EMpro-EE - multi-functional energy measuring devices for front panel installation

User manual

UM EN MM-EE-EEM-MA550
Order No. 1475401

User manual

EMpro-EE - multi-functional energy measuring devices for front panel installation

UM EN MM-EE-EEM-MA550, Revision 02 2023-05-10

This user manual is valid for:

Designation	Order No.
MM-EE-EEM-MA550	1475401

1475401_en_02

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phoenixcontact.com

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1 For your safety

Read this user manual carefully and keep it for future reference.

1.1 Labeling of warning notes

This symbol indicates hazards that could lead to personal injury.

There are three signal words indicating the severity of a potential injury.

DANGER
Indicates a hazard with a high risk level. If this hazardous situation is not avoided, it will result in death or serious injury.

WARNING
Indicates a hazard with a medium risk level. If this hazardous situation is not avoided, it could result in death or serious injury.

CAUTION
Indicates a hazard with a low risk level. If this hazardous situation is not avoided, it could result in minor or moderate injury.

This symbol together with the **NOTE** signal word warns the reader of actions that might cause property damage or a malfunction.

Here you will find additional information or detailed sources of information.

1.2 Qualification of users

The use of products described in this user manual is oriented exclusively to:

– Electrically skilled persons or persons instructed by them. The users must be familiar with the relevant safety concepts of automation technology as well as applicable standards and other regulations
– Qualified application programmers and software engineers. The users must be familiar with the relevant safety concepts of automation technology as well as applicable standards and other regulations.

1.3 Field of application of the product

1.3.1 Intended use

The EMpro-EE energy measuring devices described in this user manual are suitable for installation in electrical systems with different voltage levels and performance classes. Keep in mind that electrical systems pose hazards due to high voltages, high short-circuit currents, electric arcs and/or other hazards.

1.3.2 Product changes

Changes or modifications to hardware and software of the device are not permitted.

Incorrect operation or modifications to the device can endanger your safety or damage the device. Do not repair the device yourself. If the device is defective, please contact Phoenix Contact.

1.4 Safety notes

The "exclamation mark" on the device labeling means that you need to:

Read the installation note in its entirety. Follow the installation note to avoid impairing the intended protection.

- The installation, operation, and maintenance work must be completed by a qualified electrician. Follow the installation instructions as described. When installing and operating the device, the applicable regulations and safety directives (including national safety directives), as well as general technical regulations must be observed.
- Use an appropriate voltage measuring device to ensure that no voltage is present.
- Install the device in accordance with instructions described in the installation notes. Accessing circuits within the device is prohibited.
- Repairs may only be carried out by the manufacturer.
- Only clean the device with a suitable damp cloth. Switch the device off before cleaning and do not use abrasive agents or solvents.
- Ensure that all connection terminals are connected correctly to prevent the device from being damaged.
- Observe the maximum permissible voltages (600 V AC phase/phase or 345 V AC phase/neutral conductor).

2 Device description

The multifunction energy analyzer MM-EE-EEM-MA550 is a top new-generation intelligent panel meter, used not only in the electricity transmission and power distribution system, but also in the power consumption measurement and analysis in high voltage intelligent power grid.

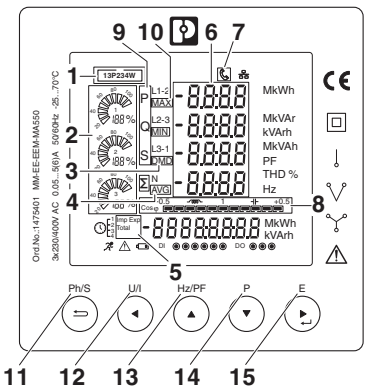
This document provides operating, maintenance and installation instructions for the Phoenix Contact MM-EE-EEM-MA550. The unit measures and displays the characteristics of 1p2w, 3p4w and 3p3w supplies, including voltage, frequency, current, power and active and reactive energy, imported or exported, Harmonic, Power factor, Max. Demand etc. Energy is measured in terms of kWh, kVArh and kVAh. Maximum demand current can be measured over preset periods of up to 60minutes.

In order to measure energy, the unit requires voltage and current inputs in addition to the supply required to power the product. The requisite current input(s) are obtained via current transformers. The MM-EE-EEM-MA550 can be configured to work with a wide range of CTs, giving the unit a wide range of operation. Built-in interfaces provide RS485 Modbus RTU communication.

The unit uses plug-in terminals for easy wiring and push-in mechanism for quick installation.

2.1 Operating and indication elements

Figure 2-1 Operating and indication elements



1 System type
2 Bar graph for power indication
3 DMD
4 Σ:Total
AVG: Average

5 IMP/EXP: import/Export Value,
Total: Total value

6 Measurement units

7 RS485 Modbus communication

8 The status bar of the total power factor

9 P: active power
Q: reactive power
S: apparent power

10 MAX/MIN Value

11 Ph/S: Click
- Power, voltage, current and energy of each phase
- Exit from the menu

Press 2S:
- Automatic Scroll display ON / OFF

12 U/I: Click
- Voltage and current of the selected system type.

(3p4w, 3p3w and 1p2w)
- Phase sequence
- Left key

Press 2S:
- Individual Harmonic Distortion of Voltage up to 63rd

13 Hz/PF: Click
- Power factor, frequency, Max. Demand.
- Max. and Min. of current and voltage
- Up key

Press 2S:
- Individual Harmonic Distortion of Current up to 63rd

14 P: Click
- Display active power, reactive power and apparent power
- Down key

Press 2S:
- Modbus setting information

15 E: Click
- Display total / import / export active or reactive energy
- Right key

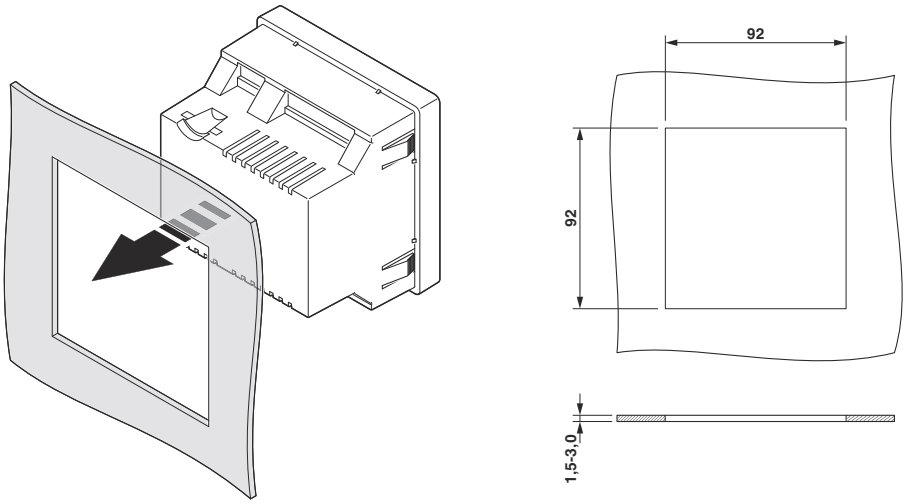
Press 2S:
- Set-up mode entry
- Confirmation

3 Mounting and installation

3.1 Mounting

You can install the device in a front panel or control cabinet door.

Figure 3-1 Mounting

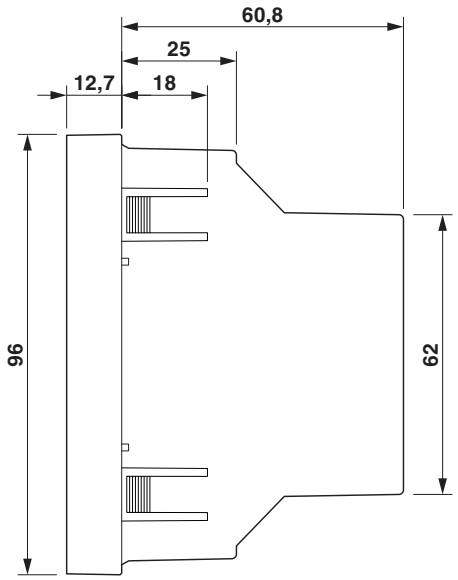


The unit may be mounted in a panel of any thickness up to a maximum of 3 mm.

Leave enough space behind the instrument to allow for bends in the connection cables.

The unit is intended for use in a reasonably stable ambient temperature within the range -25°C to +70°C. Do not mount the unit where there is excessive vibration or in excessive direct sunlight.

