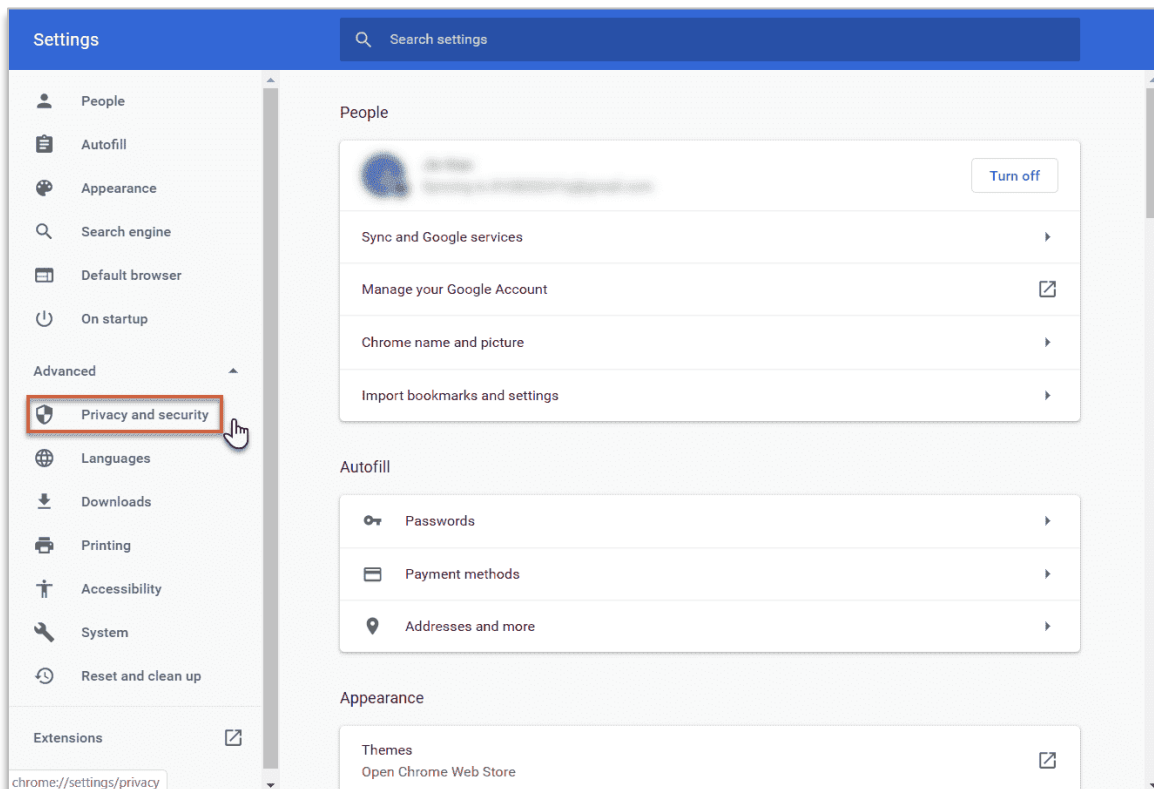


Figure 3-59 Open Setting page of Google Chrome

- 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.

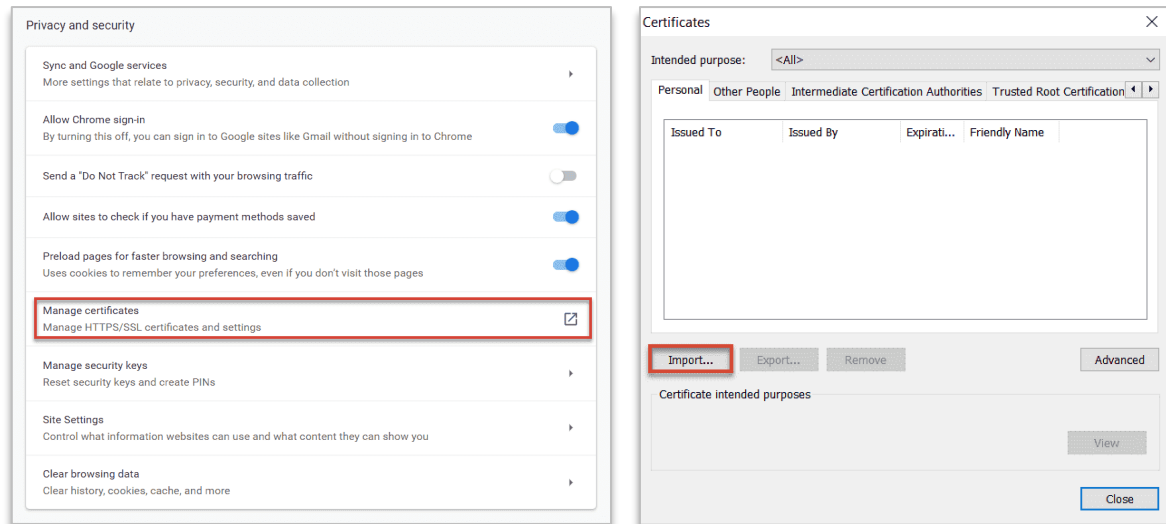


Figure 3-60 Manage certificates -> Import certificate

- 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.

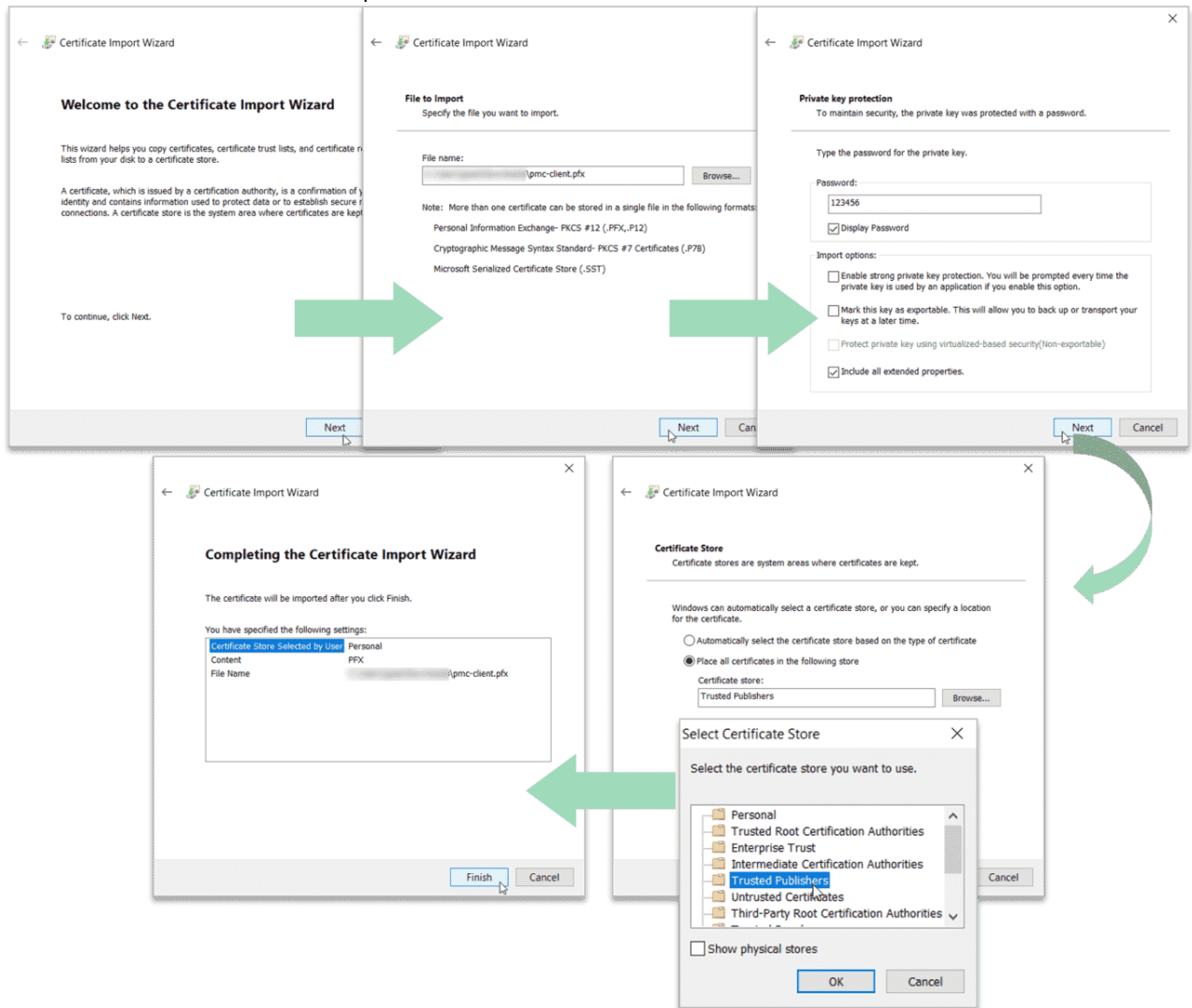


Figure 3-61 Import .pfx certificate

### 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>**.

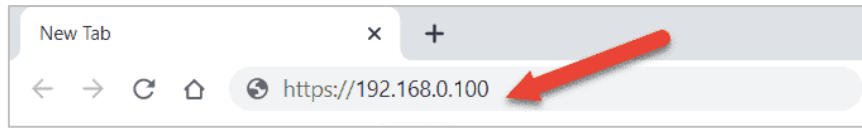


Figure 3-62 Web IP Address

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

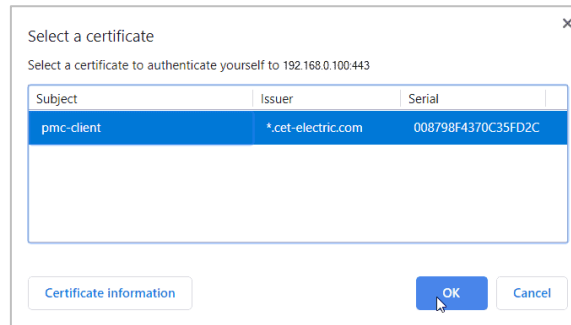


Figure 3-63 Select a certificate

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

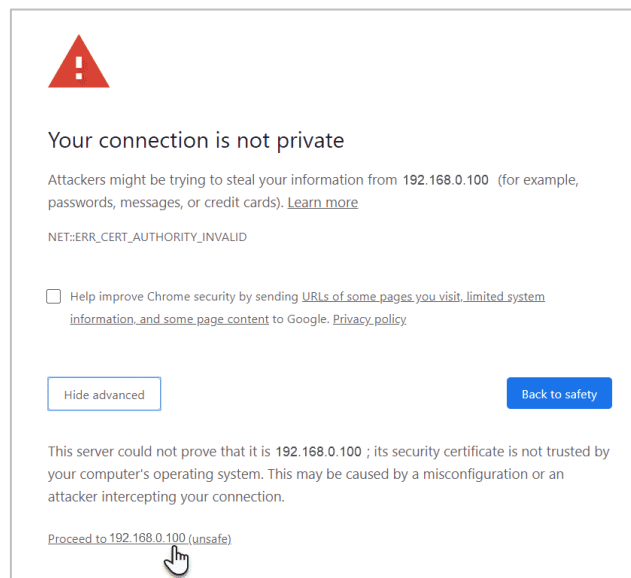


Figure 3-64 Privacy Error

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

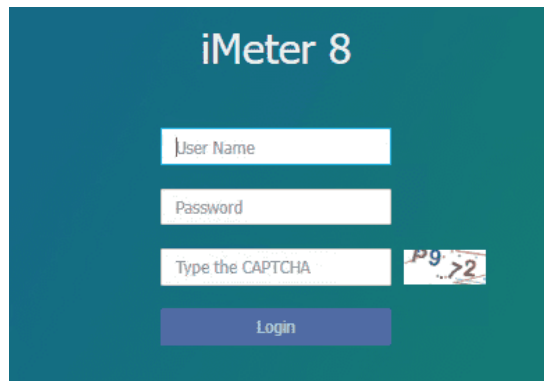


Figure 3-65 iMeter 8 Web Login Interface

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:

| Web Operation   |                     | operator                                  | user      | auditor |
|-----------------|---------------------|-------------------------------------------|-----------|---------|
| Modify Password |                     | ✓                                         | ✓         | ✓       |
| PQ Insight      |                     | ✓                                         |           | ✗       |
| Metering        |                     |                                           |           | ✗       |
| Power Quality   |                     | ✓                                         | View Only | ✗       |
| Events          | Device Log          | (View and Export)                         |           | ✗       |
|                 | SOE Log             |                                           |           | ✗       |
|                 | PQ Counter          | ✓                                         |           | ✗       |
|                 | Audit Log           | ✗                                         | ✗         | ✓       |
| Setup           | Basic               |                                           |           | ✗       |
|                 | PQ                  |                                           |           | ✗       |
|                 | Dmd. & Energy       |                                           |           | ✗       |
|                 | Record              |                                           |           | ✗       |
|                 | Setpoint            | ✓                                         | View Only | ✗       |
|                 | I/O                 | (View and Config.)                        |           | ✗       |
|                 | Others              |                                           |           | ✗       |
|                 | Alarm Email         |                                           |           | ✗       |
|                 | Advanced            |                                           |           | ✗       |
|                 | Device & Site Info. |                                           |           | ✗       |
|                 | Diagnostics         |                                           |           |         |
|                 | User Management     | ✓ (only adding and deleting user account) | ✗         | ✗       |
|                 | Maintenance         | ✓                                         | ✗         | ✗       |

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.

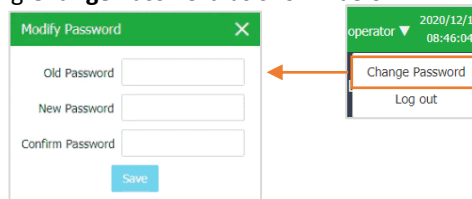


Figure 3-67 Change Web Interface Login Password

### 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:

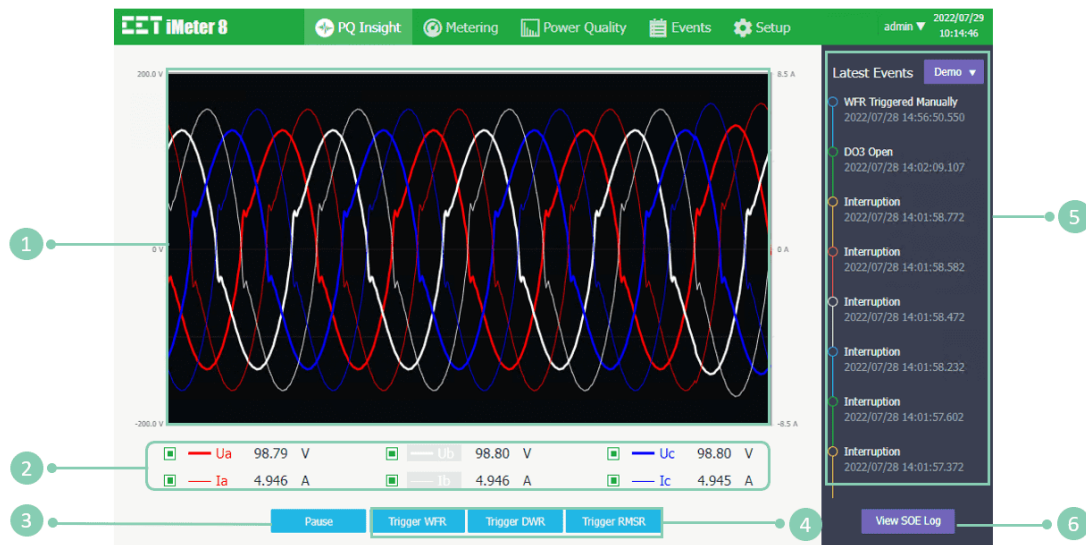


Figure 3-68 PQ Insight of Web Interface

|   |                                                                                                |
|---|------------------------------------------------------------------------------------------------|
| 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 <b>SOE Log</b> page (Display if there are 8 SOE Events in the <b>Latest Events</b> 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.

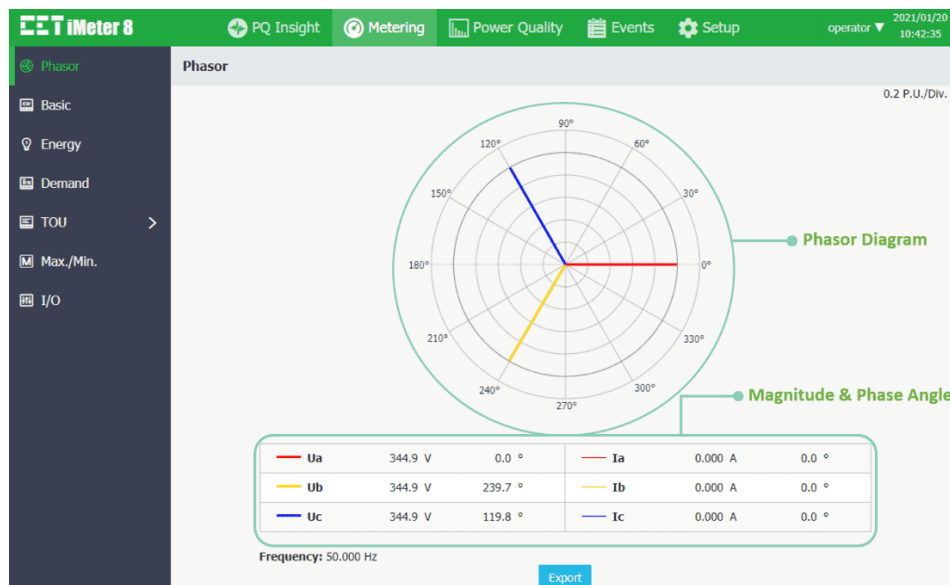


Figure 3-69 Phasor Interface

### 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.

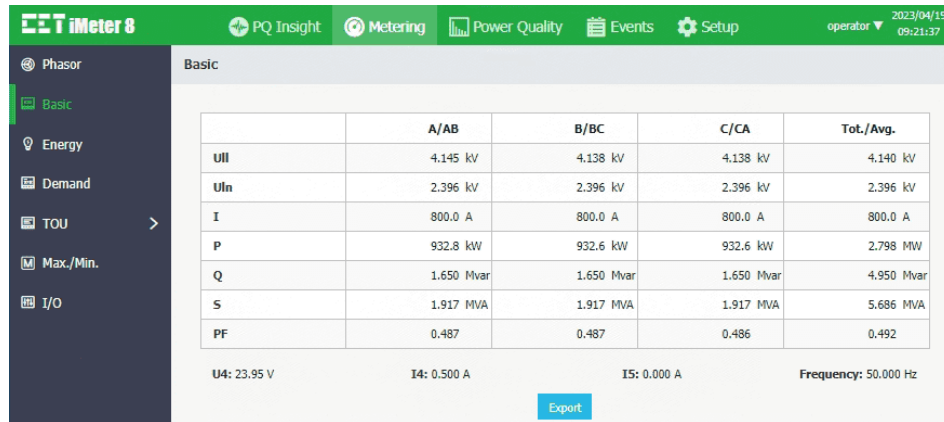


Figure 3-70 Basic Interface

### 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.

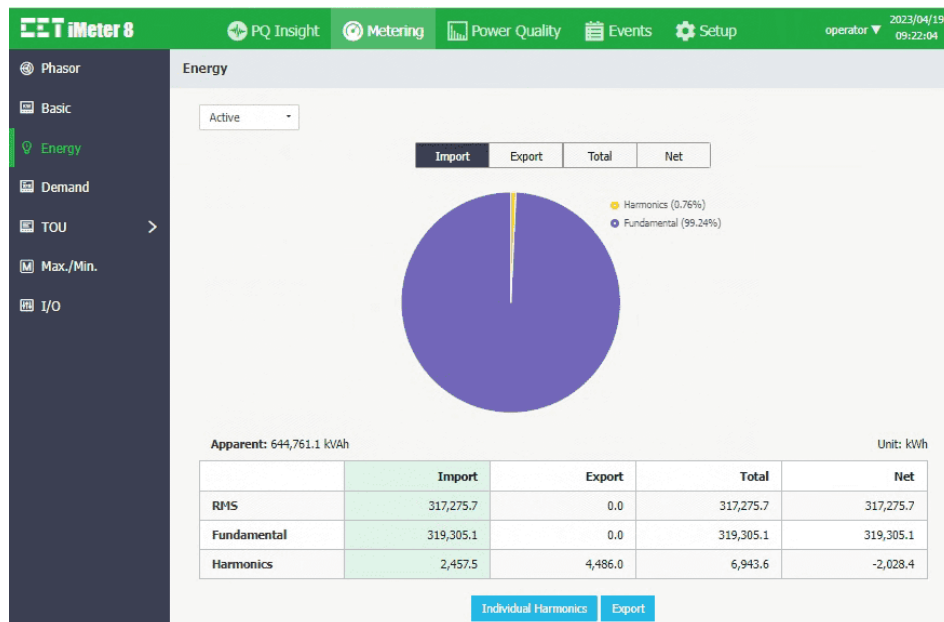


Figure 3-71 Energy Web Interface

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.

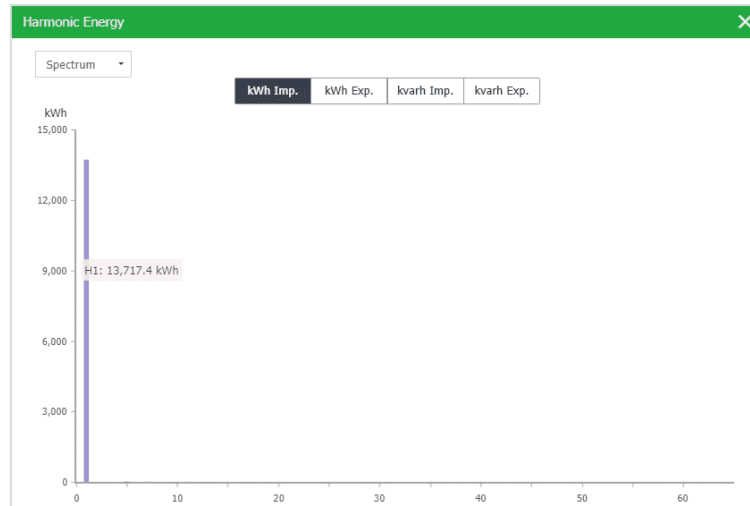


Figure 3-72 Individual Harmonics Spectrum Web Interface

- **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.

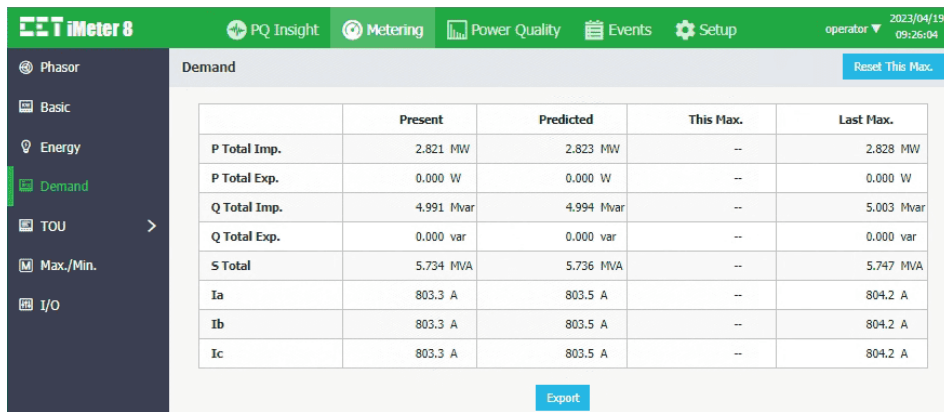


Figure 3-74 Demand Interface

### 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**.

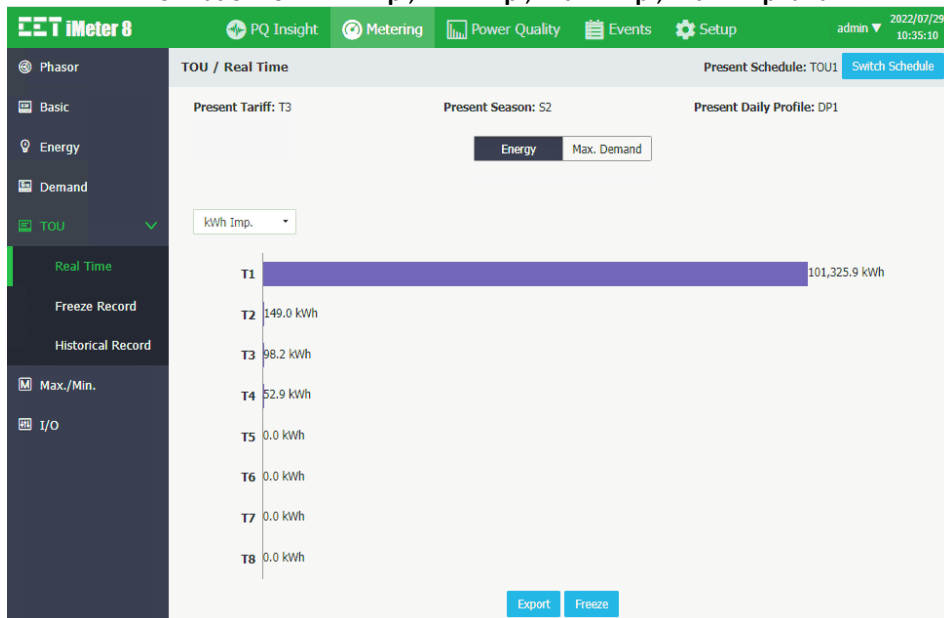


Figure 3-75 Real Time TOU Interfaces

- **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.**

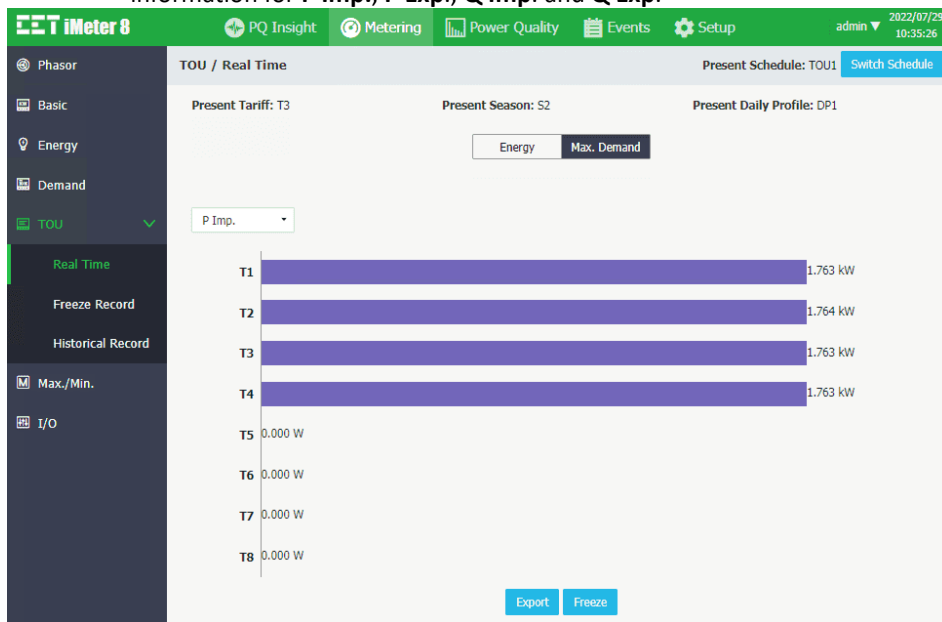


Figure 3-76 Real Time TOU Max. Demand

#### 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.

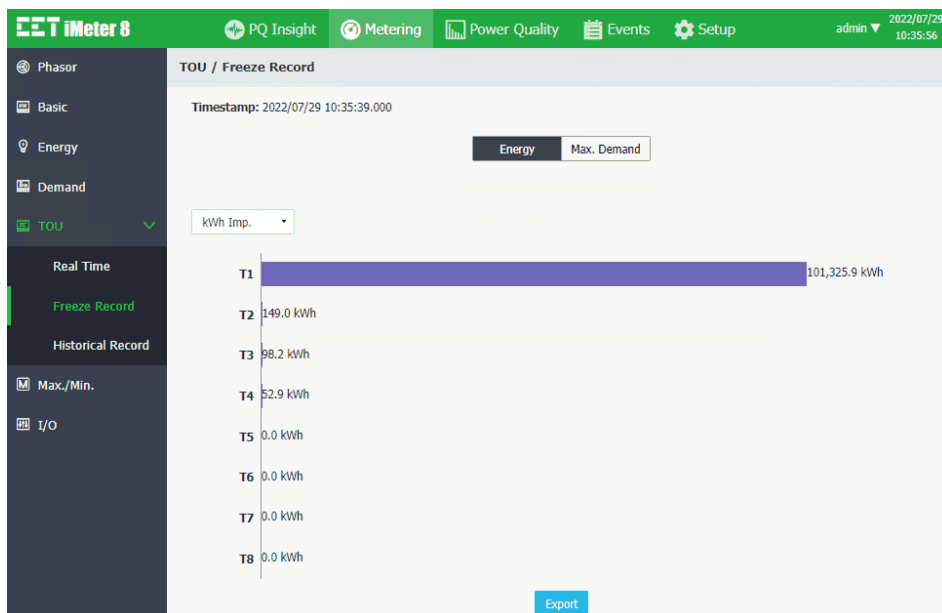


Figure 3-77 Freeze TOU Record Interfaces

#### 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.

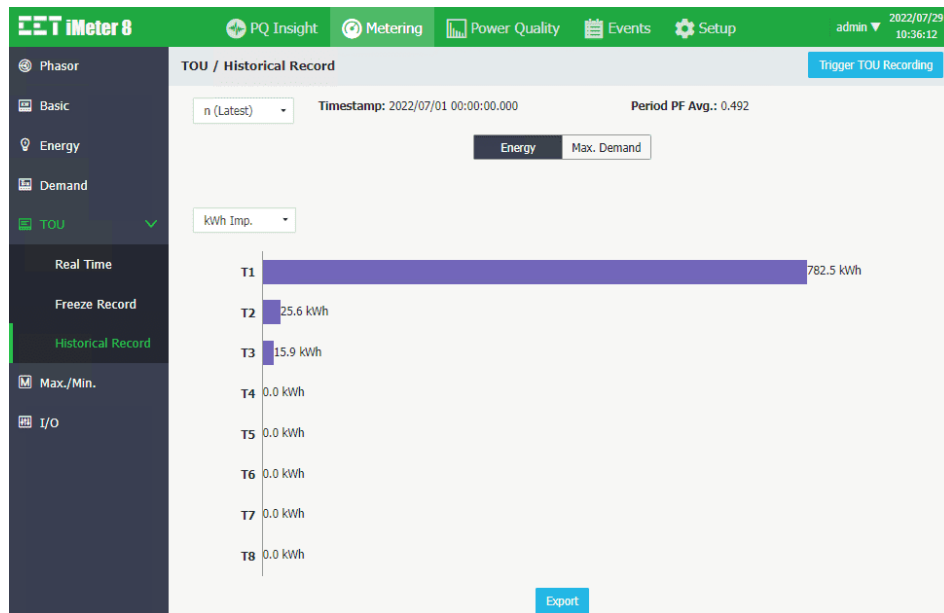


Figure 3-78 Historical Record TOU Record Interfaces

### 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.

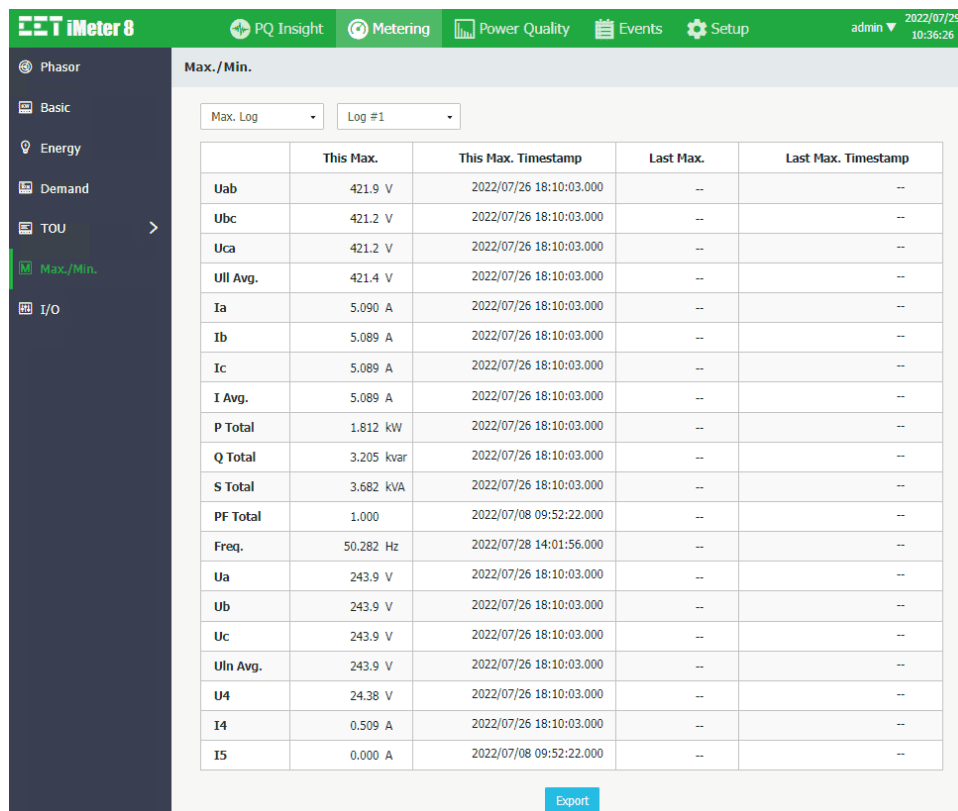


Figure 3-79 Max./Min. Interface

### 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.

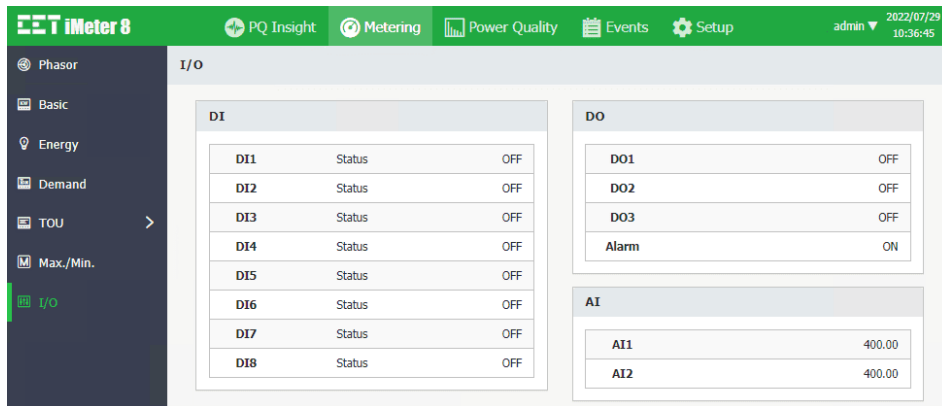


Figure 3-80 I/O Interface

### 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**, **Interharmonics**, **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 63<sup>rd</sup> 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.

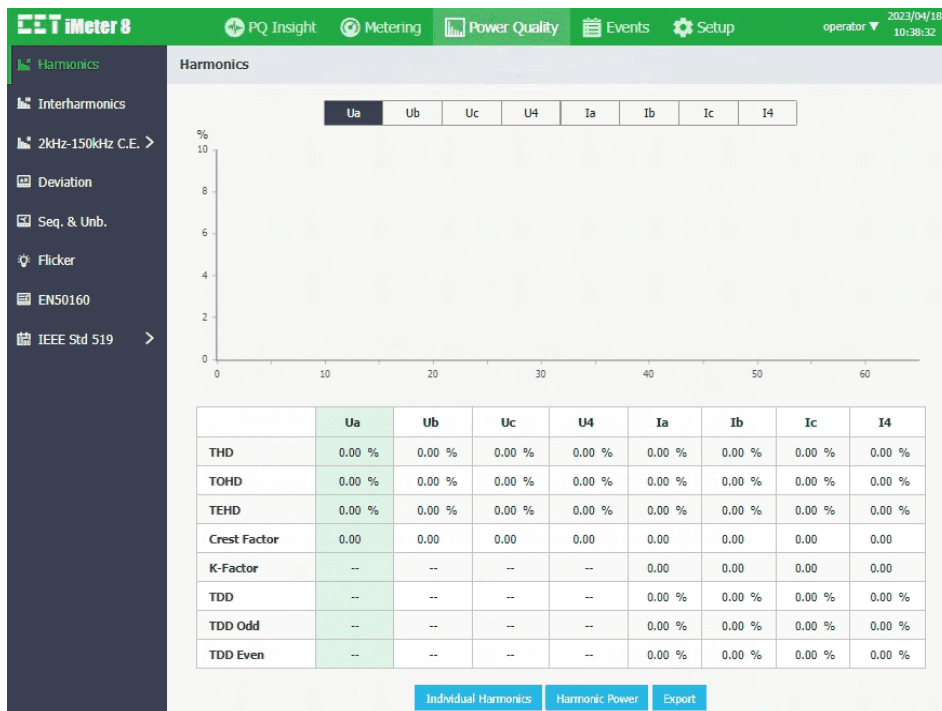


Figure 3-81 Harmonics Interface

- 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.

| Individual Harmonics    |          |         |        |
|-------------------------|----------|---------|--------|
| Ua Ub Uc U4 Ia Ib Ic I4 |          |         |        |
| Order                   | %HD      | RMS     | Angle  |
| 01                      | 100.00 % | 100.4 V | 0.0 °  |
| 02                      | 1.00 %   | 1.005 V | 60.0 ° |
| 03                      | 6.40 %   | 6.424 V | 60.0 ° |
| 04                      | 0.50 %   | 0.502 V | 60.0 ° |
| 05                      | 4.00 %   | 4.015 V | 60.0 ° |
| 06                      | 0.26 %   | 0.261 V | 60.0 ° |
| 07                      | 2.80 %   | 2.810 V | 60.0 ° |
| 08                      | 0.26 %   | 0.261 V | 60.0 ° |
| 09                      | 2.20 %   | 2.208 V | 60.0 ° |
| 10                      | 0.26 %   | 0.261 V | 60.0 ° |
| 11                      | 1.80 %   | 1.807 V | 60.0 ° |
| 12                      | 0.10 %   | 0.101 V | 60.0 ° |
| 13                      | 1.40 %   | 1.405 V | 60.0 ° |
| 14                      | 0.00 %   | 0.001 V | 0.0 °  |
| 15                      | 1.20 %   | 1.205 V | 60.0 ° |
| 16                      | 0.00 %   | 0.001 V | 0.0 °  |
| 17                      | 1.00 %   | 1.004 V | 60.0 ° |

Figure 3-82 %HD, RMS and Angle Interface

| Harmonic Power |          |            |          |        |
|----------------|----------|------------|----------|--------|
| L1 L2 L3       |          |            |          |        |
| Order          | P        | Q          | S        | PF     |
| Total          | 1.884 W  | -0.412 var | 1.928 VA | 0.977  |
| 01             | 249.1 W  | 438.6 var  | 504.4 VA | 0.494  |
| 02             | -0.026 W | 0.044 var  | 0.051 VA | -0.509 |
| 03             | -2.066 W | -0.035 var | 2.066 VA | -1.000 |
| 04             | -0.006 W | -0.011 var | 0.013 VA | -0.478 |
| 05             | 0.423 W  | -0.687 var | 0.807 VA | 0.525  |
| 06             | 0.003 W  | 0.000 var  | 0.003 VA | 0.999  |
| 07             | 0.184 W  | 0.350 var  | 0.395 VA | 0.465  |
| 08             | -0.002 W | 0.003 var  | 0.003 VA | -0.538 |
| 09             | -0.244 W | -0.012 var | 0.244 VA | -0.999 |
| 10             | -0.002 W | -0.003 var | 0.003 VA | -0.450 |
| 11             | 0.090 W  | -0.136 var | 0.163 VA | 0.553  |
| 12             | 0.000 W  | 0.000 var  | 0.000 VA | 0.954  |
| 13             | 0.043 W  | 0.089 var  | 0.099 VA | 0.435  |
| 14             | 0.000 W  | 0.000 var  | 0.000 VA | 1.000  |
| 15             | -0.072 W | -0.006 var | 0.073 VA | -0.996 |

Figure 3-83 Harmonic Power Interface

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

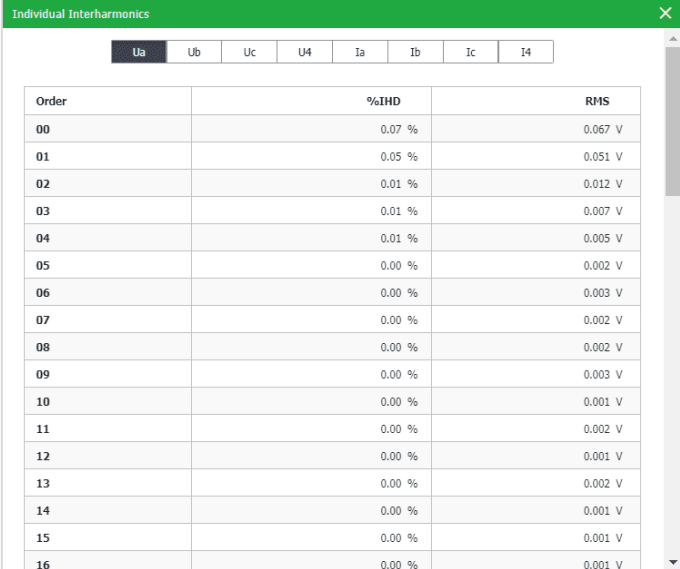
### 3.2.4.3.2 Interharmonics

Click **Interharmonics** on the left-hand pane and the following screen appears which displays up to 63<sup>rd</sup> 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.

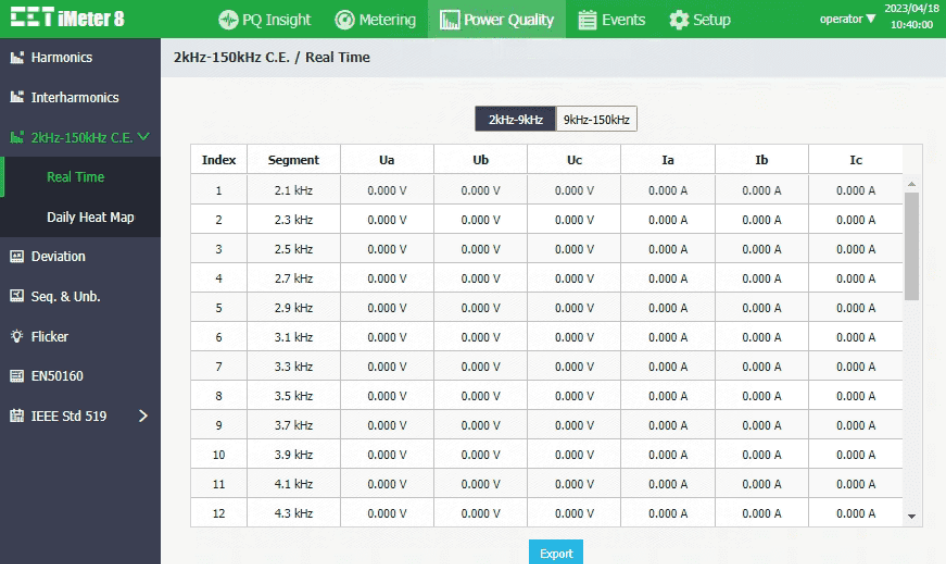
### 3.2.4.3.3 (Optional) 2kHz-150kHz C.E.

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.



| Index | Segment | Ua      | Ub      | Uc      | Ia      | Ib      | Ic      |
|-------|---------|---------|---------|---------|---------|---------|---------|
| 1     | 2.1 kHz | 0.000 V | 0.000 V | 0.000 V | 0.000 A | 0.000 A | 0.000 A |
| 2     | 2.3 kHz | 0.000 V | 0.000 V | 0.000 V | 0.000 A | 0.000 A | 0.000 A |
| 3     | 2.5 kHz | 0.000 V | 0.000 V | 0.000 V | 0.000 A | 0.000 A | 0.000 A |
| 4     | 2.7 kHz | 0.000 V | 0.000 V | 0.000 V | 0.000 A | 0.000 A | 0.000 A |
| 5     | 2.9 kHz | 0.000 V | 0.000 V | 0.000 V | 0.000 A | 0.000 A | 0.000 A |
| 6     | 3.1 kHz | 0.000 V | 0.000 V | 0.000 V | 0.000 A | 0.000 A | 0.000 A |
| 7     | 3.3 kHz | 0.000 V | 0.000 V | 0.000 V | 0.000 A | 0.000 A | 0.000 A |
| 8     | 3.5 kHz | 0.000 V | 0.000 V | 0.000 V | 0.000 A | 0.000 A | 0.000 A |
| 9     | 3.7 kHz | 0.000 V | 0.000 V | 0.000 V | 0.000 A | 0.000 A | 0.000 A |
| 10    | 3.9 kHz | 0.000 V | 0.000 V | 0.000 V | 0.000 A | 0.000 A | 0.000 A |
| 11    | 4.1 kHz | 0.000 V | 0.000 V | 0.000 V | 0.000 A | 0.000 A | 0.000 A |
| 12    | 4.3 kHz | 0.000 V | 0.000 V | 0.000 V | 0.000 A | 0.000 A | 0.000 A |

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.

