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Network Analyzer

M4M 30
User manual

Table of Contents

1.General information

1.1.Use and storage of the manual

Carefully read this manual and adhere to the indications described prior to using the device.

This manual contains all of the safety information, the technical aspects and the operations necessary to ensure the correct use of the device and maintain it in safe conditions.

1.2.Copyright

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1.3.Liability disclaimer

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1.4.General safety warnings

Non-adherence to the following points can lead to serious injury or death.

Use the suitable personal protection devices and adhere to the current regulations governing electrical safety.

- This device must be installed exclusively by qualified personnel who have read all of the information relative to the installation.
- Check that the voltage supply and measurement are compatible with the range permitted by the device.
- Ensure that all current and voltage supplies are disconnected prior to carrying out any controls, visual inspections and tests on the device.
- Always assume that all circuits are under voltage until they are completely disconnected, subjected to tests and labelled.
- Disconnect all of the power supply prior to working on the device.
- Always use a suitable voltage detection device to check that the supply is interrupted.
- Pay attention to any dangers and carefully check the work area ensuring that no instruments or foreign objects have been left inside the compartment in which the device is housed.
- The correct use of this device depends on a correct manipulation, installation and use.hdfh
- Failure to adhere to the basic installation information can lead to injuries as well as damage to the electric instruments or to any other product.
- **NEVER** connect an external fuse in by-pass.
- Disconnect all of the input and output wires before carrying out a dielectric rigidity test or an insulation test on an instrument in which the device is installed.
- The tests carried out at a high voltage can damage the device's electronic components.
- The device has to be installed inside a switchboard.
- Installation of M4M shall include a switch or circuit breaker for the connection of auxiliary supply and voltage measurement. The switch or circuit breaker must be suitably located and easily reachable and must be marked as the disconnecting device for M4M.
- Switch off circuit breaker or switch before disconnecting from the auxiliary supply and voltage measurement or connecting to the auxiliary supply or voltage measurement.

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1.5.Cyber Security Disclaimer

M4M 30 network analyzer is designed to be connected and to communicate information and data via a network interface, which should be connected to a secure network. It is your sole responsibility to provide and continuously ensure a secure connection between the product and your network or any other network (as the case may be) and to establish and maintain appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of antivirus programs, etc.) to protect the M4M 30 network analyzer product, the network, its system and interfaces against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB S.p.A. and its affiliates are not liable for damages and/or losses related to such security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Although ABB S.p.A. provides functionality testing on the products and updates that we release, you should institute your own testing program for any product updates or other major system updates (to include but not limited to code changes, configuration file changes, third party software updates or patches, hardware change out, etc.) to ensure that the security measures that you have implemented have not been compromised and system functionality in your environment is as expected.

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2.Packaging contents
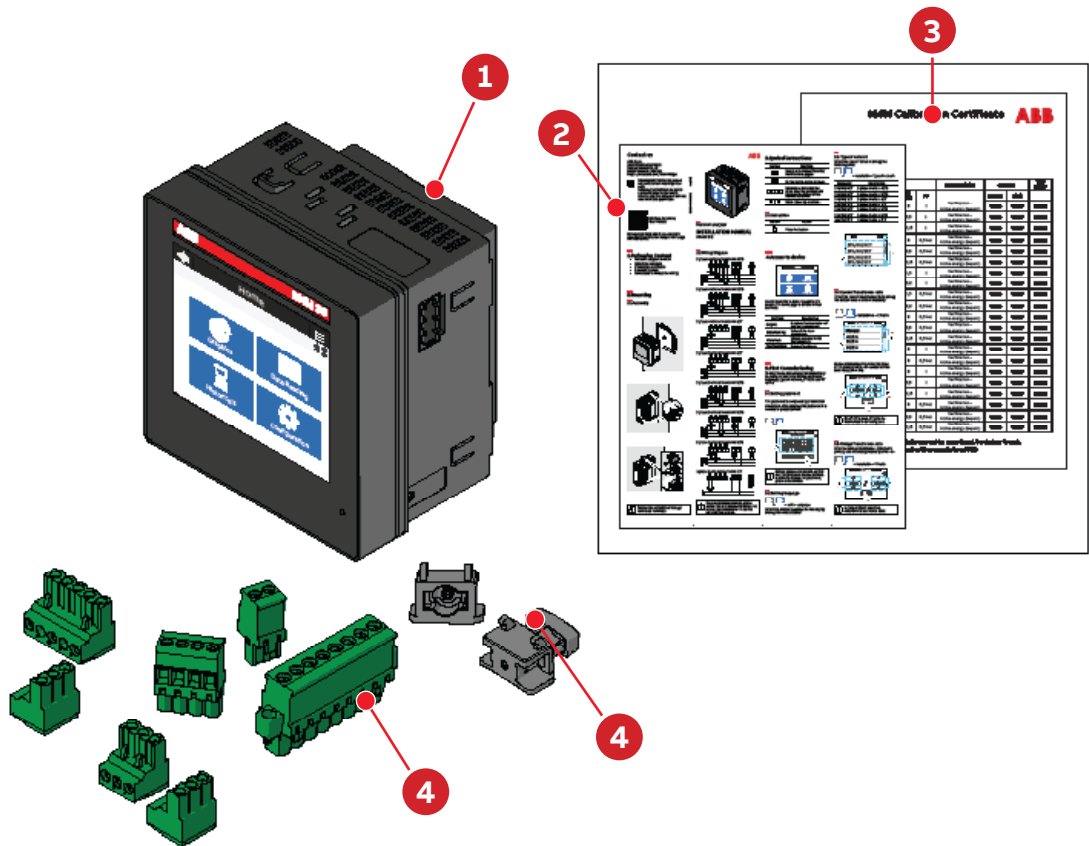
Packaging contents	
1	Network analyzer M4M 30
2	Installation manual
3	Calibration certificate
4	Installation accessories (removable terminals, fixing clips)

(i) The number and type of removable terminals in the package varies according to the different versions. Please refer to below table to check the removable terminals included in each package.

Product Name	Current input terminal (8 poles)	Voltage input terminal (4 poles)	Auxiliary supply terminal (2 poles)	Programmable I/O terminal n.1 (5 poles)	Programmable I/O terminal n.2 (3 poles)	Analogue outputs terminal (3 poles)	RS485 terminal (3 poles)
M4M 30 MODBUS	X	X	X	X	-	-	X
M4M 30 ETHERNET	X	X	X	X	-	-	-
M4M 30 PROFIBUS	X	X	X	X	-	-	-
M4M 30 I/O	X	X	X	X	X	X	X
M4M 30 BACNET	X	X	X	X	-	-	-
M4M 30 ROGOWSKI	-	X	X	X	-	-	X

(i) Please notice that terminals for current input on M4M 30 Rogowski are pre-wired on ABB's R4M Rogowski coils

3. Technical characteristics

3.1. Description of the device

M4M 30 is ABB's network analyzer range that allows complete power quality analysis and energy efficiency evaluations.

All M4M 30 network analyzers are equipped with touchscreen color display for simplified access to the device and with Bluetooth module for smart commissioning.

