

PMC-351

Smart DIN Energy Meter

User Manual

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Standards Compliance



DANGER

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



CAUTION

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



DANGER

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

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



Limited warranty

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

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Chapter 1 Introduction

This manual explains how to use the PMC-351 Smart DIN Energy Meter. Throughout the manual the term “meter” generally refers to all models.

This chapter provides an overview of the PMC-351 meter and summarizes many of its key features.

1.1 Overview

The PMC-351 Smart DIN Energy Meter is CET’s latest offer for the Low Voltage Power/Energy metering market. Equipped with an industrial-grade microprocessor in 1P compact size, it boasts high processing speed and the capability to achieve 64 Samples/Cycle. It provides high-accuracy true RMS measurements of up to two channels of single-phase or three-phase voltage, current, and power, and additionally features rapid refresh response for anti-reverse power flow data. Moreover, the PMC-351 is packed with functions including Demand, Power Quality Analysis, Setpoint, SOE as well as Wiring Diagnosis. It supports the connection of Split-Core CT and offers various optional wired and wireless communication modes, including Wi-Fi, Bluetooth, Ethernet and RS-485. Thus, the PMC-351 becomes an ideal component for online monitoring and wireless communication in Balcony/Household PV Energy Storage Systems, Commercial and Industrial Power Systems, as well as Low-Voltage Distribution Systems.

You can setup the meter via our free configuration software. The meter is also supported by our PecStar® iEMS Integrated Energy Management System.

Following is a list of typical applications for the PMC-351:

- Balcony PV Energy Storage System
- Residential PV Energy Storage System
- Residential Multi-Inverter AC Coupling System
- Industrial and Commercial Power System
- AC Low Voltage Distribution System

1.2 Features

Ease of use

- Easy installation with DIN Rail mounting, no tools required
- Simple commissioning and low-deployment cost with Split-Core CT and wireless communication
- Press-Fit plug-in terminals and antenna plug-in interfaces simplify construction and wiring

Basic Measurements (Refresh cycle: 1s)

- 1- Φ SMs (1- Φ SM option)
 - Voltage and Frequency
 - I, I Angle, P/Q/S, PF, Fundamental PF/P and Harmonic P for SM1 and/or SM2
 - kWh/kvarh Import/Export/Net/Total, kVAh and kvarh Q1-Q4 for SM1 and/or SM2
 - Present Demands for Current and P/Q/S
 - Device Operating Time (Running Hours)
- 3- Φ SMs (3- Φ SM option)
 - ULN, ULL per Phase and Average and Frequency
 - I per Phase and Average, In (Calculated Neutral Current) for SM1 and/or SM2
 - P/Q/S and PF per Phase and Total for SM1 and/or SM2
 - U and I Phase Angles
 - Fundamental P/PF per Phase and Total, and Total Harmonic P for SM1 and/or SM2
 - 3-phase and Per-phase kWh/kvarh Import/Export/Net/Total, kVAh Total and kvarh Q1-Q4 for SM1 and/or SM2
 - Present Demands for per Phase Current and P/Q/S
 - Device Operating Time (Running Hours)

Enhanced Measurements

- 1- Φ SMs (1- Φ SM option)
 - K-Factor and Crest Factor for Current
 - U and I THD, TOHD, TEHD and Individual Harmonics up to 31st

- 3- Φ SMs (3- Φ SM option)
 - K-Factor and Crest Factor for Current
 - U and I Unbalance, Components (Zero, Positive and Negative Sequence)
 - U and I THD, TOHD, TEHD and Individual Harmonics up to 31st

High-Speed Measurements (Refresh cycle: <100ms)

- 1- Φ SMs (1- Φ SM option)
 - Voltage and Frequency
 - I, P/Q/S, PF for SM1 and/or SM2
- 3- Φ SMs (3- Φ SM option)
 - ULN, ULL per Phase and Frequency
 - I per Phase, P/Q/S and PF per Phase and Total

Anti-Reverse Power Flow

- High sampling rate of power and current measurements, and communicates with energy storage systems to achieve the anti-reverse power flow function
- Response Time RS-485 @ 50ms and Wi-Fi @100ms

Setpoints

- 10 user programmable Setpoints with extensive list of monitoring parameters including Voltage, Current, Frequency, Power, THD, Unbalance, Phase Reversal, Demands for SM1 and/or SM2, etc.
- Configurable thresholds, time delays and parameters

SOE Log

- 16 events time-stamped to ± 1 ms resolution
- Setup changes, Setpoint, Clear Actions, etc.

Built-in Web Interface

- Access Point (AP) and Station Access (STA) Modes
- Support access to data, network configuration and parameters setup via local PC or Mobile

Diagnostics

- Frequency Out-of-Range, Loss of Voltage / Current
- P Direction per Phase and Total
- Incorrect U & I Phase Sequence

Communications

- Optically isolated RS-485 port at 1200 to 38,400 bps, supporting Modbus RTU
- 1 optional Ethernet Port with Modbus TCP support [#]
- Optional Wi-Fi-enabled (2412-2484MHz) with AP/STA dual modes, supporting RPC protocol
- Optional Bluetooth (2402-2480MHz) connects to 3rd party Mobile Apps, supporting Modbus RTU

System Integration

- Supported by our PecStar® iEMS and free configuration software
- Easy integration into other Automation or SCADA systems via Modbus RTU/TCP protocol and various wireless communication modes

[#] Official release for Expansion Communication Option "WBE" with an Ethernet Port is scheduled for Q4 2026.

1.3 PMC-351's application in a wireless IoT based EMS using wired/wireless network

The PMC-351 can be used to monitor 3-phase or single-phase power system and become a vital component of an intelligent, distributed and wireless IoT based EMS or Condition Monitoring System.

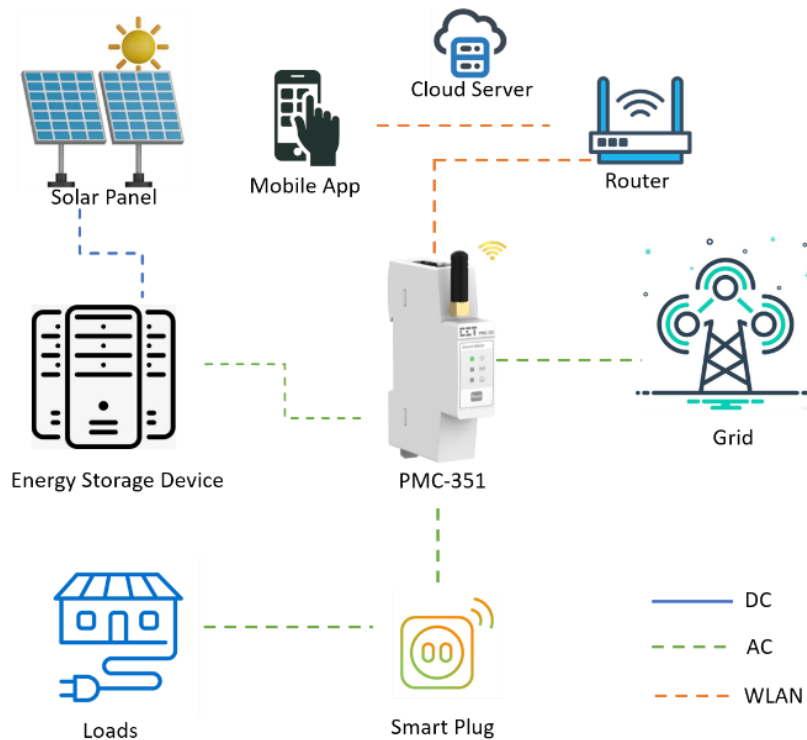


Figure 1-1 PMC-351's application in a wireless IoT based EMS using wired/wireless network

Note:

The Mobile APP pictured above refers to a third-party APP, such as those provided by ESS manufacturers. The user pairs with the PMC-351 via Bluetooth using this APP and sends the local Wi-Fi credentials. After the PMC-351 joins the network, the app communicates with it over Wi-Fi for real-time monitoring.

1.4 Getting more information

Additional information is available from CET via the following sources:

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

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

Chapter 2 Installation



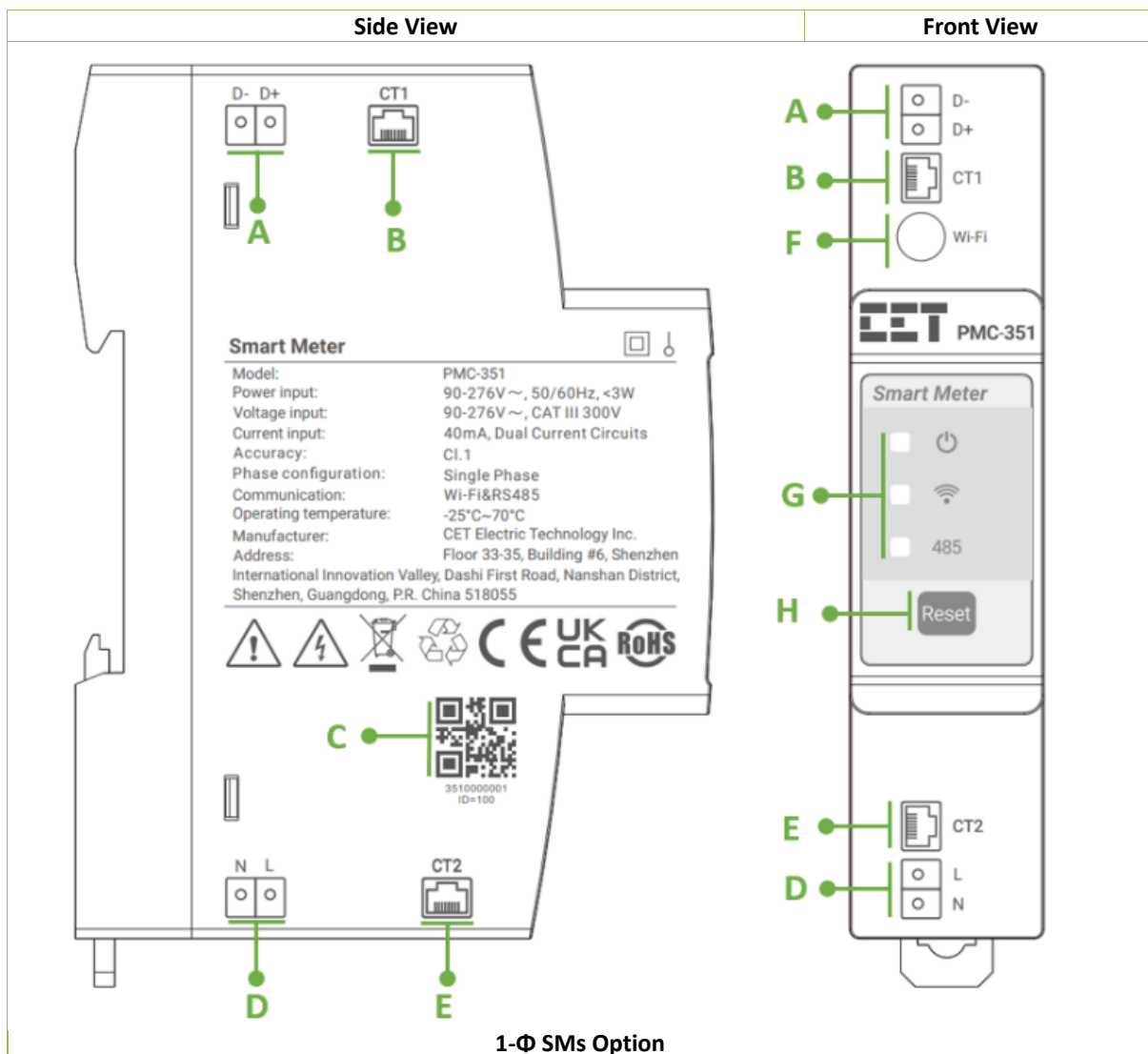
Caution

Installation of the PMC-351 should only be performed by qualified, competent personnel who have the appropriate training and experience with high voltage and current devices. The meter must be installed in accordance with all local and national electrical codes.

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

2.1 Appearance

2.1.1 Main Unit



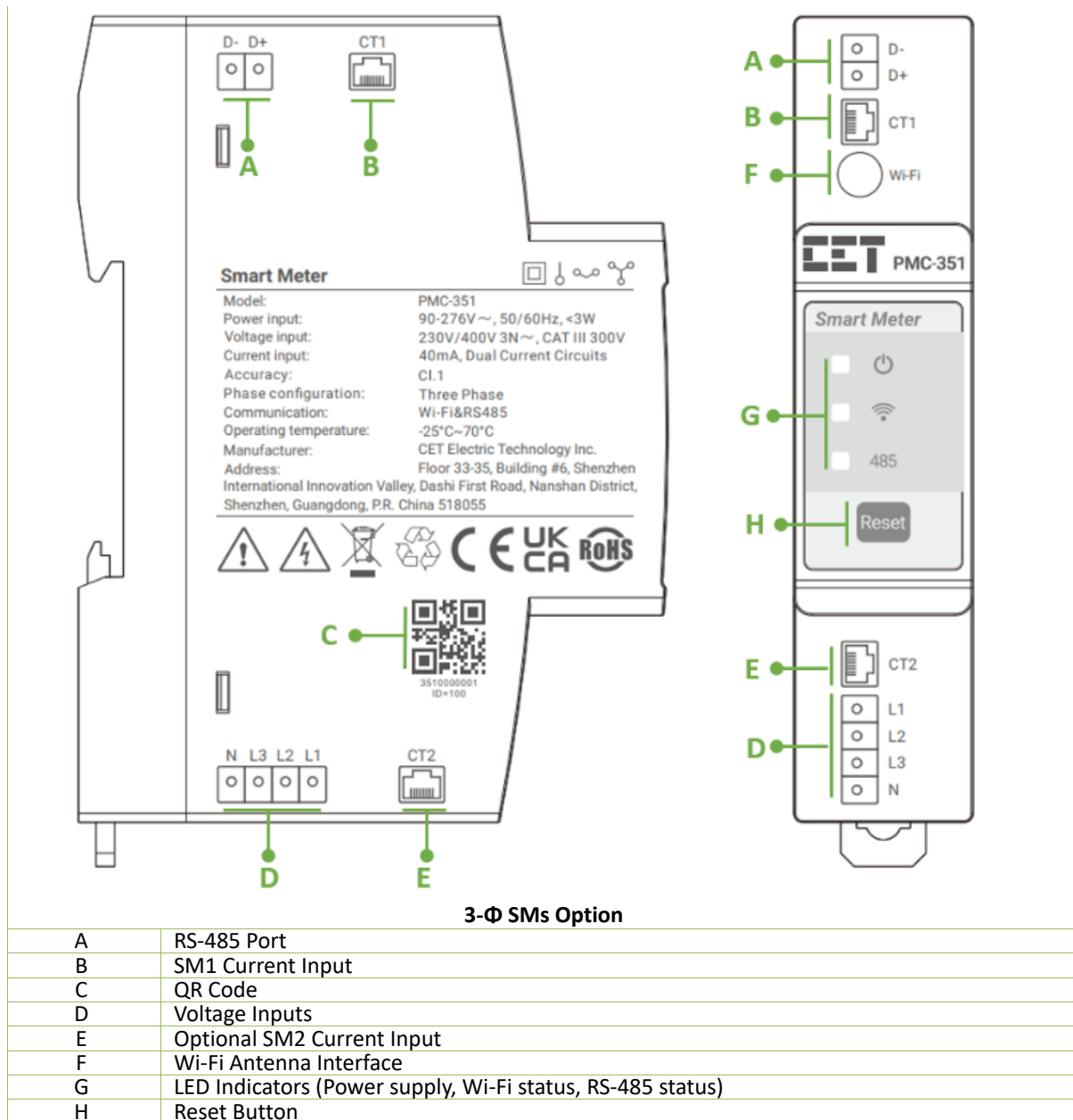


Figure 2-1 Appearance

2.1.2 LED Indicator

There are three LED indicators (6 status) on the PMC-351's Front Panel as described below:

Indicator	Color	Status	Description
	Green	On	Device is powered on.
		Off	Device is powered off.
	Orange	On	Normal Wi-Fi Connection in AP Mode.
	Green	On	Normal Wi-Fi Connection in STA Mode.
		Blink	Abnormal Wi-Fi Connection in STA Mode.
	Green	Blink	The indicator blinks green when transmitting data.

Table 2-1 LED Indicators

2.1.3 Built-in Web Interface

When the Expansion Communication option is equipped with “WBE” or “WBR”, the PMC-351 supports both AP (Access Point) mode and STA (Station) mode. Here are the detailed steps for Web interface login and configuration.

Step 1: Once the device is powered on and within close proximity to the user, the user can connect to the device’s AP in the list of Wi-Fi networks discovered or scanned by his/her mobile phone or PC as a client. The default AP SSID of PMC-351 is “351-device Serial Number (e.g. 351-3603196259)” and the AP Password is “abcd1234-”. The SN with 10 digits in length can be found below the QR code on the device side nameplate. After connection, the Wi-Fi indicator light on the device will be solid orange. AP mode has a limited range; move closer to the device if the connection is unstable.

Step 2: After connection of AP SSID, the user can open a Web browser (any version) to enter the URL 192.168.0.100 and the following interface appears. Enter Username and Password to login.

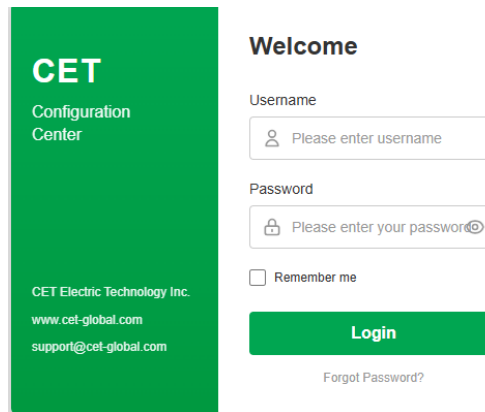


Figure 2-2 CET Configuration Center Login

Note:

- Username = “user” (Both default username and password consist of lowercase letters.)
- Password = “abcd1234-”

Step 3: After first login, you will be required to change your password. The new password length must be 8~16 characters. The new password format is unrestricted. However, to ensure password security, we recommend using a combination of different character types.