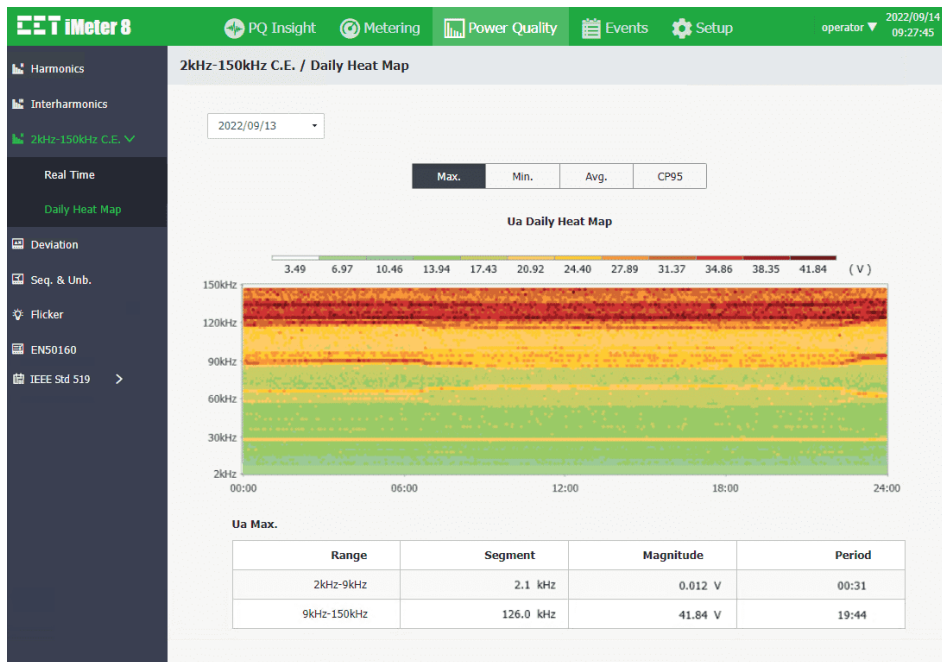


Figure 3-87 Ua Daily Heat Map Interface

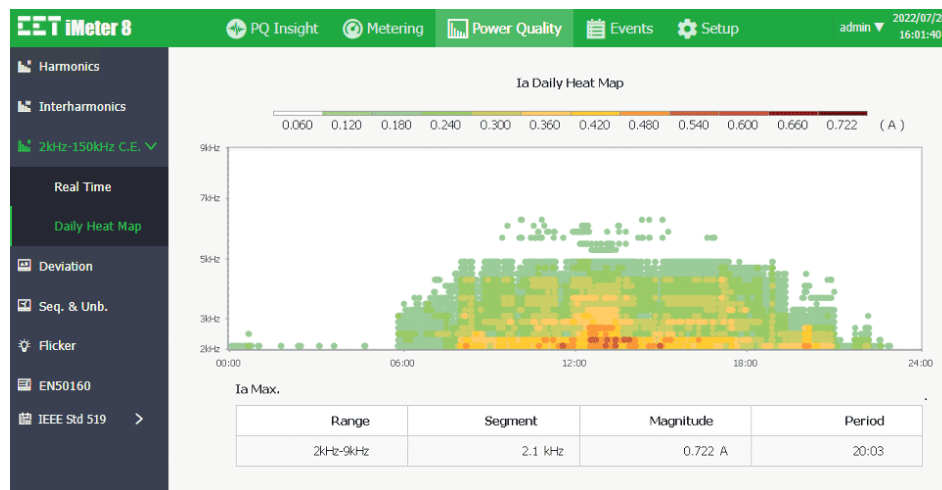


Figure 3-88 Ia Daily Heat Map Interface

### 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.

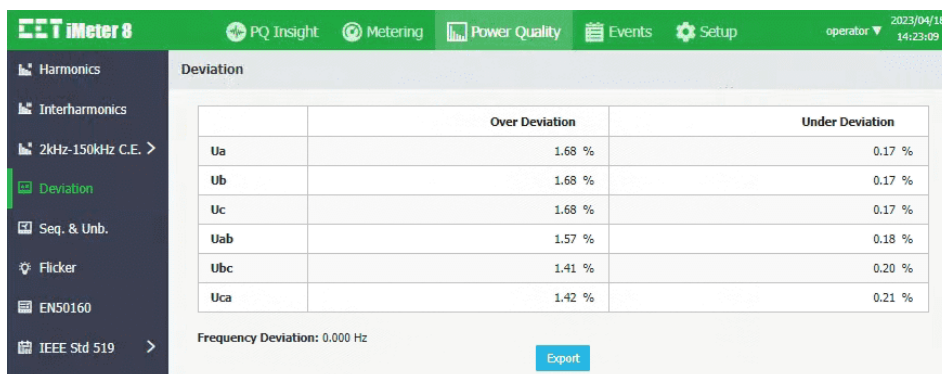


Figure 3-89 Deviation Interface

### 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.

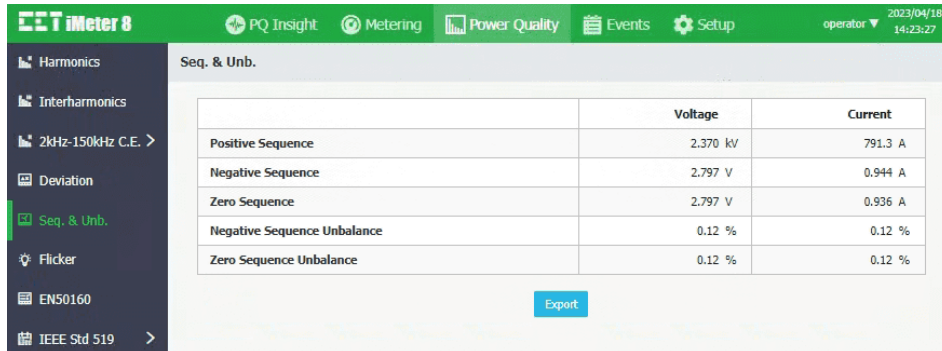


Figure 3-90 Seq. & Unb. Interface

### 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.

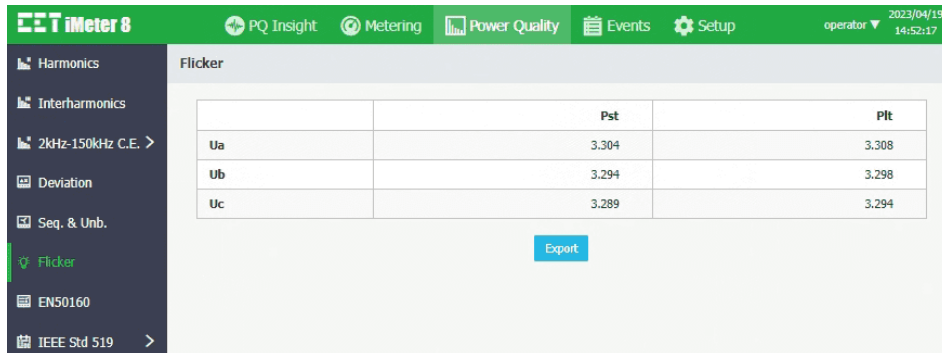


Figure 3-91 Flicker Interfaces

### 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.

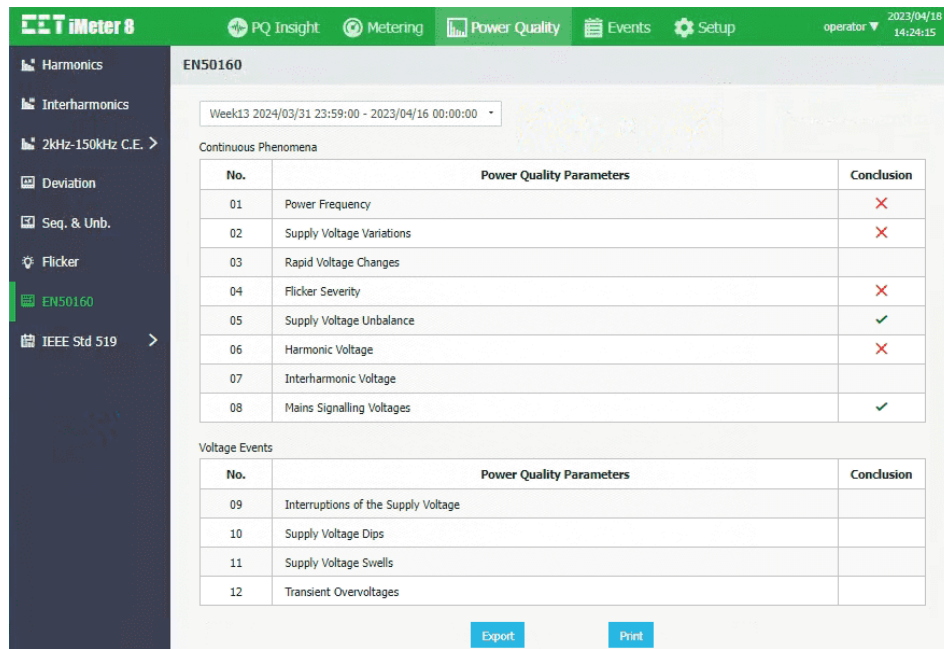


Figure 3-92 EN50160 Interfaces and Parameters' Details

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

○ **Power Frequency**

| Power Frequency |              |            |            |
|-----------------|--------------|------------|------------|
| Limit %         | Compliance % | Measured % | Conclusion |
| 99.00 ~ 101.00  | 99.50        | 0.00       | ✗          |
| 94.00 ~ 104.00  | 100.00       | 0.00       | ✗          |

Measured: 0.000 Hz ~ 0.000 Hz

Figure 3-93 Power Frequency

○ **Supply Voltage Variations**

| Supply Voltage Variations |              |            |      |      |            |
|---------------------------|--------------|------------|------|------|------------|
| Limit %                   | Compliance % | Measured % |      |      | Conclusion |
|                           |              | Ua         | Ub   | Uc   |            |
| 90.00 ~ 110.00            | 99.00        | 0.00       | 0.00 | 0.00 | ✗          |
| 85.00 ~ 115.00            | 100.00       | 0.00       | 0.00 | 0.00 | ✗          |

Measured Ua: 0.000 V ~ 0.000 V      Measured Ub: 0.000 V ~ 0.000 V      Measured Uc: 0.000 V ~ 0.000 V

Figure 3-94 Supply Voltage Variations

○ **Rapid Voltage Changes**

| Rapid Voltage Changes |          |          |
|-----------------------|----------|----------|
| Ua Count              | Ub Count | Uc Count |
| 0                     | 0        | 0        |

Figure 3-95 Rapid Voltage Changes

○ Flicker Severity

| EN50160 Report (Week29 2022/07/17 00:00:00 - 2022/07/24 00:00:00) |              |                                |        |                                |            |
|-------------------------------------------------------------------|--------------|--------------------------------|--------|--------------------------------|------------|
| Flicker Severity                                                  |              |                                |        |                                |            |
| Limit                                                             | Compliance % | Measured %                     |        |                                | Conclusion |
|                                                                   |              | Ua                             | Ub     | Uc                             |            |
| Plt ≤ 1.000                                                       | 95.00        | 100.00                         | 100.00 | 100.00                         | ✓          |
| Measured Ua Plt: 0.000 ~ 0.000                                    |              | Measured Ub Plt: 0.000 ~ 0.000 |        | Measured Uc Plt: 0.000 ~ 0.000 |            |

Figure 3-96 Flicker Severity

○ Supply Voltage Unbalance

| EN50160 Report (Week29 2022/07/17 00:00:00 - 2022/07/24 00:00:00) |              |            |            |
|-------------------------------------------------------------------|--------------|------------|------------|
| Supply Voltage Unbalance                                          |              |            |            |
| Limit %                                                           | Compliance % | Measured % | Conclusion |
| 2.00                                                              | 95.00        | 100.00     | ✓          |
| Measured U2 Unbalance: 0.00 % ~ 0.00 %                            |              |            |            |

Figure 3-97 Supply Voltage Unbalance

○ Harmonic/Interharmonic Voltage

| EN50160 Report (Week29 2022/07/17 00:00:00 - 2022/07/24 00:00:00) |         |        |      |      |              |            |        |        |            |
|-------------------------------------------------------------------|---------|--------|------|------|--------------|------------|--------|--------|------------|
| Harmonic Voltage                                                  |         |        |      |      |              |            |        |        |            |
| Order h                                                           | Limit % | CP95 % |      |      | Compliance % | Measured % |        |        | Conclusion |
|                                                                   |         | Ua     | Ub   | Uc   |              | Ua         | Ub     | Uc     |            |
| THD                                                               | 8.00    | 0.00   | 0.00 | 0.00 | 95.00        | 100.00     | 100.00 | 100.00 | ✓          |
| Odd Harmonics (Not Multiples of 3)                                |         |        |      |      |              |            |        |        |            |
| H05                                                               | 6.00    | 0.00   | 0.00 | 0.00 | 95.00        | 100.00     | 100.00 | 100.00 | ✓          |
| H07                                                               | 5.00    | 0.00   | 0.00 | 0.00 | 95.00        | 100.00     | 100.00 | 100.00 | ✓          |
| H11                                                               | 3.50    | 0.00   | 0.00 | 0.00 | 95.00        | 100.00     | 100.00 | 100.00 | ✓          |
| H13                                                               | 3.00    | 0.00   | 0.00 | 0.00 | 95.00        | 100.00     | 100.00 | 100.00 | ✓          |
| H17                                                               | 2.00    | 0.00   | 0.00 | 0.00 | 95.00        | 100.00     | 100.00 | 100.00 | ✓          |
| H19                                                               | 1.50    | 0.00   | 0.00 | 0.00 | 95.00        | 100.00     | 100.00 | 100.00 | ✓          |
| H23                                                               | 1.50    | 0.00   | 0.00 | 0.00 | 95.00        | 100.00     | 100.00 | 100.00 | ✓          |
| H25                                                               | 1.50    | 0.00   | 0.00 | 0.00 | 95.00        | 100.00     | 100.00 | 100.00 | ✓          |
| Odd Harmonics (Multiples of 3)                                    |         |        |      |      |              |            |        |        |            |
| H03                                                               | 5.00    | 0.00   | 0.00 | 0.00 | 95.00        | 100.00     | 100.00 | 100.00 | ✓          |
| H09                                                               | 1.50    | 0.00   | 0.00 | 0.00 | 95.00        | 100.00     | 100.00 | 100.00 | ✓          |
| H15                                                               | 0.50    | 0.00   | 0.00 | 0.00 | 95.00        | 100.00     | 100.00 | 100.00 | ✓          |
| H21                                                               | 0.50    | 0.00   | 0.00 | 0.00 | 95.00        | 100.00     | 100.00 | 100.00 | ✓          |

Figure 3-98 Harmonic Voltage

| EN50160 Report (Week29 2022/07/17 00:00:00 - 2022/07/24 00:00:00) |        |      |      |        |      |      |        |      |      |
|-------------------------------------------------------------------|--------|------|------|--------|------|------|--------|------|------|
| Interharmonic Voltage                                             |        |      |      |        |      |      |        |      |      |
| Order h                                                           | Avg. % |      |      | CP95 % |      |      | Max. % |      |      |
|                                                                   | Ua     | Ub   | Uc   | Ua     | Ub   | Uc   | Ua     | Ub   | Uc   |
| THD                                                               | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 |
| IH01                                                              | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 |
| IH02                                                              | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 |
| IH03                                                              | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 |
| IH04                                                              | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 |
| IH05                                                              | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 |
| IH06                                                              | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 |
| IH07                                                              | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 |
| IH08                                                              | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 |
| IH09                                                              | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 |
| IH10                                                              | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 |
| IH11                                                              | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 |
| IH12                                                              | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 |
| IH13                                                              | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 |
| IH14                                                              | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 |
| IH15                                                              | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 | 0.00   | 0.00 | 0.00 |

Figure 3-99 Interharmonic Voltage

○ Mains Signalling Voltages

| EN50160 Report (Week29 2022/07/17 00:00:00 - 2022/07/24 00:00:00) |         |              |            |        |        |            |
|-------------------------------------------------------------------|---------|--------------|------------|--------|--------|------------|
| Mains Signalling Voltages                                         |         |              |            |        |        |            |
| Signalling Frequency Hz                                           | Limit % | Compliance % | Measured % |        |        | Conclusion |
|                                                                   |         |              | Ua         | Ub     | Uc     |            |
| 1,000.0                                                           | 5.00    | 99.00        | 100.00     | 100.00 | 100.00 | ✓          |
| 2,000.0                                                           | 5.00    | 99.00        | 100.00     | 100.00 | 100.00 | ✓          |
| 3,000.0                                                           | 5.00    | 99.00        | 100.00     | 100.00 | 100.00 | ✓          |

Figure 3-100 Mains Signalling Voltages

○ Interruptions of the Supply Voltage

| EN50160 Report (Week29 2022/07/17 00:00:00 - 2022/07/24 00:00:00) |        |               |          |
|-------------------------------------------------------------------|--------|---------------|----------|
| Interruptions of the Supply Voltage                               |        |               |          |
| Duration                                                          | t ≤ 1s | 1s < t ≤ 3min | 3min < t |
| Count                                                             | 0      | 0             | 0        |

Figure 3-101 Interruptions of the Supply Voltage

○ Supply Voltage Dips

| EN50160 Report (Week29 2022/07/17 00:00:00 - 2022/07/24 00:00:00) |               |               |                |                 |                  |           |
|-------------------------------------------------------------------|---------------|---------------|----------------|-----------------|------------------|-----------|
| Supply Voltage Dips                                               |               |               |                |                 |                  |           |
| Residual Voltage u %                                              | Duration t ms |               |                |                 |                  |           |
|                                                                   | 10 ≤ t ≤ 200  | 200 < t ≤ 500 | 500 < t ≤ 1000 | 1000 < t ≤ 5000 | 5000 < t ≤ 60000 | t > 60000 |
| 90 > u ≥ 80                                                       | 0             | 0             | 0              | 0               | 0                | 0         |
| 80 > u ≥ 70                                                       | 0             | 0             | 0              | 0               | 0                | 0         |
| 70 > u ≥ 40                                                       | 0             | 0             | 0              | 0               | 0                | 0         |
| 40 > u ≥ 5                                                        | 0             | 0             | 0              | 0               | 0                | 0         |
| 5 > u                                                             | 0             | 0             | 0              | 0               | 0                | 0         |

Figure 3-102 Supply Voltage Dips

○ Supply Voltage Swells

| EN50160 Report (Week29 2022/07/17 00:00:00 - 2022/07/24 00:00:00) |               |                |                  |           |
|-------------------------------------------------------------------|---------------|----------------|------------------|-----------|
| Supply Voltage Swells                                             |               |                |                  |           |
| Swell Voltage u %                                                 | Duration t ms |                |                  |           |
|                                                                   | 10 ≤ t ≤ 500  | 500 < t ≤ 5000 | 5000 < t ≤ 60000 | t > 60000 |
| u ≥ 200                                                           | 0             | 0              | 0                | 0         |
| 200 > u ≥ 160                                                     | 0             | 0              | 0                | 0         |
| 160 > u ≥ 140                                                     | 0             | 0              | 0                | 0         |
| 140 > u ≥ 120                                                     | 0             | 0              | 0                | 0         |
| 120 > u ≥ 110                                                     | 0             | 0              | 0                | 0         |

Figure 3-103 Supply Voltage Swells

○ Transient Overvoltages

| EN50160 Report (Week29 2022/07/17 00:00:00 - 2022/07/24 00:00:00) |          |          |
|-------------------------------------------------------------------|----------|----------|
| Transient Overvoltages                                            |          |          |
| Ua Count                                                          | Ub Count | Uc Count |
| 0                                                                 | 0        | 0        |

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.

EN50160 Report (Week29 2022/07/17 00:00:00 - 2022/07/24 00:00:00)

Print

iMeter 8

EN50160 Report

Conclusion

Continuous Phenomena

Period: 2022/07/17 00:00:00 - 2022/07/24 00:00:00

| No. | Power Quality Parameters  | Conclusion |
|-----|---------------------------|------------|
| 01  | Power Frequency           | ×          |
| 02  | Supply Voltage Variations | ×          |
| 03  | Rapid Voltage Changes     |            |
| 04  | Flicker Severity          | ✓          |
| 05  | Supply Voltage Unbalance  | ✓          |
| 06  | Harmonic Voltage          | ✓          |
| 07  | Interharmonic Voltage     |            |
| 08  | Mains Signalling Voltages | ✓          |

Voltage Events

| No. | Power Quality Parameters            | Conclusion |
|-----|-------------------------------------|------------|
| 09  | Interruptions of the Supply Voltage |            |
| 10  | Supply Voltage Dips                 |            |
| 11  | Supply Voltage Swells               |            |

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

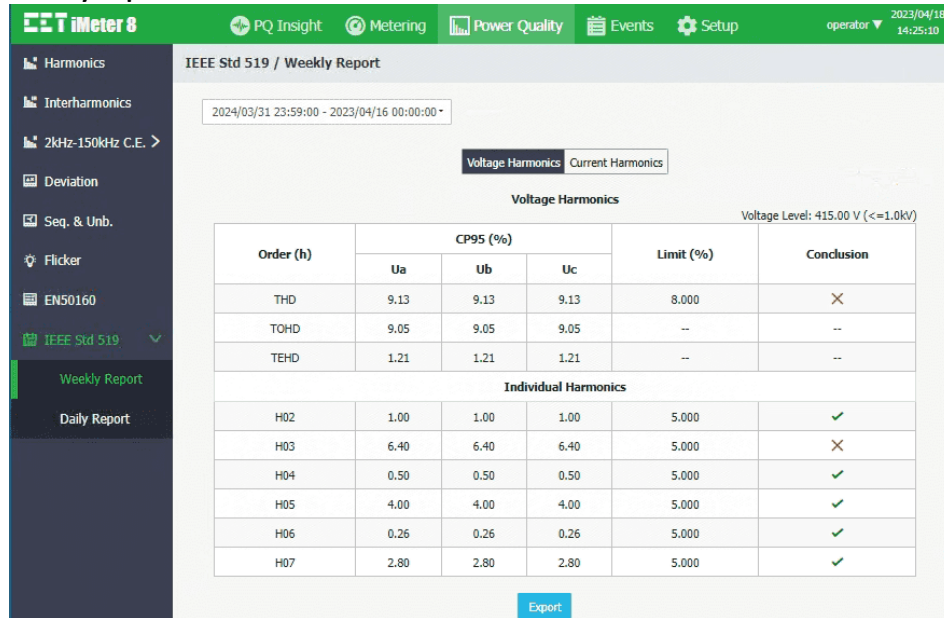


Figure 3-106 Voltage Harmonics IEEE Std 519 Weekly Report

#### 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.

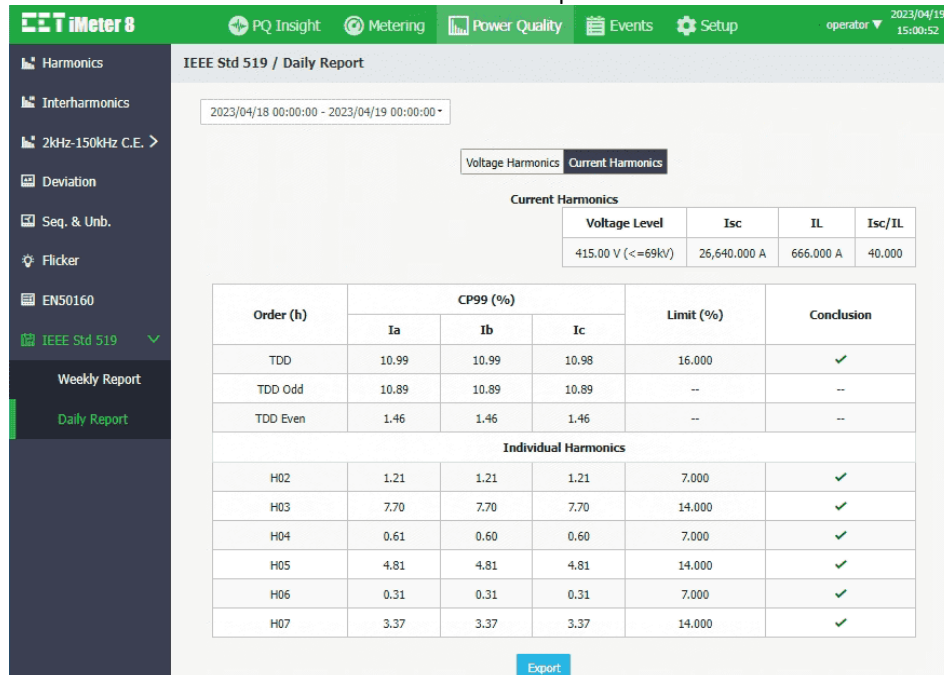


Figure 3-107 Current Harmonics IEEE Std 519 Daily Report

### 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.

| No. | Timestamp               | Description            | Detail |
|-----|-------------------------|------------------------|--------|
| 1   | 2022/07/29 13:27:46.029 | DO3 Open               |        |
| 2   | 2022/07/29 13:27:36.025 | Interruption           |        |
| 3   | 2022/07/29 13:27:36.029 | DO3 Closed             |        |
| 4   | 2022/07/29 12:18:57.714 | DO3 Open               |        |
| 5   | 2022/07/29 12:18:47.710 | Interruption           |        |
| 6   | 2022/07/29 12:18:47.714 | DO3 Closed             |        |
| 7   | 2022/07/29 10:48:40.833 | DO3 Open               |        |
| 8   | 2022/07/29 10:48:30.829 | Interruption           |        |
| 9   | 2022/07/29 10:48:30.833 | DO3 Closed             |        |
| 10  | 2022/07/28 14:56:50.550 | WFR Triggered Manually |        |

No. of Events: 669, No. of Filtered Events: 669

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

| DO3 Closed                               |
|------------------------------------------|
| Event Timestamp: 2022/07/29 12:18:47.714 |
| Operated by: Interruption                |

Figure 3-109 DOx Operated by an Interruption Event

#### 2) Setpoint

| Under U Dev. Setpoint Return                                  |
|---------------------------------------------------------------|
| Event Timestamp: 2022/03/03 13:32:54.854                      |
| Return Value: 2.42%    Min. Value: -1.60%    Duration: 2.200s |

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.

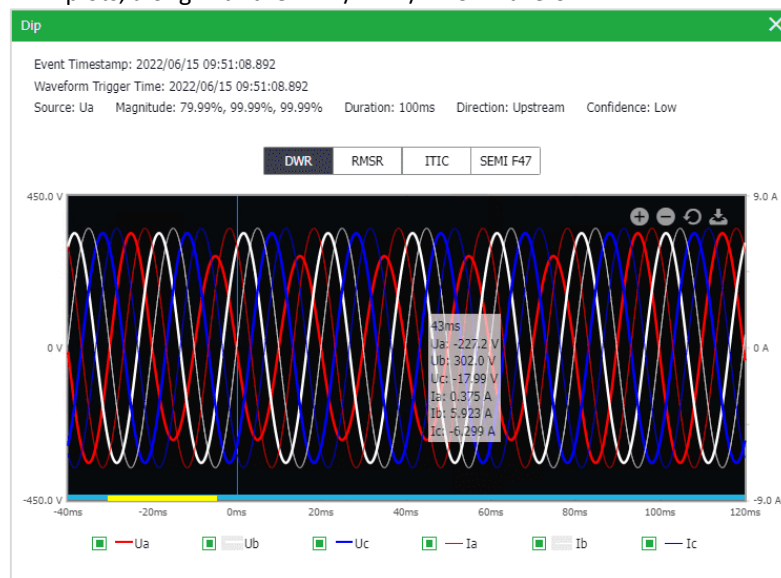


Figure 3-112 Dip Event Interface

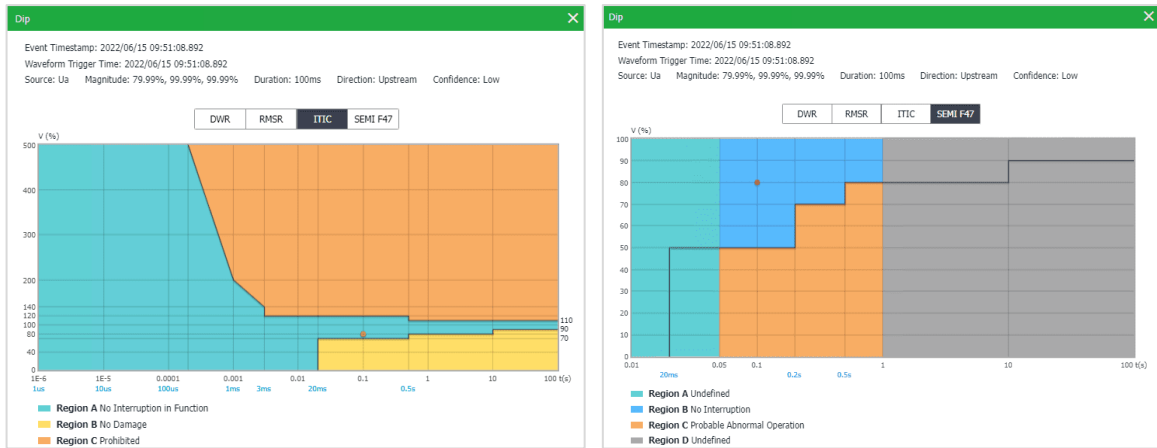


Figure 3-113 Dip on ITIC and SEMI F47 Interface

### 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 shows the Device Log interface. The interface includes a sidebar with 'SOE Log', 'Device Log', and 'PQ Counters'. The main area displays a table of device log events. The table has columns: No., Timestamp, Description, and Detail. The table lists 10 events, including 'Setup Changes', 'Power On', 'Power Off', and 'TOU Freeze Triggered Manually'. At the bottom, it shows 'No. of Events: 794, No. of Filtered Events: 794' and an 'Export' button.

| No. | Timestamp               | Description                   | Detail |
|-----|-------------------------|-------------------------------|--------|
| 1   | 2022/07/29 10:47:51.563 | Setup Changes                 |        |
| 2   | 2022/07/29 10:47:15.035 | Setup Changes                 |        |
| 3   | 2022/07/29 10:45:57.521 | Power On                      |        |
| 4   | 2022/07/29 10:44:32.991 | Power Off                     |        |
| 5   | 2022/07/29 10:35:39.322 | TOU Freeze Triggered Manually |        |
| 6   | 2022/07/28 17:57:00.944 | Power On                      |        |
| 7   | 2022/07/28 17:55:34.793 | Power Off                     |        |
| 8   | 2022/07/28 15:19:59.674 | Setup Changes                 |        |
| 9   | 2022/07/28 14:56:38.893 | Setup Changes                 |        |
| 10  | 2022/07/28 14:53:45.650 | Setup Changes                 |        |

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.

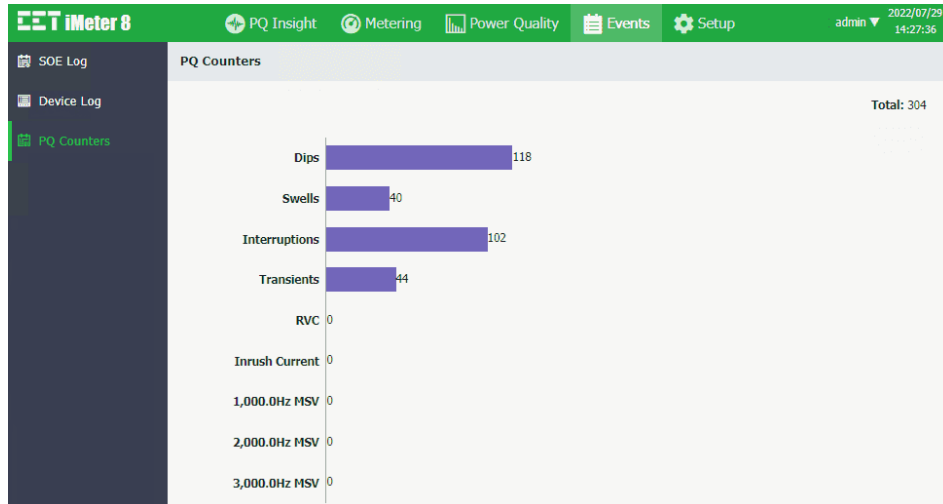


Figure 3-115 PQ Counter Interface

### 3.2.4.4.4 Audit Log

Login the Web Server 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.

| No. | Timestamp               | Username | Description                   | Conclusion |
|-----|-------------------------|----------|-------------------------------|------------|
| 1   | 2023/04/18 14:45:44.185 | auditor  | View Audit Log                | Succeeded  |
| 2   | 2023/04/18 14:45:44.165 | auditor  | Logged In                     | Succeeded  |
| 3   | 2023/04/18 14:45:04.010 | admin    | Logged Out                    | Succeeded  |
| 4   | 2023/04/18 14:44:45.277 | admin    | Logged In                     | Succeeded  |
| 5   | 2023/04/18 14:44:03.268 | auditor  | Invalid Login: Wrong Password | Failed     |
| 6   | 2023/04/18 14:43:20.655 | auditor  | Invalid Login: Wrong Password | Failed     |
| 7   | 2023/04/18 14:34:34.566 | auditor  | Invalid Login: Wrong Password | Failed     |
| 8   | 2023/04/18 14:33:30.363 | auditor  | Logged Out                    | Succeeded  |
| 9   | 2023/04/18 14:28:30.411 | auditor  | View Audit Log                | Succeeded  |
| 10  | 2023/04/18 14:28:30.377 | auditor  | Logged In                     | Succeeded  |

No. of Events: 1223, No. of Filtered Events: 1223

Refresh Export Clear

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**.

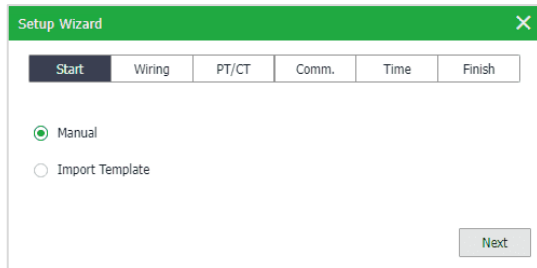


Figure 3-117 Wizard-Start-Manual

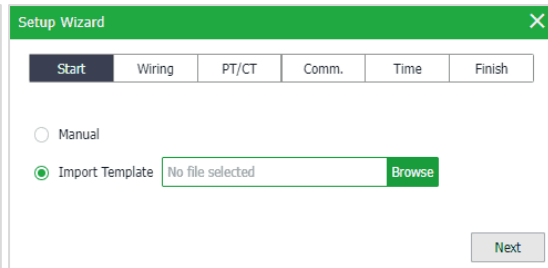


Figure 3-118 Wizard-Start-Import Template

- **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.

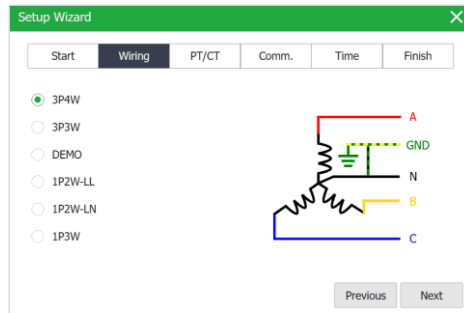


Figure 3-119 Wizard-Wiring

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

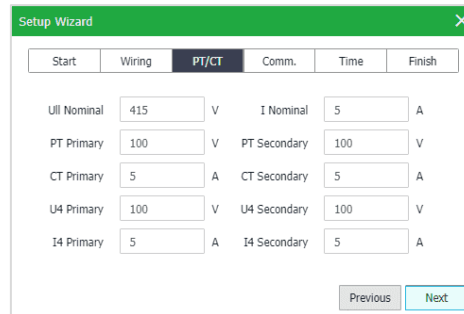


Figure 3-120 Wizard-PT/CT

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

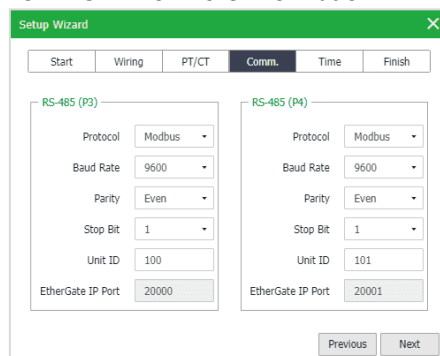


Figure 3-121 Wizard-Comm.

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

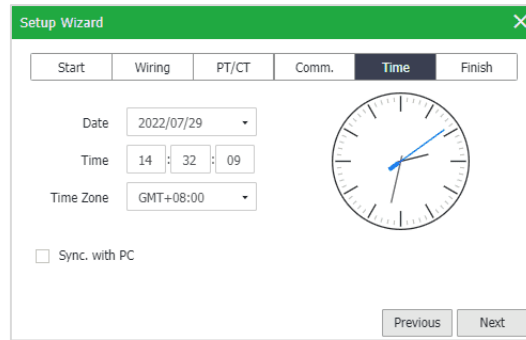


Figure 3-122 Wizard-Time

- **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.

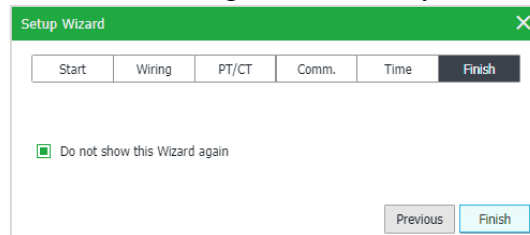


Figure 3-123 Wizard-Finish

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

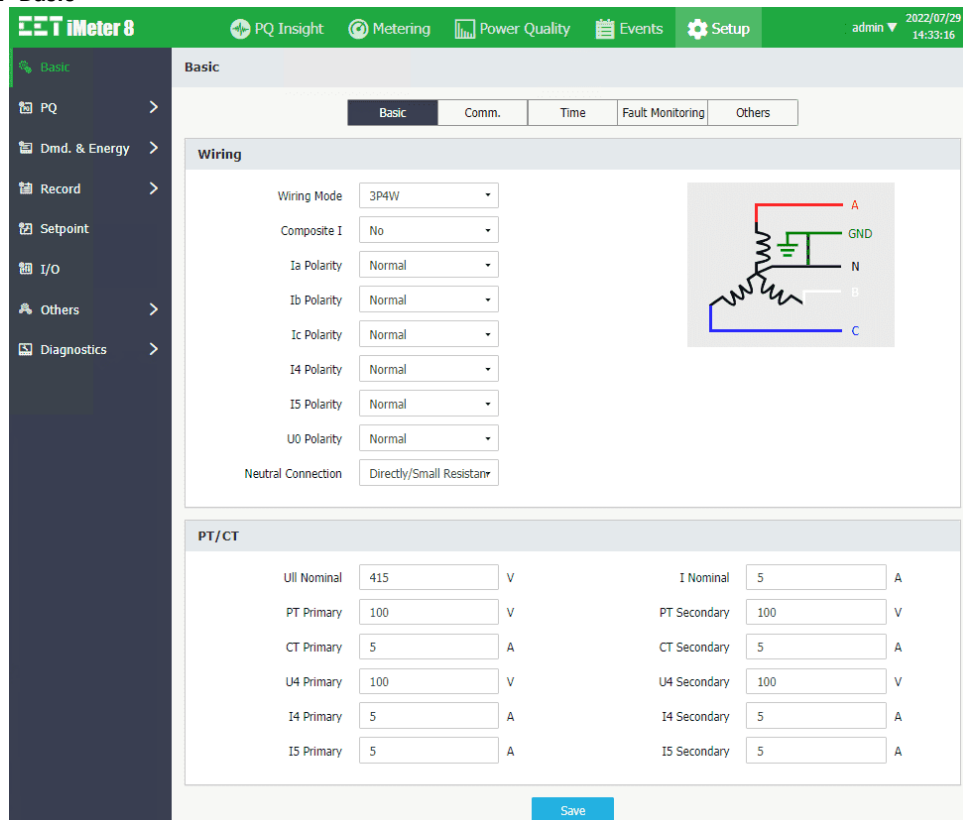


Figure 3-124 Channels Color Settings

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

| Parameter                                                                                         | Range, Default*                                                                                            | Parameter                  | Range, Default*                                                                                                                                          |
|---------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Wiring</b><br>(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<br>(Display when the corresponding options are equipped)                                     | 5A (50A) @ 10mV/A*<br>20A @ 10mV/A<br>200A @ 1mV/A<br>500A @ 1mV/A<br>500A (550A) @ 1mV/A<br>5kA @ 0.1mV/A | Ia/Ib/Ic/I4/I5<br>Polarity | Normal*, Reverse                                                                                                                                         |
| U0 Polarity                                                                                       | Normal*, Reverse                                                                                           | Neutral Connection         | <ul style="list-style-type: none"> <li>Directly/Small Resistance/Reactance*</li> <li>Ungrounded/High Resistance</li> <li>Arc Suppression Coil</li> </ul> |
| <b>PT/CT</b>                                                                                      |                                                                                                            |                            |                                                                                                                                                          |
| 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).

**iMeter 8** PQ Insight Metering Power Quality Events Setup admin 2022/07/29 14:53:11

**Basic**

Basic Comm. Time Fault Monitoring Others

**Ethernet (P1/P2)**

P1 Enable IP Address 1 192.168.0.100 Subnet Mask 1 255.255.255.0 Gateway 192.168.1.1

P2 Enable IP Address 2 192.168.1.100 Subnet Mask 2 255.255.255.0

**DNS**

Preferred Server 8.8.8.8 Alternative Server 114.114.114.114

**RS-485 (P3)**

Protocol Modbus Baud Rate 9600 Parity Even Stop Bit 1 Unit ID 100 EtherGate IP Port 20000

**RS-485 (P4)**

Protocol Modbus Baud Rate 9600 Parity Even Stop Bit 1 Unit ID 101 EtherGate IP Port 20001

**White List**

☒ Enable

| No. | IP Address |
|-----|------------|
|     |            |
|     |            |

Save

**Figure 3-125 Comm. Setup Interface**

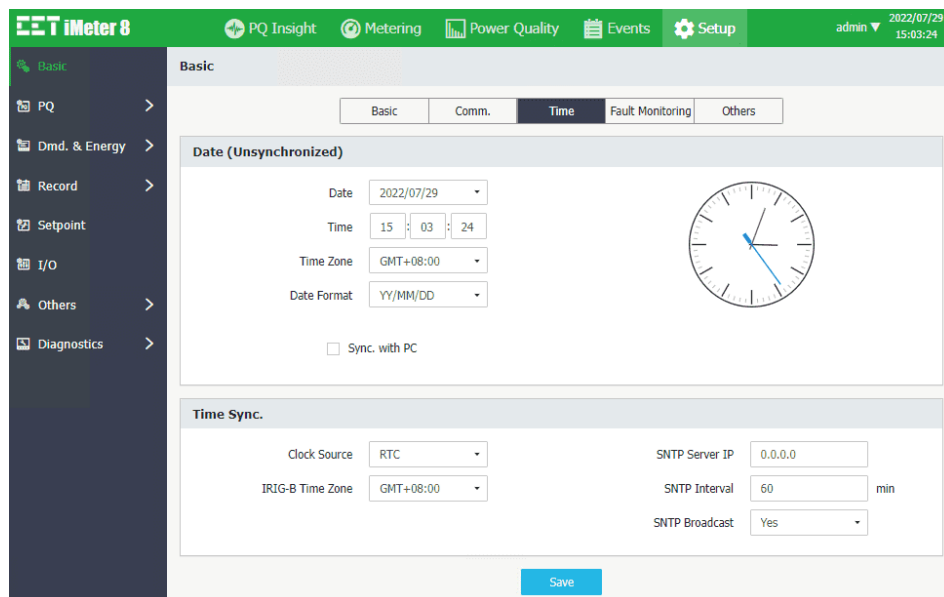
The following table illustrates the ranges and default values for the Comm. parameter:

| Parameter                                                                                  | Range, Default*                                                                                                                   | Parameter          | Range, Default*                                      |
|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------|------------------------------------------------------|
| <b>Ethernet (P1/P2)</b> 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*                                                                                                                      |                    |                                                      |
| <b>DNS</b>                                                                                 |                                                                                                                                   |                    |                                                      |
| Preferred Server                                                                           | Specifies the primary DNS Server. 8.8.8.8*                                                                                        | Alternative Server | Specifies the secondary DNS Server. 114.114.114.114* |
| <b>RS-485 (P3)</b>                                                                         |                                                                                                                                   |                    |                                                      |
| 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*                                  |
| <b>RS-485 (P4)</b>                                                                         |                                                                                                                                   |                    |                                                      |
| 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*                                  |
| <b>White List</b>                                                                          |                                                                                                                                   |                    |                                                      |
| 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*                                       |
|-------------|-------------------------------------------------------------|-------------------|-------------------------------------------------------|
| <b>Date</b> |                                                             | <b>Time Sync.</b> |                                                       |
| 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*                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Others</b>           |                                                                                                                                                                                                                                                                                                                                                                       |
| Language                | English*, Simplified Chinese, Traditional Chinese                                                                                                                                                                                                                                                                                                                     |
| Delimiter               | <ul style="list-style-type: none"> <li>99,999.999*: "," is used as the x1000 delimiter and "." as the decimal point.</li> <li>99 999,999: " " is used as the x1000 delimiter and "," as the decimal point.</li> </ul>                                                                                                                                                 |
| <b>Algorithm</b>        |                                                                                                                                                                                                                                                                                                                                                                       |
| 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)                                                                                                                                                                                                                                                                                                                                                    |
| 14 TDD Preset IL (Pri.) | <ul style="list-style-type: none"> <li>0: represents to use the TDD calculation method compatible with the standard TDD calc. in IEEE_519</li> <li>non-zero value: it is the preset IL for TDD Calculation</li> </ul> <p>As per the IEEE Std 519-2022, IL = maximum demand load current the PCC (point of common coupling) under normal load operating conditions</p> |

**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**

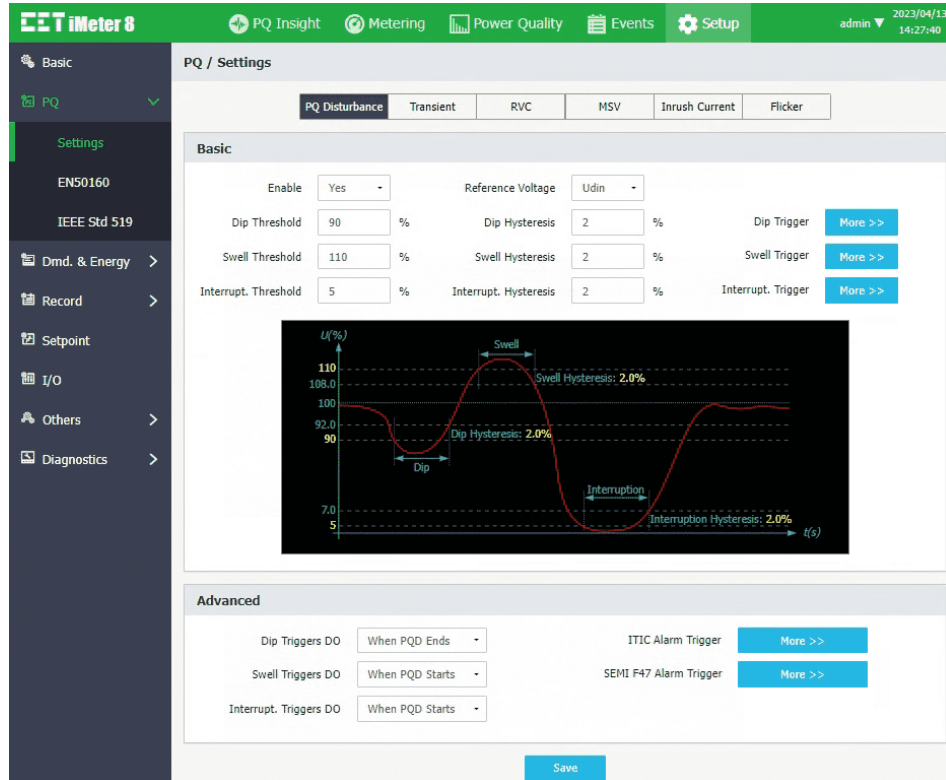


Figure 3-129 PQ Disturbance Setup Interface

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

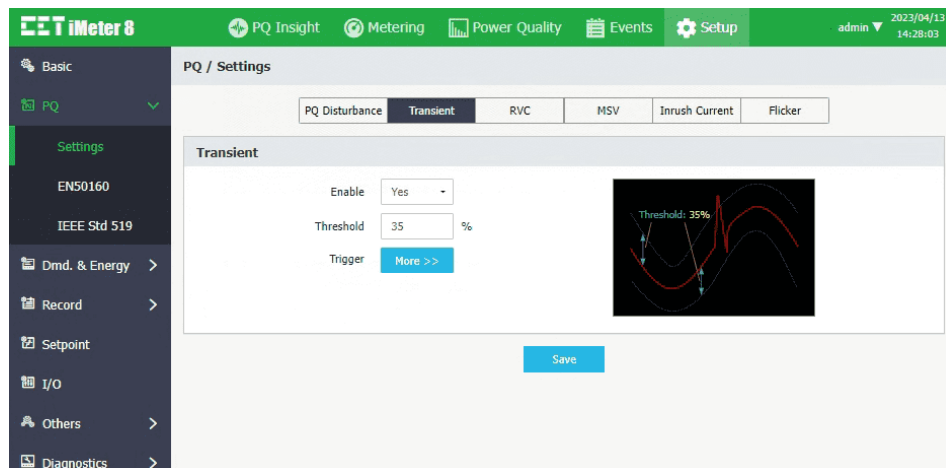


Figure 3-130 Transient Setup Interface

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

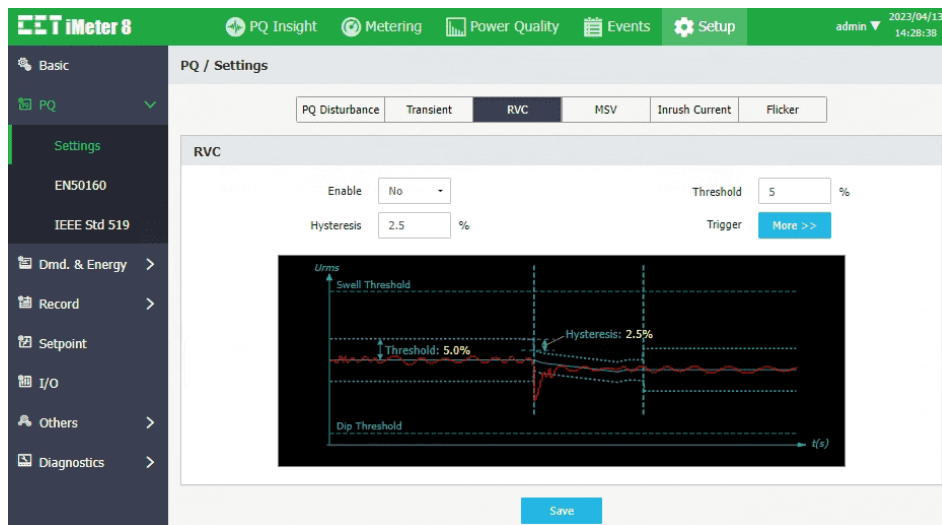


Figure 3-131 RVC Setup Interface

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

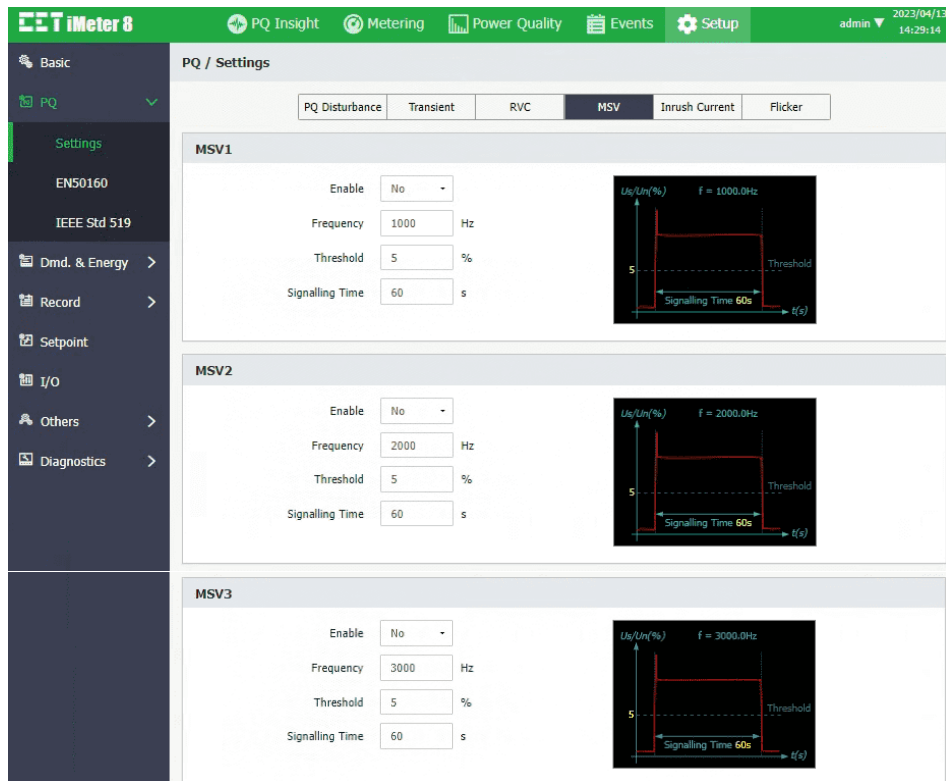
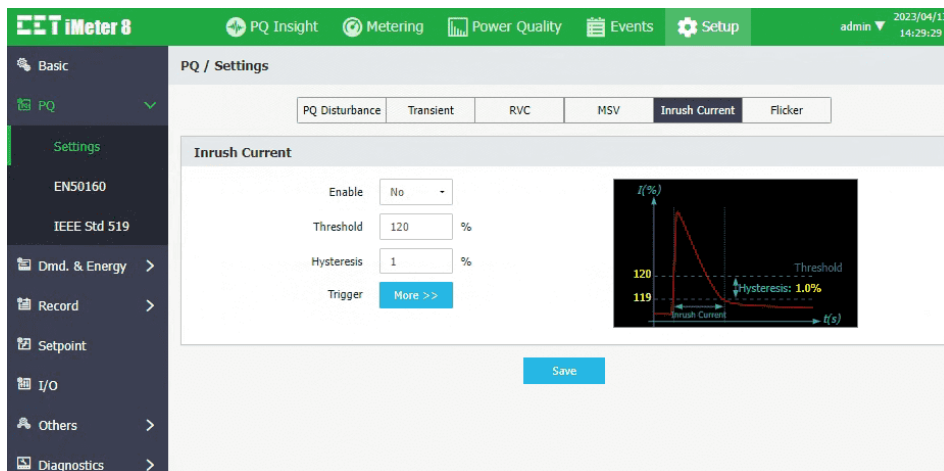


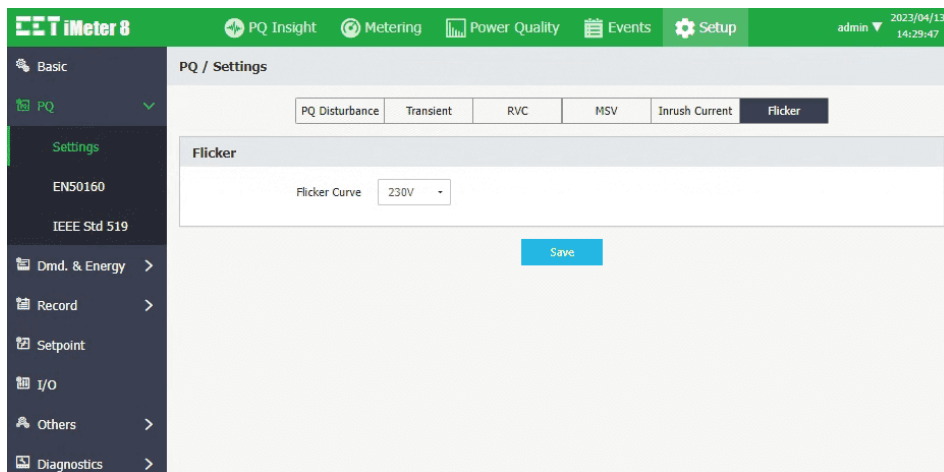
Figure 3-132 MSV Setup Interface

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



**Figure 3-133 Inrush Current Setup Interface**

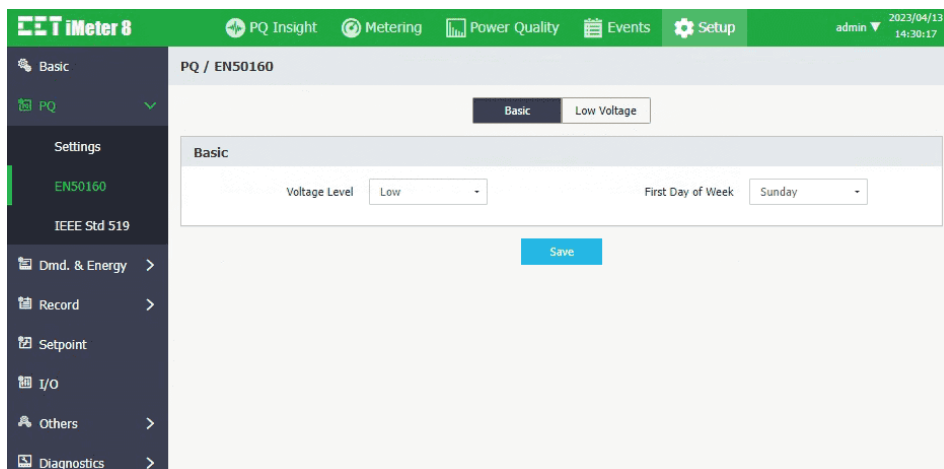
- **Flicker** The options for **Flicker Curve** are 120V and 230V (default). For more information, please refer to **Section 4.5.4** .



