

ZEUS METER



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FCC & INNOVATION, SCIENCE AND ECONOMIC DEVELOPMENT CANADA COMPLIANCE

The radio module is inserted into the electronic housing of the meter at manufacture. It has no user serviceable parts.

User Information (Part 15.105):

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- reorient or relocate the receiving antenna
- increase the separation between the equipment and the receiver
- connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- consult the dealer or an experienced radio/TV technician for help

If you experience trouble with this equipment, please use the Return Material Authorization (RMA) feature available at the Online Customer Services at www.portal.elstersolutions.com. Do not attempt to repair this equipment yourself unless you are replacing the entire module.

Compliance Statement (FCC Part 15.19 and ISED Canada): This device complies with part 15 of the FCC Rules and with ISED Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation of the device.

Énoncé de Conformité: Cet appareil est conforme à la Partie 15 des règles de la FCC et aux CNR d'ISED Canada applicables aux appareils radio exempts de licence. L'utilisation de cet appareil est soumise aux deux conditions suivantes : (1) Cet appareil ne doit pas provoquer d'interférences nocives et (2) cet appareil doit accepter toutes les interférences reçues notamment celles pouvant provoquer un fonctionnement intempestif de l'appareil.

Antenna Compliance: Under ISED Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by ISED Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'ISED Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par ISED Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

This radio transmitter has been approved by ISED Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio a été approuvé par ISED Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Warning (Part 15.21): Changes or modifications not expressly approved by meter manufacturer could void the user's authority to operate the equipment.

RF Radiation Safety Guidelines: This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

This equipment should be installed and operated to provide a separation distance >20 cm from all persons.

Directives de Sécurité de Radiofréquence: Cet équipement est conforme aux limites d'exposition aux radiations définies par la Commission Fédérale des Communications (FCC) pour un environnement non contrôlé. Cet équipement doit être installé et utilisé de manière à maintenir une distance de séparation > 20 cm avec toutes les personnes.

Collocation Statement: This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Déclaration de Co-localisation: Cet émetteur ne doit pas être co-localisé ou opérant en conjonction avec aucune autre antenne ou transmetteur.

- 900 MHz dipole antenna 2.1dBi

DISPOSAL INFORMATION

This product contains electronics components which should be disposed of in accordance with applicable regulations.

DISCLAIMER OF WARRANTIES AND LIMITATION OF LIABILITY

Unless otherwise stated in a written agreement, the manufacturer does not provide any warranties for this product or its documentation. This includes all implied warranties, such as acceptability or fitness for a particular purpose.

The information in this manual is based on the manufacturer's experience with the product. It is provided for general guidance only and may not cover every situation. If you need more details, please contact the manufacturer.

The information, instructions, safety notices, and recommendations provided in this manual are supplied solely for guidance and reference. No warranties—express, implied are made regarding their accuracy, completeness, or suitability for any specific purpose. This includes, but is not limited to, implied warranties of acceptability, fitness for a particular application, or reliability based on industry practices or prior usage. Users are solely responsible for applying this information appropriately and safely.

The manufacturer will not be liable for any indirect, incidental, special, or consequential damages of any kind. This includes, but is not limited to, loss of profits, loss of use, business interruption, or claims from third parties arising from the use of this product or this manual.

SAFETY INFORMATION

The installation, operation, and maintenance of this product involve potential hazards, such as high voltages or moving parts. To ensure safe use, the following practices must be observed:

- Carefully read and follow all safety instructions, warnings, and recommendations in this manual.
- Do not remove or reproduce pages from this manual. Doing so may cause important cross-references or safety information to be missed, which could result in personal injury, equipment damage, or even death.
- Ensure that all personnel involved in installing, operating, or maintaining this product are aware of and understand the safety instructions provided.

In this manual, safety instructions are presented immediately before the relevant step or information. Safety notices are classified as follows:

NOTICE

Indicates important information regarding installation, operation, or maintenance that is not safety-related but should be followed to avoid problems.

⚠ CAUTION

Alerts personnel to a potential hazard that could result in minor injury, equipment damage, or property damage if ignored.

⚠ WARNING

Indicates a hazard that could cause serious injury, death, significant equipment, or property damage if not followed.

⚠ DANGER

Indicates an immediate hazard that will result in serious injury, death, or major equipment/property damage if not followed.

CHAPTER - 1

INTRODUCTION

1.1 The ZEUS Meter

This manual provides an overview of the features, versatility and operating characteristics of the Zeus energy meter.

1.2 Initial Release of the ZEUS Meter



The **ZEUS Energy Meter** is a precision-engineered, ANSI-compliant revenue-grade energy metering solution designed to meet the evolving needs of both **utility and municipal providers**, as well as **commercial and sub-metering** applications. Developed in alignment with **ANSI** standards, the Meter ensures accuracy, reliability and secure communication in various deployment environments.

Designed for seamless integration into energy management systems, the Meter supports **bi-directional energy measurement**, **four-quadrant metering**, and **advanced profiling** features, making it suitable for residential, commercial, and industrial applications.

1.3 Key Capabilities and Features

1.3.1 Revenue Grade Energy Measurement

The Energy Meter delivers high-precision measurement of key electrical parameters including:

- Delivered and Received Energy parameters - Active (kWh), Reactive (kVARh), and Apparent (kVAh).
- Delivered and Received Power parameters - Active (kW), Reactive (kVAR), and Apparent (kVA).
- System and Phase wise - Voltage (Volts) and Current (A).
- Power factor (PF) and Frequency (Hz).

These measurements are compliant with revenue-grade standards to ensure billing accuracy.

1.3.2 Time-of-Use (TOU) Functionality

The meter includes fully configurable Time-of-Use (TOU) functionality to support dynamic pricing structures. It allows:

- Up to 4 Seasons:
Spring, Summer, Fall, and Winter.
- 4 Day Types:
Weekdays, Weekends, Holidays, and Special Days.
- 4 Tariff Tiers (A, B, C, and D) for flexible energy pricing.

This configuration enables utilities to optimize load management, reduce peak demand, and encourage energy efficiency through pricing strategies.

1.3.3 Load Profile Logging

The Meter supports advanced logging functions for detailed system analysis:

- 6 Selectable Energy Channels. **For details refer section 2.9.2**
- Configurable interval lengths of 1, 5, 10, 15, 30, & 60 minutes.

These logs provide insight into consumption patterns and system performance, which are valuable for energy audits and diagnostics.

1.3.4 Advanced Calendar Functionality

An integrated calendar engine enhances operational scheduling. Users can configure:

- TOU Schedules
- Seasonal and Day-Type transitions
- Holiday calendars
- Daylight Saving Time (DST) settings
- Demand reset and self-read schedules
- TOU Registers Data
- Billing data
- Midnight data

These features ensure the meter automatically adapts to seasonal, regulatory, and billing cycle changes with minimal manual intervention.

1.4 ANSI Standard Compliance

The meter is designed to comply with, and in many cases surpass, the performance, accuracy, and safety requirements outlined in the following ANSI standards for electric metering:

Standard	Date	Title
ANSI C12.18	2006 (2S016)	American National Standard for Protocol Specification for ANSI Type 2 Optical port
ANSI C12.10	2011 (2S021)	Physical Aspects of Watt- hour Meters
UL 2735	2013	Standard For Safety for Electricity Meters
ANSI C12.19	2021	American National Standard for Utility Industry End Device Data Tables
ANSI C12.1	2022	American National Standards for Electric Meters – Code for Electricity Metering

CHAPTER - 2

PRODUCT SPECIFICATIONS

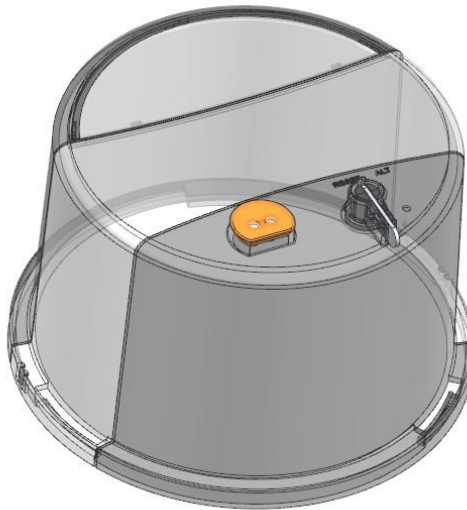
2.1 PHYSICAL SPECIFICATIONS

The Energy Meter is built with three main assemblies:

- Meter Cover
- Electronic Assembly
- Base Assembly

2.1.1 Meter Cover

The Meter Cover is the outer enclosure that protects internal components from dust and moisture. It is made of high-impact, flame-retardant polycarbonate and includes a transparent window for viewing the display and indicators.



2.1.2 Electronic Assembly

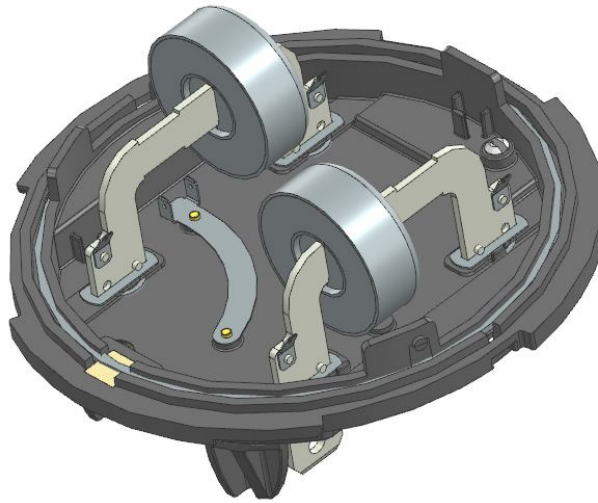
The Electronic Assembly is the core functional unit of the meter. It contains the main PCB (Printed Circuit Board), micro-controller, energy metering ICs, display unit, LED's, and communication modules. This assembly handles signal processing, energy calculations, and data communication.

2.1.3 Base Assembly

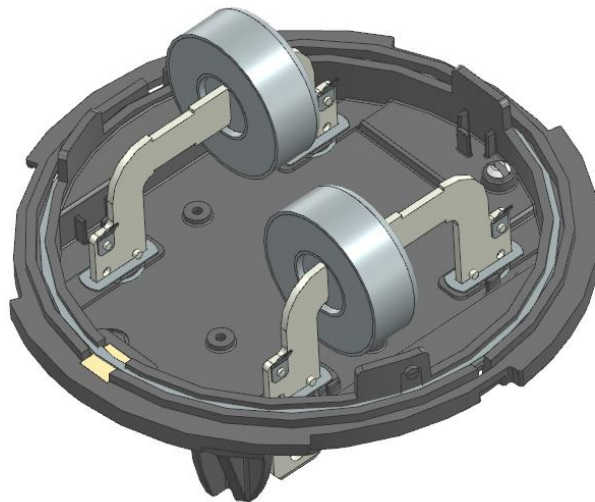
The Base Assembly houses the terminal block for wiring connections and provides structural support to the entire meter. It ensures safe and reliable connection to the electrical system and securely holds the electronic assembly in place.

Together, these assemblies ensure the meter's durability, safety, and reliable performance under various operating conditions.

For 12S:

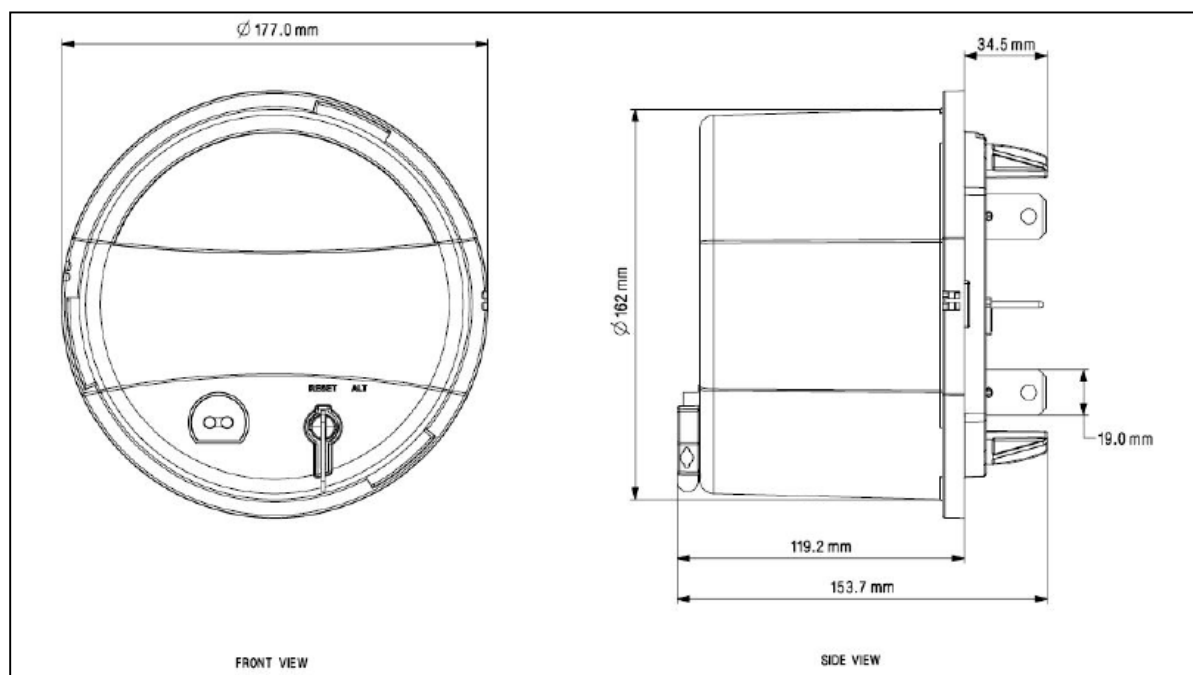


For 2S:



2.2 Dimensions

The physical dimensions of the Energy Meter are illustrated in the image below. This includes overall height, width, depth, and mounting specifications. Ensure sufficient clearance around the meter for wiring, ventilation, and access during installation or maintenance. All measurements are in millimeters (mm).



