

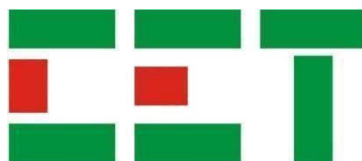
iMeter 5

Advanced Modular Power Quality Analyzer

User Manual

Version: V1.0

March 31, 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.



DANGER

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

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

Limited warranty

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

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Chapter 1 Introduction

The iMeter 5 is one of CET's latest Advanced Modular PQ Analyzer designed for the compliance monitoring market as it offers unsurpassed functionality by combining Class 0.2S Accuracy and advanced PQ Features in an industry-standard compact DIN96 form factor with a stunning, high resolution, color IPS LCD display. The iMeter 5 complies with such standards as IEC 62053-22: 2020 Class 0.2S, IEC 62052-31: 2015, IEC 61000-4-30 Ed. 3.1 Class S / Class A Compliant, IEC 61000-4-15, IEC 61000-4-7, EN 50160-2022, IEEE Std 519-2022. Furthermore, the iMeter 5 offers up to 4GB memory, 4xDI, 2xDO, dual 10/100BaseT Daisy Chain Ethernet ports, an RS-485 port and an RJ45 port for modular I/O expansion. It can be easily integrated into Building Management Systems, Power Quality Monitoring Systems as well as Substation Automation Systems with Modbus TCP/IP, BACnet/IP, SNMP, IEC 61850, IEC 60870-5-104 and other protocols. These features make the iMeter 5 become a vital component of various systems for different applications.

Following is a list of typical applications for the iMeter 5:

- Class 0.2S Revenue Metering
- PQ Monitoring of Mains and Critical Feeders
- HV, MV and LV Applications
- Data Centers, Semiconductor Fabs, Heavy Industries, Renewable Energy Applications
- 7x24 Automated Manufacturing Facilities
- IEC 61850 support for Substation Automation and Smart Grid
- Retrofit applications with optional Class 0.5S Split-Core Current Probes

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

1.1 Features

Basic Features

- IEC 62053-22 Class 0.2S kWh metering with Multi-Tariff TOU
- True RMS @ 512 samples/cycle sampling
- 512MB (Classic Model), 2GB (Class S Model) or 4GB (Class A Model) on-board log memory
- Industrial-grade, 3.5" High-Resolution Color IPS LCD @ 320x240
- Device Operating Time (Running Hours)
- Time Sync. via NTP, IRIG-B, or GPS 1PPS output
- 32 Programmable Setpoints
- Dual 10/100BaseT Daisy Chain Ethernet and 1xRS-485 ports as well as 1xRJ45 port for modular I/O expansion

Power Quality Features

- Optional IEC 61000-4-30 Ed. 3.1 Class S / Class A compliant
- EN 50160-2022 and IEEE Std 519-2022 Reporting
- Dips, Swells, Interruptions, Transients, Rapid Voltage Change, Inrush Current, Mains Signalling Voltage and Flicker monitoring
- Real-time Waveform Capture (WFC), Waveform Recording (WFR) & Disturbance Waveform Recording (DWR) in COMTRADE File format
- Disturbance Direction Indicator for Dips, Swells and Interruptions
- Statistical Data Recording and ½ cycle RMS Recording

Front Panel Display and Web Interface

- True RMS Real-time, Harmonics, Power and Energy Measurements
- Phasor Diagram, Harmonics & Interharmonics Histogram
- Real-time WFC of 3-phase U & I @ 128 samples/cycle x 4 cycles
- Event WF Display @ max. 512 samples/cycle and ITIC/SEMI F47 Curves
- Trend Curves for Daily/Monthly Energy Consumption, DR & SDR Log
- 3-Phase Total and Per-Phase AER & IER Logs
- Max. & Min. Logs
- Deviation, Sequence Components & Unbalance
- Demands and Multi-Tariff TOU
- Device and SOE Logs, PQ Counters and I/O Status
- Device Configuration and Diagnostics

Power Quality Metering

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

- Power Frequency
- Magnitude of the Supply Voltage
- Flicker
- Supply Voltage Dips, Swells and Interruptions
- Supply Voltage Unbalance
- Voltage Harmonics and Interharmonics
- Mains Signalling Voltage on the Supply Voltage
- Rapid Voltage Changes (RVC)
- Flagging
- Measurement of Overdeviation and Underdeviation Parameters
- Magnitude of Current
- Harmonic and Interharmonic Currents
- Current Unbalance

Harmonic and Interharmonic Measurements

- U and I THD, TOHD, TEHD, TIHD, TOIHD, TEIHD and TH (RMS)
- Current TDD, TDD Odd and TDD Even
- U and I Individual Harmonics (%HD and RMS) from 2nd to 63rd #
- K-Factor for Current, Crest Factor for Current and Voltage
- U and I Individual Interharmonics (%IHD and RMS) from 1st to 63rd #
- Fundamental U, I, P, Q, S, Phase Angle and Displacement PF
- Harmonic Phase Angle from 2nd to 63rd
- U and I DC Components

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

Sequence and Unbalance

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

Dips, Swells, Interruptions Recording

- Dips, Swells, Interruptions detection @ 10ms (½ cycle at 50 Hz)
- Trigger for DO, SOE Log, DR, WFR, DWR, RMSR, iTrigger and Alarm Email
- Configurable DO trigger for the Start or End of a PQ disturbance
- 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 PQ disturbances that are outside of the respective tolerance curves

Transients Recording

- Transients capture as short as 40us for sub-cycle disturbances such as capacitor switching and resonance phenomena
- Trigger for DO, SOE Log, WFR, DWR, RMSR, iTrigger and Alarm Email
- Display of Event specific WFR, DWR and/or RMSR on the Front Panel and Web Interface

Rapid Voltage Change

- Detection of a quick transition in RMS voltage between two steady-states

Inrush Current Monitoring

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

Disturbance Direction Indicator

- Determine if a PQ 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 Change, 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 I4 (Measured Neutral Current), In (Calculated Neutral Current), Ung (Neutral-to-Ground Voltage), Frequency and IR (Calculated Residual Current)

High-Speed Measurements

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

Energy

- Per-phase kWh, kvarh Import/Export/Net/Total and kVAh Total
- Total RMS kWh, kvarh Import/Export/Net/Total and kVAh Total
- Total Fundamental kWh, kvarh Import/Export/Net/Total
- Total Harmonic kWh, kvarh Import/Export/Net/Total and Harmonic kWh, kvarh Import/Export from 2nd to 63rd

Demands

- Present and Predicted Demand for 3-phase U, U Avg., I, I Avg., I Fund., P, Q, S, PF as well as I4, I4 Fund.
- Max. Demands for 3-phase I, I Fund., UII & I Avg., as well as Power of This Month & Last Month (or Since Last Reset & Before Last Reset)
- Demand Synchronization with DI
- Max./Min. per Demand Interval

Multi-Tariff TOU capability

- Two independent sets of TOU Schedules
 - Up to 12 Seasons
 - 90 Holidays or Alternate Days and 3 Weekdays
 - 20 Daily Profiles, each with 12 Period
 - 8 Tariffs, each providing the following information:
 - kWh/kvarh Import/Export and kVAh
 - P/Q Import/Export Max. Demands
 - Register rollover at 100,000,000,000.000 kWh
- Switching between two TOU schedules manually or according to pre-programmed time
- 12 Historical Logs for Energy and Max. Demand

Data and Event Recorders

Non-Volatile Log Memory

- Up to 4GB on-board log memory

Interval Energy Recorder (IER) and Accumulative Energy Recorder (AER)

- Both IER Log and AER Log support the recording of per-phase and Total RMS kWh, kvarh Import/Export/Total/Net and kVAh Total, Total Fundamental/Harmonic kWh, kvarh Import/Export
- Recording interval from 1 minute to 65,535 minutes
- Max. Recording Depth @ 65,535 records for each group
- Support FIFO or Stop-When-Full Mode
- Support to read and export the IER/AER logs via built-in web server[#]

[#]feature supported in Firmware V1.50.01 and later

Statistical Data Recorder (SDR)

- 4 SDR logs of max. 64 parameters each
- Recording of the Max., Min., Avg. and 95th percentile values for real-time measurements including U, I, P, Q, S, PF, Freq., Harmonics, Deviations and Unbalances
- Recording Interval from 1 to 60 minutes
- Configurable depths for recording up to 450 days at 15-min interval
- Downloadable via free software
- Support FIFO or Stop-When-Full Mode

Data Recorder (DR)

- 8 DR Logs of max. 32 parameters each
- RMS/Fundamental/Harmonic/Interharmonic Measurements, Demands, Deviations, Mains Signalling Voltages, Unbalances and Flicker
- Configurable Recording Offset and Interval from 1s to 40 days
- Max. Recording Depth @ 120,000 records
- Support FIFO or Stop-When-Full Mode
- BEC 2021 Compliant Data Recording for 3 years at 15-minute interval

Trend Curve for SDR and DR

- Trend display for recorded SDR and DR parameters at selectable Interval via built-in web server
- Ability to export the recorded logs in tabular form via the web server

Max./Min. Recorder (MMR)

- 4 Max./Min. Recorders of max. 20 programmable 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

Daily / Monthly Energy Consumption Trend Curve

- 36 Monthly and 31 Daily Energy Consumption Trend Display for kWh, kvarh Import/Export and kVAh Total on Front Panel and Web Interface
- Ability to export the Energy Log in tabular form via the web server
- FIFO Recording Mode

SOE Log

- 512 FIFO events time-stamped to ± 1 ms resolution
- Setpoint event, I/O operation, Dips, Swells, Interruptions, Transients, Rapid Voltage Change, Inrush Current, Mains Signalling Voltage, iTrigger, etc.
- Record the characteristic data of Setpoint event as well as WFR, DWR, RMSR, ITIC and SEMI F47 Curve for PQ events

Device Log

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

Real-Time Waveform and Waveform Recorder (WFR)

- Real-time WFC @ 128 samples/cycle x 4 cycles
- WFR with max. 128 entries
- Simultaneous capture of 3-phase Voltage and 4-phase Current Inputs
- Programmable formats and pre-fault cycles including 640x16, 320x32, 160x64, 80x128, 40x256, 20x512 (No. of cycles x Samples/Cycle)
- Scheduled WFR with max. repetition of 10,000 times and programmable schedule from 1 to 1440 min
- COMTRADE file format, downloadable from the on-board Web Server or FTPS Server

Disturbance Waveform Recorder

- 128 entries
- Simultaneous recording of all Voltage (U1-U3) 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 360 seconds of 1-cycle absolute peak values
 - Post Fault: 15 cycles @ 512 samples/cycle

RMS Recorder (RMSR)

- 128 entries
- 8 parameters max., selectable U, I, P, Q, S, PF, Freq. 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

iTrigger

- Cross trigger DO, SOE Log, WFR, DWR, RMSR and Alarm Email with other iMeter devices within the same local area network (LAN)
- Group ID and MAC Address provided as the trigger source

IEEE Std 519-2022 Report

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

Setpoints

PQ Setpoints

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

Control Setpoints

- 32 Control Setpoints can be configured with extensive monitoring sources including U, I, Freq., P, Q, S, PF, Demands, Harmonics, Unbalances, Deviations, Flickers, Phase Reversal/Loss, TC and AI, 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 changes
- Trigger DO, DR, SOE Log, WFR, DWR, RMSR, iTrigger and Alarm Email

Inputs and Outputs

Digital Inputs

- 4 channels, volts free dry contact, 24VDC internal wetted
- 1000Hz sampling for 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 Switching based on DI Status

Digital Outputs

- Standard 2 channels Form A for general purpose control and alarming
- Optional 2 SS Relays for Energy Pulsing applications

Modular I/O Expansion

- RJ45 connector for modular I/O expansion such as AI, AO, DI, DO, Ir (Residual Current) and TC (Temperature) Inputs

Communications

Ethernet Ports (P1, P2)

- Dual 10/100BaseT Daisy Chain Ethernet Ports with RJ45 connector
- Selectable IP Addressing Mode – DHCP and Static
- White List for Client Access Control
- Protocols supported: Modbus TCP, HTTP/HTTPS, NTP, SMTP, SNMP, FTPS, RSTP, MQTT, BACnet/IP, IEC 61850 and IEC 60870-5-104
- 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 5xModbus TCP and 5xIEC61580

RS-485 (P3)

- One optically isolated RS-485 port with Baud Rate from 1.2 to 38.4 kbps
- Modbus RTU, Ethernet Gateway and Modbus Master[#]
- Supports up to 31 downstream Modbus Slave Devices[#]

[#]Modbus Master is supported in Firmware V1.50.01 and later

Time Synchronization

- Battery-backed Real-time clock @ 6ppm ($\leq 0.5s/day$)
- Time Sync. with auto-selection among Modbus RTU/TCP, NTP, GPS 1PPS and IRIG-B

System Integration

PecStar® iEMS

- The iMeter 5 is supported by CET's PecStar® iEMS.

On-board Web/FTPS Server

- 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 FTPS Server allows Excel files for the IEEE Std 519-2022 Daily and Weekly reports and waveform records in COMTRADE format to be downloaded without any special software. The downloaded files can be subsequently viewed using software that supports these industry standard file formats

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
- Ability to export IER, AER, DR and SDR Logs as well as EN 50160-2022 and IEEE Std 519-2022 Reports

3rd Party System Integration

- Easy integration into Substation Automation, Utility SCADA or BMS systems via Modbus, IEC 61850, IEC 60870-5-104 and BACnet/IP protocols

1.2 Features Differences

Features	Model	Classic (PQA)	Class S (PQI-S)	Class A (PQI-A)
High-speed Measurement		■	■	■
I4 Measurement		■	■	■
In (Calculated Neutral Current)		■	■	■
IR (Calculated Residual Current)		■	■	■
Memory Size		512MB	2GB	4GB
IEC 61000-4-30 Compliant		--	Class S	Class A
Interharmonics		--	■	■
Flicker (Pst, Plt)		--	■	■
Rapid Voltage Change		--	■	■
Transient		--	■	■
Inrush Current		--	■	■
Mains Signalling Voltage		--	--	■
2kHz-9kHz C. E.		--	--	■
Individual Harm. Energy		--	--	■

U & I DC Component	--	■	■
EN 50160-2022 Report	--	■	■
IEEE 519-2022 Report	--	■	■
Statistical Data Recording	--	■	■
Modbus Gateway/Master	■	■	■
Web Server (HTTP/HTTPS)	■	■	■
FTP/FTPS	■	■	■
SNMP	■	■	■
MQTT	■	■	■
BACnet/IP	■	■	■
IEC 60870-5-104	■	■	■
IEC 61850	--	■	■
Alarm Email (SMTP)	■	(Support to upload EN 50160/IEEE 519 Report)	(Support to upload EN 50160/IEEE 519 Report)
GPS & IRIG-B Time Sync.	--	■	■
iTrigger	--	■	■
Daily/Monthly Energy Curve	■	■	■
Trend Curve for SDR and DR	■	■	■
DWR	--	--	■

-- Not Applicable

■ Supported

1.3 iMeter 5's application in Power and Energy Management and Analyzer Systems

The iMeter 5 can be used to monitor 3P4W (WYE) or 3P3W (Delta) connected power system. Modbus communications allow real-time data, events, DI status, DR Logs, WFR Logs and other information to be transmitted to an Integrated Energy Management System such as PecStar® iEMS.

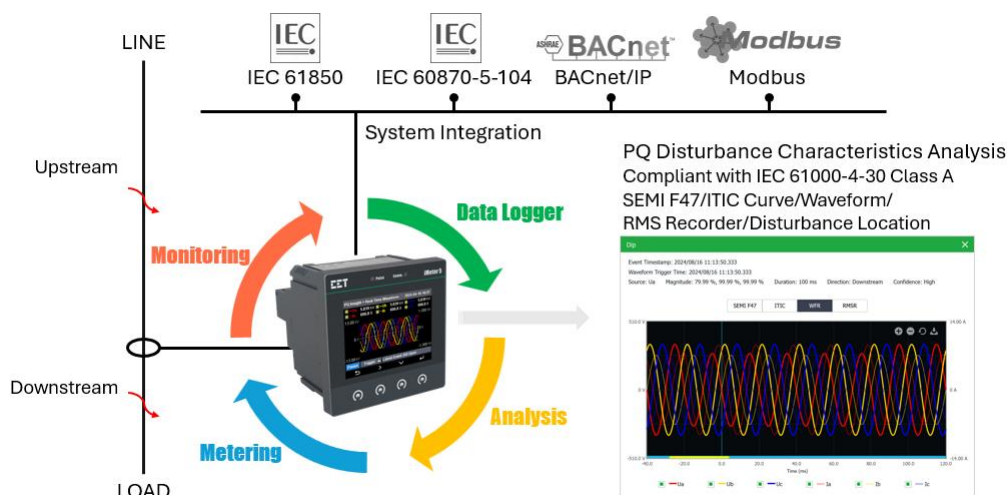


Figure 1-1 Application Diagram

1.4 Getting more information

Additional information is available from CET via the following sources:

- Visit www.cet-global.com
- Contact your local representative

Contact CET directly via email at support@cet-global.com

Chapter 2 Installation



Caution

Installation of the iMeter 5 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

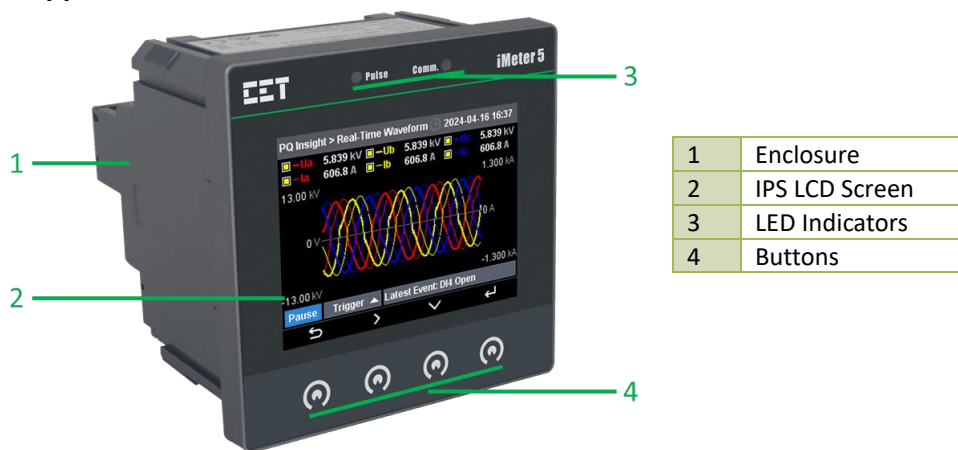
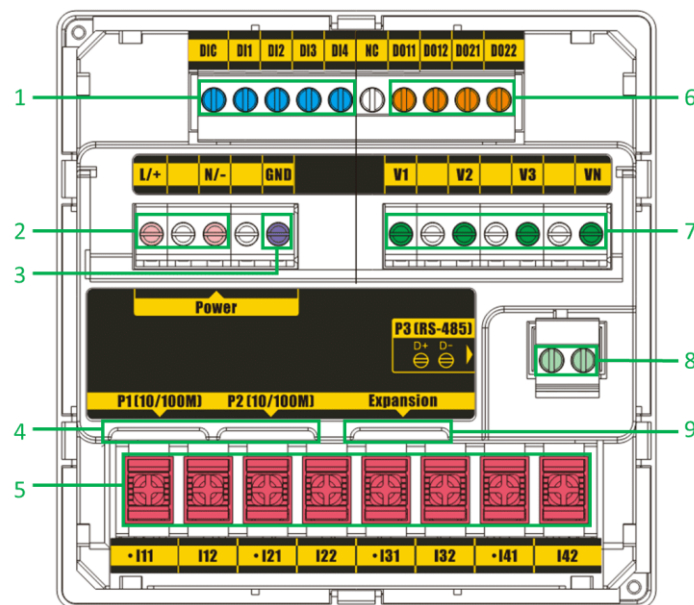


Figure 2-1 Appearance



1	4xDigital Input	2	Power Supply	3	Ground Terminal	4	10/100BaseT Ethernet Port
5	4xCurrent Input	6	2xDigital Output	7	3xVoltage Input	8	RS-485 Port
9	RJ45 Port for Expansion Module						

Figure 2-2 Terminals Diagram

2.2 Unit Dimensions

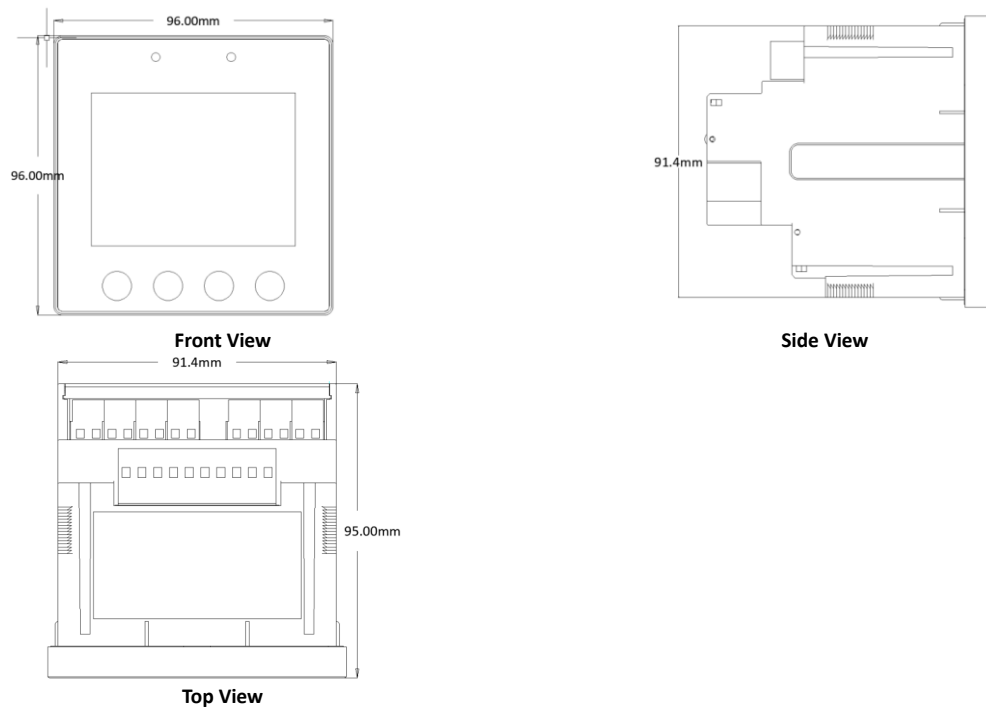


Figure 2-3 Dimensions

2.3 Terminal Dimensions

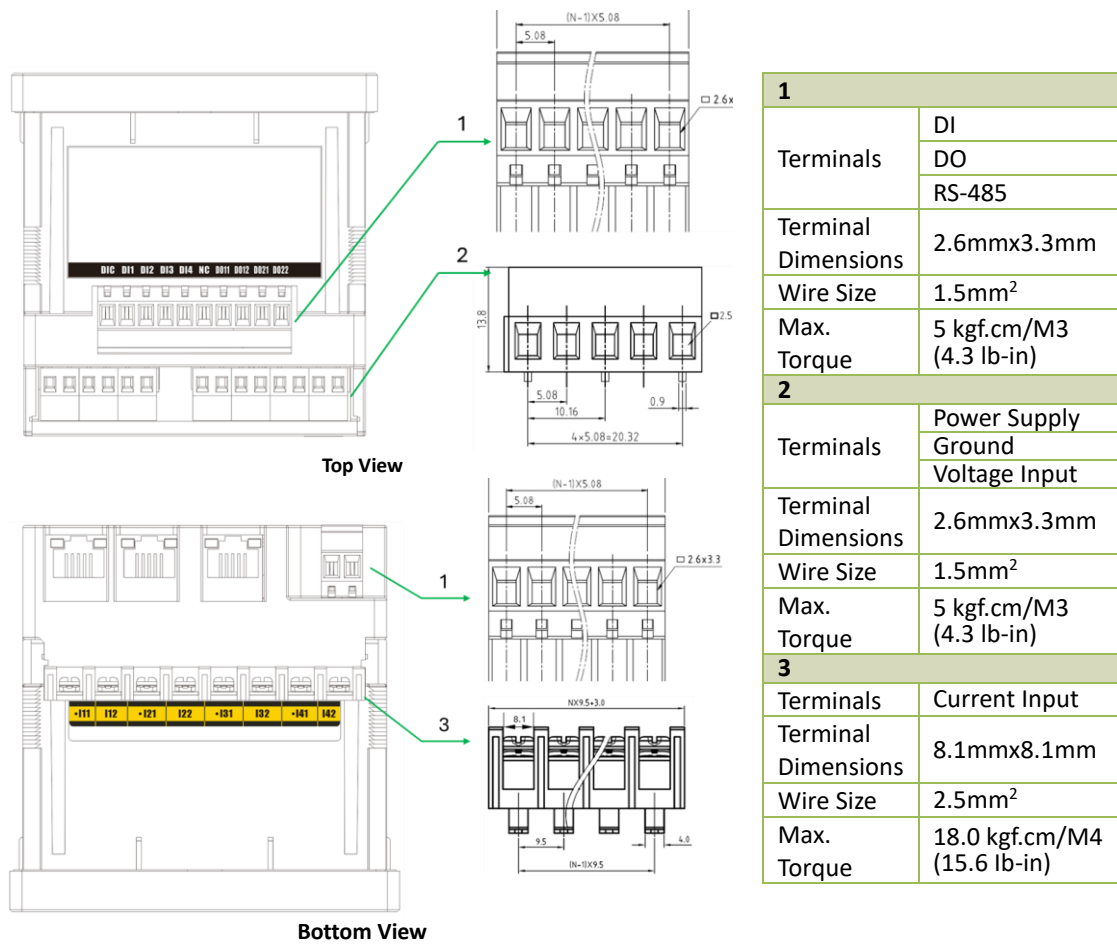


Figure 2-4 Terminal Dimensions

2.4 SSCP Dimensions

1) PMC-SCCP-50A-500mV-B-A-B (unit: mm)

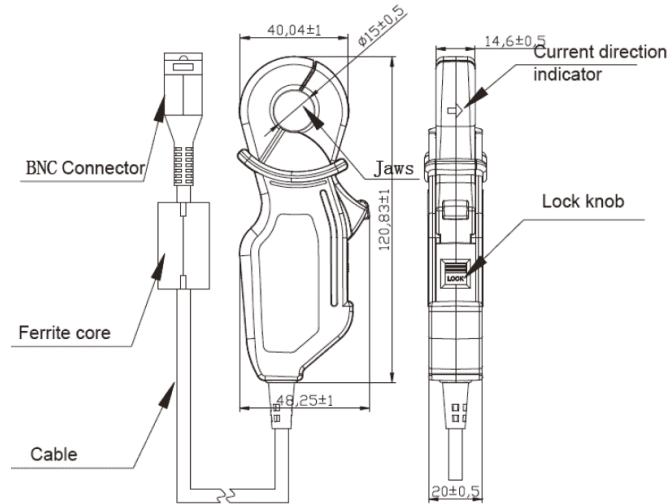


Figure 2-5 PMC-SCCP-50A-500mV-B-A-B Dimensions

2) PMC-SCCP-200A-200mV-B-B-B (unit: mm)

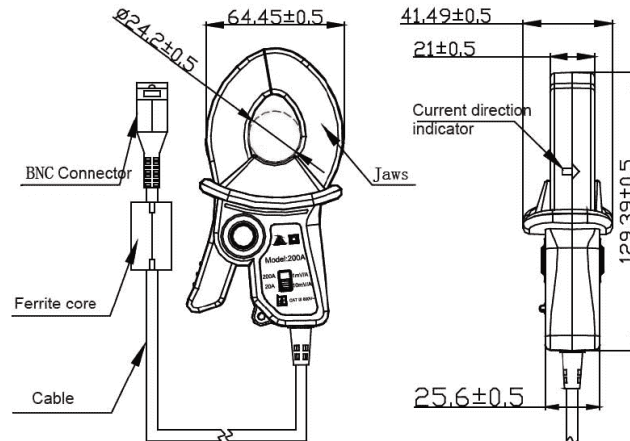


Figure 2-6 PMC-SCCP-200A-200mV-B-B-B Dimensions

3) PMC-SCCP-500A-500mV-B-B-B (unit: mm)

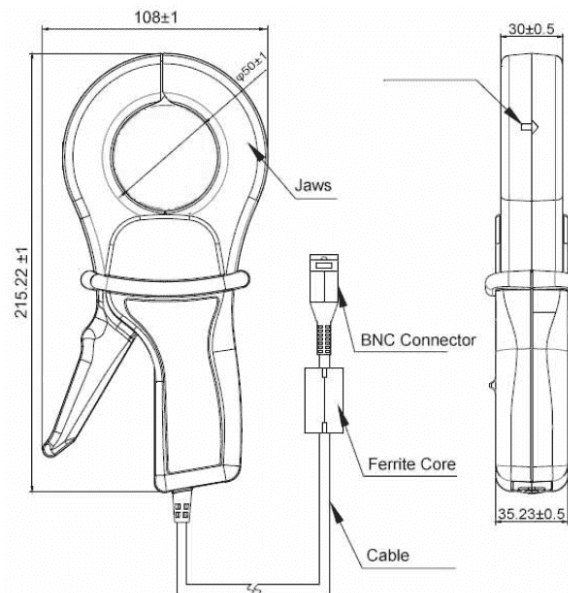


Figure 2-7 PMC-SCCP-500A-500mV-B-B-B Dimensions

4) **PMC-SCCP-5kA-500mV-B-C-C-100**

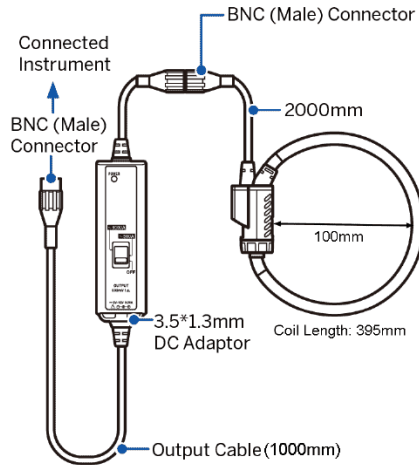


Figure 2-8 PMC-SCCP-5kA-500mV-B-C-C-100 Dimensions

5) **PMC-SCCP-5kA-500mV-B-C-C-150**

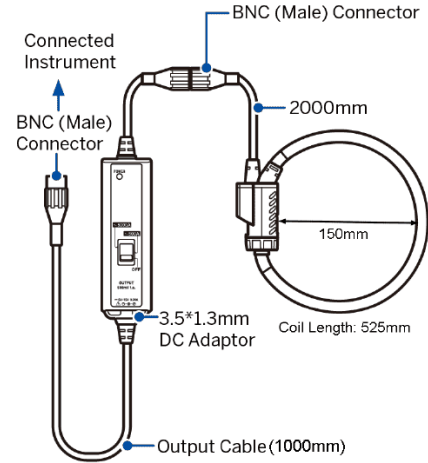


Figure 2-9 PMC-SCCP-5kA-500mV-B-C-C-150 Dimensions

6) **PMC-SCCP-5kA-500mV-B-C-C-254**

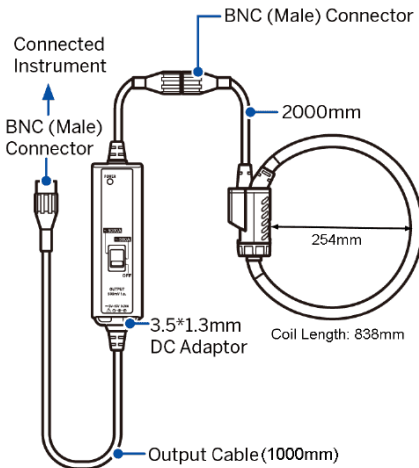


Figure 2-10 PMC-SCCP-5kA-500mV-B-C-C-254 Dimensions

7) **PMC-SCCP-5kA-500mV-B-C-C-371**

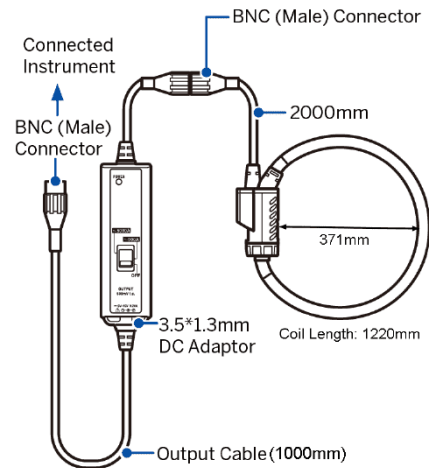


Figure 2-11 PMC-SCCP-5kA-500mV-B-C-C-371 Dimensions

2.5 Mounting

The iMeter 5 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 92mmx92mm cutout as shown in Figure 2-12
- Re-install and tighten the mounting brackets against the panel to secure the meter

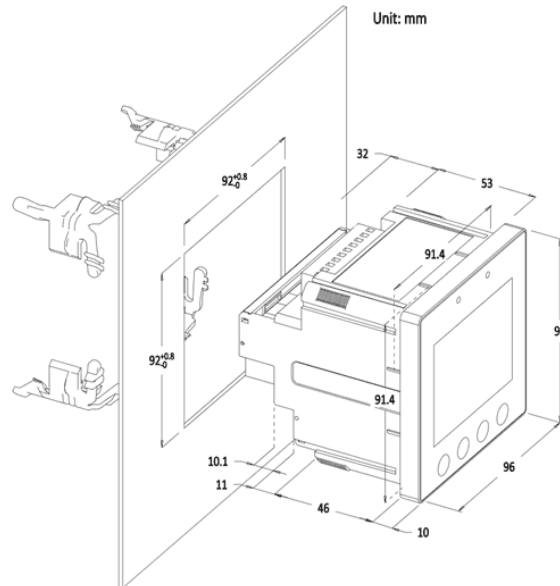


Figure 2-12 Installation

2.6 Wiring Connections

iMeter 5 can satisfy almost any three phase power systems. Please read this section carefully before installation and choose the correct wiring method for your power system. The following wiring modes are supported:

- 3-Phase 4-Wire Wye Direct Connection with 4CTs
- 3-Phase 4-Wire Wye with 3PTs and 4CTs
- 3-Phase 3-Wire Grounded Wye with no PTs & 3CTs
- 3-Phase 3-Wire Grounded Wye with 3PTs and 3CTs
- 3-Phase 3-Wire Direct Delta Direct Connection with 3CTs
- 3-Phase 3-Wire Open Delta with 2PTs and 3CTs
- 3-Phase 3-Wire Open Delta with 2PTs and 2CTs
- 1-Phase 3-Wire Direct Connections with 2CTs
- 1-Phase 2-Wire L-N Direct Connections with 1CT
- 1-Phase 2-Wire L-L Direct Connections with 1CT

Caution

Under no circumstances should the PT secondary be shorted.

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

2.6.1 3-Phase 4-Wire Wye Direct Connection with 4CTs

Please consult the serial number label to ensure that the system phase voltage is less than or equal to the device's voltage input specification. Set the **Wiring Mode** to 3P4W.

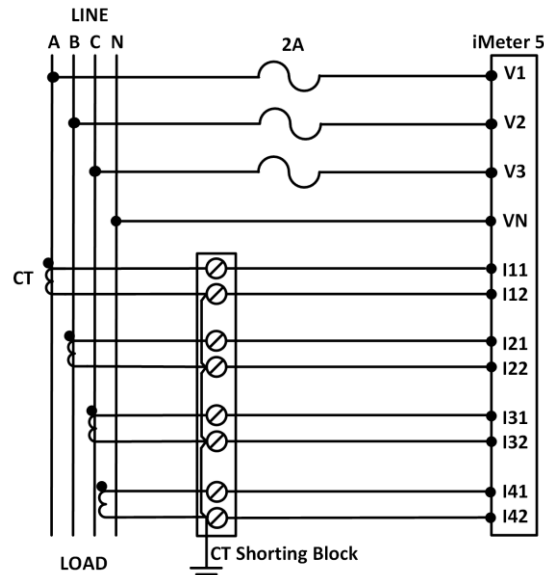


Figure 2-13 3-Phase 4-Wire Wye Direct Connection with 4CTs

2.6.2 3-Phase 4-Wire Wye with 3PTs & 4CTs

Please consult the serial number label to ensure that the rated PT secondary voltage is less than or equal to the device's voltage input specification. Set the **Wiring Mode** to 3P4W.

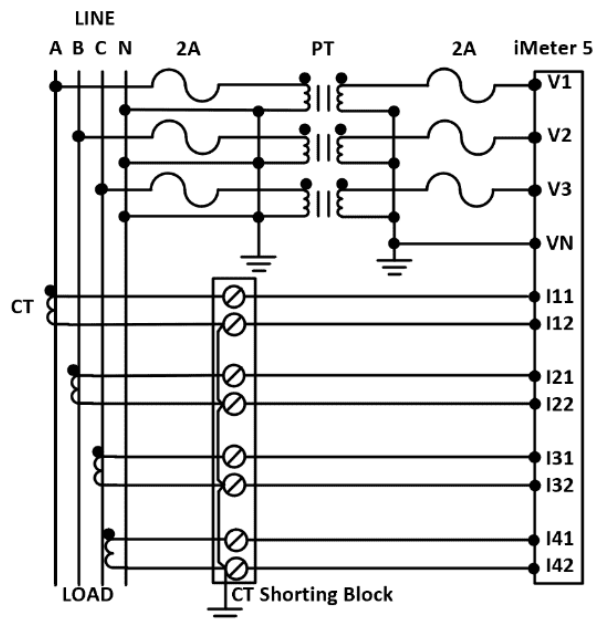


Figure 2-14 3-Phase 4-Wire Wye with 3PTs & 4CTs

2.6.3 3-Phase 3-Wire Grounded Wye with no PTs & 3CTs

Please consult the serial number label to ensure that the system phase voltage is less than or equal to the device's voltage input specification. Set the **Wiring Mode** to 3P4W.

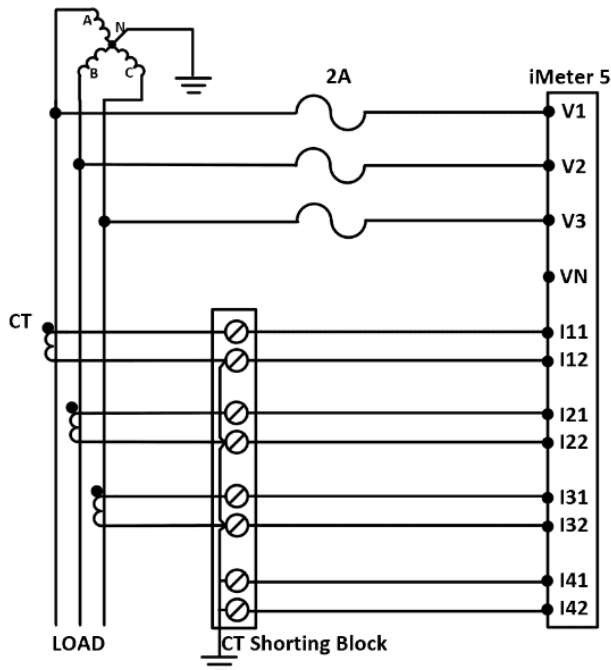


Figure 2-15 3-Phase 3-Wire Grounded Wye with no PTs & 3CTs

2.6.4 3-Phase 3-Wire Grounded Wye with 3PTs & 3CTs

Please consult the serial number label to ensure that the rated PT secondary voltage is less than or equal to the device's voltage input specification. Set the **Wiring Mode** to 3P4W.

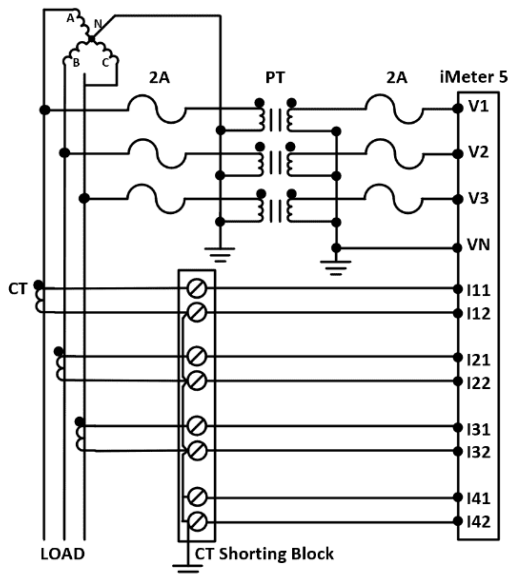


Figure 2-16 3-Phase 3-Wire Grounded Wye with 3PTs & 3CTs

2.6.5 3-Phase 3-Wire Direct Delta Connection with 3CTs

Please consult the serial number label to ensure that the rated PT secondary voltage is less than or equal to the device's voltage input specification. Set the **Wiring Mode** to 3P3W.

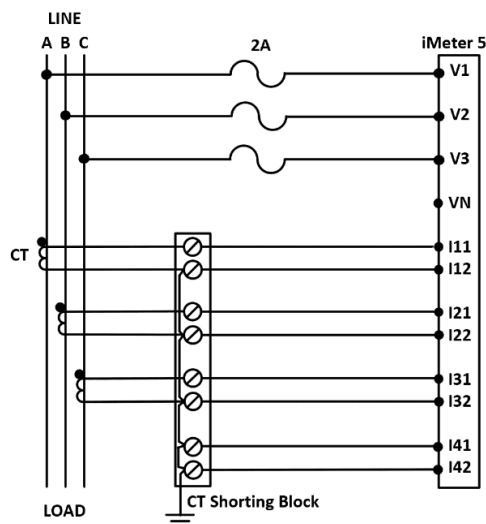


Figure 2-17 3-Phase 3-Wire Direct Delta Connection with 3CTs

2.6.6 3-Phase 3-Wire Open Delta with 2PTs & 3CTs

Please consult the serial number label to ensure that the rated PT secondary voltage is less than or equal to the device's voltage input specification. Set the **Wiring Mode** to 3P3W.

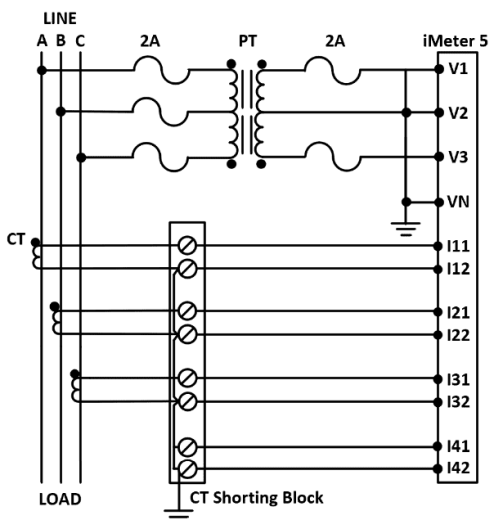


Figure 2-18 3-Phase 3-Wire Open Delta with 2PTs & 3CTs

2.6.7 3-Phase 3-Wire Open 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 device's voltage input specification. Set the **Wiring Mode** to 3P3W.

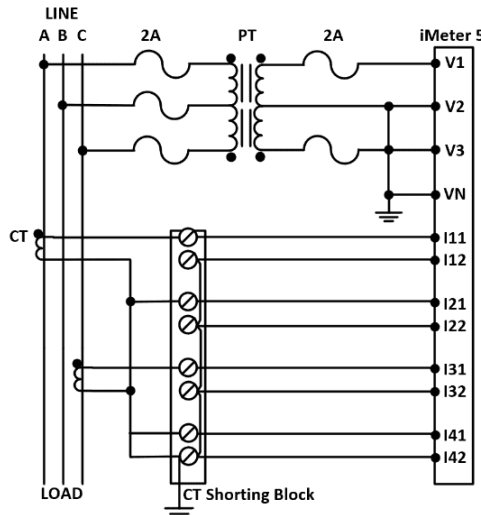


Figure 2-19 3-Phase 3-Wire Open Delta with 2PTs and 2CTs

2.6.8 1-Phase 3-Wire Direct Connections with 2CTs

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.

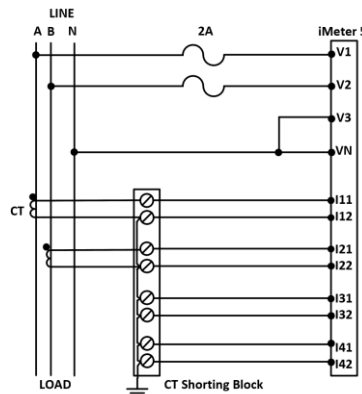


Figure 2-20 1-Phase 3-Wire Direct Connections with 2CTs

2.6.9 1-Phase 2-Wire L-N Direct Connections with 1CT

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.

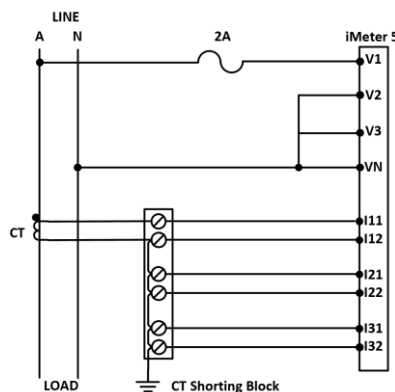


Figure 2-21 1-Phase 2-Wire L-N Direct Connections with 1CT

2.6.10 1-Phase 2-Wire L-L Direct Connections with 1CT

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**.

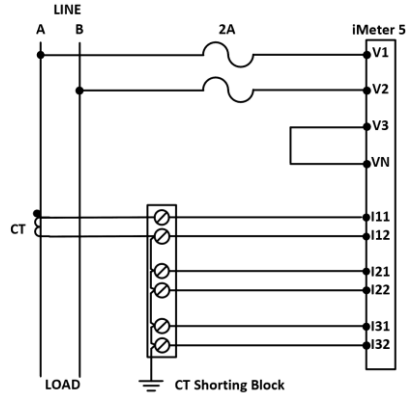


Figure 2-22 1-Phase 2-Wire L-L Direct Connections with 1CT

2.7 Communications Wiring

2.7.1 Ethernet Port (10/100BaseT)

2.7.1.1 Pin Description

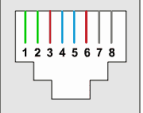
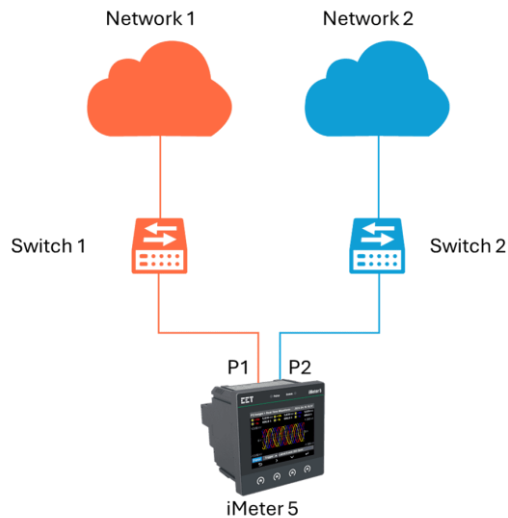
RJ45 Connector	Pin	Meaning
	1	Transmit Data+
	2	Transmit Data-
	3	Receive Data+
	4,5,7,8	NC
	6	Receive Data-

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

2.7.1.2 Ethernet Mode

The iMeter 5 supports both **Normal Mode** and **Switch Mode** (Daisy-Chain) topologies illustrated in the following sections.

Normal Mode



Switch Mode

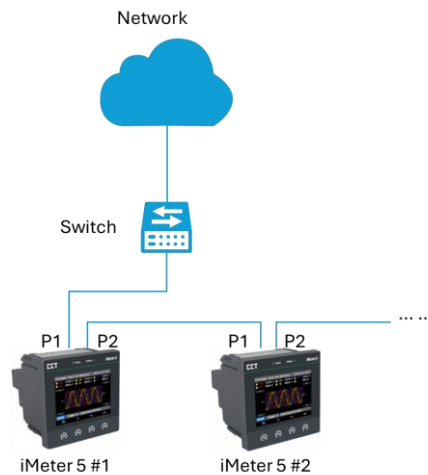


Figure 2-23 Ethernet Normal Mode and Switch Mode

In addition, the iMeter 5 also supports Rapid Spanning Tree Protocol (RSTP) to achieve optimal method for forwarding network traffic without any unnecessary redundancy.

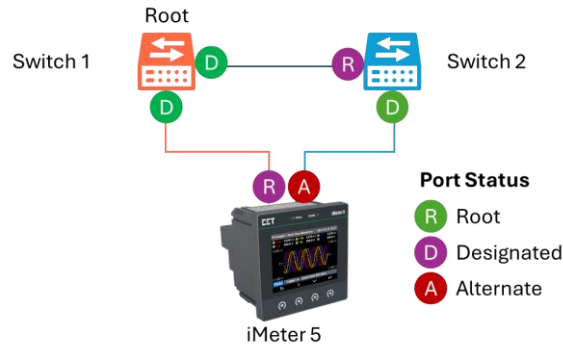


Figure 2-24 Ethernet RSTP Mode

2.7.2 RS-485 Port

The iMeter 5 provides one RS-485 port and supports the Modbus RTU protocol. Up to 32 devices can be connected on an 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 an RS-485 communications port, an Ethernet-to-RS-485 gateway or USB/RS-485 converter with optically isolated outputs and surge protection should be used.

The following figure illustrates the RS-485 communication connections on iMeter 5:

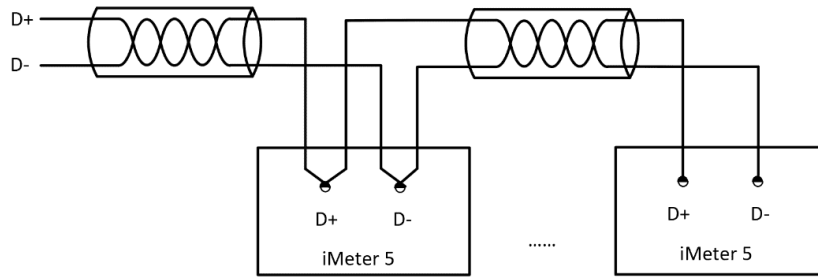


Figure 2-25 RS-485 Communication Connections

2.8 Digital Input Wiring

The following figure illustrates the Digital Input connections on iMeter 5:

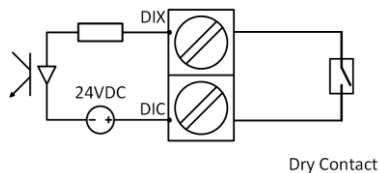


Figure 2-26 DI Connections

2.9 GPS 1PPS Input wiring

The GPS terminals on the iMeter 5 can be connected for GPS 1PPS Time Sync. or IRIG-B Time Sync.

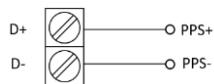


Figure 2-27 GPS 1PPS Time Sync.



Figure 2-28 IRIG-B Time Sync.

2.10 Digital Output Wiring

The following figure illustrates the Digital Output connections on iMeter 5:

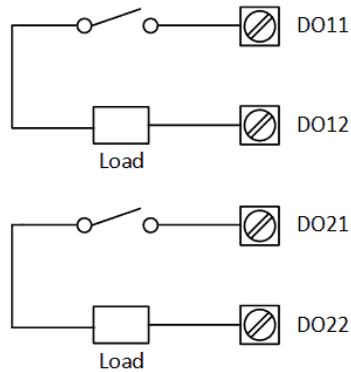


Figure 2-29 DO Connections

2.11 Pulse Output Wiring

The following figure illustrates the Pulse Output connections on iMeter 5.

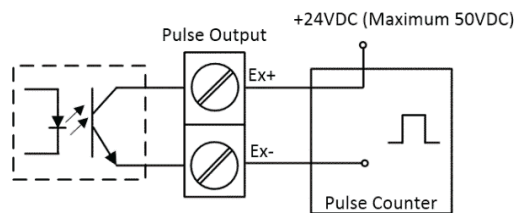


Figure 2-30 Pulse Output (Solid State Relay) Connections for Energy Pulsing

2.12 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.

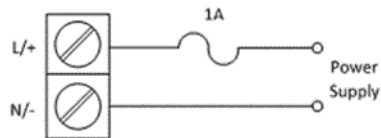


Figure 2-31 Power Supply Connections

Chapter 3 User Interface

3.1 Front Panel Interface

The following screenshot shows the Real-Time Waveform Capture display on the iMeter 5 Front Panel, which is equipped with a High-Resolution IPS Color Dot-Matrix Display @ 320x240. There are two LED indicators which are used for Run/Energy Pulsing, and Comm. status monitoring. The iMeter 5 also provides four buttons for data display and setup configuration.

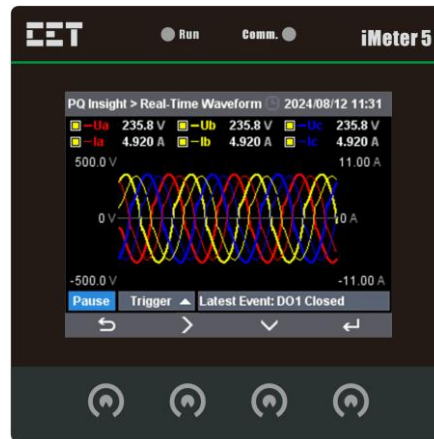


Figure 3-1 Front Panel Interface

3.1.1 LED Indicator

The following table illustrates the definitions for LED indicators.

LED Indicator	Color	Status	Description
Run	Green	Flashing	Device is running normally
		OFF	Device is running abnormally
Comm.	Green	Flashing	Pulsing based on the rate of Energy Consumption
		OFF	No Communication

Table 3-1 LED Indicator Definition

3.1.2 Front Panel Button

The iMeter 5 Front Panel features four touch buttons that serve diverse functions across various interfaces, with dynamically displayed key symbols beneath the screen corresponding to their respective operations.

The following table provides an overview of the Front Panel Button's operations.

Keys	Metering / Power Quality / PQ Insight / Event Menu	Setup Menu
	The <<> and <>> are used for navigation around different Main Menus on the Front Panel.	
<^> <V> <<> <>>	Before a sub-menu is selected, ☞ Press <^> or <V> to navigate the sub-menu list. After a sub-menu is selected, ☞ Press <^> or <V> to display different pages of parameters. ☞ Use <<> or <>> to scroll to the next tab at the top pane. ☞ In the WFR and DWR page, press <<> or <>> to scroll backward or forward through the waveform and <^> or <V> to zoom in/out of the waveform.	Before a parameter is selected, ☞ Use <<>, <>>, <^> and <V> buttons to navigate around. If a parameter is selected, ☞ For a numeric parameter, press <^> to increment a numeric value. ☞ For an enumerated parameter, press <^> or <V> to scroll through the selection list.
<↵>	☞ Press <↵> to enter the selected Sub-menu ☞ In PQ Insight , press <↵> to Pause/Refresh the WF Capture, toggle the signal selection for WF display, manually trigger WFR/DWR or view the latest event details.	Before a parameter is selected and modified, ☞ pressing <↵> selects a parameter for modification. After a parameter is modified ☞ pressing <↵> saves the present value of the selected parameter into memory.
<↵>	Press <↵> to exit the current display.	☞ Press <↵> to cancel the current change. ☞ Press <↵> to exit a setup page, a pop-up window will prompt to save the changes.

Table 3-2 Front Panel Button Description

3.1.3 Front Panel Display

The Front Panel Display allows the user to view data and perform basic configuration. The main menu consists of 5 items, **Metering**, **Power Quality**, **PQ Insight**, **Events** and **Setup**. Each item has sub-menus for detailed data viewing or setup configuration. All data and setup parameters can be viewed without a password, but a valid **Front Panel Password** is required to make setup changes. The default **Front Panel Password** is 000001.

The following figure provides an overview of the menus.

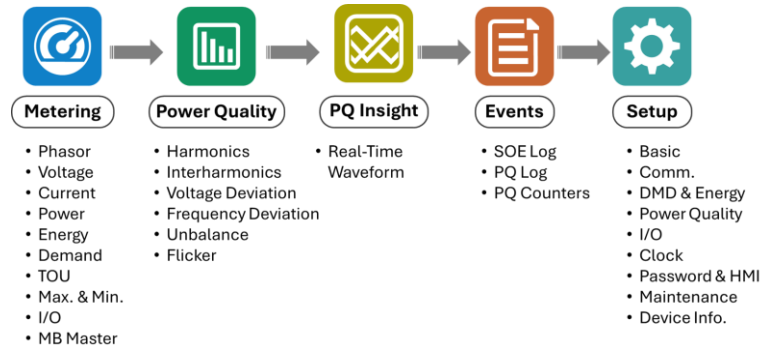


Figure 3-2 Front Panel Display

3.1.3.1 Metering

The **Metering** menu consists of **Phasor**, **Voltage**, **Current**, **Power**, **Energy**, **Demand**, **TOU**, **Max. & Min.**, **I/O** and **MB Master** (supported in Firmware V.1.50.01 and later). The following sections provide an overview of these submenus.

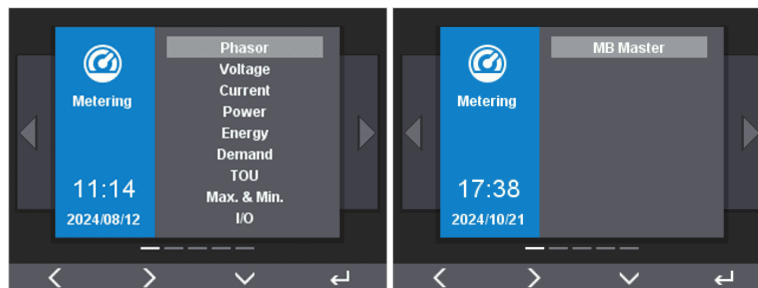


Figure 3-3 Metering Menu

3.1.3.1.1 Phasor

Enter the **Phasor** sub-menu and the following screen appears which displays the magnitude and phase information.

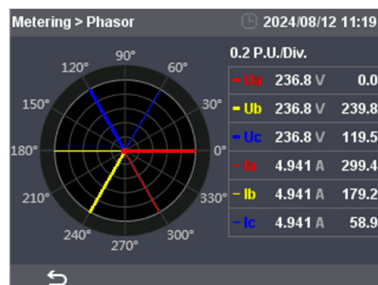
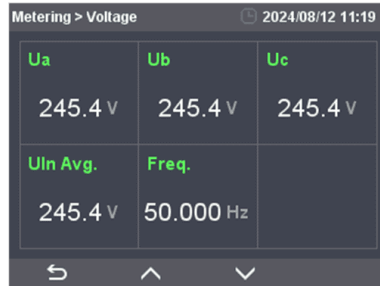


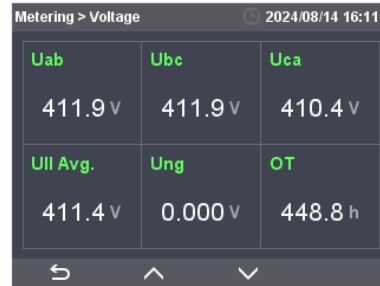
Figure 3-4 Phasor

3.1.3.1.2 Voltage

Enter the **Voltage** sub-menu and the following screens are available. Use the <Λ> or <V> to scroll through the different displays for 3-Ø and average Uln, Ull as well as Ung, OT (Operating Time) and Frequency.



3-Ø and average Uln and Frequency



3-Ø and average Ull, Ung and OT

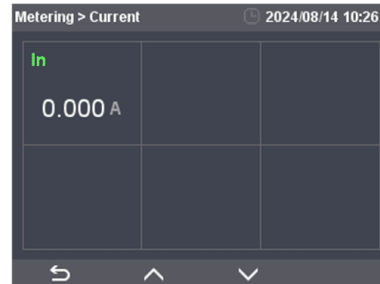
Figure 3-5 Voltage Measurements

3.1.3.1.3 Current

Enter the **Current** sub-menu and the 3-Ø and average currents as well as I4, IR (Calculated Residual Current) and In (Calculated Neutral Current) are displayed.



3-Ø and average Current, I4 and IR



In

Figure 3-6 Current Measurements

3.1.3.1.4 Power

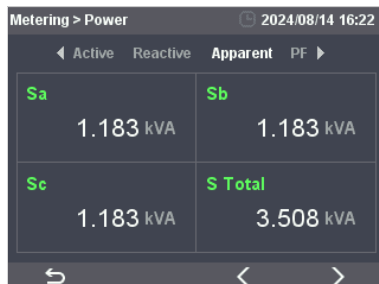
Enter the **Power** sub-menu and the following screens are available. Use the <<> or <>> to scroll to the different displays for 3-Ø and Total P, Q, S and PF.



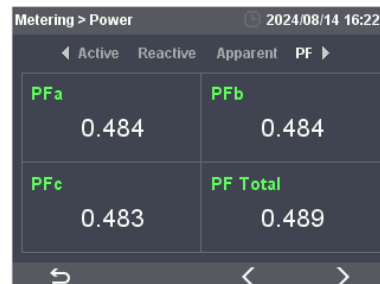
Active Power



Reactive Power



Apparent Power



Power Factor

Figure 3-7 Power Measurements

3.1.3.1.5 Energy

Enter the **Energy** sub-menu and the following screens are available. Press << or >> button to scroll among RMS, Fundamental, Total Harmonic measurements as well as Daily and Monthly Energy consumption curves.

Use <V> button to scroll to the different displays for kWh, kvarh Import/Export/Total/Net and kVAh Total.

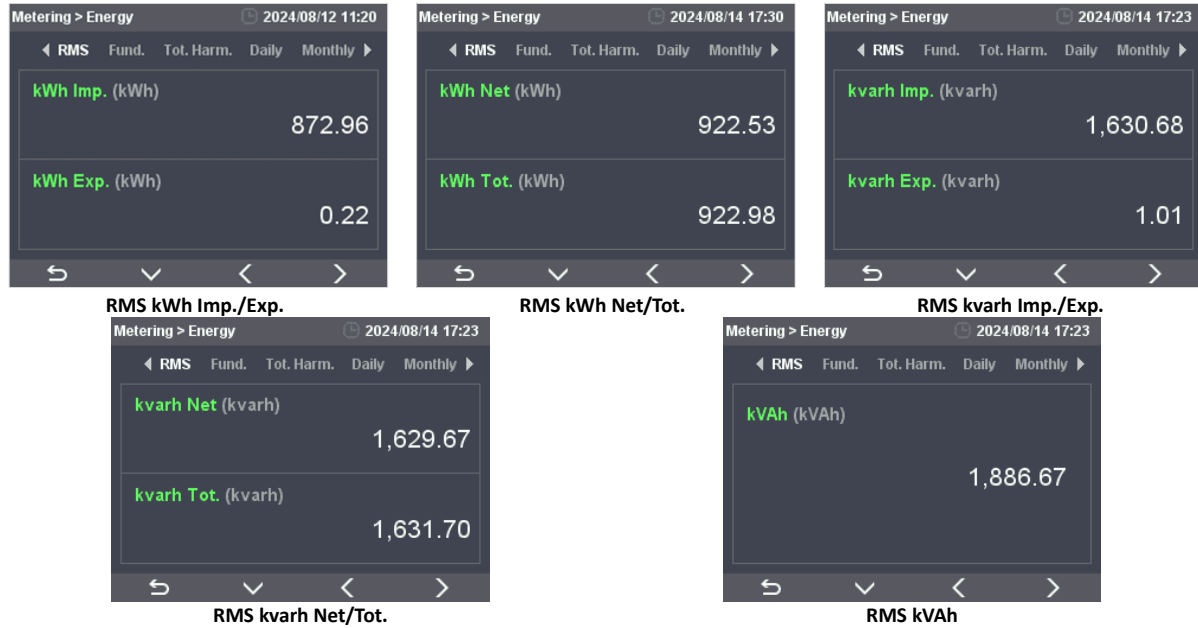


Figure 3-8 RMS Energy Measurements

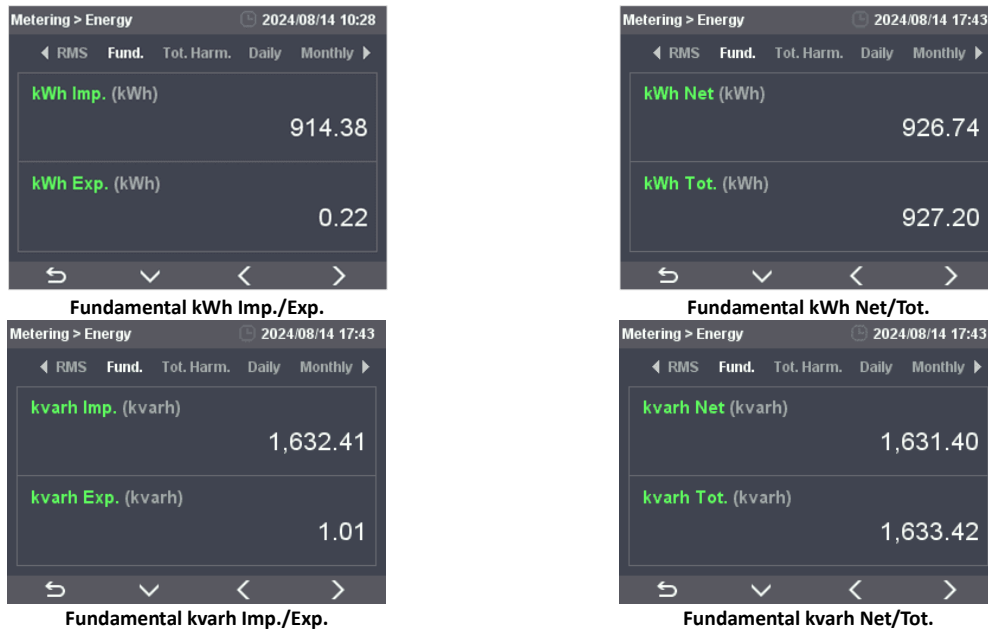


Figure 3-9 Fundamental Energy Measurements

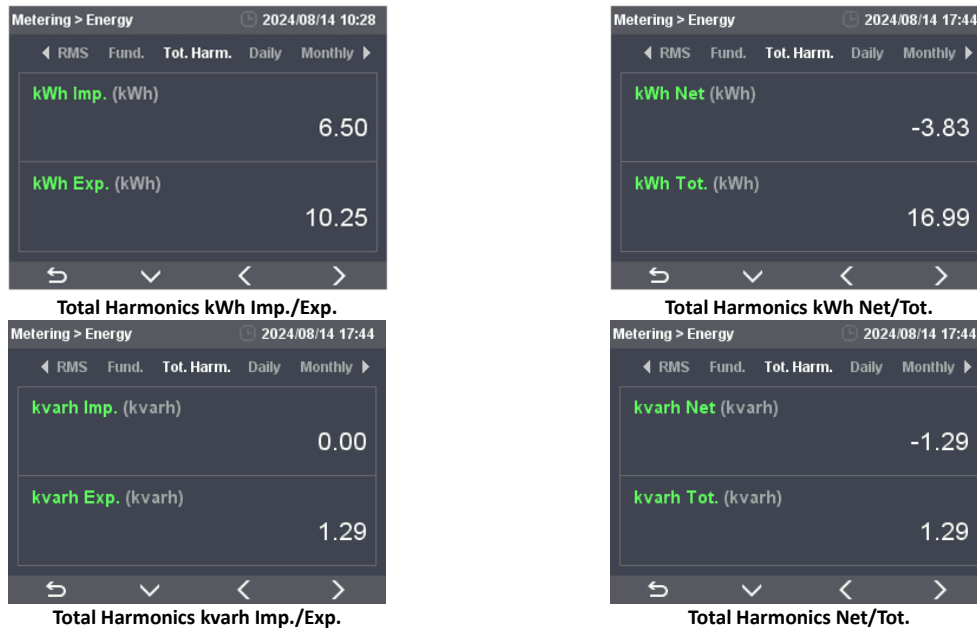


Figure 3-10 Total Harmonics Energy Measurements

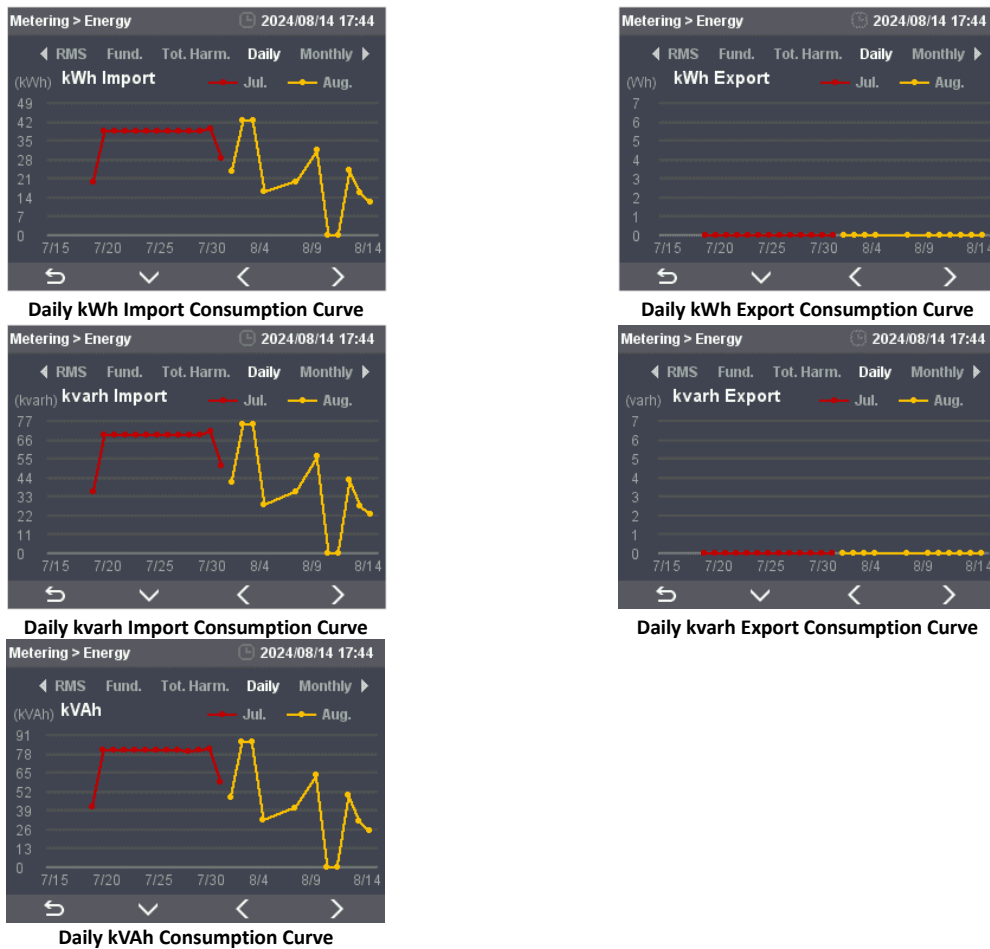
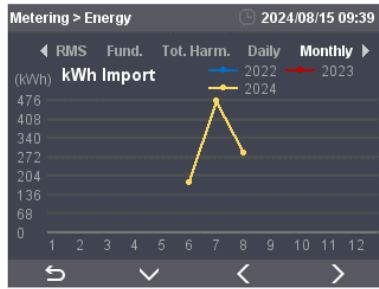


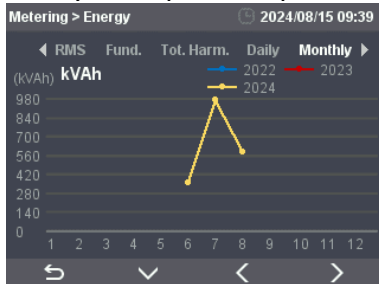
Figure 3-11 Daily Energy Consumption Curve



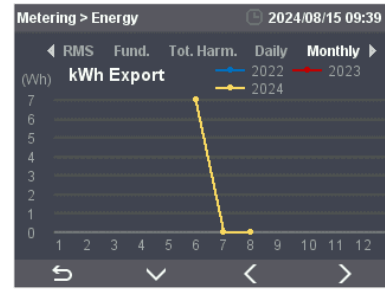
Monthly kWh Import Consumption Curve



Monthly kvarh Import Consumption Curve



Monthly kVAh Consumption Curve



Monthly kWh Export Consumption Curve

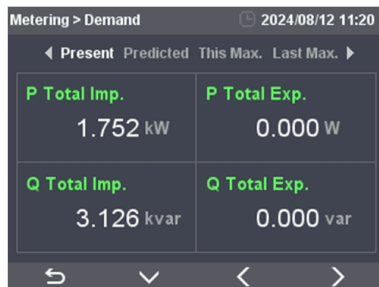


Monthly kvarh Export Consumption Curve

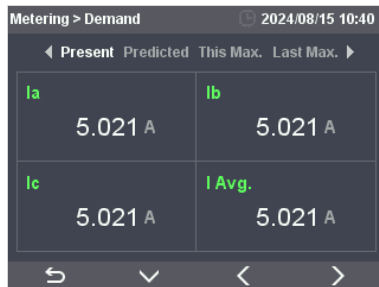
Figure 3-12 Monthly Energy Consumption Curve

3.1.3.1.6 Demand

Enter the **Demand** sub-menu and the following screens are available. Press the << or >> button to scroll among Present, Predicted, This Max. and Last Max. Demand measurements. Use the <V> button to scroll to the different parameters for P Total Imp./Exp., Q Total Imp./Exp., S, 3-Ø and average Current as well as UII Avg.



Present Demand for P, Q Import/Export



Present Demand for Current

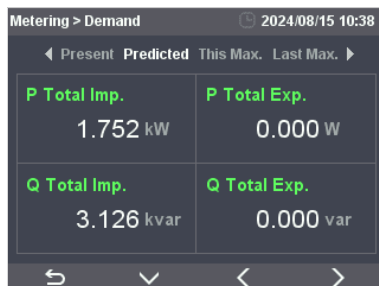


Present Demand for S

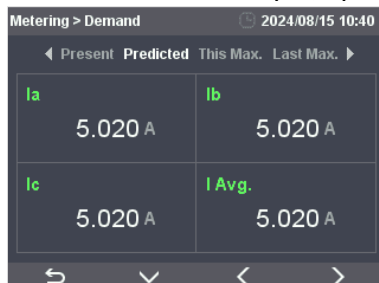


Present Demand for UII Avg.

Figure 3-13 Present Demand Measurements



Predicted Demand for P, Q Import/Export



Predicted Demand for Current



Predicted Demand for S



Predicted Demand for UII Avg.

Figure 3-14 Predicted Demand Measurements

Under **This Max./Last Max.** Demand, use the <V> button to scroll to the different parameters for P, Q, S and 3- $\emptyset$ and average current.

Metering > Demand 2024/08/15 10:38

◀ Present Predicted **This Max.** Last Max. ▶

Since: 2024/08/02 10:34:35

	Max. Demand	Timestamp
P Total Imp.	1.752 kW	2024/08/09 09:30:00
P Total Exp.	0.000 W	2024/08/02 11:00:00
Q Total Imp.	3.127 kvar	2024/08/09 09:30:00
Q Total Exp.	0.000 var	2024/08/02 11:00:00
S Total	3.585 kVA	2024/08/09 09:30:00

⏮ ⏭ ⏪ ⏩ ⏴ ⏵

This Max. Demand Measurements for Power

Metering > Demand 2024/08/15 10:38

◀ Present Predicted **This Max.** Last Max. ▶

Since: 2024/08/02 10:34:35

	Max. Demand	Timestamp
Ia	5.021 A	2024/08/05 00:15:00
Ib	5.021 A	2024/08/05 00:15:00
Ic	5.021 A	2024/08/05 00:15:00
I Avg.	5.021 A	2024/08/05 00:15:00
Ull Avg.	415.8 V	2024/08/05 00:15:00

⏮ ⏭ ⏪ ⏩ ⏴ ⏵

This Max. Demand Measurement for Current and Ull Avg.

Figure 3-15 This Max. Demand Measurements

Metering > Demand 2024/08/15 10:39

◀ Present Predicted **This Max.** Last Max. ▶

Since: 2024/08/02 10:34:35

	Max. Demand	Timestamp
P Total Imp.	1.752 kW	2024/08/09 09:30:00
P Total Exp.	0.000 W	2024/08/02 11:00:00
Q Total Imp.	3.127 kvar	2024/08/09 09:30:00
Q Total Exp.	0.000 var	2024/08/02 11:00:00
S Total	3.585 kVA	2024/08/09 09:30:00

⏮ ⏭ ⏪ ⏩ ⏴ ⏵

Last Max. Demand Measurements for Power

Metering > Demand 2024/08/15 10:39

◀ Present Predicted **This Max.** Last Max. ▶

Since: 2024/08/02 10:34:35

	Max. Demand	Timestamp
Ia	5.021 A	2024/08/05 00:15:00
Ib	5.021 A	2024/08/05 00:15:00
Ic	5.021 A	2024/08/05 00:15:00
I Avg.	5.021 A	2024/08/05 00:15:00
Ull Avg.	415.8 V	2024/08/05 00:15:00

⏮ ⏭ ⏪ ⏩ ⏴ ⏵

Last Max. Demand Measurements for Current and Ull Avg.

Figure 3-16 Last Max. Demand Measurements

3.1.3.1.7 TOU

Enter the **TOU** sub-menu and the following screens are available, which display the Present Tariff/Season/Daily Profile and the corresponding kWh, kvarh Import/Export and kVAh. Use the <<> or <>> button to scroll among the T1 to T8.

Metering > TOU 2024/08/12 11:20

◀ T1 T2 T3 T4 T5 T6 T7 T8 ▶

Present Tariff / Season / Daily Profile: T1 / S1 / DP1

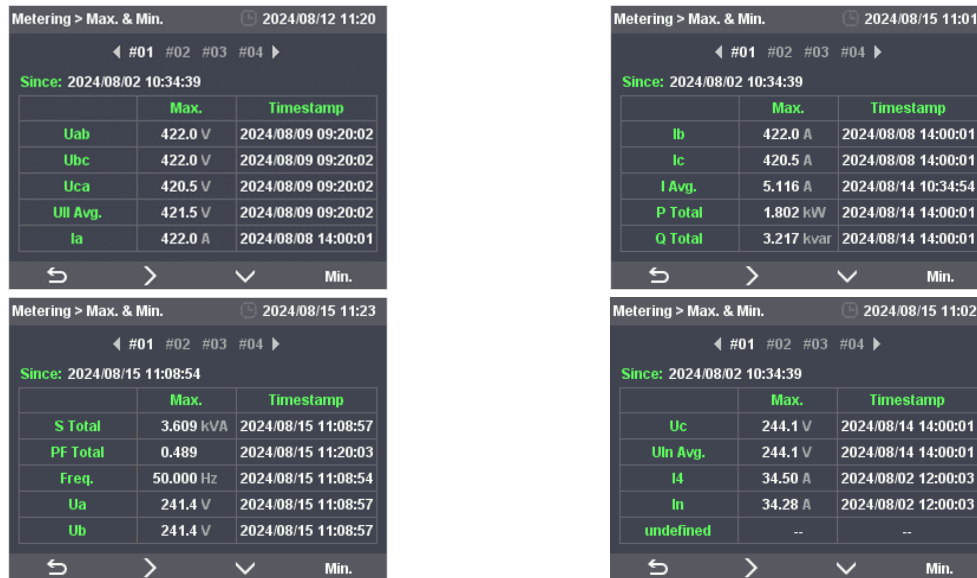
kWh Imp. (kWh)	872.96
kWh Exp. (kWh)	0.22
kvarh Imp. (kvarh)	1,542.21
kvarh Exp. (kvarh)	1.01
kVAh (kVAh)	1,785.24

⏮ ⏭ ⏪ ⏩ ⏴ ⏵

Figure 3-17 TOU Measurements

3.1.3.1.8 Max. & Min.

Enter the **Max. & Min.** sub-menu and the following screens are available. Use the button under **<Min.>** or **<Max.>** to scroll between **Max.** and **Min.** Use the **<<>** or **<>>** button to scroll among the 4 Max./Min. Recorders and then use **<V>** scroll to the different parameters.



Max. Recorder #1 Measurements
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. Use the **<<>** or **<>>** button to scroll among DI and DO.



Figure 3-19 I/O

3.1.3.1.10 MB Master

Enter the **MB Master** sub-menu (supported in Firmware V1.50.01 and later) and the data for connected slaves will display. Use the **<<>** or **<>>** button to scroll among the 31 slaves and then use **<V>** scroll to the different parameters. The measurements displayed for each slave may be different due to the device type with different parameters. Please refer to **Section 4.13** for more information.

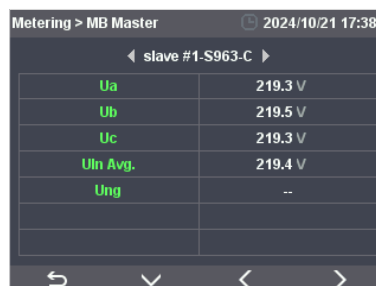


Figure 3-20 MB Master

3.1.3.2 Power Quality

The **Power Quality** menu includes **Harmonics**, **Interharmonics**, **Voltage Deviation**, **Frequency Deviation**, **Unbalance** and **Flicker**. The following sections provide a quick overview of these screens.

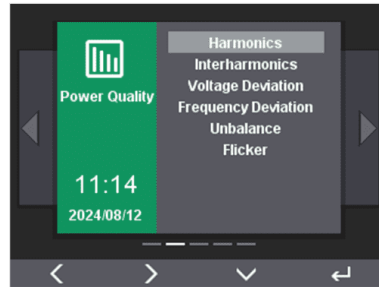


Figure 3-21 Power Quality Menu

3.1.3.2.1 Harmonics

Enter the **Harmonics** sub-menu and the following screens are available. Use << or >> to scroll between the **Harmonic Spectrum** for 3-Ø Voltages and 4-Ø Currents.

1. Press the button under <**THD**> to view the THD, TOHD, TEHD and Crest Factor measurements and use the <V> button to view the TDD, TDD Odd, TDD Even and K-Factor measurements for Currents.
2. Press the button under <**Details**> to view the Individual Harmonics and use the <^> or <V> button to view the %HD, RMS and Angle measurement for 3-Ø Voltages and 4-Ø Currents for the respective individual harmonics.
3. Press <↩> to return to the previous level.

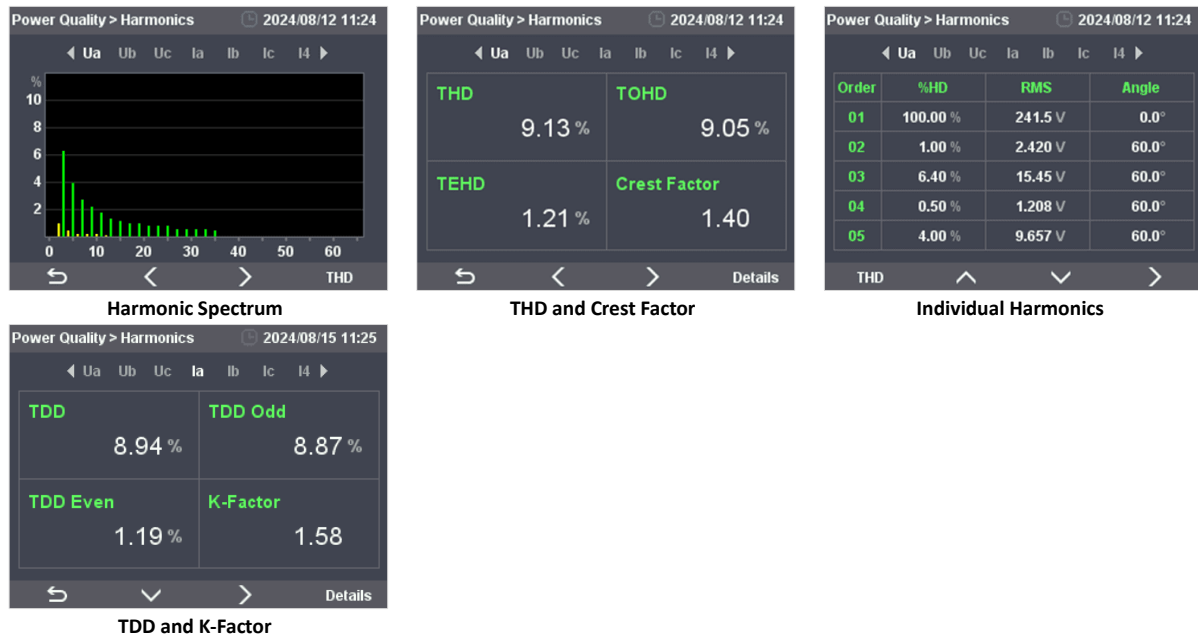
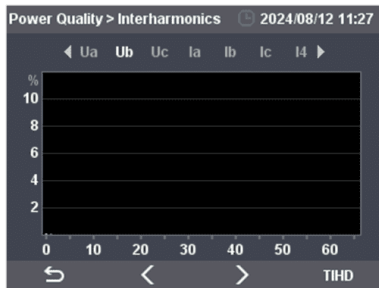


Figure 3-22 Harmonics Display

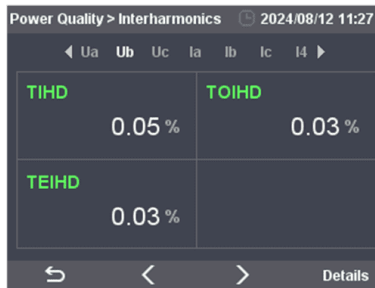
3.1.3.2.2 Interharmonics

Enter the **Interharmonics** sub-menu and the following screens are available. Use << or >> to scroll between the **Interharmonic Spectrum** for 3-Ø Voltages and 4-Ø Currents.