**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** .

**PQ / EN50160**

Basic Low Voltage

**Power Frequency**

Wide Tolerance: 100 %  
Wide Tolerance Limit: 94 ~ 104 %  
Narrow Tolerance: 99.5 %  
Narrow Tolerance Limit: 99 ~ 101 %

**Supply Voltage Variations**

Wide Tolerance: 100 %  
Wide Tolerance Limit: 85 ~ 110 %  
Narrow Tolerance: 95 %  
Narrow Tolerance Limit: 90 ~ 110 %

**Flicker Severity**

Tolerance: 95 %  
Limit: 1

**Supply Voltage Unbalance**

Tolerance: 95 %  
Limit: 2 %

**Voltage Harmonic Limits**

| Harmonic | Tolerance | Harmonic | Total |
|----------|-----------|----------|-------|
| H02      | 2 %       | H03      | 5 %   |
| H04      | 1 %       | H05      | 6 %   |
| H06      | 0.5 %     | H07      | 5 %   |
| H08      | 0.5 %     | H09      | 1.5 % |
| H10      | 0.5 %     | H11      | 3.5 % |
| H12      | 0.5 %     | H13      | 3 %   |
| H14      | 0.5 %     | H15      | 0.5 % |
| H16      | 0.5 %     | H17      | 2 %   |
| H18      | 0.5 %     | H19      | 1.5 % |
| H20      | 0.5 %     | H21      | 0.5 % |
| H22      | 0.5 %     | H23      | 1.5 % |
| H24      | 0.5 %     | H25      | 1.5 % |

Save

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.

**PQ / IEEE Std 519**

Basic Limit

**Basic**

IEEE Std 519 Mode: Standard  
First Day of Week: Sunday  
PCC Voltage\*: 415 V  
Alert Notification: Periodic Email  
HVDC: Disable  
Power Generation Facilities: Disable  
Max. Short Circuit Current: 40000 A

\*PCC Voltage=ULI Nominal x PT Ratio (PCC = Point of Common Coupling)

Save

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** .

PQ / IEEE Std 519

Basic Limit

Harmonic Voltage

|     |     |   |     |   |   |
|-----|-----|---|-----|---|---|
| THD | 1.5 | % | H02 | 1 | % |
| H03 | 1   | % | H04 | 1 | % |
| H05 | 1   | % | H06 | 1 | % |
| H07 | 1   | % | H08 | 1 | % |
| H09 | 1   | % | H10 | 1 | % |
| H11 | 1   | % | H12 | 1 | % |
| H13 | 1   | % | H14 | 1 | % |
| H15 | 1   | % | H16 | 1 | % |
| H17 | 1   | % | H18 | 1 | % |
| H19 | 1   | % | H20 | 1 | % |
| H21 | 1   | % | H22 | 1 | % |
| H23 | 1   | % | H24 | 1 | % |
| H25 | 1   | % | H26 | 1 | % |
| H27 | 1   | % | H28 | 1 | % |
| H29 | 1   | % | H30 | 1 | % |
| H31 | 1   | % | H32 | 1 | % |
| H33 | 1   | % | H34 | 1 | % |
| H35 | 1   | % | H36 | 1 | % |
| H37 | 1   | % | H38 | 1 | % |
| H39 | 1   | % | H40 | 1 | % |
| H41 | 1   | % | H42 | 1 | % |
| H43 | 1   | % | H44 | 1 | % |
| H45 | 1   | % | H46 | 1 | % |
| H47 | 1   | % | H48 | 1 | % |
| H49 | 1   | % | H50 | 1 | % |

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**.

| Current Harmonics |        |
|-------------------|--------|
| TDD               | 1.5 %  |
| H03               | 1 %    |
| H05               | 1 %    |
| H07               | 1 %    |
| H09               | 1 %    |
| H11               | 0.5 %  |
| H13               | 0.5 %  |
| H15               | 0.5 %  |
| H17               | 0.38 % |
| H19               | 0.38 % |
| H21               | 0.38 % |
| H23               | 0.15 % |
| H25               | 0.15 % |
| H27               | 0.15 % |
| H29               | 0.15 % |
| H31               | 0.15 % |
| H33               | 0.15 % |
| H35               | 0.1 %  |
| H37               | 0.1 %  |
| H39               | 0.1 %  |
| H41               | 0.1 %  |
| H43               | 0.1 %  |
| H45               | 0.1 %  |
| H47               | 0.1 %  |
| H49               | 0.1 %  |
| H02               | 0.5 %  |
| H04               | 0.5 %  |
| H06               | 0.5 %  |
| H08               | 1 %    |
| H10               | 1 %    |
| H12               | 0.5 %  |
| H14               | 0.5 %  |
| H16               | 0.5 %  |
| H18               | 0.38 % |
| H20               | 0.38 % |
| H22               | 0.38 % |
| H24               | 0.15 % |
| H26               | 0.15 % |
| H28               | 0.15 % |
| H30               | 0.15 % |
| H32               | 0.15 % |
| H34               | 0.15 % |
| H36               | 0.1 %  |
| H38               | 0.1 %  |
| H40               | 0.1 %  |
| H42               | 0.1 %  |
| H44               | 0.1 %  |
| H46               | 0.1 %  |
| H48               | 0.1 %  |
| H50               | 0.1 %  |

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.

**iMeter 8** | PQ Insight | Metering | Power Quality | Events | Setup | operator | 2022/07/29 15:22:17

**Dmd. & Energy / Demand**

**Settings**

Sync. Mode: SLD | Period: 15 min

# of Sliding Windows: 1 | Predicted Sensitivity: 70

**Self-Read Time**

☐ Month End  
☐ Each Month 1 Day 0 Hour  
☒ Manual

Save

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**.

The screenshot shows the 'Energy Preset' configuration interface. The left sidebar has 'Energy' selected under 'Dmd. & Energy'. The main area has tabs for 'Energy Preset', 'Energy Pulse', and 'Energy Log'. Under 'Preset Values', there are input fields for kWh Import (101626.365), kWh Export (0), kvarh Import (179788.302), kvarh Export (0), and kVAh (206523.018). A 'Save' button is located at the bottom right of the preset values section.

**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**.

The screenshot shows the 'Energy Pulse' configuration interface. The left sidebar has 'Energy' selected. The main area has tabs for 'Energy Preset', 'Energy Pulse', and 'Energy Log'. Under 'Energy Pulse', there are fields for Pulse Type (Secondary), Energy / Pulse (0.1 kwh/imp), Pulse Constant (1000 imp/kwh), and four event selection fields (E1, E2, E3, E4) all set to N/A. A 'Save' button is at the bottom right.

**Figure 3-142 Energy Pulse Setup Interface**

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

The screenshot shows the 'Energy Log' configuration interface. The left sidebar has 'Energy' selected. The main area has tabs for 'Energy Preset', 'Energy Pulse', and 'Energy Log'. Under 'Energy Log', there are two sections: 'Interval Energy Recorder' and 'Accumulative Energy Recorder'. Each section has fields for Record Mode (FIFO), Record Interval (15 min), Start Date (2000/01/01), and Start Time (00:00:00). A 'Save' button is at the bottom right.

**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.

Dmd. & Energy / TOU

Labels Basic **Daily Profiles** Seasons Alternate Days

**TOU1**

| No. | Daily Profile Name | Details        |
|-----|--------------------|----------------|
| 1   | Profile 1          | 00:00-24:00 T1 |
| 2   | Profile 2          | 00:00-24:00 T1 |
| 3   | Profile 3          | 00:00-24:00 T1 |
| 4   | Profile 4          | 00:00-24:00 T1 |

**TOU2**

| No. | Daily Profile Name | Details        |
|-----|--------------------|----------------|
| 1   | Profile 1          | 00:00-24:00 T1 |
| 2   | Profile 2          | 00:00-24:00 T1 |
| 3   | Profile 3          | 00:00-24:00 T1 |
| 4   | Profile 4          | 00:00-24:00 T1 |

Save

**Profile 1**

Name: Profile 1

| No. | Start Time      | Tariff |
|-----|-----------------|--------|
| 1   | 00 : Hh 00 : mm | T1     |
| 2   | 00 : Hh 00 : mm | T1     |

OK Cancel

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.

Dmd. & Energy / TOU

Labels Basic Daily Profiles **Seasons** Alternate Days

**TOU1**

| No. | Start Date | WKDAY Daily Profile | WKEND1 Daily Profile | WKEND2 Daily Profile |   |
|-----|------------|---------------------|----------------------|----------------------|---|
| 1   | 01 M 01 D  | Profile 1           | Profile 1            | Profile 1            | + |
|     |            |                     |                      |                      |   |
|     |            |                     |                      |                      |   |
|     |            |                     |                      |                      |   |

**TOU2**

| No. | Start Date | WKDAY Daily Profile | WKEND1 Daily Profile | WKEND2 Daily Profile |   |
|-----|------------|---------------------|----------------------|----------------------|---|
| 1   | 01 M 01 D  | Profile 1           | Profile 1            | Profile 1            | + |
|     |            |                     |                      |                      |   |
|     |            |                     |                      |                      |   |
|     |            |                     |                      |                      |   |

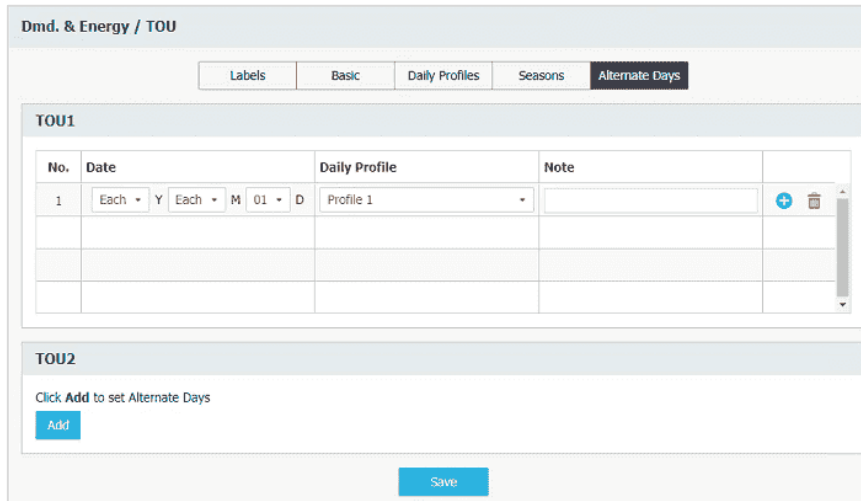
Save

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**

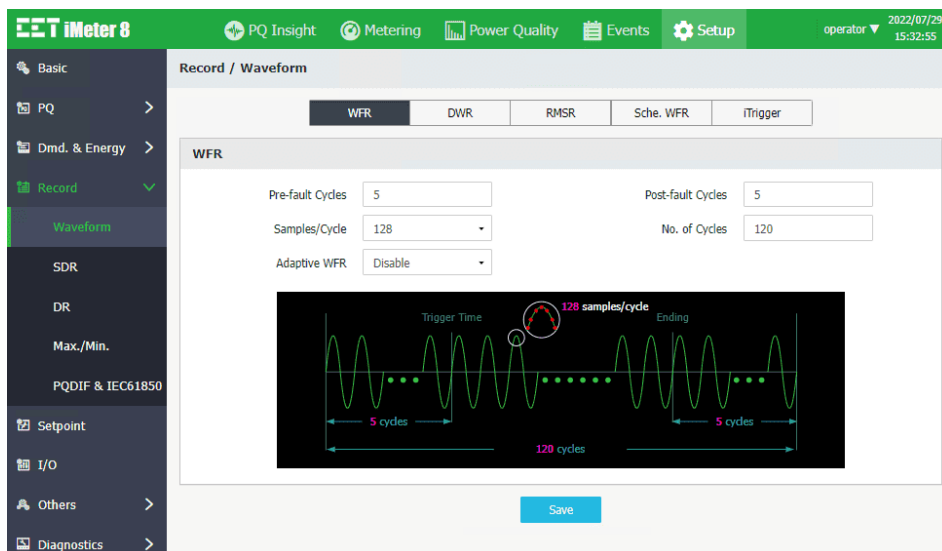
### 3.2.4.5.4 Record

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**.

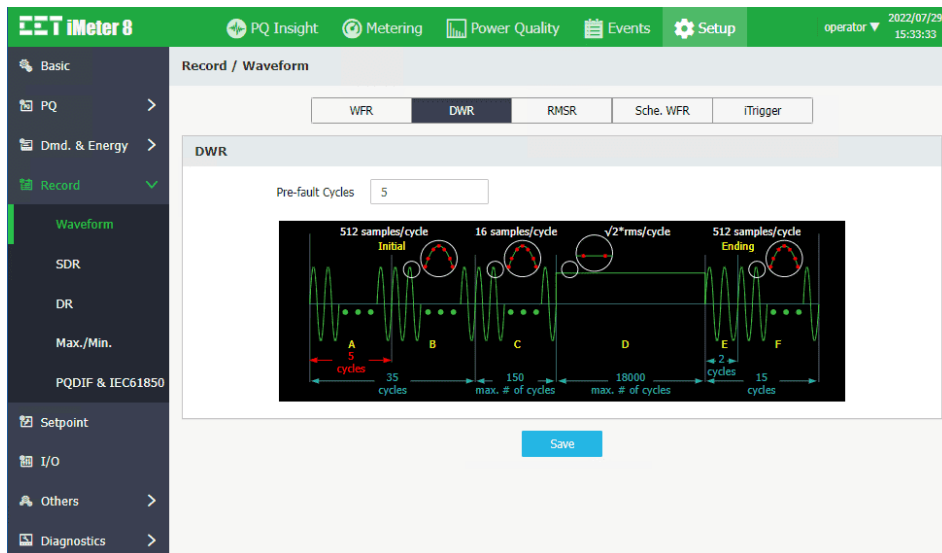


Figure 3-150 DWR Setup Interface

- 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** .

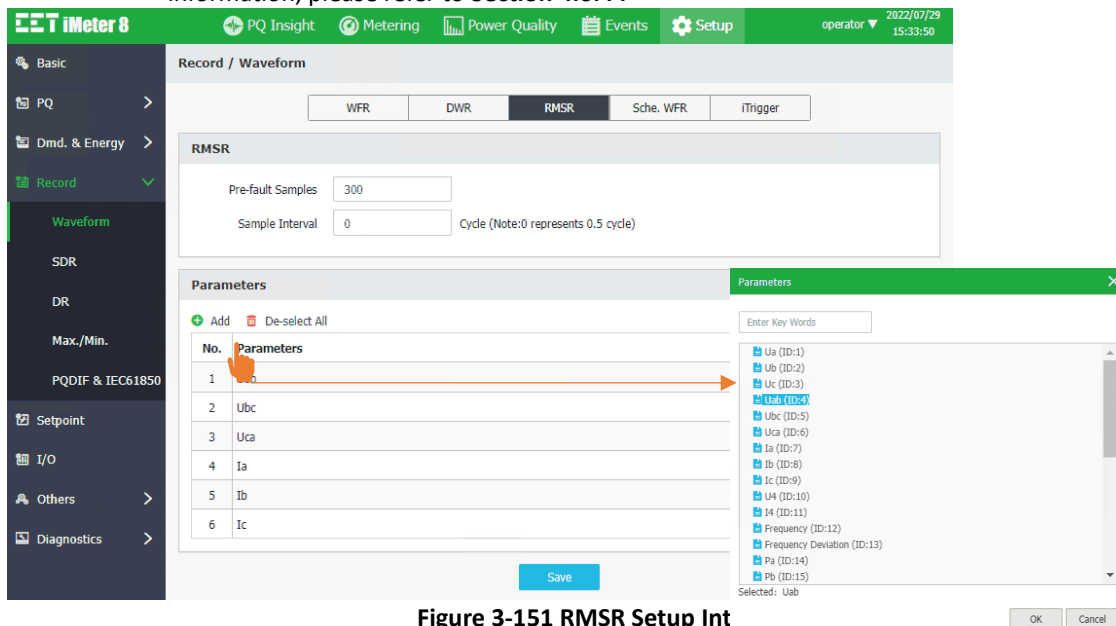


Figure 3-151 RMSR Setup Int

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

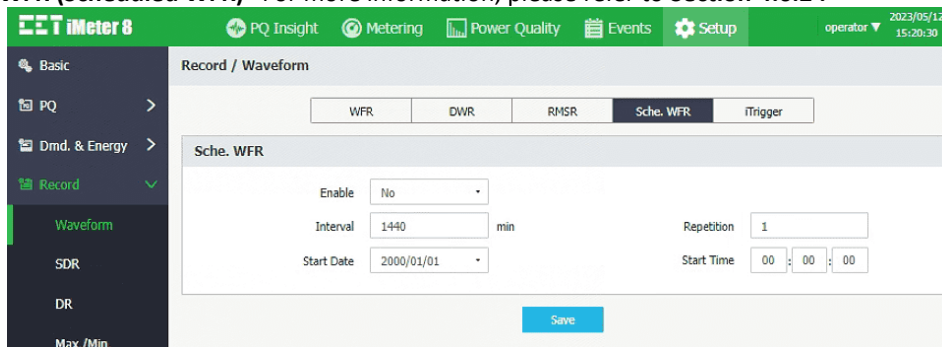


Figure 3-152 Sche. WFR Setup Interface

- **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.

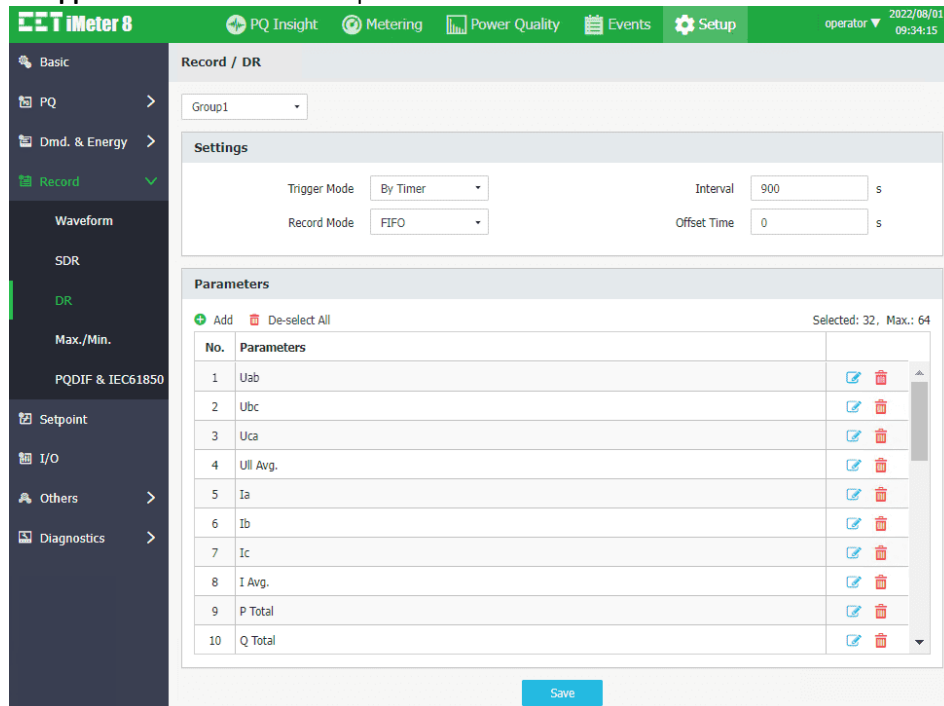


Figure 3-155 DR Setup Interface

### 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.

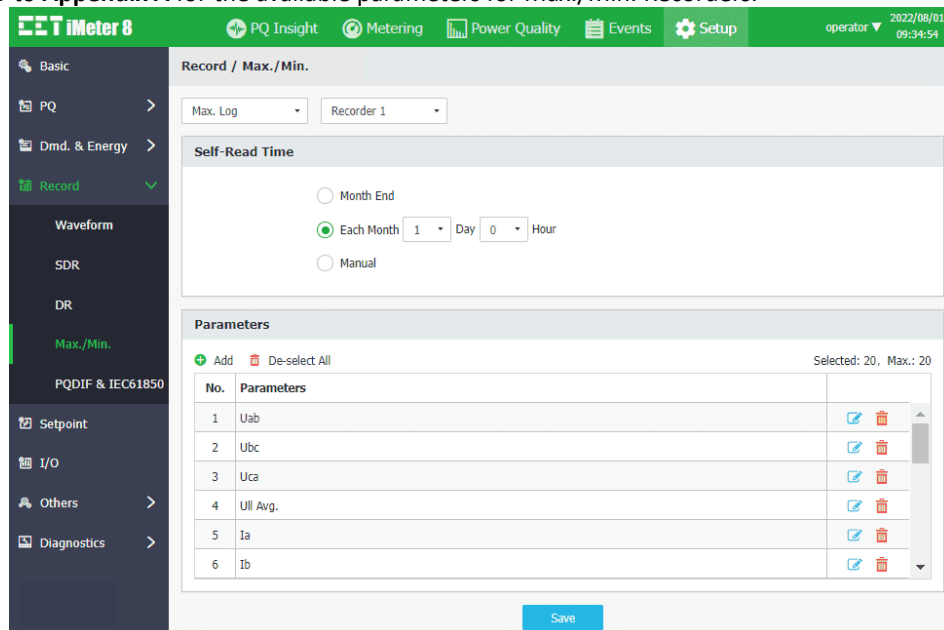


Figure 3-156 Setup Max./Min. Interface

### 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.

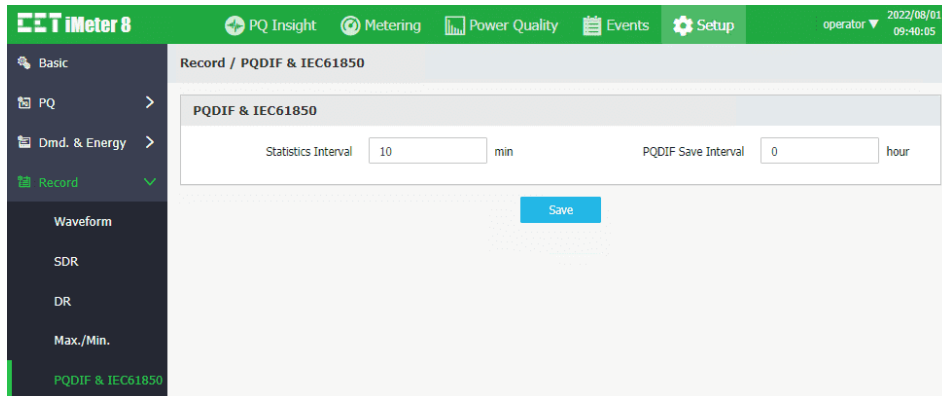


Figure 3-157 Setup PQDIF & IEC61850 Interface

### 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.

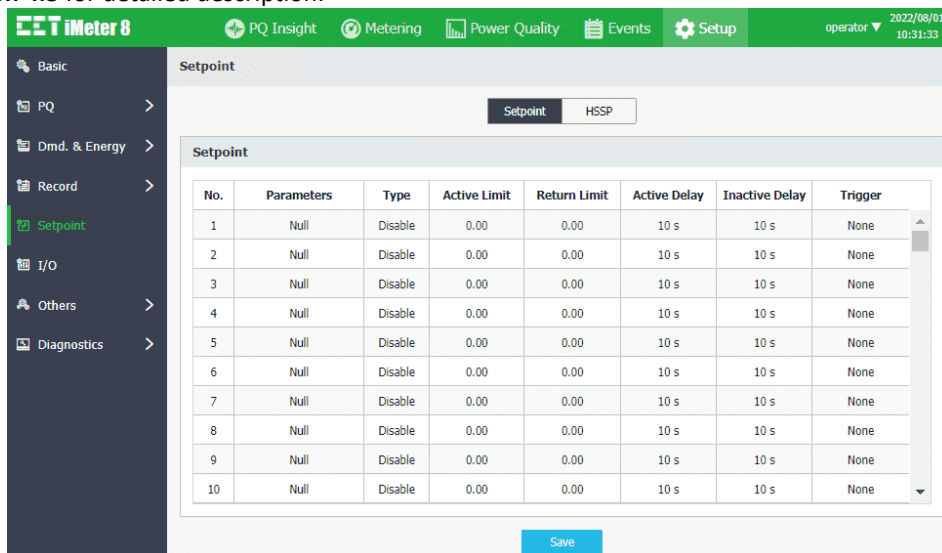


Figure 3-158 Standard Setpoint Setup Interface

- **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.

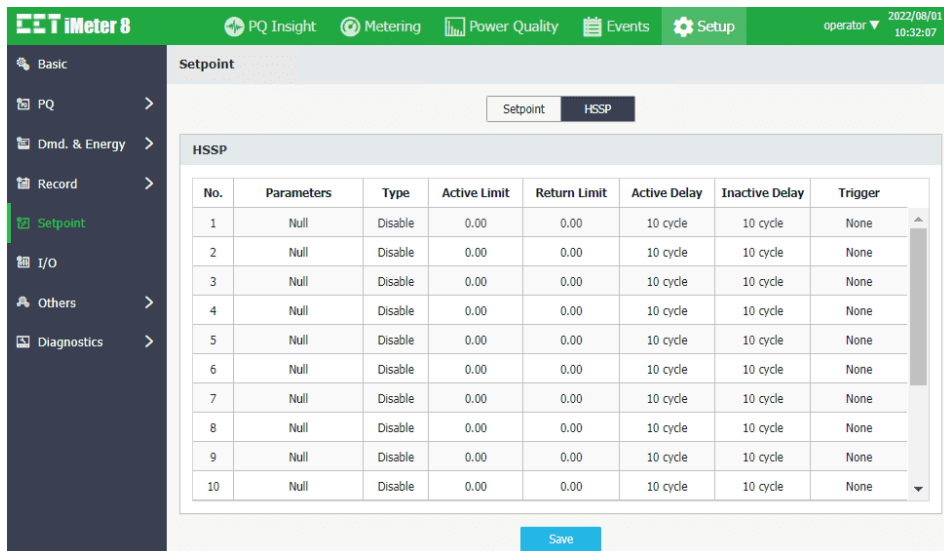


Figure 3-159 HS Setpoint Setup Interface

### 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.

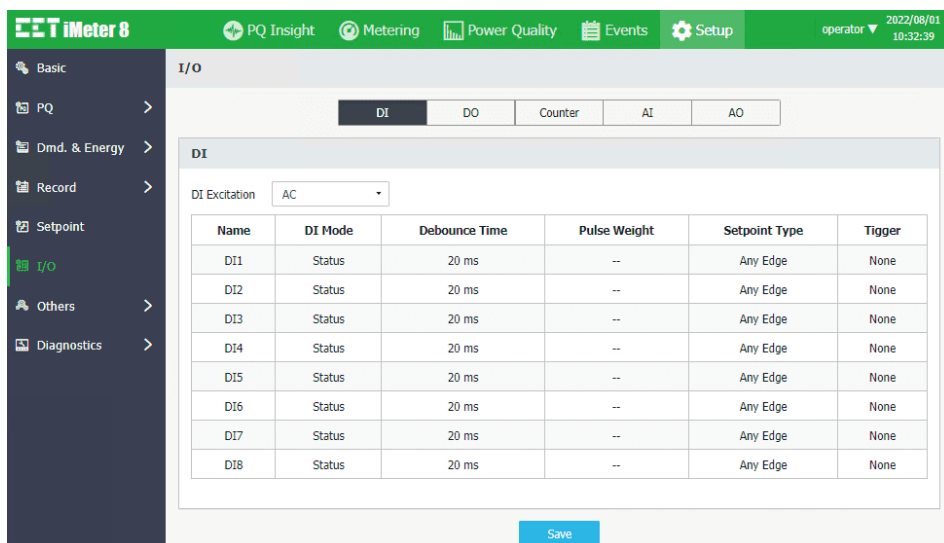


Figure 3-160 DI Setup Interface

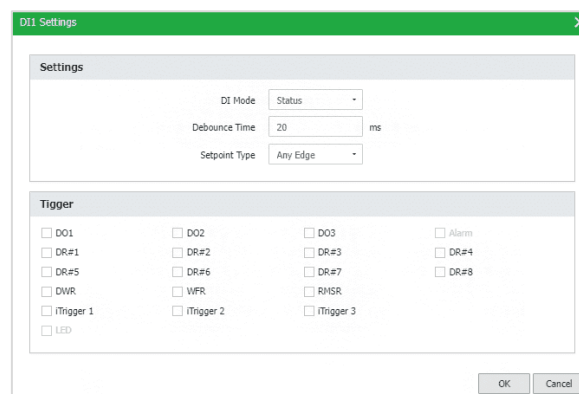


Figure 3-161 DIx Setup Interface

### 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

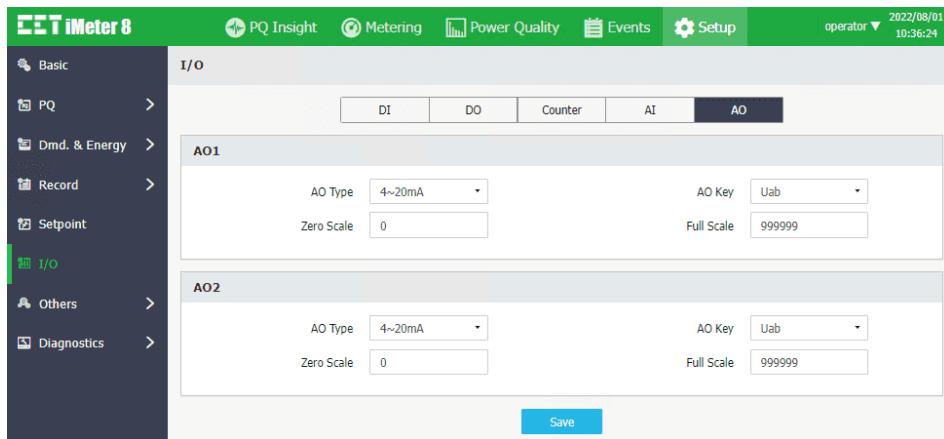
### AI (Optional)

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.



The screenshot shows the 'I/O' setup interface for AO1 and AO2 channels. The top navigation bar includes 'Basic', 'PQ', 'Dmd. & Energy', 'Record', 'Setpoint', 'I/O', 'Others', and 'Diagnostics'. The 'I/O' section is active, showing tabs for DI, DO, Counter, AI, and AO. Under the AO tab, there are two channels, AO1 and AO2. Each channel has a dropdown for 'AO Type' set to '4~20mA', a text input for 'Zero Scale' set to '0', a dropdown for 'AO Key' set to 'Uab', and a text input for 'Full Scale' set to '999999'. A 'Save' button is at the bottom right.

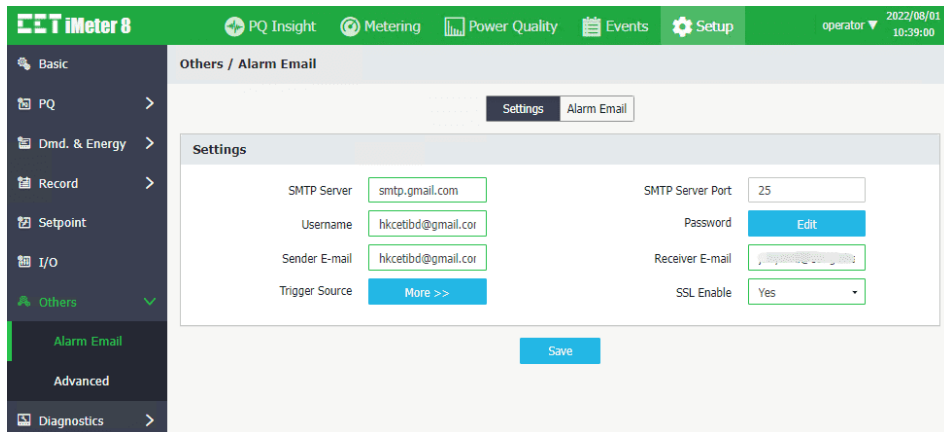
Figure 3-165 AO Setup Interface

### 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

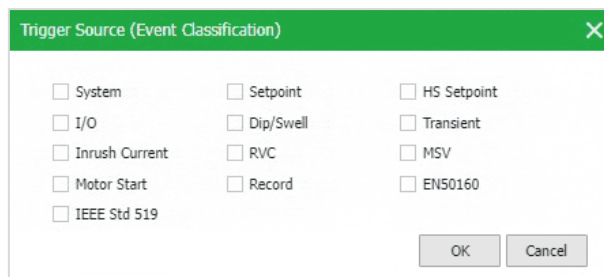
- **Settings** Please refer to **Section 4.9** for more information.



The screenshot shows the 'Others / Alarm Email' settings interface. The top navigation bar is the same as Figure 3-165. The 'Others' menu is expanded, showing 'Alarm Email' and 'Advanced'. The 'Alarm Email' sub-menu is active, showing a 'Settings' tab. The settings include: 'SMTP Server' (smtp.gmail.com), 'SMTP Server Port' (25), 'Username' (hkctibtd@gmail.com), 'Password' (with an 'Edit' button), 'Sender E-mail' (hkctibtd@gmail.com), 'Receiver E-mail' (with a selection icon), 'Trigger Source' (with a 'More >>' button), and 'SSL Enable' (Yes). A 'Save' button is at the bottom right.

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.



The screenshot shows the 'Trigger Source (Event Classification)' dialog box. It has a green title bar with a close button. The dialog contains a grid of checkboxes for various event types: System, I/O, Inrush Current, Motor Start, IEEE Std 519, Setpoint, Dip/Swell, RVC, Record, HS Setpoint, Transient, MSV, and ENS0160. At the bottom right, there are 'OK' and 'Cancel' buttons.

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

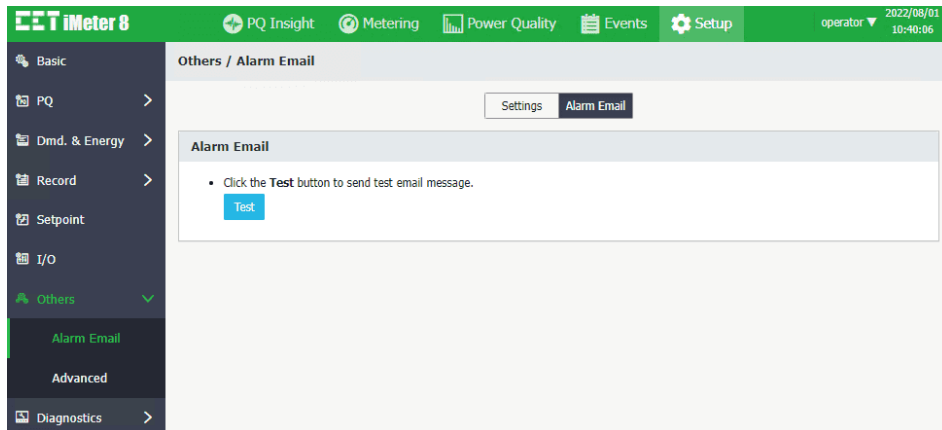
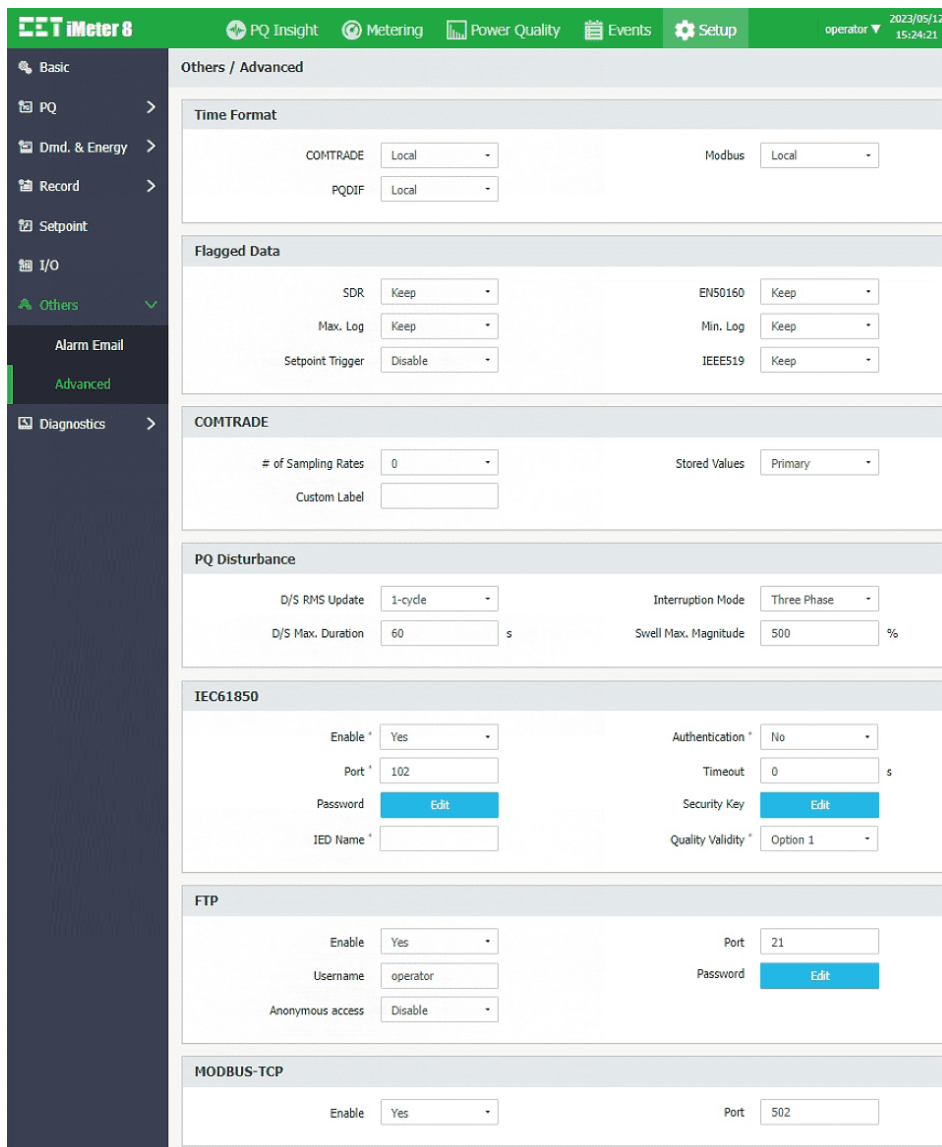


Figure 3-168 Test Alarm Email Interface

#### 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.



**Front Panel**

HMI Security  USB

**Web**

Enable  Client Validate   
 Port  Login Timeout  min  
 HTTPS Timeout  ms

**Web White List**

☐ Enable Host Header Validate

| No. | Host Header |
|-----|-------------|
|     |             |
|     |             |
|     |             |

\* Please add Mapped IP Address and Port to the White List if host header validate is enabled. eg. 172.17.7.100:200

**Audit Log**

Record Mode

**Aggregation Interval**

Parameter Magnitudes  Frequency

**Others**

Freq. Dev. Record  HS Frequency \*   
 Energy Short Rollover  LED Reset Mode   
 PQDIF Events Storage Mode  Transient Peak Threshold  %\*√2Un  
 2kHz-150kHz C.E. \*  C.E. Voltage Threshold  V  
 C.E. Current Threshold  %\*In

**IEEE 1588 (PTP)\***

Domain  Priority 1   
 Priority 2

\* Please reboot the device under Setup>Diagnostics>Maintenance>Restart for the changes to take effect.