2.3 STYLE NUMBER DETAILS

2.3.1 Style Number Fields

The Style Number provides a concise code that identifies the configuration and features of each meter model. It is structured to communicate key specifications such as the system type, current rating, communication capabilities, and output options. Understanding this code allows users, technicians, and utility providers to quickly verify meter compatibility and functionality.

The table below breaks down each segment of the style number into its corresponding feature, including:

- **System Type:**
Indicates the meter form
Example: R2 (2S)/R12 (12S)
- **Current Range:** Specifies the supported ampere range
LoRa Communication: Denotes whether LoRa wireless communication is enabled
2 Relay Output: Identifies the presence of dual relay pulse outputs

Example:

Z042201031 - ZEUS R2 240V 200A KYZ + LoRa NA915

Meter:	Z	0	4	2	2	0	1	0	31
Product/Family									
Metrology/Hardware Revision									
Base Terminal Jaw									
4 - R2									
5 - R12									
Voltage									
2 - 240V									
Current									
2 - Class 200									
Service Disconnect Switch									
0 - None									
Metrology Feature									
1 - Demand, LP, and TOU									
Comm. HW Revision									
Comm. Feature									
00 - None									
11 - LoRa NA915									
30 - KYZ									
31 - KYZ + LoRa NA915									

2.4 SYSTEM ARCHITECTURE

The Energy Meter is engineered with a precision measurement and intelligent control architecture that ensures high accuracy, secure data handling, and seamless integration with utility systems. It incorporates advanced voltage and current sensing circuits that condition input signals using resistor voltage dividers and current transformers. These signals are filtered and passed to high-resolution ADC for precise digital conversion.

Once digitized, the signals are processed by an embedded metrology engine capable of calculating real-time electrical parameters such as voltage, current, power (active, reactive, and apparent), energy consumption, frequency, and power factor. These calculations use optimized digital signal processing algorithms to ensure compliance with industry standards and billing accuracy requirements.

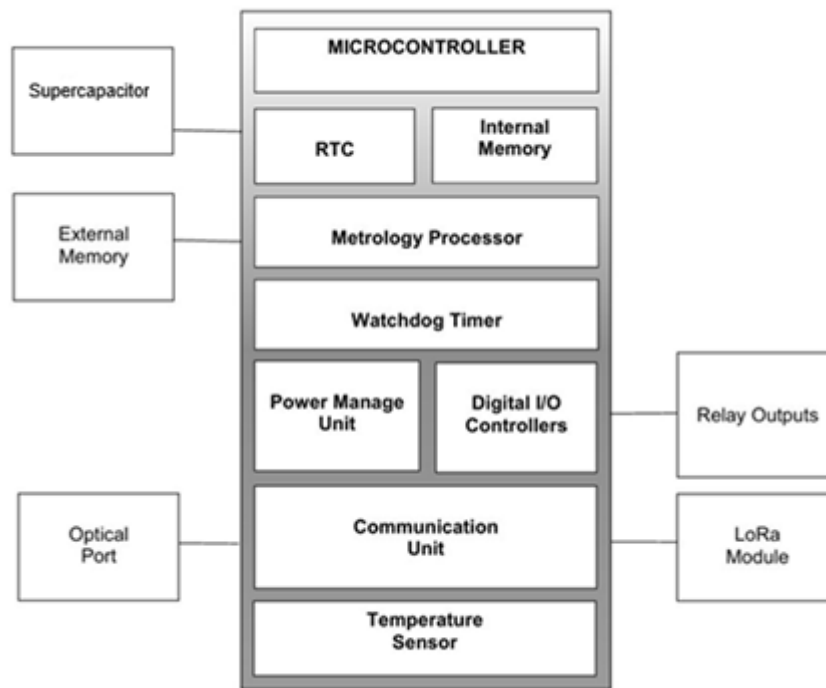
At the core of the system, a dedicated micro-controller (MCU) manages overall operations including data acquisition, measurement computations, user interface control, data logging, and communication with external systems. The MCU also handles Time-of-Use (TOU) functionality by referencing a real-time clock (RTC), which maintains accurate timekeeping even during power outages through the use of a super capacitor.

The meter includes non-volatile memory for securely storing configuration settings, energy usage logs, load profile interval data, and firmware. This allows for reliable record-keeping, remote diagnostics, and long-term data retention. Volatile memory is used for fast processing tasks and buffering.

The user interface features a high-contrast LCD that clearly displays key metrics such as voltage, current, energy usage, power factor, tariff tier, and time/date. Alphanumeric fields and status indicators help convey messages, diagnostics, and configuration identifiers. Directional arrows and energy flow symbols show whether energy is being delivered or received, while tier indicators identify the current tariff rate based on TOU scheduling.

For communication, the meter supports multiple protocols including LoRa and Optical communication, allowing real-time data exchange, remote meter reading, and firmware updates.

Finally, the meter's power supply unit includes surge protection and wide voltage input tolerance, providing stable operation under varying grid conditions. It powers all internal subsystems efficiently, while maintaining isolation and protection.



2.5 FUNDAMENTALS OF OPERATION

2.5.1 Power Supply

The meter is powered through a wide-range AC power supply designed for reliable operation under varying service conditions. It accepts input voltages from 96 VAC to 264 VAC, ensuring compatibility with standard low-voltage utility networks. The meter requires Phase A voltage to be present for the system to initialize and function. Internally, the AC input is converted into regulated 8V DC and 3.3V DC outputs, which supply power to the core meter components, including the metrology engine and communication modules. Additionally, the power supply supports auxiliary functions that provides backup energy to retain real-time clock and critical communication data during power interruptions.

2.5.2 RTC Backup

The Energy Meter features an internal real-time clock (RTC) that maintains accurate timekeeping even during power outages. This is supported by an on-board super capacitor providing up to **8 hours** of backup power for the RTC. This ensures continuous operation of time-dependent functions such as demand intervals, event logging, and TOU without interruption.

2.5.3 Micro-controller

The meter features a high-performance dual-core 32-bit micro-controller, engineered to efficiently manage both metrology and system-level operations. The primary core handles fundamental metrology tasks such as voltage and current sampling, as well as the calculation of basic energy and instrumentation parameters. The secondary core manages advanced system functions including demand and interval data processing, LCD control, optical communication, and interfacing with the communication module. Additionally, the micro-controller integrates the real-time clock (RTC), ensuring accurate timekeeping across all functions.

2.5.4 Memory and Data Retention

The meter utilizes non-volatile memory systems to ensure reliable data preservation. Metrology related data is stored in high-capacity serial flash memory, while critical system configuration data is retained in serial EEPROM.

A high-speed serial interface enables efficient communication between the micro-controller and the non-volatile memory, ensuring data integrity even during power loss or system resets.

2.5.5 Voltage Measurement Circuitry

The meter incorporates precision voltage dividers on the main board to accurately scale phase voltages to levels suitable for digital processing. These reduced voltage signals are fed to the micro-controller's analog-to-digital converters, enabling high-accuracy sampling for metrology computations and system monitoring.

2.5.6 LCD Display Interface

The liquid crystal display (LCD) on the meter provides clear and concise information related to metrology and meter status. It presents real-time values such as energy readings, demand, and voltage, along with icons that offer immediate visual cues. These icons indicate the presence of phase voltages and the direction of energy flow through the meter. This intuitive interface ensures that users and utility personnel can quickly interpret the operational state of the meter at a glance.

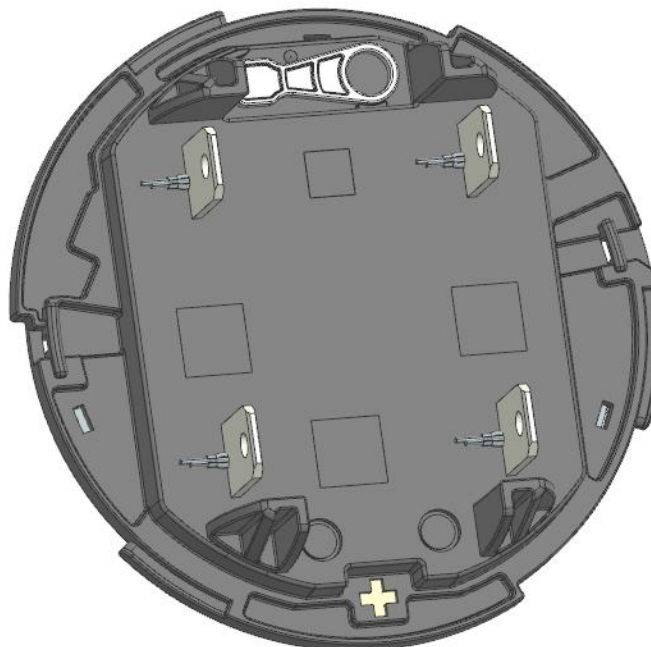
2.5.7 Current Sensing Mechanism

The meter is equipped with precision current sensors mounted within the meter base PCB. These sensors measure the current flowing to the connected load and convert it into scaled-down signals. These signals are then accurately sampled by the micro-controller's analog-to-digital converters for metrology computations. This mechanism ensures reliable and accurate current measurement essential for billing and monitoring purposes.

2.5.8 Meter Form Blade Configuration

The meter supports ANSI standard meter forms, specifically Forms 2S and 12S. The meter base includes form-specific blade configurations that establish electrical connections with the meter socket. These blades provide inputs to the precision voltage dividers and supply power to the internal systems. This standardized configuration ensures compatibility with utility installations and accurate metering based on the specific service type.

For meter form 2S: 4 Blades



For meter form 12S: 5 Blades



2.6 Billing Data

In accordance with ANSI standards, the Energy Meter facilitates accurate and reliable billing through its daily midnight snapshot mechanism. At 00:00 hours (midnight) of each day, day of the week (sun-sat), or day of the month (1-31), the meter captures and stores a cumulative record of energy registers and other electrical parameters.

Based on the user-defined settings, the system provides billing data and historical records according to the following storage capacities:

1. Daily Records: Snapshots are stored for up to 365 days.
2. Weekly Records: Billing data is maintained for up to 6.5 years.
3. Monthly Records: Cumulative billing data is archived for up to 30 years.

By utilizing these snapshots, the meter calculates the total consumption for any given billing cycle. This flexible configuration ensures that the user receives precise billing data tailored to their specific reporting requirements while maintaining a robust long-term historical audit trail.

1. Energy Consumption Calculation:

Daily consumption is calculated as:

$$\{\text{Daily Consumption (kWh)}\} = \{\text{Closing Reading}\} - \{\text{Opening Reading}\}$$

Weekly consumption is calculated as:

$$\{\text{Weekly Consumption (kWh)}\} = \{\text{Closing Reading}\} - \{\text{Opening Reading}\}$$

Monthly consumption is calculated as:

$$\{\text{Monthly Consumption (kWh)}\} = \{\text{Closing Reading}\} - \{\text{Opening Reading}\}$$

This method ensures accurate measurement of total energy used over the billing period.

The total consumption is then applied to the applicable tariff rates (which may include slab-based pricing, fixed charges, and taxes) to generate the final electricity bill.

Note: Within the Calendar Settings, if the Self-Read and Demand Reset functions are enabled, the meter follows a strict operational sequence to ensure data integrity:

Billing Data Generation: The meter first captures and stores the billing data snapshot for the current period.

Application of Settings: Once the billing data is successfully recorded, the Self-Read and Demand Reset settings are applied to the meter.

This ensures that the final billing report includes all consumption data before the demand registers are reset for the new billing cycle.

Billing Parameters	2S	12S
kWh Delivered	√	√
kWh Received	√	√
Previous Maximum Demand kW Delivered	√	√
Previous Maximum Demand kW Received	√	√
Tariff A kWh Delivered	√	√
Tariff B kWh Delivered	√	√
Tariff C kWh Delivered	√	√
Tariff D kWh Delivered	√	√
Tariff A Maximum Demand kW Delivered	√	√
Tariff B Maximum Demand kW Delivered	√	√
Tariff C Maximum Demand kW Delivered	√	√
Tariff D Maximum Demand kW Delivered	√	√
Tariff A kWh Received	√	√
Tariff B kWh Received	√	√
Tariff C kWh Received	√	√
Tariff D kWh Received	√	√
Tariff A Maximum Demand kW Received	√	√
Tariff B Maximum Demand kW Received	√	√
Tariff C Maximum Demand kW Received	√	√
Tariff D Maximum Demand kW Received	√	√

2.6.1 Tariff-Based Billing Data– Time of Use (TOU)

For utilities that implement time-of-use or seasonal billing structures, the meter offers detailed tariff-specific billing data. The meter maintains separate records up to four configurable tariffs, capturing:

1. Tariff-wise kWh Delivered – energy usage during each tariff window
2. Tariff-wise kWh Received – energy received during each tariff window
3. Tariff-wise Maximum Demand (kW) Delivered – highest power usage per tariff
4. Tariff-wise Maximum Demand (kW) Received – highest power sent back per tariff

This granularity supports complex billing models, demand incentives, and load management programs. It also enables customers to adapt their usage habits based on pricing windows, improving both system efficiency and customer cost control.