3.2. Main functionalities

| Real-time	
TRMS current	•
TRMS Voltage	•
Frequency	•
Active, Reactive and Apparent Power	•
Power Factor	•
Operating timer, countdown timer	•
Energy	
Active, Reactive and Apparent Energy	•
4 quadrant Energy (Import/Export)	•
Tariffs	•
Power quality	
THD (I, VLN, VLL)	•
Individual Harmonics	40th
Unbalances (I, VLN, VLL)	•
Neutral current	Measured
Phasors (I, VLN)	•
Waveforms (I, VLN, VLL)	•
Data recording and logs	
Single alarms	25
Warnings, alarms and errors logs	•
Complex alarms with logics	4
Demand values (average)	Advanced
Min/Max Demand values	Advanced
Energy Trending logs	•
RTC	•
HMI	
Graphs visualization	Advanced
Notifications	•
Homepage and favourite page	•
Password protection	•
Connectivity	
Automatic integration in ABB Ability™ EDCS	•
Bluetooth Low Energy	•
Communication Protocols	Modbus RTU, Modbus TCP/IP, Profibus DP-V0, BACnet/IP
RJ45 Daisy Chain (Ethernet version)	•

3.3.Versions

Product Name	I/O	Communication protocol
M4M 30 MODBUS	4 programmable I/O	Modbus RTU, Bluetooth
M4M 30 ETHERNET	4 programmable I/O	Modbus TCP/IP, Bluetooth
M4M 30 PROFIBUS	4 programmable I/O	Profibus DP-V0, Bluetooth
M4M 30 I/O	6 programmable I/O, 2 analogue outputs	Modbus RTU, Bluetooth
M4M 30 ROGOWSKI	4 programmable I/O	Modbus RTU, Bluetooth
M4M 30 BACNET	4 programmable I/O	BACnet/IP, Bluetooth

3.4.Overall dimensions
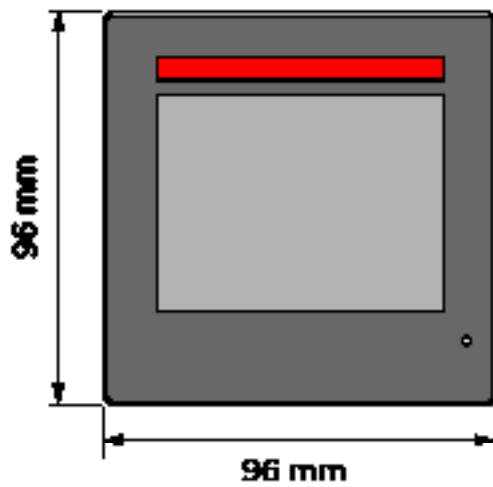
IEC 61554
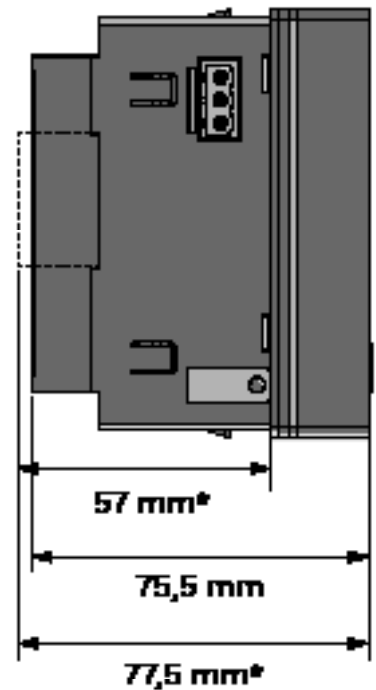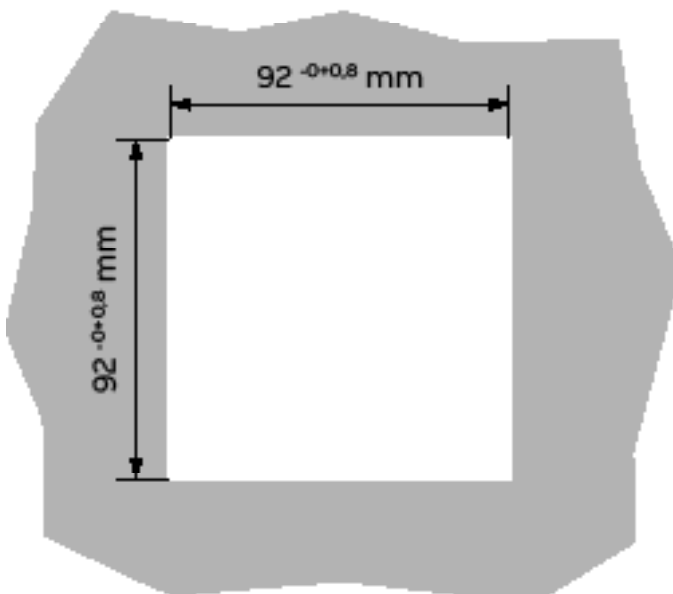
*with terminal.

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3.5. Technical data

Auxiliary power supply		
Voltage range	[V]	48 to 240 VAC/VDC ±15%
Frequency	[Hz]	50/60 Hz ±5%
Power Consumption	[VA]	10 VA max
Installation category		CAT III 300V class per IEC 61010-1 edition 3
Protection fuse		T1 A - 277 VAC

Measurement accuracy*	
Measurement type	True RMS up to the 40th harmonic
	128 samples per cycle, zero blind
IEC 61557-12	IEC 61557-12 PMD/S/K70/0,5
Active energy	Class 0,5 acc. to IEC 61557-12
	Class 0,5S acc. to IEC 62053-22
Reactive energy	Class 2 acc. to IEC 61557-12
	Class 2S acc. to IEC 62053-23
Active power	Class 0,5 acc. to IEC 61557-12
Reactive power	Class 1 acc. to IEC 61557-12
Apparent power	Class 0,5 acc. to IEC 61557-12
Voltage	Class 0,2 acc. to IEC 61557-12
Current	Class 0,2 acc. to IEC 61557-12
Neutral current	Class 0,2 acc. to IEC 61557-12
Frequency	Class 0,1 acc. to IEC 61557-12
Unbalances	Class 0,2 acc. to IEC 61557-12
Harmonics, THD (Current, voltage)	Class 1 acc. to IEC 61557-12

*Accuracy referred to insertion with .../5A CT or Rogowski coils. Derating for .../1A CT.

Voltage measurement inputs		
Measurement range	[V]	50 - 400 VAC (L-N) 87 - 690 VAC (L-L)
Measurement category		400V~ (CAT III)
Rated frequency	[Hz]	50-60 Hz
Max. VT secondary (indirect connection)	[V]	400 VAC (L-N)
Max over voltage	[V]	800 VAC (L-L)
Protection fuse		T1 A - 277 VAC

Current measurement inputs	
Number of current inputs	4 (L1, L2, L3, N)
Indirect insertion with CT	
CT secondary	5 A (Class 0.5S)
	1 A (Class 1)
Measurement range without accuracy derating	50 mA - 6 A
Starting current	5 mA
Burden	0.024 VA at 6 A
Indirect insertion with Rogowski coils	(only M4M 30 Rogowski)
Rated current	10000 A
Measurement range without accuracy derating	100 A - 12 kA
Starting current	10 A

I/O

Digital Output

Voltage (min - max)		5 - 240 VAC/DC
Current (min - max)		2 - 100 mA
Max ON state drop voltage		1,5 V
Max R value at Min voltage conditions (5 V)		1750 Ohm
Min R value at Max voltage conditions (240 V)		2400 Ohm
Pulse duration	[ms]	20 ms ON, 20 ms OFF
Pulse frequency		25 Hz
Alarm activation delay	[s]	1 - 900 s (programmable)
Alarm return hysteresis		0 - 40% (programmable)

Digital Input

Maximum Voltage	240 VAC/DC
Max voltage for OFF state on input	20 VAC/DC
Min voltage for ON state on input	45 VAC/DC

Analogue Output

Programmable electrical parameters	Span [0 - 20 mA or 4 - 20 mA]
Load	Typical 250 Ohm, max 500 Ohm