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.                                                                                                                 | <ul style="list-style-type: none"><li>Local*</li><li>UTC</li></ul>               |
| 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. | <ul style="list-style-type: none"><li>Keep*</li><li>Remove</li></ul>             |
| EN50160                                         |                                                                                                                                                                          |                                                                                  |
| Max. Log                                        |                                                                                                                                                                          |                                                                                  |
| Min. Log                                        |                                                                                                                                                                          |                                                                                  |
| IEEE519                                         |                                                                                                                                                                          |                                                                                  |
| Setpoint Trigger                                |                                                                                                                                                                          | <ul style="list-style-type: none"><li>Disable*</li><li>Enable</li></ul>          |
| COMTRADE: Specifies format for WF COMTRADE file |                                                                                                                                                                          |                                                                                  |
| # of Sampling Rates                             | Specifies the number of Sampling Rates                                                                                                                                   | <ul style="list-style-type: none"><li>0*</li><li>No. of Sampling Rates</li></ul> |
| Stored Values                                   | Specifies the stored COMTRADE is primary value or secondary value.                                                                                                       | <ul style="list-style-type: none"><li>Primary*</li><li>Secondary</li></ul>       |
| Custom Label                                    | Specifies the custom label of the COMTRADE file.                                                                                                                         |                                                                                  |
| PQ Disturbance                                  |                                                                                                                                                                          |                                                                                  |
| D/S RMS Update                                  | $U_{rms}$ for Dips/Swells/Interruptions evaluation. <ul style="list-style-type: none"><li>Computed every cycle and shifted by 1/2 cycle</li></ul>                        | <ul style="list-style-type: none"><li>1 cycle*</li><li>½-cycle</li></ul>         |

|                             |                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                       |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
|                             | <ul style="list-style-type: none"> <li>Computed every 1/2 cycle and shifted by 1/2 cycle</li> </ul>                                                                                                                                                                                                                                              |                                                                                                                       |
| Interruption Mode           | Specifies the trigger mode of the interruption. <ul style="list-style-type: none"> <li>The <math>U_{rms}</math> of any phase is lower than the Interruption Threshold, the Interruptions will be triggered.</li> <li>All 3 phase <math>U_{rms}</math> are lower than the Interruption Threshold, the Interruptions will be triggered.</li> </ul> | <ul style="list-style-type: none"> <li>Single Phase</li> <li>Three Phase*</li> </ul>                                  |
| 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*                                                                                                     |
| <b>IEC61850</b>             |                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                       |
| Enable                      | Enable IEC61850 or not.                                                                                                                                                                                                                                                                                                                          | <ul style="list-style-type: none"> <li>No</li> <li>Yes*</li> </ul>                                                    |
| Authentication              | Specifies enable Client Authentication or not                                                                                                                                                                                                                                                                                                    | <ul style="list-style-type: none"> <li>No*</li> <li>Yes</li> </ul>                                                    |
| 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.                                                                                                                                                                                                                                                                                             | 6365742D656C6563747269632E636F6D*                                                                                     |
| IED Name                    | Specifies IED (Intelligent Electronic Device) name.                                                                                                                                                                                                                                                                                              |                                                                                                                       |
| Quality Validity            | Specifies IEC 61850 Validity Mode.                                                                                                                                                                                                                                                                                                               | 0 = Option 1 (all good) *                                                                                             |
| <b>FTP</b>                  |                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                       |
| Enable                      | Enable FTP or not.                                                                                                                                                                                                                                                                                                                               | <ul style="list-style-type: none"> <li>No</li> <li>Yes*</li> </ul>                                                    |
| 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.                                                                                                                                                                                                                                                                                                           | <ul style="list-style-type: none"> <li>Disable*</li> <li>Enable</li> </ul>                                            |
| <b>MODBUS-TCP</b>           |                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                       |
| Enable                      | Enable Modbus TCP or not.                                                                                                                                                                                                                                                                                                                        | <ul style="list-style-type: none"> <li>Disable</li> <li>Enable*</li> </ul>                                            |
| Port                        | Specifies the port of the Modbus TCP                                                                                                                                                                                                                                                                                                             | 1 to 65535, 502*                                                                                                      |
| <b>Front Panel</b>          |                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                       |
| HMI Security                | Enable Front Panel's security protection or not.                                                                                                                                                                                                                                                                                                 | <ul style="list-style-type: none"> <li>Disable*</li> <li>Enable</li> </ul>                                            |
| USB                         | Enable USB Function or not                                                                                                                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>Disable*</li> <li>Enable</li> </ul>                                            |
| <b>Web</b>                  |                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                       |
| Enable                      | Enable Web login or not.                                                                                                                                                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>Disable</li> <li>Enable*</li> </ul>                                            |
| Client Validate             | Enable Web Client validation or not.                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>Disable*</li> <li>Enable</li> </ul>                                            |
| 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*                                                                                                  |
| <b>Web White List~</b>      |                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                       |
| Enable Host Header Validate | Enable Web Host Header validation or not.                                                                                                                                                                                                                                                                                                        | <ul style="list-style-type: none"> <li>Disable*</li> <li>Enable</li> </ul>                                            |
| Host Header White list      | Added mapped IP Address and port to the white list after enabling <b>Enable Host Header Validate</b> .                                                                                                                                                                                                                                           | Eg: 172.17.7.100:200                                                                                                  |
| <b>Audit Log</b>            |                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                       |
| Record Mode                 | Specifies record mode for audit log.                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>FIFO*</li> <li>Stop When Full</li> </ul>                                       |
| <b>Aggregation Interval</b> |                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                       |
| Parameter Magnitudes        | Specifies the interval for the basic measurement shall be aggregated                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>50/60-cycle*</li> <li>150/180-cycle</li> <li>10-min</li> <li>2-hour</li> </ul> |
| Frequency                   | Specifies the interval for the Freq. shall be aggregated                                                                                                                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>1s*</li> <li>3s</li> <li>10s</li> </ul>                                        |
| <b>Others</b>               |                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                       |
| Freq. Dev. Record           | Enable Frequency deviation recorder or not                                                                                                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>Disable*</li> <li>Enable</li> </ul>                                            |
| HS Frequency                | Enable High-speed Frequency measurement.                                                                                                                                                                                                                                                                                                         |                                                                                                                       |
| Energy Short Rollover       | Specifies the maximum value of Energy register.                                                                                                                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>0=99,999,999,999 (kWh/kvarh/kVAh)*</li> <li>1=999,999,999</li> </ul>           |

|                          |                                                                   |                                                                                   |
|--------------------------|-------------------------------------------------------------------|-----------------------------------------------------------------------------------|
|                          |                                                                   | (kWh/kvarh/kVAh)                                                                  |
| LED Reset Mode           | Reset Mode of LED Indicators.                                     | <ul style="list-style-type: none"> <li>• Auto*</li> <li>• Manual</li> </ul>       |
| PQDIF Event Storage Mode | Specifies if the PQDIF event is stored separately or not.         | <ul style="list-style-type: none"> <li>• Combined</li> <li>• Separated</li> </ul> |
| Transient Peak Threshold | Specifies the peak threshold for the Transient Evaluation method. | 0* to 500 (%Un* $\sqrt{2}$ )                                                      |
| 2kHz-150kHz C.E.         | Enable 2kHz-150kHz C.E. function.                                 | <ul style="list-style-type: none"> <li>• Disable</li> <li>• Enable*</li> </ul>    |
| 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)<br>0.05 means 0.05%*In                                               |
| <b>IEEE 1588 (PTP)</b>   |                                                                   |                                                                                   |
| 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.

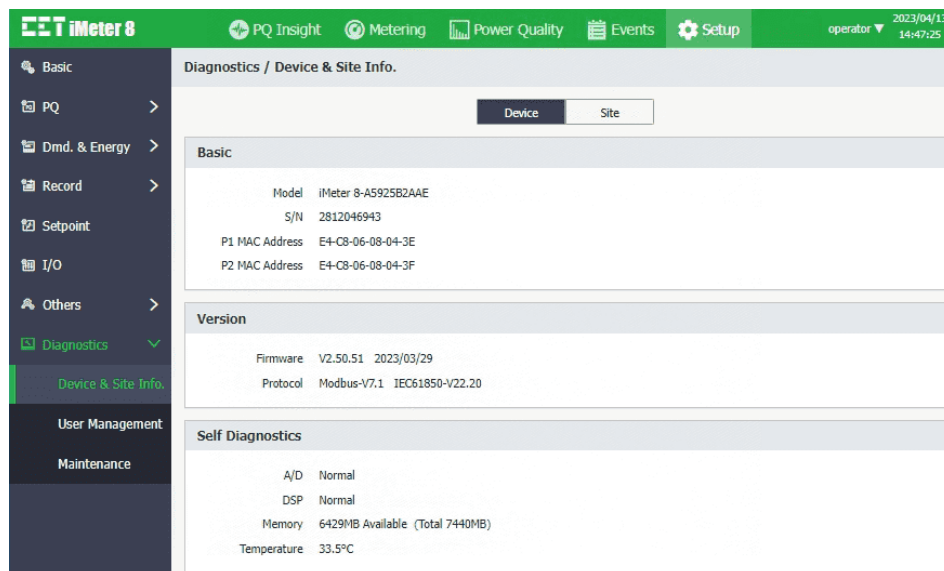
**Table 3-12 Advanced Setup Interface**

### 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**

The screenshot shows the 'Diagnostics / Device & Site Info.' page in the iMeter 8 software. The left-hand navigation pane is visible with options: Basic, PQ, Dmd. & Energy, Record, Setpoint, I/O, Others, Diagnostics (selected), Device & Site Info. (active), User Management, and Maintenance. The main content area has tabs for 'Device' and 'Site'. The 'Site' tab is selected, showing two sections: 'Substation Information' and 'Site Information'. 'Substation Information' contains five input fields labeled Tag 1 through Tag 5, each with a value starting with 'devTag'. 'Site Information' contains seven input fields labeled Tag 1 through Tag 7, each with a value starting with 'circuitTag'. A 'Save' button is located at the bottom right of the form.

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.

The screenshot shows the 'Diagnostics / User Management' page in the iMeter 8 software. The left-hand navigation pane is visible with options: Basic, PQ, Dmd. & Energy, Record, Setpoint, I/O, Others, Diagnostics (selected), Device & Site Info., User Management (active), and Maintenance. The main content area shows a 'User Management' section with a table listing users. The table has columns for 'No.', 'Username', and 'Authority'. There are two rows: one for 'operator' with 'Operator' authority and one for 'user' with 'User' authority. To the right of the table are icons for adding (+) and removing (trash) users. A vertical scrollbar is visible on the right side of the table.

| No. | Username | Authority |                                                                                       |
|-----|----------|-----------|---------------------------------------------------------------------------------------|
| 1   | operator | Operator  |  |
| 2   | user     | User      |  |
|     |          |           |                                                                                       |
|     |          |           |                                                                                       |
|     |          |           |                                                                                       |

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.

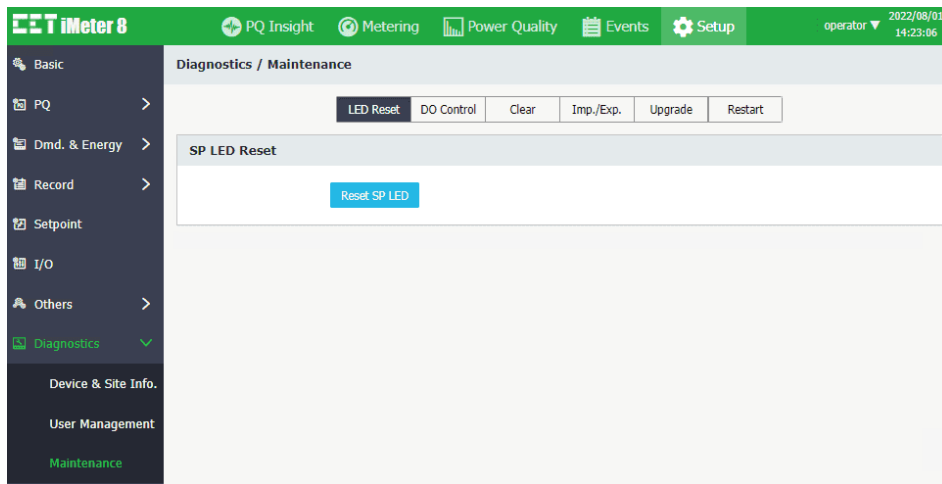


Figure 3-173 LED Reset Interface

- **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.

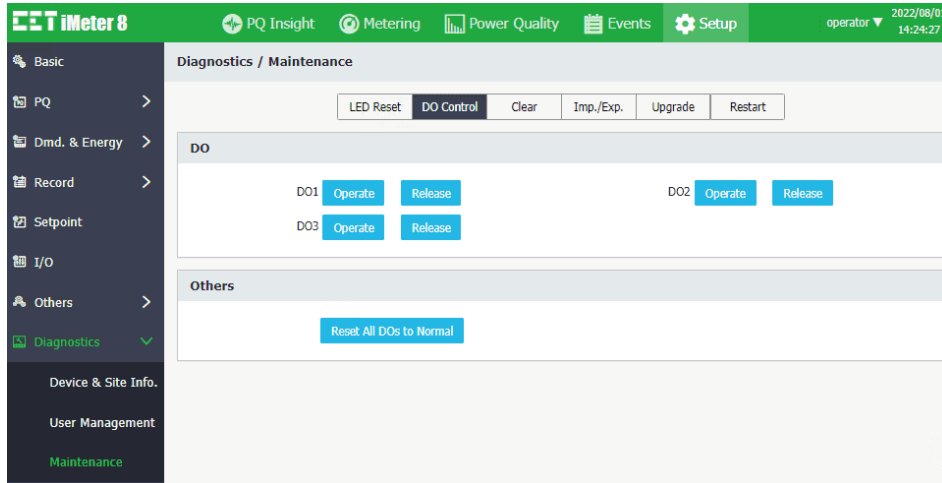


Figure 3-174 DO Control Interface

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

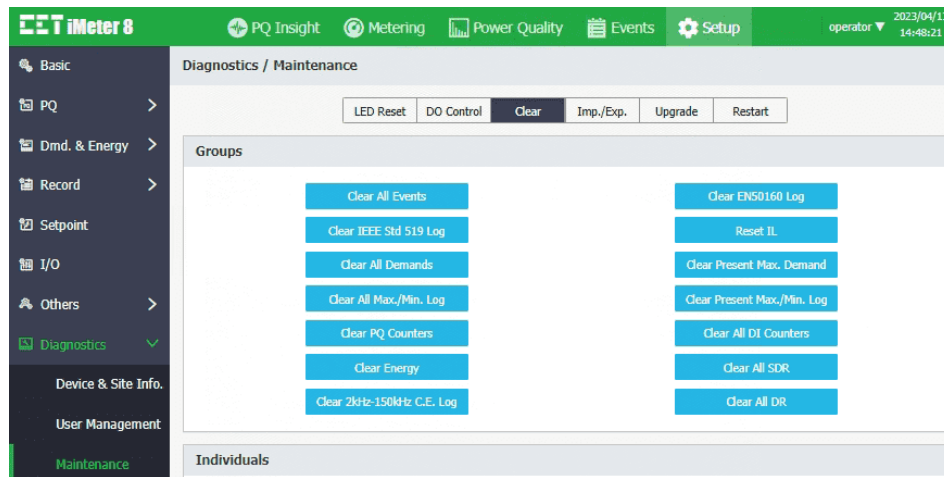


Figure 3-175 Clear Groups

- **Clear Individuals**

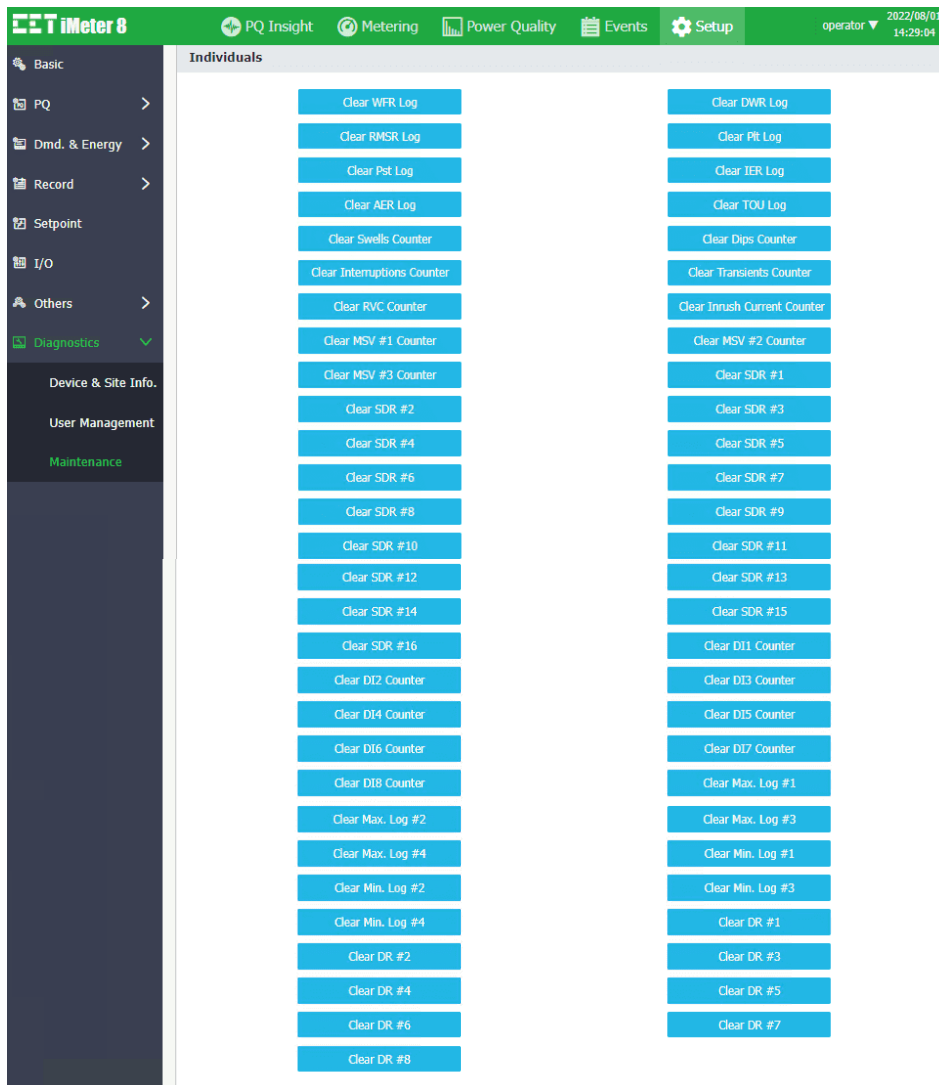


Figure 3-176 Clear Individuals Interface

- **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.

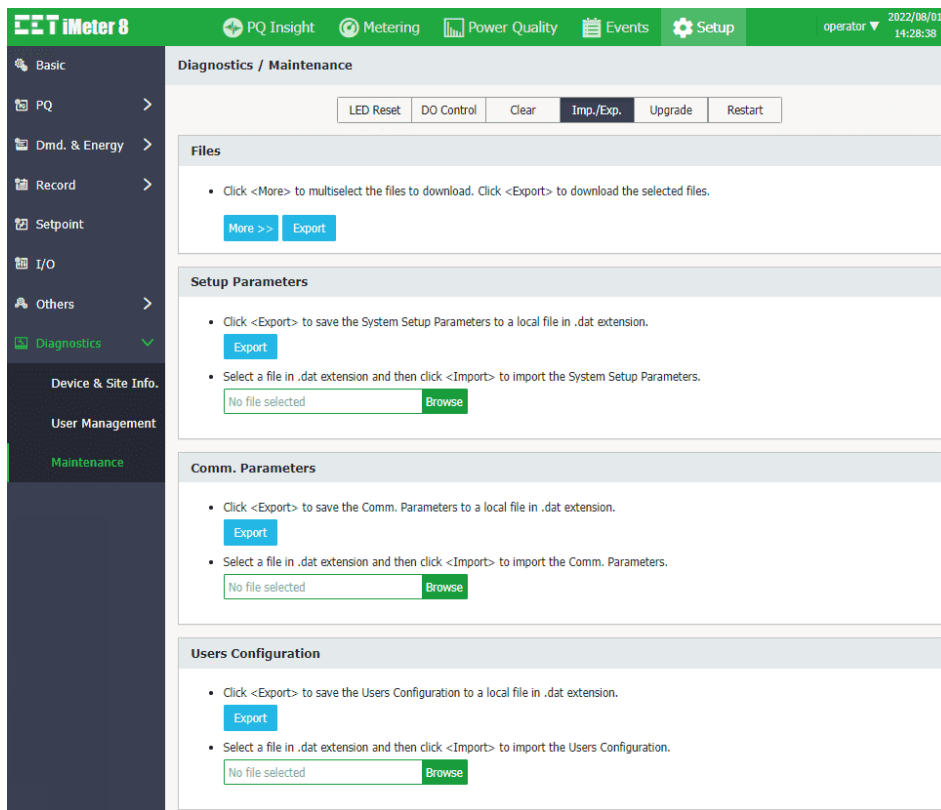


Figure 3-177 Imp./Exp. Interface

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

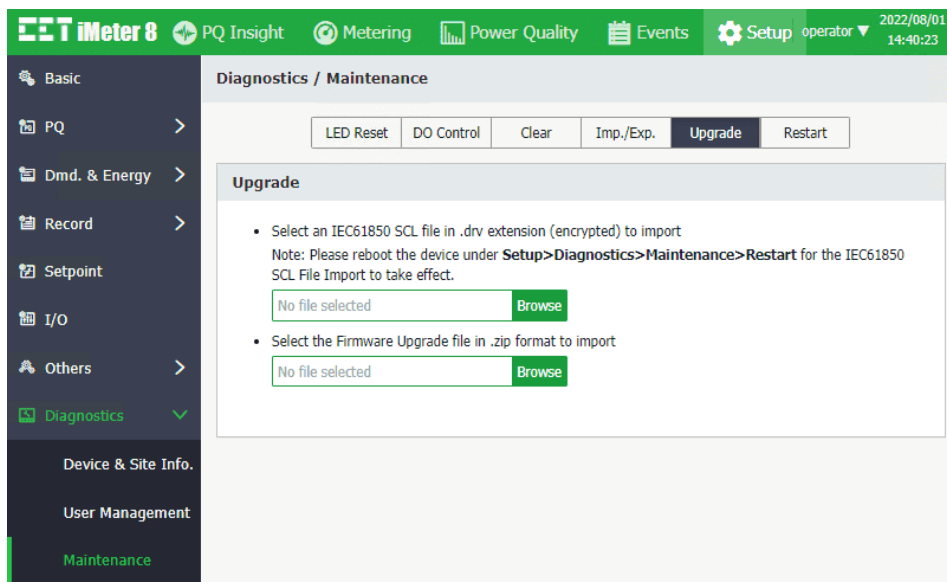


Figure 3-178 Upgrade Interface

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.

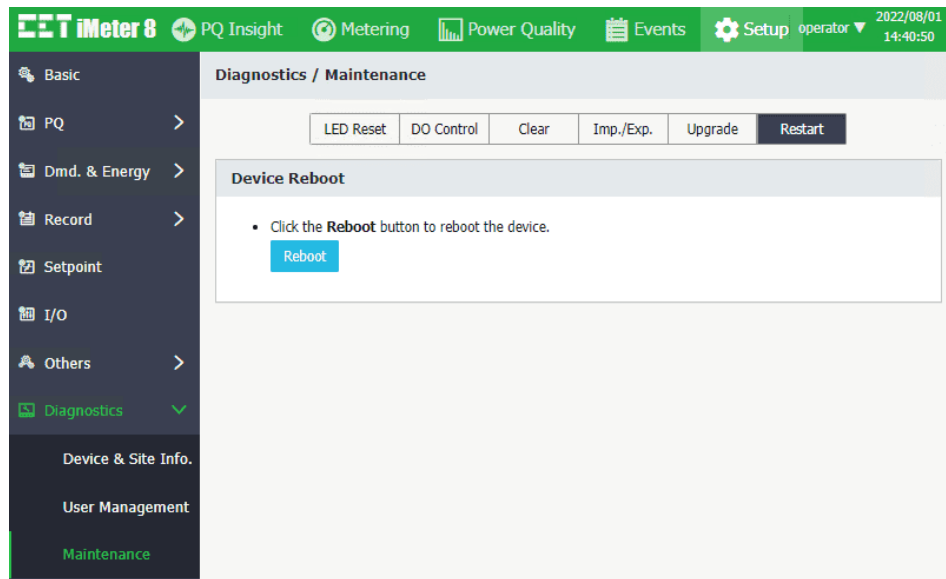


Figure 3-179 Restart Interface

## 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*                                             |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| <b>Dlx Function</b>            | DI can be configured as a Status Input, Pulse Counter or DMD Sync. Only one DI should be programmed as <b>DMD Sync</b> . Only DI1 to DI3 can be configured as <b>Tariff Switch</b> .                                                                                                            | 0=Status Input*<br>1=Pulse Counter<br>2=DMD Sync<br>3=Tariff Switch |
| <b>Dlx Debounce</b>            | 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*                                                 |
| <b>Dlx Setpoint Type</b>       | Specifies the valid transition type, whether it's positive, negative or any edge, for a DI Setpoint to become active. The <b>Dlx Setpoint Type</b> is only used when a DI is configured as a <b>Status Input</b> and only affects which edge would trigger the Waveform Recorder if configured. | 0=Any Edge*<br>1=Positive<br>2=Negative                             |
| <b>Dlx Trigger<sup>1</sup></b> | 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 <b>Table 4-2</b>                                                |
| <b>Dlx Pulse Weight</b>        | Specifies the incremental value for each received pulse. This is only used when a DI is configured as a <b>Pulse Counter</b> .                                                                                                                                                                  | 1* to 1,000,000                                                     |
| <b>DI Excitation Mode</b>      | Specifies the excited mode for each DI.                                                                                                                                                                                                                                                         | 0=DC*, 1=AC                                                         |

**Table 4-1 DI Setup Parameters**

The table below provides a list of Dlx'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   |
|----------|------------|-------------|------------|-----------|--------|--------------|----------|
| <b>0</b> | Alarm      | <b>7</b>    | DO7 Closed | <b>19</b> | DR #1  | <b>26</b>    | DR #8    |
| <b>1</b> | DO1 Closed | <b>8</b>    | Reserved   | <b>20</b> | DR #2  | <b>27</b>    | DWR      |
| <b>2</b> | DO2 Closed | <b>9-14</b> | Reserved   | <b>21</b> | DR #3  | <b>28</b>    | WFR      |
| <b>3</b> | DO3 Closed | <b>15</b>   | iTrigger 1 | <b>22</b> | DR #4  | <b>29</b>    | RMSR     |
| <b>4</b> | DO4 Closed | <b>16</b>   | iTrigger 2 | <b>23</b> | DR #5  | <b>30~31</b> | Reserved |
| <b>5</b> | DO5 Closed | <b>17</b>   | iTrigger 3 | <b>24</b> | DR #6  |              |          |
| <b>6</b> | DO6 Closed | <b>18</b>   | Reserved   | <b>25</b> | 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*               |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| <b>LOP Alarm</b>                        | 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*                |
| <b>Arm before Execute</b>               | Enable or disable the <b>Arm Before Execute</b> feature for the DO.                                                                              | 0=Enabled*, 1=Disabled                |
| <b>Alarm/DOx Pulse Width (x=1 to 7)</b> | 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)<br>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*                                                      |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| <b>Ex Source (x=1 to 4)</b> | Specify the source to which the energy pulse output is proportional.                                                                                                                                                                                                                                                                                           | See <b>Table 4-5 Ex Source</b>                                               |
| <b>Pulse Constant</b>       | 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^ |
| <b>Energy / Pulse~</b>      | Specify required energy to trigger 1 energy pulse.                                                                                                                                                                                                                                                                                                             | 1* to 65535 (x0.1)kxh/imp                                                    |
| <b>Energy Pulse Type~</b>   | Specify the energy pulse mode.<br><ul style="list-style-type: none"> <li>0: apply to the setting of the <b>Pulse Constant</b> (register 41350), which means energy pulse is based on the secondary value.</li> <li>1: apply to the setting of the <b>Energy / Pulse</b> (register 41351), which means energy pulsing is based on the primary value.</li> </ul> | 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       |
|----------|-----------------|-----------|--------------|-----------|-------------------|
| <b>1</b> | kWh Total       | <b>7</b>  | kWh Total TH | <b>13</b> | kvarh Total Fund. |
| <b>2</b> | kWh Imp.        | <b>8</b>  | kWh Imp. TH  | <b>14</b> | kvarh Imp. Fund.  |
| <b>3</b> | kWh Exp.        | <b>9</b>  | kWh Exp. TH  | <b>15</b> | kvarh Exp. Fund.  |
| <b>4</b> | kWh Total Fund. | <b>10</b> | kvarh Total  | <b>16</b> | kvarh Total TH    |
| <b>5</b> | kWh Imp. Fund.  | <b>11</b> | kvarh Imp.   | <b>17</b> | kvarh Imp. TH     |
| <b>6</b> | kWh Exp. Fund.  | <b>12</b> | kvarh Exp.   | <b>18</b> | 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  $Z = 2 \times V_{\text{nominal}} \times I_{\text{nominal}}$ , where  $V_{\text{nominal}}$  and  $I_{\text{nominal}}$  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  $V_{\text{nominal}}$  and  $I_{\text{nominal}}$ ) 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*    |
|-------------------|-----------------------------------------------------------------------------------------------------------|----------------------------|
| <b>Type</b>       | Select between 0-20mA or 4-20mA input                                                                     | 4~20mA*, 0~20mA            |
| <b>Zero Scale</b> | 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*  |
| <b>Full Scale</b> | 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  $(100^\circ\text{C} - (-25^\circ\text{C})) \times (12\text{mA} - 4\text{mA}) / (20\text{mA} - 4\text{mA}) + (-25^\circ\text{C}) = 37.50^\circ\text{C}$ .

### 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* |
|-------------------|-------------------------------------------------------------------------------------------------------------|-------------------------|
| <b>AOx Type</b>   | Select between 0-20mA or 4-20mA input                                                                       | 4~20mA*, 0~20mA         |
| <b>AOx Key</b>    | Defines the parameter to which the Analog Output is proportional. see <b>Analog Output Parameters</b> table | 0* to 15                |
| <b>Zero Scale</b> | 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* |
| <b>Full Scale</b> | 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 |
|----------|-------------|-------|------|-----------|------------------------|--------|------|
| <b>0</b> | Uab         | x1    | V    | <b>8</b>  | P Total                | x1     | kW   |
| <b>1</b> | Ubc         |       | V    | <b>9</b>  | Q Total                |        | kvar |
| <b>2</b> | Uca         |       | V    | <b>10</b> | S Total                |        | kVA  |
| <b>3</b> | ULL Average |       | V    | <b>11</b> | PF Total               | x0.001 | -    |
| <b>4</b> | Ia          |       | A    | <b>12</b> | Frequency              | x0.01  | Hz   |
| <b>5</b> | Ib          |       | A    | <b>13</b> | P Total Present Demand | x1     | kW   |
| <b>6</b> | Ic          |       | A    | <b>14</b> | Q Total Present Demand |        | kvar |
| <b>7</b> | I Average   |       | A    | <b>15</b> | 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  $(1250A-500A) \times (20mA-4mA) / (2000A-500A) + 4mA = 12.00$  (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                                                                                                    |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>Voltage</b>   | Ua, Ub, Uc, ULN Avg, Uab, Ubc, Uca, ULL Avg, U4                                                                                                                                                                                                                                                                  | Ua, Ub, Uc, ULN Avg, Uab, Ubc, Uca, ULL Avg, U4                                                                     |
| <b>Current</b>   | Ia, Ib, Ic, I Avg, I4, I5                                                                                                                                                                                                                                                                                        | Ia, Ib, Ic, I Avg, I4, I5                                                                                           |
| <b>Frequency</b> | Frequency                                                                                                                                                                                                                                                                                                        | Frequency                                                                                                           |
| <b>Power</b>     | Pa/Pb/Pc Import/Export, Total P Import/Export<br>Qa/Qb/Qc Import/Export, Total Q Import/Export<br>Sa/Sb/Sc, S Total                                                                                                                                                                                              | Pa/Pb/Pc Import/Export, P Total Import/Export<br>Qa/Qb/Qc Import/Export, Q Total Import/Export<br>Sa/Sb/Sc, S Total |
| <b>PF</b>        | PFa, PFb, PFc, PF Total                                                                                                                                                                                                                                                                                          | PFa, PFb, PFc, PF Total                                                                                             |
| <b>Harmonics</b> | Ua (Uab) THD/TOHD/TEHD<br>Ub (Ubc) THD/TOHD/TEHD<br>Uc (Uca) THD/TOHD/TEHD<br>U4 THD/TOHD/TEHD<br>Ia Fund./THD/TOHD/TEHD/K-Factor<br>Ib Fund./THD/TOHD/TEHD/K-Factor<br>Ic Fund./THD/TOHD/TEHD/K-Factor<br>I4 Fund./THD/TOHD/TEHD/K-Factor                                                                       | -                                                                                                                   |
| <b>Unbalance</b> | U0/U2 Unbalance, I0/I2 Unbalance                                                                                                                                                                                                                                                                                 | -                                                                                                                   |
| <b>Deviation</b> | Ua Deviation/Over Deviation/Under Deviation<br>Ub Deviation/Over Deviation/Under Deviation<br>Uc Deviation/Over Deviation/Under Deviation<br>Uab Deviation/Over Deviation/Under Deviation<br>Ubc Deviation/Over Deviation/Under Deviation<br>Uca Deviation/Over Deviation/Under Deviation<br>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)          |
|----------------|----------------------------------------------------|
| <b>Power</b>   | Total P Import/Export, Total Q Import/Export       |
| <b>Current</b> | 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                                                                              |
|------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>Voltage</b>   | Ua, Ub, Uc, ULN Avg, Uab, Ubc, Uca, ULL Avg, U4                                                                     |
| <b>Current</b>   | Ia, Ib, Ic, I Avg, I4, I5                                                                                           |
| <b>Frequency</b> | Frequency                                                                                                           |
| <b>Power</b>     | Pa/Pb/Pc Import/Export, Total P Import/Export<br>Qa/Qb/Qc Import/Export, Total Q Import/Export<br>Sa/Sb/Sc, S Total |

|                  |                                                                                                                                                                                                                                                                                                                  |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PF</b>        | PFa, PFb, PFc, PF Total                                                                                                                                                                                                                                                                                          |
| <b>Harmonics</b> | Ua (Uab) THD/TOHD/TEHD<br>Ub (Ubc) THD/TOHD/TEHD<br>Uc (Uca) THD/TOHD/TEHD<br>U4 THD/TOHD/TEHD<br>Ia Fund./THD/TOHD/TEHD/K-Factor<br>Ib Fund./THD/TOHD/TEHD/K-Factor<br>Ic Fund./THD/TOHD/TEHD/K-Factor<br>I4 Fund./THD/TOHD/TEHD/K-Factor                                                                       |
| <b>Unbalance</b> | U0/U2 Unbalance, I0/I2 Unbalance                                                                                                                                                                                                                                                                                 |
| <b>Deviation</b> | Ua Deviation/Over Deviation/Under Deviation<br>Ub Deviation/Over Deviation/Under Deviation<br>Uc Deviation/Over Deviation/Under Deviation<br>Uab Deviation/Over Deviation/Under Deviation<br>Ubc Deviation/Over Deviation/Under Deviation<br>Uca Deviation/Over Deviation/Under Deviation<br>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* |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| <b>Demand Sync. Mode</b>    | <b>SLD</b> - Internally synchronized to the meter clock<br><b>Sync. DI</b> - Externally synchronized to a DI that has been programmed as a Demand Sync Input by setting the <b>DI Mode</b> setup parameter as <b>DMD Sync</b> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0=SLD*<br>1=Sync. DI    |
| <b>Demand Period</b>        | 1 to 60 minutes. For example, if the <b># of Sliding Windows</b> is set as 1 and the <b>Demand Period</b> is 15, the demand cycle will be 1×15=15min.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1 to 60 minutes<br>15*  |
| <b># of Sliding Windows</b> | Number of Sliding Windows.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1* to 15                |
| <b>Self-Read Time</b>       | The <b>Self-Read Time</b> allows the user to specify the time and day of the month for the Max. Demand Self-Read operation. The <b>Self-Read Time</b> supports three options: <ul style="list-style-type: none"> <li>A zero value means that the Self-Read will take place at 00:00 of the first day of each month.</li> <li>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.</li> <li>A 0xFFFF value will disable the Self-Read operation and replace it with manual operation. A manual reset will cause the Max. Demand of <b>This Month</b> to be transferred to the Max. Demand of <b>Last Month</b> and then reset. The terms <b>This Month</b> and <b>Last Month</b> will become <b>Since Last Reset</b> and <b>Before Last Reset</b>.</li> </ul> | 0xFFFF*                 |
| <b>Predicted Response</b>   | 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.

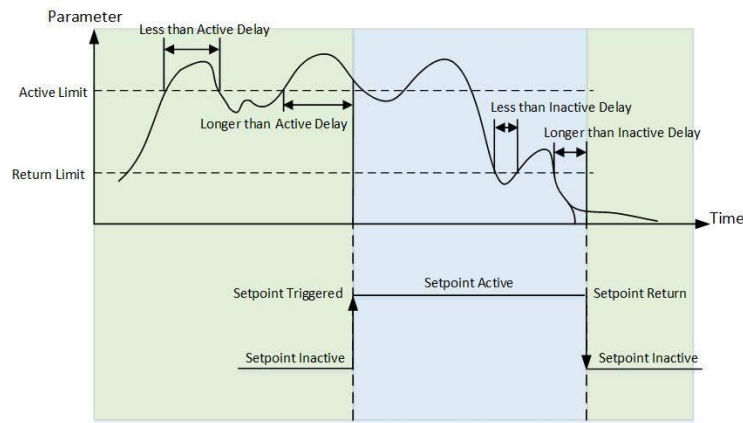


Figure 4-1 Over Setpoints

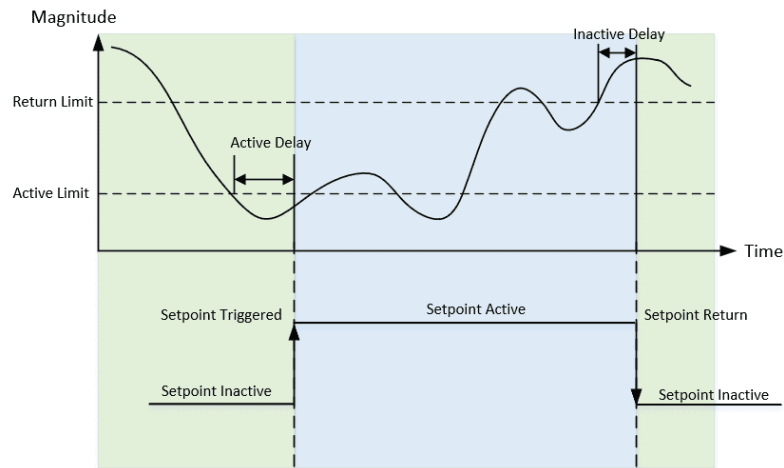


Figure 4-2 Under Setpoints

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*<br>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 <b>Active Delay</b> 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 <b>Inactive Delay</b> 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  | $\Sigma$ kW Exp. Pred. DMD   |
| 2   | ULL       | 29  | U TIHD    | 56  | $\Sigma$ kvar Exp. Pred. DMD |
| 3   | U4        | 30  | U TOIHD   | 57  | $\Sigma$ 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 | $\sum$ kW Imp. DMD         | 0x3F000000 | I H63 RMS             |
| 21 | Frequency Deviation | 48 | $\sum$ kvar Imp. DMD       | 0x40000000 | I HD02                |
| 22 | Phase Reversal      | 49 | $\sum$ kW Exp. DMD         | ...        | I HD03~I HD62         |
| 23 | U THD               | 50 | $\sum$ kvar Exp. DMD       | 0x7D000000 | I HD63                |
| 24 | U TOHD              | 51 | $\sum$ kVA DMD             | 0x81000000 | I IH01 RMS            |
| 25 | U TEHD              | 52 | PF Total DMD               | ...        | I IH02 RMS~I IH62 RMS |
| 26 | I THD               | 53 | $\sum$ kW Imp. Pred. DMD   | 0xBF000000 | I IH63 RMS            |
| 27 | I TOHD              | 54 | $\sum$ kvar Imp. Pred. DMD |            |                       |

Table 4-16 Setpoint Parameters

| Bit | Action                  | Bit  | Action                  | Bit | Action | Bit   | Action   |
|-----|-------------------------|------|-------------------------|-----|--------|-------|----------|
| 0   | Alarm <sup>1</sup>      | 7    | DO7 Closed <sup>2</sup> | 19  | DR #1  | 26    | DR #8    |
| 1   | DO1 Closed              | 8    | LED Alarm <sup>3</sup>  | 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 <sup>2</sup> | 16   | iTrigger 2              | 23  | DR #5  | 30~31 | Reserved |
| 5   | DO5 Closed <sup>2</sup> | 17   | iTrigger 3              | 24  | DR #6  |       |          |
| 6   | DO6 Closed <sup>2</sup> | 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,  $I_{max}$ , exceeds the motor starting current threshold (1.2Ie)
- 2) The  $I_{max}$  exceeds 0.004In (In stands for nominal current of iMeter 8) with a preset delay of 0.1s.

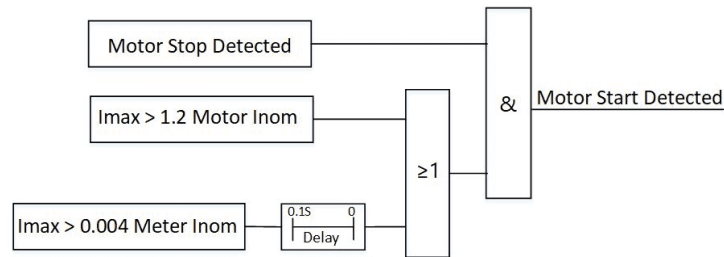


Figure 4-3 Motor Start Detected

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

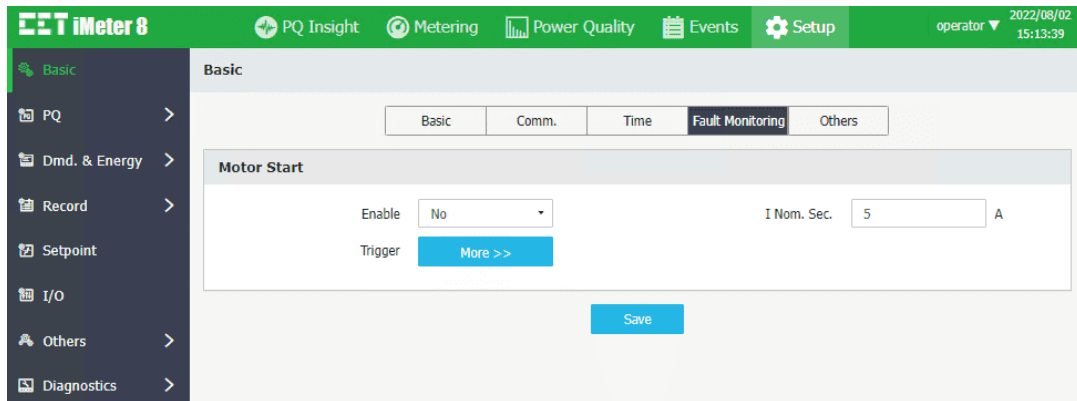


Figure 4-4 Motor Setup via the Web Interface

- Motor Running**

The iMeter 8 considers the motor has gone into running mode when it detects the  $I_{max}$  is in the range of  $1.2I_n$  to  $0.02I_n$  for at least 60ms.

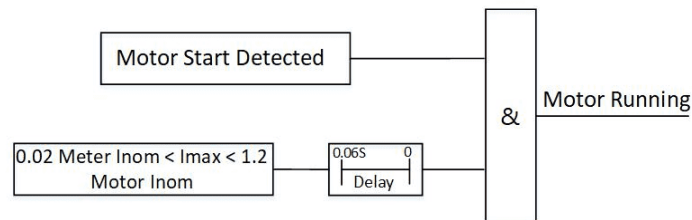


Figure 4-5 Motor Running

- Motor Stop**

The iMeter 8 considers the motor stopped based on the detection of  $I_{max} < 0.02I_n$  with a preset delay of 0.1s.

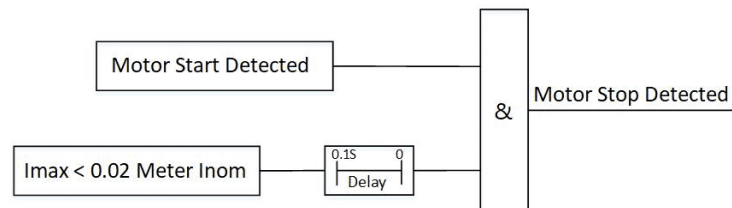


Figure 4-6 Motor Stop Detected

- 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  $\pm 0.003\text{Hz}$ . The measurement range is  $\pm 10\%$  of  $f_{\text{nominal}}$ , 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:

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

where  $f_{\text{nominal}}$  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**

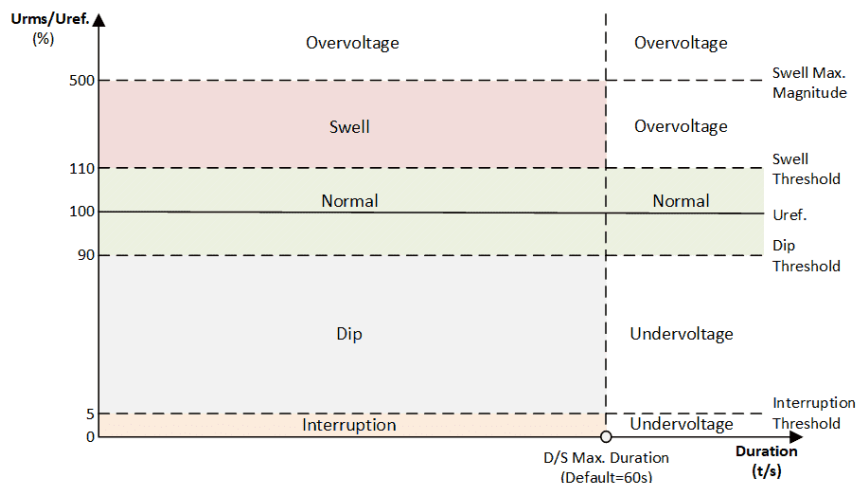
*On polyphase systems a Swell begins when the  $U_{rms(1/2)}$  voltage of one or more channels rises above the Swell Threshold and ends when the  $U_{rms(1/2)}$  voltage on all measured channels is equal to or below the Swell Threshold minus the Hysteresis voltage.*

###### **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**].

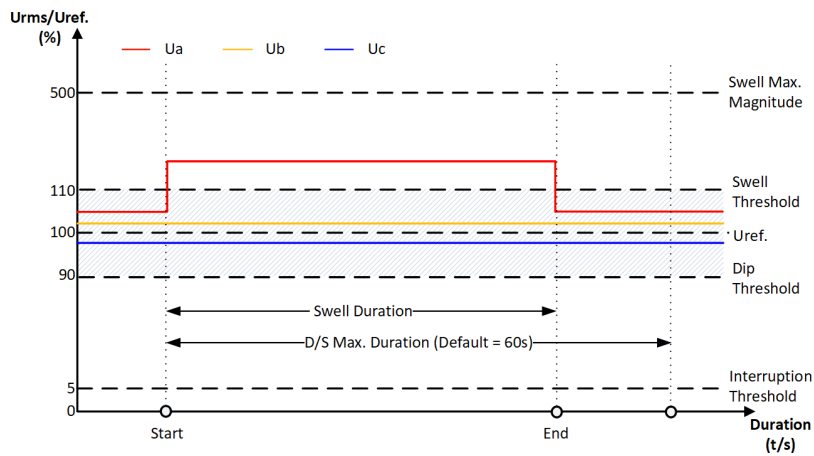


Figure 4-8 Swells Detection Criteria

- **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].

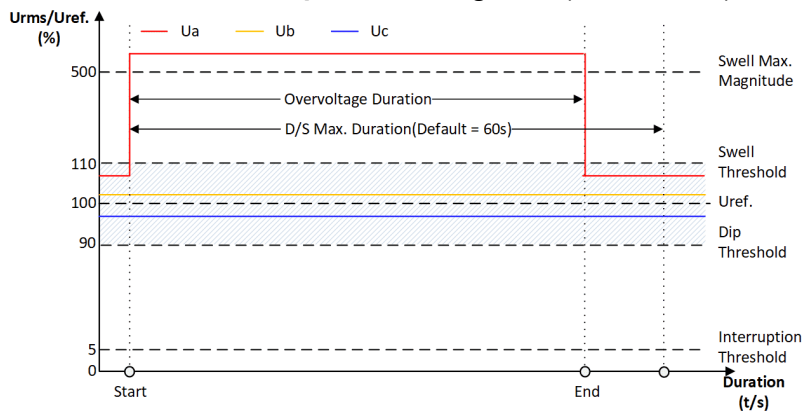


Figure 4-9 Overvoltage Detection Criteria 1

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)

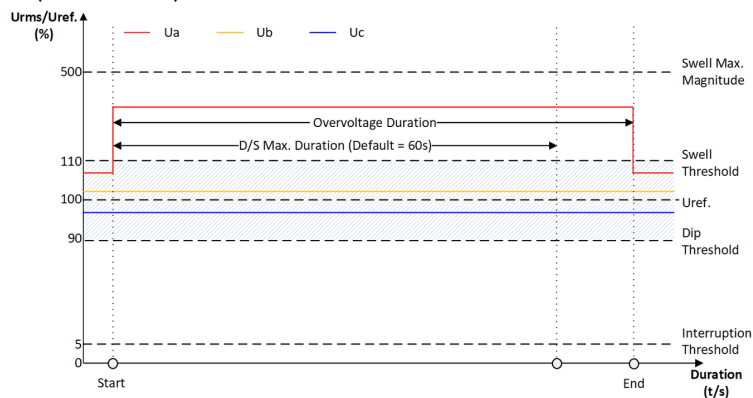


Figure 4-10 Overvoltage Detection Criteria 2

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).

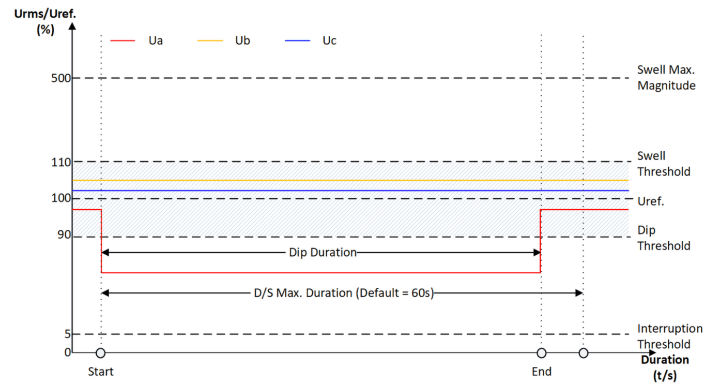


Figure 4-11 Dip

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.]**.

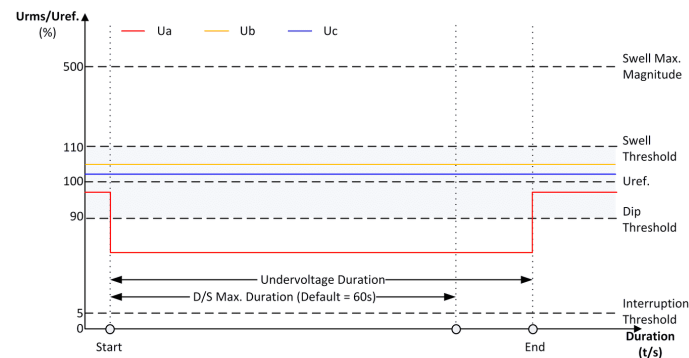


Figure 4-12 Undervoltage

- **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.