The billing data architecture in the meter ensures accurate, auditable, and tariff-aligned energy tracking. Whether for traditional billing or advanced energy programs, these records deliver the data integrity and detail required by modern utilities.

2.7 Midnight Data

The Energy Meter is designed to record daily energy consumption in compliance with ANSI (American National Standards Institute) standards for electric meters. At exactly 00:00 hours (midnight) each day, the meter captures a snapshot of cumulative usage data, effectively finalizing the energy consumption for the preceding day. This daily snapshot includes a range of key electrical parameters, as outlined in the table below:

Midnight Parameters	2S	12S
kWh Delivered	√	√
kWh Received	√	√
Previous Maximum Demand kW Delivered	√	√
Previous Maximum Demand kW Received	√	√
Tariff A kWh Delivered	√	√
Tariff B kWh Delivered	√	√
Tariff C kWh Delivered	√	√
Tariff D kWh Delivered	√	√
Tariff A Maximum Demand kW Delivered	√	√
Tariff B Maximum Demand kW Delivered	√	√
Tariff C Maximum Demand kW Delivered	√	√
Tariff D Maximum Demand kW Delivered	√	√
Tariff A kWh Received	√	√
Tariff B kWh Received	√	√
Tariff C kWh Received	√	√
Tariff D kWh Received	√	√
Tariff A Maximum Demand kW Received	√	√
Tariff B Maximum Demand kW Received	√	√
Tariff C Maximum Demand kW Received	√	√
Tariff D Maximum Demand kW Received	√	√

The energy meter automatically captures and stores a detailed snapshot of key energy parameters at midnight each day upto 365 days. This feature ensures daily accuracy in energy tracking and lays the foundation for billing, analytic, and performance monitoring.

2.7.1 Time Reference – Unix Time stamp

Each midnight record is tagged with a Unix Time Stamp of Last Midnight, providing an exact system-generated reference for when the data was captured. This time stamp aligns all data to a precise daily boundary, enabling clear historical comparisons.

2.7.2 System Energy Data

At every midnight, the meter logs:

1. Total kWh Delivered – cumulative energy delivered to the load
2. Total kWh Received – cumulative energy received from the load

These values give a clear picture of energy flow direction and quantity, helping utilities manage demand and customers track usage.

2.7.3 System Demand Data

Alongside energy, the meter records:

1. Maximum Demand (kW) Delivered
2. Maximum Demand (kW) Received

These peak values represent the highest observed power usage and are essential for utilities applying demand-based billing or load profiling.

2.7.4 Time-of-Use (TOU) Granularity

For TOU enabled operations, the meter logs separate midnight data for upto four tariff periods.

For each tariff, the following are recorded:

1. Tariff-wise kWh Delivered & Received
2. Tariff-wise Max Demand (kW) Delivered & Received

This level of granularity empowers utilities to implement dynamic pricing models, encourage off-peak usage and gain deeper insight into customer behavior.

2.8 DEMAND CALCULATIONS

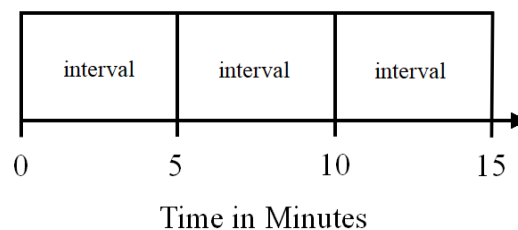
The meter supports demand calculations in two modes:

- Blocked interval
- Rolling interval

2.8.1 Blocked Interval

Demand is calculated and updated only at the end of each fixed demand interval (measured in minutes). The meter accumulates demand values once the full interval is complete.

For example, if the demand interval is 5 minutes, the demand value updates every 5 minutes, showing the average power consumption during that period.



2.8.2 Rolling Interval

The Energy Meter supports rolling (sliding) demand measurement, which provides a more responsive view of power usage by averaging demand over overlapping time periods. This method uses two configurable parameters:

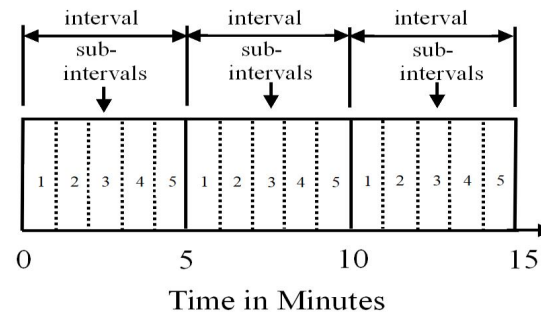
Demand Interval – The total time window used to calculate average demand. It is set in minutes and must evenly divide into 60 (e.g., 15, 30, or 60 minutes).

Sub-interval – A shorter time slice within the demand interval. This is also set in minutes and must divide evenly into the selected demand interval.

These parameters are configured using the Configuration Software.

Example Scenario:

If the meter is configured with a 5-minute demand interval and a 1-minute sub-interval, the meter calculates demand every 1 minutes. This produces a continuous, overlapping view of demand useful for identifying rapid increases in usage without waiting for the full demand interval to complete.



2.8.3 Maximum Demand

Maximum Demand (also called peak demand) represents the highest demand value recorded during a billing period. The meter calculates demand for each demand interval and compares it with the previously stored maximum demand. If the new demand value exceeds the stored maximum, it updates the maximum demand accordingly. In addition to maximum demand, the meter maintains records of cumulative and continuous cumulative demand.

2.8.3.1 Cumulative Maximum Demand

When a demand reset occurs, the current maximum demand value is added to the cumulative maximum demand total. Unlike the instantaneous maximum demand, the cumulative maximum demand is never reset to zero. This design ensures that unauthorized resets do not erase historical peak demand data. The cumulative maximum demand only changes during demand resets. To find the maximum demand for a billing period after a reset, subtract the previous cumulative maximum demand from the current cumulative value.

Example:

Suppose the cumulative max demand before reset is 100 kW. During the billing period, the max demand reaches 30 kW. After a demand reset, the cumulative max demand becomes 130 kW ($100 + 30$). To find the max demand during this billing period, subtract 100 from 130, giving 30 kW.

2.8.3.2 Continuous Cumulative Maximum Demand

Continuous cumulative max demand operates in a manner similar to cumulative max demand, but with a key distinction. Its value is always the sum of the previous continuous cumulative demand and the difference between current max demand and previous max demand. During a billing period, it increases only when the max demand increases, by the same amount. Demand resets do not affect the continuous cumulative max demand.

Example:

If the continuous cumulative max demand at the start of the billing period is 200 kW and the current max demand is 50 kW and previous max demand was 25 kW, the continuous cumulative max demand becomes 225 kW. It continues to increase as demand rises and does not reset.

2.9 LOGS & DATA SETS

2.9.1 Event Logging

The meter is capable of storing up to 400 events in its event log, each recorded with a corresponding date and time stamp. Once the log reaches its maximum capacity, the meter will automatically overwrite the oldest entries in a first-in, first-out manner (FIFO).

2.9.2 Load profile Logging

The Energy Meter supports logging of 30 energy parameters from which 6 can be logged at a time by assigning to 6 load profile channel allowing flexible monitoring.

The interval length for logging energy data can be configured to 1, 5, 10, 15, 30, or 60 minutes, providing customize granularity based on user needs.

Load Profile Parameters	2S	12S
kWh Delivered	√	√
kWh Received	√	√
kVARh Delivered	√	√
kVARh Received	√	√
kVAh Delivered	√	√
kVAh Received	√	√
System kWh	√	√
System kVARh	√	√
System kVAh	√	√
Net kWh	√	√
Net kVARh	√	√
Net kVAh	√	√
PH-A kWh Delivered	√	√
PH-A kWh Received	√	√
PH-A kWh Sum	√	√
PH-A kVARh Delivered	√	√
PH-A kVARh Received	√	√
PH-A kVARh Sum	√	√
PH-A kVAh Delivered	√	√
PH-A kVAh Received	√	√
PH-A kVAh Sum	√	√
PH-C kWh Delivered	√	√
PH-C kWh Received	√	√
PH-C kWh Sum	√	√
PH-C kVARh Delivered	√	√
PH-C kVARh Received	√	√
PH-C kVARh Sum	√	√
PH-C kVAh Delivered	√	√
PH-C kVAh Received	√	√
PH- C kVAh Sum	√	√

2.9.3 Time of Use Data

The Energy Meter's Time-of-Use (TOU) feature lets users track energy consumption based on customized schedules that reflect different times of day, days of the week, and seasons of the year. This flexibility helps users or utilities apply variable rates and manage energy costs more effectively.

Users can define recurring events such as holidays, seasonal changes, and daylight saving time adjustments. These events automatically update the meter's schedule each year, ensuring the TOU settings stay accurate without manual intervention. There's also the ability to set non-recurring events for special one-time adjustments.

The meter supports dividing the year into multiple seasons, with each season further categorized into different day types like weekdays, weekends, holidays, or special days. This layered approach means rates can change dynamically depending on the time of year and day type, enabling more precise billing and energy management.

Within each season and day type, users can configure tier rate levels and specify exact times when rates switch. This allows for granular control over how energy consumption is measured and billed during peak and off-peak periods.

Overall, the TOU functionality provides a powerful and flexible way to align energy monitoring with real-world billing and operational requirements, helping users optimize energy usage and costs throughout the year.

2.9.4 Self Read

The meter supports Self Read capture, a scheduled snapshot of metered data, stored internally for later retrieval. Self Reads are configured to occur at predefined intervals or can be triggered manually via local or remote commands, depending on utility requirements.

Each Self Read stores a complete image of selected cumulative energy and demand registers along with a time stamp. These records are non-volatile and persist through power loss, enabling historical profiling, consumption validation, and off-cycle billing analysis.

Captured Parameters:

The Self Read profile includes the following data categories:

1. Total Energy Values:

→ Delivered and received kWh, kVARh, and kVAh.

2. Cumulative Demand Registers:

→ Cumulative kW, kVAR, and kVA demand for delivered, received, and total vectors.

→ Separate tracking for each demand type, supporting energy flow differentiation, and net metering use cases.

3. Continuous Cumulative Demand:

→ Parallel tracking of cumulative demand values without reset, supporting rolling demand analytic, and system-level load analysis.

4. Maximum Demand Registers:

→ Peak kW, kVAR, and kVA demand readings recorded during the billing period.

→ Includes conventionally separated Maximilian (delivered/received/total).

5. Time-of-Use (TOU) Demand by Tariff:

→ Per-tariff kW and kVAR demand accumulation (Tariff A through D).

→ Enables TOU-based billing and analysis under Multi-rate structures.

6. Time Stamp:

→ Each Self Read record is marked with a full date/time stamp, compliant with ANSI C12.19 time formats.

Application and Retrieval

Self Read data is retrievable through the optical port. The number of Self Read records retained in memory is configurable and can be managed through the meter's programming tool or head-end system.

Self Read functionality ensures billing integrity during communication outages and supports validation of billing determinants, load profile reconstruction, and compliance auditing.

2.9.5 Previous Demand Reset

The meter records a complete snapshot of demand and energy data at each Demand Reset event. This functionality supports billing, auditing, and analysis by retaining all relevant measurement values just prior to the most recent reset cycle. The Previous Demand Reset data is essential for identifying trends, validating billing intervals, and diagnosing load behavior across multiple demand periods.

Each snapshot is stored in non-volatile memory and includes a full register set similar to the current billing data, captured immediately before a manual, scheduled, or remote demand reset operation.

Captured Parameters:

The following register values are recorded at the moment of the last demand reset:

1. Total Energy:

→ Delivered and received kWh, kVARh, and kVAh totals accumulated prior to reset.

2. Cumulative Demand Values:

→ Are-reset cumulative kW, kVAR, and kVA demands, recorded separately for delivered, received and total vectors.

→ Enables review of prior billing-period totals.

3. Continuous Cumulative Demand:

→ Non-forgettable cumulative demand registers also captured at the reset point for reference, supporting consistency checks against rolling demand records.

4. Maximum Demand Values:

→ Last period peak demand values across kW, kVAR, and kVA, including directional breakdowns.

→ Supports interval-based demand tracking and peak shaving analysis.

5. Time-of-Use (TOU) Demand Registers:

→ Per-tariff kW and kVAR demand recorded just prior to reset for all defined TOU periods (Tariffs A–D).

→ Facilitates rate-tier-based billing audits and retrospective TOU analysis.

6. Reset Time Stamp:

→ The time and date at which the demand reset occurred is logged, establishing the boundary between billing or analysis periods.