Mechanical characteristics

|		
Overall dimensions		96 mm x 96 mm x 77,5 mm (Depth inside the switchboard: 57mm)
IP degree of protection (IEC 60529)		Front: IP54
		Terminals: IP20
Weight	[g]	400

Terminal characteristics

|	
Voltage inputs	Nominal cross section: 2,5 mm^2 Solid/stranded wire: 0,2 - 2,5 mm^2 (AWG 24 - 12) Pitch: 7,62 mm Poles: 4
Current inputs	Nominal cross section: 2,5 mm^2 Solid/stranded wire: 0,2 - 2,5 mm^2 (AWG 24 - 12) Pitch: 5,08 mm Poles: 8 Screw flanges for fixing
RS-485 Serial port	Nominal cross section: 2,5 mm^2 Solid/stranded wire: 0,2 - 2,5 mm^2 (AWG 24 - 12) Pitch: 5,08 mm Poles: 3
I/O	Nominal cross section: 2,5 mm^2 Solid/stranded wire: 0,2 - 2,5 mm^2 (AWG 24 - 12) Pitch: 5,08 mm Poles: 5 (Programmable I/O) Poles: 3 (Programmable I/O only on M4M 30 I/O) Poles: 3 (Analogue outputs, only on M4M 30 I/O)
Rogowski current probes	Only with ABB Rogowski probes: -R4M-200: 200 mm diameter (2CSG202150R1101) -R4M-80: 80 mm diameter (2CSG202160R1101)

Climatic conditions

Operating temperature	-25 to 70 °C (K70 acc. to IEC 61557-12)
Storage temperature	-40 to 85 °C (K70 acc. to IEC 61557-12)
Relative humidity	Max 93% (non-condensing) at 40°C
Pollution degree	2
Altitude	< 2000 m

User Interface

Access to device	Touchscreen
Display type	Graphic color display
Display dimensions	70 x 52 mm (3.5")

Communication protocol

Modbus RTU	**M4M 30 Modbus, M4M 30 I/O, M4M 30 Rogowski**
Communication interface	RS485 with optical isolation
Baud rate	9.6, 19.2, 38.4, 57.6, 115.2 kbps
Parity number	Odd, Even, None
Stop bit	1, 2
Address	1-247
Connector	3 pole terminal
Profibus DP-V0	**M4M 30 Profibus**
Protocol	Profibus with slave DP-V0 function in compliance with IEC 61158 regulations
Communication interface	RS485 with optical isolation
Baud rate	Automatic detection [9.6 - 12 Mbps]
Address	0-126
Connector	DB 9 female connector (do not use connectors with 90° cable outlet)
LED indicators	Green for communication status
	Red for communication error
Modbus TCP/IP	**M4M 30 Ethernet**
Protocol	Modbus TCP/IP
Communication interface	RJ45 (2 ports for daisy-chain feature)
BACnet	**M4M 30 Bacnet**
Protocol	BACnet/IP
Communication interface	RJ45

Bluetooth

Type	BLE (Bluetooth Low Energy)

Real-time clock

Clock drift	~ 0.4 seconds per day
Battery backup time	~ 3 years without control power

Standards

Power metering and monitoring devices (PMD)	IEC 61557-12 (IEC 62053-22, IEC 62053-23)
Electrical safety	IEC 61010-1
EMC	IEC 61326-1 (IEC 61000-3-2, IEC 61000-3-3, IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-8, IEC 61000-4-11)

4.Installation

4.1.Assembly
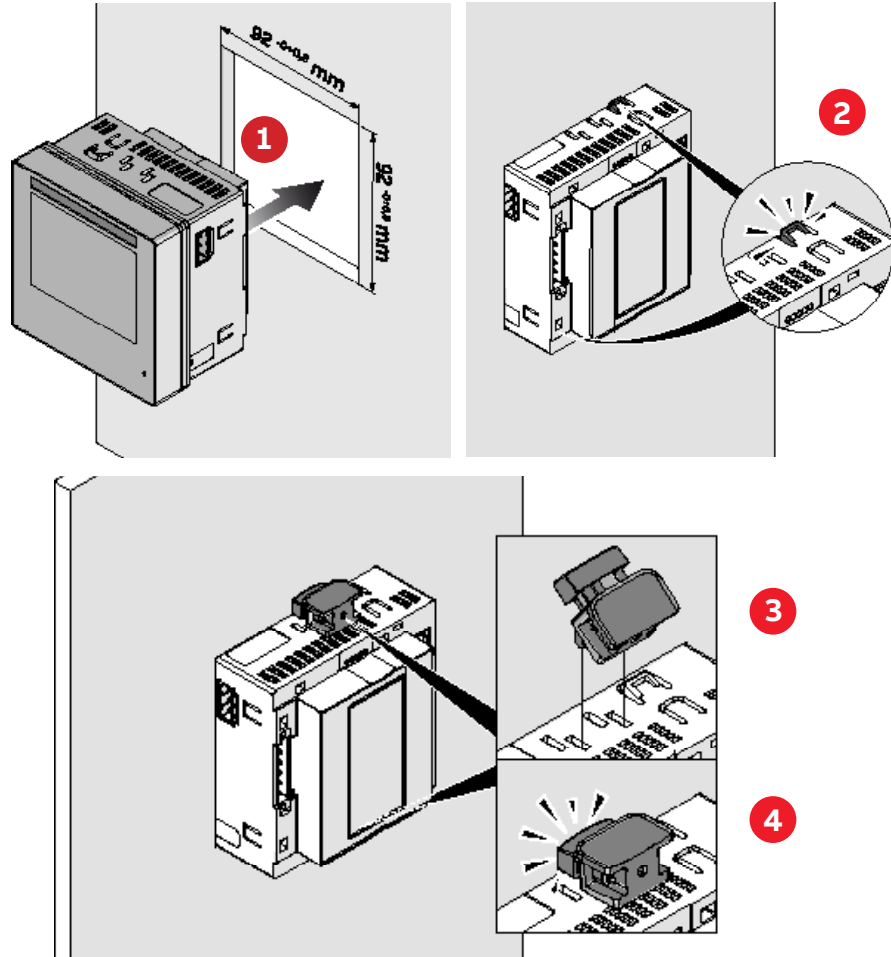
4.2.Disassembly
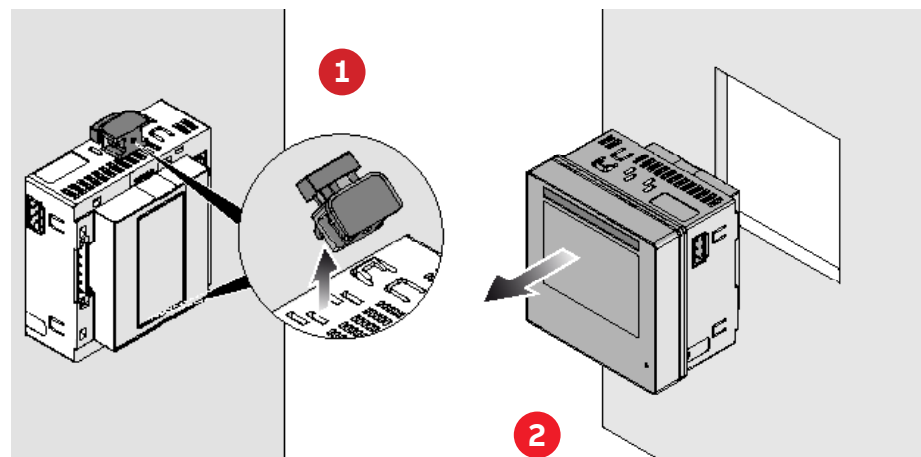
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4.3.Wiring diagrams

The operations to carry out for the correct connection of the device, based on the type of electric line available, are described in this section.