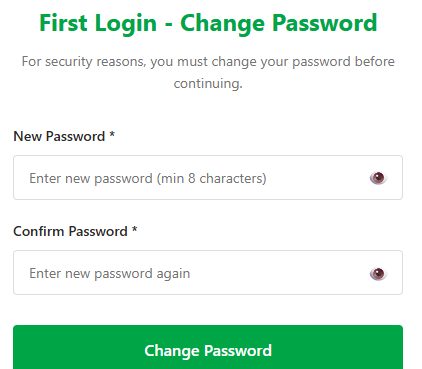


Figure 2-3 First Login - Change Password

If the user needs to change the Web Interface’s login password again at a later time, it can be changed by clicking on the down arrow at the upper right-hand corner of the page and then selecting Change Password as shown below.

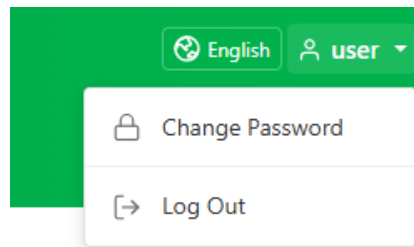


Figure 2-4 Change Password

Step 4: Once the password has been changed, the user will be able to access the CET Configuration Center interface. The user can select an available Wi-Fi network from the list in an on-site environment and connect to it as a client. Upon successful network connection, the device in STA mode is able to perform data queries, parameter settings and firmware upgrade.

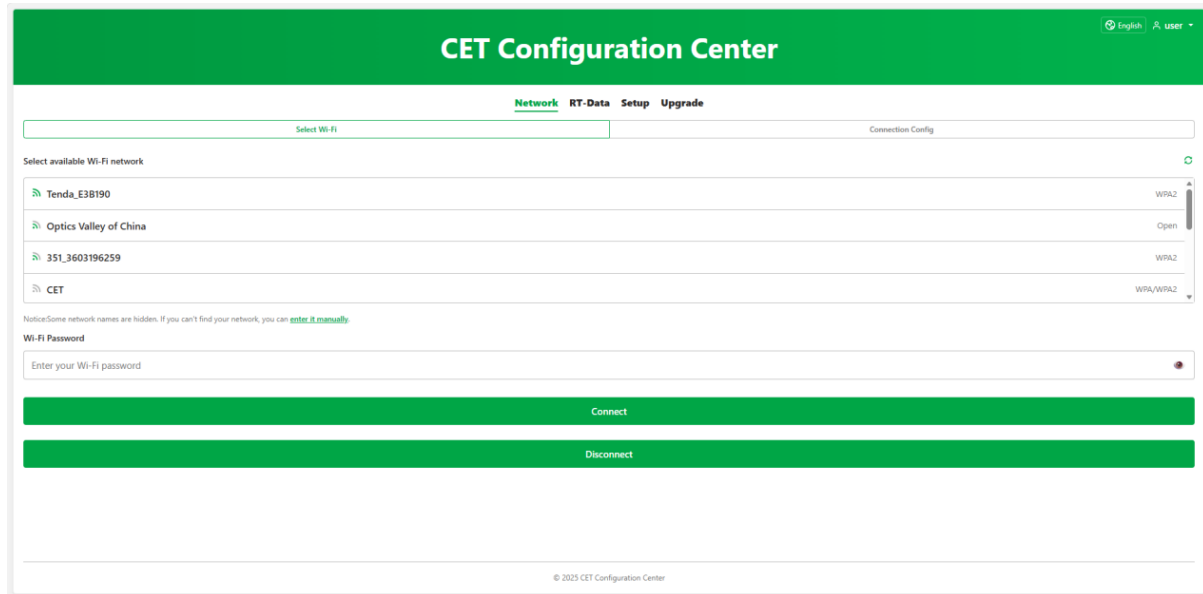


Figure 2-5 Network Connection in STA Mode

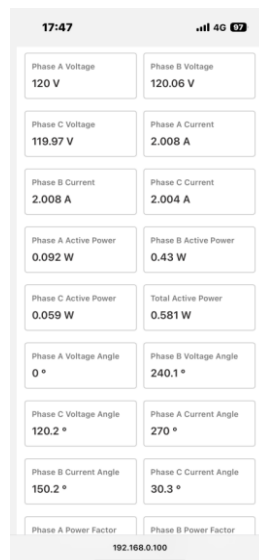


Figure 2-6 Data Querying

Step 5: In addition, user may click on the button “Connection Config” to edit the device’s AP SSID and AP Password based on varying requirements and then click on the button “Edit Configuration”. The new Wi-Fi name must be at most 31 characters and its password must be 8~63 characters. After that, the device will restart its AP using the new SSID and password, an error will be displayed on the interface, and the user needs to reconnect to the Wi-Fi when device is in the AP mode.

CET Configuration Center
English user

Network
RT-Data
Setup
Upgrade

Select Wi-Fi
Connection Config

AP SSID

AP Password

Edit Configuration

© 2023 CET Configuration Center

https://192.168.0.100/

Figure 2-7 Connection Config

2.1.4 Split-Core CT Appearances & Specifications

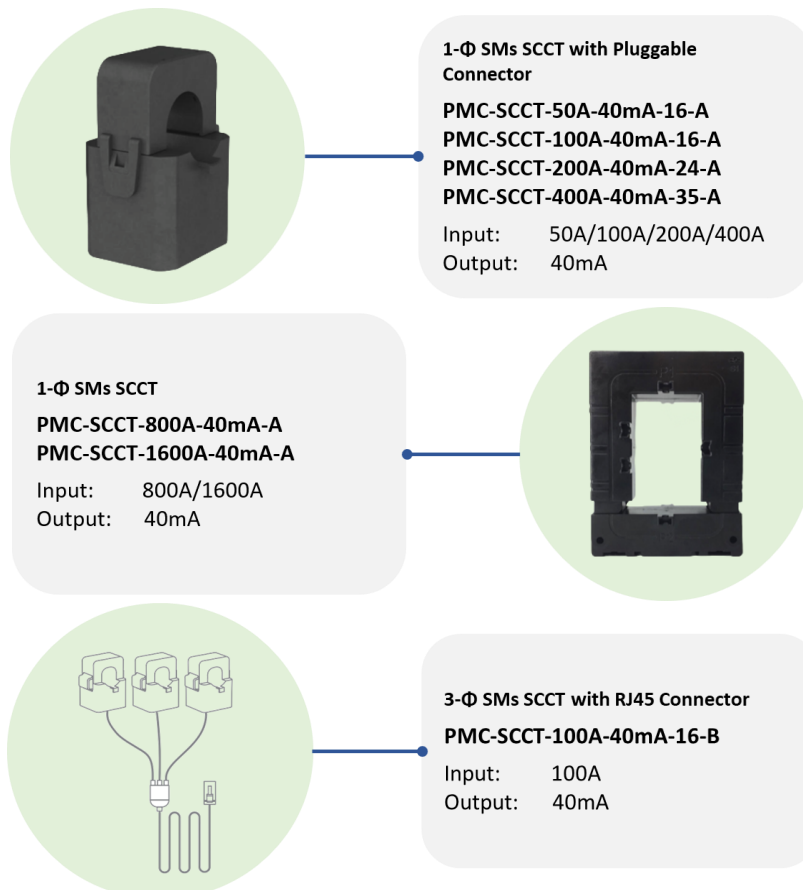


Figure 2-8 Split-Core CT Appearances & Specifications

2.1.5 Antenna Appearances & Specifications ^

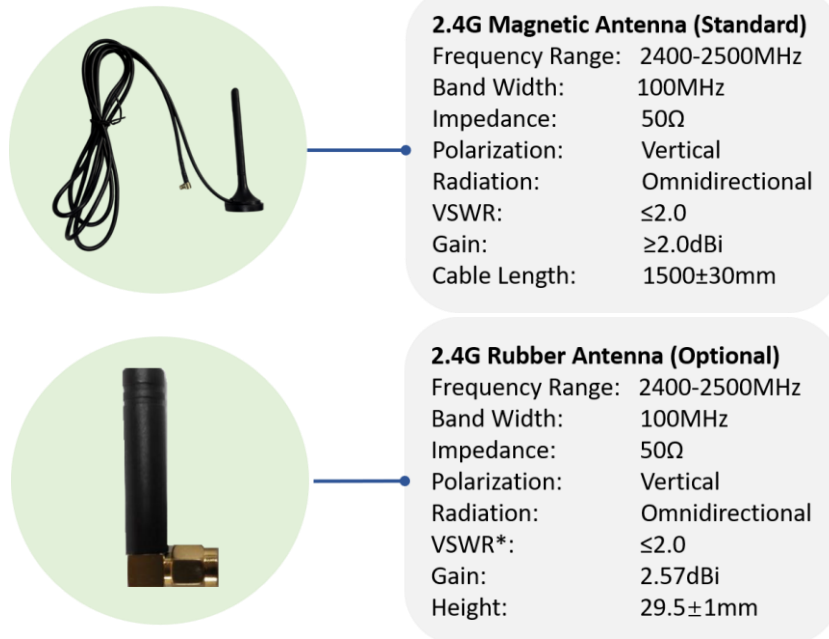


Figure 2-9 Antenna Appearances & Specifications

* VSWR=Voltage Standing Wave Ratio

^ The upper magnetic antenna comes as standard. If you need the rubber antenna, please contact CET for details.

2.2 Dimensions

2.2.1 Unit Dimensions

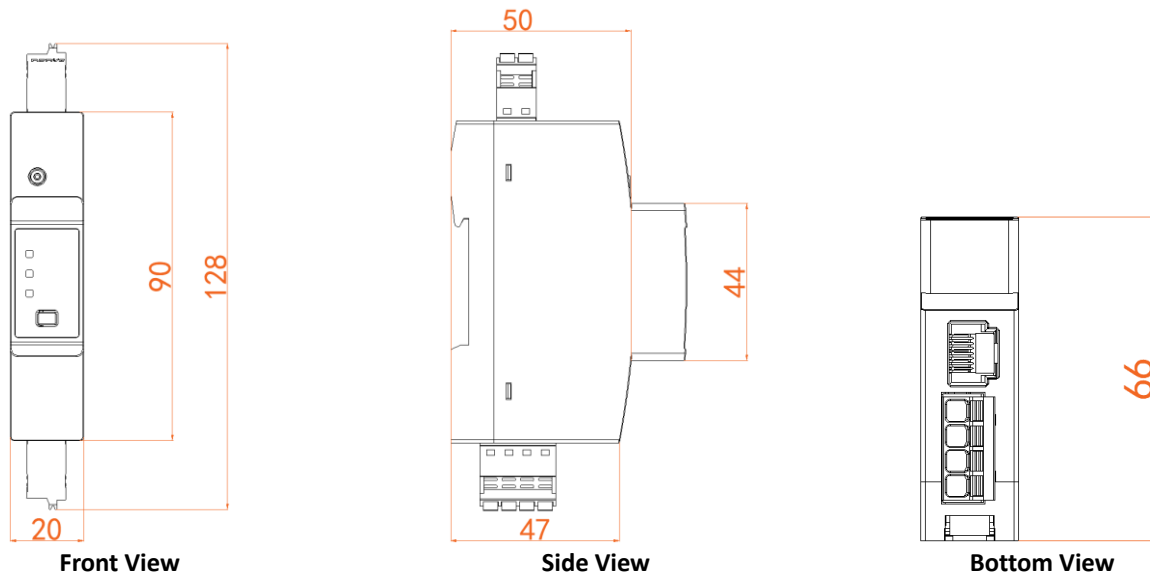


Figure 2-10 Unit Dimensions

2.2.2 Terminal Dimensions

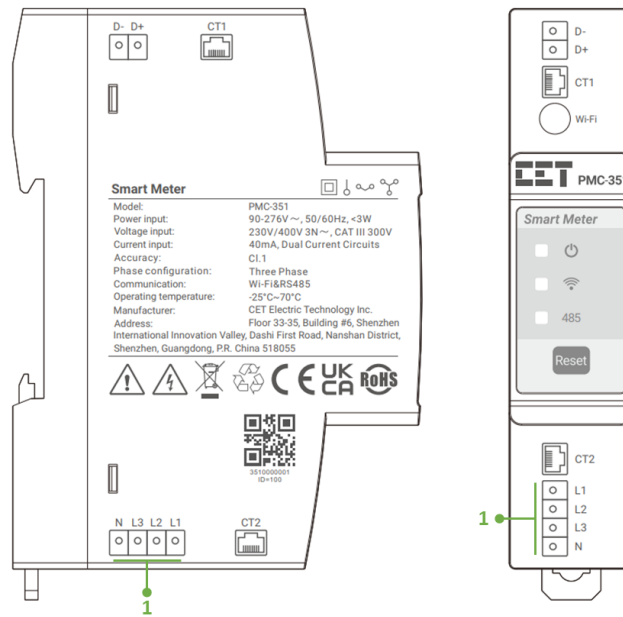


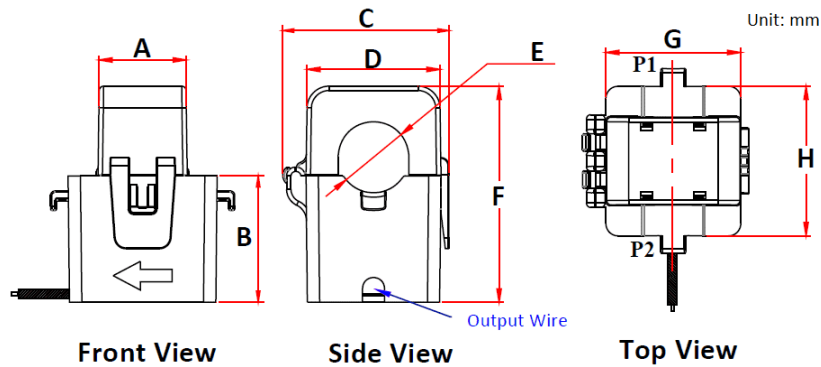
Figure 2-11 Terminal Dimensions

Type	Terminal	Terminal Dimension (mm)	Wire Size (mm ²)	Torque	
				Tightening	Max.
1	Power Supply Voltage Inputs RS-485	2.8*3.1	0.2-2.5mm ² (14-24AWG)	10 kgf.cm/ 8.86 lb-in/ 1 N.m	15 kgf.cm/ 13 lb-in/ 1.46 N.m

Table 2-2 Terminal Dimensions

2.2.3 CT Dimensions

2.2.3.1 50A/40mA, 100A/40mA, 200A/40mA or 400A/40mA SCCT



Model	A	B	C	D	E	F	G	H
PMC-SCCT-50A-40mA-16-A	19	26.5	36.3	30	Ø16	47	30	30
PMC-SCCT-100A-40mA-16-A	20.9	28.6	37.8	30.26	Ø16	48.9	30.7	33.9
PMC-SCCT-200A-40mA-24-A	20	41	53.8	44.3	Ø24	70.0	45.0	40.2
PMC-SCCT-400A-40mA-35-A	22.5	47	67.2	57.3	Ø35	83.05	58.2	42.8

Table 2-3 50A/40mA, 100A/40mA, 200A/40mA, 400A/40mA SCCT Dimension

2.2.3.2 800A Split-Core CT (PMC-SCCT-800A-40mA-A)

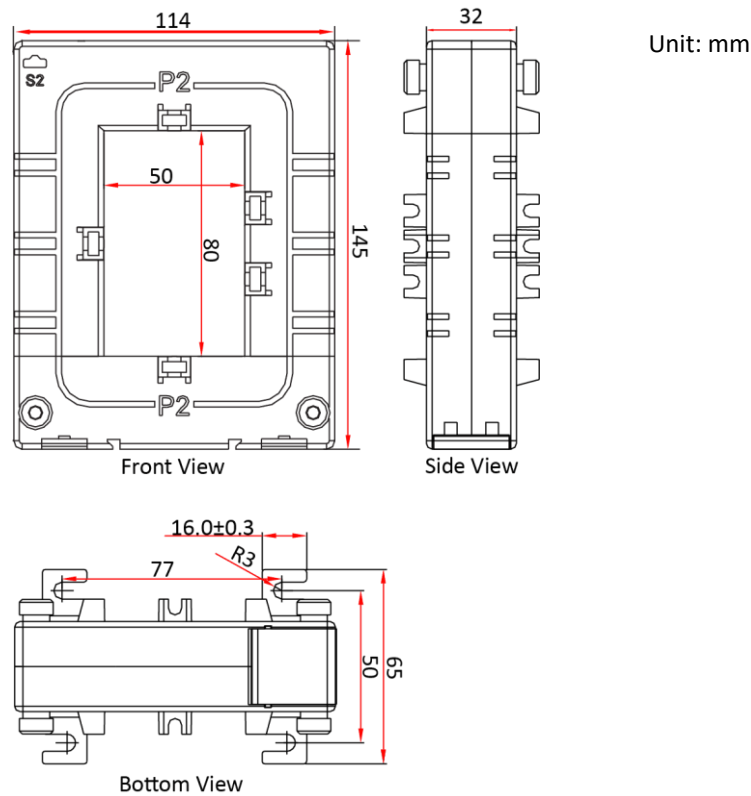


Figure 2-12 800A SCCT Dimensions

2.2.3.3 1600A Split-Core CT (PMC-SCCT-1600A-40mA-A)

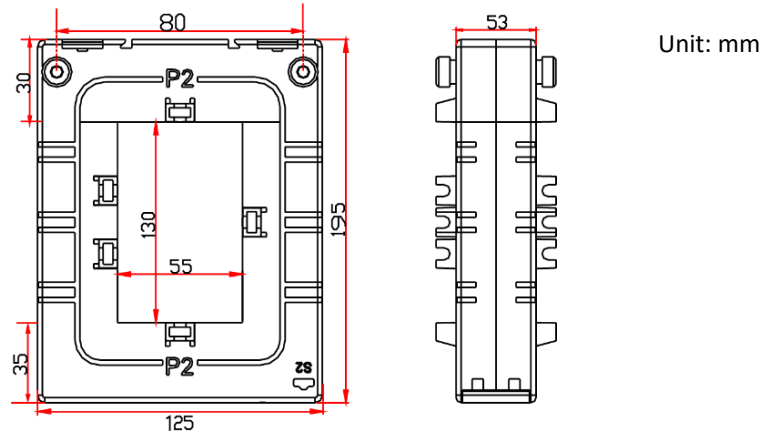


Figure 2-13 1600A SCCT Dimensions

2.3 Mounting

The PMC-351 should be installed in a dry environment with no dust and kept away from heat, radiation and electrical noise source.