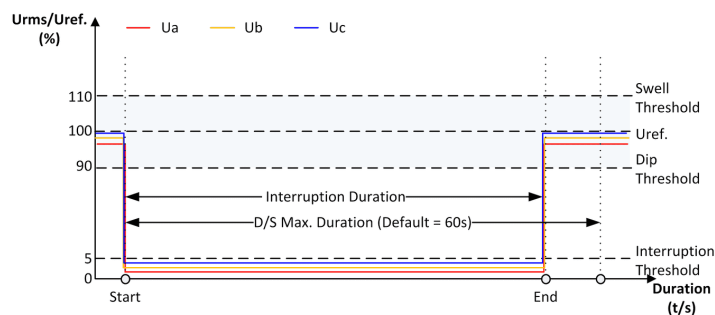


Figure 4-13 Interruption

#### 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:

- The **Voltage Interruption Threshold** shall be set below the **Dip Threshold**.
- The **Dip/Swell Hysteresis** must be less than the **Dip/Swell Thresholds**.
- The **Rapid Voltage Changes (RVC) Threshold** must be less than the **Dip and Swell Thresholds**.
- 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 <sub>ref</sub> ) <sup>1</sup> | U <sub>din</sub> (Nominal Voltage), U <sub>sr</sub> (Sliding Reference Voltage)                                                                                                                                                                                              | U <sub>din</sub> |
| Swell Threshold (Limit)                            | 101 to 200 (x0.01 U <sub>ref</sub> .)                                                                                                                                                                                                                                        | 110              |
| Dip Threshold (Limit)                              | 1 to 99 (x0.01 U <sub>ref</sub> )                                                                                                                                                                                                                                            | 90               |
| Interruption Threshold (Limit)                     | 0 to 50 (x0.01 U <sub>ref</sub> )                                                                                                                                                                                                                                            | 5                |
| Swell Hysteresis                                   | 1 to 1000 (x0.001 U <sub>ref</sub> )                                                                                                                                                                                                                                         | 20               |
| Dip Hysteresis                                     |                                                                                                                                                                                                                                                                              |                  |
| Interruption Hysteresis                            |                                                                                                                                                                                                                                                                              |                  |
| Swell Trigger Action                               | See Note 2                                                                                                                                                                                                                                                                   | DWR, RMSR        |
| Dip Trigger Action                                 |                                                                                                                                                                                                                                                                              |                  |
| Interruption Trigger Action                        |                                                                                                                                                                                                                                                                              |                  |
| Advanced                                           |                                                                                                                                                                                                                                                                              |                  |
| Dip Triggers DO <sup>3</sup>                       | <ul style="list-style-type: none"><li>When PQD Starts</li><li>When PQD Ends</li></ul>                                                                                                                                                                                        | When PQD Ends    |
| Swell Triggers DO <sup>3</sup>                     |                                                                                                                                                                                                                                                                              | When PQD Starts  |
| Interrupt. Triggers DO <sup>3</sup>                |                                                                                                                                                                                                                                                                              | When PQD Starts  |
| D/S RMS Update <sup>4</sup>                        | <ul style="list-style-type: none"><li>0 = Magnitude RMS for Dips/Swells/Interruptions computed by every 1 cycle and shifted by 1/2 cycle.</li><li>1 = computed by every 1/2 cycle and shifted by 1/2 cycle.</li></ul>                                                        | 0                |
| Interruption Mode <sup>5</sup>                     | <ul style="list-style-type: none"><li>0 = The voltage of any phase is lower than the Interruption Threshold, the Interruptions will be triggered.</li><li>1 = All 3 phase voltages are lower than the Interruption Threshold, the Interruptions will be triggered.</li></ul> | 1                |
| D/S Max. Duration                                  | 1-600s                                                                                                                                                                                                                                                                       | 60               |
| Swell Max. Magnitude                               | 101-500 (%)                                                                                                                                                                                                                                                                  | 500              |

**Table 4-19 PQ Disturbance Parameters**

**Notes:**

- 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 U<sub>sr</sub> is not used in LV systems.

- 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<br>(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**

- PQD Trigger DO modes:

| DO Action Modes | DO Close When           | DO Release When                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| When PQD Starts | Swell Starts            | <ul style="list-style-type: none"> <li>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.</li> <li>Pulse Width <math>\neq</math> 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: <ul style="list-style-type: none"> <li>Swell turns to Overvoltage</li> <li>Dip turns to Undervoltage</li> <li>Dip turns to Interruption</li> <li>Interruption turns to Undervoltage</li> </ul> </li> </ul> |
|                 | Dip Starts              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                 | Interruption Starts     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| When PQD Ends   | Swell Event Ends        | <ul style="list-style-type: none"> <li>DO Pulse Width = 0, release after 1s</li> <li>DO Pulse Width <math>\neq</math> 0, release after <i>[the event ends + Pulse Width]</i></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                 | Dip Event Ends          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                 | Interruption Event Ends |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

Table 4-21 PQD Trigger DO modes

- The **Dip/Swell RMS Update** determines if the  $U_{rms}$  is computed every cycle and then shifted by  $\frac{1}{2}$  cycle (register value = 0) or if the  $U_{rms}$  is computed every  $\frac{1}{2}$  cycle and then shifted by  $\frac{1}{2}$  cycle (register value = 1).
- 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.

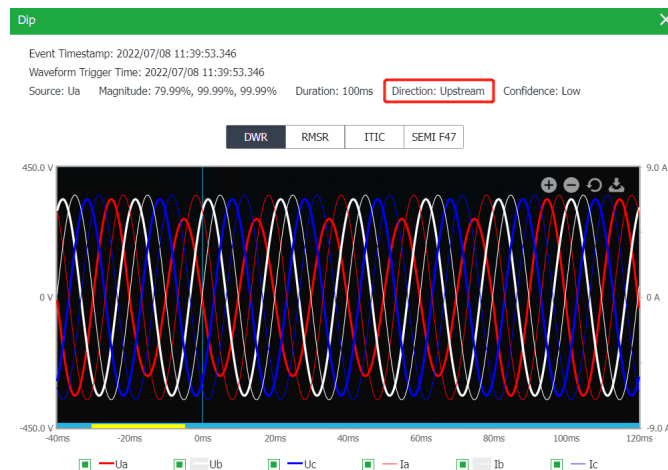


Figure 4-14 Disturbance Direction Location

#### 4.5.6.4 DWR for PQ Disturbance

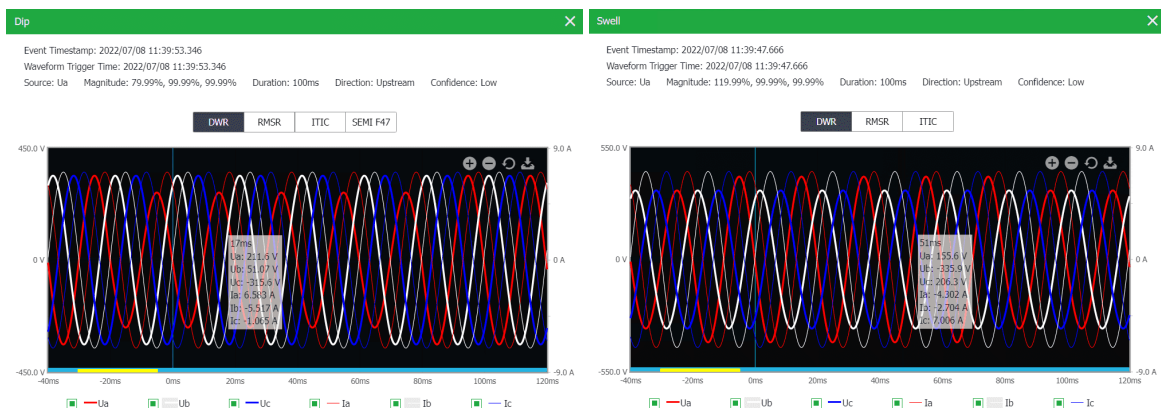


Figure 4-15 DWR of Dips and Swells Event



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 20 $\mu$ s (@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 U <sub>din</sub> , 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.

$$V2 \text{ Unbalance} = \frac{V2}{V1} \times 100\%, I2 \text{ Unbalance} = \frac{I2}{I1} \times 100\% \text{ (Negative Sequence Unbalance)}$$

$$V0 \text{ Unbalance} = \frac{V0}{V1} \times 100\%, I0 \text{ Unbalance} = \frac{I0}{I1} \times 100\% \text{ (Zero Sequence Unbalance)}$$

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:

$$\text{Voltage K}^{\text{th}} \text{ Harmonic/Interharmonic Distortion} = \frac{U_k}{U_1} \times 100\% \quad \text{where } U_1 \text{ is the Fundamental Voltage}$$

$$\text{Current K}^{\text{th}} \text{ Harmonic/Interharmonic Distortion} = \frac{I_k}{I_1} \times 100\% \quad \text{where } I_1 \text{ is the Fundamental Current}$$

#### b) RMS Method:

$$\text{Voltage K}^{\text{th}} \text{ Harmonic /Interharmonic Distortion} = \frac{U_k}{\sqrt{\sum_{K=1}^{\infty} U_K^2}} \times 100\% \quad \text{where the denominator is the RMS}$$

$$\text{Current K}^{\text{th}} \text{ Harmonic/Interharmonic Distortion} = \frac{I_k}{\sqrt{\sum_{K=1}^{\infty} I_K^2}} \times 100\% \quad \text{where the denominator is the RMS}$$

#### c) Nominal Method:

$$\text{Voltage K}^{\text{th}} \text{ Harmonic /Interharmonic Distortion} = \frac{U_k}{U_{\text{nom}}} \times 100\% \quad \text{where } U_{\text{nom}} \text{ is the Nominal Voltage}$$

$$\text{Current K}^{\text{th}} \text{ Harmonic /Interharmonic Distortion} = \frac{I_k}{I_{\text{nom}}} \times 100\% \quad \text{where } I_{\text{nom}} \text{ is the Nominal Current}$$

### 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)**.

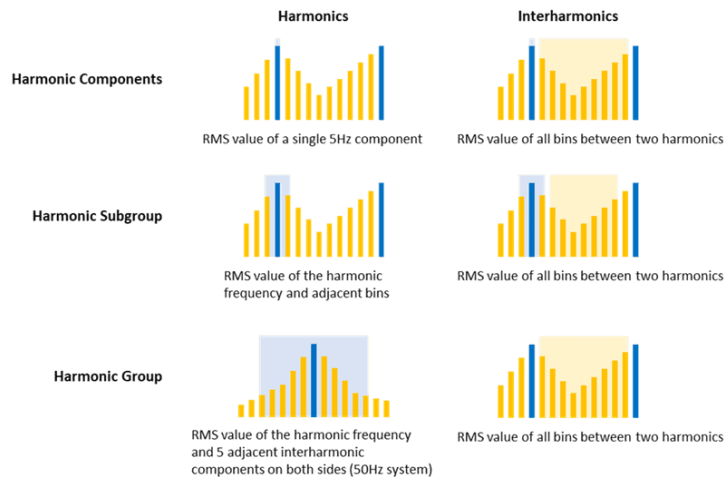


Figure 4-18 Harmonic Calculation Method

### 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):

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

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 **63<sup>rd</sup>** 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  $I_L$**  parameter or computed automatically with the following algorithm (When **TDD Preset  $I_L$  = 0**) as per IEEE Std 519-2022.

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

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

Where

$M$  denotes the device running time in month

$I_i$  denotes the maximum current demand in each month

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

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

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  $I_L$  = **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*<br>1=% of RMS<br>2=% of Nominal |
| Harmonic Calculation Method | Specifies the mode of calculating harmonic.                                                                                                                                                                                                                                                                                                                                                                                | 0=Subgroup*<br>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<br>• 0: represents to use the TDD calculation method compatible with the standard TDD calc. in IEEE Std 519-2022<br>• non-zero value: it is the preset IL for TDD Calculation<br>As per IEEE Std 519-2022: <i>IL = maximum demand load current at the PCC (point of common coupling) under normal load operating conditions</i> | 0*~30,000A (x0.001)                                 |
| I4 TDD Preset IL Primary    |                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                     |

Table 4-23 Setup parameters for Harmonic

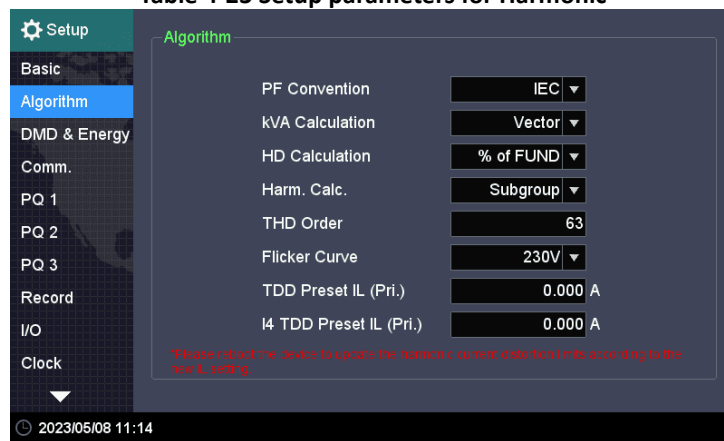


Figure 4-19 PQ-Harmonics Setup Interface

#### 4.5.9.5 Harmonics Power

The iMeter 8 provides Individual Harmonic to the 63<sup>rd</sup> 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 63<sup>rd</sup> 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

$I_h$  =  $I_{hth}$  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:

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

where

$|X|_{\text{peak}}$  = Peak amplitude of the waveform  
 $X_{\text{rms}}$  = 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%  $U_{\text{din}}$  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.

| 60.0Hz MSV                         |                                   | × |
|------------------------------------|-----------------------------------|---|
| Timestamp: 2019/09/06 17:57:05.407 |                                   |   |
| Trigger Channel: A                 | Max. Volt.: 9.22%, 11.64%, 10.32% |   |

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 $U_{\text{din}}$ , 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  $U_{din}$  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**,  **$\Delta U_{max}$**  and  **$\Delta U_{ss}$** .

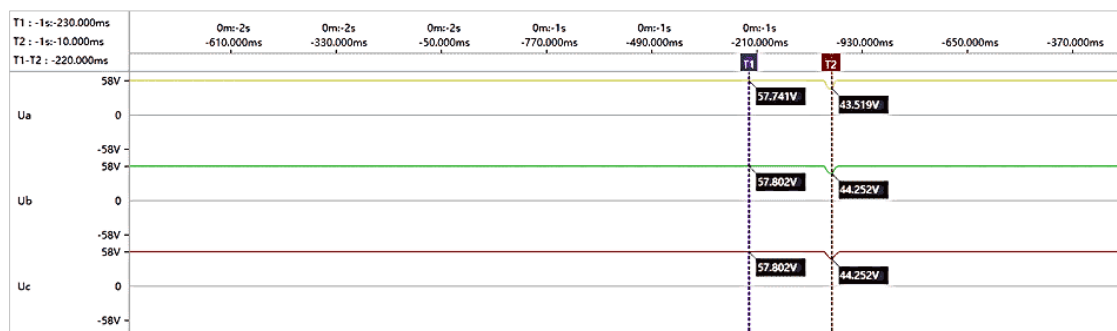
- **Start Time** When the “Voltage-is-Steady-State” logic signal becomes False and initiates the RVC event.
- **Duration** 100/120 half-cycle prior to the “Voltage-is-Steady-State” logic signal returns to True from False.
- **$\Delta U_{max}$**  The absolute maximum difference between any of the  $U_{rms(1/2)}$  values during the RVC event and the final arithmetic mean 100/120  $U_{rms(1/2)}$  value just prior to the RVC event.
- **$\Delta U_{ss}$**  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 $U_{din}$ , 5%* |
| Hysteresis | 0.1 to 5 (%) of $U_{din}$ , 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  $U_{din}$ . The underdeviation  $U_{rms-under}$  and overdeviation  $U_{rms-over}$  parameters are determined by the following equations:

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

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

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

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

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

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

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

$U_{rms-under, i} / U_{rms-over, i}$  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  $I > 2I_n$  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 | B8  | Pst.        |
| B1  |                    | B9  |             |
| B2  |                    | B10 |             |
| B3  |                    | B11 |             |
| B4  | Freq.              | B12 | Plt.        |
| B5  |                    | B13 |             |
| B6  |                    | B14 |             |
| B7  |                    | B15 |             |

**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  $I_{half\_cycle-rms}$  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*           |
|-------------------|-----------------------------|------------------|-----------------------------------|
| <b>Enable</b>     | Yes, No*                    | <b>Threshold</b> | 10% to 500% of $I_n$ , 120%*      |
| <b>Hysteresis</b> | 0.1% to 100% of $I_n$ , 1%* | <b>Trigger</b>   | 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/<br>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.

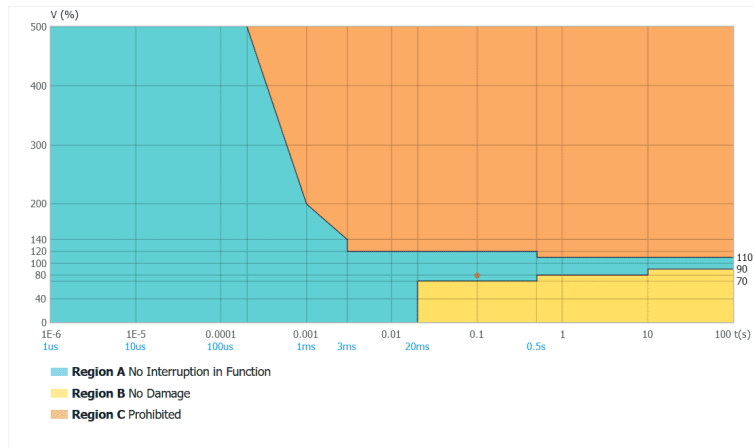


Figure 4-31 ITIC Curve

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

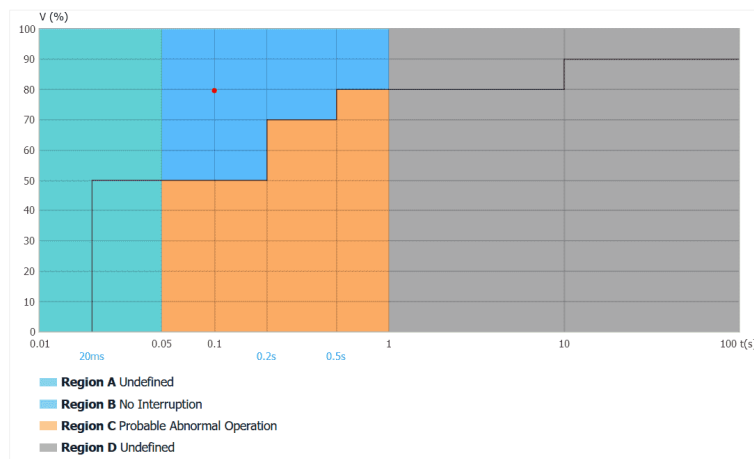


Figure 4-32 SEMI F47 Curve

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<br>If Pulse Width=0, the DO will be released after 1s.<br>If Pulse Width≠0, the DO will be released after the configured Pulse width. | None    |
| SEMI F47 Alarm Trigger | If the DO is closed when the SEMI F47 Alarm becomes active, the DO keeps the Closed state.                                                                   |         |

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 supraharmois 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- $\emptyset$   $U_{rms}$  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- $\emptyset$  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.

| Index | Segment | Ua      | Ub      | Uc      | Ia      | Ib      | Ic      |
|-------|---------|---------|---------|---------|---------|---------|---------|
| 1     | 2.1 kHz | 48.90 V | 58.90 V | 68.90 V | 302.4 A | 462.4 A | 622.4 A |
| 2     | 2.3 kHz | 49.00 V | 59.00 V | 69.00 V | 304.0 A | 464.0 A | 624.0 A |
| 3     | 2.5 kHz | 49.10 V | 59.10 V | 69.10 V | 305.6 A | 465.6 A | 625.6 A |
| 4     | 2.7 kHz | 49.20 V | 59.20 V | 69.20 V | 307.2 A | 467.2 A | 627.2 A |
| 5     | 2.9 kHz | 49.30 V | 59.30 V | 69.30 V | 308.8 A | 468.8 A | 628.8 A |
| 6     | 3.1 kHz | 49.40 V | 59.40 V | 69.40 V | 310.4 A | 470.4 A | 630.4 A |
| 7     | 3.3 kHz | 49.50 V | 59.50 V | 69.50 V | 312.0 A | 472.0 A | 632.0 A |
| 8     | 3.5 kHz | 49.60 V | 59.60 V | 69.60 V | 313.6 A | 473.6 A | 633.6 A |
| 9     | 3.7 kHz | 49.70 V | 59.70 V | 69.70 V | 315.2 A | 475.2 A | 635.2 A |
| 10    | 3.9 kHz | 49.80 V | 59.80 V | 69.80 V | 316.8 A | 476.8 A | 636.8 A |
| 11    | 4.1 kHz | 49.90 V | 59.90 V | 69.90 V | 318.4 A | 478.4 A | 638.4 A |
| 12    | 4.3 kHz | 50.00 V | 60.00 V | 70.00 V | 320.0 A | 480.0 A | 640.0 A |

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.

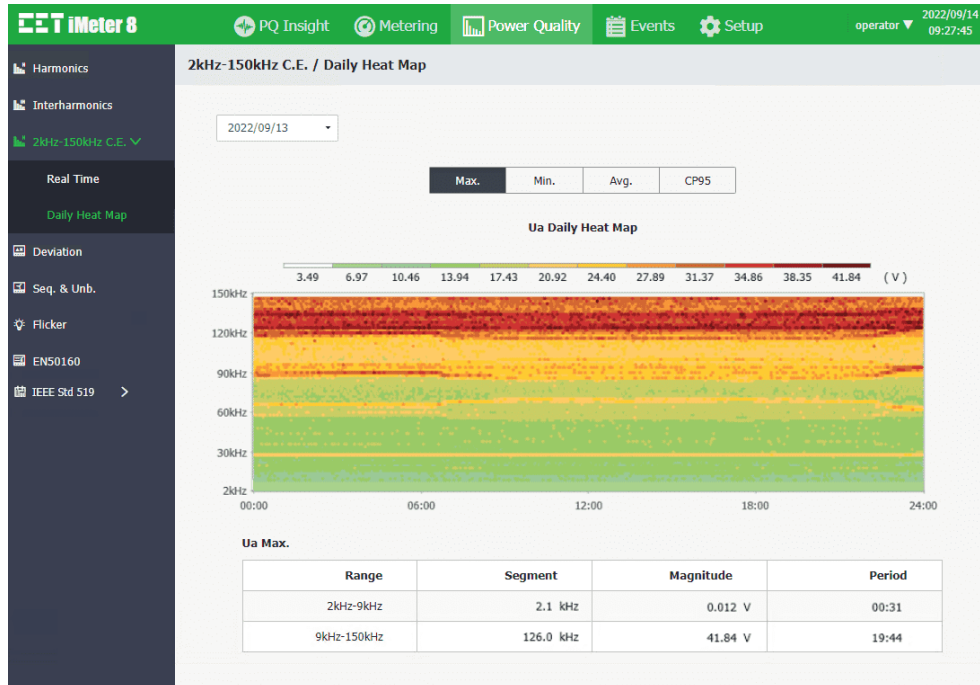


Figure 4-24 Ua Daily Heat Map Interface

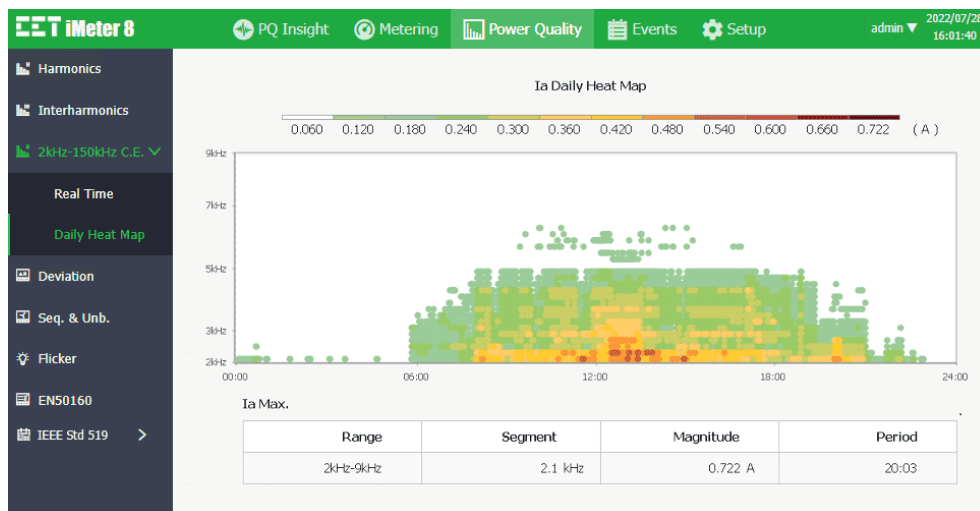


Figure 4-25 Ia Daily Heat Map Interface

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 99<sup>th</sup> percentile 3s values should be less than 1.5 times the values given in the table below.
- Weekly 95<sup>th</sup> 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     |
| $1 \text{ kV} < V \leq 69$ kV   | 3.0                     | 5.0     |
| $69 \text{ kV} < V \leq 161$ kV | 1.5                     | 2.5     |
| $161 \text{ kV} < V$            | 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 99<sup>th</sup> percentile 3s values should be less than 2.0 times the values given in the table below.
- Weekly 99<sup>th</sup> percentile 10-min values should be less than 1.5 times the values given in the table below.
- Weekly 95<sup>th</sup> percentile 10-min values should be less than the values given in the table below.

| 120V – 69kV system  |                   |                  |                  |                  |                     |      |
|---------------------|-------------------|------------------|------------------|------------------|---------------------|------|
| $I_{sc}/I_L$        | $2 \leq h < 11^*$ | $11 \leq h < 17$ | $17 \leq h < 23$ | $23 \leq h < 35$ | $35 \leq h \leq 50$ | TDD  |
| $< 20^{\sim}$       | 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 |                   |                  |                  |                  |                     |      |
| $I_{sc}/I_L$        | $2 \leq h < 11^*$ | $11 \leq h < 17$ | $17 \leq h < 23$ | $23 \leq h < 35$ | $35 \leq h \leq 50$ | TDD  |
| $< 20^{\sim}$       | 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  |                   |                  |                  |                  |                     |      |
| $I_{sc}/I_L$        | $2 \leq h < 11^*$ | $11 \leq h < 17$ | $17 \leq h < 23$ | $23 \leq h < 35$ | $35 \leq h \leq 50$ | TDD  |
| $< 25^{\sim}$       | 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  |
| $\geq 50$           | 3.0               | 1.5              | 1.15             | 0.45             | 0.22                | 3.75 |

**Table 4-35 Current Harmonic Compliance Limit**

\* For  $h \leq 6$ , even harmonics are limited to 50% of the Harmonic limits shown in the table.

$\sim$  Power generation facilities are limited to these values of current distortion, regardless of actual  $I_{sc}/I_L$  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     | <b>Standard</b> <sup>1</sup> – Use measured $I_L$ for <b>SCR</b> calculation and determining the limits according to IEEE Std 519-2022 for report generation.<br><b>Custom</b> – Use custom <b>TDD Preset IL</b> for <b>SCR</b> 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 <b>HVDC</b> 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 $I_{sc}/I_L$                                                                                                                         |
| 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 <b>PCC voltage</b> 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.<br>Periodic Email – Send an email if an evaluation result in the report is fail.                                                                                                                                                                  |

Table 4-36 IEEE Std 519 Report Parameters Configuration

#### Notes:

- In **Standard** mode, for a new installation, the monthly maximum current demand is not available.
  - If Preset  $I_L \neq 0$ : the meter will use Preset  $I_L$  for SCR calculation and determining the current harmonic distortion limits in the first month ( $M < 1$ ),
  - If Preset  $I_L = 0$ : 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 ( $M < 1$ ).
- 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.
- Modification of the **Short Circuit Current** ( $I_{sc}$ ) may change the SCR ( $I_{sc}/I_L$ ) ratio and result in a change in the harmonic

current distortion limits.

- 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 **99<sup>th</sup> percentile** values for **THD** and **Individual Harmonics** from 2<sup>nd</sup> to 7<sup>th</sup>, along with the IEEE Std 519 specified limits and a pass/fail conclusion where **✓** denotes the positive evaluation while **✗** denotes the negative evaluation.

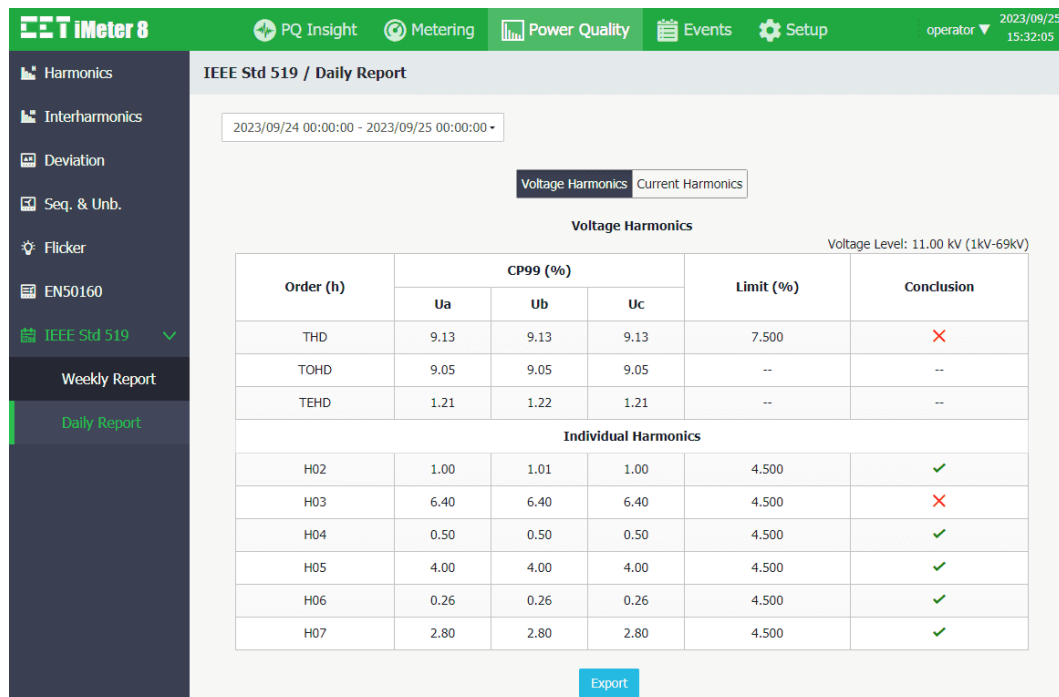


Figure 4-27 IEEE Std 519 Daily Voltage Harmonics Compliance Report

- 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 **99<sup>th</sup> percentile** values for the **TDD**, and **Individual Harmonics** from 2<sup>nd</sup> to 7<sup>th</sup>, along with the IEEE Std 519 specified limits and a pass/fail conclusion where **✓** denotes the positive evaluation while **✗** denotes the negative evaluation.

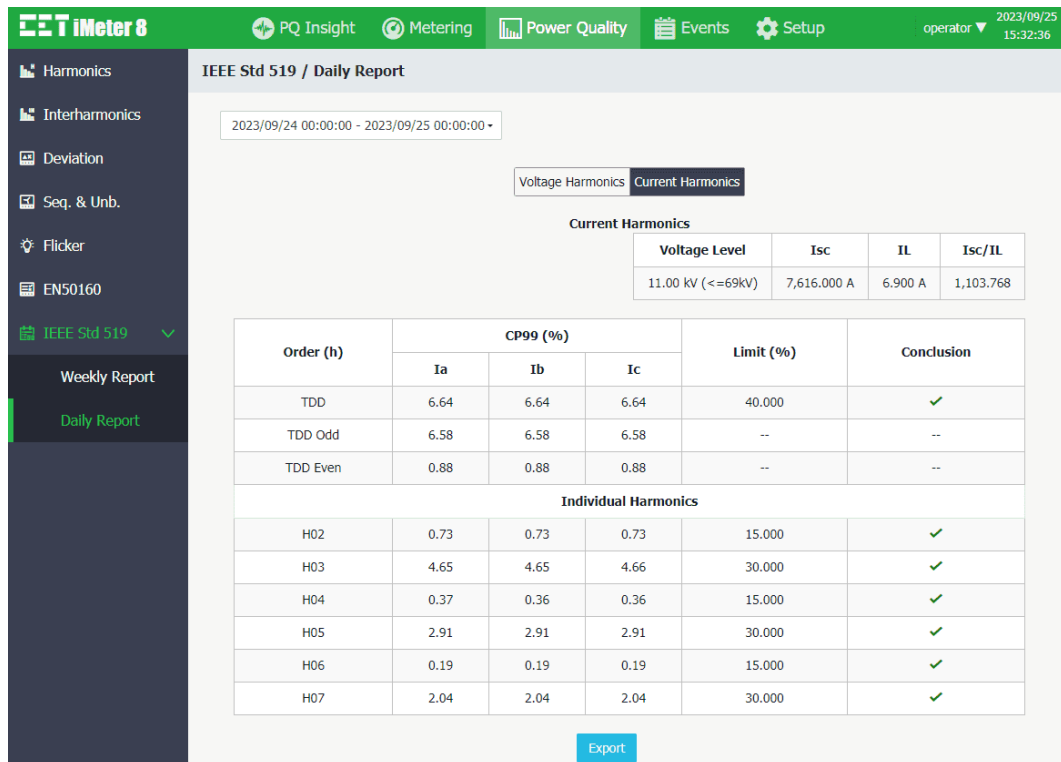


Figure 4-28 IEEE Std 519 Daily Current Harmonics Compliance Report

#### 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 **95<sup>th</sup>** percentile values for **THD** and **Individual Harmonics** from 2<sup>nd</sup> to 7<sup>th</sup>, along with the IEEE Std 519 specified limits and a pass/fail conclusion.

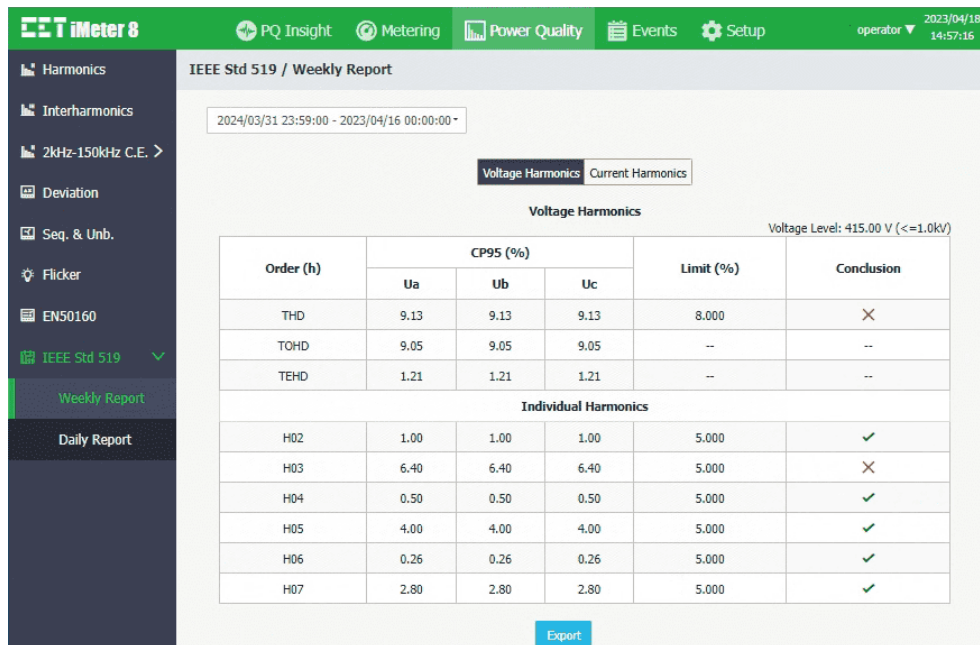


Figure 4-29 IEEE Std 519 Weekly Voltage Harmonics Compliance Report

- Current Harmonic Compliance Report**

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

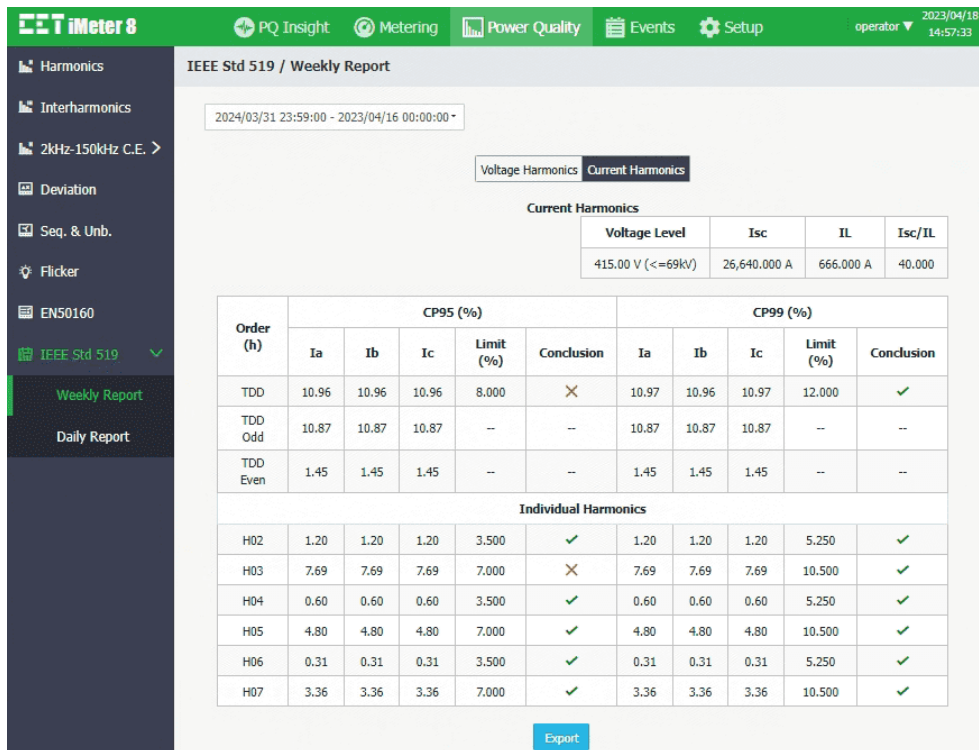


Figure 4-30 IEEE Std 519 Weekly Current Harmonics Compliance Report

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 2<sup>nd</sup> to 50<sup>th</sup>, as well as current **TDD** and **Individual Harmonics** from 2<sup>nd</sup> to 50<sup>th</sup>. 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  | 2~16 Cycles, 5*         | No. of Cycles | Range of Cycles @ Samples/Cycle, 100*    |
| Post-Fault Cycles |                         |               | • (40-3200) @128      • (40-800) @ 512   |
| Samples/Cycle     | 128, 256, 512*, 1024    |               | • (40-1600) @ 256      • (40-400) @ 1024 |
| Adaptive WFR      | 0=Enabled, 1=Disabled*  |               |                                          |

Table 4-39 WFR Setup Parameters

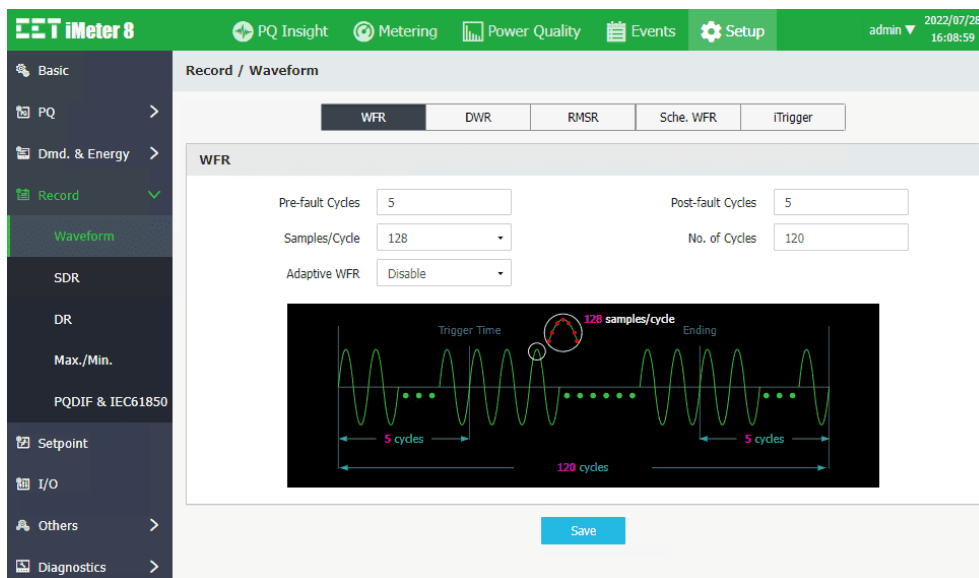


Figure 4-31 Set WFR via Web Interface

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

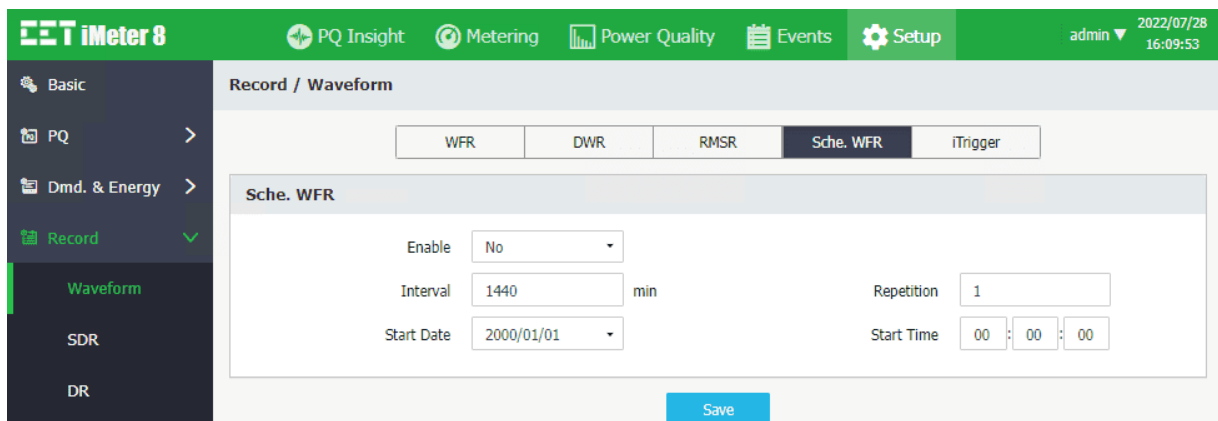


Figure 4-32 Set Sche. WFR via Web Interface

### 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.

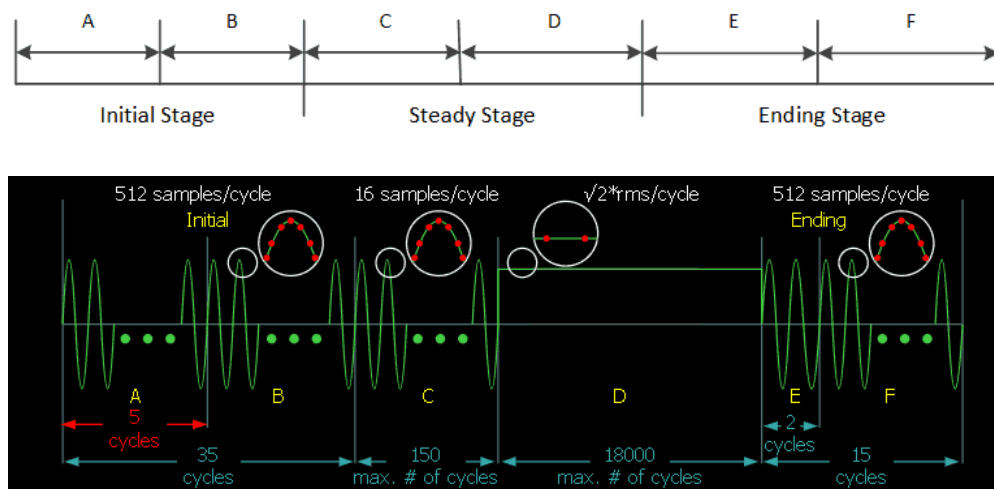


Figure 4-33 Disturbance Location

| 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<br>If the <b>Trigger Mode</b> is set to | Parameters           | Please refer to <b>Appendices A</b> and <b>C</b> for a complete list of the Data Recorder |

|  |                                                                            |  |                                                                     |
|--|----------------------------------------------------------------------------|--|---------------------------------------------------------------------|
|  | <b>Triggered by Setpoint</b> , the <b>Offset Time</b> 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 <b>Appendix A</b> and <b>B</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 <b>Self-Read Time</b> for the <b>Max. Demand Log</b> is used to specify the time and day of the month for the <b>Max./Min.</b> Self-Read operation. Please refer to <b>Section 4.2.4</b> for a complete description of the <b>Self-Read Time</b> and its operation. |
| Number of Parameters | 0 to 20                                                                                                                                                                                                                                                                      |
| Parameter 1 to 20    | See <b>Appendix A</b>                                                                                                                                                                                                                                                        |

**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<br>Uab, Ubc, Uca                 | 150/180 cycles |
| Current RMS            | Ia, Ib, Ic                                  |                |
| Voltage Deviation      | Ua/Ub/Uc Deviation<br>Uab/Ubc/Uca Deviation |                |
| Fundamental RMS        | Ua/Ub/Uc H01 RMS<br>Ia/Ib/Ic H01 RMS        |                |
| Unbalance              | U2/U0 Unbalance<br>I2/I0 Unbalance          |                |
| Sequence Components    | U1, U2, U0<br>I1, I2, I0                    |                |
| Harmonic Voltage       | Ua/Ub/Uc THD                                |                |
|                        | Ua/Ub/Uc TOHD                               |                |
|                        | Ua/Ub/Uc TEHD                               |                |
|                        | Ua/Ub/Uc HD01                               |                |
|                        | ...                                         |                |
| Harmonic Current       | Ua/Ub/Uc HD63                               |                |
|                        | Ia/Ib/Ic THD                                |                |
|                        | Ia/Ib/Ic TOHD                               |                |
|                        | Ia/Ib/Ic TEHD                               |                |
|                        | Ia/Ib/Ic H01 RMS                            |                |
|                        | ...                                         |                |
| Inter-Harmonic Voltage | Ia/Ib/Ic H63 RMS                            |                |
|                        | Ua/Ub/Uc THD                                |                |
|                        | Ua/Ub/Uc TOHD                               |                |
|                        | Ua/Ub/Uc TEHD                               |                |
|                        | Ua/Ub/Uc HD01                               |                |
| Inter-Harmonic Current | ...                                         |                |
|                        | Ua/Ub/Uc HD63                               |                |
|                        | 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    | kW <sub>a</sub> /kW <sub>b</sub> /kW <sub>c</sub> , kV <sub>a</sub> /kV <sub>b</sub> /kV <sub>c</sub> , kVA <sub>a</sub> /kVA <sub>b</sub> /kVA <sub>c</sub> , PF <sub>a</sub> /PF <sub>b</sub> /PF <sub>c</sub> , kW Total, kvar Total, kVA Total | 150/180 cycles |
| Total Power          | kW <sub>a</sub> /kW <sub>b</sub> /kW <sub>c</sub> , kV <sub>a</sub> /kV <sub>b</sub> /kV <sub>c</sub> , kVA <sub>a</sub> /kVA <sub>b</sub> /kVA <sub>c</sub> , PF <sub>a</sub> /PF <sub>b</sub> /PF <sub>c</sub> , kW Total, kvar Total, kVA Total | 150/180 cycles |
| Total Harmonic Power | kW <sub>a</sub> /kW <sub>b</sub> /kW <sub>c</sub> TH, kV <sub>a</sub> /kV <sub>b</sub> /kV <sub>c</sub> TH, kVA <sub>a</sub> /kVA <sub>b</sub> /kVA <sub>c</sub> 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*<br>iTrigger 2: WFR*<br>iTrigger 3: RMSR* |
| iTrigger Group x               | -1 to 16383<br>-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 1 <sup>st</sup>                                 |
| Alternate Days # | A day can be defined as an Alternate Day, such as May 1 <sup>st</sup> . 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<br>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 <b>Enable SSL for SMTP</b> as <b>Yes</b> , 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.

