SENSORS

User Manual

Power Meter - Panel Mount with Display

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Notices and Warnings

Notices

Please **read all of this manual** before you install, operate or maintain this product. Pay attention to notes, warnings and instructions. The manufacturer cannot be held liable for any damage which occurs as a result of noncompliance with this manual.

Do not tamper with the product. Should the product be tampered with in any manner other than a procedure which is described and specified in this manual, the warranty is cancelled and the manufacturer is exempt from liability.

The product is designed exclusively for the application described in this manual. Use of this product in conditions not specified in this manual or, contrary to the instructions provided by the manufacturer, is considered improper handling of the product and will void the warranty. The manufacturer will not be held liable for any damages resulting from improper use of the product.

This manual should be read carefully by relevant personnel and the end user**.** This manual should be kept with the product and be made available as needed. **Once you install or use the product, you accept that you have read, understood and complied with this manual**.

CAA Sensors endeavours to make the content of this manual correct, but is not responsible for omissions or errors and the consequences caused. If in doubt, or if you have any questions regarding this manual or the product, please contact CAA Sensors.

Warnings

Ignoring warnings can lead to serious injury and/or cause damage!

When handling, operating or carrying out maintenance on this product, personnel must employ safe working practices and observe all local health & safety requirements and regulations.

Improper operation or maintenance of this product could be dangerous and result in an accident causing damage to machinery, personal injury or death.

The manufacturer cannot anticipate every possible circumstance which may represent a potential hazard. The warnings in this manual cover the most common potential hazards and are therefore not all-inclusive. If the user employs an operating procedure, an item of equipment or a method of working which is not specifically recommended by the manufacturer they must ensure that the product will not be damaged or made unsafe and that there is no risk to persons or property.

NEVER CHANGE ORIGINAL COMPONENTS WITH ALTERNATIVES.

Introduction

Multi-Function Power Meter

Intended use

CAA Sensors power meters are suitable for use in manufacturing, industrial and base building environments providing the power meter's specifications are met. This includes:

- Input (measured) voltage is less than 600 vAC
- Measured current is less than 10,000 Amps
- The power meter is used with external Rogowski coils or external CT (333mV only)
- The ambient operating temperature is between -20°C to +70°C (-4°F to +158°F).
- The power meter is not used in explosive areas.

Refer to the *Specifications* section (next page) for full requirements.

About the power meter

This multi-function, 3 phase, power meter measures voltage, amps, kilowatts, power factor, reactive power (kVa), total kilowatts, kilowatt hours and electrical system harmonics.

The power meter:

- can be used on 3 phase or single phase systems
- is simple to install via a standard 96 panel type, snap on type (no screws)
- is easy to configure via the in-built display
- only requires 24vDC power supply
- can be connected into your data acquisition system
- can be installed on mains supply
- can be used for sub metering individual equipment or sub loads
- has Modbus/RTU output.

Why should you monitor power?

- Reduce operating and energy costs
- Improve understanding of energy usage (eg spikes, variation)
- Identify phase and voltage issues
- Identify power factor and harmonic issues
- Compare and challenge your energy bill
- Improve efficiency and reduce waste
- Monitor your mains power supply usage and quality
- Monitor individual equipment usage or sub system loads

Specifications

Power Meter Specifications

Power Meter Details		
Type	Multi-function power meter	
Applications	Power analysis Tariff meter	
Mounting	Panel Mount, snap on	
Poles Description	3PH4W (3 or 4 CT) 1PH3W	3PH3W (2 or 3 CT) 1PH2W
Connection	Screw terminals	
Display	LCD Display	
Dimensions	96 mm L x 96 mm W x 45 mm D 3.78" L x 3.78" W x 1.77" D	
Weight	259 grams	
Colour	White and Black	
Installation Type	Permanent installation or temporary installation	
Warranty	12 months	
Operating Conditions		
Power Supply	18-36VDC	
Max Power Consumption	3.5 VA	
Operating temperature	-20°C to +70°C	-4°F to +158°F
Storage temperature	-40°C to +85°C	-40°F to +185°F
Humidity rating	5% to 95% RH at 50°C (non-condensing)	
IP degree of protection	IP20 conforming to IEC 60629	

Pollution degree	2: Normally only nonconductive pollution occurs. Temporary conductivity caused by condensation is to be expected.	
Altitude	3000m Max	
Overvoltage category	CAT III 1000V It is suitable for distribution systems below 277 / 480vAC	
Dielectric withstand	As per IEC61010-1, Doubled insulated front panel display	
Insulation Strength	IEC61010-1	
Accuracy		
Accuracy **Note**: The accuracy of the power meter is affected by the quality of installation. On-site conditions such as oil, high humidity or other impurities can also affect the accuracy of the power meter	Current	±0.1% + accuracy of current sensor
	Rated current	500A (0.5% from 10A to 600A) 3,000A (0.5% from 30A to 3600A) 10kA (0.5% from 100A to 12kA)
	Rogowski coil specification	±0.5% (85mV/kA@50Hz)
	Voltage	±0.2% (60V to 600V AC)
	Grid Frequency	±0.01% (45-65Hz)
	Power factor	±0.005
	Active/Apparent Power	IEC62053-22 Level 0.5S
	Reactive power	IEC62053-21 Level 1S
	Active energy	IEC62053-22 Level 0.5S
	Reactive energy	IEC62053-21 Level 1S
Input		
Input type	External CT (333mV only) **or** External Rogowski coil (500A or 1,000A or 3,000A)	
Current - Channel Input Voltage Range	0-900 mVAC peak, 636 mV RMS	
Current - VCT	0 – 99999 A	

Voltage - Channel Input Voltage Range	0~600 VAC Phase Voltage
Voltage - Maximum range	720 VAC Phase Voltage
Digital input	2 dry contact inputs, optocoupler isolated (5kVrms)
Output	
Output parameters	Voltage, Amps and Kilowatts for each phase, power factor, reactive power (kVa), total Kilowatts, Kilowatt hours and electrical system harmonics
Relay Output	1 electromagnetic relay output, contact capacity: 3A 30V DC, 3A 250V AC
Communication	Modbus RS485
EMC	
Electrostatic discharge	Level IV (IEC61000-4-2)
Radiated immunity	Level III (IEC61000-4-3)
EFT Electrical fast burst immunity	Level IV (IEC61000-4-4)
Surge immunity	Level IV (IEC61000-4-5)
Conducted disturbance immunity	Level III (IEC61000-4-6)
Power frequency magnetic field immunity	0.5mT (IEC61000-4-8)
Conduction and radiation	Class B (EN55022)
Standard compliance	
EN 62052-11,EN61557-12,EN 62053-21,EN 62053-22,EN 62053-23,EN 50470-1,EN 50470-3, EN 61010-1, EN 61010-2, EN 61010-031	

Communication Specifications - Modbus RS485

	Communication
Transmission mode	One RS485 communication interface
Interface type	2 wire, Half duplex
Communication rate	2400bps to 115200bps
Communication protocol	MODBUS RTU
	Settings
Communication address	1 to 247 (default 1)
Baud rate	2400 to 38400 baud (default 19200)
Parity	Even, Odd, None (default)
Data Bit	8
Stop bit	1

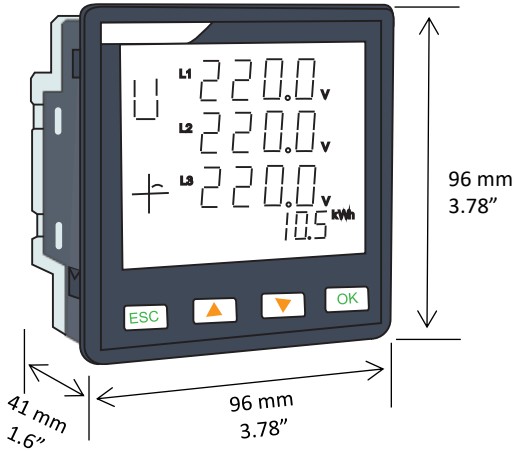
Data Display Specifications

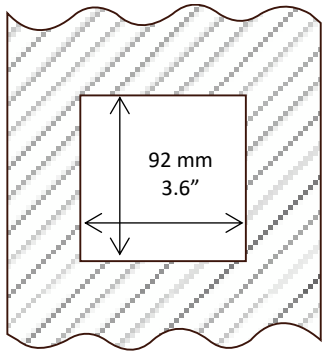
	Instantaneous Values
Phase Voltage	U1, U2, U3, AVG
Line Voltage	U12, U23, U31, AVG
Current	I1, I2, I3, AVG, IN
Grid Frequency	F1, F2, F3, Σ (total)
Power Factor (PF)	PF1, PF2, PF3, Σ (total)
Fundamental power factor (DPF)	DPF1, DPF2, DPF3, Σ (total)
Active power	P1, P2, P3, Σ (total)
Reactive power	Q1, Q2, Q3, Σ (total)
Apparent power	S1, S2,S 3, Σ (total)

Energy	
Active energy Pos.	EP1, EP2, EP3, Σ (total)
Active Energy Neg.	EP1, EP2, EP3, Σ (total)
Reactive Energy Pos.	EQ1, EQ2, EQ3, Σ (total)
Reactive energy Neg.	EQ1, EQ2, EQ3, Σ (total)
Apparent Energy	ES1, ES2, ES3, Σ (total)
Tariff Energy	ET1, ET2, ET3, ET4, ET5, ET6
Note	When the total Energy reaches 1.0 x 10^9 kVARh, the energy of each phase will automatically clear to zero
Harmonics	
Voltage Harmonic Distortion	THD (Total harmonic percentage), TOHD (Odd total harmonic percentage), TEHD (Even total harmonic percentage), Fractional harmonics of order 1-50
Voltage Harmonic Value	
Current Harmonic Distortion	THD (Total harmonic percentage), TOHD (Odd total harmonic percentage), TEHD (Even total harmonic percentage), Fractional harmonics of order 1-50
Current Harmonic Value	
Phasor diagram	
Phasor diagram	between voltage and current
Phase Sequence	Voltage, current
Voltage Angle	U1, U2, U3
Current Angle	I1, I2, I3
UI Angle	UI1, UI2, UI3
Demand	
Demand	Total Active power Total Reactive power Total Apparent power
Active power DMD Max	Maximum demand and time
Reactive power DMD Max.	Maximum demand and time

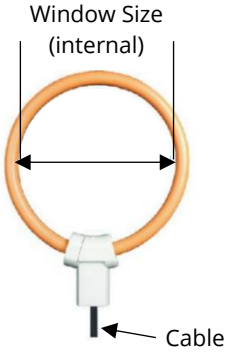
Apparent power DMD Max.	Maximum demand and time
Unbalance	
Voltage unbalance	Negative order, zero order
Current unbalance	Negative order, zero order
Max & Min	
Phase Voltage	Phases and averages
Line Voltage	Phases and averages
Current	Phases and averages
Active power	Phases and averages
Reactive power	Phases and averages
Apparent power	Phases and averages

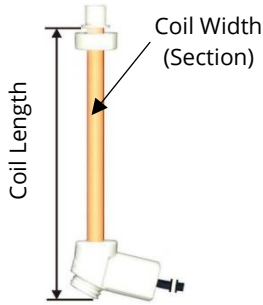
Power Meter Dimensions

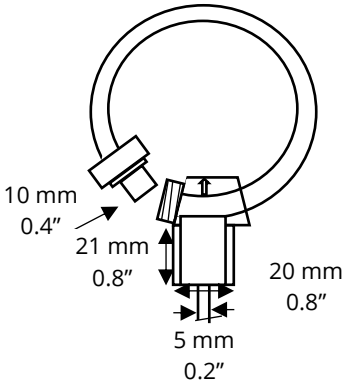




Rogowski Coil Specifications







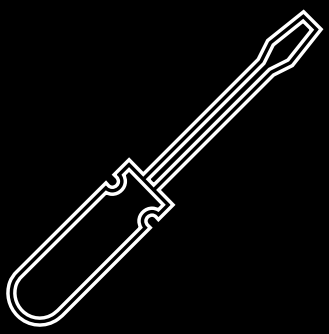
	500 Amps	1,000 Amps	3,000 Amp
Rated Current	500 A	1,000 A	3,000 A
Coil Resistance	140 (± 10) Ω	210 (± 10) Ω	290 (± 10) Ω
Window Size (Internal)	50 mm or 1.97”	100 mm or 3.94”	150 mm or 5.91”
Coil Length	200 mm or 7.87”	350 mm or 13.78”	510 mm or 20.08”
Coil Width (Section)	8 mm		
Cable Length	5 meters		
Weight	140 g	150 g	160 g
Ratio	Calibrated:	85mV / kA@50Hz	
	Uncalibrated:	110mV / kA@50Hz	
Read Accuracy	Calibrated:	<0.5% (central position, 25℃)	
	Uncalibrated:	< 5% tolerance (central position, 25℃)	
Maximum Current Measurable	100kA		
Position Error	±1% maximum		
Output on 0A (zero drift)	≤0.05 mV		