1. Press the button under <**TIHD**> to view the TIHD, TOIHD and TEIHD measurements.
2. Press the button under <**Detail**> to view the Individual Interharmonics and use the <^> or <v> button to view the %IHD and RMS measurements for 3-Ø Voltage and 4-Ø Current from IH00 to IH63.
3. Press <↩> to return to the previous level.



Interharmonic Spectrum



TIHD

Order	%IHD	RMS
00	0.03 %	0.065 V
01	0.03 %	0.069 V
02	0.01 %	0.019 V
03	0.00 %	0.008 V
04	0.00 %	0.009 V

Individual Interharmonics

Figure 3-23 Interharmonics

3.1.3.2.3 Voltage Deviation

Enter the **Voltage Deviation** sub-menu and the following screens are available. Use the <^> or <v> button to scroll through the displays for Over/Under Deviation measurements for 3-Ø Uln and Ull.

Ua Over	Ub Over	Uc Over
0.51 %	0.51 %	0.52 %
Ua Under	Ub Under	Uc Under
0.00 %	0.00 %	0.00 %

Uln Over/Under Deviations

Uab Over	Ubc Over	Uca Over
0.29 %	0.29 %	0.00 %
Uab Under	Ubc Under	Uca Under
0.00 %	0.00 %	0.07 %

Ull Over/Under Deviations

Figure 3-24 Voltage Deviation

3.1.3.2.4 Frequency Deviation



Figure 3-25 Frequency Deviation

3.1.3.2.5 Unbalance

Enter the **Unbalance** sub-menu and the following screens are available. Use the <Λ> or <V> button to scroll through the displays for negative sequence (U2/I2) and zero sequence (U0/I0) unbalances as well as the positive/negative/zero sequence components for Voltage and Current.



Negative/Zero Sequence Unbalances



Positive/Negative/Zero Sequence Components

Figure 3-26 Unbalance

3.1.3.2.6 Flicker

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



Figure 3-27 Flicker

3.1.3.3 PQ Insight

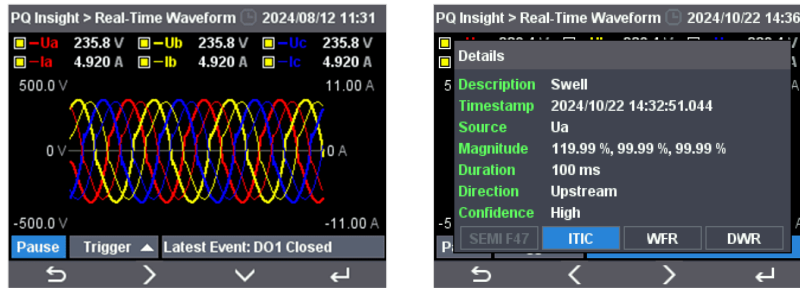
The **PQ Insight** menu mainly provides the Real-Time Waveform display.



Figure 3-28 PQ Insight

3.1.3.3.1 Real-Time Waveform Capture (WFC)

This screen shows the Real-Time Waveform Capture for 3- ϕ voltages and currents at 128 samples/cycle for 4 cycles that is updated every second. Use <V>, and <>> to navigate around the screen. One can toggle the display of a particular voltage or current channel, **Pause/Refresh** the WFC update or manually trigger a WFR (Waveform Recorder), DWR (Disturbance Waveform Recorder) or iTrigger Recorder, or check the details of the latest SOE event displayed at the bottom of the screen with ITIC/SEMI curves and WFR/DWR waveforms.



Pause/Refresh WFC Update

Check Details of the Latest SOE Event

Figure 3-29 Real-Time Waveform

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.

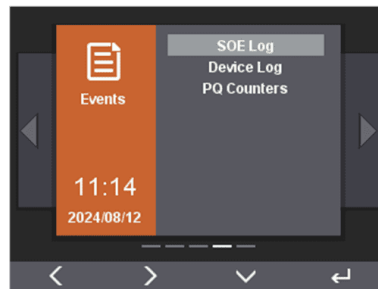
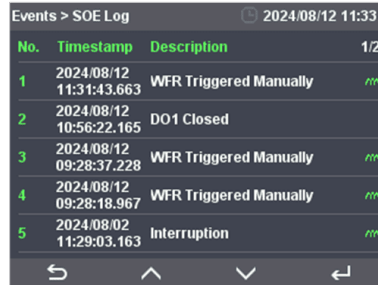


Figure 3-30 Events

3.1.3.4.1 SOE Log

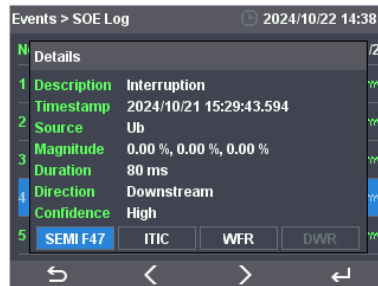
Enter the **SOE Log** sub-menu and the following screens are available. The **SOE Log** screen displays up to 1024 logs starting with the most recent event. Use <A> or <V> to quickly move through the pages. Press <↵> to enter a desired event page and then use the <A> or <V> to scroll through the event list. Press <↵> to select and view the event details.



No.	Timestamp	Description	
1	2024/08/12 11:31:43.663	WFR Triggered Manually	mm
2	2024/08/12 10:56:22.165	DO1 Closed	
3	2024/08/12 09:28:37.228	WFR Triggered Manually	mm
4	2024/08/12 09:28:18.967	WFR Triggered Manually	mm
5	2024/08/02 11:29:03.163	Interruption	mm

Figure 3-31 SOE Log

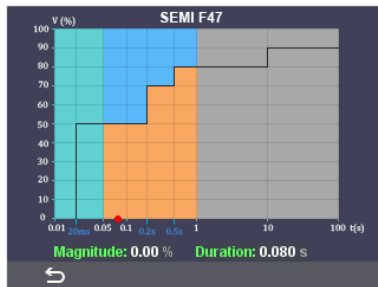
If the selected event is a PQ event, the **Details** dialog box may provide the options for displaying the SEMI F47/ITIC curves or the WFR and/or DWR waveform. Press <<> or <>> to select the option and then press <↵> to view the respective display.



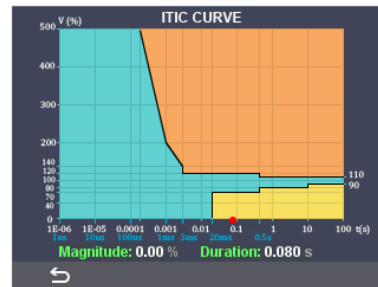
Details		
1	Description	Interruption
2	Timestamp	2024/10/21 15:29:43.594
3	Source	Ub
4	Magnitude	0.00 %, 0.00 %, 0.00 %
5	Duration	80 ms
6	Direction	Downstream
7	Confidence	High
<input checked="" type="button"/> SEMI F47 ITIC WFR DWR		

Figure 3-32 Event Details

Here are some examples for these displays:

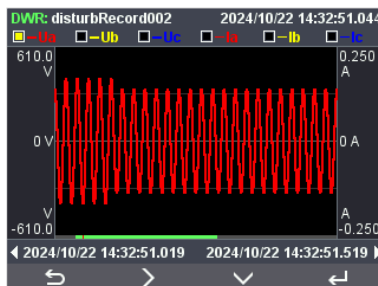


SEMI F47 Curve

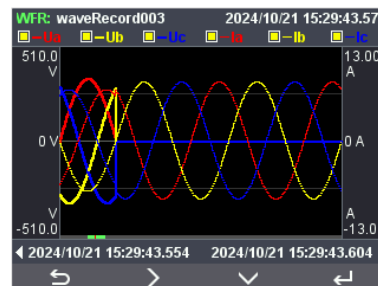


ITIC Curve

Figure 3-33 Examples for SEMI F47/ITIC Curve



DWR triggered by Swell



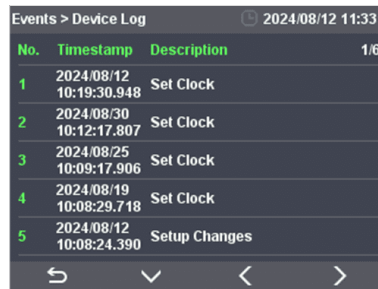
WFR triggered by Interruption

Figure 3-34 Examples for DWR (Swell) / WFR (Interruption)

Inside the waveform display, press <V> to zoom in/out of the waveform or press <>> to scroll forward/backward of the waveform on the time scale.

3.1.3.4.2 Device Log

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



No.	Timestamp	Description	1/6
1	2024/08/12 10:19:30.948	Set Clock	
2	2024/08/30 10:12:17.807	Set Clock	
3	2024/08/25 10:09:17.906	Set Clock	
4	2024/08/19 10:08:29.718	Set Clock	
5	2024/08/12 10:08:24.390	Setup Changes	

Figure 3-35 Device Log

3.1.3.4.3 PQ Counters

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



Counter	Count
Supply Voltage Swells	1
Supply Voltage Dips	1
Supply Voltage Interruptions	1
Transient Overvoltages	1
Rapid Voltage Changes	0
Inrush Current	0
MSV 1,000.00Hz	0
MSV 2,000.00Hz	0
MSV 3,000.00Hz	0
Total	4

Figure 3-36 PQ Counters

3.1.3.5 Setup

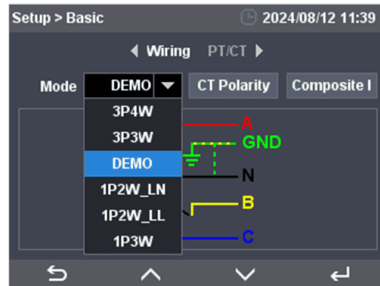
The **Setup** menu consists of **Basic**, **Comm.**, **DMD & Energy**, **Power Quality**, **I/O**, **Clock**, **Password & HMI**, **Maintenance** and **Device Info**. The following sections provide a quick overview of these screens.



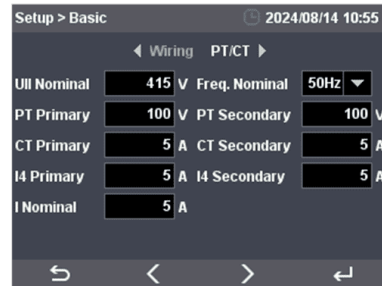
Figure 3-37 Setup Menu

3.1.3.5.1 Basic

Enter the **Basic** sub-menu and the following screens are available. Use the << or >> scroll between **Wiring** and **PT/CT** setup. Press <V> to scroll among different parameters. Press <↵> to select and modify the desired parameter. The Front Panel Password is required for any setup changes. Please refer to **Table 3-5** for the range and the default values of these parameters.



Wiring Setup

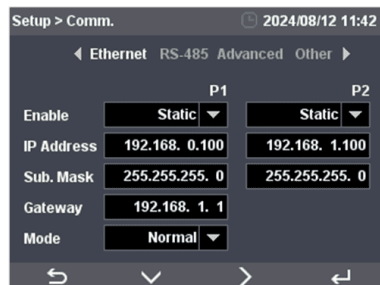


PT/CT Setup

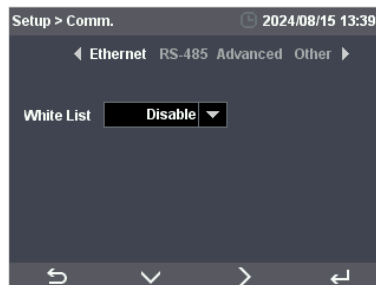
Figure 3-38 Basic Setup

3.1.3.5.2 Comm.

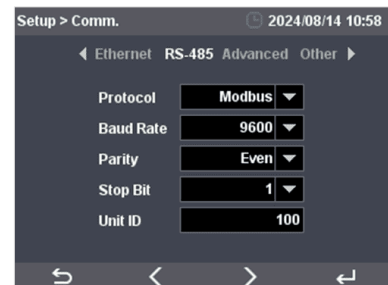
Enter the **Comm.** sub-menu and the following screens are available. Use the << or >> to scroll among **Ethernet**, **RS-485**, **Advanced**, **Other** and **MB Master** (MB Master supported in Firmware V1.50.01 and later).



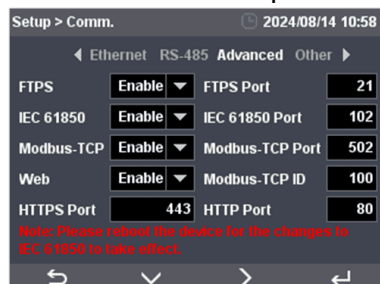
Ethernet Port Setup



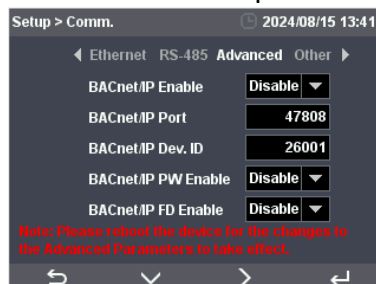
White List Setup



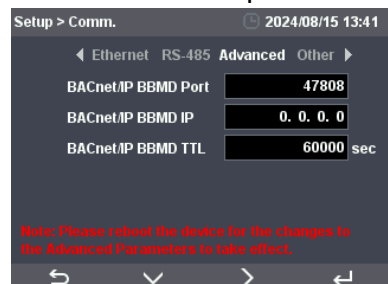
RS-485 Setup



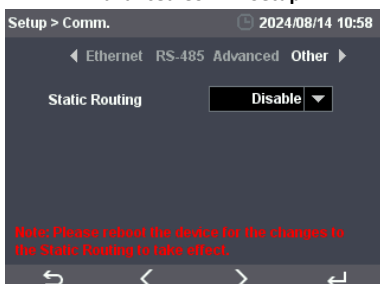
Advanced Comm. Setup



BACnet/IP Setup



BACnet/IP BBMD Setup



Static Routing Setup

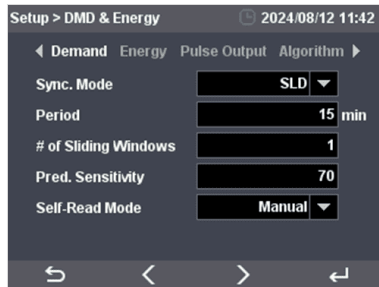


MB Master Setup

Figure 3-39 Comm. Setup

3.1.3.5.3 DMD & Energy

Enter the **DMD & Energy** sub-menu and the following screens are available. Use << or >> button to scroll among **Demand**, **Energy**, **Pulse Output** and **Algorithm**.



Setup > DMD & Energy 2024/08/12 11:42

◀ Demand Energy Pulse Output Algorithm ▶

Sync. Mode SLD ▼

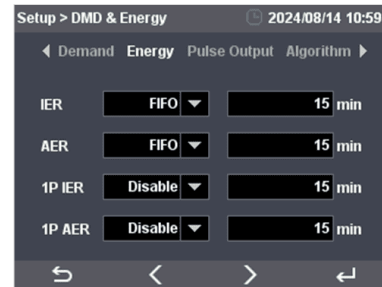
Period 15 min

of Sliding Windows 1

Pred. Sensitivity 70

Self-Read Mode Manual ▼

Demand Setup



Setup > DMD & Energy 2024/08/14 10:59

◀ Demand Energy Pulse Output Algorithm ▶

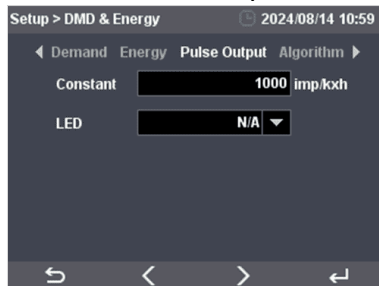
IER FIFO ▼ 15 min

AER FIFO ▼ 15 min

1P IER Disable ▼ 15 min

1P AER Disable ▼ 15 min

Energy Log Setup



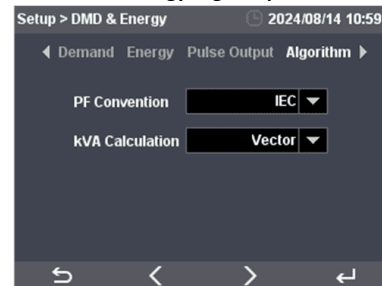
Setup > DMD & Energy 2024/08/14 10:59

◀ Demand Energy Pulse Output Algorithm ▶

Constant 1000 imp.kxh

LED N/A ▼

Pulse Output Setup



Setup > DMD & Energy 2024/08/14 10:59

◀ Demand Energy Pulse Output Algorithm ▶

PF Convention IEC ▼

kVA Calculation Vector ▼

Algorithm Setup

Figure 3-40 Demand & Energy Setup

3.1.3.5.4 Power Quality

Enter the **Power Quality** sub-menu and the following screens are available. Use << or >> button to scroll among **PQD**, **Transient**, **RVC**, **Inrush**, **Harmonics**, **Flicker** and **IEEE519** settings.



Setup > Power Quality 2024/08/14 11:42

◀ PQD Transient RVC Inrush Harmonics Flicker ▶

Enable Yes ▼

Ref. Volt. Udin ▼

Threshold 90 %

Swell 110 %

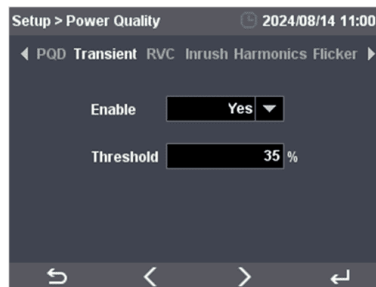
Interruption 5 %

Hysteresis 2.0 %

Hysteresis 2.0 %

Hysteresis 2.0 %

PQ Disturbance Setup



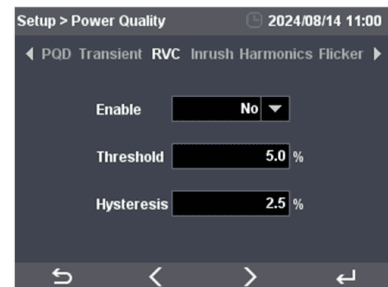
Setup > Power Quality 2024/08/14 11:00

◀ PQD Transient RVC Inrush Harmonics Flicker ▶

Enable Yes ▼

Threshold 35 %

Transient Setup



Setup > Power Quality 2024/08/14 11:00

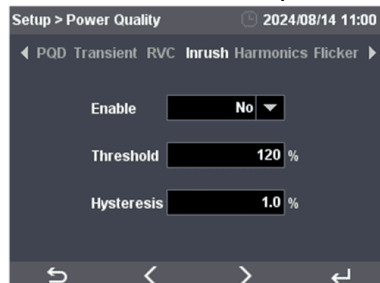
◀ PQD Transient RVC Inrush Harmonics Flicker ▶

Enable No ▼

Threshold 5.0 %

Hysteresis 2.5 %

RVC Setup



Setup > Power Quality 2024/08/14 11:00

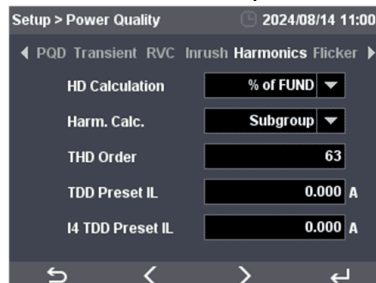
◀ PQD Transient RVC Inrush Harmonics Flicker ▶

Enable No ▼

Threshold 120 %

Hysteresis 1.0 %

Inrush Current Setup



Setup > Power Quality 2024/08/14 11:00

◀ PQD Transient RVC Inrush Harmonics Flicker ▶

HD Calculation % of FUND ▼

Harm. Calc. Subgroup ▼

THD Order 63

TDD Preset IL 0.000 A

I4 TDD Preset IL 0.000 A

Harmonics Setup

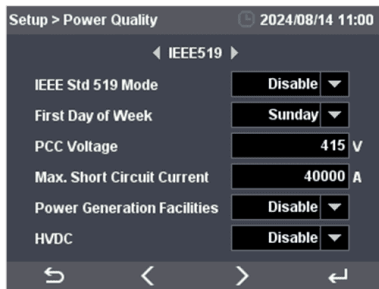


Setup > Power Quality 2024/08/14 11:00

◀ PQD Transient RVC Inrush Harmonics Flicker ▶

Flicker Curve 230V ▼

Flicker Setup



IEEE 519 Setup

Figure 3-41 Power Quality Setup

3.1.3.5.5 I/O

Enter the **I/O** sub-menu and the following screens are available. Use the << or >> to scroll between **DI** and **DO** settings. Please refer to **Section 4.1** for more information.



DI Setup

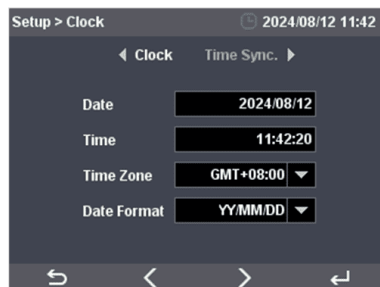


DO Setup

Figure 3-42 I/O Setup

3.1.3.5.6 Clock

Enter the **Clock** sub-menu and the following screens are available. Use the << or >> to scroll between **Clock** and **Time Sync.** settings. Please refer to **Section 4.8** for more information.



Clock Setup

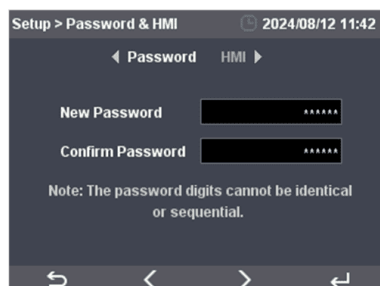


Time Synchronization Setup

Figure 3-43 Clock Setup

3.1.3.5.7 Password & HMI

Enter the **Password** sub-menu and the following screens are available. Use << or >> to scroll between **Password** and **HMI** settings.



Password Setup



HMI Setup

Figure 3-44 Password & HMI Setup

3.1.3.5.8 Maintenance

Enter the **Maintenance** sub-menu and the following screens are available. Use the << or >> to scroll between **DO**, **Clear**, **Restart** and **Advanced**.

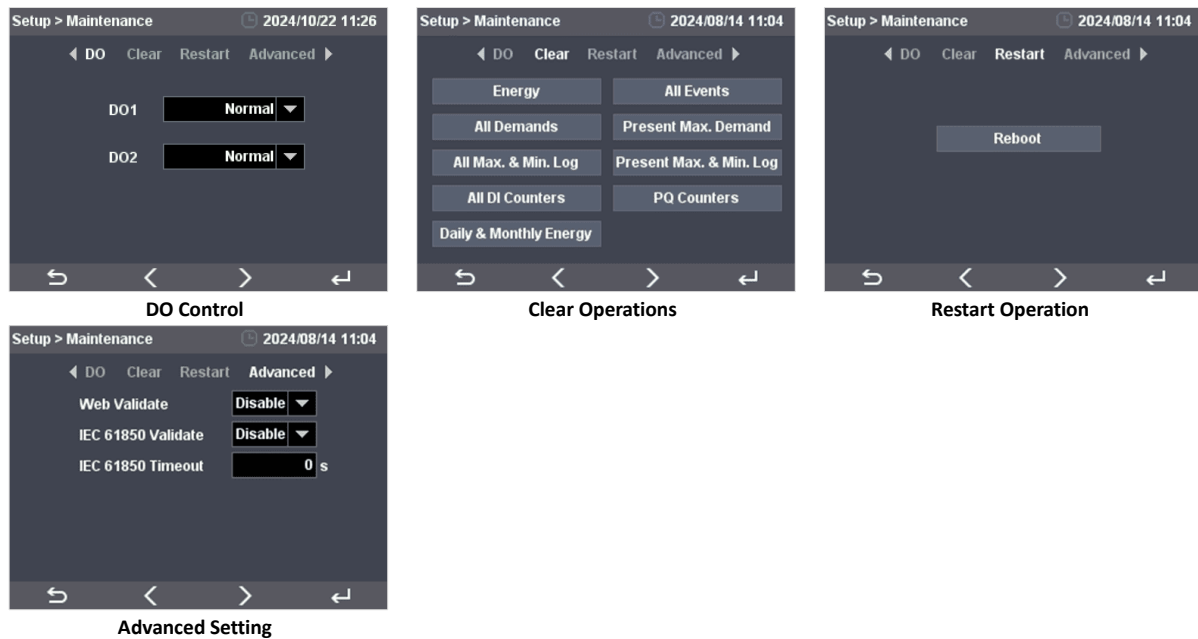


Figure 3-45 Maintenance Setting

3.1.3.5.9 Device Info.

Enter the **Device Info.** sub-menu and the following screens are available. Use the << or >> button to scroll between **Basic**, **Version**, **Self Diag.** and **Ethernet** information.

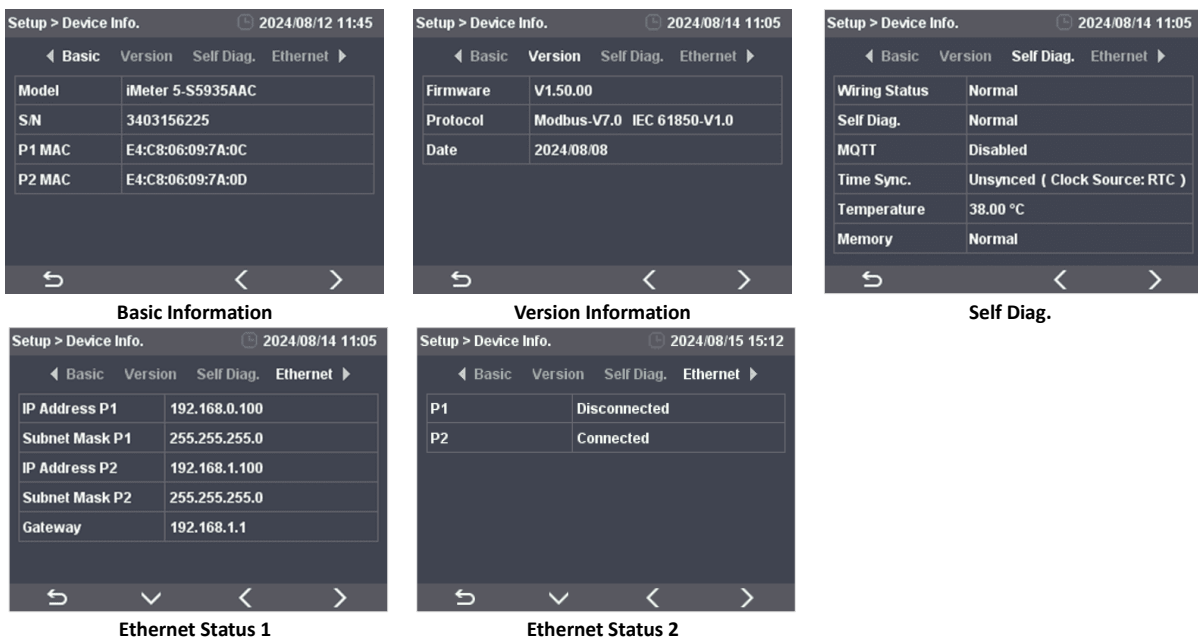


Figure 3-46 Device Info.

3.2 On-board Web Interface

The iMeter 5's Web Interface is compatible with various web browsers.

Browser	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 Web Browser Supported

The default IP address of the Ethernet ports of the iMeter 5 is 192.168.0.100 (P1) and 192.168.1.100 (P2). 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 access the meter.

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 11 (for other MS Windows systems, please refer to this [link](#) for more instructions).

Click  **Network & Internet**, select the **Ethernet** network if the PC is connected to and then find the appropriate Ethernet connection.

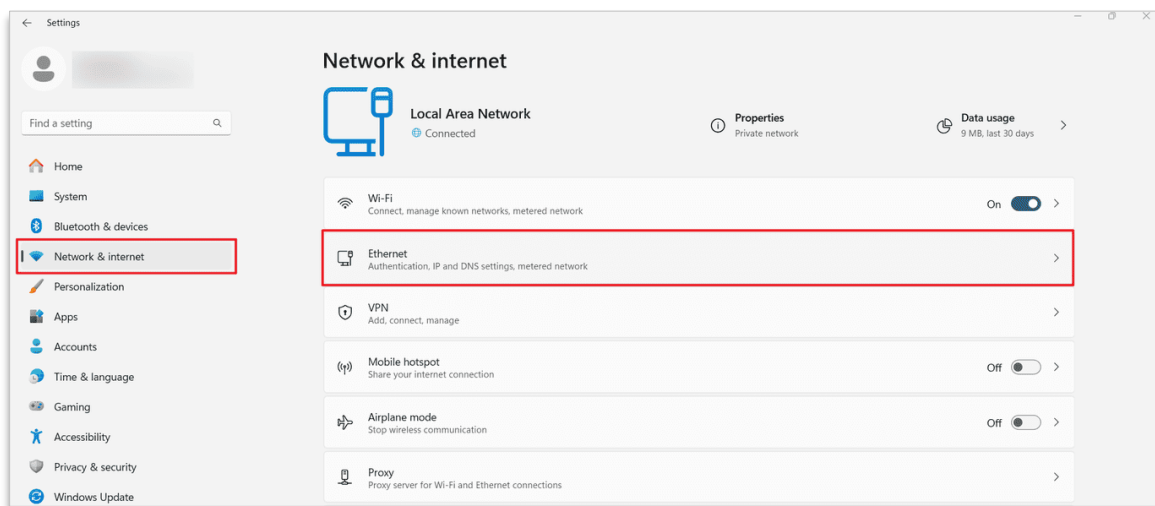


Figure 3-47 Settings-> Network & Internet

Click **Edit** for **IP assignment** option.

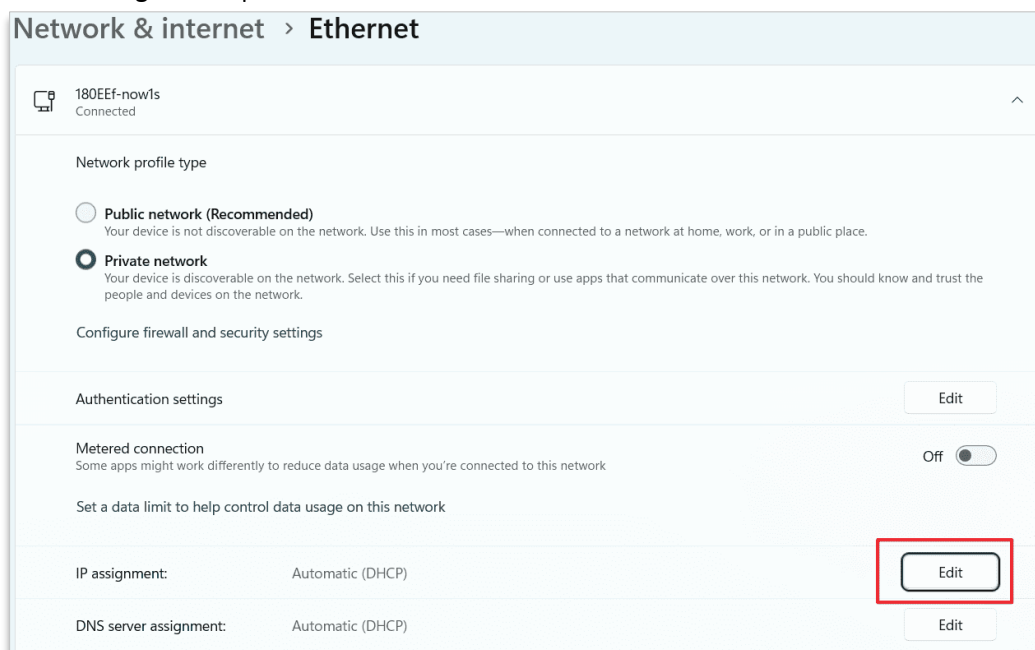


Figure 3-48 Network and Sharing Center

Set the IP assignment as Manual and enable the IPv4 with proper IP address, Subnet mask and Gateway setting.

Edit IP settings

Manual

IPv4

☒ On

IP address
192.168.1.30

Subnet mask
255.255.255.0

Gateway
192.168.1.1

Preferred DNS
8.8.8.8

DNS over HTTPS
Off

Alternate DNS

Save Cancel

Figure 3-49 Setting PC's IP Address

3.2.2 Configure iMeter 5's IP Address

The iMeter 5's IP address can be retrieved automatically from the DHCP server or configured with a static address.

The default setting of the iMeter 5 is to obtain an IP address by manual configuration. Under **Enable P1/P2 = Static** setting in the **Setup > Comm.** menu on the Front Panel, set the **IP Address**, **Sub. Mask**, **Gateway** accordingly.

Setup > Comm. 2024/08/12 11:42

◀ Ethernet RS-485 Advanced Other ▶

	P1	P2
Enable	Static	Static
IP Address	192.168. 0.100	192.168. 1.100
Sub. Mask	255.255.255. 0	255.255.255. 0
Gateway	192.168. 1. 1	
Mode	Normal	

◀ ▶ ↶ ↷

Figure 3-50 Manually Configure IP Address via Front Panel

If **DHCP** is used for the IP addressing mode, the current IP address can be found in the **Setup > Device Info. > Ethernet** menu on the Front Panel.

Setup > Device Info. 2024/08/14 11:05

◀ Basic Version Self Diag. Ethernet ▶

IP Address P1	192.168.0.100
Subnet Mask P1	255.255.255.0
IP Address P2	192.168.1.100
Subnet Mask P2	255.255.255.0
Gateway	192.168.1.1

◀ ▶ ↶ ↷

Figure 3-51 IP Address Information on the Front Panel

3.2.3 Accessing Web Interface

- 1) If the Web Client Validate is enabled (disabled by default), it's required to import the HTTPS certificate for web validation in **Google Chrome** as follows (if Client Validate is disabled, skip this step). The HTTPS certificate can be obtained from [here](#).
 - a. Click the **Menu** icon  on **Chrome** and then select **Settings**.

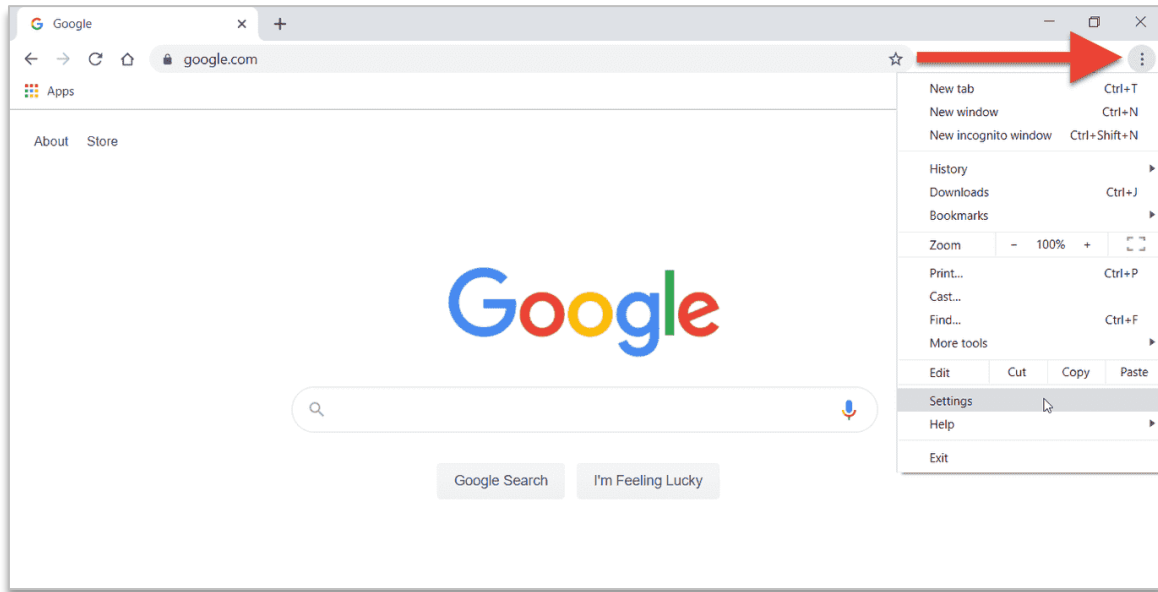


Figure 3-52 Chrome Settings

- b. Expand the **Advanced** menu on the left-hand side and go to **Privacy and security**.

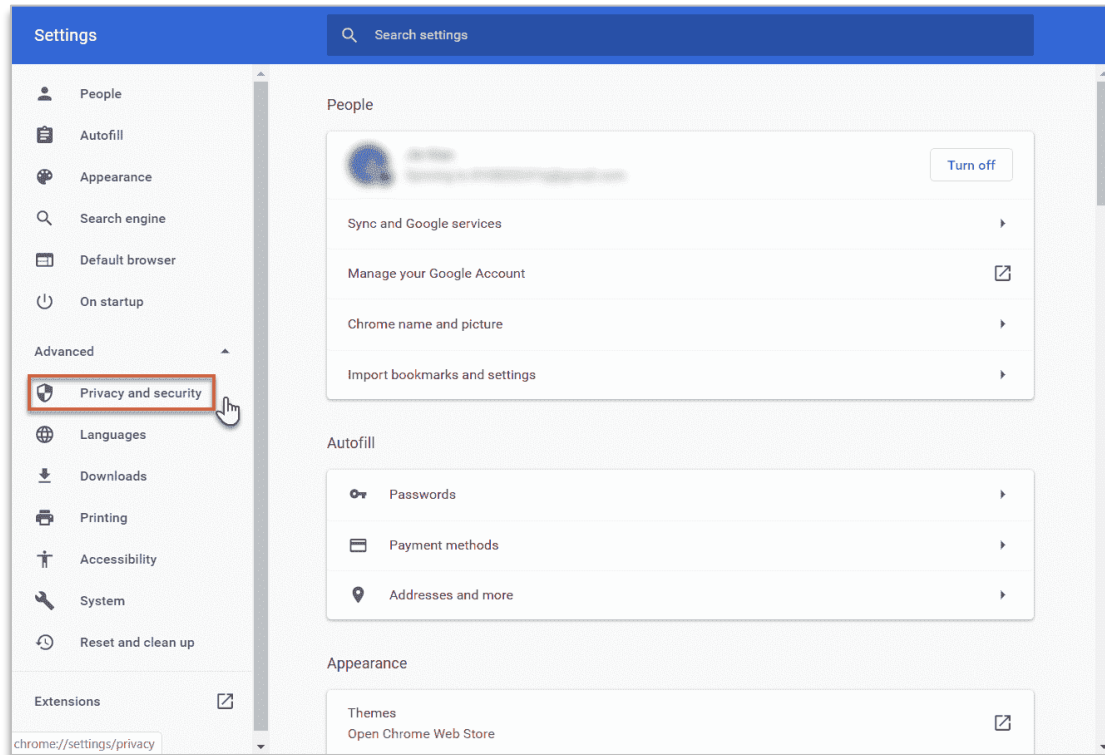


Figure 3-53 Privacy and security

- c. Choose **Manage certificates** and then click on **Import...** on the **Certificates** dialog box.

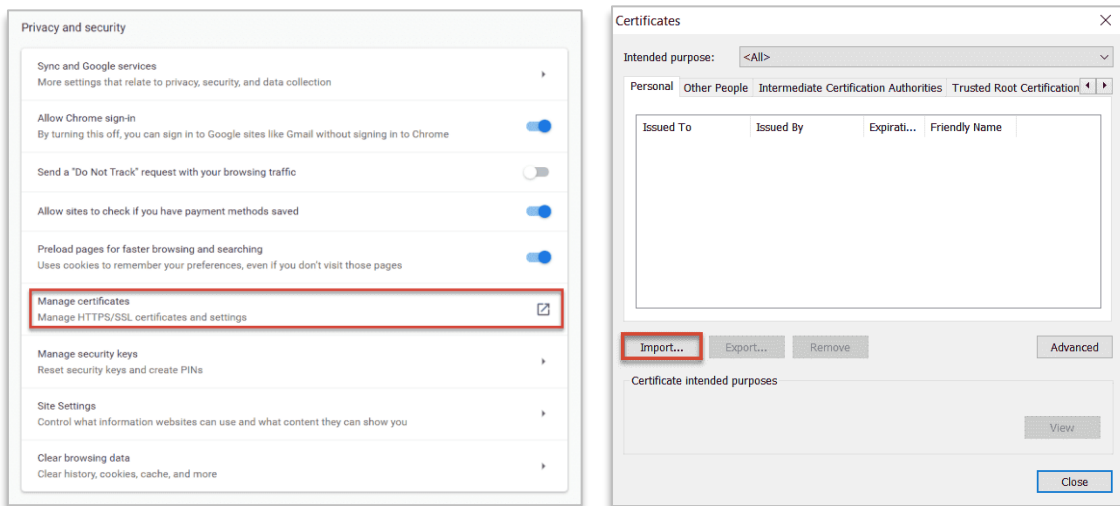


Figure 3-54 Manage certificates -> Import certificate

- d. 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.

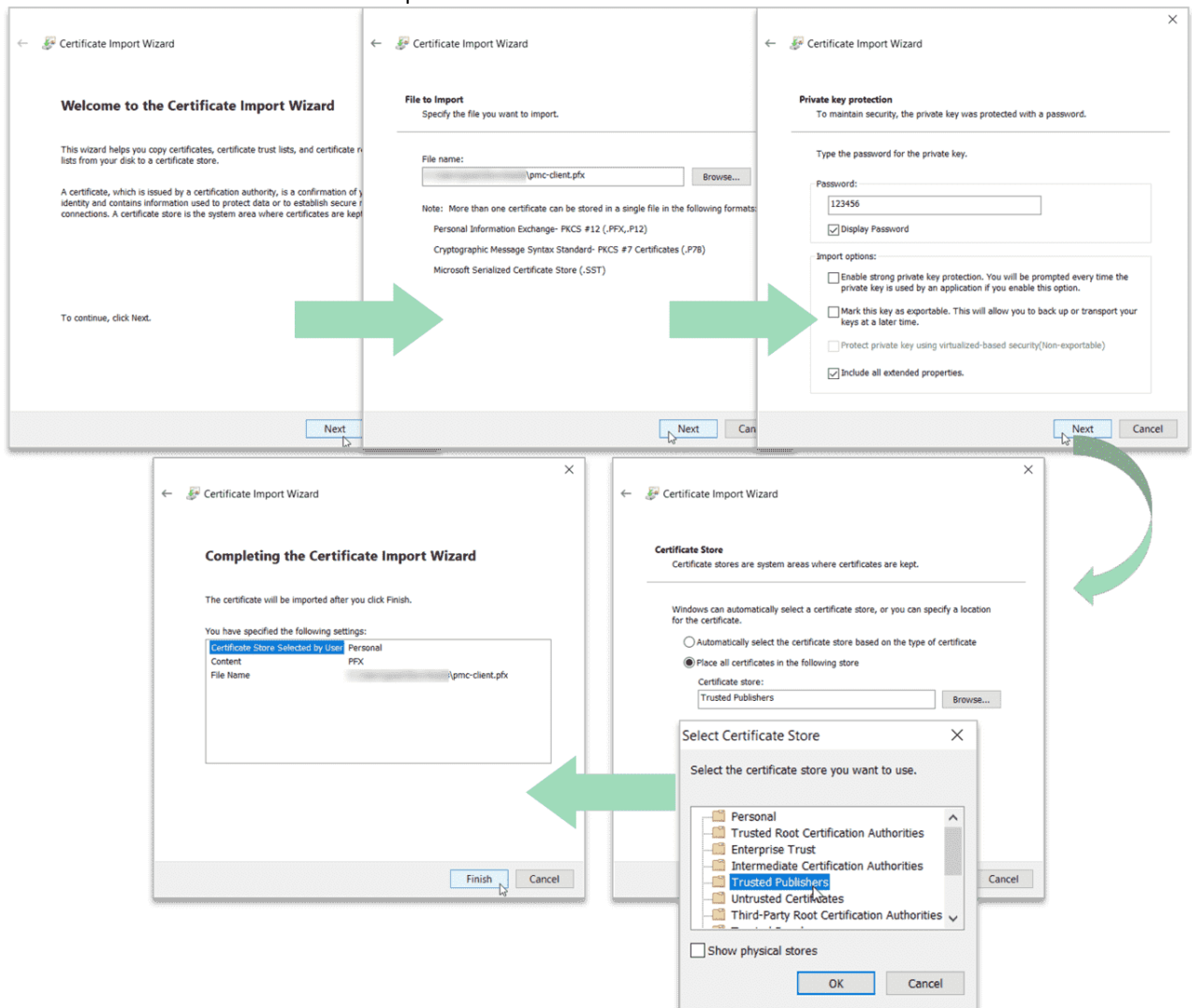


Figure 3-55 Import .pfx certificate

- 2) Restart **Chrome** and enter the complete IP address such as <https://192.168.0.100> in the address area of **Google Chrome**, and then press <Enter>.

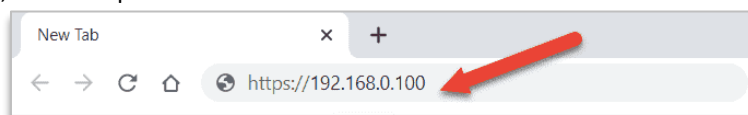


Figure 3-56 Web Logon

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

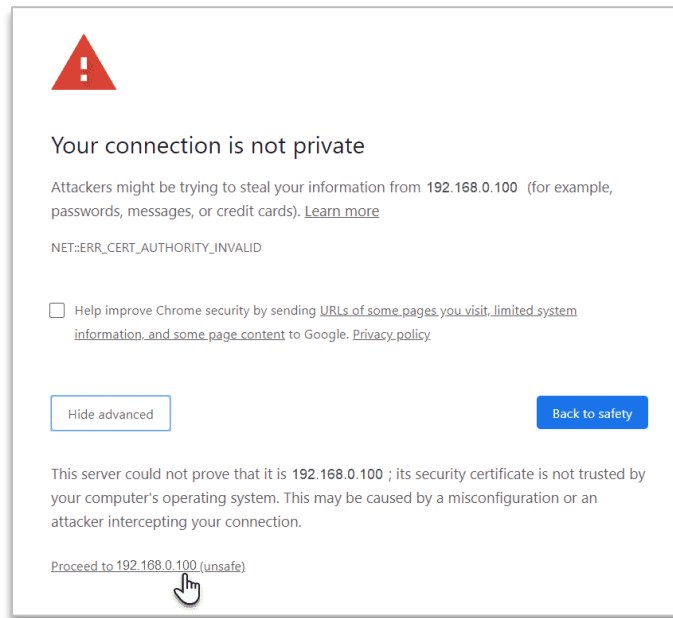


Figure 3-57 Privacy Error

- 4) The iMeter 5's login page appears.

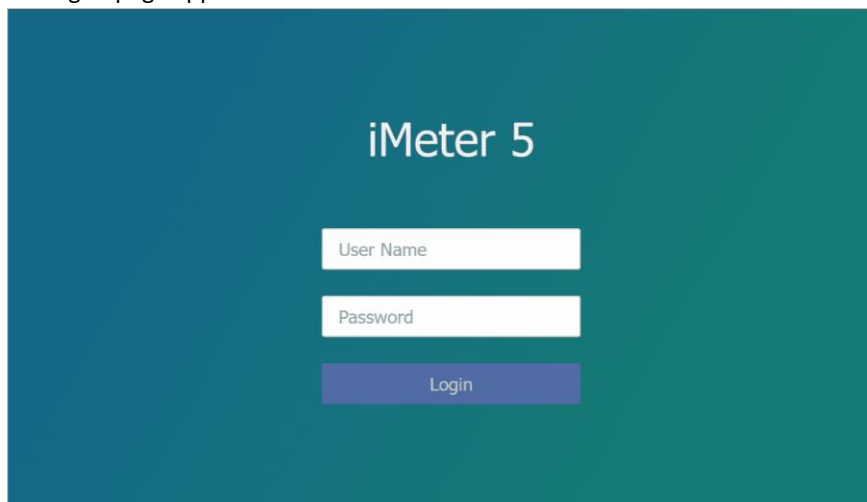


Figure 3-58 Web Interface

- 5) The user is required to login to the web interface to view data or change setup parameters. The figure below lists the different users and the corresponding authorities.

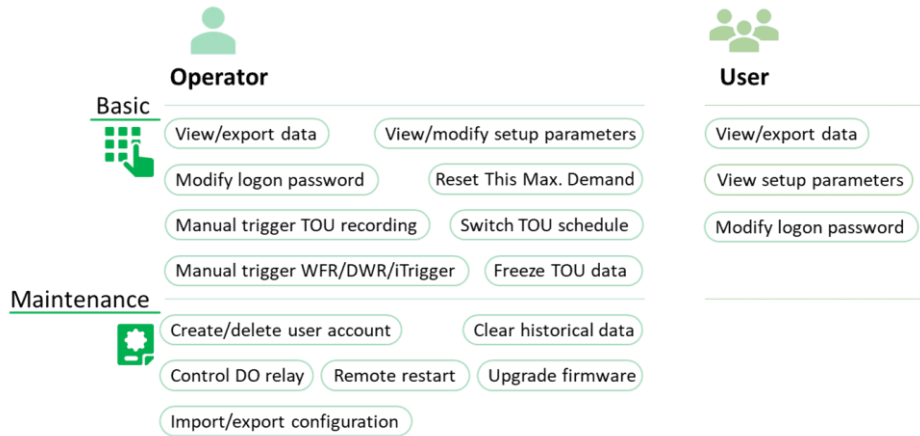


Figure 3-59 Authorities with their Permission Levels

As the figure shown, **Operator** has a higher permission than **User**. The default **Login Info.** for the operator and user accounts are listed below:

Account	Username	Password
Operator	operator	abcd1234-
User	user	abcd1234-

Table 3-4 Default Username and Password for Operator and User accounts

- 6) The iMeter 5's Web Interface appears after login. There are five items at the **Title Bar – PQ Insight, Metering, Power Quality, Events and Setup.**



Figure 3-60 Title Bar

- 7) 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.

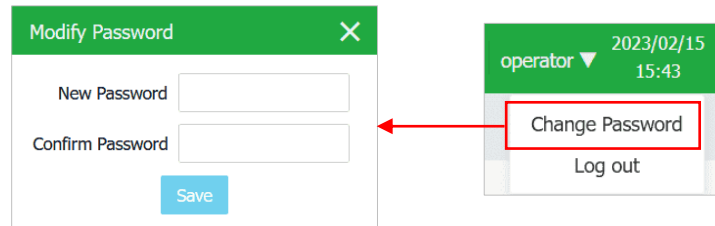
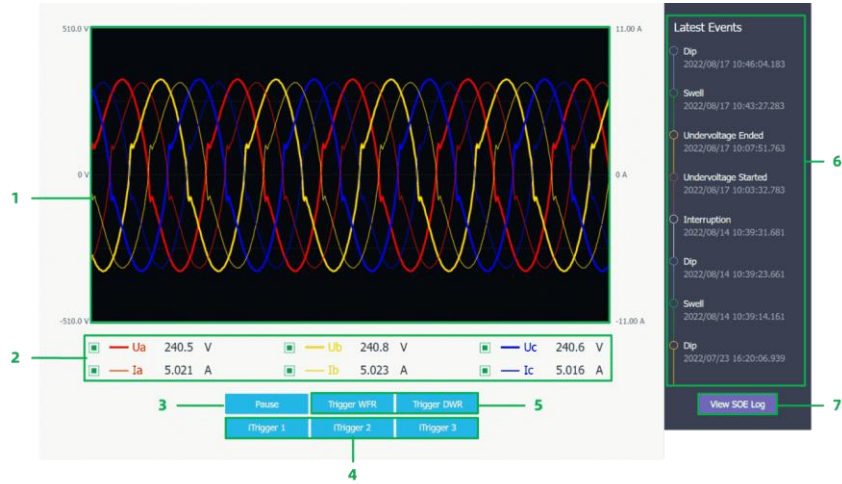


Figure 3-61 Change Web Interface Password

3.2.3.1 PQ Insight

Click **PQ Insight** menu and the **Real-time Waveform** is displayed which includes the following information and operations:



1	Voltage & Current Waveforms	5	Manual trigger WFR/DWR
2	Select/de-select Voltage/Current channels	6	Latest 8 events in SOE Log
3	Toggle between <Pause> & <Refresh> for waveform update	7	Enter SOE Log
4	Manual trigger iTrigger 1/2/3		

Figure 3-62 PQ Insight

3.2.3.2 Metering

Click **Metering** at the **Title Bar** and its sub-menus appear on the left-hand pane which include **Phasor**, **RMS**, **Fundamental**, **Energy**, **Demand**, **TOU**, **Max./Min.** and **I/O**. The following sections provide an overview of these sub-menus.

3.2.3.2.1 Phasor

Click **Phasor** on the left-hand pane and the following screen appears which displays the magnitude and phase information 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 for the Web Browser.

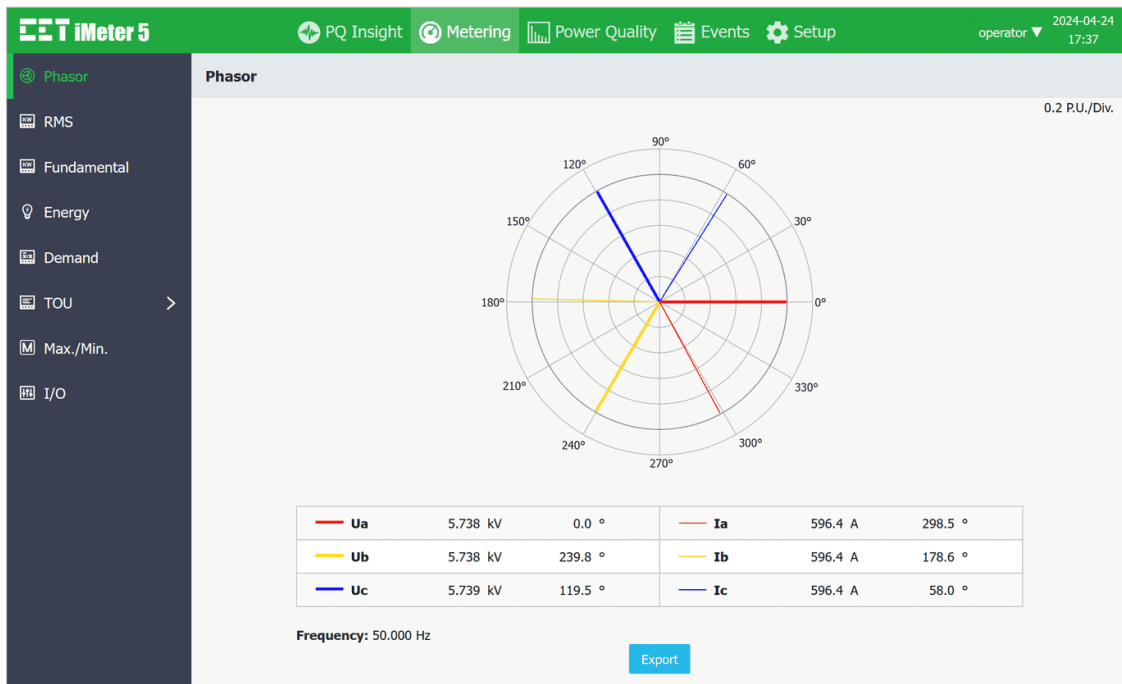


Figure 3-63 Phasor Diagram

3.2.3.2.2 RMS

Click **RMS** on the left-hand pane and the following screen appears which shows the real-time RMS readings for 3-Ø Voltages, Currents, Powers and Power Factors as well as Ung, I4, In (calculated Neutral Current), OT (Operating Time), Frequency, IR and optional Ir. Click **Export** to save the data on this page to a .csv file at the default download folder.

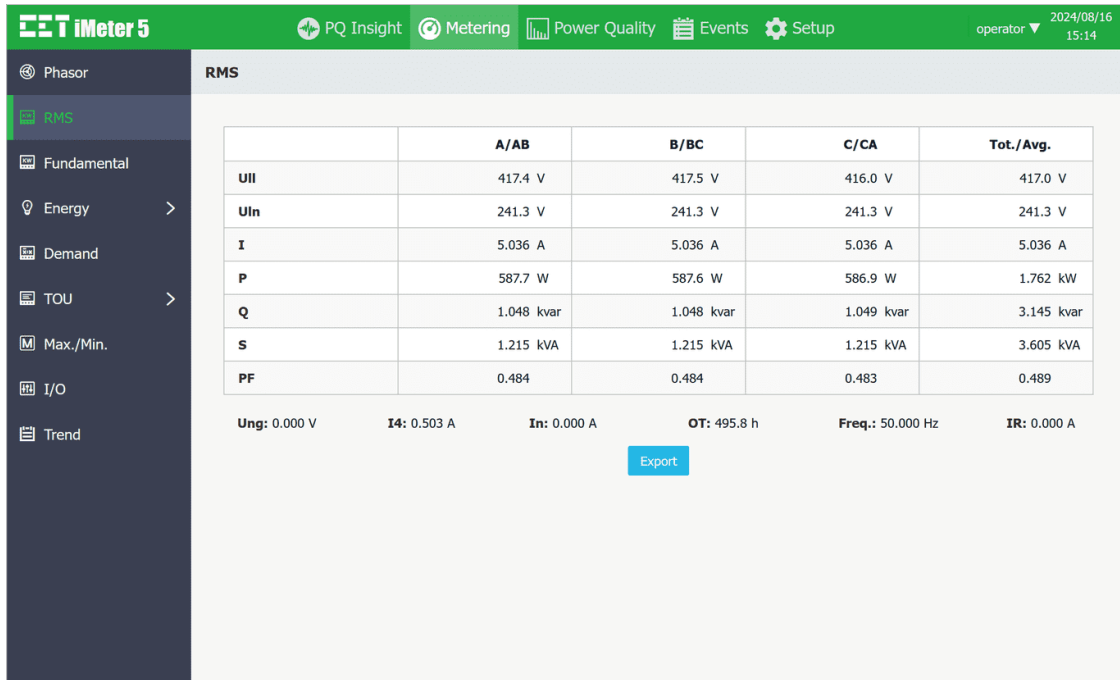


Figure 3-64 RMS Metering

3.2.3.2.3 Fundamental

Click **Fundamental** on the left-hand pane and the following screen appears which shows the fundamental readings for 3-Ø Voltages, Currents, Power, Power Factor and I4. Click **Export** to save the data on this page to a .csv file at the default download folder.

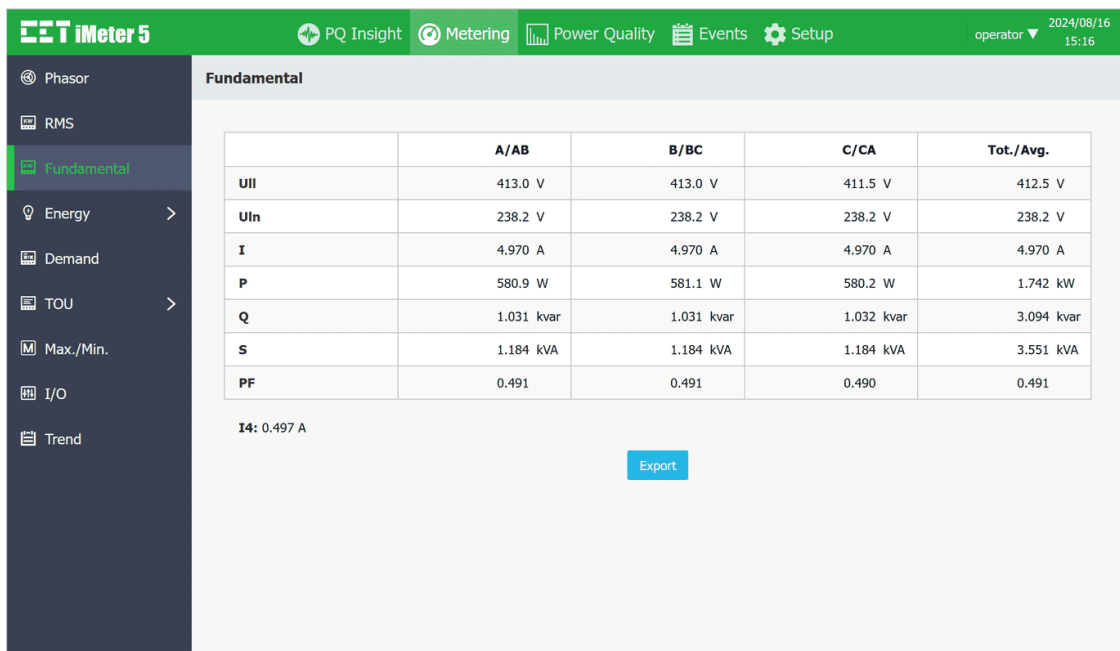


Figure 3-65 Fundamental Metering

3.2.3.2.4 Energy

Click **Energy** on the left-hand pane to view the **Real Time**, **Consump. Curve** and **Energy Log**.

3.2.3.2.4.1 Real Time

This page displays the present **RMS**, **Fundamental** and **Harmonics** kWh/kvarh for **Import/Export/Net/Total** as well as the **Total 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 all the Real Time Energy information to a .csv file at the default download folder.

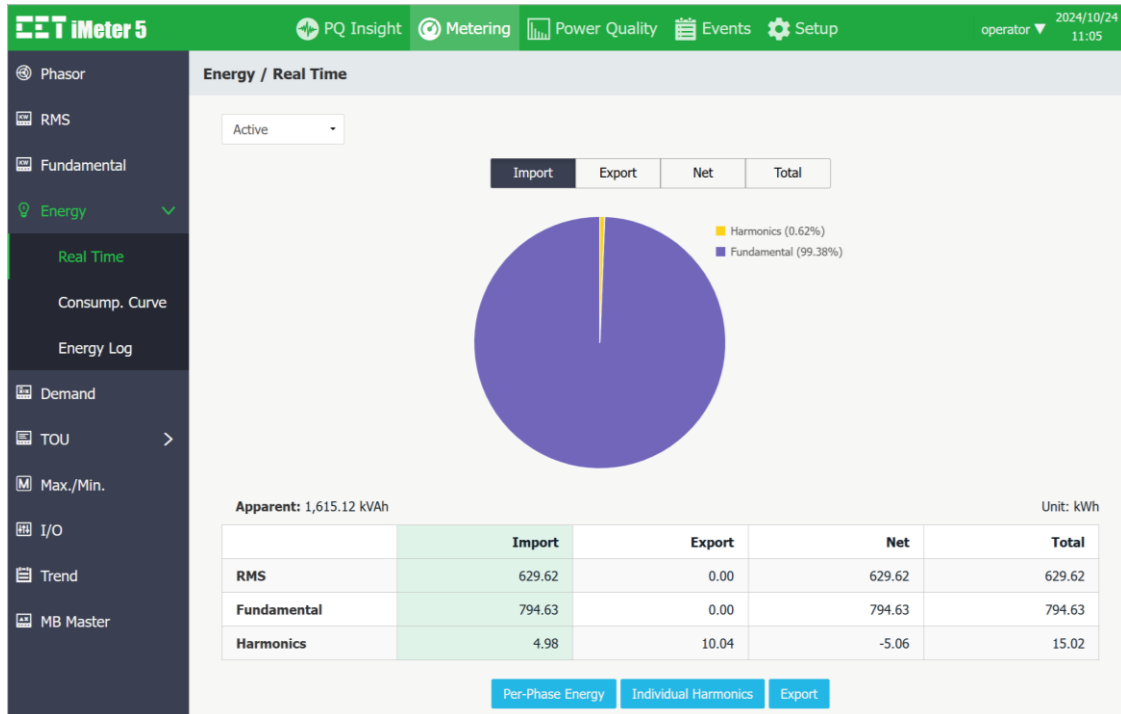


Figure 3-66 Real Time Energy Interface

Click **Per-Phase Energy** and the per-phase kWh, kvarh Import/Export/Net/Total and kVAh measurements are available.

Per-Phase Energy				
	A	B	C	
	Import	Export	Net	Total
kWh	464,945.80	0.00	464,945.80	464,945.80
kvarh	812,873.79	0.00	812,873.79	812,873.79
kVAh	--	--	--	947,153.28

Figure 3-67 Per-phase Energy

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

- 1) **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** spectrum.



Figure 3-68 Individual Harmonics Spectrum

- 2) **Table**

Harmonic Energy				
Table				
Order	kWh Imp. (kWh)	kWh Exp. (kWh)	kvarh Imp. (kvarh)	kvarh Exp. (kvarh)
01	521,602.03	0.00	907,725.05	0.00
02	0.00	53.05	90.34	0.00
03	0.00	4,286.66	0.00	47.30
04	0.00	12.75	0.00	22.86
05	863.77	0.00	0.00	1,434.49
06	7.08	0.00	0.15	0.00
07	391.87	0.00	720.85	0.00
08	0.00	3.71	6.02	0.00
09	0.00	506.22	0.00	16.72
10	0.00	3.30	0.00	6.25

Figure 3-69 Individual Harmonics Table

3.2.3.2.4.2 Consump. Curve

If the Energy Consumption Curve is enabled (See **Section 3.2.3.5.3.2**), click on the **Daily** or **Monthly** tab at the top to view the Daily Energy Consumption or Monthly Energy Consumption curves, respectively. This consumption data is updated based on the Daily/Monthly Self-Read Time.

Click **kWh Import/kWh Export/kvarh Import/kvarh Export/kVAh** from the drop-down list to switch among different energy usage displays.

Click **Export** to save all the Daily/Monthly Energy Consumption log to a .csv file at the default download folder.
Click **Refresh** to update the latest energy usage data manually.

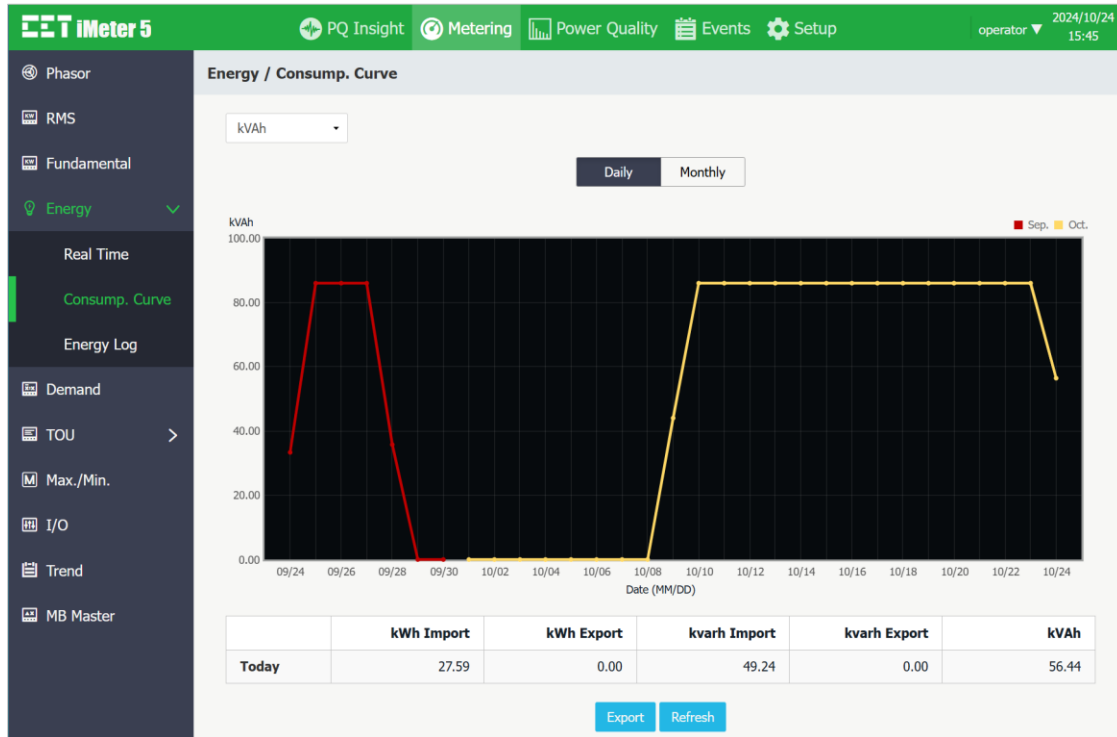


Figure 3-70 Daily Consumption Curve

3.2.3.2.4.3 Energy Log

The iMeter 5 supports the retrieval of the Energy Log via web server in Firmware V1.50.01 and later. Click on **Energy Log** menu and **AER/IER/Per-Phase AER/Per-Phase IER** tab at the top to retrieve the 3-Phase Total AER/IER and Per-Phase AER/IER Log independently.

By default, this page displays the latest log and the **Total Index Number** indicating the number of logs available.

Enter the log index N ($1 < N < \text{Total Index Number}$) for the log to be read in the **Index** field and click **Read** to retrieve the specified AER/IER/Per-Phase AER/Per-Phase IER Log with timestamp.

Click **Export** to save the latest up to 10,000 records before the Present displayed log (included) to a .csv file at the default download folder.

iMeter 5 PQ Insight Metering Power Quality Events Setup operator 2024/11/03 14:47

Energy / Energy Log

AER IER Per-Phase AER Per-Phase IER

Index 3 Read Total Index Number: 6240

Timestamp		2024/08/15 11:45:00.000
RMS	kWh Import (kWh)	954.63
	kWh Export (kWh)	0.22
	kWh Net (kWh)	954.41
	kWh Total (kWh)	954.86
	kvarh Import (kvarh)	1,687.95
	kvarh Export (kvarh)	1.01
	kvarh Net (kvarh)	1,686.93
	kvarh Total (kvarh)	1,688.97
Fundamental	kVAh (kVAh)	1,952.31
	kWh Import (kWh)	958.67
	kWh Export (kWh)	0.22
	kvarh Import (kvarh)	1,688.71
Harmonics	kvarh Export (kvarh)	1.01
	kWh Import (kWh)	6.78
	kWh Export (kWh)	10.82
	kvarh Import (kvarh)	0.00
	kvarh Export (kvarh)	1.34

Note: Click <Export> to download the latest up to 10,000 Logs before the Present Index entered and read above.

Export

Figure 3-71 Energy Log Interface

3.2.3.2.5 Demand

Click **Demand** on the left-hand pane and the following screen appears which shows the readings for **Present Demand**, **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 **Export** to save the **Demand** data on this page to a .csv file at the default download folder.

Click **Reset This Max.** (only accessible for **Operator**) 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.

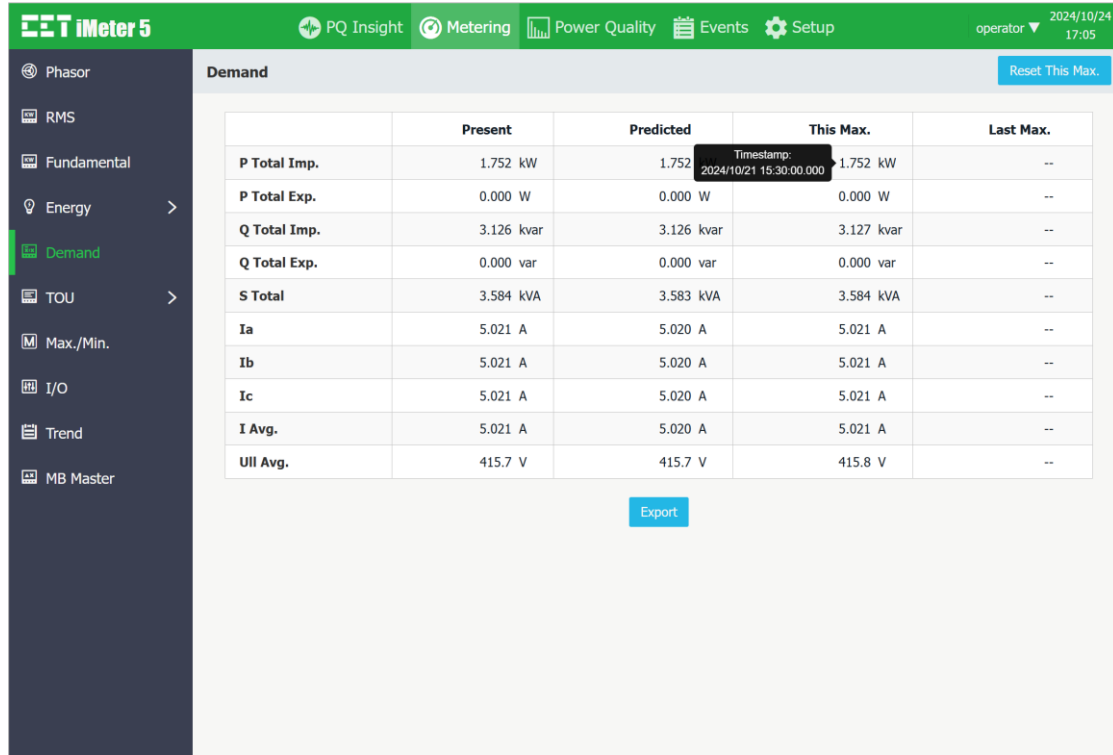


Figure 3-72 Demand Interface

3.2.3.2.6 TOU

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

3.2.3.2.6.1 Real Time

The 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 for TOU1 and TOU2.

- 3) **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**.

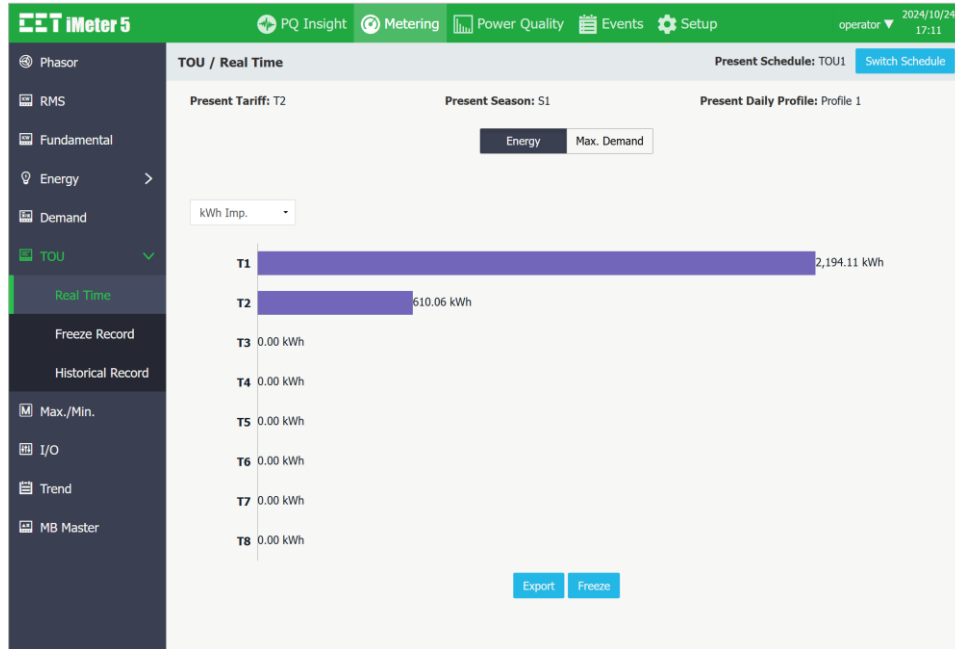


Figure 3-73 Real Time TOU Energy

- 4) **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.**

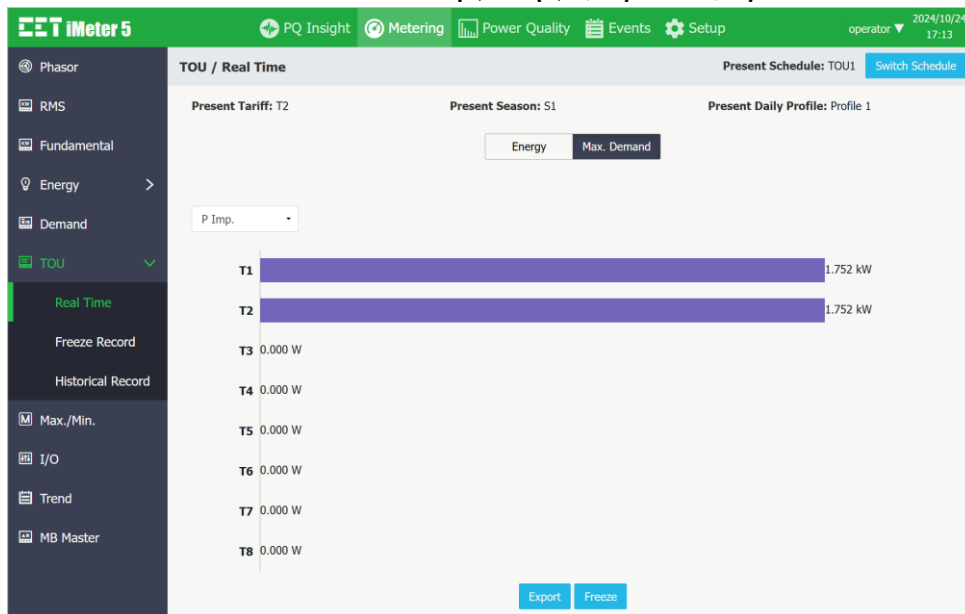


Figure 3-74 Real Time TOU Max. Demand

Click **Export** to save the **Real Time TOU** data to a .csv file at the default download folder. Click **Freeze** to take a momentary snapshot of the TOU Energy and Max. Demand.

3.2.3.2.6.2 Freeze Record

The iMeter 5 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.

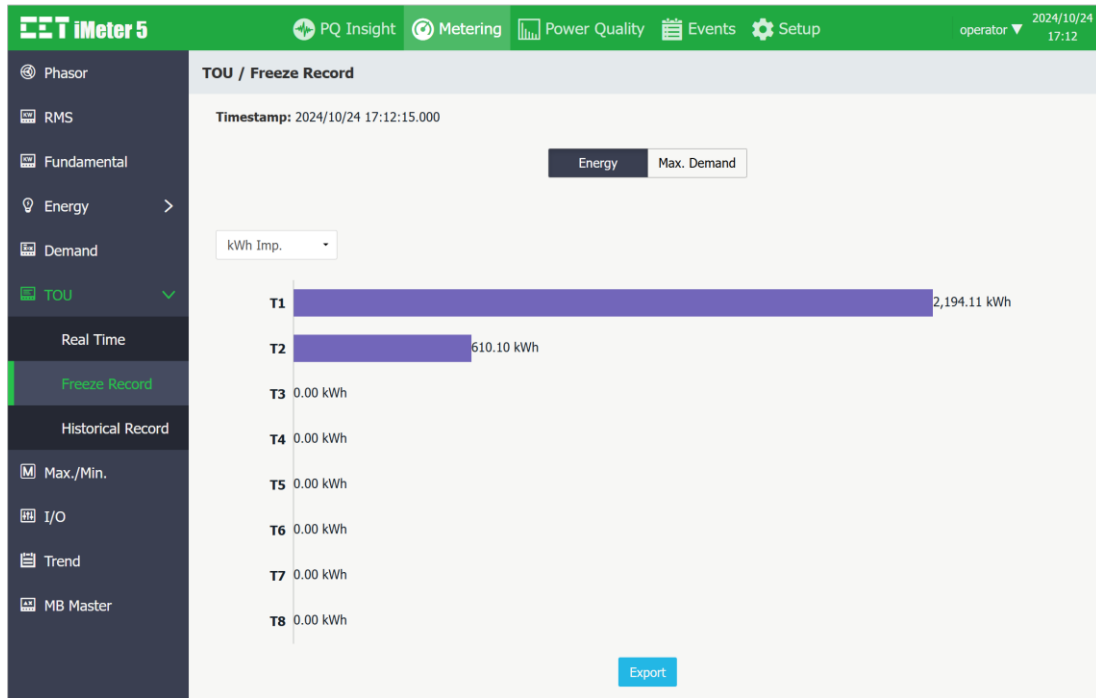


Figure 3-75 TOU Freeze Record

3.2.3.2.6.3 Historical Record

The iMeter 5 can restore up to 12 historical records with timestamp based on the first-in-first-out 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** data to a .csv file at the default download folder.

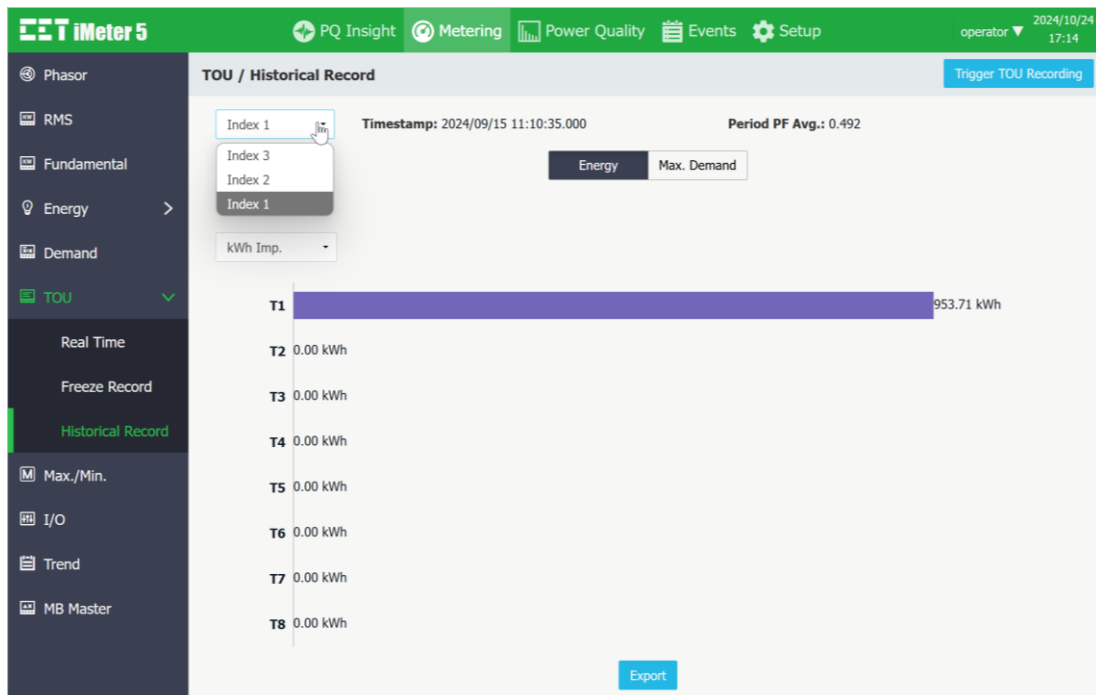


Figure 3-76 TOU – Historical Record

3.2.3.2.7 Max./Min.

Click **Max./Min.** on the left-hand pane and the following screen appears which displays the 4 Max./Min. recorders.