Figure 3-2 Mounting introduction



3.2 Network type

Figure 3-3 3P4W 1CT Balance load

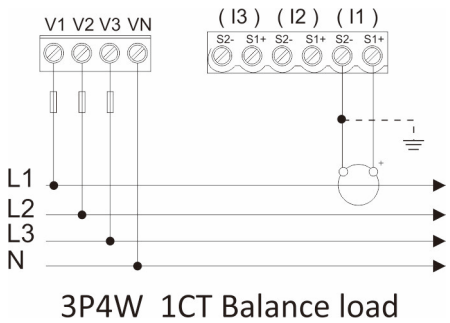


Figure 3-4 3P4W 3PTs 3CTs

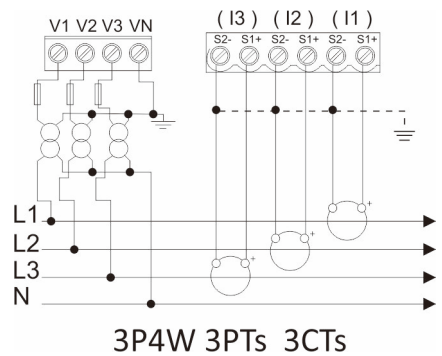


Figure 3-5 3P4W 3CTs

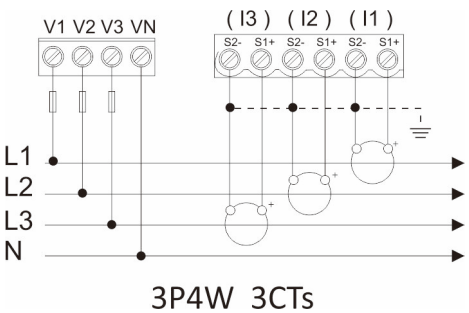


Figure 3-6 3P3W 2PTs 2CTs

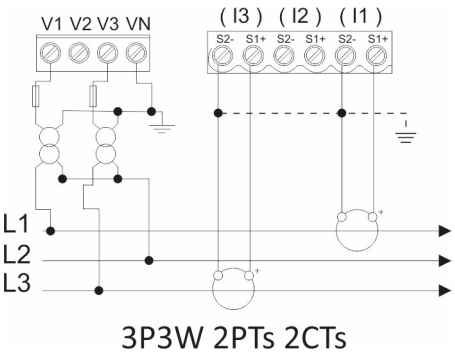


Figure 3-7 1P2W(L+N) 1CT

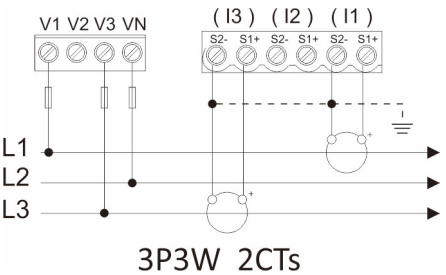
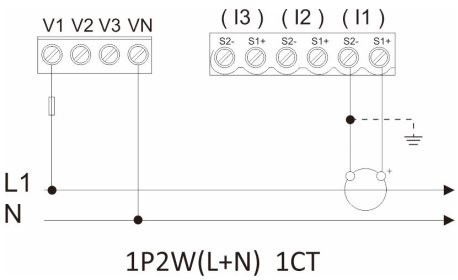


Figure 3-8 3P3W 2CTs



3.3 Modbus/RTU installation

Figure 3-9 Connection assignment of Modbus/RTU

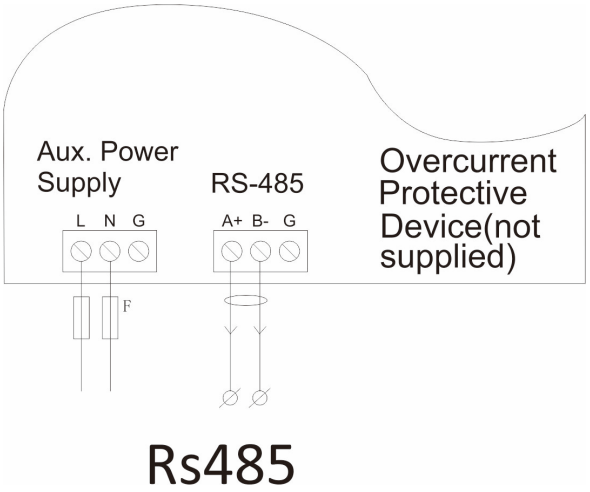
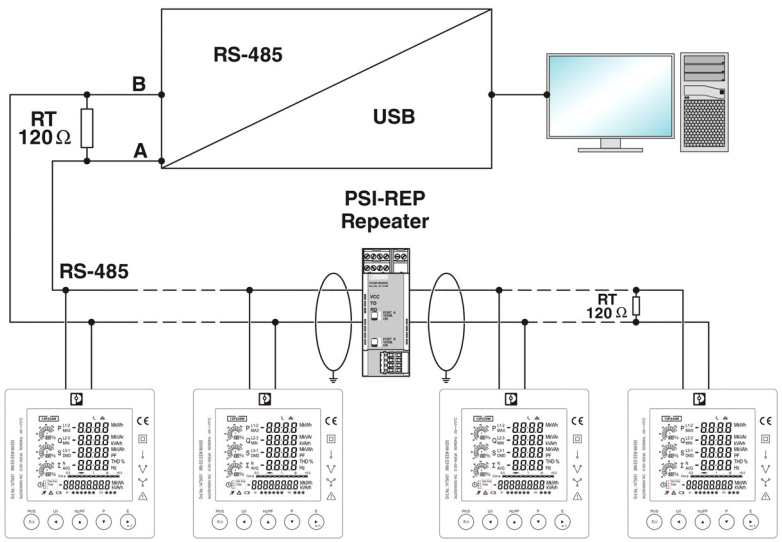


Figure 3-10 Modbus/RTU network



4 Configuration

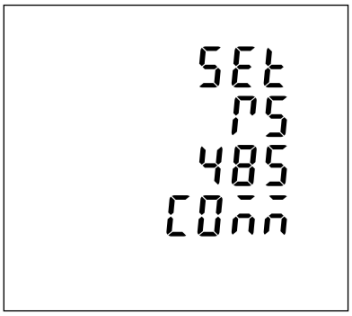
4.1 Password Entry

Setting-up mode is password protected, so you must enter the correct password.

Default password: 1000

By firmly press the button E for 2 s, the password screen appears. Use Hz/PF and P, E to set the password. If an incorrect password is entered, the display shows ERR.

4.2 Communication

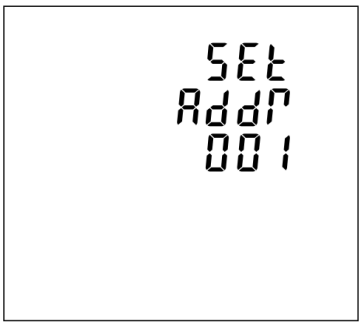


Communication set up menu:

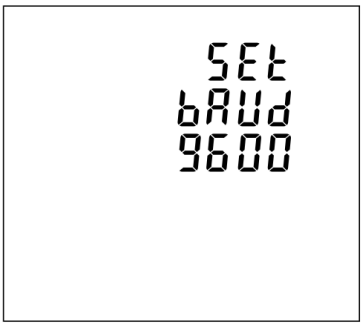
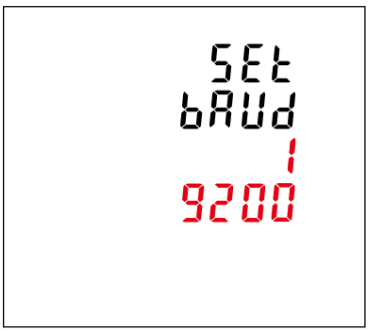
The RS485 port can be used for communications using Modbus RTU protocol. Parameters such as Address, Baud rate, Parity, stop bit can be selected.

Long press E to enter the communication menu, which including Address option.

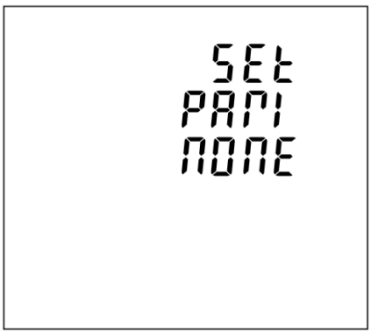
4.3 Address

	An RS485 network can accommodate up to 247 different devices, each identified by an address. Modbus address range 001 … 247 Default 001 Long press E to enter the selection routine, the address setting will flash. Use Hz/PF and P, E to set the address with the range 001 … 247. And long press E for confirmation.