Phase error	≤0.5°		
Linearity	±0.2% reading		
Bandwidth	1Hz to 100 Hz (-3db)		
Shielded	100% coil, 100% output cable		
Voltage Insulation	Coil: 3,000V Signal cable: 1,000V		
Compliance	LVD EN 61010-1:2010 EMC EN 61326-1:2013		
Safety	1000V CATIII ,600V CATIV		
Materials	Coil & cable	Thermoplastic rubber, flame retardant UL 94 V-0 rated	
	Couplings	PA6 UL 94 V-O rated	
Operation Temperature	-30℃ to +80℃	-22°F to 176°F	
Storage Temperature	-40℃ to +90℃	-40°F to 194°F	
Installation Type	Temporary or permanent installation		
Warranty	12 months		

Rogowski Coil Position Sensitivity

Conductor Position	Typical Error (%)
● Adjacent to the center of coil	0.2%
● Adjacent to the inside coil	＜1%

Installation



Installation

WARNING! Risk of electrical shock.

Any contact with energised parts of the product, may lead to an electrical shock, serious injuries or even death. The user shall take all measures necessary to protect against electrical shock.

Notes

- Users should be suitably qualified, licensed and experienced to install, operate, maintain and remove this product.
- Please follow local and national regulations before/during installation and operation.
- **Before installing the product, make sure it is rated for your system** (refer to the "Specifications" section).
  - Use of the product outside specified ranges or operating parameters can lead to malfunctions and may damage the product or system.
- The system must be disconnected from any power supply during installation, maintenance and removal work.
- Certain parts of the product may carry hazardous live voltage (e.g. primary conductor). The user shall take all measures necessary to protect against electrical shock. A protective enclosure or additional insulation barrier may be necessary.
- Do not use this product in explosive areas.
- Do not stress the Rogowski Coils by applying any kind of mechanical force (i.e. twisting, puncturing, excessive pressure, tight bending, etc.) as this will dramatically degrade the device's accuracy.
- Do not disassemble the product.
- The product must be installed properly, otherwise it may lead to inaccurate measurement values.
- The product should be maintained and checked for faulty wiring on a regular basis.
- **Incorrect installation can damage the product, cause it to work incorrectly or result in injury or death.**

Installation Overview

Step 1 – Insert the power meter into the panel

Step 2 – Attach Rogowski coils around wires

Step 3 – Wire Rogowski coils, 24vDC power supply and Modbus communication cable to power meter

Step 4 – Set up (configure) the power meter

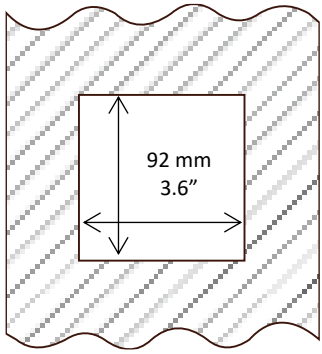
Installation – Mechanical

Installation and maintenance shall be done with the main power supply disconnected. Local and national regulations must be fully observed.

Mount the Power Meter

Step 1 – Cut a 92mm square hole in the panel (see diagram below)

Step 2 – Insert power meter into the hole. The connection is snap on type. No screws required



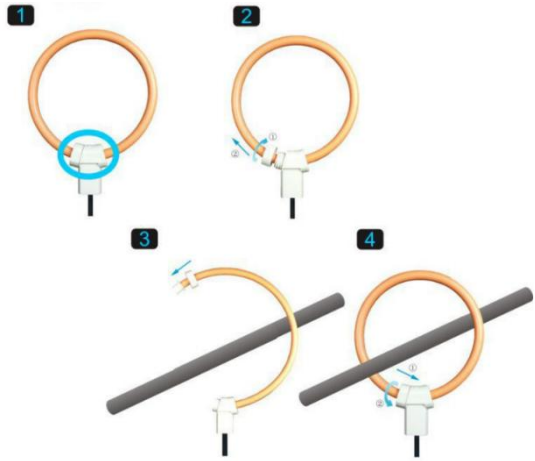
Attach Rogowski Coils

Step 1 – Locate clip on the Rogowski Coil base unit

Step 2 – Unscrew clip and pull out coil from base unit

Step 3 – Place coil over conductor, ensuring arrow faces toward the load

Step 4 – Insert coil back into base unit and screw clip to secure the coil



Installation – Electrical

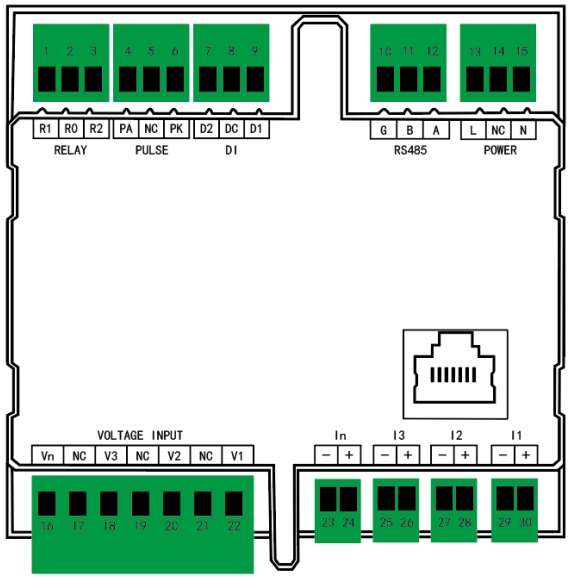
WARNING! Risk of electrical shock

Incorrect wiring or contact with energised parts of the product, may lead to an electrical shock which can lead to serious injuries or even death. The user shall take all measures necessary to protect against electrical shock.

Notes:

- Always check the wires to make sure they are wired correctly.
- Consider all local and national safety requirements and regulations for electrical installations.
- **The system must be disconnected from any power supply during installation and maintenance work.**
- Any electrical work on the system is only allowed by authorised and qualified personal.

Port Definition



Port Number	Port Name	Port Function	Remarks
1	R1	Relay normally open contacts	Relay output with normally open and normally closed contacts
2	R0	Relay common contacts	
3	R2	Relay normally closed contacts	
4	PA	Pulse output positive terminal	Pulse output - Active Energy pulse output
5	NC	Empty terminal	
6	PK	Pulse output negative terminal	
7	D2	Digital input channel 2	Digital input - the two channels are dry contact inputs
8	DC	Digital channel common end	
9	D1	Digital input channel 1	
10	G	RS485 GND	RS485 Communication
11	B	RS485 B	

Port Number	Port Name	Port Function	Remarks
12	A	RS485 A	
13	L	Power supply (+)	Power supply
14	NC	Empty terminal	
15	C	Power supply (-)	
16	Vn	N-phase voltage input	Voltage input channels
17	NC	Empty terminal	
18	V3	C-phase voltage input	
19	NC	Empty terminal	
20	V2	B-phase voltage input	
21	NC	Empty terminal	
22	V1	A-phase voltage input	
23	In-	N-phase current input negative	Current input
24	In+	N-phase current input positive	
25	I3-	C-phase current input negative	
26	I3+	C-phase current input positive	
27	I2-	B-phase current input negative	
28	I2+	B-phase current input positive	
29	I1-	A-phase current input negative	
30	I1+	A-phase current input positive	

Wiring Diagrams

WARNING: Incorrect wiring and installation can cause an electric shock, electrocution or damage to the power meter or other equipment. It may also void the warranty.

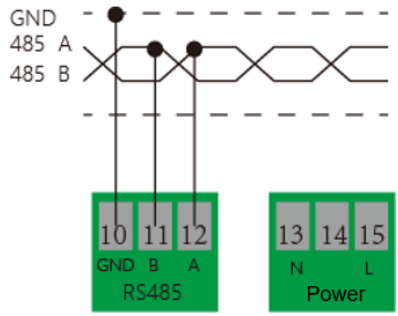
Before installing the power meter, make sure it is rated for your system (refer to Specification section).

Notes:

- The actual wiring type of the meter must be consistent with the wiring method of the internal configuration of the meter.
- The phase sequence of voltage and current must be in accordance with the phase sequence of ABC, otherwise the meter will show that the voltage and current phase sequence is wrong
- When using the current sensor, the direction of the current arrow on the sensor must be consistent with the actual current flow direction.

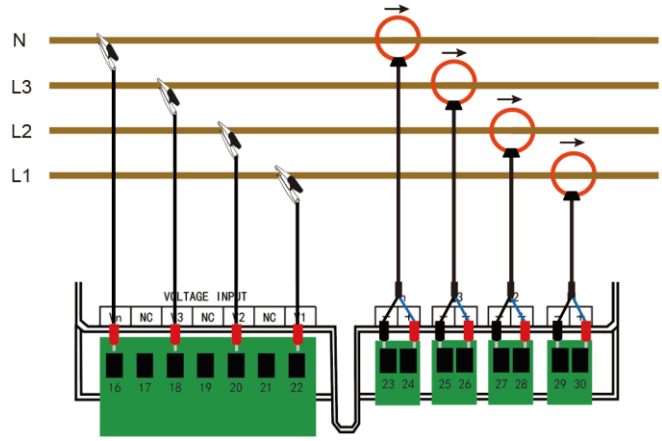
Modbus Communication Wiring Diagram

The electricity meter is equipped with an RS485 communication interface that supports the ModBus RTU protocol. The RS485 communication interface requires the use of shielded twisted pair connections, which are connected in the form of a daisy chain. In long-distance high-speed situations, a 120 Ω resistor needs to be connected in parallel at both ends of the daisy chain.