Move the mouse pointer over the readings for **This Max.** and **Last Max.** to show the corresponding timestamp.

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.

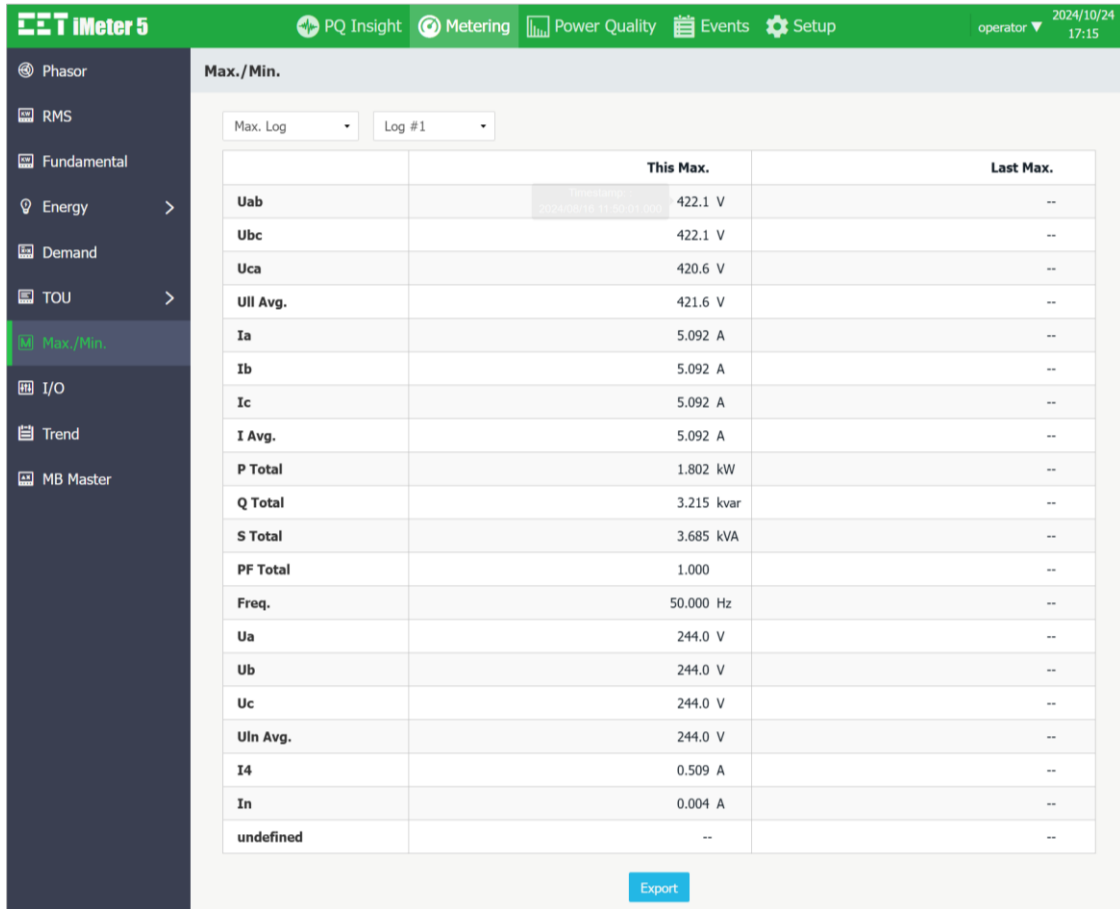


Figure 3-77 Max./Min. Interface

3.2.3.2.8 I/O

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

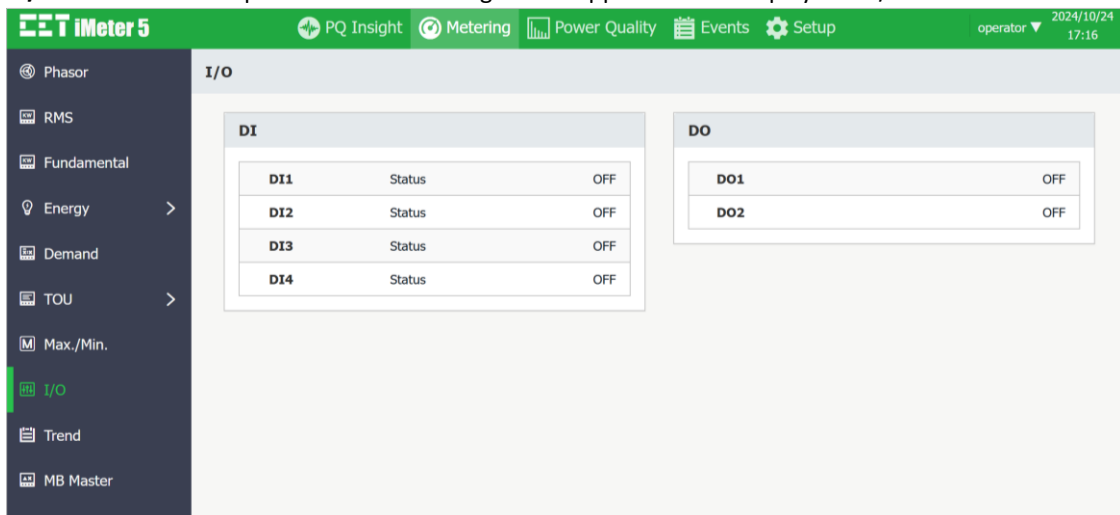


Figure 3-78 I/O Interface

3.2.3.2.9 Trend

Click **Trend** on the left-hand pane and the following screen appears which displays the trending curves for the Max./Min./Avg./CP95 values of SDR parameters or the measurement of DR parameters.

To view the trend curve of a desired SDR/DR parameter over a specific time period, select a specific period (up to the last 30 days), the SDR/DR group to which the parameter belongs and the desired SDR/DR parameter in order.

Inside the SDR/DR trend curve display, there are three control icons .

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

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

Move the mouse pointer over a particular point on the trend curve to view the timestamp and the recorded values.

Select/de-select the Max./Min./Avg./CP95 channels to show/hide the corresponding displays.

Click **Export** to export the SDR/DR logs displayed on the current page to a .csv file at the default download folder.

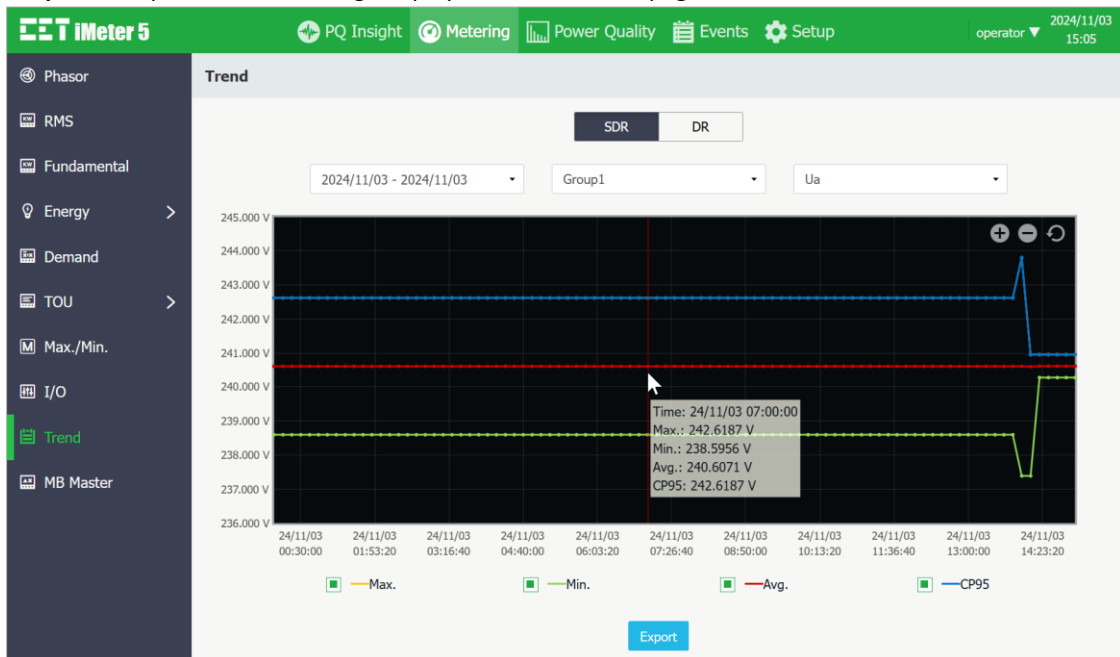


Figure 3-79 SDR Trend Interface

3.2.3.2.10 MB Master

Click **MB Master** (supported in Firmware V1.50.01 or later) on the left-hand pane and select Slave #01 to Slave #31 from the drop-down box on the left to view the real-time slave's measurements.

Providing that the slave is connected and communicating, the **Basic, Energy, Demand, Unbalance & Sequence, Harmonics** and **I/O Data** will be uploaded to the iMeter 5. Click Export to save the slave's data displayed on the current page to a .csv file at the default Download folder.

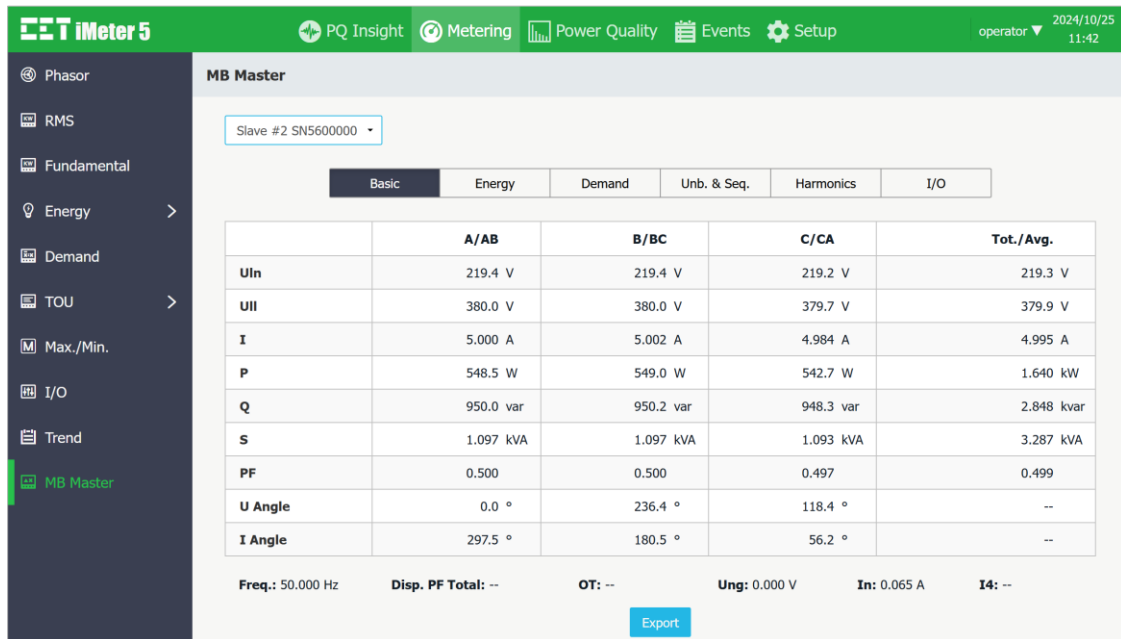


Figure 3-80 MB Master – Slave's Basic Data

3.2.3.3 Power Quality

Click **Power Quality** at the **Title Bar** and its sub-menus appear on the left-hand pane which include **Harmonics, Interharmonics, 2kHz-9kHz C.E. (optional), Deviation, Unb. & Seq., Flicker, EN50160** and **IEEE Std 519**. The following sections provide a quick overview of these web pages.

3.2.3.3.1 Harmonics

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

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

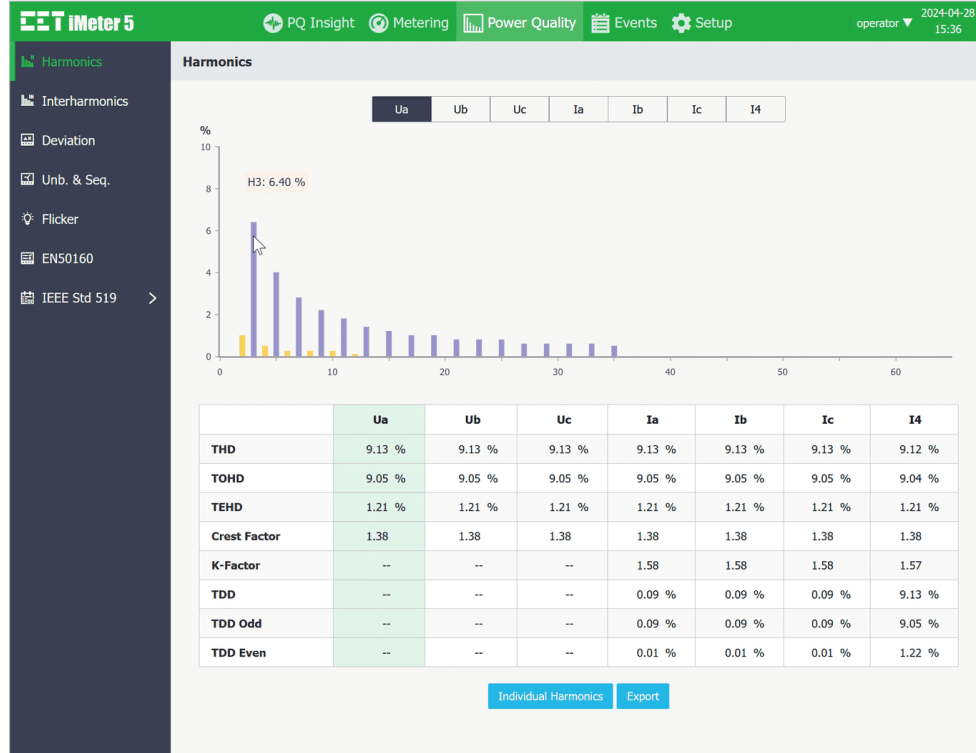


Figure 3-81 Harmonics Interface

- Click **Individual Harmonics** at the bottom of the page to view the %HD, RMS and Angle for 3- ϕ Voltages and Currents in a table format.

The screenshot shows the 'Individual Harmonics' window. It contains a table with columns for Order, %HD, RMS, and Angle. The table lists data for harmonics from order 01 to 16.

Order	%HD	RMS	Angle
01	100.00 %	5.808 kV	0.0 °
02	1.00 %	58.07 V	60.0 °
03	6.40 %	371.6 V	60.0 °
04	0.50 %	29.04 V	60.0 °
05	4.00 %	232.3 V	60.0 °
06	0.26 %	15.09 V	60.0 °
07	2.80 %	162.6 V	60.0 °
08	0.26 %	15.11 V	60.0 °
09	2.20 %	127.8 V	60.0 °
10	0.26 %	15.10 V	60.0 °
11	1.80 %	104.5 V	60.0 °
12	0.10 %	5.835 V	0.0 °
13	1.40 %	81.29 V	60.0 °
14	0.00 %	0.090 V	0.0 °
15	1.20 %	69.69 V	60.0 °
16	0.00 %	0.059 V	0.0 °

Figure 3-82 Harmonics – Individual Harmonics

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

3.2.3.3.3 Optional 2kHz-9kHz C.E.

Click **2kHz-9kHz C.E.** on the left-hand pane to view the the U_{rms}/I_{rms} C.E. in the frequency band of 2kHz-9kHz with a resolution 3s.

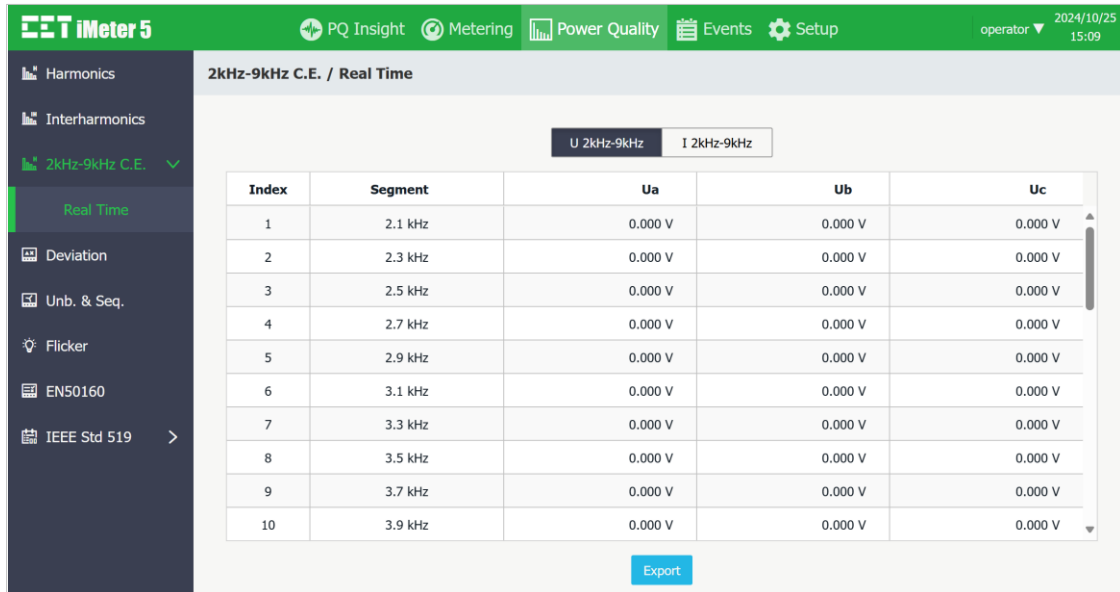


Figure 3-85 Real Time U_{rms} C.E. @ 2kHz-9kHz

3.2.3.3.4 Deviation

Click **Deviation** on the left-hand pane to display the **Over/Under Deviation** measurements for 3- ϕ Uln and Ull as well as **Frequency Deviation**.

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

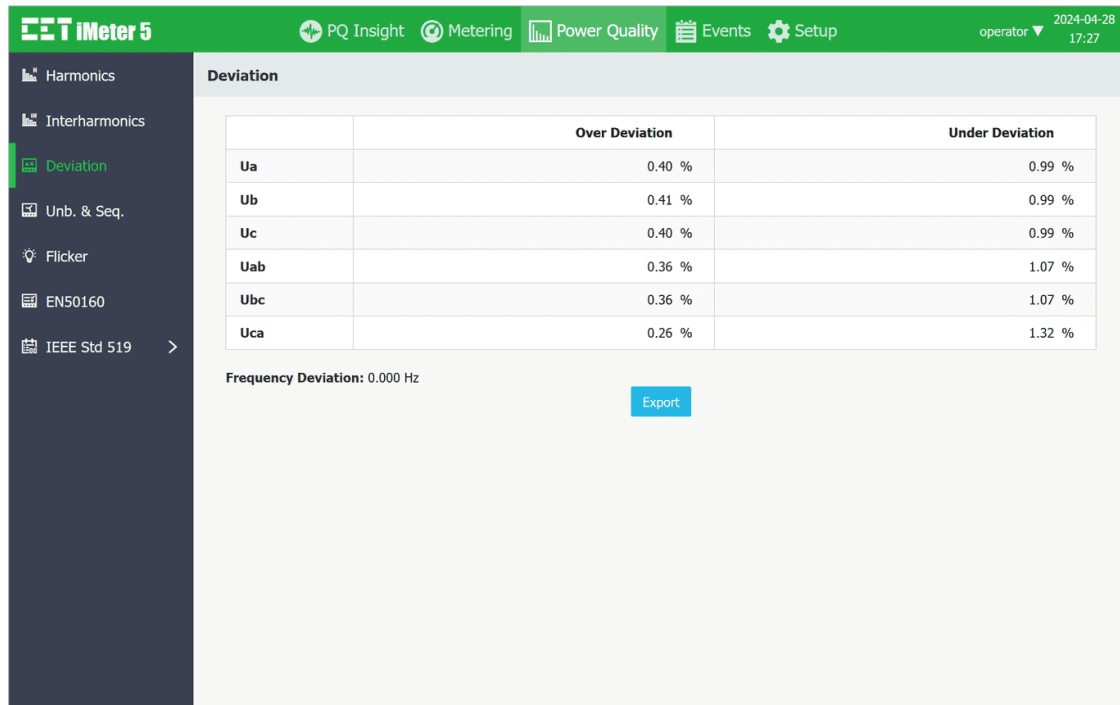


Figure 3-86 Deviation Interface

3.2.3.3.5 Unb. & Seq.

Click **Unb. & Seq.** on the left-hand pane to display the **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.

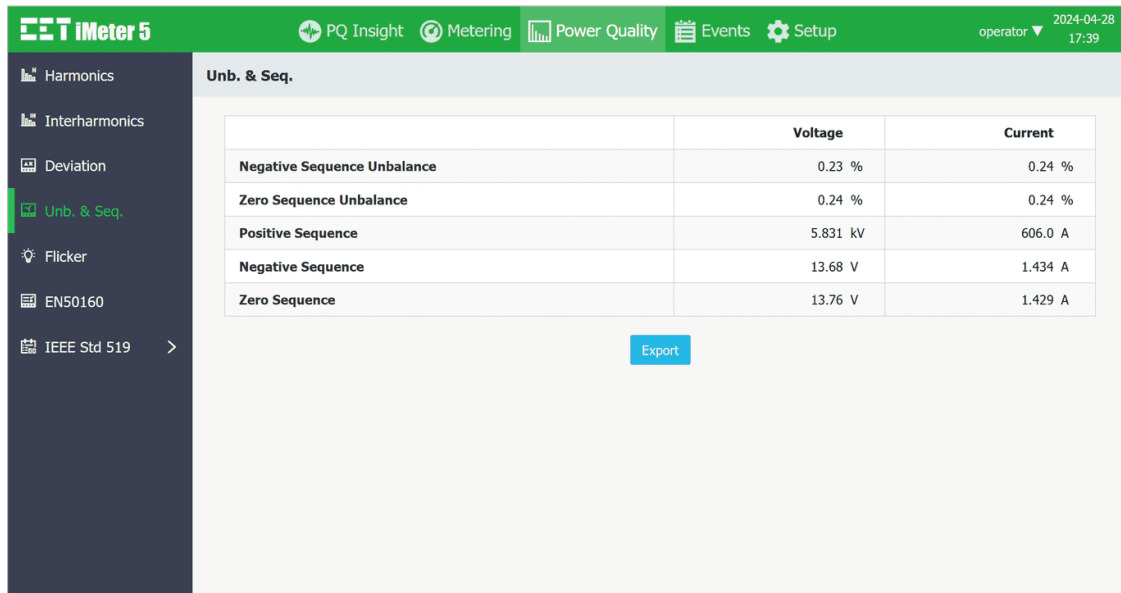


Figure 3-87 Unb. & Seq. Interface

3.2.3.3.6 Flicker

Click **Flicker** on the left-hand pane to display the **Pst/Plt** measurements for 3- $\emptyset$ voltages. Click **Export** to save the data to a .csv file at the default download Folder.

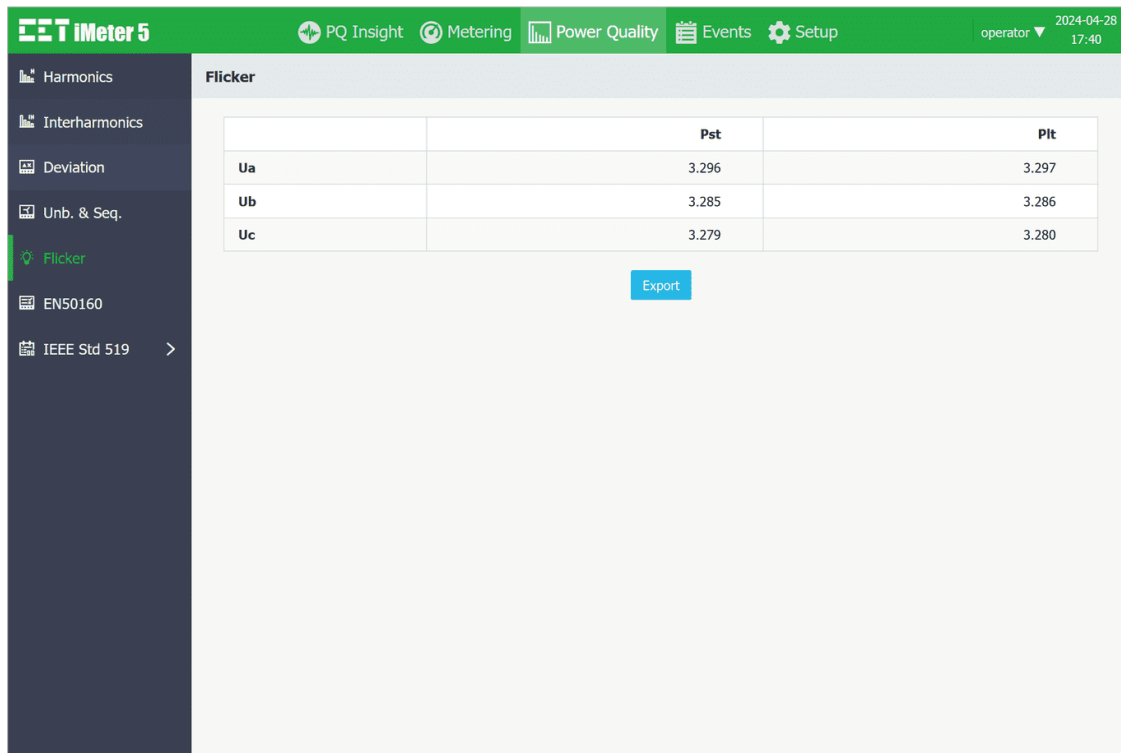


Figure 3-88 Flicker Interface

3.2.3.3.7 EN50160

Click **EN50160** on the left-hand pane and the following screen appears. Click on the drop-down list at the top to select the period for the desired EN50160 summary report. As shown in Figure 3-89, ✓ 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 EN50160Report_WeekXX.xls file for the currently selected period.

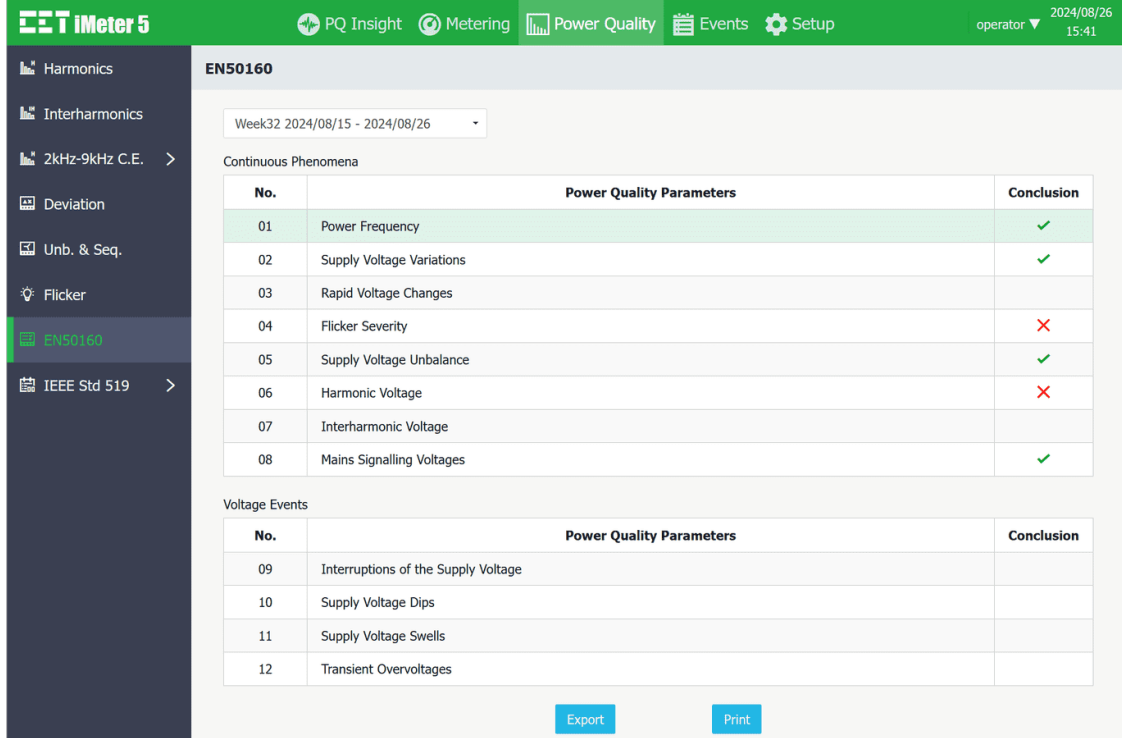


Figure 3-89 EN50160 Summary Report

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

- **Power Frequency**

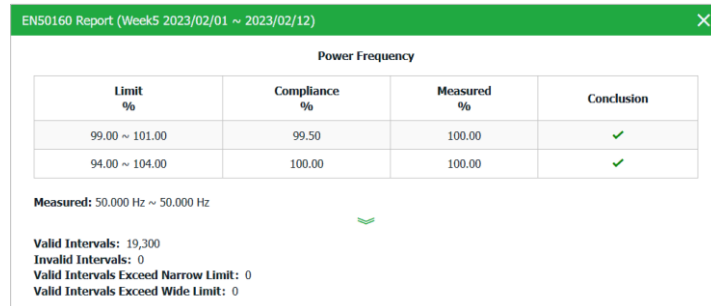


Figure 3-90 Power Frequency

- Supply Voltage Variations

EN50160 Report (Week5 2023/02/01 ~ 2023/02/12)					
Supply Voltage Variations					
Limit %	Compliance %	Measured %			Conclusion
		Ua	Ub	Uc	
90.00 ~ 110.00	95.00	100.00	100.00	100.00	✓
85.00 ~ 110.00	100.00	100.00	100.00	100.00	✓
Measured Ua: 166.0 kV ~ 166.1 kV Measured Ub: 166.0 kV ~ 166.1 kV Measured Uc: 166.0 kV ~ 166.1 kV					
⌵					
Statistics	Ua	Ub	Uc		
Valid Intervals	322	322	322		
Invalid Intervals	0	0	0		
Valid Intervals Exceed Narrow Limit	0	0	0		
Valid Intervals Exceed Wide Limit	0	0	0		

Figure 3-91 Supply Voltage Variations

- Rapid Voltage Changes

EN50160 Report (Week5 2023/02/01 ~ 2023/02/12)		
Rapid Voltage Changes		
Ua Count	Ub Count	Uc Count
0	0	0

Figure 3-92 Rapid Voltage Changes

- Flicker Severity

EN50160 Report (Week5 2023/02/01 ~ 2023/02/12)					
Flicker Severity					
Limit	Compliance %	Measured %			Conclusion
		Ua	Ub	Uc	
Plt ≤ 1.000	95.00	0.00	0.00	0.00	✗
Measured Ua Plt: 3.304 ~ 3.307 Measured Ub Plt: 3.294 ~ 3.296 Measured Uc Plt: 3.290 ~ 3.292					
⌵					
Statistics	Ua Plt	Ub Plt	Uc Plt		
Valid Intervals	26	26	26		
Invalid Intervals	0	0	0		
Valid Intervals Exceed Compliance	26	26	26		
CP95	3.307	3.296	3.292		

Figure 3-93 Flicker Severity

- Supply Voltage Unbalance

EN50160 Report (Week5 2023/02/01 ~ 2023/02/12)			
Supply Voltage Unbalance			
Limit %	Compliance %	Measured %	Conclusion
2.00	95.00	100.00	✓
Measured U2 Unbalance: 0.12 % ~ 0.12 %			
⌵			
Valid Intervals: 322 Invalid Intervals: 0 Valid Intervals Exceed Compliance: 0 CP95: 0.12 %			

Figure 3-94 Supply Voltage Unbalance

- Harmonic Voltage

EN50160 Report (Week5 2023/02/01 ~ 2023/02/12)									
Harmonic Voltage									
Order h	Limit %	CP95 %			Compliance %	Measured %			Conclusion
		Ua	Ub	Uc		Ua	Ub	Uc	
THD	8.00	9.13	9.13	9.13	95.00	0.00	0.00	0.00	✗
Odd Harmonics (Not Multiples of 3)									
H05	6.00	4.00	4.00	4.00	95.00	100.00	100.00	100.00	✓
H07	5.00	2.80	2.80	2.80	95.00	100.00	100.00	100.00	✓
H11	3.50	1.80	1.80	1.80	95.00	100.00	100.00	100.00	✓
H13	3.00	1.40	1.40	1.40	95.00	100.00	100.00	100.00	✓
H17	2.00	1.00	1.00	1.00	95.00	100.00	100.00	100.00	✓
H19	1.50	1.00	1.00	1.00	95.00	100.00	100.00	100.00	✓
H23	1.50	0.80	0.80	0.80	95.00	100.00	100.00	100.00	✓
H25	1.50	0.80	0.80	0.80	95.00	100.00	100.00	100.00	✓
Odd Harmonics (Multiples of 3)									
H03	5.00	6.40	6.40	6.40	95.00	0.00	0.00	0.00	✗
H09	1.50	2.20	2.20	2.20	95.00	0.00	0.00	0.00	✗
H15	0.50	1.20	1.20	1.20	95.00	0.00	0.00	0.00	✗
H21	0.50	0.80	0.80	0.80	95.00	0.00	0.00	0.00	✗

Figure 3-95 Harmonic Voltage

- Interharmonic Voltage

EN50160 Report (Week5 2023/02/01 ~ 2023/02/12)									
Interharmonic Voltage									
Order h	Avg. %			CP95 %			Max. %		
	Ua	Ub	Uc	Ua	Ub	Uc	Ua	Ub	Uc
TIHD	0.06	0.07	0.07	0.08	0.08	0.08	0.10	0.10	0.10
IH01	0.04	0.04	0.05	0.05	0.06	0.06	0.05	0.07	0.07
IH02	0.01	0.01	0.02	0.01	0.02	0.02	0.01	0.03	0.03
IH03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
IH04	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.02
IH05	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.01
IH06	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.01
IH07	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.01
IH08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
IH09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
IH10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
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

Figure 3-96 Interharmonic Voltage

- Mains Signalling Voltages

EN50160 Report (Week5 2023/02/01 ~ 2023/02/12)							
Mains Signalling Voltages							
Signalling Frequency Hz	Limit %	Compliance %	Measured %			Conclusion	
			Ua	Ub	Uc		
1,000.00	5.00	99.00	100.00	100.00	100.00	✓	
2,000.00	5.00	99.00	100.00	100.00	100.00	✓	
3,000.00	5.00	99.00	100.00	100.00	100.00	✓	
⌵							
Statistics		Valid Intervals	Invalid Intervals	Valid Intervals Exceed Compliance	Max.	Min.	CP95
MSV1	Ua	64,329	0	0	1.164 V	0.344 V	0.833 V
	Ub	64,329	0	0	2.146 V	0.344 V	2.042 V
	Uc	64,329	0	0	2.152 V	0.309 V	2.150 V
MSV2	Ua	64,329	0	0	0.892 V	0.352 V	0.567 V
	Ub	64,329	0	0	1.132 V	0.352 V	1.005 V
	Uc	64,329	0	0	1.308 V	0.277 V	1.306 V
MSV3	Ua	64,329	0	0	0.641 V	0.356 V	0.579 V
	Uib	64,329	0	0	0.877 V	0.356 V	0.876 V

Figure 3-97 Mains Signalling Voltages

- Interruptions of the Supply Voltage

EN50160 Report (Week5 2023/02/01 ~ 2023/02/12)			
Interruptions of the Supply Voltage			
Duration	$t \leq 1s$	$1s < t \leq 3min$	$3min < t$
Count	0	0	0

Figure 3-98 Interruptions of the Supply Voltage

- Supply Voltage Dips

EN50160 Report (Week5 2023/02/01 ~ 2023/02/12)						
Supply Voltage Dips						
Residual Voltage u %	Duration t ms					
	$10 \leq t \leq 200$	$200 < t \leq 500$	$500 < t \leq 1000$	$1000 < t \leq 5000$	$5000 < t \leq 60000$	$t > 60000$
$90 > u \geq 80$	0	0	0	0	0	0
$80 > u \geq 70$	0	0	0	0	0	0
$70 > u \geq 40$	0	0	0	0	0	0
$40 > u \geq 5$	0	0	0	0	0	0
$5 > u$	0	0	0	0	0	0

Figure 3-99 Supply Voltage Dips

- Supply Voltage Swells

EN50160 Report (Week5 2023/02/01 ~ 2023/02/12)				
Supply Voltage Swells				
Swell Voltage u %	Duration t ms			
	$10 \leq t \leq 500$	$500 < t \leq 5000$	$5000 < t \leq 60000$	$t > 60000$
$u \geq 200$	0	0	0	0
$200 > u \geq 160$	0	0	0	0
$160 > u \geq 140$	0	0	0	0
$140 > u \geq 120$	0	0	0	0
$120 > u > 110$	0	0	0	0

Figure 3-100 Supply Voltage Swells

- Transient Overvoltages

EN50160 Report (Week5 2023/02/01 ~ 2023/02/12)		
Transient Overvoltages		
Ua Count	Ub Count	Uc Count
0	0	0

Figure 3-101 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 (Week41 2024/10/13 - 2024/10/20)

Print

iMeter 5

EN50160 Report

Conclusion

Continuous Phenomena

Period: Week41 2024/10/13 - 2024/10/20

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 3-102 Preview for Printing EN50160 Report

3.2.3.3.8 IEEE Std 519

Click **IEEE Std 519** at the **Title Bar** to view the IEEE standard 519 weekly report and daily report. Please refer to **Section 4.3.20** for more information. 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.

3.2.3.3.8.1 Weekly Report

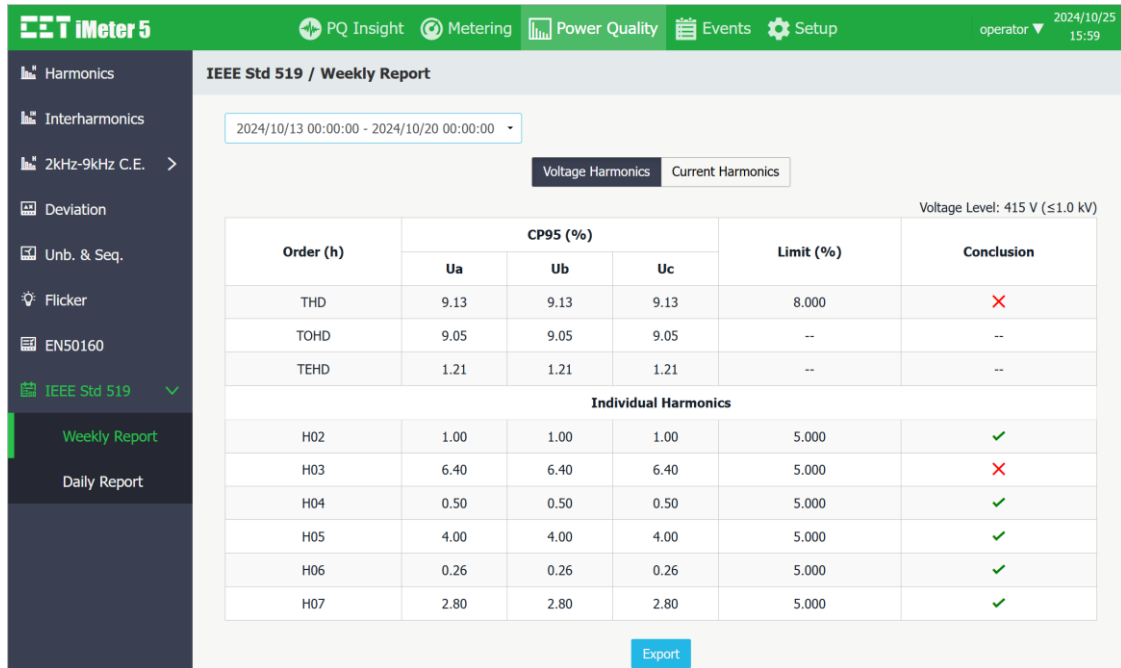


Figure 3-103 IEEE Std 519 Voltage Harmonics Compliance Weekly Report

3.2.3.3.8.2 Daily Report

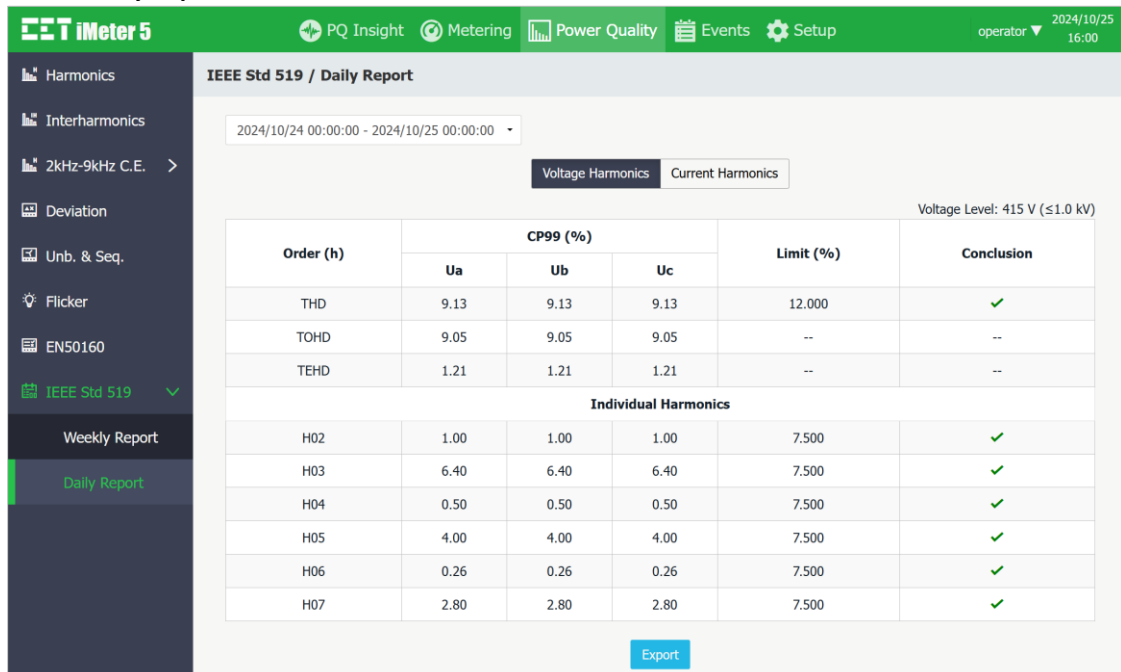


Figure 3-104 IEEE Std 519 Voltage Harmonics Compliance Daily Report

3.2.3.4 Events

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

3.2.3.4.1 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 mechanisms.

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 such as Dip/Swell, Transient, RVC, MSV, Inrush Current, Setpoint, I/O and Record (WFR, DWR, RMSR, iTrigger and DR).

Keyword Search: Enter a keyword in the text box on the right to search for events that contain the keyword.

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.

No.	Timestamp	Description	Waveform
1	2024-04-19 15:44:25.427	DO1 Open	
2	2024-04-19 15:44:24.427	DO1 Closed	
3	2024-04-19 15:44:04.711	WFR Triggered Manually	
4	2024-04-19 15:34:14.369	Interruption	
5	2024-04-16 16:51:23.069	Dip	
6	2024-04-16 16:38:17.629	Swell	
7	2024-04-16 16:38:17.619	U Relative RMS Change	
8	2024-04-08 15:17:01.506	DI4 Open	
9	2024-04-08 15:16:57.837	DI4 Closed	
10	2024-04-08 15:16:57.215	DI3 Open	

Figure 3-105 SOE Log Interface

Here are several examples for SOE Log details:

- DO1 Closed:

Figure 3-106 DO1 Operated by a Setpoint Event

- Over Uln Setpoint Return:

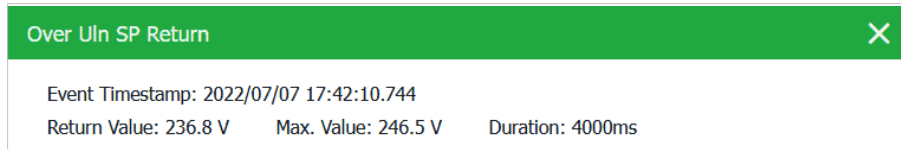


Figure 3-107 Over Uln Setpoint Return

- Over Uln Setpoint Active:



Figure 3-108 Over Uln Setpoint Active

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 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.

- When a PQ setpoint is configured to trigger WFR (**Waveform Recorder**), DWR (**Disturbance Waveform Recorder**), and/or RMSR (**RMS Recording**), the recorded Swell events will have the option of showing the ITIC plot while the Dip/Interruptions events will have the option of showing both the ITIC and SEMI F47 plots, along with the WFR/DWR/RMSR waveform.



Figure 3-109 Interruption on SEMI F47 Interface

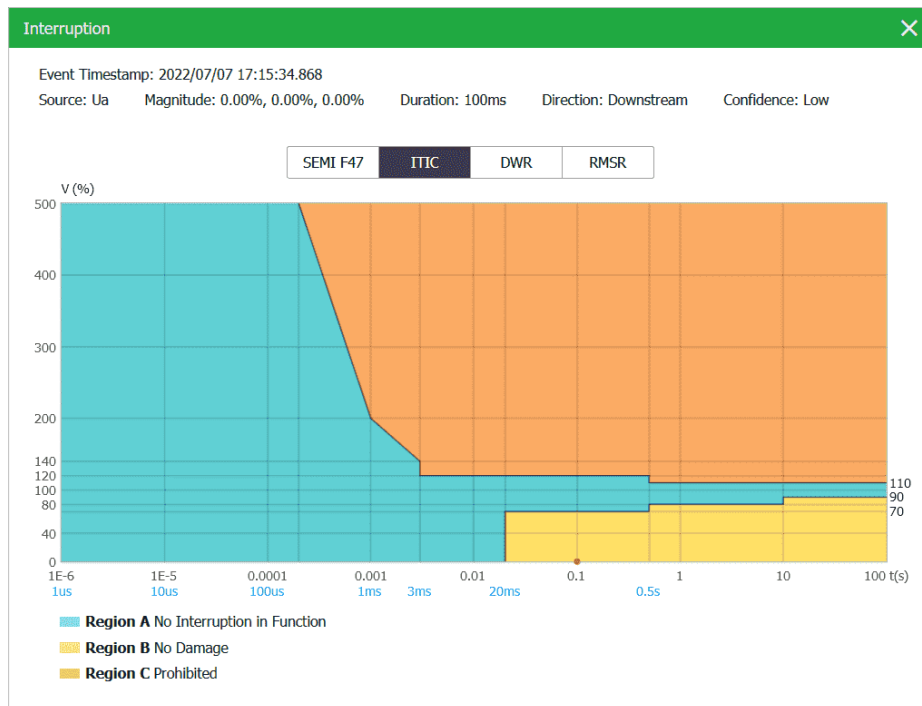


Figure 3-110 Interruption on ITIC Interface



Figure 3-111 RMSR for Interruption Event

3.2.3.4.2 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 Search: Enter a keyword in the text box on the right to search for events that contain the keyword.

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

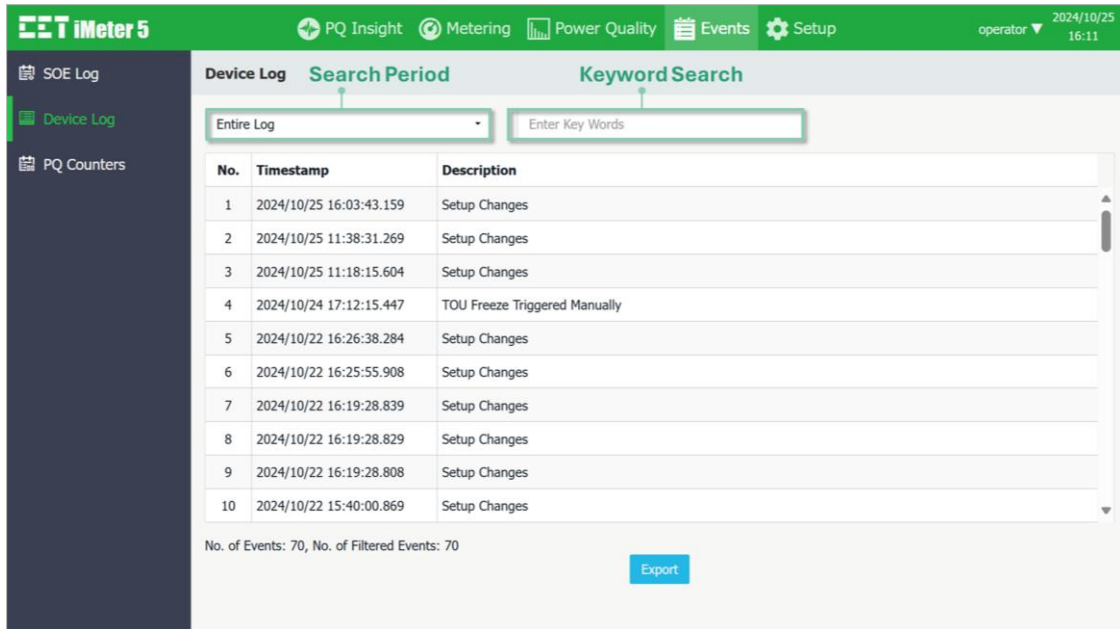


Figure 3-112 Device Log Interface

3.2.3.4.3 PQ Counters

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

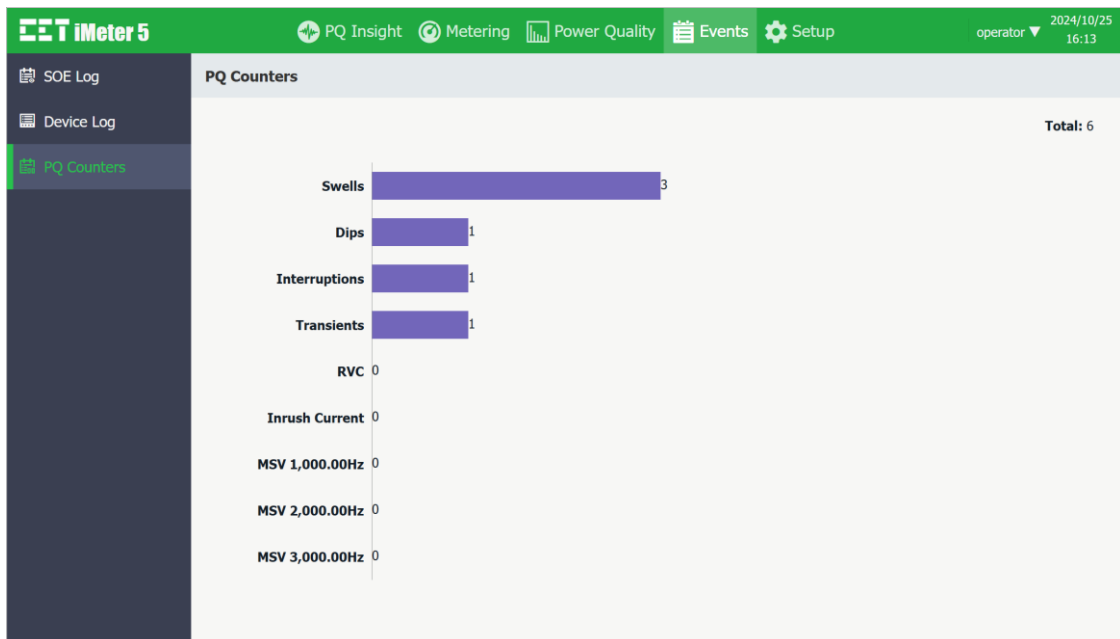


Figure 3-113 PQ Counters Interface

3.2.3.5 Setup

Click **Setup** at the **Title Bar** and its sub-menus appear on the left-hand pane which include **Basic**, **Comm.**, **Dmd. & Energy**, **PQ**, **Record**, **Setpoint**, **I/O**, **Clock**, **Email** and **Diagnostics**.

3.2.3.5.1 Basic

Click **Basic** on the left-hand pane and the following screen appears which has three tabs: **Basic** and **UI**.

3.2.3.5.1.1 Basic > Basic Settings

Figure 3-114 Basic Settings Interface

The following table illustrates the ranges and default values for the basic parameters.

Parameter	Range/Default*	Parameter	Range/Default*
Wiring		PT/CT	
Wiring Mode	3P4W*, 3P3W, DEMO, 1P2W_LN, 1P2W_LL, 1P3W	Freq. Nominal	50Hz*, 60Hz
Composite I	No*/Ia/Ib/Ic	U/I Nominal	1 to 1500V, 415V*
SCCP (Optional)	5A (50A) @ 10mV/A, 20A @ 10mV/A, 200A @ 1mV/A, 500A @ 1mV/A, 500A (550A) @ 1mV/A, 5kA @ 0.1mV/A	I Nominal	1 to 10,000A, 5A*
Ia/Ib/Ic/I4 Polarity	Ia Normal*/Reverse, Ib Normal*/Reverse, Ic Normal*/Reverse, I4 Normal*/Reverse	PT Primary	1 to 1000000V, 100V*
		PT Secondary	1 to 1500V, 100V*
		CT Primary	1 to 30000A, 5A*
		CT Secondary	1 to 50A, 5A*
		I4 Primary	1 to 30000A, 5A*
		I4 Secondary	1 to 50A, 5A*

Table 3-5 Basic Parameters

Click on the wiring graphics on the right-hand side to set the **Channels Color**:

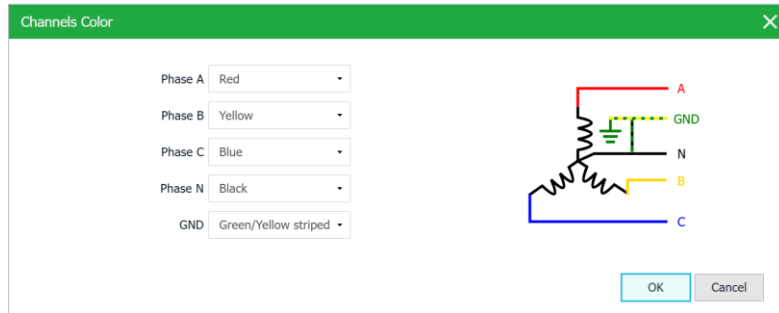


Figure 3-115 Channels Color Settings

3.2.3.5.1.2 Basic > UI

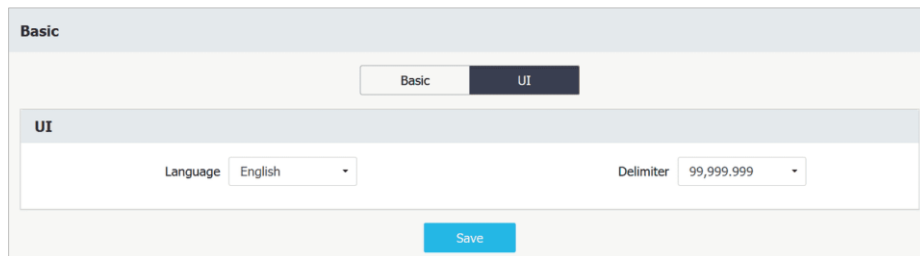


Figure 3-116 UI Settings Interface

3.2.3.5.2 Comm.

3.2.3.5.2.1 Comm. > Basic

Click **Comm.** on the left-hand pane and the following screen appears which has four tabs: **Basic**, **Advanced**, **MQTT** and optional **MB Master**.

Figure 3-117 Basic Communication Setup Interface

The following table illustrates the setup range and default values for Basic Communications parameters.

Parameter	Range/Default*	Parameter	Range/Default*
Ethernet		RS-485	
Enable P1/P2	No, Static*, DHCP	Protocol	Modbus*, EtherGate, MB Master, Disable
IP Address P1	192.168.0.100*	Baud Rate	1200, 2400, 4800, 9600*, 19200, 38400
IP Address P2	192.168.1.100*	Parity	None, Odd, Even*
Subnet Mask 1/2	255.255.255.0*	Stop Bit	1, 2*
Gateway	192.168.0.1*	Unit ID	1 to 247, 100*
White List	Disabled*, Enabled	EtherGate IP Port	20000 to 60000, 20000*
Ethernet Mode	Normal*, Switch, RSTP	Static Routing	
DNS		Enable	Yes, No*
Preferred Server	8.8.8.8*	IP Address	Null*
Alternative Server	114.114.114.114*	Subnet Mask	Null*
		Gateway	Null*

Table 3-6 Basic Communication Setup Parameters

Notes:

- The web connection will be interrupted when **DHCP** is selected, please obtain the current IP address via the device Front Panel under **Setup > Device Info. > Ethernet** and re-login.
- Please note that the IP addresses for P1 and P2 should not be in the same segment.

3.2.3.5.2.2 Comm. > Advanced

Comm.

Basic **Advanced** MQTT MB Master

Modbus TCP

Enable Yes ID 100

Port 502

Web

Enable Yes SSL/TLS Enable Yes

HTTPS Port 443 HTTP Port 80

IEC 61850*

Enable Yes Port 102

IED Name

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

FTPS

Enable Yes SSL/TLS Enable No

Port 21

Note: It is recommended to use a client that supports the encrypted FTP protocols (FTPS, TLS1.1 and above) to access the FTPS service.

SNMP

Enable No Port 161

Read-only Password public Read-write Password private

BACnet/IP*

Enable Yes Device ID 26001

UDP Port 47808 FD Enable No

BBMD IP 0.0.0.0 BBMD Port 47808

BBMD TTL 60000 s PW Enable No

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

IEC104

Mode Disabled Common Address 1

Energy Upload Interval 0 s RT Data Upload Interval 0 s

Timeout 5 min Energy Type INT32

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

Save

Figure 3-118 Advanced Communication Setup Interface

The following table illustrates the setup range and default values for Advanced Communication parameters.

Parameter	Range/Default*	Parameter	Range/Default*
Modbus TCP			
Enable	Yes*, No	ID	1-247, 100*
Port	1-65535, 502*		
Web			
Enable	Yes*, No	SSL/TLS Enable	Yes, No*
HTTPS Port	1-65535, 443*	HTTP Port	1-65535, 80*
IEC 61850~			

Enable	Yes*, No	Port	1-65535, 102*
IED Name	Null*		
FTPS			
Enable	Yes*, No	SSL/TLS Enable	Yes, No*
Port	1-65535, 21*		
SNMP			
Enable	Yes, No*	Port	1-65535, 161*
Read-only Password	public*	Read-write Password	private*
BACnet/IP~			
Enable	Yes, No*	Device ID	0 to 4,194,303, 26001*
UDP Port	1 to 65535, 47808*	FD Enable	Yes, No*
BBMD IP	0.0.0.0*	BBMD Port	1 to 65535, 47808*
BBMD TTL	0 to 65536s, 60000*	PW Enable	Yes, No*
IEC 104			
Mode	Disabled*, Server	Common Address	1 to 65535, 1*
Energy Upload Interval	0s*, 0 to 4,294,967,295s	RTD Data Upload Interval	0s*, 0 to 4,294,967,295s
Timeout	1 to 65535 min, 5 min*	Energy Type	INT32*, INT64

Table 3-7 Advanced Communication Setup Parameters

Note:

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

3.2.3.5.2.3 Comm. > MQTT

The screenshot shows the 'Comm.' configuration page with the 'MQTT' tab selected. It contains two sections: 'Basic Settings' and 'Upload Parameters'. In 'Basic Settings', 'Enable' is set to 'No', 'Port' is '1883', 'User' and 'Client ID' are empty, 'Address' is empty, 'Encryption' is 'No', 'Password' is empty, and 'Device ID' is empty. In 'Upload Parameters', 'Http Url' and 'APP Key' are empty, 'APP ID' is empty, and 'Upload Type' is 'Disable'. A 'Save' button is at the bottom.

Figure 3-119 MQTT Setup Interface

3.2.3.5.2.4 Comm. > MB Master

The screenshot shows the 'Comm.' configuration page with the 'MB Master' tab selected. It displays three slave configurations. Each slave has 'Enable' (Yes/No), 'Unit ID', 'Type' (PMC-53A), and 'Device Name' fields. Slave #01 has Unit ID 101 and Device Name 'Slave #1'. Slave #02 has Unit ID 102 and Device Name 'Slave #2'. Slave #03 has Unit ID 103 and Device Name 'Slave #3'. Each slave section has a 'Select Data' button and a 'More >>' button.

Figure 3-120 MB Master Setup Interface

3.2.3.5.3 Dmd. & Energy

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

3.2.3.5.3.1 Demand

For more information, please refer to **Section 4.2.4**.

Figure 3-121 Demand Setup Interface

The following table illustrates the setup range and default values for Demand setup parameters.

Parameter	Range/Default*	Parameter	Range/Default*
Settings			
Sync. Mode	SLD*, Sync. DI	Period	1 to 60 min, 15*
# of Sliding Windows	1 to 15, 15*	Predicted Sensitivity	70 to 99, 70*
Self-Read Time			
Self-Read Time	Month End, Each Month X (X = 1 to 28) Day Y (Y = 0 to 23) Hour, Manual*		

Table 3-8 Demand Setup Parameters

3.2.3.5.3.2 Energy

Click **Energy** on the left-hand pane to access the **Energy Preset**, **Energy Log**, **Energy Pulse** and **Consump. Curve** configurations.

- 1) **Energy Preset** Supports the presetting of Total and per-phase kWh Import/Export, kvarh Import/Export and kVAh Total. The valid range for the pre-defined energy should be between 0 to 99,999,999,999.999.

iMeter 5 PQ Insight Metering Power Quality Events Setup operator 2024/10/26 09:38

Dmd. & Energy / Energy

Energy Preset Energy Log Energy Pulse Consump. Curve

Preset Values

kWh Import	686.8	kWh	kWh Export	0	kWh
kvarh Import	1511.02	kvarh	kvarh Export	0	kvarh
kVAh	1732.09	kVAh			
Phase A kWh Import	282.33	kWh	Phase A kWh Export	0	kWh
Phase A kvarh Import	503.6	kvarh	Phase A kvarh Export	0	kvarh
Phase A kVAh	583.91	kVAh			
Phase B kWh Import	282.38	kWh	Phase B kWh Export	0	kWh
Phase B kvarh Import	503.58	kvarh	Phase B kvarh Export	0	kvarh
Phase B kVAh	583.91	kVAh			
Phase C kWh Import	281.98	kWh	Phase C kWh Export	0	kWh
Phase C kvarh Import	503.8	kvarh	Phase C kvarh Export	0	kvarh
Phase C kVAh	583.91	kVAh			

Save

Figure 3-122 Energy Preset Interface

- 2) **Energy Log** Please refer to **Section 4.5.1** for a detailed description of the parameters below.

Dmd. & Energy / Energy

Energy Preset Energy Log Energy Pulse Consump. Curve

Accumulative Energy Recorder

Record Mode: FIFO Record Interval: 15 min

Start Date: 2000/01/01 Start Time: 00 : 00 : 00

Interval Energy Recorder

Record Mode: FIFO Record Interval: 15 min

Start Date: 2000/01/01 Start Time: 00 : 00 : 00

Per-Phase Accumulative Energy Recorder

Record Mode: FIFO Record Interval: 15 min

Start Date: 2000/01/01 Start Time: 00 : 00 : 00

Per-Phase Interval Energy Recorder

Record Mode: FIFO Record Interval: 15 min

Start Date: 2000/01/01 Start Time: 00 : 00 : 00

Save

Figure 3-123 Energy Log Setup Interface

- **Energy Pulse**

Dmd. & Energy / Energy

Energy Preset
Energy Log
Energy Pulse
Consump. Curve

Energy Pulse

Pulse Constant
1000
imp/kwh
E1
N/A
E2
N/A
LED
N/A

Save

Figure 3-124 Energy Pulse Setup Interface

- **Consump. Curve**

Dmd. & Energy / Energy

Energy Preset
Energy Log
Energy Pulse
Consump. Curve

Settings

Enable
Yes

Daily Self-Read Time

Each Day
0
Hour
0
min

Monthly Self-Read Time

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

Save

Figure 3-125 Consump. Curve

3.2.3.5.3.3 TOU

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

3) Labels

The screenshot displays the 'Labels' configuration page within the iMeter 5 software. The interface includes a top navigation bar with icons for PQ Insight, Metering, Power Quality, Events, and Setup. A left sidebar lists various system components, with 'TOU' currently selected. The main content area is titled 'Dmd. & Energy / TOU' and features tabs for 'Labels', 'Basic', 'Daily Profiles', 'Seasons', and 'Alternate Days'. The 'Labels' tab is active, showing three main sections: 'Weekday', 'Tariff', and two 'TOU' sections (TOU1 and TOU2).

Weekday Configuration:

Weekday1	WKDAY	Weekday2	WKEND 1
Weekday3	WKEND 2		

Tariff Configuration:

Tariff1	T1	Tariff2	T2
Tariff3	T3	Tariff4	T4
Tariff5	T5	Tariff6	T6
Tariff7	T7	Tariff8	T8

TOU1 Daily Profile Name Configuration:

Profile1	Profile 1	Profile2	Profile 2
Profile3	Profile 3	Profile4	Profile 4
Profile5	Profile 5	Profile6	Profile 6
Profile7	Profile 7	Profile8	Profile 8
Profile9	Profile 9	Profile10	Profile 10
Profile11	Profile 11	Profile12	Profile 12
Profile13	Profile 13	Profile14	Profile 14
Profile15	Profile 15	Profile16	Profile 16
Profile17	Profile 17	Profile18	Profile 18
Profile19	Profile 19	Profile20	Profile 20

TOU2 Daily Profile Name Configuration:

Profile1	Profile 1	Profile2	Profile 2
Profile3	Profile 3	Profile4	Profile 4
Profile5	Profile 5	Profile6	Profile 6
Profile7	Profile 7	Profile8	Profile 8
Profile9	Profile 9	Profile10	Profile 10
Profile11	Profile 11	Profile12	Profile 12
Profile13	Profile 13	Profile14	Profile 14
Profile15	Profile 15	Profile16	Profile 16
Profile17	Profile 17	Profile18	Profile 18
Profile19	Profile 19	Profile20	Profile 20

A 'Save' button is located at the bottom center of the configuration area.

Figure 3-126 Labels Setup Interface

4) Basic

Dmd. & Energy / TOU

Labels Basic Daily Profiles Seasons Alternate Days

Define Day Types

Sunday WKDAY
Tuesday WKDAY
Thursday WKDAY
Saturday WKDAY
Monday WKDAY
Wednesday WKDAY
Friday WKDAY

TOU Record Self-Read Time

☒ Each Month 1 Day 0 Hour
☐ Manual

Switching Time of TOU1 and TOU2

☐ 2000 Year 1 Month 01 Day 0 Hour
☒ Manual

Save

Figure 3-127 Basic Settings Interface

5) Daily Profiles

Dmd. & Energy / TOU

Labels Basic Daily Profiles Seasons Alternate Days

TOU1

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

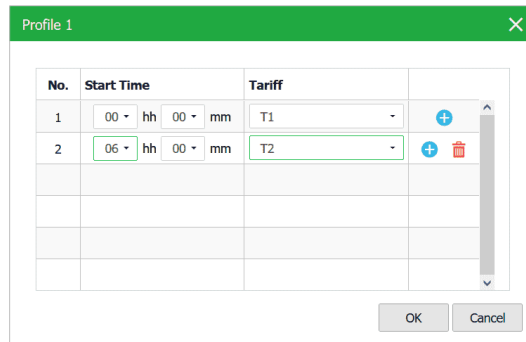
TOU2

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

Save

Figure 3-128 Daily Profiles Setup Interface

Click on a particular **Daily Profile** and the following dialog box appears which allows the **Start Time** and **Tariff** for each **Period** to be defined until the entire day has been filled. As **Figure 3-129** shown, the **Start Time** for the first **Period** is fixed at 00:00 and cannot be modified. Each **Daily Profile** supports a maximum of 12 **Periods** in a minimum of 1-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.



Profile 1

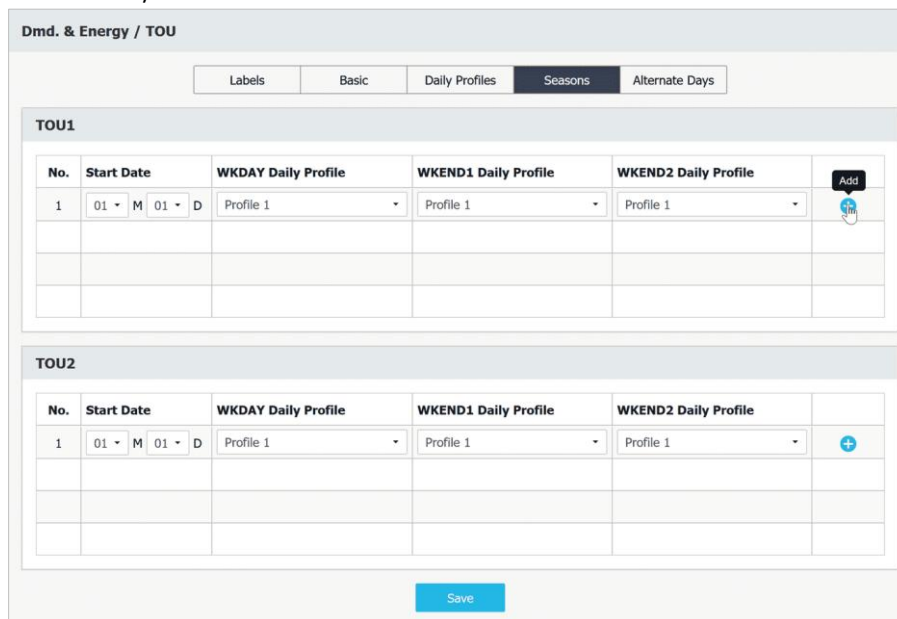
No.	Start Time	Tariff
1	00 hh 00 mm	T1
2	06 hh 00 mm	T2

OK Cancel

Figure 3-129 TOU – DP1 Setting Dialog

6) Seasons

Click on **Seasons** and the following page appears which allows the **Start Date**, **WKDAY Daily Profile**, **WKEND1 Daily Profile**, **WKEND2 Daily Profile** each **Season** to be defined until the entire year has been filled. Up to 12 seasons can be defined for each TOU. 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 on 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

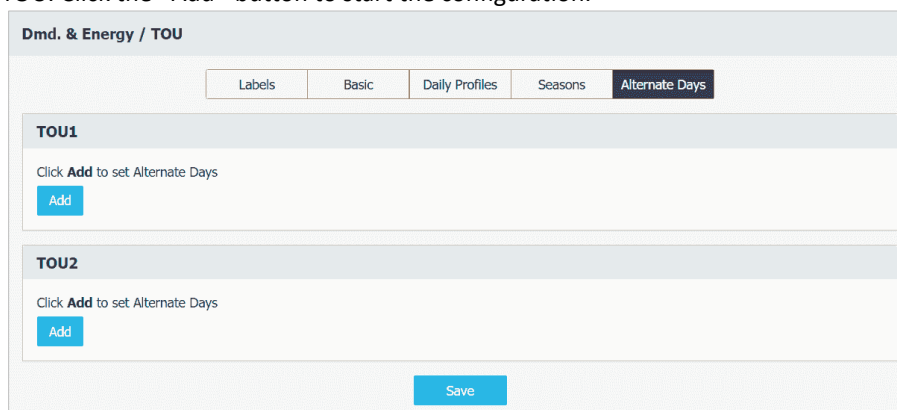
No.	Start Date	WKDAY Daily Profile	WKEND1 Daily Profile	WKEND2 Daily Profile	
1	01 M 01 D	Profile 1	Profile 1	Profile 1	

Save

Figure 3-130 Seasons Setup Interface

7) 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.



Dmd. & Energy / TOU

Labels Basic Daily Profiles Seasons Alternate Days

TOU1

Click **Add** to set Alternate Days

Add

TOU2

Click **Add** to set Alternate Days

Add

Save

Figure 3-131 TOU – Alternate Days

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

Dmd. & Energy / TOU

Labels Basic Daily Profiles Seasons **Alternate Days**

TOU1

No.	Date	Daily Profile	
1	Each Y Each M 01 D	Profile 1	 

TOU2

Click **Add** to set Alternate Days

Add

Save

Figure 3-132 Alternate Days Setup Interface

3.2.3.5.3.4 Algorithm

iMeter 5 PQ Insight Metering Power Quality Events Setup operator 2024-05-06 09:54

Basic Comm. **Dmd. & Energy** Demand Energy TOU **Algorithm** PQ Record

Dmd. & Energy / Algorithm

Power Algorithm

PF Convention IEC KVA Calculation Vector

Save

Figure 3-133 Power Algorithm Setup Interface

3.2.3.5.4 PQ

Click **PQ** on the left-hand pane to expand the sub-menu to show **Settings**, **EN 50160** and **IEEE Std 519**.

3.2.3.5.4.1 PQ > Settings

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

- **PQ Disturbance** For more information, please refer to **Section 4.3.5**.

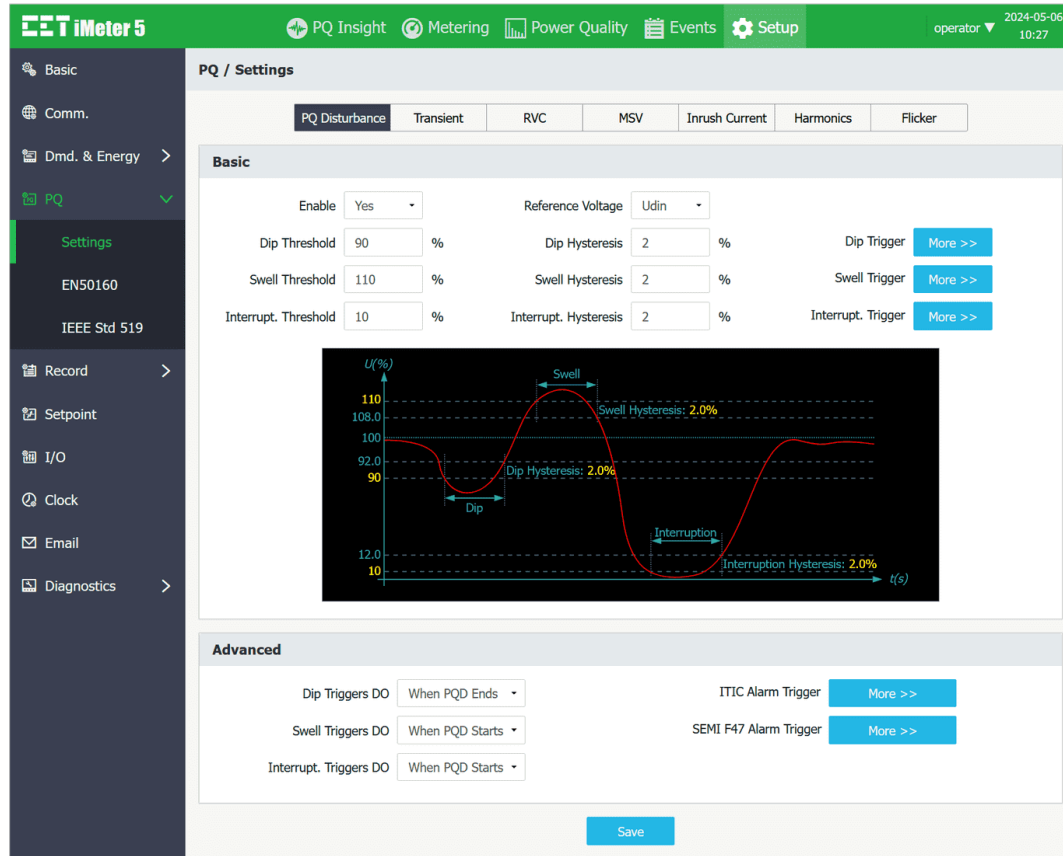


Figure 3-134 PQ Disturbance Settings Interface

- **Transient** For more information, please refer to **Section 4.3.6**.

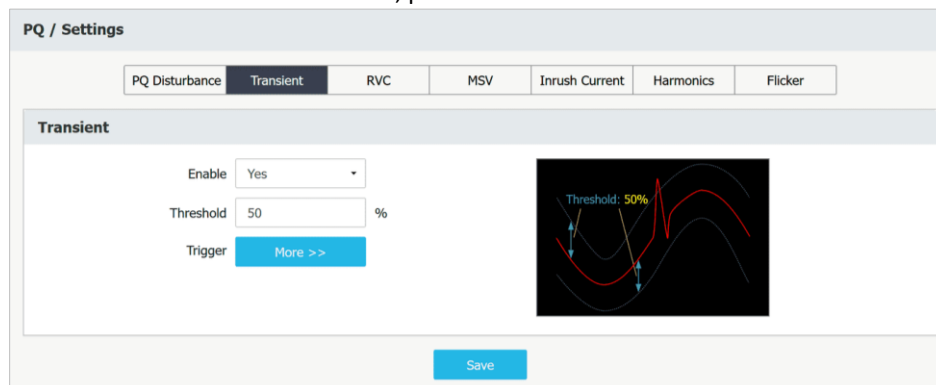


Figure 3-135 Transient Settings Interface

- RVC

For more information, please refer to **Section 4.3.13**.

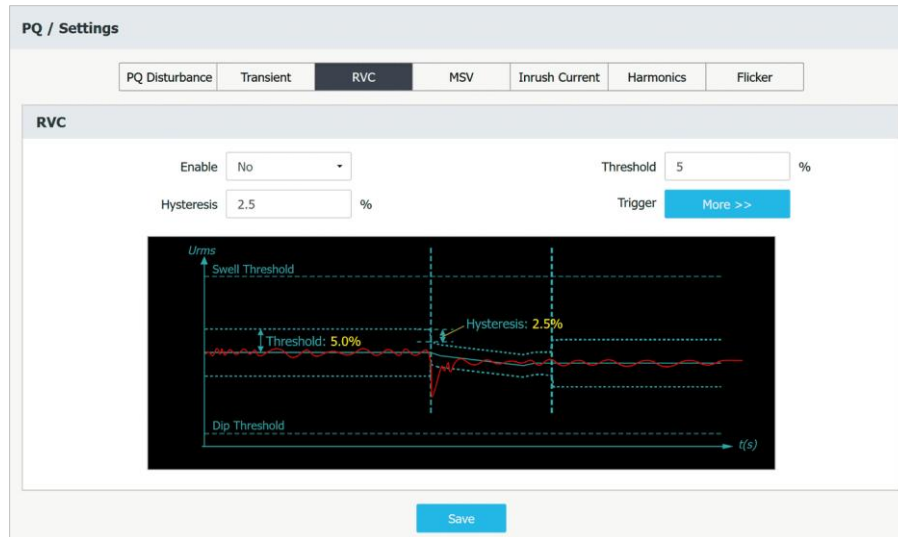


Figure 3-136 RVC Settings Interface

- MSV

For more information, please refer to **Section 4.3.12**.

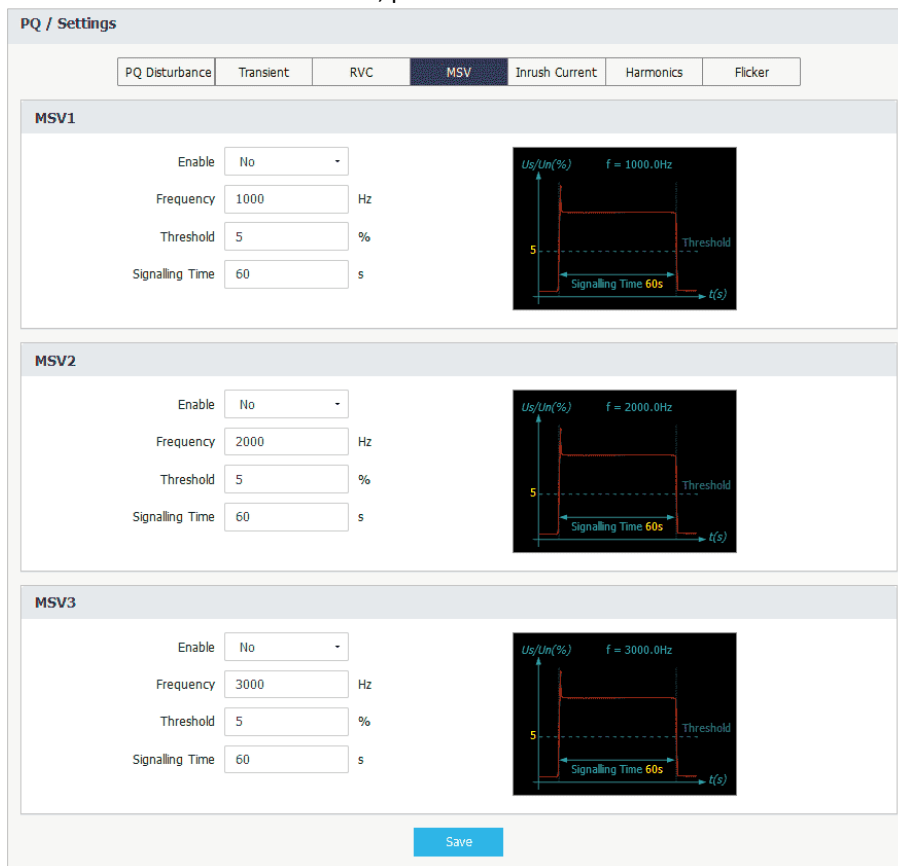


Figure 3-137 MSV Settings Interface

- **Inrush Current** For more information, please refer to **Section 4.3.17**.

Figure 3-138 Inrush Current Settings Interface

- **Harmonics** For more information, please refer to **Section 4.3.9**.

Figure 3-139 Harmonics Settings Interface

The following table illustrates the setup range and default values for Harmonics Setup parameters.

Parameter	Range/Default*	Parameter	Range/Default*
Harmonics			
THD Order	2 to 63, 63*	HD Calculation	% of FUND*, % of RMS, % of UN
TDD Preset IL#	0 to 30000 (x0.001A), 0*	Harm. Cal. Method	Subgroup*, Group
I4 TDD Preset IL#			

Table 3-9 Harmonics Setup Parameters

TDD Preset IL ≠ 0: The predefined IL value is used for the TDD calculation.

TDD Preset IL = 0: Measured IL is used for the TDD calculation according to the IEEE 519-2022 standard

- **Flicker** The options for **Flicker Curve** are 120V and 230V (default). For more information, please refer to **Section 4.3.4**.

Figure 3-140 Flicker Settings Interface

3.2.3.5.4.2 PQ > EN50160

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

Figure 3-141 EN50160 Basic Setup Interface

Figure 3-142 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 4.3.18**.

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

Supply Voltage Variations	
Wide Tolerance	100 %
Narrow Tolerance	95 %
Wide Tolerance Limit	85 ~ 110 %
Narrow Tolerance Limit	90 ~ 110 %

Flicker Severity	
Tolerance	95 %
Limit	1

Supply Voltage Unbalance	
Tolerance	95 %
Limit	2 %

Voltage Harmonic Limits	
Tolerance	95 %
Total	8 %
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 %

Figure 3-142 Default Limits of the EN50160 Parameters for Low Voltage

3.2.3.5.4.3 PQ > IEEE Std 519

This page allows the users to configure the IEEE Std 519 report related parameters. For more information, please refer to **Table 4-22**.

Basic

IEEE Std 519 Mode:

First Day of Week:

PCC Voltage: V

Alert Notification:

HVDC:

Power Generation Facilities:

Max. Short Circuit Current: A

Note: PCC = U/I Nominal x PT Ratio (PCC = Point of Common Coupling)

Figure 3-143 IEEE Std 519 Basic Configuration

Figure 3-144 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 4.3.20**.

Limit

Harmonic Voltage

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

Figure 3-144 Default Voltage Harmonic Limits of IEEE Std 519-2022 for Above 161kV Systems

Figure 3-145 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 4.3.20**.

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 3-145 Default Current Harmonic Limits for SCR Ratio < 25, Above 161kV Power Systems

3.2.3.5.5 Record

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

3.2.3.5.5.1 Waveform

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

8) **WFR** For more information, please refer to **Section 4.5.2**.