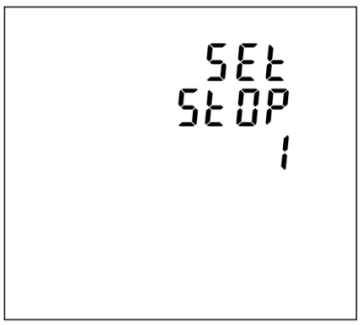
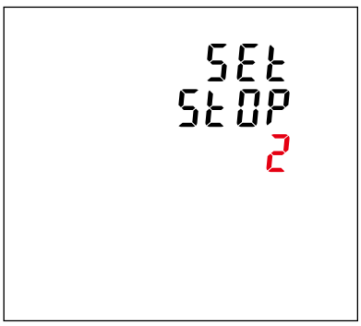
4.4 Baud rate

	Baud rate options: 2400 4800 9600 19200 38400 (bps). Default: 9600bps From the Communication menu, use Hz/PF and P to select the Baud rate options. Long press E to enter the selection routine. The Baud Rate setting will flash. Use Hz/PF and P to choose Baud Rate.
	Example shows: SET Baud rate: 19200 (bps) And long press E for confirmation.

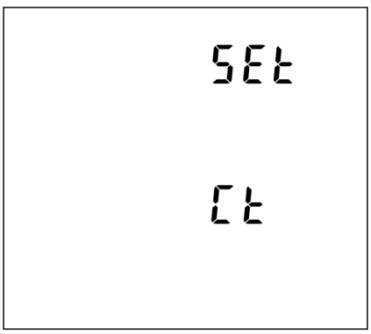
4.5 Parity

	Parity Options: NONE, EVEN, ODD. Default Parity: NONE From the Communication menu, Use Hz/PF ▲ and P ▼ to select the Parity options. Long press E ▶↵ to enter the selection routine. The Parity setting will flash. Use Hz/PF ▲ and P ▼ to choose Parity.
	Example shows: Set Parity: EVEN *Note that Parity can only be changed to EVEN when the Stop Bits is set to 1. And long press E ▶↵ for confirmation. Press Ph/S ⮌ to return the communication set up menu.
	Example shows: Set Parity: Odd *Note that Parity can only be changed to Odd when the Stop Bits is set to 1. And long press E ▶↵ for confirmation. Press Ph/S ⮌ to return the communication set up menu.

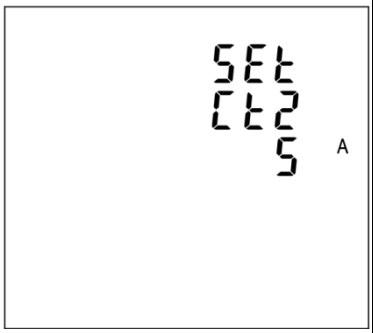
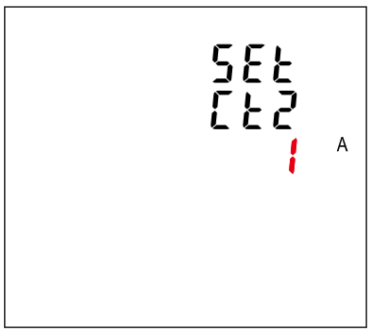
4.6 Stop bit

	Stop Bit options: 1 or 2. Default Stop Bit: 1 Note that if parity is set to ODD or EVEN, Stop Bits will be set to 1 and cannot be changed. From the Communication menu, use Hz/PF ▲ and P ▼ to select the Stop Bit options. Long press E ▶↵ to enter the Stop Bit routine. The Stop Bit setting will flash. Use Hz/PF ▲ and P ▼ to choose Stop Bit.
	Example shows Set Stop bit 2 And long press E ▶↵ for confirmation. Press Ph/S ⮌ to return the Communication set up menu.

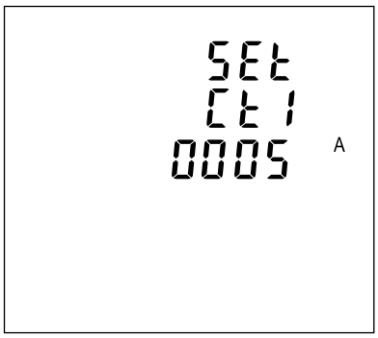
4.7 CT

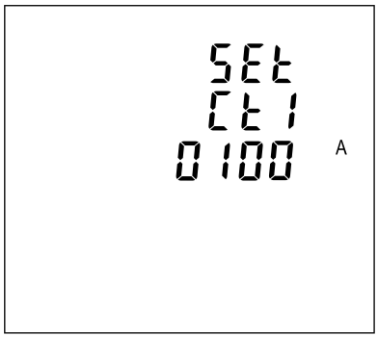
	CT set up menu: From the main Set-up menu, use Hz/PF ▲ and P ▼ to select the CT option.

4.7.1 CT2

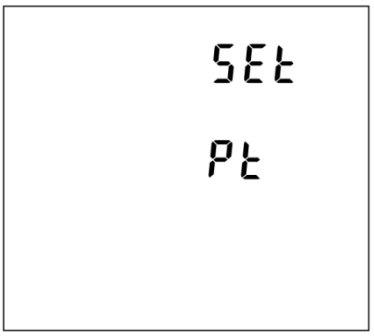
	Set secondary current input the meter Options: 5 A or 1 A Default CT2: 5 A Long press E to enter the CT2 routine. Press E for 2s, the CT2 setting will flash. Use Hz/PF and P to choose CT2 with 5 A or 1 A.
	Example shows: Set CT2 1 A And long press E for confirmation.

4.7.2 CT1

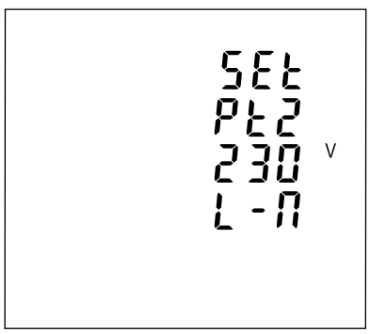
	Set primary current input the meter Options: 1 … 9999 Default CT1: 5 A Use Hz/PF and P to enter the CT1 routine. Press E for 2s, the CT1 setting will flash. Use Hz/PF and P to choose CT1 with 1…9999.

	Example shows: Set CT1 100A And long press E for confirmation. Press Ph/S to return the CT set up menu.

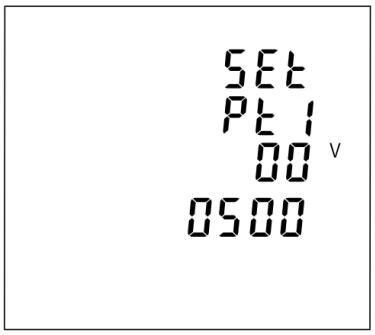
4.8 PT

	PT set up menu: The PT option sets the primary voltage and secondary voltage of the voltage transformer (PT) that give into the meter. For example: if the PT connect to the meter is 10000/100V, primary voltage is 10000V, secondary voltage is 100V. Long press E to enter the PT2 routine. Press E for 2s, the PT2 setting will flash. Use Hz/PF and P, E to choose PT2 with 50 … 600.

4.8.1 PT2

	Set secondary voltage input the meter Range: 50 … 600V Default: 230V And long press E for confirmation.

4.8.2 PT1



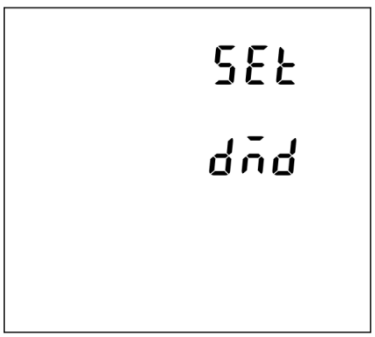
Set primary voltage input the meter

Range: 50 … 600000V

Default: 230V

Then press P to enter the PT1 routine. press E for 2s, the PT1 setting will flash. Use Hz/PF and P, E to select PT1. And long press E for confirmation. Press Ph/S to return the PT set up menu.

4.9 Demand



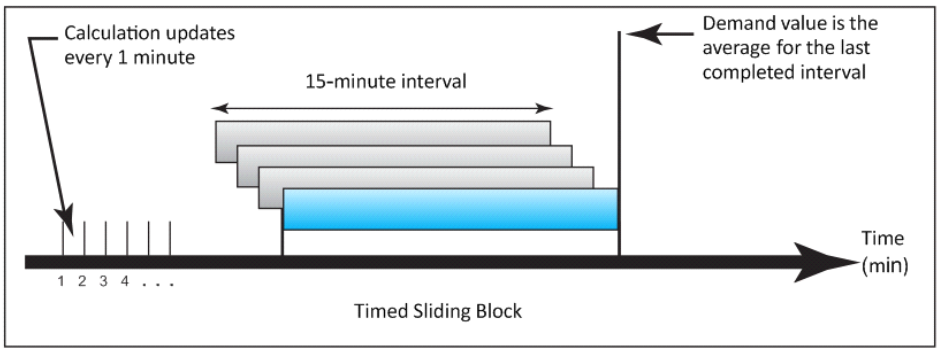
This sets the period in minutes over which the current and power readings are integrated for maximum demand measurement. The options are: OFF, 5, 8, 10, 15,30, 60 minutes.

From the Set-up menu, use Hz/PF and P to select the Demand option.