Parameters	2S	12S
Total kWh delivered	√	√
Total kWh received	√	√
Total kVARh delivered	√	√
Total kVARh received	√	√
Total kVAh delivered	√	√

Cumulative kW delivered demand	√	√
Continuous Cumulative kW delivered demand	√	√
Max kW delivered demand	√	√
Cumulative kW received demand	√	√
Continuous Cumulative kW received demand	√	√
Max kW received demand	√	√
Cumulative kW total demand	√	√
Continuous Cumulative kW total demand	√	√
Max kW total demand	√	√
Cumulative kVAR delivered demand	√	√
Continuous Cumulative kVAR delivered demand	√	√
Max kVAR delivered demand	√	√
Cumulative kVAR received demand	√	√
Continuous Cumulative kVAR received demand	√	√
Max kVAR received demand	√	√
Cumulative kVAR total demand	√	√
Continuous Cumulative kVAR total demand	√	√
Max kVAR total demand	√	√
Cumulative kVA delivered demand	√	√
Continuous Cumulative kVA delivered demand	√	√
Max kVA delivered demand	√	√
Cumulative kVA received demand	√	√
Continuous Cumulative kVA received demand	√	√
Max kVA received demand	√	√
Cumulative kVA total demand	√	√
Continuous Cumulative kVA total demand	√	√
Max kVA total demand	√	√

Application and Retrieval

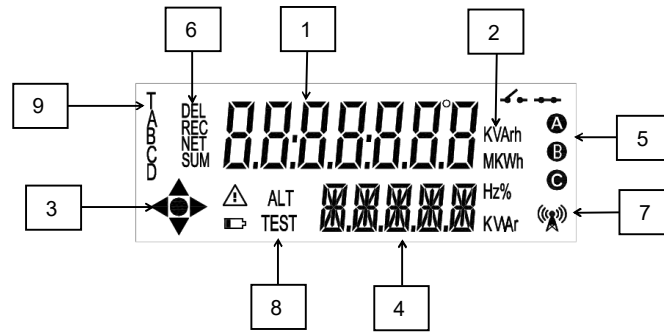
The Previous Demand Reset data is accessible through the meter's optical interface. It can be used in conjunction with Self Read and Load Profile data to reconstruct energy usage patterns, validate customer billing complaints, or evaluate the performance of demand management programs.

Retention of this data is limited to the most recent demand reset cycle. If multiple-period historical tracking is required, Self Reads or Load Profile logging should be enabled accordingly.

CHAPTER - 3

OPERATING INSTRUCTIONS

3.1 LCD REGIONS



The image above illustrates the LCD display integrated into our energy meter, which provides clear and detailed visual feedback for various operational parameters. The display is designed for readability and efficient user interaction, incorporating the following key features:

1. Seven bold numeric digits used for presenting measured quantities such as voltage, current, and energy consumption.
2. Corresponding units of measurement that clearly indicate what each numerical value represents.
3. Directional indicators to show the direction of current flow or energy (Delivered/Received).
4. Five bold alphanumeric characters that assist in displaying messages, codes, or configuration identifiers.
5. Potential indicators which signal the presence of phase voltage.
6. Energy direction and rate indicators that help users understand real-time energy flow and applicable tariff rates.
7. Communication status icon indicating active data transmission or communication with external systems.
8. Alternate and test mode indicators that display when the meter is operating in special diagnostic or alternate display modes.
9. This region shows the TOU tier (rate) data being shown on display.

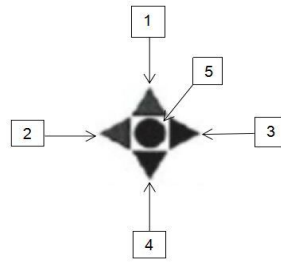
3.2 UOM Identifier

The UOM (Unit of Measure) Identifier indicates the unit for the quantity currently displayed on the meter. It helps users quickly recognize the type and scale of the measured value.

The Energy Meter supports the following units:

Basic Units (Unity Scale)	Kilo Units (×1,000 Scale)
W – Watt (Active Power)	kW – Kilowatt
Wh – Watt-hour (Active Energy)	kWh – Kilowatt-hour
VA – Volt-Ampere (Apparent Power)	kVA – Kilo volt-Ampere
VAh – Volt-Ampere-hour (Apparent Energy)	kVAh – Kilo volt-Ampere-hour
VAR – Volt-Ampere Reactive (Reactive Power)	kVAR – Kilo var
VARh – Volt-Ampere Reactive-hour (Reactive Energy)	kVARh – Kilo var-hour

3.3 ENERGY INDICATORS



1. Delivered Reactive Power present Indicator
2. Received Active Energy Indicator as per Ke ratio
3. Delivered Active Energy Indicator as per Ke ratio
4. Received Reactive Power present Indicator
5. Active Energy Indication on pulse as per Kh Ratio

The Energy Meter includes several key indicators to display real-time power and energy status. The Delivered Energy Indicator and Received Energy Indicator show the direction of active energy flow delivered or received. Similarly, the Delivered Reactive Power Indicator and Received Reactive Power Indicator signal the direction of reactive power flow. These indicators help users monitor both active and reactive power exchange.

The Pulse Indicator flashes to represent energy consumption in real time. It is based on the meter's Kh value, which defines the amount of energy (in Wh) per pulse. A lower Kh means more frequent pulses for the same energy consumed. In contrast, the Delivered and Received Energy Indicators operate based on the Ke value, which specifies how many pulses equal one kilowatt-hour (kWh).

For example, with $Ke = 1000$ pulses/kWh, the meter records 1 kWh after every 1000 pulses. These constants ensure accurate energy measurement and data logging.

3.4 Operating Modes

3.4.1 Normal Mode (Metering Mode)

Normal Mode is the display mode of the energy meter, where key electrical parameters are automatically shown in a rotating sequence. This mode allows users to quickly view essential information such as energy consumption and demand without requiring any manual interaction with the device. It is intended for regular monitoring and provides a clear snapshot of the meter's readings during normal operation.

3.4.2 Alternate Mode

Alternate Mode is the default display mode on the Energy Meter which provides access to additional electrical parameters beyond those shown in Normal Mode (Metering Mode). These values offers deeper insights into the system's performance and are typically used for more detailed diagnostics, load analysis, or system verification. The display cycles through these values automatically when it is in Alternate mode. The meter also provides timekeeping information for reference and synchronization. Meter Time displays the current internal time of the Energy Meter, while Meter Date shows the current calendar date stored in the meter.

Display Screen Selection

Out of 177 available screens, up to 100 can be selected across Normal, Alternate, and Test modes in any combination.

3.4.3 Test Mode

Test Mode on the Energy Meter is used for verifying meter accuracy and performance during installation or maintenance. It isolates specific readings for controlled testing without affecting regular data.

Note: Energy measured in Test Mode does not affect the main energy counters, ensuring test results remain separate from operational data.

3.5 Demand Reset

The energy meter supports multiple methods for initiating a demand reset. A demand reset clears accumulated demand values and related data, ensuring accurate tracking for the next billing cycle or operational period. This function can be triggered locally, remotely, or scheduled as required by utility operations.

3.5.1 Demand Reset Methods

A demand reset can be initiated through any of the following methods:

- A command issued locally via the optical communications
- A scheduled calendar event
- A scheduled downlink received through LoRa

3.5.2 Actions Performed During Demand Reset

Regardless of the reset method, the meter performs the following operations:

- Stores a copy of the present register data in the previous demand data area
- Resets demand calculations (present interval and all sub interval data)
- Resets the demand values reported in the present register data
- Resets the previous interval demands to zero
- Resets the present demands to zero
- Adds the present maximum demand to the cumulative demand and resets the present maximum demand for total and TOU demands
- Increments the number of demand resets
- Clears the date and time of present maximum demands

3.5.3 Demand Reset Lockout

The Energy Meter support Configuration software, by which a demand reset lockout time can be defined. The demand reset lockout can remain in effect for up to maximum 255 minutes after a demand reset (regardless of the method of demand reset). It can be set through configuration software (0 to 255 minutes). During the demand reset lockout, subsequent demand resets will be ignored by the meter. This prevents accidental, subsequent demand resets. If a power failure occurs during the demand reset lockout period, the lockout is released upon power restoration.

3.5.4 Demand Forgiveness Time

Demand Forgiveness Time refers to a configured time window during which the meter ignores or does not record demand readings. This is typically used during system start-up, reset, or after outages, when temporary power surges might otherwise result in inaccurately high demand charges.

In electric utility meters, this feature ensures fair billing by preventing non-representative demand spikes (e.g. during equipment warm-up or restoration after power loss) from being recorded in the billing demand. It is particularly useful in commercial or industrial settings where large equipment may cause brief high loads upon start-up.

Demand Forgiveness Time can be set through configuration software (0 to 255 minutes).

Example Scenario:

If a 2 minutes Demand Forgiveness Time is set, the meter will ignore demand values recorded during the first 2 minutes after power restoration, meter reset, or specific event triggers.

3.6 Timekeeping

The Energy Meter includes an internal real-time clock (RTC) that maintains accurate time and date information, which is essential for logging energy usage, demand intervals, and event records.

The meter supports Daylight Saving Time (DST) functionality, which can be enabled or disabled depending on regional requirements. When enabled, the meter automatically adjusts the clock forward or backward according to the predefined DST schedule set during configuration. This ensures that time-based functions, such as demand calculation and load profiling, remain accurate even when seasonal time changes occur.

Time synchronization is managed remotely using the Configuration software, which allows secure access for configuration and clock adjustments. In the event of a power outage, the meter retains time settings using an internal super capacitor, ensuring continued accuracy without data loss.

Note: Default setting of DST is OFF. It can be enabled or disabled using Configuration software.

3.7 CONFIGURATION PARAMETERS VIA OPTICAL PORT

3.7.1 Overview and benefits

The Energy Meter allows advanced configuration of its operational behavior through the optical communication port, compliant with the ANSI C12.19 protocol. This functionality enables utility companies and authorized users to remotely configure, manage, and optimize the meter's performance using dedicated software.

These parameters are organized into key categories such as Time-of-Use (TOU) settings, Load Profiles, Display behavior, Date/Time settings, and Demand configuration. Configuration performed using an optical probe and PC-based tool, providing a convenient and non-intrusive way to update meter settings without opening the meter.

Key benefits of this feature:

1. Tailors the meter behavior for different seasons, holidays, or special events.
2. Enables automated demand resets and self-read operations.
3. Supports utility load analysis through detailed interval data.
4. Enhances billing accuracy and display customization.

These programmable settings improve the meter's flexibility and ensure compliance with different regulatory or customer-specific requirements.

3.7.1.1 Time-of-Use (TOU) Settings:

3.7.1.1.1 Recurring Events:

Configure up to 35 recurring events with the following options:

- Event Types: Holiday, Season Change, and DST Start/End
- Self Read/Demand Reset: Yes or No
- Month: 1–12 or Every Month. (It shows 13 in the month column)
- Day: 1–31.

Options:

1. On the same Date.
2. First [Weekday] on or after date.
3. Second [Weekday] on or after date
4. Third [Weekday] on or after date
5. Fourth [Weekday] on or after date
6. Last [Weekday] of the month
7. Every week on [Weekday] (It shows 14 in the month column after writing this setting into the meter)
8. Special rules (e.g., advance or postpone based on weekends)
9. Every X days starting from a given date. (It shows 15 in the month column after writing this setting into the meter)

3.7.1.1.2 Non-Recurring Events:

Supports 255 events configured with:

- Event Date (DDMMYYYY)
- Event Type: Holiday or Season Change
- Season, Self Read and Demand Reset options

3.7.1.1.3 Day Type Assignment per Season:

→ Assign day types (Weekday, Weekend, Holiday, and Special Day) for each day of the week and holidays across 4 seasons.

3.7.1.1.4 Tier Settings:

→ Up to 80 switch times (Minimum tier switch time is 15 Minutes)
→ Define: Season, Day Type, Rate (1–4), and Start Time (HHMM)

3.7.2 Load Profile Settings

→ Channels: Up to 6 configurable channels.
→ Interval Length: 1, 5, 10, 15, 30, and 60 minutes
→ Sources: Selectable Parameters from List.
→ Pulse Divisor: User-definable (1-255)
Pulse Divisor is representation of Energy Wh/pulse.

3.7.3 Display Settings

→ Leading Zeros (Energy/Demand): Present or Absent
→ Digits Before/After Decimal: 1 to 5 digits
→ Date Format: MMDDYY/YMMMDD/DDMMYY
→ Time Format: 24H or 12H (AM/PM)
→ Auto Scroll & Hold Times: 1–15 seconds/minutes for various display modes
→ Screen Selection: User-defined list of display parameters Max 100.

3.7.4 Date and Time Settings

→ DST Entry/Exit: Hour, Minute, and Second
→ DST Offset: In minutes
→ Time Zone Offset: In hours
→ Date & Time: Directly configurable via optical Software

3.7.5 Demand Settings

→ Integration Period: Up to 60 minutes
→ Method: Block or Rolling Window
→ Sub-Interval: 1 to 10 minutes
→ Lockout Period: 0–255 minutes
→ Forgiveness Time: 0–255 minutes
→ Automatic Demand Reset Setting: None, Daily, Weekly, and Monthly

3.7.6 Event Log Settings

Event logging can be enabled, disabled, or configured for different event types through Configuration software. Parameters such as maximum event count and FIFO overwrite settings are also available.

CHAPTER - 4

METER TOOLS

4.1 Self Test

The Energy Meter performs automatic self-tests in accordance with ANSI C12.1 standards to ensure ongoing reliability and accuracy. These self-tests are executed at regular intervals or during power-up and they help detect internal faults, memory errors, or measurement inconsistencies. During the power up meter completes its self-test & full display initialization sequence (full segment glow) within approximately 6.50 seconds.

During a self-test, the meter verifies the integrity of its memory, display, real-time clock, measurement circuits, and firmware. If any issue is detected, the meter may log an event and activate an alert or error indicator depending on configuration. These diagnostics help ensure that the meter remains compliant with utility-grade accuracy and performance requirements.