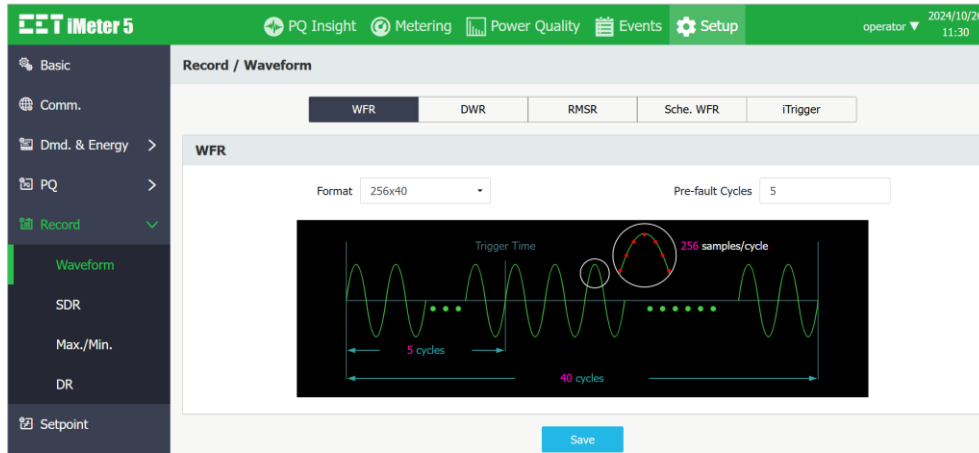


Figure 3-146 WFR Settings Interface

- **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 4.5.3**.

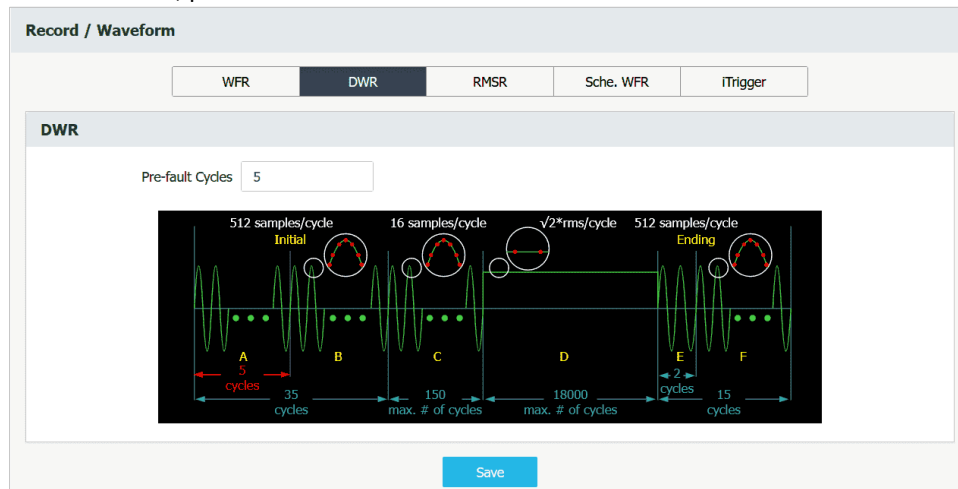
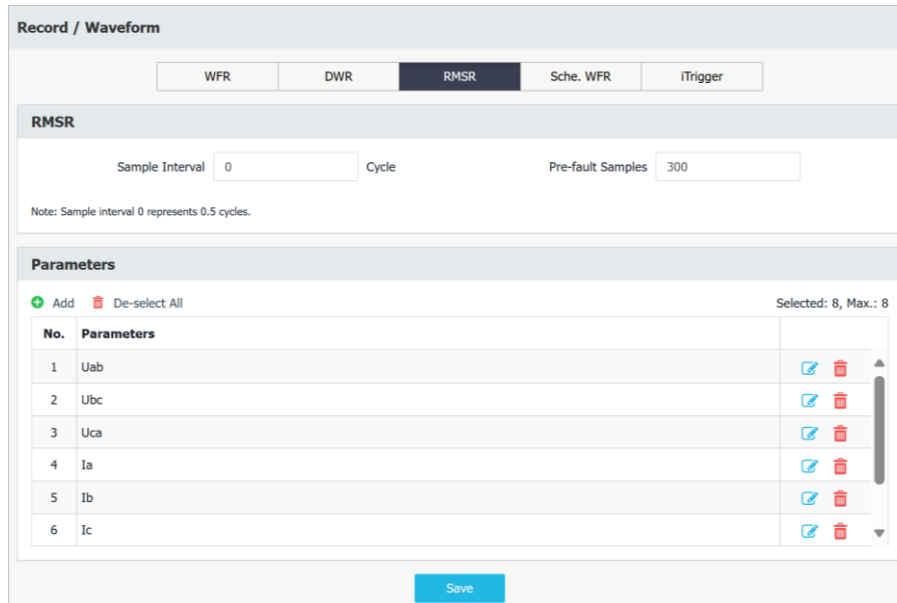


Figure 3-147 DWR Settings Interface

- RMSR** Click “+ Add” to add a batch of parameters by selecting one or more desired parameters from the **RMSR Source Parameters Dialog Box** (See Figure 3-149) 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 4.5.4**.

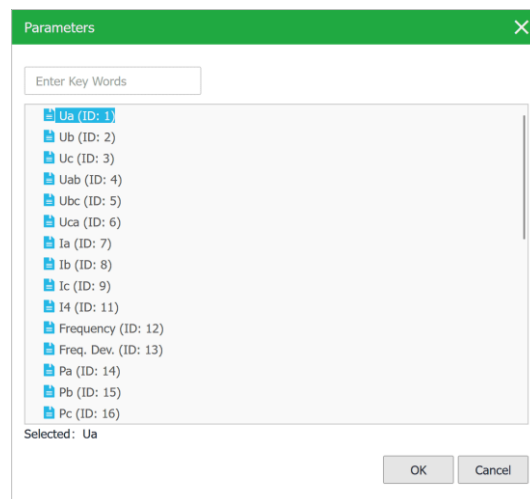


The interface shows the 'Record / Waveform' section with tabs for WFR, DWR, RMSR (selected), Sche. WFR, and iTrigger. Under the RMSR tab, there are input fields for 'Sample Interval' (0) and 'Pre-fault Samples' (300). A note states: 'Note: Sample interval 0 represents 0.5 cycles.' Below this is a 'Parameters' section with a table of selected parameters.

No.	Parameters	
1	Uab	 
2	Ubc	 
3	Uca	 
4	Ia	 
5	Ib	 
6	Ic	 

Buttons: + Add, De-select All, Save. Selected: 8, Max.: 8.

Figure 3-148 RMSR Setup Interface



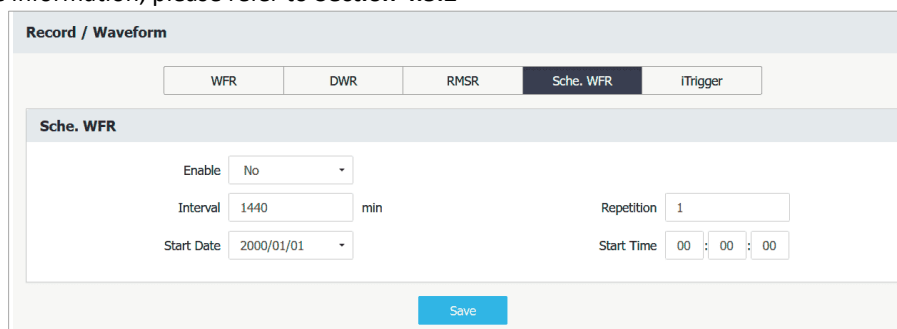
The dialog box titled 'Parameters' contains a search field 'Enter Key Words'. A list of parameters is shown, each with a selection icon and an ID:

- Ua (ID: 1)
- Ub (ID: 2)
- Uc (ID: 3)
- Uab (ID: 4)
- Ubc (ID: 5)
- Uca (ID: 6)
- Ia (ID: 7)
- Ib (ID: 8)
- Ic (ID: 9)
- I4 (ID: 11)
- Frequency (ID: 12)
- Freq. Dev. (ID: 13)
- Pa (ID: 14)
- Pb (ID: 15)
- Pc (ID: 16)

Selected: Ua. Buttons: OK, Cancel.

Figure 3-149 RMSR Source Parameters Dialog Box

- Sche. WFR (Scheduled WFR)**
 For more information, please refer to **Section 4.5.2**



The interface shows the 'Record / Waveform' section with tabs for WFR, DWR, RMSR, Sche. WFR (selected), and iTrigger. Under the Sche. WFR tab, there are settings for 'Enable' (No), 'Interval' (1440 min), 'Start Date' (2000/01/01), 'Repetition' (1), and 'Start Time' (00:00:00). A 'Save' button is at the bottom.

Figure 3-150 Sche. WFR Settings Interface

- **iTrigger** For more information, please refer to **Section 4.6**.

The interface shows the 'Record / Waveform' section with tabs for WFR, DWR, RMSR, Sche. WFR, and iTrigger. The iTrigger tab is active, showing a 'Basic' configuration area. It includes an 'Enable' dropdown set to 'No', a 'Group ID' input field with '1', and three 'More >>' buttons for iTrigger 1, 2, and 3 Actions. A note at the bottom states: 'Note: The iTrigger 1/2/3 Actions are cross triggered by other devices configured with the same iTrigger Group ID.' A 'Save' button is at the bottom right.

Figure 3-151 iTrigger Setup Interface

3.2.3.5.5.2 SDR

The iMeter 5 comes standard with 4 Statistical Data Recorders of 64 parameters each. Please refer to **Section 4.5.7** for more information.

The interface shows the 'Record / SDR' section. It includes a 'Group1' dropdown, 'Settings' for SDR Interval (10 min) and Record Mode (FIFO), and a 'Parameters' table. The table has columns for No., Parameters, and actions (edit and delete). The table is populated with 8 parameters: Freq., Ua, Ub, Uc, Uln Avg., Uab, Ubc, and Uca. A 'Save' button is at the bottom right.

No.	Parameters		
1	Freq.		
2	Ua		
3	Ub		
4	Uc		
5	Uln Avg.		
6	Uab		
7	Ubc		
8	Uca		

Figure 3-152 SDR Settings Interface

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.

The dialog box shows a 'Parameters' window with a 'Keyword Search' section. It includes an 'Enter Key Words' input field and a list of categories: RMS, Fundamental, Demand, and Power Quality. A table on the right lists parameters with columns for No. and Name. The table is currently empty. 'OK' and 'Cancel' buttons are at the bottom right.

No.	Name

Figure 3-153 SDR Source Parameters Dialog Box

3.2.3.5.5.3 Max./Min.

The iMeter 5 supports 4 Max./Min Recorders of 20 parameters each. Please refer to **Section 4.5.9** for the explanation of the Self-Read Time.

Figure 3-154 Max./Min. Setup Interface

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 3-155 Max./Min. Source Parameters Dialog Box

3.2.3.5.6 Setpoint

Click **Setpoint** on the left-hand pane to configure the setup parameters for **Setpoint**.

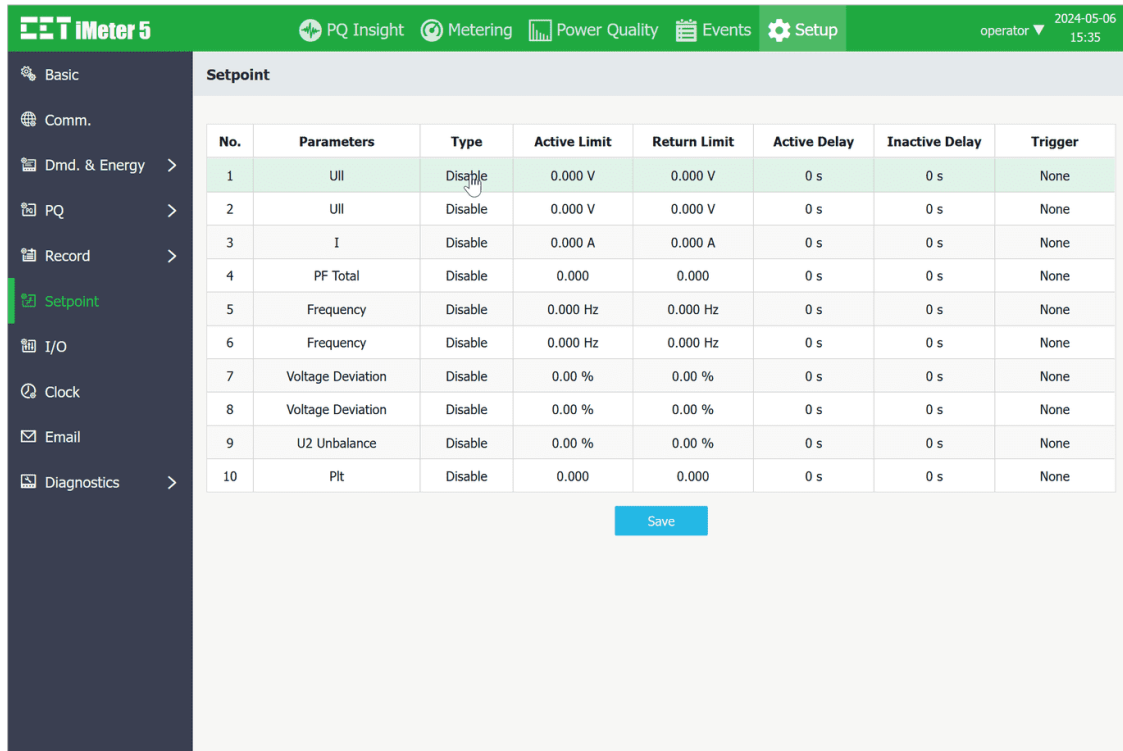


Figure 3-158 Setpoint Setup Interface

Click on a particular Setpoint and the **Setpoint Settings** dialog box appears.

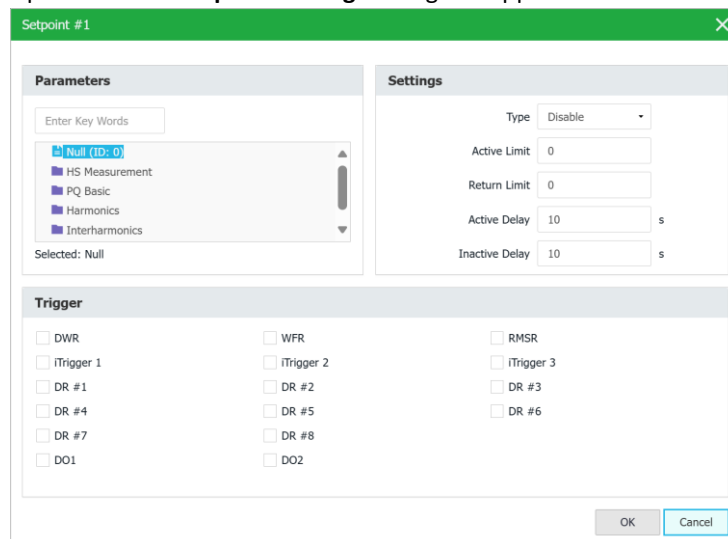


Figure 3-159 Setpoint Settings Dialog Box

3.2.3.5.7 I/O

Click **I/O** on the left-hand pane to configure the I/O parameters. Please refer to **Section 4.1** for more information.

- DI**

Name	DI Mode	Debounce Time	Pulse Weight	Setpoint Type	Trigger
DI1	Status	20 ms	--	Any Edge	None
DI2	Status	20 ms	--	Any Edge	None
DI3	Status	20 ms	--	Any Edge	None
DI4	Status	20 ms	--	Any Edge	None

Figure 3-160 DI Setup Interface

Click on a particular DI and the **DI Settings** dialog box appears. Please refer to **Section 4.1.1** for more information.

Figure 3-161 DI Settings Dialog Box

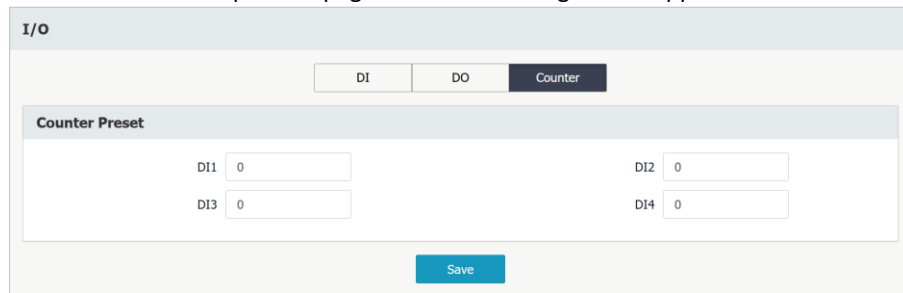
- DO**

Click the **DO** tab at the top of the page and the following screen appears. Please refer to **Section 4.1.2** 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.

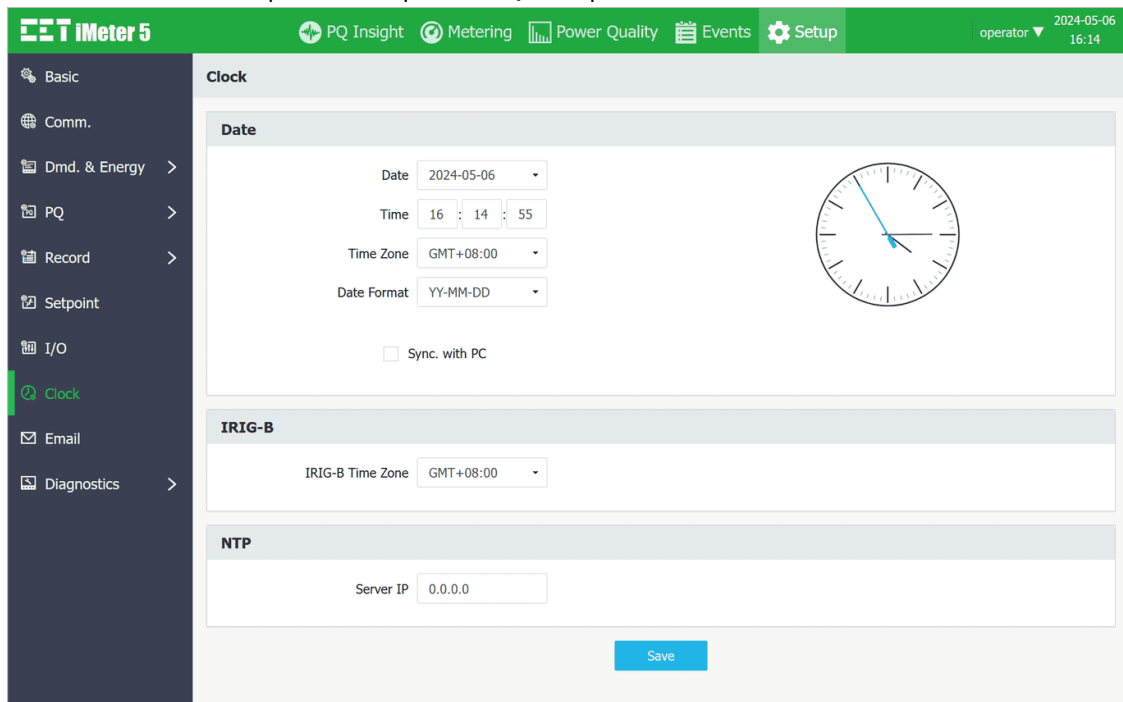


The Counter Setup Interface is a web-based form. At the top, there is a header bar with the text "I/O". Below this, there are three tabs: "DI", "DO", and "Counter". The "Counter" tab is currently selected. Underneath the tabs, there is a section titled "Counter Preset". This section contains four input fields for DI1, DI2, DI3, and DI4, each with a value of "0". At the bottom of the section, there is a blue "Save" button.

Figure 3-163 Counter Setup Interface

3.2.3.5.8 Clock

Click **Clock** on the left-hand pane to setup the **Date/Time** parameters.



The Clock Settings Interface is a web-based form. At the top, there is a green header bar with the text "iMeter 5" and several icons for "PQ Insight", "Metering", "Power Quality", "Events", and "Setup". The "Setup" icon is highlighted. To the right of the header bar, there is a dropdown menu for "operator" and a timestamp "2024-05-06 16:14". On the left side, there is a dark blue sidebar with a list of menu items: "Basic", "Comm.", "Dmd. & Energy", "PQ", "Record", "Setpoint", "I/O", "Clock", "Email", and "Diagnostics". The "Clock" item is highlighted. The main content area is titled "Clock" and contains three sections: "Date", "IRIG-B", and "NTP". The "Date" section has fields for "Date" (2024-05-06), "Time" (16:14:55), "Time Zone" (GMT+08:00), and "Date Format" (YY-MM-DD). There is also a checkbox for "Sync. with PC". The "IRIG-B" section has a field for "IRIG-B Time Zone" (GMT+08:00). The "NTP" section has a field for "Server IP" (0.0.0.0). At the bottom of the section, there is a blue "Save" button.

Figure 3-164 Clock Settings

3.2.3.5.9 Email

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

The screenshot displays the 'Email' configuration page in the CET iMeter 5 software. The left sidebar lists various system functions, with 'Email' highlighted. The main panel has tabs for 'Settings' and 'Alarm Email'. Under the 'Settings' tab, there are input fields for SMTP configuration: SMTP Server (0.0.0.0), SMTP Server Port (25), Username, Password (with an 'Edit' button), Sender E-mail, Receiver E-mail, Trigger Source (with a 'More >>' button), and SSL/TLS (set to 'Disable'). A 'Save' button is located at the bottom right of the settings area.

Figure 3-165 Alarm Email Setup Interface

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

The 'Trigger Source (Event Classification)' dialog box is shown. It contains a grid of checkboxes for selecting event types that can trigger an alarm email. The options are: System, Record, Inrush Current, ENS0160, Setpoint, Dip/Swell, RVC, IEEE Std 519, I/O, Transient, and MSV. 'OK' and 'Cancel' buttons are at the bottom right.

Figure 3-166 Trigger Source Dialog Box

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

The screenshot shows the 'Alarm Email' test interface. It has tabs for 'Settings' and 'Alarm Email'. The 'Alarm Email' tab is selected, showing a text area with the instruction 'Click <Test> to send test email message.' and a blue 'Test' button below it.

Figure 3-167 Alarm Email Test Interface

3.2.3.5.10 Diagnostics

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

3.2.3.5.10.1 Device & Site Info.

- **Device Info.**

The screenshot displays the iMeter 5 web interface. The top navigation bar includes links for PQ Insight, Metering, Power Quality, Events, and Setup. The left sidebar shows a menu with options: Basic, Comm., Dmd. & Energy, PQ, Record, Setpoint, I/O, Clock, Email, Diagnostics (expanded), Device & Site Info. (selected), Maintenance, User Management, and Advanced. The main content area shows the 'Device & Site Info.' page with tabs for 'Device' and 'Site'. The 'Device' tab is active, displaying the following information:

Basic	
Model	iMeter 5-ASCCPA935BAC
S/N	3403156225
P1 MAC Address	E4:C8:06:09:7A:0C
P2 MAC Address	E4:C8:06:09:7A:0D

Version	
Firmware	V1.50.01 2024/09/14
Protocol	Modbus-V7.1 IEC 61850-V1.0
MQTT Version	MQTT-V1.0

Self Diagnostics	
Self Diagnostics	Normal
Wiring Status	Normal
Temperature	39.00°C
MQTT Link	Disabled
Time Sync.	Unsynced (Clock Source: RTC, Diff.: 0.00ms)
Memory	Normal

Ethernet	
P1	Disconnected
IP Address P1	192.168.0.100
Subnet Mask P1	255.255.255.0
P2	Connected
IP Address P2	192.168.1.100
Subnet Mask P2	255.255.255.0
Gateway	192.168.1.1

Figure 3-168 Device Info.

- **Site Info.**

Diagnostics / Device & Site Info.

Device Site

Substation Information

Tag 1 devTag0

Tag 2 devTag1

Tag 3 devTag2

Tag 4 devTag3

Site Information

Tag 1 circuit:Tag 0

Tag 2 circuit:Tag 1

Tag 3 circuit:Tag 2

Tag 4 circuit:Tag 3

Tag 5 circuit:Tag 4

Tag 6 circuit:Tag 5

Tag 7 circuit:Tag 6

Tag 8 circuit:Tag 7

Tag 9 circuit:Tag 8

Tag 10 circuit:Tag 9

Save

Figure 3-169 Site Info. Setup Interface

3.2.3.5.10.2 Maintenance

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

DO Control Perform Manual **DO Control** and **Reset all DOs to Normal**.

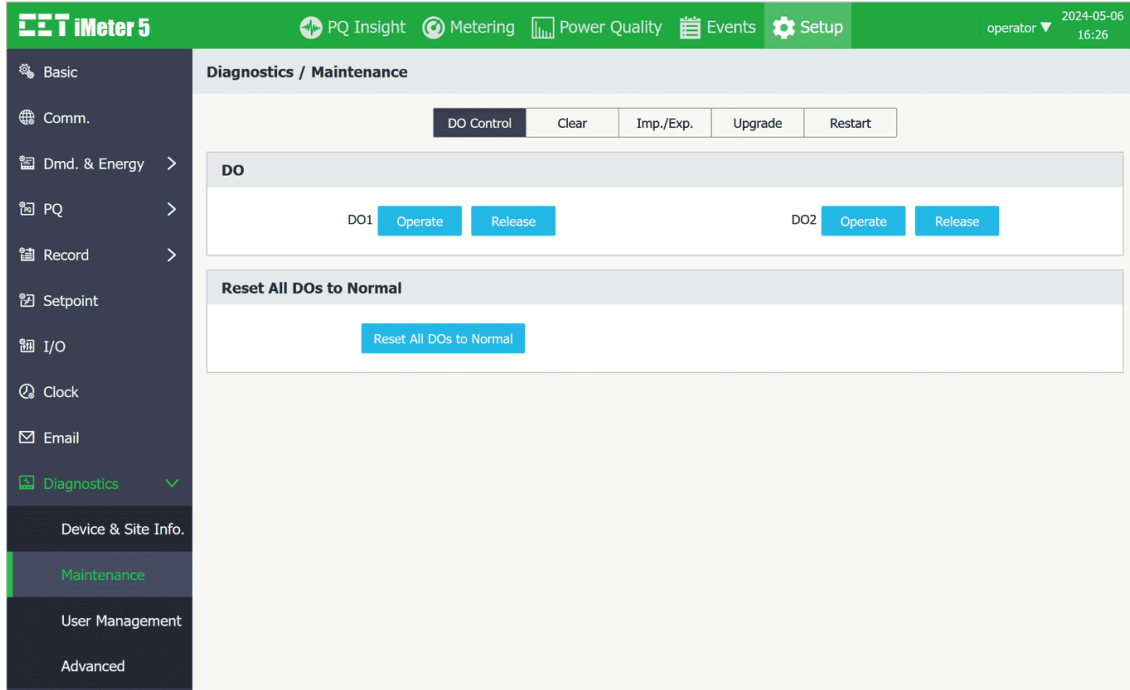


Figure 3-170 DO Control Interface

Depending on the **DO Pulse Width** setting, the DO may behave differently when it is operated. 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 operated and will only return to the **Inactive** state when it's 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 **Release** operation. In addition, if an DO is already in a **Released** state, the **DO Release** command would fail and generate an error message as shown below.

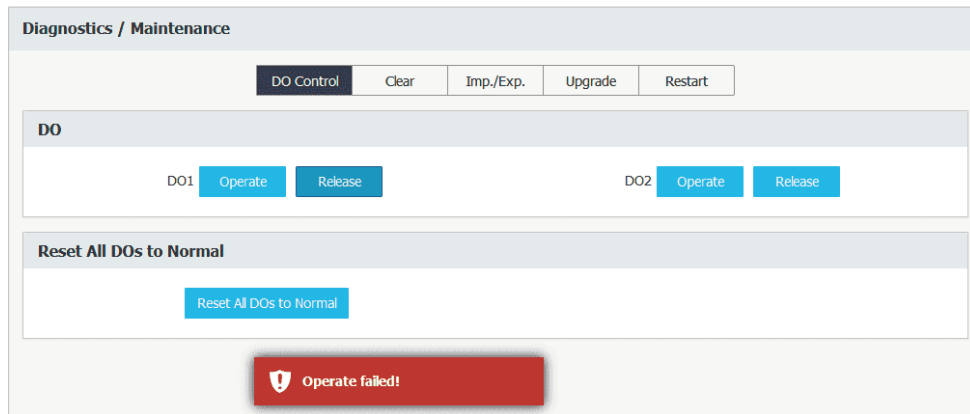


Figure 3-171 DO Release Command Failed

Clear

Click the **Clear** tab at the top of the page and the following screen appears which allows the users to perform the various Clear operations by group or individually.

Groups	
Clear Energy	Clear All Events
Clear All Demands	Clear Present Max. Demand
Clear All Max./Min. Log	Clear Present Max./Min. Log
Clear All DI Counters	Clear PQ Counters
Reset IL	Clear All SDR
Clear All DR	Clear IEEE Std 519 Log
Clear EN50160 Log	Clear D/M Energy Consump.

Individuals	
Clear Device Log	Clear SOE Log
Clear WFR Log	Clear RMSR Log
Clear AER Log	Clear IER Log
Clear Per-Phase AER Log	Clear Per-Phase IER Log
Clear TOU Log	Clear Operating Time
Clear Dips Counter	Clear Swells Counter
Clear Interruptions Counter	Clear Transients Counter
Clear RVC Counter	Clear Inrush Current Counter
Clear MSV #1 Counter	Clear MSV #2 Counter
Clear MSV #3 Counter	Clear DI1 Counter
Clear DI2 Counter	Clear DI3 Counter
Clear DI4 Counter	Clear DWR Log
Clear Pst Log	Clear Plt Log
Clear SDR #1	Clear SDR #2
Clear SDR #3	Clear SDR #4
Clear DR #1	Clear DR #2
Clear DR #3	Clear DR #4
Clear DR #5	Clear DR #6
Clear DR #7	Clear DR #8
Clear Max. Log #1	Clear Min. Log #1
Clear Max. Log #2	Clear Min. Log #2
Clear Max. Log #3	Clear Min. Log #3
Clear Max. Log #4	Clear Min. Log #4

Figure 3-172 Clear Operations Interface

Imp. /Exp. Import or Export System Setup Parameters.

The screenshot shows the 'Diagnostics / Maintenance' section with a tabbed interface. The 'Imp./Exp.' tab is selected. Below the tabs, there is a 'Setup Parameters' section. It contains two instructions: 'Click <Export> to save the System Setup Parameters to a local file in .zip extension.' with an 'Export' button, and 'Select a file in .zip extension and then click <Import> to import the System Setup Parameters.' with a file selection input showing 'No file selected' and a 'Browse' button.

Figure 3-173 Imp./Exp. Interface

Upgrade Only a user with **Operator** authority can perform the Firmware Upgrade for iMeter 5. It's strongly recommended to clear the browser cache after upgrading the firmware for the normal display.

The screenshot shows the 'Diagnostics / Maintenance' section with a tabbed interface. The 'Upgrade' tab is selected. Below the tabs, there is an 'Upgrade' section. It contains one instruction: 'Select the Firmware Upgrade file in .zip format to import.' with a file selection input showing 'No file selected' and a 'Browse' button.

Figure 3-174 Upgrade Interface

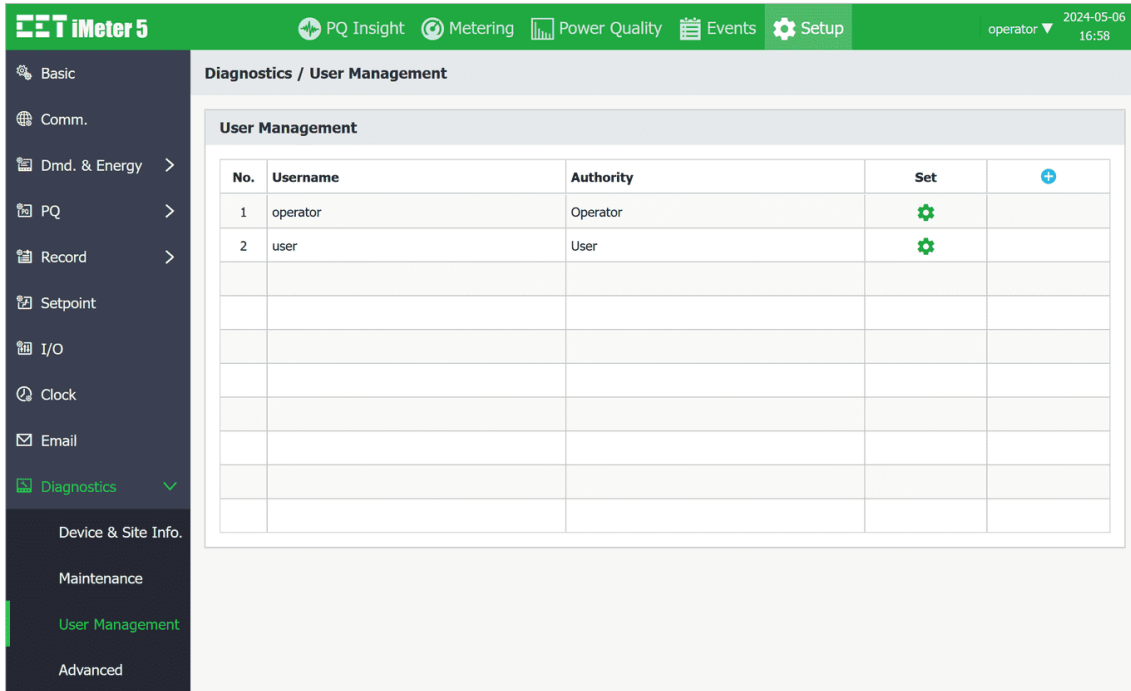
Restart Click the **Restart** tab at the top of the page and the following screen appears which allows the meter to be restarted via the Web Interface.

The screenshot shows the 'Diagnostics / Maintenance' section with a tabbed interface. The 'Restart' tab is selected. Below the tabs, there is a 'Device Reboot' section. It contains one instruction: 'Click <Reboot> to reboot the device.' with a 'Reboot' button.

Figure 3-175 Restart Interface

3.2.3.5.10.3 User Management

The user with Operator authority can click  to add a new user account or  to remove an existing user account. The account manager can click  to modify the account password.



No.	Username	Authority	Set	
1	operator	Operator		
2	user	User		

Figure 3-176 User Management Interface

3.2.3.5.10.4 Advanced

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

Diagnostics / Advanced

Time Format

COMTRADE Local Modbus Local

Flagged Data

Setpoint Trigger Disable SDR Keep
Max. Log Keep Min. Log Keep
EN50160 Keep IEEE519 Keep

COMTRADE

of Sampling Rates 0 Stored Values Primary
Custom Label PQMonitor

PQ Disturbance

D/S RMS Update 1-cycle Interruption Mode Three Phase
D/S Max. Duration 60 s Swell Max. Magnitude 500 %
Disturbance Direction Enable

IEC 61850

Authentication No Timeout 0 s
Password Edit Security Key Edit
Quality Validity Disable Debug Setting Disable
Debug Msg. Export To File Debug Msg. Class Key Information

Web

Client Validate No Login Timeout 0 min

Threshold

OT Threshold 0.1 % Transient Peak Threshold 110 %*√2Un
C.E. Voltage Threshold 0.25 V C.E. Current Threshold 0.05 %

Function Enable

HMI Security Disable Flicker Recorder Enable
EN50160 Trend DataRec Disable

Others

Energy Short Rollover 99,999,999,999 Neutral Connection Directly/Small Resistance

Save

Figure 3-177 Others-> Advanced Setup Interface

Chapter 4 Applications

4.1 Inputs and Outputs

4.1.1 Digital Input

The iMeter 5 comes standard with four self-excited Digital Inputs that are internally wetted at 24 VDC with a sampling frequency of 1000Hz and programmable debounce. The iMeter 5 provides the following programmable functions for its Digital Inputs:

- **Status Input** Status Inputs 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, Web Interface as well as through communications. Changes in Digital Input status are stored as events in the SOE Log in 1 ms resolution.
- **Pulse Counting** Pulse counting facilitates WAGES (Water, Air, Gas, Electricity and Steam) information collection with a fixed incremental value of 1 for each pulse received.
- **Demand Sync Pulse** One of the Digital Inputs can be programmed to receive Demand Sync Pulse. Only one DI can be programmed as **DMD Sync**. For example, to set DI4 as Demand Sync Input, DI1 to DI3 must not be programmed as a **DMD Sync** input.
- **Tariff Switching** Up to 3 Digital Inputs may be used to select to which of the 8 Tariffs the energy consumption should be accumulated. The 3 Digital Inputs (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 following table describes the DI's setup parameters:

Parameter	Definition	Options/Default*
DIx Function	Each DI can be configured as a Status Input, Pulse Counter or DMD SYNC DI. Only DI1 to DI3 can be configured as Tariff Switch .	0=Status Input* 1=Pulse Counter 2=DMD Sync 3=Tariff Switch
DIx Debounce	Specifies the minimum duration the DI must remain in the Active or Inactive state before a state change is considered to be valid.	1 to 9999 (ms) 20*
DIx Setpoint Type	Specifies the transition edge, whether it's positive, negative or any, for a DI Setpoint to become active. The DI Setpoint Type is only used when a DI is configured as a Status Input.	Any Edge*, Positive, Negative
DIx Pulse Weight	Specifies the incremental value for each received pulse. This is only used when a DI is configured as a Pulse Counter	1* to 1,000,000
DIx Trigger	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.	DO/DR/iTrigger/ WFR/DWR/RMSR

Table 4-1 DI Setup Parameters

Note:

- The DIx Setpoint Type only affects which edge would trigger the Waveform Recorder if configured.

4.1.2 Digital Output

The iMeter 5 comes standard with two Form A Electromechanical Digital Outputs. Digital Outputs are normally used for setpoint alarming, load control, or remote control applications.

Digital Outputs on the iMeter 5 can be used in the following applications:

- 1) **Front Panel Control** Manually operated from the Front Panel. Please refer to the **Maintenance-> DO** in **Section 3.1.3.5.8** for a detailed description.
- 2) **Remote Control** Remotely operated over communications via 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, iTriggers AND/OR Alarm Email upon becoming active. Please refer to **Section 4.4** for a detailed description.
- 4) **PQ Disturbance Setpoint** PQ Disturbance setpoint can be programmed to trigger DO, DR, WFR/DWR/RMSR, iTrigger AND/OR Alarm Email upon becoming active. Dips/Swells/Interruption setpoints can be programmed to trigger DO. Please refer to **Section 4.3.5** for a detailed description.
- 5) **ITIC/SEMI F47 Setpoint** ITIC/SEMI F47 setpoint can be programmed to trigger DO AND/OR iTrigger upon becoming active. Please refer to **Section 4.3.19** for a detailed description.
- 6) **Transient Setpoint** Transient setpoint can be programmed to trigger DO, WFR/DWR/RMSR, iTrigger AND/OR Alarm Email upon becoming active. Please refer to **Section 4.3.6** for a detailed description.
- 7) **RVC Setpoint** RVC setpoint can be programmed to trigger DO, WFR/DWR/RMSR, iTrigger AND/OR Alarm Email upon becoming active. Please refer to **Section 4.3.13** for a detailed description.
- 8) **Inrush Setpoint** Inrush Setpoint can be programmed to trigger DO, DR, WFR/DWR/RMSR, iTrigger AND/OR Alarm Email upon becoming active. Please refer to **Section 4.3.17** for a detailed description.

DOs on the iMeter 5 has the following setup parameters:

Parameter	Definition	Options/Default*
Arm Before Execute	Enable or disable the Arm Before Execute feature for the Alarm/DO	0=Disabled*, 1=Enabled
DOx (x=1 to 2) Pulse Width	Specifies the duration for which the DO will be active when a Remote Operate or Setpoint Trigger command is received to operate it.	0 to 6000 (x 0.1s), 0 (Latch Mode) *

Table 4-2 DO Setup Parameters

Since there are multiple ways to trigger the Digital Outputs on the iMeter 5, a prioritized scheme has been developed to avoid conflicts between different applications. In general, Front Panel Control has the highest priority and can override other applications. Remote Control, Control Setpoint, Dip/Swell/Interruption Setpoint, ITIC/SEMI F47 Setpoint, Transient Setpoint, RVC Setpoint and Inrush Current Setpoint the same priority, meaning that they can all be programmed to control the same Digital 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 Digital Output is not recommended if the user intends to generate a control signal in response to a specific setpoint condition.

4.1.3 Energy Pulse Output (Optional)

The iMeter 5 optionally comes with two Solid State Relay Outputs for kWh and kvarh pulsing. Energy Pulse Outputs are typically used for accuracy testing. Energy pulsing can be configured from the Front Panel, Web Interface or communications.

The following table illustrates the ranges and default values for the Energy Pulse parameters.

Parameters	Options/Default*	Parameters	Options/Default*
Pulse Constant ¹	1-65535, 1000*	E1/E2	See Table 4-4, N/A*

Table 4-3 Energy Pulse Parameters

Notes:

1. The **Pulse Constant** (K) indicates how many output pulses are generated per unit of energy consumed. One would use a higher Pulse Constant K for a light-load system in an accuracy testing situation to reduce the test time.
2. The following table illustrates the available options for the Energy Pulse parameters.

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

Table 4-4 Available options for Energy Pulse

4.2 Metering

4.2.1 Basic Measurements

The iMeter 5 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, PF, Phase Angles as well as I4 (Measured Neutral Current), In (Calculated Neutral Current), Ung (Neutral-to-Ground Voltage), Frequency and IR (Calculated Residual Current)

4.2.2 High-Speed Measurements

The iMeter 5 provides the following high-speed measurements which are available through communications.

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

4.2.3 Energy Measurements

The iMeter 5 provides Energy measurements for the following parameters shown in Table 4-5 with a resolution of 0.1 and a maximum value of $\pm 100,000,000,000,000.0$. 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 Interface or communications. Besides, the energy registers can be preset to user-defined values through the Web Interface or via communications.

The iMeter 5 provides the following energy measurements:

3-phase Total		
RMS kWh Import	RMS kvarh Import	kVAh Total
RMS kWh Export	RMS kvarh Export	
RMS kWh Net	RMS kvarh Net	
RMS kWh Total	RMS kvarh Total	
Fundamental kWh Import	Fundamental kvarh Import	
Fundamental kWh Export	Fundamental kvarh Export	
Harmonic kWh Import	Harmonic kvarh Import	
Harmonic kWh Export	Harmonic kvarh Export	
kWh Import H02	kvarh Import H02	
...	...	
kWh Import H63	kvarh Import H63	
kWh Export H02	kvarh Export H02	
...	...	
kWh Export H63	kvarh Export H63	

Per-phase		
kWh Import	kvarh Import	kVAh Total
kWh Export	kvarh Export	
kWh Net	kvarh Net	
kWh Total	kvarh Total	

Table 4-5 Energy Measurements

4.2.4 Demand

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

4.2.4.1 Present and Predicted Demand

iMeter 5 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 5 provides the following Present Demand and Predicted Demand parameters:

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

Table 4-6 Present Demand and Predicted Demand Parameters

4.2.4.2 Max. Demand

iMeter 5 also provides the Max. Demand of This Month and Last Month or Since Last Reset and 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 (Before Last Reset) and then reset each month at the **Self-Read Time** or after a manual reset.

The iMeter 5 records the Max. Demand for This Month (Since Last Reset) and Last Month (Before Last Reset) with timestamps for the parameters listed in Table 4-7 Max. Demand . The Max. Demand can be accessed from the Front Panel, Web Interface or communications. The Max. Demand for This Month can be reset manually via communications. The iMeter 5 provides the following Max. Demand parameters:

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

Table 4-7 Max. Demand Measurements

4.2.4.3 Max./Min Values Per Demand Period

In addition, the iMeter 5 provides the max./min. value per demand period of the following measurements which can be retrieved through communications.

	Max./Min. Measurements Per Demand Period
Voltage	Ua, Ub, Uc, UIn Avg, Uab, Ubc, Uca, UII Avg
Current	Ia, Ib, Ic, I Avg, I4
Frequency	Frequency
Power	Pa Import/Export, Pb Import/Export, Pc Import/Export, Total P Import/Export, Qa Import/Export, Qb Import/Export, Qc Import/Export, Total Q Import/Export, Sa, Sb, Sc, Total S
PF	PfA, PfB, PfC, PF Total
Harmonics	Ua (Uab) THD/TOHD/TEHD, Ub (Ubc) THD/TOHD/TEHD, Uc (Uca) THD/TOHD/TEHD, Ia Fund. /THD/TOHD/TEHD/K-Factor, Ib Fund. /THD/TOHD/TEHD/K-Factor, Ic Fund. /THD/TOHD/TEHD/K-Factor, I4 Fund. /THD/TOHD/TEHD/K-Factor
Deviation	Ua Deviation/Over Deviation/Under Deviation, Ub Deviation/Over Deviation/Under Deviation, Uc Deviation/Over Deviation/Under Deviation, Uab Deviation/Over Deviation/Under Deviation, Ubc Deviation/Over Deviation/Under Deviation, Frequency Deviation
Unbalance	U0 Unbalance, U2 Unbalance, I0 Unbalance, I2 Unbalance

Table 4-8 Max./Min. Values Per Demand Period

The iMeter 5 provides the following setup parameters.

Setup Parameter	Definition	Options/*Default
Sync. Mode	SLD – Internally synchronized to the meter's real-time clock. Sync. DI – Externally synchronized to a DI that has been programmed as a Demand Sync Input by setting the DI Function as "DMD Sync".	0 = SLD* 1 = Sync. DI
Demand Period	1 to 60 minutes. For example, if the # of Sliding Windows is set as 1 and the Demand Period is 15, the demand cycle will be 1×15=15min.	1 to 60 min 15*
# of Sliding Windows	The number of Sliding Windows.	1 to 15, 1*
Self-Read Time	The Self-Read Time allows the user to specify the time and day of the month for the Max. Demand Self-Read operation. The Self-Read Time supports three options: - A zero value means that the Self-Read will take place at 00:00 of the first day of each month. - A non-zero value means that the Self-Read will take place at a specific time and day based on the formula: Self-Read Time = Day * 100 + Hour where 0 ≤ Hour ≤ 23 and 1 ≤ Day ≤ 28. For example, the value 1512 means that the Self-Read will take place at 12:00pm on the 15th day of each month.	0xFFFF*

	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.	
Predicted Response	The Predicated Response shows the speed of the predicted demand output. A value between 70 and 99 is recommended for a reasonably fast response. Specify a higher value for higher sensitivity.	70 to 99, 70*

Table 4-9 Demand Setup Parameters

4.3 Power Quality Parameters

4.3.1 Power Frequency and Freq. Deviation

The iMeter 5 is capable of measuring **Frequency** accurate to $\pm 0.003\text{Hz}$. The measurement range is $\pm 10\%$ of f_{nominal} , which is 40Hz to 72Hz.

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 5 also computes **Freq. Deviation** as per below:

$$\text{Freq. Deviation} = f - f_{\text{nominal}}$$

where f_{nominal} is the Nominal Frequency

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

4.3.2 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 **dip**, **swell**, **voltage interruption** and **transient**. The RMS value includes voltage related measurements such as **harmonic**, **interharmonic**, **mains signalling**, etc.

4.3.3 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.

4.3.4 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 5 provides the flicker measurements in accordance with **Section 5.3** of **IEC 61000-4-30 Ed.3 Standard** for Class A performance (where **IEC 61000-4-15 Standard** applies).

4.3.4.1 Configuration

To correctly evaluate flicker measurements, it is necessary to select the lamp-model voltage (i.e., **Flicker Curve**, 120V or 230V) used in the flicker measurement algorithm according to the nominal voltage.

4.3.4.2 Measurement

The iMeter 5 provides the following Flicker measurements.

- Short-term flicker severity (P_{st}) measured over a 10-minute interval.
- Long-term flicker severity (P_{lt}) calculated from a rolling sequence of 12 P_{st} according to the following formula:

$$P_{lt} = \sqrt[3]{\sum_{i=1}^{12} \frac{P_{st_i}^3}{12}}$$

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

The Pst and Plt measurements can be accessed through Front Panel, Web Server or through Communications.

Pst/Plt values above 1.00 are generally considered 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.

4.3.5 PQ Disturbance – Dip/Swell/Interruption

The iMeter 5 supports the detection of the supply voltage dips, swells and interruptions 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 5 provides Dips/Swells/Interruptions detection for voltage quality monitoring on a per phase basis, which support multiple triggers at the same time, including **DR, WFR/DWR/RMSR, DO, iTrigger, SOE and Alarm Email**. The timestamp, duration and magnitudes of per phase voltage of each dip/swell/interruption would be recorded by the meter.

4.3.5.1 Dips/Swells/Interruptions 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.

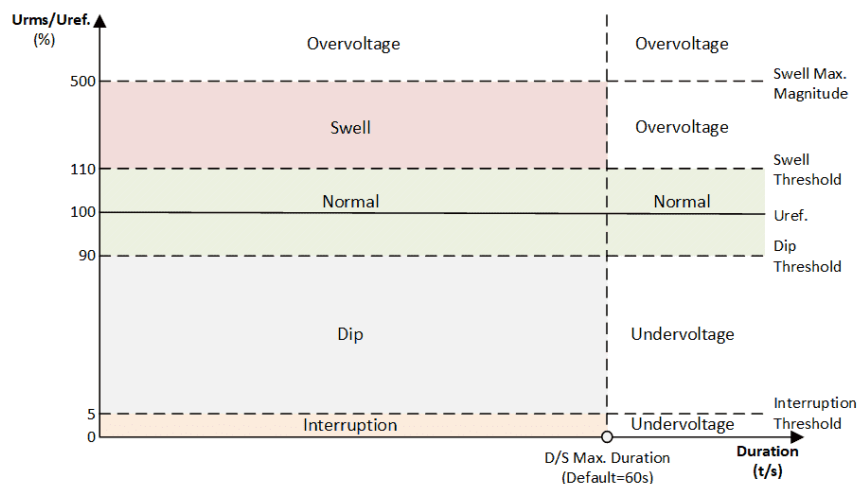


Figure 4-1 PQ Disturbance Detections

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 called an interruption.

Swell

Swell detection starts when the following criteria are satisfied simultaneously:

- The RMS voltage (U_{rms}) of one or more channels rise above the **[Swell Threshold (Default: 110%) x U_{ref} .]**
- All 3 channels U_{rms} are below the **[Swell Max. Magnitude (Default: 500%) x U_{ref} .]**
- **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 - Hysteresis) x U_{ref} .]**

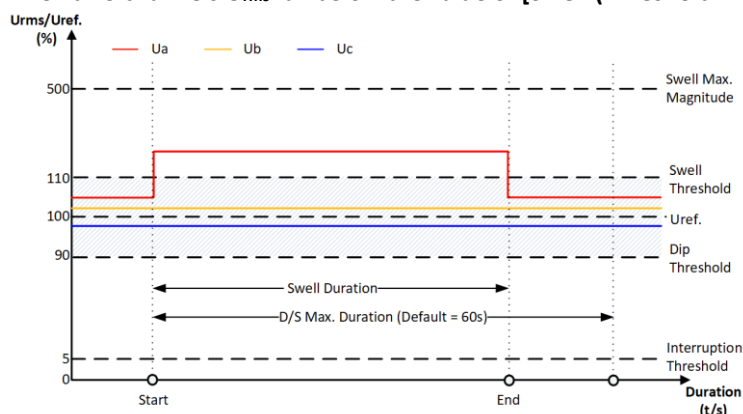


Figure 4-2 Swell Detection Criteria

Overvoltage

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

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

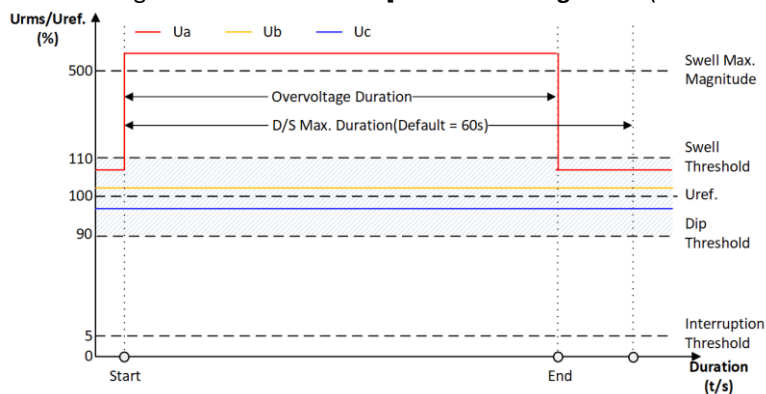


Figure 4-3 Overvoltage Detection Criteria 1

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

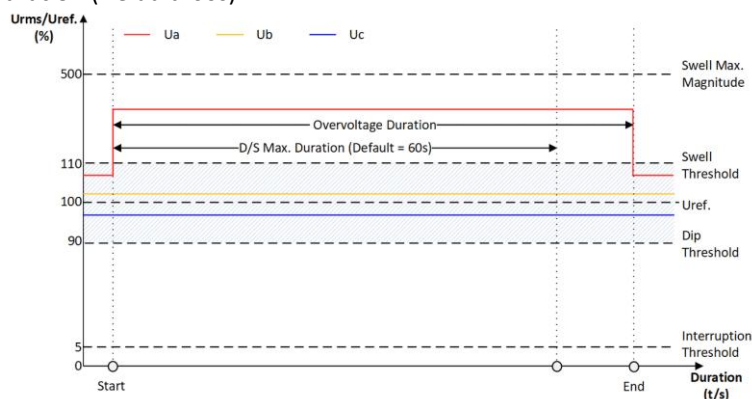


Figure 4-4 Overvoltage Detection Criteria 2

Overvoltage detection ends when all 3 channels voltage falls below the value of **[Swell (Threshold - Hysteresis) x U_{ref} .]**

Dip

Dip detection starts when the following criteria are satisfied simultaneously:

- The voltage U_{rms} of one or more channels falls below the [**Dip Threshold** (Default: 90%) x U_{ref} .] but exceeds the [**Interruption Threshold** (Default: 5%) x U_{ref} .].
- **Duration** is shorter than **D/S Max. Duration** (Default: 60s).

Dip detection ends when all 3 channels voltage exceed [**Dip (Threshold + Hysteresis)** x U_{ref} .].

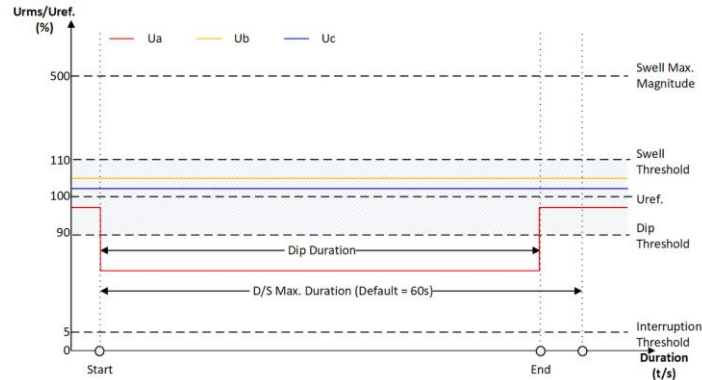


Figure 4-5 Dip Detection Criteria

Interruption

Interruption detection starts when the following criteria are satisfied simultaneously:

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

Any one of channels voltage is equal to or greater than the [**Interruption (Threshold + Hysteresis)** x U_{ref} .], the interruption detection ends.

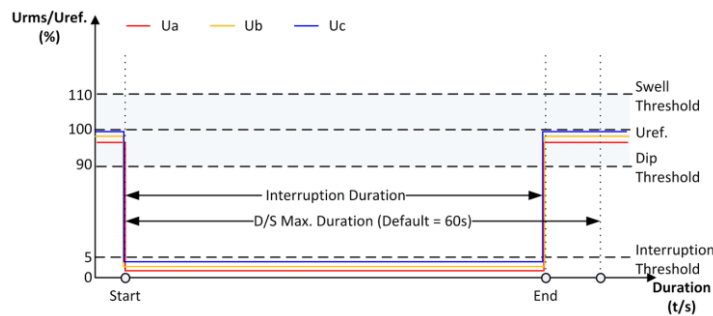


Figure 4-6 Interruption Detection Criteria

Undervoltage

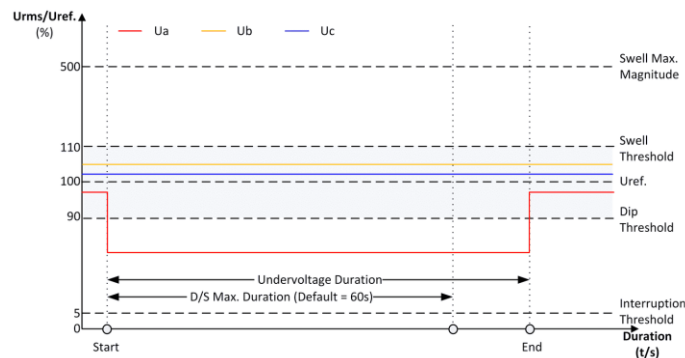


Figure 4-7 Undervoltage Detection Criteria

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

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

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

4.3.5.2 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 **PQ Disturbance** 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.

Parameter	Options/Range	Default
Basic		
Enable	Enable Dip/Swell/Interruption detection, 0=No, 1=Yes	1
Reference Voltage (Uref.)	Udin (Nominal Voltage), U _{sr} ¹ (Sliding Reference Voltage)	Udin
Swell Threshold	101 to 200 (x0.01 Uref.)	110
Dip Threshold	1 to 99 (x0.01 Uref.)	90
Interruption Threshold	0 to 50 (x0.01 Uref.)	5
Swell Hysteresis	1 to 1000 (x0.001 Uref.)	20
Dip Hysteresis		
Interruption Hysteresis		
Swell Trigger Actions	See Note 2	DWR, RMSR
Dip Trigger Actions		
Interruption Trigger Actions		
Advanced		
Dip Triggers DO ³	When PQD Starts, When PQD Ends	When PQD Ends
Swell Triggers DO ³		When PQD Starts
Interrupt. Triggers DO ³		When PQD Starts
D/S RMS Update ⁴	1-cycle, ½ -cycle	1-cycle
Interruption Mode ⁵	Three Phase, Single Phase	Three Phase
D/S Max. Duration	1-600 (s)	60
Swell Max. Magnitude	101-500 (%)	500
Disturbance Direction	0=Enable, 1=Disable	0

Table 4-10 PQ Disturbance Parameters

Notes:

1. 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_{sr} is not used in LV systems.

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

BIT	Trigger	BIT	Trigger	BIT	Trigger
0	DO1 Closed	19	DR #5	26	iTrigger 3
1	DO2 Closed	20	DR #6	27	DWR
2-14	Reserved	21	DR #7	28	WFR
15	DR #1	22	DR #8	29	RMSR
16	DR #2	23	Reserved	30-31	Reserved
17	DR #3	24	iTrigger 1		
18	DR #4	25	iTrigger 2		

Table 4-11 Swell/Dip/Interruption Trigger

3. PQD Trigger DO modes:

PQD Triggers DO	DO Closed When	DO Released When
When PQD Starts	Swell Starts	- Pulse Width = 0, DO will be released when PQD ends or PQD becomes invalid. If there is a new event that triggers the DO, the DO will remain the Closed state and be released when all the trigger sources return. - Pulse Width $\neq$ 0, DO will be released after the pulse width. If there is a new event that triggers the DO, the DO's pulse width will be recalculated. PQD becomes invalid if Overvoltage/Undervoltage or a Dip transitioned to interruption is detected.
	Dip Starts	
	Interruption Starts	
When PQD Ends	Swell Ends	- DO Pulse Width = 0, DO will be released after 1s - DO Pulse Width $\neq$ 0, DO will be released after [PQD ends + Pulse Width]
	Dip Ends	
	Interruption Ends	

Table 4-12 PQD Trigger DO Modes

4. The **D/S RMS Update** determines if the U_{rms} is computed every cycle and then shifted by $\frac{1}{2}$ cycle or U_{rms} is computed every $\frac{1}{2}$ cycle and then shifted by $\frac{1}{2}$ cycle.
5. If the **Interruption Mode** is set to **Single Phase**, the interruption detection starts when any one phase voltage U_{rms} falls below the **[Interruption Threshold x U_{ref}]** and ends when all three phases voltage exceed the value of **[Interruption (Threshold - Hysteresis) x U_{ref}]**.

4.3.5.3 Disturbance Direction Indicator

The iMeter 5 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.

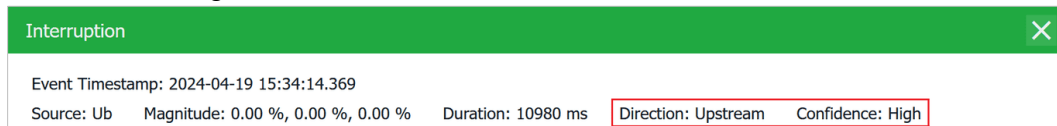


Figure 4-8 Disturbance Direction Indicator on the Web Interface

4.3.6 Transient Voltage

The iMeter 5 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 40us at 512 samples for sub-cycle disturbances such as capacitor switching and resonance phenomena, in accordance with **section 5.6 & A.4.4 of IEC 61000-4-30 Ed.3** standard.

The iMeter 5 provides the following setup parameters for transient voltages which can be programmed via the Front Panel, Web Interface and communications:

Parameter	Options/Value, Default*	Parameter	Options/Value, Default*
Enable	Yes, No*	Threshold	5% to 500% of U_{din} , 35%*
Trigger	WFR*, DWR, RMSR, iTrigger, DO		

Table 4-13 Transient Parameters

4.3.6.1 WFR of Transient Event



Figure 4-9 Transient Event @ 512 samples/cycle x 100 cycles

4.3.7 Phase Angle

Phase Angles analysis is used to identify the angle relationship between 3-phase voltages and currents. In 3P4W or 3P3W system in which the phase angles between consecutive line voltages, are not all equal. The degree of inequality is usually expressed as the ratios of the negative- and zero-sequence components to the positive-sequence component, which is called **Unbalance**. 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.

4.3.8 Supply Voltage and Current Unbalance

The iMeter 5 provides both the zero-sequence and negative-sequence unbalance measurements for Voltage and Current, respectively, 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.

Negative Sequence Unbalance:

$$U2 \text{ Unbalance} = \frac{U_2}{U_1} \times 100\%$$

$$I2 \text{ Unbalance} = \frac{I_2}{I_1} \times 100\%$$

Zero Sequence Unbalance:

$$U0 \text{ Unbalance} = \frac{U_0}{U_1} \times 100\%$$

$$I0 \text{ Unbalance} = \frac{I_0}{I_1} \times 100\%$$

where

U0, U1 and U2 are the zero, positive and negative sequence components for voltage, respectively.

I0, I1 and I2 are the zero, positive and negative sequence components for current, respectively.

4.3.9 Harmonic and Interharmonic

4.3.9.1 Voltage/Current Harmonic Measurements

The following table illustrates the Voltage and Current harmonic/interharmonic measurements on the meter.

Measurements	Ua	Ub	Uc	Ia	Ib	Ic	I4
THD, TOHD, TEHD, DC Components to HD63 (%)	■	■	■	■	■	■	■
TDD, TDD Odd, TDD Even (%)	--	--	--	■	■	■	■
K-Factor	--	--	--	■	■	■	■
Crest Factor	■	■	■	■	■	■	■
TH, TEH, TOH, DC Components to H63 (RMS)	■	■	■	■	■	■	■
TIHD, TOIHD, TEIHD, IHD00 to IHD63 (%)	■	■	■	■	■	■	■
TIH, TIEH, TIOH, IH00 to IH63 (RMS)	■	■	■	■	■	■	■

Table 4-14 Voltage and Current Harmonic/Interharmonic measurements

4.3.9.2 Harmonic Calculation Method

The basic measurement of 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, Figure 4-10. On iMeter 5, the user shall select either by a 10/12-cycle **Harmonic Group**, designated $Y_{g,h}$, or a 10/12-cycle **Subgroup**, designated $Y_{sg,h}$.

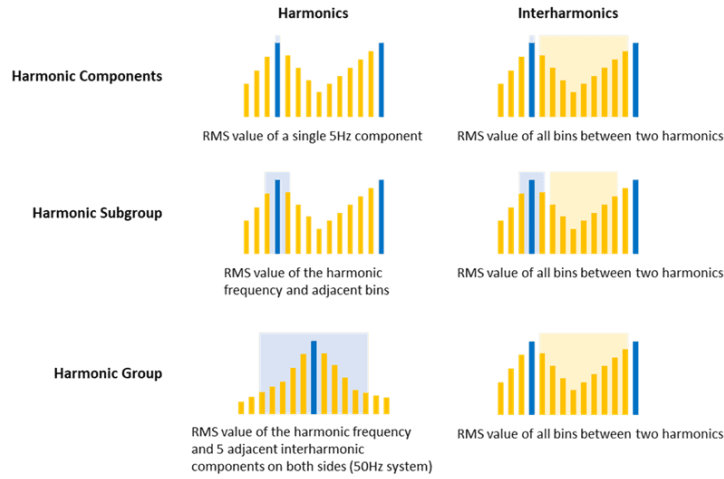


Figure 4-10 Harmonic Calculation Method

4.3.9.3 THD

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

Total harmonic distortion (THD):

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

where

h = harmonic order (1, 2, 3, 4, ... up to 63)

$Y_{H,h}$ =RMS value of h^{th} harmonic component

Group total harmonic distortion (THDG):

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

where

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

Subgroup total harmonic distortion (THDS):

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

where

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

On the iMeter 5, the **THD** will be calculated using **THDG** or **THDS** depending on the harmonic calculation method (**Group** or **Subgroup**).

4.3.9.4 HD/IHD Calculation Methods

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

a) Fundamental Method:

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

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

b) RMS Method:

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

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

c) Nominal Method:

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

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

4.3.9.5 Real-time TDD and IL

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

TDD of Current is calculated by the formula below:

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

where

I_L = Maximum Demand Load Current

h = Harmonic Order (1, 2, 3, 4, etc.)

I_h = RMS Load Current at the h^{th} Harmonic

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

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

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

- If less than 12 month's data is available, the I_L is 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, 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 can be set through the Front Panel, Web Interface, or via Communications.



Figure 4-11 PQ-Harmonics Setup Interface

4.3.9.6 Harmonic Power

The iMeter 5 provides Individual Harmonics to the 63rd order and the TH (Total Harmonic) P, Q, S and PF for 3- ϕ and Total. The Total 3- ϕ 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.

Harmonic Power				
L1 L2 L3				
Order	P	Q	S	PF
Total	3.706 W	-0.679 var	3.767 VA	0.984
01	418.7 W	750.8 var	859.6 VA	0.487
02	-0.044 W	0.074 var	0.086 VA	-0.511
03	-3.520 W	-0.021 var	3.520 VA	-1.000
04	-0.011 W	-0.019 var	0.022 VA	-0.493
05	0.700 W	-1.184 var	1.375 VA	0.509
06	0.006 W	0.000 var	0.006 VA	1.000
07	0.329 W	0.588 var	0.674 VA	0.488
08	-0.003 W	0.005 var	0.006 VA	-0.519
09	-0.416 W	-0.008 var	0.416 VA	-1.000
10	-0.003 W	-0.005 var	0.006 VA	-0.485
11	0.145 W	-0.238 var	0.278 VA	0.519
12	0.001 W	0.001 var	0.001 VA	0.704

Figure 4-12 Harmonic Power measurement displayed on Web

4.3.9.7 Harmonic Energy

The iMeter 5 provides the Total Harmonic Energy Measurements for kWh, kvarh Import/Export and kVAh as well as the Individual Harmonic Energy Measurements to the 63rd order for kWh, kvarh Import/Export. The Harmonic Energy can be retrieved via the Front Panel, Web Interface and Communications.

Harmonic Energy				
Table				
Order	kWh Imp. (kWh)	kWh Exp. (kWh)	kvarh Imp. (kvarh)	kvarh Exp. (kvarh)
01	16,068.2	0.0	28,875.0	0.0
02	0.0	1.6	2.8	0.0
03	0.0	135.2	0.0	0.8
04	0.0	0.3	0.0	0.6
05	26.8	0.0	0.0	45.4
06	0.1	0.0	0.0	0.0
07	12.5	0.0	22.5	0.0
08	0.0	0.0	0.1	0.0
09	0.0	15.9	0.0	0.2
10	0.0	0.0	0.0	0.1
11	5.5	0.0	0.0	9.0
12	0.0	0.0	0.0	0.0
13	3.0	0.0	5.6	0.0

Figure 4-13 Harmonic Energy Displayed on the Web Server

4.3.10 K-Factor

K-Factor is defined as the weighted sum of the harmonic load currents according to their effect on transformer heating, as derived from **ANSI/IEEE C57.110**. The **K-Factor** is an expression of the potential energy losses in transformers due to harmonic and eddy current losses at the fundamental frequency. A **K-Factor** of 1.0 indicates a linear load (no harmonics). The higher the **K-Factor**, the greater the harmonic heating effect.

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

I_h = h_{th} Harmonic Current in RMS

h_{max} = Highest harmonic order

4.3.11 Crest Factor

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

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

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

X_{rms} = RMS value

4.3.12 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 5 can monitor the Mains Signalling Voltage in a higher frequency band than system frequency (50Hz or 60Hz) in accordance with **Section 5.10 of IEC 61000-4-30 Ed.3 Standard** for Class A performance.

As per 5.10 of IEC 61000-4-30 Ed.3:

- *Mains Signalling Voltage is RMS voltage of mains signal.*
- *Mains signalling voltage measurement shall be based on*
 - *Either the corresponding 10/12-cycle r.m.s. value interharmonic bin*
 - *Or the r.m.s. of the four nearest 10/12-cycle r.m.s. value interharmonic bins*
- *The beginning of a signalling emission shall be detected when the measured value of the concerned interharmonic exceeds a threshold. The measured values are recorded during a period of time specified by the user, in order to give the level and the sequence of the signal voltage.*
- *The user must select a detection threshold above 0.3% U_{din} as well as the length of the recording period up to 120s.*

The iMeter 5 provides the following setup parameters which can be programmed via the Front Panel, Web Interface and communications:

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

Table 4-15 MSV Parameters

The iMeter 5 can simultaneously detect three different frequencies for Mains Signalling Voltage. The emission signalling will trigger SOE, recording the Trigger Source and Max. Volt. of three-phase voltages.

4.3.13 RVC (Rapid Voltage Change)

The iMeter 5 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 Urms (1/2) values remain within an RVC threshold from the arithmetic mean of those 100/120 Urms (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.

4.3.13.1 Rapid Voltage Change Evaluation

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

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

The iMeter 5 provides the following setup parameters which can be programmed via the Front Panel, Web Interface or communications:

Parameter	Options/Value, Default*	Parameter	Options/Value, 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 4-16 RVC Parameters

4.3.13.2 RMSR for an RVC Event

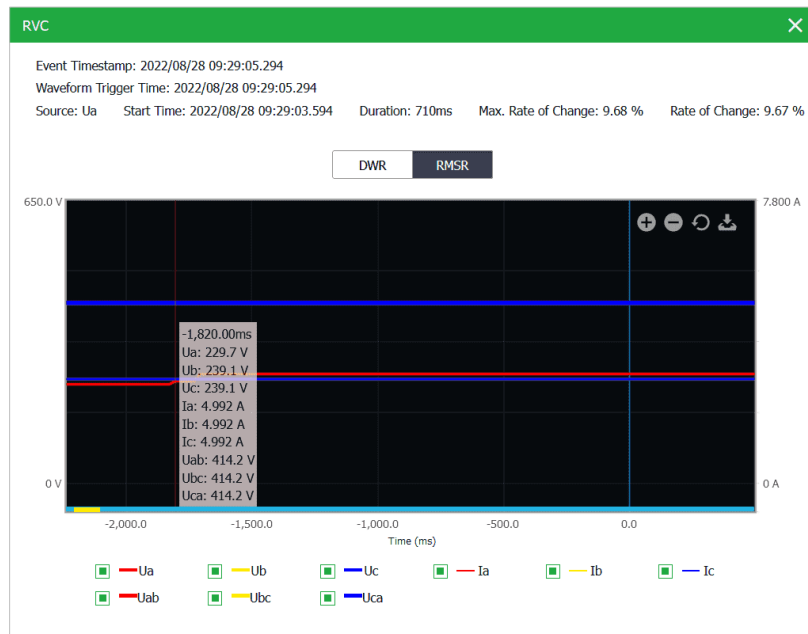


Figure 4-14 RMSR for an RVC Event

4.3.14 Underdeviation and Overdeviation

The iMeter 5 provides the ability to capture the **Voltage Deviation** in accordance with the **IEC 61000-4-30 Ed.3 Standard**.

As per Section 5.12 and 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 5 is capable of measuring Voltage Deviations 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.

4.3.15 Flagging Concept

The iMeter 5 supports the Flagging Concept as per **Section 4.7 of 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 overcurrent ($I > 2I_n$) on iMeter 5.

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

For SDR Log, Max. Log, Min. Log, IEEE Std 519 Report, and/or EN50160 Log, 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” indicates the flagged data has been kept.

4.3.16 Conducted Emissions in the 2kHz to 9kHz range

The iMeter 5 is capable of providing an overview of conducted emissions in the supraharmois 2kHz-9kHz range in a power quality context, compliant with **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 9 kHz range can be found in **IEC 61000-4-7: 2002, Annex B**.*

4.3.16.1 Measurement Method – 2kHz to 9kHz

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. In stead, 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 centre 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.

4.3.16.2 Real-Time RMS Data

The iMeter 5 provides real-time 3- ϕ U_{rms} and I_{rms} for 2kHz to 9kHz which is divided into 35 equal-width segments.

1. Frequency band resolution – 200Hz bins
2. Aggregation interval – 3s

All the real-time measurements are retrievable via the front panel, Web Interface or through Communications.

4.3.17 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 IEC61000-4-30 Ed.2 Standard**, the iMeter 5 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 4-15 Inrush Current - displayed on Web Server

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

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

Table 4-17 Inrush Current Parameters

4.3.18 EN50160-2022 Compliance Report

The EN50160-2022 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 EN50160-2022 Standard document.

The iMeter 5 can measure, summarize data and statistical relevant data of the voltage at a network user's supply terminals in public low voltage ($LV \leq 1kV$), medium voltage ($1kV < Un \leq 36kV$), high voltage ($36kV < Un \leq 150kV$) and extra high voltage ($150kV < Un \leq 800kV$) AC electricity networks under normal operating conditions, in accordance with the EN50160-2022 standard. Further, the device will create a report per week based on the following measurements 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.

EN50160 Parameter	Setting	Voltage Level	LV	MV	HV	EHV
Power Frequency	Wide Tolerance (%)		100	100	100	100
	Wide Tolerance Limit (%)		94 ~ 104	94 ~ 104	94 ~ 104	94 ~ 104
	Narrow Tolerance (%)		99.5	99.5	99.5	99.5
	Narrow Tolerance Limit (%)		99 ~ 101	99 ~ 101	99 ~ 101	99 ~ 101
Supply Voltage Variations	Wide Tolerance (%)		100	100	100	100
	Wide Tolerance Limit (%)		85 ~ 110	85 ~ 115	85 ~ 115	85 ~ 115
	Narrow Tolerance (%)		95	99	99	99
	Narrow Tolerance Limit (%)		90 ~ 110	90 ~ 110	90 ~ 110	90 ~ 110
Flicker Severity	Tolerance (%)		95	95	95	95
	Limit		1	1	1	1
Supply Voltage Unbalance	Tolerance (%)		95	95	95	95
	Limit (%)		2	2	2	2
Voltage Harmonic Limits	Tolerance (%)		95	95	95	95
	Total (%)		8	8	8	8
	H02 (%)		2	2	1.9	1.9
	H03 (%)		5	5	3	3
	H04 (%)		1	1	1	1
	H05 (%)		6	6	5	5
	H06 (%)		0.5	0.5	0.5	0.5
	H07 (%)		5	5	4	4
	H08 (%)		0.5	0.5	0.5	0.5
	H09 (%)		1.5	1.5	1.3	1.3
	H10 (%)		0.5	0.5	0.5	0.5
	H11 (%)		3.5	3.5	3	3
	H12 (%)		0.5	0.5	0.5	0.5
	H13 (%)		3	3	2.5	2.5
	H14 (%)		0.5	0.5	0.5	0.5
	H15 (%)		1	0.5	0.5	0.5
	H16 (%)		0.5	0.5	0.5	0.5
	H17 (%)		2	2	2	2
	H18 (%)		0.5	0.5	0.5	0.5
	H19 (%)		1.5	1.5	1.5	1.5
	H20 (%)		0.5	0.5	0.5	0.5
	H21 (%)		0.75	0.5	0.5	0.5
	H22 (%)		0.5	0.5	0.5	0.5
	H23 (%)		1.5	1.5	1.5	1.5
	H24 (%)		0.5	0.5	0.5	0.5
	H25 (%)		1.5	1.5	1.5	1.5

Table 4-18 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 Web Interface or via communications. The iMeter 5 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 3.2.3.3.7** for an EN50160 sample report from the Web Interface.

4.3.19 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 B): Voltage dips, dropouts, and steady-state voltages in this region are not expected to damage the ITE. It is possible to cause the load to drop out due to lack of energy.

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

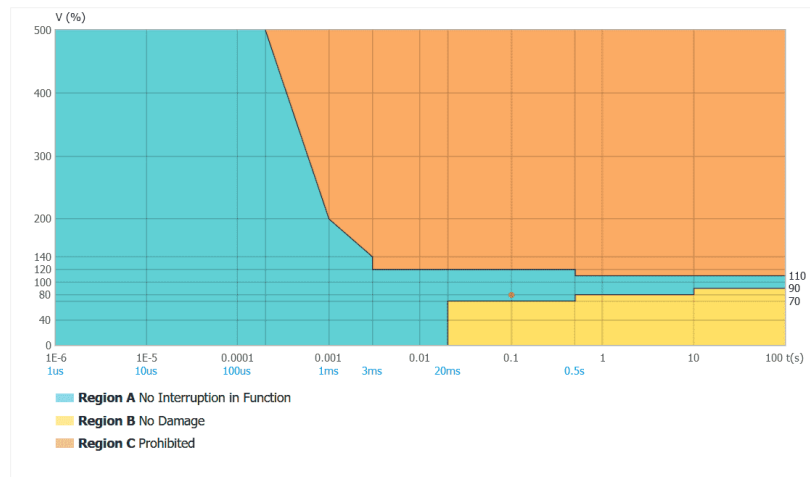


Figure 4-16 ITIC Plot Descriptions

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

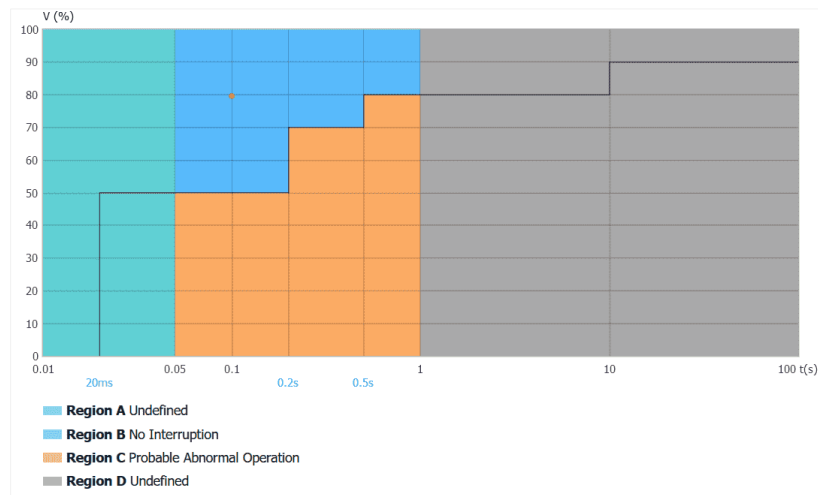


Figure 4-17 SEMI F47 Plot Descriptions

ITIC & SEMI F47 Curve and Alarm

The iMeter 5'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 will trigger DO/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 C** which means the voltage exceeds Dip/Swell or Interruption limits and the latest voltage exceeds the tolerate limit, the DO/iTrigger would be triggered.
- SEMI F47 Alarm: When the voltage exceeds the Dip limits and the latest voltage exceeds the tolerate limit, the DO/iTrigger would be triggered.

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

Parameter	Definition	Default
ITIC/SEMI F47 Alarm Trigger	DOs and iTriggers If Pulse Width = 0, the DO will be released after 1s. If Pulse Width ≠ 0, the DO will be released after the configured Pulse width. If the DO is closed when the SEMI F47 Alarm becomes active, the DO keeps the Closed state.	N/A

Table 4-19 Definitions for ITIC/SEMI F47 Alarm Trigger

4.3.20 IEEE Std 519-2022 Compliance Report

The IEEE 519 standard describes 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 5 provides a solution that generates IEEE 519-2022 compliance Daily and Weekly reports with easy configurations.

The IEEE 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).

4.3.20.1 Terms Definition

The definition of the following terms applied to this section are described below. 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.

4.3.20.2 Harmonics Evaluation

The IEEE 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 519-2022, the Voltage Harmonic compliance criteria are:

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

Bus Voltage V at PCC	Individual Harmonic (%)	THD (%)
$V \leq 1.0$ kV	5.0	8.0
$1 \text{ kV} < V \leq 69$ 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 4-20 Voltage Harmonic Compliance Limit

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

And the Current Harmonic compliance criteria are:

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

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

Table 4-21 Current Harmonic Compliance Limit

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

** Power generation facilities are limited to these values of current distortion, regardless of actual 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

4.3.20.3 Configuration

To generate the IEEE Std 519 Daily/Weekly reports, the iMeter 5 automatically switches to the applicable voltage and current harmonic limits according to the IEEE 519-2022 standard based on the following IEEE Std 519 basic parameters configuration.

Figure 4-18 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*	Comment
IEEE Std 519 Mode	Disable* / Standard / Custom	Standard – Use measured $IL^{(1)}$ for SCR calculation and determining the limits according to IEEE Std 519-2022 for report generation. Custom – Use custom TDD Preset $IL^{(2)}$ (See Section 4.3.9.5) for SCR calculation. User may customize the harmonic limits for report generation.
HVDC	Enable / Disable*	High-voltage systems (> 161kV) are allowed to have a higher voltage THD where the cause is an HVDC terminal. In this condition, enable the HVDC parameter to increase the voltage THD tolerance to 2% (See Table 4-20).
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 4-21, regardless of actual I_{sc}/I_L .
PCC Voltage	1 to 9,999,000 (V), 415*	PCC Voltage = Ull Nominal x PT Ratio.
Max. Short Circuit Current	1 to 9,999,000 (A), 40000*	This is the maximum short circuit current could be produced at PCC according to the PCC voltage and the supply impedance at PCC, rather than the maximum MCCB rating.
Alert Notification	Alarm Email*, Periodic Email	Alarm Email – Send an email when the report is generated. Periodic Email – Send an email if an evaluation result in the report is failed.

Table 4-22 IEEE Std 519 Report Parameters Configuration

Notes:

- 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 ($M < 1$).
- It is necessary to reboot the device to allow the new changes to **Preset IL** to take effect. The harmonic current distortion limits will be updated accordingly after reboot.
- 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.
- 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.

4.3.20.4 Report Generation

The iMeter 5 generates the IEEE Std 519 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 5 can store up to 356 daily reports and 52 weekly reports on a first-in-first-out basis.