The unit provides block interval demand calculation. In this method, you select a 'block' of time that power meter uses for the demand calculation. You choose how the power meter handles that block of time (interval). Two different modes are optional.

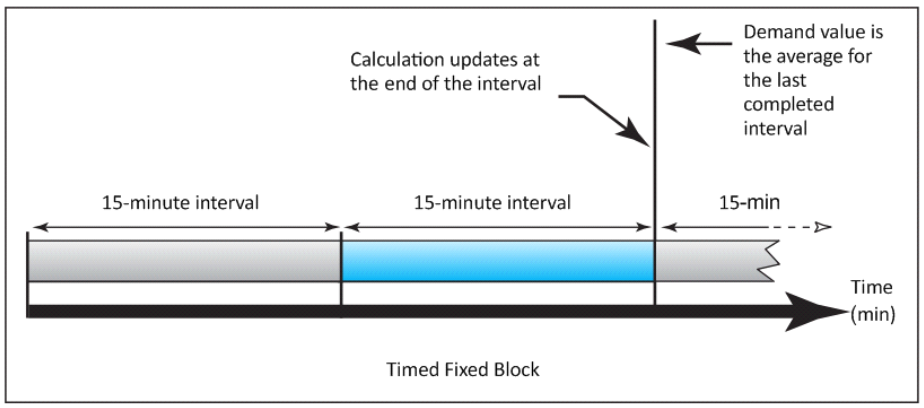
Slide Block: Select a demand interval time (DIT) from 1 to 60 minutes (in 1 minute increments). Set the calculation update time from 1 to 59minutes. The power meter displays the demand value for the last completed interval.

Figure 4-1 Timed Sliding Block

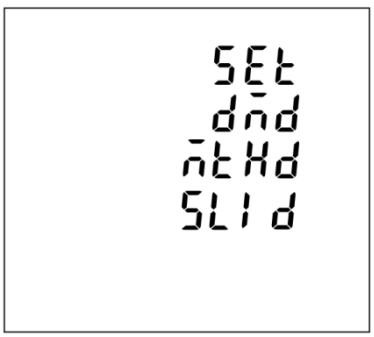


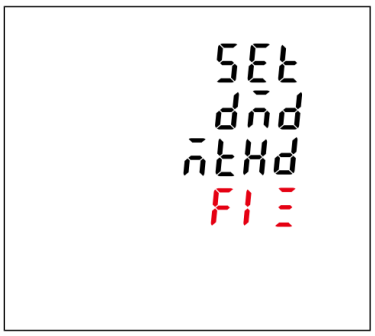
Fixed Block: Select an interval from 1 to 60 minutes (in 1 minute increments). The power meter calculates an updates the demand at the end of each interval.

Figure 4-2 Timed Fixed Block



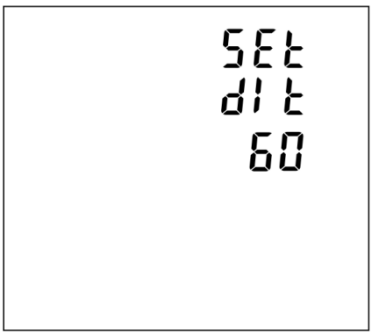
4.9.1 Demand method

	The screen shows the Demand calculation method: Slid Options: Fix and Slid Use Hz/PF ▲ and P ▼ to enter Demand calculation method.



Long press E to enter the routine. The setting will flash. Use Hz/PF and P to choose Options. And long press E for confirmation.

4.9.2 Demand interval time/ Block time (DIT)

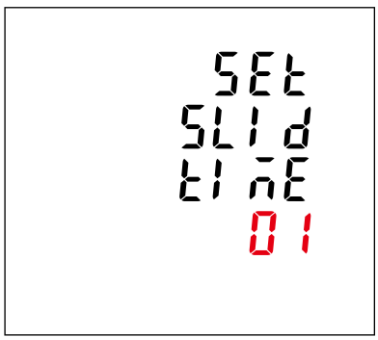


The screen will show the currently selected integration time.

Default is 60 minutes. range from 1 to 60. Off means function closed.

Then press P to enter the DIT routine. Press E for 2s, the setting will flash. Use Hz/PF and P to choose Options. And long press E for confirmation.

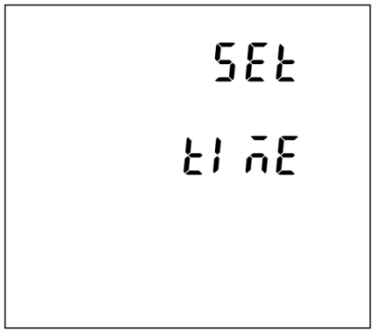
4.9.3 Sliding time



The screen will show the Sliding time for the sliding mode.

The sliding time shall be set not bigger than the DIT.

4.10 Time

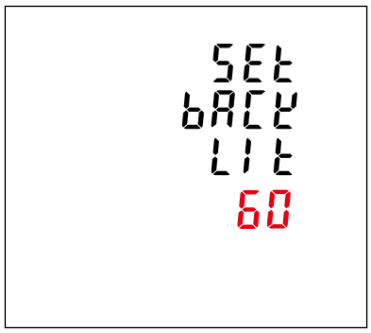


Time set up menu:

This option sets the backlight lasting time and display scroll time.

From the Set-up menu, use Hz/PF ▲ and P ▼ to select the Time option.

4.10.1 Backlight time



The meter provides a function to set the backlit lasting time.

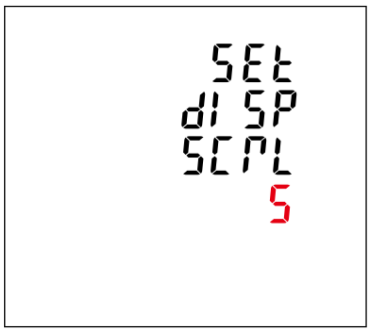
Options: ON/OFF/5/10/30/60/120 minutes. Default: 60

If it is seated as 5, the backlit will be off in 5 minutes.

Note: if it is set as ON, the backlit will always be on.

Long press E ▶↵ to enter the Backlit time routine. Press E ▶↵ for 2s, the setting will flash. Use Hz/PF ▲ and P ▼ to choose Options. And long press E ▶↵ for confirmation.

4.10.2 Display scroll time



The meter provides a function to set the Display scroll time.

Options: 1 … 255s

Default: 5

If it is seated as 5, the display will scroll every 5s.

Use Hz/PF ▲ and P ▼ to select Display scroll time option. Press E ▶↵ for 2s, the setting will flash. Use Hz/PF ▲ and P ▼ to choose Options. And Long press E ▶↵ for confirmation. Press Ph/S ⮌ to return to the time set up menu.

4.11 System

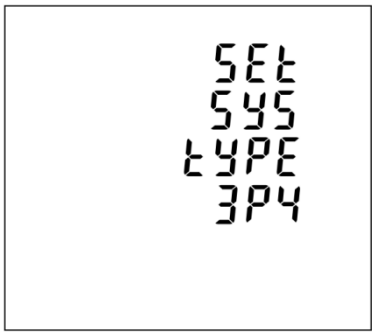
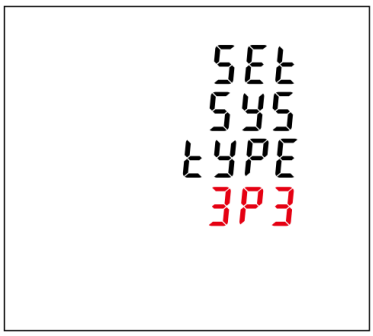
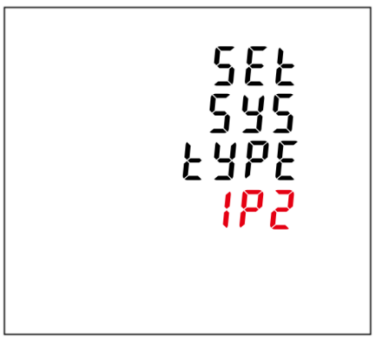
System set up menu:

The Unit has a default setting of 3 phase 4 wire (3p4w). Use this section to set the type of electrical system.