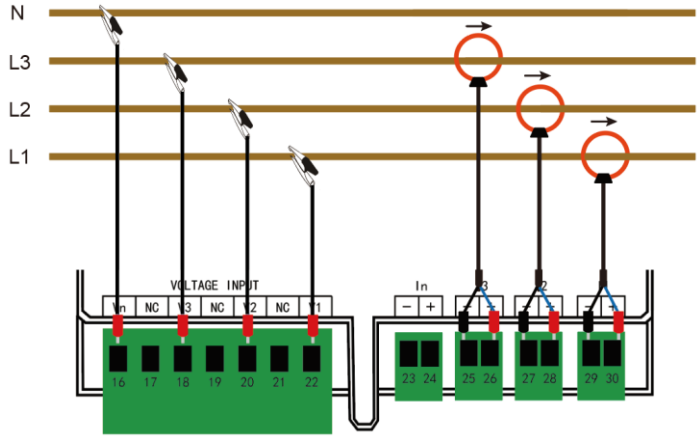
3PH4W 4CT

Three-phase four-wire 4CT (3PH4W_4CT) requires 4 current sensors, and the N-phase current is measured through the sensor



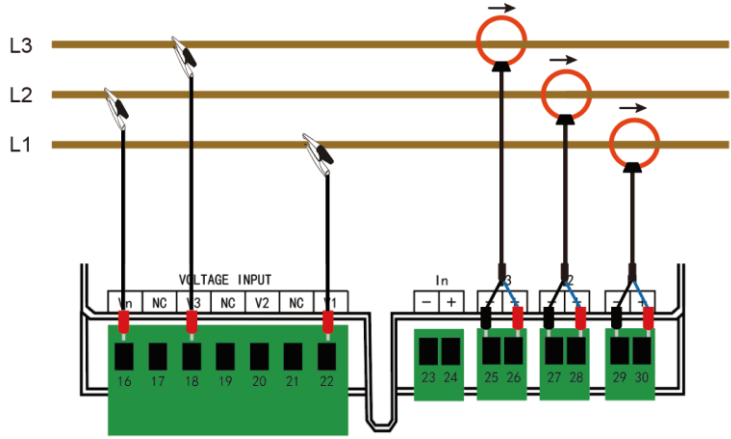
3PH4W 3CT

Three-phase four-wire 3CT (3PH4W_3CT) requires 3 current sensors, and the N-phase current is calculated by calculation



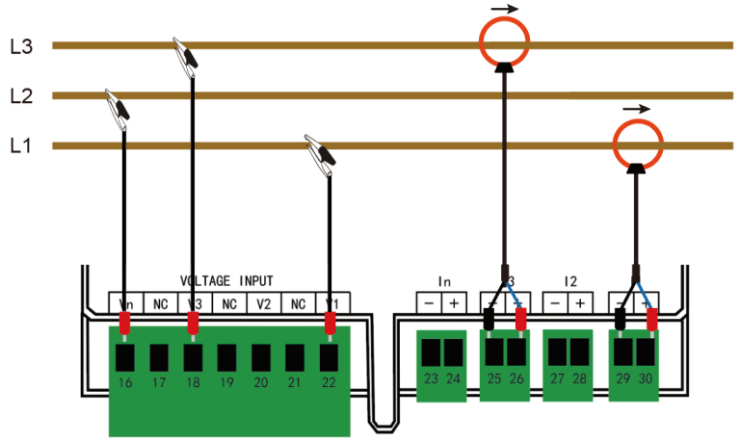
3PH3W 3CT

Three-phase three-wire 3CT (3PH3W_3CT) requires 3 current sensors, and the B-phase current is measured through the sensor



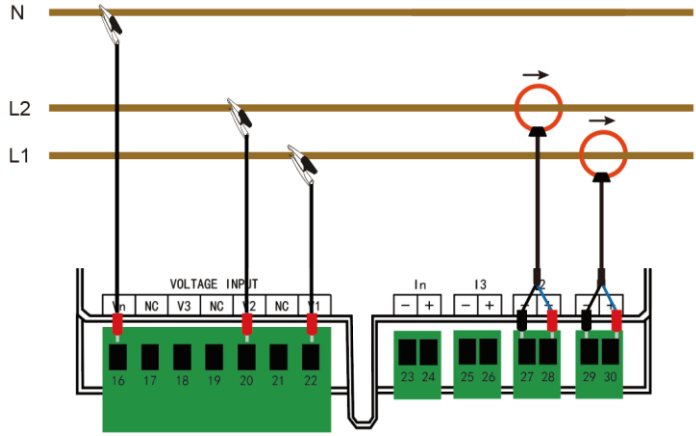
3PH3W 2CT

Three-phase three-wire 2CT (3PH3W_2CT) requires 2 current sensors, and the B phase current is calculated by calculation



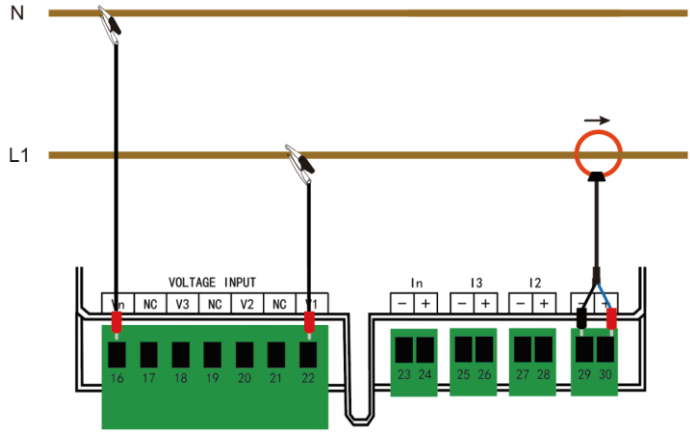
1PH3W 2CT

One-phase three-wire 2CT (1PH3W_2CT) requires 2 current sensors.



1PH2W 1CT

One-phase two-wire 1CT (1PH2W_1CT) requires 1 current sensor.



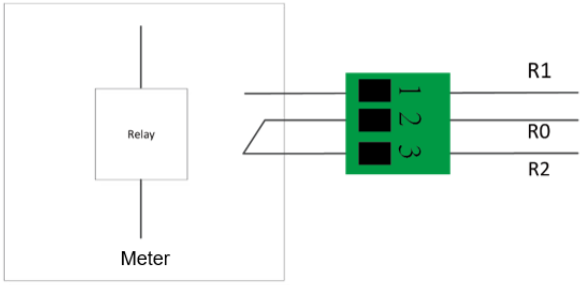
Relay Output

The power meter is equipped with a relay output that is a normally open contact. The terminal markings are R1 and R0, where R0 is the common contact and R1 is the normally open contact. The maximum load capacity of the relay is 3A 30V DC and 3A 250V AC

The closed state of the normally open contact of the relay is displayed on the meter display interface.

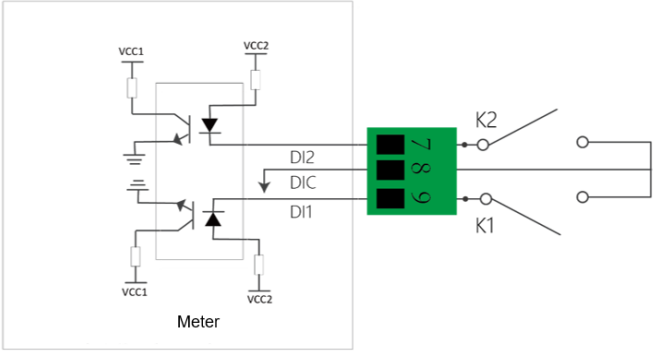
There are two types of relay output control modes, which can be modified through the meter operation interface or Modbus.

Relay output control mode	Description
Manual	The relay output is controlled via the meter operator interface or Modbus
Alarm	The relay output is controlled by setting alarm parameters



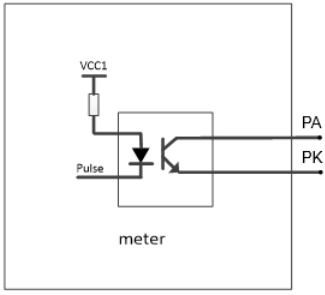
Digital Input

The power meter is equipped with two digital switching inputs, which are connected by passive dry contact. The terminal blocks are identified as: DI1, DI2, DIC, where DIC is the common contact. The status of two digital switching inputs can be read through RS485/ModBus protocol, and the status of digital switching input is displayed on the meter display interface.



Energy pulse output

The power meter is equipped with an active power pulse output. The electric energy pulse constant EC can be viewed through the meter information interface. The internal optocoupler of the meter is isolated, the maximum allowable passing current is 80mA DC, and the working voltage range is 5V ~ 80V DC.



Energy pulse output connection diagram

Installation - Configuration

Before using the power meter, you **must configure it for your system.**

If you change the Rogowski Coils size or type of current sensors, then you must reconfigure the Current Sensor settings accordingly.

Note: Incorrect settings will result in incorrect data.

The table below shows the settings that must be configured. Other settings may also need to be configured. You need a password to access the Settings Menu.

- **Default password for the setting menu: 1000**
- If you change the password and then forget it, enter the last four digits of the device serial number to enter the Settings menu.

Step 1 – Press the ok button until you get to the Meter Info screen

Step 2 – Enter the password (1000):

- short press the up or down key to modify the value size,
- long press the up or down key to switch the value to be modified (the corresponding value will flash)
- press the ok key to confirm the password

If the password is correct you will enter the configuration interface. If it is incorrect, you will stay on the input password screen.

Step 3 - Use the Up and Down buttons to cycle through the configuration options.

Step 4 - Press the ok to select a setting.

Step 5 – To change a setting:

- short press the up or down key to modify the value size,

- long press the up or down key to switch the value to be modified (the corresponding value will flash)
- press the ok key to confirm the setting. You may get a prompt to confirm the setting. Use the up or down key to select Yes or No then pressure the ok key

Press the ESC button to go back to the previous screen.

Configuration Screens

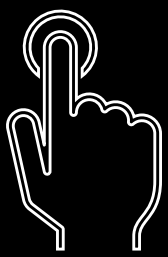
	Setting	Value	Description or Comment
Grid parameters 9r Id	Wiring Type	3.4.4 3.4.3 3.3.3 3.3.2 1.3 1.2	Three phase, 4 wire, 4CT Three phase, 4 wire, 3CT Three phase, 3 wire, 3CT Three phase, 3 wire, 2CT Single-phase three-wire system Single-phase two-wire system
	Frequency	50 60	Note: This frequency must be consistent with the actual nominal frequency of the grid
	Nomination Voltage		Note: the nominal voltage must be consistent with the actual nominal voltage of the grid.

	Setting	Value	Description or Comment
	PT Ratio		This page is used to configure the voltage transformer Transformation ratio = (primary voltage / secondary voltage value) * 10000. unit V/V when the device voltage transformer is connected. **When there is no PT access, the value needs to be set to 10000**
	Current Conversation Coefficient		This page is used to configure the current conversion coefficient of the device Value = (actual conversion factor value) * 10000. **When the conversion current value is not required, the value needs to be set to 10000** The meter shows the current value = the measured current value * the conversion coefficient
Current transformer parameters CUr	Current Sensor Type		
	Phase ABC Current Sensor Ratio		
	Phase ABC Nominal Current		

	Setting	Value	Description or Comment
	Phase N Current Sensor Ratio		
	Phase N Nominal Current		
	Current Sensor Direction		
	Current Sensor Channel		
dr IF	Zero-drift suppression parameters		
tAr 1	Tariff parameters		
dMd	Demand parameters		
CoM	Communication parameters		
rELY	Relay parameters		
dEU	Device parameters		
CLr	Clear		
	Modbus Status		Enabled or Disabled
	Device ID		000-247
	Baud rate		2400, 4800, 9600, 19200, 38400
	Parity		None, Odd, Even

	Setting	Value	Description or Comment
	Stop Bits		1 or 2
	Demand Method		Fixed or Sliding
	Demand Interval		1-60 minutes (15 minutes is the default option)
	Tariff details		
	System Time		Year / month / day time: minutes: seconds

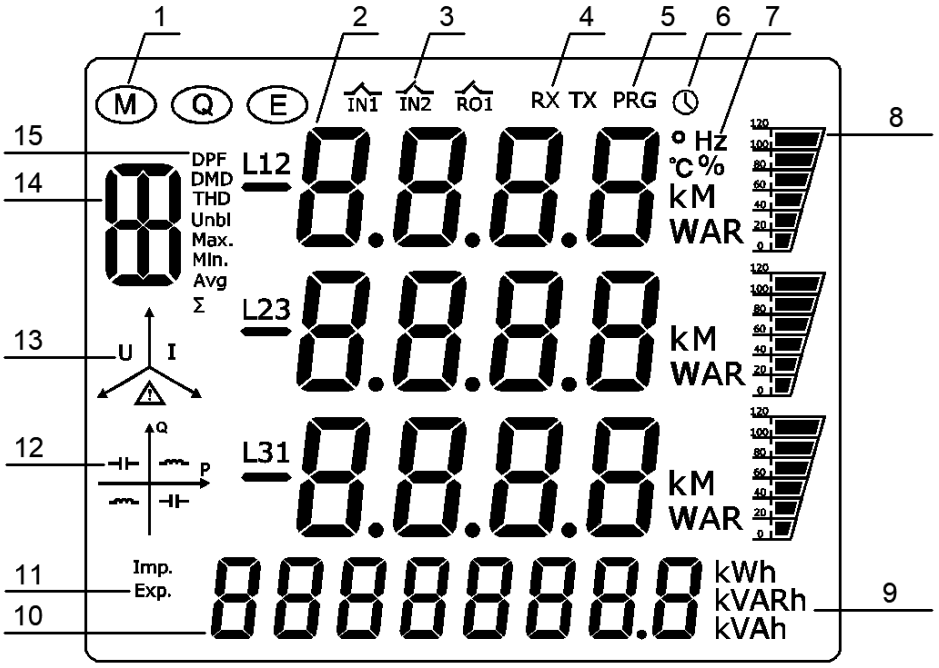
Operation



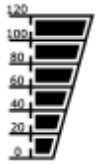
Using the Power Meter

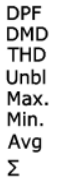
HMI / Display

The meter adopts LCD display and 4 control buttons, and all the display segments of the screen are shown in the figure below.