Self-test results are stored in the meter's event log and can be reviewed using the Configuration software, supporting proactive maintenance and compliance verification.

4.2 Data Parameters and Reports

The meter offers a comprehensive set of electrical measurements and logs accessible through its meter tools interface. These tools provide critical data for billing, load analysis, and system diagnostics.

4.2.1 Key Data Categories

4.2.1.1 Energy Measurements:

- Active, reactive, and apparent energy values for both delivered and received directions.
- Supports Multi-tariff (TOU) configurations for detailed energy tracking per tariff.

4.2.1.2 Maximum Demand:

- Records peak demand values for active power.
- Tracks cumulative and continuous cumulative demand to ensure accurate monitoring over billing periods.

4.2.1.3 Time-of-Use (TOU) Data:

- Detailed energy and demand data segregated by tariff periods.
- Enables utilities to apply differential rates and monitor consumption patterns.

4.2.1.4 Snapshot Data:

- Midnight readings capturing system and tariff-specific energy and demand values.
- Billing cycle snapshots for comprehensive billing accuracy.

4.2.1.5 Event Log:

- Stores historical meter events and alarms for troubleshooting and auditing purposes.

4.2.1.6 Benefits:

- Accurate Billing: Multi-tariff energy and demand data help ensure precise customer billing.
- Load Management: Detailed demand tracking aids utilities in managing peak loads and system stability.
- Diagnostic Insights: Event logs and system snapshots assist in quick fault detection and maintenance planning.

4.3 System Instantaneous Parameters

System Instrumentation also referred to as Instantaneous Quantities provides a real-time snapshot of electrical parameters at the meter location. These measurements are designed to support diagnostic analysis, system monitoring, and field troubleshooting by offering immediate visibility into the operating conditions at the service point.

Unlike billing data, which is averaged over defined intervals (typically in minutes), instantaneous quantities data is captured and displayed instantly, allowing users to assess the current state of the electrical system at a given moment. This makes it a valuable tool for identifying voltage issues, unbalanced loads, or phase-specific anomalies during service evaluations.

Instantaneous values are typically available per phase (e.g., L1, L2, and L3), giving a more detailed view of system behavior than aggregate billing quantities, which usually represent the combined values across all phases. As a result, there may be expected differences between similar billing and instrumentation readings.

Through the Configuration software, users can view and configure the display of instantaneous quantities for various meter modes, including Normal, Alternate, and Test modes. This flexibility ensures that the most relevant parameters are visible based on operational needs or maintenance activities.

System Instrumentation supports utility teams with real-time visibility to ensure accurate diagnostics and faster resolution of on-site issues making it an essential function beyond billing operations.

4.3.1 Instantaneous Parameter Availability

The table below summarizes the instantaneous electrical parameters available for monitoring on the energy meter across different meter forms 2S and 12S. Each parameter provides real-time insight into system conditions, aiding diagnostics, load analysis, and system performance evaluation.

Parameters include voltage, current, active/reactive/apparent power, power factor, system frequency, temperature, and demand integration time. Availability is indicated by a check-mark (✓) for supported quantities and an absence or cross (×) for unsupported ones.

This differentiation ensures that the meter model deployed aligns with the monitoring needs of the installation site, optimizing both cost and functionality.

Instantaneous Quantity	2S	12S
PH-A Volt	✓	✓
PH-C Volt	×	✓
PH-A Current	✓	✓
PH-C Current	✓	✓
System Voltage	✓	✓
System Current	✓	✓
PH-A Active Power	✓	✓
PH-C Active Power	✓	✓
PH-A Reactive Power	✓	✓
PH-C Reactive Power	✓	✓
PH-A Apparent Power	✓	✓
PH-C Apparent Power	✓	✓
System Active Power	✓	✓
System Reactive Power	✓	✓
System Apparent Power	✓	✓
PH-A Power Factor	✓	✓
PH-C Power Factor	✓	✓
System PF	✓	✓

System Frequency	√	√
Temperature	√	√
Demand Integration Time (DIT)	√	√

4.4 Under & Over Threshold Settings

The Meter can record voltage, current, and phase angle disturbances by logging under and over threshold events on each phase of set parameters. These events are detected when the measured parameter deviates beyond configured thresholds for a specified duration (qualification time). The under threshold event occurs when the measured parameter temporarily drops below a defined percentage of the nominal value. Conversely, The over threshold event occurs when the measured parameter temporarily exceeds a configured threshold.

To qualify as an event, the measured parameter must remain outside the threshold for longer than qualification time.

Each valid event is time-stamped and includes the affected phase, measured value, and event duration. These events are available for review in the meter monitoring system application, supporting diagnostics, and compliance analysis.

Trip delay settings (10 to 3600 sec) for parameters such as voltage, current, and PF can be configured through the configuration software. Standard alarm such as voltage, current, and power factor will reset to normal condition after 60 seconds.

4.5 Temperature Thresholds

The Energy Meter is designed to operate reliably within a temperature range of -40°C to +85°C inside the meter cover. This wide operating range ensures stable performance under various environmental conditions.

The meter continuously monitors its internal temperature to protect against overheating or extreme cold, which could affect accuracy or device longevity. If the temperature exceeds safe limits, the meter can log an alert for maintenance attention.

4.6 Demand Thresholds

The Energy Meter includes a demand monitoring feature that helps track power usage and identify potential overload conditions. A demand threshold is configured to represent the maximum allowable power consumption over a specified time interval.

When the measured demand exceeds this configured threshold, the meter triggers a continuous alarm to notify users of the over-demand condition. This alarm remains active as long as the demand stays above the threshold.

Note: The Meter is designed for monitoring only. It does not include a control switch or automatic load-shedding functionality. Users must take manual action in response to demand alarms.

This feature is useful for energy management, helping facilities avoid peak demand penalties, and maintaining efficient power usage.

Available Demand Threshold Options:

1. Del. MAX kW Demand Threshold
2. Rec. MAX kW Demand Threshold
3. Del. MAX kVA_{rh} Demand Threshold
4. Rec. MAX kVA_{rh} Demand Threshold
5. Del. MAX kVA_h Demand Threshold
6. Rec. MAX kVA_h Demand Threshold

CHAPTER - 5

OUTPUTS

5.1 Optical Pulse Outputs

The Meter is equipped with an optical pulse output that facilitates remote energy monitoring and verification. This output emits pulses corresponding to energy consumption, providing a reliable method for external data collection without direct electrical connections.

The optical port utilizes an infrared LED and photo-transistor to transmit pulses. The pulse rate and quantity per pulse is 0.1 Hr/Pulse, allowing for precise alignment with the metered energy units.

Depending on the meter's operating mode, the optical pulse output behavior may vary. In standard operation, the meter emits pulses at a rate proportional to the energy consumed. For testing or calibration purposes, the pulse rate can be adjusted to facilitate accurate measurement and verification processes.

To ensure compatibility with external devices, the optical pulse output adheres to industry-standard specifications, enabling seamless integration with data loggers, remote reading systems, and other monitoring equipment.

5.2 Relay Configuration

Mode No.	Mode Name	Description
1	Disabled	Relay driver is turned off. No output is generated.
2	KYZ Output	Generates pulse outputs based on selected energy parameters. Configurable pulse divisor (1–999) and pulse width (10–255 ms).
3	Demand Threshold	Relay activates when demand exceeds a predefined threshold and remains active until a complete interval ends without exceeding the threshold.
4	End of Interval	Activates for 5 seconds at the end of each demand sub-interval.
5	Cold Load Pickup	Activates while Demand Forgiveness is active—typically used during cold load pickup scenarios.
6	Alarm Indication	Relay triggers in response to specific meter alarms, warnings, or event codes (selectable by the user).
7	Rate Indication	Relay triggers based on active Time-of-Use rate. User can select from Rate A, B, C, and D.

5.3 KYZ Output Mode – Detailed Configuration

When KYZ Output mode is selected, the relay generates pulses corresponding to a selected energy source. The following parameters must be configured:

Pulse Divisor: Settable from 1 to 999.

Pulse Width: Adjustable from 10 to 255 milliseconds.

KYZ Source Options:

1. kWh Delivered
2. kWh Received
3. kVARh Delivered
4. kVARh Received
5. Q1 kVARh
6. Q2 kVARh

7. Q3 kVARh
8. Q4 kVARh

These settings allow the meter to emit pulses based on energy accumulation, suitable for external counters, and data loggers .

Use Case Examples:

1. Relay A as KYZ Output for kWh Delivered, pulse width of 50 ms, divisor 10 used for external pulse loggers.
2. Relay B as Demand Threshold Alarm, configured to trigger at 50 kW used to activate load shedding.
3. Relay A as Rate Indication, triggering during Rate C used for rate-based control actions or alerts.

Notes:

1. Both relays are electrically isolated and can be connected to external devices or control systems.
2. If no relay function is needed, it is recommended to set the relay mode to Disabled to avoid unintended switching.
3. Alarms configured to trigger the Alarm Indication mode must be defined under the appropriate meter event setup.

5.4 LoRa Port Mapping

The meter supports communication over the LoRaWAN protocol using defined uplink and downlink ports.

Each port corresponds to specific data types or control functions. These ports are used by the meter to transmit critical data to the server (uplink) and receive commands or configurations from the server (downlink). The following table lists the supported LoRaWAN ports and their respective functions :

5.4.1 Uplink Ports (Meter → Server):

Sr. No.	Port Number	Description
1	Port 0	DR0
2	Port 1	Shows Enable Ports in the meter
3	Port 8	Meter Hardware/Firmware Versions
4	Port 40	Service Alarms
5	Port 41	Board/Memory Alarms
6	Port 42	Tamper Alarms
7	Port 44	Calendar Alarms
8	Port 96	Current Register Data
9	Port 112	Load Profile Delivered kWh
10	Port 113	Load Profile Received kWh
11	Port 144	Midnight Total
12	Port 145	Midnight TOU Delivered
13	Port 146	Midnight TOU Received
14	Port 147	Billing Total
15	Port 148	Billing TOU Delivered
16	Port 149	Billing TOU Received

LoRa Data Transmission Details

5.4.1.1 Port 0

During meter power-up, the device initially transmits uplinks at DR0 while establishing synchronization with the network server. These DR0 uplinks are used to align SF, bandwidth, SNR, date, and time and are not intended for user decoding. Within the same 5-minute window (31 uplinks), once SF7 and BW500 are reached, Port 96 data is transmitted and becomes decodable by the user, indicating completion of synchronization.

5.4.1.2 Port 1

Port 1 transmits information about the status of other ports in the meter specifically which ports are currently enabled or disabled for data transmission. This provides a control layer to determine active communication channels in the device.

5.4.1.3 Port 8

Port 8 provides detailed meter configuration data including the form of the meter, meteorology firmware version (with major, minor, and patch identifiers), the communication type in use, communication firmware version, the configured region of LoRa operation, and the LoRa MAC version used by the LoRa module. This information is essential for validating firmware compatibility and region-specific LoRaWAN compliance.

5.4.1.4 Port 40

Port 40 delivers the service alarms based on voltage, current, power factor, and if reverse power is visible or occur, depends upon the qualification time set for each parameter.

5.4.1.5 Port 41

Port 41 delivers the board/memory alarms based on crystal oscillator, table CRC, and eeprom access.

5.4.1.6 Port 42

Port 42 delivers the tamper alarms based on the activity done by the user on meter like TEST mode button pressed by the user, Demand reset etc., and if RTC is missing or low.

5.4.1.7 Port 44

Port 44 delivers the calendar alarms based on the operation done by user or LoRa ports uplink by which meter is corrected it's time or any parameter related to calendar like Abrupt calendar change (Season, Day, Month, DST etc), or Time.

5.4.1.8 Port 96

Port 96 sends comprehensive real-time register data, such as the current Unix time stamp, total energy delivered and received (in kWh) in form of ke pulses (Energy in Watt/ke ratio), and their corresponding maximum demand values (in kW). It also transmits the multiplier (CT×PT), meter temperature, currently active TOU rate, voltage presence flags per phase, load-side voltage status, and disconnect switch state. In addition, it reports momentary and sustained outages, total outage duration, demand reset counts, DST status, and presence of any active alarms.

5.4.1.9 Port 112

It is used to transmit the load profile data related to delivered energy. It includes the Unix time stamp of the first interval, the measurement unit, the configured logging interval (in minutes), total delivered kWh energy in the form of ke pulses (Energy in Watt/ke ratio), and the data from the last sixteen recorded intervals of delivered kWh, which helps in analyzing consumption trends.

5.4.1.10 Port 113

Port 113 functions similarly to Port 112 but focuses on received energy. It provides the time stamp of the first interval, units of measurement, the logging interval, total received kWh energy in the form of ke pulses (Energy in Watt / ke ratio), and the last sixteen recorded intervals of received kWh. This helps track energy received from other sources like solar panels or the grid.

5.4.1.11 Port 144

Port 144 carries total system data recorded at midnight. It transmits the last recorded midnight time stamp, the CT × PT multiplier, system total kWh delivered, and received and their respective maximum demand readings. This snapshot is useful for daily performance analysis.

5.4.1.12 Port 145

Port 145 provides midnight readings specific to TOU (Time-of-Use) energy delivered for each of the four tariffs. It includes energy and demand values for each TOU category as of the last recorded midnight, helping to evaluate load shifting and tariff-based consumption patterns.