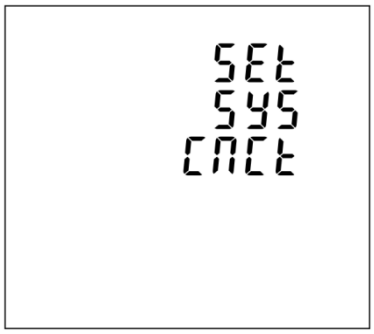
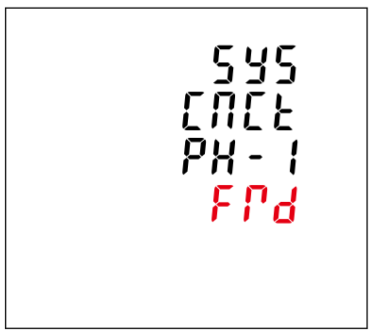
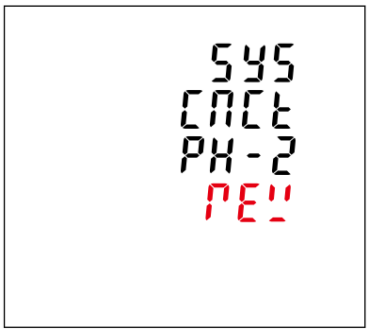
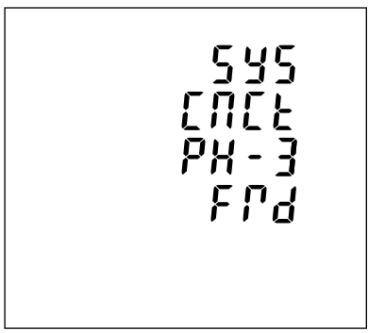
Options: 3P34,3P3W,1P2W

From the Set-up menu, use Hz/PF ▲ and P ▼ to select the System option

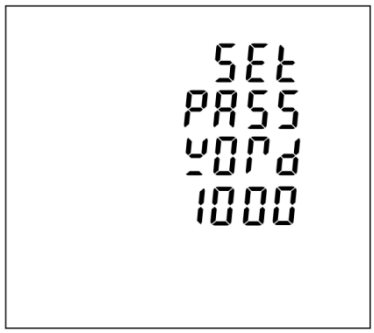
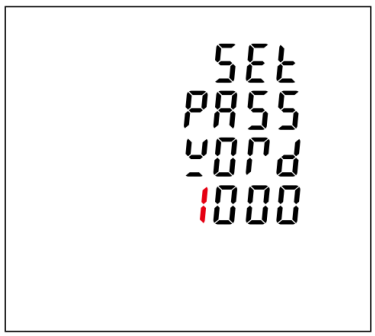
4.11.1 System type

	The screen shows the currently selected power supply is three phase four wire Long press E to enter the System type routine. Press E for 2s, the setting will flash. Use Hz/PF and P to choose Options. And Long press E for confirmation.
	Example shows: The screen shows the currently selected power supply is three phase three wire
	Example shows: The screen shows the currently selected power supply is single phase two wire

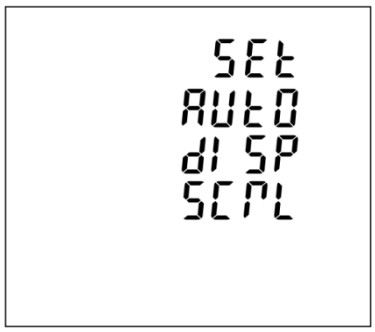
4.11.2 System connect

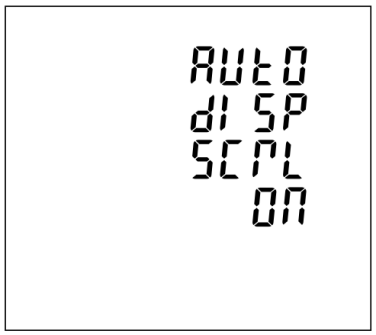
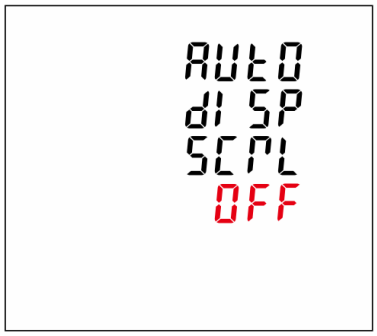
	This unit provides a function with Reverse connected current inputs correction setting. Use Hz/PF and P to select the correction option.
	Options: Frd (forward) and rEv (reverse) The default is FRD (forward) Long press E to enter the Phase 1 correction. Press E for 2s, the setting will flash. Use Hz/PF and P to choose Options. And long press E for confirmation.
	Press P enter Phase 2 correction. Press E for 2s, the setting will flash. Use Hz/PF and P to choose Options. And long press E for confirmation.
	Press P enter Phase 3 correction. Press E for 2s, the setting will flash. Use Hz/PF and P to choose Options. And long press E for confirmation. Press Ph/S to return the System set up menu.

4.11.3 Change password

	This unit provides a function with password setting. Default: 1000 Options:0000 … 99999 Use Hz/PF ▲ and P ▼ to select the change password option.
	Press E ▶↵ for 2s, the setting will flash. Use Hz/PF ▲ and P ▼, E ▶↵ to choose Options. And long press E ▶↵ for confirmation.

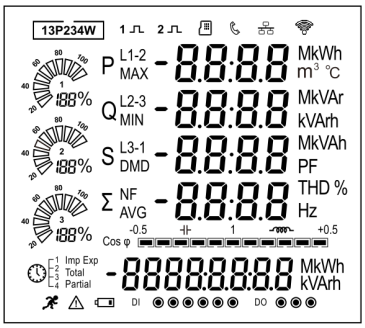
4.11.4 Automatic display scroll

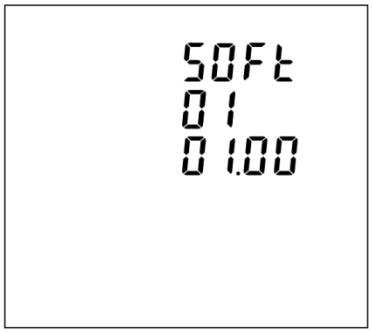
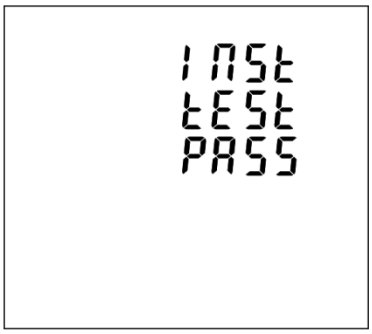
	This unit provides a function with automatic display scroll setting. Options: on and off There are two ways: Use Hz/PF ▲ and P ▼ to select the automatic display scroll option. Press E ▶↵ for 2s, the setting will flash. Use Hz/PF ▲ and P ▼ to choose options “On” or “Off”. And long press E ▶↵ for confirmation.

	Escape the Setting menu. Long press Ph/S for 2 s. For example, the screen shows the currently selected Automatic Scroll display ON.
	Long press Ph/S for 2 s, then the screen shows the currently selected Automatic Scroll display OFF.

5 Operation

5.1 Start up screens

	The first screen lights all LED segments and can be used as a display LED check.

	The second screen indicates the software version of the unit. (The left picture is just for reference)
	The unit performs a self - test and the screen indicates if the test is passed.

After a short delay, the default measurement screen appears.

5.2 Buttons and Displays

5.2.1 Buttons Function

Buttons	Click	Press 2S
Ph/S 	– Displays power, voltage, current and energy information of each phase – Exit from the menu	– Automatic Scroll display ON / OFF
U/I 	– Display Voltage and current information of the selected system type. (3p4w, 3p3w and 1p2w) – Phase sequence – Left side move	– Individual Harmonic Distortion of Voltage up to 63rd

Hz/PF 	– Display power factor, frequency, Max. Demand. – Max. and Min. of current and voltage – Up page or add value	– Individual Harmonic Distortion of Current up to 63rd
P 	– Display active power, reactive power and apparent power information of the selected system type. – Down page or reduce value	– Running hour – Full Screen checking – Modbus setting information
E 	– Display total / import / export active or reactive energy information of the selected system type. – Right side move	– Set-up mode entry – Confirmation

5.2.2 Display Mode Screen Sequence

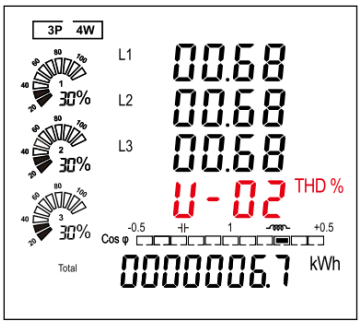
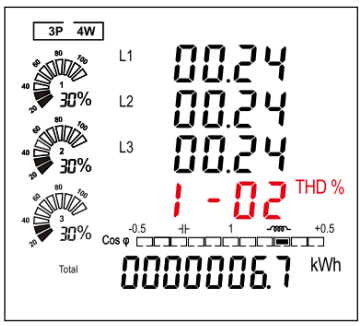
Click	3 Phase 4 Wire		3 Phase 3 Wire		1 Phase 2 Wire	
	Screen	Parameters	Screen	Parameters	Screen	Parameters
Ph/S 	1	Phase 1 – Power Voltage Current kWh			1	Phase 1 – Power Voltage Current kWh
	2	Phase 2 – Power Voltage Current kWh				
	3	Phase 3 – Power Voltage Current kWh				
	4	Phase 1 – Power Voltage Current kVArh			2	Phase 1 – Power Voltage Current kVArh
	5	Phase 2 – Power Voltage Current kVArh				
	6	Phase 3 – Power Voltage Current kVArh				