No.	Symbol	Description
1	M Q E	**M**: Indicates that the current interface is a real-time measurement data display **Q**: Indicates that the current interface is a power quality display **E**: Indicates that the current interface is an energy display

No.	Symbol	Description
2	8	Used to display various data
3	IN1 IN2 RO1	**IN1**: Status display for digital input channel 1 **IN2**: Status display for digital input channel 2 **RO1**: Status display of relay output channel
4	RX TX	The communication status display. When there is data sent and received, **RX TX** will be displayed, otherwise there will be no display
5	PRG	Device configuration mode displays, in which device parameters can be configured
6		Device information mode display, in which you can view device information
7	Measurement data units	Voltage: V, KV, MV Current: A, KA, MA Active power: W, KW, MW Reactive power: VAR, KVAR, MVAR Apparent power: VA, KVA, MVA Frequency: Hz Percentage: %
8		Voltage, current, power as a percentage of nominal value is displayed
9	kWh kVARh kVAh	Energy unit display **kWh**: Active Energy **kVARh**: Reactive Energy **kVAh**: Apparent Energy
10	8	Energy value display
11	Imp. Exp.	Energy positive and negative displays **Imp**.: Positive Energy **Exp**.: Negative Energy

No.	Symbol	Description
12		Power quadrant and load capacitance display
13		Voltage and current phase sequence display When the voltage phase sequence is incorrect, the symbol () flashes When the current phase sequence is incorrect, the symbol () flashes
14		Used to display data types: Voltage: U Current: I Active power: P Reactive power: Q Apparent power: S Energy: E
15		Types of power quality parameters: Power factor: PF Displacement power factor: DPF Demand: DMD Total harmonics Distortion: THD, Unbalance: Unbl Maximum: Max. Minimum: Min. Average: Avg Total: Σ

The four buttons of the meter are shown below:

Button	Description
ESC	**Back key:** - Used to exit the current operation interface - Switch between data display and settings (configuration)
▲	**Up key:** Short Press: - Switch the interface display - change values Long press: - shift
▼	**Down key:** Short Press: - Switch the interface display - change values Long press: - shift
ok	**Confirm key**: Used to confirm the operation

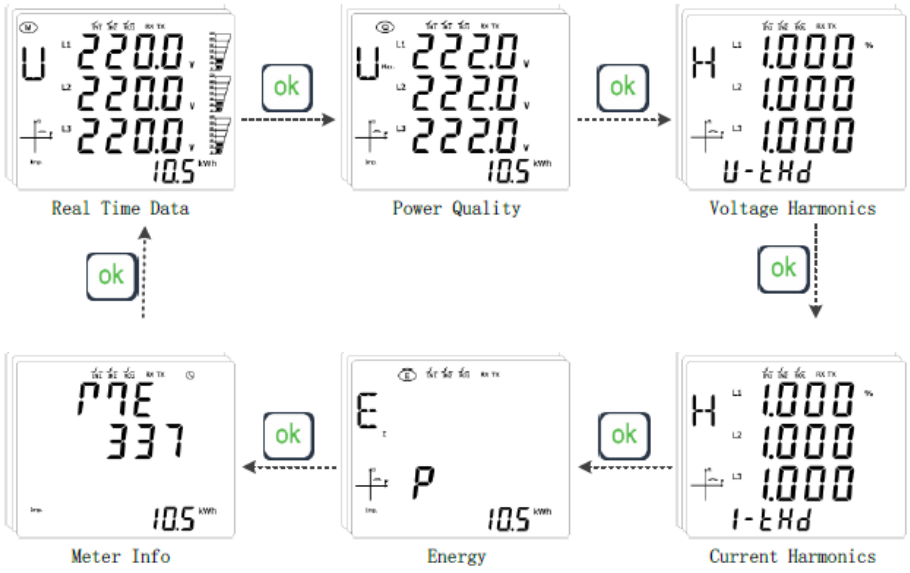
Switching between Data and Settings

To switch between the data display and the settings menus, press the ESC button

Data Displays

There are a total of 6 data display modes: (i) real-time measurement data display, (ii) power quality display, (iii) voltage harmonic display, (iv) current harmonic display, (v) Energy display and (vi) device information display.

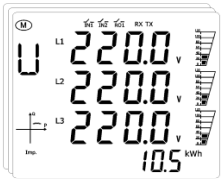
To switch between the data displays, press the ok button

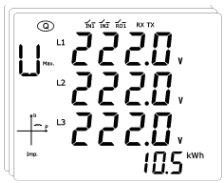
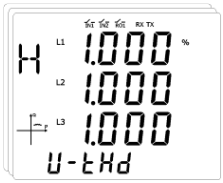


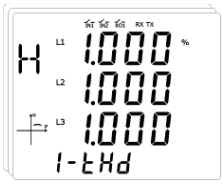
Sub-Displays

Each of the 6 data displays (shown above) have sub-displays (see table below). Sub-displays will vary depending on the wiring types.

Use the Up and Down buttons  to cycle through the other displays

Data Display	Sub Displays Wiring type will determine which sub displays you can see
Real Time Data 	Phase Voltage Line Voltage Phase/Line Voltage AVG Current Phase N Current Phase ABC Current AVG Frequency Total Frequence PF Total PF DPF Total DPF Active Power Total Active Power Reactive Power Total Reactive Power Apparent Power Total Apparent Power
Power Quality	Phase Voltage Max Phase Voltage Min Line Voltage Mas Line Voltage Min Current Max

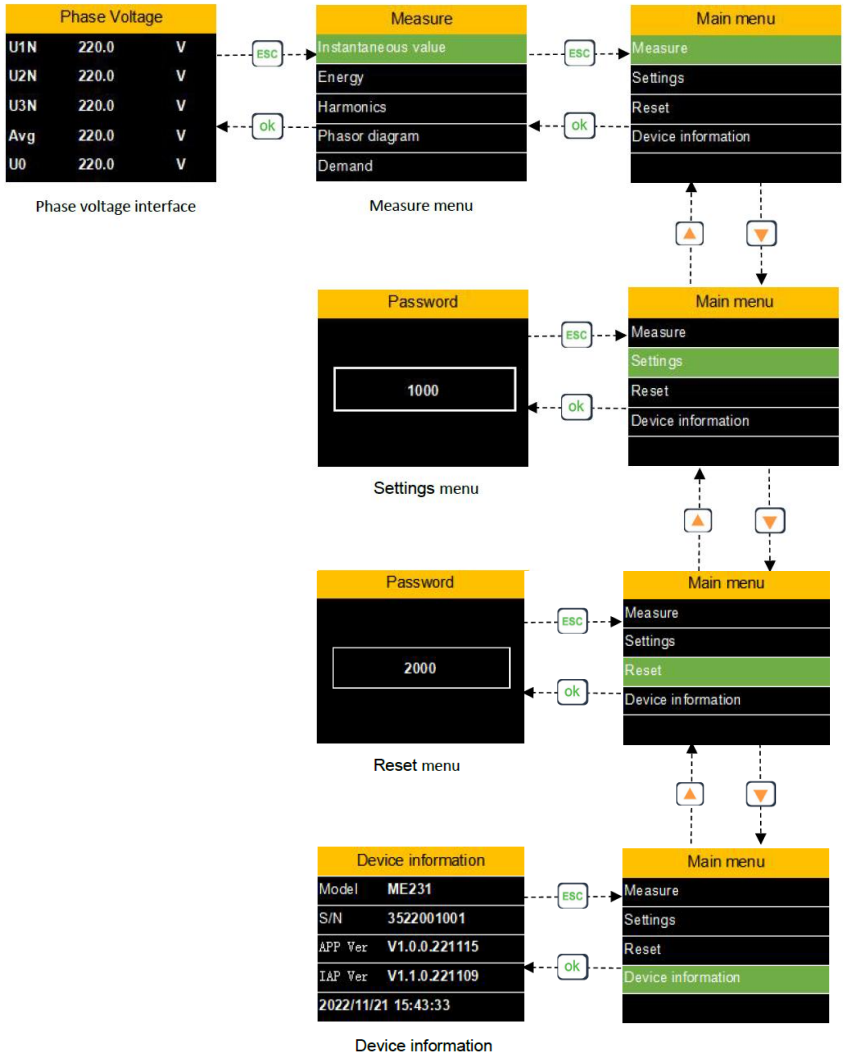
Data Display	Sub Displays Wiring type will determine which sub displays you can see
	Current Min Active Power Max Total Active Power Max Active Power Min Total Active Power Min Reactive Power Max Total Reactive Power Max Reactive Power Min Total Reactive Power Min Apparent Power Max Total Apparent Power Max Apparent Power Min Total Apparent Power Min Voltage Negative sequence/zero sequence imbalance Current Negative sequence/zero sequence imbalance Voltage Angle Current Angle Power Factor Angle Active Power Demand Total Active Power Demand Active Power Demand Max Total Active Power Demand Max Reactive Power Demand Total Reactive Power Demand Reactive Power Demand Max Total Reactive Power Demand Max Apparent Power Demand Total Apparent Power Demand Apparent Power Demand Max Total Apparent Power Demand Max
Voltage Harmonics 	Voltage THD Voltage 1st harmonic distortion Voltage 2nd harmonic distortion . . Voltage 3rd to 48th harmonic distortion .

Data Display	Sub Displays Wiring type will determine which sub displays you can see
	. Voltage 49th harmonic distortion Voltage 50th harmonic distortion
Current Harmonics 	Current THD Current 1st harmonic distortion Current 2nd harmonic distortion . . Current 3rd to 48th harmonic distortion . . Current 49th harmonic distortion Current 50th harmonic distortion
Energy 	Total Active Energy Import Phase A Active Energy Import Phase B Active Energy Import Phase C Active Energy Import Total Reactive Energy Import Phase A Reactive Energy Import Phase B Reactive Energy Import Phase C Reactive Energy Import Total Apparent Energy Phase A Apparent Energy Phase B Apparent Energy Phase C Apparent Energy Total Active Energy Export Phase A Active Energy Export Phase B Active Energy Export Phase C Active Energy Export Total Reactive Energy Export Phase A Reactive Energy Export Phase B Reactive Energy Export Phase C Reactive Energy Export Tariff Energy-1 Tariff Energy-2 Tariff Energy-3 Tariff Energy-4

Data Display	Sub Displays Wiring type will determine which sub displays you can see
	Tariff Energy-5 Tariff Energy-6
Meter Info 	Meter Model Firmware Version Serial Number Date Time Address Baud Rate Parity Stop Bit Energy Cost Internal Temperature

Menu Structure

- Press the **ESC** or **OK** buttons to move between menus and sub-menus.
- Press the **Up** or **Down** button to move between options within a menu.



Phase voltage interface

Measure menu

Settings menu

Reset menu

Device information

Settings Menu

The Settings Menu options are used to configure the power meter. At a minimum, you must check / set the following information before using the power meter. You must also update the Current Sensor information if you change Rogowski Coil size.