5.4.1.13 Port 146

Port 146 is the counterpart of Port 145 and provides TOU-specific readings for received energy. It includes both kWh received and maximum demand per tariff at the last recorded midnight, enabling balance Delivered/Received analysis under different TOU slabs.

5.4.1.14 Port 147

Port 147 communicates total billing data for the current billing cycle. It includes the time stamp of the last billing cycle, multiplier, total delivered and received energy, and the corresponding maximum demand values. These are essential for customer billing and energy reconciliation.

5.4.1.15 Port 148

Port 148 offers billing cycle data broken down by TOU for delivered energy. It provides kWh delivered and maximum demand for each of the four TOU tariffs at the last billing instance, giving utilities granular insight into energy usage behavior over the billing period.

5.4.1.16 Port 149

Port 149 delivers the TOU-based received energy data for the billing cycle. Similar to Port 148, it includes kWh received and maximum demand readings for all four tariffs, completing the detailed energy flow analysis between consumption and generation.

In addition to transmitting energy and configuration data, the meter communicates a comprehensive set of alarms via Ports 40, 41, 42, and 44. These alarms encompass a broad range of operational and diagnostic conditions, including voltage and current anomalies (such as missing phases, low levels, or over-threshold values), power factor irregularities, and reverse power flow events. The system also monitors and reports critical internal errors, including EEPROM access issues, crystal oscillator, and Checksum mismatches. Along with test mode activation (via button or optical interface) and RTC battery status indicators. Furthermore, the meter provides outage-related notifications such as momentary or sustained outage events and system reboots. Calendar-related alarms are also transmitted, identifying TOU schedule discrepancies, date mismatches, rollover occurrences, and unauthorized or abrupt time adjustments.

5.4.2 Downlink Ports (Server → Meter):

Sr. No.	Port Number	Description
16	Port 200	Disable / Enable Ports
17	Port 201	Change Transmit Times of Ports

18	Port 202	Alarm Controls
19	Port 204	Request a port on LoRa
20	Port 205	Set Calendar Actions “ Demand Reset “

5.5 LoRaWAN Data Transmission Details

The meter will initiate a join request and successfully associate with the LoRaWAN Network Server (LNS) within approximately 1–2 minutes. Following the join process, an additional 5–6 minutes may be required for Spreading Factor (SF) adaptation and Data Rate (DR) optimization, depending on the initial data rate parameters configured by the LNS.

Uplink (902–914 MHz)

- Devices such as smart meters or sensors transmit data to the LoRaWAN gateway using sub-bands within the 902–914 MHz range.
- Multiple uplink channels are typically used to improve throughput and reduce collisions.

Downlink (915–928 MHz)

- The gateway sends data or acknowledgments back to the end devices using the 915–928 MHz range.
- Downlink transmissions are carefully managed to comply with ****duty cycle**** and ****power restrictions****.

Alarms on LoRa are as follows:

Alarm Indication	2S	12S
Phase A Voltage Missing	√	√
Phase A Voltage Low	√	√
Phase A Voltage Over Threshold	√	√
Phase A Voltage Good	√	√
Phase C Voltage Missing	×	√
Phase C Voltage Low	×	√
Phase C Voltage Over Threshold	×	√
Phase C Voltage Good	×	√
Phase A Current Missing	√	√
Phase A Current Low	√	√
Phase A Current Over Threshold	√	√
Phase A Current Good	√	√
Phase C Current Missing	√	√
Phase C Current Low	√	√
Phase C Current Over Threshold	√	√
Phase C Current Good	√	√
Phase A Leading Power Factor	√	√
Phase A Lagging Power Factor (Low)	√	√
Phase A Good PF	√	√
Phase C Leading Power Factor	√	√

Phase C Lagging Power Factor (Low)	√	√
Phase C Good PF	√	√
Reverse power on phase A	√	√
Reverse power on phase C	√	√
Test Mode Through Optical Port	√	√
Test Mode Button Press	√	√
Meter is in Test Mode	√	√
Test Mode Timed out	√	√
LCD Check	√	√
Demand Reset through button Press	√	√
Demand Reset Through Optical Port	√	√
Demand Reset through Down link	√	√
Momentary Outage < 5 min	√	√
Sustainable Outage > 5 min	√	√
3 Pin Reboot	√	√
Meter Installed	√	√
TOU A Delivered Roll-Over	√	√
TOU B Delivered Roll-Over	√	√
TOU C Delivered Roll-Over	√	√
TOU D Delivered Roll-Over	√	√
Total Delivered Roll-Over	√	√
TOU A Received Roll-Over	√	√
TOU B Received Roll-Over	√	√
TOU C Received Roll-Over	√	√
TOU D Received Roll-Over	√	√
Total Received Roll-Over	√	√
Gap in Billing Data	√	√
Abrupt Calendar Change (TOU) - Day Light Saving Observance	√	√
Abrupt Calendar Change (TOU) - Season Change	√	√
Abrupt Calendar Change (TOU) - Day of Week	√	√
Abrupt Calendar Change (DATE) - Year (Month and day inherently change)	√	√
Abrupt Calendar Change (DATE) - Month (day inherently change)	√	√
Abrupt Calendar Change (DATE) - Day	√	√
Time Changed - Meter Time invalid, has not been corrected	√	√
Time Changed - Meter Time was invalid, Corrected by Optical Interface	√	√
Time Changed - Meter Time was invalid, Corrected by Server	√	√
Crystal Oscillator Error	√	√
Table CRC Error	√	√
EEPROM Access Error	√	√

Note: Sustainable Outage will rollover after every 18 hours and it will starts again from 0.

CHAPTER - 6

CODES

6.1 Event Codes

The Meter continuously monitors its operating conditions and records system events using predefined Event Codes. These events are crucial for diagnostics, system auditing, and ensuring proper meter operation over time.

Event codes are categorized into two types:

1. Standard Events: These events are based on C12.19 standard, commonly used across meter types, including power status changes, configuration updates, communication logs, and error detection.

2. Other Events: These are meter-specific events apart from C12.19 standard. They help to provide additional operational information beyond the standard events.

Each event is logged with a description of the condition it represents. These events are stored in the meter's memory with a time stamp, allowing for historical tracking and remote diagnostics.

The following table outlines all recognized Standard and Other Event Codes, along with their corresponding descriptions:

Standard Events are as follows:

Standard Events	
Name	Description
Primary power down	Loss of main power supply
Primary power up	Restoration of main power
Time changed (new time)	Meter clock was adjusted
Table written to	Data table modified
Communication terminated normally	Normal end of communication session
Communication terminated abnormally	Unexpected communication drop
Demand reset occurred	Demand registers cleared
Self read occurred	Meter performed a self-read
Daylight saving time On	DST became active
Daylight saving time Off	DST was deactivated
Season change	Billing season changed
Rate change	Tariff rate schedule updated
Special schedule activation	Custom schedule activated
Test mode started	Meter entered in test mode
Test mode stopped	Meter exited test mode
Demand overload detected	Load exceeded demand threshold
Reverse rotation detected	Energy flow reversed

Other Events are as follows:

Other Events	
Name	Description
Phase A voltage Off (inactive)	Phase A voltage lost
Phase A voltage good (active)	Phase A voltage restored
Meter Installed	Meter Installed
System delivered kVARh Rollover	System delivered energy rolled over
Phase C voltage Off (inactive)	Phase C voltage lost
Phase C voltage good (active)	Phase C voltage restored
System received kVARh Rollover	System received energy rolled over
System delivered kVAh Rollover	System delivered energy rolled over
System received kVAh Rollover	System received energy rolled over
System Total kWh Rollover	System total energy rolled over
System Total kVARh Rollover	System total energy rolled over
System Total kVAh Rollover	System total energy rolled over
System Net kWh Rollover	System net energy rolled over
Temperature Overload	Temperature exceeded threshold limit
Billing Overload	Billing count exceeded the limit
Midnight Overload	Midnight count exceeded the limit
System Net kVARh Rollover	System net energy rolled over
System delivered kWh Rollover	System delivered energy rolled over
System received kWh Rollover	System received energy rolled over
Tariff A active delivered rollover	Delivered energy rolled over (Tariff A)
Tariff B active delivered rollover	Delivered energy rolled over (Tariff B)
Tariff C active delivered rollover	Delivered energy rolled over (Tariff C)
Tariff D active delivered rollover	Delivered energy rolled over (Tariff D)
Tariff A active received rollover	Received energy rolled over (Tariff A)
Tariff B active received rollover	Received energy rolled over (Tariff B)
Tariff C active received rollover	Received energy rolled over (Tariff C)
Tariff D active received rollover	Received energy rolled over (Tariff D)
System Net kVAh Rollover	System net energy rolled over

Note: Once a first midnight snapshot has been recorded, which is of 01-01-2001 (DD-MM-YYYY), the **Meter Installed event** (Only 1st time, after meter power ON) will no longer be available for generation and the date/time will be corrected by the network server, then the 2nd midnight data will store the correct midnight snapshot data.

CHAPTER - 7

INSTALLATION

7.1 Initial Inspection

The Meter is factory-calibrated, tested, and ready for field installation. It is essential to follow all safety guidelines and proper procedures during installation to ensure personal safety and to maintain the accuracy and integrity of the meter.

Before installing the meter, perform a **preliminary inspection** to verify that the unit has not sustained any damage during transport or handling.

Visually check for the following:

- No broken, missing, or loose components
- No signs of overheating or burning
- No cracked housing or bent terminals
- Nameplate matches the intended service (Form 2S or 12S)

Do not install or energize a meter showing signs of physical or electrical damage. Doing so could compromise meter accuracy or cause malfunction. If any damage is suspected, contact your authorized service provider or technical support before proceeding.

The Meter is designed for use with Form **2S (single-phase)** and **12S (network service)** installations. Ensure correct wiring according to the connection diagram. Improper connections can lead to incorrect readings or equipment failure.

While Forms 2S and 12S do not involve current transformer (CT) secondaries like some other forms (e.g., 3S or 4S), care must still be taken to ensure proper terminal torque, insulation, and grounding during installation.

Always follow applicable local and national electrical codes and ensure power is isolated before handling meter terminals.

7.2 Commissioning the Meter

CAUTION

Ensure that the Meter selected matches the system's service type, maximum current, and voltage capacity. Using an incompatible meter may result in equipment failure. Always confirm that the meter's voltage and current ratings are equal to or exceed the maximum values of the service.

WARNING

Never attempt to open or remove the meter cover while the device is energized. Only trained and authorized personnel should install or service metering equipment. High voltages are present and failure to observe proper safety procedures can result in serious injury, equipment damage, or fatality.

→ To install the Meter safely and correctly, follow this procedure:

1. Align the meter blades with the corresponding jaws in the socket enclosure.

2. Hold the meter firmly on both sides and press it straight into the socket until it is fully seated. If insertion is difficult, gently rock the meter vertically while applying forward pressure.

3. Once the meter is properly installed and securely fitted, power may be applied to bring the unit into service.

7.3 Initial Setup & Verification

Once the Meter has been installed and powered on, it's important to confirm that it is functioning as expected and correctly configured for the electrical service.

Begin by checking that the service voltage detection (if enabled) displays the correct system configuration on the LCD screen. All phase indicators should be active and steady. A slow-blinking phase indicator signifies that the corresponding phase voltage is low or below the configured minimum threshold, while a fast-blinking indicator signifies that the phase voltage has exceeded the configured over-voltage threshold. If a phase is missing, its indicator will not be displayed.

If there is a connected load, verify that the energy pulse indicator on the display is blinking, confirming energy consumption is being registered. Also, ensure that the directional energy flow arrows are pointing in the correct direction, indicating proper current flow alignment.

Next, confirm that all required utility seals are securely applied and intact. Any missing or broken seals should be addressed immediately. Document key installation details, such as meter location, serial number, or any notes relevant to field verification.

If the meter does not behave as expected, begin troubleshooting by verifying the wiring against the meter's connection diagram. Ensure the service type matches what's indicated on the meter nameplate, that the meter is rated for the site's voltage and current and that there's no physical or electrical damage present. Finally, inspect the seals again any broken seal may be a sign of tampering and should be reported according to your utility's procedure.

7.4 Removing the Meter from service

WARNING

Only qualified personnel should remove the Meter from service. Do not attempt removal while the meter is energized. Always follow approved safety procedures to prevent exposure to hazardous voltages. Failure to do so may result in serious injury, equipment damage, or death.

WARNING

The Meter supports Forms 2S and 12S (Self contained meters), if installed in environments involving current transformers, ensure circuit-closing devices are in place before disconnecting. Open-circuiting energized CT secondaries can create dangerous voltage levels and pose serious safety risks.

When decommissioning the meter, follow these steps to ensure a safe and proper removal:

1. Record Meter Data: Before disconnecting, make sure all required readings are collected either from the display or via the Configuration software for billing or diagnostic purposes.

2. Isolate Power: Disconnect voltage and current sources safely according to utility protocol. Ensure the meter is fully De-energized before continuing.

3. Remove Security Seals: Carefully cut or unlock any utility seals, collars, or locking devices securing the meter to the socket.

4. Extract the Meter: Grip both sides of the meter firmly and pull straight outward. If it does not release easily, gently rock the meter up and down while applying steady backward pressure.

After removal, store the meter in a protective container or return it according to your organization's handling and service procedures. Inspect the socket for damage or wear before installing a replacement unit.