⚠️ The installation and the cabling of the device must be carried out by qualified personnel.

⚡ Danger of electrocution, burning and electric arc.
Use the personal protection devices suitable to adhere to the current regulations governing electrical safety.
Prior to carrying out any connections check the sectioning of the electric supply with the voltage detection device.

- M4M 30 MODBUS connection
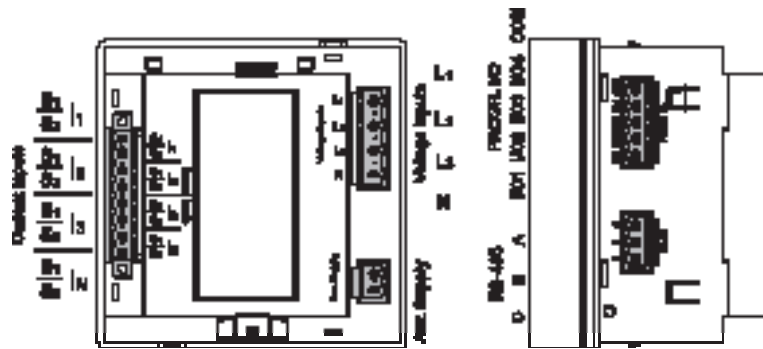
- M4M 30 ETHERNET connection
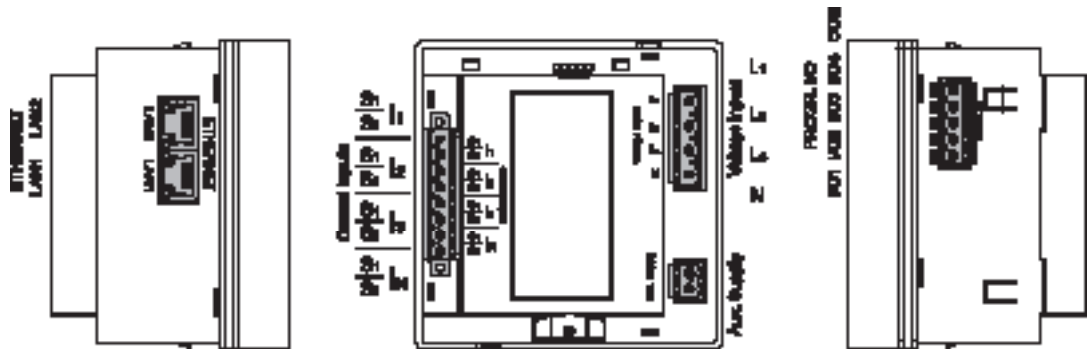
- M4M 30 PROFIBUS connection
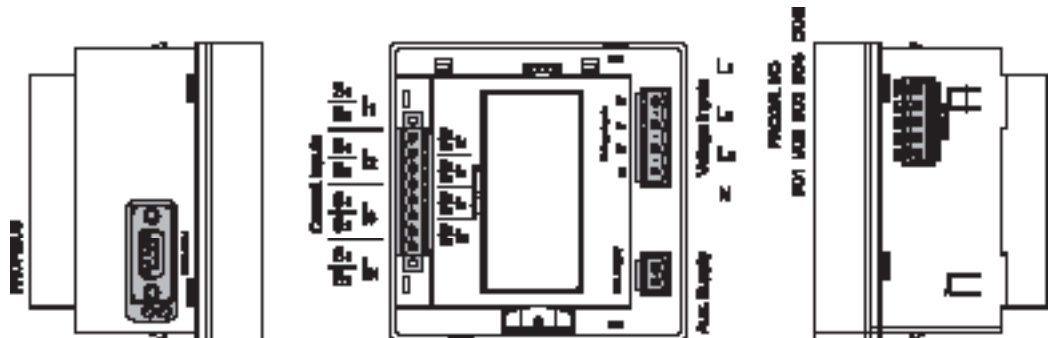
- M4M 30 I/O connection
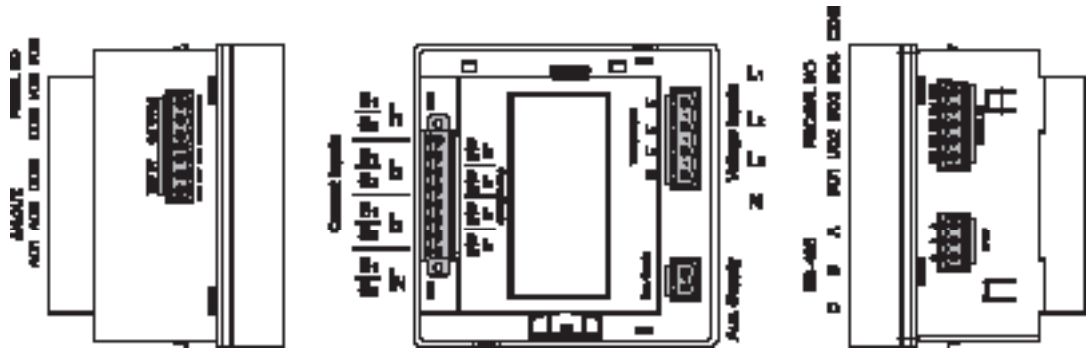
- M4M 30 BACNET connection
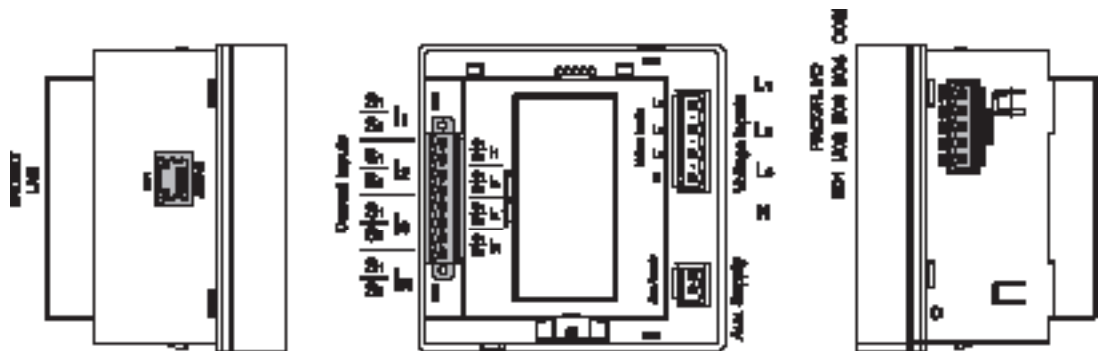
- M4M 30 ROGOWSKI connection
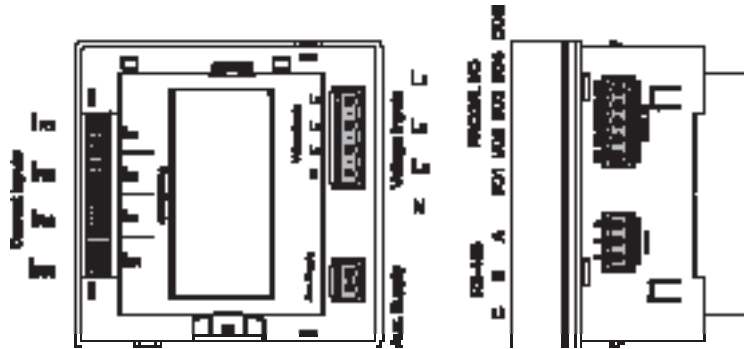
Wiring diagrams - M4M 30 Modbus, M4M 30 Ethernet, M4M 30 I/O, M4M 30 Profibus, M4M 30 Bacnet

The M4M 30 can be used on different type of network (please refer to chapter "" for the configuration on the device).
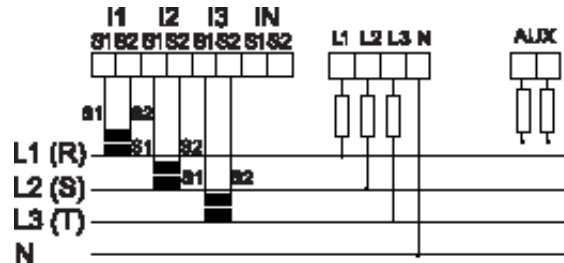
According to the type of network that has been chosen, the parameters visualized on the device HMI change.