4.3.20.4.1 Daily Report Displayed on Web Server

1. Voltage Harmonic Compliance Report

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

IEEE Std 519 / Daily Report					
2023/07/30 00:00:00 - 2023/07/31 00:00:00					
Voltage Harmonics Current Harmonics					
Voltage Level: 415 V (≤1.0 kV)					
Order (h)	CP99 (%)			Limit (%)	Conclusion
	Ua	Ub	Uc		
THD	9.13	9.13	9.13	12.000	✓
TOHD	9.05	9.05	9.05	--	--
TEHD	1.21	1.21	1.21	--	--
Individual Harmonics					
H02	1.00	1.00	1.00	7.500	✓
H03	6.40	6.40	6.40	7.500	✓
H04	0.50	0.50	0.50	7.500	✓
H05	4.00	4.00	4.00	7.500	✓
H06	0.26	0.26	0.26	7.500	✓
H07	2.80	2.80	2.80	7.500	✓
Export					

Figure 4-19 IEEE Std 519 Daily Voltage Harmonics Compliance Report

2. Current Harmonic Compliance Report

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

IEEE Std 519 / Daily Report					
2023/07/30 00:00:00 - 2023/07/31 00:00:00					
Voltage Harmonics Current Harmonics					
Voltage Level		Isc	IL	Isc/IL	
415 V (120 V-69 kV)		80.000 A	5.038 A	15.879	
Order (h)	CP99 (%)			Limit (%)	Conclusion
	Ia	Ib	Ic		
TDD	0.11	0.11	0.11	10.000	✓
TDD Odd	0.11	0.11	0.11	--	--
TDD Even	0.02	0.02	0.02	--	--
Individual Harmonics					
H02	0.01	0.01	0.01	4.000	✓
H03	0.08	0.08	0.08	8.000	✓
H04	0.01	0.01	0.01	4.000	✓
H05	0.05	0.05	0.05	8.000	✓
H06	0.00	0.00	0.00	4.000	✓
H07	0.04	0.04	0.04	8.000	✓
Export					

Figure 4-20 IEEE Std 519 Daily Current Harmonics Compliance Report

4.3.20.4.2 Weekly Report Displayed on Web Server

3. Voltage Harmonic Compliance Report

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

IEEE Std 519 / Weekly Report

2023/07/28 10:37:00 - 2023/07/30 00:00:00

Voltage Harmonics

Current Harmonics

Voltage Level: 415 V (≤1.0 kV)

Order (h)	CP95 (%)			Limit (%)	Conclusion
	Ua	Ub	Uc		
THD	9.13	9.13	9.13	8.000	✗
TOHD	9.05	9.05	9.05	--	--
TEHD	1.21	1.21	1.21	--	--
Individual Harmonics					
H02	1.00	1.00	1.00	5.000	✓
H03	6.40	6.40	6.40	5.000	✗
H04	0.50	0.50	0.50	5.000	✓
H05	4.00	4.00	4.00	5.000	✓
H06	0.26	0.26	0.26	5.000	✓
H07	2.80	2.80	2.80	5.000	✓

Export

Figure 4-21 IEEE Std 519 Weekly Voltage Harmonics Compliance Report

4. Current Harmonic Compliance Report

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

IEEE Std 519 / Weekly Report

2023/07/28 10:37:00 - 2023/07/30 00:00:00

Voltage Harmonics

Current Harmonics

Voltage Level	Isc	IL	Isc/IL
415 V (120 V-69 kV)	80.000 A	5.038 A	15.879

Order (h)	CP95 (%)					CP99 (%)				
	Ia	Ib	Ic	Limit (%)	Conclusion	Ia	Ib	Ic	Limit (%)	Conclusion
TDD	0.11	0.11	0.11	5.000	✓	0.11	0.11	0.11	7.500	✓
TDD Odd	0.11	0.11	0.11	--	--	0.11	0.11	0.11	--	--
TDD Even	0.02	0.02	0.02	--	--	0.02	0.02	0.02	--	--

Individual Harmonics

H02	0.01	0.01	0.01	2.000	✓	0.01	0.01	0.01	3.000	✓
H03	0.08	0.08	0.08	4.000	✓	0.08	0.08	0.08	6.000	✓
H04	0.01	0.01	0.01	2.000	✓	0.01	0.01	0.01	3.000	✓
H05	0.05	0.05	0.05	4.000	✓	0.05	0.05	0.05	6.000	✓
H06	0.00	0.00	0.00	2.000	✓	0.00	0.00	0.00	3.000	✓
H07	0.04	0.04	0.04	4.000	✓	0.04	0.04	0.04	6.000	✓

Export

Figure 4-22 IEEE Std 519 Weekly Current Harmonics Compliance Report

The entire IEEE Std 519 Daily/Weekly Compliance Report provided by iMeter 5 includes the **Min.**, **Max.**, **Avg.** and percentile values for voltage **THD** and **Individual Harmonics** from 2nd to 50th, as well as current **TDD** and **Individual Harmonics** from 2nd to 50th. The user may obtain the entire report for a given date by exporting it from the Web/FTP server or by communication or receive it by e-mail via the SMTPS service as soon as it is generated or if the evaluation result of any item in the report is fail.

4.4 Setpoint

The iMeter 5 comes with 32 programmable Setpoints which allow users to initiate an action in response to a specific condition. Typical setpoint applications include alarming, control and power quality monitoring.

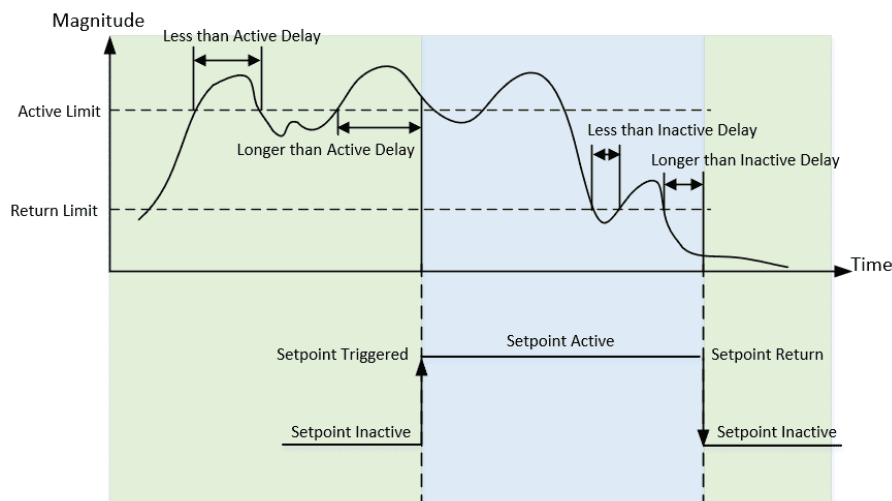


Figure 4-23 Over Setpoint

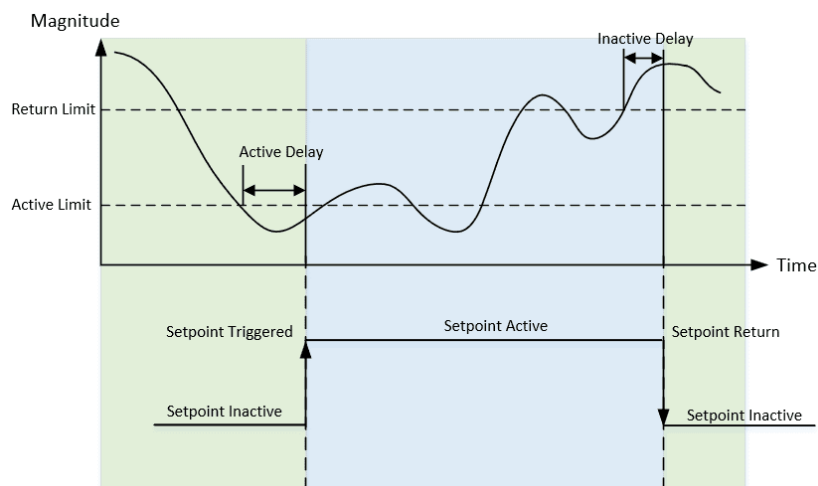


Figure 4-24 Under Setpoint

The Setpoints can be programmed via the Web Interface or communications and have the following setup parameters:

Parameters	Definition	Options/Default*
Type	Disabled, Over or Under Setpoint.	0=Disabled* 1=Over, 2=Under
Parameter	Specify the parameter to be monitored.	See Table 4-24
Active Limit	Specify the value that the setpoint parameter must exceed for Over Setpoint or go below for Under Setpoint for the setpoint to become active.	-2,147,483,648 to 2,147,483,647, Null*
Return Limit	Specify the value that the setpoint parameter must go below for Over Setpoint or exceed for Under Setpoint for the setpoint to become inactive.	-2,147,483,648 to 2,147,483,647, Null*
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.	0 to 9999.99 (s), 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.	0 to 9999.99 (s), 10*
Trigger	Specify what action a setpoint can take when it becomes active.	None*, DR, DO, DWR, WFR, RMSR, iTrigger

Table 4-23 Description for Setpoint Parameters

The iMeter 5 provides the following Setpoint parameters. Parameter 1 to 16 can be set with a shorter Active/Inactive Delay duration from 0.01s to 0.99s (i.e., ½ cycle to 49.5 cycles) for a high-speed setpoint action.

ID	Parameter	Resolution	ID	Parameter	Resolution
0	Null	--			
Basic					
1	UIn	0.1V	103	I2 Unbalance	0.1%
2	UII	0.1V	104	U Fund.	0.1V
3	Reserved	0.1V	105	I Fund.	0.1A
4	I	0.1A	106	U Deviation	0.1%
5	I4	0.1A	107	U Over Deviation	0.1%
6	Reserved	--	108	U Under Deviation	0.1%
7	P Total	0.1W	109	Frequency	0.01Hz
8	Q Total	0.1var	110	Frequency Deviation	0.01Hz
9	S Total	0.1VA	212	Phase Loss	--
10	PF Total	0.001	213	Phase Reversal	--
11	U1	0.1V	214	Reserved	--
12	U2	0.1V	215	Reserved	--
13	U0	0.1V	216	Reserved	--
14	I1	0.1A	217	Reserved	--
15	I2	0.1A	218	2kHz-9kHz C.E.	0.1V
16	I0	0.1A	219	Pst	0.1
100	U0 Unbalance	0.1%	220	Plt	0.1
101	U2 Unbalance	0.1%	222	Reserved	--
102	I0 Unbalance	0.1%			
Harmonics					
Harmonics Distortion					
111	U THD	0.1%	116	I TEHD	0.1%
112	U TOHD	0.1%	135	U OHD	0.1%
113	U TEHD	0.1%	136	U EHD	0.1%
114	I THD	0.1%	137	I OHD	0.1%
115	I TOHD	0.1%	138	I EHD	0.1%
Individual Harmonics Distortion					
0x20000	U HD02	0.1%	0x40000000	I HD02	0.1%
0x30000	U HD03	0.1%	0x41000000	I HD03	0.1%
...	...	...	...	...	...
0x3F0000	U HD63	0.1%	0x7D000000	I HD63	0.1%
Harmonics RMS					
123	U TH RMS	0.1V	126	I TH RMS	0.1A
124	U TOH RMS	0.1V	127	I TOH RMS	0.1A
125	U TEH RMS	0.1V	128	I TEH RMS	0.1A
Individual Harmonics RMS					
0x400000	U H02 RMS	0.1V	0x2000000	I H02 RMS	0.1A
0x410000	U H03 RMS	0.1V	0x3000000	I H03 RMS	0.1A
...	...	...	...	...	...
0x7D0000	U H63 RMS	0.1V	0x3F000000	I H63 RMS	0.1A
Interharmonics					
Interharmonics Distortion			Interharmonics RMS		
117	U TIHD	0.1%	129	U TIH RMS	0.1V
118	U TOIHD	0.1%	130	U TOIH RMS	0.1V
119	U TEIHD	0.1%	131	U TEIH RMS	0.1V
120	I TIHD	0.1%	132	I TIH RMS	0.1A
121	I TOIHD	0.1%	133	I TOIH RMS	0.1A
122	I TEIHD	0.1%	134	I TEIH RMS	0.1A
Individual Interharmonics Distortion			Individual Interharmonics RMS		
0x810000	U IHD01	0.1%	0x81000000	I IH01 RMS	0.1A
0x820000	U IHD02	0.1%	0x82000000	I IH02 RMS	0.1A
...	...	...	...	...	...
0xBF0000	U IHD63	0.1%	0xBF000000	I IH63 RMS	0.1A
Demand					
Present			Predicted		
200	P Total Imp. DMD	0.1W	206	P Total Imp. DMD	0.1W
201	Q Total Imp. DMD	0.1var	207	Q Total Imp. DMD	0.1var
202	P Total Exp. DMD	0.1W	208	P Total Exp. DMD	0.1W
203	Q Total Exp. DMD	0.1var	209	Q Total Exp. DMD	0.1var
204	S Total Exp. DMD	0.1VA	210	S Total Exp. DMD	0.1VA
205	PF Total DMD	0.001	211	PF Total DMD	0.001

Table 4-24 Setpoint Parameters

4.5 Data Logging

4.5.1 IER/AER

The iMeter 5 provides a fixed capacity of 65535 entries for both IER (Interval Energy Recorder) and AER (Accumulative Energy Recorder) Logs for the parameters specified in **Table 4-25 IER/AER Parameters**. 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.

3-phase Total		
RMS kWh Import	RMS kvarh Import	kVAh Total
RMS kWh Export	RMS kvarh Export	
RMS kWh Net	RMS kvarh Net	
RMS kWh Total	RMS kvarh Total	
Fundamental kWh Import	Fundamental kvarh Import	
Fundamental kWh Export	Fundamental kvarh Export	
Harmonic kWh Import	Harmonic kvarh Import	
Harmonic kWh Export	Harmonic kvarh Export	
Per-phase		
kWh Import	kvarh Import	kVAh Total
kWh Export	kvarh Export	
kWh Net	kvarh Net	
kWh Total	kvarh Total	

Table 4-25 IER/AER Parameters

All the IER/AER logs can be retrieved through communications or on-board FTP server. In Firmware V1.50.01 and later, users can access the 3-phase Total and Per-Phase AER/IER record with timestamp via the built-in web server (See **Section 3.2.3.2.4.3**).

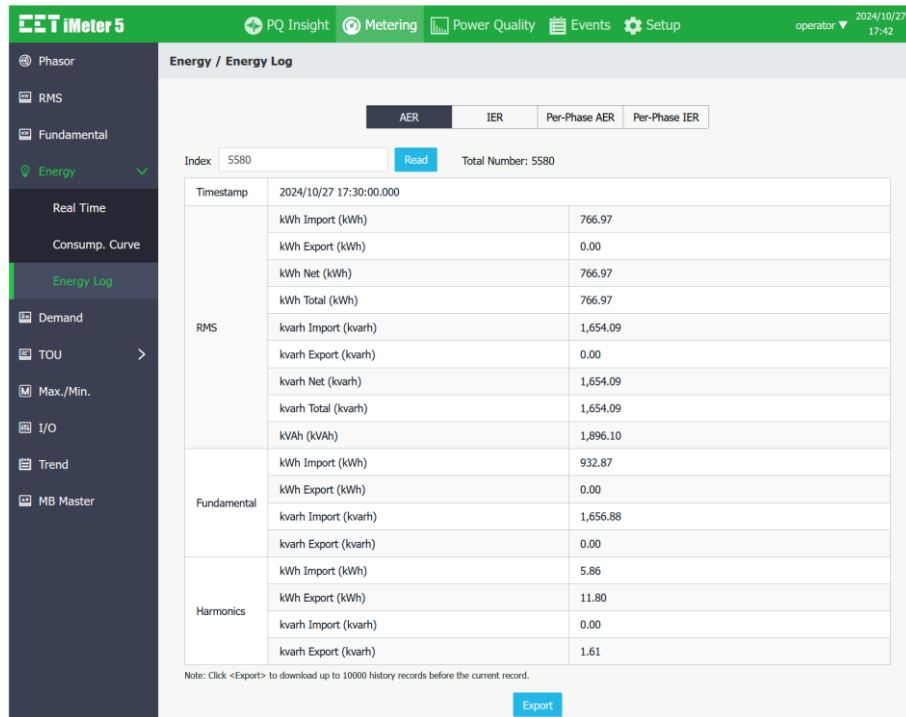


Figure 4-25 Retrieve Energy Log via Web Server

The IER/AER setup parameters, which include **Recording Mode**, **Recording Interval**, **Start Date** and **Start Time**, can be programmed from the Front Panel, Web Interface or communications.

Figure 4-26 Energy Log Setup Interface via Web Server

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 parameters where * indicates the default value.

Parameter	Range/Default*	Parameter	Range/Default*
Interval/Accumulative Energy			
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 4-26 Energy Log Parameters

4.5.2 WFR (Waveform Recorder)

The iMeter 5 supports the waveform recording of 3-phase Voltages and 4-phase Currents at a maximum resolution of 512 samples/cycle. WFR on the iMeter 5 can be triggered by PQ Disturbance (Dips/Swells/Interruptions), Transients, Rapid Voltage Changes, Inrush Current, Setpoints, iTrigger, 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 on 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 FTPS/Web Server or via communications. The programming of the WFR is supported via the Web Interface (Please refer to **Section 3.2.3.5.5.1**) 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 x Samples/Cycle	640 x 16, 320 x 32, 160 x 64, 80 x 128, 40 x 256*, 20 x 12
Adaptive WFR	0=Disabled*, 1=Enabled		

Table 4-27 WFR Setup Parameters

The iMeter 5 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/Value, Default*	Parameter	Options/Value, Default*
Enable	Yes, No*	Interval	1 to 65535 min, 1440*
Repetition	0 to 10000, 1* (0 means disabled)	Start Date	2000-01-01*
		Start Time	00:00:00*

Table 4-28 Scheduled WFR Setup Parameters

4.5.3 DWR (Disturbance Waveform Recorder)

The iMeter 5 model supports the Disturbance Waveform Recording of 3-phase Voltages and 4-phase Currents at a maximum resolution of 512 samples/cycle. The DWR can be triggered by Dips, Swells, Interruptions, Transients, RVC, Inrush Current, Setpoints, iTrigger, DI Status Changes or even manually triggered via the Web Interface and communications. The DWR log is stored in the devices' 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 on a FIFO basis, with the newest DWR log replacing the oldest one. Each DWR log consists of the following stages:

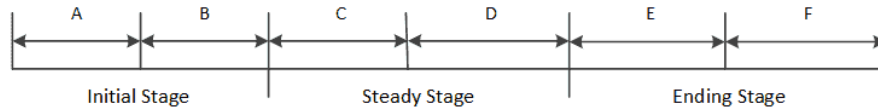
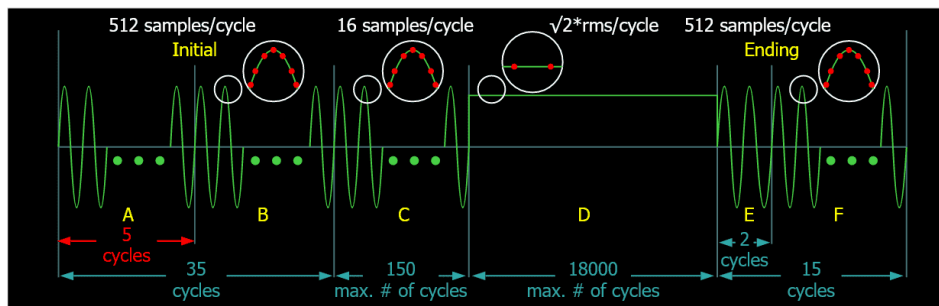


Figure 4-27 DWR Stages



Stage	Description	Recording Length	Recording Frequency
A	Pre-Fault cycles for the Initial Stage	5 to 10 cycles	512 Samples/Cycle
B	Post-Fault cycles for the Initial Stage	25 to 30 cycles	512 Samples/Cycle
C	Extended WFR 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	Post-Fault cycles of the Ending Stage	13 cycles	512 Samples/Cycle

Table 4-29 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, then D would be 0.
If $C = 150$ cycles, then the data for stage D will be recorded.
If $D = 18,000$ cycles, the recording of the stage D data ends even if the disturbance is not finished.

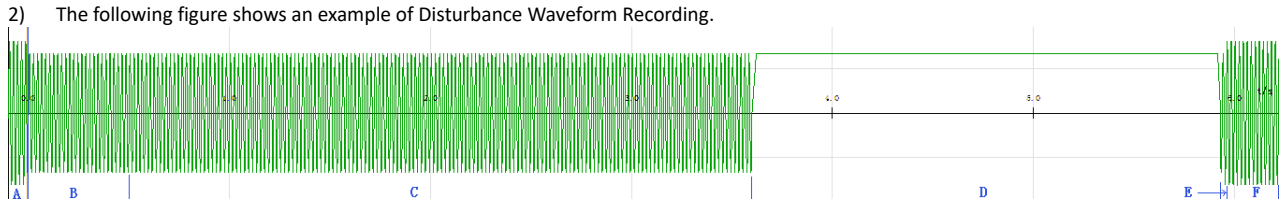


Figure 4-28 An Example for DWR

4.5.4 RMSR (RMS Recorder)

The iMeter 5 provides high-speed RMS recording for max. 8 parameters which can be triggered by Dips, Swells, Interruptions, Transients, RVC, Inrush Current, Setpoints, iTrigger, DI status changes or manually via communications. The RMSR Logs are stored in the devices' non-volatile memory in COMTRADE file format and will not suffer any loss in the event of a power failure. The RMSR has a capacity of 128 entries on a FIFO basis.

All RMSR can be accessible via the on-board FTPS Server or communications by our PecStar® iEMS. The programming of the RMSR is supported via the Front Panel, Web Server or through 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/Value, Default*	Parameter	Options/Value, Default*
Pre-fault Samples	100 to 500, 300*	Sample Interval	0 to 60, 0* (0 represents 0.5 cycle)

Table 4-30 RMSR Parameters

Table 4-31 below illustrates the available source parameters for RMSR recording.

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

Table 4-31 Available Parameters for RMSR

4.5.5 Pst Log

iMeter 5's Pst Log can store up 56520 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 the 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 the Web Server (See **Section 3.2.3.5.10.2**) or via communications.

4.5.6 Plt Log

iMeter 5'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 the 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 first-in-first-out basis. The Plt Log can be reset from the Web Server (See **Section 3.2.3.5.10.2**) or via communications.

4.5.7 SDR (Statistical Data Recorder)

The iMeter 5 provides 4 groups of SDRs for max. 64 parameters each to record the Max./Min./Average/CP95 measurements with configurable record depth and interval. 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 the Web Server or through communications. Each **SDR** provides the following setup parameters:

Setup Parameters	Range/Default*
Record Interval	0 (disabled) to 60 min, 10 min*
Record Mode	0=Stop-when-Full, 1=First-In-First-Out*
Record Depth	1 to 43200, 43200*
Parameter 1 to 64	See Appendix A (Source Parameters) and Section 5.19.19.2 (SDR Default Settings)

Table 4-32 Setup Parameters for SDR

The **SDR** is operational when the values of the **Record Interval** and **Number of Parameters** are both non-zero.

4.5.8 DR (Data Recorder)

The iMeter 5 provides 8 Data Recorders (**DR**) capable of recording 32 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 programming of the Data Recorder is supported via the on-board Web Server or through communications. Each Data Recorder provides the following setup parameters:

Parameter	Options/Range, Default*
Triggered Mode	Disabled, Triggered by Timer*, Triggered by Setpoint
Record Interval	0 to 3,456,000 (seconds), 900*
Record Mode	Stop-When-Full, First-In-First-Out*
Record Depth	0 to 65,535 (for DR #1 to DR #7), 65535* 0 to 120,000 (for DR #8), 120,000*
Offset Time	0* (no offset) to 43200 If the Trigger Mode is set to Triggered by Setpoint , the Offset Time will be disregarded.
Parameters	Please refer to Appendix A (Source Parameters) and Section 5.19.20.2 (DR Default Settings)

Table 4-33 Setup Parameters for DR

The DR Log is only operational when the values of **Triggered Mode**, **Record Interval**, **Record Mode** and **Record Depth** 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.

4.5.9 Max./Min. Recorder

The iMeter 5 provides 4 **Max./Min. Recorders** of max. 20 parameters each for **This Month (Since Last Reset)** and **Last Month (Before Last Reset)**. Each log includes the relevant Max./Min. values and timestamps. 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 the Web Server or through communications. Each Max./Min. recorder provides the following setup parameters:

Parameters	Value
Self-Read time	The same Self-Read Time for the Max. Demand Recorder is used to specify the time and day of the month for the Max./Min. Self-Read operation. Please refer to Section 4.2.4.2 for a complete description of the Self-Read Time and its operation.
# of Parameters	0 to 20
Parameter 1 to 20	See Appendix A (Source Parameters) and Section 5.19.21(Max./Min. Recorder Default Settings)

Table 4-34 Setup Parameters for Max./Min. Log

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 server or through communications. And the Max./Min. logs can be reset via Front Panel or Web Interface.

4.5.10 SOE Log

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

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

Please refer to **Appendix C** for the SOE Classification.

4.5.11 Device Log

The Device Log can store up to 1024 events such as Power-on, Power-off, Setup Changes, Clear operations 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 timestamp in 1ms resolution.

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

Please refer to **Appendix B** for the Device Log Classification.

4.5.12 PQ Counters

The iMeter 5 supports the counting of the different PQ Events as illustrated in Table 4-35 below. When a particular event is detected, the corresponding counter will be incremented by one. 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 Server or communications.

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

Table 4-35 PQ Event Counter

4.6 iTrigger

The WFR/DWR/RMSR/DO of iMeter 5 can be cross triggered by other iTrigger-enabled devices residing on the same subnet of the LAN (Local Area Network) and configured with the same iTrigger Group ID. The Actions can be configured as WFR, DWR, RMSR and/or DO via the Web Interface.

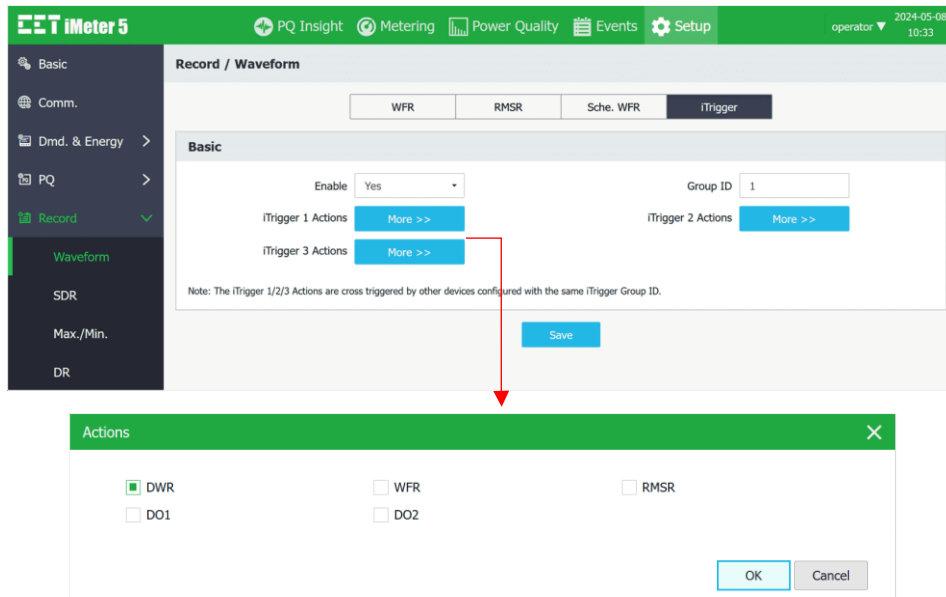


Figure 4-29 iTrigger Settings Interface via Web Interface

As a result, the iMeter 5 provides Source MAC Address and Source Group ID in its SOE details.

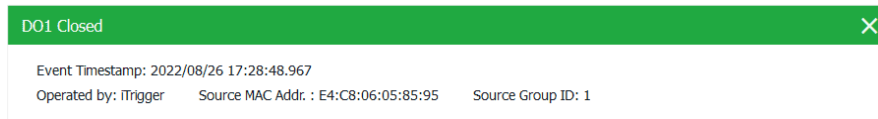


Figure 4-30 Trigger Source

Vice versa, the iMeter 5 can also cross-trigger other iMeter's iTrigger if it is triggered manually or by a Setpoint (control setpoint, PQD setpoint, etc.) with iTrigger 1, 2 and/or 3 set as the Trigger Actions.

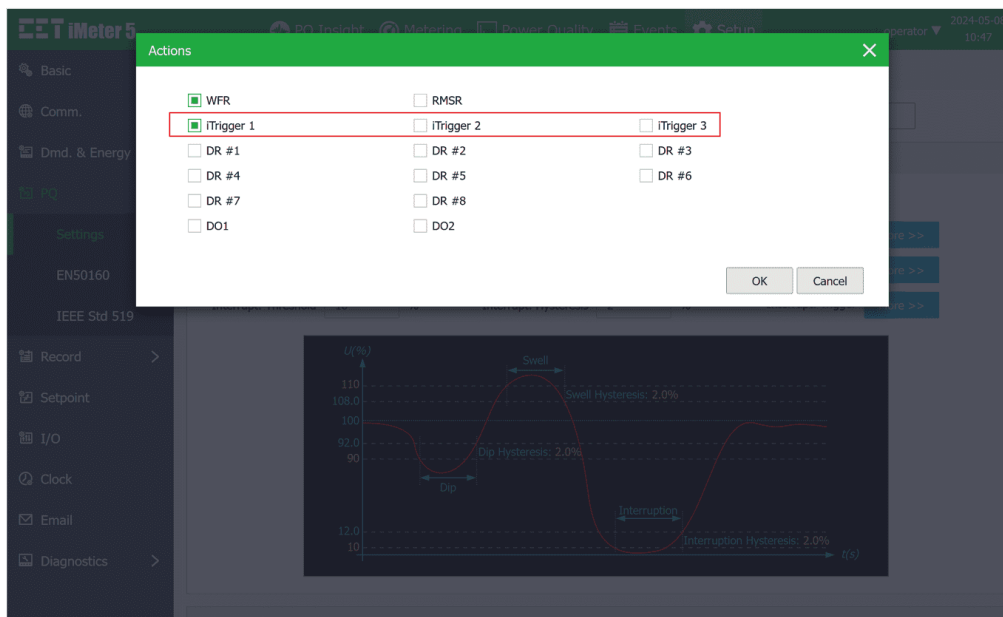


Figure 4-31 Configure iTrigger as PQD Trigger Actions on iMeter 5

4.7 TOU (Time of Use)

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 accumulate energy consumption into different TOU tariffs based on the time of consumption.

The TOU feature 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 Period
- 8 Tariffs

Instead of using the TOU schedule to switch between Tariffs, the iMeter 5 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 **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 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 4-36 DIs and the Number of Tariffs Setup

Each TOU schedule has the following setup parameters and can be programmed via the Web Server or communications:

Parameters	Definition	Options
Daily Profile #	Specify a daily rate schedule which can be divided into a maximum of 12 periods. 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 st
Alternate Days #	A day can be defined as an Alternate Day, such as May 1 st . Each Alternate Day is assigned a Daily Profile.	1 to 90.
Day Types	Specify the day type of the week. Each day of a week can be assigned a day type such as Weekday1, Weekday2, Weekday3 and Alternate Days. The Alternate Day has the highest priority.	Weekday1, Weekday2, Weekday3 and Alternate Days
Switching Time	Specify when to switch from one TOU schedule to another. Writing 0xFFFFFFFF to this parameter disables switching between TOU schedules.	Format: YYYYMMDDHH Default=0xFFFFFFFF

Table 4-37 TOU Setup Parameters

For each of the 8 Tariff Rates, the iMeter 5 provides the following measurements: kWh Import/Export, kvarh Import/Export, kVAh, P/Q/S Max. Demand with their timestamps. All these data are available via the Front Panel, Web Interface, and communications. The TOU Logs can be reset through the Web Server or via communications.

4.8 Time Synchronization

The iMeter 5 provides timestamps for all recorded data so it's extremely important for the clock to be properly synchronized to achieve precise time stamping for Energy, Power Quality and Event analysis. The iMeter 5 supports the time synchronization with auto-selection among RTC, Modbus RTU, NTP, GPS 1PPS and IRIG-B for best precision.

The iMeter 5 displays the Time Sync. status with Clock Source and the difference between the meter clock and the GPS receiver/PTP Grand Master.

Self Diagnostics	
Self Diagnostics	Normal
Wiring Status	Normal
Temperature	39.00°C
MQTT Link	Disabled
Time Sync.	Synchronizing (Clock Source: NTP, Diff.: -863988.00ms)
Memory	Normal

Figure 4-32 Time Sync. Status

The different time sync. options are discussed in the following sections.

4.8.1 RTC

The iMeter 5 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.

4.8.2 GPS

GPS receivers often provide a 1PPS (1 Pulse per Second) output which the iMeter 5 can be connected to synchronize its millisecond clock via its RS-485 terminals. Please refer to Figure 2-27 for the 1PPS wiring diagram. An incoming PPS signal on an input time synchronization connector can be repeated to one or two output time synchronization. The iMeter 5 can automatically detect and accept both RS-485 and RS-232 signals from the GPS receiver.

Only the precise PPS second tick is transmitted over the cabling, the time-of-day information shall be provided via another communication path, for example Modbus RTU over RS-485 or NTP over Ethernet.

4.8.3 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 5 accepts an IRIG-B signal as the time source to provide a precision time reference. The iMeter 5 can automatically detect the RS-485 differential signal carrying the IRIG-B full date/time information via its RS-485 terminals. Please refer to Figure 2-28 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 5 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.

4.8.4 NTP

NTP (Network Time Protocol) can be used to synchronize the iMeter 5's clock with an external **NTP Server** through its Ethernet port providing that the network has been properly configured. The programming of the **NTP Server** is supported via the Front Panel, Web Server, or communications.

4.8.5 Modbus RTU/TCP

The iMeter 5's clock can be synchronized through communications using the Modbus RTU /TCP protocol. Please refer to **Section 5.21** for a detailed description.

4.8.6 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 is 60 minutes. Please consult the PecStar iEMS's user manual for a complete description.

4.9 Alarm Email (SMTP)

iMeter 5 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:

- iMeter 5's serial number and an event counter indicating the number of events in the email
- Event Description and Characteristic values
- Event timestamp

If the alarm email is configured to forward the EN50160 report or the IEEE Std 519 report, the report will be sent in .xls format as an attachment to the email as soon as it is generated.

The programming of the Alarm Email setup parameters is supported via the Web Server and communications. The iMeter 5 provides the following SMTP setup parameters:

Parameters	Definition/Option
SMTP Server	IP/domain name of the SMTP Server, e.g., smtp.gmail.com (up to 31 characters long).
SMTP Server Port	0 to 65535 (Default=25)
Username	The Username should not exceed 39 characters.
Password	Logon password for sender email address. This string is up to 19 characters long.
Sender Email	Sender's Email Address. This string is up to 39 characters long.
Receiver Email	Receiver's Email address. This string is up to 89 characters long. Different receivers should be separated by ";" symbol. For example, xxxx@gmail.com; xxxx@outlook.com
SSL/TLS Enable	Enable the Secure Socket Layer encryption protocol for SMTP - Yes/No.
Trigger Source	System, Setpoint, I/O, Record, Dip/Swell, Transient, Inrush Current, RVC, MSV, Motor Start, EN50160 and IEEE Std 519.

Table 4-38 Email Setup Parameters

Here is an example of how to configure a PQ Disturbance to trigger an Alarm Email.

1. Click on **Setup-> PQ -> Settings** as shown below. Enable the PQ Disturbance detection and configure the Threshold and Hysteresis properly.

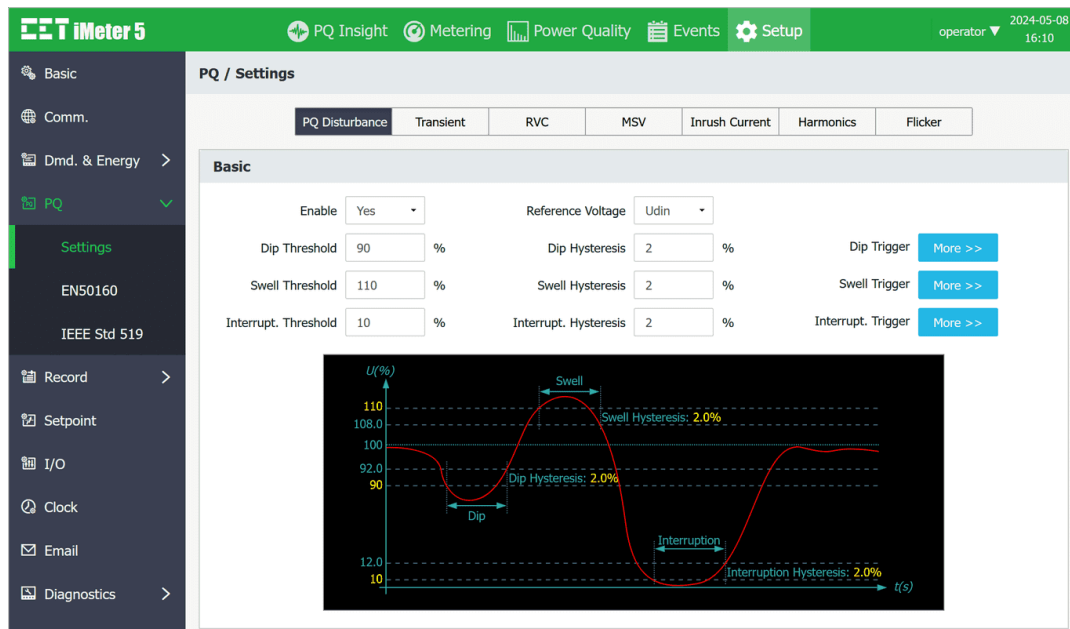


Figure 4-33 Setpoint Settings

2. Click **Setup-> Comm.-> Basic** as shown below. Please configure the IP Address, Subnet Mask, Gateway and DNS Server properly to make sure the meter can be connected to the Internet.

Figure 4-34 Communication Settings Interface

3. Click on **Setup-> Others-> Alarm Email-> Settings** as shown below. Please note that all the SMTP information should be entered correctly (please log into the Sender Email account to confirm the SMTP settings).

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

For Gmail:

SMTP Server – smtp.gmail.com

SMTP IP Port – 465

Sender E-mail – example@gmail.com

Receiver Email – ****@***.com

SSL Enable – Yes

Password – Please see the following guide (the Google account password could not work due to the verification mechanism of Google).

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

Figure 4-35 2-Step Verification on Google Account

- b. Since iMeter 5 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 5.

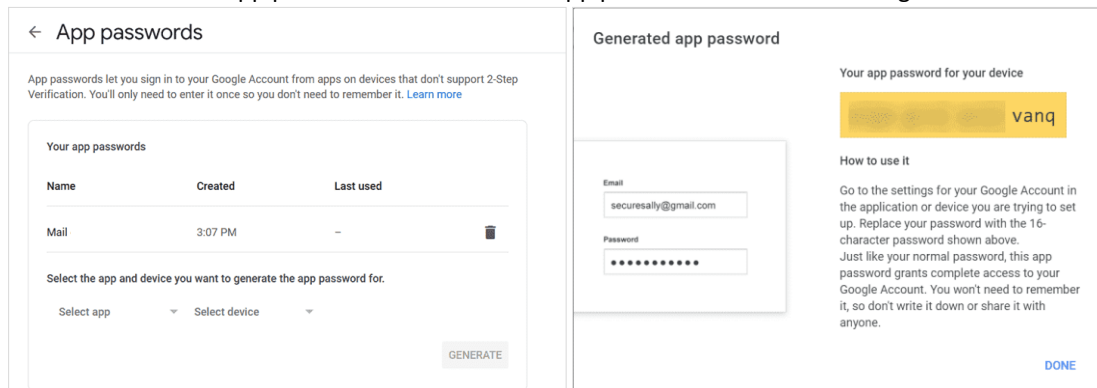


Figure 4-36 Retrieve App Password for Google Account

For Outlook:

SMTP Server – smtp.office365.com

SMTP IP Port – 587

Sender E-mail – example@outlook.com

Receiver E-mail – ****@***.com

SSL Enable: No (Outlook uses STARTTLS for SMTP service so there is no need to enable SSL).

Password: Please see the following guide (Similarly, the password of Outlook account could not work due to the Verification mechanism of Microsoft).

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

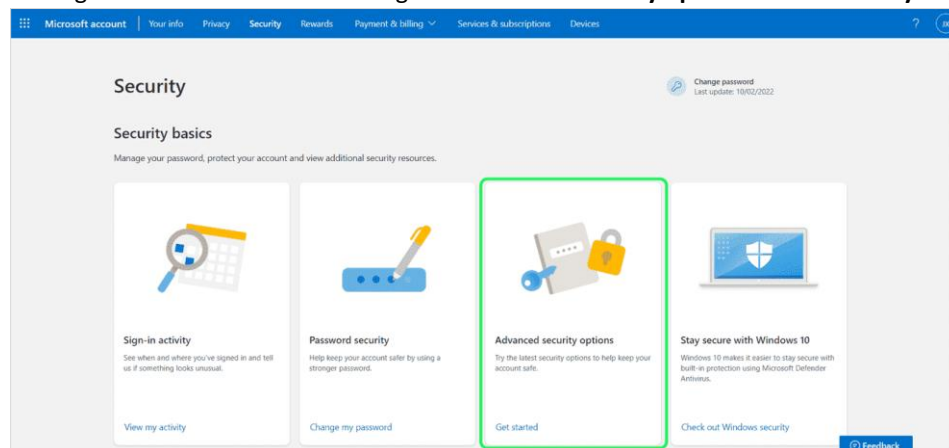


Figure 4-37 Security Setting for Microsoft Account

- 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 5.

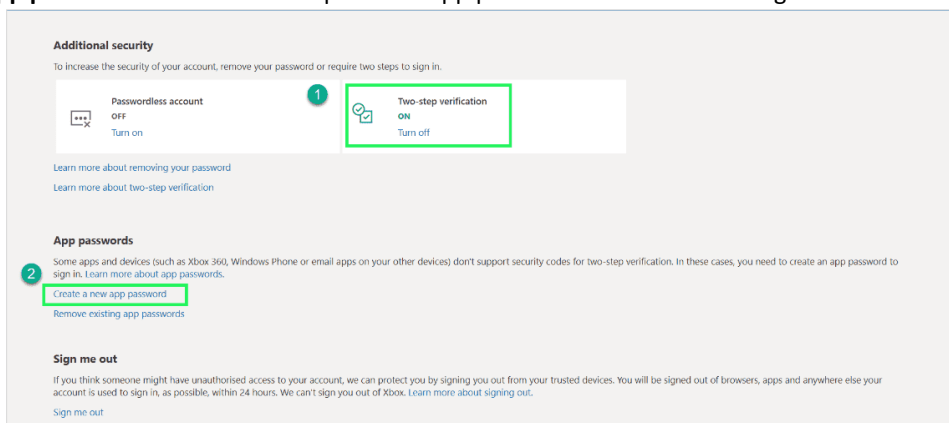


Figure 4-38 Retrieve App Password for Microsoft Account

4. Enter the App Password created from the Google or Microsoft account into the Password setting. Click **Save** to store the configuration in the iMeter 5. The message “**Set Succeeded**” will appear if the configuration is accepted by the meter.

Figure 4-39 Alarm Email Setting via Web Server

5. Select the **Alarm Email** tab to send a Test Email by clicking on **Test**. The message “Email 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 5 should be checked that it is connected to the Internet.

Figure 4-40 Send Test Email

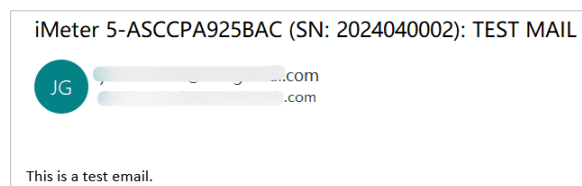


Figure 4-41 An Example of Test Email

6. If the Receiver receives the test email successfully, please return to **Alarm Email Settings** 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 4-42 Trigger Source Dialog

7. When the Setpoint is activated, an Alarm Email will be sent to the Receiver by the iMeter 5, providing the SMTP configuration is correct.

iMeter 5-ASCCPA925BAC (SN: 2024040002): Swell



SOE Log			
No.	Timestamp	Description	Details
1	2024-05-08 16:49:35.871	Swell	Source: Ua; Magnitude: 120.00 %, 99.99 %, 99.99 %; Duration: 99 ms; Direction: Downstream; Confidence: Low;

Figure 4-43 Alarm Email

4.10 Ethernet Gateway

The iMeter 5'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 5's Ethernet (P1/P2) and RS-485 ports (P3). This eliminates the need for an additional, external Ethernet-to-RS-485 Gateway, simplifies the overall network design and saves 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 5's Ethernet port at its IP Address and the default IP Port No. 20000. The iMeter 5 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. The RS-485-enabled device receives the Modbus RTU packet and sends its response back to the iMeter 5, 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 configuring the iMeter 5's Ethernet Gateway via P1:

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

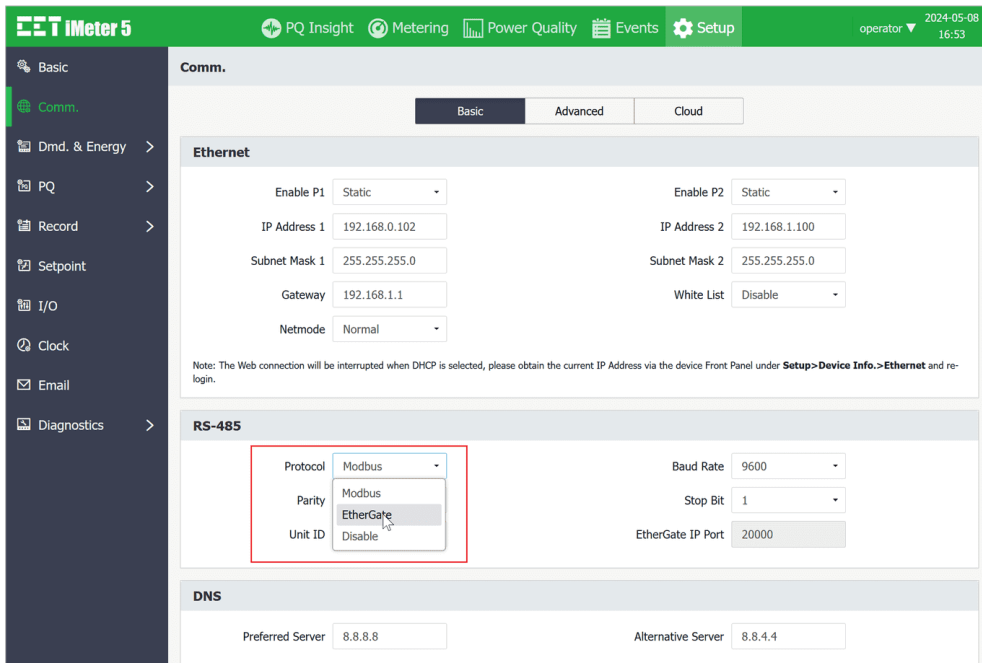


Figure 4-44 Select "EtherGate" Mode on Web Server

- Connect the RS-485-enabled devices (i.e., PMC-53A) to the RS-485 port of the iMeter 5.

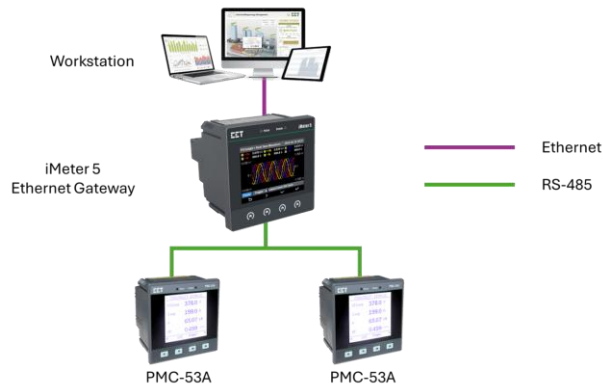


Figure 4-45 Typical Application for Ethernet Gateway

- Configure the Master Software (e.g., PecStar iEMS) on the WorkStation to communicate with the RS-485-enabled devices via iMeter 5'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.
- Make sure the serial port settings such as Baud Rate and Data Format are identical between the iMeter 5's RS-485 port and the RS-485-enabled devices.
- The Master Software should be able to communicate with the RS-485-enabled devices via the iMeter 5's Ethernet Gateway, providing that all the necessary configuration is correct.

4.11 SNMP

4.11.1 Overview

Simple Network Management Protocol (SNMP) is widely used in Network Management Systems (NMS) to monitor and manage network devices for conditions that deserve administrative attention.

There are three main components in an SNMP-managed network: Network Management System, Agent and Managed Device.

- ☞ A **Network Management System (NMS)** is a piece of software or hardware that executes applications to monitor and control network devices. It serves as the human-machine interface in an SNMP-managed network.
- ☞ An **Agent** is a software module that resides in a managed device and serves as an interface between NMS and the physical device.
- ☞ A **Managed Device** is a network node that resides on a managed network and contains an SNMP agent. Managed devices collect and store information which is then made available to NMS via SNMP.

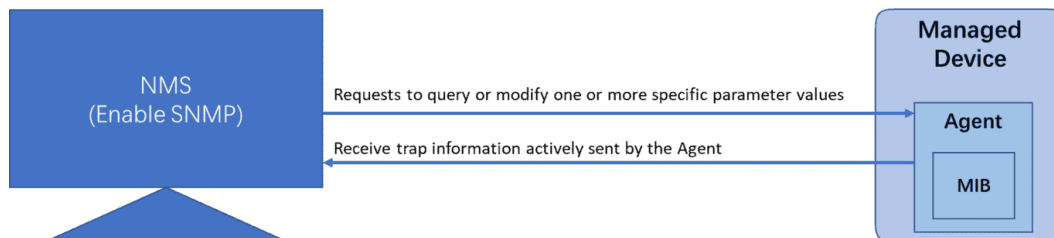


Figure 4-46 SNMP Structure

iMeter 5's basic measurements can be read and sent via SNMP. In addition, event records can be sent to an NMS in Trap format. The iMeter 5 provides the following information via SNMP.

	Parameters
Device Info.	Device Name, Firmware Version, Firmware Date, Device SN, Device Temperature, Self-diagnostic, Total Memory, Available Memory, Device Model
Status	Setpoint Status, DI Status, DO Status
Real-time Data	Primary Ua/Ub/Uc/Uln Avg. RMS, Primary Uab/Ubc/Uca/Ull Avg. RMS, Primary Ia/Ib/Ic/I Avg. RMS, Primary I4, Pa/Pb/Pc/P Total RMS, Qa/Qb/Qc/Q Total RMS, Sa/Sb/Sc/ S Total RMS, PFa/PFb/PFc/PF Total RMS

Energy Data	Σ kWh Import/Export/Net/Total, Σ kvarh Import/Export/Net/Total, Σ kVAh
Harmonic Distortion	Ua/Ub/Uc/Ia/Ib/Ic/I4 THD, TOHD, TEHD, Ua/Ub/Uc HD00 to HD63

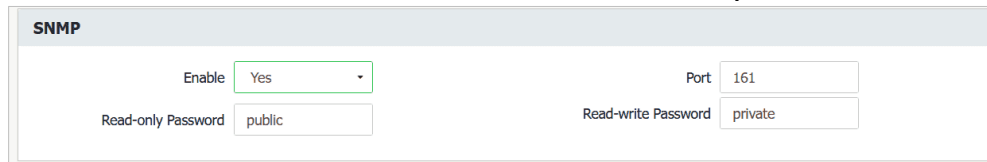
Table 4-39 Data Provided by the iMeter 5 via SNMP

4.11.2 Using SNMP

This section provides the guideline for communicating with the iMeter 5 in SNMP protocol using MG-SOFT MIB Browser as the NMS software. It's assumed that the reader is somewhat familiar with SNMP.

Please execute the steps below.

- Enable the SNMP service on the iMeter 5 via the Web Interface under **Setup -> Comm. -> Advanced** menu.



The image shows the 'SNMP' configuration window. It has two main sections: 'Enable' and 'Port'. The 'Enable' section has a dropdown menu set to 'Yes' and a 'Read-only Password' field set to 'public'. The 'Port' section has a 'Read-write Password' field set to 'private'.

Figure 4-47 SNMP Settings on Web Server

- Download the MIB definition (source) file for iMeter 5 from [here](#) and save it to the **SMI** folder under the installation path of MG-SOFT.

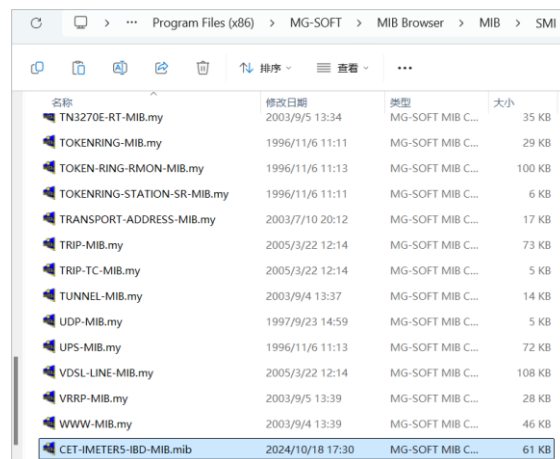


Figure 4-48 Save the MIB Definition File to SMI Folder

- Run the **MIB Compiler**. Click on  in the toolbar and select the CET-IMETERD5-IBD-MIB.my file to compile.

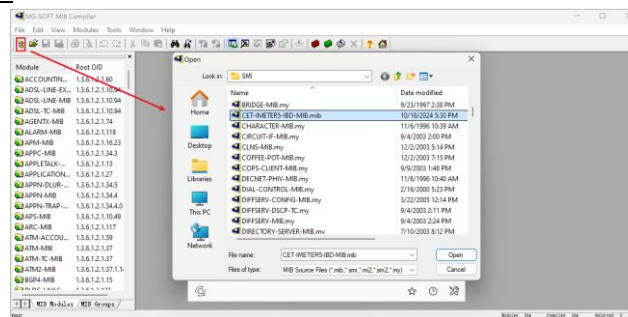


Figure 4-49 Compiler MIB Definition File

- After a successful compilation, the Compiled MIB Modules dialog box appears which allows the user to save the compiled MIB file.

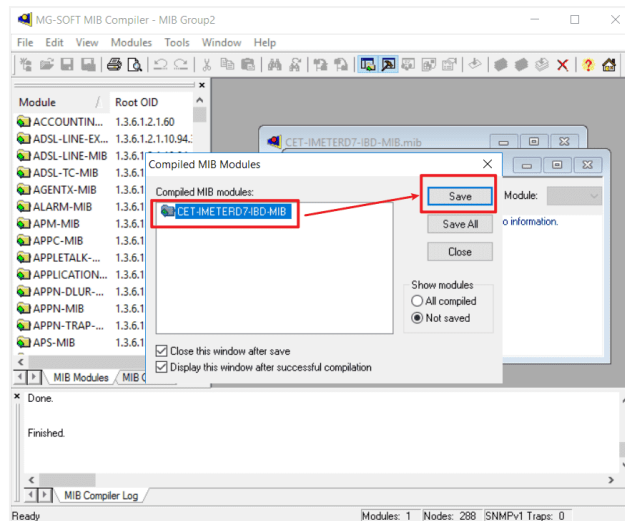


Figure 4-50 Compiled MIB Modules dialog box

The **Save As** dialog box appears to prompt the user where to save the compiled file. It's recommended to save the file to the default folder of MIB Browser.

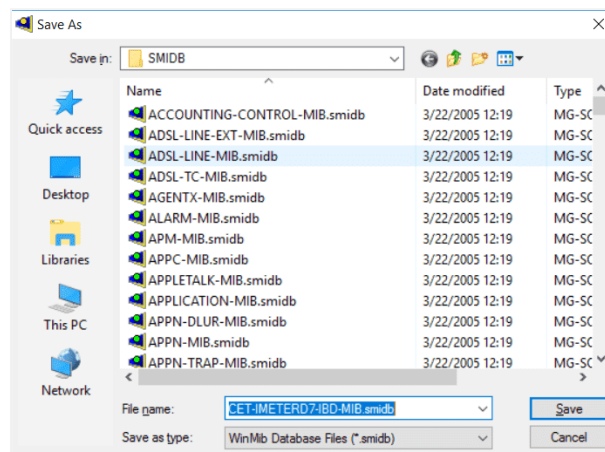


Figure 4-51 Save the Compiled File

- Run the MIB Browser as Administrator. Click **MIB** tab and select CET-IMETERD7-IBD-MIB in the **MIB Modules** window and click  to upload the selected MIB module.

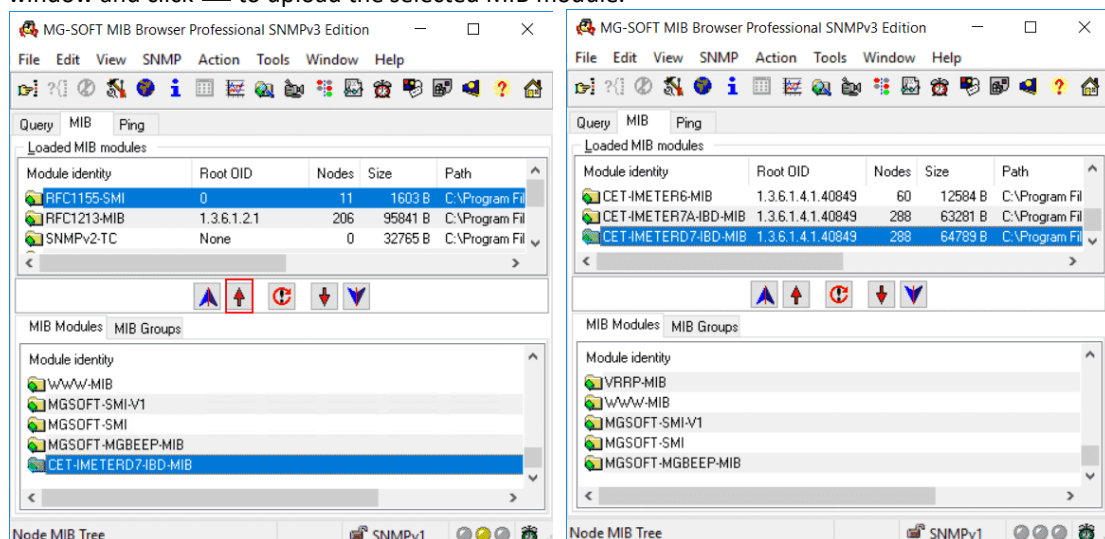


Figure 4-52 Upload MIB Module

- Click the **Query** tab and enter the IP address of iMeter 5. Click  to set the SNMP version and Port number in the SNMP Protocol Preferences dialog box.

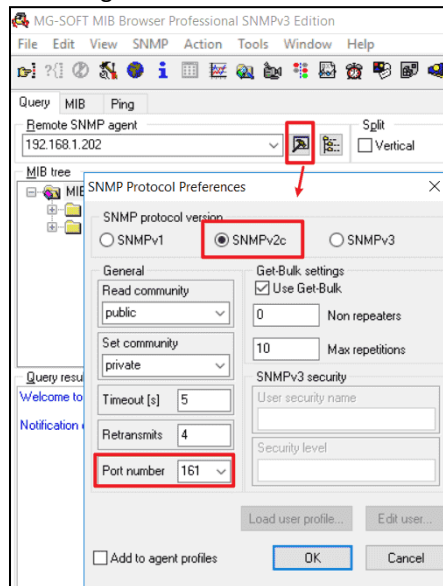


Figure 4-53 Set IP & SNMP Protocol Preferences

- In the **MIB Tree** panel, expand the MIB Tree and select the iMeter 5 node to connect it by right-clicking it and choosing **Contact** from the pop-up context menu.

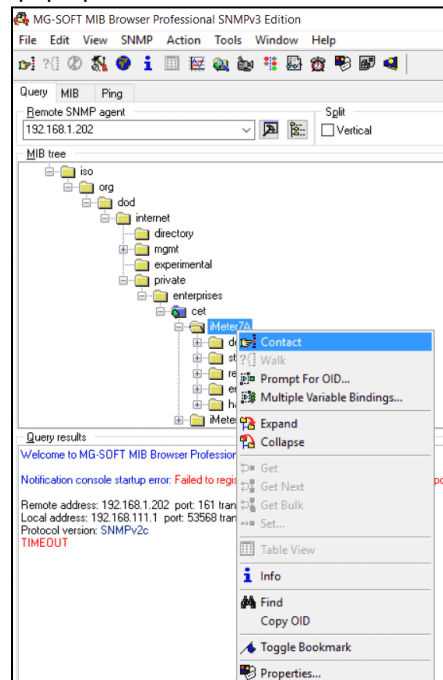


Figure 4-54 Connect the iMeter 5 via SNMP

- The user can query the Real-time measurements by Walk / Get command. For more instructions on MIB Browser, please refer to the [User Manual of MIB Browser](#).

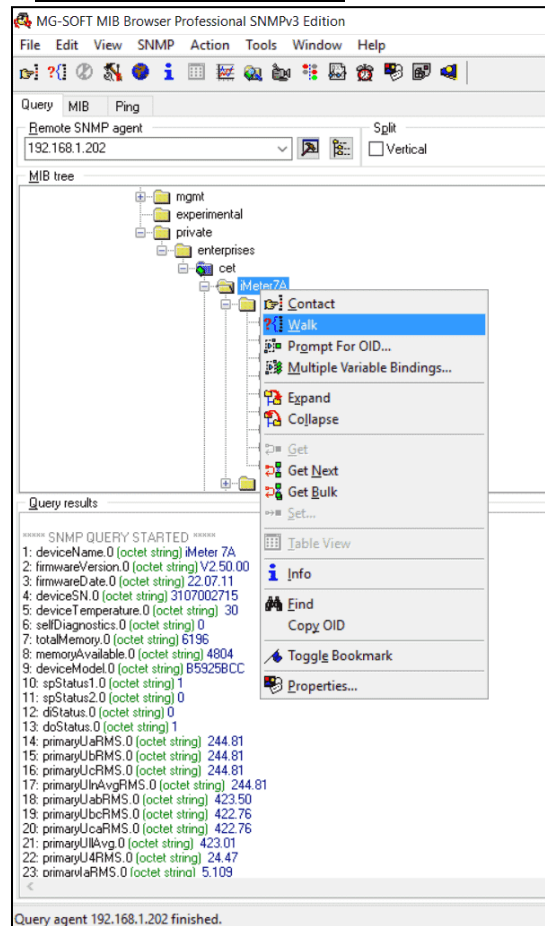


Figure 4-55 Query Measurements

4.12 On-board FTPS Server

File Transfer Protocol Secure (FTPS) is used to download COMTRADE files and other logged measurement data, such as the EN 50160 report, IEEE Std 519 report and the 2kHz to 9kHz Supraharmonic C.E. daily report, from the meter using an FTPS client software, such as FileZilla.

The iMeter 5 can support 5 FTPS connection simultaneously. And the FTPS timeout period is 5 minutes. Please note that the file structure of the FTPS files on iMeter 5 is not permitted to change.

4.12.1 Access the FTPS Server

The following section illustrates the steps for accessing the iMeter 5's FTPS Server via FileZilla.

1. Configure the FTPS settings at **Setup -> Comm. -> Advanced** on the Web Server of the iMeter 5.

FTPS

Enable

Yes

SSL/TLS Enable

Yes

Port

21

Note: It is recommended to use a client that supports the encrypted FTP protocols (FTPS, TLS1.1 and above) to access the FTPS service.

Figure 4-56 FTPS Settings on Web

2. Connect to the FTPS Server.

- a. Enter the IP address, Username, Password and Port information for verification. Please note the Username/Password for FTPS and Web servers are identical. Click on **Quickconnect** button.



Figure 4-57 FireZilla Connection

- b. Please tick on the selection box for **Always trust this certificate in future sessions** as showing in the following pop window and click on **OK**.

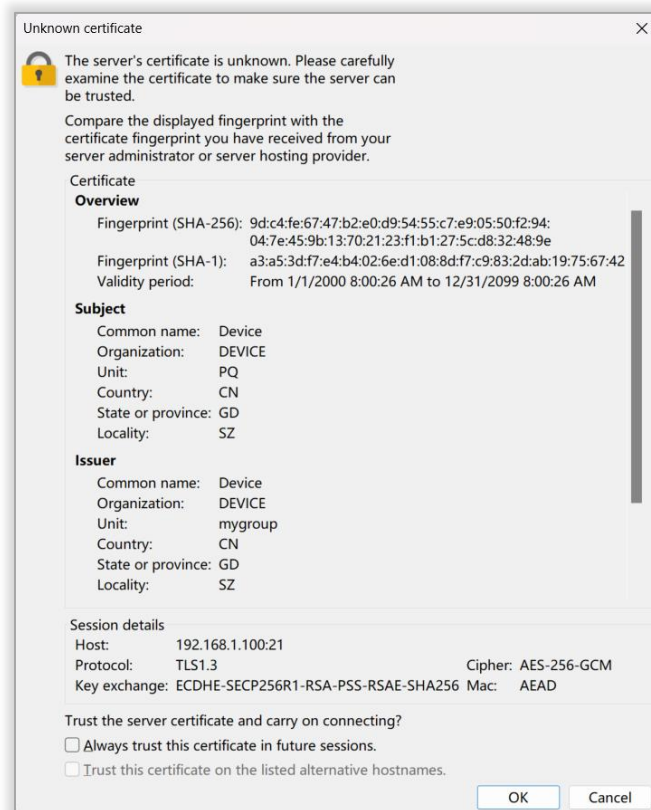


Figure 4-58 Trust Certificate

3. If the FTPS Server is connected successfully, the iMeter 5's FTPS site is displayed as shown in the following screenshot.



Figure 4-59 iMeter 5's FTPS Server

4.12.2 Quick Overview for FTPS Files

The following section provides a quick overview of the `disturbRecord`, `faultRecord`, `rmsRecord` in the `/comtrade` folder as well as the EN50160 report and the IEEE Std 519 report. Please copy the required files to your local computer before opening them with the appropriate application.

4.12.2.1 COMTRADE Files

COMTRADE (IEEE Standard Common Format for Transient Data Exchange) is a file format for storing oscillography and status data related for transient power system disturbance.

Three folders, `/disturbRecord`, `/rmsRecord` and `/waveRecord`, are discussed here under the `/comtrade` folder. In each folder, a set of COMTRADE files for a given event consists of two to four files with the same filename but different extensions, `*.HDR` (optional), `*.CFG`, `*.DAT` and `*.INF` (optional).

1. **HDR (Header)** – contains general information about the event. It is written in ASCII format and its contents do not need to be stored in any particular order.
2. **CFG (Configuration)** – a text file in ASCII or binary format. It contains only numbers and corresponds to samples taken of analog and digital channels, channel names, units, conversion factors, electrical system frequency, sampling frequency, sampling rates, date and time, and the format in which the data file was recorded.
3. **DAT (Data)** – a text file in ASCII or binary format. It contains only numbers and corresponds to samples taken of analog and digital quantities. Its correct interpretation depends on the information contained in the configuration file. In the configuration file are specified means to translate these values accordingly to real quantities, such as volts and amperes.
4. **INF (Information)** – a text file in ASCII or UTF-8 format. It contains extra information beyond the minimum required for the application of the dataset.

The file name consists of four parts, the waveform recorder type, the logging sequence (please refer to **Section 5.4 Note 5**), the recording start time and the file extension. For example, for the file, `disturbRecord-001-20220108_162530-274.dat`, its filename indicates that this file contains the COMTRADE data for the disturbance event recorded on 8th, Jan. 2022, 16:25:30.274 and that it is the oldest event recorded.

`/disturbRecord` saves the disturbance waveform recordings.

Filename	Filesize	Filetype	Last modified
disturbRecord-001-20220719_165945_681.dat	614,400	DAT File	2022/7/19 16:59:46
disturbRecord-001-20220719_165945_681.hdr	294	HDR File	2022/7/19 16:59:46
disturbRecord-001-20220719_165945_681.inf	115	Setup Inf...	2022/7/19 16:59:46
disturbRecord-002-20220719_165950_901.cfg	764	Configur...	2022/7/19 16:59:51
disturbRecord-002-20220719_165950_901.dat	614,400	DAT File	2022/7/19 16:59:51
disturbRecord-002-20220719_165950_901.hdr	294	HDR File	2022/7/19 16:59:51
disturbRecord-002-20220719_165950_901.inf	112	Setup Inf...	2022/7/19 16:59:51
disturbRecord-003-20220719_165956_811.cfg	764	Configur...	2022/7/19 16:59:57

Figure 4-60 disturbRecord Files

`/faultRecord` saves the waveform recordings including the scheduled waveform recording with fixed sampling rate configuration.

Filename	Filesize	Filetype	Last modified
waveRecord-001-20220719_170011_161.dat	1,228,800	DAT File	2022/7/19 17:00:13
waveRecord-001-20220719_170011_161.hdr	308	HDR File	2022/7/19 17:00:13
waveRecord-001-20220719_170011_161.inf	115	Setup Inf...	2022/7/19 17:00:13
waveRecord-002-20220719_170028_173.cfg	768	Configur...	2022/7/19 17:00:30
waveRecord-002-20220719_170028_173.dat	1,228,800	DAT File	2022/7/19 17:00:30
waveRecord-002-20220719_170028_173.hdr	314	HDR File	2022/7/19 17:00:30
waveRecord-002-20220719_170028_173.inf	115	Setup Inf...	2022/7/19 17:00:30

Figure 4-61 faultRecord Files

/rmsRecord saves the RMS recordings.

Filename	Filesize	Filetype	Last modified
 rmsRecord-001-20220719_165945_681.dat	216,000	DAT File	2022/7/19 17:00:54
 rmsRecord-002-20220720_104231_064.cfg	1,005	Configur...	2022/7/20 10:43:40
 rmsRecord-002-20220720_104231_064.dat	216,000	DAT File	2022/7/20 10:43:40
 rmsRecord-003-20220722_094501_025.cfg	1,005	Configur...	2022/7/22 9:46:10
 rmsRecord-003-20220722_094501_025.dat	216,000	DAT File	2022/7/22 9:46:10

Figure 4-62 rmsRecord Files

4.12.2.2 EN 50160 Report

/en50160/report saves the latest 53 EN50160 reports in .xls format. The downloaded .xls spreadsheets can be open in Excel.

Filename	Filesize	Filetype	Last modified
..			
 en50160Report_0.xls	66,168	Microsof...	2021/12/26 0:00:06
 en50160Report_1.xls	66,165	Microsof...	2022/1/9 0:00:06
 en50160Report_10.xls	66,181	Microsof...	2022/3/21 8:20:04
 en50160Report_11.xls	66,181	Microsof...	2022/3/27 0:00:05
 en50160Report_12.xls	66,181	Microsof...	2022/4/3 0:00:05
 en50160Report_13.xls	66,181	Microsof...	2022/4/10 0:00:06

Figure 4-63 EN50160 Report

4.12.2.3 IEEE Std 519 Report

/ieee519/report saves the latest 365 daily reports and 53 weekly reports in chronological order. The downloaded report in .xls format can be opened in Excel.

Filename	Filesize	Filetype	Last modified
 IEEE519Report_Day_9.xls	131,089	Microsof...	2023/1/9 0:00:05
 IEEE519Report_Day_10.xls	131,089	Microsof...	2023/1/10 0:00:05
 IEEE519Report_Day_11.xls	131,089	Microsof...	2023/1/11 0:00:05
 IEEE519Report_Day_12.xls	131,089	Microsof...	2023/1/12 0:00:05
 IEEE519Report_Day_13.xls	131,089	Microsof...	2023/1/13 0:00:05
 IEEE519Report_Day_14.xls	131,089	Microsof...	2023/1/14 0:00:05
 IEEE519Report_Day_15.xls	131,089	Microsof...	2023/1/15 0:00:05
 IEEE519Report_Week_7.xls	196,465	Microsof...	2023/1/15 0:00:06

Figure 4-64 IEEE Std 519 Report

4.13 Modbus Master

4.13.1 Overview

iMeter 5 supports the Modbus Master feature (supported in Firmware V1.50.01 and later) which can periodically communicate with Modbus Slaves via Modbus RTU.

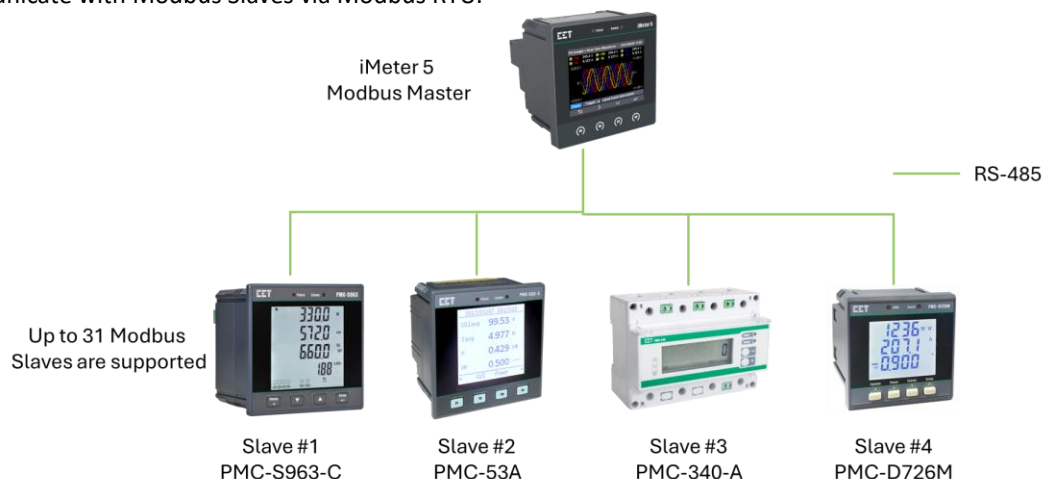


Figure 4-65 Modbus Master-to-Slave Connections

4.13.2 Measurements

Both the Front Panel and the Web Interface support the display for the MB Slave's real-time measurements (See Chapter 3). The following table illustrates the MB Slaves supported by iMeter 5 with the specified Modbus protocol version (e.g., PMC-53A with Modbus V1.6) and their accessible parameters via iMeter 5's interface.

Parameters	PMC-53A V1.6/ PMC-53A-E V1.1	PMC-53M-A V1.0	PMC-340-A V1.0/ PMC-340-B V1.3	PMC-D726M V1.3	PMC-S963-C V1.5/ PMC-S963-E V1.5
Ua	✓	✓	✓	✓	✓
Ub	✓	✓	✓	✓	✓
Uc	✓	✓	✓	✓	✓
Uln Avg.	✓	✓	✓	✓	✓
Uab	✓	✓	✓	✓	✓
Ubc	✓	✓	✓	✓	✓
Uca	✓	✓	✓	✓	✓
Ull Avg.	✓	✓	✓	✓	✓
Ung	✓	x	x	x	PMC-S963-E Only
Ia	✓	✓	✓	✓	✓
Ib	✓	✓	✓	✓	✓
Ic	✓	✓	✓	✓	✓
I Avg.	✓	✓	✓	✓	✓
Ua/Uab Angle	✓	✓	✓	✓	✓
Ub/Ubc Angle	✓	✓	✓	✓	✓
Uc/Uca Angle	✓	✓	✓	✓	✓
Ia Angle	✓	✓	✓	✓	✓
Ib Angle	✓	✓	✓	✓	✓
Ic Angle	✓	✓	✓	✓	✓
In (Calculated)	✓	✓	✓	✓	✓
I4	✓	x	x	x	x
dPF	✓	✓	x	x	x
Operating Time	✓	✓	✓	x	x
U1	✓	✓	x	x	✓
U2	✓	✓	x	x	✓
U0	✓	✓	x	x	✓
I1	✓	✓	x	x	✓
I2	✓	✓	x	x	✓
I0	✓	✓	x	x	✓
kWh Import	✓	✓	✓	✓	✓
kWh Export	✓	✓	✓	✓	✓
kWh Net	✓	✓	✓	x	✓
kWh Total	✓	✓	✓	x	✓
kvarh Import	✓	✓	✓	✓	✓
kvarh Export	✓	✓	✓	✓	✓
kvarh Net	✓	✓	✓	x	✓
kvarh Total	✓	✓	✓	x	✓
kVAh	✓	✓	✓	✓	✓
Ia DMD.	✓	✓	✓	✓	x

Ib DMD.	✓	✓	✓	✓	×
Ic DMD.	✓	✓	✓	✓	×
I Avg. DMD.	✓	×	×	×	×
Ua DMD.	PMC-53A-E only	×	×	×	×
Ub DMD.	PMC-53A-E only	×	×	×	×
Uc DMD.	PMC-53A-E only	×	×	×	×
Uln Avg. DMD.	PMC-53A-E only	×	×	×	×
Uab DMD.	PMC-53A-E only	×	×	×	×
Ubc DMD.	PMC-53A-E only	×	×	×	×
Uca DMD.	PMC-53A-E only	×	×	×	×
Ull average DMD.	✓	×	×	×	×
P Total DMD.	✓	×	✓	✓	✓
Q Total DMD.	✓	✓	✓	✓	×
S Total DMD.	✓	✓	✓	✓	×
Ia This Max. DMD.	✓	✓	✓	✓	×
Ib This Max. DMD.	✓	✓	✓	✓	×
Ic This Max. DMD.	✓	✓	✓	✓	×
I Avg. This Max. DMD.	✓	×	×	×	×
Ua This Max. DMD.	PMC-53A-E only	×	×	×	×
Ub This Max. DMD.	PMC-53A-E only	×	×	×	×
Uc This Max. DMD.	PMC-53A-E only	×	×	×	×
Uln Avg. This Max. DMD.	PMC-53A-E only	×	×	×	×
Uab This Max. DMD.	PMC-53A-E only	×	×	×	×
Ubc This Max. DMD.	PMC-53A-E only	×	×	×	×
Uca This Max. DMD.	PMC-53A-E only	×	×	×	×
Ull Avg. This Max. DMD.	✓	×	×	×	×
P This Max. DMD.	✓	✓	✓	✓	✓
Q This Max. DMD.	✓	✓	✓	✓	×
S This Max. DMD.	✓	✓	✓	✓	×
U Unbalance	✓	✓	✓	✓	✓
I Unbalance	✓	✓	✓	✓	✓
Ia TDD	✓	✓	✓	✓	✓
Ib TDD	✓	✓	✓	✓	✓
Ic TDD	✓	✓	✓	✓	✓
Ia THD	✓	✓	✓	✓	✓
Ib THD	✓	✓	✓	✓	✓
Ic THD	✓	✓	✓	✓	✓
Ua THD	✓	✓	✓	✓	✓
Ub THD	✓	✓	✓	✓	✓
Uc THD	✓	✓	✓	✓	✓
DI Status	✓	✓	PMC-340-B only	✓	✓
DO Status	✓	✓	×	✓	✓

Table 4-40 Available Measurements on the Supported MB Slaves

4.13.3 Configurations

The following section describes the steps for configuring a PMC-53A as a MB Slave for iMeter 5.

1. Confirm the Modbus RTU settings on the PMC-53A.

RS-485(P1)	
Protocol	Modbus
Unit ID	101
Baud Rate	9600
Data Format	8E1
ESC	↑ ↓ Enter

Figure 4-66 Modbus RTU settings on the PMC-53A

2. Set the RS-485 Protocol of iMeter 5 to **MB Master**.

The screenshot shows the 'Comm.' settings page for iMeter 5. The 'Basic' tab is selected, and the 'Ethernet' section is expanded. Under 'Ethernet', there are two columns of settings for P1 and P2. P1 settings: Enable P1 (Static), IP Address 1 (192.168.0.100), Subnet Mask 1 (255.255.255.0), Gateway (192.168.1.1), Ethernet Mode (Normal). P2 settings: Enable P2 (Static), IP Address 2 (192.168.1.100), Subnet Mask 2 (255.255.255.0), White List (Disable). A note at the bottom of the Ethernet section states: 'Note: The Web connection will be interrupted when DHCP is selected, please obtain the current IP Address via the device Front Panel under Setup>Device Info.>Ethernet and re-login.' Below the Ethernet section is the 'RS-485' section. The 'Protocol' is set to 'MB Master' (highlighted with a red box). Other settings include Baud Rate (9600), Parity (Even), Stop Bit (1), Unit ID (100), and EtherGate IP Port (20000).

Figure 4-67 P1 (RS-485) Settings on iMeter 5

3. Under **Setup** -> **Comm.** -> **MB Master**, configure the Slave settings based on the Modbus RTU parameters of PMC-53A.

The screenshot shows the 'MB Master' settings page for iMeter 5. The 'Basic' tab is selected, and the 'MB Master' section is expanded. There are two sections for configuring slave devices. The first section is for 'Slave #1': Enable (Yes), Type (PMC-53A), Unit ID (101), Device Name (Slave #1), and a 'Select Data' button with a 'More >>' link. The second section is for 'Slave #2': Enable (Yes), Type (PMC-S963-E), Unit ID (54), Device Name (Slave #2 SN56000), and a 'Select Data' button with a 'More >>' link.

Figure 4-68 MB Master Settings on iMeter 5

- Click **"More >>"** on **Select Data** filed and select the data desired to display. The user can quickly select/de-select all Pages by clicking **Select All/Clear All** or duplicate the existing settings from a specific MB Slave by selecting it from the **Import from** the drop-down list.

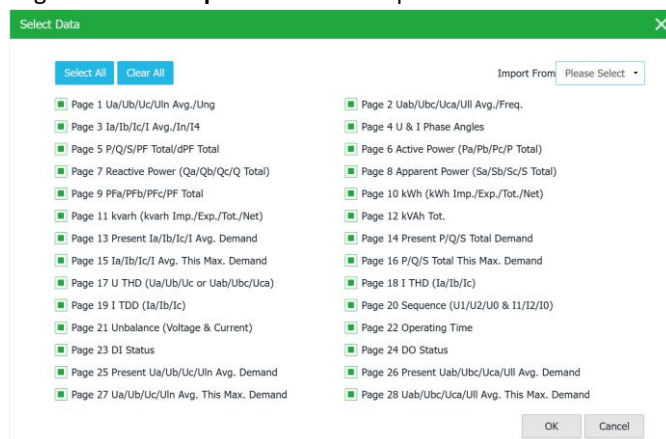


Figure 4-69 Select Data

The following table illustrates the Slave's Data Type details displayed on Page 1 to Page 28.

Page	Data Type
Page 1	Ua / Ub / Uc / Uln Avg. / Ung
Page 2	Uab / Ubc / Uca / Ull Avg. / Freq.
Page 3	Ia / Ib / Ic / I Avg. / In / I4
Page 4	Ua / Uab Angle, Ub / Ubc Angle, Uc / Uca Angle, Ia Angle, Ib Angle, Ic Angle
Page 5	P / Q / S / PF Total / Disp. PF Total
Page 6	Pa / Pb / Pc / P Total
Page 7	Qa / Qb / Qc / Q Total
Page 8	Sa / Sb / Sc / S Total
Page 9	PFa / PFb / PFc / PF Total
Page 10	kWh Imp. / Exp. / Tot. / Net
Page 11	kvarh Imp. / Exp. / Tot. / Net
Page 12	kVAh Tot.
Page 13	Ia / Ib / Ic / I Avg. Present DMD
Page 14	P / Q / S Total Present DMD
Page 15	Ia / Ib / Ic / I Avg. This Max. DMD
Page 16	P / Q / S Total This Max. DMD
Page 17	Ua / Uab THD, Ub / Ubc THD, Uc / Uca THD
Page 18	Ia / Ib / Ic THD
Page 19	Ia / Ib / Ic TDD
Page 20	U1 / U2 / U0 & I1 / I2 / I0 (For Sequence)
Page 21	U Unb., I Unb. (For Unbalance)
Page 22	Operating Time
Page 23	Dlx (x=1, 2, 3, ...,6)
Page 24	DOx (x=1, 2, 3, 4)
Page 25	Ua / Ub / Uc / Uln Avg. Present DMD (If supported)
Page 26	Uab / Ubc / Uca / Ull Avg. Present DMD (If supported)
Page 27	Ua / Ub / Uc / Uln Avg. This Max. DMD (If supported)
Page 28	Uab / Ubc / Uca / Ull Avg. This Max. DMD (If supported)

Table 4-41 Details for FP Display Pages

Chapter 5 Modbus Map

This chapter provides a complete description of the Modbus register map (**Protocol Version 7.1**) for the iMeter 5 to facilitate the development of 3rd party Modbus RTU communications driver for accessing information on the meter.