Steps:

1. Before installation, make sure that the DIN Rail is already in place.
2. Move the installation clips at the back of the PMC-351 downward to the “unlock” position.
3. Align the top of the mounting channel at the back of the PMC-351 at an angle against the top of the DIN Rail as shown in **Figure 2-14** below.
4. Rotate the bottom of the PMC-351 towards the back while applying a slight pressure to make sure that the device is completely and securely fixed on to the DIN Rail.
5. Push the installation clips upward to the “lock” position to secure the PMC-351 on to the DIN Rail.

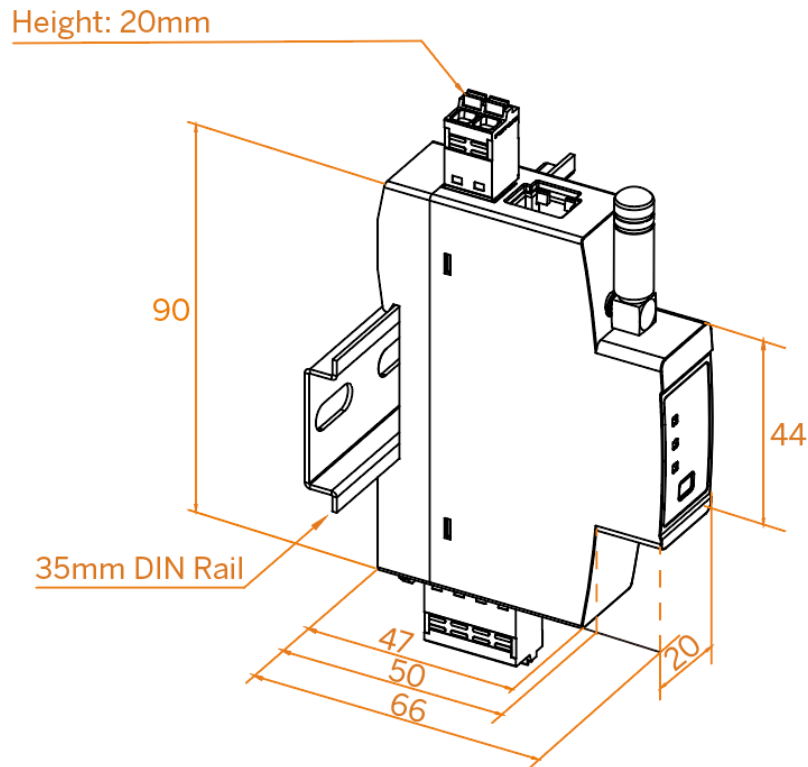


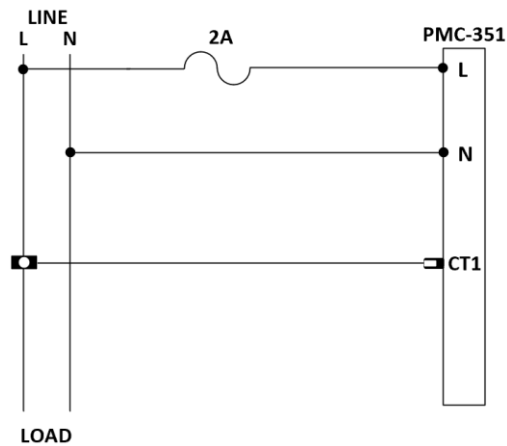
Figure 2-14 Installation

2.4 Wiring Mode

Please read this section carefully before installation and choose the correct wiring method for your power system.

2.4.1 1 Branch Feeder

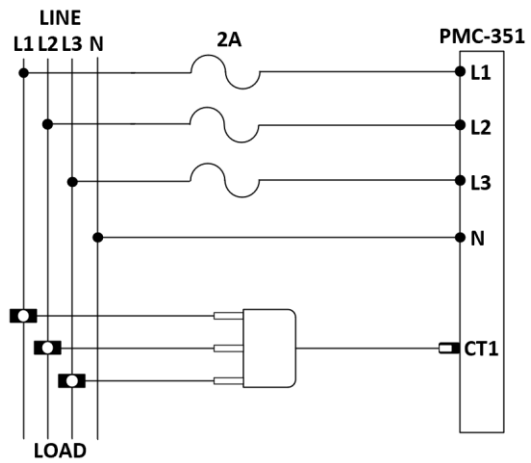
- 1- Φ Sub-Meters



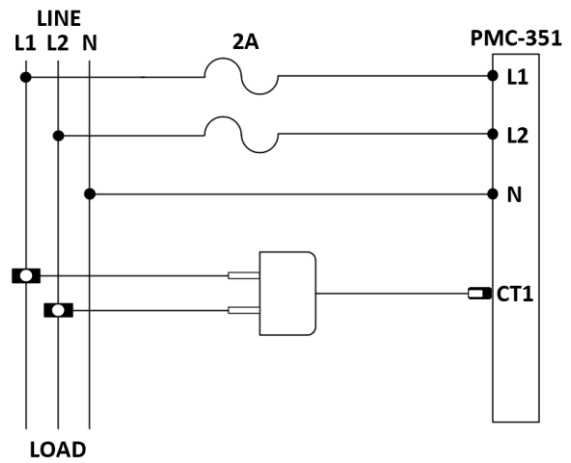
1P2W UIn with 1CT

Figure 2-15 1 Branch Feeder, 1- Φ Sub-Meters

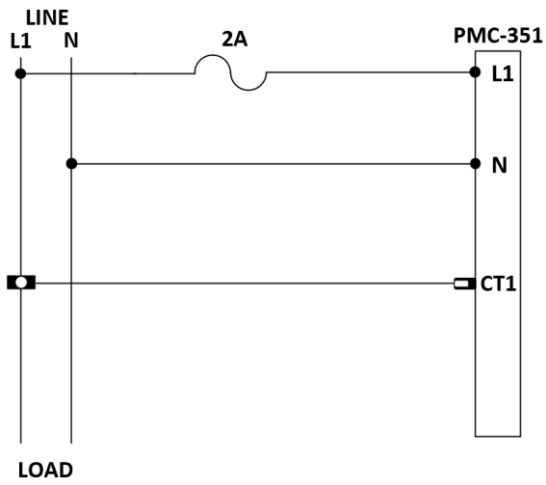
- 3- Φ Sub-Meters (Optional)



3P4W with 3CTs



1P3W with 2CTs

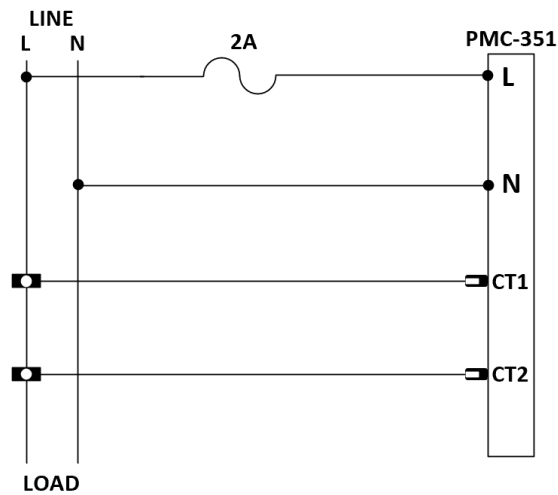


1P2W UIn with 1CT

Figure 2-16 1 Branch Feeder, 3- Φ Sub-Meters

2.4.2 2 Branch Feeders (Optional)

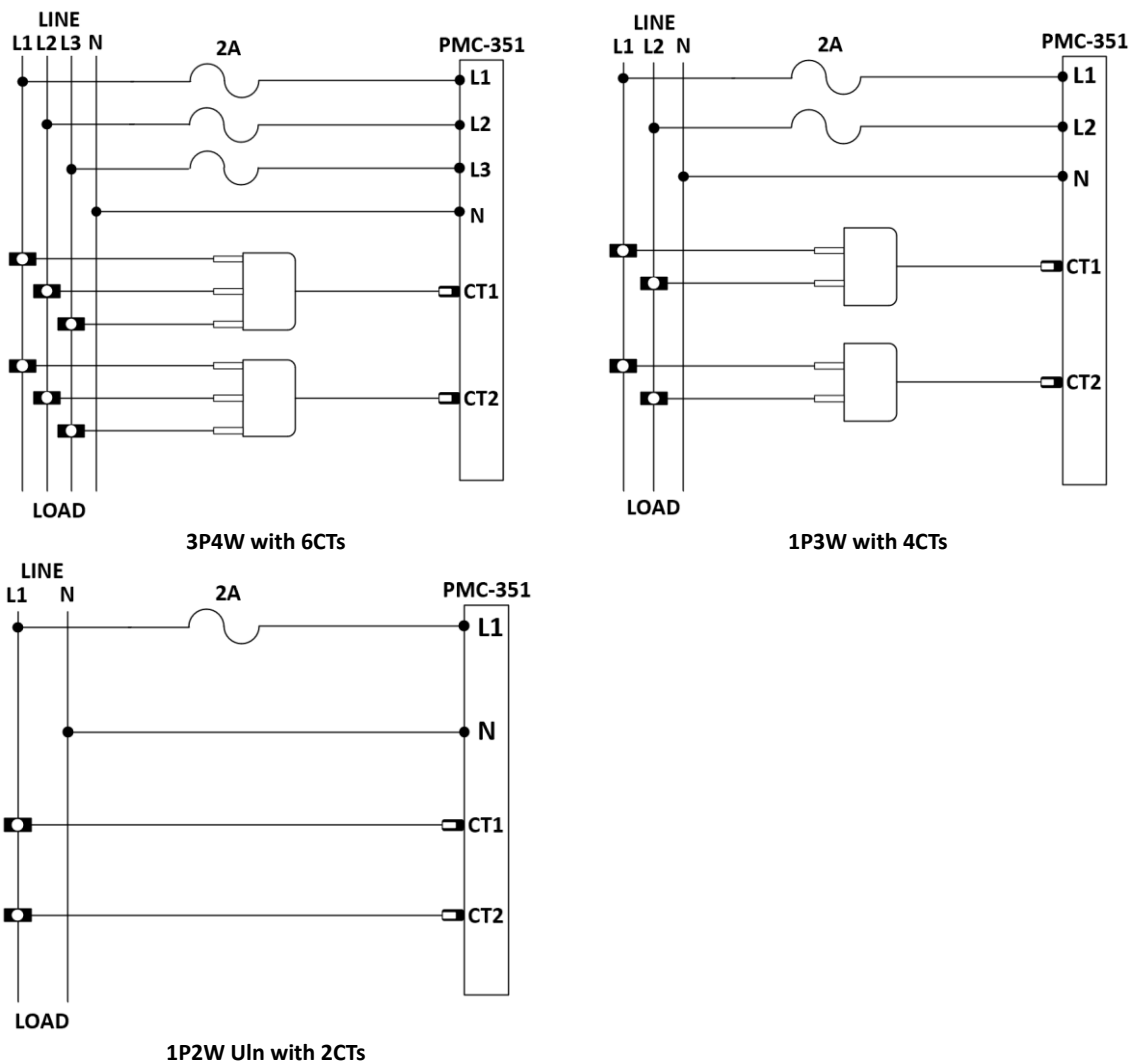
- 1- Φ Sub-Meters



1P2W UIn with 2CTs

Figure 2-17 2 Branch Feeders, 1- Φ Sub-Meters

- 3- Φ Sub-Meters

Figure 2-18 2 Branch Feeders, 3- Φ Sub-Meters

2.5 SCCT Installation

**Caution**

Please make sure that the circuit is de-energized before installing the SCCT for maximum safety. Do not open circuit the SCCT's secondary output under any circumstances while the circuit is energized. Failure to observe proper precaution while working with this product may result in serious injury or death.

2.5.1 Wiring for 50A/40mA, 100A/40mA, 200A/40mA or 400A/40mA SCCT

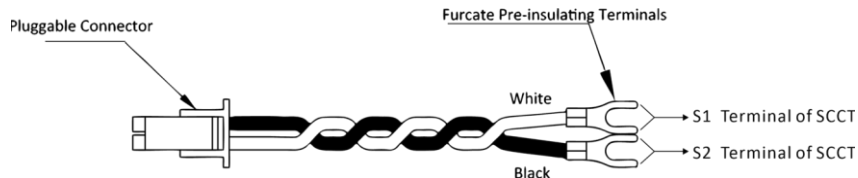
Steps:

- These SCCTs come with a pluggable connector at the end of the output wires. Insert the 2-pin pluggable connector securely into the Current Input terminal on the PMC-351.
- Open the SCCT by slightly pulling on the clip. Please ensure that SCCT's contact surface is clean and without contaminants for best accuracy performance.
- Put the cable through the opening of the SCCT and make sure that Current flow direction is aligned with the arrow marking on the SCCT. Close the SCCT and make sure that the clip is securely latched.
- Secure the cable to the SCCT with a wire strap.



Figure 2-19 50A/40mA, 100A/40mA, 200A/40mA or 400A/40mA SCCT Installation

2.5.2 Wiring for 800A/40mA or 1600A/40mA SCCT



Steps:

1. Connect the white and black leads with the spade connector of the PMC-BCC-350-2 to the SCCT's S1 and S2 terminals, respectively, and insert the 2-pin pluggable connector to the meter's Current Input terminal of the PMC-351.
2. Open the SCCT by removing the thumb-screws that hold the SCCT together and make sure that SCCT's contact surface is clean and without contaminants for best accuracy performance.
3. Install the SCCT around the busbar and then carefully secure it using the provided mounting fixtures such as mounting bolts and insulation caps as shown below.
4. Reassemble the SCCT and tighten the thumb screws.

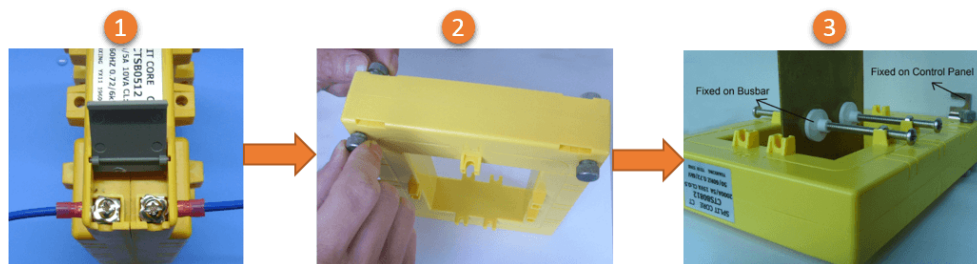


Figure 2-20 800A/40mA, 1600A/40mA SCCT installation

Notes:

1. Please separate the adjacent CTs by about 2 cm to reduce potential magnetic interference.
2. Please ensure the Load Current does not exceed the CT's Primary Current specification.

2.6 Antenna Installation

Connect either the 2.0dBi or 2.57dBi antenna to the PMC-351 by applying the correct torque to tighten the connection as shown in the figure below. For best communication performance, the antenna should be mounted outside of a metal enclosure and preferably positioned vertically. The base of the 2dBi antenna is equipped with a magnetic coupler for easy mounting on metal surface.

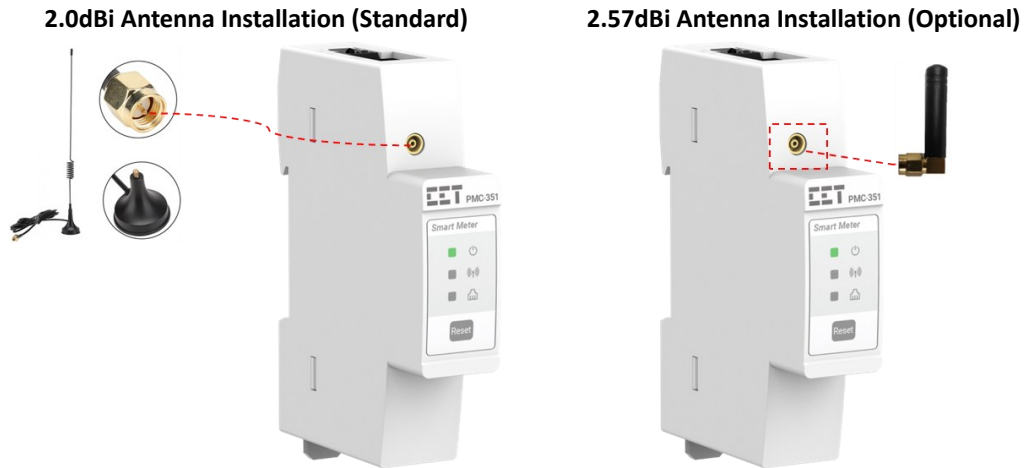


Figure 2-21 Antenna Connection

2.7 RS-485 Wiring

The PMC-351 provides one standard RS-485 port that supports the Modbus RTU protocol. Up to 32 devices can be connected on a RS-485 bus. The overall length of the RS-485 cable connecting all devices should not exceed 1200m.

If the master station does not have a RS-485 communications port, an Ethernet-to-RS-485 gateway or USB/RS-485 converter with optically isolated outputs and surge protection should be used. The following figure illustrates the RS-485 connections on the PMC-351.

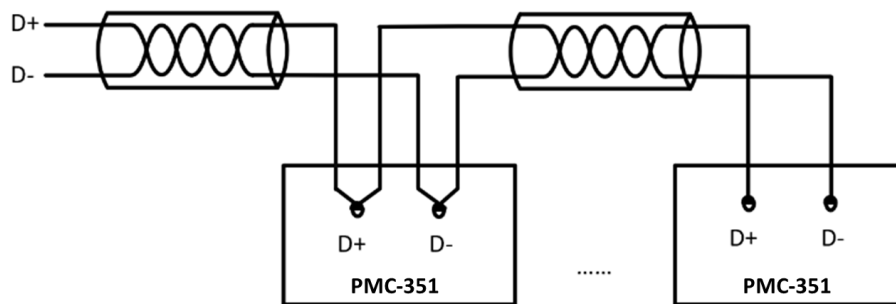


Figure 2-22 RS-485 Connections

2.8 Power Supply Wiring

The PMC-351 is self-powered from the voltage inputs and does not require an independent power supply. When the 1- Φ SMs option is selected, it is powered by L/+ and N/-. When the 3- Φ SMs option is selected, it is powered by L1/+ and N/-.