Below the wiring diagrams for M4M 30 working with CT …/5A or …/1A (M4M 30 Modbus, M4M 30 Ethernet, M4M 30 I/O, M4M 30 Profibus, M4M 30 Bacnet) are shown:
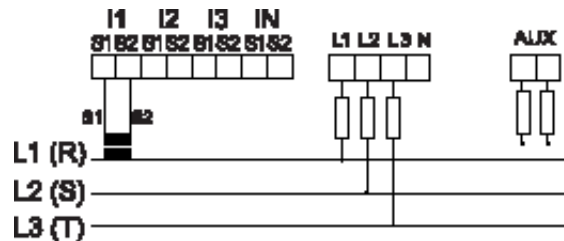
- 3-phase 4-wire network with 4CTs
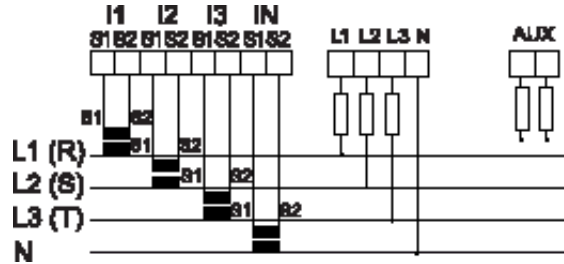
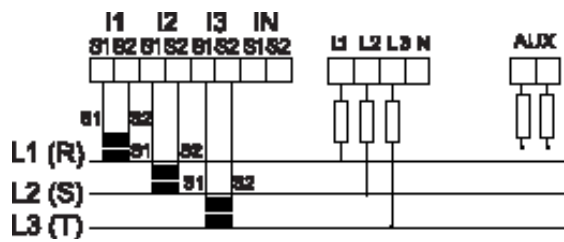- 3-phase 4-wire network with 3CTs

- 3-phase 4-wire network with 1CT
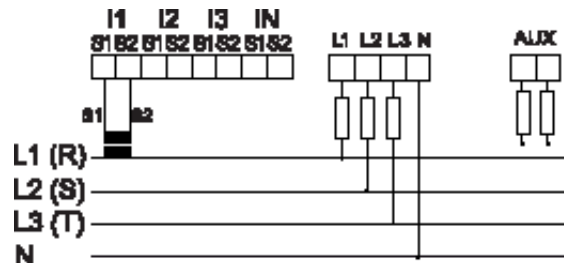
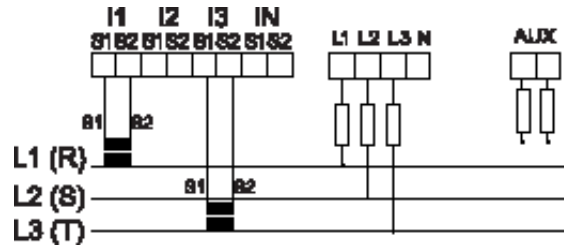

- 3-phase 3-wire network with 1CT
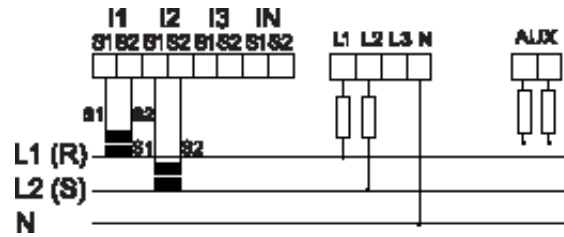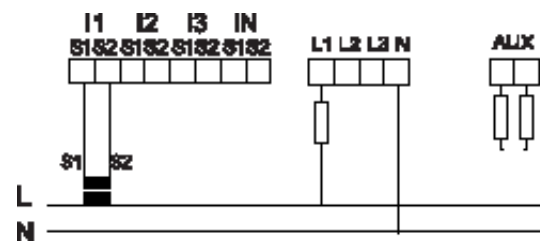

- 3-phase 3-wire network with 3CTs

- 3-phase 3-wire network with 2CTs
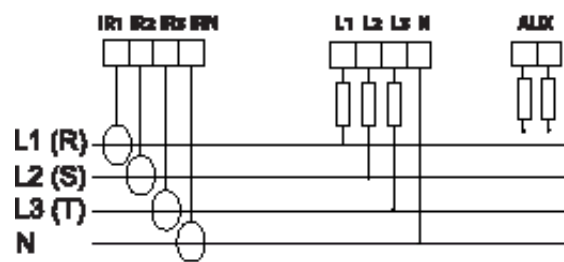

- 2-phase 3-wire network with 2CTs
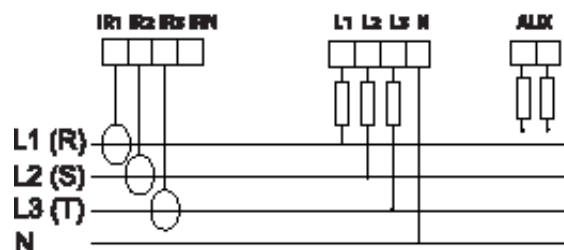

- 1-phase 2-wire network with 1CT

Wiring diagrams - M4M 30 Rogowski

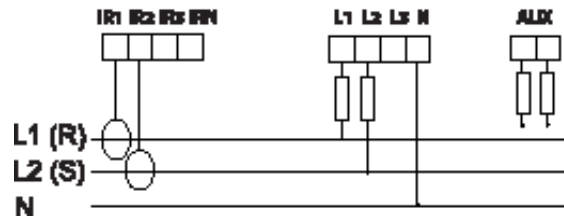Below the wiring diagrams for M4M 30 working with Rogowski coils are shown:

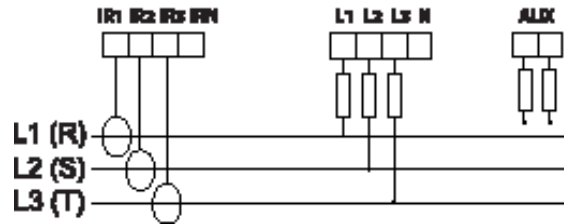- 3-phase 4-wire network with 4RogCTs

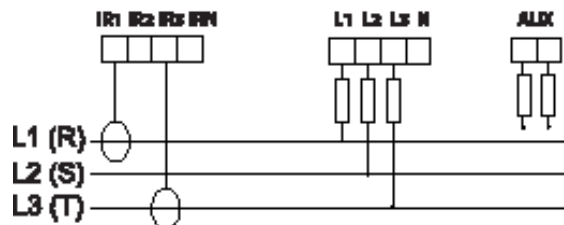- 3-phase 4-wire network with 3RogCTs
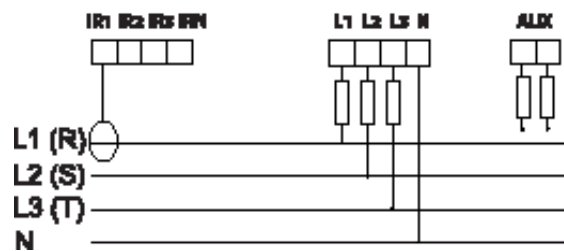
- 2-phase 3-wire network with 2RogCTs