- Wire Type (eg 3P3W_3CT)
- Frequency (eg 50Hz)
- Nominal Voltage (eg 240VAC)
- VT and CT ratio (eg 1.0)
- Current sensor type (eg 1,000 Amp Rogowski Coil)
- Modbus RS485 settings (device ID, baud rate, parity, stop bits)

Password

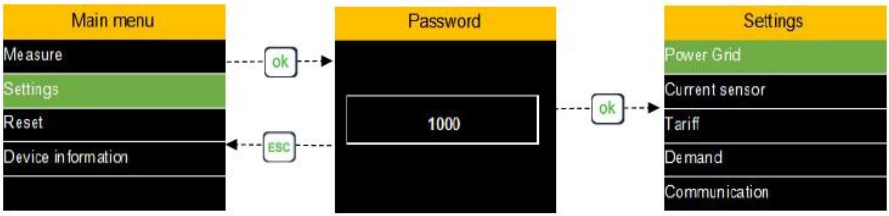
You need to enter a password to access the power meter settings.

Default password for Settings menu = 1000.

Forgot your password? Enter the last four digits of the device serial number to enter the Settings menu.

To enter the password:

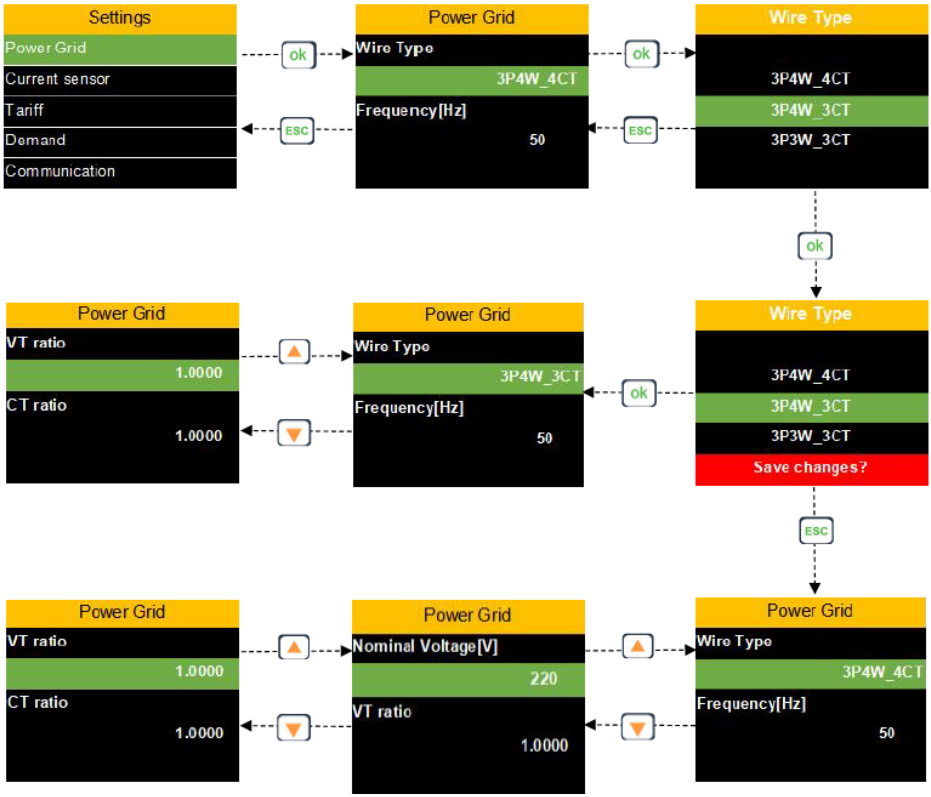
- Press the **OK** button
- **Short press** the **Up** or **Down** button to change the number
- **Long press** the **Up** or **Down** to move left or right (to select the previous / next number). Short press up / down to change the number. Repeat for all digits
- Once the password is correct, press the **OK** button.
    - If the password is correct, you will see the Settings screen
    - If the password is incorrect, you will stay on the Password screen.



Settings > Power Grid

The **Power Grid** sub-menu sets the Wiring Type, Frequency, Nominal Voltage, VT ratio and CT ratio.

- **Wire Type**: 3P4W 4CT, 3P4W 3CT, 3P3W 3CT, 3P3W 2CT, 1P3W, 1P2W
- **Frequency**: 50 or 60
- **Nominal Voltage**: 00001-65535
- **VT ratio**: 1~10000
    - (primary end voltage / secondary end voltage)*10000.Unit V/V
- **CT ratio**: 1~10000
    - (primary end current / secondary end current)*10000.Unit A/A.

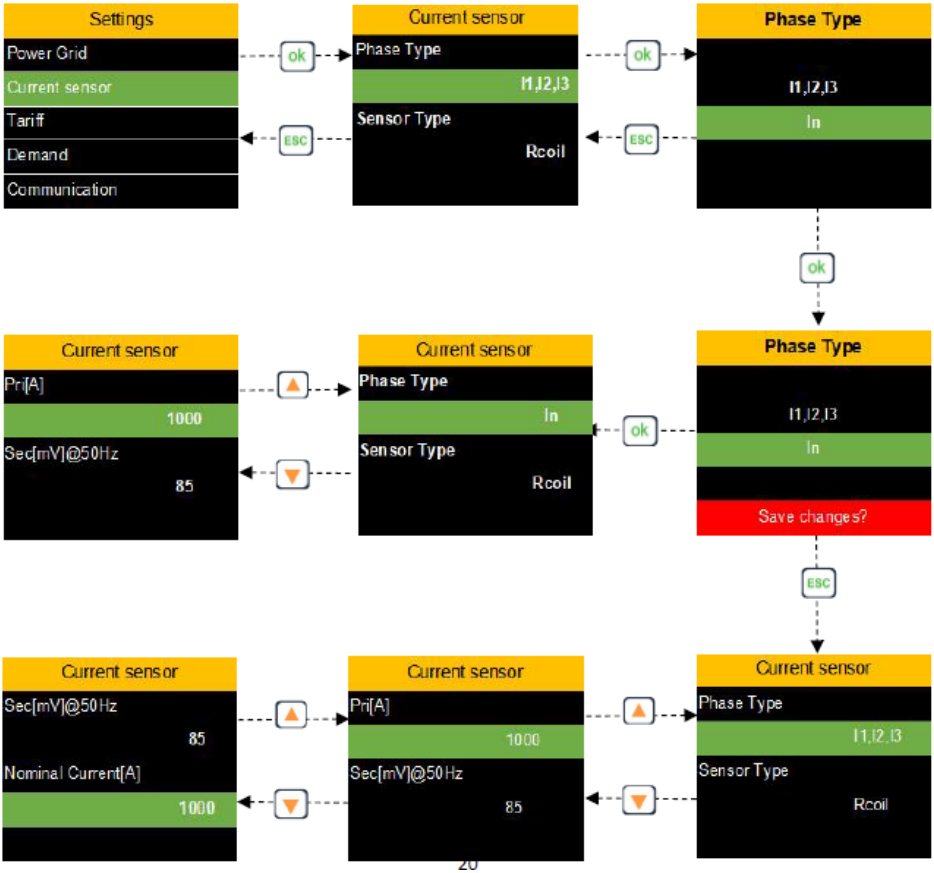


Settings > Current Sensor

The **Current Sensor** sub-menu sets the type of current sensor you will use.

- **Phase Type**: I1, I2, I3 or In
- **Sensor Type**: Rcoil (Rogowski coil) or VCT (Voltage output type CT)
- **Rated current of Rogowski coil (Pr[A]):** 500, 1000 or 3000
- **Nominal Current**: (the actual measured rated current value): 500, 1000 or 3000
- **secondary output value corresponding to the rated primary current (Sec[mV]@50Hz**: 85

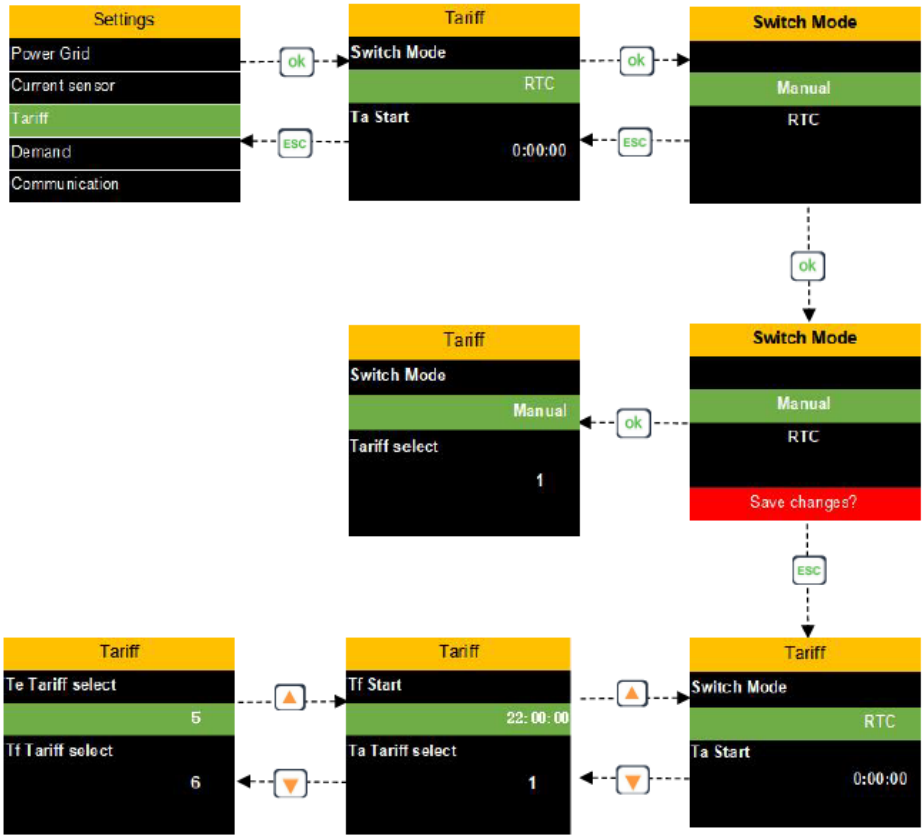
Note: If you replace the Rogowski Coil with different size or ratio, the Pri/Sec must be reset.



Settings > Tariff

The **Tariff** sub-menu sets the Switch Mode, Start time and Tariff select.

- **Switch Mode**: Manual or RTC
- **Manual Mode**: Can set Ta, Tb, Tc, Td, Te, Tf, 6 Tariff select
- **RTC Mode**: Can set Ta, Tb, Tc, Td, Te, Tf, 6 Start times and 6 Tariff select.



Settings > Demand

The **Demand** sub-menu sets the Calculation Method and Calculation Interval (in minutes).

Calculation method

- Fixed: updates the demand according to the calculation interval
- Sliding type: updates the demand once a minute

Calculation interval (minutes)

- Range: 1-60 minutes
- Default: 15 minutes

Settings > Communication

The **Communication** sub-menu sets the Modbus RS485 settings.