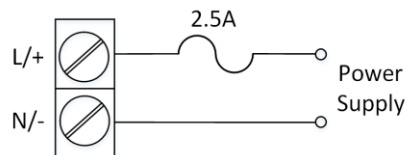


Figure 2-23 Self-powered Power Supply Connections

Chapter 3 Applications

3.1 Power and Energy

3.1.1 Basic Measurements

The PMC-351 provides the following basic measurements which are available through communication:

- 1- Φ SMs

Parameter	1- Φ SMs
Voltage	●
Frequency	●
Current Phase Angle	●
Current	●
P	●
Q	●
S	●
Power Factor	●
Fundamental PF	●
Fundamental P	●
Harmonic P	●
Device Operating Time	●

- 3- Φ SMs

Parameter	Phase A	Phase B	Phase C	Total	Average
ULN	●	●	●	-	●
ULL	●	●	●	-	●
Current	●	●	●	-	●
P	●	●	●	●	-
Q	●	●	●	●	-
S	●	●	●	●	-
Power Factor	●	●	●	●	-
Frequency	●	-	-	-	-
U Phase Angle	●	●	●	-	-
I Phase Angle	●	●	●	-	-
Neutral Current	-	-	-	In calculated)	-
Fundamental P	●	●	●	●	-
Fundamental PF	●	●	●	●	-
Harmonic P	-	-	-	●	-
Device Operating Time	-	-	-	●	-

Table 3-1 Basic Measurements

3.1.2 High-Speed Measurements

Besides the basic measurements, the PMC-351 provides the following High-Speed measurements which are available through communication:

- 1- Φ SMs

Parameter	1- Φ SMs
Voltage	●
Current	●
P	●
Q	●
S	●
Power Factor	●
Frequency	●

- 3- Φ SMs

Parameter	Phase A	Phase B	Phase C	Total	Average
ULN	●	●	●	-	-
ULL	●	●	●	-	-
Current	●	●	●	-	-
P	●	●	●	●	-
Q	●	●	●	●	-

S	●	●	●	●	-
Power Factor	●	●	●	●	-
Frequency	●	-	-	-	-

Table 3-2 High-Speed Measurements

3.1.3 Energy Measurements

The PMC-351 provides Energy measurements for active energy (kWh), reactive energy (kvarh) and apparent energy (kVAh) with a resolution of 0.01 kxh and maximum value of 10,000,000,000. When the maximum value is reached, the energy registers will automatically roll over to zero. The energy can be reset manually through communication. The PMC-351 provides the following energy measurements:

Per-Phase & 3-Phase Total	kWh Import/Export/Net/Total kvarh Import/Export/Net/Total	kvarh of Q1/Q2/Q3/Q4 kVAh Total
--------------------------------------	--	------------------------------------

Table 3-3 Energy Measurement

3.1.4 Demand Measurements

Demand is defined as the average power consumption over a fixed interval (usually 15 minutes) based on the Sliding Window method. The PMC-351 provides Present Demand of Ia, Ib, Ic, and P/Q/S for SM1 and/or SM2, updated once a second.

The PMC-351 provides the following setup parameters:

Setup Parameter	Definition	Options
Demand Period	1 to 60 minutes. For example, if the # of Sliding Windows is set as 1 and the Demand Period is 15, the demand cycle will be 1×15=15min.	1 to 60 min Default=15
# of Sliding Windows	Number of Sliding Windows.	1 to 15 Default=1

Table 3-4 Demand Setup

3.2 Power Quality

3.2.1 Phase Angles

The PMC-351 provides Voltage and Current Phase Angle measurements for 3-Φ SMs. Phase analysis is used to identify the angle relationship between 3-phase Voltages and Currents.

In 3P4W or 3P3W system in which the phase angles between consecutive line voltages, are not all equal. The degree of the inequality is usually expressed as the ratios of the negative- and zero-sequence components to the positive-sequence component, which is called Unbalance. For WYE connected systems, the per-phase difference of the Current and Voltage angles should correspond to the per-phase PF. For example, if the PF is 0.5 Lag and the Voltage phase angles are 0.0°, 240.0° and 120.0°, the Current phase angles should have the values of -60.0°, 180.0° and 60.0°.

3.2.2 Unbalance

The PMC-351 provides Voltage and Current Unbalance measurements for 3-Φ SMs. The calculation method of Voltage and Current Unbalances is based on the ratio of Positive and Negative Sequence Components.

$$\text{Voltage Unbalance} = \frac{V_2}{V_1} \times 100\%$$

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

where

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

and

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

3.2.3 K-Factor

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

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

where

I_h = I_{th} Harmonic Current in RMS

h_{max} = Highest harmonic order

3.2.4 Crest Factor

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

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

where

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

X_{rms} = RMS value

3.2.5 Harmonics

The PMC-351 provides Voltage and Current with THD, TOHD, TEHD and up to the 31st individual harmonics analysis. All harmonic parameters are available through communications.

The following table illustrates the available Voltage and Current Harmonics measurements on the PMC-351.

	Phase A/AB	Phase B/BC	Phase C/CA
Harmonic-Voltage	THD	THD	THD
	TEHD	TEHD	TEHD
	TOHD	TOHD	TOHD
	2 nd Harmonics	2 nd Harmonics	2 nd Harmonics
	...	...	...
	31 st Harmonics	31 st Harmonics	31 st Harmonics
Harmonic-Current	THD	THD	THD
	TEHD	TEHD	TEHD
	TOHD	TOHD	TOHD
	2 nd Harmonics	2 nd Harmonics	2 nd Harmonics
	...	...	...
	31 st Harmonics	31 st Harmonics	31 st Harmonics
	K-Factor	K-Factor	K-Factor
	Crest-Factor	Crest-Factor	Crest-Factor

Table 3-5 Harmonic Measurements

There are two methods for calculating the **THD**, which are based on Fundamental (THDf) and RMS (THDr). **Fundamental** is defined as the lowest frequency of a periodic waveform.

THDf:

$$\text{THDf} = \frac{\sqrt{\sum_{n=2}^{\infty} I_n^2}}{I_1} \times 100\%$$

THDr:

$$\text{THDr} = \frac{\sqrt{\sum_{n=2}^{\infty} I_n^2}}{\sqrt{\sum_{n=1}^{\infty} I_n^2}} \times 100\%$$

where I_1 represents the RMS value of the fundamental component, and I_n represents the RMS value for the nth harmonic.

3.3 Setpoints

The PMC-351 comes standard with 10 user-programmable Setpoints which provide extensive control by allowing a user to initiate an action in response to a specific condition. Typical setpoint applications include alarming, fault detection and power quality monitoring.

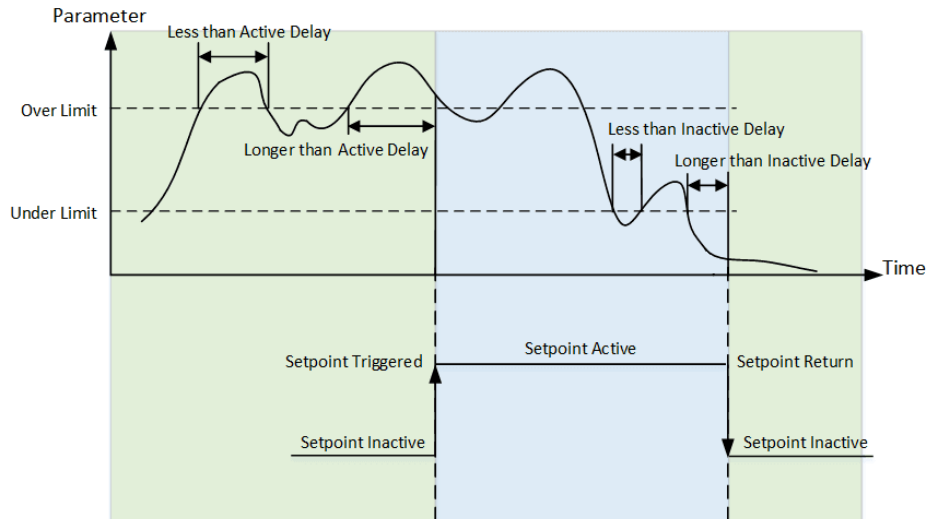


Figure 3-1 Over Setpoint

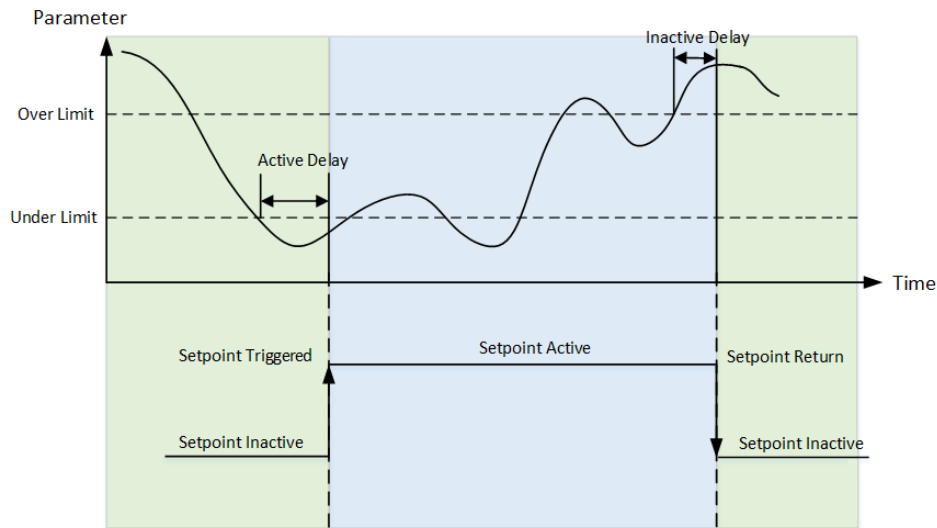


Figure 3-2 Under Setpoint

Setpoints can be programmed via communication and have the following setup parameters:

Parameter	Definition	Options/Default*
Setpoint Type	Over or Under Setpoint.	0=Disabled* 1=Over Setpoint 2=Under Setpoint
Setpoint Parameter	Specify the parameter to be monitored.	See Table 3-7 Setpoint Parameters
Over Limit	Specify the value that the setpoint parameter must exceed for Over Setpoint to become active or go below for Under Setpoint to become inactive.	0*
Under Limit	Specify the value that the setpoint parameter must go below for Over Setpoint to become inactive or exceed for Under Setpoint to become active.	0*
Active Delay	Specify the minimum duration that the setpoint condition must be met before the setpoint becomes active. An event will be generated and stored in the SOE Log. The range of the Active Delay is between 0 and 9999 seconds.	0* to 9999s
Inactive Delay	Specify the minimum duration that the setpoint return condition must be met before the setpoint becomes inactive. An event will be generated and stored in the SOE Log. The range of the Inactive Delay is between 0 and 9999 seconds.	0* to 9999s
Trigger (Reserved)	Specify what action a setpoint would take when it becomes active.	0 = None*

Table 3-6 Description for Setpoint Parameters

The table below illustrates the Setpoint Parameters.

Key	Setpoint Parameter	Scale	Unit
0	None	-	-
1	UIn (Any Phase Voltage)	x1	V
2	UII (Any Line Voltage)		A
3	I (Any Phase Current)		Hz
4	In (Calculated Neutral Current)		W
5	Frequency		var
6	P (kW Total)		VA
7	Q (kvar Total)		-
8	S (kVA Total)		V
9	PF (PF Total)		V
10	Phase A Voltage		V
11	Phase B Voltage		V
12	Phase C Voltage		V
13	UAB		A
14	UBC		A
15	UCA		A
16	I1		100%
17	I2		100%
18	I3		100%
19	U THD		100%
20	U TOHD		100%
21	U TEHD		100%
22	I THD		100%
23	I TOHD		100%
24	I TEHD		100%
25	Voltage Unbalance		100%
26	Current Unbalance		100%
27	Phase Reversal ¹	-	-
28	Ia Demand	x1	A
29	Ib Demand		A
30	Ic Demand		A
31	P Total Pres. Demand		W
32	Q Total Pres. Demand		var
33	S Total Pres. Demand		VA

Table 3-7 Setpoint Parameters

Notes:

1. When **Phase Reversal** is set as the **Setpoint Parameter**, the **Setpoint Type** should be set to 1 (i.e., Over Setpoint). The **Setpoint Type=2** (i.e., Under Setpoint) is invalid. In addition, the **Over Limit** and **Under Limit** should be set as 0 and 1, respectively.

3.4 Anti-Reverse Power Flow

With the fast calculation of voltage, power and current measurements, PMC-351 communicates with energy storage systems to achieve the anti-reverse power flow function. The typical application scenarios include Balcony PV Energy Storage Anti-Reverser Power Flow Monitoring and Residential PV Energy Storage Anti-Reverser Power Flow Monitoring, etc.

3.5 SOE Log

The PMC-351's SOE Log can store up to 16 events such as Power-on, Power-off, Setup changes and Setpoint events in its non-volatile memory. Each event record includes the event classification, its relevant parameter values and a timestamp in ± 1 ms resolution. The SOE Log can be retrieved or reset via communications. If there are more than 16 events, the newest event will replace the oldest event on a First-In-First-Out basis.

3.6 Diagnostics

The PMC-351 provides wiring error detection for 3P4W and 3P3W wiring modes, which allow users to check for possible problems especially during the initial commissioning stage. The following wiring errors may be detected:

- Frequency Out-of-Range
- Voltage / Current Phase Loss
- Incorrect Voltage and Current Phase Sequence
- P Direction per phase and Total

Please note the detections above are based on the assumptions below:

- The Voltage and Current Phase Sequence are consistent
- P is P Import, which means the P is over 0
- The wiring is correct
- 3P4W wiring mode supports all detections
- 3P3W wiring mode does not support the detection of Voltage Phase Loss and P Direction per phase

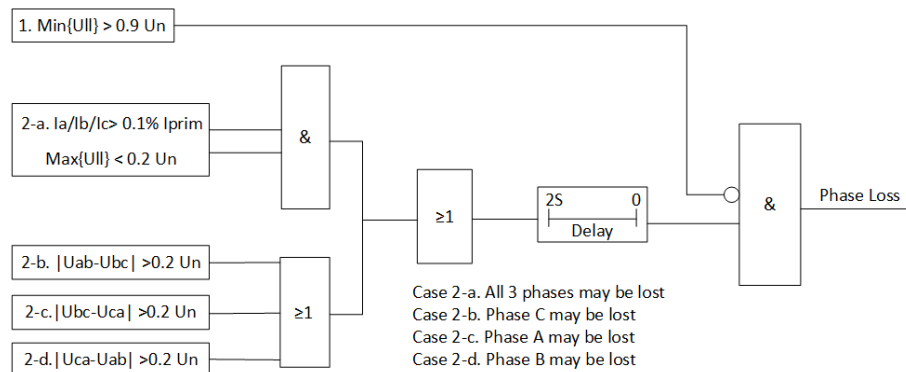
The Diagnostic register (0101) indicates the status of the wiring error detection with a bit value of 1 meaning active and 0 meaning inactive which are illustrated in table below:

Bit	Event
B00	Summary Bit (Set if any other bit is set)
B01	Frequency is out of range between 45 to 65Hz (3P4W only)
B02	Voltage Phase Loss (3P4W only)
B03	Current Phase Loss (3P4W only)
B04~B05	Reserved
B06	Voltage Phase Reversal (3P4W only)
B07	Current Phase Reversal (3P4W only)
B08	Negative P Total may be abnormal (3P4W only)
B09	Negative Pa may be abnormal (3P4W only)
B10	Negative Pb may be abnormal (3P4W only)
B11	Negative Pc may be abnormal (3P4W only)
B12~B15	Reserved

Table 3-8 Wiring Diagnostic Register

3.6.1 Voltage Phase Loss

The **Voltage Phase Loss** status under the **Wiring Diagnostic** register (0101) is based on the following logic diagram. During **Voltage Phase Loss**, the **Voltage Phase Reversal** detection is invalid.



where U_n and I_{prim} represent the nominal Voltage and Current in Primary values. For the Voltage and Current Phase Loss detection to work correctly, the PT Primary and CT Primary should be configured to represent the respective nominal values.

Figure 3-3 Voltage Phase Loss Logic

3.6.2 Current Phase Loss

The following requirements should be met simultaneously for the **Current Phase Loss** status to be valid. During **Current Phase Loss**, the **Current Phase Reversal** detection is invalid.

1. Any one or two phases Current = 0.
2. At least one phase Current $\geq 0.1\% I_{prim}$

Chapter 4 Modbus Register Map

This chapter provides a complete description of the Modbus register map (**Protocol Version 1.0**) for the PMC-351 to facilitate the development of 3rd party communications driver for accessing information on the PMC-351. For a complete Modbus Protocol Specification, please visit <http://www.modbus.org>. The PMC-351 supports the following Modbus functions:

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

The following table provides a description of the different data formats used for the Modbus registers. The PMC-351 uses the Big Endian byte ordering system.

Format	Description
UINT16/INT16	Unsigned/Signed 16-bit Integer
UINT32/INT32	Unsigned/Signed 32-bit Integer
Float	IEEE 754 32-bit Single Precision Floating Point Number

4.1 Basic Measurements

4.1.1 3-Phase Basic Measurements (Optional) ~

4.1.1.1 Basic Measurements for Branch 1

Register	Property	Description	Format	Scale	Unit
0000	RO	Uan	Float	x1	V
0002	RO	Ubn	Float		
0004	RO	Ucn	Float		
0006	RO	Uln Average	Float		
0008	RO	Uab	Float		
0010	RO	Ubc	Float		
0012	RO	Uca	Float		A
0014	RO	Ull Average	Float		
0016	RO	Ia	Float		
0018	RO	Ib	Float		W
0020	RO	Ic	Float		
0022	RO	I Average	Float		
0024	RO	Pa	Float		var
0026	RO	Pb	Float		
0028	RO	Pc	Float		
0030	RO	P Total	Float		VA
0032	RO	Qa	Float		
0034	RO	Qb	Float		
0036	RO	Qc	Float		-
0038	RO	Q Total	Float		
0040	RO	Sa	Float		
0042	RO	Sb	Float		Hz
0044	RO	Sc	Float		
0046	RO	S Total	Float		
0048	RO	PFa	Float		°
0050	RO	PFb	Float		
0052	RO	PFc	Float		
0054	RO	PF Total	Float		°
0056	RO	Frequency	Float		
0058	RO	Uan/Uab (3P3W) Angle	Float		
0060	RO	Ubn/Ubc (3P3W) Angle	Float		°
0062	RO	Ucn/Uca (3P3W) Angle	Float		
0064	RO	Ia Angle	Float		
0066	RO	Ib Angle	Float		°
0068	RO	Ic Angle	Float		
0070	RO	In (Calculated Neutral Current)	Float		
0072	RO	Reserved	Float		-
0074	RO	Fundamental PFa	Float		-

0076	RO	Fundamental PFb	Float		
0078	RO	Fundamental PFc	Float		
0080	RO	Fundamental PF Total	Float		
0082	RO	Fundamental Pa	Float		
0084	RO	Fundamental Pb	Float	x1	W
0086	RO	Fundamental Pc	Float		
0088	RO	Fundamental P Total	Float		
0090	RO	Harmonics P Total	Float		
0092	RO	Device Operating Time	UINT32	x0.1	Hour

Table 4-1 3-Phase Branch 1 Measurements

~ Available when the options are equipped with Input Current Option "3" and Input Voltage Option "3". And the same applies to all subsequent 3-phase-related options.