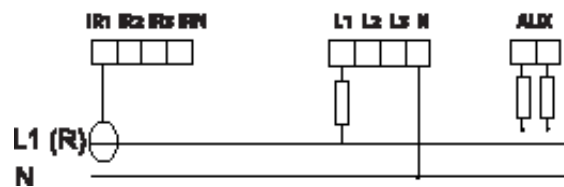- 3-phase 3-wire network with 3RogCTs

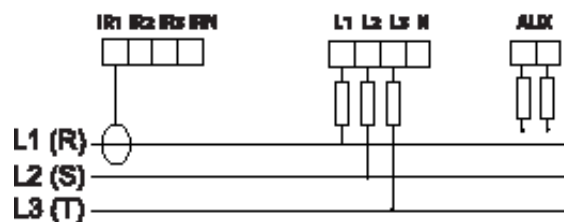- 3-phase 3-wire network with 2RogCTs

- 3-phase 4-wire network with 1RogCT

- 1-phase 2-wire network with 1RogCT

- 3-phase 3-wire network with 1RogCT

Inputs and outputs connections

- Programmable I/O: Alarm output with external relays for load command. Example of wiring for I/O1 as alarm output, COM is common for all I/O:
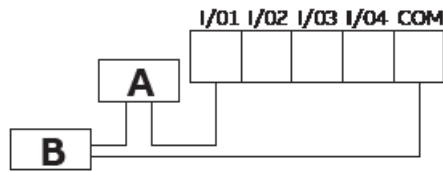
A: V aux 48 V a.c./d.c. 100mA
B: External relay

- Programmable I/O: Pulse output. Example of wiring for I/O1 as pulse output, COM is common for all I/O:
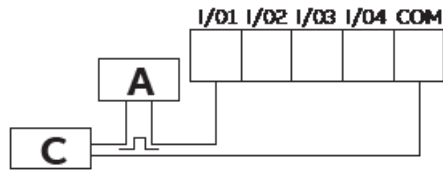
A: V aux 48 V a.c./d.c. 100mA
C: Pulse acquisition

- Programmable I/O: Tariff input. Please note that only I/O1, I/O2, I/O3 can be used as tariff inputs. Example of wiring for I/O1 as tariff input, COM is common for all I/O:
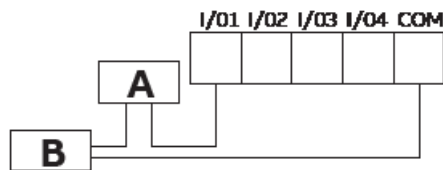
A: 24-240VDC / 57-240VAC
B: Tariff acquisition

- Programmable I/O: Pulse input for external pulse acquisition. Example of wiring for I/O1 as pulse input, COM is common for all I/O:
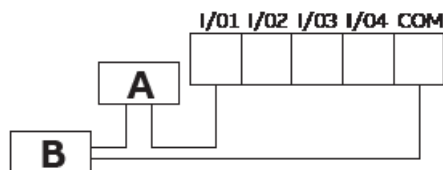
A: 24-240VDC / 57-240VAC
B: Pulse acquisition (Impulse length at least 30 mS)

ⓘ Same wiring schemes apply for I/O5 and I/O6 available only on M4M 30 I/O.

- Analogue outputs, typical load 250 Ohm, max 500 Ohm (available only on M4M 30 I/O):
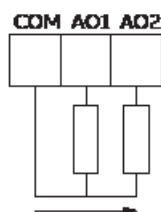
5.Access to device

5.1.Homepage

The device menu is divided into four sections.
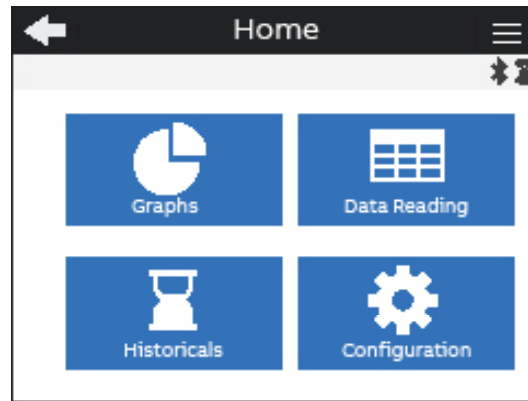
Menu	Description
Graphs	Graphical representation of the main measured parameters.
Data reading	Reading of the main measured parameters.
Historicals	Reading of the measured parameters recorded in the flash memory.
Configuration	Setup of the device.

5.2.Navigation symbols

Symbol	Description
≡	Shortcut key with 3 sections: Notifications, Favourite page and Home.
←	Return to the previous page.
+ −	Increase or decrease the value. Keeping pressed will increase the speed of the number variation.
∧ ∨	Move cursor up or down.
⟨ ⟩	Move to previous or next page.
	Bluetooth enabled.
	Notifications.
	Favourite page.
	Home.
	Configuration mode is protected (needed to enter password).
	Configuration mode is unprotected (password already entered).

5.3.Notification icons

Symbol	Description
	Alarms: user settable (related to specific parameters, threshold, etc).
	Warnings: related to installation conditions and device settings.
	Errors: related to the device and to self-diagnostics in general.

5.4.Overview of menu pages

Each section of the device contains different menus and submenus as per below tables:

HOME → Graphs

Menu	Description
Realtime Graphs	Bargraphs for voltage (L-N, L-L), current, power (active, reactive, apparent).
Waveforms	Waveforms visualization for voltage (L-N, L-L), current.
Harmonics	Harmonic composition of voltage (L-N, L-L), current.
Phasors	Phasor diagram for voltage L-N and current and visualization of displacements.

HOME → Data Reading

Menu	Description
Realtime	Summary, voltage (L-N, L-L), current, power (active, reactive, apparent), frequency.
Energy	Active, reactive, apparent energy, import, export and net, including tariffs if defined.
Power quality	THD (voltage, current), unbalances (voltage, current), power factor and cosphi per each phase.
Average	Average values in the latest period for voltage, current and power (active, reactive, apparent).
Min value	Minimum values forvoltage, current and demand power (active, reactive, apparent).
Max value	Maximum values for voltage, current and demand power (active, reactive, apparent).
I/O	I/O status according to the I/O type and M4M version.
Notifications	List of notifications divided into alarms, warnings, errors.
Timers	Count-up timer (on hours), count-down timer (maintenance timer).

HOME → Historicals

Menu	Description
Load profile	Stored load profiles and trends associated to realtime parameters.
Max/Min Demand	Stored max/min demand values (up to 3 each) of realtime parameters.
Energy - Trend	Trend of energy consumption values over a certain period
Energy - Snapshots	Instantaneous snapshots of energy consumption cumulative values

 HOME → **Configuration**

Menu	Description
Unit	Settings related to the device itself.
Installation	Settings related to the installation conditions.
Historicals	Settings related to Historicals functionalities, stored on the flash memory.
I/O	Definition of I/O type of the M4M version.
Alarms	Definition of alarm conditions to be visualized as notifications or linked to I/O.
Complex Alarms	Definition of user-defined logics based on single alarms to be visualized as notifications or linked to I/O.
Tariffs	Definition of tariffs via clock, communication or input.
Communication	Settings related to the embedded communication protocols of the M4M version.
Other settings	Settings for average values, timers, energy conversion, warning levels of harmonics.

5.5.Data entry

For the configuration it is possible either to choose from a list of values or to manually enter a value.