The iMeter 5 supports the following Modbus functions:

- 1) Read Holding Registers (Function Code 0x03)
- 2) Force Single Coil (Function Code 0x05)
- 3) Preset Multiple Registers (Function Code 0x10)

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

5.1 Function Code and Data Format

5.1.1 03 (0x03) Read Holding Registers

The following table illustrates the Data Format for Read Holding Registers Request/Response packet.

Request Packet (Master Station to iMeter 5)		Response Packet (iMeter 5 to Master Station)	
Field Name	Bytes	Field Name	Bytes
Slave Address	1 Byte	Slave Address	1 Byte
Function Code (0x03)	1 Byte	Function Code (0x03)	1 Byte
Starting Address Hi	1 Byte	Byte Count N	1 Byte
Starting Address Lo	1 Byte	Data 1 Hi	1 Byte
No. of Registers Hi	1 Byte	Data 1 Lo	1 Byte
No. of Registers Lo	1 Byte	...	
Error Check (CRC)	2 Bytes	Data N/2 Hi	1 Byte
		Data N/2 Lo	1 Byte
		Error Check (CRC)	2 Bytes

Table 5-1 Data Format for 0x03 Request/Response Packet

5.1.2 05 (0x05) Force Single Coil

The following table illustrates the Data Format for Force Single Coil Arm/Execute Request/Response packet.

Arm Request/Response

Request Packet (Master Station to iMeter 5)		Response Packet (iMeter 5 to Master Station)	
Field Name	Bytes	Field Name	Bytes
Slave Address	1 Byte	Slave Address	1 Byte
Function Code (0x05)	1 Byte	Function Code (0x05)	1 Byte
Output Address Hi	1 Byte	Output Address Hi	1 Byte
Output Address Lo	1 Byte	Output Address Lo	1 Byte
Output Value Hi (0xFF)	1 Byte	Output Value Hi (0xFF)	1 Byte
Output Value Lo (0x00)	1 Byte	Output Value Lo (0x00)	1 Byte
Error Check (CRC)	2 Bytes	Error Check (CRC)	2 Bytes

Table 5-2 Data Format for 0x05 Arm Request/Response Packet

Execute Request/Response

Request Packet (Master Station to iMeter 5)		Response Packet (iMeter 5 to Master Station)	
Field Name	Bytes	Field Name	Bytes
Slave Address	1 Byte	Slave Address	1 Byte
Function Code (0x05)	1 Byte	Function Code (0x05)	1 Byte
Output Address Hi	1 Byte	Output Address Hi	1 Byte
Output Address Lo	1 Byte	Output Address Lo	1 Byte
Output Value Hi (0xFF)	1 Byte	Output Value Hi (0xFF)	1 Byte
Output Value Lo (0x00)	1 Byte	Output Value Lo (0x00)	1 Byte
Error Check (CRC)	2 Bytes	Error Check (CRC)	2 Bytes

Table 5-3 Data Format for 0x05 Execute Request/Response Packet

The iMeter 5 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.

5.1.3 16 (0x10) Write Multiple Registers

The following table illustrates the Data Format for Write Multiple Registers request/response packet.

Request Packet (Master Station to iMeter 5)		Response Packet (iMeter 5 to Master Station)	
Field Name	Bytes	Field Name	Bytes
Slave Address	1 Byte	Slave Address	1 Byte
Function Code (0x10)	1 Byte	Function Code (0x10)	1 Byte
Starting Address Hi	1 Byte	Starting Address Hi	1 Byte
Starting Address Lo	1 Byte	Starting Address Lo	1 Byte
No. of Registers Hi	1 Byte	No. of Registers Hi	1 Byte
No. of Registers Lo	1 Byte	No. of Registers Lo	1 Byte
Byte Count N	1 Byte	Error Check (CRC)	2 Bytes
Data 1 Hi	1 Byte		
Data 1 Lo	1 Byte		
...			
Data N/2 Hi	1 Byte		
Data N/2 Lo	1 Byte		
Error Check (CRC)	2 Bytes		

Table 5-4 Data Format for 0x10 Request/Response Packet

5.2 Register Format

The following table provides a description of the different data formats used for the Modbus registers.

Format	Description
UINT16/INT16	Unsigned/signed 16-bit integer
UINT32/INT32	Unsigned/signed 32-bit integer
INT64	Signed 64-bit integer
FLOAT	IEEE 754 32-bit floating point number (single precision)
BITMAP	16-bit or 32-bit binary register where each bit represents a specific quantity
CHAR	16-bit binary register which represents a single Unicode character.

Table 5-5 Register Format

5.3 Data Encoding

The iMeter 5 uses the Big-Endian byte ordering system. This means that when a numeric quantity larger than a single byte is transmitted, the most significant byte is sent first. For example, value of Register 0000 is "0x44 71 13 88", the first byte sent is "0x44", then "0x71", "0x13" and finally "0x88".

5.4 Basic Measurement

Register	Property	Description	Format	Unit
0000	RO	Ua ¹	FLOAT	V
0002	RO	Ub ¹	FLOAT	V
0004	RO	Uc ¹	FLOAT	V
0006	RO	Uln Avg. ¹	FLOAT	V
0008	RO	Uab	FLOAT	V
0010	RO	Ubc	FLOAT	V
0012	RO	Uca	FLOAT	V
0014	RO	Ull Avg.	FLOAT	V
0016	RO	Ia	FLOAT	A
0018	RO	Ib	FLOAT	A
0020	RO	Ic	FLOAT	A
0022	RO	I Avg.	FLOAT	A
0024	RO	Pa (kW _a) ¹	FLOAT	W
0026	RO	Pb (kW _b) ¹	FLOAT	W
0028	RO	Pc (kW _c) ¹	FLOAT	W
0030	RO	P (kW) Total	FLOAT	W
0032	RO	Qa (kvar _a) ¹	FLOAT	var
0034	RO	Qb (kvar _b) ¹	FLOAT	var
0036	RO	Qc (kvar _c) ¹	FLOAT	var
0038	RO	Q (kvar) Total	FLOAT	var
0040	RO	Sa (kVA _a) ¹	FLOAT	VA

0042	RO	Sb (kVAb) ¹	FLOAT	VA
0044	RO	Sc (kVAc) ¹	FLOAT	VA
0046	RO	S (kVA) Total	FLOAT	VA
0048	RO	PFa ¹	FLOAT	--
0050	RO	PFb ¹	FLOAT	--
0052	RO	PFc ¹	FLOAT	--
0054	RO	PF Total	FLOAT	--
0056	RO	Frequency	FLOAT	Hz
0058	--	Reserved	--	--
0060	RO	I4	FLOAT	A
0062	RO	Ung	FLOAT	V
0064	RO	Real-time Data Timestamp - Second (UNIX Time) ²	UINT32	s
0066	RO	Real-time Data Timestamp - Millisecond (UNIX Time) ²	UINT32	ms
0068	RO	Frequency Timestamp - Second (UNIX Time) ²	UINT32	s
0070	RO	Frequency Timestamp - Millisecond (UNIX Time) ²	UINT32	ms
0072	RO	Pst Timestamp - Second (UNIX Time) ²	UINT32	s
0074	RO	Pst Timestamp - Millisecond (UNIX Time) ²	UINT32	ms
0076	RO	Plt Timestamp - Second (UNIX Time) ²	UINT32	s
0078	RO	Plt Timestamp - Millisecond (UNIX Time) ²	UINT32	ms
0080	RO	Flagging Status of Real-time Voltage Data ²	BITMAP	
0081	RO	Flagging Status of Real-time Current Data ²	BITMAP	
0082	RO	Flagging Status of Frequency Measurements ²	BITMAP	
0083	RO	Flagging Status of Pst Measurements ²	BITMAP	
0084	RO	Flagging Status of Plt Measurements ²	BITMAP	
0085~0092	--	Reserved	--	
0093~0094	RO	Setpoint Status ⁴	BITMAP	
0095~0096	---	Reserved	--	
0097~0113	--	Reserved	--	
0115	RO	Dips Counter	UINT32	
0117	RO	Swells Counter	UINT32	
0119	RO	Interruption Counter	UINT32	
0121	RO	Transient Counter	UINT32	
0123	RO	RVC (Rapid Voltage Change) Counter	UINT32	
0125	RO	Inrush Current Counter	UINT32	
0127	--	Reserved	--	
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 Counter	UINT32	
0137	RO	Device Log Pointer ⁵	UINT32	
0139	RO	SOE Log Pointer ⁵	UINT32	
0141	RO	WFR Log Pointer ⁵	UINT32	
0143	RO	RMSR Log Pointer ⁵	UINT32	
0145	RO	DWR Log Pointer ⁵	UINT32	
0147~0157	--	Reserved	--	
0159	RO	SDR Log #1 Pointer ⁵	UINT32	
0161	RO	SDR Log #2 Pointer ⁵	UINT32	
0163	RO	SDR Log #3 Pointer ⁵	UINT32	
0165	RO	SDR Log #4 Pointer ⁵	UINT32	
0167	--	Reserved	--	
0169	--	Reserved	--	
0171	--	Reserved	--	
0173	--	Reserved	--	
0175~0205	--	Reserved	--	
0207	RO	DR Log #1 Pointer ⁵	UINT32	
0209	RO	DR Log #2 Pointer ⁵	UINT32	
0211	RO	DR Log #3 Pointer ⁵	UINT32	
0213	RO	DR Log #4 Pointer ⁵	UINT32	
0215	RO	DR Log #5 Pointer ⁵	UINT32	
0217	RO	DR Log #6 Pointer ⁵	UINT32	

0219	RO	DR Log #7 Pointer ⁵	UINT32	
0221	RO	DR Log #8 Pointer ⁵	UINT32	
0223~0237	--	Reserved	--	
0239	RO	Pst Log Pointer ⁵	UINT32	
0241	RO	Plt Log Pointer ⁵	UINT32	
0243	--	Reserved	--	
0245	RO	3-phase Total IER Log Pointer ⁵	UINT32	
0247	RO	EN 50160 Report Pointer ⁵	UINT32	
0249	RO	Reserved	UINT32	
0251	RO	Historical TOU Log Pointer ⁵	UINT32	
0253	--	Reserved	--	
0255	RO	Device Running Hour	UINT32	x0.1 H
0257	RO	3-phase Total AER Log Pointer ⁵	UINT32	
0259	--	Reserved	--	
0261	RO	Conduct Emissions in the 2kHz-150kHz Range Recorder Pointer ⁵	UINT32	
0263	RO	IR (calculated Residual Current)	FLOAT	A
0265	RO	IEEE Std 519-2022 Daily Report Log Pointer	UINT32	
0267	RO	IEEE Std 519-2022 Weekly Report Log Pointer	UINT32	
0269	RO	Per-phase AER Log Pointer	UINT32	
0271	RO	Per-phase IER Log Pointer	UINT32	
0273	RO	In (calculated Neutral Current)	UINT32	
0275	RO	Daily Energy Consumption Log Pointer	UINT32	
0277	RO	Monthly Energy Consumption Log Pointer	UINT32	
0273~0293	--	Reserved	--	
0294	RO	HS Frequency	FLOAT	Hz
0296	RO	dFreq.	FLOAT	Hz/s
0300	--	Reserved	--	
0302	--	Reserved	--	
0304~0306	--	Reserved	--	
0308	RO	DI Status ⁶	BITMAP	
0309	--	Reserved	--	
0310	RO	DO Status ⁷	BITMAP	
0311~0316	--	Reserved	--	
0318	--	Reserved	--	
0320	--	Reserved	--	
0322	--	Reserved	--	
0323	RO	MQTT Status		

Table 5-6 Basic Measurement

Notes:

- 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.
- The Second register and the Millisecond register must be read in a single transaction.
- The bit value of "1" for **Flagging Status of Real-time Current Data** register (0081) means the measurement is flagged due to overcurrent. The table below lists details of the **Flagging Status** registers (0080, 0082 to 0084).

Flagging Status

BIT	Description	BIT	Description
B0	Real-time Voltage Data (Register 0080)	B0	Pst (Register 0083)
B1		B1	Swell
B2		B2	Interruption
B0	Frequency (Register 0082)	B0	Plt (Register 0084)
B1		B1	Swell
B2		B2	Interruption

Table 5-7 Flagging Status

- The BIT0 to BIT31 of Setpoint Status (0093) stand for the status of Setpoint 1 to Setpoint 32, respectively, with a bit value of "1" meaning active, while "0" meaning inactive.
- 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. A value of 0 indicates that the recorder doesn't contain any logs. 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	Recorder	Depth	Recorder	Depth
Device Log	512	DWR	128	Plt	4380	DR	65535	SDR (1-8)	43200

SOE	512	RMSR	128	IER	65535	EN 50160	53		
WFR	128	Pst	52560	AER	65535	Historical TOU	12		

Table 5-8 Log Depth

- For the DI Status register, the bit values of B0 to B3 represent the states of DI1 to DI4, respectively, with “1” meaning Active (Closed) and “0” meaning Inactive (Open).
- For the DO Status register, the bit value of B0 and B1 represent the states of DO1 to DO2, respectively, with “1” meaning Operated (Closed) and “0” meaning Released (Open).

5.5 High-Speed Measurement

Register	Property	Description	Format	Unit
0350	RO	High-Speed Measurement Timestamp – Second (UNIX Time)		
0352	RO	High-Speed Measurement Timestamp – Millisecond (UNIX Time)		
0354	RO	Ua ¹	FLOAT	V
0356	RO	Ub ¹	FLOAT	V
0358	RO	Uc ¹	FLOAT	V
0360	RO	Uln Avg. ¹	FLOAT	V
0362	RO	Uab	FLOAT	V
0364	RO	Ubc	FLOAT	V
0366	RO	Uca	FLOAT	V
0368	RO	Ull Avg.	FLOAT	V
0370	RO	Ia	FLOAT	A
0372	RO	Ib	FLOAT	A
0374	RO	Ic	FLOAT	A
0376	RO	I Avg.	FLOAT	A
0378	RO	Pa (kW) ¹	FLOAT	W
0380	RO	Pb (kW) ¹	FLOAT	W
0382	RO	Pc (kW) ¹	FLOAT	W
0384	RO	P (kW) Total	FLOAT	W
0386	RO	Qa (kvar) ¹	FLOAT	var
0388	RO	Qb (kvar) ¹	FLOAT	var
0390	RO	Qc (kvar) ¹	FLOAT	var
0392	RO	Q (kvar) Total	FLOAT	var
0394	RO	Sa (kVA) ¹	FLOAT	VA
0396	RO	Sb (kVA) ¹	FLOAT	VA
0398	RO	Sc (kVA) ¹	FLOAT	VA
0400	RO	S (kVA) Total	FLOAT	VA
0402	RO	PFa ¹	FLOAT	--
0404	RO	PFb ¹	FLOAT	--
0406	RO	PFc ¹	FLOAT	--
0408	RO	PF Total	FLOAT	--
0410	RO	Frequency	FLOAT	Hz
0412	RO	U4	FLOAT	V
0414	RO	I4	FLOAT	A
0416	RO	dFreq.	FLOAT	Hz/s

Table 5-9 High-Speed Measurement

Note

- 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.

5.6 3-Phase Total Energy Measurement (INT64)

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

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

Register	Property	Description	Format	Scale	Unit
0500	RW	ΣkWh Imp.	INT64	1	wh
0504	RW	ΣkWh Exp.	INT64	1	wh
0508	RW	Σkvarh Imp.	INT64	1	varh
0512	RW	Σkvarh Exp.	INT64	1	varh
0516	RW	ΣkVAh	INT64	1	VAh

0520	RO	Σ kWh Net	INT64	1	wh
0524	RO	Σ kWh Total	INT64	1	wh
0528	RO	Σ kvarh Net	INT64	1	varh
0532	RO	Σ kvarh Total	INT64	1	varh

Table 5-10 3-phase Total Energy Measurement (INT64)

5.7 3-phase Total Energy Measurement (INT32)

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

$$\Sigma kxh (\text{Import/Export/Net/Total})$$

$$= E1 \times 100 \text{ GWh} + E2 \times 0.1 \text{ kWh}$$

$$= E1 \times 10^8 \text{ kWh} + E2 \times 0.1 \text{ kWh}$$

The E1 and E2 registers have a maximum value of 100 and 1000,000,000, 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 1×10^{11} kxh. The E1 and E2 registers must be written simultaneously.

Register	Property	Description	Format	Scale	Unit
0550	RW	Σ kWh Import E1	INT32	1	100 GWh
0552	RW	Σ kWh Import E2	INT32	0.1	kWh
0554	RW	Σ kWh Export E1	INT32	1	100 GWh
0556	RW	Σ kWh Export E2	INT32	0.1	kWh
0558	RW	Σ kvarh Import E1	INT32	1	100 Gvarh
0560	RW	Σ kvarh Import E2	INT32	0.1	kvarh
0562	RW	Σ kvarh Export E1	INT32	1	100 Gvarh
0564	RW	Σ kvarh Export E2	INT32	0.1	kvarh
0566	RW	Σ kVAh E1	INT32	1	100 GVAh
0568	RW	Σ kVAh E2	INT32	0.1	kVAh
0570	RO	Σ kWh Net E1	INT32	1	100 GWh
0572	RO	Σ kWh Net E2	INT32	0.1	kWh
0574	RO	Σ kWh E1	INT32	1	100 GWh
0576	RO	Σ kWh E2	INT32	0.1	kWh
0578	RO	Σ kvarh Net E1	INT32	1	100 Gvarh
0580	RO	Σ kvarh Net E2	INT32	0.1	kvarh
0582	RO	Σ kvarh Total E1	INT32	1	100 Gvarh
0584	RO	Σ kvarh Total E2	INT32	0.1	kvarh

Table 5-11 3-phase Total Energy Measurement (INT32)

5.8 Per-phase Energy Measurements (INT64)

The Energy registers will roll over to zero automatically when the maximum value is reached, which depends on the **Energy Short 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
7500	RW	Phase A kWh Import	INT64	1	wh
7504	RW	Phase A kWh Export	INT64	1	wh
7508	RO	Phase A kWh Net	INT64	1	wh
7512	RO	Phase A kWh Total	INT64	1	wh
7516	RW	Phase A kvarh Import	INT64	1	varh
7520	RW	Phase A kvarh Export	INT64	1	varh
7524	RO	Phase A kvarh Net	INT64	1	varh
7528	RO	Phase A kvarh Total	INT64	1	varh
7532	RW	Phase A kVAh Total	INT64	1	VAh
7536	RW	Phase B kWh Import	INT64	1	wh
7540	RW	Phase B kWh Export	INT64	1	wh
7544	RO	Phase B kWh Net	INT64	1	wh
7548	RO	Phase B kWh Total	INT64	1	wh
7552	RW	Phase B kvarh Import	INT64	1	varh
7556	RW	Phase B kvarh Export	INT64	1	varh
7560	RO	Phase B kvarh Net	INT64	1	varh
7564	RO	Phase B kvarh Total	INT64	1	varh
7568	RW	Phase B kVAh Total	INT64	1	VAh

7572	RW	Phase C kWh Import	INT64	1	wh
7576	RW	Phase C kWh Export	INT64	1	wh
7580	RO	Phase C kWh Net	INT64	1	wh
7584	RO	Phase C kWh Total	INT64	1	wh
7588	RW	Phase C kvarh Import	INT64	1	varh
7592	RW	Phase C kvarh Export	INT64	1	varh
7596	RO	Phase C kvarh Net	INT64	1	varh
7600	RO	Phase C kvarh Total	INT64	1	varh
7604	RW	Phase C kVAh Total	INT64	1	VAh

Table 5-12 Per-phase Energy Measurements

5.9 Per-phase Energy Measurements (INT32)

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

$$\sum kxh (\text{Import/Export/Net/Total})$$

$$= E1 \times 100 \text{ GWh} + E2 \times 0.1 \text{ kWh}$$

$$= E1 \times 10^8 \text{ kWh} + E2 \times 0.1 \text{ kWh}$$

The E1 and E2 registers have a maximum value of 100 and 1000,000,000, 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 $1 \times 10^{11} \text{ kXh}$. The E1 and E2 registers must be written simultaneously.

Register	Property	Description	Format	Scale	Unit
7650	RW	Phase A kWh Import E1	INT32	1	100 GWh
7652	RW	Phase A kWh Import E2	INT32	0.1	kWh
7654	RW	Phase A kWh Export E1	INT32	1	100 GWh
7656	RW	Phase A kWh Export E2	INT32	0.1	kWh
7658	RO	Phase A kWh Net E1	INT32	1	100 GWh
7660	RO	Phase A kWh Net E2	INT32	0.1	kWh
7662	RO	Phase A kWh Total E1	INT32	1	100 GWh
7664	RO	Phase A kWh Total E2	INT32	0.1	kWh
7666	RW	Phase A kvarh Import E1	INT32	1	100 Gvarh
7668	RW	Phase A kvarh Import E2	INT32	0.1	kvarh
7670	RW	Phase A kvarh Export E1	INT32	1	100 Gvarh
7672	RW	Phase A kvarh Export E2	INT32	0.1	kvarh
7674	RO	Phase A kvarh Net E1	INT32	1	100 Gvarh
7676	RO	Phase A kvarh Net E2	INT32	0.1	kvarh
7678	RO	Phase A kvarh Total E1	INT32	1	100 Gvarh
7680	RO	Phase A kvarh Total E2	INT32	0.1	kvarh
7682	RW	Phase A kVAh Total E1	INT32	1	100 GVAh
7684	RW	Phase A kVAh Total E2	INT32	0.1	kVAh
7686	RW	Phase B kWh Import E1	INT32	1	100 GWh
7688	RW	Phase B kWh Import E2	INT32	0.1	kWh
7690	RW	Phase B kWh Export E1	INT32	1	100 GWh
7692	RW	Phase B kWh Export E2	INT32	0.1	kWh
7694	RO	Phase B kWh Net E1	INT32	1	100 GWh
7696	RO	Phase B kWh Net E2	INT32	0.1	kWh
7698	RO	Phase B kWh Total E1	INT32	1	100 GWh
7700	RO	Phase B kWh Total E2	INT32	0.1	kWh
7702	RW	Phase B kvarh Import E1	INT32	1	100 Gvarh
7704	RW	Phase B kvarh Import E2	INT32	0.1	kvarh
7706	RW	Phase B kvarh Export E1	INT32	1	100 Gvarh
7708	RW	Phase B kvarh Export E2	INT32	0.1	kvarh
7710	RO	Phase B kvarh Net E1	INT32	1	100 Gvarh
7712	RO	Phase B kvarh Net E2	INT32	0.1	kvarh
7714	RO	Phase B kvarh Total E1	INT32	1	100 Gvarh
7716	RO	Phase B kvarh Total E2	INT32	0.1	kvarh
7718	RW	Phase B kVAh Total E1	INT32	1	100 GVAh
7720	RW	Phase B kVAh Total E2	INT32	0.1	kVAh
7722	RW	Phase C kWh Import E1	INT32	1	100 GWh
7724	RW	Phase C kWh Import E2	INT32	0.1	kWh
7726	RW	Phase C kWh Export E1	INT32	1	100 GWh
7728	RW	Phase C kWh Export E2	INT32	0.1	kWh

7730	RO	Phase C kWh Net E1	INT32	1	100 GWh
7732	RO	Phase C kWh Net E2	INT32	0.1	kWh
7734	RO	Phase C kWh Total E1	INT32	1	100 GWh
7736	RO	Phase C kWh Total E2	INT32	0.1	kWh
7738	RW	Phase C kvarh Import E1	INT32	1	100 Gvarh
7740	RW	Phase C kvarh Import E2	INT32	0.1	kvarh
7742	RW	Phase C kvarh Export E1	INT32	1	100 Gvarh
7744	RW	Phase C kvarh Export E2	INT32	0.1	kvarh
7746	RO	Phase C kvarh Net E1	INT32	1	100 Gvarh
7748	RO	Phase C kvarh Net E2	INT32	0.1	kvarh
7750	RO	Phase C kvarh Total E1	INT32	1	100 Gvarh
7752	RO	Phase C kvarh Total E2	INT32	0.1	kvarh
7754	RW	Phase C kVAh Total E1	INT32	1	100 GVAh
7756	RW	Phase C kVAh Total E2	INT32	0.1	kVAh

Table 5-13 Per-phase Energy Measurements (INT32)

5.10 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	

Table 5-14 DI Pulse Counter

5.11 PQ Measurement

Register	Property	Description	Format	Unit
0700	RO	Ua Deviation ¹	FLOAT	
0702	RO	Ub Deviation ¹	FLOAT	
0704	RO	Uc Deviation ¹	FLOAT	
0706	RO	Uab Deviation	FLOAT	
0708	RO	Ubc Deviation	FLOAT	
0710	RO	Uca Deviation	FLOAT	
0712	RO	Ua Over Deviation ¹	FLOAT	
0714	RO	Ub Over Deviation ¹	FLOAT	
0716	RO	Uc Over Deviation ¹	FLOAT	
0718	RO	Uab Over Deviation	FLOAT	
0720	RO	Ubc Over Deviation	FLOAT	
0722	RO	Uca Over Deviation	FLOAT	
0724	RO	Ua Under Deviation ¹	FLOAT	
0726	RO	Ub Under Deviation ¹	FLOAT	
0728	RO	Uc Under Deviation ¹	FLOAT	
0730	RO	Uab Under Deviation	FLOAT	
0732	RO	Ubc Under Deviation	FLOAT	
0734	RO	Uca Under Deviation	FLOAT	
0736	RO	Freq. Deviation	FLOAT	Hz
0738~0748	--	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	FLOAT	
0772	RO	Ub/Ubc Pst	FLOAT	
0774	RO	Uc/Uca Pst	FLOAT	
0776	RO	Ua/Uab Plt	FLOAT	

0778	RO	Ub/Ubc Plt	FLOAT	
0780	RO	Uc/Uca Plt	FLOAT	
0782	--	Reserved	--	
0784	RO	Ia TDD	FLOAT	
0786	RO	Ib TDD	FLOAT	
0788	RO	Ic TDD	FLOAT	
0790	RO	I4 TDD	FLOAT	
0792	--	Reserved	--	
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	--	Reserved	--	
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	--	Reserved	--	
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	--	Reserved	--	
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	--	Reserved	--	
0834	RO	Ua Crest Factor	FLOAT	
0836	RO	Ub Crest Factor	FLOAT	
0838	RO	Uc Crest Factor	FLOAT	
0840	--	Reserved	--	
0842	RO	Ua/Uab MSV #1	FLOAT	V
0844	RO	Ub/Ubc MSV #1	FLOAT	V
0846	RO	Uc/Uca MSV #1	FLOAT	V
0848	RO	Ua/Uab MSV #2	FLOAT	V
0850	RO	Ub/Ubc MSV #2	FLOAT	V
0852	RO	Uc/Uca MSV #2	FLOAT	V
0854	RO	Ua/Uab MSV #3	FLOAT	V
0856	RO	Ub/Ubc MSV #3	FLOAT	V
0858	RO	Uc/Uca MSV #3	FLOAT	V

Table 5-15 PQ Measurement

Note

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.

5.12 Harmonic and Interharmonic Measurement**5.12.1 Harmonic Distortion**

Register	Property	Description	Format	Unit/Scale
1000	RO	Ua/Uab THD ¹	FLOAT	%/x100
1002	RO	Ub/Ubc THD ¹	FLOAT	%/x100
1004	RO	Uc/Uca THD ¹	FLOAT	%/x100
1006	--	Reserved	--	--
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	--	Reserved	--	--
1018	RO	Ua/Uab TOHD ¹	FLOAT	%/x100
1020	RO	Ub/Ubc TOHD ¹	FLOAT	%/x100
1022	RO	Uc/Uca TOHD ¹	FLOAT	%/x100
1024	--	Reserved	--	%/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	--	Reserved	--	--
1036	RO	Ua/Uab TEHD ¹	FLOAT	%/x100
1038	RO	Ub/Ubc TEHD ¹	FLOAT	%/x100
1040	RO	Uc/Uca TEHD ¹	FLOAT	%/x100
1042	--	Reserved	--	--
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	--	Reserved	--	--
1054	RO	Ua/Uab DC Component ¹	FLOAT	%/x100
1056	RO	Ub/Ubc DC Component ¹	FLOAT	%/x100
1058	RO	Uc/Uca DC Component ¹	FLOAT	%/x100
1060	--	Reserved	--	--
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	--	Reserved	--	--
1072	RO	Ua/Uab HD01 ¹	FLOAT	%/x100
1074	RO	Ub/Ubc HD01 ¹	FLOAT	%/x100
1076	RO	Uc/Uca HD01 ¹	FLOAT	%/x100
1078	--	Reserved	--	--
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	--	Reserved	--	--
...	...	...	...	%/x100
2188	RO	Ua/Uab HD63 ¹	FLOAT	%/x100
2190	RO	Ub/Ubc HD63 ¹	FLOAT	%/x100
2192	RO	Uc/Uca HD63 ¹	FLOAT	%/x100
2194	--	Reserved	--	--
2196	RO	Ia HD63	FLOAT	%/x100
2198	RO	Ib HD63	FLOAT	%/x100
2200	RO	Ic HD63	FLOAT	%/x100
2202	RO	I4 HD63	FLOAT	%/x100
2204	--	Reserved	--	--

Table 5-16 Harmonic Distortion

Note

- 1) When the Wiring Mode is 3P3W, the Ua/Ub/Uc THD, TOHD, TEHD and Individual Harmonics mean Uab/Ubc/Uca THD, TOHD, TEHD and Individual Harmonics.

5.12.2 Harmonic RMS Measurement

Register	Property	Description	Format	Unit
2300	RO	Ua/Uab TH RMS ¹	FLOAT	V
2302	RO	Ub/Ubc TH RMS ¹	FLOAT	V
2304	RO	Uc/Uca TH RMS ¹	FLOAT	V
2306	--	Reserved	--	--
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	--	Reserved	--	--
2318	RO	Ua/Uab TOH RMS ¹	FLOAT	V
2320	RO	Ub/Ubc TOH RMS ¹	FLOAT	V
2322	RO	Uc/Uca TOH RMS ¹	FLOAT	V
2324	--	Reserved	--	--
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	--	Reserved	--	--
2336	RO	Ua/Uab TEH RMS ¹	FLOAT	V
2338	RO	Ub/Ubc TEH RMS ¹	FLOAT	V
2340	RO	Uc/Uca TEH RMS ¹	FLOAT	V
2342	--	Reserved	--	--
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	--	Reserved	--	--
2354	RO	Ua/Uab DC Component RMS ¹	FLOAT	V
2356	RO	Ub/Ubc DC Component RMS ¹	FLOAT	V
2358	RO	Uc/Uca DC Component RMS ¹	FLOAT	V
2360	--	Reserved	--	--
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	--	Reserved	--	--
2372	RO	Ua/Uab H01 RMS ¹	FLOAT	V
2374	RO	Ub/Ubc H01 RMS ¹	FLOAT	V
2376	RO	Uc/Uca H01 RMS ¹	FLOAT	V
2378	--	Reserved	--	--
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	--	Reserved	--	--
...	RO	...	...	...
3488	RO	Ua/Uab H63 RMS ¹	FLOAT	V
3490	RO	Ub/Ubc H63 RMS ¹	FLOAT	V
3492	RO	Uc/Uca H63 RMS ¹	FLOAT	V
3494	--	Reserved	--	--
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	--	Reserved	--	--

Table 5-17 Harmonic RMS Measurement

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, respectively.

5.12.3 Fundamental Power

Register	Property	Description	Format	Unit
27000	RO	P Total Fund.	FLOAT	W
27002	RO	Q Total Fund.	FLOAT	var
27004	RO	S Total Fund.	FLOAT	VA
27006	RO	dPF	FLOAT	

Table 5-18 Fundamental Power

5.12.4 Harmonic Power

Register	Property	Description	Format	Unit
28000	RO	Pa TH ¹	FLOAT	W
28002	RO	Pb TH ¹	FLOAT	W
28004	RO	Pc TH ¹	FLOAT	W
28006	RO	P TH	FLOAT	W
28008	RO	Qa TH ¹	FLOAT	var
28010	RO	Qb TH ¹	FLOAT	var
28012	RO	Qc TH ¹	FLOAT	var
28014	RO	Q TH	FLOAT	var
28016	RO	Sa TH ¹	FLOAT	VA
28018	RO	Sb TH ¹	FLOAT	VA
28020	RO	Sc TH ¹	FLOAT	VA
28022	RO	S TH	FLOAT	VA
28024	RO	PFa TH ¹	FLOAT	
28026	RO	PFb TH ¹	FLOAT	
28028	RO	PFc TH ¹	FLOAT	
28030	RO	PF TH	FLOAT	
28032~28038	--	Reserved	--	
28040	RO	Pa H01 ¹	FLOAT	W
28042	RO	Pb H01 ¹	FLOAT	W
28044	RO	Pc H01 ¹	FLOAT	W
28046	RO	Qa H01 ¹	FLOAT	var
28048	RO	Qb H01 ¹	FLOAT	var
28050	RO	Qc H01 ¹	FLOAT	var
28052	RO	Sa H01 ¹	FLOAT	VA
28054	RO	Sb H01 ¹	FLOAT	VA
28056	RO	Sc H01 ¹	FLOAT	VA
28058	RO	PFa H01 ¹	FLOAT	
28060	RO	PFb H01 ¹	FLOAT	
28062	RO	PFc H01 ¹	FLOAT	

Table 5-19 Harmonic Power

Note

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

5.12.5 Harmonic Angle

Register	Property	Description	Format	Unit
30018	RO	Ua/Uab H01 Angle ¹	FLOAT	°
30020	RO	Ub/Ubc H01 Angle ¹	FLOAT	
30022	RO	Uc/Uca H01 Angle ¹	FLOAT	
30024	--	Reserved	--	
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	--	Reserved	--	
...	RO	...	FLOAT	
31134	RO	Ua/Uab H63 Angle ¹	FLOAT	
31136	RO	Ub/Ubc H63 Angle ¹	FLOAT	
31138	RO	Uc/Uca H63 Angle ¹	FLOAT	
31140	--	Reserved	--	
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	--	Reserved	--	

Table 5-20 Harmonic Angle

Note

When the **Wiring Mode** is **3P3W**, the Phase A/B/C Voltage Individual Angles mean Phase AB/BC/CA Voltage Individual Angles, respectively.

5.12.6 Harmonic Energy (INT64)

The Energy registers will roll over to zero automatically when the maximum value is reached, which depends on the **Energy Short 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	Unit
31500	RW	Total Harmonic kWh Import	INT64	wh
31504	RW	Total Harmonic kWh Export	INT64	wh
31508	RW	Total Harmonic kvarh Import	INT64	varh
31512	RW	Total Harmonic kvarh Export	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	--	
31600	RW	Fundamental kWh Import	INT64	wh
31604	RW	Fundamental kWh Export	INT64	wh
31608	RW	Fundamental kvarh Import	INT64	varh
31612	RW	Fundamental kvarh Export	INT64	varh
31616	RO	Fundamental kWh Net	INT64	wh
31620	RO	Fundamental kWh Total	INT64	wh
31624	RO	Fundamental kvarh Net	INT64	varh
31628	RO	Fundamental kvarh Total	INT64	varh
31632	RW	kWh Imp. H02	INT64	wh
31636	RW	kWh Exp. H02	INT64	wh
31640	RW	kvarh Imp. H02	INT64	varh
31644	RW	kvarh Exp. H02	INT64	varh
...	RW	...	INT64	
32608	RW	kWh Imp. H63	INT64	Wh
32612	RW	kWh Exp. H63	INT64	Wh
32616	RW	kvarh Imp. H63	INT64	varh
32620	RW	kvarh Exp. H63	INT64	varh

Table 5-21 Harmonic Energy (INT64)

5.12.7 Harmonic Energy (INT32)

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

$$\sum kxh (\text{Import/Export/Net/Total})$$

$$= E1 \times 100 \text{ GWh} + E2 \times 0.1 \text{ kWh}$$

$$= E1 \times 10^8 \text{ kWh} + E2 \times 0.1 \text{ kWh}$$

The E1 and E2 registers have a maximum value of 100 and 1000,000,000, 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 1×10^{11} kXh. The E1 and E2 registers must be written simultaneously.

Register	Property	Description	Format	Scale	Unit
32800	RW	Total Harmonic kWh Import E1	INT32	1	100 GWh
32802	RW	Total Harmonic kWh Import E2	INT32	0.1	kWh
32804	RW	Total Harmonic kWh Export E1	INT32	1	100 GWh
32806	RW	Total Harmonic kWh Export E2	INT32	0.1	kWh
32808	RW	Total Harmonic kvarh Import E1	INT32	1	100 Gvarh
32810	RW	Total Harmonic kvarh Import E2	INT32	0.1	kvarh
32812	RW	Total Harmonic kvarh Export E1	INT32	1	100 Gvarh
32814	RW	Total Harmonic Export E2	INT32	0.1	kvarh
32816	RO	Total Harmonic kWh Net E1	INT32	1	100 GWh
32818	RO	Total Harmonic kWh Net E2	INT32	0.1	kWh
32820	RO	Total Harmonic kWh Total E1	INT32	1	100 GWh
32822	RO	Total Harmonic kWh Total E2	INT32	0.1	kWh
32824	RO	Total Harmonic kvarh Net E1	INT32	1	100 Gvarh
32826	RO	Total Harmonic kvarh Net E2	INT32	0.1	kvarh
32828	RO	Total Harmonic kvarh Total E1	INT32	1	100 Gvarh
32830	RO	Total Harmonic kvarh Total E2	INT32	0.1	kvarh
32832	RW	Fundamental kWh Import E1	INT32	1	100 GWh
32834	RW	Fundamental kWh Import E2	INT32	0.1	kWh
32836	RW	Fundamental kWh Export E1	INT32	1	100 GWh
32838	RW	Fundamental kWh Export E2	INT32	0.1	kWh
32840	RW	Fundamental kvarh Import E1	INT32	1	100 Gvarh
32842	RW	Fundamental kvarh Import E2	INT32	0.1	kvarh
32844	RW	Fundamental kvarh Export E1	INT32	1	100 Gvarh
32846	RW	Fundamental kvarh Export E2	INT32	0.1	kvarh
32848	RO	Fundamental kWh Net E1	INT32	1	100 GWh
32850	RO	Fundamental kWh Net E2	INT32	0.1	kWh
32852	RO	Fundamental kWh Total E1	INT32	1	100 GWh
32854	RO	Fundamental kWh Total E2	INT32	0.1	kWh
32856	RO	Fundamental kvarh Net E1	INT32	1	100 Gvarh
32858	RO	Fundamental kvarh Net E2	INT32	0.1	kvarh
32860	RO	Fundamental kvarh Total E1	INT32	1	100 Gvarh
32862	RO	Fundamental kvarh Total E2	INT32	0.1	kvarh

Table 5-22 Harmonic Energy (INT32)

5.12.8 Interharmonic Distortion Measurement

Register	Property	Description	Format	Unit/Scale
33100	RO	Ua/Uab TIHD ¹	FLOAT	%, x100
33102	RO	Ub/Ubc TIHD ¹	FLOAT	%, x100
33104	RO	Uc/Uca TIHD ¹	FLOAT	%, x100
33106	--	Reserved	--	--
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	--	Reserved	--	--
33118	RO	Ua/Uab TOIHD ¹	FLOAT	%, x100
33120	RO	Ub/Ubc TOIHD ¹	FLOAT	%, x100
33122	RO	Uc/Uca TOIHD ¹	FLOAT	%, x100
33124	--	Reserved	--	--
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	--	Reserved	--	--
33136	RO	Ua/Uab TEIHD ¹	FLOAT	%, x100
33138	RO	Ub/Ubc TEIHD ¹	FLOAT	%, x100
33140	RO	Uc/Uca TEIHD ¹	FLOAT	%, x100
33142	--	Reserved	--	--
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	--	Reserved	--	--
33154	RO	Ua/Uab IHD00 ¹	FLOAT	%, x100
33156	RO	Ub/Ubc IHD00 ¹	FLOAT	%, x100
33158	RO	Uc/Uca IHD00 ¹	FLOAT	%, x100
33160	--	Reserved	--	--
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	--	Reserved	--	--
33172	RO	Ua/Uab IHD01 ¹	FLOAT	%, x100
33174	RO	Ub/Ubc IHD01 ¹	FLOAT	%, x100
33176	RO	Uc/Uca IHD01 ¹	FLOAT	%, x100
33178	--	Reserved	--	--
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	--	Reserved	--	--
...	...	...	...	...
34288	RO	Ua/Uab IHD63 ¹	FLOAT	%, x100
34290	RO	Ub/Ubc IHD63 ¹	FLOAT	%, x100
34292	RO	Uc/Uca IHD63 ¹	FLOAT	%, x100
34294	--	Reserved	--	--
34296	RO	Ia IHD63	FLOAT	%, x100
34298	RO	Ib IHD63	FLOAT	%, x100
34300	RO	Ic IHD63	FLOAT	%, x100
34302	RO	I4 IHD63	FLOAT	%, x100
34304	--	Reserved	--	--

Table 5-23 Interharmonic Distortion Measurement

Note

- 1) When the Wiring Mode is 3P3W, the Ua/Ub/Uc TIHD, TOIHD, TEIHD and Individual IHDs mean Uab/Ubc/Uca TIHD, TOIHD, TEIHD and Individual IHDs, respectively.

5.12.9 Interharmonic RMS Measurement

Register	Property	Description	Format	Unit
34500	RO	Ua/Uab TIH RMS ¹	FLOAT	V
34502	RO	Ub/Ubc TIH RMS ¹	FLOAT	V
34504	RO	Uc/Uca TIH RMS ¹	FLOAT	V
34506	--	Reserved	--	--
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	--	Reserved	--	--
34518	RO	Ua/Uab TOIH RMS ¹	FLOAT	V
34520	RO	Ub/Ubc TOIH RMS ¹	FLOAT	V
34522	RO	Uc/Uca TOIH RMS ¹	FLOAT	V
34524	--	Reserved	--	--
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	--	Reserved	--	--
34536	RO	Ua/Uab TEIH RMS ¹	FLOAT	V
34538	RO	Ub/Ubc TEIH RMS ¹	FLOAT	V
34540	RO	Uc/Uca TEIH RMS ¹	FLOAT	V
34542	--	Reserved	--	--
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	--	Reserved	--	--
34554	RO	Ua/Uab IH00 RMS ¹	FLOAT	V
34556	RO	Ub/Ubc IH00 RMS ¹	FLOAT	V
34558	RO	Uc/Uca IH00 RMS ¹	FLOAT	V
34560	--	Reserved	--	--
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	--	Reserved	--	--
34572	RO	Ua/Uab IH01 RMS ¹	FLOAT	V
34574	RO	Ub/Ubc IH01 RMS ¹	FLOAT	V
34576	RO	Uc/Uca IH01 RMS ¹	FLOAT	V
34578	--	Reserved	--	--
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	--	Reserved	--	--
...	RO	...	FLOAT	
35688	RO	Ua/Uab IH63 RMS ¹	FLOAT	V
35690	RO	Ub/Ubc IH63 RMS ¹	FLOAT	V
35692	RO	Uc/Uca IH63 RMS ¹	FLOAT	V
35694	--	Reserved	--	--
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	--	Reserved	--	--

Table 5-24 Interharmonic RMS Measurement

Note

- 1) When the Wiring Mode is 3P3W, 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.

5.13 Demand

5.13.1 Present Demand

Register	Property	Description	Format	Unit
3600	RO	Ua ¹	FLOAT	V
3602	RO	Ub ¹	FLOAT	V
3604	RO	Uc ¹	FLOAT	V
3606	RO	Uln Avg.	FLOAT	V
3608	--	Reserved	--	--
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	--	Reserved	--	A
3630	RO	Pa Imp. ¹	FLOAT	W
3632	RO	Pb Imp. ¹	FLOAT	W
3634	RO	Pc Imp. ¹	FLOAT	W
3636	RO	P Total Imp.	FLOAT	W
3638	RO	Pa Exp. ¹	FLOAT	W
3640	RO	Pb Exp. ¹	FLOAT	W
3642	RO	Pc Exp. ¹	FLOAT	W
3644	RO	P Total Exp.	FLOAT	W
3646	RO	Qa Imp. ¹	FLOAT	var
3648	RO	Qb Imp. ¹	FLOAT	var
3650	RO	Qc Imp. ¹	FLOAT	var
3652	RO	Q Total Imp.	FLOAT	var
3654	RO	Qa Exp. ¹	FLOAT	var
3656	RO	Qb Exp. ¹	FLOAT	var
3658	RO	Qc Exp. ¹	FLOAT	var
3660	RO	Q Total Exp.	FLOAT	var
3662	RO	kVAa ¹	FLOAT	VA
3664	RO	kVAb ¹	FLOAT	VA
3666	RO	kVAc ¹	FLOAT	VA
3668	RO	S Total	FLOAT	VA
3670	RO	PFa ¹	FLOAT	--
3672	RO	PFb ¹	FLOAT	--
3674	RO	PFc ¹	FLOAT	--
3676	RO	PF Total	FLOAT	--
3678	RO	Frequency	FLOAT	Hz
3680	RO	Ua Deviation ¹	FLOAT	100%
3682	RO	Ub Deviation ¹	FLOAT	100%
3684	RO	Uc Deviation ¹	FLOAT	100%
3686	RO	Uab Deviation	FLOAT	100%
3688	RO	Ubc Deviation	FLOAT	100%
3690	RO	Uca Deviation	FLOAT	100%
3692	RO	Ua Over Deviation ¹	FLOAT	100%
3694	RO	Ub Over Deviation ¹	FLOAT	100%
3696	RO	Uc Over Deviation ¹	FLOAT	100%
3698	RO	Uab Over Deviation	FLOAT	100%
3700	RO	Ubc Over Deviation	FLOAT	100%
3702	RO	Uca Over Deviation	FLOAT	100%
3704	RO	Ua Under Deviation ¹	FLOAT	100%
3706	RO	Ub Under Deviation ¹	FLOAT	100%
3708	RO	Uc Under Deviation ¹	FLOAT	100%
3710	RO	Uab Under Deviation	FLOAT	100%

3712	RO	Ubc Under Deviation	FLOAT	100%
3714	RO	Uca Under Deviation	FLOAT	100%
3716	RO	Frequency Deviation	FLOAT	100%
3718	RO	U0 Unbal.	FLOAT	
3720	RO	U2 Unbal.	FLOAT	
3722	RO	I0 Unbal.	FLOAT	
3724	RO	I2 Unbal.	FLOAT	
3726	RO	Ia K-Factor	FLOAT	
3728	RO	Ib K-Factor	FLOAT	
3730	RO	Ic K-Factor	FLOAT	
3732	RO	I4 K-Factor	FLOAT	
3734	--	Reserved	--	
3736	RO	Ua/Uab THD ²	FLOAT	
3738	RO	Ub/Ubc THD ²	FLOAT	
3740	RO	Uc/Uca THD ²	FLOAT	
3742	--	Reserved	--	--
3744	RO	Ia THD	FLOAT	
3746	RO	Ib THD	FLOAT	
3748	RO	Ic THD	FLOAT	
3750	RO	I4 THD	FLOAT	
3752	--	Reserved	--	
3754	RO	Ua/Uab TOHD ²	FLOAT	
3756	RO	Ub/Ubc TOHD ²	FLOAT	
3758	RO	Uc/Uca TOHD ²	FLOAT	
3760	--	Reserved	--	--
3762	RO	Ia TOHD	FLOAT	
3764	RO	Ib TOHD	FLOAT	
3766	RO	Ic TOHD	FLOAT	
3768	RO	I4 TOHD	FLOAT	
3770	--	Reserved	--	
3772	RO	Ua/Uab TEHD ²	FLOAT	
3774	RO	Ub/Ubc TEHD ²	FLOAT	
3776	RO	Uc/Uca TEHD ²	FLOAT	
3778	--	Reserved	--	--
3780	RO	Ia TEHD	FLOAT	
3782	RO	Ib TEHD	FLOAT	
3784	RO	Ic TEHD	FLOAT	
3786	RO	I4 TEHD	FLOAT	
3788	--	Reserved	--	
3790	RO	Ia Fund.	FLOAT	A
3792	RO	Ib Fund.	FLOAT	A
3794	RO	Ic Fund.	FLOAT	A
3796	RO	I4 Fund.	FLOAT	A
3798	--	Reserved	--	--
3800	RO	In	FLOAT	A
3804	RO	IR	FLOAT	A

Table 5-25 Present Demand

Note

- 1) When the Wiring Mode is 3P3W, the Present Demands for Ua/Ub/Uc, Uln Average, P Import/Export, Q Import/Export, S, PF, and Voltage Deviation, have no meaning and their registers are reserved.
- 2) When the Wiring Mode is 3P3W, the Present Demands for Ua/Ub/Uc THD, TOHD and TEHD mean the Demands for Uab/Ubc/Uca THD, TOHD and TEHD.

5.13.2 Predicted Demand

Register	Property	Description	Format	Unit
3900	RO	Ua ¹	FLOAT	V
3902	RO	Ub ¹	FLOAT	V
3904	RO	Uc ¹	FLOAT	V
3906	RO	Uln Avg.	FLOAT	V
3908	--	Reserved	--	--

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3910	RO	Uab	FLOAT	V
3912	RO	Ubc	FLOAT	V
3914	RO	Uca	FLOAT	V
3916	RO	UII 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	--	Reserved	--	A
3930	RO	Pa Imp. ¹	FLOAT	W
3932	RO	Pb Imp. ¹	FLOAT	W
3934	RO	Pc Imp. ¹	FLOAT	W
3936	RO	P Total Imp.	FLOAT	W
3938	RO	Pa Exp. ¹	FLOAT	W
3940	RO	Pb Exp. ¹	FLOAT	W
3942	RO	Pc Exp. ¹	FLOAT	W
3944	RO	P Total Exp.	FLOAT	W
3946	RO	Qa Imp. ¹	FLOAT	var
3948	RO	Qb Imp. ¹	FLOAT	var
3950	RO	Qc Imp. ¹	FLOAT	var
3952	RO	Q Total Imp.	FLOAT	var
3954	RO	Qa Exp. ¹	FLOAT	var
3956	RO	Qb Exp. ¹	FLOAT	var
3958	RO	Qc Exp. ¹	FLOAT	var
3960	RO	Q Total Exp.	FLOAT	var
3962	RO	kVAa ¹	FLOAT	VA
3964	RO	kVAb ¹	FLOAT	VA
3966	RO	kVAc ¹	FLOAT	VA
3968	RO	S Total	FLOAT	VA
3970	RO	PFa ¹	FLOAT	-
3972	RO	PFb ¹	FLOAT	-
3974	RO	PFc ¹	FLOAT	-
3976	RO	PF Total	FLOAT	-
3978	RO	Frequency	FLOAT	Hz
3980	RO	Ia Fund.	FLOAT	A
3982	RO	Ib Fund.	FLOAT	A
3984	RO	Ic Fund.	FLOAT	A
3986	RO	I4 Fund.	FLOAT	A
3988	--	Reserved	--	--
3990	RO	In	FLOAT	A
3992	RO	IR	FLOAT	A

Table 5-26 Predicted Demand

Note

- 1) When the Wiring Mode is 3P3W, the Predicted Demands for Ua/Ub/Uc, UII Average, P Import/Export, Q Import/Export, S and PF, have no meaning and their registers are reserved.

5.13.3 Max. Value per Demand Period

Register	Property	Description	Format	Unit
4100	RO	Ua ¹	See Table 5-30	V
4106	RO	Ub ¹		
4112	RO	Uc ¹		
4118	RO	Uln Avg. ¹		
4124	--	Reserved		
4130	RO	Uab		
4136	RO	Ubc		
4142	RO	Uca		
4148	RO	Ull Avg.		A
4154	RO	Ia		
4160	RO	Ib		
4166	RO	Ic		
4172	RO	I avg		
4178	RO	I4		W
4184	RO	Reserved		
4190	RO	Pa Imp. ¹		
4196	RO	Pb Imp. ¹		W
4202	RO	Pc Imp. ¹		
4208	RO	P Imp. Total		
4214	RO	Pa Exp. ¹		var
4220	RO	Pb Exp. ¹		
4226	RO	Pc Exp. ¹		
4232	RO	P Exp. Total		VA
4238	RO	Qa Imp. ¹		
4244	RO	Qb Imp. ¹		
4250	RO	Qc Imp. ¹		Hz
4256	RO	Q Imp. Total		
4262	RO	Qa Exp. ¹		
4268	RO	Qb Exp. ¹		100%
4274	RO	Qc Exp. ¹		
4280	RO	Q Exp. Total		
4286	RO	kVAa ¹		
4292	RO	kVAb ¹		
4298	RO	kVAc ¹		
4304	RO	S Total		
4310	RO	PFa ¹		
4316	RO	PFb ¹		
4322	RO	PFc ¹		
4328	RO	PF Total		
4334	RO	Frequency		
4340	RO	Ua Deviation ¹		
4346	RO	Ub Deviation ¹		
4352	RO	Uc Deviation ¹		
4358	RO	Uab Deviation		
4364	RO	Ubc Deviation		
4370	RO	Uca Deviation		
4376	RO	Ua Over Deviation ¹		
4382	RO	Ub Over Deviation ¹		
4388	RO	Uc Over Deviation ¹		
4394	RO	Uab Over Deviation		
4400	RO	Ubc Over Deviation		
4406	RO	Uca Over Deviation		
4412	RO	Ua Under Deviation ¹		
4418	RO	Ub Under Deviation ¹		
4424	RO	Uc Under Deviation ¹		
4430	RO	Uab Under Deviation		
4436	RO	Ubc Under Deviation		
4442	RO	Uca Under Deviation		

4448	RO	Frequency Deviation		
4454	RO	U0 Unbalance		
4460	RO	U2 Unbalance		
4466	RO	I0 Unbalance		
4472	RO	I2 Unbalance		
4478	RO	Ia K-Factor		
4484	RO	Ib K-Factor		
4490	RO	Ic K-Factor		
4496	RO	I4 K-Factor		
4502	RO	Reserved		
4508	RO	Ua/Uab THD ²		
4514	RO	Ub/Ubc THD ²		
4520	RO	Uc/Uca THD ²		
4526	--	Reserved		
4532	RO	Ia THD		
4538	RO	Ib THD		
4544	RO	Ic THD		
4550	RO	I4 THD		
4556	RO	Reserved		
4562	RO	Ua/Uab TOHD ²		
4568	RO	Ub/Ubc TOHD ²		
4574	RO	Uc/Uca TOHD ²		
4580	--	Reserved		
4586	RO	Ia TOHD		
4592	RO	Ib TOHD		
4598	RO	Ic TOHD		
4604	RO	I4 TOHD		
4610	RO	Reserved		
4616	RO	Ua/Uab TEHD ²		
4622	RO	Ub/Ubc TEHD ²		
4628	RO	Uc/Uca TEHD ²		
4634	--	Reserved		
4640	RO	Ia TEHD		
4646	RO	Ib TEHD		
4652	RO	Ic TEHD		
4658	RO	I4 TEHD		
4664	RO	Reserved		
4670	RO	Ia Fund.		A
4676	RO	Ib Fund.		A
4682	RO	Ic Fund.		A
4688	RO	I4 Fund.		A

Table 5-27 Max. Value per Demand Period

Note

- 1) When the Wiring Mode is 3P3W, the Max. Value per Demand Period for Ua/Ub/Uc, Uln Average, P Import/Export, Q Import/Export, S, PF, and Voltage Deviation, have no meaning and their registers are reserved.
- 2) When the Wiring Mode is 3P3W, the Max. Value per Demand Period for Ua/Ub/Uc THD, TOHD and TEHD mean the Demands for Uab/Ubc/Uca THD, TOHD and TEHD.

5.13.4 Min. Value per Demand Period

Register	Property	Description	Format	Unit
4800	RO	Ua ¹	See Table 5-30	V
4806	RO	Ub ¹		
4812	RO	Uc ¹		
4818	RO	Uln Avg. ¹		
4824	--	Reserved		
4830	RO	Uab		
4836	RO	Ubc		
4842	RO	Uca		
4848	RO	Ull Avg.		
4854	RO	Ia		A
4860	RO	Ib		
4866	RO	Ic		
4872	RO	I Avg.		
4878	RO	I4		
4884	--	Reserved		W
4890	RO	Pa Imp. ¹		
4896	RO	Pb Imp. ¹		
4902	RO	Pc Imp. ¹		
4908	RO	P Imp. Total		
4914	RO	Pa Exp. ¹		W
4920	RO	Pb Exp. ¹		
4926	RO	Pc Exp. ¹		
4932	RO	P Exp. Total		
4938	RO	Qa Imp. ¹		var
4944	RO	Qb Imp. ¹		
4950	RO	Qc Imp. ¹		
4956	RO	Q Imp. Total		
4962	RO	Qa Exp. ¹		
4968	RO	Qb Exp. ¹		
4974	RO	Qc Exp. ¹		
4980	RO	Q Exp. Total		
4986	RO	kVAa ¹		VA
4992	RO	kVAb ¹		
4298	RO	kVAc ¹		
5004	RO	S Total		
5010	RO	PFa ¹		
5016	RO	PFb ¹		
5022	RO	PFc ¹		
5028	RO	PF Total		
5034	RO	Freq.		Hz
5040	RO	Ua Deviation ¹		100%
5046	RO	Ub Deviation ¹		
5052	RO	Uc Deviation ¹		
5058	RO	Uab Deviation		
5064	RO	Ubc Deviation		
5070	RO	Uca Deviation		
5076	RO	Ua Over Deviation ¹		
5082	RO	Ub Over Deviation ¹		
5088	RO	Uc Over Deviation ¹		
5094	RO	Uab Over Deviation		
5100	RO	Ubc Over Deviation		
5106	RO	Uca Over Deviation		
5112	RO	Ua Under Deviation ¹		
5118	RO	Ub Under Deviation ¹		
5124	RO	Uc Under Deviation ¹		
5130	RO	Uab Under Deviation		
5136	RO	Ubc Under Deviation		
5142	RO	Uca Under Deviation		

5148	RO	Freq. Deviation		
5154	RO	U0 Unbalance		
5160	RO	U2 Unbalance		
5166	RO	I0 Unbalance		
5172	RO	I2 Unbalance		
5178	RO	Ia K-Factor		
5184	RO	Ib K-Factor		
5190	RO	Ic K-Factor		
5196	RO	I4 K-Factor		
5202	--	Reserved		
5208	RO	Ua/Uab THD ²		
5214	RO	Ub/Ubc THD ²		
5220	RO	Uc/Uca THD ²		
5226	--	Reserved		
5232	RO	Ia THD		
5238	RO	Ib THD		
5244	RO	Ic THD		
5250	RO	I4 THD		
5256	--	Reserved		
5262	RO	Ua/Uab TOHD ²		
5268	RO	Ub/Ubc TOHD ²		
5274	RO	Uc/Uca TOHD ²		
5280	--	Reserved		
5286	RO	Ia TOHD		
5292	RO	Ib TOHD		
5298	RO	Ic TOHD		
5304	RO	I4 TOHD		
5310	RO	Reserved		
5316	RO	Ua/Uab TEHD ²		
5322	RO	Ub/Ubc TEHD ²		
5328	RO	Uc/Uca TEHD ²		
5334	--	Reserved		
5340	RO	Ia TEHD		
5346	RO	Ib TEHD		
5352	RO	Ic TEHD		
5358	RO	I4 TEHD		
5364	--	Reserved		
5370	RO	Ia Fund.		A
5376	RO	Ib Fund.		A
5382	RO	Ic Fund.		A
5388	RO	I4 Fund.		A

Table 5-28 Min. Value per Demand Period

Note

- 1) When the Wiring Mode is 3P3W, the Min. Value per Demand Period for Ua/Ub/Uc, Uln Average, P Import/Export, Q Import/Export, S, PF, and Voltage Deviation, have no meaning and their registers are reserved.
- 2) When the Wiring Mode is 3P3W, the Min. Value per Demands for Ua/Ub/Uc THD, TOHD and TEHD mean the Demands for Uab/Ubc/Uca THD, TOHD and TEHD.

5.13.5 This/Last Max. Demand Log

This Max.	Last Max.	Property	Description	Format	Unit
5500	5700	RO	P Imp. Total	See Table 5-30	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
5572	5772	RO	I Avg.		A
5578	5778	RO	UII Avg.		V

Table 5-29 This/Last Max. Demand Log

Note

- 1) The following table illustrates Demand Data Structure:

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

Table 5-30 Demand Data Structure

5.14 Real-time IER and AER

5.14.1 Real-time 3-phase Total IER and AER (INT64)

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

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

IER	AER	Property	Description	Format	Unit
5800	5900	RO	Total RMS kWh Import	INT64	wh
5804	5904	RO	Total RMS kWh Export	INT64	wh
5808	5908	RO	Total RMS kWh Total	INT64	wh
5812	5912	RO	Total RMS kvarh Import	INT64	varh
5816	5916	RO	Total RMS kvarh Export	INT64	varh
5820	5920	RO	Total RMS kvarh Total	INT64	varh
5824	5924	RO	Total RMS kVAh Total	INT64	VAh
5828	5928	RO	Fundamental kWh Import	INT64	wh
5832	5932	RO	Fundamental kWh Export	INT64	wh
5836	5936	RO	Fundamental kvarh Import	INT64	varh
5840	5940	RO	Fundamental kvarh Export	INT64	varh
5844	5944	RO	Total Harmonic kWh Import	INT64	wh
5848	5948	RO	Total Harmonic kWh Export	INT64	wh
5852	5952	RO	Total Harmonic kvarh Import	INT64	varh
5856	5956	RO	Total Harmonic kvarh Export	INT64	varh
5860	5960	RO	Total RMS kWh Net	INT64	wh
5864	5964	RO	Total RMS kvarh Net	INT64	varh

Table 5-31 Real-time 3-phase Total IER and AER (INT64)

5.14.2 Real-time 3-phase Total IER and AER (INT32)

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

$$\sum kxh \text{ (Import/Export/Net/Total)}$$

$$= E1 \times 100 \text{ GWh} + E2 \times 0.1 \text{ kWh}$$

$$= E1 \times 10^8 \text{ kWh} + E2 \times 0.1 \text{ kWh}$$

The E1 and E2 registers have a maximum value of 100 and 1000,000,000, 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 kWh (Import/Export/Net/Total) has a maximum value of 1×10^{11} kWh. The E1 and E2 registers must be written simultaneously.

IER	AER	Property	Description	Format	Scale	Unit
6000	6100	RO	Total RMS kWh Import E1	INT32	1	100 GWh
6002	6102	RO	Total RMS kWh Import E2	INT32	0.1	kWh
6004	6104	RO	Total RMS kWh Export E1	INT32	1	100 GWh
6006	6106	RO	Total RMS kWh Export E2	INT32	0.1	kWh
6008	6108	RO	Total RMS kWh Total E1	INT32	1	100 GWh
6010	6110	RO	Total RMS kWh Total E2	INT32	0.1	kWh
6012	6112	RO	Total RMS kvarh Import E1	INT32	1	100 Gvarh
6014	6114	RO	Total RMS kvarh Import E2	INT32	0.1	kvarh
6016	6116	RO	Total RMS kvarh Export E1	INT32	1	100 Gvarh
6018	6118	RO	Total RMS kvarh Export E2	INT32	0.1	kvarh
6020	6120	RO	Total RMS kvarh Total E1	INT32	1	100 Gvarh
6022	6122	RO	Total RMS kvarh Total E2	INT32	0.1	kvarh
6024	6124	RO	Total RMS kVAh Total E1	INT32	1	100 GVAh
6026	6126	RO	Total RMS kVAh Total E2	INT32	0.1	GVAh
6028	6128	RO	Fundamental kWh Import E1	INT32	1	100 GWh
6030	6130	RO	Fundamental kWh Import E2	INT32	0.1	kWh
6032	6132	RO	Fundamental kWh Export E1	INT32	1	100 GWh
6034	6134	RO	Fundamental kWh Export E2	INT32	0.1	kWh
6036	6136	RO	Fundamental kvarh Import E1	INT32	1	100 Gvarh
6038	6138	RO	Fundamental kvarh Import E2	INT32	0.1	kvarh
6040	6140	RO	Fundamental kvarh Export E1	INT32	1	100 Gvarh
6042	6142	RO	Fundamental kvarh Export E2	INT32	0.1	kvarh
6044	6144	RO	Total Harmonic kWh Import E1	INT32	1	100 GWh
6046	6146	RO	Total Harmonic kWh Import E2	INT32	0.1	kWh
6048	6148	RO	Total Harmonic kWh Export E1	INT32	1	100 GWh
6050	6150	RO	Total Harmonic kWh Export E2	INT32	0.1	kWh
6052	6152	RO	Total Harmonic kvarh Import E1	INT32	1	100 Gvarh
6054	6154	RO	Total Harmonic kvarh Import E2	INT32	0.1	kvarh
6056	6156	RO	Total Harmonic kvarh Export E1	INT32	1	100 Gvarh
6058	6158	RO	Total Harmonic kvarh Export E2	INT32	0.1	kvarh
6060	6160	RO	Total RMS kWh Net E1	INT32	1	100 GWh
6062	6162	RO	Total RMS kWh Net E2	INT32	0.1	kWh
6064	6164	RO	Total RMS kvarh Net E1	INT32	1	100 Gvarh
6066	6166	RO	Total RMS kvarh Net E2	INT32	0.1	kvarh

Table 5-32 Real-time 3-phase Total IER and AER (INT32)

5.14.3 Real-time Per-phase IER and AER (INT64)

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

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

IER	AER	Property	Description	Format	Unit
7800	7950	RO	Phase A kWh Import	INT64	wh
7804	7954	RO	Phase A kWh Export	INT64	wh
7808	7958	RO	Phase A kWh Net	INT64	wh
7812	7962	RO	Phase A kWh Total	INT64	wh
7816	7966	RO	Phase A kvarh Import	INT64	varh
7820	7970	RO	Phase A kvarh Export	INT64	varh
7824	7974	RO	Phase A kvarh Net	INT64	varh
7828	7978	RO	Phase A kvarh Total	INT64	varh
7832	7982	RO	Phase A kVAh Total	INT64	VAh
7836	7986	RO	Phase B kWh Import	INT64	wh
7840	7990	RO	Phase B kWh Export	INT64	wh
7844	7994	RO	Phase B kWh Net	INT64	wh
7848	7998	RO	Phase B kWh Total	INT64	wh
7852	8002	RO	Phase B kvarh Import	INT64	varh
7856	8006	RO	Phase B kvarh Export	INT64	varh
7860	8010	RO	Phase B kvarh Net	INT64	varh
7864	8014	RO	Phase B kvarh Total	INT64	varh
7868	8018	RO	Phase B kVAh Total	INT64	VAh
7872	8022	RO	Phase C kWh Import	INT64	wh
7876	8026	RO	Phase C kWh Export	INT64	wh
7880	8030	RO	Phase C kWh Net	INT64	wh

7884	8034	RO	Phase C kWh Total	INT64	wh
7888	8038	RO	Phase C kvarh Import	INT64	varh
7892	8042	RO	Phase C kvarh Export	INT64	varh
7896	8046	RO	Phase C kvarh Net	INT64	varh
7900	8050	RO	Phase C kvarh Total	INT64	varh
7904	8054	RO	Phase C kVAh Total	INT64	VAh

Table 5-33 Real-time Per-phase IER and AER (INT64)

5.14.4 Real-time Per-phase IER and AER (INT32)

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

$$\sum kxh (\text{Import/Export/Net/Total})$$

$$= E1 \times 100 \text{ GWh} + E2 \times 0.1 \text{ kWh}$$

$$= E1 \times 10^8 \text{ kWh} + E2 \times 0.1 \text{ kWh}$$

The E1 and E2 registers have a maximum value of 100 and 1000,000,000, 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 $1 \times 10^{11} \text{ kXh}$. The E1 and E2 registers must be written simultaneously.

IER	AER	Property	Description	Format	Scale	Unit
8100	8250	RO	Phase A kWh Import E1	INT32	1	100 GWh
8102	8252	RO	Phase A kWh Import E2	INT32	0.1	kWh
8104	8254	RO	Phase A kWh Export E1	INT32	1	100 GWh
8106	8256	RO	Phase A kWh Export E2	INT32	0.1	kWh
8108	8258	RO	Phase A kWh Net E1	INT32	1	100 GWh
8110	8260	RO	Phase A kWh Net E2	INT32	0.1	kWh
8112	8262	RO	Phase A kWh Total E1	INT32	1	100 GWh
8114	8264	RO	Phase A kWh Total E2	INT32	0.1	kWh
8116	8266	RO	Phase A kvarh Import E1	INT32	1	100 Gvarh
8118	8268	RO	Phase A kvarh Import E2	INT32	0.1	kvarh
8120	8270	RO	Phase A kvarh Export E1	INT32	1	100 Gvarh
8122	8272	RO	Phase A kvarh Export E2	INT32	0.1	kvarh
8124	8274	RO	Phase A kvarh Net E1	INT32	1	100 Gvarh
8126	8276	RO	Phase A kvarh Net E2	INT32	0.1	kvarh
8128	8278	RO	Phase A kvarh Total E1	INT32	1	100 Gvarh
8130	8280	RO	Phase A kvarh Total E2	INT32	0.1	kvarh
8132	8282	RO	Phase A kVAh Total E1	INT32	1	100 GVAh
8134	8284	RO	Phase A kVAh Total E2	INT32	0.1	kVAh
8136	8286	RO	Phase B kWh Import E1	INT32	1	100 GWh
8138	8288	RO	Phase B kWh Import E2	INT32	0.1	kWh
8140	8290	RO	Phase B kWh Export E1	INT32	1	100 GWh
8142	8292	RO	Phase B kWh Export E2	INT32	0.1	kWh
8144	8294	RO	Phase B kWh Net E1	INT32	1	100 GWh
8146	8296	RO	Phase B kWh Net E2	INT32	0.1	kWh
8148	8298	RO	Phase B kWh Total E1	INT32	1	100 GWh
8150	8300	RO	Phase B kWh Total E2	INT32	0.1	kWh
8152	8302	RO	Phase B kvarh Import E1	INT32	1	100 Gvarh
8154	8304	RO	Phase B kvarh Import E2	INT32	0.1	kvarh
8156	8306	RO	Phase B kvarh Export E1	INT32	1	100 Gvarh
8158	8308	RO	Phase B kvarh Export E2	INT32	0.1	kvarh
8160	8310	RO	Phase B kvarh Net E1	INT32	1	100 Gvarh
8162	8312	RO	Phase B kvarh Net E2	INT32	0.1	kvarh
8164	8314	RO	Phase B kvarh Total E1	INT32	1	100 Gvarh
8166	8316	RO	Phase B kvarh Total E2	INT32	0.1	kvarh
8168	8318	RO	Phase B kVAh Total E1	INT32	1	100 GVAh
8170	8320	RO	Phase B kVAh Total E2	INT32	0.1	kVAh
8172	8322	RO	Phase C kWh Import E1	INT32	1	100 GWh
8174	8324	RO	Phase C kWh Import E2	INT32	0.1	kWh
8176	8326	RO	Phase C kWh Export E1	INT32	1	100 GWh
8178	8328	RO	Phase C kWh Export E2	INT32	0.1	kWh
8180	8330	RO	Phase C kWh Net E1	INT32	1	100 GWh
8182	8332	RO	Phase C kWh Net E2	INT32	0.1	kWh
8184	8334	RO	Phase C kWh Total E1	INT32	1	100 GWh
8186	8336	RO	Phase C kWh Total E2	INT32	0.1	kWh
8188	8338	RO	Phase C kvarh Import E1	INT32	1	100 Gvarh
8190	8340	RO	Phase C kvarh Import E2	INT32	0.1	kvarh
8192	8342	RO	Phase C kvarh Export E1	INT32	1	100 Gvarh
8194	8344	RO	Phase C kvarh Export E2	INT32	0.1	kvarh

8196	8346	RO	Phase C kvarh Net E1	INT32	1	100 Gvarh
8198	8348	RO	Phase C kvarh Net E2	INT32	0.1	kvarh
8200	8350	RO	Phase C kvarh Total E1	INT32	1	100 Gvarh
8202	8352	RO	Phase C kvarh Total E2	INT32	0.1	kvarh
8204	8354	RO	Phase C kVAh Total E1	INT32	1	100 GVAh
8206	8356	RO	Phase C kVAh Total E2	INT32	0.1	kVAh

Table 5-34 Real-time Per-phase IER and AER (INT32)

5.15 Real-time Energy Consumption

Register	Property	Description	Format	Unit
8400	RO	Today's RMS kWh Import Consumption	INT64	wh
8404	RO	Today's RMS kWh Export Consumption	INT64	wh
8408	RO	Today's RMS kvarh Import Consumption	INT64	varh
8412	RO	Today's RMS kvarh Export Consumption	INT64	varh
8416	RO	Today's RMS kVAh Consumption	INT64	VAh
8420	RO	RMS kWh Import Consumption in This Month	INT64	wh
8424	RO	RMS kWh Export Consumption in This Month	INT64	wh
8428	RO	RMS kvarh Import Consumption in This Month	INT64	varh
8432	RO	RMS kvarh Export Consumption in This Month	INT64	varh
8436	RO	RMS kVAh Consumption in This Month	INT64	VAh

Table 5-35 Real-time Energy Consumption

5.16 2kHz - 9kHz C.E. Real-time Measurement

Register	Property	Description	Format	Unit
6200	RO	Timestamp-sec (UNIX) ¹	UINT32	s
6202	RO	Timestamp-ms (UNIX) ¹	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	
6414-6839	RO	Reserved	--	
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 5-36 2kHz - 150kHz C.E. Real-time Measurement

Note

1. The Second register and the Millisecond register must be read in a single transaction.

5.17 MB Slave Real-time Measurements

In Firmware V1.50.01 and later, the iMeter 5 supports up to 31 downstream Modbus Slave devices. Writing Slave ID No. to register 8500 will update the slave's real-time measurements read from register 8501 to 8755.

Register	Property	Description	Format	Scale/Unit	Notes
8500	RW	MB Slave ID No.	UINT16	--	1 to 31
8501	RO	Ua	FLOAT	V, x1	
8503	RO	Ub	FLOAT	V, x1	
8505	RO	Uc	FLOAT	V, x1	
8507	RO	Uln Avg.	FLOAT	V, x1	
8509	RO	Ung	FLOAT	V, x1	
8511	RO	Uab	FLOAT	V, x1	
8513	RO	Ubc	FLOAT	V, x1	
8515	RO	Uca	FLOAT	V, x1	

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8517	RO	Ull average	FLOAT	V, x1	
8519	RO	Ia	FLOAT	A, x1	
8521	RO	Ib	FLOAT	A, x1	
8523	RO	Ic	FLOAT	A, x1	
8525	RO	I Avg.	FLOAT	A, x1	
8527	RO	Pa	FLOAT	W, x1	
8529	RO	Pb	FLOAT	W, x1	
8531	RO	Pc	FLOAT	W, x1	
8533	RO	P Total	FLOAT	W, x1	
8535	RO	Qa	FLOAT	var, x1	
8537	RO	Qb	FLOAT	var, x1	
8539	RO	Qc	FLOAT	var, x1	
8541	RO	Q Total	FLOAT	var, x1	
8543	RO	Sa	FLOAT	VA, x1	
8545	RO	Sb	FLOAT	VA, x1	
8547	RO	Sc	FLOAT	VA, x1	
8549	RO	S Total	FLOAT	VA, x1	
8551	RO	PFa	FLOAT	--	
8553	RO	PFb	FLOAT	--	
8555	RO	PFc	FLOAT	--	
8557	RO	PF Total	FLOAT	--	
8559	RO	Frequency	FLOAT	Hz, x1	
8561	RO	Ua (3P4W) / Uab (3P3W) Phase Angle	FLOAT	°	
8563	RO	Ub (3P4W) / Ubc (3P3W) Phase Angle	FLOAT	°	
8565	RO	Uc (3P4W) / Uca (3P3W) Phase Angle	FLOAT	°	
8567	RO	Ia Phase Angle	FLOAT	°	
8569	RO	Ib Phase Angle	FLOAT	°	
8571	RO	Ic Phase Angle	FLOAT	°	
8573	RO	In (Calculated)	FLOAT	A, x1	
8575	RO	I4	FLOAT	A, x1	
8577	RO	dPF	FLOAT	--	
8579	RO	Device Operating Time	UINT32	Hour, x0.1	
8581	RO	U1 (Positive Sequence)	FLOAT	V, x1	
8583	RO	U2 (Negative Sequence)	FLOAT	V, x1	
8585	RO	U0 (Zero Sequence)	FLOAT	V, x1	
8587	RO	I1 (Positive Sequence)	FLOAT	A, x1	
8589	RO	I2 (Negative Sequence)	FLOAT	A, x1	
8591	RO	I0 (Zero Sequence)	FLOAT	A, x1	
8593	RO	kWh Import	INT32	kWh, x0.1	
8595	RO	kWh Export	INT32	kWh, x0.1	
8597	RO	kWh Net	INT32	kWh, x0.1	
8599	RO	kWh Total	INT32	kWh, x0.1	
8601	RO	kvarh Import	INT32	kvarh, x0.1	
8603	RO	kvarh Export	INT32	kvarh, x0.1	
8605	RO	kvarh Net	INT32	kvarh, x0.1	
8607	RO	kvarh Total	INT32	kvarh, x0.1	
8609	RO	kVAh	INT32	kVAh, x0.1	
8611	RO	Ia Present Demand	FLOAT	A, x1	
8613	RO	Ib Present Demand	FLOAT	A, x1	
8615	RO	Ic Present Demand	FLOAT	A, x1	
8617	RO	I average Present Demand	FLOAT	A, x1	
8619	RO	Ua Present Demand	FLOAT	V, x1	
8621	RO	Ub Present Demand	FLOAT	V, x1	
8623	RO	Uc Present Demand	FLOAT	V, x1	
8625	RO	Uln average Present Demand	FLOAT	V, x1	
8627	RO	Uab Present Demand	FLOAT	V, x1	
8629	RO	Ubc Present Demand	FLOAT	V, x1	
8631	RO	Uca Present Demand	FLOAT	V, x1	
8633	RO	Ull average Present Demand	FLOAT	V, x1	
8635	RO	P Total Present Demand	FLOAT	W, x1	
8637	RO	Q Total Present Demand	FLOAT	var, x1	
8639	RO	S Total Present Demand	FLOAT	VA, x1	
8641	RO	Ia This Max. Demand	See Table 5-38	A, x1	
8647	RO	Ib This Max. Demand		A, x1	
8653	RO	Ic This Max. Demand		A, x1	
8659	RO	I average This Max. Demand		A, x1	

8665	RO	Ua This Max. Demand		V, x1	
8671	RO	Ub This Max. Demand		V, x1	
8677	RO	Uc This Max. Demand		V, x1	
8683	RO	Uln average This Max. Demand		V, x1	
8689	RO	Uab This Max. Demand		V, x1	
8695	RO	Ubc This Max. Demand		V, x1	
8701	RO	Uca This Max. Demand		V, x1	
8707	RO	Ull average This Max. Demand		V, x1	
8713	RO	P This Max. Demand		W, x1	
8719	RO	Q This Max. Demand		var, x1	
8725	RO	S This Max. Demand		VA, x1	
8731	RO	U Unbalance	FLOAT	--	
8733	RO	I Unbalance	FLOAT	--	
8735	RO	Ia TDD	FLOAT	--	
8737	RO	Ib TDD	FLOAT	--	
8739	RO	Ic TDD	FLOAT	--	
8741	RO	Ia THD	FLOAT	--	
8743	RO	Ib THD	FLOAT	--	
8745	RO	Ic THD	FLOAT	--	
8747	RO	Ua THD	FLOAT	--	
8749	RO	Ub THD	FLOAT	--	
8751	RO	Uc THD	FLOAT	--	
8753	RO	DI Status	UINT16	--	
8754	RO	DO Status	UINT16	--	
8755	RO	MB Master Connection Status	UINT16	--	0=Normal, 1=Abnormal

Table 5-37 MB Slave Real-time Measurements

Note:

- The following table illustrates the details for Max. Demand Data Format.

Offset	Property	Description	Format	Note
+0	RO	High-order Byte: Year	Timestamp	1-99 (Year-2000)
		Low-order Byte: Month		1 to 12
+1	RO	High-order Byte: Day		1 to 31
		Low-order Byte: Hour		0 to 23
+2	RO	High-order Byte: Minute		0 to 59
		Low-order Byte: Second		0 to 59
+3	RO	Millisecond		0 to 999
+4~+5	RO	Max. Demand	Float	/

Table 5-38 MB Slave's Max. Demand Data Format

5.18 Data Logging**5.18.1 Device Log Buffer**

The iMeter 5 can store up to 512 entries in 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 Index N*	UINT32
10002~10039	RO	Event #N	See Table 5-40
10040~10077	RO	Event #N+1	
...	RO	...	
10344~10381	RO	Event #N+9	

Table 5-39 Device Log Buffer

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

+6 to +37	RO	Event Values	See Appendix B	-
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Table 5-40 Device Log Data Structure

5.18.2 SOE Log Buffer

The iMeter 5 can store up to 512 entries of 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
10502~10539	RO	Event #N	See Table 5-42
10540~10577	RO	Event #N+1	
...		...	
10844~10881	RO	Event #N+9	

Table 5-41 SOE Log Buffer

Offset	Property	Description	Format	Range
+0	RO	High-order Byte: Event Classification	UINT16	-
	RO	Low-order Byte: Sub-Classification		
+1	RO	High-order Byte: Record Time - Year	UINT16	0-99 (Year-2000)
	RO	Low-order Byte: Record Time - Month		1 to 12
+2	RO	High-order Byte: Record Time - Day	UINT16	1 to 31
	RO	Low-order Byte: Record Time - Hour		0 to 23
+3	RO	High-order Byte: Record Time - Minute	UINT16	0 to 59
	RO	Low-order Byte: Record Time - Second		0 to 59
+4	RO	Record Time: Millisecond	UINT16	0 to 999
+5	--	Reserved		
+6 to +37	RO	Event Values	See Appendix C	-

Table 5-42 SOE Log Data Structure

5.18.3 Latest PQD Log

5.18.3.1 PQD Log Buffer

Register	Property	Description	Format
22000~22035	RO	The Latest Swell Event	See Table 5-44
22036~22071	RO	The Latest Dip Event	
22072~22107	RO	The Latest Interruption Event	

Table 5-43 POD Log Buffer

5.18.3.2 PQD Log Data Structure

Offset	Property	Description	Format	Range
+0	RO	Record Time	UINT16	High Order - Year
	RO			Low Order - Month
+1	RO		UINT16	High Order - Day
	RO			Low Order - Hour
+2	RO		UINT16	High Order - Minute
	RO			Low Order - Second
+3	RO		UINT16	Millisecond
+4 to +5	--	Reserved	--	-
+6	RO	Source	UINT32	1=Ua, 2=Ub, 3=Uc, 4=Uab, 5=Ubc, 6=Uca
+8	RO	Peak Residual Voltage (%)	FLOAT	-
+10	RO	Duration (ms)	UINT32	-
+12	RO	Ua Residual Voltage (%)	FLOAT	-
+14	RO	Ub Residual Voltage (%)	FLOAT	-
+16	RO	Uc Residual Voltage (%)	FLOAT	-
+18	RO	Disturbance Direction	UINT32	1=Upstream, 2=Downstream
+20	RO	Confidence	UINT32	1=Low, 2=Middle, 3=High
+22	RO	Ua Benchmark (Primary)	FLOAT	-
+24	RO	Ub Benchmark (Primary)	FLOAT	-
+26	RO	Uc Benchmark (Primary)	FLOAT	-
+28	--	Reserved	--	-
+30	RO	Location in SEMI F47 Plot	UINT32	0=Reserved 1=Region A (undefined), 2=Region B (no interruption), 3=Region C (probable abnormal operation), 4=Region D (undefined)
+32	RO	Location in ITIC Plot	UINT32	0=Reserved 1=Region A (no interruption in function) 2=Region B (no damage) 3=Region C (Prohibited)
+34	--	Reserved	--	-

Table 5-44 PQD Log Data Structure

5.18.4 Statistical Data Recorder

Register	Property	Description	Format
11000~11518	RO	SDR #1 Log Buffer	See Section 5.18.4.1
11600~12118	RO	SDR #2 Log Buffer	
12200~12718	RO	SDR #3 Log Buffer	
12800~13318	RO	SDR #4 Log Buffer	

Table 5-45 SDR Log Buffer

5.18.4.1 SDR Log Structure

The iMeter 5 provides 4 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≤4)	UINT32	-
+2~+4	RO	Record Time	See Note 1	
+5	RO	Flagging Data Status ²	UINT16	0=Not Flagged 1=Flagged & Removed 2=Flagged & Kept

+6~+13	RO	Data Item #N	See Note 3	-
+14~+21	RO	Data Item #N+1		
...		...		
+510~+517	RO	Data Item #N+63		

Table 5-46 SDR Log Buffer Structure

Notes:

1. Record Time Data Structure

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

Table 5-47 Record Time Data Structure

2. For SDR Log, if the corresponding **Eliminate Flagged Data** (Register 40825) is set to Remove, the 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 certain group of data has been flagged and removed while "2" indicates the flagged data has been kept.