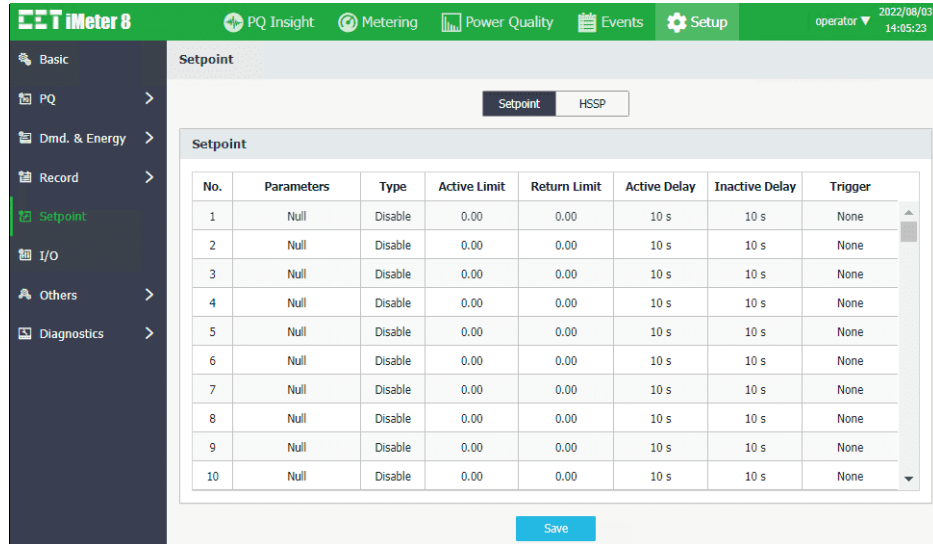


Figure 4-36 Setpoint Settings

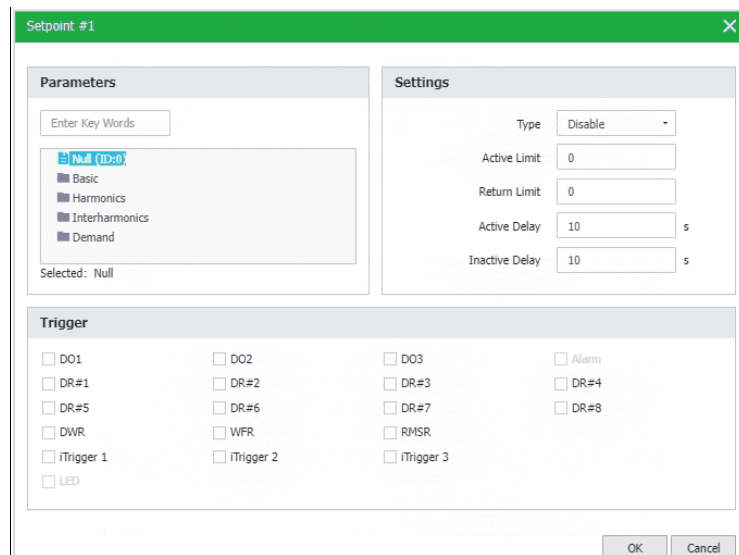


Figure 4-37 Setpoint#1 Settings Dialog

- 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.

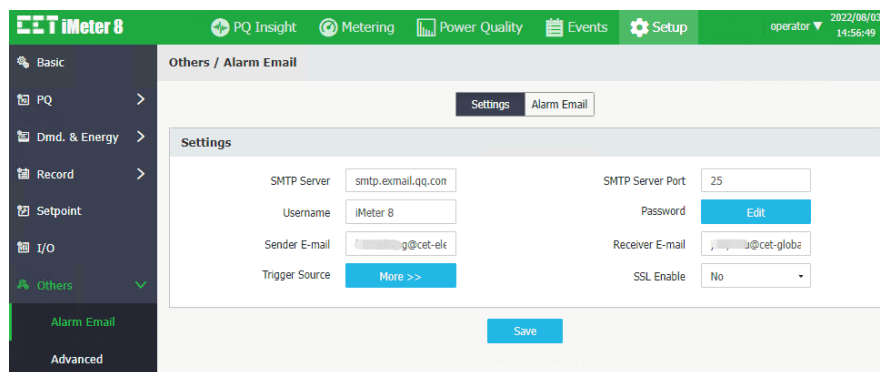


Figure 4-38 Alarm Email Settings via Web

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](mailto:example@gmail.com)
  - Receiver Email – [\\*\\*\\*\\*@\\*\\*\\*.com](mailto:****@***.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.

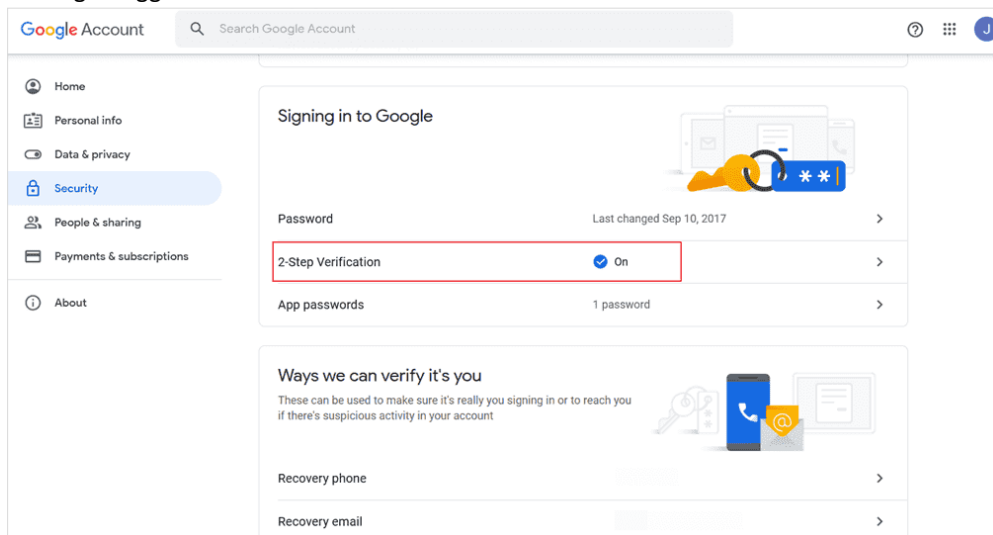


Figure 4-39 2-Step Verification on Google Account

- 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.

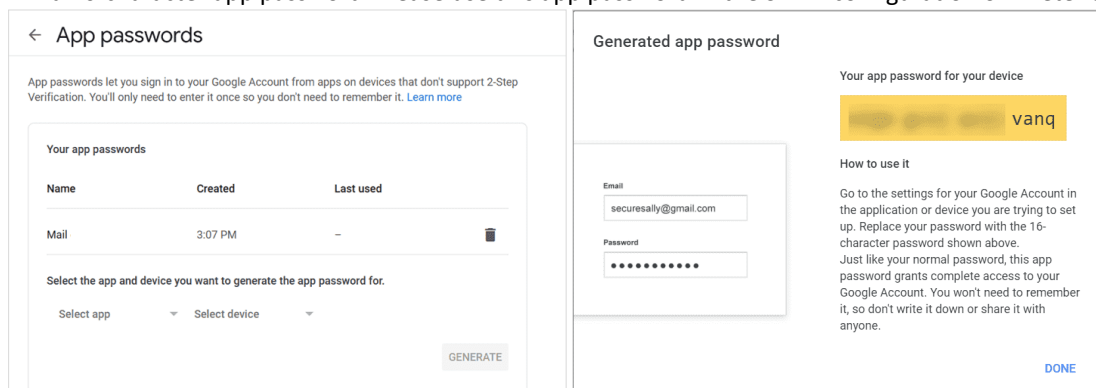


Figure 4-40 Retrieve App Password for Google Account

#### For Outlook:

- SMTP Server – smtp.office365.com
  - SMTP IP Port – 587
  - Sender E-mail – [example@outlook.com](mailto:example@outlook.com)
  - Receiver E-mail – [\\*\\*\\*\\*@\\*\\*\\*.com](mailto:****@***.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.

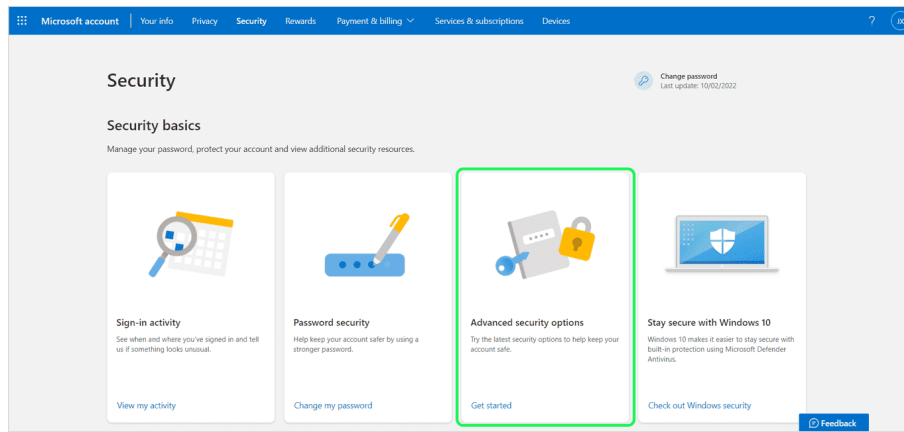


Figure 4-41 Security Setting for Microsoft Account

- 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.

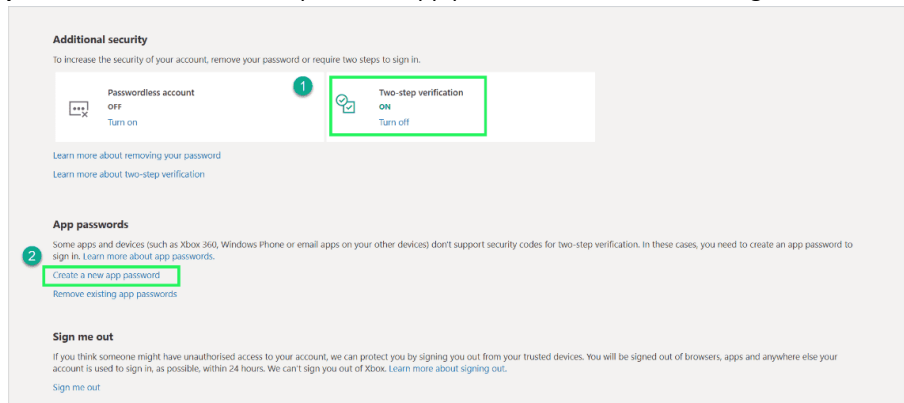


Figure 4-42 Retrieve App Password for Microsoft Account

- 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.

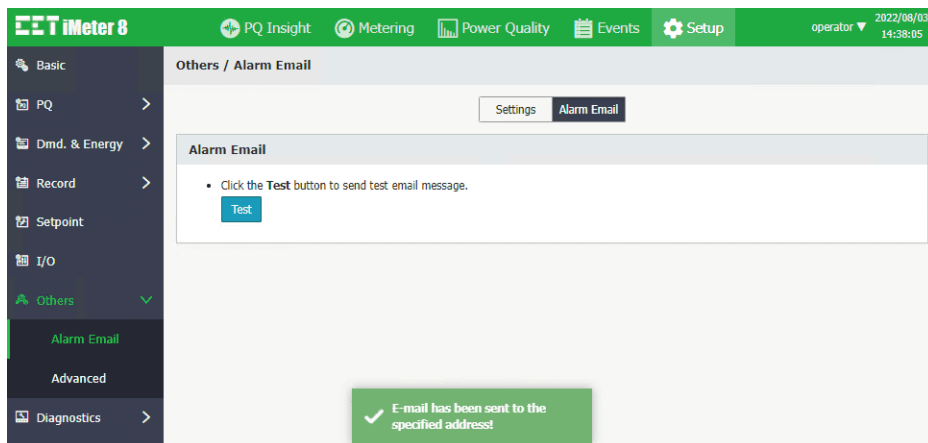


Figure 4-43 Send Test Email

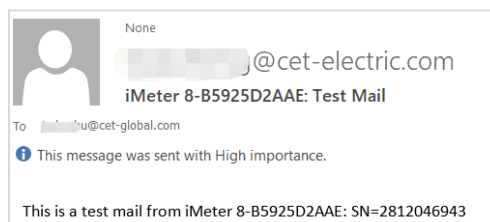


Figure 4-44 An Example of Test Email

- 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.

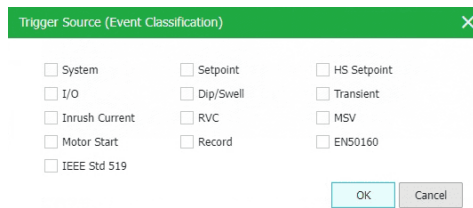


Figure 4-45 Trigger Source Dialog

- 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 <b>SNTP Server</b>                                                                                                                                                                                                                                                                                                                                              | 0.0.0.0  |
| <b>Broadcast Synchronization</b> |                                                                                                                                                                                                                                                                                                                                                                                           |          |
| 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 <b>Section 5.10.6 System Setup</b> , 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.

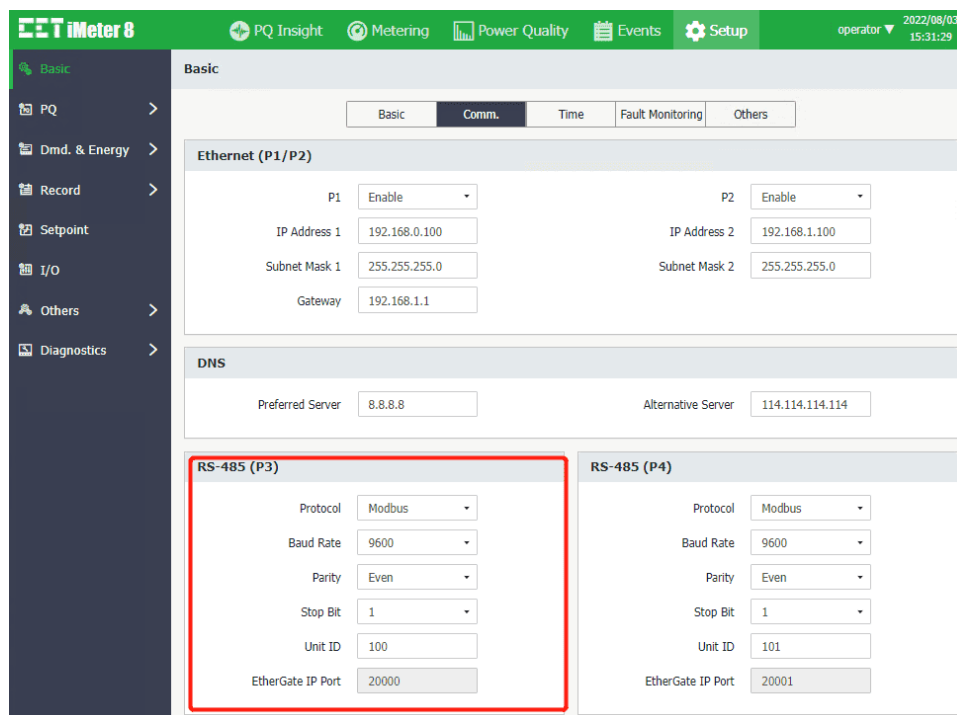
#### 4.11 Ethernet Gateway

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.

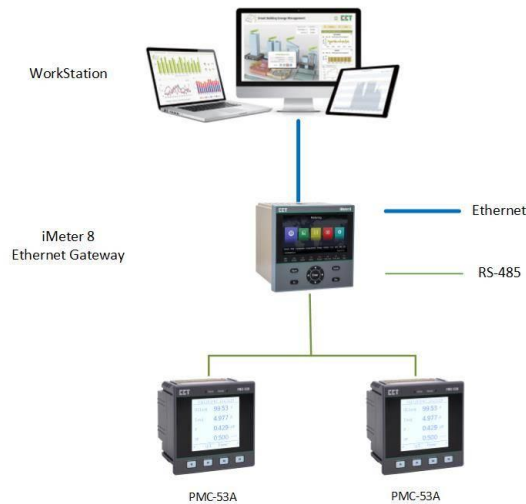
The following illustrates the steps of configuration the iMeter 8's Ethernet Gateway via P3:

- 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.

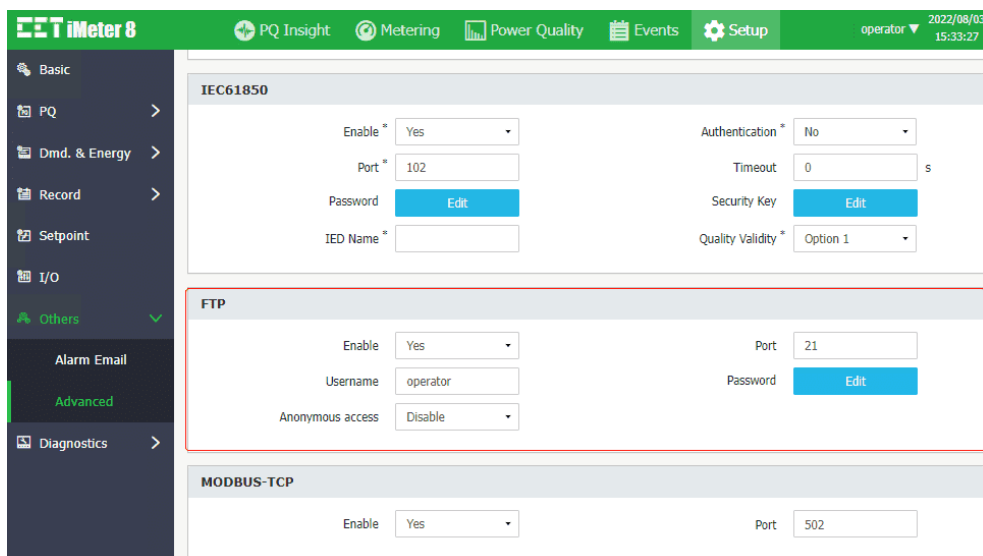
## 4.12 On-board FTP Server

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

ftp://192.168.1.100/.

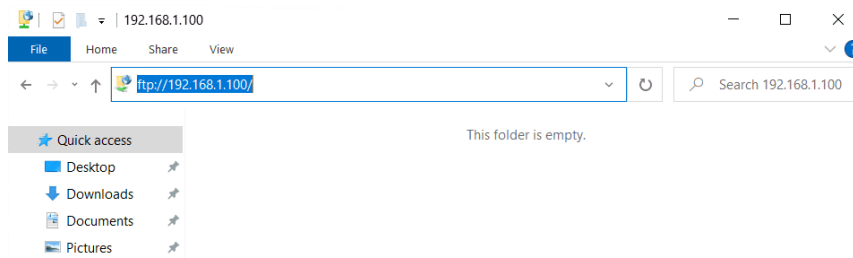


Figure 4-50 Windows File Explorer

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.

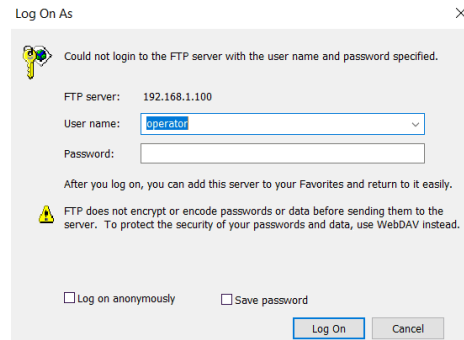


Figure 4-51 Log On As dialog

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

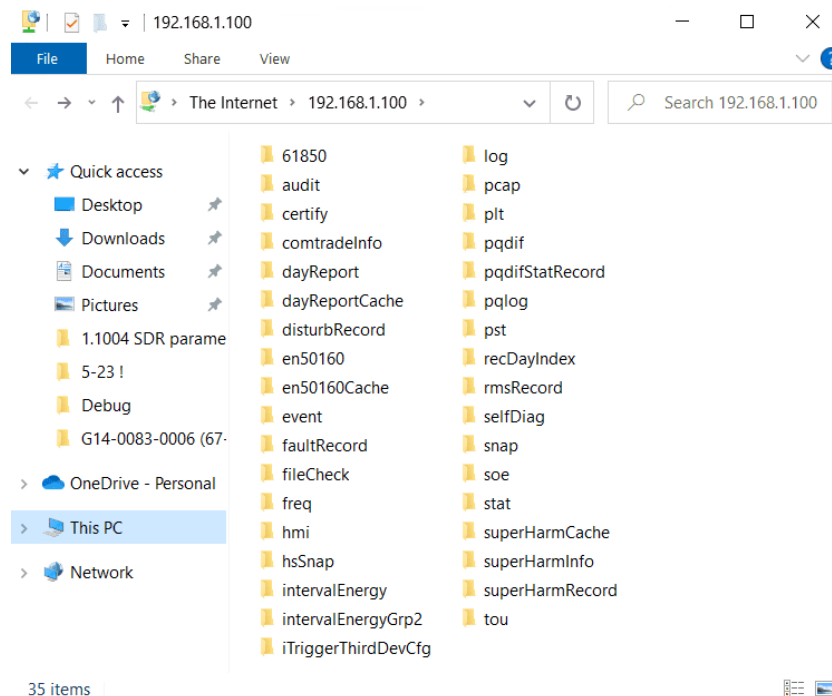


Figure 4-52 iMeter 8's FTP Server

#### 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.

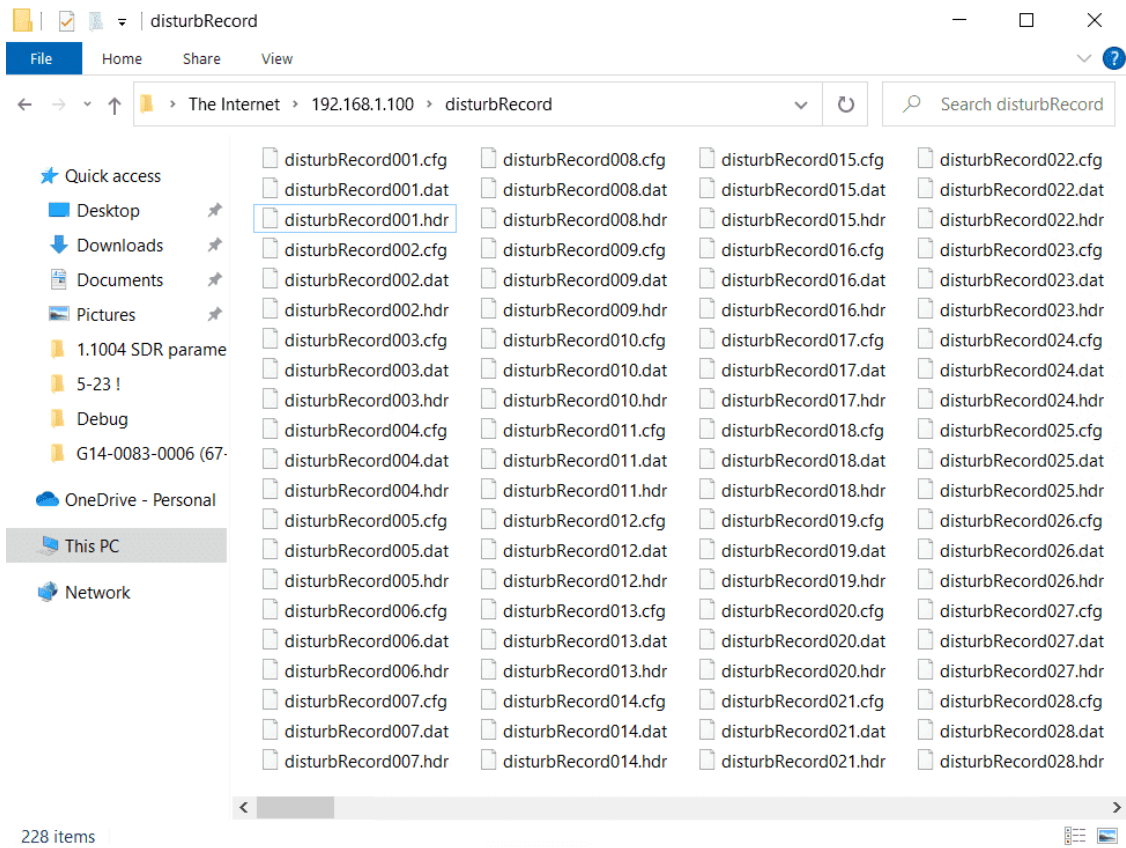


Figure 4-53 disturbRecord Files

**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.

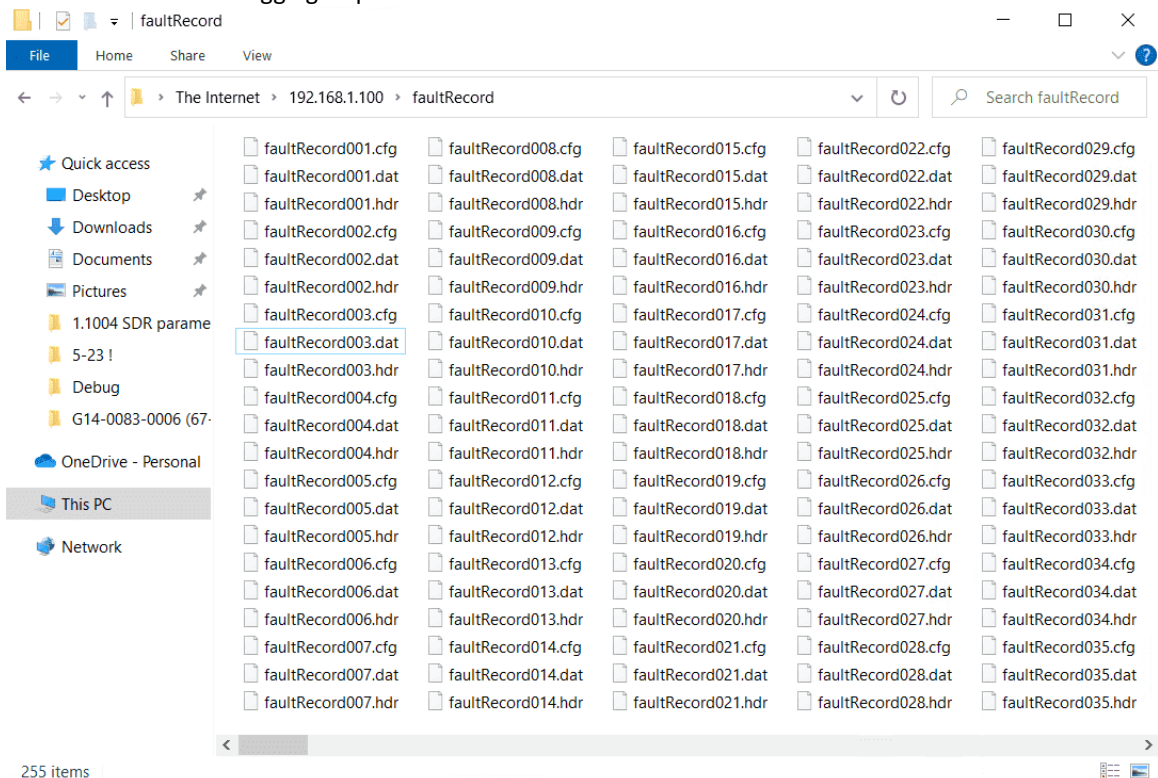


Figure 4-54 faultRecord Files

**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.

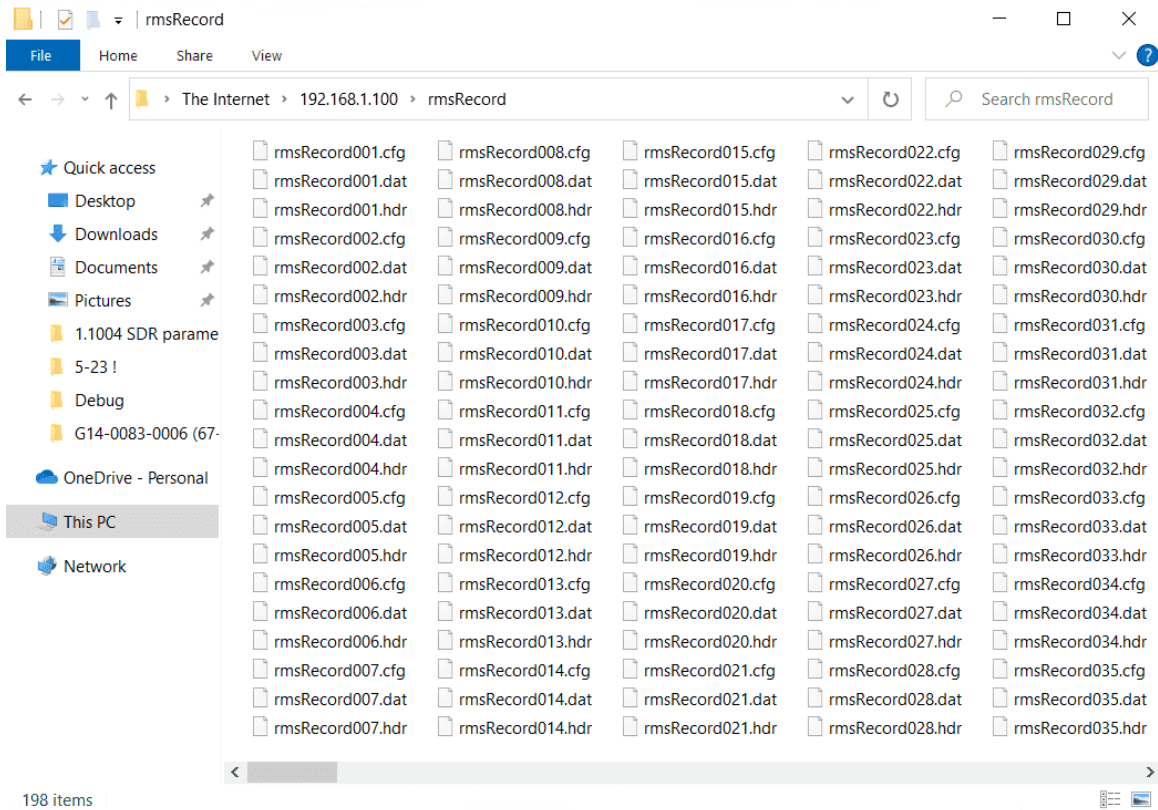


Figure 4-55 rmsRecord Files

**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.

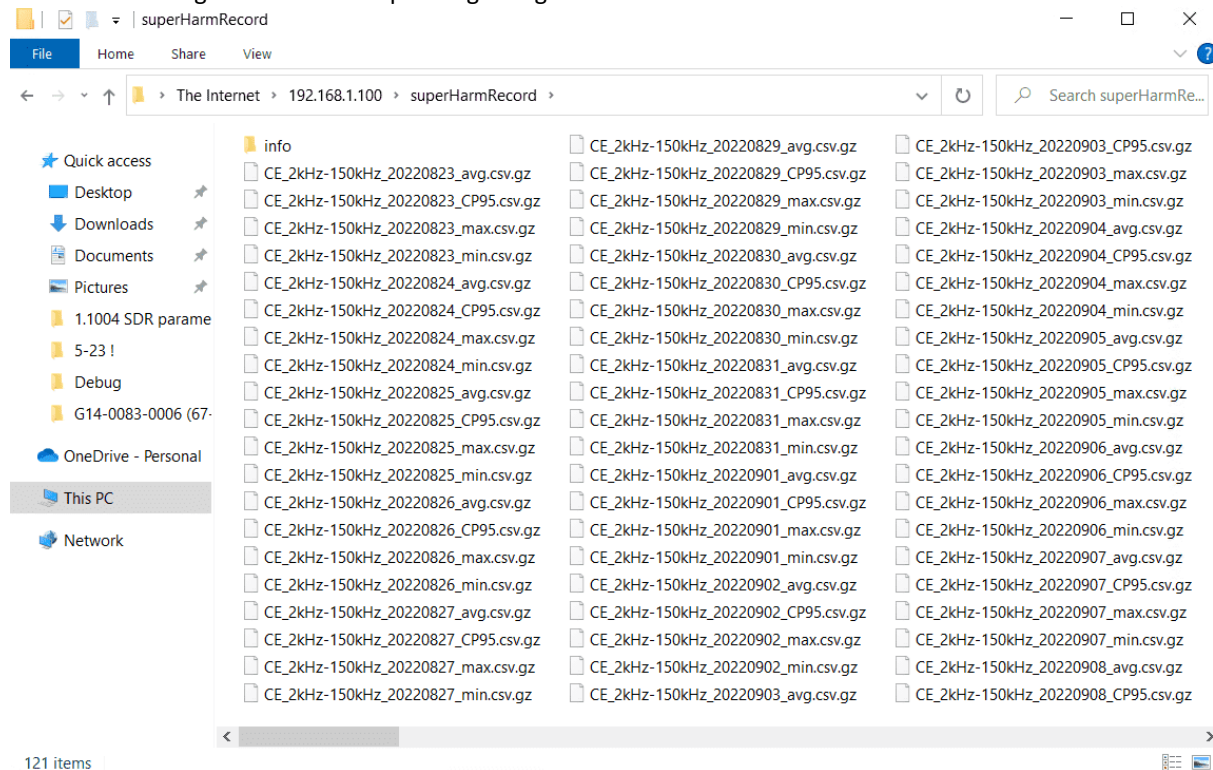


Figure 4-56 superHarmRecord Files

## 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 3<sup>rd</sup> 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 <sup>1</sup>                                    | Float  | V    |
| 0002      | RO       | Ub <sup>1</sup>                                    | Float  | V    |
| 0004      | RO       | Uc <sup>1</sup>                                    | Float  | V    |
| 0006      | RO       | ULN Avg. <sup>1</sup>                              | 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 <sup>1</sup>                                    | Float  | W    |
| 0026      | RO       | Pb <sup>1</sup>                                    | Float  | W    |
| 0028      | RO       | Pc <sup>1</sup>                                    | Float  | W    |
| 0030      | RO       | P Total                                            | Float  | W    |
| 0032      | RO       | Qa <sup>1</sup>                                    | Float  | var  |
| 0034      | RO       | Qb <sup>1</sup>                                    | Float  | var  |
| 0036      | RO       | Qc <sup>1</sup>                                    | Float  | var  |
| 0038      | RO       | Q Total                                            | Float  | var  |
| 0040      | RO       | Sa <sup>1</sup>                                    | Float  | VA   |
| 0042      | RO       | Sb <sup>1</sup>                                    | Float  | VA   |
| 0044      | RO       | Sc <sup>1</sup>                                    | Float  | VA   |
| 0046      | RO       | S Total                                            | Float  | VA   |
| 0048      | RO       | PFa <sup>1</sup>                                   | Float  | --   |
| 0050      | RO       | Pfb <sup>1</sup>                                   | Float  | --   |
| 0052      | RO       | Pfc <sup>1</sup>                                   | 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 <sup>2</sup>     | UINT16 |      |
| 0081~0092 |          | Reserved                                           | Float  |      |
| 0093      | RO       | Standard Setpoint Status #1 <sup>3</sup>           | UINT32 |      |
| 0095      | RO       | Standard Setpoint Status #2 <sup>3</sup>           | UINT32 |      |
| 0097      | RO       | Standard Setpoint Status #3 <sup>3</sup>           | UINT32 |      |
| 0099      | RO       | Standard Setpoint Status #4 <sup>3</sup>           | UINT32 |      |
| 0101      | RO       | Standard Setpoint Status #5 <sup>3</sup>           | UINT32 |      |
| 0103      | RO       | Standard Setpoint Status #6 <sup>3</sup>           | UINT32 |      |
| 0105      | RO       | Standard Setpoint Status #7 <sup>3</sup>           | UINT32 |      |
| 0107      | RO       | Standard Setpoint Status #8 <sup>3</sup>           | UINT32 |      |
| 0109      | RO       | Standard Setpoint Status #9 <sup>3</sup>           | UINT32 |      |
| 0111      | RO       | HS Setpoint Status <sup>3</sup>                    | UINT32 |      |

# CET Electric Technology

|           |    |                                                 |        |  |
|-----------|----|-------------------------------------------------|--------|--|
| 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 <sup>4</sup>                 | UINT32 |  |
| 0139      | RO | SOE Log Pointer <sup>4</sup>                    | UINT32 |  |
| 0141      | RO | WFR Log Pointer <sup>4</sup>                    | UINT32 |  |
| 0143      | RO | RMSR Log Pointer <sup>4</sup>                   | UINT32 |  |
| 0145      | RO | DWR Log Pointer <sup>4</sup>                    | UINT32 |  |
| 0147~0157 | RO | Reserved                                        | UINT32 |  |
| 0159      | RO | SDR Log #1 Pointer <sup>4</sup>                 | UINT32 |  |
| 0161      | RO | SDR Log #2 Pointer <sup>4</sup>                 | UINT32 |  |
| 0163      | RO | SDR Log #3 Pointer <sup>4</sup>                 | UINT32 |  |
| 0165      | RO | SDR Log #4 Pointer <sup>4</sup>                 | UINT32 |  |
| 0167      | RO | SDR Log #5 Pointer <sup>4</sup>                 | UINT32 |  |
| 0169      | RO | SDR Log #6 Pointer <sup>4</sup>                 | UINT32 |  |
| 0171      | RO | SDR Log #7 Pointer <sup>4</sup>                 | UINT32 |  |
| 0173      | RO | SDR Log #8 Pointer <sup>4</sup>                 | UINT32 |  |
| 0175      | RO | SDR Log #9 Pointer <sup>4</sup>                 | UINT32 |  |
| 0177      | RO | SDR Log #10 Pointer <sup>4</sup>                | UINT32 |  |
| 0179      | RO | SDR Log #11 Pointer <sup>4</sup>                | UINT32 |  |
| 0181      | RO | SDR Log #12 Pointer <sup>4</sup>                | UINT32 |  |
| 0183      | RO | SDR Log #13 Pointer <sup>4</sup>                | UINT32 |  |
| 0185      | RO | SDR Log #14 Pointer <sup>4</sup>                | UINT32 |  |
| 0187      | RO | SDR Log #15 Pointer <sup>4</sup>                | UINT32 |  |
| 0189      | RO | SDR Log #16 Pointer <sup>4</sup>                | UINT32 |  |
| 0191~0205 | RO | Reserved                                        | UINT32 |  |
| 0207      | RO | DR Log #1 Pointer <sup>4</sup>                  | UINT32 |  |
| 0209      | RO | DR Log #2 Pointer <sup>4</sup>                  | UINT32 |  |
| 0211      | RO | DR Log #3 Pointer <sup>4</sup>                  | UINT32 |  |
| 0213      | RO | DR Log #4 Pointer <sup>4</sup>                  | UINT32 |  |
| 0215      | RO | DR Log #5 Pointer <sup>4</sup>                  | UINT32 |  |
| 0217      | RO | DR Log #6 Pointer <sup>4</sup>                  | UINT32 |  |
| 0219      | RO | DR Log #7 Pointer <sup>4</sup>                  | UINT32 |  |
| 0221      | RO | DR Log #8 Pointer <sup>4</sup>                  | UINT32 |  |
| 0223~0237 | RO | Reserved                                        | UINT32 |  |
| 0239      | RO | Pst Log Pointer <sup>4</sup>                    | UINT32 |  |
| 0241      | RO | Plt Log Pointer <sup>4</sup>                    | UINT32 |  |
| 0243      | RO | Reserved                                        | UINT32 |  |
| 0245      | RO | IER Log Pointer <sup>4</sup>                    | UINT32 |  |
| 0247      | RO | EN50160 Report Pointer <sup>4</sup>             | UINT32 |  |
| 0249      | RO | Reserved                                        | UINT32 |  |
| 0251      | RO | Historical TOU Log Pointer <sup>4</sup>         | UINT32 |  |
| 0253      | RO | Reserved                                        | UINT32 |  |
| 0255      | RO | Frequency Deviation Log Pointer                 | UINT32 |  |
| 0257      | RO | AER Log Pointer <sup>4</sup>                    | 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 <sup>4</sup>  | UINT32 |  |
| 0267      | RO | IEEE Std 519 Weekly Report Pointer <sup>4</sup> | UINT32 |  |
| 0269      | RO | Max. Demand Log Pointer <sup>4</sup>            | 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 <sup>5</sup>         | UINT16 |  |
| 0309      |    | Reserved                       | UINT16 |  |
| 0310      | RO | DO Status <sup>6</sup>         | UINT16 |  |
| 0311~0312 |    | Reserved                       | UINT32 |  |
| 0314      | RO | Audit Log Pointer <sup>4</sup> | 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 | B8  | Pst.        |
| B1  |                   | B9  |             |
| B2  |                   | B10 |             |
| B3  |                   | B11 |             |
| B4  | Frequency         | B12 | Plt.        |
| B5  |                   | B13 |             |
| B6  |                   | B14 |             |
| B7  |                   | B15 |             |

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 |
|-----|-------------|-----|-------------|-----|-------------|-----|-------------|
|-----|-------------|-----|-------------|-----|-------------|-----|-------------|

|           |                |           |                |            |                 |            |                 |
|-----------|----------------|-----------|----------------|------------|-----------------|------------|-----------------|
| <b>B0</b> | HS Setpoint #1 | <b>B4</b> | HS Setpoint #5 | <b>B8</b>  | HS Setpoint #9  | <b>B12</b> | HS Setpoint #13 |
| <b>B1</b> | HS Setpoint #2 | <b>B5</b> | HS Setpoint #6 | <b>B9</b>  | HS Setpoint #10 | <b>B13</b> | HS Setpoint #14 |
| <b>B2</b> | HS Setpoint #3 | <b>B6</b> | HS Setpoint #7 | <b>B10</b> | HS Setpoint #11 | <b>B14</b> | HS Setpoint #15 |
| <b>B3</b> | HS Setpoint #4 | <b>B7</b> | HS Setpoint #8 | <b>B11</b> | HS Setpoint #12 | <b>B15</b> | 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       | $\Sigma$ kWh Imp.    | INT64  | 1     | wh   |
| 0504     | RW       | $\Sigma$ kWh Exp.    | INT64  | 1     | wh   |
| 0508     | RW       | $\Sigma$ kvarh Imp.  | INT64  | 1     | varh |
| 0512     | RW       | $\Sigma$ kvarh Exp.  | INT64  | 1     | varh |
| 0516     | RW       | $\Sigma$ kVAh        | INT64  | 1     | VAh  |
| 0520     | RO       | $\Sigma$ kWh Net     | INT64  | 1     | wh   |
| 0524     | RO       | $\Sigma$ kWh Total   | INT64  | 1     | wh   |
| 0528     | RO       | $\Sigma$ kvarh Net   | INT64  | 1     | varh |
| 0532     | RO       | $\Sigma$ 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:

$$\begin{aligned}
 &\Sigma kxh \text{ (Import/Export/Net/Total)} \\
 &= E1 \times 100 \text{ Gxh} + E2 \times 0.1 \text{ kxh} \\
 &= E1 \times 10^8 \text{ kxh} + E2 \times 0.1 \text{ kxh}
 \end{aligned}$$

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  $1 \times 10^{11}$  kxh. The E1 and E2 registers must be written simultaneously.

| Register | Property | Description            | Format | Scale | Unit    |
|----------|----------|------------------------|--------|-------|---------|
| 0550     | RW       | $\Sigma$ kWh Import E1 | INT32  | 1     | 100 GWh |
| 0552     | RW       | $\Sigma$ kWh Import E2 | INT32  | 0.1   | kWh     |
| 0554     | RW       | $\Sigma$ kWh Export E1 | INT32  | 1     | 100 GWh |
| 0556     | RW       | $\Sigma$ kWh Export E2 | INT32  | 0.1   | kWh     |

|      |    |                          |       |     |           |
|------|----|--------------------------|-------|-----|-----------|
| 0558 | RW | $\Sigma$ kvarh Import E1 | INT32 | 1   | 100 Gvarh |
| 0560 | RW | $\Sigma$ kvarh Import E2 | INT32 | 0.1 | kvarh     |
| 0562 | RW | $\Sigma$ kvarh Export E1 | INT32 | 1   | 100 Gvarh |
| 0564 | RW | $\Sigma$ kvarh Export E2 | INT32 | 0.1 | kvarh     |
| 0566 | RW | $\Sigma$ kVAh E1         | INT32 | 1   | 100 GVAh  |
| 0568 | RW | $\Sigma$ kVAh E2         | INT32 | 0.1 | kVAh      |
| 0570 | RO | $\Sigma$ kWh Net E1      | INT32 | 1   | 100 GWh   |
| 0572 | RO | $\Sigma$ kWh Net E2      | INT32 | 0.1 | kWh       |
| 0574 | RO | $\Sigma$ kWh Total E1    | INT32 | 1   | 100 GWh   |
| 0576 | RO | $\Sigma$ kWh Total E2    | INT32 | 0.1 | kWh       |
| 0578 | RO | $\Sigma$ kvarh Net E1    | INT32 | 1   | 100 Gvarh |
| 0580 | RO | $\Sigma$ kvarh Net E2    | INT32 | 0.1 | kvarh     |
| 0582 | RO | $\Sigma$ kvarh Total E1  | INT32 | 1   | 100 Gvarh |
| 0584 | RO | $\Sigma$ 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 <sup>1</sup>  | INT32  |                  |
| 0668     | RW       | DI10 Counter <sup>1</sup> | INT32  |                  |
| 0670     | RW       | DI11 Counter <sup>1</sup> | INT32  |                  |
| 0672     | RW       | DI12 Counter <sup>1</sup> | INT32  |                  |
| 0674     | RW       | DI13 Counter <sup>1</sup> | INT32  |                  |
| 0676     | RW       | DI14 Counter <sup>1</sup> | INT32  |                  |
| 0678     | RW       | DI15 Counter <sup>1</sup> | INT32  |                  |
| 0680     | RW       | DI16 Counter <sup>1</sup> | 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 <sup>1</sup>       | Float  |      |
| 0702      | RO       | Ub Deviation <sup>1</sup>       | Float  |      |
| 0704      | RO       | Uc Deviation <sup>1</sup>       | Float  |      |
| 0706      | RO       | Uab Deviation                   | Float  |      |
| 0708      | RO       | Ubc Deviation                   | Float  |      |
| 0710      | RO       | Uca Deviation                   | Float  |      |
| 0712      | RO       | Ua Over Deviation <sup>1</sup>  | Float  |      |
| 0714      | RO       | Ub Over Deviation <sup>1</sup>  | Float  |      |
| 0716      | RO       | Uc Over Deviation <sup>1</sup>  | Float  |      |
| 0718      | RO       | Uab Over Deviation              | Float  |      |
| 0720      | RO       | Ubc Over Deviation              | Float  |      |
| 0722      | RO       | Uca Over Deviation              | Float  |      |
| 0724      | RO       | Ua Under Deviation <sup>1</sup> | Float  |      |
| 0726      | RO       | Ub Under Deviation <sup>1</sup> | Float  |      |
| 0728      | RO       | Uc Under Deviation <sup>1</sup> | 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 <sup>2</sup>    | Float |   |
| 0772 | RO | Ub/Ubc Pst <sup>2</sup>    | Float |   |
| 0774 | RO | Uc/Uca Pst <sup>2</sup>    | Float |   |
| 0776 | RO | Ua/Uab Plt <sup>2</sup>    | Float |   |
| 0778 | RO | Ub/Ubc Plt <sup>2</sup>    | Float |   |
| 0780 | RO | Uc/Uca Plt <sup>2</sup>    | 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 <sup>2</sup> | Float | V |
| 0844 | RO | Ub/Ubc MSV #1 <sup>2</sup> | Float | V |
| 0846 | RO | Uc/Uca MSV #1 <sup>2</sup> | Float | V |
| 0848 | RO | Ua/Uab MSV #2 <sup>2</sup> | Float | V |
| 0850 | RO | Ub/Ubc MSV #2 <sup>2</sup> | Float | V |
| 0852 | RO | Uc/Uca MSV #2 <sup>2</sup> | Float | V |
| 0854 | RO | Ua/Uab MSV #3 <sup>2</sup> | Float | V |
| 0856 | RO | Ub/Ubc MSV #3 <sup>2</sup> | Float | V |
| 0858 | RO | Uc/Uca MSV #3 <sup>2</sup> | 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 <sup>1</sup> | Float  | %/x100     |
| 1002     | RO       | Ub/Ubc THD <sup>1</sup> | Float  | %/x100     |
| 1004     | RO       | Uc/Uca THD <sup>1</sup> | 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 <sup>1</sup>         | Float | %/x100 |
| 1020 | RO  | Ub/Ubc TOHD <sup>1</sup>         | Float | %/x100 |
| 1022 | RO  | Uc/Uca TOHD <sup>1</sup>         | 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 <sup>1</sup>         | Float | %/x100 |
| 1038 | RO  | Ub/Ubc TEHD <sup>1</sup>         | Float | %/x100 |
| 1040 | RO  | Uc/Uca TEHD <sup>1</sup>         | 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 <sup>1</sup> | Float | %/x100 |
| 1056 | RO  | Ub/Ubc DC Component <sup>1</sup> | Float | %/x100 |
| 1058 | RO  | Uc/Uca DC Component <sup>1</sup> | 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 <sup>1</sup>         | Float | %/x100 |
| 1074 | RO  | Ub/Ubc HD01 <sup>1</sup>         | Float | %/x100 |
| 1076 | RO  | Uc/Uca HD01 <sup>1</sup>         | 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 <sup>1</sup>         | Float | %/x100 |
| 2190 | RO  | Ub/Ubc HD63 <sup>1</sup>         | Float | %/x100 |
| 2192 | RO  | Uc/Uca HD63 <sup>1</sup>         | 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:**