U/I 	1	Voltage L1-N Voltage L2-N Voltage L3-N			1	Voltage L1-N
	2	Voltage L1-L2 Voltage L2-L3 Voltage L3-L1	1	Voltage L1-L2 Voltage L2-L3 Voltage L3-L1		
	3	Current L1 Current L2 Current L3 Current Neutral	2	Current L1 Current L2 Current L3	2	Current L1
	4	THD% of Voltage L1 THD% of Voltage L2 THD% of Voltage L3	3	THD% of Voltage L1-2 THD% of Voltage L2-3 THD% of Voltage L3-1	3	THD% of Voltage L1
	5	THD% of Current L1 THD% of Current L2 THD% of Current L3	4	THD% of Current L1 THD% of Current L2 THD% of Current L3	4	THD% of Current L1
	6	Phase Sequence	5	Phase Sequence		

Hz/PF 	1	Total Power Factor Frequency	1	Total Power Factor Frequency	1	Total Power Factor Frequency
	2	PF L1 PF L2 PF L3				
	3	Max. DMD of Current L1 Max. DMD of Current L2 Max. DMD of Current L3	2	Max. DMD of Current L1 Max. DMD of Current L2 Max. DMD of Current L3	2	Max. DMD of Current L1
	4	Max. DMD of W Max. DMD of VAr Max. DMD of VA	3	Max. DMD of W Max. DMD of VAr Max. DMD of VA	3	L1 Max. DMD of W L1 Max. DMD of VAr L1 Max. DMD of VA
	5	Max. Voltage L1-N Max. Voltage L2-N Max. Voltage L3-N	4	Max. Voltage L1-L2 Max. Voltage L2-L3 Max. Voltage L3-L1	4.	Max. Voltage L1-N
	6	Min. Voltage L1-N Min. Voltage L2-N Min. Voltage L3-N	5	Min. Voltage L1-L2 Min. Voltage L2-L3 Min. Voltage L3-L1	5.	Min. Voltage L1-N
	7	Max. Current L1 Max. Current L2 Max. Current L3 Max. Current Neutral	6	Max. Current L1 Max. Current L2 Max. Current L3	6	Max. Current L1
	8	Min. Current L1 Min. Current L2 Min. Current L3 Min. Current Neutral	7	Min. Current L1 Min. Current L2 Min. Current L3	7	Min. Current L1
	9	Max. W Max. VAr Max. VA	8	Max. W Max. VAr Max. VA	8	Max. W Max. VAr Max. VA
	10	Min. W Min. VAr Min. VA	9	Min. W Min. VAr Min. VA	9	Min. W Min. VAr Min. VA

P 	1	Active Power L1 Active Power L2 Active Power L3				
	2	Reactive Power L1 Reactive Power L2 Reactive Power L3				
	3	Apparent Power L1 Apparent Power L2 Apparent Power L3				
	4	Total Active Power Total Reactive Power Total Apparent Power	1	Total Active Power Total Reactive Power Total Apparent Power	1	L1 Active Power L1 Reactive Power L1 Apparent Power
E 	1	Total kWh	1	Total kWh	1	Total kWh
	2	Total kVArh	2	Total kVArh	2	Total kVArh
	3	Import kWh	3	Import kWh	3	Import kWh
	4	Export kWh	4	Export kWh	4	Export kWh
	5	Import kVArh	5	Import kVArh	5	Import kVArh
	6	Export KVArh	6	Export KVArh	6	Export KVArh

5.2.3 Individual Harmonic Distortion:

	Press the button U/I for 2 seconds to check Harmonic distortion of Voltage 2~63rd Harmonic Distortion of Voltage
	Press the button Hz/PF for 2 seconds to check Harmonic distortion of Current 2~63rd Harmonic Distortion of Current

6 Technical data

Table 6-1

Electrical characteristics			
Type of measurement			RMS including harmonics on three phase AC system (3P, 3P+N) 128 samples per cycle
Measurement accuracy	Power		IEC 61557-12 Class 0.5
	Active Energy		IEC 62053-22 Class 0.5S
	Reactive Energy		IEC 62053-23 Class 2
	Frequency		± 0.2%
	Current		± 0.2%
	Voltage		± 0.2%
	Power Factor		± 0.01
	Harmonic Distortion		2
Data Update Rate			1 s nominal
Input-Voltage	VT Primary		50 … 600000 V AC
	Un		230 V Ph/N
	Measured Voltage with Over-range and Crest Factor		87 … 600 V AC(Ph/Ph) 50 … 345 V AC(Ph/N)
	Permanent Overload		600 V Ph/Ph 345 V Ph/N
	Impedance		1M Ω
	Frequency Range		45 … 65Hz
Input- Current	CT Ratings	Primary	1 … 9999A
		Secondary	1A / 5A
	Measured current with Over-range and Crest Factor		5m A … 6 A
	Withstand		Continuous 6A 120 A for 0.5 s
	Impedance		<1 MΩ
	Frequency Range		45 … 65 Hz
	Burden		<0.036 VA at 6 A
Auxiliary Power Supply	Operating Range		85 … 275 V AC / 120 … 380V DC
	Power Consumption		< 10 VA/2W
	Frequency		45 … 65 Hz
Mechanical Characteristics			
Weight			305 g
IP Degree of Protection (IEC 60529)			IP51 front display
Dimensions (width/height/depth)			96mm x 96mm x 73.4mm
Mounting Position			Vertical

Panel Thickness	1.5 … 3 mm
Material of meter case	Self-extinguishing UL 94 V-0
Mechanical environment	M1
Environmental Characteristics	
Operating Temperature	-25 … 70°C
Storage Temperature	-40 … 70°C
Humidity Rating	<95% RH at 50 °C (non-condensing)
Pollution Degree	2
Altitude	2000 m
Vibration	10 … 50 Hz, IEC 60068-2-6
Electromagnetic Compatibility	
Electrostatic Discharge	IEC 61000-4-2
Immunity to Radiated Fields	IEC 61000-4-3
Immunity to Fast Transients	IEC 61000-4-4
Immunity to Impulse Waves	IEC 61000-4-5
Conducted Immunity	IEC 61000-4-6
Immunity to Magnetic Fields	IEC 61000-4-8
Immunity to Voltage Dips	IEC 61000-4-11
Radiated Emissions	EN55011 Class A
Conducted Emissions	EN55011 Class A
Harmonics	IEC 61000-3-2
Safety	
Measurement Category	Per IEC61010-1 CAT III
Current Inputs	Require external Current Transformer for Insulation
Over voltage Category	CAT III
Dielectric Withstand	As per IEC 61010-1 Double Insulated front panel display
Protective Class	II
Communications	
Interface standard and protocol	RS485 and MODBUS RTU
Communication address	1 ... 247
Transmission mode	Half duplex
Data type	Floating point
Transmission distance	1000 m Maximum
Transmission speed	2400 … 38400 bps
Parity	None (default), Odd, Even
Stop bits	1 or 2
Response time	<100 mS

Table 6-2

Features	Description MM-EE-EEM-MA550
Instantaneous Measurements	
Current	●
Voltage Ph/Ph	●
Ph/N	●
Frequency	●
Active power	●
Reactive power	●
Apparent power	●
Power factor	●
Energy Values	
Active energy	●
Reactive energy	●
Apparent energy	●
Demand Values	
Current	●
Active, reactive, apparent power	●
Maximum Demand Values	
Maximum current	●
Maximum active power	●
Maximum reactive power	●
Maximum apparent power	●
Min. and Max. Value	
Active power per phase and total	●
Reactive power per phase and total	●
Apparent power per phase and total	●
PF per phase and total	●
Current per phase and average	●
THDi per phase	●
THDu Ph/Ph and Ph/N	●
Power-Quality Values	
Total harmonic distortion	●
Individual Harmonic distortion	63rd
Network	
Single phase 2 wire	●
Single phase 3 wire	●
Three phase 3 wire	●
Three phase 4 wire	●

CT programmable	●
PT programmable	●
Communications	
RS485	●
Accuracy	
Active energy	Cl. 0.5s
Reactive energy	Cl. 2
Current	0.2%
Voltage	0.2%
THD and IHD	2%
Hz	0.2%
Number of measurement points per circle	128
Auxiliary power supply	●

Note: ● = included

7 Modbus register Map

7.1 Measuring values

Table 7-1 Measuring values

Decimal start address	Hexadecimal start address	Type	Functions	Format
30001	0x0000	Read	04	Float