List of values
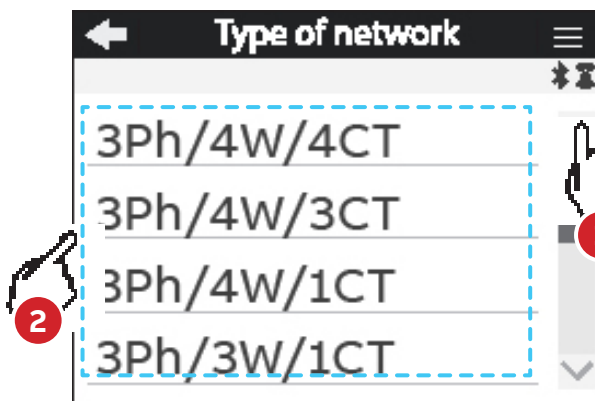
1. Scroll the list on of values or fields.
2. Select one option

Manual data entry
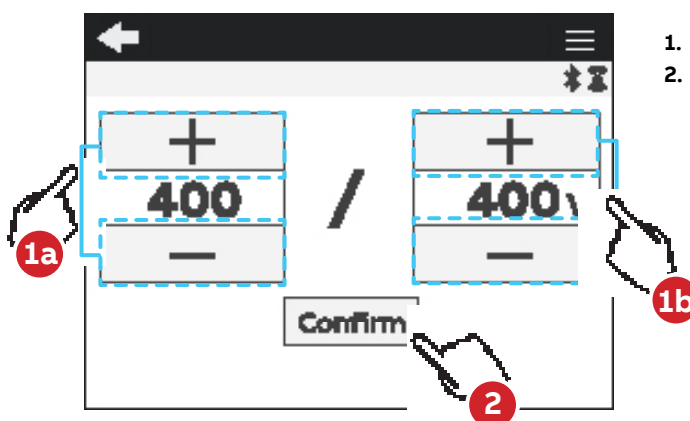
1. Enter the values available in display
2. Press **Confirm** to confirm the modification.

Keeping pressed [+][–] will increase the speed of the number variation.

Confirmation pop-up

For some configurations of the device it is mandatory to give further confirmation after data entry. A confirmation pop-up is shown on the screen:
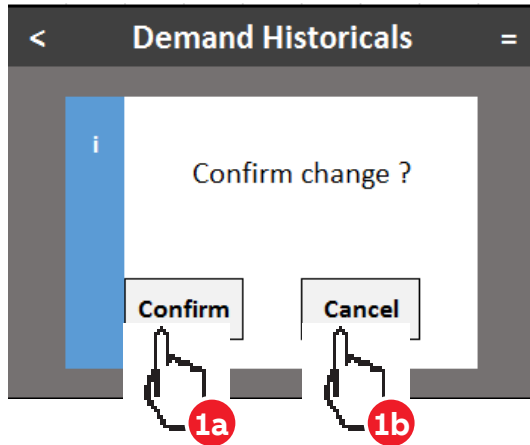
1a. Press **Confirm** to confirm the modification.
1b. Press **Cancel** to return to previous page.

Operation succeeded pop-up bar

When the configuration is completed successfully, the green pop-up bar "Operation succeeded" will appear.
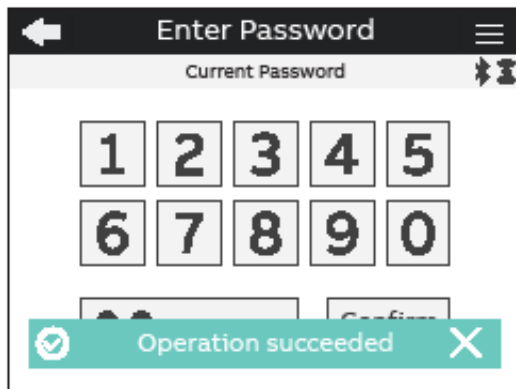
—
5.6.Favourite page

It is possible set a page as a "Favourite page", that is then easily accessible by clicking the"Favourite" key.

Setting - Favourite page
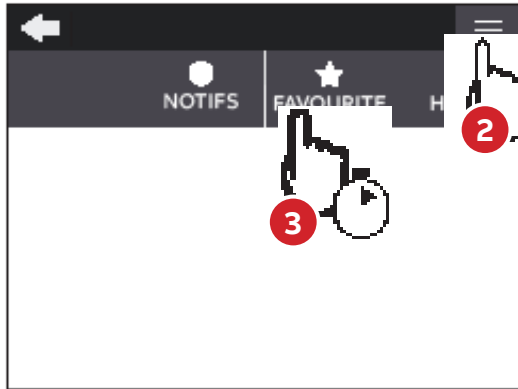
1. Enter the page you would like to set as favourite
2. Select ▤ Shortcut key.
3. Hold on ★ Favourite key confirm for **3 seconds**.
4. When the configuration is completed, the green pop-up bar **Operation succeeded** will appear.

Display - Favourite page
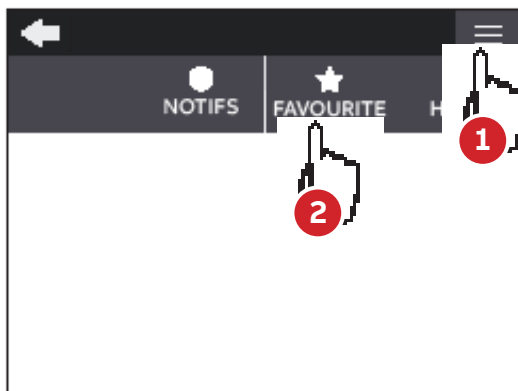
1. Select ▤ Shortcut key.
2. Select ★ Favourite key.

To reset the **Favourite page** follow above steps when inside Homepage.

Only the pages from Graphs, Data Reading and Historicals menus can be set as favourite.

Menu list pages cannot be set as favourite page.

6.First commissioning

At first power up of M4M network analyzers, wizard procedure will guide the user in the first commissioning steps:

1. Set the language (please refer to chapter "6.1.Language")
2. Set a password (please refer to chapter "6.2.Password for the first use")
3. Set the date and time on the device (please refer to chapter "6.3.Date and time")
4. Set the type of network (please refer to chapter "6.4.Type of network")
5. Set the current transformers ratio (please refer to chapter "6.5.CT ratio")
6. Set the voltage transformers ratio (please refer to chapter "6.6.VT ratio")

6.1.Language

It is possible to change the display language to one of the languages present in the device.

HOME → **Configuration** → **Unit** → **Language**

1. Scroll the list of fields
2. Select the desired language for the display among the ones available.

6.2.Password for the first use

A password can be set by the user to protect the Configuration menu and avoid any unwanted modification to the device settings.
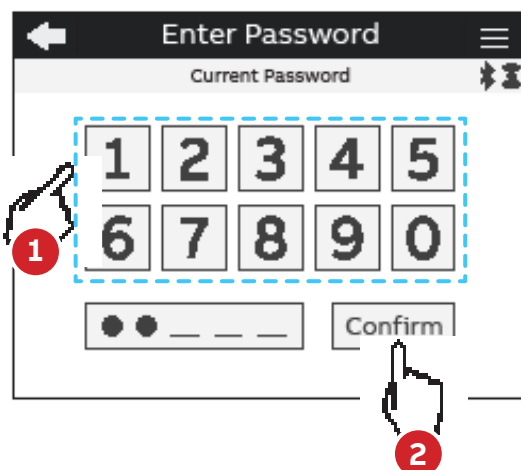
1. At the first use it is mandatory to define a password. The password must be composed by 5 numerical characters.
2. Press **Confirm** to confirm modification

ⓘ In order to disable the password, please set the new password as 00000.
The password can be changed in any moment in Configurations -> Unit -> Modify password (please refer to chapter "7.1 Unit")

—

6.3.Date and time

Setting date and time is mandatory in order to use the time-related functionalities on the device (e.g. Historicals, Maximum, Minimum). Please notice that if no date and time are set, no timestamp will be available on the measured data.