- 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.
- When the **Wiring Mode** is **1P2W L-N** or **1P2W L-L**, the B and C phase voltages THD/TOHD/TEHD/HDxx have no meaning, and their registers are reserved. When the **Wiring Mode** is **1P3W L-N**, the C phase voltages THD/TOHD/TEHD/HDxx 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 <sup>1</sup> | Float  | V    |
| 2302     | RO       | Ub/Ubc TH RMS <sup>1</sup> | Float  | V    |
| 2304     | RO       | Uc/Uca TH RMS <sup>1</sup> | 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 <sup>1</sup>          | Float | V   |
| 2320 | RO | Ub/Ubc TOH RMS <sup>1</sup>          | Float | V   |
| 2322 | RO | Uc/Uca TOH RMS <sup>1</sup>          | 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 <sup>1</sup>          | Float | V   |
| 2338 | RO | Ub/Ubc TEH RMS <sup>1</sup>          | Float | V   |
| 2340 | RO | Uc/Uca TEH RMS <sup>1</sup>          | 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 <sup>1</sup> | Float | V   |
| 2356 | RO | Ub/Ubc DC Component RMS <sup>1</sup> | Float | V   |
| 2358 | RO | Uc/Uca DC Component RMS <sup>1</sup> | 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 <sup>1</sup>          | Float | V   |
| 2374 | RO | Ub/Ubc H01 RMS <sup>1</sup>          | Float | V   |
| 2376 | RO | Uc/Uca H01 RMS <sup>1</sup>          | 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 <sup>1</sup>          | Float | V   |
| 3490 | RO | Ub/Ubc H63 RMS <sup>1</sup>          | Float | V   |
| 3492 | RO | Uc/Uca H63 RMS <sup>1</sup>          | 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       | $\Sigma$ kW Fund.   | Float  | W    |
| 27002    | RO       | $\Sigma$ kvar Fund. | Float  | var  |
| 27004    | RO       | $\Sigma$ kVA Fund.  | Float  | VA   |
| 27006    | RO       | dPF                 | Float  |      |
| 27008    | RO       | $\Sigma$ kW H02     | Float  | W    |
| 27010    | RO       | $\Sigma$ kvar H02   | Float  | var  |
| 27012    | RO       | $\Sigma$ kVA H02    | Float  | VA   |
| 27014    | RO       | PF H02              | Float  |      |
| ...      |          | ...                 |        |      |
| 27496    | RO       | $\Sigma$ kW H63     | Float  | W    |
| 27498    | RO       | $\Sigma$ kvar H63   | Float  | var  |

|       |    |                  |       |    |
|-------|----|------------------|-------|----|
| 27500 | RO | $\Sigma$ 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 <sup>1</sup>   | Float  | W    |
| 28002       | RO       | Pb TH <sup>1</sup>   | Float  | W    |
| 28004       | RO       | Pc TH <sup>1</sup>   | Float  | W    |
| 28006       | RO       | P TH                 | Float  | W    |
| 28008       | RO       | Qa TH <sup>1</sup>   | Float  | var  |
| 28010       | RO       | Qb TH <sup>1</sup>   | Float  | var  |
| 28012       | RO       | Qc TH <sup>1</sup>   | Float  | var  |
| 28014       | RO       | Q TH                 | Float  | var  |
| 28016       | RO       | Sa TH <sup>1</sup>   | Float  | VA   |
| 28018       | RO       | Sb TH <sup>1</sup>   | Float  | VA   |
| 28020       | RO       | Sc TH <sup>1</sup>   | Float  | VA   |
| 28022       | RO       | S TH                 | Float  | VA   |
| 28024       | RO       | PFa TH <sup>1</sup>  | Float  |      |
| 28026       | RO       | PFb TH <sup>1</sup>  | Float  |      |
| 28028       | RO       | PFc TH <sup>1</sup>  | Float  |      |
| 28030       | RO       | PF TH                | Float  |      |
| 28032~28038 |          | Reserved             | Float  |      |
| 28040       | RO       | Pa H01 <sup>1</sup>  | Float  | W    |
| 28042       | RO       | Pb H01 <sup>1</sup>  | Float  | W    |
| 28044       | RO       | Pc H01 <sup>1</sup>  | Float  | W    |
| 28046       | RO       | Qa H01 <sup>1</sup>  | Float  | var  |
| 28048       | RO       | Qb H01 <sup>1</sup>  | Float  | var  |
| 28050       | RO       | Qc H01 <sup>1</sup>  | Float  | var  |
| 28052       | RO       | Sa H01 <sup>1</sup>  | Float  | VA   |
| 28054       | RO       | Sb H01 <sup>1</sup>  | Float  | VA   |
| 28056       | RO       | Sc H01 <sup>1</sup>  | Float  | VA   |
| 28058       | RO       | PFa H01 <sup>1</sup> | Float  |      |
| 28060       | RO       | PFb H01 <sup>1</sup> | Float  |      |
| 28062       | RO       | PFc H01 <sup>1</sup> | Float  |      |
| ...         | RO       | ...                  | Float  |      |
| 29528       | RO       | Pa H63 <sup>1</sup>  | Float  | W    |
| 29530       | RO       | Pb H63 <sup>1</sup>  | Float  | W    |
| 29532       | ...      | Pc H63 <sup>1</sup>  | Float  | W    |
| 29534       | RO       | Qa H63 <sup>1</sup>  | Float  | var  |
| 29536       | RO       | Qb H63 <sup>1</sup>  | Float  | var  |
| 29538       | RO       | Qc H63 <sup>1</sup>  | Float  | var  |
| 29540       | RO       | Sa H63 <sup>1</sup>  | Float  | VA   |
| 29542       | RO       | Sb H63 <sup>1</sup>  | Float  | VA   |
| 29544       | RO       | Sc H63 <sup>1</sup>  | Float  | VA   |
| 29546       | RO       | PFa H63 <sup>1</sup> | Float  |      |
| 29548       | RO       | PFb H63 <sup>1</sup> | Float  |      |
| 29550       | RO       | PFc H63 <sup>1</sup> | 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 <sup>1</sup> | Float  | °    |
| 30020    | RO       | Ub/Ubc H01 Angle <sup>1</sup> | Float  |      |
| 30022    | RO       | Uc/Uca H01 Angle <sup>1</sup> | 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 <sup>1</sup> | Float |
| 31136 | RO | Ub/Ubc H63 Angle <sup>1</sup> | Float |
| 31138 | RO | Uc/Uca H63 Angle <sup>1</sup> | 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 <sup>1</sup>   | INT64  | wh   |
| 31504       | RW       | Total Harmonic kWh Export                | INT64  | wh   |
| 31508       | RW       | Total Harmonic kvarh Import <sup>1</sup> | INT64  | varh |
| 31512       | RW       | Total Harmonic kvarh Export <sup>1</sup> | 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 <sup>1</sup>                | INT64  | wh   |
| 31604       | RW       | kWh Exp. H01 <sup>1</sup>                | INT64  | wh   |
| 31608       | RW       | kvarh Imp. H01 <sup>1</sup>              | INT64  | varh |
| 31612       | RW       | kvarh Exp. H01 <sup>1</sup>              | INT64  | varh |
| 31616       | RW       | kWh Imp. H02 <sup>1</sup>                | INT64  | wh   |
| 31620       | RW       | kWh Exp. H02 <sup>1</sup>                | INT64  | wh   |
| 31624       | RW       | kvarh Imp. H02 <sup>1</sup>              | INT64  | varh |
| 31628       | RW       | kvarh Exp. H02 <sup>1</sup>              | INT64  | varh |
| ...         | RW       | ...                                      | INT64  |      |
| 32592       | RW       | kWh Imp. H63 <sup>1</sup>                | INT64  | wh   |
| 32596       | RW       | kWh Exp. H63 <sup>1</sup>                | INT64  | wh   |
| 32600       | RW       | kvarh Imp. H63 <sup>1</sup>              | INT64  | varh |
| 32604       | RW       | kvarh Exp. H63 <sup>1</sup>              | 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 <sup>1</sup>  | Float  | %, x100    |
| 33102    | RO       | Ub/Ubc TIHD <sup>1</sup>  | Float  | %, x100    |
| 33104    | RO       | Uc/Uca TIHD <sup>1</sup>  | 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 <sup>1</sup> | Float  | %, x100    |
| 33120    | RO       | Ub/Ubc TOIHD <sup>1</sup> | Float  | %, x100    |

|       |     |                           |       |         |
|-------|-----|---------------------------|-------|---------|
| 33122 | RO  | Uc/Uca TOIHD <sup>1</sup> | 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 <sup>1</sup> | Float | %, x100 |
| 33138 | RO  | Ub/Ubc TEIHD <sup>1</sup> | Float | %, x100 |
| 33140 | RO  | Uc/Uca TEIHD <sup>1</sup> | 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 <sup>1</sup> | Float | %, x100 |
| 33156 | RO  | Ub/Ubc IHD00 <sup>1</sup> | Float | %, x100 |
| 33158 | RO  | Uc/Uca IHD00 <sup>1</sup> | 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 <sup>1</sup> | Float | %, x100 |
| 33174 | RO  | Ub/Ubc IHD01 <sup>1</sup> | Float | %, x100 |
| 33176 | RO  | Uc/Uca IHD01 <sup>1</sup> | 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 <sup>1</sup> | Float | %, x100 |
| 34290 | RO  | Ub/Ubc IHD63 <sup>1</sup> | Float | %, x100 |
| 34292 | RO  | Uc/Uca IHD63 <sup>1</sup> | 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 <sup>1</sup>  | Float  | V    |
| 34502    | RO       | Ub/Ubc TIH RMS <sup>1</sup>  | Float  | V    |
| 34504    | RO       | Uc/Uca TIH RMS <sup>1</sup>  | 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 <sup>1</sup> | Float  | V    |
| 34520    | RO       | Ub/Ubc TOIH RMS <sup>1</sup> | Float  | V    |
| 34522    | RO       | Uc/Uca TOIH RMS <sup>1</sup> | 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 <sup>1</sup> | Float | V |
| 34538 | RO | Ub/Ubc TEIH RMS <sup>1</sup> | Float | V |
| 34540 | RO | Uc/Uca TEIH RMS <sup>1</sup> | 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 <sup>1</sup> | Float | V |
| 34556 | RO | Ub/Ubc IH00 RMS <sup>1</sup> | Float | V |
| 34558 | RO | Uc/Uca IH00 RMS <sup>1</sup> | 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 <sup>1</sup> | Float | V |
| 34574 | RO | Ub/Ubc IH01 RMS <sup>1</sup> | Float | V |
| 34576 | RO | Uc/Uca IH01 RMS <sup>1</sup> | 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 <sup>1</sup> | Float | V |
| 35690 | RO | Ub/Ubc IH63 RMS <sup>1</sup> | Float | V |
| 35692 | RO | Uc/Uca IH63 RMS <sup>1</sup> | 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 &amp; 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 <sup>1</sup>           | Float  | V    |
| 3602     | RO       | Ub <sup>1</sup>           | Float  | V    |
| 3604     | RO       | Uc <sup>1</sup>           | 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. <sup>1</sup>      | Float  | W    |
| 3632     | RO       | Pb Imp. <sup>1</sup>      | Float  | W    |
| 3634     | RO       | Pc Imp. <sup>1</sup>      | Float  | W    |
| 3636     | RO       | P Total Imp.              | Float  | W    |
| 3638     | RO       | Pa Exp. <sup>1</sup>      | Float  | W    |
| 3640     | RO       | Pb Exp. <sup>1</sup>      | Float  | W    |
| 3642     | RO       | Pc Exp. <sup>1</sup>      | Float  | W    |
| 3644     | RO       | P Total Exp.              | Float  | W    |
| 3646     | RO       | Qa Imp. <sup>1</sup>      | Float  | var  |
| 3648     | RO       | Qb Imp. <sup>1</sup>      | Float  | var  |
| 3650     | RO       | Qc Imp. <sup>1</sup>      | Float  | var  |
| 3652     | RO       | Q Total Imp.              | Float  | var  |
| 3654     | RO       | Qa Exp. <sup>1</sup>      | Float  | var  |
| 3656     | RO       | Qb Exp. <sup>1</sup>      | Float  | var  |
| 3658     | RO       | Qc Exp. <sup>1</sup>      | Float  | var  |
| 3660     | RO       | Q Total Exp.              | Float  | var  |
| 3662     | RO       | Sa <sup>1</sup>           | Float  | VA   |
| 3664     | RO       | Sb <sup>1</sup>           | Float  | VA   |
| 3666     | RO       | Sc <sup>1</sup>           | Float  | VA   |
| 3668     | RO       | S Total                   | Float  | VA   |
| 3670     | RO       | PFa <sup>1</sup>          | Float  | --   |
| 3672     | RO       | PFb <sup>1</sup>          | Float  | --   |
| 3674     | RO       | PFc <sup>1</sup>          | Float  | --   |
| 3676     | RO       | PF Total                  | Float  | --   |
| 3678     | RO       | Frequency                 | Float  | Hz   |
| 3680     | RO       | Ua Deviation <sup>1</sup> | Float  | 100% |

|      |    |                                 |       |      |
|------|----|---------------------------------|-------|------|
| 3682 | RO | Ub Deviation <sup>1</sup>       | Float | 100% |
| 3684 | RO | Uc Deviation <sup>1</sup>       | 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 <sup>1</sup>  | Float | 100% |
| 3694 | RO | Ub Over Deviation <sup>1</sup>  | Float | 100% |
| 3696 | RO | Uc Over Deviation <sup>1</sup>  | 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 <sup>1</sup> | Float | 100% |
| 3706 | RO | Ub Under Deviation <sup>1</sup> | Float | 100% |
| 3708 | RO | Uc Under Deviation <sup>1</sup> | 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 <sup>2</sup>         | Float |      |
| 3738 | RO | Ub/Ubc THD <sup>2</sup>         | Float |      |
| 3740 | RO | Uc/Uca THD <sup>2</sup>         | 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 <sup>2</sup>        | Float |      |
| 3756 | RO | Ub/Ubc TOHD <sup>2</sup>        | Float |      |
| 3758 | RO | Uc/Uca TOHD <sup>2</sup>        | 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 <sup>2</sup>        | Float |      |
| 3774 | RO | Ub/Ubc TEHD <sup>2</sup>        | Float |      |
| 3776 | RO | Uc/Uca TEHD <sup>2</sup>        | 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 <sup>1</sup>      | Float  | V    |
| 3902     | RO       | Ub <sup>1</sup>      | Float  | V    |
| 3904     | RO       | Uc <sup>1</sup>      | 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. <sup>1</sup> | Float  | W    |
| 3932     | RO       | Pb Imp. <sup>1</sup> | Float  | W    |
| 3934     | RO       | Pc Imp. <sup>1</sup> | Float  | W    |
| 3936     | RO       | P Total Imp.         | Float  | W    |
| 3938     | RO       | Pa Exp. <sup>1</sup> | Float  | W    |
| 3940     | RO       | Pb Exp. <sup>1</sup> | Float  | W    |
| 3942     | RO       | Pc Exp. <sup>1</sup> | Float  | W    |
| 3944     | RO       | P Total Exp.         | Float  | W    |
| 3946     | RO       | Qa Imp. <sup>1</sup> | Float  | var  |
| 3948     | RO       | Qb Imp. <sup>1</sup> | Float  | var  |
| 3950     | RO       | Qc Imp. <sup>1</sup> | Float  | var  |
| 3952     | RO       | Q Total Imp.         | Float  | var  |
| 3954     | RO       | Qa Exp. <sup>1</sup> | Float  | var  |
| 3956     | RO       | Qb Exp. <sup>1</sup> | Float  | var  |
| 3958     | RO       | Qc Exp. <sup>1</sup> | Float  | var  |
| 3960     | RO       | Q Total Exp.         | Float  | var  |
| 3962     | RO       | Sa <sup>1</sup>      | Float  | VA   |
| 3964     | RO       | Sb <sup>1</sup>      | Float  | VA   |
| 3966     | RO       | Sc <sup>1</sup>      | Float  | VA   |
| 3968     | RO       | S Total              | Float  | VA   |
| 3970     | RO       | PFa <sup>1</sup>     | Float  | -    |
| 3972     | RO       | PFb <sup>1</sup>     | Float  | -    |
| 3974     | RO       | PFc <sup>1</sup>     | 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 <sup>1</sup>      | See Section 5.7.5<br>Demand Data<br>Structure | V    |
| 4106     | 4806 | RO       | Ub <sup>1</sup>      |                                               |      |
| 4112     | 4812 | RO       | Uc <sup>1</sup>      |                                               |      |
| 4118     | 4818 | RO       | ULN Avg <sup>1</sup> |                                               |      |
| 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                   |                                               |      |
| 4160     | 4860 | RO       | Ib                   |                                               | A    |
| 4166     | 4866 | RO       | Ic                   |                                               |      |
| 4172     | 4872 | RO       | I Avg                |                                               |      |
| 4178     | 4878 | RO       | I4                   |                                               |      |
| 4184     | 4884 | RO       | I5                   |                                               |      |

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|------|------|----|---------------------------------|--|------|
| 4190 | 4890 | RO | Pa Imp. <sup>1</sup>            |  | W    |
| 4196 | 4896 | RO | Pb Imp. <sup>1</sup>            |  |      |
| 4202 | 4902 | RO | Pc Imp. <sup>1</sup>            |  |      |
| 4208 | 4908 | RO | P Imp. Total                    |  |      |
| 4214 | 4914 | RO | Pa Exp. <sup>1</sup>            |  |      |
| 4220 | 4920 | RO | Pb Exp. <sup>1</sup>            |  | W    |
| 4226 | 4926 | RO | Pc Exp. <sup>1</sup>            |  |      |
| 4232 | 4932 | RO | P Exp. Total                    |  |      |
| 4238 | 4938 | RO | Qa Imp. <sup>1</sup>            |  |      |
| 4244 | 4944 | RO | Qb Imp. <sup>1</sup>            |  |      |
| 4250 | 4950 | RO | Qc Imp. <sup>1</sup>            |  | var  |
| 4256 | 4956 | RO | Q Imp. Total                    |  |      |
| 4262 | 4962 | RO | Qa Exp. <sup>1</sup>            |  |      |
| 4268 | 4968 | RO | Qb Exp. <sup>1</sup>            |  |      |
| 4274 | 4974 | RO | Qc Exp. <sup>1</sup>            |  |      |
| 4280 | 4980 | RO | Q Exp. Total                    |  | VA   |
| 4286 | 4986 | RO | Sa <sup>1</sup>                 |  |      |
| 4292 | 4992 | RO | Sb <sup>1</sup>                 |  |      |
| 4298 | 4298 | RO | Sc <sup>1</sup>                 |  |      |
| 4304 | 5004 | RO | S Total                         |  |      |
| 4310 | 5010 | RO | PFa <sup>1</sup>                |  | Hz   |
| 4316 | 5016 | RO | PFb <sup>1</sup>                |  |      |
| 4322 | 5022 | RO | PFc <sup>1</sup>                |  |      |
| 4328 | 5028 | RO | PF Total                        |  |      |
| 4334 | 5034 | RO | Frequency                       |  |      |
| 4340 | 5040 | RO | Ua Deviation <sup>1</sup>       |  | 100% |
| 4346 | 5046 | RO | Ub Deviation <sup>1</sup>       |  |      |
| 4352 | 5052 | RO | Uc Deviation <sup>1</sup>       |  |      |
| 4358 | 5058 | RO | Uab Deviation                   |  |      |
| 4364 | 5064 | RO | Ubc Deviation                   |  |      |
| 4370 | 5070 | RO | Uca Deviation                   |  |      |
| 4376 | 5076 | RO | Ua Over Deviation <sup>1</sup>  |  |      |
| 4382 | 5082 | RO | Ub Over Deviation <sup>1</sup>  |  |      |
| 4388 | 5088 | RO | Uc Over Deviation <sup>1</sup>  |  |      |
| 4394 | 5094 | RO | Uab Over Deviation              |  |      |
| 4400 | 5100 | RO | Ubc Over Deviation              |  |      |
| 4406 | 5106 | RO | Uca Over Deviation              |  |      |
| 4412 | 5112 | RO | Ua Under Deviation <sup>1</sup> |  |      |
| 4418 | 5118 | RO | Ub Under Deviation <sup>1</sup> |  |      |
| 4424 | 5124 | RO | Uc Under Deviation <sup>1</sup> |  |      |
| 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 <sup>2</sup>         |  |      |
| 4514 | 5214 | RO | Ub/Ubc THD <sup>2</sup>         |  |      |
| 4520 | 5220 | RO | Uc/Uca THD <sup>2</sup>         |  |      |
| 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 <sup>2</sup>        |  |      |
| 4568 | 5268 | RO | Ub/Ubc TOHD <sup>2</sup>        |  |      |
| 4574 | 5274 | RO | Uc/Uca TOHD <sup>2</sup>        |  |      |
| 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 <sup>2</sup> |  |   |
| 4622 | 5322 | RO | Ub/Ubc TEHD <sup>2</sup> |  |   |
| 4628 | 5328 | RO | Uc/Uca TEHD <sup>2</sup> |  |   |
| 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<br>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 &amp; AER Real-time Measurements (INT64)

### 5.8.2 Real-time IER & AER (INT32)

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

$$\begin{aligned} \sum kxh (\text{Import/Export/Net/Total}) \\ &= E1 \times 100 \text{ Gxh} + E2 \times 0.1 \text{ kxh} \\ &= E1 \times 10^8 \text{ kxh} + E2 \times 0.1 \text{ kxh} \end{aligned}$$

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  $1 \times 10^{11}$  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 &amp; 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 | UINT16 | 0-37 (Year-2000) |
|        | RO       |             |        | 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,<br>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<br>1=Region A (undefined),<br>2=Region B (no interruption),<br>3=Region C (probable abnormal operation),<br>4=Region D (undefined) |
| +32      | RO | Location in ITIC Plot     |                     | UINT32 | 0=Reserved<br>1=Region A (no interruption in function)<br>2=Region B (no damage)<br>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 <sup>2</sup>     | See Note 1) | -                                                        |
| +5     | RO       | Flagging Data Status         | UINT16      | 0=Not Flagged<br>1=Flagged & Removed<br>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     | 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<br>1=Before Last Reset/Last Month |
| +2        | RO       | Recording Time <sup>2</sup> | Bitmap |                                                                 |
| +5        | RO       | Flagging Data Status        | UINT16 | 0=Not Flagged<br>1=Flagged & Removed<br>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       | 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       | High-Year (-2000)            | Bitmap                                       |                            |
|        |          | Low- Month                   |                                              |                            |
| +1     | RO       | High- Day                    |                                              |                            |
|        |          | Low- Hour                    |                                              |                            |
| +2     | RO       | High- Minute                 |                                              |                            |
|        |          | Low- Second                  |                                              |                            |
| +3     | RO       | Flagging Status <sup>1</sup> | Bit 0=Dip, Bit 1=Swell<br>Bit 2=Interruption | 0=Not Flagged<br>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 &amp; 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 &amp; AER Log Data Structure (INT64)

| Offset  | Property | Description                 | Format | Note |
|---------|----------|-----------------------------|--------|------|
| +0~+2   | RO       | Start Time <sup>1</sup>     | 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 &amp; 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 &amp; AER Log Buffer (INT32)

## 5.9.8.4 IER &amp; AER Log Data Structure (INT32)

| Offset  | Property | Description                    | Format | Note |
|---------|----------|--------------------------------|--------|------|
| +0~+2   | RO       | Start Time <sup>1</sup>        | 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 &amp; AER Log Data Structure (INT32)

## Note:

- 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  |                                                                                                     |
| 24310       | RO | Ub Plt CP95            | Float  | CP95 of Plt for 3-phase over 1 week                                                                 |
| 24312       | RO | Uc Plt CP95            | Float  |                                                                                                     |
| 24314       | RO | U Unbalance Conclusion | UINT32 |                                                                                                     |
| 24316       | RO | U Unbalance N Valid    | UINT32 |                                                                                                     |
| 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 |                                                                                                     |
| 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 2 <sup>nd</sup> 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 25 <sup>th</sup> 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 2 <sup>nd</sup> 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 25 <sup>th</sup> 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 2 <sup>nd</sup> 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 25 <sup>th</sup> harmonics on 3-phase over 1 week                                           |
| 25046       | RO | Ub H25 Min.            | Float  |                                                                                                     |

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|             |    |                          |        |                                                                |
|-------------|----|--------------------------|--------|----------------------------------------------------------------|
| 25048       | RO | Uc H25 Min.              | Float  |                                                                |
| 25050~25060 |    | Reserved                 |        |                                                                |
| 25062       | RO | Ua H02 CP95              | Float  | CP95 2 <sup>nd</sup> 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 25 <sup>th</sup> 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 2 <sup>nd</sup> 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 25 <sup>th</sup> 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 1 <sup>st</sup> 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 25 <sup>th</sup> 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 1 <sup>st</sup> 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 25 <sup>th</sup> 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 1 <sup>st</sup> 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 25 <sup>th</sup> 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 1 <sup>st</sup> 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 25 <sup>th</sup> 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                                               |

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|             |    |                    |        |                                                                                                            |
|-------------|----|--------------------|--------|------------------------------------------------------------------------------------------------------------|
| 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       | High: Year (-2000)<br>Low: Month |        |
| +1     | RO       | High: Day<br>Low: Hour           |        |
| +2     | RO       | High: Minute<br>Low: Second      |        |
| +3~+4  | RO       | Frequency Value                  |        |

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<br>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                              | Float                |
| 36505       | RO       | Period PF Avg. (Avg. PF over the Period) |                      |
| 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    | See Section 5.9.11.5 |
| 36903~36942 | RO       | Tariff #1 Data |                      |
| 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 <sup>1</sup>   |        |
| 25     | RO       | kW Exp. Max. Demand                          | Float  |
| 27     | RO       | kW Exp. Max. Demand Timestamp <sup>1</sup>   |        |
| 30     | RO       | kvar Imp. Max. Demand                        | Float  |
| 32     | RO       | kvar Imp. Max. Demand Timestamp <sup>1</sup> |        |
| 35     | RO       | kvar Exp. Max. Demand                        | Float  |
| 37     | RO       | kvar Exp. Max. Demand Timestamp <sup>1</sup> |        |

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 <sup>1</sup>      | UINT32 |            | 0=Weekly Report*<br>1=Daily Report |
| 38702    | RW       | Report Index N <sup>1</sup>   | UINT32 |            |                                    |
| 38705    | RO       | Start Time <sup>2</sup>       | UINT32 |            |                                    |
| 38708    | RO       | End Time <sup>2</sup>         | 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 (CP99)  | 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 1 <sup>st</sup> Sample   | Float  |            |
| ...         | RO       | ...                         | Float  |            |
| 54030       | RO       | Ia 512 <sup>nd</sup> Sample | Float  |            |
| 54032       | RO       | Ib 1 <sup>st</sup> Sample   | Float  |            |
| ...         | RO       | ...                         | Float  |            |
| 55054       | RO       | Ib 512 <sup>nd</sup> Sample | Float  |            |
| 55056       | RO       | Ic 1 <sup>st</sup> Sample   | Float  |            |
| ...         | RO       | ...                         | Float  |            |
| 56078       | RO       | Ic 512 <sup>nd</sup> Sample | Float  |            |
| 56080       | RO       | Ua 1 <sup>st</sup> Sample   | Float  |            |
| ...         | RO       | ...                         | Float  |            |
| 57102       | RO       | Ua 512 <sup>nd</sup> Sample | Float  |            |
| 57104       | RO       | Ub 1 <sup>st</sup> Sample   | Float  |            |
| ...         | RO       | ...                         | Float  |            |
| 58126       | RO       | Ub 512 <sup>nd</sup> Sample | Float  |            |
| 58128       | RO       | Uc 1 <sup>st</sup> Sample   | Float  |            |
| ...         | RO       | ...                         | Float  |            |
| 59150       | RO       | Uc 512 <sup>nd</sup> 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                      | 1 to 247, 100*                         |
| 40001       | RW       |                    | Baud rate <sup>1</sup>       | 0 to 5, 3*                             |
| 40002       | RW       |                    | Parity                       | 0=None, 1=Odd, 2=Even*                 |
| 40003       | RW       |                    | Stop Bit                     | 1=1 Bit*, 2=2 Bits                     |
| 40004       | RW       |                    | Protocol                     | 0=Modbus RTU*, 1=EtherGate, 2=Disabled |
| 40005       | RW       |                    | EtherGate Port               | 20000* to 60000                        |
| 40006~40007 | RW       | Reserved           | UINT16                       |                                        |
| 40008       | RW       | RS-485 Port 2 (P4) | Unit ID                      | 1 to 247, 101*                         |
| 40009       | RW       |                    | Baud rate <sup>1</sup>       | 0 to 5, 3*                             |
| 40010       | RW       |                    | Parity                       | 0=None, 1=Odd, 2=Even*                 |
| 40011       | RW       |                    | Stop Bit                     | 1=1 Bit*, 2=2 Bits                     |
| 40012       | RW       |                    | Protocol                     | 0=Modbus RTU*, 1=EtherGate, 2=Disabled |
| 40013       | RW       |                    | EtherGate Port               | 20000 to 60000, 20001*                 |
| 40014~40015 | RW       | Reserved           | UINT16                       |                                        |
| 40016       | RW       | Ethernet 1 (P1)    | IP Address <sup>2</sup>      | 0xC0A80064 (192.168.0.100)             |
| 40018       | RW       |                    | Subnet Mask <sup>2</sup>     | 0xFFFFFFFF (255.255.255.0)             |
| 40020       | RW       |                    | Default Gateway <sup>2</sup> | 0xC0A80001 (192.168.0.1)               |
| 40022       | RW       | Reserved           |                              |                                        |
| 40024       | RW       | Ethernet 2         | IP Address <sup>2</sup>      | 0xC0A80164 (192.168.1.100)             |

|             |    |      |                           |        |                               |
|-------------|----|------|---------------------------|--------|-------------------------------|
| 40026       | RW | (P2) | Subnet Mask <sup>2</sup>  | UINT32 | 0xFFFFFFFF (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:**

- Baudrate options: 0=1200, 1=2400, 2=4800, 3=9600, 4=19200, 5=38400
- 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 <sup>1</sup>                | UINT16 | 0=Status Input*, 1=Pulse Counter<br>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 <sup>2</sup>       | 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 <sup>1</sup>                | 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 <sup>2</sup>       | UINT16 | 0=Any Edge*, 1=Positive, 2=Negative                              |
| 40168       | RW       | DI8 Setpoint Trigger                 | UINT32 | 0*                                                               |
| 40170~40171 | RW       | Reserved                             | UINT16 |                                                                  |
| 40172       | RW       | DI9 Mode <sup>1,4</sup>              | UINT16 | 0=Status Input*, 1=Pulse Counter, 2=DMD Sync                     |
| 40173       | RW       | DI9 Debounce <sup>4</sup>            | UINT16 | 1 to 9999 (ms), 20ms*                                            |
| 40174       | RW       | DI9 Pulse Weight <sup>4</sup>        | UINT32 | 1*~1,000,000                                                     |
| 40176       | RW       | DI9 Setpoint Type <sup>2,4</sup>     | UINT16 | 0=Any Edge*, 1=Positive, 2=Negative                              |
| 40177       | RW       | DI9 Setpoint Trigger <sup>3,4</sup>  | UINT32 | 0*                                                               |
| 40179~40180 | RW       | Reserved                             | UINT16 |                                                                  |
| ...         |          | ...                                  | UINT16 | ...                                                              |
| 40235       | RW       | DI16 Mode <sup>1,4</sup>             | UINT16 | 0=Status Input*, 1=Pulse Counter, 2=DMD Sync                     |
| 40236       | RW       | DI16 Debounce <sup>4</sup>           | UINT16 | 1 to 9999 (ms), 20ms*                                            |
| 40237       | RW       | DI16 Pulse Weight <sup>4</sup>       | UINT32 | 1*~1,000,000                                                     |
| 40239       | RW       | DI16 Setpoint Type <sup>2,4</sup>    | UINT16 | 0=Any Edge*, 1=Positive, 2=Negative                              |
| 40240       | RW       | DI16 Setpoint Trigger <sup>3,4</sup> | UINT32 | 0*                                                               |
| 40242~40243 | RW       | Reserved                             | UINT16 |                                                                  |
| 40244       | RW       | DI Excitation Type                   | UINT16 | 0=DC*, 1=AC                                                      |

Table 5-75 DI Setup Parameter

**Notes:**

- 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**.
- The DIx Setpoint Type only affects which edge would trigger the Waveform Recorder, RMS Recorder and iTrigger, if configured.
- 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 Dlx'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 <sup>1</sup> | UINT16 | 0=Enabled*, 1=Disabled          |
| 40302    | RW       | Alarm Pulse Width               | UINT16 | 0* (Latch Mode) to 6000 (x0.1s) |
| 40303    | RW       | DO1 Pulse Width <sup>2</sup>    | UINT16 |                                 |
| 40304    | RW       | DO2 Pulse Width <sup>2</sup>    | UINT16 |                                 |
| 40305    | RW       | DO3 Pulse Width <sup>2</sup>    | UINT16 |                                 |
| 40306    | RW       | DO4 Pulse Width <sup>2,3</sup>  | UINT16 |                                 |
| 40307    | RW       | DO5 Pulse Width <sup>2,3</sup>  | UINT16 |                                 |
| 40308    | RW       | DO6 Pulse Width <sup>2,3</sup>  | UINT16 |                                 |
| 40309    | RW       | DO7 Pulse Width <sup>2,3</sup>  | 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 <sup>1</sup> | 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 <sup>1</sup> | 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,<br>-1 represents Cross-Group<br>Trigger disabled |
| 40729    | RW       | iTrigger Group 2 | INT16  |                                                               |
| 40730    | RW       | iTrigger Group 3 | INT16  |                                                               |

|       |    |                                 |        |                                                                                                                                    |
|-------|----|---------------------------------|--------|------------------------------------------------------------------------------------------------------------------------------------|
| 40731 | RW | iTrigger 1 Actions <sup>1</sup> | UINT32 | DWR*                                                                                                                               |
| 40733 | RW | Reserved                        | UINT16 |                                                                                                                                    |
| 40734 | RW | iTrigger 2 Actions <sup>1</sup> | UINT32 | WFR*                                                                                                                               |
| 40736 | RW | Reserved                        | UINT16 |                                                                                                                                    |
| 40737 | RW | iTrigger 3 Actions <sup>1</sup> | 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*)<br>BIT1=Multicast (0*)<br>BIT2= Multicast Receive (0*)<br>BIT3=Multicast Send (0*)<br>0=Disabled, 1=Enabled |
| 40742 | RW | Multicast IP                    | UINT32 | 0xE0000100 ~ 0xFFFFFFFF,<br>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 <sup>1</sup>           | UINT16 | 0*, 1                                                                                                                                |
| 40752       | RW       | Interruption Mode <sup>2</sup>              | 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 <sup>11</sup>        | UINT16 | 0=No*, 1=Yes                                                                                                                         |
| 40757       | RW       | PQD Triggers DO                             | UINT16 | BIT0=Swell triggers DO (0*)<br>BIT1=Dip triggers DO (1*)<br>BIT2=Interruption triggers DO (0*)<br>0=When PQD Starts, 1=When PQD Ends |
| 40758       | RW       | Energy Rollover                             | UINT16 | 0=99,999,999,999 (kWh/kvarh/kVAh)*<br>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<br>Format 2: smtp.163.com                                                                           |
| 40780       | RW       | 1588 Time Sync. PTP Domain <sup>11</sup>    | UINT16 | 0* to 255                                                                                                                            |
| 40781       | RW       | 1588 Time Sync. PTP Primary 1 <sup>11</sup> | UINT16 | 0 to 255, 240*                                                                                                                       |
| 40782       | RW       | 1588 Time Sync. PTP Primary 2 <sup>11</sup> | UINT16 | 0 to 255, 240*                                                                                                                       |
| 40783~40792 | RW       | 61850 IED Name <sup>11</sup>                | Char   | Null*                                                                                                                                |
| 40793       | RW       | IEC 61850 Validity Mode <sup>11</sup>       | UINT16 | 0 = Option 1 (all good)*                                                                                                             |
| 40794~40795 |          | Reserved                                    |        |                                                                                                                                      |
| 40796       | RW       | HS Frequency Enable <sup>11</sup>           | UINT16 | 0=Disabled*, 1=Enabled                                                                                                               |
| 40797       | RW       | SSH Enable                                  | UINT16 | 0=Disabled*, 1=Enabled                                                                                                               |
| 40798       | RW       | Reserved                                    | UINT16 |                                                                                                                                      |
| 40799       | RW       | Delimiter <sup>3</sup>                      | UINT16 | 0=Option 1*, 1=Option 2                                                                                                              |
| 40800       | RW       | Clock Source                                | UINT16 | 0=RTC*, 1=SNTP, 2=GPS, 3=IRIG-B,<br>4=Reserved, 5=1588-P1, 6=1588-P2                                                                 |
| 40801       | RW       | Time Zone <sup>4</sup>                      | UINT16 | 0 to 32, 26*                                                                                                                         |
| 40802       | RW       | IRIG-B Time Zone <sup>4</sup>               | UINT16 | 0 to 32, 26*                                                                                                                         |
| 40803       | RW       | Language                                    | UINT16 | 0=English*, 1= Simplified Chinese<br>2=Traditional Chinese                                                                           |
| 40804       | RW       | Date Format                                 | UINT16 | 0=YYMMDD*, 1=MMDDYY<br>2=DDMMYY, 3=YYYY-MM-DD<br>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 <sup>6</sup>             | UINT16 | 0x00                                                             |
| 40820       | RW | Reserved                                             | UINT16 |                                                                  |
| 40821       | RW | Aggregation Interval (Refresh Rate) <sup>7</sup>     | UINT16 | 0=50/60cycles*<br>1=150/180cycles<br>2=10-min<br>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 <sup>8</sup>              | UINT16 | 0=0*, 1=Actual Sampling                                          |
| 40825       | RW | Eliminate Flagged Data <sup>9</sup>                  | UINT16 | 0=Disabled*, 1=Enabled                                           |
| 40826~40833 | RW | FTP User Name <sup>10</sup>                          | Char   | operator*                                                        |
| 40834~40841 | RW | FTP User Password <sup>10</sup>                      | 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 | 443*                                                             |
| 40860       | RW | FTP Port No.                                         | UINT16 | 1 to 65535                                                       |
| 40861       | RW | Telnet Port No.                                      | UINT16 | 21*                                                              |
| 40862~40863 | RW | Reserved                                             | UINT16 | 23*                                                              |
| 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 <sup>11</sup> | UINT16 | 0=Disabled*, 1=Enabled                                           |
| 40879~40886 | RW | IEC 61850 Client Authentication Key                  | CHAR   | ASCII (Must occupy 16 bytes)<br>6365742D656C6563747269632E636F6D |
| 40887~40892 | RW | IEC 61850 Authentication Code <sup>12</sup>          | 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. <sup>11</sup>                     | 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  $\frac{1}{2}$  cycle (register value = 0) or if the  $U_{rms}$  is computed every  $\frac{1}{2}$  cycle and then shifted by  $\frac{1}{2}$  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 **Interrupt 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 <sup>2</sup>      | CHAR   | 40 characters, Null*   |
| 40925    | RW       | Source User Name <sup>3</sup>          | CHAR   | 40 characters, Null*   |
| 40945    | RW       | Login Password <sup>4</sup>            | CHAR   | 20 characters, Null*   |
| 40955    | RW       | Destination Email Address <sup>5</sup> | 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       |            | 21  | Reserved                             |            |
| 13   | Setpoint       | SOE Log    | 22  | Motor Start                          |            |
| 14   | HS Setpoint    |            | 23  | Reserved                             |            |
| 15   | I/O            |            | 24  | Record<br>(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](mailto: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](mailto: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<br>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 <sup>1</sup>             | Bitmap | 0=Normal*, 1=Reverse                                                                              |
| 41026    | RW       | Composite I                          | UINT16 | 0= No Composite*, 1=Phase A<br>2=Phase B, 3=Phase C                                               |
| 41027    | RW       | Power Factor Convention <sup>2</sup> | UINT16 | 0=IEC*, 1=IEEE, 2=-IEEE                                                                           |
| 41028    | RW       | kVA Calculation <sup>3</sup>         | UINT16 | 0=Vector*, 1=Standard                                                                             |
| 41029    | RW       | HD Calculation                       | UINT16 | 0=% of FUND*, 1=% of RMS<br>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 <sup>4</sup> |        | 0=Disabled, 1=Enabled*                                                                            |
| 41033    | RW       | U0 Polarity                          | UINT16 | 0=Normal*, 1=Reverse                                                                              |
| 41034    | RW       | Neutral Connection                   | UINT16 | 0=Directly/Small Resistance/Reactance*<br>1=Ungrounded/High Resistance<br>2= Arc Suppression Coil |
| 41035    | RW       | SCCP Option                          | UINT16 | • 0=5A (50A) @10mV/A*<br>• 1=20A@10mV/A                                                           |

|       |    |                                       |        |                                                                                                                                                    |
|-------|----|---------------------------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------|
|       |    |                                       |        | <ul style="list-style-type: none"> <li>• 2=200A@1mV/A</li> <li>• 3=500A @1mV/A</li> <li>• 4=500A(550A) @1mV/A</li> <li>• 5=5kA @0.1mV/A</li> </ul> |
| 41036 | RW | Reserved                              | UINT16 |                                                                                                                                                    |
| 41037 | RW | TDD Preset IL Primary <sup>5</sup>    | UINT32 |                                                                                                                                                    |
| 41039 | RW | I4 TDD Preset IL Primary <sup>5</sup> | UINT32 | 0*~30,000A (x0.001A)                                                                                                                               |

<sup>5</sup>~Available in the Firmware V2.51.50 or later

**Table 5-89 Basic Setup Parameters**

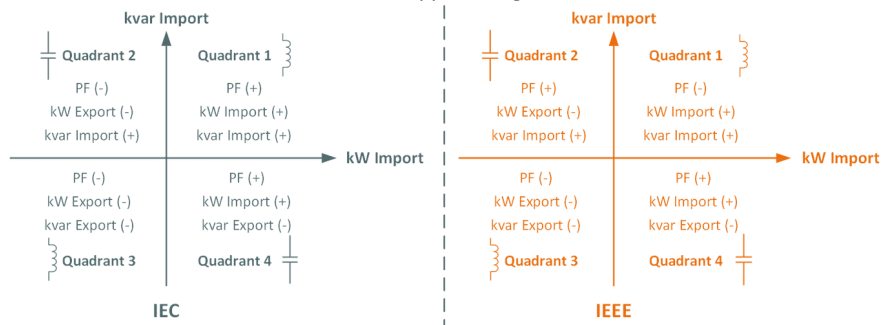
**Notes:**

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):**  $kVA_{total} = \sqrt{kW_{total}^2 + kvar_{total}^2}$

**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 <sup>2</sup>          | UINT32 | DWR & RMSR*                                                   |
| 41087       | RW       | Reserved                                    | UINT16 |                                                               |
| 41088       | RW       | Dip Trigger Actions <sup>2</sup>            | UINT32 | DWR & RMSR*                                                   |
| 41090       | RW       | Reserved                                    | UINT16 |                                                               |
| 41091       | RW       | Interruption Trigger Actions <sup>2</sup>   | UINT32 | DWR & RMSR*                                                   |
| 41093       | RW       | Reserved                                    | UINT16 |                                                               |
| 41094       | RW       | ITIC Alarm Trigger Actions <sup>3</sup>     | UINT32 | DO, iTrigger                                                  |
| 41096       | RW       | SEMI F47 Alarm Trigger Actions <sup>3</sup> | 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)*<br>1=Usr (Sliding Reference Voltage) |
| 41102       | RW       | Swell Threshold <sup>1</sup>                | UINT16 | 101 to 200 (x0.01Udin/Usr), 110*                              |
| 41103       | RW       | Dip Threshold <sup>1</sup>                  | UINT16 | 1 to 99 (x0.01 Udin/Usr), 90*                                 |
| 41104       | RW       | Interruption Threshold <sup>1</sup>         | UINT16 | 0 to 50 (x0.01 Udin/Usr), 5*                                  |
| 41105       | RW       | Swell Hysteresis <sup>1</sup>               | UINT16 |                                                               |
| 41106       | RW       | Dip Hysteresis <sup>1</sup>                 | UINT16 | 1 to 1000 (x0.001 Udin/Usr), 20*                              |
| 41107       | RW       | Interruption Hysteresis <sup>1</sup>        | UINT16 |                                                               |
| 41108~41110 | RW       | Reserved                                    | UINT32 |                                                               |
| 41112       | RW       | Transient Enable                            | UINT16 | 0=Disabled, 1=Enabled*                                        |
| 41113       | RW       | Transient Threshold <sup>1</sup>            | UINT16 | 5 to 500 (%), 35*                                             |
| 41114       | RW       | Transient Trigger <sup>3</sup>              | UINT32 | WFR*                                                          |
| 41116~41119 | RW       | Reserved                                    | UINT16 |                                                               |

|             |    |                                                 |        |                                                            |
|-------------|----|-------------------------------------------------|--------|------------------------------------------------------------|
| 41120       | RW | Inrush Current Enable                           | UINT16 | 0=Disabled*, 1=Enabled                                     |
| 41121       | RW | Inrush Current Threshold <sup>1</sup>           | 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 <sup>4</sup>      | 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 <sup>4</sup>                        | 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 U <sub>din</sub> /U <sub>sr</sub> ), 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 U <sub>din</sub> /U <sub>sr</sub> ), 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 U <sub>din</sub> /U <sub>sr</sub> ), 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 <sup>2</sup>        | UINT32 | WFR & RMSR*                                                |

Table 5-91 PQ Log Setup

**Notes:**

- The values for the **Dip Threshold**, **Swell Threshold**, **Voltage Interruption Threshold** and **Dip/Swell Hysteresis** should be configured to meet the following criteria:
  - The **Voltage Interruption Threshold** shall be set below **Dip Threshold**.
  - The **Dip/Swell Hysteresis** must be less than the **Dip/Swell Threshold**.
  - The **RVC Threshold** must be less than the **Dip and Swell Thresholds**.
  - Regardless of whether **Dip/Swell** is enabled, the conditions for a), b) and c) must always be met.
- 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 Dlx'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 <sup>1</sup> | UINT16 | Default=0xFFFF (Manual) |
| 41254    | RW       | Predicated Response         | UINT16 | 70* to 99               |

**Table 5-94 Demand Setup**

**Notes:**

- 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  $0 \leq \text{Hour} \leq 23$  and  $1 \leq \text{Day} \leq 28$ . 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*<br>• (40-3200) @ 128<br>• (40-1600) @ 256<br>• (40-800) @ 512<br>• (40-400) @ 1024 |
| 41303    | RW       | Sampling Rates            | UINT16 | 0=128 Samples/Cycles<br>1=256 Samples/Cycles<br>2=512 Samples/Cycles*<br>3=1024 Samples/Cycles                           |
| 41304    | RW       | Adaptive WFR <sup>1</sup> | 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*<br>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:**