Address (Register)	Input Register Parameter				Address Hex	
	Description	Length (bytes)	Data Format	Unit	Hi Byte	Lo Byte
30001	Phase 1 line to neutral volts.	4	Float	V	00	00
30003	Phase 2 line to neutral volts.	4	Float	V	00	02
30005	Phase 3 line to neutral volts.	4	Float	V	00	04
30007	Phase 1 current.	4	Float	A	00	06
30009	Phase 2 current.	4	Float	A	00	08
30011	Phase 3 current.	4	Float	A	00	0A
30013	Phase 1 active power.	4	Float	W	00	0C
30015	Phase 2 active power.	4	Float	W	00	0E
30017	Phase 3 active power.	4	Float	W	00	10
30019	Phase 1 apparent power.	4	Float	VA	00	12
30021	Phase 2 apparent power.	4	Float	VA	00	14
30023	Phase 3 apparent power.	4	Float	VA	00	16
30025	Phase 1 reactive power.	4	Float	VAr	00	18
30027	Phase 2 reactive power.	4	Float	VAr	00	1A
30029	Phase 3 reactive power.	4	Float	VAr	00	1C
30031	Phase 1 power factor (1).	4	Float	None	00	1E
30033	Phase 2 power factor (1).	4	Float	None	00	20
30035	Phase 3 power factor (1).	4	Float	None	00	22
30037	Phase 1 phase angle.	4	Float	Degrees	00	24
30039	Phase 2 phase angle.	4	Float	Degrees	00	26
30041	Phase 3 phase angle.	4	Float	Degrees	00	28
30043	Average line to neutral volts.	4	Float	V	00	2A
30047	Average line current.	4	Float	A	00	2E
30049	Sum of line currents.	4	Float	A	00	30
30053	Total system power.	4	Float	W	00	34
30057	Total system volt amps.	4	Float	VA	00	38
30061	Total system VAr.	4	Float	VAr	00	3C
30063	Total system power factor (1).	4	Float	None	00	3E
30067	Total system phase angle.	4	Float	Degrees	00	42
30071	Frequency of supply voltages.	4	Float	Hz	00	46
30073	Total import active energy.	4	Float	kWh	00	48
30075	Total export active energy.	4	Float	kWH	00	4A

30077	Total import reactive energy.	4	Float	kVArh	00	4C
30079	Total export reactive energy.	4	Float	kVArh	00	4E
30081	Total apparent energy.	4	Float	kVAh	00	50
30083	Ah.	4	Float	Ah	00	52
30085	Total system power demand (2).	4	Float	W	00	54
30087	Maximum total system power demand (2).	4	Float	W	00	56
30089	Import active power demand	4	Float	W	00	58
30091	Import active power max. demand	4	Float	W	00	5A
30093	Export active power demand	4	Float	W	00	5C
30095	Export active power max. demand	4	Float	W	00	5E
30101	Total system VA demand.	4	Float	VA	00	64
30103	Maximum total system VA demand.	4	Float	VA	00	66
30105	Neutral current demand.	4	Float	Amps	00	68
30107	Maximum neutral current demand.	4	Float	Amps	00	6A
30109	Total system reactive power demand. (2)	4	Float	VAr	00	6C
30111	Maximum total system reactive power demand (2)	4	Float	VAr	00	6E
30161	Voltage phase sequence (normal=1, reverse=2, phase missing =3)	4	Float	None	00	A0
30163	Current phase sequence (normal=1, reverse=2, phase missing =3)	4	Float	None	00	A2
30193	Nature of the load (Resistive =1, inductive =2, capacitive =3)	4	Float	None	00	C0
30195	Nature of L1 load (Resistive =1, inductive =2, capacitive =3)	4	Float	None	00	C2
30197	Nature of L2 load (Resistive =1, inductive =2, capacitive =3)	4	Float	None	00	C4
30199	Nature of L3 load (Resistive =1, inductive =2, capacitive =3)	4	Float	None	00	C6
30201	Line 1 to Line 2 volts.	4	Float	V	00	C8
30203	Line 2 to Line 3 volts.	4	Float	V	00	CA
30205	Line 3 to Line 1 volts.	4	Float	V	00	CC
30207	Average line to line volts.	4	Float	V	00	CE
30225	Neutral current.	4	Float	A	00	E0
30235	Phase 1 L/N volts THD	4	Float	%	00	EA
30237	Phase 2 L/N volts THD	4	Float	%	00	EC
30239	Phase 3 L/N volts THD	4	Float	%	00	EE
30241	Phase 1 Current THD	4	Float	%	00	F0
30243	Phase 2 Current THD	4	Float	%	00	F2
30245	Phase 3 Current THD	4	Float	%	00	F4
30249	Average line to neutral volts THD.	4	Float	%	00	F8
30251	Average line current THD.	4	Float	%	00	FA
30255	Total system power factor (1).	4	Float	Degrees	00	FE
30259	Phase 1 current demand.	4	Float	A	01	02
30261	Phase 2 current demand.	4	Float	A	01	04

30263	Phase 3 current demand.	4	Float	A	01	06
30265	Maximum phase 1 current demand.	4	Float	A	01	08
30267	Maximum phase 2 current demand.	4	Float	A	01	0A
30269	Maximum phase 3 current demand.	4	Float	A	01	0C
30335	Line 1 to line 2 volts THD.	4	Float	%	01	4E
30337	Line 2 to line 3 volts THD.	4	Float	%	01	50
30339	Line 3 to line 1 volts THD.	4	Float	%	01	52
30341	Average line to line volts THD.	4	Float	%	01	54
30343	Total active Energy (3)	4	Float	kWh	01	56
30345	Total reactive Energy (3)	4	Float	kVArh	01	58
30347	L1 import active Energy	4	Float	kWh	01	5A
30349	L2 import active Energy	4	Float	kWh	01	5C
30351	L3 import active Energy	4	Float	kWh	01	5E
30353	L1 export active Energy	4	Float	kWh	01	60
30355	L2 export active Energy	4	Float	kWh	01	62
30357	L3 export active Energy	4	Float	kWh	01	64
30359	L1 total active Energy	4	Float	kWh	01	66
30361	L2 total active Energy	4	Float	kWh	01	68
30363	L3 total active Energy	4	Float	kWh	01	6A
30365	L1 import reactive energy	4	Float	kVArh	01	6C
30367	L2 import reactive energy	4	Float	kVArh	01	6E
30369	L3 import reactive energy	4	Float	kVArh	01	70
30371	L1 export reactive energy	4	Float	kVArh	01	72
30373	L2 export reactive energy	4	Float	kVArh	01	74
30375	L3 export reactive energy	4	Float	kVArh	01	76
30377	L1 total reactive energy	4	Float	kVArh	01	78
30379	L2 total reactive energy	4	Float	kVArh	01	7A
30381	L3 total reactive energy	4	Float	kVArh	01	7C
30403	Voltage 2~63rd Harmonic L1	248	Float	%	01	92
30527	Voltage 2~63rd Harmonic L2	248	Float	%	02	0E
30651	Voltage 2~63rd Harmonic L3	248	Float	%	02	8A
30775	Current 2~63rd Harmonic L1	248	Float	%	03	06
30899	Current 2~63rd Harmonic L2	248	Float	%	03	82
31023	Current 2~63rd Harmonic L3	248	Float	%	03	FE
31147	Voltage Total Harmonic L1	4	Float	%	04	7A
31149	Voltage Total Harmonic L2	4	Float	%	04	7C
31151	Voltage Total Harmonic L3	4	Float	%	04	7E
31153	Current Total Harmonic L1	4	Float	%	04	80
31155	Current Total Harmonic L2	4	Float	%	04	82
31157	Current Total Harmonic L3	4	Float	%	04	84
31285	Voltage unbalance factor (zero-sequence)	4	Float	%	05	04
31287	Voltage unbalance factor (negative - sequence)	4	Float	%	05	06
31289	Current unbalance factor (zero-sequence)	4	Float	%	05	08
31291	Current unbalance factor (negative - sequence)	4	Float	%	05	0A
32649	Maximum value of total active power	4	Float	W	0A	58
32651	Maximum value of total reactive power	4	Float	VAr	0A	5A