CHAPTER - 8

TERMINOLOGY

8.1 ANSI (American National Standards Institute): An organization that develops and oversees voluntary consensus standards in the United States, including standards for electrical meters.

8.2 Billing Data: The recorded quantities measured by the meter used for billing purposes. Also known as register data or tariff data.

8.3 Delivered Energy: Energy supplied to an electric service.

8.4 Demand: The average power consumption calculated over a specified time period.

- **Demand Interval:** The duration over which demand is measured. This period can be set in minutes and includes options such as 1, 2, 3, 4, 5, 6, 15, 20, 30, or 60 minutes.

8.5 Demand Reset: The process of resetting the current maximum demand value to zero.

- **Demand Threshold:** A preset demand level that, when reached, triggers a warning flag.

8.6 Display Quantity: Any measurable value shown on the meter's LCD screen.

8.7 Energy: The total power consumed over time.

8.8 Impulse: A single change in the state of an output, such as switching a test LED on or off.

8.9 Interval Data Recording: A feature that stores energy consumption data for specific time intervals while the meter is powered.

- **Load Profiling:** Another term for interval data recording, showing energy usage over specific periods.

8.10 Ke: A constant representing the smallest discrete unit of energy measured or output by the meter, often used in pulse outputs.

8.11 Kh: A meter constant indicating the amount of energy (Wh/VAh/VARh) represented by each pulse emitted by the optical port or LCD indicator.

8.12 LCD (Liquid Crystal Display): The screen on the meter that shows measured values and meter status.

- **LCD Test Mode:** A diagnostic display mode where all segments of the LCD show the number "8" and all indicators are lit to verify proper operation.

8.13 Line Frequency: The frequency of the alternating current voltage, typically 60 Hz for this meter.

8.14 Maximum Demand: The highest demand recorded during any demand interval within a billing cycle.

8.15 Optical Port: A communication interface on the meter's front panel that uses light pulses for data transfer between the meter and external devices.

8.16 Previous Billing Data: A stored snapshot of the current billing register data saved from the most recently completed billing cycle.

- **Previous Season Data:** A stored copy of register data saved at the most recent seasonal change.

8.17 Pulse: Two consecutive state changes of an output, often used in testing Eds, such as on-off-on or off-on-off transitions.

8.18 Real Time: The meter's clock synchronized with an external source, such as a cellular network or control system.

- **Relative Time:** A time measurement based on the meter's internal clock from power-up, not synchronized with an external reference.

8.19 Received Energy: Energy returned or received by the utility from the electric service.

8.20 TOU (Time-of-Use): A billing method that records energy consumption and demand separately based on the time of day.

- **Timekeeping:** The meter's capability to maintain accurate time and date information, typically synchronized with a network source (**Default Date/Time of the meter after power ON and before data/time synchronized by the network server - 01-01-2001 (DDMMYYYY)/00:00:00**).

8.21 Time-of-Use Rate Structure: A rate structure that charges different rates depending on the time when energy is consumed.

Register Data: See billing data section 2.6.

Tariff Data: See Tariff based billing data section 2.6.1.

8.22 Default Settings:

Sr. No.	Parameters	Default Settings	Available Settings
1	Service Voltage	240VLL (2S) 120VLN (12S)	240VLL (2S) 120, 208 and 277 VLN (12S)
2	Service Current	200A	200A
3	Tier Setting	A	A,B,C, and D
4	Season Setting	Winter	Spring, Summer, Fall, and Winter
5	Relay 1 & Relay 2	KYZ Output	1.Disable
			2.KYZ Output
			3.Demand Threshold
			4.End of Interval
			5.Cold Load Pickup
			6.Alarm Indication
			7.Rate Indication
5.1	KYZ output for Relay 1	kWh Delivered	1.kWh Delivered
			2.kWh Received

			3.kVARh Delivered
			4.kVARh Received
			5.Q1 kVARh
			6.Q2 kVARh
			7.Q3 kVARh
			8.Q4 kVARh
5.2	KYZ output for Relay 2	kWh Received	1.kWh Delivered
			2.kWh Received
			3.kVARh Delivered
			4.kVARh Received
			5.Q1 kVARh
			6.Q2 kVARh
			7.Q3 kVARh
			8.Q4 kVARh
5.3	Demand Threshold for Relay 1	Del. MAX kW DMD Threshold	1.Del.MAX kW DMD Threshold
			2.Rec.MAX kW DMD Threshold
			3.Del.MAX kVAR Demand Threshold
			4.Rec.MAX kVAR DMD Threshold
			5.Del.MAX kVA DMD Threshold
			6.Rec.MAX kVA DMD Threshold

5.4	Alarm Indication for Relay 1/2	Phase A Voltage Missing	Refer to Section 5.3
5.5	Rate Indication for Relay 1/2	Rate A	1.Rate A
			2.Rate B
			3.Rate C
			4.Rate D
5.6	Pulse Divisor	10	(1 - 999)
5.7	Pulse Width	40	(10 - 255)
6.	Under Threshold Setting (% Service Voltage & Service Current)	-	-
6.1	Voltage A Under Threshold	90%	(1-99%)
6.2	Voltage C Under Threshold	90%	(1-99%)
6.3	Current A Under Threshold	1%	(1-99%)
6.4	Current C Under Threshold	1%	(1-99%)
6.5	Phase Angle A Lag Under Threshold	18.2	(1.0 - 360.0)
6.6	Phase Angle C Lag Under Threshold	18.2	(1.0 - 360.0)
6.7	Phase Angle A Lead Under Threshold	198.2	(1.0 - 360.0)
6.8	Phase Angle C Lead Under Threshold	198.2	(1.0 - 360.0)
7	Over Threshold Settings (% Service Voltage & Service Current)	-	-
7.1	Voltage A Over Threshold	110%	(101-120%)

7.2	Voltage C Over Threshold	110%	(101-120%)
7.3	Current A Over Threshold	110%	(101-120%)
7.4	Current C Over Threshold	110%	(101-120%)
7.5	Phase Angle A Lag Over Threshold	161.8	(1.0 - 360.0)
7.6	Phase Angle C Lag Over Threshold	161.8	(1.0 - 360.0)
7.7	Phase Angle A Lead Over Threshold	341.8	(1.0 - 360.0)
7.8	Phase Angle C Lead Over Threshold	341.8	(1.0 - 360.0)
7.9	Del. MAX kW Demand Threshold	7.2	(0.1-192.0)
7.10	Rec. MAX kW Demand Threshold	7.2	(0.1-192.0)
7.11	Del. MAX kVAR Demand Threshold	7.2	(0.1-192.0)
7.12	Rec. MAX kVAR Demand Threshold	7.2	(0.1-192.0)
7.13	Del. MAX kVA Demand Threshold	7.2	(0.1-192.0)
7.14	Rec. MAX kVA Demand Threshold	7.2	(0.1-192.0)
8	Demand Interval	Block	Block/Rolling
8.1	Interval Length (Min)	15	1, 2, 3, 4, 5, 10, 15, 20, 30, and 60

8.2	Sub-Interval Length	1	1, 2, 3, 4, 5, 6, and 10 (applicable only for rolling)
8.3	Demand Lockout Time	5	0 - 255 minutes
8.4	Demand Forgiveness Time	1	0 - 255 minutes
8.5	Automatic Demand Reset (Schedule)	None	Daily, Weekly, and Monthly
9	Load Profile	Number of Channels 6	Refer Section 2.9.2
9.1	Interval Length (Min)	15	1, 5, 10, 15, 30, and 60
9.2	Pulse Divisor (Wh/Pulse)	1	1 - 255
9.3	Channel 1	kWh Delivered	Refer Section 2.9.2
9.4	Channel 2	kWh Received	Refer Section 2.9.2
9.5	Channel 3	kVARh Delivered	Refer Section 2.9.2
9.6	Channel 4	kVARh Received	Refer Section 2.9.2
9.7	Channel 5	kVAh Delivered	Refer Section 2.9.2
9.8	Channel 6	kVAh Received	Refer Section 2.9.2
10	Event Log	All	All
11	Trip delay settings	-	-
11.1	Trip Delay Low Voltage A	900 Sec.	10 Sec. to 3600 Sec.
11.2	Trip Delay Low Voltage C	900 Sec.	10 Sec. to 3600 Sec.
11.3	Trip Delay Low Current A	900 Sec.	10 Sec. to 3600 Sec.
11.4	Trip Delay Low Current C	900 Sec.	10 Sec. to 3600 Sec.

11.5	Trip Delay Leading PF A	900 Sec.	10 Sec. to 3600 Sec.
11.6	Trip Delay Leading PF C	900 Sec.	10 Sec. to 3600 Sec.
11.7	Trip Delay Lagging PF A	900 Sec.	10 Sec. to 3600 Sec.
11.8	Trip Delay Lagging PF C	900 Sec.	10 Sec. to 3600 Sec.
11.9	Trip Delay Over Voltage A	900 Sec.	10 Sec. to 3600 Sec.
11.10	Trip Delay Over Voltage C	900 Sec.	10 Sec. to 3600 Sec.
11.11	Trip Delay Over Current A	900 Sec.	10 Sec. to 3600 Sec.
11.12	Trip Delay Over Current C	900 Sec.	10 Sec. to 3600 Sec.
11.13	Trip Delay kW reverse power A	900 Sec	10 Sec. to 3600 Sec.
11.14	Trip Delay kW reverse power C	900 Sec	10 Sec. to 3600 Sec.
11.15	Trip Delay system kW reverse power	900 Sec	10 Sec. to 3600 Sec.

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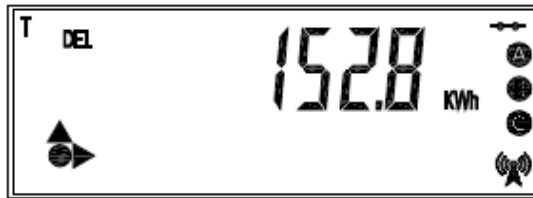
DISPLAY ITEMS

9.1 DISPLAYABLE ITEMS

Mode Changes:

To change display modes, the user can configure the settings through the Configuration software. The software includes a dedicated 'Display' tab, which allows users to select the desired display mode and specify the corresponding screen hold duration for that mode.

9.1.1 Energy Quantities



The meter displays various accumulated energy quantities that are essential for monitoring power consumption and system performance. The key energy values presented include:

- 1. Active Energy (Wh, kWh):** Total real energy consumed or delivered over time.
- 2. Reactive Energy (VARh, kVARh):** Energy associated with reactive power, useful for analyzing power factor and reactive demand.
- 3. Apparent Energy (VAh, kVAh):** Combined measure of both active and reactive energy, indicating total system loading.

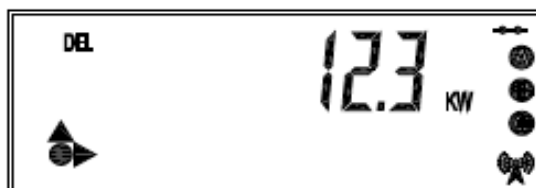
Decimal Display Configuration

Users can configure the number of decimal digits shown for energy values based on desired resolution:

- 0 decimal places – Format: xxxxx
- 1 decimal place – Format: xxxxx.x
- 2 decimal places – Format: xxxx.xx
- 3 decimal places – Format: xxx.xxx

This flexibility allows for simplified displays or more precise readings, depending on the application's needs.

9.1.2 Demand Quantities



The meter displays demand quantities to help monitor peak power usage and manage load efficiently. Demand values represent the average power consumed over a specified interval and are critical for demand-based billing and system planning.

The following demand quantities may be displayed:

1. **Active Demand (W, kW):** Indicates the average real power consumed during the demand interval.
2. **Reactive Demand (VAR, kVAR):** Represents the average reactive power during the interval.
3. **Apparent Demand (VA, kVA):** Shows the average apparent power, combining both real and reactive components.

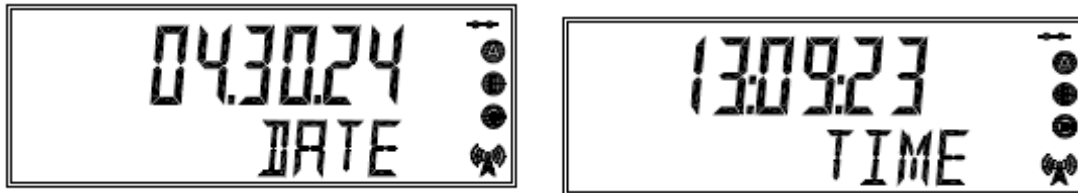
Decimal Display Configuration:

Users can configure the number of decimal digits shown for energy values based on desired resolution:

- 0 decimal places – Format: xxxxx
- 1 decimal place – Format: xxxxx.x
- 2 decimal place – Format: xxxx.xx
- 3 decimal places – Format: xxx.xxx
- 4 decimal places – Format: xx.xxxx

This flexibility allows for simplified displays or more precise readings, depending on the application's needs.

9.1.3 Date and Time Display



The meter supports multiple formats for both date and time, allowing users to align the display with regional or operational preferences.