- 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)<br>Low - Month |
| +1     | High - Day<br>Low - Hour           |
| +2     | High - Minute<br>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 <sup>1</sup>  | UINT16 | 0=1000*, 1=3200, 2=5000<br>3=6400, 4=12800 (imp/kWh)<br>5=a value between 0 and 65535 |
| 41351    | RW       | Energy / Pulse <sup>2</sup>         | UINT16 | 1* to 65535, x0.1 kxh/imp                                                             |
| 41352    | RW       | Energy Pulse Type                   | UINT16 | See note 3), 0*                                                                       |
| 41353    | RW       | Energy Pulse Output #1 <sup>4</sup> | UINT16 | 0* to 18                                                                              |
| 41354    | RW       | Reserved                            | UINT16 |                                                                                       |
| 41355    | RW       | Energy Pulse Output #2 <sup>4</sup> | UINT16 | 0* to 18                                                                              |
| 41356    | RW       | Reserved                            | UINT16 |                                                                                       |
| 41357    | RW       | Energy Pulse Output #3 <sup>4</sup> | UINT16 | 0* to 18                                                                              |
| 41358    | RW       | Reserved                            | UINT16 |                                                                                       |
| 41359    | RW       | Energy Pulse Output #4 <sup>4</sup> | 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  $Z = V_{\text{nominal}} \times I_{\text{nominal}} \times 2$ , where  $V_{\text{nominal}}$  and  $I_{\text{nominal}}$  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  $V_{\text{nominal}}$  and  $I_{\text{nominal}}$ ) 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 <sup>1</sup>      | UINT32 | 0*                                               |
| 41402    | RW       |               | Type                        | UINT16 | 0=Disabled*<br>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 <sup>2</sup> | UINT32 | 0=Disabled*                                      |
| 41411    | RW       |               | Reserved                    | UINT32 |                                                  |
| ...      |          | ...           |                             |        | ...                                              |
| 44715    | RW       | Setpoint #256 | Parameter <sup>1</sup>      | UINT32 | 0*                                               |
| 44717    | RW       |               | Type                        | UINT16 | 0=Disabled*<br>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 <sup>2</sup> | 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 <sup>3</sup> | 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      | See Table 5-102 above                            |
| 45402    | RW       |                 | Type           | 0=Disabled*<br>1=Over Setpoint, 2=Under Setpoint |
| 45403    | RW       |                 | Active Limit   | 0*                                               |
| 45405    | RW       |                 | Inactive Limit | 0*                                               |
| 45407    | RW       |                 | Active Delay   | 0 to 9999 cycle, 10*                             |
| 45408    | RW       |                 | Inactive Delay | 0 to 9999 cycle, 10*                             |
| 45409    | RW       |                 | Trigger Action | See Table 5-103, Default=0                       |
| 45411    | RW       |                 | Reserved       |                                                  |
| ...      |          | ...             |                | ...                                              |
| 45595    | RW       | HS Setpoint #16 | Parameter      | See Table 5-102 above                            |
| 45597    | RW       |                 | Type           | 0=Disabled*<br>1=Over Setpoint, 2=Under Setpoint |
| 45598    | RW       |                 | Active Limit   | 0*                                               |
| 45600    | RW       |                 | Inactive Limit | 0*                                               |
| 45602    | RW       |                 | Active Delay   | 0 to 9999 cycle, 10*                             |
| 45603    | RW       |                 | Inactive Delay | 0 to 9999 cycle, 10*                             |
| 45604    | RW       |                 | Trigger Action | See Table 5-103, Default=0                       |
| 45606    | RW       |                 | Reserved       |                                                  |

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<br>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 <b>Appendix A</b> and <b>B</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 <b>Section 5.10.17.2</b><br><b>Data Recorder Setup Data Structure</b> |
| 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 <sup>1</sup>       | UINT16 | 0=Disabled, 1=Triggered by Timer<br>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 <sup>2</sup>     | UINT16 | 0 to 43200 (s)                                                                                                                                                |
| +6     | RW       | Number of Parameters <sup>3</sup> | UINT16 | 0 to 64                                                                                                                                                       |
| +7     | RW       | Parameter 1                       | UINT16 | Please refer to <b>Appendices A</b> and <b>C</b> 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  $0 \leq \text{Hour} \leq 23$  and  $1 \leq \text{Day} \leq 28$ . 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 &amp; AER Setup

| Register |       | Property | Description    | Format | Range/Option, Default*                                  |
|----------|-------|----------|----------------|--------|---------------------------------------------------------|
| IER      | AER   |          |                |        |                                                         |
| 49700    | 49730 | RW       | Recording Mode | UINT16 | 0=Disabled<br>1=Stop-When-Full<br>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<br>~<br>49706 | 49734<br>~<br>49736 | RW | Start Time <sup>2</sup> | 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 &amp; 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 <sup>1</sup>                  | UINT16 | 0=Disabled*, 1=Standard<br>2=Custom                                       |
| 44801    | RW       | HVDC Enable <sup>2</sup>                        | UINT16 | 0=No*, 1=Yes                                                              |
| 44802    | RW       | Enable Power Generation Facilities <sup>3</sup> | UINT16 | 0=No*, 1=Yes                                                              |
| 44803    | RW       | PCC Voltage                                     | UINT32 | 1~9999000V, 415*<br>PCC Voltage = $U_{llNominal} \times PT \text{ Ratio}$ |
| 44805    | RW       | Max. Short-Circuit Current (SCR) <sup>4</sup>   | UINT32 | 1~9999000A, 40000*                                                        |
| 44807    | RW       | First Day of Week <sup>5</sup>                  | UINT16 | 0=Sunday*<br>1~0=Monday to Saturday                                       |
| 44808    | RW       | Alert Notification                              | UINT16 | 0=Alarm Email*<br>1=Periodic Email                                        |

Table 5-116 IEEE Std 519-2022 Report Basic Parameters Setup

#### Notes:

- 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  $\neq 0$ : 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 ( $M < 1$ ).
- The **HVDC** is used for High-voltage systems ( $> 161\text{kV}$ ) 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%.
- 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  $I_{sc}/I_L$
- Modification of the **Max. Short Circuit Current** ( $I_{sc}$ ) may change the SCR ( $I_{sc}/I_L$ ) 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.
- 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*<br>1=Weekday2<br>2=Weekday3 |
| 50101    | RW       | Monday Setup  | UINT16 |                                         |
| 50102    | RW       | Tuesday Setup | UINT16 |                                         |

|       |    |                    |        |                              |
|-------|----|--------------------|--------|------------------------------|
| 50103 | RW | Wednesday Setup    | UINT16 | See Note 2)<br>DDHH, 0x0100* |
| 50104 | RW | Thursday Setup     | UINT16 |                              |
| 50105 | RW | Friday Setup       | UINT16 |                              |
| 50106 | RW | Saturday Setup     | UINT16 |                              |
| 50107 | RW | TOU Switch Time    | UINT32 |                              |
| 50109 | RW | TOU Self-read Time | UINT16 |                              |

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 20<sup>th</sup>, 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 <sup>1</sup>                                     | 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<br>High-order Byte: Month<br>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. 1<sup>st</sup> 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 &amp; #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  | UINT16 | 0 ≤ Hour < 24            |
|        |          |                       |        | 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 <sup>1</sup>  | UINT32 | See Notes 1)   |
| 2      | RW       | Alternate Day #1 Daily Profile      | UINT16 | 0* to 19       |
| 3      | RW       | Alternate Day #2 Date <sup>1</sup>  | UINT32 | See Notes 1)   |
| 5      | RW       | Alternate Day #2 Daily Profile      | UINT16 | 0* to 19       |
| 6      | RW       | Alternate Day #3 Date <sup>1</sup>  | UINT32 | See Notes 1)   |
| 8      | RW       | Alternate Day #3 Daily Profile      | UINT16 | 0* to 19       |
| 9      | RW       | Alternate Day #4 Date <sup>1</sup>  | UINT32 | See Notes 1)   |
| 11     | RW       | Alternate Day #4 Daily Profile      | UINT16 | 0* to 19       |
| 12     | RW       | Alternate Day #5 Date <sup>1</sup>  | UINT32 | See Notes 1)   |
| 14     | RW       | Alternate Day #5 Daily Profile      | UINT16 | 0* to 19       |
| 15     | RW       | Alternate Day #6 Date <sup>1</sup>  | UINT32 | See Notes 1)   |
| 17     | RW       | Alternate Day #6 Daily Profile      | UINT16 | 0* to 19       |
| 18     | RW       | Alternate Day #7 Date <sup>1</sup>  | UINT32 | See Notes 1)   |
| 19     | RW       | Alternate Day #7 Daily Profile      | UINT16 | 0* to 19       |
| 21     | RW       | Alternate Day #8 Date <sup>1</sup>  | UINT32 | See Notes 1)   |
| 22     | RW       | Alternate Day #8 Daily Profile      | UINT16 | 0* to 19       |
| 24     | RW       | Alternate Day #9 Date <sup>1</sup>  | UINT32 | See Notes 1)   |
| 25     | RW       | Alternate Day #9 Daily Profile      | UINT16 | 0* to 19       |
| 27     | RW       | Alternate Day #10 Date <sup>1</sup> | UINT32 | See Notes 1)   |
| 29     | RW       | Alternate Day #10 Daily Profile     | UINT16 | 0* to 19       |
| ...    |          | ...                                 |        |                |
| 240    | RW       | Alternate Day #81 Date <sup>1</sup> | UINT32 | See Notes 1)   |
| 242    | RW       | Alternate Day #81 Daily Profile     | UINT16 | 0* to 19       |
| 243    | RW       | Alternate Day #82 Date <sup>1</sup> | UINT32 | See Notes 1)   |
| 245    | RW       | Alternate Day #82 Daily Profile     | UINT16 | 0* to 19       |
| 246    | RW       | Alternate Day #83 Date <sup>1</sup> | UINT32 | See Notes 1)   |
| 248    | RW       | Alternate Day #83 Daily Profile     | UINT16 | 0* to 19       |
| 249    | RW       | Alternate Day #84 Date <sup>1</sup> | UINT32 | See Notes 1)   |
| 251    | RW       | Alternate Day #84 Daily Profile     | UINT16 | 0* to 19       |
| 252    | RW       | Alternate Day #85 Date <sup>1</sup> | UINT32 | See Notes 1)   |
| 254    | RW       | Alternate Day #85 Daily Profile     | UINT16 | 0* to 19       |
| 255    | RW       | Alternate Day #86 Date <sup>1</sup> | UINT32 | See Notes 1)   |
| 256    | RW       | Alternate Day #86 Daily Profile     | UINT16 | 0* to 19       |
| 258    | RW       | Alternate Day #87 Date <sup>1</sup> | UINT32 | See Notes 1)   |
| 260    | RW       | Alternate Day #87 Daily Profile     | UINT16 | 0* to 19       |
| 261    | RW       | Alternate Day #88 Date <sup>1</sup> | UINT32 | See Notes 1)   |
| 263    | RW       | Alternate Day #88 Daily Profile     | UINT16 | 0* to 19       |
| 264    | RW       | Alternate Day #89 Date <sup>1</sup> | UINT32 | See Notes 1)   |
| 266    | RW       | Alternate Day #89 Daily Profile     | UINT16 | 0* to 19       |
| 267    | RW       | Alternate Day #90 Date <sup>1</sup> | 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:**

- 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.

- Initiate Modbus connection to the device.
- 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.
- 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:

- Recorder type:** Indicates the type of recorder (i.e., **WFR** for Waveform Recorder, **DWR** for Disturbance Recorder, **RMSR** for RMS Recorder).
- Logging Index:** A numerical value representing the specific log file.
- 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 <sup>1</sup>                                        | 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 <sup>2</sup>                                      | UINT16 |                                                                   |
| 9210      | WO       | Clear DI10 Counter <sup>2</sup>                                     | UINT16 |                                                                   |
| 9211      | WO       | Clear DI11 Counter <sup>2</sup>                                     | UINT16 |                                                                   |
| 9212      | WO       | Clear DI12 Counter <sup>2</sup>                                     | UINT16 |                                                                   |
| 9213      | WO       | Clear DI13 Counter <sup>2</sup>                                     | UINT16 |                                                                   |
| 9214      | WO       | Clear DI14 Counter <sup>2</sup>                                     | UINT16 |                                                                   |
| 9215      | WO       | Clear DI15 Counter <sup>2</sup>                                     | UINT16 |                                                                   |
| 9216      | WO       | Clear DI16 Counter <sup>2</sup>                                     | 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 <sup>3</sup>                                 | UINT16 |                                                                   |
| 9264      | WO       | Clear IER                                                           | UINT16 |                                                                   |
| 9265      | WO       | Clear AER                                                           | UINT16 |                                                                   |
| 9266~9274 | WO       | Reserved                                                            | UINT16 |                                                                   |

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|-----------|----|-----------------------------------------|--------|
| 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 <sup>4</sup>           | UINT16 |
| 9283      | WO | Clear Max. Log#1 <sup>5</sup>           | UINT16 |
| 9284      | WO | Clear Max. Log#2 <sup>5</sup>           | UINT16 |
| 9285      | WO | Clear Max. Log#3 <sup>5</sup>           | UINT16 |
| 9286      | WO | Clear Max. Log#4 <sup>5</sup>           | UINT16 |
| 9287      | WO | Reset IL                                | UINT16 |
| 9288      | WO | Clear Min. Log#1 <sup>5</sup>           | UINT16 |
| 9289      | WO | Clear Min. Log#2 <sup>5</sup>           | UINT16 |
| 9290      | WO | Clear Min. Log#3 <sup>5</sup>           | UINT16 |
| 9291      | WO | Clear Min. Log#4 <sup>5</sup>           | UINT16 |
| 9292      | WO | Clear IEEE Std 519 Report               | UINT16 |
| 9293      | WO | Clear All Demand <sup>6</sup>           | UINT16 |
| 9294      | WO | Clear This Max. Demand Log <sup>7</sup> | 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 60005 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                      | UINT16 | 0-37 (Year-2000)                                                                          |
|                     |                   | High-order Byte: Year   |        | 1 to 12                                                                                   |
|                     |                   | Low-order Byte: Month   |        |                                                                                           |
| 60001               | 9001              | RW                      | UINT16 | 1 to 31                                                                                   |
|                     |                   | High-order Byte: Day    |        | 0 to 23                                                                                   |
|                     |                   | Low-order Byte: Hour    |        |                                                                                           |
| 60002               | 9002              | RW                      | UINT16 | 0 to 59                                                                                   |
|                     |                   | High-order Byte: Minute |        | 0 to 59                                                                                   |
|                     |                   | Low-order Byte: Second  |        |                                                                                           |
| 60003               | 9003              | RW                      | UINT16 | 0 to 999                                                                                  |
| 60004<br>~<br>60005 | 9004<br>~<br>9005 | RW                      | UINT32 | 0x386D4380 to 0x7FE8177F                                                                  |
|                     |                   | UNIX Time               |        | 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                      | UINT16 | 0=Unsync., 1=Sync.                                                                        |

Table 5-129 Time Registers

## 5.15 Information

### 5.15.1 Meter Information

| Register            | Property          | Description              | Format | Note                                                                                                 |
|---------------------|-------------------|--------------------------|--------|------------------------------------------------------------------------------------------------------|
| 60200<br>~<br>60219 | 9800<br>~<br>9819 | RO                       | Char   | See Note 1                                                                                           |
|                     |                   | Meter Model <sup>1</sup> |        |                                                                                                      |
| 60220               | 9820              | RO                       | UINT16 | e.g. 10000 shows the version is V1.00.00                                                             |
| 60221               | 9821              | RO                       | UINT16 | e.g. 10 shows the version is V1.0                                                                    |
| 60222               | 9822              | RO                       | UINT16 | e.g. 0100 means the version is V01.00<br>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 <sup>2</sup> | UINT32 |                                                                                                                       |
| 60232 | 9832 | RO | Reserved                  |        |                                                                                                                       |
| 60233 | 9833 | RO | Device Temperature (°C)   | Float  |                                                                                                                       |
| 60235 | 9835 | RO | PPC Diagnostics Info.     | UINT32 | Bit0: System Parameters Error<br>Bit1: Secret Parameters Error<br>Bit2: DSP Error<br>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           |

|           |                |    |                                                |     |
|-----------|----------------|----|------------------------------------------------|-----|
| Bit 12/11 | DI Excitation  | 10 | 16xDI + 8xDO + 4xSS Pulse Outputs              | C   |
|           |                | 11 | 8xDI + 4xDO + 2xAI + 2xAO + 2xSS Pulse Outputs | D   |
|           |                | 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 <sup>1</sup> | 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   | 16 characters |              |
| 52098       | RW       | Site Information Tag 4 | Char   |               | 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  | ΣkW H02                  |
| 2        | 10002     | 20002  | 30002  | Ua                         | 1724     | 11724     | 21724  | 31724  | Σkvar H02                |
| 3        | 10003     | 20003  | 30003  | Ub                         | 1725     | 11725     | 21725  | 31725  | ΣkVA H02                 |
| 4        | 10004     | 20004  | 30004  | Uc                         | 1726     | 11726     | 21726  | 31726  | PF Avg. 02               |
| 5        | 10005     | 20005  | 30005  | U4                         | 1727     | 11727     | 21727  | 31727  | ΣkW H03                  |
| 6        | 10006     | 20006  | 30006  | ULN Avg.                   | 1728     | 11728     | 21728  | 31728  | Σkvar H03                |
| 7        | 10007     | 20007  | 30007  | Uab                        | 1729     | 11729     | 21729  | 31729  | ΣkVA 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  | ΣkW H62                  |
| 11       | 10011     | 20011  | 30011  | Ia                         | 1964     | 11964     | 21964  | 31964  | Σkvar H62                |
| 12       | 10012     | 20012  | 30012  | Ib                         | 1965     | 11965     | 21965  | 31965  | ΣkVA H62                 |
| 13       | 10013     | 20013  | 30013  | Ic                         | 1966     | 11966     | 21966  | 31966  | PF Avg. H62              |
| 14       | 10014     | 20014  | 30014  | I4                         | 1967     | 11967     | 21967  | 31967  | ΣkW H63                  |
| 15       | 10015     | 20015  | 30015  | I5                         | 1968     | 11968     | 21968  | 31968  | Σkvar H63                |
| 16       | 10016     | 20016  | 30016  | I Avg.                     | 1969     | 11969     | 21969  | 31969  | ΣkVA H63                 |
| 17       | 10017     | 20017  | 30017  | ΣkW <sub>a</sub>           | 1970     | 11970     | 21970  | 31970  | PF Avg. H63              |
| 18       | 10018     | 20018  | 30018  | ΣkW <sub>b</sub>           | 1971     | 11971     | 21971  | 31971  | ΣkW <sub>a</sub> Fund.   |
| 19       | 10019     | 20019  | 30019  | ΣkW <sub>c</sub>           | 1972     | 11972     | 21972  | 31972  | ΣkW <sub>b</sub> Fund.   |
| 20       | 10020     | 20020  | 30020  | ΣkW                        | 1973     | 11973     | 21973  | 31973  | ΣkW <sub>c</sub> Fund.   |
| 21       | 10021     | 20021  | 30021  | Σkvar <sub>a</sub>         | 1974     | 11974     | 21974  | 31974  | Σkvar <sub>a</sub> Fund. |
| 22       | 10022     | 20022  | 30022  | Σkvar <sub>b</sub>         | 1975     | 11975     | 21975  | 31975  | Σkvar <sub>b</sub> Fund. |
| 23       | 10023     | 20023  | 30023  | Σkvar <sub>c</sub>         | 1976     | 11976     | 21976  | 31976  | Σkvar <sub>c</sub> Fund. |
| 24       | 10024     | 20024  | 30024  | Σkvar                      | 1977     | 11977     | 21977  | 31977  | ΣkV <sub>Aa</sub> Fund.  |
| 25       | 10025     | 20025  | 30025  | ΣkV <sub>Aa</sub>          | 1978     | 11978     | 21978  | 31978  | ΣkV <sub>Ab</sub> Fund.  |
| 26       | 10026     | 20026  | 30026  | ΣkV <sub>Ab</sub>          | 1979     | 11979     | 21979  | 31979  | ΣkV <sub>Ac</sub> Fund.  |
| 27       | 10027     | 20027  | 30027  | ΣkV <sub>Ac</sub>          | 1980     | 11980     | 21980  | 31980  | dPF <sub>a</sub>         |
| 28       | 10028     | 20028  | 30028  | ΣkVA                       | 1981     | 11981     | 21981  | 31981  | dPF <sub>b</sub>         |
| 29       | 10029     | 20029  | 30029  | PF <sub>a</sub>            | 1982     | 11982     | 21982  | 31982  | dPF <sub>c</sub>         |
| 30       | 10030     | 20030  | 30030  | PF <sub>b</sub>            | 1983     | 11983     | 21983  | 31983  | ΣkW <sub>a</sub> H02     |
| 31       | 10031     | 20031  | 30031  | PF <sub>c</sub>            | 1984     | 11984     | 21984  | 31984  | ΣkW <sub>b</sub> H02     |
| 32       | 10032     | 20032  | 30032  | PF Avg.                    | 1985     | 11985     | 21985  | 31985  | ΣkW <sub>c</sub> H02     |
| 33       | 10033     | 20033  | 30033  | U <sub>a</sub> Dev.        | 1986     | 11986     | 21986  | 31986  | Σkvar <sub>a</sub> H02   |
| 34       | 10034     | 20034  | 30034  | U <sub>b</sub> Dev.        | 1987     | 11987     | 21987  | 31987  | Σkvar <sub>b</sub> H02   |
| 35       | 10035     | 20035  | 30035  | U <sub>c</sub> Dev.        | 1988     | 11988     | 21988  | 31988  | Σkvar <sub>c</sub> H02   |
| 36       | 10036     | 20036  | 30036  | U <sub>ab</sub> Dev.       | 1989     | 11989     | 21989  | 31989  | ΣkV <sub>Aa</sub> H02    |
| 37       | 10037     | 20037  | 30037  | U <sub>bc</sub> Dev.       | 1990     | 11990     | 21990  | 31990  | ΣkV <sub>Ab</sub> H02    |
| 38       | 10038     | 20038  | 30038  | U <sub>ca</sub> Dev.       | 1991     | 11991     | 21991  | 31991  | ΣkV <sub>Ac</sub> H02    |
| 39       | 10039     | 20039  | 30039  | U <sub>a</sub> Over Dev.   | 1992     | 11992     | 21992  | 31992  | PF <sub>a</sub> H02      |
| 40       | 10040     | 20040  | 30040  | U <sub>b</sub> Over Dev.   | 1993     | 11993     | 21993  | 31993  | PF <sub>b</sub> H02      |
| 41       | 10041     | 20041  | 30041  | U <sub>c</sub> Over Dev.   | 1994     | 11994     | 21994  | 31994  | PF <sub>c</sub> H02      |
| 42       | 10042     | 20042  | 30042  | U <sub>ab</sub> Over Dev.  | ...      | ...       | ...    | ...    | ...                      |
| 43       | 10043     | 20043  | 30043  | U <sub>bc</sub> Over Dev.  | 2715     | 12715     | 22715  | 32715  | ΣkW <sub>a</sub> H63     |
| 44       | 10044     | 20044  | 30044  | U <sub>ca</sub> Over Dev.  | 2716     | 12716     | 22716  | 32716  | ΣkW <sub>b</sub> H63     |
| 45       | 10045     | 20045  | 30045  | U <sub>a</sub> Under Dev.  | 2717     | 12717     | 22717  | 32717  | ΣkW <sub>c</sub> H63     |
| 46       | 10046     | 20046  | 30046  | U <sub>b</sub> Under Dev.  | 2718     | 12718     | 22718  | 32718  | Σkvar <sub>a</sub> H63   |
| 47       | 10047     | 20047  | 30047  | U <sub>c</sub> Under Dev.  | 2719     | 12719     | 22719  | 32719  | Σkvar <sub>b</sub> H63   |
| 48       | 10048     | 20048  | 30048  | U <sub>ab</sub> Under Dev. | 2720     | 12720     | 22720  | 32720  | Σkvar <sub>c</sub> H63   |
| 49       | 10049     | 20049  | 30049  | U <sub>bc</sub> Under Dev. | 2721     | 12721     | 22721  | 32721  | ΣkV <sub>Aa</sub> H63    |
| 50       | 10050     | 20050  | 30050  | U <sub>ca</sub> Under Dev. | 2722     | 12722     | 22722  | 32722  | ΣkV <sub>Ab</sub> H63    |
| 51       | 10051     | 20051  | 30051  | Freq. Dev.                 | 2723     | 12723     | 22723  | 32723  | ΣkV <sub>Ac</sub> H63    |
| 52       | 10052     | 20052  | 30052  | Reserved                   | 2724     | 12724     | 22724  | 32724  | PF <sub>a</sub> H63      |
| 53       | 10053     | 20053  | 30053  | Reserved                   | 2725     | 12725     | 22725  | 32725  | PF <sub>b</sub> H63      |
| 54       | 10054     | 20054  | 30054  | Reserved                   | 2726     | 12726     | 22726  | 32726  | PF <sub>c</sub> H63      |
| 55       | 10055     | 20055  | 30055  | U0 Unb.                    | 2727     | 12727     | 22727  | 32727  | U <sub>a</sub> TIHD      |
| 56       | 10056     | 20056  | 30056  | U2 Unb.                    | 2728     | 12728     | 22728  | 32728  | U <sub>b</sub> TIHD      |
| 57       | 10057     | 20057  | 30057  | I0 Unb.                    | 2729     | 12729     | 22729  | 32729  | U <sub>c</sub> TIHD      |
| 58       | 10058     | 20058  | 30058  | I2 Unb.                    | 2730     | 12730     | 22730  | 32730  | U4 TIHD                  |
| 59       | 10059     | 20059  | 30059  | U0                         | 2731     | 12731     | 22731  | 32731  | U <sub>a</sub> TOIHD     |
| 60       | 10060     | 20060  | 30060  | U2                         | 2732     | 12732     | 22732  | 32732  | U <sub>b</sub> TOIHD     |
| 61       | 10061     | 20061  | 30061  | U1                         | 2733     | 12733     | 22733  | 32733  | U <sub>c</sub> TOIHD     |

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|     |       |       |       |                 |      |       |       |       |             |
|-----|-------|-------|-------|-----------------|------|-------|-------|-------|-------------|
| 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 |

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|      |       |       |       |            |      |       |       |       |                |
|------|-------|-------|-------|------------|------|-------|-------|-------|----------------|
| 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   |

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|      |       |       |       |                       |      |       |       |       |                  |
|------|-------|-------|-------|-----------------------|------|-------|-------|-------|------------------|
| 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 | $\Sigma k W a$ TH     | 5779 | 15779 | 25779 | 35779 | Uca Angle        |
| 1680 | 11680 | 21680 | 31680 | $\Sigma k W b$ TH     | 5780 | 15780 | 25780 | 35780 | Uab Fund. Angle  |
| 1681 | 11681 | 21681 | 31681 | $\Sigma k W c$ TH     | 5781 | 15781 | 25781 | 35781 | Ubc Fund. Angle  |
| 1682 | 11682 | 21682 | 31682 | $\Sigma k v a r a$ TH | 5782 | 15782 | 25782 | 35782 | Uca Fund. Angle  |
| 1683 | 11683 | 21683 | 31683 | $\Sigma k v a r b$ TH | 5783 | 15783 | 25783 | 35783 | Uab H02 Angle    |

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|      |       |       |       |                       |      |       |       |       |               |
|------|-------|-------|-------|-----------------------|------|-------|-------|-------|---------------|
| 1684 | 11684 | 21684 | 31684 | $\Sigma$ kvarc TH     | 5784 | 15784 | 25784 | 35784 | Ubc H02 Angle |
| 1685 | 11685 | 21685 | 31685 | $\Sigma$ kVAa TH      | 5785 | 15785 | 25785 | 35785 | Uca H02 Angle |
| 1686 | 11686 | 21686 | 31686 | $\Sigma$ kVAb TH      |      |       |       |       |               |
| 1687 | 11687 | 21687 | 31687 | $\Sigma$ 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 | $\Sigma$ kWa TH SUM   | 5970 | 15970 | 25970 | 35970 | Ubc TIHD      |
| 1692 | 11692 | 21692 | 31692 | $\Sigma$ kWb TH SUM   | 5971 | 15971 | 25971 | 35971 | Uca TIHD      |
| 1693 | 11693 | 21693 | 31693 | $\Sigma$ kWc TH SUM   | 5972 | 15972 | 25972 | 35972 | Uab TOIHD     |
| 1694 | 11694 | 21694 | 31694 | $\Sigma$ kvara TH SUM | 5973 | 15973 | 25973 | 35973 | Ubc TOIHD     |
| 1695 | 11695 | 21695 | 31695 | $\Sigma$ kvarb TH SUM | 5974 | 15974 | 25974 | 35974 | Uca TOIHD     |
| 1696 | 11696 | 21696 | 31696 | $\Sigma$ kvarc TH SUM | 5975 | 15975 | 25975 | 35975 | Uab TEIHD     |
| 1697 | 11697 | 21697 | 31697 | $\Sigma$ kVAa TH SUM  | 5976 | 15976 | 25976 | 35976 | Ubc TEIHD     |
| 1698 | 11698 | 21698 | 31698 | $\Sigma$ kVAb TH SUM  | 5977 | 15977 | 25977 | 35977 | Uca TEIHD     |
| 1699 | 11699 | 21699 | 31699 | $\Sigma$ kVAc TH SUM  | 5978 | 15978 | 25978 | 35978 | Uab TH RMS    |
| 1703 | 11703 | 21703 | 31703 | $\Sigma$ kWa TH ABS   | 5979 | 15979 | 25979 | 35979 | Ubc TH RMS    |
| 1704 | 11704 | 21704 | 31704 | $\Sigma$ kWb TH ABS   | 5980 | 15980 | 25980 | 35980 | Uca TH RMS    |
| 1705 | 11705 | 21705 | 31705 | $\Sigma$ kWc TH ABS   | 5981 | 15981 | 25981 | 35981 | Uab TOH RMS   |
| 1706 | 11706 | 21706 | 31706 | $\Sigma$ kvara TH ABS | 5982 | 15982 | 25982 | 35982 | Ubc TOH RMS   |
| 1707 | 11707 | 21707 | 31707 | $\Sigma$ kvarb TH ABS | 5983 | 15983 | 25983 | 35983 | Uca TOH RMS   |
| 1708 | 11708 | 21708 | 31708 | $\Sigma$ kvarc TH ABS | 5984 | 15984 | 25984 | 35984 | Uab TEH RMS   |
| 1709 | 11709 | 21709 | 31709 | $\Sigma$ kVAa TH ABS  | 5985 | 15985 | 25985 | 35985 | Ubc TEH RMS   |
| 1710 | 11710 | 21710 | 31710 | $\Sigma$ kVAb TH ABS  | 5986 | 15986 | 25986 | 35986 | Uca TEH RMS   |
| 1711 | 11711 | 21711 | 31711 | $\Sigma$ kVAc TH ABS  | 5987 | 15987 | 25987 | 35987 | Uab TIH RMS   |
| 1715 | 11715 | 21715 | 31715 | $\Sigma$ kW TH        | 5988 | 15988 | 25988 | 35988 | Ubc TIH RMS   |
| 1716 | 11716 | 21716 | 31716 | $\Sigma$ kvar TH      | 5989 | 15989 | 25989 | 35989 | Uca TIH RMS   |
| 1717 | 11717 | 21717 | 31717 | $\Sigma$ 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 | $\Sigma$ kW Fund.     | 5992 | 15992 | 25992 | 35992 | Uca TOIH RMS  |
| 1720 | 11720 | 21720 | 31720 | $\Sigma$ kvar Fund.   | 5993 | 15993 | 25993 | 35993 | Uab TEIH RMS  |
| 1721 | 11721 | 21721 | 31721 | $\Sigma$ 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. |

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|                         |                       |       |                           |       |                       |
|-------------------------|-----------------------|-------|---------------------------|-------|-----------------------|
| 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.              |       |                       |
| <b>Predicted Demand</b> |                       |       |                           |       |                       |
| 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.          |       |                       |
| <b>Max./Min. Demand</b> |                       |       |                           |       |                       |
| 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 <sup>2</sup>       | 1=FIFO          | 1=FIFO              | 1=FIFO      | 1=FIFO           |
| Number of Parameters <sup>5</sup> | 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                      |              |              |              |              |
| <b>Parameter</b>                  | <b>SDR 5</b> | <b>SDR 6</b> | <b>SDR 7</b> | <b>SDR 8</b> |
| Recording Interval                | 10           | 10           | 10           | 10           |
| Recording Mode <sup>2</sup>       | 1=FIFO       | 1=FIFO       | 1=FIFO       | 1=FIFO       |
| Number of Parameters <sup>5</sup> | 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       |               |               |
| <b>Parameter</b>                  | <b>SDR 9</b> | <b>SDR 10</b> | <b>SDR 11</b> | <b>SDR 12</b> |
| Recording Interval                | 10           | 10            | 10            | 10            |
| Recording Mode <sup>2</sup>       | 1=FIFO       | 1=FIFO        | 1=FIFO        | 1=FIFO        |
| Number of Parameters <sup>5</sup> | 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    |
| <b>Parameter</b>                  | <b>SDR 13</b> | <b>SDR 14</b> | <b>SDR 15</b> | <b>SDR 16</b> |
| Recording Interval                | 10            | 10            | 10            | 10            |
| Recording Mode <sup>2</sup>       | 1=FIFO        | 1=FIFO        | 1=FIFO        | 1=FIFO        |
| Number of Parameters <sup>5</sup> | 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 Plt        |
| Parameter 54                      | Ub IHD10      | Ub IHD26      | Ub IHD42      | Ub Plt        |
| Parameter 55                      | Uc IHD10      | Uc IHD26      | Uc IHD42      | Uc Plt        |
| 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        |

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|              |          |          |          |  |
|--------------|----------|----------|----------|--|
| 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        | <b>UINT32:</b> Source<br>Bit0: Ua, Bit1: Ub, Bit2: Uc<br>Bit3: Uab, Bit4: Ubc, Bit5: Uca<br><b>FP32:</b> Max./Min. Residual Voltage<br><b>UINT32:</b> Duration (ms)<br><b>FP32:</b> Ua Residual<br><b>FP32:</b> Ub Residual<br><b>FP32:</b> Uc Residual<br><b>UINT32:</b> Disturbance Direction Location:<br>1=UpStream, 2=DownStream<br><b>UINT32:</b> Confidence: 1=Low, 2=Middle, 3=High<br><b>FP32:</b> Ua Benchmark (Primary)<br><b>FP32:</b> Ub Benchmark (Primary)<br><b>FP32:</b> Uc Benchmark (Primary)<br><b>UINT32:</b> Reserved |
|                        | 1                  | Voltage Dips          | Refer to <b>Voltage Swells</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                        | 2                  | Voltage Interruption  | Refer to <b>Voltage Swells</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                        | 3                  | Over-Voltage Start    | <b>UINT32:</b> Source<br>Bit0: Ua, Bit1: Ub, Bit2: Uc<br>Bit3: Uab, Bit4: Ubc, Bit5: Uca<br><b>FP32:</b> Ua Residual<br><b>FP32:</b> Ub Residual<br><b>FP32:</b> Uc Residual<br><b>UINT32:</b> Disturbance Direction Location:<br>1=UpStream, 2=DownStream<br><b>UINT32:</b> Confidence: 1=Low, 2=Middle, 3=High<br><b>FP32:</b> Ua Benchmark (Primary)<br><b>FP32:</b> Ub Benchmark (Primary)<br><b>FP32:</b> Uc Benchmark (Primary)<br><b>UINT32:</b> Reserved                                                                            |
|                        | 4                  | Over-Voltage Return   | <b>UINT32:</b> Duration (ms)<br><b>FP32:</b> Ua Residual<br><b>FP32:</b> Ub Residual<br><b>FP32:</b> Uc Residual<br><b>FP32:</b> Ua Benchmark (Primary)<br><b>FP32:</b> Ub Benchmark (Primary)<br><b>FP32:</b> Uc Benchmark (Primary)<br><b>UINT32:</b> Reserved                                                                                                                                                                                                                                                                            |
|                        | 5                  | Under-Voltage Start   | Refer to <b>Over-Voltage Start</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                        | 6                  | Under -Voltage Return | Refer to <b>Over-Voltage Return</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 0xA2: Transient        | 0                  | Transient Voltage     | <b>FP32:</b> Max./Min. Disturbance<br><b>UINT32:</b> Duration (μs)<br><b>FP32:</b> Ua Disturbance<br><b>FP32:</b> Ub Disturbance<br><b>FP32:</b> Uc Disturbance                                                                                                                                                                                                                                                                                                                                                                             |
| 0xA3: Inrush Current   | 0                  | Inrush Current Start  | <b>UINT32:</b> Source<br>Bit0: Ua, Bit1: Ub, Bit2: Uc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                        | 1                  | Inrush Current Return | <b>UINT32:</b> Duration (ms)<br><b>FP32:</b> Ia Disturbance Max. (A)<br><b>FP32:</b> Ib Disturbance Max. (A)<br><b>FP32:</b> Ic Disturbance Max. (A)<br><b>FP32:</b> Ia RMS during Disturbance (A)<br><b>FP32:</b> Ib RMS during Disturbance (A)<br><b>FP32:</b> Ic RMS during Disturbance (A)                                                                                                                                                                                                                                              |
| 0xA4: RVC              | 0                  | Rapid Voltage Change  | <b>UINT32:</b> Start Time (s)<br><b>UINT32:</b> Start Time (ms)<br><b>UINT32:</b> Duration (ms)<br><b>FP32:</b> Max. Voltage Change Rate                                                                                                                                                                                                                                                                                                                                                                                                    |

|                           |     |                         |                                                                                                                                                                                                                            |
|---------------------------|-----|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                           |     |                         | <b>FP32:</b> Steady Voltage Change Rate<br><b>UINT32:</b> Source<br>Bit0: Ua, Bit1: Ub, Bit2: Uc<br>Bit3: Uab, Bit4: Ubc, Bit5: Uca                                                                                        |
| 0xA5: MSV                 | 0   | MSV #1 Start            | <b>FP32:</b> Frequency (Hz)<br><b>UINT32:</b> Phase<br>Bit0: Ua, Bit1: Ub, Bit2: Uc<br>Bit3: Uab, Bit4: Ubc, Bit5: Uca                                                                                                     |
|                           | 1   | MSV #1 End              | <b>FP32:</b> Frequency (Hz)<br><b>FP32:</b> Ua MSV Max.<br><b>FP32:</b> Ub MSV Max.<br><b>FP32:</b> 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         | <b>FP32:</b> I <sub>max</sub><br><b>FP32:</b> U <sub>min</sub><br><b>UINT32:</b> Duration (ms)                                                                                                                             |
| 0xA8: Reserved            |     |                         |                                                                                                                                                                                                                            |
| 0xA9: Setpoint            | 0   | Over Setpoint Active    | <b>UINT32:</b> Setpoint Parameter<br><b>FP32:</b> Active Value<br><b>UINT32:</b> Setpoint Number (0-255)                                                                                                                   |
|                           | 1   | Over Setpoint Inactive  | <b>UINT32:</b> Setpoint Parameter<br><b>FP32:</b> Inactive Value<br><b>UINT32:</b> Setpoint Number (0-255)<br><b>FP32:</b> Maximum during the setpoint active<br><b>UINT32:</b> Duration (ms)                              |
|                           | 128 | Under Setpoint Active   | <b>UINT32:</b> Setpoint Parameter<br><b>FP32:</b> Active Value<br><b>UINT32:</b> Setpoint Number (0-255)                                                                                                                   |
|                           | 129 | Under Setpoint Inactive | <b>UINT32:</b> Setpoint Parameter<br><b>FP32:</b> Inactive Value<br><b>UINT32:</b> Setpoint Number (0-255)<br><b>FP32:</b> Maximum during the setpoint active<br><b>UINT32:</b> Duration (ms)                              |
| 0xAA: High-Speed Setpoint | 0   | OverSetpoint Active     | <b>UINT32:</b> Setpoint Parameter<br><b>FP32:</b> Active Value<br><b>UINT32:</b> Setpoint Number (0-15)                                                                                                                    |
|                           | 1   | OverSetpoint Inactive   | <b>UINT32:</b> Setpoint Parameter<br><b>FP32:</b> Inactive Value<br><b>UINT32:</b> Setpoint Number (0-15)<br><b>FP32:</b> Maximum during the setpoint active<br><b>UINT32:</b> Duration (ms)                               |
|                           | 128 | UnderSetpoint Active    | <b>UINT32:</b> Setpoint Parameter<br><b>FP32:</b> Active Value<br><b>UINT32:</b> Setpoint Number (0-15)                                                                                                                    |
|                           | 129 | UnderSetpoint Inactive  | <b>UINT32:</b> Setpoint Parameter<br><b>FP32:</b> Inactive Value<br><b>UINT32:</b> Setpoint Group Number (0-15)<br><b>FP32:</b> Maximum during the setpoint active<br><b>UINT32:</b> Duration (ms)                         |
| 0xAB: I/O Changes         | 0   | DIx Closed              | <b>UINT32:</b> DI Number, Bit0 to Bit7 stands for DI1 to DI8                                                                                                                                                               |
|                           | 1   | DIx Opened              |                                                                                                                                                                                                                            |
|                           | 2   | DOx Operated            | <b>UINT32:</b> DO Number: 0=Alarm, 1=DO1<br><b>UINT32:</b> Trigger Source<br>0=DI<br>1=Setpoint<br>2=HS Setpoint<br>3=Reserved<br>4=Transient<br>10=Front Panel<br>11=Reserved<br>12=Swells<br>13=Dips<br>14=Interruptions |

|                 |   |             |                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------|---|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                 |   |             | 5=Rapid Voltage Change<br>6=Inrush Current<br>7=Reserved<br>8=Remote Control<br>9=Pulse Width<br>15=ITIC Curve Alarm<br>16=SEMI F47 Curve Alarm<br>17=Motor Start<br>18=iTrigger<br>19= Reserved                                                                                                                                                                                                                                |
|                 |   |             | <b>UINT32:</b> Source MAC Address<br><b>UINT32:</b> Source Group ID                                                                                                                                                                                                                                                                                                                                                             |
|                 | 3 | DO Released | <b>UINT 32:</b> DO Number: 0=Alarm, 1=DO1<br><b>UINT32:</b> Trigger Source<br>0=DI<br>1=Setpoint<br>2=HS Setpoint<br>3=Reserved<br>4=Transient<br>5=Rapid Voltage Change<br>6=Inrush Current<br>7=Reserved<br>8=Remote Control<br>9=Pulse Width<br>10=Front Panel<br>11=Reserved<br>12=Swells<br>13=Dips<br>14=Interruptions<br>15=ITIC Curve Alarm<br>16=SEMI F47 Curve Alarm<br>17=Motor Start<br>18=iTrigger<br>19= Reserved |
| 0xAC: Recorders | 0 | WFR         | <b>UINT32:</b> Trigger Source:<br>0=Manual, 1=iTrigger, 2= Schedule WFR                                                                                                                                                                                                                                                                                                                                                         |
|                 | 1 | DWR         |                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                 | 2 | RMSR        | (Only for Trigger Source = iTrigger)<br><b>UINT32:</b> iTrigger Group<br><b>UINT64:</b> iTrigger Source MAC Address (Last 6 ASCII Digits)                                                                                                                                                                                                                                                                                       |
|                 | 3 | DR Start    | <b>UINT32:</b> DR Number<br>BIT0 to BIT7 stands for DR1 to DR8<br><b>UINT32:</b> Trigger Source<br>0=DI Change, 1=Setpoint, 2=Reserved,<br>3=PQ Disturbance, 4=Inrush Current                                                                                                                                                                                                                                                   |
|                 | 4 | DR End      | <b>UINT32:</b> DR Number<br>BIT0 to BIT7 stands for DR1 to DR8<br><b>UINT32:</b> Trigger Source<br>0=DI Change<br>2=Reserved,<br>4=Inrush Current<br>6=Setpoint Settings<br>Changed<br>8=PQ Disturbance Settings<br>Changed<br>1=Setpoint<br>3=PQ Disturbance<br>5=DI Settings Changed<br>7=Reserved<br>9=Inrush Current Settings<br>Changed<br>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<br>Writing 0xFFFFFFFF to clear all SDR Logs                                                                            |
|                      | 13                 | Clear DR                             | 0~7= DR# 1~ DR# 8<br>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<br>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<br>1= Clear All Demand                                                                                        |
|                      | 26                 | Clear EN 50160 Log                   |                                                                                                                                            |
|                      | 27                 | Reserved                             |                                                                                                                                            |
|                      | 28                 | Clear PQ Counter                     | 0=Dips<br>1=Swells<br>2=Interruptions<br>3=Transient<br>4=RVC<br>5=Inrush Current<br>6=Reserved<br>7~9=MSV# 1~MSV# 3<br>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<br>1= Manual. #2 to #1<br>2=Auto. #1 to #2<br>3=Auto. #2 to #1                                                           |
|                      | 34                 | Hardware Alarm                       | Device Self Diagnostics PPC<br>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<br>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                                                                                                                                       |

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|  |       |                                   |      |
|--|-------|-----------------------------------|------|
|  | 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<br>< 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 $\pm$ 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                                                           | 500 $\Omega$ 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                                                            |

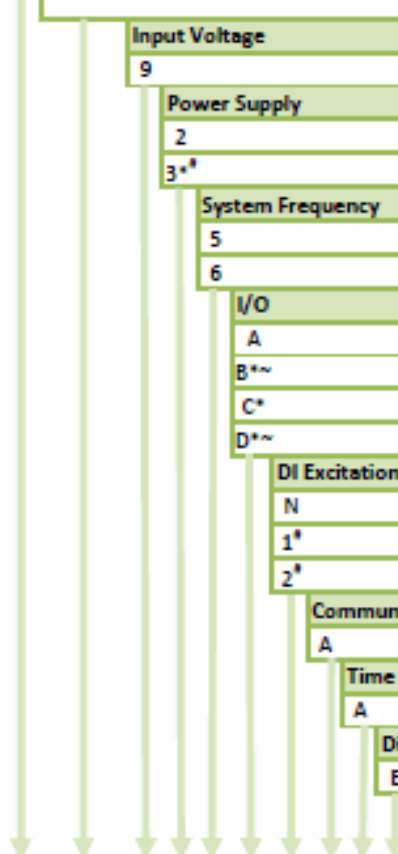
**Accuracy**

| Parameters   | Accuracy                                                   | Resolution |
|--------------|------------------------------------------------------------|------------|
| Voltage (U)  | $\pm 0.1\%$                                                | 0.001V     |
| I1, I2, I3   | $\pm 0.1\%$                                                | 0.001A     |
|              | SCCPA Option: $\pm 0.1\% + \text{Error of SCCP}$           |            |
| I4           | $\pm 0.1\%$                                                |            |
| I5           | $\pm 0.5\%$                                                | 0.001kX    |
| P, Q, S      | $\pm 0.2\%$                                                |            |
|              | SCCPA Option: $\pm 0.5\%$                                  |            |
| 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                                    | 0.1kvarh   |
|              | IEC 62053-23 Class 2                                       |            |
|              | SCCPA Option: IEC 62053-24 Class 1                         |            |
| PF           | $\pm 0.2\%$                                                | 0.001      |
|              | SCCPA Option: $\pm 0.5\%$                                  |            |
| Frequency    | $\pm 0.003 \text{ Hz}$                                     | 0.001Hz    |
| Harmonics    | IEC 61000-4-7 Class I                                      | 0.001      |
| Phase Angles | $\pm 0.2^\circ$                                            | 0.1°       |
|              | SCCPA Option: $\pm 0.2^\circ + \text{Phase Error of SCCP}$ |            |
| U Unbalance  | $\pm 0.1 \%$                                               | 0.01%      |
| I Unbalance  | $\pm 0.5\%$                                                | 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<br>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<br><br>AC Voltage: 2kV @ 1 minute<br>Insulation Resistance: >100MΩ<br>Impulse Voltage: 6kV, 1.2/50μs                                        | IEC 62052-11: 2003<br>IEC 62053-22: 2003<br>EN 61010-1: 2010 + A1: 2019 |
| EMC Compatibility<br>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<br>Electric<br>Technology                                                                                         |   | Version 20230508 |   |   |   |   |   |   |   |                                      |
| Product Code                                                                       |                                      |                                                                                                                       |   | Description      |   |   |   |   |   |   |   |                                      |
| iMeter 8 Advanced Power Quality Analyzer                                           |                                      |                                                                                                                       |   |                  |   |   |   |   |   |   |   |                                      |
|  | Basic Feature                        |                                                                                                                       |   |                  |   |   |   |   |   |   |   |                                      |
|                                                                                    | A                                    | 1024 samples/cycle, 8GB On-Board Memory<br>IEC 61000-4-30 Ed. 3.1 Class A Certified                                   |   |                  |   |   |   |   |   |   |   |                                      |
|                                                                                    | B*~                                  | 1024 samples/cycle, 8GB On-Board Memory<br>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 $\pm$ 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**

CET Electric Technology Inc.

E: [support@cet-global.com](mailto:support@cet-global.com)

W: [www.cet-global.com](http://www.cet-global.com)