4.1.1.2 Basic Measurements for Branch 2 (Optional)

Register	Property	Description	Format	Scale	Unit
0110	RO	Ia	Float	x1	A
0112	RO	Ib	Float		
0114	RO	Ic	Float		
0116	RO	I Average	Float		
0118	RO	Pa	Float		W
0120	RO	Pb	Float		
0122	RO	Pc	Float		
0124	RO	P Total	Float		
0126	RO	Qa	Float		var
0128	RO	Qb	Float		
0130	RO	Qc	Float		
0132	RO	Q Total	Float		
0134	RO	Sa	Float		VA
0136	RO	Sb	Float		
0138	RO	Sc	Float		
0140	RO	S Total	Float		
0142	RO	PFa	Float		-
0144	RO	PFb	Float		
0146	RO	PFc	Float		
0148	RO	PF Total	Float		
0150	RO	Ia Angle	Float		°
0152	RO	Ib Angle	Float		°
0154	RO	Ic Angle	Float		°
0156	RO	In (Calculated Neutral Current)	Float		A
0158	RO	Reserved	Float		-
0160	RO	Fundamental PFa	Float		-
0162	RO	Fundamental PFb	Float		
0164	RO	Fundamental PFc	Float		
0166	RO	Fundamental PF Total	Float		
0168	RO	Fundamental Pa	Float	x1	W
0170	RO	Fundamental Pb	Float		
0172	RO	Fundamental Pc	Float		
0174	RO	Fundamental P Total	Float		
0176	RO	Harmonics P Total	Float		

Table 4-2 3-Phase Branch 2 Measurements

4.1.1.3 3-Phase General Status

Register	Property	Description	Format	Note
0100	RO	Setpoint Alarm Status ¹	UINT16	
0101	RO	Wiring Diagnostic Status (Branch 1) ²	UINT16	
0102	RO	SOE Log Pointer ³	UINT32	
0104	RO	Reserved	UINT16	
0105	RO	Wiring Diagnostic Status (Optional Branch 2) ⁴	UINT16	Available in 2 Branch Feeders options.
0106	RO	Ethernet Status ⁵	UINT16	

Table 4-3 3-Phase General Status

Notes:

1. This register acts as a virtual I/O for quick alarm event identification. The B0 to B9 indicate the various states for Setpoint 1 to 10 with a bit value of "1" meaning Active and "0" meaning Inactive.

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Setpoint10	Setpoint9
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Setpoint8	Setpoint7	Setpoint6	Setpoint5	Setpoint4	Setpoint3	Setpoint2	Setpoint1

Table 4-4 3-Phase Setpoint Alarm Status Register

2. The following table illustrates the Wiring Diagnostic Status for Branch 1 with “0” meaning Normal and “1” meaning Abnormal:

Bit	Event
B00	Summary Bit (Set if any other bit is set)
B01	Frequency is out of range between 45 to 65Hz (3P4W only)
B02	Voltage Phase Loss (3P4W only)
B03	Current Phase Loss (Branch 1) (3P4W only)
B04~B05	Reserved
B06	Voltage Phase Reversal (3P4W only)
B07	Current Phase Reversal (Branch 1) (3P4W only)
B08	Negative P Total may be abnormal (Branch 1) (3P4W only)
B09	Negative Pa may be abnormal (Branch 1) (3P4W only)
B10	Negative Pb may be abnormal (Branch 1) (3P4W only)
B11	Negative Pc may be abnormal (Branch 1) (3P4W only)
B12~B15	Reserved

Table 4-5 3-Phase Wiring Diagnostic Status Register (Branch 1)

3. The range of the SOE Log Pointers is between 0 and 0xFFFFFFFFH. The Log Pointer is incremented by one for every new log generated and will roll over to 0 if its current value is 0xFFFFFFFFH. If a Clear SOE Log is performed via communications, the corresponding Log Pointer will be reset to zero, and the SOE Log Pointer will be immediately incremented by one with a new “Clear SOE” event. When the number of events is larger than the Log Depth, the latest 16 SOE logs are stored on a FIFO basis.

4. The following table illustrates the Wiring Diagnostic Status for Branch 2 with “0” meaning Normal and “1” meaning Abnormal:

Bit	Event
B00	Summary Bit (Set if any other bit is set)
B01	Frequency is out of range between 45 to 65Hz (3P4W only)
B02	Voltage Phase Loss (3P4W only)
B03	Current Phase Loss (Branch 2) (3P4W only)
B04~B05	Reserved
B06	Voltage Phase Reversal (3P4W only)
B07	Current Phase Reversal (Branch 2) (3P4W only)
B08	Negative P Total may be abnormal (Branch 2) (3P4W only)
B09	Negative Pa may be abnormal (Branch 2) (3P4W only)
B10	Negative Pb may be abnormal (Branch 2) (3P4W only)
B11	Negative Pc may be abnormal (Branch 2) (3P4W only)
B12~B15	Reserved

Table 4-6 3-Phase Wiring Diagnostic Status Register (Branch 2)

5. The table below illustrates the Ethernet Status register.

Bit 8~15: Error Code	Bit 0~7: Offline Status
0=Initialization 1=Wiring Connected 2=DNS Resolution 3=Port Opened 7=TCP Connection in Progress 8=Response Timeout 9=TCP Connection Closed	0=Offline 1=Online

Table 4-7 Ethernet Status Register

4.1.2 1-Phase Basic Measurements ~

4.1.2.1 Two Branches Basic Measurements

Register	Property	Description	Format	Scale	Unit
2000	RO	Voltage	Float	x1	V
2002	RO	Frequency	Float		Hz
2004	RO	Current Phase Angle (Branch 1)	Float		°
2006	RO	Current (Branch 1)	Float		A
2008	RO	P (Branch 1)	Float		W
2010	RO	Q (Branch 1)	Float		var
2012	RO	S (Branch 1)	Float		VA
2014	RO	PF (Branch 1)	Float		-
2016	RO	Reserved	Float		-

2018	RO	Reserved	Float		-
2020	RO	Fundamental PF (Branch 1)	Float		-
2022	RO	Fundamental P (Branch 1)	Float		W
2024	RO	Harmonics P (Branch 1)	Float		W
2026	RO	Current Phase Angle (Optional Branch 2)	Float		°
2028	RO	Current (Optional Branch 2)	Float		A
2030	RO	P (Optional Branch 2)	Float		W
2032	RO	Q (Optional Branch 2)	Float		var
2034	RO	S (Optional Branch 2)	Float		VA
2036	RO	PF (Optional Branch 2)	Float		-
2038	RO	Reserved	Float		-
2040	RO	Reserved	Float		-
2042	RO	Fundamental PF (Optional Branch 2)	Float		-
2044	RO	Fundamental P (Optional Branch 2)	Float		W
2046	RO	Harmonics P (Optional Branch 2)	Float		W
2048	RO	Device Operating Time	UINT32	x0.1	Hour

Table 4-8 1-Phase Measurements

~ Available when the options are equipped with Input Current Option "1" and Input Voltage Option "1". And the same applies to all subsequent 1-phase-related options.

4.1.2.2 1-Phase General Status

Register	Property	Description	Format	Note
2100	RO	Setpoint Alarm Status ¹	UINT16	
2101	RO	Wiring Diagnostic Status (Branch 1) ²	UINT16	
2102	RO	SOE Log Pointer ³	UINT32	
2104	RO	Reserved	UINT16	
2105	RO	Wiring Diagnostic Status (Optional Branch 2) ⁴	UINT16	Available in 2 Branch Feeders options.

Table 4-9 1-Phase General Status

Notes:

1. This register acts as a virtual I/O for quick alarm event identification. The B0 to B9 indicate the various states for Setpoint 1 to 10 with a bit value of "1" meaning Active and "0" meaning Inactive.

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Setpoint10	Setpoint9
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Setpoint8	Setpoint7	Setpoint6	Setpoint5	Setpoint4	Setpoint3	Setpoint2	Setpoint1

Table 4-10 1-Phase Setpoint Alarm Status Register

2. The following table illustrates the Wiring Diagnostic Status for Branch 1 with "0" meaning Normal and "1" meaning Abnormal:

Bit	Event
B00	Summary Bit (Set if any other bit is set)
B01	Frequency is out of range between 45 to 65Hz
B02	Reserved
B03	Current Phase Loss (Branch 1)
B04~B07	Reserved
B08	Negative P Total may be abnormal (Branch 1)
B09~B15	Reserved

Table 4-11 1-Phase Branch 1 Wiring Diagnostic Status Register

3. The range of the SOE Log Pointers is between 0 and 0xFFFFFFFF. The Log Pointer is incremented by one for every new log generated and will roll over to 0 if its current value is 0xFFFFFFFF. If a Clear SOE Log is performed via communications, the corresponding Log Pointer will be reset to zero, and the SOE Log Pointer will be immediately incremented by one with a new "Clear SOE" event. When the number of events is larger than the Log Depth, the latest 16 SOE logs are stored on a FIFO basis.

4. The following table illustrates the Wiring Diagnostic Status for Branch 2 with "0" meaning Normal and "1" meaning Abnormal:

Bit	Event
B00	Summary Bit (Set if any other bit is set)
B01~B02	Reserved
B03	Current Phase Loss (Branch 2)
B04~B07	Reserved
B08	Negative P Total may be abnormal (Branch 2)
B09~B15	Reserved

Table 4-12 1-Phase Branch 2 Wiring Diagnostic Status Register

4.2 High-Speed Measurements

4.2.1 3-Phase High-Speed Measurements (Optional)

Register	Property	Description	Format	Scale	Unit
0200	RO	Uan	Float	x1	V
0202	RO	Ubn	Float		
0204	RO	Ucn	Float		
0206	RO	Uab	Float		
0208	RO	Ubc	Float		
0210	RO	Uca	Float		
0212	RO	Frequency	Float		A
0214	RO	Ia (Branch 1)	Float		
0216	RO	Ib (Branch 1)	Float		
0218	RO	Ic (Branch 1)	Float		
0220	RO	Pa (Branch 1)	Float		
0222	RO	Pb (Branch 1)	Float		W
0224	RO	Pc (Branch 1)	Float		
0226	RO	P Total (Branch 1)	Float		
0228	RO	Qa (Branch 1)	Float		var
0230	RO	Qb (Branch 1)	Float		
0232	RO	Qc (Branch 1)	Float		
0234	RO	Q Total (Branch 1)	Float		VA
0236	RO	PFa (Branch 1)	Float		
0238	RO	PFb (Branch 1)	Float		
0240	RO	PFc (Branch 1)	Float		-
0242	RO	PF Total (Branch 1)	Float		
0244	RO	Sa (Branch 1)	Float		
0246	RO	Sb (Branch 1)	Float		Hz
0248	RO	Sc (Branch 1)	Float		
0250	RO	S Total (Branch 1)	Float		
0252~0257	RO	Reserved	Float		°
0258	RO	Ia (Optional Branch 2)	Float		
0260	RO	Ib (Optional Branch 2)	Float		
0262	RO	Ic (Optional Branch 2)	Float		°
0264	RO	Pa (Optional Branch 2)	Float		
0266	RO	Pb (Optional Branch 2)	Float		
0268	RO	Pc (Optional Branch 2)	Float		°
0270	RO	P Total (Optional Branch 2)	Float		
0272	RO	Qa (Optional Branch 2)	Float		
0274	RO	Qb (Optional Branch 2)	Float		A
0276	RO	Qc (Optional Branch 2)	Float		
0278	RO	Q Total (Optional Branch 2)	Float		
0280	RO	PFa (Optional Branch 2)	Float		-
0282	RO	PFb (Optional Branch 2)	Float		
0284	RO	PFc (Optional Branch 2)	Float		
0286	RO	PF Total (Optional Branch 2)	Float		W
0288	RO	Sa (Optional Branch 2)	Float		
0290	RO	Sb (Optional Branch 2)	Float		
0292	RO	Sc (Optional Branch 2)	Float		
0294	RO	S Total (Optional Branch 2)	Float		

Table 4-13 3-Phase High-Speed Measurements Register

4.2.2 1-Phase High-Speed Measurements

Register	Property	Description	Format	Scale/Unit	Note
2200	RO	Voltage	Float	V	
2202	RO	Frequency	Float	Hz	
2204	RO	Current (Branch 1)	Float	A	
2206	RO	P (Branch 1)	Float	W	
2208	RO	Q (Branch 1)	Float	var	
2210	RO	PF (Branch 1)	Float	-	
2212	RO	S (Branch 1)	Float	VA	
2214	RO	Current (Optional Branch 2)	Float	A	Available in 2 Branch Feeders options.
2216	RO	P (Optional Branch 2)	Float	W	

2218	RO	Q (Optional Branch 2)	Float	var	
2220	RO	PF (Optional Branch 2)	Float	-	
2222	RO	S (Optional Branch 2)	Float	VA	

Table 4-14 1-Phase High-Speed Measurements Register

~ Available when the options with Input Current Option "1" and Input Voltage Option "1".

4.3 Energy Measurements

The Energy registers have a maximum value of 1,000,000,000.00 and will roll over to zero automatically when it is reached. The actual energy value is 0.01 times of the register value.

4.3.1 3-Phase Energy Measurements (Optional)

4.3.1.1 Branch 1 3-Phase Energy Measurements

Register	Property	Description	Format	Scale	Unit
0500	RW	kWh Import	INT32	x0.01	kWh
0502	RW	kWh Export	INT32		
0504	RO	kWh Net	INT32		
0506	RO	kWh Total	INT32		
0508	RW	kvarh Import	INT32		kvarh
0510	RW	kvarh Export	INT32		
0512	RO	kvarh Net	INT32		
0514	RO	kvarh Total	INT32		
0516	RW	kVAh	INT32		kVAh
0518	RW	kvarh Q1	INT32		kvarh
0520	RW	kvarh Q2	INT32		
0522	RW	kvarh Q3	INT32		
0524	RW	kvarh Q4	INT32		

Table 4-15 Branch 1 3-Phase Energy Measurements

4.3.1.2 Phase A (L1) Energy Measurements for Branch 1

Register	Property	Description	Format	Scale	Unit
0620	RW	kWh Import	INT32	x0.01	kWh
0622	RW	kWh Export	INT32		
0624	RO	kWh Net	INT32		
0626	RO	kWh Total	INT32		
0628	RW	kvarh Import	INT32		kvarh
0630	RW	kvarh Export	INT32		
0632	RO	kvarh Net	INT32		
0634	RO	kvarh Total	INT32		
0636	RW	kVAh	INT32		kVAh
0638	RW	kvarh Q1	INT32		kvarh
0640	RW	kvarh Q2	INT32		
0642	RW	kvarh Q3	INT32		
0644	RW	kvarh Q4	INT32		

Table 4-16 Branch 1 Phase A Energy Measurements

4.3.1.3 Phase B (L2) Energy Measurements for Branch 1

Register	Property	Description	Format	Scale	Unit
0740	RW	kWh Import	INT32	x0.01	kWh
0742	RW	kWh Export	INT32		
0744	RO	kWh Net	INT32		
0746	RO	kWh Total	INT32		
0748	RW	kvarh Import	INT32		kvarh
0750	RW	kvarh Export	INT32		
0752	RO	kvarh Net	INT32		
0754	RO	kvarh Total	INT32		
0756	RW	kVAh	INT32		kVAh
0758	RW	kvarh Q1	INT32		kvarh
0760	RW	kvarh Q2	INT32		
0762	RW	kvarh Q3	INT32		
0764	RW	kvarh Q4	INT32		

Table 4-17 Branch 1 Phase B Energy Measurements

4.3.1.4 Phase C (L3) Energy Measurements for Branch 1

Register	Property	Description	Format	Scale	Unit
0860	RW	kWh Import	INT32	x0.01	kWh
0862	RW	kWh Export	INT32		
0864	RO	kWh Net	INT32		
0866	RO	kWh Total	INT32		
0868	RW	kvarh Import	INT32		kvarh
0870	RW	kvarh Export	INT32		
0872	RO	kvarh Net	INT32		
0874	RO	kvarh Total	INT32		
0876	RW	kVAh	INT32		kVAh
0878	RW	kvarh Q1	INT32		kvarh
0880	RW	kvarh Q2	INT32		
0882	RW	kvarh Q3	INT32		
0884	RW	kvarh Q4	INT32		

Table 4-18 Branch 1 Phase C Energy Measurements**4.3.1.5 Branch 2 3-Phase Energy Measurements (Optional)**

Register	Property	Description	Format	Scale	Unit
0920	RW	kWh Import	INT32	x0.01	kWh
0922	RW	kWh Export	INT32		
0924	RO	kWh Net	INT32		
0926	RO	kWh Total	INT32		
0928	RW	kvarh Import	INT32		kvarh
0930	RW	kvarh Export	INT32		
0932	RO	kvarh Net	INT32		
0934	RO	kvarh Total	INT32		
0936	RW	kVAh	INT32		kVAh
0938	RW	kvarh Q1	INT32		kvarh
0940	RW	kvarh Q2	INT32		
0942	RW	kvarh Q3	INT32		
0944	RW	kvarh Q4	INT32		

Table 4-19 Branch 2 3-Phase Energy Measurements**4.3.1.6 Phase A (L1) Energy Measurements for Branch 2 (Optional)**

Register	Property	Description	Format	Scale	Unit
0980	RW	kWh Import	INT32	x0.01	kWh
0982	RW	kWh Export	INT32		
0984	RO	kWh Net	INT32		
0986	RO	kWh Total	INT32		
0988	RW	kvarh Import	INT32		kvarh
0990	RW	kvarh Export	INT32		
0992	RO	kvarh Net	INT32		
0994	RO	kvarh Total	INT32		
0996	RW	kVAh	INT32		kVAh
0998	RW	kvarh Q1	INT32		kvarh
1000	RW	kvarh Q2	INT32		
1002	RW	kvarh Q3	INT32		
1004	RW	kvarh Q4	INT32		