Date Format Options:

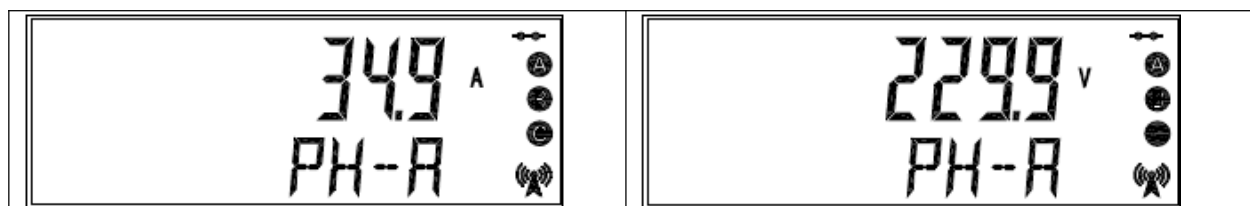
1. MMDDYY – Month-Day-Year
2. YYMMDD – Year-Month-Day
3. DDMMYY – Day-Month-Year

Time Format Options:

1. 24-hour format – Displays time in HH:MM format (e.g., 18:30 for 6:30 PM)
2. 12-hour format – Displays time with AM/PM indicators (e.g., 06:30 PM)

These format settings are user-selectable and typically configured using Configuration software.

9.1.4 Instantaneous Parameters



The Instantaneous Parameter Display provides real-time measurements of key electrical values to help users monitor system conditions continuously. While the meter captures many instantaneous parameters across all phases, this section shows examples of Phase A voltage and current readings. These live values give a quick snapshot of the voltage level and load current on Phase A, assisting in assessing power quality and load balance at a glance. Other instantaneous parameters are available and can be viewed as needed through the meter's display or software interface.

9.1.5 LCD Alarms

The Zeus energy meter has 12 alarms that are displayed on the LCD screen. When any one of the 12 parameters meets its corresponding alarm condition, the alarm will appear on the display. The alarm parameters are listed below:

Sr. No.	Parameter	Error Code
1	Phase A Current Missing	AE-09
2	Phase A Current Low	AE-10
3	Phase A Current Over Threshold	AE-11
4	Phase C Current Missing	AE-13
5	Phase C Current Low	AE-14
6	Phase C Current Over Threshold	AE-15
7	Phase A Leading Power Factor	AE-18
8	Phase A Lagging Power Factor (Low)	AE-19
9	Phase C Leading Power Factor	AE-22
10	Phase C Lagging Power Factor (Low)	AE-23
11	Reverse power on phase A	AE-26
12	Reverse power on phase C	AE-27



The device displays alarm codes in the following format:

Diagnostic alarms appear with the prefix **dIAG**.

Alarm will appear with the prefix **AE**, followed by a **two-digit error code**.

The device also displays caution symbol if:

- 1) Any of the alarm present on display as listed in above table.
- 2) Any of the voltage alarm condition occur as given below:
 - A) Phase A Voltage Missing
 - B) Phase A Voltage Low
 - C) Phase A Voltage Over Threshold
 - D) Phase C Voltage Missing
 - E) Phase C Voltage Low
 - F) Phase C Voltage Over Threshold

Note: All LCD alarms has their qualification time (Trip delay Setting, which can be configured by the BMS software), when the qualification time is completed then the alarm will displayed on the LCD display.

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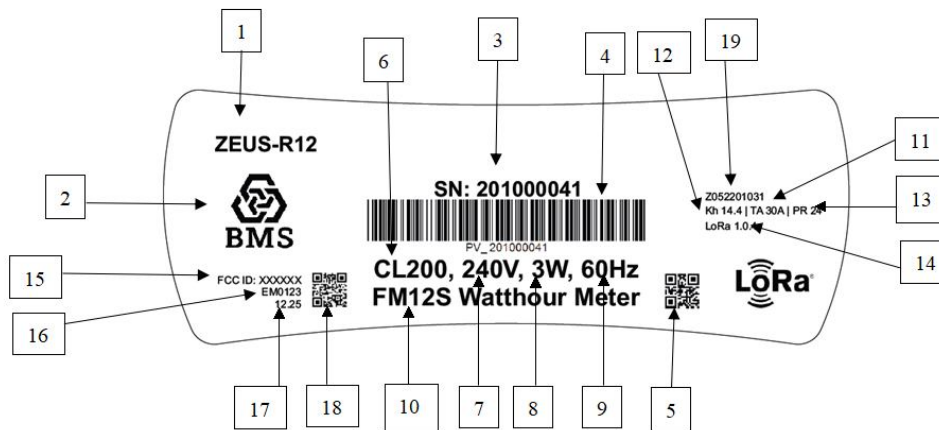
NAMEPLATE INFORMATION

10.1 METER NAMEPLATE

The meter nameplate provides essential technical and identification information required for installation, operation, and maintenance.

It typically includes the meter model, serial number, voltage and current rating, frequency, date of manufacture, and supported communication interface such as LoRa.

This nameplate helps ensure that the correct meter is installed and facilitates traceability and serviceability throughout the meter's life cycle.



10.2 Overview

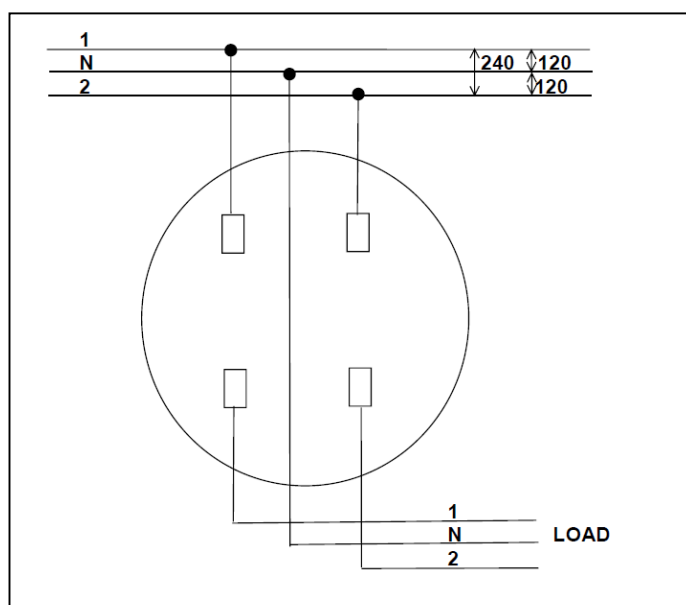
1. Model name
2. Manufacturer Trademark or Name
3. Manufacturer Serial Number
4. Meter Bar Code key
5. DEVEUI QR Code
6. Current Class
7. Rated voltage
8. Number of wires
9. Frequency
10. Meter Form & Watthour Meter
11. Test Amperes
12. Watthour per LED pulse
13. PR Ratio
14. LoRa Module Firmware Version
15. FCC ID
16. Item Number
17. Manufacturing Date in WWYY
18. Manufacturer QR
19. Style Number

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WIRING DIAGRAMS

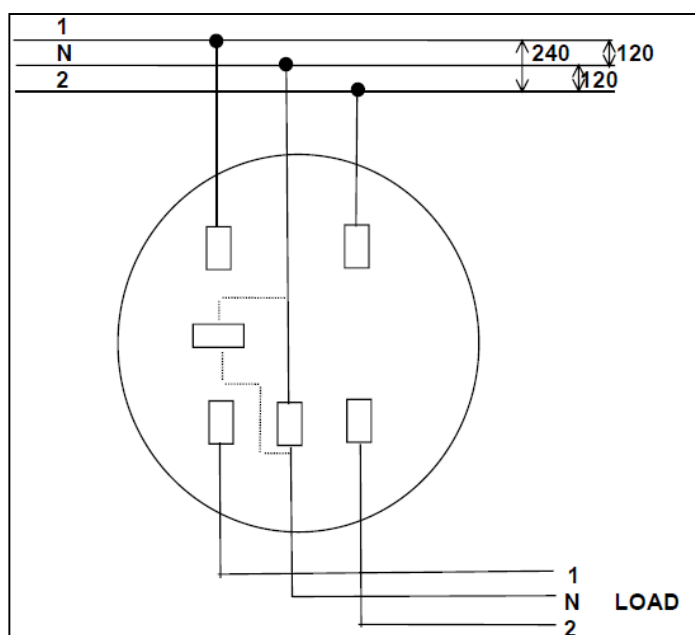
11.1 Form 2S

11.1.1 3 Wire Split Phase

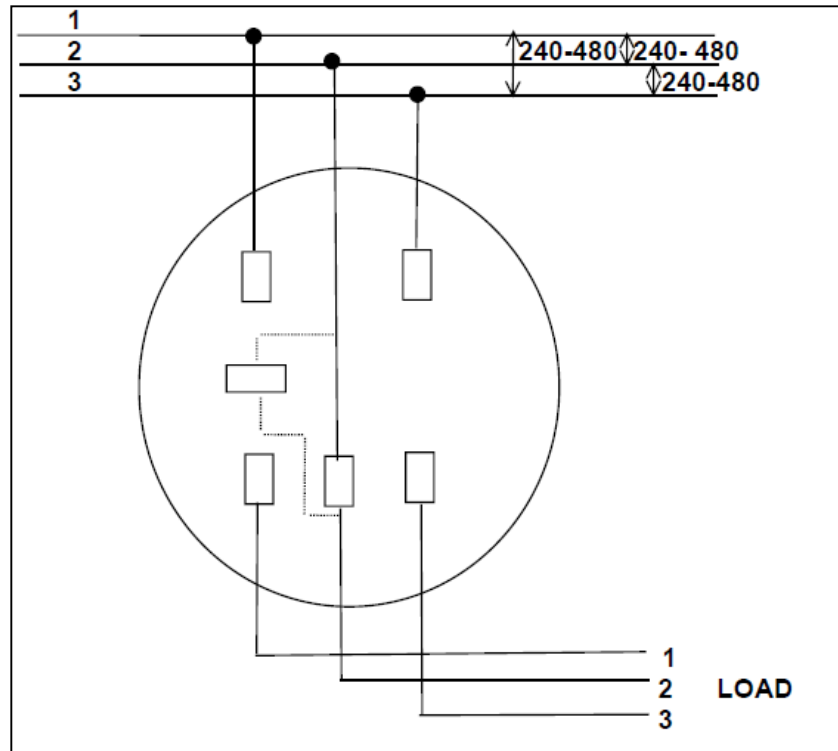


11.2 Form 12S

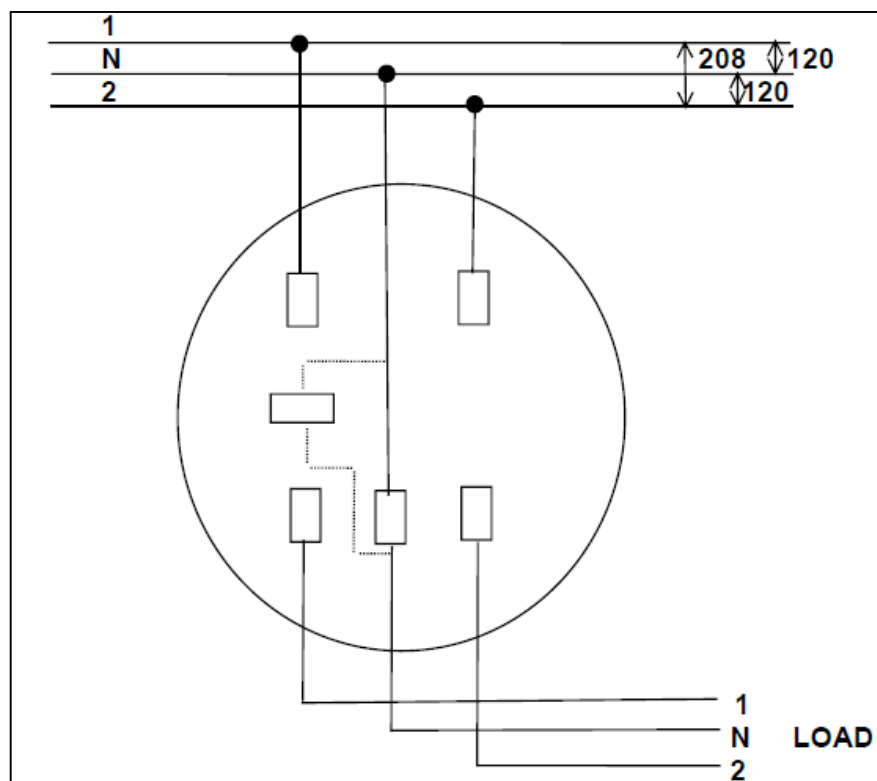
11.2.1 3 Wire Single Phase



11.2.2 3 Wire Delta



11.2.3 3 Wire Network



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TECHNICAL SPECIFICATIONS

Voltage Range:
Form 2S – 120 to 240 V
Form 12S – 120 to 480 V

Current Rating:
Class 200 (CL200)

Frequency:
Nominal 60 Hz $\pm 2\%$

Accuracy Class:
Class 0.5 (ANSI C12.1 compliant)

Supported Forms:
2S and 12S

Temperature Range:
–40°C to +85°C (Inside meter cover)

Humidity Range:
0 to 100%, non-condensing

Real-Time Clock (RTC):
8 hours of backup during power outage

Applicable ANSI Standards:
ANSI C12.1, C12.10, C12.18, C12.19, and UL 2735

Optical Communication:
ANSI C12.18 Type 2 optical port, 9600 bps

Radio Communication:
Unlicensed 900 MHz (US915) LoRa

Time-of-Use (TOU):
Supports 4 Seasons and 4 Tiers

KYZ Outputs:
2 independent pulse outputs

VA Burden:
Less than 20 VA

Meter Weight:
Approximately 1.2 kg