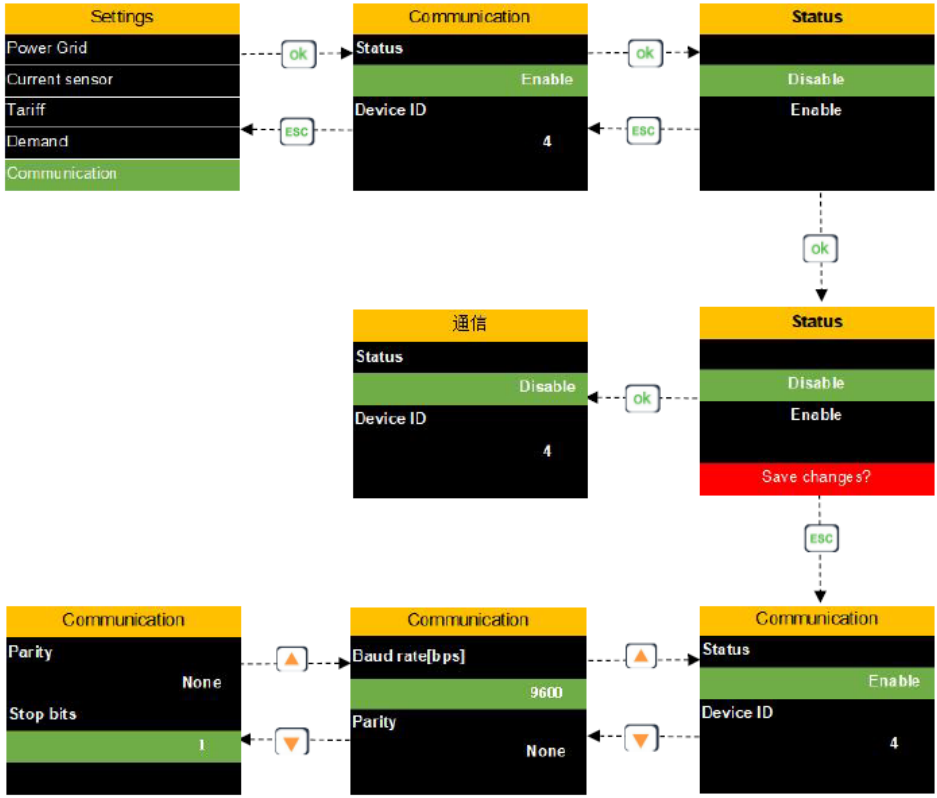
Status: Enable or Disable

Device ID (Address): 000-247 (default = 1)

Baud rate[bps]: 2400, 4800, 9600, 19200, 38400 (default = 19200)

Parity: None, Odd, Even (default = None)

Stop bits: 1 or 2 (default = 1)



Settings > HMI

The **HMI** sub-menu sets the Language, Clock, Key Tone and Backlight Brightness.

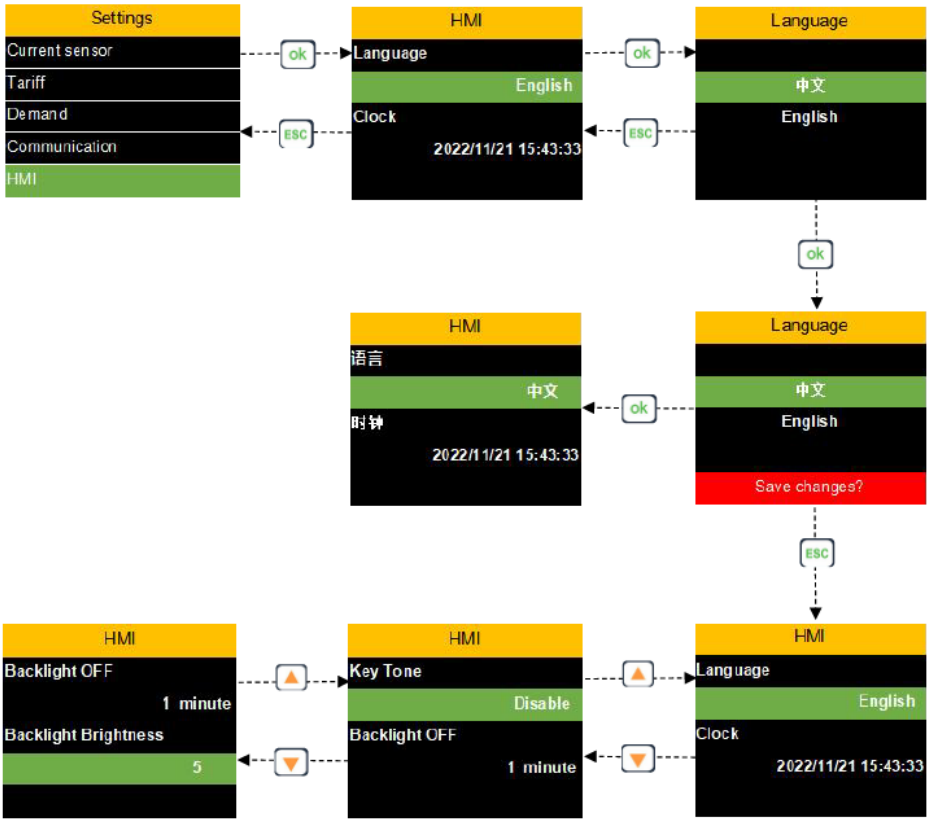
Language: English or Chinese

Clock: Year / month / day time: minutes: seconds

Key Tone: Enable or Disable

Backlight OFF: Never, 1 minute, 2 minutes, 3 minutes, 4 minutes, 5 minutes

Backlight Brightness: 1-5

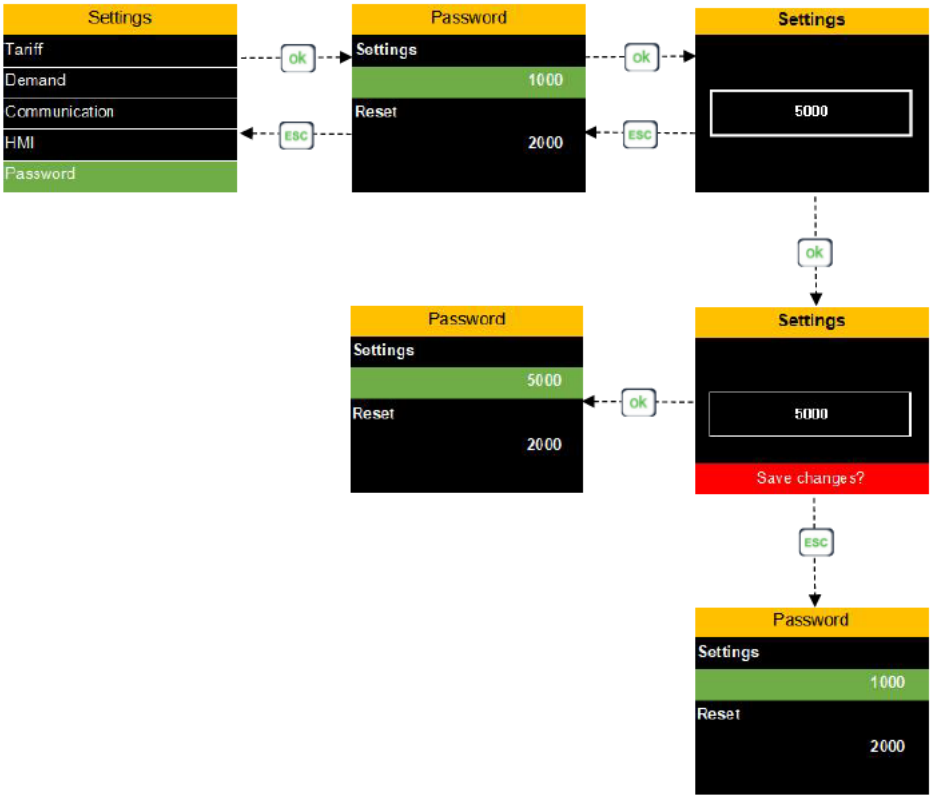


Settings > Password

The **Password** sub-menu allows you to change the settings menu and/or reset menu password.

Settings password: 0001-9999 (default = 1000)

Reset password: 0001-9999 (default = 2000)



Warranty

CAA Sensors provides a 12-month warranty for all Power Meters. The warranty covers materials and workmanship under the stated operating conditions from the date of delivery. Please report any findings immediately and within the warranty time.

If faults occur during the warranty period CAA Sensors will repair or replace the defective unit, without charge for repair labour and material costs but there is a charge for other services such as labour to remove or reinstall the instrument, transport and packing. Warranty repairs do not extend the period of warranty.

The following damage is excluded from this warranty:

- Improper use and non-adherence to the user manual.
- Use of unsuitable accessories.
- External influences (e.g. damage caused by vibration, damage during transportation, excess heat or moisture).

The warranty is cancelled when one of the following situations occurs:

- The user opens the measurement instrument without a direct request written in this manual.
- Repairs or modifications are undertaken by third parties or unauthorised persons.
- The serial number has been changed, damaged or removed.

Other claims, especially damage occurring on the outside of the instrument (e.g. dents, marks), are not included unless responsibility is legally binding.

Need help?

For more information, contact CAA Sensors:

- Phone: +61 494095632
- WhatsApp: +61 494095632
- E-mail: sales@caasensors.com

Modbus Communication

Appendix – Modbus Communication Protocol

Modbus communications overview

This power meter adopts standard protocol — **Modbus-RTU**.

You can change the **baud rate** of communication to 1200, 2400, 4800, 9600 etc.

Error detection: CRC16 (cyclic redundancy check).

Modbus communications settings

Before communicating with the device using Modbus-RTU protocol, use the Power Meter's Display to configure the following settings:

Parameters	Available Values	Default Value
Baud rate	1200 Baud 2400 Baud 4800 Baud 9600 Baud 19200 Baud 38400 Baud 57600 Baud	9600 Baud
Data bits	8	8
Parity	Odd Even None	None
Stop bits	1	1
Address	1–247	1

Command Request

Slave Address	Function Code	Command Block	CRC
8-Bits	8-Bits	N×8-Bits	16-Bits Checking

Functional code

Functional code tells what function addressed terminal equipment can execute. The following table lists the functional code that used by this power meter, as well as their significance and function.

Function Code		Function Name	Behaviour
Decimal	Hexa-decimal		
3	03H	Read Holding Registers	Read present HEX from one or more registers.
16	10H	Write Multiple Registers	Write present HEX on multiple registers.

Register table

Register tables have the following columns:

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description

Where

- **Register Alias**: The meaning of the register
- **Register Address**: Modbus address of register encoded in the Modbus frame, in decimal (dec)
- **Action**: The read/write by command register
- **Size**: The data size in Int16
- **Type**: The encoding data type
- **Units**: The unit of the register value

- **Range**: The permitted values for this variable, usually a subset of what the format allows
- **Description**: Provides information about the register and the values that apply

Unit Table

The following data types appear in the Modbus register list:

Type	Description	Range
UInt16	16-bit unsigned integer	0 to 65535
Int16	16-bit signed integer	-32768 to +32767
UInt32	32-bit unsigned integer	0 to 4 294 967 295
UInt64	64 bit unsigned integer	0 to 18 446 744 073 709 551 615
UTF8	8-bit field	Multibyte character encoding for Unicode
Float32	32-bit value	Standard representation IEEE for floating number (with single precision)
Bitmap	–	–
Date Time	–	-

Date Time Format

	Units															
Word	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	Reserved (0)								Year (0–99, year from 2000)							
2	Month (1–12)								Day (1–31)							
3	Hour (0–23)								Minute (0–59)							
4	Millisecond (0–59999)															

Configure Meter

You can configure the power meter by writing command and command parameters to corresponding command registers using Modbus function 16.

Command request

The following table describes a Modbus command request:

Slave Address (8 bits)	Function Code (8 bits)	Command Register Address (16 bits)		Command Register Number (16 bits)		Data Length (8 bits)	Command Register Value (16 bits) X N				CRC (16 bits)	
1-247	16	High 8 bits	Low 8 bits	High 8 bits	Low 8 bits	N×2	Command		Parameter		Low 8 bits	High 8 bits
							High 8 bits	Low 8 bits	High 8 bits	Low 8 bits		

Command Result

The command result can be obtained by reading registers 424 and 425.

The following table describes the command result:

Register Address	Content	Size (Int16)	Data (example)
424	Requested Command Number	1	1001(set Date Time)
425	Result	1	0 = Valid Operation 80 = Invalid Command 81 = Invalid Parameter 82 = Invalid Number of Parameters 83 = Operation Not Performed

Command Request Example

Slave Address (8 bits)	Function Code (8 bits)	Command Register Address (16 bits)		Command Register Number (16 bits)		Data Length (8 bits) N x 2	Command Register Value (16 bits) X N				CRC (16 bits)	
							Command		Parameter			
		High 8 bits	Low 8 bits	High 8 bits	Low 8 bits		High 8 bits	Low 8 bits	High 8 bits	Low 8 bits	High 8 bits	Low 8 bits

Function code (0x10=16) Operation

Function code (0x10=16) is used to configure the meter.