Table 4-20 Branch 2 Phase A Energy Measurements**4.3.1.7 Phase B (L2) Energy Measurements for Branch 2 (Optional)**

Register	Property	Description	Format	Scale	Unit
1040	RW	kWh Import	INT32	x0.01	kWh
1042	RW	kWh Export	INT32		
1044	RO	kWh Net	INT32		
1046	RO	kWh Total	INT32		
1048	RW	kvarh Import	INT32		kvarh
1050	RW	kvarh Export	INT32		
1052	RO	kvarh Net	INT32		
1054	RO	kvarh Total	INT32		
1056	RW	kVAh	INT32		kVAh
1058	RW	kvarh Q1	INT32		kvarh
1060	RW	kvarh Q2	INT32		
1062	RW	kvarh Q3	INT32		
1064	RW	kvarh Q4	INT32		

Table 4-21 Branch 2 Phase B Energy Measurements

4.3.1.8 Phase C (L3) Energy Measurements for Branch 2 (Optional)

Register	Property	Description	Format	Scale	Unit
1100	RW	kWh Import	INT32	x0.01	kWh
1102	RW	kWh Export	INT32		
1104	RO	kWh Net	INT32		
1106	RO	kWh Total	INT32		
1108	RW	kvarh Import	INT32		kvarh
1110	RW	kvarh Export	INT32		
1112	RO	kvarh Net	INT32		
1114	RO	kvarh Total	INT32		
1116	RW	kVAh	INT32		kVAh
1118	RW	kvarh Q1	INT32		kvarh
1120	RW	kvarh Q2	INT32		
1122	RW	kvarh Q3	INT32		
1124	RW	kvarh Q4	INT32		

Table 4-22 Branch 2 Phase C Energy Measurements

4.3.2 1-Phase Energy Measurements

Register	Property	Description	Format	Scale	Unit
2400	RW	kWh Import (Branch 1)	INT32	x0.01	kWh
2402	RW	kWh Export (Branch 1)	INT32		
2404	RO	kWh Net (Branch 1)	INT32		
2406	RO	kWh Total (Branch 1)	INT32		
2408	RW	kvarh Import (Branch 1)	INT32		kvarh
2410	RW	kvarh Export (Branch 1)	INT32		
2412	RO	kvarh Net (Branch 1)	INT32		
2414	RO	kvarh Total (Branch 1)	INT32		
2416	RW	kVAh (Branch 1)	INT32		kVAh
2418	RW	kvarh Q1 (Branch 1)	INT32		kvarh
2420	RW	kvarh Q2 (Branch 1)	INT32		
2422	RW	kvarh Q3 (Branch 1)	INT32		
2424	RW	kvarh Q4 (Branch 1)	INT32		
2450	RW	kWh Import (Optional Branch 2)	INT32		kWh
2452	RW	kWh Export (Optional Branch 2)	INT32		
2454	RO	kWh Net (Optional Branch 2)	INT32		
2456	RO	kWh Total (Optional Branch 2)	INT32		
2458	RW	kvarh Import (Optional Branch 2)	INT32		kvarh
2460	RW	kvarh Export (Optional Branch 2)	INT32		
2462	RO	kvarh Net (Optional Branch 2)	INT32		
2464	RO	kvarh Total (Optional Branch 2)	INT32		
2466	RW	kVAh (Optional Branch 2)	INT32		kVAh
2468	RW	kvarh Q1 (Optional Branch 2)	INT32		kvarh
2470	RW	kvarh Q2 (Optional Branch 2)	INT32		
2472	RW	kvarh Q3 (Optional Branch 2)	INT32		
2474	RW	kvarh Q4 (Optional Branch 2)	INT32		

Table 4-23 1-Phase Energy Measurements

4.4 Power Quality Measurements

4.4.1 3-Phase PQ Measurements (Optional)

4.4.1.1 3-Phase Basic PQ Measurements

Register	Property	Description	Format	Scale	Unit
1318	RO	Ia K-Factor (Branch 1)	Float	x1	-
1320	RO	Ib K-Factor (Branch 1)	Float		-
1322	RO	Ic K-Factor (Branch 1)	Float		-
1324	RO	Ia Crest Factor (Branch 1)	Float		-
1326	RO	Ib Crest Factor (Branch 1)	Float		-
1328	RO	Ic Crest Factor (Branch 1)	Float		-
1330	RO	Voltage Unbalance	Float		-
1332	RO	Current Unbalance (Branch 1)	Float		-
1334	RO	Positive Sequence Voltage	Float		V
1336	RO	Negative Sequence Voltage	Float		V
1338	RO	Zero Sequence Voltage	Float		V

1340	RO	Positive Sequence Current (Branch 1)	Float		A
1342	RO	Negative Sequence Current (Branch 1)	Float		A
1344	RO	Zero Sequence Current (Branch 1)	Float		A
1346~1355	RO	Reserved	Float		-
1356	RO	Ia K-Factor (Optional Branch 2)	Float		-
1358	RO	Ib K-Factor (Optional Branch 2)	Float		-
1360	RO	Ic K-Factor (Optional Branch 2)	Float		-
1362	RO	Ia Crest Factor (Optional Branch 2)	Float		-
1364	RO	Ib Crest Factor (Optional Branch 2)	Float		-
1366	RO	Ic Crest Factor (Optional Branch 2)	Float		-
1368	RO	Current Unbalance (Optional Branch 2)	Float		-
1370	RO	Positive Sequence Current (Optional Branch 2)	Float		A
1372	RO	Negative Sequence Current (Optional Branch 2)	Float		A
1374	RO	Zero Sequence Current (Optional Branch 2)	Float		A

Table 4-24 3-Phase Basic PQ Measurements

4.4.1.2 3-Phase Current Harmonic Measurements for Branch 1

Register	Property	Description	Format	Scale	Unit
1400	RO	Ia THD	Float	x1	- (0.1 means 10%)
1402	RO	Ib THD	Float		
1404	RO	Ic THD	Float		
1406	RO	Ia TOHD	Float		
1408	RO	Ib TOHD	Float		
1410	RO	Ic TOHD	Float		
1412	RO	Ia TEHD	Float		
1414	RO	Ib TEHD	Float		
1416	RO	Ic TEHD	Float		
1418	RO	Ia HD02	Float		
1420	RO	Ib HD02	Float		
1422	RO	Ic HD02	Float		
1424~1590	RO	...	Float		
1592	RO	Ia HD31	Float		
1594	RO	Ib HD31	Float		
1596	RO	Ic HD31	Float		

Table 4-25 3-Phase Current Harmonic Measurements for Branch 1

4.4.1.3 3-Phase Voltage Harmonic Measurements

Register	Property	Description	Format	Scale	Unit
1600	RO	Uan/Uab THD	Float	x1	- (0.1 means 10%)
1602	RO	Ubn/Ubc THD	Float		
1604	RO	Ucn/Uca THD	Float		
1606	RO	Uan/Uab TOHD	Float		
1608	RO	Ubn/Ubc TOHD	Float		
1610	RO	Ucn/Uca TOHD	Float		
1612	RO	Uan/Uab TEHD	Float		
1614	RO	Ubn/Ubc TEHD	Float		
1616	RO	Ucn/Uca TEHD	Float		
1618	RO	Uan/Uab HD02	Float		
1620	RO	Ubn/Ubc HD02	Float		
1622	RO	Ucn/Uca HD02	Float		
1624~1790	RO	...	Float		
1792	RO	Uan/Uab HD31	Float		
1794	RO	Ubn/Ubc HD31	Float		
1796	RO	Ucn/Uca HD31	Float		

Table 4-26 3-Phase Voltage Harmonic Measurements

4.4.1.4 3-Phase Current Harmonic Measurements for Branch 2 (Optional)

Register	Property	Description	Format	Scale	Unit
1800	RO	Ia THD	Float	x1	-
1802	RO	Ib THD	Float		(0.1 means 10%)

1804	RO	Ic THD	Float		
1806	RO	Ia TOHD	Float		
1808	RO	Ib TOHD	Float		
1810	RO	Ic TOHD	Float		
1812	RO	Ia TEHD	Float		
1814	RO	Ib TEHD	Float		
1816	RO	Ic TEHD	Float		
1818	RO	Ia HD02	Float		
1820	RO	Ib HD02	Float		
1822	RO	Ic HD02	Float		
1824~1990	RO	...	Float		
1992	RO	Ia HD31	Float		
1994	RO	Ib HD31	Float		
1996	RO	Ic HD31	Float		

Table 4-27 3-Phase Current Harmonic Measurements for Branch 2

4.4.2 1-Phase PQ Measurements

4.4.2.1 1-Phase Basic PQ Measurements

Register	Property	Description	Format	Scale	Note
2500	RO	I K-Factor (Branch 1)	Float	x1	Available in 2 Branch Feeders options.
2502	RO	I Crest Factor (Branch 1)	Float		
2504	RO	I K-Factor (Optional Branch 2)	Float		
2506	RO	I Crest Factor (Optional Branch 2)	Float		

Table 4-28 1-Phase Basic PQ Measurements

4.4.2.2 Current Harmonic Measurements for Branch 1

Register	Property	Description	Format	Scale	Unit
2600	RO	I THD	Float	x1	- (0.1 means 10%)
2602	RO	I TOHD	Float		
2604	RO	I TEHD	Float		
2606	RO	I HD02	Float		
...	RO	...	Float		
2664	RO	I HD31	Float		

Table 4-29 1-Phase Current Harmonic Measurements for Branch 1

4.4.2.3 Current Harmonic Measurements for Branch 2 (Optional)

Register	Property	Description	Format	Scale	Unit
2700	RO	I THD	Float	x1	- (0.1 means 10%)
2702	RO	I TOHD	Float		
2704	RO	I TEHD	Float		
2706	RO	I HD02	Float		
...	RO	...	Float		
2764	RO	I HD31	Float		

Table 4-30 1-Phase Current Harmonic Measurements for Branch 2

4.4.2.4 Voltage Harmonic Measurements

Register	Property	Description	Format	Scale	Unit
2800	RO	U THD	Float	x1	- (0.1 means 10%)
2802	RO	U TOHD	Float		
2804	RO	U TEHD	Float		
2806	RO	U HD02	Float		
...	RO	...	Float		
2864	RO	U HD31	Float		

Table 4-31 1-Phase Voltage Harmonic Measurements

4.5 Present Demands

4.5.1 3-Phase Present Demands (Optional)

Register	Property	Description	Format	Scale/Unit	Note
3000	RO	Ia Demand (Branch 1)	Float	A	
3002	RO	Ib Demand (Branch 1)	Float		
3004	RO	Ic Demand (Branch 1)	Float		
3006	RO	P Total Demand (Branch 1)	Float	W	

3008	RO	Q Total Demand (Branch 1)	Float	var	
3010	RO	S Total Demand (Branch 1)	Float	VA	
3012	RO	Ia Demand (Optional Branch 2)	Float	A	Available in 2 Branch Feeders options.
3014	RO	Ib Demand (Optional Branch 2)	Float		
3016	RO	Ic Demand (Optional Branch 2)	Float		
3018	RO	P Total Demand (Optional Branch 2)	Float	W	
3020	RO	Q Total Demand (Optional Branch 2)	Float	var	
3022	RO	S Total Demand (Optional Branch 2)	Float	VA	

Table 4-32 3-Phase Present Demand Measurements

4.5.2 1-Phase Present Demands

Register	Property	Description	Format	Scale/Unit	Note
2900	RO	I Demand (Branch 1)	Float	A	
2902	RO	P Demand (Branch 1)	Float	W	
2904	RO	Q Demand (Branch 1)	Float	var	
2906	RO	S Demand (Branch 1)	Float	VA	
2908	RO	I Demand (Optional Branch 2)	Float	A	Available in 2 Branch Feeders options.
2910	RO	P Demand (Optional Branch 2)	Float	W	
2912	RO	Q Demand (Optional Branch 2)	Float	var	
2914	RO	S Demand (Optional Branch 2)	Float	VA	

Table 4-33 1-Phase Present Demand Measurements

4.6 Wi-Fi Status Setup

Register	Property	Description	Format	Note
300	RW	ESP32 Firmware Version	UNIT16	e.g. 10000 shows the version is V1.00.00
301	RW	Firmware Date: Year-2000	UNIT16	e.g. 100110 means January 10, 2010
302	RW	Firmware Date: Month	UNIT16	
303	RW	Firmware Date: Day	UNIT16	
304	RW	Connection Status (STA Mode)	UNIT16	
305	RW	Signal Strength (STA Mode)	NIT16	
306	RW	Local IP of ESP32 Module (STA Mode)	UNIT32	
308	RW	Currently Connected AP SSID (STA Mode)	UNIT16*16	
324	RW	Currently Connected AP Password (STA Mode)	UNIT16*32	

Table 4-34 Wi-Fi Status Setup

Notes:

1. The Wi-Fi Status Register is writable only by the ESP32. Although a write via the serial port returns a success response, the written value will quickly be overwritten by an ESP32 write refresh, meaning the write appears successful but takes no effect.

4.7 SOE Log

The SOE Log Pointer points to the register address within the SOE Log where the next event will be stored. The following formula is used to determine the register address of the most recent SOE event referenced by the SOE Log Pointer value:

$$\text{Register Address} = 10000 + \text{Modulo}(\text{SOE Log Pointer}-1/16) * 8$$

Register	Property	Description	Format
10000~10007	RO	Event 1	See Note 1
10008~10015	RO	Event 2	
10016~10023	RO	Event 3	
10024~10031	RO	Event 4	
10032~10039	RO	Event 5	
10040~10047	RO	Event 6	
10048~10055	RO	Event 7	
10056~10063	RO	Event 8	
10064~10071	RO	Event 9	
10072~10079	RO	Event 10	
10080~10087	RO	Event 11	

10088~10095	RO	Event 12	
10096~10103	RO	Event 13	
10104~10111	RO	Event 14	
10112~10119	RO	Event 15	
10120~10127	RO	Event 16	

Table 4-35 SOE Log

Notes:

1. SOE Log Data Structure

Offset	Property	Description	Unit
+0	RO	Hi: Event Classification	See Note 2
	RO	Lo: Sub-Classification	
+1	RO	Hi: Year	0-37 (Year-2000)
	RO	Lo: Month	1 to 12
+2	RO	Hi: Day	1 to 31
	RO	Lo: Hour	0 to 23
+3	RO	Hi: Minute	0 to 59
	RO	Lo: Second	0 to 59
+4	RO	Millisecond	0 to 999
+5	RO	Hi: Reserved	-
	RO	Lo: Status	-
+6 to +7	RO	Event Value (Float)	-

Table 4-36 SOE Log Data Structure

2. SOE Classification

Event Classification	Sub-Classification	Status	Event Value	Description
1	1	-	-	Reserved
2	1	-	-	Reserved
3=Setpoint	1	2/1	Setpoint Value/ Return Value	3-Φ SM Over Uln Setpoint Active/Return
	2	2/1		3-Φ SM Over Ull Setpoint Active/Return
	3	2/1		3-Φ SM Branch 1 Over Current Setpoint Active/Return
	4	2/1		3-Φ SM Branch 1 Over In Setpoint Active/Return
	5	2/1		3-Φ SM Over Frequency Setpoint Active/Return
	6	2/1		3-Φ SM Branch 1 Over P Total Setpoint Active/Return
	7	2/1		3-Φ SM Branch 1 Over Q Total Setpoint Active/Return
	8	2/1		3-Φ SM Branch 1 Over S Total Setpoint Active/Return
	9	2/1		3-Φ SM Branch 1 Over PF Total Setpoint Active/Return
	10	2/1		3-Φ SM Over Uan Setpoint Active/Return
	11	2/1		3-Φ SM Over Ubn Setpoint Active/Return
	12	2/1		3-Φ SM Over Ucn Setpoint Active/Return
	13	2/1		3-Φ SM Over Uab Setpoint Active/Return
	14	2/1		3-Φ SM Over Ubc Setpoint Active/Return
	15	2/1		3-Φ SM Over Uca Setpoint Active/Return
	16	2/1		3-Φ SM Branch 1 Over Ia Setpoint Active/Return
	17	2/1		3-Φ SM Branch 1 Over Ib Setpoint Active/Return
	18	2/1		3-Φ SM Branch 1 Over Ic Setpoint Active/Return
	19	2/1		3-Φ SM Over Voltage THD Setpoint Active/Return
	20	2/1		3-Φ SM Over Voltage TOHD Setpoint Active/Return
	21	2/1		3-Φ SM Over Voltage TEHD Setpoint Active/Return
	22	2/1		3-Φ SM Branch 1 Over Current THD Setpoint Active/Return
	23	2/1		3-Φ SM Branch 1 Over Current TOHD Setpoint Active/Return
	24	2/1		3-Φ SM Branch 1 Over Current TEHD Setpoint Active/Return
	25	2/1		3-Φ SM Over Voltage Unbalance Setpoint Active/Return
	26	2/1		3-Φ SM Branch 1 Over Current Unbalance Setpoint Active/Return
	27	2/1		3-Φ SM Branch 1 Phase Reversal Setpoint Active/Return
	28	2/1		3-Φ SM Branch 1 Over Ia Demand Setpoint Active/Return
	29	2/1		3-Φ SM Branch 1 Over Ib Demand Setpoint Active/Return
	30	2/1		3-Φ SM Branch 1 Over Ic Demand Setpoint Active/Return
	31	2/1		3-Φ SM Branch 1 Over P Total Demand Setpoint Active/Return
	32	2/1		3-Φ SM Branch 1 Over Q Total Demand Setpoint Active/Return
	33	2/1		3-Φ SM Branch 1 Over S Total Demand Setpoint Active/Return
	34~40	2/1		Reserved
	41	2/1		3-Φ SM Under Uln Setpoint Active/Return
	42	2/1		3-Φ SM Under Ull Setpoint Active/Return
	43	2/1		3-Φ SM Branch 1 Under Current Setpoint Active/Return