3. 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 5-48 SDR Data Item Structure

5.18.5 DR (Data Recorder) Log

The iMeter 5 provides 8 groups of DR with each recording depth of 65535. Writing N to the **DR #X Log Index N** 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 20600 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
20600-20733	RO	Data Recorder #1 Log Buffer	See Table 5-50
20735-20869	RO	Data Recorder #2 Log Buffer	
20870-21004	RO	Data Recorder #3 Log Buffer	
21005-21139	RO	Data Recorder #4 Log Buffer	
21140-21274	RO	Data Recorder #5 Log Buffer	
21275-21409	RO	Data Recorder #6 Log Buffer	
21410-21544	RO	Data Recorder #7 Log Buffer	
21545-21679	RO	Data Recorder #8 Log Buffer	

Table 5-49 DR Log Buffer

Offset	Properties	Format	Description
+0	RW	UINT32	Data Recorder Log #X Index N
+2	RO	UINT16	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 5-50 Data Recorder Log Structure

5.18.6 Max./Min. Log

5.18.6.1 MM Log Buffer

Register	Description	Format
22200~22306	Max. #1 Log Buffer	See Section 5.18.6.2
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 5-51 MM Log Buffer

5.18.6.2 MM Log Buffer Structure

Offset	Property	Description	Format	Range/Options
+0	RW	Max./Min. #X Log Index N	UINT32	0=Since Last Reset/This Month 1=Before Last Reset/Last Month
+2	RO	Record Time		See Table 5-53
+5	RO	Flagging Data Status ²	UINT16	0=Not Flagged 1=Flagged & Removed 2=Flagged & kept
+6~+10	RO	Data Item #1		See Table 5-54
+11~+15	RO	Data Item #2		
...	RO	...		
+101~+105	RO	Data Item #20		

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

Notes:

- Please refer to Table 5-53 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	Range
+0	RO	Year	UINT16	0-99 (Year-2000)
	RO	Month		1 to 12
+1	RO	Day	UINT16	1 to 31
	RO	Hour		0 to 23
+2	RO	Minute	UINT16	0 to 59
	RO	Second		0 to 59

Table 5-53 Time Structure

- For Max./Min. Log, if the corresponding Flagged Data Setup (Register 40825) is set to Remove, the 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 certain group of data has been flagged and removed while "2" indicates the flagged data has been kept.
- 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 5-54 MM Data Structure

5.18.7 Pst/Plt Log

5.18.7.1 Pst Log Buffer

The iMeter 5 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 5.18.7.3
23412~23421	RO	Log N+1	
...		...	
23492~23501	RO	Log N+9	

Table 5-55 Pst Log Buffer

5.18.7.2 Plt Log Buffer

The iMeter 5 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 4990 to register 23601 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 5.18.7.3
23612~23621	RO	Log N+1	
...		...	
23692~23701	RO	Log N+9	

Table 5-56 Plt Log

5.18.7.3 Pst/Plt Log Data Structure

Offset	Property	Description	Format	Range/Unit
+0	RO	Record Time	UINT16	High-Year (-2000)
				Low- Month
+1	RO	Record Time	UINT16	High- Day
				Low- Hour
+2	RO	Record Time	UINT16	High- Minute
				Low- Second
+3	RO	Flagging Status ¹	BITMAP	See Note 1
+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 5-57 Pst/Plt Log Data Structure

Note:

1. In the **Flagging Status** register for Pst and Plt Log, a value of “1” indicates that a certain group of data has been flagged due to Dip (BIT0), Swell (BIT1) and/or Interruption (BIT2).

5.18.8 IER & AER Log

The iMeter 5 can store up to 65535 IER and AER Logs for 3-phase total and per-phase, independently. Writing N to the **IER/AER Log Index** will update the #N (to #N+1) Log Buffer. For example, if the **3-phase Total 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.

5.18.8.1 3-phase Total IER/AER Log (INT64)

IER	AER	Property	Description	Format
23800	24000	RW	IER/AER Log Index N	UINT32
23802~23875	24002~24075	RO	Log #N	See Section 5.18.8.2
23876~23949	24076~24149	RO	Log #N+1	

Table 5-58 3-phase Total IER/AER Log Buffer (INT64)

5.18.8.2 3-phase Total IER & AER Log Data Structure (INT64)

Offset	Property	Description	Format	Note
+0~+2	RO	Start Time ¹	UINT16	
+3~+5	RO	End Time ¹	UINT16	
+6~+9	RO	RMS kWh Import	INT64	
+10~+13	RO	RMS kWh Export	INT64	
+14~+17	RO	RMS kWh Total	INT64	
+18~+21	RO	RMS kvarh Import	INT64	
+22~+25	RO	RMS kvarh Export	INT64	
+26~+29	RO	RMS kvarh Total	INT64	
+30~+33	RO	RMS 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	Harmonic kWh Import	INT64	
+54~+57	RO	Harmonic kWh Export	INT64	
+58~+61	RO	Harmonic kvarh Import	INT64	
+62~+65	RO	Harmonic kvarh Export	INT64	
+66~+69	RO	RMS kWh Net	INT64	
+70~+73	RO	RMS kvarh Net	INT64	

Table 5-59 3-phase Total IER & AER Log Data Structure (INT64)

Note:

1. The following table illustrates the Data Structure of the Start/End Time.

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

Table 5-60 Time Structure

5.18.8.3 Per-phase IER/AER Log (INT64)

IER	AER	Property	Description	Format
24200	24350	RW	IER/AER Log Index N	UINT32
24202~24315	24352~24464	RO	Log #N	See Section 5.18.8.4

Table 5-61 Per-phase IER/AER Log Buffer (INT64)

5.18.8.4 Per-phase IER & AER Log Data Structure (INT64)

Offset	Property	Description	Format	Note
+0~+2	RO	Start Time ¹	UINT16	
+3~+5	RO	End Time ¹	UINT16	
+6~+9	RO	Phase A kWh Import	INT64	
+10~+13	RO	Phase A kWh Export	INT64	
+14~+17	RO	Phase A kWh Net	INT64	
+18~+21	RO	Phase A kWh Total	INT64	
+22~+25	RO	Phase A kvarh Import	INT64	
+26~+29	RO	Phase A kvarh Export	INT64	
+30~+33	RO	Phase A kvarh Net	INT64	
+34~+37	RO	Phase A kvarh Total	INT64	
+38~+41	RO	Phase A kVAh Total	INT64	
+42~+45	RO	Phase B kWh Import	INT64	
+46~+49	RO	Phase B kWh Export	INT64	
+50~+53	RO	Phase B kWh Net	INT64	
+54~+57	RO	Phase B kWh Total	INT64	
+58~+61	RO	Phase B kvarh Import	INT64	
+62~+65	RO	Phase B kvarh Export	INT64	
+66~+69	RO	Phase B kvarh Net	INT64	
+70~+73	RO	Phase B kvarh Total	INT64	
+74~+77	RO	Phase B kVAh Total	INT64	
+78~+81	RO	Phase C kWh Import	INT64	
+82~+85	RO	Phase C kWh Export	INT64	
+86~+89	RO	Phase C kWh Net	INT64	
+90~+93	RO	Phase C kWh Total	INT64	
+94~+97	RO	Phase C kvarh Import	INT64	
+98~+101	RO	Phase C kvarh Export	INT64	
+102~+105	RO	Phase C kvarh Net	INT64	
+106~+109	RO	Phase C kvarh Total	INT64	
+110~+113	RO	Phase C kVAh Total	INT64	

Table 5-62 Per-phase IER & AER Log Data Structure (INT64)

Note:

2. The following table illustrates the Data Structure of the Start/End Time.

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

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

Table 5-63 Time Structure

5.18.8.5 3-phase Total IER/AER Log (INT32)

IER	AER	Property	Description	Format
24500	25000	RW	IER/AER Log Index N	UINT32
24502~24575	25002~25075	RO	Log #N	See Section 5.18.8.6
24576~24649	25076~25149	RO	Log #N+1	

Table 5-64 3-phase Total IER & AER Log Buffer (INT32)

5.18.8.6 3-phase Total IER/AER Log Data Structure (INT32)

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

$$\sum kxh \text{ (Import/Export/Net/Total)}$$

$$= E1 \times 100 \text{ GWh} + E2 \times 0.1 \text{ kWh}$$

$$= E1 \times 10^8 \text{ kWh} + E2 \times 0.1 \text{ kWh}$$

The E1 and E2 registers have a maximum value of 100 and 1000,000,000, 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 1×10^{11} kXh. The E1 and E2 registers must be written simultaneously.

Offset	Property	Description	Format	Note
+0~+2	RO	Start Time ¹	UINT16	
+3~+5	RO	End Time	UINT16	
+6~+7	RO	Total RMS kWh Import E1	INT32	
+8~+9	RO	Total RMS kWh Import E2	INT32	
+10~+11	RO	Total RMS kWh Export E1	INT32	
+12~+13	RO	Total RMS kWh Export E2	INT32	
+14~+15	RO	Total RMS kWh Total E1	INT32	
+16~+17	RO	Total RMS kWh Total E2	INT32	
+18~+19	RO	Total RMS kvarh Import E1	INT32	
+20~+21	RO	Total RMS kvarh Import E2	INT32	
+22~+23	RO	Total RMS kvarh Export E1	INT32	
+24~+25	RO	Total RMS kvarh Export E2	INT32	
+26~+27	RO	Total RMS kvarh Total E1	INT32	
+28~+29	RO	Total RMS kvarh Total E2	INT32	
+30~+31	RO	Total RMS kVAh Total E1	INT32	
+32~+33	RO	Total RMS 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	Total RMS kWh Net E1	INT32	
+68~+69	RO	Total RMS kWh Net E2	INT32	
+70~+71	RO	Total RMS kvarh Net E1	INT32	
+72~+73	RO	Total RMS kvarh Net E2	INT32	

Table 5-65 3-phase Total IER & 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	0-99 (Year-2000)

	RO	Month		1 to 12
+1	RO	Day	UINT16	1 to 31
	RO	Hour		0 to 23
+2	RO	Minute	UINT16	0 to 59
	RO	Second		0 to 59

Table 5-66 Time Structure

5.18.8.7 Per-phase IER/AER Log (INT32)

IER	AER	Property	Description	Format
24700	24850	RW	IER/AER Log Index N	UINT32
24702~24815	24852~24965	RO	Log #N	See Section 5.18.8.8

Table 5-67 Per-phase IER & AER Log Buffer (INT32)

5.18.8.8 Per-phase IER/AER Log Data Structure (INT32)

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

$$\sum kxh (\text{Import/Export/Net/Total})$$

$$= E1 \times 100 \text{ GWh} + E2 \times 0.1 \text{ kWh}$$

$$= E1 \times 10^8 \text{ kWh} + E2 \times 0.1 \text{ kWh}$$

The E1 and E2 registers have a maximum value of 100 and 1000,000,000, 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 1×10^{11} kXh. The E1 and E2 registers must be written simultaneously.

Offset	Property	Description	Format	Note
+0~+2	RO	Start Time ¹	UINT16	
+3~+5	RO	End Time	UINT16	
+6~+7	RO	Phase A kWh Import E1	INT32	
+8~+9	RO	Phase A kWh Import E2	INT32	
+10~+11	RO	Phase A kWh Export E1	INT32	
+12~+13	RO	Phase A kWh Export E2	INT32	
+14~+15	RO	Phase A kWh Net E1	INT32	
+16~+17	RO	Phase A kWh Net E2	INT32	
+18~+19	RO	Phase A kWh Total E1	INT32	
+20~+21	RO	Phase A kWh Total E2	INT32	
+22~+23	RO	Phase A kvarh Import E1	INT32	
+24~+25	RO	Phase A kvarh Import E2	INT32	
+26~+27	RO	Phase A kvarh Export E1	INT32	
+28~+29	RO	Phase A kvarh Export E2	INT32	
+30~+31	RO	Phase A kvarh Net E1	INT32	
+32~+33	RO	Phase A kvarh Net E2	INT32	
+34~+35	RO	Phase A kvarh Total E1	INT32	
+36~+37	RO	Phase A kvarh Total E2	INT32	
+38~+39	RO	Phase A kVAh Total E1	INT32	
+40~+41	RO	Phase A kVAh Total E2	INT32	
+42~+43	RO	Phase B kWh Import E1	INT32	
+44~+45	RO	Phase B kWh Import E2	INT32	
+46~+47	RO	Phase B kWh Export E1	INT32	
+48~+49	RO	Phase B kWh Export E2	INT32	
+50~+51	RO	Phase B kWh Net E1	INT32	
+52~+53	RO	Phase B kWh Net E2	INT32	
+54~+55	RO	Phase B kWh Total E1	INT32	
+56~+57	RO	Phase B kWh Total E2	INT32	
+58~+59	RO	Phase B kvarh Import E1	INT32	
+60~+61	RO	Phase B kvarh Import E2	INT32	
+62~+63	RO	Phase B kvarh Export E1	INT32	
+64~+65	RO	Phase B kvarh Export E2	INT32	
+66~+67	RO	Phase B kvarh Net E1	INT32	
+68~+69	RO	Phase B kvarh Net E2	INT32	
+70~+71	RO	Phase B kvarh Total E1	INT32	
+72~+73	RO	Phase B kvarh Total E2	INT32	
+74~+75	RO	Phase B kVAh Total E1	INT32	
+76~+77	RO	Phase B kVAh Total E2	INT32	
+78~+79	RO	Phase C kWh Import E1	INT32	
+80~+81	RO	Phase C kWh Import E2	INT32	
+82~+83	RO	Phase C kWh Export E1	INT32	
+84~+85	RO	Phase C kWh Export E2	INT32	

+86~+87	RO	Phase C kWh Net E1	INT32	
+88~+89	RO	Phase C kWh Net E2	INT32	
+90~+91	RO	Phase C kWh Total E1	INT32	
+92~+93	RO	Phase C kWh Total E2	INT32	
+94~+95	RO	Phase C kvarh Import E1	INT32	
+96~+97	RO	Phase C kvarh Import E2	INT32	
+98~+99	RO	Phase C kvarh Export E1	INT32	
+100~+101	RO	Phase C kvarh Export E2	INT32	
+102~+103	RO	Phase C kvarh Net E1	INT32	
+104~+105	RO	Phase C kvarh Net E2	INT32	
+106~+107	RO	Phase C kvarh Total E1	INT32	
+108~+109	RO	Phase C kvarh Total E2	INT32	
+110~+111	RO	Phase C kVAh Total E1	INT32	
+112~+113	RO	Phase C kVAh Total E2	INT32	

Table 5-68 Per-phase IER & 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	0-99 (Year-2000)
	RO	Month		1 to 12
+1	RO	Day	UINT16	1 to 31
	RO	Hour		0 to 23
+2	RO	Minute	UINT16	0 to 59
	RO	Second		0 to 59

Table 5-69 Time Structure

5.18.9 IEEE Std 519-2022 Report

The iMeter 5 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 25202 will update the log buffer with the latest daily report.

Register	Property	Description	Format	Unit	Note
25200	RW	Log type	UINT32		0=Weekly Report, 1=Daily Report
25202	RW	Log index N	UINT32		
25204~25206	RO	Start time ¹	UINT16		
25207~25209	RO	End time ¹	UINT16		
25210	RO	U harmonic compliance conclusion	UINT32		BIT0: 0=Pass, 1=Fail
25212	RO	U harmonic valid evaluation interval	UINT32		
25214	RO	U harmonic invalid evaluation interval	UINT32		
25216	RO	U THD compliance conclusion	UINT32		BIT0: 0=Pass, 1=Fail
25218	RO	I harmonic compliance conclusion	UINT32		BIT0: 0=Pass, 1=Fail
25220	RO	I harmonic valid evaluation interval	UINT32		
25222	RO	I harmonic invalid evaluation interval	UINT32		
25224	RO	TDD compliance conclusion	UINT32		BIT0: 0=Pass, 1=Fail
25226	RO	Ua / Uab THD CP95 value	FLOAT	%/x100	
25228	RO	Ua / Uab THD CP99 value	FLOAT	%/x100	
25230	RO	Ub / Ubc THD CP95 value	FLOAT	%/x100	
25232	RO	Ub / Ubc THD CP99 value	FLOAT	%/x100	
25234	RO	Uc / Uca THD CP95 value	FLOAT	%/x100	
25236	RO	Uc / Uca THD CP99 value	FLOAT	%/x100	
25238	RO	Ua / Uab TOHD CP95 value	FLOAT	%/x100	
25240	RO	Ua / Uab TOHD CP99 value	FLOAT	%/x100	
25242	RO	Ub / Ubc TOHD CP95 value	FLOAT	%/x100	
25244	RO	Ub / Ubc TOHD CP99 value	FLOAT	%/x100	
25246	RO	Uc / Uca TOHD CP95 value	FLOAT	%/x100	
25248	RO	Uc / Uca TOHD CP99 value	FLOAT	%/x100	
25250	RO	Ua / Uab TEHD CP95 value	FLOAT	%/x100	
25252	RO	Ua / Uab TEHD CP99 value	FLOAT	%/x100	
25254	RO	Ub / Ubc TEHD CP95 value	FLOAT	%/x100	
25256	RO	Ub / Ubc TEHD CP99 value	FLOAT	%/x100	
25258	RO	Uc / Uca TEHD CP95 value	FLOAT	%/x100	
25260	RO	Uc / Uca TEHD CP99 value	FLOAT	%/x100	

25262	RO	Ua / Uab HD02 CP95 value	FLOAT	%/x100	
25264	RO	Ua / Uab HD02 CP99 value	FLOAT	%/x100	
25266	RO	Ub / Ubc HD02 CP95 value	FLOAT	%/x100	
25268	RO	Ub / Ubc HD02 CP99 value	FLOAT	%/x100	
25270	RO	Uc / Uca HD02 CP95 value	FLOAT	%/x100	
25272	RO	Uc / Uca HD02 CP99 value	FLOAT	%/x100	
...	RO	...	FLOAT	%/x100	
25838	RO	Ua / Uab 50 th harmonic CP95 value	FLOAT	%/x100	
25840	RO	Ua / Uab 50 th harmonic CP99 value	FLOAT	%/x100	
25842	RO	Ub / Ubc 50 th harmonic CP95 value	FLOAT	%/x100	
25844	RO	Ub / Ubc 50 th harmonic CP99 value	FLOAT	%/x100	
25846	RO	Uc / Uca 50 th harmonic CP95 value	FLOAT	%/x100	
25848	RO	Uc / Uca 50 th harmonic CP99 value	FLOAT	%/x100	
25850	RO	Ia TDD CP95 value	FLOAT	%/x100	
25852	RO	Ia TDD CP99 value	FLOAT	%/x100	
25854	RO	Ib TDD CP95 value	FLOAT	%/x100	
25856	RO	Ib TDD CP99 value	FLOAT	%/x100	
25858	RO	Ic TDD CP95 value	FLOAT	%/x100	
25860	RO	Ic TDD CP99 value	FLOAT	%/x100	
25862	RO	Ia TDD Odd CP95 value	FLOAT	%/x100	
25864	RO	Ia TDD Odd CP99 value	FLOAT	%/x100	
25866	RO	Ib TDD Odd CP95 value	FLOAT	%/x100	
25868	RO	Ib TDD Odd CP99 value	FLOAT	%/x100	
25870	RO	Ic TDD Odd CP95 value	FLOAT	%/x100	
25872	RO	Ic TDD Odd CP99 value	FLOAT	%/x100	
25874	RO	Ia TDD Even CP95 value	FLOAT	%/x100	
25876	RO	Ia TDD Even CP99 value	FLOAT	%/x100	
25878	RO	Ib TDD Even CP95 value	FLOAT	%/x100	
25880	RO	Ib TDD Even CP99 value	FLOAT	%/x100	
25882	RO	Ic TDD Even CP95 value	FLOAT	%/x100	
25884	RO	Ic TDD Even CP99 value	FLOAT	%/x100	
25886	RO	Ia DD02 CP95 value	FLOAT	%/x100	
25888	RO	Ia DD02 CP99 value	FLOAT	%/x100	
26890	RO	Ib DD02 CP95 value	FLOAT	%/x100	
25892	RO	Ib DD02 CP99 value	FLOAT	%/x100	
25894	RO	Ic DD02 CP95 value	FLOAT	%/x100	
25896	RO	Ic DD02 CP99 value	FLOAT	%/x100	
...	RO	...	FLOAT	%/x100	
26462	RO	Ia DD50 CP95 value	FLOAT	%/x100	
26464	RO	Ia DD50 CP99 value	FLOAT	%/x100	
26466	RO	Ib DD50 CP95 value	FLOAT	%/x100	
26468	RO	Ib DD50 CP99 value	FLOAT	%/x100	
26470	RO	Ic DD50 CP95 value	FLOAT	%/x100	
26472	RO	Ic DD50 CP99 value	FLOAT	%/x100	

Table 5-70 IEEE Std 519-2022 Report

Note:

- The following table illustrates the Data Structure of the Start/End Time.

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

Table 5-71 Time Structure

- The IEEE Std 519-2022 compliance report provides Daily CP99, Weekly CP95 and Weekly CP99 values. When Log Type is set to Daily, the corresponding registers for CP95 are invalid.
- When the Wiring Mode is 3P3W, the percentile values for the Uln harmonic distortion and individual harmonics mean the Ull harmonic distortion and individual harmonics.

5.18.10 Daily/Monthly Energy Consumption Log

The iMeter 5 can independently store up to 31 daily (1-month) Energy Consumption reports and 36 (3-year) Monthly Energy Consumption reports. Writing N to the **Log Index** will update the daily report / weekly report Log Buffer. For example, if the

Daily Energy Consumption Log Pointer (Register 0275) = 30, writing 30 to register 26702 will update the log buffer with the latest daily report.

Register	Property	Description	Format	Unit	Note
26700	RW	Log type	UINT32		0=Daily Log (default) 1=Monthly Log
26702	RW	Daily/Monthly Log Index N	UINT32		
26704	RO	Daily/Monthly Log Start Time ¹	UINT16		
26707	RO	Daily/Monthly Log End Time ¹	UINT16		
26710	RO	RMS kWh Import Consumption	INT64	Wh	
26714	RO	RMS kWh Export Consumption	INT64	Wh	
26718	RO	RMS kvarh Import Consumption	INT64	varh	
26722	RO	RMS kvarh Export Consumption	INT64	varh	
26724	RO	RMS kVAh Consumption	INT64	VAh	

Table 5-72 Daily/Monthly Energy Consumption Log

Note:

- The following table illustrates the Data Structure of the Start/End Time.

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

Table 5-73 Time Structure

5.18.11 TOU Log

5.18.11.1 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	UINT16	0~11: Daily Profile 1~12
36003	RO	Present Daily Profile Index	UINT16	0~19: Daily Profile Index 1~20
36004	RO	Present Weekday Type	UINT16	0=Weekday 1, 1=Weekday 2 2=Weekday 3, 3=Special Day
36005	RO	Present TOU Schedule	UINT16	0~1
36006	RO	TOU Log Pointer	UINT32	

Table 5-74 TOU Real-time Status

5.18.11.2 Real-time TOU Log

Register	Description	Format
36100~36139	Tariff #1 Data	See Section 5.18.11.5
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 5-75 TOU Real-time Log

5.18.11.3 TOU Historical Log

The iMeter 5 can store up to 12 months of TOU Historical Log. Retrieve the newest 12 entries of TOU logs by writing the 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 the **Historical TOU Data Record Pointer** is 100, then you can write 100 to 89 into the **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	UINT16
36505	RO	Period PF Avg. (Avg. PF over the Period)	FLOAT
36507~36546	RO	Tariff #1 Data	See Section 5.18.11.5
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 5-76 TOU Historical Log

5.18.11.4 TOU Freeze Log

Register	Property	Description	Format
36900	RO	Record Time	UINT16
36903~36942	RO	Tariff #1 Data	See Section 5.18.11.5
36943~36982	RO	Tariff #2 Data	
36983~37022	RO	Tariff #3 Data	
37023~37062	RO	Tariff #4 Data	
37063~37102	RO	Tariff #5 Data	
37103~37142	RO	Tariff #6 Data	
37143~37182	RO	Tariff #7 Data	
37183~37222	RO	Tariff #8 Data	

Table 5-77 TOU Freeze Log

5.18.11.5 TOU Log Data Structure

Offset	Property	Description	Format	Unit
+0	RO	kWh Import	INT64	Wh
+4	RO	kWh Export	INT64	Wh
+8	RO	kvarh Import	INT64	varh
+12	RO	kvarh Export	INT64	varh
+16	RO	kVAh	INT64	VAh
+20	RO	P Import Max. Demand	FLOAT	W
+22~+24	RO	P Import Max. Demand Timestamp ¹	UINT16	--
+25	RO	P Export Max. Demand	FLOAT	W
+27~+29	RO	P Export Max. Demand Timestamp ¹	UINT16	--
+30	RO	Q Import Max. Demand	FLOAT	var
+32~+34	RO	Q Import Max. Demand Timestamp ¹	UINT16	--
+35	RO	Q Export Max. Demand	FLOAT	var
+37~+39	RO	Q Export Max. Demand Timestamp ¹	UINT16	--

Table 5-78 TOU Log Data Structure

Notes:

1) The following table illustrates the register of timestamps:

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

Table 5-79 Timestamp Format

2) The TOU Demand Logs with their timestamps should be read in one transaction. For example, read the start register 36120 with an offset of 5 registers to retrieve the Real-time TOU Demand Log in one transmission.

5.19 Device Setting

5.19.1 iTrigger Setting

Register	Property	Description	Format	Range/Option, Default*
38000	RW	iTrigger Enable	UINT16	0=No*, 1=Yes
38001	RW	GOOSE VLAN ID	UINT16	0 ~ 4095, 1*
38002	RW	Group ID	UINT16	0 ~ 16383, 1*
38003	RW	iTrigger Group 1	INT16	-1* ~ 16383, (-1 represents Cross-Group Trigger disabled)
38004	RW	iTrigger Group 2	INT16	
38005	RW	iTrigger Group 3	INT16	
38006	RW	iTrigger 1 Actions	BITMAP	See Note 1, 0x80000000* (DWR)
38008	RW	iTrigger 2 Actions	BITMAP	See Note 1, 0x10000000* (WFR)
38010	RW	iTrigger 3 Actions	BITMAP	See Note 1, 0x20000000* (RMSR)

38012	RW	Version	UINT16	0=V1*, 1=V2
38013	RW	GOOSE Enable	BITMAP	BIT0=GOOSE Enable (1*) BIT1=Multicast (0*) BIT2= Multicast Receive (1*) BIT3=Multicast Send (1*) 0=Disabled, 1=Enabled
38014	RW	Multicast IP	UINT32	0xE0000100 ~ 0xEFFFFFFF, 0xEF060708 (239.6.7.8)*
38016	RW	Multicast Send Port	UINT16	0 ~ 65535, 60000*
38017	RW	Multicast Received Port	UINT16	0 ~ 65535, 60001*
38018	RW	P1 Mode for iTrigger Message	UINT16	0=Forbidden, 1=Receive only, 2=Transmit only, 3=Receive and Transmit*
38019	RW	P2 Mode for iTrigger Message	UINT16	0=Forbidden, 1=Receive only, 2=Transmit only, 3=Receive and Transmit*
38021-38032	RW	iTrigger Group 4 to 16	INT16	-1* ~ 16383, (-1 represents Cross-Group Trigger disabled)

Table 5-80 iTrigger Setting

Note:

1. The following table illustrates the details of the **Trigger Actions** register with a bit value of “1” meaning Active while “0” meaning Inactive.

BIT	Trigger	BIT	Trigger
0	DO1 Closed	27	DWR
1	DO1 Closed	28	WFR
2-26	Reserved	29	RMSR

Table 5-81 iTrigger Trigger Actions

5.19.2 Static Routing Setting

Register	Property	Description	Format	Range/Option, Default*
39545	RW	Static Routing IP Address	UINT32	0*
39547	RW	Static Routing Subnet Mask	UINT32	0*
39549	RW	Static Routing Gateway	UINT32	0*
39551	RW	Static Routing Enable	UINT16	0=No*, 1=Yes

Table 5-82 Static Routing Setting

5.19.3 IEC 60870-5-104 Application Setting

Register	Property	Description	Format	Range/Option, Default*
39700	RW	IEC 104 Operating Mode	UINT16	0=Disabled*, 1=Server
39701	RW	IEC 104 Common Address of ASDU	UINT16	1-65535, 1*
39702	RW	Real-time Energy Upload Interval	UINT32	0-4,294,967,295 (s), 0 means disabled
39704	RW	Real-time Measurement Upload Interval	UINT32	
39706	RW	Time-out for long idle state	UINT16	1-65535 (mins.), 5*
39707	RW	Time Sync. Interval	UINT16	0-65535 (mins.),
39708	RW	Energy Upload Format	UINT16	0=INT32*, 1=INT64

Table 5-83 IEC 60870-5-104 Application Setting

5.19.4 BACnet/IP Application Setting

Register	Property	Description	Format	Range/Option, Default*
39800	RW	BACnet/IP Enable	UINT16	0=No*, 1=Yes
39801	RW	BACnet/IP Device ID	UINT32	0 to 4194303, 26001*
39803	RW	UDP Port	UINT16	1 to 65535, 47808*
39804	RW	Foreign Device Enable	UINT16	0=No*, 1=Yes
39805	RW	BBMD IP	UINT32	0*
39807	RW	BBMD Port	UINT16	1 to 65535, 47808*
39808	RW	BBMD TTL	UINT16	0 to 65535, 60000*
39809	RW	PW Enable (for RD-B, DCC-B services)	UINT16	0=No*, 1=Yes

Table 5-84 BACnet/IP Application Setting

5.19.5 MQTT Application Setting

Register	Property	Description	Format	Range/Option, Default*
39900	RW	MQTT Enable	UINT16	0=No*, 1=Yes
39901	RW	Service Port	UINT16	1 to 65535, 47808*
39902	RW	Encryption Enable	UINT16	0=No*, 1=Yes
39903	RW	File Upload Mode	UINT16	0= Disabled*, 1=via HTTP, 2=via Protocol

39904-39936	RW	Server Address (Domain Name/IP Address)	CHAR	0* (Less than 63 ASCII characters)
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Table 5-85 MQTT Application Setting

5.19.6 Communication Setting

Register	Property	Description	Format	Range/Option, Default*
40000	RW	RS-485 Port Unit ID	UINT16	1~247, 100*
40001	RW	RS-485 Port Baud Rate	UINT16	0=1200, 1=2400, 3=9600*, 4=19200, 5=38400
40002	RW	RS-485 Port Parity	UINT16	0=None, 1=Odd, 2=Even*
40003	RW	RS-485 Port Stop Bit	UINT16	1=1*, 2=2
40004	RW	RS-485 Port Protocol ¹	UINT16	0=Modbus*, 1=Ethernet Gateway, 2=Disabled, 3=Modbus Master
40005	RW	Ethernet Gateway Port	UINT16	20000~60000, 20000*
40006~40015	--	Reserved	--	--
40016	RW	IP Address 1	UINT32	0xC0A80064 (192.168.0.100)
40018	RW	Subnet Mask 1	UINT32	0xFFFFFFFF (255.255.255.0)
40020	RW	Default Gateway	UINT32	0xC0A80001 (192.168.0.1)
40022	RW	IP Address 2	UINT32	0xC0A80164 (192.168.1.100)
40024	RW	Subnet Mask 2	UINT32	0xFFFFFFFF (255.255.255.0)
40026	RW	Preferred DNS	UINT32	0x8080808 (8.8.8.8)
40028	RW	Alternative DNS	UINT32	0x72727272 (114.114.114.114)
40030	RW	Network Mode	UINT16	1=Switch Mode, 2=Normal*, 3=RSTP
40031	--	Reserved	--	--
40032	RW	White List Control	UINT16	0=Disabled*, 1=Enabled
40033	RW	White List IP1	UINT32	0*
40035	RW	White List IP2	UINT32	0*
...	RW	...	UINT32	0*
40063	RW	White List IP16	UINT32	0*
40065	RW	NTP Server	UINT32	0*
40067-40068	--	Reserved	--	--
40069	RW	RSTP Bridge Priority	UINT16	0 to 15, 8*
40070	RW	RSTP Hello Time	UINT16	1 to 10 (s), 2*
40071	RW	Max. Age Time	UINT16	6 to 40 (s), 20*
40072	RW	Forward Delay	UINT16	4 to 30 (s), 15*
40073	RW	Ethernet Port 1 Path Cost	UINT32	0 to 200, 000, 0* (0 means self-adaptive)
40075	RW	Ethernet Port 1 Priority	UINT16	0 to 15, 8* (smaller number for higher priority)
40076	RW	Ethernet Port 2 Path Cost	UINT32	0 to 200, 000, 0* (0 means self-adaptive)
40078	RW	Ethernet Port 2 Priority	UINT16	0 to 15, 8* (smaller number for higher priority)

Table 5-86 Communication Setting

Note:

1. The Modbus Master feature is supported in Firmware V1.50.01 and later.

5.19.7 DI Setting

Register	Property	Description	Format	Range/Option, Default*
40100	RW	DI1 Mode	UINT16	0=Status Input*, 1=Pulse Counter, 2=DMD Sync., 3=Tariff Switch
40101	RW	DI1 Debounce	UINT16	1 to 9999 (ms), 20ms*
40102	RW	DI1 Pulse Weight	UINT32	1*~1,000,000
40104	RW	DI1 Setpoint Type ²	UINT16	0=Any Edge*, 1=Positive, 2=Negative
40105	RW	DI1 Setpoint Trigger	BITMAP	0*
40106~40108	--	Reserved	--	--
...	...	...	UINT16	...
40127	RW	DI4 Mode ¹	UINT16	0=Status Input*, 1=Pulse Counter, 2=DMD Sync
40128	RW	DI4 Debounce	UINT16	1 to 9999 (ms), 20ms*
40129	RW	DI4 Pulse Weight	UINT32	1*~1,000,000
40131	RW	DI4 Setpoint Type ²	UINT16	0=Any Edge*, 1=Positive, 2=Negative
40132	RW	DI4 Setpoint Trigger	BITMAP	0*

Table 5-87 DI Setting

Notes:

1. Only one DI should be programmed as the **DMD Sync.** To use a different DI for DMD Sync., the existing DI must first be reset to **Status Input** before programming the new DI for **DMD Sync.**, otherwise the configuration will be unsuccessful.
Only DI1 to DI3 can be set as **Tariff Switch**.
2. The DI4 Setpoint Type only affects which edge would trigger the Waveform Recorder, and RMS Recorder, if configured.

3. The table below provides a list of Dlx's Setpoint Trigger, with a value of "1" meaning Active and "0" meaning Inactive.

BIT	Action	BIT	Action	BIT	Action	BIT	Action
0	DO1 Closed	17	DR #3	22	DR #8	27	DWR
1	DO2 Closed	18	DR #4	23	Reserved	28	WFR
2-14	Reserved	19	DR #5	24	iTrigger 1	29	RMSR
15	DR #1	20	DR #6	25	iTrigger 2		
16	DR #2	21	DR #7	26	iTrigger 3		

Table 5-88 Dlx's Setpoint Triggers

5.19.8 DO Setting

Register	Property	Description	Format	Range/Option, Default*
40301	RW	Arm Before Execute	UINT16	0=Enabled*, 1=Disabled
40302	RW	DO1 Pulse Width	UINT16	0* (Latch Mode) to 6000 (x0.1s)
40303	RW	DO2 Pulse Width	UINT16	

Table 5-89 DO Setting

Notes:

- The **Arm Before Execute** setup register is used to specify if the relays need to be armed before they can be operated on.
- 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.

5.19.9 Algorithm Setting

Register	Property	Description	Format	Range/Option, Default*
40580	RW	PF Convention	UINT16	0=IEC*, 1=IEEE, 2=-IEEE
40581	RW	kVA Calculation	UINT16	0=Vector*, 1=Standard
40582	RW	HD Calculation	UINT16	0=% of FUND*, 1=% of RMS, 2=% of Vnom
40583	RW	Harmonic Calculation Method	UINT16	0=Subgroup*, 1=Group
40584	RW	THD Order	UINT16	2~63, 63*
40585	RW	Flicker Curve	UINT16	0=120V, 1=230V*

Table 5-90 Algorithm Setting

Notes:

- PF Convention: -IEEE is the same as IEEE but with the opposite sign.

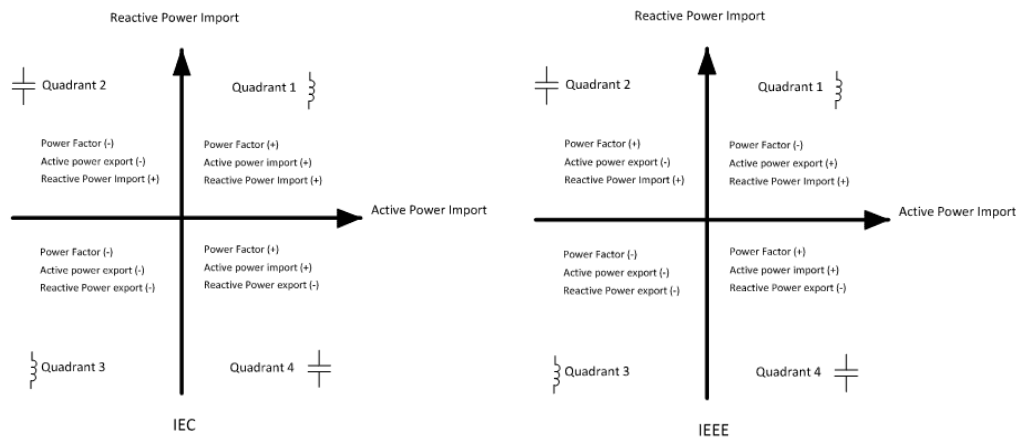


Figure 5-1 PF Convention

- There are two ways to calculate kVA:

Mode V (Vector method): $kVA_{total}^2 = kW_{total}^2 + kvar_{total}^2$

Mode S (Scalar method): $kVA_{total} = kVA_a + kVA_b + kVA_c$

5.19.10 Other Setting

Register	Property	Description	Format	Range/Option, Default*
40751	RW	D/S RMS Update ¹	UINT16	0=1/2-cycle*, 1=1-cycle
40752	RW	Interruption Mode ²	UINT16	0=Single Phase, 1=Three Phase*
40753	--	Reserved	--	
40754	RW	D/S Max. Duration	UINT16	1~600 (s), 60*
40755	RW	Swell Max. Duration	UINT16	101~500 (%), 500*
40756	--	Reserved	--	
40757	--	Reserved	--	
40758	RW	Energy Short Rollover	UINT16	0=Disabled*, 1=Enabled
40759	--	Reserved	--	
40760	--	Reserved	--	

40761	--	Reserved	--	
40762	--	Reserved	--	
40763	--	Reserved	--	
40764~40779	RW	SMTP Server	CHAR	Null* (Less than 32 characters)
40780~40787	RW	SNMP Read-only Password	CHAR	public* (Less than 16 characters)
40788~40795	RW	SNMP Read & Write Password	CHAR	private* (Less than 16 characters)
40796	RW	Enable FTPS SSL/TLS	UINT16	0=No*, 1=Yes
40797	RW	Enable HTTP SSL/TLS	UINT16	0=No*, 1=Yes
40798	--	Reserved	--	
40799	RW	Delimiter ³	UINT16	0=Option 1*, 1=Option 2
40800	--	Reserved	--	
40801	RW	Time Zone	UINT16	0~32 (See Note 4), 26*
40802	RW	IRIG-B Time Zone	UINT16	0~32 (See Note 4), 26*
40803	RW	Language	UINT16	0=English*, 1=Chinese
40804	RW	Date Format	UINT16	0=YYYY/MM/DD*, 1=MM/DD/YYYY 2=DD/MM/YYYY, 3=YYYY-MM-DD 4=MM-DD-YYYY, 5=DD-MM-YYYY
40805	--	Reserved	--	
40806	RW	LCD Timeout	UINT16	0~60 (min), 5*
40807	RW	LCD Backlight	UINT16	50~100 (%), 90*
40808	RW	Phase A Color	UINT16	0~13 (See Note 5), 1*
40809	RW	Phase B Color	UINT16	0~13 (See Note 5), 4*
40810	RW	Phase C Color	UINT16	0~13 (See Note 5), 8*
40811	RW	Phase N Color	UINT16	0~13 (See Note 5), 13*
40812	RW	GND Color	UINT16	0=Green, 1=Yellow-Green striped*
40813	RW	Front Panel Password	UINT32	000000~999999, 000001*
40815	--	Reserved	--	
40817	RW	Flagged Data Trigger Setpoint ⁶	UINT32	0=Yes, 1=No*
40819	RW	Modbus/COMTRADE Time Format	BITMAP	0~15 (See Note 7), 0*
40820	RW	Enable SNMP	UINT16	0=No*, 1=Yes
40821	RW	SNMP Port	UINT16	1~65535, 161*
40822~40823	--	Reserved	--	
40824	RW	No. of Sampling Rates (COMTRADE)	UINT16	0~1 (See Note 8), 0*
40825	RW	Eliminate Flagged Data	BITMAP	0~63 (See Note 9), 0*
40826~40842	--	Reserved	--	
40843	RW	Enable FTPS	UINT16	0=No, 1=Yes*
40844	RW	Enable Flicker Log	UINT16	0=No, 1=Yes*
40845~40856	--	Reserved	--	
40857	RW	Enable Web/DiagSys/HTTP	UINT16	0=No, 1=Yes*
40858	RW	Enable Web Client Validate	UINT16	0=No*, 1=Yes
40859	RW	HTTP Port	UINT16	1~65535, 80*
40860	RW	HTTPS Port	UINT16	1~65535, 443*
40861	RW	FTPS Port	UINT16	1~65535, 21*
40862~40863	--	Reserved	--	
40864	RW	Enable Modbus TCP	UINT16	0=No, 1=Yes*
40865	RW	Modbus TCP Port	UINT16	1~65535, 502*
40866	RW	Enable HMI Security	UINT16	0=No*, 1=Yes
40867	RW	Enable IEC 61850 ¹⁰	UINT16	0=No, 1=Yes*
40868	RW	Enable P1	UINT16	0=No, 1=Manual*, 2=DHCP
40869	RW	Enable P2	UINT16	
40870	RW	Modbus TCP Unit ID	UINT16	1~247, 100*
40871	--	Reserved	--	
40872	RW	Enable SMTP SSL/TLS	UINT16	0=No*, 1=Yes
40873	RW	IEC 61850 Debug Setting	UINT16	0=Disable*, 1=Enable
40874	RW	IEC 61850 Debug Message Export	UINT16	0=Disable, 1=To File*, 2=To Debug Port
40875	RW	IEC 61850 Debug Message Class	UINT16	0=Serious Error, 1=System Error, 2=Program Error, 3=Key Info., 4=Information, 5=Debug Info.
40876	RW	IEC 61850 Quality Validity	UINT16	0=Disabled*, 1=Domestic, 2=IBD
40877	RW	IEC 61850 Authentication	UINT16	0=Disable*, 1=Enable
40878~40886	RW	IEC 61850 Security Key	CHAR	Default=abcd01234567\$%^& (Must be 16 characters)
40887~40893	RW	IEC 61850 Password	CHAR	01+SN* (Up to 12 characters)
40894	RW	IEC 61850 Timestamp Offset	UINT16	0* (s), "0" means the time difference is not examined
40895	RW	COMTRADE Stored Value Type	UINT16	0=Secondary, 1=Primary*
40896	RW	Web Login Timeout	UINT16	0~1440 (min), 5*

40897	RW	IEC 61850 Port ¹⁰	UINT16	1~65535, 102*
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Table 5-91 Other Setting

Notes:

- The **Dip/Swell RMS Update** register determines if the Urms is computed every cycle and then shifted by ½ cycle (register value = 0) or if the Urms is computed every ½ cycle and then shifted by ½ cycle (register value = 1).
- The **Interrupt Mode** register determines if an Interruption event should start when the Urms of all 3 phases (register value = 1) or when the Urms of any phase (register value = 0) are lower than the Interruption Threshold.
- 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).
- The **IRIG-B Time Zone** setting is valid only when the iMeter 5 is connected to an IRIG-B signal output. The following table lists the Codes for different Time Zones.

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

Table 5-92 Time Zone Codes

- 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 5-93 Wire Color Options

- A value of “1” for Flagged Data Trigger Setpoint means the following behavior exist
 - When the Setpoint (including PQ Setpoint, Control Setpoint and etc.) or Alarm (ITIC Alarm, SEMI F47 Alarm and etc.) Active Limit is reached, the Setpoint/Alarm couldn't be activated due to the triggered value containing flagged data.
 - Once the iMeter 5 is powered on, all the measurements will be flagged and the Setpoint/Alarm are blocked until the voltage measured exceeds the Dip Limit but beyond the Swell Limit.
- 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, EN 50160 Log, TOU Log, IER and AER Log.
BIT1	COMTRADE	Timestamp of COMTRADE file including the first/trigger point in the .cfg file

Table 5-94 Modbus/COMTRADE Time Format

- “0” means the DWR file in COMTRADE format doesn't include any sampling section information.
- 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.

Others	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
Reserved	IEEE Std 519 Log	Reserved	EN 50160 Log	Min. Log	Max. Log	SDR Log

Table 5-95 Eliminate Flagged Data Detail

- Modification written to this register requires a device reboot to take effect.

5.19.11 SMTP Setting

Register	Property	Description	Format	Range/Option, Default*
40900	RW	SMTP Trigger Event Classification	BITMAP	Note 1), 0*
40902	RW	SMTP Service Port	UINT16	1 to 65535, 25*
40903	RW	Reserved	UINT32	
40905	RW	Source Email Address ²	CHAR	40 characters (including terminator), Null*
40925	RW	Source User Name ³	CHAR	40 characters (including terminator), Null*
40945	RW	Login Password ⁴	CHAR	20 characters (including terminator), Null*
40955	RW	Destination Email Address ⁵	CHAR	90 characters (including terminator), Null*

Table 5-96 SMTP Setting

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	BIT	Classification
BIT0	Device Log Events (See Appendix B)	BIT8	Inrush Current
BIT1	Setpoint	BIT9	RVC
BIT2	I/O	BIT10	MSV
BIT3	Record (WFR, DWR, RMSR, etc.)	BIT11	Reserved
BIT4	Reserved	BIT12	Reserved
BIT5	Reserved	BIT13	EN 50160 Report
BIT6	Dip/Swell/Interruption	BIT14-BIT26	Reserved
BIT7	Transient	BIT27	IEEE Std 519 Report

Table 5-97 SMTP Trigger Event Register (40900)

- 2) This string parameter may be up to 40 characters (including the terminator) long and specifies the source email address that appears in the **"From"** field of the email. For example, if the email address is iMeter.5@cet-electric.com, set the parameter as "69 4D 65 74 65 72 20 35 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 (including the terminator) 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 (including terminator) long and specifies the Logon Password to login the **"Source Email Address"** account. For example, if the password is "iMeter 5", set the parameter as "69 4D 65 74 65 72 20 35 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 (including terminator) 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.5@cet-electric.com, so set the registers as " 69 4D 65 74 65 72 20 35 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. Different receivers should be separated by ";" symbol.

5.19.12 Basic Setting

Register	Property	Description	Format	Range/Option, Default*
41000	RW	Wiring Mode	UINT16	1= 3P4W*, 2=Reserved, 3=3P3W, 4=Demo, 5=1P2W_LN, 6=1P2W_LL, 7=1P3W
41001	RW	PT Primary	UINT32	1 to 1,000,000 (V), 100*
41003	RW	PT Secondary	UINT32	1 to 1,500 (V), 100*
41005	RW	CT Primary	UINT32	1 to 30,000 (A), 5*
41007	RW	CT Secondary	UINT32	1 to 50 (A), 5*
41009	--	Reserved	--	
41011	--	Reserved	--	
41013	RW	I4 Primary	UINT32	1 to 30,000 (A), 5*
41015	RW	I4 Secondary	UINT32	1 to 50 (A), 5*
41017	--	Reserved	--	
41019	--	Reserved	--	
41021	RW	UII Nominal (Secondary)	UINT32	1 to 1,500 (V), 415*
41023	RW	I Nominal (Secondary)	UINT32	1 to 10,000 (A), 5*
41025	RW	CT Polarity	BITMAP	Bit0 to Bit3 represent Ia, Ib, Ic and I4 0=Normal*, 1=Reverse
41026	RW	Composite I	UINT16	0= No Composite*, 1=Phase A 2=Phase B, 3=Phase C
41027	--	Reserved	--	
41028	RW	Neutral Connection	UINT16	0=Directly/Small Resistance/Reactance*, 1=Ungrounded/High Resistance, 2=Arc Suppression Coil
41029	RW	Nominal Frequency	UINT16	0=50Hz*, 1=60Hz
41030	--	Reserved	--	
41031	--	Reserved	--	
41032	RW	Operating Time Threshold	UINT16	1~1,000 (x0.001 Inominal), 1*
41033	--	Reserved	--	
41034	--	Reserved	--	
41035	RW	SCCP Option	UINT16	0=5A (50A) @10mV/A*, 1=20A@10mV/A, 2=200A@1mV/A, 3=500A @1mV/A, 4=500A(550A) @1mV/A, 5=5kA @0.1mV/A
41036	--	Reserved	--	
41037	RW	TDD Preset IL Primary ^{1,2}	UINT32	0*~30,000A (x0.001A)
41039	RW	I4 TDD Preset IL Primary ^{1,2}	UINT32	

Table 5-98 Basic Setting

Notes:

- 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_519
- non-zero value: the unit is A and it is the preset IL for TDD Calculation

Besides, according to the IEEE_519

IL = maximum demand load current (fundamental frequency component) at the PCC (point of common coupling)

- It is necessary to reboot the device to allow the new changes to **Preset IL** to take effect. The harmonic current distortion limits will be updated accordingly after reboot.

5.19.13 PQ Setting

Register	Property	Description	Format	Range/Option, Default*
41085	RW	Swell Trigger Actions	BITMAP	See Note 1, 0x28000000* (DWR & RMSR)
41087	RW	Swell Triggers DO	UINT16	0=When PQD starts*, 1=When PQD Ends
41088	RW	Dip Trigger Actions	BITMAP	See Note 1, 0x28000000* (DWR & RMSR)
41090	RW	Dip Triggers DO	UINT16	0=When PQD starts, 1=When PQD Ends*
41091	RW	Interruption Trigger Actions	BITMAP	See Note 1, 0x28000000* (DWR & RMSR)
41093	RW	Interruption Triggers DO	UINT16	0=When PQD starts*, 1=When PQD Ends
41094	RW	ITIC Alarm	BITMAP	See Note 1, 0* (Null)
41096	RW	SEMI F47 Alarm	BITMAP	
41098~41099	--	Reserved	--	
41100	RW	Dip/Swell Enable	UINT16	0=No, 1=Yes*
41101	RW	Dip/Swell Voltage Reference	UINT16	0=Udin(Nominal Voltage)* 1=Usr (Sliding Reference Voltage)
41102	RW	Swell Threshold ²	UINT16	101 to 200 (x0.01 Udin/Usr), 110*
41103	RW	Dip Threshold ²	UINT16	1 to 99 (x0.01 Udin/Usr), 90*
41104	RW	Interruption Threshold ²	UINT16	0 to 50 (x0.01 Udin/Usr), 5*
41105	RW	Swell Hysteresis ²	UINT16	1 to 1000 (x0.001 Udin/Usr), 20*
41106	RW	Dip Hysteresis ²	UINT16	
41107	RW	Interruption Hysteresis ²	UINT16	
41108~41112	--	Reserved	--	
41116	RW	Transient Enable	UINT16	0=No, 1=Yes*
41117	RW	Transient Threshold	UINT16	5 to 500 (%), 35*
41118	RW	Transient Trigger	BITMAP	See Note 1, 0x10000000* (WFR)
41120	RW	Inrush Current Enable	UINT16	0=No*, 1=Yes
41121	RW	Inrush Current Threshold	UINT16	10 to 500 (%), 120*
41122	RW	Inrush Current Hysteresis	UINT16	1 to 1000 (0.1% to 100%), 10*
41123	RW	Inrush Current Trigger	BITMAP	See Note 1, 0x10000000* (WFR)
41126	RW	Disturbance Direction Enable	UINT16	0=No, 1=Yes*
41128	RW	RVC Enable	UINT16	0=No*, 1=Yes
41129	RW	RVC Threshold ²	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	UINT32	See Note 1, 0x20000000* (RMSR)
41135~41153	--	Reserved	--	
41154	RW	MSV #1 Enable	UINT16	0=No*, 1=Yes
41155	--	Reserved	--	
41156	RW	MSV #1 Threshold	UINT16	3 to 1000 (x0.001 Udin/Usr), 50*
41157	RW	MSV #1 Signalling Time	UINT16	1 to 120s, 60*
41158	RW	MSV #1 Frequency	UINT32	6000 to 300000 (x0.01Hz), 100000*
41160	RW	MSV #2 Enable	UINT16	0=No*, 1=Yes
41161	--	Reserved	--	
41162	RW	MSV #2 Threshold	UINT16	3 to 1000 (x0.001 Udin/Usr), 50*
41163	RW	MSV #2 Signalling Time	UINT16	1 to 120s, 60*
41164	RW	MSV #2 Frequency	UINT32	6000 to 300000 (x0.01Hz), 200000*
41166	RW	MSV #3 Enable	UINT16	0=No*, 1=Yes
41167	--	Reserved	--	
41168	RW	MSV #3 Threshold	UINT16	3 to 1000 (x0.001 Udin/Usr), 50*
41169	RW	MSV #3 Signalling Time	UINT16	1 to 120s, 60*
41170	RW	MSV #3 Frequency	UINT32	6000 to 300000 (x0.01Hz), 300000*

Table 5-99 PQ Setting**Notes:**

- The following table illustrates the details of the **Trigger Actions** register with a bit value of "1" meaning Active while "0" meaning Inactive.

BIT	Action	BIT	Action	BIT	Action	BIT	Action
0	DO1 Closed	17	DR #3	22	DR #8	27	DWR

1	DO2 Closed	18	DR #4	23	Reserved	28	WFR
2-14	Reserved	19	DR #5	24	iTrigger 1	29	RMSR
15	DR #1	20	DR #6	25	iTrigger 2		
16	DR #2	21	DR #7	26	iTrigger 3		

Table 5-100 Trigger Actions

2. The values for the **Dip Threshold**, **Swell Threshold**, **Voltage Interruption Threshold** and **Dip/Swell/Interruption 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** and **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 be met.

5.19.14 Demand Setting

Register	Property	Description	Format	Range/Option, Default*
41250	RW	Demand Sync. Mode	UINT16	0=SLD*, 1=SYNC DI
41251	RW	Demand Period	UINT16	1 to 60 minutes, 15*
41252	RW	Number of Sliding Windows	UINT16	1* to 15
41253	RW	Self-Read Time ¹	UINT16	Default=0xFFFF(Manual)
41254	RW	Predicated Response	UINT16	70* to 99

Table 5-101 Demand Setup

Note:

1. The **Self-Read Time** allows the user to specify the time and day of the month for the Max. Demand Self-Read operation. The **Self-Read Time** supports three options:
- A zero value means that the Self-Read will take place at 00:00 of the first day of each month.
 - A non-zero value means that the Self-Read will take place at a specific time and day based on the formula: Self-Read Time = Day * 100 + Hour where $0 \leq \text{Hour} \leq 23$ and $1 \leq \text{Day} \leq 28$. For example, the value 1512 means that the Self-Read will take place at 12:00 pm 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**.

5.19.15 WFR Setting

Register	Property	Description	Format	Range/Option, Default*
41300	RW	Pre-fault Cycles of WFR	UINT16	2 to 16 (cycles), 5*
41301	--	Reserved	--	
41302	--	Reserved	--	
41303	RW	Sampling Rates	UINT16	(Samples/cycle x Cycle): 0 = 16 x 640 1 = 32 x 320 2 = 64 x 160 3 = 128 x 80 4 = 256 x 40* 5 = 512 x 20
41304	--	Reserved	--	
41305	--	Reserved	--	
41306	RW	Pre-fault Cycles of DWR	UINT16	5* to 10 Cycles
41307	RW	Scheduled WFR Enable	UINT16	0=No*, 1=Yes
41308~41310	RW	Scheduled WFR Start Time	UINT16	See Note 1), 00(Y)01(M)01(D), 00:00:00*
41311	RW	Scheduled WFR Interval	UINT16	1 to 65535 (minutes), 1440*
41312	RW	Repetitions	UINT16	0 to 10000, 1* 0 indicates scheduled WFR feature disabled
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 2), 4 (Uab)*
41316	RW	Channel 2	UINT16	See Note 2), 5 (Ubc)*
41317	RW	Channel 3	UINT16	See Note 2), 6 (Uca)*
41318	RW	Channel 4	UINT16	See Note 2), 7 (Ia)*
41319	RW	Channel 5	UINT16	See Note 2), 8 (Ib)*
41320	RW	Channel 6	UINT16	See Note 2), 9 (Ic)*
41321	RW	Channel 7	UINT16	See Note 2), 12 (Frequency)*
41322	RW	Channel 8	UINT16	See Note 2), 13 (Frequency Deviation)*
41323	RW	Channel 9	UINT16	See Note 2), 1 (Ua)*

41324	RW	Channel 10	UINT16	See Note 2), 2 (Ub)*
41325	RW	Channel 11	UINT16	See Note 2), 3 (Uc)*
41326	RW	Channel 12	UINT16	See Note 2), 0*
41327	RW	Channel 13	UINT16	See Note 2), 0*
41328	RW	Channel 14	UINT16	See Note 2), 0*
41329	RW	Channel 15	UINT16	See Note 2), 0*
41330	RW	Channel 16	UINT16	See Note 2), 0*

Table 5-102 WFR Setting

Notes:

1. The following table illustrates the **Scheduled WFR Start Time** structure.

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

Table 5-103 Scheduled WFR Start Time Structure

2. The table below lists the available parameters for each channel, please note that the channel should be configured continually from Channel 1.

ID	Parameter	ID	Parameter	ID	Parameter	ID	Parameter
0	Null	9	Ic	18	Qb	27	Ull Avg.
1	Ua	10	Reserved	19	Qc	28	I Avg.
2	Ub	11	I4	20	Sa	29	P Total
3	Uc	12	Frequency	21	Sb	30	Q Total
4	Uab	13	Freq. Dev.	22	Sc	31	S Total
5	Ubc	14	Pa	23	PFa	32	PF Total
6	Uca	15	Pb	24	PFb	33	Reserved
7	Ia	16	Pc	25	PFc	34	Reserved
8	Ib	17	Qa	26	Uln Avg.		

Table 5-104 Available RMSR Channel

5.19.16 Energy Pulse Setting

Register	Property	Description	Format	Range/Option, Default*
41348	RW	Energy Pulse Constant ¹	UINT32	1 to 65535, 1000*
41350	--	Reserved	--	
41351	RW	Energy Pulse Output #1 ²	UINT16	0* to 18
41352	RW	Energy Pulse Output #2 ²	UINT16	0* to 18
41353	--	Reserved	--	
41354	RW	LED Pulse Output	UINT16	0* to 18

Table 5-105 Energy Pulse Setup

Note:

1. The **Pulse Constant** (K) indicates how many output pulses are generated per unit of energy consumed. One would use a higher Pulse Constant K for a light-load system in an accuracy testing situation to reduce the test time.
2. The following table illustrates the valid options for the Energy Pulse Output 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 5-106 Energy Pulse Output Setup Register

5.19.17 Setpoint Setting

Register	Property	Description	Format	Range/Option, Default*
41401	RW	Setpoint #1	Parameter ¹	0*
41403	RW		Type	0=Disabled* 1=Over Setpoint, 2=Under Setpoint
41404	RW		Active Limit	-2147483647 to 2147483647, Null*
41406	RW		Return Limit	-2147483647 to 2147483647, Null*
41408	RW		Active Delay	0 to 999,999 (x0.01s), 1000*
41410	RW		Trigger Action ²	0=Disabled*
41412	RW		Inactive Delay	0 to 999,999 (x0.01s), 1000*

41414	RW	Setpoint #2	Parameter ¹	UINT32	0*
41416	RW		Type	UINT16	0=Disabled* 1=Over Setpoint, 2=Under Setpoint
41417	RW		Active Limit	INT32	-2147483647 to 2147483647, Null*
41419	RW		Return Limit	INT32	-2147483647 to 2147483647, Null*
41421	RW		Active Delay	UINT32	0 to 999,999 (x0.01s), 1000*
41423	RW		Trigger Action ²	BITMAP	0=Disabled*
41425	RW		Inactive Delay	UINT32	0 to 999,999 (x0.01s), 1000*
41427	RW	Setpoint #3	...	...	...
41440	RW	Setpoint #4	...	...	...
41453	RW	Setpoint #5	...	...	...
41466	RW	Setpoint #6	...	...	...
41479	RW	Setpoint #7	...	...	...
41492	RW	Setpoint #8	...	...	...
41505	RW	Setpoint #9	...	...	...
...	...	...	...	...	...
41804	RW	Setpoint #32	...	...	...

Table 5-107 Setpoint Setting

Notes:

- The iMeter 5 provides the following Setpoint parameters. Parameter 1 to 16 can be set with a shorter Active/Inactive Delay range from 0.01s to 0.99s (i.e., ½ cycle to 49.5 cycles) for a high-speed setpoint action.

ID	Parameter	Resolution	ID	Parameter	Resolution
0	Null	--			
Basic					
1	UIn	0.1V	103	I2 Unbalance	0.1%
2	UII	0.1V	104	U Fund.	0.1V
3	Reserved	0.1V	105	I Fund.	0.1A
4	I	0.1A	106	U Deviation	0.1%
5	I4	0.1A	107	U Over Deviation	0.1%
6	Reserved	--	108	U Under Deviation	0.1%
7	P Total	0.1W	109	Frequency	0.01Hz
8	Q Total	0.1var	110	Frequency Deviation	0.01Hz
9	S Total	0.1VA	212	Phase Loss	--
10	PF Total	0.001	213	Phase Reversal	--
11	U1	0.1V	214	Reserved	--
12	U2	0.1V	215	Reserved	--
13	U0	0.1V	216	Reserved	--
14	I1	0.1A	217	Reserved	--
15	I2	0.1A	218	2kHz-9kHz C.E.	0.1V
16	I0	0.1A	219	Pst	0.1
100	U0 Unbalance	0.1%	220	Plt	0.1
101	U2 Unbalance	0.1%	222	Reserved	--
102	I0 Unbalance	0.1%			
Harmonics					
Harmonics Distortion					
111	U THD	0.1%	116	I TEHD	0.1%
112	U TOHD	0.1%	135	U OHD	0.1%
113	U TEHD	0.1%	136	U EHD	0.1%
114	I THD	0.1%	137	I OHD	0.1%
115	I TOHD	0.1%	138	I EHD	0.1%
Individual Harmonics Distortion					
0x20000	U HD02	0.1%	0x40000000	I HD02	0.1%
0x30000	U HD03	0.1%	0x41000000	I HD03	0.1%
...	...	...	...	...	...
0x3F0000	U HD63	0.1%	0x7D000000	I HD63	0.1%
Harmonics RMS					
123	U TH RMS	0.1V	126	I TH RMS	0.1A
124	U TOH RMS	0.1V	127	I TOH RMS	0.1A
125	U TEH RMS	0.1V	128	I TEH RMS	0.1A
Individual Harmonics RMS					
0x400000	U H02 RMS	0.1V	0x2000000	I H02 RMS	0.1A
0x410000	U H03 RMS	0.1V	0x3000000	I H03 RMS	0.1A
...	...	...	...	...	...
0x7D0000	U H63 RMS	0.1V	0x3F000000	I H63 RMS	0.1A
Interharmonics					

Interharmonics Distortion			Interharmonics RMS		
117	U TIHD	0.1%	129	U TIH RMS	0.1V
118	U TOIHD	0.1%	130	U TOIH RMS	0.1V
119	U TEIHD	0.1%	131	U TEIH RMS	0.1V
120	I TIHD	0.1%	132	I TIH RMS	0.1A
121	I TOIHD	0.1%	133	I TOIH RMS	0.1A
122	I TEIHD	0.1%	134	I TEIH RMS	0.1A
Individual Interharmonics Distortion			Individual Interharmonics RMS		
0x810000	U IHD01	0.1%	0x81000000	I IH01 RMS	0.1A
0x820000	U IHD02	0.1%	0x82000000	I IH02 RMS	0.1A
...	...	...	...	...	...
0xBF0000	U IHD63	0.1%	0xBF000000	I IH63 RMS	0.1A
Demand					
Present			Predicted		
200	P Total Imp. DMD	0.1W	206	P Total Imp. DMD	0.1W
201	Q Total Imp. DMD	0.1var	207	Q Total Imp. DMD	0.1var
202	P Total Exp. DMD	0.1W	208	P Total Exp. DMD	0.1W
203	Q Total Exp. DMD	0.1var	209	Q Total Exp. DMD	0.1var
204	S Total Exp. DMD	0.1VA	210	S Total Exp. DMD	0.1VA
205	PF Total DMD	0.001	211	PF Total DMD	0.001

Table 5-108 Setpoint Parameters

2. The iMeter 5 provides the following Setpoint Triggers.

BIT	Action	BIT	Action	BIT	Action	BIT	Action
0	DO1 Closed	17	DR #3	22	DR #8	27	DWR
1	DO2 Closed	18	DR #4	23	Reserved	28	WFR
2-14	Reserved	19	DR #5	24	iTrigger 1	29	RMSR
15	DR #1	20	DR #6	25	iTrigger 2		
16	DR #2	21	DR #7	26	iTrigger 3		

Table 5-109 Setpoint Trigger

5.19.18 MB Master Setting

Register	Property	Description	Format
43100-43124	RW	Slave #1 Configuration	See Table 5-111
43125-43149	RW	Slave #2 Configuration	
43150-43174	RW	Slave #3 Configuration	
43175-43199	RW	Slave #4 Configuration	
43200-43224	RW	Slave #5 Configuration	
...	RW	...	
43825-43824	RW	Slave #30 Configuration	
43850-43874	RW	Slave #31 Configuration	

Table 5-110 MB Slave Setup

Offset	Properties	Description	Format	Options/Range, Default*
+0	RW	Enable the Slave	UINT16	0=No*, 1=Yes
+1	RW	Device Type	UINT16	See Note 1, 0*
+2	RW	Unit ID	UINT16	1 to 247, See Note 2
+3	RW	Data Type	UINT32	See Note 3, 0x00*
+5 to +24	RW	Device Name	ASCII	Null*

Table 5-111 MB Slave Setup Data Structure

Notes:

- The value of **Device Type** register, 0 to 7 stands for "PMC-53A", "PMC-53A-E", "PMC-53M-A", "PMC-340-B", "PMC-340-A", "PMC-D726M", "PMC-S963-C" and "PMC-S963-E", respectively.
- The default Unit ID for the slave consists of 100 + Slave ID (from 1 to 31). For example, the default Unit ID for Slave #21 is 121.
- The Data Type displayed for the slave on the Front Panel and Web Interface of iMeter 6 can be configured via the following bit values.

Bit	Page	Data Type
Bit0	Page 1	Ua / Ub / Uc / Uln Avg. / Ung
Bit1	Page 2	Uab / Ubc / Uca / Ull Avg. / Freq.
Bit2	Page 3	Ia / Ib / Ic / I Avg. / In / I4
Bit3	Page 4	Ua / Uab Angle, Ub / Ubc Angle, Uc / Uca Angle, Ia Angle, Ib Angle, Ic Angle
Bit4	Page 5	P / Q / S / PF Total / Disp. PF Total
Bit5	Page 6	Pa / Pb / Pc / P Total
Bit6	Page 7	Qa / Qb / Qc / Q Total
Bit7	Page 8	Sa / Sb / Sc / S Total
Bit8	Page 9	PFa / PFb / PFc / PF Total
Bit9	Page 10	kWh Imp. / Exp. / Tot. / Net

Bit10	Page 11	kvarh Imp. / Exp. / Tot. / Net
Bit11	Page 12	kVAh Tot.
Bit12	Page 13	Ia / Ib / Ic / I Avg. Present DMD
Bit13	Page 14	P / Q / S Total Present DMD
Bit14	Page 15	Ia / Ib / Ic / I Avg. This Max. DMD
Bit15	Page 16	P / Q / S Total This Max. DMD
Bit16	Page 17	Ua / Uab THD, Ub / Ubc THD, Uc / Uca THD
Bit17	Page 18	Ia / Ib / Ic THD
Bit18	Page 19	Ia / Ib / Ic TDD
Bit19	Page 20	U1 / U2 / U0 & I1 / I2 / I0 (For Sequence)
Bit20	Page 21	U Unb., I Unb. (For Unbalance)
Bit21	Page 22	Operating Time
Bit22	Page 23	Dlx (x=1, 2, 3, ...,6)
Bit23	Page 24	DOx (x=1, 2, 3, 4)
Bit24	Page 25	Ua / Ub / Uc / Uln Avg. Present DMD (If supported)
Bit25	Page 26	Uab / Ubc / Uca / Ull Avg. Present DMD (If supported)
Bit26	Page 27	Ua / Ub / Uc / Uln Avg. This Max. DMD (If supported)
Bit27	Page 28	Uab / Ubc / Uca / Ull Avg. This Max. DMD (If supported)

Table 5-112 Data Type Setup Format

5.19.19 SDR Setting

Register	Property	Description	Format
45700~45766	RW	SDR #1	See Section 5.19.19.1 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 5-113 SDR Setup Registers

5.19.19.1 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	Recording Depth	UINT16	1 to 43200
+3	RW	Parameter 1	UINT16	Please refer to Appendix A for a complete list of the SDR Parameters
+4	RW	Parameter 2	UINT16	
...	RW	...	UINT16	
+66	RW	Parameter 64	UINT16	

Table 5-114 SDR Setup Data Structure

5.19.19.2 SDR Default Setting

Parameter	SDR 1	SDR 2	SDR 3	SDR 4
Recording Interval	10	10	10	10
Recording Mode	1=FIFO	1=FIFO	1=FIFO	1=FIFO
Number of Parameters	64	59	63	64
Parameter 1	Freq.	Uab Angle	Ua HD02	Uab HD17
Parameter 2	Ua RMS	Ubc Angle	Ub HD02	Ubc HD17
Parameter 3	Ub RMS	Uca Angle	Uc HD02	Uca HD17
Parameter 4	Uc RMS	I4 Angle	Ua HD03	Uab HD19
Parameter 5	Uln RMS Avg.	U0	Ub HD03	Ubc HD19
Parameter 6	Uab RMS	U2	Uc HD03	Uca HD19
Parameter 7	Ubc RMS	U1	Ua HD05	Uab HD21
Parameter 8	Uca RMS	I0	Ub HD05	Ubc HD21
Parameter 9	Ull RMS Avg.	I2	Uc HD05	Uca HD21

Parameter 10	Ia RMS	I1	Ua HD07	Uab HD23
Parameter 11	Ib RMS	U2 Unbalance	Ub HD07	Ubc HD23
Parameter 12	Ic RMS	I2 Unbalance	Uc HD07	Uca HD23
Parameter 13	I4 RMS	U0 Unbalance	Ua HD09	Uab HD25
Parameter 14	Current RMS Avg.	I0 Unbalance	Ub HD09	Ubc HD25
Parameter 15	Pa	Ua Deviation	Uc HD09	Uca HD25
Parameter 16	Pb	Ub Deviation	Ua HD11	Ia HD02
Parameter 17	Pc	Uc Deviation	Ub HD11	Ib HD02
Parameter 18	P Total	Uab Deviation	Uc HD11	Ic HD02
Parameter 19	Qa	Ubc Deviation	Ua HD13	I4 HD02
Parameter 20	Qb	Uca Deviation	Ub HD13	Ia HD03
Parameter 21	Qc	Freq. Deviation	Uc HD13	Ib HD03
Parameter 22	Q Total	Uab THD	Ua HD15	Ic HD03
Parameter 23	Sa	Ubc THD	Ub HD15	I4 HD03
Parameter 24	Sb	Uca THD	Uc HD15	Ia HD05
Parameter 25	Sc	Uab TOHD	Ua HD17	Ib HD05
Parameter 26	S Total	Ubc TOHD	Ub HD17	Ic HD05
Parameter 27	PFa	Uca TOHD	Uc HD17	I4 HD05
Parameter 28	PFb	Uab TEHD	Ua HD19	Ia HD07
Parameter 29	PFc	Ubc TEHD	Ub HD19	Ib HD07
Parameter 30	PF Total	Uca TEHD	Uc HD19	Ic HD07
Parameter 31	Ua Fund. RMS	Ua THD	Ua HD21	I4 HD07
Parameter 32	Ub Fund. RMS	Ub THD	Ub HD21	Ia HD09
Parameter 33	Uc Fund. RMS	Uc THD	Uc HD21	Ib HD09
Parameter 34	U4 Fund. RMS	Ia THD	Ua HD23	Ic HD09
Parameter 35	Uab Fund. RMS	Ib THD	Ub HD23	I4 HD09
Parameter 36	Ubc Fund. RMS	Ic THD	Uc HD23	Ia HD11
Parameter 37	Uca Fund. RMS	I4 THD	Ua HD25	Ib HD11
Parameter 38	Ia Fund. RMS	Ua TOHD	Ub HD25	Ic HD11
Parameter 39	Ib Fund. RMS	Ub TOHD	Uc HD25	I4 HD11
Parameter 40	Ic Fund. RMS	Uc TOHD	Uab HD02	Ia HD13
Parameter 41	I4 Fund. RMS	Ia TOHD	Ubc HD02	Ib HD13
Parameter 42	Pa Fund.	Ib TOHD	Uca HD02	Ic HD13
Parameter 43	Pb Fund.	Ic TOHD	Uab HD03	I4 HD13
Parameter 44	Pc Fund.	I4 TOHD	Uba HD03	Ia HD15
Parameter 45	P Total Fund.	Ua TEHD	Uca HD03	Ib HD15
Parameter 46	Qa Fund.	Ub TEHD	Uab HD05	Ic HD15
Parameter 47	Qb Fund.	Uc TEHD	Ubc HD05	I4 HD15
Parameter 48	Qc Fund.	Ia TEHD	Uca HD05	Ia HD17
Parameter 49	Q Total Fund.	Ib TEHD	Uab HD07	Ib HD17
Parameter 50	Sa Fund.	Ic TEHD	Ubc HD07	Ic HD17
Parameter 51	Sb Fund.	I4 TEHD	Uca HD07	I4 HD17
Parameter 52	Sc Fund.	Ia TDD	Uab HD09	Ua TIHD
Parameter 53	S Total Fund.	Ib TDD	Ubc HD09	Ub TIHD
Parameter 54	dPFa	Ic TDD	Uca HD09	Uc TIHD
Parameter 55	dPFb	I4 TDD	Uab HD11	Ia TIHD
Parameter 56	dPFc	Ia K-Factor	Ubc HD11	Ib TIHD
Parameter 57	dPF Total	Ib K-Factor	Uca HD11	Ic TIHD
Parameter 58	I Residual (Cal.)	Ic K-Factor	Uab HD13	I4 TIHD
Parameter 59	Ua Angle	I4 K-Factor	Ubc HD13	Ua Pst
Parameter 60	Ub Angle		Uca HD13	Ub Pst
Parameter 61	Uc Angle		Uab HD15	Uc Pst
Parameter 62	Ia Angle		Ubc HD15	Ua Plt
Parameter 63	Ib Angle		Uca HD15	Ub Plt
Parameter 64	Ic Angle			Uc Plt

Table 5-115 SDR Default Setting

5.19.20 DR Setting

Register	Property	Description	Format
47298~47338	RW	Data Recorder #1	See Section 5.19.20.1 Data Recorder Setup Data Structure
47400~47470	RW	Data Recorder #2	
47500~47570	RW	Data Recorder #3	
47600~47670	RW	Data Recorder #4	
47700~47770	RW	Data Recorder #5	
47800~47870	RW	Data Recorder #6	
47900~47970	RW	Data Recorder #7	

48000~48070	RW	Data Recorder #8	
-------------	----	------------------	--

Table 5-116 Data Recorder Setup Registers

5.19.20.1 Data Recorder Setup Data Structure

Offset	Property	Description	Format	Range/Options
+0	RW	Recording Depth	UINT32	1 to 65535
+2	RW	Trigger Mode ¹	UINT16	0=Disabled, 1=Triggered by Timer 2=Triggered by Setpoint
+3	RW	Recording Mode	UINT16	0=Stop-When-Full, 1=First-In-Frist-Out
+4	RW	Reserved	UINT16	
+5	RW	Recording Interval	UINT32	1 to 3,456,000 (s)
+7	RW	Recording Offset ²	UINT16	0 to 43200 (s)
+8	--	Reserved	--	--
+9	RW	Parameter 1	UINT16	Please refer to Appendix A for a complete list of the Data Recorder Parameters.
+10	RW	Parameter 2	UINT16	
+11	RW	Parameter 3	UINT16	
+12	RW	Parameter 4	UINT16	
+13	RW	Parameter 5	UINT16	
+14	RW	Parameter 6	UINT16	
+15	RW	Parameter 7	UINT16	
+16	RW	Parameter 8	UINT16	
+17	RW	Parameter 9	UINT16	
+18	RW	Parameter 10	UINT16	
+19	RW	Parameter 11	UINT16	
+20	RW	Parameter 12	UINT16	
+21	RW	Parameter 13	UINT16	
+22	RW	Parameter 14	UINT16	
+23	RW	Parameter 15	UINT16	
+24	RW	Parameter 16	UINT16	
+25	RW	Parameter 17	UINT16	
+26	RW	Parameter 18	UINT16	
+27	RW	Parameter 19	UINT16	
+28	RW	Parameter 20	UINT16	
+29	RW	Parameter 21	UINT16	
+30	RW	Parameter 22	UINT16	
+31	RW	Parameter 23	UINT16	
+32	RW	Parameter 24	UINT16	
+33	RW	Parameter 25	UINT16	
+34	RW	Parameter 26	UINT16	
+35	RW	Parameter 27	UINT16	
+36	RW	Parameter 28	UINT16	
+37	RW	Parameter 29	UINT16	
+38	RW	Parameter 30	UINT16	
+39	RW	Parameter 31	UINT16	
+40	RW	Parameter 32	UINT16	

Table 5-117 DR Setup Data Structure

Notes:

- 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.
- 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**.
- Appendix A** provides a list of available parameters for data recording. If **Number of parameters** is set to 0, the Data Recorder is disabled.

5.19.20.2 DR Default Setting

Parameter	DR 1	DR 2	DR 3	DR 4
Recording Depth	65535	65535	65535	65535
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
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

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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)	Ua Pst
Parameter 25	Sb	Sb Demand	U1 (+ve Sequence)	Ub Pst
Parameter 26	Sc	Sc Demand	U2 (-ve Sequence)	Uc Pst
Parameter 27	PFa	PFa Demand	I0 (Zero Sequence)	
Parameter 28	PFb	PFb Demand	I1 (+ve Sequence)	
Parameter 29	PFc	PFc Demand	I2 (-ve Sequence)	
Parameter 30	I4	I4 Demand		
Parameter 31				
Parameter 32				
Parameter	DR 5	DR 6	DR 7	DR 8
Recording Depth	65535	65535	65535	120000
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
Parameter 1	Uab			Uab
Parameter 2	Ubc			Ubc
Parameter 3	Uca			Uca
Parameter 4	Ia			Ia
Parameter 5	Ib			Ib
Parameter 6	Ic			Ic
Parameter 7	I4			I4
Parameter 8	PF Total			PF Total
Parameter 9	kWh Total			kWh Import (Total)
Parameter 10	S Demand			S Demand (Total)
Parameter 11	Ua/Uab THD			Ua/Uab THD
Parameter 12	Ub/Ubc THD			Ub/Ubc THD
Parameter 13	Uc/Uca THD			Uc/Uca THD
Parameter 14	Ia THD			Ia THD
Parameter 15	Ib THD			Ib THD
Parameter 16	Ic THD			Ic THD
Parameter 17				Ua
Parameter 18				Ub
Parameter 19				Uc
Parameter 20				Uln Avg.
Parameter 21				Ull Avg.
Parameter 22				I Avg.
Parameter 23				
Parameter 24				
Parameter 25				
Parameter 26				
Parameter 27				
Parameter 28				
Parameter 29				
Parameter 30				
Parameter 31				

Parameter 32				
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Table 5-118 DR Default Setting

5.19.21 Max./Min. Recorder Setting

Please refer to **Appendix A** for a complete list of the Max./Min. Recorder Parameters.

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 12:00 pm 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**.