Request data format:

No.	Alias	Type	Range (decimal)	Description
1	Salve ID	UInt8	1-247	
2	Function code	UInt8	16	
3	Registers Start address	UInt16	-	Big-Endian (Sending order)
4	Registers Numbers	UInt16	1-123	Big-Endian (Sending order)
5	Bytes of Registers Values	UInt8		Registers Numbers x 2
6	Value of Register 1	UInt16	-	Big-Endian (Sending order)
7	...	UInt16	-	Big-Endian (Sending order)
8	Value of Register n	UInt16	-	Big-Endian (Sending order)

No.	Alias	Type	Range (decimal)	Description
9	CRC-16 Check	UInt16	-	Little-Endian (Sending order)

Response data format:

No.	Alias	Type	Range (decimal)	Description
1	Salve ID	UInt8	1-247	
2	Function code	UInt8	16	
3	Registers Start address	UInt16	300	Big-Endian
4	Registers Numbers	UInt16	1-123	Big-Endian
5	CRC-16 Check	UInt16	-	Little-Endian

Attention: Function code (0x10=16) can only write data to "Command Register, that is, only registers starting from 300 can be written data.

For example: Configure "Digital Outputs" (command=1005)

No.	Alias	Type	Range (decimal)	Range (hexadecimal)	Description
1	Salve ID	UInt8	1	01	
2	Function code	UInt8	16	10	
3	Registers Start address	UInt16	300	012C	Big-Endian (Sending order)
4	Registers Numbers	UInt16	2	0002	Big-Endian (Sending order)
5	Bytes of Registers Values	UInt8	4	04	

No.	Alias	Type	Range (decimal)	Range (hexadecimal)	Description
6	Value of Register 300	UInt16	1005	03ED	Big-Endian (Sending order)
7	Value of Register 301	UInt16	1	0001	Big-Endian (Sending order)
9	CRC-16 Check	UInt16	50093	C3AD	Little-Endian (Sending order)

Request data send as follows: 01 10 01 2C 00 02 04 03 ED 00 01 AD C3

If the configured data is right, the meter will response data as follows: 01 10 01 2C 00 02 81 FD

No.	Alias	Type	Range (hexadecimal)	Range (decimal)
1	Salve ID	UInt8	01	1
2	Function code	UInt8	10	16
3	Registers Start address	UInt16	012C	300
4	Registers Numbers	UInt16	0002	2
7	Value of Register 301	UInt16	81FD	1

Function code (0x03=3) Operation

Function code (0x03=3) is used to read registers values

Request data format

No.	Alias	Type	Range (decimal)	Description
1	Salve ID	UInt8	1-247	
2	Function code	UInt8	3	
3	Registers Start address	UInt16	-	Big-Endian (Sending order)
4	Registers Numbers	UInt16	1-125	Big-Endian (Sending order)
5	CRC-16 Check	UInt16	-	Little-Endian (Sending order)

Response data format

No.	Alias	Type	Range (decimal)	Description
1	Salve ID	UInt8	1-247	
2	Function code	UInt8	3	
3	Bytes of Registers Values	UInt8	-	Registers Numbers *2
4	Value of Register 1		-	Big-Endian
5	...		-	Big-Endian
6	Value of Register n		-	Big-Endian
7	CRC-16 Check	UInt16	-	Little-Endian

For example: Read Voltage A, B, C value (Address starts 2147)

No.	Alias	Type	Range (decimal)	Range (hexadecimal)	Description
1	Salve ID	UInt8	1	0x01	
2	Function code	UInt8	3	0x03	
3	Registers Start address	UInt16	2147	0x0863	
4	Registers Numbers	UInt16	6	0x0006	
5	CRC-16 Check	UInt16	46647	0xB637	

Request data send as follows: 01 03 08 63 00 06 37 B6

Response data as follows: 01 03 0C 43 5C 00 00 43 5D 00 00 43 5E 00 00 14 AC

No.	Alias	Type	Range (decimal)	Range (hexadecimal)	Description
1	Salve ID	UInt8	01	1	
2	Function code	UInt8	03	3	
3	Bytes of Registers Values	UInt8	0C	12	
4	Voltage A	float32	435C0000	220V	
5	Voltage B	float32	435D0000	221V	
6	Voltage C	float32	435E0000	222V	
7	CRC-16 Check	UInt16	14AC		

Exception response

Exception response frame format

No.	Alias	Type	Range (decimal)	Range (hexadecimal)	Description
1	Salve ID	UInt8	1-247	0x01-0xF7	
2	Function code	UInt8	(128+3) (128+16)	(0x80+0x03) (0x80+0x10)	
3	Exception code	UInt8			
4	CRC-16 Check	UInt16			Little-Endian

Exception code of MODBUS

Code (hexadecimal)	Name	Meaning
0x01	ILLEGAL FUNCTION	The function code received in the query is not an allowable action for the meter
0x02	ILLEGAL DATA ADDRESS	The data address received in the query is not an allowable address for the meter
0x03	ILLEGAL DATA VALUE	A value contained in the query data field is not an allowable value for the meter
0x04	DEVICE FAILURE	An unrecoverable error occurred while the server was attempting to perform the requested action.

Command List

Set System Date Time

Command Number	Action R/W	Size	Type	Units	Range	Description
1001	Write (W)	1	UInt16	-	2000-2099	Year
	Write (W)	1	UInt16	-	1-12	Month
	Write (W)	1	UInt16	-	1-31	Day
	Write (W)	1	UInt16	-	0-23	Hour
	Write (W)	1	UInt16	-	0-59	Minute
	Write (W)	1	UInt16	-	0-59	Second

Set Communications

Command Number	Action R/W	Size	Type	Units	Range	Description
1002	Write (W)	1	UInt16	-	1-247	Slave Address
	Write (W)	1	UInt16	-	0,1,2,3,4,5,6	Baud Rate 0=1200 1=2400 2=4800 3=9600 4=19200 5=38400 6=57600
	Write (W)	R/WC	UInt16	-	0,1,2	Parity 0 = Odd 1 = Even 2 = None

Set Power System

Command Number	Action R/W	Size	Type	Units	Range	Description
1003	Write (W)	1	UInt16	-	0,1,2,3,4	Wiring 0 = 1PH2W L–N 1 = 1PH2W L–L 2 = 3PH4W 3 = 3PH3W 4 = 1PH3W_LLN
	Write (W)	1	UInt16	Hz	50,60	Nominal Frequency VT Primary
	Write (W)	2	UInt32	V	>0	VT Secondary =RealValue*1000
	Write (W)	2	UInt32	V	>0	CT Primary
	Write (W)	2	UInt32	A	>0	CT Secondary =RealValue*1000
	Write (W)	2	UInt32	mV	>0	Rcoil Primary
	Write (W)	2	UInt32	A	>0	Rcoil Secondary =RealValue*1000
	Write (W)	2	UInt32	mV	>0	Voltage Connection 0 = Direct Connect 1 = 3 VT
	Write (W)	1	UInt16	-	0,1	Current Connection 0 = Rogowski coil 1 = CT

Set Harmonic Times

Command Number	Action R/W	Size	Type	Units	Range	Description
1004	Write (W)	1	UInt16	-	2-52	HX harmonic times
	Write (W)	1	UInt16	-	2-52	HY harmonic times
	Write (W)	1	UInt16	-	2-52	HZ harmonic times

Set Digital Output

Command Number	Action R/W	Size	Type	Units	Range	Description
1005	Write (W)	1	UInt16	-	0,1	1= Relay output on 0 = Relay output off

Reset Energy

Command Number	Action R/W	Size	Type	Units	Range	Description
2000	Write (W)	1	UInt16	-	100-103	100: Reset Phase 1 101: Reset Phase 2 102: Reset Phase 3 103: Reset Phase 1, 2, 3

Reset Peak Demand

Command Number	Action R/W	Size	Type	Units	Range	Description
2002	Write (W)	1	UInt16	-	1	1: Reset Peak Demand

Modbus Register List

Meter

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Meter Model	50	R	20	UTF8	-	
Serial Number	70	R	2	UInt32	-	
Firmware Version	72	R	1	UInt16	-	DLF format: X.Y.ZTT
Date Time	73	R/WC	4	Data Time	-	Date/Time Reg.73: Year 00-99 (year from 2000 to 2099) Reg.74: Month (b15:b8), Day (b7:b0) Reg.75: Hour (b15:b8), Minute (b7:b0) Reg. 76: Millisecond

Communications

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Address	80	R/WC	1	UInt16	-	1 to 247
Baud Rate	81	R/WC	1	UInt16	-	0 = 1200 1 = 2400 2 = 4800 3 = 9600 4 = 19200

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
						5 = 38400 6 = 57600
Parity	82	R/WC	1	UInt16	-	0 = ODD 1 = EVEN 2 = None

Power System

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Wiring Type	90	R/WC	1	UInt16	-	0 = 1PH2W L–N 1 = 1PH2W L–L 2 = 3PH4W 3 = 3PH3W 4 = 1PH3W_LLN
Nominal Frequency	91	R/WC	1	UInt16	Hz	
VT Primary	92	R/WC	2	UInt32	V	
VT Secondary	94	R/WC	2	UInt32	V	RealValue=ReadValue/1000
CT Primary	96	R/WC	2	UInt32	A	
CT Secondary	98	R/WC	2	UInt32	mV	RealValue=ReadValue/1000
Rcoil Primary	100	R/WC	2	UInt32	A	
Rcoil Secondary	102	R/WC	2	UInt32	mV	RealValue=ReadValue/1000
Voltage Connection	104	R/WC	1	UInt16	-	0 = Direct Connect 1 = 3 VT
Current Connection	105	R/WC	1	UInt16	-	0 = Rogowski coil 1 = CT

Digital Output Status

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Digital Output Status	150	R/WC	1	-	-	1 = Relay output on 0 = Relay output off

Tariff Status

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Tariff Status	160	R/WC	1	-	-	1 = Tariff 1 2 = Tariff 2 3 = Tariff 3 4 = Tariff 4

Command Register

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Command Code	300	R/W	1	UInt16	-	
Parameter 001	301	R/W	1	UInt16	-	
Parameter 002	302	R/W	1	UInt16	-	
...	...	R/W	1	UInt16	-	
Parameter 123	423	R/W	1	UInt16	-	
Requested Command	424	R	1	UInt16	-	
Command Result	425	R	1	UInt16	-	0 = Valid Operation 80 = Invalid Command 81 = Invalid Parameter

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
						82 = Invalid Number of Parameters 83 = Operation Not Performed

Basic Data - Power factor, frequency, harmonics, Current, voltage, power

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Power Factor						
PF1	2000	R	2	Float32	-	Phase 1 Power Factor
PF2	2002	R	2	Float32	-	Phase 2 Power Factor
PF3	2004	R	2	Float32	-	Phase 3 Power Factor
PF Avg	2006	R	2	Float32	-	Average of PF1, PF2, PF3
DPF1	2008	R	2	Float32	-	Phase 1 Displacement Power Factor
DPF2	2010	R	2	Float32	-	Phase 2 Displacement Power Factor
DPF3	2012	R	2	Float32	-	Phase 3 Displacement Power Factor
DPF Avg	2014	R	2	Float32	-	Average Of DPF1, DPF2, DPF3
Frequency						
Freq1	2016	R	2	Float32	Hz	Phase 1 Frequency
Freq2	2018	R	2	Float32	Hz	Phase 2 Frequency

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Freq3	2020	R	2	Float32	Hz	Phase 3 Frequency
FreqAvg	2022	R	2	Float32	Hz	Average of Freq1, Freq2, Freq3
Harmonics Configuration						
HX harmonic times	2024	R/WC	1	UInt16	-	Range:2-52
HY harmonic times	2025	R/WC	1	UInt16	-	Range:2-52
HZ harmonic times	2026	R/WC	1	UInt16	-	Range:2-52
Current Harmonics						
I1THDx	2027	R	2	Float32	%	Phase 1 X times harmonics current distortion
I2THDx	2029	R	2	Float32	%	Phase 2 X times harmonics current distortion
I3THDx	2031	R	2	Float32	%	Phase 3 X times harmonics current distortion
ITHDx Avg	2033	R	2	Float32	%	Average of I1THDx, I2THDx, I3THDx
I1THDy	2035	R	2	Float32	%	Phase 1 y times harmonics current distortion
I2THDy	2037	R	2	Float32	%	Phase 2 y times harmonics current distortion