	44	2/1		3-Φ SM Branch 1 Under In Setpoint Active/Return
	45	2/1		3-Φ SM Under Frequency Setpoint Active/Return
	46	2/1		3-Φ SM Branch 1 Under P Total Setpoint Active/Return
	47	2/1		3-Φ SM Branch 1 Under Q Total Setpoint Active/Return
	48	2/1		3-Φ SM Branch 1 Under S Total Setpoint Active/Return
	49	2/1		3-Φ SM Branch 1 Under PF Total Setpoint Active/Return
	50	2/1		3-Φ SM Under Uan Setpoint Active/Return
	51	2/1		3-Φ SM Under Ubn Setpoint Active/Return
	52	2/1		3-Φ SM Under Ucn Setpoint Active/Return
	53	2/1		3-Φ SM Under Uab Setpoint Active/Return
	54	2/1		3-Φ SM Under Ubc Setpoint Active/Return
	55	2/1		3-Φ SM Under Uca Setpoint Active/Return
	56	2/1		3-Φ SM Branch 1 Under Ia Setpoint Active/Return
	57	2/1		3-Φ SM Branch 1 Under Ib Setpoint Active/Return
	58	2/1		3-Φ SM Branch 1 Under Ic Setpoint Active/Return
	59	2/1		3-Φ SM Under Voltage THD Setpoint Active/Return
	60	2/1		3-Φ SM Under Voltage TOHD Setpoint Active/Return
	61	2/1		3-Φ SM Under Voltage TEHD Setpoint Active/Return
	62	2/1		3-Φ SM Branch 1 Under Current THD Setpoint Active/Return
	63	2/1		3-Φ SM Branch 1 Under Current TOHD Setpoint Active/Return
	64	2/1		3-Φ SM Branch 1 Under Current TEHD Setpoint Active/Return
	65	2/1		3-Φ SM Under Voltage Unbalance Setpoint Active/Return
	66	2/1		3-Φ SM Branch 1 Under Current Unbalance Setpoint Active/Return
	67	2/1		3-Φ SM Branch 1 Under Ia Demand Setpoint Active/Return
	68	2/1		3-Φ SM Branch 1 Under Ib Demand Setpoint Active/Return
	69	2/1		3-Φ SM Branch 1 Under Ic Demand Setpoint Active/Return
	70	2/1		3-Φ SM Branch 1 Under P Total Demand Setpoint Active/Return
	71	2/1		3-Φ SM Branch 1 Under Q Total Demand Setpoint Active/Return
	72	2/1		3-Φ SM Branch 1 Under S Total Demand Setpoint Active/Return
	73~110	2/1		Reserved
	111	2/1		3-Φ SM Branch 2 Over Current Setpoint Active/Return
	112	2/1		3-Φ SM Branch 2 Over In Setpoint Active/Return
	113	2/1		3-Φ SM Branch 2 Over P Total Setpoint Active/Return
	114	2/1		3-Φ SM Branch 2 Over Q Total Setpoint Active/Return
	115	2/1		3-Φ SM Branch 2 Over S Total Setpoint Active/Return
	116	2/1		3-Φ SM Branch 2 Over PF Total Setpoint Active/Return
	117	2/1		3-Φ SM Branch 2 Over Ia Setpoint Active/Return
	118	2/1		3-Φ SM Branch 2 Over Ib Setpoint Active/Return
	119	2/1		3-Φ SM Branch 2 Over Ic Setpoint Active/Return
	120	2/1		3-Φ SM Branch 2 Over Voltage THD Setpoint Active/Return
	121	2/1		3-Φ SM Branch 2 Over Voltage TOHD Setpoint Active/Return
	122	2/1		3-Φ SM Branch 2 Over Voltage TEHD Setpoint Active/Return
	123	2/1		3-Φ SM Branch 2 Over Current Unbalance Setpoint Active/Return
	124	2/1		3-Φ SM Branch 2 Phase Reversal Setpoint Active/Return
	125	2/1		3-Φ SM Branch 2 Over Ia Demand Setpoint Active/Return
	126	2/1		3-Φ SM Branch 2 Over Ib Demand Setpoint Active/Return
	127	2/1		3-Φ SM Branch 2 Over Ic Demand Setpoint Active/Return
	128	2/1		3-Φ SM Branch 2 Over P Total Demand Setpoint Active/Return
	129	2/1		3-Φ SM Branch 2 Over Q Total Demand Setpoint Active/Return
	130	2/1		3-Φ SM Branch 2 Over S Total Demand Setpoint Active/Return
	131~150	2/1		Reserved
	151	2/1		3-Φ SM Branch 2 Under Current Setpoint Active/Return
	152	2/1		3-Φ SM Branch 2 Under In Setpoint Active/Return
	153	2/1		3-Φ SM Branch 2 Under P Total Setpoint Active/Return
	154	2/1		3-Φ SM Branch 2 Under Q Total Setpoint Active/Return
	155	2/1		3-Φ SM Branch 2 Under S Total Setpoint Active/Return
	156	2/1		3-Φ SM Branch 2 Under PF Total Setpoint Active/Return
	157	2/1		3-Φ SM Branch 2 Under Ia Setpoint Active/Return
	158	2/1		3-Φ SM Branch 2 Under Ib Setpoint Active/Return
	159	2/1		3-Φ SM Branch 2 Under Ic Setpoint Active/Return
	160	2/1		3-Φ SM Branch 2 Under Current THD Setpoint Active/Return
	161	2/1		3-Φ SM Branch 2 Under Current TOHD Setpoint Active/Return
	162	2/1		3-Φ SM Branch 2 Under Current TEHD Setpoint Active/Return
	163	2/1		3-Φ SM Branch 2 Under Current Unbalance Setpoint Active/Return
	164	2/1		3-Φ SM Branch 2 Under Ia Demand Setpoint Active/Return
	165	2/1		3-Φ SM Branch 2 Under Ib Demand Setpoint Active/Return

	166	2/1		3-Φ SM Branch 2 Under Ic Demand Setpoint Active/Return
	167	2/1		3-Φ SM Branch 2 Under P Total Demand Setpoint Active/Return
	168	2/1		3-Φ SM Branch 2 Under Q Total Demand Setpoint Active/Return
	169	2/1		3-Φ SM Branch 2 Under S Total Demand Setpoint Active/Return
	170~190	2/1		Reserved
	191	2/1		1-Φ SM Over Voltage Setpoint Active/Return
	192	2/1		1-Φ SM Branch 1 Over Current Setpoint Active/Return
	193	2/1		1-Φ SM Branch 2 Over Current Setpoint Active/Return
	194	2/1		1-Φ SM Over Frequency Setpoint Active/Return
	195	2/1		1-Φ SM Branch 1 Over P Total Setpoint Active/Return
	196	2/1		1-Φ SM Branch 1 Over Q Total Setpoint Active/Return
	197	2/1		1-Φ SM Branch 1 Over S Total Setpoint Active/Return
	198	2/1		1-Φ SM Branch 1 Over PF Total Setpoint Active/Return
	199	2/1		1-Φ SM Branch 2 Over P Total Setpoint Active/Return
	200	2/1		1-Φ SM Branch 2 Over Q Total Setpoint Active/Return
	201	2/1		1-Φ SM Branch 2 Over S Total Setpoint Active/Return
	202	2/1		1-Φ SM Branch 2 Over PF Total Setpoint Active/Return
	203	2/1		1-Φ SM Over Voltage THD Setpoint Active/Return
	204	2/1		1-Φ SM Over Voltage TOHD Setpoint Active/Return
	205	2/1		1-Φ SM Over Voltage TEHD Setpoint Active/Return
	206	2/1		1-Φ SM Branch 1 Over Current THD Setpoint Active/Return
	207	2/1		1-Φ SM Branch 1 Over Current TOHD Setpoint Active/Return
	208	2/1		1-Φ SM Branch 1 Over Current TEHD Setpoint Active/Return
	209	2/1		1-Φ SM Branch 2 Over Current THD Setpoint Active/Return
	210	2/1		1-Φ SM Branch 2 Over Current TOHD Setpoint Active/Return
	211	2/1		1-Φ SM Branch 2 Over Current TEHD Setpoint Active/Return
	212	2/1		1-Φ SM Branch 1 Over Current Demand Setpoint Active/Return
	213	2/1		1-Φ SM Branch 1 Over P Total Demand Setpoint Active/Return
	214	2/1		1-Φ SM Branch 1 Over Q Total Demand Setpoint Active/Return
	215	2/1		1-Φ SM Branch 1 Over S Total Demand Setpoint Active/Return
	216	2/1		1-Φ SM Branch 2 Over Current Demand Setpoint Active/Return
	217	2/1		1-Φ SM Branch 2 Over P Total Demand Setpoint Active/Return
	218	2/1		1-Φ SM Branch 2 Over Q Total Demand Setpoint Active/Return
	219	2/1		1-Φ SM Branch 2 Over S Total Demand Setpoint Active/Return
	220	2/1		1-Φ SM Under Voltage Setpoint Active/Return
	221	2/1		1-Φ SM Branch 1 Under Current Setpoint Active/Return
	222	2/1		1-Φ SM Branch 2 Under Current Setpoint Active/Return
	223	2/1		1-Φ SM Under Frequency Setpoint Active/Return
	224	2/1		1-Φ SM Branch 1 Under P Total Setpoint Active/Return
	225	2/1		1-Φ SM Branch 1 Under Q Total Setpoint Active/Return
	226	2/1		1-Φ SM Branch 1 Under S Total Setpoint Active/Return
	227	2/1		1-Φ SM Branch 1 Under PF Total Setpoint Active/Return
	228	2/1		1-Φ SM Branch 2 Under P Total Setpoint Active/Return
	229	2/1		1-Φ SM Branch 2 Under Q Total Setpoint Active/Return
	230	2/1		1-Φ SM Branch 2 Under S Total Setpoint Active/Return
	231	2/1		1-Φ SM Branch 2 Under PF Total Setpoint Active/Return
	232	2/1		1-Φ SM Under Voltage THD Setpoint Active/Return
	233	2/1		1-Φ SM Under Voltage TOHD Setpoint Active/Return
	234	2/1		1-Φ SM Under Voltage TEHD Setpoint Active/Return
	235	2/1		1-Φ SM Branch 1 Under Current THD Setpoint Active/Return
	236	2/1		1-Φ SM Branch 1 Under Current TOHD Setpoint Active/Return
	237	2/1		1-Φ SM Branch 1 Under Current TEHD Setpoint Active/Return
	238	2/1		1-Φ SM Branch 2 Under Current THD Setpoint Active/Return
	239	2/1		1-Φ SM Branch 2 Under Current TOHD Setpoint Active/Return
	240	2/1		1-Φ SM Branch 2 Under Current TEHD Setpoint Active/Return
	241	2/1		1-Φ SM Branch 1 Under Current Demand Setpoint Active/Return
	242	2/1		1-Φ SM Branch 1 Under P Total Demand Setpoint Active/Return
	243	2/1		1-Φ SM Branch 1 Under Q Total Demand Setpoint Active/Return
	244	2/1		1-Φ SM Branch 1 Under S Total Demand Setpoint Active/Return
	245	2/1		1-Φ SM Branch 2 Under Current Demand Setpoint Active/Return
	246	2/1		1-Φ SM Branch 2 Under P Total Demand Setpoint Active/Return
	247	2/1		1-Φ SM Branch 2 Under Q Total Demand Setpoint Active/Return
	248	2/1		1-Φ SM Branch 2 Under S Total Demand Setpoint Active/Return
4=Self-diagnosis	1	1	0	Reserved
5=Operations	1	0	0	Reserved
	2	0	0	Power Off

	3~29	0		Reserved
	30	0	0	Clear Present Energy
	31~33	0	0	Reserved
	34	0	0	Clear All Demand via Comm.
	35~36	0	0	Reserved
	37	0	0	Clear All Data via Comm.
	38	0	0	Clear SOE Log via Comm.
	39~40	0	0	Reserved
	41	0	0	Clear Device Operating Time via Comm.
	42	0	0	Reserved
	43	0	0	Setup Changes via Comm.
	44	0	0	Preset Energy Value via Comm.
	45~54	0	0	Reserved

Table 4-37 SOE Classification

3. All the registers about Branch 2 are only available when 2 Branch Feeders option is selected.

4.8 Device Setup

4.8.1 Basic Setup

Register	Property	Description	Format	Range, Default*
6000	RW	PT Primary	UINT32	1 to 1,000,000V, 381*
6002	RW	PT Secondary	UINT32	1 to 690V, 381*
6004	RW	CT Primary (Branch 1)	UINT32	1 to 30,000A, 100*
6006	RW	CT Secondary (Branch 1)	UINT32	1 to 10000mA, 40*
6008	RW	CT Primary (Optional Branch 2) ¹	UINT32	1 to 30,000A, 100*
6010	RW	CT Secondary (Optional Branch 2) ¹	UINT32	1 to 10000mA, 40*
6012	RW	SCCT Type	UINT16	0=Split-core CT*, 1= Solid-core CT
6013~6015	RW	Reserved	-	-
6016	RW	Energy Pulse Constant	UINT32	1~0xFFFFFFFF, 500*
6018	RW	LED Energy Pulse	UINT16	0=Disabled, 1=kWh Total (Branch 1) *, 2=kvarh Total (Branch 1), 3=kWh Import (Branch 1), 4=kWh Export (Branch 1), 5=kvarh Import (Branch 1), 6=kvarh Export (Branch 1), 7=kWh Total (Branch 2), 8=kvarh Total (Branch 2), 9=kWh Import (Branch 2), 10=kWh Export (Branch 2), 11=kvarh Import (Branch 2), 12=kvarh Export (Branch 2)
6019	RW	Reserved	UINT16	-
6020	RW	Wiring Mode ²	UINT16	0=DEMO, 1=1P2W_LN, 3=1P3W, 5=3P4W*
6021	RW	Power Factor Convention	UINT16	0=IEC*, 1=IEEE, 2=-IEEE
6022	RW	kVA Calculation	UINT16	0=Vector*, 1=Scalar
6023	RW	3-Φ SM Branch 1 IA Polarity 1-Φ SM Branch 1 I Polarity	UINT16	0=Normal*, 1=Reverse
6024	RW	3-Φ SM Branch 1 IB Polarity 1-Φ SM Invalid	UINT16	
6025	RW	3-Φ SM Branch 1 IC Polarity 1-Φ SM Invalid	UINT16	
6026	RW	THD Calculation ³	UINT16	
6027	RW	Power Calculation	UINT16	0=Total*, 1=Fundamental
6028	RW	3-Φ SM Branch 1 Current Phase Sequence 1-Φ SM Invalid	UINT16	0: IA/IB/IC*, 1: IB/IC/IA, 2: IC/IA/IB, 3: IA/IC/IB, 4: IC/IB/IA, 5: IB/IA/IC
6029	RW	Wi-Fi Configuration	UINT16	0=AP*, 1=Bluetooth
6030	RW	Current Threshold of Device Operating Time	UINT16	1* to 1000 (x0.001I _{prim})
6031	RW	Demand Period ⁵	UINT16	1 to 60 (minutes), 15*
6032	RW	Number of Sliding Windows ⁵	UINT16	1 to 15, 1*
6033	RW	Power Flow Direction	UINT16	0=Forward*, 1=Reverse
6034	RW	Load Type	UINT16	0=Inductive*, 1=Capacitive

6035	RW	Phase Angle Threshold	UINT16	0~120, 5°*
6036	RW	3-Φ SM Branch 2 IA Polarity ¹	UINT16	0=Normal*, 1=Reverse
		1-Φ SM Branch 2 I Polarity ¹		
6037	RW	3-Φ SM Branch 2 IB Polarity ¹	UINT16	
		1-Φ SM Invalid		
6038	RW	3-Φ SM Branch 2 IC Polarity ¹	UINT16	0: IA/IB/IC*, 1: IB/IC/IA, 2: IC/IA/IB, 3: IA/IC/IB, 4: IC/IB/IA, 5: IB/IA/IC
		1-Φ SM Invalid		
6039	RW	3-Φ SM Branch 2 Current Phase Sequence ¹	UINT16	
		1-Φ SM Invalid		

Table 4-38 Basic Setup Parameters

Notes:

1. Only available when the 2-Branch Feeders option is selected.
2. For the 1-Φ SM option, 0=DEMO, while other values=normal wiring.
3. There are two ways to calculate THD:

THDf:

$$\text{THDf} = \frac{\sqrt{\sum_{n=2}^{\infty} I_n^2}}{I_1} \times 100\%$$

where I_1 represents the RMS value of the fundamental component, and I_n represents the RMS value for the n^{th} harmonic with n for harmonic order.

THDr:

$$\text{THDr} = \frac{\sqrt{\sum_{n=2}^{\infty} I_n^2}}{\sqrt{\sum_{n=1}^{\infty} I_n^2}} \times 100\%$$

where I_n represents the RMS value for the n^{th} harmonic with n for harmonic order.

4. This parameter enables 3-phase current reassignment when the current wiring is incorrect, ensuring accurate power data acquisition. For instance, if the actual current wiring order is IB, IA, IC, set this parameter to 5 (IB/IA/IC).
5. The Present Demand and Predicted Demand will be reset once the **Demand Period/No. of Sliding Windows** is changed.