32653	Maximum value of total apparent power	4	Float	VA	0A	5C
32655	Maximum value of phase 1 active power	4	Float	W	0A	5E
32657	Maximum value of phase 2 active power	4	Float	W	0A	60
32659	Maximum value of phase 3 active power	4	Float	W	0A	62
32661	Maximum value of phase 1 reactive power	4	Float	VAr	0A	64
32663	Maximum value of phase 2 reactive power	4	Float	VAr	0A	66
32665	Maximum value of phase 3 reactive power	4	Float	VAr	0A	68
32667	Maximum value of phase 1 apparent power	4	Float	VA	0A	6A
32669	Maximum value of phase 2 apparent power	4	Float	VA	0A	6C
32671	Maximum value of phase 3 apparent power	4	Float	VA	0A	6E
32673	Maximum value of phase 1 current	4	Float	A	0A	70
32675	Maximum value of phase 2 current	4	Float	A	0A	72
32677	Maximum value of phase 3 current	4	Float	A	0A	74
32679	Maximum value of neutral current	4	Float	A	0A	76
32681	Maximum value of total currents	4	Float	A	0A	78
32683	Maximum value of phase 1 line to neutral voltage	4	Float	V	0A	7A
32685	Maximum value of phase 2 line to neutral voltage	4	Float	V	0A	7C
32687	Maximum value of phase 3 line to neutral voltage	4	Float	V	0A	7E
32689	Maximum value of line 1 to line 2 voltage	4	Float	V	0A	80
32691	Maximum value of line 2 to line3 voltage	4	Float	V	0A	82
32693	Maximum value of line 3 to line 1 voltage	4	Float	V	0A	84
32695	Minimum value of total active power	4	Float	W	0A	86
32697	Minimum value of total reactive power	4	Float	VAr	0A	88
32699	Minimum value of total apparent power	4	Float	VA	0A	8A
32701	Minimum value of phase 1 active power	4	Float	W	0A	8C
32703	Minimum value of phase 2 active power	4	Float	W	0A	8E
32705	Minimum value of phase 3 active power	4	Float	W	0A	90
32707	Minimum value of phase 1 reactive power	4	Float	VAr	0A	92
32709	Minimum value of phase 2 reactive power	4	Float	VAr	0A	94
32711	Minimum value of phase 3 reactive power	4	Float	VAr	0A	96
32713	Minimum value of phase 1 apparent power	4	Float	VA	0A	98
32715	Minimum value of phase 2 apparent power	4	Float	VA	0A	9A
32717	Minimum value of phase 3 apparent power	4	Float	VA	0A	9C
32719	Minimum value of phase 1 current	4	Float	A	0A	9E
32721	Minimum value of phase 2 current	4	Float	A	0A	A0
32723	Minimum value of phase 3 current	4	Float	A	0A	A2
32725	Minimum value of neutral current	4	Float	A	0A	A4
32727	Minimum value of total currents	4	Float	A	0A	A6
32729	Minimum value of phase 1 line to neutral voltage	4	Float	V	0A	A8
32731	Minimum value of phase 2 line to neutral voltage	4	Float	V	0A	AA

32733	Minimum value of phase 3 line to neutral voltage	4	Float	V	0A	AC
32735	Minimum value of line 1 to line 2 voltage	4	Float	V	0A	AE
32737	Minimum value of line 2 to line3 voltage	4	Float	V	0A	B0
32739	Minimum value of line 3 to line 1 voltage	4	Float	V	0A	B2
32763	Maximum value of total power factor	4	Float	None	0A	CA
32765	Maximum value of L1 power factor	4	Float	None	0A	CC
32767	Maximum value of L2 power factor	4	Float	None	0A	CE
32769	Maximum value of L3 power factor	4	Float	None	0A	D0
32771	Maximum value of L1 voltage THD	4	Float	%	0A	D2
32773	Maximum value of L2 voltage THD	4	Float	%	0A	D4
32775	Maximum value of L3 voltage THD	4	Float	%	0A	D6
32777	Maximum value of L1 current THD	4	Float	%	0A	D8
32779	Maximum value of L2 current THD	4	Float	%	0A	DA
32781	Maximum value of L3 current THD	4	Float	%	0A	DC
32783	Minimum value of total power factor	4	Float	None	0A	DE
32785	Minimum value of L1 power factor	4	Float	None	0A	E0
32787	Minimum value of L2 power factor	4	Float	None	0A	E2
32789	Minimum value of L3 power factor	4	Float	None	0A	E4
32791	Minimum value of L1 voltage THD	4	Float	%	0A	E6
32793	Minimum value of L2 voltage THD	4	Float	%	0A	E8
32795	Minimum value of L3 voltage THD	4	Float	%	0A	EA
32797	Minimum value of L1 current THD	4	Float	%	0A	EC
32799	Minimum value of L2 current THD	4	Float	%	0A	EE
32801	Minimum value of L3 current THD	4	Float	%	0A	F0

Notes:

1 1. The power factor has its sign adjusted to indicate the direction of the current. Positive refers to forward current, negative refers to reverse current.

2 2. The power sum demand calculation is for import – export.

3 3. Total active energy / reactive energyequals to Import + export.

7.2 Device information and configuration

Table 7-2 Device information and configuration

Decimal start address	Hexadecimal start address	Function cde
40001	0x0000	03/10

Address Register	Parameter	Address Hex		Valid range	Mode
		High Byte	Low Byte		
40001	Demand Time	00	00	Read minutes into first demand calculation. When the Demand Time reaches the Demand Period then the demand values are valid. **Length : 4 byte** **Data Format : Float**	ro
40003	Demand Period	00	02	Write demand period: 0~60 minutes, Default 60. Range: 0~60, 0 means function closed **Length : 4 byte** **Data Format : Float**	r/w
40005	Slide time	00	04	Default 1, min. Range: 1 ~59 (Demand Period -1). **Length : 4 byte** **Data Format : Float**	r/w
40007	Demand calculation method	00	06	Default 0, 0 = sliding block 1 = fixed block **Length : 4 byte** **Data Format : Float**	r/w
40011	System Type	00	0A	Write system type: 1 = 1P2W; 2 = 3P3W; 3 = 3P4W,(default); 6 = 3P4W Balance load; **Length : 4 byte** **Data Format : Float** (KPPA is asked)	r/w
40015	Key Parameter Programming Authorization (KPPA)	00	0E	Read: to get the status of the KPPA 0 = not authorized,1 = authorized Write the correct password to get KPPA,enable to program key parameters. **Length : 4 byte** **Data Format : Float**	r/w

40019	Parity and stop bit	00	12	Write the network port parity/stop bits for MODBUS Protocol, where: 0 = One stop bit and no parity, default. 1 = One stop bit and even parity. 2 = One stop bit and odd parity.3 = Two stop bits and no parity. **Length : 4 byte** **Data Format : Float**	r/w
40021	Modbus address	00	14	Write the network port node Address: 1 to 247 for MODBUS Protocol, default 1. **Length : 4 byte** **Data Format : Float**	r/w
40025	Password	00	18	Read: to get the password of the meter Write: to program the new password of the meter Default 1000 **Length : 4 byte** **Data Format : Float**	r/w
40029	Network Baud Rate	00	1C	Write the network port baud rate for MODBUS Protocol, where: 0 = 2400 baud. 1 = 4800 baud. 2 = 9600 baud, default. 3 = 19200 baud. 4 = 38400 baud **Length : 4 byte** **Data Format : Float**	r/w
40047	PT1	00	2E	PT1 Range 50- 600000V, Default 230 **Length : 4 byte** **Data Format : Float** (KPPA is asked)	r/w
40049	PT2	00	30	PT2 Range 50- 600V, Default 230 **Length : 4 byte** **Data Format : Float** (KPPA is asked)	r/w
40051	CT1	00	32	CT1 Range 1-9999A, Default 5, **Length : 4 byte** **Data Format : Float** (KPPA is asked)	r/w
40053	CT2	00	34	CT2 Range: 1A or 5A , Default 5A **Length : 4 byte** **Data Format : Float** (KPPA is asked)	r/w

40057	Current Direction correction（when the external CT is connected reversely）	00	38	0 = L1 Frd,L2 Frd,L3 Frd 1 = L1 Rev,L2 Frd,L3 Frd 2 = L1 Frd,L2 Rev,L3 Frd 3 = L1 Rev,L2 Rev,L3 Frd 4 = L1 Frd,L2 Frd,L3 Rev 5 = L1 Rev,L2 Frd,L3 Rev 6 = L1 Frd,L2 Rev,L3 Rev 7 = L1 Rev,L2 Rev,L3 Rev Default 0 **Length : 4 byte** **Data Format :Float** (KPPA is asked)	r/w
40059	Automatic Scroll Display Time	00	3A	Default 5 s Range 1~255 **Length : 4 byte** **Data Format : Float**	r/w
40061	Backlit time	00	3C	Default 60 min Range 0~121, 0 means backlit always on, 121 means backlit always off **Length : 4byte** **Data Format : Float**	r/w
461457	Reset historical data	F0	10	**00 00 = reset demand info** **00 03 = reset energy info** **00 04 = reset max. and min. data** **Length : 2 byte** **Data Format: Hex**	ro
463793	Running time	F9	30	Continuous working period--hour **Length : 4 byte** **Data Format : Float**	r/w
464513	Serial number	FC	00	Serial number **Length : 4 byte** **Data Format : unsigned int32** **Note: Only read**	ro

A Appendixes

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Section 3

Section 4

A 2 List of tables

Section 6

Section 7

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