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
I3THDy	2039	R	2	Float32	%	Phase 3 y times harmonics current distortion
ITHDy Avg	2041	R	2	Float32	%	Average of U1THDy, U2THDy, U3THDy
I1THDz	2043	R	2	Float32	%	Phase 1 z times harmonics current distortion
I2THDz	2045	R	2	Float32	%	Phase 2 z times harmonics current distortion
I3THDz	2047	R	2	Float32	%	Phase 3 z times harmonics current distortion
ITHDz Avg	2049	R	2	Float32	%	Average of U1THDz, U2THDz, U3THDz
I1THD	2051	R	2	Float32	%	Phase 1 total harmonics current distortion
I2THD	2053	R	2	Float32	%	Phase 2 total harmonics current distortion
I3THD	2055	R	2	Float32	%	Phase 3 total harmonics current distortion
ITHD Avg	2057	R	2	Float32	%	Average of U1THD, U2THD, U3THD
I1THx	2059	R	2	Float32	V	Phase 1 x times harmonics current
I2THx	2061	R	2	Float32	V	Phase 2 x times harmonics current

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
I3THx	2063	R	2	Float32	V	Phase 3 x times harmonics current
ITHx Avg	2065	R	2	Float32	V	Average of U1THx, U2THx, U3THx
I1THy	2067	R	2	Float32	V	Phase 1 y times harmonics current
I2THy	2069	R	2	Float32	V	Phase 2 y times harmonics current
I3THy	2071	R	2	Float32	V	Phase 3 y times harmonics current
ITHy Avg	2073	R	2	Float32	V	Average of U1THy, U2THy, U3THy
I1THz	2075	R	2	Float32	V	Phase 1 z times harmonics current
I2THz	2077	R	2	Float32	V	Phase 2 z times harmonics current
I3THz	2079	R	2	Float32	V	Phase 3 z times harmonics current
ITHz Avg	2081	R	2	Float32	V	Average of U1THz, U2THz, U3THz
Voltage Harmonics						
U1THDx	2083	R	2	Float32	%	Phase 1 X times harmonics voltage distortion
U2THDx	2085	R	2	Float32	%	Phase 2 X times harmonics voltage distortion
U3THDx	2087	R	2	Float32	%	Phase 3 X times harmonics voltage distortion

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
UTHDx Avg	2089	R	2	Float32	%	Average of U1THDx, U2THDx, U3THDx
U1THDy	2091	R	2	Float32	%	Phase 1 y times harmonics voltage distortion
U2THDy	2093	R	2	Float32	%	Phase 2 y times harmonics voltage distortion
U3THDy	2095	R	2	Float32	%	Phase 3 y times harmonics voltage distortion
UTHDy Avg	2097	R	2	Float32	%	Average of U1THDy, U2THDy, U3THDy
U1THDz	2099	R	2	Float32	%	Phase 1 z times harmonics voltage distortion
U2THDz	2101	R	2	Float32	%	Phase 2 z times harmonics voltage distortion
U3THDz	2103	R	2	Float32	%	Phase 3 z times harmonics voltage distortion
UTHDz Avg	2105	R	2	Float32	%	Average of U1THDz, U2THDz, U3THDz
U1THD	2107	R	2	Float32	%	Phase 1 total harmonics voltage distortion
U2THD	2109	R	2	Float32	%	Phase 2 total harmonics voltage distortion

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
U3THD	2111	R	2	Float32	%	Phase 3 total harmonics voltage distortion
UTHD Avg	2113	R	2	Float32	%	Average of U1THD, U2THD, U3THD
U1THx	2115	R	2	Float32	V	Phase 1 x times harmonics voltage
U2THx	2117	R	2	Float32	V	Phase 2 x times harmonics voltage
U3THx	2119	R	2	Float32	V	Phase 3 x times harmonics voltage
UTHx Avg	2121	R	2	Float32	V	Average of U1THx, U2THx, U3THx
U1THy	2123	R	2	Float32	V	Phase 1 y times harmonics voltage
U2THy	2125	R	2	Float32	V	Phase 2 y times harmonics voltage
U3THy	2127	R	2	Float32	V	Phase 3 y times harmonics voltage
UTHy Avg	2129	R	2	Float32	V	Average of U1THy, U2THy, U3THy
U1THz	2131	R	2	Float32	V	Phase 1 z times harmonics voltage
U2THz	2133	R	2	Float32	V	Phase 2 z times harmonics voltage
U3THz	2135	R	2	Float32	V	Phase 3 z times harmonics voltage
UTHz Avg	2137	R	2	Float32	V	Average of U1THz, U2THz, U3THz
Current						

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
I1	2139	R	2	Float32	A	Phase 1 Current
I2	2141	R	2	Float32	A	Phase 2 Current
I3	2143	R	2	Float32	A	Phase 3 Current
Current Avg	2145	R	2	Float32	A	Average of I1, I2, I3
Voltage						
U1	2147	R	2	Float32	V	Phase 1 Voltage
U2	2149	R	2	Float32	V	Phase 2 Voltage
U3	2151	R	2	Float32	V	Phase 3 Voltage
Voltage Avg	2153	R	2	Float32	V	Average of U1, U2, U3
Power						
P1	2155	R	2	Float32	kW	Active Power Phase 1
P2	2157	R	2	Float32	kW	Active Power Phase 1
P3	2159	R	2	Float32	kW	Active Power Phase 1
PTotal	2161	R	2	Float32	kW	Total Active Power
FQ1	2163	R	2	Float32	kVAR	Fundamental Reactive Power Phase 1
FQ2	2165	R	2	Float32	kVAR	Fundamental Reactive Power Phase 2
FQ3	2167	R	2	Float32	kVAR	Fundamental Reactive Power Phase 3
FQTotal	2169	R	2	Float32	kVAR	Total Fundamental Reactive Power
S1	2171	R	2	Float32	kVA	Apparent Power Phase 1

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
S2	2173	R	2	Float32	kVA	Apparent Power Phase 2
S3	2175	R	2	Float32	kVA	Apparent Power Phase 3
STotal	2177	R	2	Float32	kVA	Total Apparent Power

Energy

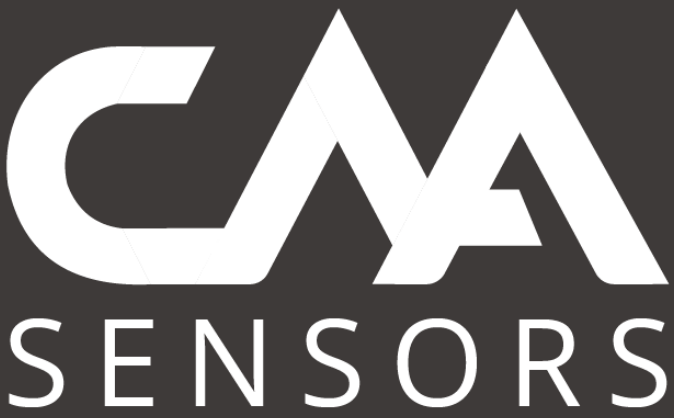
The energy values automatically reset to 0 when total energy reaches the limit of 1.0 x 10^9 kWh, 1.0 x 10^9 kVarh, or 1.0 x 10^9 kVah

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Active Energy						
EP1Imp	4000	R	2	UInt32	kWh	Active Energy Import Phase 1
EP2Imp	4002	R	2	UInt32	kWh	Active Energy Import Phase 2
EP3Imp	4004	R	2	UInt32	kWh	Active Energy Import Phase 3
EPsumImp	4006	R	2	UInt32	kWh	Total Active Energy Import Phase All
EP1Exp	4008	R	2	UInt32	kWh	Active Energy Export Phase 1
EP2Exp	4010	R	2	UInt32	kWh	Active Energy Export Phase 2
EP3Exp	4012	R	2	UInt32	kWh	Active Energy Export Phase 3

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
EPsumExp	4014	R	2	UInt32	kWh	Total Active Energy Export Phase All
Reactive Energy						
EQ1Imp	4024	R	2	UInt32	kVarh	Reactive Energy Import Phase 1
EQ2Imp	4026	R	2	UInt32	kVarh	Reactive Energy Import Phase 2
EQ3Imp	4028	R	2	UInt32	kVarh	Reactive Energy Import Phase 3
EQsumImp	4030	R	2	UInt32	kVarh	Total Reactive Energy Import Phase All
EQ1Exp	4032	R	2	UInt32	kVarh	Reactive Energy Export Phase 1
EQ2Exp	4034	R	2	UInt32	kVarh	Reactive Energy Export Phase 2
EQ3Exp	4036	R	2	UInt32	kVarh	Reactive Energy Export Phase 3
EQsumExp	4038	R	2	UInt32	kVarh	Total Reactive Energy Export Phase All
Apparent Energy						
ES1Imp	4048	R	2	UInt32	kVAh	Apparent Energy Import Phase 1
ES2Imp	4050	R	2	UInt32	kVAh	Apparent Energy Import Phase 2
ES3Imp	4052	R	2	UInt32	kVAh	Apparent Energy Import Phase 3
ESsumImp	4054	R	2	UInt32	kVAh	Total Apparent Energy Import Phase All

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
ES1Exp	4056	R	2	UInt32	kVAh	Apparent Energy Export Phase 1
ES2Exp	4058	R	2	UInt32	kVAh	Apparent Energy Export Phase 2
ES3Exp	4060	R	2	UInt32	kVAh	Apparent Energy Export Phase 3
ESsumExp	4062	R	2	UInt32	kVAh	Total Apparent Energy Export Phase All
Power / Current Demand						
PDemand	5000	R	2	Float32	kW	Active Power Present Demand
PPeakDemand	5002	R	2	Float32	kW	Active Power Peak Demand
PPeakDemandDate	5004	R	4	Date time	-	Active Power Peak Demand Date/Time
QDemand	5008	R	2	Float32	kW	Reactive Power Present Demand
QPeakDemand	5010	R	2	Float32	kW	Reactive Power Peak Demand
QPeakDemandDate	5012	R	4	Date time	-	Reactive Power Peak Demand Date/Time
SDemand	5016	R	2	Float32	kW	Apparent Power Present Demand
SPeakDemand	5018	R	2	Float32	kW	Apparent Power Peak Demand
SPeakDemandDate	5020	R	4	Date time	-	Apparent Power Peak Demand Date/Time
I1Demand	5024	R	2	Float32	kW	Current I1 Present Demand

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
I1PeakDemand	5026	R	2	Float32	kW	Current I1 Peak Demand
I1PeakDemandDate	5028	R	4	Date time	-	Current I1 Peak Demand Date/Time
I2Demand	5032	R	2	Float32	kW	Current I2 Present Demand
I2PeakDemand	5034	R	2	Float32	kW	Current I2 Peak Demand
I2PeakDemandDate	5036	R	4	Date time	-	Current I2 Peak Demand Date/Time
I3Demand	5040	R	2	Float32	kW	Current I3 Present Demand
I3PeakDemand	5042	R	2	Float32	kW	Current I3 Peak Demand
I3PeakDemandDate	5044	R	4	Date time	-	Current I3 Peak Demand Date/Time
IAvgDemand	5048	R	2	Float32	kW	Current IAvg Present Demand
IAvgPeakDemand	5050	R	2	Float32	kW	Current IAvg Peak Demand
IAvgPeakDemand Date	5052	R	4	Date time	-	Current IAvg Peak Demand Date/Time



CAA Sensors Pty Ltd

Address: 2/7 Narabang Way, Belrose NSW 2085, Australia

Phone / WhatsApp: +61 494 095 632

E-mail: sales@caasensors.com

Website: www.caasensors.com