5.19.21.1 Max./Min. Recorder #1 Setup

Max.	Min.	Property	Description	Format	Range/Option, Default*
48900	49300	RW	Self-read Time	UINT16	Manual/Auto, 0xFFFF*
48901	49301	--	Reserved	--	--
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	I4*
48920	49320	RW	Parameter #19	UINT16	In*
48921	49321	RW	Parameter #20	UINT16	

Table 5-119 Max./Min. Recorder #1 Setup

5.19.21.2 Max./Min. Recorder #2 Setup

Max.	Min.	Property	Description	Format	Range/Option, Default*
49000	49400	RW	Self-read Time	UINT16	Manual/Auto, 0xFFFF*
49001	49401	--	Reserved	--	--
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	
49019	49419	RW	Parameter #18	UINT16	

49020	49420	RW	Parameter #19	UINT16	
49021	49421	RW	Parameter #20	UINT16	

Table 5-120 Max. Recorder #2 Setup

5.19.21.3 Max./Min. Recorder #3 Setup

Max.	Min.	Property	Description	Format	Range/Option, Default*
49100	49500	RW	Self-read Time	UINT16	Manual/Auto, 0xFFFF*
49101	49501	--	Reserved	--	--
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 5-121 Max./Min. Recorder #3 Setup

5.19.21.4 Max./Min. Recorder #4 Setup

Max.	Min.	Property	Description	Format	Range/Option, Default*
49200	49600	RW	Self-read Time	UINT16	Manual/Auto, 0xFFFF*
49201	49601	--	Reserved	--	--
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 5-122 Max./Min. Recorder #4 Setup

5.19.22 IER/AER Setting

5.19.22.1 3-phase Total IER/AER Setting

AER	IER	Property	Description	Format	Range/Option, Default*
49700	49706	RW	Recording Mode	UINT16	0=Disabled 1=Stop-When-Full 2=First-In-First-Out*
49701	49707	RW	Recording Interval	UINT16	1 to 65535 (min), 15*

49702-49704	49708-49710	RW	Start Time	High-order Byte: Year	UINT16	0-99 (Year-2000)
				Low-order Byte: Month		1 to 12
				High-order Byte: Day	UINT16	1 to 31
				Low-order Byte: Hour		0 to 23
				High-order Byte: Minute	UINT16	0 to 59
				Low-order Byte: Second		0 to 59

Table 5-123 3-phase Total IER/AER Setting

5.19.22.2 Per-phase IER/AER Setting

AER	IER	Property	Description		Format	Range/Option, Default*
49712	49718	RW	Recording Mode		UINT16	0=Disabled* 1=Stop-When-Full 2=First-In-First-Out
49713	49719	RW	Recording Interval		UINT16	1 to 65535 (min), 15*
49714-49716	49720-49722	RW	Start Time	High-order Byte: Year	UINT16	0-99 (Year-2000)
				Low-order Byte: Month		1 to 12
				High-order Byte: Day	UINT16	1 to 31
				Low-order Byte: Hour		0 to 23
				High-order Byte: Minute	UINT16	0 to 59
				Low-order Byte: Second		0 to 59

Table 5-124 Per-phase IER/AER Setting

5.19.23 EN 50160 Setting

The default values in **Section 5.19.23.2** may be different for LV, MV and HV levels such that it's required to set Register 49790 **Voltage Level** first.

5.19.23.1 Basic

Register	Property	Description	Format	Range/Option, Default*
49790	RW	Voltage Level	UINT16	0=LV*, 1=MV, 2=HV, 3=Extra High
49791	RW	Start Week	UINT16	0=Sunday* 1~6=Monday to Saturday
49792	RW	Enable EN 50160 Report	UINT16	0=No, 1=Yes*

Table 5-125 EN 50160 Basic Setup

5.19.23.2 EN 50160 Parameters

Register	Property	Description	Format	Scale/Unit, Default*
49800	RW	Freq Wide Tolerance	INT32	10000* (x0.0001, %)
49802	RW	Freq positive deviation wide limit	INT32	10400* (x0.0001, %)
49804	RW	Freq negative deviation wide limit	INT32	9400* (x0.0001, %)
49806	RW	Freq narrow tolerance	INT32	9950* (x0.0001, %)
49808	RW	Freq positive deviation narrow limit	INT32	10100* (x0.0001, %)
49810	RW	Freq negative deviation narrow limit	INT32	9900 (x0.0001, %)
49812	RW	Voltage wide tolerance	INT32	10000* (x0.0001, %)
49814	RW	Voltage positive deviation wide limit	INT32	LV: 11000, MV/LV/EHV: 11500 (x0.0001, %)
49816	RW	Voltage negative deviation wide limit	INT32	8500 (x0.0001, %)
49818	RW	Voltage narrow tolerance	INT32	LV: 9500, MV/HV/EHV: 9900 (x0.0001, %)
49820	RW	Voltage positive deviation narrow limit	INT32	11000 (x0.0001, %)
49822	RW	Voltage negative deviation narrow limit	INT32	9000 (x0.0001, %)
49824	RW	Flicker tolerance	INT32	9500 (x0.0001, %)
49826	RW	Flicker limit	INT32	100 (x0.01)
49828	RW	Voltage Unbalance tolerance	INT32	9500 (x0.0001, %)
49830	RW	Voltage Unbalance limit	INT32	200 (x0.0001, %)
49832	RW	Harmonic Voltage tolerance	INT32	9500 (x0.0001, %)
49834	RW	THD limit	INT32	800 (x0.0001, %)
49836	--	Reserved	--	
49838	--	Reserved	--	
49840	RW	H02 Voltage limit	INT32	LV/MV: 200 HV/EHV: 190 (x0.0001, %)
49842	RW	H03 Voltage limit	INT32	LV/MV: 500, HV/EHV: 300 (x0.0001, %)
49844	RW	H04 Voltage limit	INT32	100 (x0.0001, %)
49846	RW	H05 Voltage limit	INT32	LV/MV: 600, HV/EHV: 500 (x0.0001, %)
49848	RW	H06 Voltage limit	INT32	50 (x0.0001, %)
49850	RW	H07 Voltage limit	INT32	LV/MV: 500, HV/EHV: 400 (x0.0001, %)
49852	RW	H08 Voltage limit	INT32	50 (x0.0001, %)
49854	RW	H09 Voltage limit	INT32	LV/MV: 150, HV/EHV: 130 (x0.0001, %)

49856	RW	H10 Voltage limit	INT32	50 (x0.0001, %)
49858	RW	H11 Voltage limit	INT32	LV/MV: 350, HV/EHV: 300 (x0.0001, %)
49860	RW	H12 Voltage limit	INT32	50 (x0.0001, %)
49862	RW	H13 Voltage limit	INT32	LV/MV: 300, HV/EHV: 250 (x0.0001, %)
49864	RW	H14 Voltage limit	INT32	50 (x0.0001, %)
49866	RW	H15 Voltage limit	INT32	LV: 100, MV/HV/EHV: 50 (x0.0001, %)
49868	RW	H16 Voltage limit	INT32	50 (x0.0001, %)
49870	RW	H17 Voltage limit	INT32	LV/MV: 200, HV/EHV: 10000 (x0.0001, %)
49872	RW	H18 Voltage limit	INT32	50 (x0.0001, %)
49874	RW	H19 Voltage limit	INT32	LV/MV: 150, HV/EHV: 10000 (x0.0001, %)
49876	RW	H20 Voltage limit	INT32	50 (x0.0001, %)
49878	RW	H21 Voltage limit	INT32	LV: 75, MV/HV/EHV: 50 (x0.0001, %)
49880	RW	H22 Voltage limit	INT32	50 (x0.0001, %)
49882	RW	H23 Voltage limit	INT32	LV/MV: 150 V/EHV: 10000 (x0.0001, %)
49884	RW	H24 Voltage limit	INT32	50 (x0.0001, %)
49886	RW	H25 Voltage limit	INT32	LV/MV: 150 V/EHV: 10000 (x0.0001, %)

Table 5-126 EN 50160 Parameters Setting

5.19.24 TOU Setting

5.19.24.1 Basic Setting

Register	Property	Description	Format	Range/Option, Default*
50100	RW	Sunday Setup	UINT16	0=Weekday1* 1=Weekday2 2=Weekday3
50101	RW	Monday Setup	UINT16	
50102	RW	Tuesday Setup	UINT16	
50103	RW	Wednesday Setup	UINT16	
50104	RW	Thursday Setup	UINT16	
50105	RW	Friday Setup	UINT16	
50106	RW	Saturday Setup	UINT16	
50107	RW	TOU Switch Time	UINT32	See Note 2), 0x7FFFFFFF*
50109	RW	TOU Self-read Time	UINT16	DDHH, 0x0100*

Table 5-127 TOU Basic Setting

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 12:00 pm on March 20th, 2016. Writing 0x7FFFFFFF to this register disables the switching between TOU Schedule.

Byte 3	Byte 2	Byte 1	Byte 0
Year-2000 (0-99)	Month (1-12)	Day (1-31)	Hour (00-23)

Table 5-128 TOU Switch Time Format

5.19.24.2 Season Setting

The iMeter 5 has two sets of Season setup parameters. The base addresses for the two sets are 50200 and 50300 respectively. Register Address = Base Address + Register Offset, for example, season #2's start date of the second schedule is 50300+4 = 50304.

Offset	Property	Description	Format	Range/Option, Default*
0	RW	Season #1: Start Date ¹	UINT16	0x0101*
1	RW	Season #1: Weekday#1 Daily Profile	UINT16	0* to 19
2	RW	Season #1: Weekday#2 Daily Profile	UINT16	
3	RW	Season #1: Weekday#3 Daily Profile	UINT16	
4	RW	Season #2: Start Date	UINT16	
		High-order Byte: Month Low-order Byte: Day		
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 5-129 Season Setting

Notes:

1. The **Start Date** for the first **Season** is programmable and defaults to 01/01.
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.

5.19.24.3 Daily Profile Setting

The iMeter 5 has two sets of Daily Profile setup parameters, one for each TOU.

DP Set #1	DP Set #2	Property	Description	Format
50400~50423	50900~50923	RW	Daily Profile #1	See Table 5-131
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 5-130 Daily Profile#1 & #2 Setting

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
		High-order Byte: Hour Low-order Byte: Min		Min=0, 15, 30, 45
+3	RW	Period #2 Tariff	UINT16	0=T1, ..., 7=T8
+4	RW	Period #3 Start Time	UINT16	See Period #2 Start Time
+5	RW	Period #3 Tariff	UINT16	0=T1, ..., 7=T8
+6	RW	Period #4 Start Time	UINT16	See Period #2 Start Time
+7	RW	Period #4 Tariff	UINT16	0=T1, ..., 7=T8
+8	RW	Period #5 Start Time	UINT16	See Period #2 Start Time
+9	RW	Period #5 Tariff	UINT16	0=T1, ..., 7=T8
+10	RW	Period #6 Start Time	UINT16	See Period #2 Start Time
+11	RW	Period #6 Tariff	UINT16	0=T1, ..., 7=T8
+12	RW	Period #7 Start Time	UINT16	See Period #2 Start Time
+13	RW	Period #7 Tariff	UINT16	0=T1, ..., 7=T8
+14	RW	Period #8 Start Time	UINT16	See Period #2 Start Time
+15	RW	Period #8 Tariff	UINT16	0=T1, ..., 7=T8
+16	RW	Period #9 Start Time	UINT16	See Period #2 Start Time
+17	RW	Period #9 Tariff	UINT16	0=T1, ..., 7=T8
+18	RW	Period #10 Start Time	UINT16	See Period #2 Start Time
+19	RW	Period #10 Tariff	UINT16	0=T1, ..., 7=T8
+20	RW	Period #11 Start Time	UINT16	See Period #2 Start Time
+21	RW	Period #11 Tariff	UINT16	0=T1, ..., 7=T8
+22	RW	Period #12 Start Time	UINT16	See Period #2 Start Time
+23	RW	Period #12 Tariff	UINT16	0=T1, ..., 7=T8

Table 5-131 Daily Profile Data Structure Setup

Notes:

1. **Daily Profile #1's Period #1 Start Time** is programmable and defaults to 00:00.
2. Setting a Period's **Start Time** as 0xFFFF terminates the Daily Profile's settings. All later Daily Profile's setup parameters will be ignored, and the previous Period's duration is from its **Start Time** to the end of the day.
3. The **Start Time** of a particular Period must be later than the previous Period's.

5.19.24.4 Alternate Day Setting

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

The iMeter 5 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 Alternate Day #2's Date is 51700+3 = 51703.

Offset	Property	Description	Format	Note, Default*
0	RW	Alternate Day #1 Date ¹	UINT32	See Notes 1)
2	RW	Alternate Day #1 Daily Profile	UINT16	0* to 19
3	RW	Alternate Day #2 Date ¹	UINT32	See Notes 1)
5	RW	Alternate Day #2 Daily Profile	UINT16	0* to 19
6	RW	Alternate Day #3 Date ¹	UINT32	See Notes 1)
8	RW	Alternate Day #3 Daily Profile	UINT16	0* to 19
9	RW	Alternate Day #4 Date ¹	UINT32	See Notes 1)
11	RW	Alternate Day #4 Daily Profile	UINT16	0* to 19
12	RW	Alternate Day #5 Date ¹	UINT32	See Notes 1)
14	RW	Alternate Day #5 Daily Profile	UINT16	0* to 19
15	RW	Alternate Day #6 Date ¹	UINT32	See Notes 1)
17	RW	Alternate Day #6 Daily Profile	UINT16	0* to 19
18	RW	Alternate Day #7 Date ¹	UINT32	See Notes 1)
19	RW	Alternate Day #7 Daily Profile	UINT16	0* to 19
21	RW	Alternate Day #8 Date ¹	UINT32	See Notes 1)
22	RW	Alternate Day #8 Daily Profile	UINT16	0* to 19
24	RW	Alternate Day #9 Date ¹	UINT32	See Notes 1)
25	RW	Alternate Day #9 Daily Profile	UINT16	0* to 19
27	RW	Alternate Day #10 Date ¹	UINT32	See Notes 1)
29	RW	Alternate Day #10 Daily Profile	UINT16	0* to 19
...		...		
240	RW	Alternate Day #81 Date ¹	UINT32	See Notes 1)
242	RW	Alternate Day #81 Daily Profile	UINT16	0* to 19

243	RW	Alternate Day #82 Date ¹	UINT32	See Notes 1)
245	RW	Alternate Day #82 Daily Profile	UINT16	0* to 19
246	RW	Alternate Day #83 Date ¹	UINT32	See Notes 1)
248	RW	Alternate Day #83 Daily Profile	UINT16	0* to 19
249	RW	Alternate Day #84 Date ¹	UINT32	See Notes 1)
251	RW	Alternate Day #84 Daily Profile	UINT16	0* to 19
252	RW	Alternate Day #85 Date ¹	UINT32	See Notes 1)
254	RW	Alternate Day #85 Daily Profile	UINT16	0* to 19
255	RW	Alternate Day #86 Date ¹	UINT32	See Notes 1)
256	RW	Alternate Day #86 Daily Profile	UINT16	0* to 19
258	RW	Alternate Day #87 Date ¹	UINT32	See Notes 1)
260	RW	Alternate Day #87 Daily Profile	UINT16	0* to 19
261	RW	Alternate Day #88 Date ¹	UINT32	See Notes 1)
263	RW	Alternate Day #88 Daily Profile	UINT16	0* to 19
264	RW	Alternate Day #89 Date ¹	UINT32	See Notes 1)
266	RW	Alternate Day #89 Daily Profile	UINT16	0* to 19
267	RW	Alternate Day #90 Date ¹	UINT32	See Notes 1)
269	RW	Alternate Day #90 Daily Profile	UINT16	0* to 19

Table 5-132 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 (0-99)	Month (1-12)	Day (1-31)

Table 5-133 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.

5.19.25 IEEE Std 519-2022 Report Setting**5.19.25.1 Basic Setting**

Register	Property	Description	Format	Range/Option, Default*
52600	RW	IEEE Std 519 mode ¹	UINT16	0=Disable*, 1=Standard, 2=Custom
52601	RW	Enable HVDC ²	UINT16	0=No*, 1=Yes
52602	RW	Enable power generation facilities ³	UINT16	0=No*, 1=Yes
52603	RW	PCC Voltage ⁴	UINT32	1 to 9,999,000 (V), 415*
52605	RW	Max. Short Circuit Current ^{5,6}	UINT32	1 to 9,999,000 (A), 40,000*
52607	RW	First Day of Week	UINT16	0=Sunday*, 1~6=Monday to Saturday
52608	RW	Alert Notification	UINT16	1=Alarm Email*, 1=Periodic Email

Table 5-134 IEEE Std 519-2022 Report Setting Parameters

Notes:

1. The **Standard** and **Custom** modes for the IEEE Std 519 report determine the IL and limits for report generation.

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** (See Section 4.3.9.5) for **SCR** calculation. User may customize the harmonic limits in Section 5.19.25.2 for report generation.

In **Standard** mode, for a new installation, the monthly maximum current demand is not available.

- If Preset IL ≠ 0: the meter will use Preset IL for SCR calculation and determining the current harmonic distortion limits in the first month (M < 1),
 - If Preset IL = 0: the meter will use the greater of **This Max. Current Demand** and **I Nominal*CT Ratio** for SCR cal. and for determining the current harmonic distortion limits in the first month (M < 1).
2. High-voltage systems (> 161kV) are allowed to have a higher voltage THD where the cause is an HVDC terminal. In this condition, enable the **HVDC** parameter to increase the voltage THD tolerance to 2% (See Table 4-20).
3. For power generation equipment, enable this parameter to limit the current distortion to those value in row for < 20 or < 25 group in Table 4-21, regardless of actual Isc/IL.
4. PCC Voltage = Ull Nominal x PT Ratio
5. 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.
6. Modification of the **Max. Short Circuit Current** (Isc) may change the SCR (Isc/IL) ratio and result in a change in the harmonic current distortion limits.

5.19.25.2 IEEE Std 519-2022 Parameters

Register	Property	Description	Format	Scale/Unit, Default*
52610	RW	VTHD Limit	UINT32	800* (x0.01, %)

52612	RW	2 nd Harmonic Voltage Limit	UINT32	500* (x0.01, %)
52614	RW	3 rd Harmonic Voltage Limit	UINT32	500* (x0.01, %)
...	RW	...	UINT32	500* (x0.01, %)
52708	RW	50 th Harmonic Voltage Limit	UINT32	500* (x0.01, %)
52710-52714	--	Reserved	UINT32	--
52716	RW	TDD Limit	UINT32	2000* (x0.01, %)
52718	RW	2 nd Harmonic Current Limit	UINT32	1500* (x0.01, %)
52720	RW	3 rd Harmonic Current Limit	UINT32	1500* (x0.01, %)
...	RW	...	UINT32	
52734	RW	10 th Harmonic Current Limit	UINT32	1500* (x0.01, %)
52736	RW	11 th Harmonic Current Limit	UINT32	700* (x0.01, %)
52738	RW	12 th Harmonic Current Limit	UINT32	700* (x0.01, %)
...	RW	...	UINT32	700* (x0.01, %)
52746	RW	16 th Harmonic Current Limit	UINT32	700* (x0.01, %)
52748	RW	17 th Harmonic Current Limit	UINT32	600* (x0.01, %)
52750	RW	18 th Harmonic Current Limit	UINT32	600* (x0.01, %)
...	RW	...	UINT32	600* (x0.01, %)
52758	RW	22 nd Harmonic Current Limit	UINT32	600* (x0.01, %)
52760	RW	23 rd Harmonic Current Limit	UINT32	250* (x0.01, %)
52762	RW	24 th Harmonic Current Limit	UINT32	250* (x0.01, %)
...	RW	...	UINT32	250* (x0.01, %)
52782	RW	34 th Harmonic Current Limit	UINT32	250* (x0.01, %)
52784	RW	35 th Harmonic Current Limit	UINT32	140* (x0.01, %)
52786	RW	36 th Harmonic Current Limit	UINT32	140* (x0.01, %)
...	RW	...	UINT32	140* (x0.01, %)
52814	RW	50 th Harmonic Current Limit	UINT32	140* (x0.01, %)

Table 5-135 IEEE Std 519-2022 Parameters

5.19.26 Daily/Monthly Energy Consumption Setup

Register	Property	Description	Format	Options/Range, Default*
52900	RW	Enable Energy Consumption Log	UINT16	0=No, 1=Yes*
52901	RW	Daily Energy Consumption Log Self-read Time	UINT16	High Byte: Hour (0 to 23) Low Byte: Minute (0 to 59) 0x0000*
52902	RW	Monthly Energy Consumption Log Self-read Time	UINT32	High Byte: Reserved (00) Second High Byte: Day (1 to 28) Second Low Byte: Hour (0 to 23) Low Byte: Minute (0 to 59) 0x00000000*

Table 5-136 Daily/Monthly Energy Consumption Setup

5.19.27 Read COMTRADE File

Please refer to **Section 4.12.2.1** for the introduction to COMTRADE files.

To read the waveform files in COMTRADE format (cfg., dat., hdr. and/or .inf files) via Modbus connection, please execute the following operations.

1. Initiate Modbus connection to the device.
2. Read the specific Log Pointer register (Address 0141 for WFR, 0143 for RMSR, 0145 for DWR) and confirm that there is at least one record available.
3. File Buffer Refresh: Abbreviated Filename Specification

To refresh the file buffer (register 59505-59626), write the abbreviated filename of the file into register 59400 to 59499. Each byte in these registers (59400-59499) represents a single character of the filename.

The filename consists of three components:

- a. **Recorder type:** Indicates the type of recorder (i.e., **WFR** for Waveform Recorder, **DWR** for Disturbance Recorder, **RMSR** for RMS Recorder).
- b. **Logging Index:** A numerical value representing the specific log file.
- c. **File Extension:** Specified the file type (i.e., cfg., dat., hdr., inf.).

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 5-137 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.

5.20 Control Operation

5.20.1 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 5 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 5 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 DO1 Close	UINT16	Writing “0xFF00”
9101	WO	Execute DO1 Close	UINT16	
9102	WO	Arm DO1 Open	UINT16	
9103	WO	Execute DO1 Open	UINT16	
9104	WO	Arm DO2 Close	UINT16	
9105	WO	Execute DO2 Close	UINT16	
9106	WO	Arm DO2 Open	UINT16	
9107	WO	Execute DO2 Open	UINT16	

Table 5-138 DO Control

5.20.2 Clear/Manual Trigger Operation

Register	Property	Description	Format	Note
9200	WO	Send Test Email ¹	UINT16	Writing “0xFF00” to the register to execute the described action.
9201	WO	Clear DI1 Counter	UINT16	
9202	WO	Clear DI2 Counter	UINT16	
9203	WO	Clear DI3 Counter	UINT16	
9204	WO	Clear DI4 Counter	UINT16	
9205-9216	--	Reserved	UINT16	
9217	WO	Clear All DI Counters	UINT16	
9218	WO	Reset All DOs to Normal	UINT16	
9219	WO	Clear All Data ²	UINT16	
9220-9252	--	Reserved	--	
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	WO	Manually trigger iTrigger 1	UINT16	
9260	WO	Manually trigger iTrigger 2	UINT16	
9261	WO	Manually trigger iTrigger 3	UINT16	
9262	WO	Reset IL ³	UINT16	
9263	WO	Clear Energy Registers ⁴	UINT16	
9264	WO	Clear 3-phase Total AER Log	UINT16	
9265	WO	Clear 3-phase Total IER Log	UINT16	
9266	WO	Clear Per-phase AER Log	UINT16	
9267	WO	Clear Per-phase IER Log	UINT16	
9268-9274	--	Reserved	--	
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 ⁵	UINT16	
9283	WO	Clear This Max. Log	UINT16	
9284	WO	Clear This Min. Log	UINT16	
9285~9292	--	Reserved	--	
9293	WO	Clear All Demand ⁶	UINT16	
9294	WO	Clear This Max. Demand Log ⁷	UINT16	

9295	WO	Clear EN 50160 Log	UINT16
9296	WO	Reserved	UINT16
9297	WO	Clear SDR Log #1	UINT16
9298	WO	Clear SDR Log #2	UINT16
9299	WO	Clear SDR Log #3	UINT16
9300	WO	Clear SDR Log #4	UINT16
9301~9312	--	Reserved	--
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
9323~9326	--	Reserved	--
9327	WO	Clear Operating Time	UINT16
9328~9331	--	Reserved	--
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	--	Reserved	UINT16
9351	WO	Clear RMSR Log	UINT16
9352	WO	Clear IEEE Std 519-2022 Reports	--
9353	WO	Clear All Events	UINT16
9354	--	Reserved	--
9355	--	Reserved	--
9356	WO	Clear Device Log	UINT16
9357	WO	Clear SOE Log	UINT16
9358	WO	Clear Energy Consumption Log	UINT16

Table 5-139 Clear/Manual Trigger Operation

Notes:

1. The **Send Test Email** register can verify if the SMTP functions normally providing the SMTP configurations are correct.
2. Writing 0xFF00 to the Clear All Data register will clear all the data stored in iMeter 5 and reboot the meter.
3. 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. Writing 0xFF00 to the Clear Energy Register will clear all IER and AER logs.
5. Writing 0xFF00 to the Clear All MM Log register will clear all Max./Min. Logs (Max Demand Logs are excluded).
6. Writing 0xFF00 to the Clear All Demand register to clear the Present/Predicated Demand, as well as This Max./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 Peak Demand of This Month (Since Last Reset) will be transferred to the Peak Demand of Last Month (Before Last Reset) and then cleared.

5.21 Time Register

There are two sets of Time registers supported by the iMeter 5 - Year/Month/Day/Hour/Minute/Second (Registers # 60000 to 60003 for 6-digit addressing and Registers # 9000 to 9003 for 5-digit addressing) and UNIX Time (Registers # 60004 to

600005 for 6-digit addressing and Registers # 9004 to 9005 for 5-digit addressing). When sending time to the iMeter 5 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 60003 (or 9000 to 9003 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. 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	High-order Byte: Year
				Low-order Byte: Month
60001	9001	RW	UINT16	High-order Byte: Day
				Low-order Byte: Hour
60002	9002	RW	UINT16	High-order Byte: Minute
				Low-order Byte: Second
60003	9003	RW	UINT16	Millisecond
60004 ~ 60005	9004 ~ 9005	RW	UINT32	0x386D4380 to 0xF48656FF The corresponding time is 2000.01.01 00:00:00 to 2099.12.31 23:59:59 (GMT 0:00 Time Zone)

Table 5-140 Time Registers

5.22 Information

5.22.1 Substation Information

Register	Property	Description	Format	Default
40600	RW	Supply Company Tag 1	CHAR	devTag 0
40630	RW	Supply Company Tag 2	CHAR	devTag 1
40660	RW	Substation Name	CHAR	devTag 2
40690	RW	Voltage Level	CHAR	devTag 3
4072~40749	RW	IEC 61850 IED Name (Less than 60 characters)	CHAR	Null

Table 5-141 Substation Information

5.22.2 Site Information

Register	Property	Description	Format	Default
52000	RW	Circuit Name (Less than 16 characters)	CHAR	circuitN
52008	RW	Bus Name	CHAR	circuitTag 0
52038	RW	Station Name	CHAR	circuitTag 1
52068	RW	Station Voltage Level	CHAR	circuitTag 2
52098	RW	Assets Management ID	CHAR	circuitTag 3
52128	RW	Monitoring Network ID	CHAR	circuitTag 4
52158	RW	Commissioning Date	CHAR	circuitTag 5
52188	RW	Exclusive Use (Yes/No)	CHAR	circuitTag 6
52218	RW	Short-circuit Capacity	CHAR	circuitTag 7
52248	RW	Power Supply Capacity	CHAR	circuitTag 8
52278	RW	Customer Usage Agreement	CHAR	circuitTag 9
52308	RW	COMTRADE Tag (Less than 60 characters)	CHAR	Null

Table 5-142 Circuit Information

5.22.3 Device Information

Register	Property	Description	Format	Note
60200-60219	9800-9819	RO	CHAR	See Note 1
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 0x0000 means no 61850 support or 61850 version number error
60223	9823	RO	UINT16	e.g. 10 shows the version is V1.0
60224	9824	RO	UINT16	e.g. 130709 means July 9, 2013
60225	9825	RO	UINT16	
60226	9826	RO	UINT16	
60227	9827	RO	UINT16	
60229	9829	--	--	
60230	9830	RO	BITMAP	See Note 2
60232	9832	--	--	
60233	9833	RO	FLOAT	(°C)
60235	9835	RO	BITMAP	BIT0: System Parameters BIT1: Factory Parameters BIT2~BIT6: Reserved BIT7: NVRMA BIT8: Memory BIT9: DSP BIT10: ADC 0=Normal, 1=Error
60237	9837	--	--	
60239	9839	RO	UINT16	0=Unsync., 1=Synced., 2=Syncing.
60240-60241	9840-9841	--	--	
60243	9843	RO	UINT16	0x00A0
60244	9844	RO	UINT16	0x1EA0
60245	9845	RO	UINT16	0xAAA0
60246	9846	RO	UINT16	0x00A0
60247	9847	RO	UINT16	0x1EA1
60248	9848	RO	UINT16	0xAAA0
60249	9849	RO	UINT16	Units: MB
60250	9850	RO	UINT16	Units: MB

Table 5-143 Meter Information

Notes:

- The **Meter Model** appears in registers 60200 to 60219 and contains the ASCII encoding of the string “iMeter 5” as shown in the following table.

Register	Value (Hex)	ASCII
60200	9800	0x69
60201	9801	0x4D
60202	9802	0x65
60203	9803	0x74
60204	9804	0x65
60205	9805	0x72

60206	9806	0x20	Space
60207	9807	0x35	5
60208-60219	9808-9819	0x00	Null

Table 5-144 ASCII Coding for “iMeter 5”

2. The **Feature Code** details are illustrated in the following table.

BITS	Descriptions	Value (BIN)	Meaning	Product Code
BIT1 BIT0	Basic Feature	00	Classic model	P
		01	Class S Model	S
		10	Class A Model	A
BIT4 BIT3 BIT2	Input Current	000	5A	5
		001	1A	1
		010	Max. 500mV SCCPA or Rogowski Coil	SCCPA
BIT7 BIT6 BIT5	Input Voltage	000	400V _{LN} /690V _{LL} + 20%	9
BIT9 BIT8	Power Supply	00	95 - 250VAC/DC ± 10%, 47 - 440Hz	2
		01	20 - 60VDC	3
BIT12 BIT11 BIT10	System Frequency	000	40Hz to 72Hz	5
BIT15 BIT14 13	I/O	000	4DI + 2xDO	A
		001	4DI + 2xSS Pulse Output	B
BIT17 BIT16	Reserved			
BIT20 BIT19 BIT18	Communication	000	2x100BaseT + 1xRS-485 + 1xExpansion Port	A
BIT22 BIT21	Language	00	English	E

Table 5-145 Feature Code Details

5.22.4 Communication Status

Register	Property	Description	Format	Range
60400	RO	Present P1 IP Address	UINT32	
60402	RO	Present P1 Subnet Mask	UINT32	
60404	RO	Present P2 IP Address	UINT32	
60406	RO	Present P2 Subnet Mask	UINT32	
60408	RO	Present Default Gateway	UINT32	
60410	RO	P1 Connection Status	UINT16	0=Disconnected, 1=Connected
60411	RO	P2 Connection Status	UINT16	0=Disconnected, 1=Connected

Table 5-146 Communication Status

Appendix A - Source Parameters for SDR, DR and Max./Min. Recorders

The iMeter 5 provides the following parameters with different aggregation intervals of 50-cycle (1s), 150-cycle (3s), 10-min or 2-hour. For SDR and Max./Min Recorders, the parameters with 150-cycle are available. And for DR, the parameters with 50-cycle are available.

Key ID				Parameter	Key ID				Parameter
50-cycle	150-cycle	10-min	2-hour		50-cycle	150-cycle	10-min	2-hour	
1	10001	20001	30001	Freq.	1715	11715	21715	31715	P TH
2	10002	20002	30002	Ua	1716	11716	21716	31716	Q TH
3	10003	20003	30003	Ub	1717	11717	21717	31717	S TH
4	10004	20004	30004	Uc	1718	11718	21718	31718	PF Avg. TH
5	10005	20005	30005	Reserved	1719	11719	21719	31719	P Fund.
6	10006	20006	30006	Uln Avg.	1720	11720	21720	31720	Q Fund.
7	10007	20007	30007	Uab	1721	11721	21721	31721	S Fund.
8	10008	20008	30008	Ubc	1722	11722	21722	31722	dPF
9	10009	20009	30009	Uca	1723	11723	21723	31723	P H02
10	10010	20010	30010	Ull Avg.	1724	11724	21724	31724	Q H02
11	10011	20011	30011	Ia	1725	11725	21725	31725	S H02
12	10012	20012	30012	Ib	1726	11726	21726	31726	PF Avg. H02
13	10013	20013	30013	Ic	1727	11727	21727	31727	P H03
14	10014	20014	30014	I4	1728	11728	21728	31728	Q H03
--	--	--	--	Reserved	1729	11729	21729	31729	S H03
16	10016	20016	30016	I Avg.	1730	11730	21730	31730	PF Avg.H03
17	10017	20017	30017	Pa	...	...	...	...	...
18	10018	20018	30018	Pb	1963	11963	21963	31963	P H62
19	10019	20019	30019	Pc	1964	11964	21964	31964	Q H62
20	10020	20020	30020	P Total	1965	11965	21965	31965	S H62
21	10021	20021	30021	Qa	1966	11966	21966	31966	PF Avg. H62
22	10022	20022	30022	Qb	1967	11967	21967	31967	P H63
23	10023	20023	30023	Qc	1968	11968	21968	31968	Q H63
24	10024	20024	30024	Q Total	1969	11969	21969	31969	S H63
25	10025	20025	30025	Sa	1970	11970	21970	31970	PF Avg.H63
26	10026	20026	30026	Sb	1971	11971	21971	31971	Pa Fund.
27	10027	20027	30027	Sc	1972	11972	21972	31972	Pb Fund.
28	10028	20028	30028	S	1973	11973	21973	31973	Pc Fund.
29	10029	20029	30029	Pfa	1974	11974	21974	31974	Qa Fund.
30	10030	20030	30030	PFb	1975	11975	21975	31975	Qb Fund.
31	10031	20031	30031	PFc	1976	11976	21976	31976	Qc Fund.
32	10032	20032	30032	PF Avg.	1977	11977	21977	31977	Sa Fund.
33	10033	20033	30033	Ua Dev.	1978	11978	21978	31978	Sb Fund.
34	10034	20034	30034	Ub Dev.	1979	11979	21979	31979	Sc Fund.
35	10035	20035	30035	Uc Dev.	1980	11980	21980	31980	dPFa
36	10036	20036	30036	Uab Dev.	1981	11981	21981	31981	dPFb
37	10037	20037	30037	Ubc Dev.	1982	11982	21982	31982	dPFc
38	10038	20038	30038	Uca Dev.	1983	11983	21983	31983	Pa H02
39	10039	20039	30039	Ua Over Dev.	1984	11984	21984	31984	Pb H02
40	10040	20040	30040	Ub Over Dev.	1985	11985	21985	31985	Pc H02
41	10041	20041	30041	Uc Over Dev.	1986	11986	21986	31986	Qa H02
42	10042	20042	30042	Uab Over Dev.	1987	11987	21987	31987	Qb H02
43	10043	20043	30043	Ubc Over Dev.	1988	11988	21988	31988	Qc H02
44	10044	20044	30044	Uca Over Dev.	1989	11989	21989	31989	Sa H02
45	10045	20045	30045	Ua Under Dev.	1990	11990	21990	31990	Sb H02
46	10046	20046	30046	Ub Under Dev.	1991	11991	21991	31991	Sc H02
47	10047	20047	30047	Uc Under Dev.	1992	11992	21992	31992	Pfa H02
48	10048	20048	30048	Uab Under Dev.	1993	11993	21993	31993	PFb H02
49	10049	20049	30049	Ubc Under Dev.	1994	11994	21994	31994	PFc H02
50	10050	20050	30050	Uca Under Dev.	...	...	...	...	...
51	10051	20051	30051	Freq. Dev.	2715	12715	22715	32715	Pa H63
--	--	--	--	Reserved	2716	12716	22716	32716	Pb H63
55	10055	20055	30055	U0 Unb.	2717	12717	22717	32717	Pc H63
56	10056	20056	30056	U2 Unb.	2718	12718	22718	32718	Qa H63
57	10057	20057	30057	I0 Unb.	2719	12719	22719	32719	Qb H63
58	10058	20058	30058	I2 Unb.	2720	12720	22720	32720	Qc H63
59	10059	20059	30059	U0	2721	12721	22721	32721	Sa H63
60	10060	20060	30060	U2	2722	12722	22722	32722	Sb H63
61	10061	20061	30061	U1	2723	12723	22723	32723	Sc H63
62	10062	20062	30062	I0	2724	12724	22724	32724	Pfa H63
63	10063	20063	30063	I2	2725	12725	22725	32725	PFb H63
64	10064	20064	30064	I1	2726	12726	22726	32726	PFc H63
65	10065	20065	30065	Ia TDD	2727	12727	22727	32727	Ua TIHD

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66	10066	20066	30066	Ib TDD	2728	12728	22728	32728	Ub TIHD
67	10067	20067	30067	Ic TDD	2729	12729	22729	32729	Uc TIHD
68	10068	20068	30068	I4 TDD	2730	12730	22730	32730	Reserved
--	--	--	--	Reserved	2731	12731	22731	32731	Ua TOIHD
70	10070	20070	30070	Ia TDD Odd	2732	12732	22732	32732	Ub TOIHD
71	10071	20071	30071	Ib TDD Odd	2733	12733	22733	32733	Uc TOIHD
72	10072	20072	30072	Ic TDD Odd	2734	12734	22734	32734	Reserved
73	10073	20073	30073	I4 TDD Odd	2735	12735	22735	32735	Ua TEIHD
--	--	--	--	Reserved	2736	12736	22736	32736	Ub TEIHD
75	10075	20075	30075	Ia TDD Even	2737	12737	22737	32737	Uc TEIHD
76	10076	20076	30076	Ib TDD Even	2738	12738	22738	32738	Reserved
77	10077	20077	30077	Ic TDD Even	2739	12739	22739	32739	Ia TIHD
78	10078	20078	30078	I4 TDD Even	2740	12740	22740	32740	Ib TIHD
--	--	--	--	Reserved	2741	12741	22741	32741	Ic TIHD
80	10080	20080	30080	Ia K-Factor	2742	12742	22742	32742	I4 TIHD
81	10081	20081	30081	Ib K-Factor	--	--	--	--	Reserved
82	10082	20082	30082	Ic K-Factor	2744	12744	22744	32744	Ia TOIHD
83	10083	20083	30083	I4 K-Factor	2745	12745	22745	32745	Ib TOIHD
--	--	--	--	Reserved	2746	12746	22746	32746	Ic TOIHD
85	10085	20085	30085	Ia Crest Factor	2747	12747	22747	32747	I4 TOIHD
86	10086	20086	30086	Ib Crest Factor	--	--	--	--	Reserved
87	10087	20087	30087	Ic Crest Factor	2749	12749	22749	32749	Ia TEIHD
88	10088	20088	30088	I4 Crest Factor	2750	12750	22750	32750	Ib TEIHD
--	--	--	--	Reserved	2751	12751	22751	32751	Ic TEIHD
90	10090	20090	30090	Ua Crest Factor	2752	12752	22752	32752	I4 TEIHD
91	10091	20091	30091	Ub Crest Factor	--	--	--	--	Reserved
92	10092	20092	30092	Uc Crest Factor	2754	12754	22754	32754	Ua IHD00
93	10093	20093	30093	Reserved	2755	12755	22755	32755	Ib IHD00
94	10094	20094	30094	Ua MSV #1	2756	12756	22756	32756	Uc IHD00
95	10095	20095	30095	Ub MSV #1	2757	12757	22757	32757	Reserved
96	10096	20096	30096	Uc MSV #1	2758	12758	22758	32758	Ua IHD01
97	10097	20097	30097	Ua MSV #2	2759	12759	22759	32759	Ub IHD01
98	10098	20098	30098	Ub MSV #2	2760	12760	22760	32760	Uc IHD01
99	10099	20099	30099	Uc MSV #2	2761	12761	22761	32761	Reserved
100	10100	20100	30100	Ua MSV #3	...	...	...	...	...
101	10101	20101	30101	Ub MSV #3	3006	13006	23006	33006	Ua IHD63
102	10102	20102	30102	Uc MSV #3	3007	13007	23007	33007	Ub IHD63
103	10103	20103	30103	Ua THD	3008	13008	23008	33008	Uc IHD63
104	10104	20104	30104	Ub THD	3009	13009	23009	33009	Reserved
105	10105	20105	30105	Uc THD	3010	13010	23010	33010	Ia IHD00
106	10106	20106	30106	Reserved Reserved	3011	13011	23011	33011	Ib IHD00
107	10107	20107	30107	Ua TOHD	3012	13012	23012	33012	Ic IHD00
108	10108	20108	30108	Ub TOHD	3013	13013	23013	33013	I4 IHD00
109	10109	20109	30109	Uc TOHD	--	--	--	--	Reserved
110	10110	20110	30110	Reserved	3015	13015	23015	33015	Ia IHD01
111	10111	20111	30111	Ua TEHD	3016	13016	23016	33016	Ib IHD01
112	10112	20112	30112	Ub TEHD	3017	13017	23017	33017	Ic IHD01
113	10113	20113	30113	Uc TEHD	3018	13018	23018	33018	I4 IHD01
114	10114	20114	30114	Reserved	--	--	--	--	Reserved
115	10115	20115	30115	Ia THD	...	...	...	...	...
116	10116	20116	30116	Ib THD	3325	13325	23325	33325	Ia IHD63
117	10117	20117	30117	Ic THD	3326	13326	23326	33326	Ib IHD63
118	10118	20118	30118	I4 THD	3327	13327	23327	33327	Ic IHD63
--	--	--	--	Reserved	3328	13328	23328	33328	I4 IHD63
120	10120	20120	30120	Ia TOHD	--	--	--	--	Reserved
121	10121	20121	30121	Ib TOHD	3330	13330	23330	33330	Ua TIH RMS
122	10122	20122	30122	Ic TOHD	3331	13331	23331	33331	Ub TIH RMS
123	10123	20123	30123	I4 TOHD	3332	13332	23332	33332	Uc TIH RMS
--	--	--	--	Reserved	3333	13333	23333	33333	Reserved
125	10125	20125	30125	Ia TEHD	3334	13334	23334	33334	Ua TOIH RMS
126	10126	20126	30126	Ib TEHD	3335	13335	23335	33335	Ub TOIH RMS
127	10127	20127	30127	Ic TEHD	3336	13336	23336	33336	Uc TOIH RMS
128	10128	20128	30128	I4 TEHD	3337	13337	23337	33337	Reserved
--	--	--	--	Reserved	3338	13338	23338	33338	Ua TEIH RMS
130	10130	20130	30130	Uab Fund.	3339	13339	23339	33339	Ub TEIH RMS
131	10131	20131	30131	Ubc Fund.	3340	13340	23340	33340	Uc TEIH RMS
132	10132	20132	30132	Uca Fund.	3341	13341	23341	33341	Reserved
--	--	--	--	Reserved	3342	13342	23342	33342	Ia TIH RMS
450	10450	20450	30450	P Fund. +ve Seq.	3343	13343	23343	33343	Ib TIH RMS
451	10451	20451	30451	Q Fund. +ve Seq.	3344	13344	23344	33344	Ic TIH RMS
452	10452	20452	30452	S Unb.	3345	13345	23345	33345	I4 TIH RMS
453	10453	20453	30453	S Harmonic	--	--	--	--	Reserved
454	10454	20454	30454	In	3347	13347	23347	33347	Ia TOIH RMS

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455	10455	20455	30455	S Fund. +ve Seq.	3348	13348	23348	33348	Ib TOIH RMS
456	10456	20456	30456	S Non-Fund. Equal.	3349	13349	23349	33349	Ic TOIH RMS
457	10457	20457	30457	S Equal.	3350	13350	23350	33350	I4 TOIH RMS
458	10458	20458	30458	S Fund. Equal.	--	--	--	--	Reserved
459	10459	20459	30459	P Harmonic	3352	13352	23352	33352	Ia TEIH RMS
460	10460	20460	30460	Q HD	3353	13353	23353	33353	Ib TEIH RMS
461	10461	20461	30461	Q IHD	3354	13354	23354	33354	Ic TEIH RMS
462	10462	20462	30462	Q UHD	3355	13355	23355	33355	I4 TEIH RMS
--	--	--	--	Reserved	--	--	--	--	Reserved
500	10500	20500	30500	Ua HD00	3357	13357	23357	33357	Ua IH00 RMS
501	10501	20501	30501	Ub HD00	3358	13358	23358	33358	Ub IH00 RMS
502	10502	20502	30502	Uc HD00	3359	13359	23359	33359	Uc IH00 RMS
503	10503	20503	30503	Reserved	3360	13360	23360	33360	Reserved
504	10504	20504	30504	Ua HD01	3361	13361	23361	33361	Ua IH01 RMS
505	10505	20505	30505	Ub HD01	3362	13362	23362	33362	Ub IH01 RMS
506	10506	20506	30506	Uc HD01	3363	13363	23363	33363	Uc IH01 RMS
507	10507	20507	30507	Reserved	3364	13364	23364	33364	Reserved
...	...	...	...	...	...	...	...	...	...
748	10748	20748	30748	Ua HD62	3609	13609	23609	33609	Ua IH63 RMS
749	10749	20749	30749	Ub HD62	3610	13610	23610	33610	Ub IH63 RMS
750	10750	20750	30750	Uc HD62	3611	13611	23611	33611	Uc IH63 RMS
751	10751	20751	30751	Reserved	3612	13612	23612	33612	Reserved
752	10752	20752	30752	Ua HD63	3613	13613	23613	33613	Ia IH00 RMS
753	10753	20753	30753	Ub HD63	3614	13614	23614	33614	Ib IH00 RMS
754	10754	20754	30754	Uc HD63	3615	13615	23615	33615	Ic IH00 RMS
755	10755	20755	30755	Reserved	3616	13616	23616	33616	I4 IH00 RMS
756	10756	20756	30756	Ia HD00	--	--	--	--	Reserved
757	10757	20757	30757	Ib HD00	3618	13618	23618	33618	Ia IH01 RMS
758	10758	20758	30758	Ic HD00	3619	13619	23619	33619	Ib IH01 RMS
759	10759	20759	30759	I4 HD00	3620	13620	23620	33620	Ic IH01 RMS
--	--	--	--	Reserved	3621	13621	23621	33621	I4 IH01 RMS
761	10761	20761	30761	Ia HD01	--	--	--	--	Reserved
762	10762	20762	30762	Ib HD01	...	...	...	...	...
763	10763	20763	30763	Ic HD01	3928	13928	23928	33928	Ia IH63 RMS
764	10764	20764	30764	I4 HD01	3929	13929	23929	33929	Ib IH63 RMS
--	--	--	--	Reserved	3930	13930	23930	33930	Ic IH63 RMS
...	...	...	...	...	3931	13931	23931	33931	I4 IH63 RMS
1066	11066	21066	31066	Ia HD62	--	--	--	--	Reserved
1067	11067	21067	31067	Ib HD62	3933	13933	23933	33933	Ua Angle
1068	11068	21068	31068	Ic HD62	3934	13934	23934	33934	Ub Angle
1069	11069	21069	31069	I4 HD62	3935	13935	23935	33935	Uc Angle
--	--	--	--	Reserved	3936	13936	23936	33936	Reserved
1071	11071	21071	31071	Ia HD63	3937	13937	23937	33937	Ia Angle
1072	11072	21072	31072	Ib HD63	3938	13938	23938	33938	Ib Angle
1073	11073	21073	31073	Ic HD63	3939	13939	23939	33939	Ic Angle
1074	11074	21074	31074	I4 HD63	3940	13940	23940	33940	I4 Angle
--	--	--	--	Reserved	--	--	--	--	Reserved
1076	11076	21076	31076	Ua TH RMS	3942	13942	23942	33942	Ua Fund. Angle
1077	11077	21077	31077	Ub TH RMS	3943	13943	23943	33943	Ub Fund. Angle
1078	11078	21078	31078	Uc TH RMS	3944	13944	23944	33944	Uc Fund. Angle
1079	11079	21079	31079	Reserved	3945	13945	23945	33945	Reserved
1080	11080	21080	31080	Ua TOH RMS	3946	13946	23946	33946	Ua H02 Angle
1081	11081	21081	31081	Ub TOH RMS	3947	13947	23947	33947	Ub H02 Angle
1082	11082	21082	31082	Uc TOH RMS	3948	13948	23948	33948	Uc H02 Angle
1083	11083	21083	31083	Reserved	3949	13949	23949	33949	Reserved
1084	11084	21084	31084	Ua TEH RMS	...	...	...	...	...
1085	11085	21085	31085	Ub TEH RMS	4190	14190	24190	34190	Ua H63 Angle
1086	11086	21086	31086	Uc TEH RMS	4191	14191	24191	34191	Ub H63 Angle
1087	11087	21087	31087	Reserved	4192	14192	24192	34192	Uc H63 Angle
1088	11088	21088	31088	Ia TH RMS	4193	14193	24193	34193	Reserved
1089	11089	21089	31089	Ib TH RMS	4194	14194	24194	34194	Ia Fund. Angle
1090	11090	21090	31090	Ic TH RMS	4195	14195	24195	34195	Ib Fund. Angle
1091	11091	21091	31091	I4 TH RMS	4196	14196	24196	34196	Ic Fund. Angle
--	--	--	--	Reserved	4197	14197	24197	34197	I4 Fund. Angle
1093	11093	21093	31093	Ia TOH RMS	--	--	--	--	Reserved
1094	11094	21094	31094	Ib TOH RMS	4199	14199	24199	34199	Ia H02 Angle
1095	11095	21095	31095	Ic TOH RMS	4200	14200	24200	34200	Ib H02 Angle
1096	11096	21096	31096	I4 TOH RMS	4201	14201	24201	34201	Ic H02 Angle
--	--	--	--	Reserved	4202	14202	24202	34202	I4 H02 Angle
1098	11098	21098	31098	Ia TEH RMS	--	--	--	--	Reserved
1099	11099	21099	31099	Ib TEH RMS	...	...	...	...	...
1100	11100	21100	31100	Ic TEH RMS	4504	14504	24504	34504	Ia H63 Angle
1101	11101	21101	31101	I4 TEH RMS	4505	14505	24505	34505	Ib H63 Angle

--	--	--	--	Reserved	4506	14506	24506	34506	Ic H63 Angle
1103	11103	21103	31103	Ua DC Component	4507	14507	24507	34507	I4 H63 Angle
1104	11104	21104	31104	Ub DC Component	--	--	--	--	Reserved
1105	11105	21105	31105	Uc DC Component	5000	15000	25000	35000	Uab DC Component
1106	11106	21106	31106	Reserved	5001	15001	25001	35001	Ubc DC Component
1107	11107	21107	31107	Ua Fund.	5002	15002	25002	35002	Uca DC Component
1108	11108	21108	31108	Ub Fund.	5003	15003	25003	35003	Uab Fund.
1109	11109	21109	31109	Uc Fund.	5004	15004	25004	35004	Ubc Fund.
1110	11110	21110	31110	Reserved	5005	15005	25005	35005	Uca Fund.
1111	11111	21111	31111	Ua H02 RMS	...	...	...	...	...
1112	11112	21112	31112	Ub H02 RMS	5189	15189	25189	35189	Uab H63 RMS
1113	11113	21113	31113	Uc H02 RMS	5190	15190	25190	35190	Ubc H63 RMS
1114	11114	21114	31114	Reserved	5191	15191	25191	35191	Uca H63 RMS
1115	11115	21115	31115	Ua H03 RMS	5192	15192	25192	35192	Uab HD00
1116	11116	21116	31116	Ub H03 RMS	5193	15193	25193	35193	Ubc HD00
1117	11117	21117	31117	Uc H03 RMS	5194	15194	25194	35194	Uca HD00
1118	11118	21118	31118	Reserved	5195	15195	25195	35195	Uab HD01
...	...	...	...	...	5196	15196	25196	35196	Ubc HD01
1351	11351	21351	31351	Ua H62 RMS	5197	15197	25197	35197	Uca HD01
1352	11352	21352	31352	Ub H62 RMS	...	...	...	...	...
1353	11353	21353	31353	Uc H62 RMS	5381	15381	25381	35381	Uab HD63
1354	11354	21354	31354	Reserved	5382	15382	25382	35382	Ubc HD63
1355	11355	21355	31355	Ua H63 RMS	5383	15383	25383	35383	Uca HD63
1356	11356	21356	31356	Ub H63 RMS	--	--	--	--	Reserved
1357	11357	21357	31357	Uc H63 RMS	5390	15390	25390	35390	Uab IH02 RMS
1358	11358	21358	31358	Reserved	5391	15391	25391	35391	Ubc IH02 RMS
1359	11359	21359	31359	Ia DC Component	5392	15392	25392	35392	Uca IH02 RMS
1360	11360	21360	31360	Ib DC Component	...	...	...	...	...
1361	11361	21361	31361	Ic DC Component	5573	15573	25573	35573	Uab IH63 RMS
1362	11362	21362	31362	I4 DC Component	5574	15574	25574	35574	Ubc IH63 RMS
--	--	--	--	Reserved	5575	15575	25575	35575	Uca IH63 RMS
1364	11364	21364	31364	Ia Fund.	5576	15576	25576	35576	Uab IH00 HD
1365	11365	21365	31365	Ib Fund.	5577	15577	25577	35577	Ubc IH00 HD
1366	11366	21366	31366	Ic Fund.	5578	15578	25578	35578	Uca IH00 HD
1367	11367	21367	31367	I4 Fund.	...	...	...	...	...
--	--	--	--	Reserved	5765	15765	25765	35765	Uab IH63 HD
1369	11369	21369	31369	Ia H02 RMS	5766	15766	25766	35766	Ubc IH63 HD
1370	11370	21370	31370	Ib H02 RMS	5767	15767	25767	35767	Uca IH63 HD
1371	11371	21371	31371	Ic H02 RMS	5768	15768	25768	35768	Uab THD
1372	11372	21372	31372	I4 H02 RMS	5769	15769	25769	35769	Ubc THD
--	--	--	--	Reserved	5770	15770	25770	35770	Uca THD
1374	11374	21374	31374	Ia H03 RMS	5771	15771	25771	35771	Uab TOHD
1375	11375	21375	31375	Ib H03 RMS	5772	15772	25772	35772	Ubc TOHD
1376	11376	21376	31376	Ic H03 RMS	5773	15773	25773	35773	Uca TOHD
1377	11377	21377	31377	I4 H03 RMS	5774	15774	25774	35774	Uab TEHD
--	--	--	--	Reserved	5775	15775	25775	35775	Ubc TEHD
...	...	...	...	...	5776	15776	25776	35776	Uca TEHD
1669	11669	21669	31669	Ia H62 RMS	5777	15777	25777	35777	Uab Angle
1670	11670	21670	31670	Ib H62 RMS	5778	15778	25778	35778	Ubc Angle
1671	11671	21671	31671	Ic H62 RMS	5779	15779	25779	35779	Uca Angle
1672	11672	21672	31672	I4 H62 RMS	5780	15780	25780	35780	Uab Fund. Angle
--	--	--	--	Reserved	5781	15781	25781	35781	Ubc Fund. Angle
1674	11674	21674	31674	Ia H63 RMS	5782	15782	25782	35782	Uca Fund. Angle
1675	11675	21675	31675	Ib H63 RMS	...	...	...	...	...
1676	11676	21676	31676	Ic H63 RMS	5966	15966	25966	35966	Uab H63 Angle
1677	11677	21677	31677	I4 H63 RMS	5967	15967	25967	35967	Ubc H63 Angle
--	--	--	--	Reserved	5968	15968	25968	35968	Uca H63 Angle
1679	11679	21679	31679	Pa TH	5969	15969	25969	35969	Uab TIHD
1680	11680	21680	31680	Pb TH	5970	15970	25970	35970	Ubc TIHD
1681	11681	21681	31681	Pc TH	5971	15971	25971	35971	Uca TIHD
1682	11682	21682	31682	Qa TH	5972	15972	25972	35972	Uab TOIHD
1683	11683	21683	31683	Qb TH	5973	15973	25973	35973	Ubc TOIHD
1684	11684	21684	31684	Qc TH	5974	15974	25974	35974	Uca TOIHD
1685	11685	21685	31685	Sa TH	5975	15975	25975	35975	Uab TEIHD
1686	11686	21686	31686	Sb TH	5976	15976	25976	35976	Ubc TEIHD
1687	11687	21687	31687	Sc TH	5977	15977	25977	35977	Uca TEIHD
1688	11688	21688	31688	Pfa TH	5978	15978	25978	35978	Uab TH RMS
1689	11689	21689	31689	PFb TH	5979	15979	25979	35979	Ubc TH RMS
1690	11690	21690	31690	PFc TH	5980	15980	25980	35980	Uca TH RMS
1691	11691	21691	31691	Pa TH SUM	5981	15981	25981	35981	Uab TOH RMS
1692	11692	21692	31692	Pb TH SUM	5982	15982	25982	35982	Ubc TOH RMS
1693	11693	21693	31693	Pc TH SUM	5983	15983	25983	35983	Uca TOH RMS
1694	11694	21694	31694	Qa TH SUM	5984	15984	25984	35984	Uab TEH RMS

1695	11695	21695	31695	Qb TH SUM	5985	15985	25985	35985	Ubc TEH RMS
1696	11696	21696	31696	Qc TH SUM	5986	15986	25986	35986	Uca TEH RMS
1697	11697	21697	31697	Sa TH SUM	5987	15987	25987	35987	Uab TIH RMS
1698	11698	21698	31698	Sb TH SUM	5988	15988	25988	35988	Ubc TIH RMS
1699	11699	21699	31699	Sc TH SUM	5989	15989	25989	35989	Uca TIH RMS
1703	11703	21703	31703	Pa TH ABS	5990	15990	25990	35990	Uab TOIH RMS
1704	11704	21704	31704	Pb TH ABS	5991	15991	25991	35991	Ubc TOIH RMS
1705	11705	21705	31705	Pc TH ABS	5992	15992	25992	35992	Uca TOIH RMS
1706	11706	21706	31706	Qa TH ABS	5993	15993	25993	35993	Uab TEIH RMS
1707	11707	21707	31707	Qb TH ABS	5994	15994	25994	35994	Ubc TEIH RMS
1708	11708	21708	31708	Qc TH ABS	5995	15995	25995	35995	Uca TEIH RMS
1709	11709	21709	31709	Sa TH ABS	...	...	...	...	Reserved
1710	11710	21710	31710	Sb TH ABS	6423	16423	--	--	IR
1711	11711	21711	31711	Sc TH ABS					

All the Flicker, Demand and TC (optional) Parameters are available for SDR, DR and Max./Min Recorders.

Flicker			
ID	Parameter	ID	Parameter
50001	Ua Pst	50004	Ua Plt
50002	Ub Pst	50005	Ub Plt
50003	Uc Pst	50006	Uc Plt
Present Demand			
ID	Parameter	ID	Parameter
51001	Ua DMD	51051	Ubc Over Dev. DMD
51002	Ub DMD	51052	Uca Over Dev. DMD
51003	Uc DMD	51053	Ua Under Dev. DMD
51004	Uln Avg. DMD	51054	Ub Under Dev. DMD
51005	Reserved	51055	Uc Under Dev. DMD
51006	Uab DMD	51056	Uab Under Dev. DMD
51007	Ubc DMD	51057	Ubc Under Dev. DMD
51008	Uca DMD	51058	Uca Under Dev. DMD
51009	Ull Avg. DMD	51059	Freq. Dev. DMD
51010	Ia DMD	51060	U0 Unb. DMD
51011	Ib DMD	51061	U2 Unb. DMD
51012	Ic DMD	51062	I0 Unb. DMD
51013	I Avg. DMD	51063	I2 Unb. DMD
51014	I4 DMD	51064	Ia K-Factor DMD
51015	Reserved	51065	Ib K-Factor DMD
51016	Pa Imp. DMD	51066	Ic K-Factor DMD
51017	Pb Imp. DMD	51067	I4 K-Factor DMD
51018	Pc Imp. DMD	51068	Reserved
51019	P Total Imp. DMD	51069	Ua THD DMD
51020	Pa Exp. DMD	51070	Ub THD DMD
51021	Pb Exp. DMD	51071	Uc THD DMD
51022	Pc Exp. DMD	51072	Reserved
51023	P Total Exp. DMD	51073	Ia THD DMD
51024	Qa Imp. DMD	51074	Ib THD DMD
51025	Qb Imp. DMD	51075	Ic THD DMD
51026	Qc Imp. DMD	51076	I4 THD DMD
51027	Q Total Imp. DMD	51077	Reserved
51028	Qa Exp. DMD	51078	Ua TOHD DMD
51029	Qb Exp. DMD	51079	Ub TOHD DMD
51030	Qc Exp. DMD	51080	Uc TOHD DMD
51031	Q Total Exp. DMD	51081	Reserved
51032	Sa DMD	51082	Ia TOHD DMD
51033	Sb DMD	51083	Ib TOHD DMD
51034	Sc DMD	51084	Ic TOHD DMD
51035	S Total DMD	51085	I4 TOHD DMD
51036	PFa DMD	51086	Reserved
51037	PFb DMD	51087	Ua TEHD
51038	PFc DMD	51088	Ub TEHD
51039	PF Total DMD	51089	Uc TEHD
51040	Freq. DMD	51090	Reserved
51041	Ua Dev. DMD	51091	Ia TEHD
51042	Ub Dev. DMD	51092	Ib TEHD
51043	Uc Dev. DMD	51093	Ic TEHD
51044	Uab Dev. DMD	51094	I4 TEHD
51045	Ubc Dev. DMD	51095	Reserved
51046	Uca Dev. DMD	51096	Ia Fund. DMD
51047	Ua Over Dev. DMD	51097	Ib Fund. DMD
51048	Ub Over Dev. DMD	51098	Ic Fund. DMD

51049	Uc Over Dev. DMD	51099	I4 Fund. DMD
51050	Uab Over Dev. DMD		
Predicted Demand			
ID	Parameter	ID	Parameter
52001	Ua Pred. DMD	52021	Pb Exp. Pred. DMD
52002	Ub Pred. DMD	52022	Pc Exp. Pred. DMD
52003	Uc Pred. DMD	52023	P Total Exp. Pred. DMD
52004	Uln Avg. Pred. DMD	52024	Qa Imp. Pred. DMD
52005	Reserved	52025	Qb Imp. Pred. DMD
52006	Uab Pred. DMD	52026	Qc Imp. Pred. DMD
52007	Ubc Pred. DMD	52027	Q Total Imp. Pred. DMD
52008	Uca Pred. DMD	52028	Qa Exp. Pred. DMD
52009	Ull Avg. Pred. DMD	52029	Qb Exp. Pred. DMD
52010	Ia Pred. DMD	52030	Qc Exp. Pred. DMD
52011	Ib Pred. DMD	52031	Q Total Pred. DMD
52012	Ic Pred. DMD	52032	Sa Pred. DMD
52013	I Avg. Pred. DMD	52033	Sb Pred. DMD
52014	I4 Pred. DMD	52034	Sc Pred. DMD
52015	Reserved	52035	S Total Pred. DMD
52016	Pa Imp. Pred. DMD	52036	PFa Pred. DMD
52017	Pb Imp. Pred. DMD	52037	PFb Pred. DMD
52018	Pc Imp. Pred. DMD	52038	PFc Pred. DMD
52019	P Total Imp. Pred. DMD	52039	PF Total Pred. DMD
52020	Pa Exp. Pred. DMD	52040	Freq. Pred. DMD
This Max. Demand			
ID	Parameter	ID	Parameter
53001	P Total Imp. Max. DMD	53008	Ic Max. DMD
53002	P Total Exp. Max. DMD	53009	Ia Fund. Max. DMD
53003	Q Total Imp. Max. DMD	53010	Ib Fund. Max. DMD
53004	Q Total Exp. Max. DMD	53011	Ic Fund. Max. DMD
53005	S Total Max. DMD	53012	I4 Fund. Max. DMD
53006	Ia Max. DMD	53014	I Avg. Max. DMD
53007	Ib Max. DMD		
Last Max. Demand			
ID	Parameter	ID	Parameter
54001	P Total Imp. Last Max. DMD	54008	Ic Last Max. DMD
54002	P Total Exp. Last Max. DMD	54009	Ia Fund. Last Max. DMD
54003	Q Total Imp. Last Max. DMD	54010	Ib Fund. Last Max. DMD
54004	Q Total Exp. Last Max. DMD	54011	Ic Fund. Last Max. DMD
54005	S Total Last Max. DMD	54012	I4 Fund. Last Max. DMD
54006	Ia Last Max. DMD	54014	I Avg. Last Max. DMD
54007	Ib Last Max. DMD		
TC (optional)			
ID	Parameter	ID	Parameter
56001	TC1	56002	TC2

In Firmware V1.50.01 and later, the MB Slave's real-time measurements can be configured as the Data Recorder parameter of iMeter 5.

Slave #	Starting ID	ID Range
Slave #01	40000	40000-40299
Slave #02	40300	40300-40599
Slave #03	40600	40600-40899
Slave #04	40900	40900-41199
Slave #05-Slave #30	...	...
Slave #31	49000	49000-49299

ID Offset	Parameters	ID Offset	Parameters
0	Ua	48	kWh Net
1	Ub	49	kWh Tot.
2	Uc	50	kvarh Imp.
3	Uln Avg.	51	kvarh Exp.
4	Uab	52	kvarh Net
5	Ubc	53	kvarh Tot.
6	Uca	54	kVAh Tot.
7	Ull Avg.	55	Ia Present DMD
8	Ia	56	Ib Present DMD
9	Ib	57	Ic Present DMD
10	Ic	58	I Avg. Present DMD
11	I Avg.	59	Ua Present DMD

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12	Pa	60	Ub Present DMD
13	Pb	61	Uc Present DMD
14	Pc	62	Uln Avg. Present DMD
15	P Total	63	Uab Present DMD
16	Qa	64	Ubc Present DMD
17	Qb	65	Uca Present DMD
18	Qc	66	Ull Avg. Present DMD
19	Q Total	67	P Total Present DMD
20	Sa	68	Q Total Present DMD
21	Sb	69	S Total Present DMD
22	Sc	70	Ia This Max. DMD
23	S Total	71	Ib This Max. DMD
24	PFa	72	Ic This Max. DMD
25	PFb	73	I Avg. This Max. DMD
26	PFc	74	Ua This Max. DMD
27	PF Total	75	Ub This Max. DMD
28	Freq.	76	Uc This Max. DMD
29	Ua/UabAngle	77	Uln Avg. This Max. DMD
30	Ub/Ubc Angle	78	Uab This Max. DMD
31	Uc/Uca Angle	79	Ubc This Max. DMD
32	Ia Angle	80	Uca This Max. DMD
33	Ib Angle	81	Ull Avg. This Max. DMD
34	Ic Angle	82	P Total This Max. DMD
35	In	83	Q Total This Max. DMD
36	I4	84	S Total This Max. DMD
37	Disp. PF Total	85	U Unb.
38	Ung	86	I Unb.
39	Operating Time	87	Ia TDD
40	U1	88	Ib TDD
41	U2	89	Ic TDD
42	U0	90	Ia THD
43	I1	91	Ib THD
44	I2	92	Ic THD
45	I0	93	Ua/Uab THD
46	kWh Imp.	94	Ub/Ubc THD
47	kWh Exp.	95	Uc/Uca THD

Appendix B - Device Log Classification

Classification	Sub-Classification	Description	Event Value
1=System	0	Power On	None
	1	Power Off	None
	2	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 Setup Parameters	None
	9	Clear Factory Setup Parameters	None
	10	Reserved	None
	11	Reserved	None
	12	Clear SDR	See Note 1
	13	Clear DR	See Note 2
	14	Reserved	None
	15	Clear Energy	None
	16	Clear 3-phase Total IER Log	None
	17	Clear DI Counter	See Note 3
	18	Clear Flicker Log	BIT0: 0=Pst, 1=Plt
	19	Clear WFR	None
	20	Clear DWR	None
	22	Clear All MM Log	None
	23	Clear Max. Log	See Note 4
	24	Clear Min. Log	See Note 4
	25	Clear Max. Demand	BIT0: 0=This Max. DMD, 1=All Max. DMD
	26	Clear EN50160 Log	None
	28	Clear PQ Counters	See Note 5
	29	Clear TOU Log	None
	30	Trigger TOU Freeze	None
	31	Reserved	None
	32	Manual Trigger TOU Log	None
	33	Switch TOU Schedule	See Note 6
	34	Hardware Alarm	BIT0: System Parameters Error BIT1: Factory Parameters Error BIT2~BIT6: Reserved BIT7: NVRMA Error BIT8: Memory Error BIT9: DSP Error BIT10: ADC Error
	35	Hardware Normal	None
	38	Clear RMS Log	None
	39	Reserved	None
	40	Tariff Switch by DI	See Note 7
	41	Tariff Switch by DI Disabled	BIT0~BIT2: T1~T8
	42	Tariff Switch by DI Enabled	None
	43	Uninstall Storage	None
	46	Clear Device Log	None
	47	Clear SOE Log	None
	50	Clear 3-phase Total AER Log	None
	51	Clear All Events	None
	61	Clear Operating Time	None
	64	Clear IEEE Std 519-2022 Report	None
	65	Reset IL	None
	66	Clear Per-Phase AER	None
	67	Clear Per-Phase IER	None
	68	Clear Energy Consumption Log	None

Notes:

1. The bit value "1" for BIT0 to BIT3 of the returned value indicates the SDR Group 1 to 4 is cleared, respectively. The value "0xFFFFFFFF" means all SDR are cleared.
2. The bit value "1" for BIT0 to BIT7 of the returned value indicates the DR Group 1 to 8 is cleared, respectively. The value "0xFFFFFFFF" means all DR are cleared.
3. The bit value "1" for BIT0 to BIT3 of the returned value indicates the DI Counter 1 to 4 is cleared, respectively. The value "0xFFFFFFFF" means all DI Counters are cleared.

4. The bit value "1" for BIT0 to BIT3 of the returned value indicates the Max./Min. Recorder 1 to 4 is cleared, respectively. The value "0xFFFFFFFF" means all Max./Min. Recorders are cleared.

5. The following table illustrates the detail of the returned value for Clear PQ Counters event with a bit value of "1" meaning clear.

B0	Dip Counter	B3	Transient Counter	B6	Reserved	B9	MSV #3 Counter
B1	Swell Counter	B4	RVC Counter	B7	MSV #1 Counter	B10	All PQ Counters
B2	Interruption Counter	B5	Inrush Current Counter	B8	MSV #2 Counter		

6. The event value of Switch TOU Schedule are illustrated in the table below:

Value	Description	Value	Description
1	Switch Schedule 1 to Schedule 2 manually	3	Switch Schedule 1 to Schedule 2 automatically
2	Switch Schedule 2 to Schedule 1 manually	4	Switch Schedule 2 to Schedule 1 automatically

7. The event value of TOU Switch by DI are illustrated in the table below:

Offset	Format	Description
+0	UINT32	Tariff used before TOU Switch
+2	UINT32	Tariff used after TOU Switch

Appendix C - SOE Log Classification

Classification	Sub-Classification	Description	Value
0xA1: PQ Disturbance	0	Voltage Swell	UINT32: Source BIT0: Ua BIT1: Ub, BIT2: Uc BIT3: Uab, BIT4: Ubc, BIT5: Uca FP32: Residual Voltage Max./Min. (%) UINT32: Duration (ms)
	1	Voltage Dip	FP32: Ua Residual (%) FP32: Ub Residual (%) FP32: Uc Residual (%) UNIT32: Disturbance Direction Location 1=UpStream, 2=DownStream
	2	Voltage Interruption	UINT32: Confidence 1=Low, 2=Middle, 3=High FP32: Ua Benchmark (Primary) FP32: Ub Benchmark (Primary) FP32: Uc Benchmark (Primary) UINT32: Characteristic Type 0=Residual Voltage
	3	Overvoltage Start	UINT32: Duration (ms) FP32: Ua Residual FP32: Ub Residual
	4	Overvoltage End	FP32: Uc Residual UNIT32: Disturbance Direction Location 1=UpStream, 2=DownStream
	5	Undervoltage Start	UINT32: Confidence 1=Low, 2=Middle, 3=High FP32: Ua Benchmark FP32: Ub Benchmark
	6	Undervoltage End	FP32: Uc Benchmark UINT32: Characteristic Type 0=Residual Voltage
0xA2: Transient	0	Voltage Transient	FP32: Disturbance Max./Min. (%) UINT32: Duration (μs) FP32: Ua Disturbance (%) FP32: Ub Disturbance (%) FP32: Uc Disturbance (%)
0xA3: Inrush Current	0	Inrush Current Start	UINT32: Source BIT0: Ua, BIT1: Ub, BIT2: Uc
	1	Inrush Current End	UINT32: Duration (μs) FP32: Ia Max. Disturbance (A) FP32: Ib Max. Disturbance (A) FP32: Ic Max. Disturbance (A) FP32: Ia RMS During Disturbance (A) FP32: Ib RMS During Disturbance (A) FP32: Ic RMS During Disturbance (A)
0xA4: RVC	0	Rapid Voltage Change	UINT32: Start Time (s) UINT32: Start Time (ms) UINT32: Duration (ms) FP32: Max. Voltage Change Rate (%) FP32: Voltage Change Rate (%) UINT32: Source BIT0: Ua, BIT1: Ub, BIT2: Uc BIT3: Uab, BIT4: Ubc, BIT5: Uca
0xA5: MSV	0/2/4	MSV #1/2/3 Start	FP32: Frequency (Hz) UINT32: Source BIT0: Ua, BIT1: Ub, BIT2: Uc BIT3: Uab, BIT4: Ubc, BIT5: Uca
	1/3/5	MSV #1/2/3 End	FP32: Frequency (Hz) FP32: Ua MSV Max. (%) FP32: Ub MSV Max. (%) FP32: Uc MSV Max. (%)
0xA7: Motor Start	0	Motor Start	None
	1	Motor Start End	FP32: I _{max} FP32: U _{min} FP32: Duration (ms)

0xA9: Setpoint	0	Over Setpoint Active	UINT32: Parameter (See Table 4-24) FP32: Active Value UINT32: Setpoint Number (0 to 63)
	1	Over Setpoint Return	UINT32: Parameter (See Table 4-24) FP32: Return Value UINT32: Setpoint Number (0 to 63) FP32: Max. Value during Setpoint Active UINT32: Duration (ms)
	128	Under Setpoint Active	UINT32: Parameter (See Table 4-24) FP32: Active Value UINT32: Setpoint Number (0 to 63)
	129	Under Setpoint Return	UINT32: Parameter (See Table 4-24) FP32: Return Value UINT32: Setpoint Number (0 to 63) FP32: Min. Value during Setpoint Active UINT32: Duration (ms)
0xAB: I/O Change	0	Dlx Closed	UINT32: DI Number BIT0 to BIT3 stands for DI1 to DI4
	1	Dlx Open	
	2	DOx Operated	UINT32: DO Number BIT0 to BIT1 stands for DO1 to DO2 UINT32: Trigger Source 0=DI Change, 1=Setpoint, 2=Reserved, 3=Reserved, 4=Transient, 5=RVC, 6=Inrush Current, 7=Reserved, 8=Remote Control, 9=Pulse Width, 10=Front Panel Control, 11=Reserved, 12=Swell, 13=Dip, 14=Interruption, 15=ITIC Alarm, 16=SEMI F47 Alarm, 17=Motor Start, 18=iTrigger (Only for Trigger Source = iTrigger) UINT64: iTrigger Source MAC Address (Last 6 ASCII Digits) UINT32: iTrigger Group
	3	DOx Released	UINT32: DO Number BIT0: Alarm, BIT1 to BIT4 stands for DO1 to DO4 UINT32: Trigger Source 0=DI Change, 1=Setpoint, 2=Reserved, 3=PQ Disturbance, 4=Transient, 5=RVC, 6=Inrush Current, 7=Reserved, 8=Remote Control, 9=Pulse Width, 10=Front Panel Control, 11=Reserved, 12=Swell, 13=Dip, 14=Interruption
0xAC: Record	0	WFR Triggered	UINT32: Trigger Source 0=Manual, 1=iTrigger, 2=Schedule WFR (Only for Trigger Source = iTrigger) UINT32: iTrigger Group UINT64: iTrigger Source MAC Address (Last 6 ASCII Digits)
	1	DWR Triggered	UINT32: Trigger Source 0=Manual, 1=iTrigger (Only for Trigger Source = iTrigger) UINT64: iTrigger Source MAC Address (Last 6 ASCII Digits)
	2	RMSR Triggered	UINT32: Trigger Source 0=Manual, 1=iTrigger (Only for Trigger Source = iTrigger) UINT32: iTrigger Group UINT64: iTrigger Source MAC Address (Last 6 ASCII Digits)
	3	DRx Start	UINT32: DR Number BIT0 to BIT7 stands for DR1 to DR8 UINT32: Trigger Source 0=DI Change, 1=Setpoint, 2=Reserved, 3=PQ Disturbance, 4=Inrush Current
	4	DRx Stop	UINT32: DR Number BIT0 to BIT7 stands for DR1 to DR8 UINT32: Trigger Source 0=DI Change, 1=Setpoint, 2=Reserved, 3=PQ Disturbance, 4=Inrush Current 5=DI Settings Changed, 6=Setpoint Settings Changed, 7=Reserved, 8=PQ Disturbance Settings Changed, 9=Inrush Current Settings Changed, 10=Stop When Full

Appendix D - Technical Specification

Voltage Inputs (V1, V2, V3, VN)	
Standard (Un)	400VLN/690VLL+ 20%
Range	4-800V L-N /7-1380V L-L
Overload	2xUn continuous, 4xUn for 1s
Burden	< 0.5VA/per phase
PT Ratio	
Primary	1-1,000,000V
Secondary	1-1,500V
Measurement Category	CAT III 600V
Frequency	40Hz-72Hz
Current Inputs (-I11, I12, -I21, I22, -I31, I32, -I41, I42)	
Standard (In)	5A
Optional (In)	1A
Range	0.1% to 200% In
Starting Current	0.1% In
Overload	2xIn continuous, 4xIn for 10s, 20xIn for 1s
Burden	< 0.75VA/per phase @ 5A < 0.5VA/per phase @ 1A
CT Ratio	
Primary	1-30,000A
Secondary	1-50A
I4 Primary	1-30,000A
I4 Secondary	1-50A
SCCP Options	Split-Core Current Probe Input @ max. 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
Power Supply (L/+, N/-)	
Standard	95-250VAC/VDC $\pm$ 10%, 47-440 Hz
Optional	20-60VDC
Burden	< 14VA / 10W @ 250VAC, < 6W @ 24VDC
Overvoltage Category	OVC III 300V
Digital Inputs (DIC, DI1, DI2, DI3, DI4)	
Standard	Dry contact, 24VDC internally wetted
Sampling	1000Hz
Hysteresis	1ms minimum
Digital Outputs (DO11, DO12, DO21, DO22)	
Type	Form A Mechanical Relay
Loading	5A @ 250VAC/30VDC
Optional Solid State Pulse Outputs (E1+, E1-, E2+, E2-)	
Type	Form A Solid State Relay
Isolation	Optical
Max. Load Voltage	30VDC
Max. Forward Current	100mA
Optional Analog Output (via Modular I/O Expansion)	
Type	0-20 / 4-20 mA DC
Loading	500 Ω maximum
Overload	24 mA maximum
Terminals Max. Torque	
U & I Inputs	1.2N·m
DI, DO & RS-485	0.4N·m
Environmental Conditions	
Operating Temperature	-25°C to 70°C
Storage Temperature	-40°C to 85°C
Humidity	5% to 95% non-condensing
Atmospheric Pressure	60 kPa to 106 kPa
Pollution Degree	2
Mechanical Characteristics	
Panel Cutout	92x92 mm
Unit Dimensions	96x96x85 mm
IP Rating	54

Appendix E - Accuracy Specification

Parameters	Accuracy		Resolution
Voltage (U)		$\pm 0.1\%$	0.001V
I1, I2, I3, I4	5A/1A	$\pm 0.1\%$	0.001A
	SCCPA	$\pm 0.1\% + \text{Error of SCCP}$	
P, Q, S	5A/1A	$\pm 0.2\%$	0.001k
	SCCPA	$\pm 0.5\%$	
kWh, kVAh	5A/1A	IEC 62053-22 Class 0.2S	0.01kXh
	SCCPA	IEC 62053-21 Class 1	
kvarh	5A/1A	IEC 62053-24 Class 0.5S	0.01kvarh
		IEC 62053-23 Class 2	
	SCCPA	IEC 62053-24 Class 1	
		IEC 62053-23 Class 2	
PF	5A/1A	$\pm 0.2\%$	0.001
	SCCPA	$\pm 0.5\%$	
Phase Angle		$\pm 1^\circ$	0.1°
Freq., Freq. Deviation		$\pm 0.003 \text{ Hz}$	0.001Hz
Harmonics, Interharmonics		IEC 61000-4-7 Class I	0.01%
U Unbalance		$\pm 0.1\%$	0.01%
I Unbalance		$\pm 0.5\%$	0.01%
Pst, Plt		IEC 61000-4-15 Class F1	0.001

Appendix F - Standard Compliance

Safety Requirements	
CE LVD 2014 / 35 / EU	EN 61010-1: 2010 + A1: 2019 EN IEC 61010-2-030: 2021
Electrical Safety in Low Voltage Distribution Systems up to 1000Vac and 1500 VDC	IEC 61557-12: 2021 (PMD)
Insulation	IEC 62052-31: 2015 EN 61010-1: 2010 + A1: 2019
AC Voltage	2kV @ 1 minute
Insulation Resistance	>100MΩ
Impulse Voltage	6kV, 1.2/50μs
EMC Compatibility	
CE EMC Directive 2014 / 30 / EU (EN IEC 61326-1: 2021 + EN IEC 61326-2-3: 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 + AC: 2015
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
Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment	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 IEC 61000-6-4: 2019
Mechanical Tests	
Spring Hammer Test	IEC 62052-31: 2015
Vibration Test	IEC 62052-11: 2020
Shock Test	IEC 62052-11: 2020
Power Quality	
Voltage Characteristics of Electricity supplied by Public Distribution Systems	EN 50160: 2022
General Guide on Harmonic and Interharmonic Measurements and Instrumentation, for Power Supply Systems and Equipment Connected Thereto	IEC 61000-4-7: 2009
Flickermeter - 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
Power Quality Measurement in Power Supply Systems- Part 2: Functional Tests and Uncertainty Requirements	IEC 62586-2: 2021 Ed. 2.1

Appendix G - Ordering Guide



Version 20241108

Product Code	Description
iMeter 5 Advanced Modular Power Quality Analyzer	
	Basic Function P S* A*
	Classic Model (PQA) IEC 62053-22 Class 0.2S Compliant, 512MB Log Memory, 3-Phase True RMS Metering, Dips/Swells/Interruptions, PQ Disturbance Direction, Individual Harmonics up to 63rd, WF Recording @ 512 samples/cycle, Data Recorders, Energy Logs and Event Logs as well as Trending Curves for recorded data
	Class S Model (PQI-S) Classic Model with 2GB Log Memory+ Interharmonics, Flicker and Inrush Current, Transient Detection, Rapid Voltage Changes, Statistical Data Recorders, EN50160 and IEEE Std 519-2022 Compliance Report, IEC 61000-4-30 Ed. 3.1 Class S Compliant
	Class A Model (PQI-A) Class S Model with 4GB Memory + Mains Signalling Voltage, 2kHz-9kHz Conducted Emissions, Disturbance Waveform Recording, Individual Harmonic Energy, IEC 61000-4-30 Ed. 3.1 Class A Compliant
	Input Current 5 1 SCCPA^
	5A 1A Optional max. 500mV Input for use with SCCP CT Clamps (SCCPs not included)
	Input Voltage 9
	400VLN/690VLL + 20% (Applicable to 57-69VLN/100-120VLL, 120VLN/208VLL, 220-240VLN/380-415VLL, 277VLN/480VLL, 347VLN/600VLL and 400VLN/690VLL systems)
	Power Supply 2 3*
	95-250VAC/DC $\pm$ 10%, 47-440Hz 20-60VDC
	System Frequency 5
	40Hz-72Hz
	I/O A B
	4xDI + 2xDO (Form A Mechanical Relay) 4xDI + 2xSS Pulse Output
	Communications A
	2x10/100BaseT Daisy-Chain Ethernet Port + 1xRS-485 Port 1xExpansion Port with RJ45 Connector (for connecting I/O modules)
	Display Language E
	English
iMeter 5	iMeter 5-P5925AAE (Basic Model)

* Additional charges apply

^ The SCCPA option is compatible with the SCCP models listed in the "SCCP and Accessories" sheet. This option does not come with any Current Clamp. Please refer to the "SCCP and Accessories" sheet for more information and order the desired model and quantity as a separate item.

Contact us

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