4.8.2 Comm. Setup

Register	Property	Description	Format	Range, Default*
6400	RW	Reserved		
6401	RW	Unit ID	UINT16	1 to 247, 100*
6402	RW	Baud Rate	UINT16	0=1200, 1=2400, 2=4800, 3=9600*, 4=19200, 5=38400
6403	RW	Comm. Config.	UINT16	0=8N2, 1=8O1, 2=8E1*, 3=8N1, 4=8O2, 5=8E2

Table 4-39 Communication Setup

4.8.3 Setpoint Setup

Register	Property	Description	Format	Range, Default*
6500	RW	Setpoint Type	UINT16	0=Disabled*, 1=Over Setpoint 2=Under Setpoint
6501	RW	Parameters ¹	UINT16	0* to 99
6502	RW	Over Limit	Float	
6504	RW	Under Limit	Float	
6506	RW	Active Delay	UINT16	0* to 9999 s
6507	RW	Inactive Delay	UINT16	0* to 9999 s
6508	RW	Reserved	UINT16	
6509	RW	Reserved	UINT16	
6510~6519	RW	Setpoint #2	UINT16	Same as Setpoint #1
		...		
6580~6589	RW	Setpoint #9	UINT16	Same as Setpoint #1
6590~6599	RW	Setpoint #10	UINT16	Same as Setpoint #1

Table 4-40 Setpoint Setup

Notes:

1. The table below illustrates the Setpoint Parameters.

Key	Setpoint Parameter	Scale	Unit	Key	Setpoint Parameter	Scale	Unit
0	None	-	-	42	3-Φ SM Branch 2 Ic		A
1	Uln (Any Phase Voltage)	x1	V	43	3-Φ SM Current THD		100%
2	Ull (Any Line Voltage)			44	3-Φ SM Current TOHD		100%
3	3-Φ SM Branch 1 I (Any Phase Current)		A	45	3-Φ SM Current TEHD		100%
4	3-Φ SM Branch 1 In		A	46	3-Φ SM Branch 2 Current Unbalance		100%
5	3-Φ SM Frequency		Hz	47	3-Φ SM Branch 2 Phase Reversal		100%
6	3-Φ SM Branch 1 P (kW Total)		W	48	3-Φ SM Branch 2 Ia Demand		A
7	3-Φ SM Branch 1 Q (kvar Total)		var	49	3-Φ SM Branch 2 Ib Demand		A
8	3-Φ SM Branch 1 S (kVA Total)		VA	50	3-Φ SM Branch 2 Ic Demand		A
9	3-Φ SM Branch 1 PF (PF Total)		-	51	3-Φ SM Branch 2 P Total Demand		W
10	3-Φ SM Ua		V	52	3-Φ SM Branch 2 Q Total Demand		var
11	3-Φ SM Ub		V	53	3-Φ SM Branch 2 S Total Demand		VA
12	3-Φ SM Uc		V	54~70	Reserved		
13	3-Φ SM Uab		V	71	1-Φ SM Voltage		V
14	3-Φ SM Ubc		V	72	1-Φ SM Branch 1 I		A
15	3-Φ SM Uca		V	73	1-Φ SM Branch 2 I		A
16	3-Φ SM Branch 1 Ia		A	74	1-Φ SM Frequency		Hz
17	3-Φ SM Branch 1 Ib		A	75	1-Φ SM Branch 1 P		W
18	3-Φ SM Branch 1 Ic		A	76	1-Φ SM Branch 1 Q		var
19	3-Φ SM Voltage THD		100%	77	1-Φ SM Branch 1 S		VA
20	3-Φ SM Voltage TOHD		100%	78	1-Φ SM Branch 1 PF		-
21	3-Φ SM Voltage TEHD		100%	79	1-Φ SM Branch 2 P		W
22	3-Φ SM Branch 1 Current THD		100%	80	1-Φ SM Branch 2 Q		var
23	3-Φ SM Branch 1 Current TOHD		100%	81	1-Φ SM Branch 2 S		VA
24	3-Φ SM Branch 1 Current TEHD		100%	82	1-Φ SM Branch 2 PF		-
25	3-Φ SM Voltage Unbalance		100%	83	1-Φ SM Voltage THD		100%
26	3-Φ SM Branch 1 Current Unbalance		100%	84	1-Φ SM Voltage TOHD		100%
27	3-Φ SM Branch 1 Phase Reversal		-	85	1-Φ SM Voltage TEHD		100%
28	3-Φ SM Branch 1 Ia Demand		A	86	1-Φ SM Branch 1 Current THD		100%
29	3-Φ SM Branch 1 Ib Demand		A	87	1-Φ SM Branch 1 Current TOHD		100%
30	3-Φ SM Branch 1 Ic Demand		A	88	1-Φ SM Branch 1 Current TEHD		100%
31	3-Φ SM Branch 1 P Total Demand		W	89	1-Φ SM Branch 2 Current THD		100%
32	3-Φ SM Branch 1 Q Total Demand		var	90	1-Φ SM Branch 2 Current TOHD		100%
33	3-Φ SM Branch 1 S Total Demand		VA	91	1-Φ SM Branch 2 Current TEHD		100%
34	3-Φ SM Branch 2 I (Any Phase Current)		A	92	1-Φ SM Branch 1 I Demand		A
35	3-Φ SM Branch 2 In		A	93	1-Φ SM Branch 1 P Demand		W
36	3-Φ SM Branch 2 P (P Total)		W	94	1-Φ SM Branch 1 Q Demand		var
37	3-Φ SM Branch 2 Q (Q Total)		var	95	1-Φ SM Branch 1 S Demand		VA
38	3-Φ SM Branch 2 S (S Total)		VA	96	1-Φ SM Branch 2 I Demand		A
39	3-Φ SM Branch 2 PF (PF Total)		-	97	1-Φ SM Branch 2 P Demand		W
40	3-Φ SM Branch 2 Ia		A	98	1-Φ SM Branch 2 Q Demand		var
41	3-Φ SM Branch 2 Ib		A	99	1-Φ SM Branch 2 S Demand		VA

Table 4-41 Setpoint Parameters

4.8.4 Ethernet Setup (Optional)

Register	Property	Description	Format	Range, Default*
7200	RW	Reserved	UINT16	
7201	RW	IP Address ¹	UINT32	192.168.0.100*
7203	RW	Subnet Mask	UINT32	255.255.255.0*
7205	RW	Gateway	UINT32	192.168.0.1*
7207	RW	Modbus TCP Port	UINT16	1~65535, 502*

Table 4-42 Ethernet Setup

Notes:

1. The bits in the host ID of an IP address cannot be all 0s or all 1s. That is, an IP address cannot be set to 192.168.8.0 or 192.168.8.255.
2. Ethernet Setup is only available when the Expansion Communication option “WBE” is selected.

4.8.5 Wi-Fi Setup (Optional)

Register	Property	Description	Format	Range, Default*	Note
7500	RW	Enable TCP Loopback Test	UNIT16	0*~1	0=Disable, 1=Enable
7501	RW	TCP Loopback Test Port	UNIT16	0*~65535	
7502	RW	TCP Loopback Test Server IP	UNIT16*20	0*	
7522	RW	Name of the Connected AP (STA Mode)	UNIT16*16		
7538	RW	Password for Connecting to the AP (STA Mode)	UNIT16*32		
7570	RW	AP Name (AP Mode)	UNIT16*16	1~31 characters	
7586	RW	AP Password (AP Mode)	UNIT16*32	8~63 characters	

Table 4-43 Wi-Fi Setup

Notes:

1. Wi-Fi Setup is only available when the Expansion Communication option “WBE” or “WBR” is selected.

4.9 Time Registers

There are two sets of Time registers supported by the PMC-351 – Year/Month/Day/Hour/Minute/Second (Register # 60000 to 60002) and UNIX Time (Register # 60004). When sending time to the PMC-351 over Modbus communications, care should be taken to only write one of the two Time register sets. All registers within a Time register set must be written in a single transaction. If registers 60000 to 60004 are being written to at the same time, both Time register sets will be updated to reflect the new time specified in the UNIX Time register set (60004) and the time specified in registers 60000-60002 will be ignored. Writing to the Millisecond register (60003) is optional during a Time Set operation. When broadcasting time, the function code must be set to 0x10 (Pre-set Multiple Registers). Incorrect date or time values will be rejected by the meter. In addition, attempting to write a Time value less than Jan 1, 2000 00:00:00 will be rejected.

Register	Property	Description	Format	Note
60000	9000	RW	UINT16	Year: 10-90 (Year-2000)
				Month: 1 to 12
60001	9001	RW	UINT16	Day: 1 to 31
				Hour: 0 to 23
60002	9002	RW	UINT16	Minute: 0 to 59
				Second: 0 to 59
60003	9003	RW	UINT16	Millisecond: 0 to 999
60004 ~ 60005	9004 ~ 9005	RW	UINT32	0x4B3D3B00 to 0xE398E47F The corresponding time is 2010.01.01 00:00:00 to 2090.12.31 23:59:59 (GMT 0:00 Time Zone)

Table 4-44 Time Registers

Notes:

1. The four registers for Year, Month, Day, and Hour must be written consecutively. The two registers for UNIX time must be written consecutively. The two time formats cannot be written simultaneously.

4.10 Clear/Reset Control

Register	Property	Description	Format	Note
9602	WO	Clear All Demands Logs	UINT16	Writing “0xFF00” to the register to execute the described action.
9603	WO	Clear All Energy ¹		
9604	WO	Reserved		

9605	WO	Reserved	Writing "0xFF00" to the register to execute the described action.
9606	WO	Reserved	
9607	WO	Clear SOE Log	
9608	WO	Clear Device Operating Time	
9609	WO	Clear All Data ²	
9610	WO	Enable Wi-Fi Module	
9611	WO	Disable Wi-Fi Module	
9612	WO	Reserved	
9613	WO	Reserved	
9614	WO	Reserved	

Table 4-45 Clear Control

Notes:

1. Writing 0xFF00 to the **Clear All Energy** register to clear the 3-Φ Total and Per-Phase energy registers.
2. Writing 0xFF00 to the **Clear All Data** register to perform the clear operation for all Energy Registers, SOE Logs, Device Operating Time and so on.

4.11 Meter Information

Register		Property	Description	Format	Note
60200~60219	9800~9819	RO	Meter model ¹	UINT16	See Note 1
60220	9820	RO	Firmware Version	UINT16	e.g. 10000 shows the version is V1.00.00
60221	9821	RO	Protocol Version	UINT16	e.g. 10 shows the version is V1.0
60222	9822	RO	Firmware Update Date: Year-2000	UINT16	e.g. 100110 means January 10, 2010
60223	9823	RO	Firmware Update Date: Month	UINT16	
60224	9824	RO	Firmware Update Date: Day	UINT16	
60225	9825	RO	Serial Number	UINT32	e.g. 1001030100 means the 100 th PMC-351 that was manufactured on January 3 rd , 2010
60227	9827	RO	Reserved	UINT16	
60228	9828	RO	Reserved	UINT16	
60229	9829	RO	Feature Code	UINT16	0=1x3-Φ SM + RS-485 1=1x3-Φ SM + WBR ² 2=1x3-Φ SM + WBE ^{2, 3} 3=2x3-Φ SM + RS-485 4=2x3-Φ SM + WBR 5=1x1-Φ SM + RS-485 6=1x1-Φ SM + WBR 7=2x1-Φ SM + RS-485 8=2x1-Φ SM + WBR

Table 4-46 Meter Information

Notes:

1. The Meter Model appears in registers 60200 to 60219 and contains the ASCII encoding of the string "PMC-351" as shown in the following table.

Register	Value (Hex)	ASCII
60200	0x0050	P
60201	0x004D	M
60202	0x0043	C
60203	0x002D	-
60204	0x0033	3
60205	0x0035	5
60206	0x0031	1
60207-60219	0x0020	Null

Table 4-47 ASCII Encoding of "PMC-351"

2. WBR=Wi-Fi + Bluetooth + RS485, WBE=Wi-Fi + Bluetooth + Ethernet
3. Official release for Expansion Communication Option "WBE" with an Ethernet Port is scheduled for Q4 2026.

Appendix A Technical Specifications

Voltage Inputs (L, N or L1, L2, L3, N)	
Voltage (Un) 1-Φ SM 3-Φ SM Range Burden Overload Frequency	230VLN 230VLN/400VLL 90V-276VAC <0.02VA/phase 1.2xUn continuous, 2xUn for 1s 45-65Hz
Current Input (CT or CT1, CT2)	
Current (In) Range Starting Current External 3-Φ SM SCCT Model Accuracy Aperture Cable Length External 1-Φ SM SCCT Model Accuracy Aperture Cable Length Burden Overload	40mA 5%-120% In 0.08A PMC-SCCT-100A-40mA-16-B 0.5 Ø16mm 1m PMC-SCCT-50A-40mA-16-A PMC-SCCT-100A-40mA-16-A PMC-SCCT-200A-40mA-24-A PMC-SCCT-400A-40mA-35-A PMC-SCCT-800A-40mA-A PMC-SCCT-1600A-40mA-A 0.5 Ø16/Ø16/Ø24/Ø35/80*50/130*55 mm 2m <0.15VA/phase 1.2xIn continuous, 10xIn for 10s, 20xIn for 1s
Power Supply	
Standard Burden	90-276VAC, Self-Powered via Uan (U1) * <3W
Communications	
RS-485 (Standard) Protocol Baud Rate Ethernet (Optional) # Protocol Speed Wi-Fi (Optional) RF Range Protocol Bluetooth (Optional) RF Range Protocol	Modbus RTU 1200/2400/4800/9600/19200/38400 bps Modbus TCP 10/100 Mbps 2412-2484 MHz RPC 2402-2480 MHz Modbus RTU
Environmental Conditions	
Operating Temp. Storage Temp. Humidity Atmospheric Pressure Altitude Pollution Degree	-30°C to +70°C -40°C to +85°C 5% to 95% non-condensing 80 kPa to 106 kPa <2000m 2
Mechanical Characteristics	
Mounting Unit Dimensions IP Rating	DIN Rail 20x66x90 mm IP30

* When the 1-Φ SMs option is selected, it is powered by L/+ and N/-. When the 3-Φ SMs option is selected, it is powered by L1/+ and N/-.

Official release for Expansion Communication Option "WBE" with an Ethernet Port is scheduled for Q4 2026.

Appendix B Accuracy Specifications

Parameters	Accuracy	Resolution
Voltage	$\pm 0.5\%$	0.01V
Current	$\pm 0.5\%$	0.001A
P, Q, S	$\pm 1.0\%$	0.001kW/kvar/kVA
kWh	IEC 62053-21:2020 Class 1	0.01kWh
kvarh	IEC 62053-24: 2020 Class 1	0.01kvarh
PF	$\pm 1.0\%$	0.001
Frequency	$\pm 0.02\text{Hz}$	0.01Hz
THD	IEC 61000-4-7 Class II	0.01%

Appendix C Standards of Compliance

Safety Requirements	
CE LVD 2014/35/EU	EN 61010-1: 2010 + A1 BS EN 61010-1: 2010 + A1 EN IEC 61010-2-030: 2021 + A11 BS EN IEC 61010-2-030: 2021 + A11
Electrical Safety in Low Voltage Distribution Systems up to 1000VAC and 1500VDC	IEC 61557-12: 2021 (PMD)
Insulation AC Voltage: 2kV @ 1 minute Insulation Resistance: >100MΩ Impulse Voltage: 6kV, 1.2/50μs	IEC 62052-31: 2015 EN 61010-1: 2010 + A1 BS EN 61010-1: 2010 + A1
Electromagnetic Compatibility CE EMC Directive 2014/30/EU (EN 61326-1: 2013)	
Immunity Tests	
Electrostatic Discharge	EN 61000-4-2: 2009
Radiated Fields	EN IEC 61000-4-3: 2020
Fast Transients	EN 61000-4-4: 2019
Surges	EN 61000-4-5: 2014 + A1: 2017
Conducted Disturbances	EN 61000-4-6: 2014 + AC: 2015
Magnetic Fields	EN 61000-4-8: 2010
Voltage Dips and Interruptions	EN IEC 61000-4-11: 2020
Ring Wave	EN 61000-4-12: 2017
Immunity standard for Residential, Commercial and Light-industrial Environments	EN IEC 61000-6-1: 2019
Immunity Standard for Industrial Environments	EN IEC 61000-6-2: 2019
Emission Tests	
Limits and Methods of Measurement of Electromagnetic Disturbance Characteristics of Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment	EN 55011: 2016 + A1: 2017 + A11: 2020 + A2: 2021
Electromagnetic Compatibility of Multimedia Equipment - Emission Requirements	EN 55032:2015 + AC: 2016 + A11: 2020 + A1: 2020
Limits for Harmonic Current Emissions for Equipment with Rated Current ≤16A	EN IEC 61000-3-2: 2019 + A1 + A2
Limitation of Voltage Fluctuations and Flicker in Low-Voltage Supply Systems for Equipment with Rated Current ≤16A	EN 61000-3-3: 2013 + A1: 2019 + A2: 2021
Emission Standard for Equipment in Residential Environments	EN IEC 61000-6-3: 2021
Emission Standard for Industrial Environments	EN IEC 61000-6-4: 2019
Electromagnetic Compatibility (EMC) Standard for Radio Equipment and Services; Part 1: Common Technical Requirements	EN 301 489-1 V2.2.3: 2019
Electromagnetic Compatibility (EMC) Standard for Radio Equipment and Services; Part 17: Specific Conditions for Broadband and Wideband Data Transmission Systems; Harmonized Standard for Electromagnetic Compatibility	EN 301 489-17 V3.3.1: 2024
Wideband Transmission Systems; Data Transmission Equipment Operating in the 2.4 GHz Band; Harmonized Standard for Access to Radio Spectrum	EN 300 328 V2.2.2: 2019
Assessment of Electronic and Electrical Equipment Related to Human Exposure Restrictions for Electromagnetic Fields (0 Hz to 300 GHz)	EN IEC 62311: 2020

Mechanical Tests	
Spring Hammer Test	IEC 62052-31: 2015
Vibration Test	IEC 62052-11: 2020
Shock Test	IEC 62052-11: 2020

Appendix D Ordering Guide



Version 20260611

Product Code		Description
PMC-351 Smart DIN Energy Meter		
Basic Function		
A5		Multifunction Measurements, 1xRS-485
Branch Feeders		
1		1x SM (1x1-Φ or 3-Φ Sub-Meters)
2*		2x SM (2x1-Φ or 3-Φ Sub-Meters)
Input Current		
1		1-Phase 40mA Input for use with SCCT
3*		3-Phase 40mA Inputs for use with SCCTs
Input Voltage		
1		230VLN (-60% to +20%), for 1-Phase application
3*		230VLN/400VLL (-60% to +20%), for 3-Phase application
Power Supply		
N		90-276VAC, Self-Powered from Uan (or U1)
Frequency		
5		45-65Hz
I/O		
N		None
Expansion Communication		
R		1xRS485
WBE*		WiFi + Bluetooth + Ethernet
WBR*		WiFi + Bluetooth + RS485
Language		
E		English
PMC-351	- A5 1 1 1 N 5 N R E	PMC-351-A5111N5NRE (Standard Model)

* Additional charges apply

1) Expansion Communication Option "WBE" is only available with Branch Feeders Option "1" + Input Current Option "3" + Input Voltage Option "3".

2) Input Current Option "1" is only available with Input Voltage Option "1", Input Current Option "3" is only available with Input Voltage Option "3"

3) Wi-Fi: Supports Wi-Fi 6 (802.11ax) in the 2.4 GHz band (2412-2484 MHz). The device supports concurrent AP and STA modes, facilitating both direct device connections and integration into existing local networks.

Bluetooth: Operates in the 2.4 GHz band (2402-2480 MHz) for seamless pairing and communication with companion mobile apps.

The WiFi AP mode and Bluetooth cannot operate simultaneously.

4) Please note that mass production for Expansion Communication Option "WBE" is scheduled for Q4 2026.

Revision History Logs

Version	Date	Description of Changes
V1.0	20260821	Initial Version

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