HOME → Configuration → **Unit** → **Date/Time**
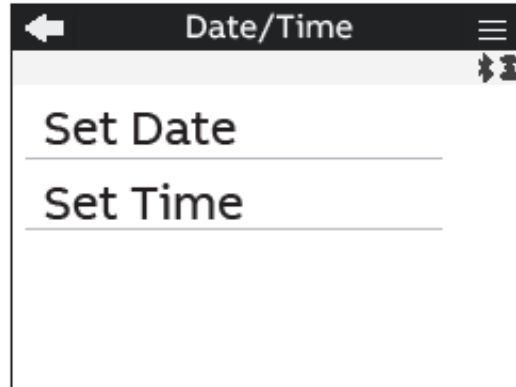
Menu	Description
Set date	Configure the current date with format YYYY/MM/DD.
Set time	Configure the current time.

—

6.4.Type of network

In order to configure the type of network it is needed to choose one of the available options according to the installation conditions.

HOME → Configuration → **Installation** → **Type of network**
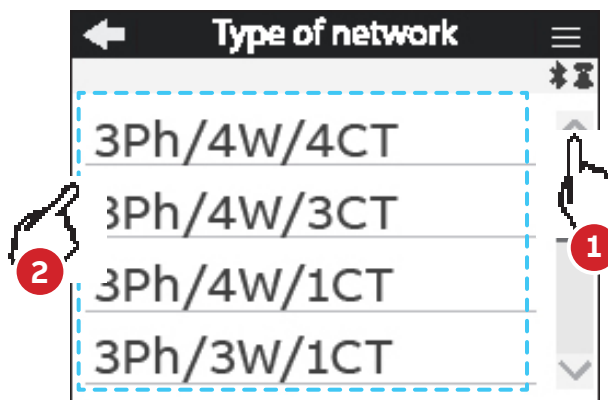
1. Scroll the list of fields
2. Select one option

According to the type of network that has been chosen, the parameters visualized on the device HMI change.

Option	Description	Option	Description
3Ph/4W/4CT	3-phase 4-wire + 4CTs	3Ph/3W/3CT	3-phase 3-wire + 3CTs
3Ph/4W/3CT	3-phase 4-wire + 3CTs	3Ph/3W/2CT	3-phase 3-wire + 2CTs
3Ph/4W/1CT	3-phase 4-wire + 1CT	2Ph/3W/2CT	2-phase 3-wire + 2CTs
3Ph/3W/1CT	3-phase 3-wire + 1CT	1Ph/2W/1CT	1-phase 2-wire + 1CT

—
6.5. CT ratio

M4M is capable to measure current only via indirect connection by means of current transformers CTs.../5A or .../1A (M4M 30 Modbus, M4M 30 Ethernet, M4M 30 I/O, M4M 30 Profibus, M4M 30 Bacnet), or Rogowski coils (M4M 30 Rogowski).

If CTs are used, then on the network analyzer it is needed to set the transformation ratio of the installed current transformers.

If Rogowski coils are used (M4M 30 Rogowski), it is not needed to set any transformation ratio.

In order to configure the current transformers ratio it is possible either to choose the values from a list of values (default settings) or to manually enter a value.

CT ratio - Default values

HOME → Configuration → **Installation** → **CT ratio L1 L2 L3**
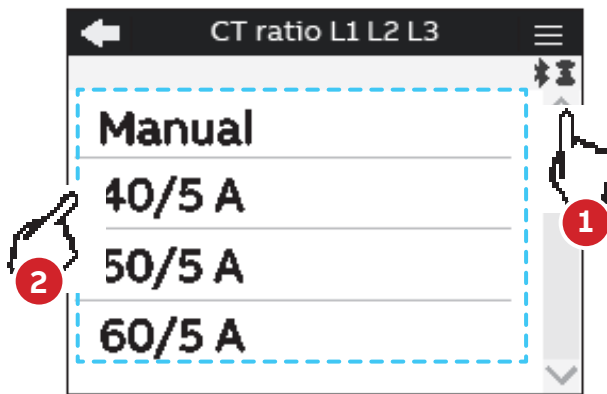
1. Scroll the list of values
2. Select one option

Default values of CT ratio L1 L2 L3	Default values of CT ratio L1 L2 L3
40/5	200/5
50/5	250/5
60/5	400/5
80/5	600/5
100/5	800/5
150/5	1000/5

CT ratio - Manual entry

HOME → Configuration → **Installation** → **CT ratio L1 L2 L3**
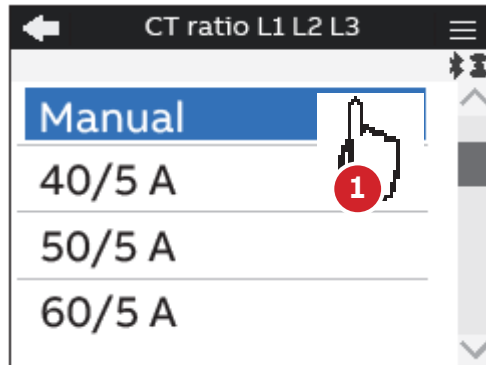
1. Select the option "Manual".
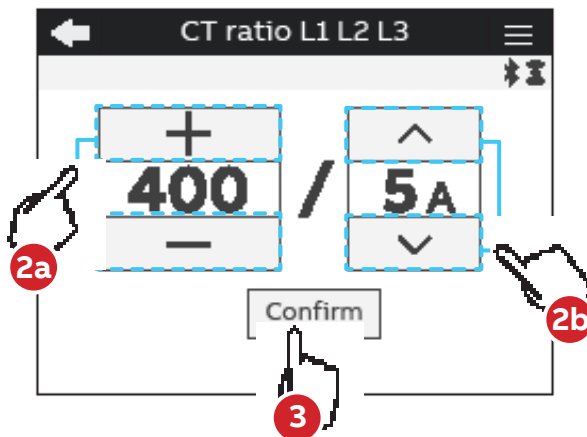
2. Scroll the numerical values available in either ascending or descending order until the required number is obtained. Insert a value between **1 A** and **999999 A** for the primary, select **1 A** or **5 A** for the secondary. The default values are **5** for the primary and **5** for the secondary.
3. Press **Confirm** to confirm the modification.

If the CT is replaced varying the value of the transformation ratio, before proceeding it is recommended to:

1. Note down the value of the energy counts accumulated with the previous ratio.
2. Reset the energy counts.
3. Insert a new value of the transformation ratio.

Please notice that if M4M 30 Rogowski is being used, no CT ratio has to be set for Rogowski coils.
Primary of CT has to be higher than the secondary.

In case a 4th current transformer is used to measure the neutral current, CT ratio for the Neutral has to be configured.

HOME → Configuration → **Installation** → **CT ratio Neutral**
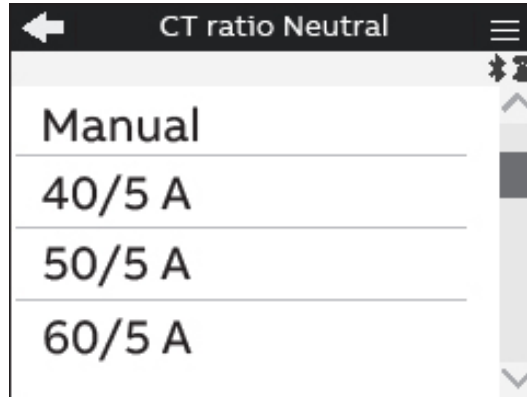
ⓘ Default values are the same as for CT ratio L1 L2 L3.
In case of manual entry, please refer to the manual entry of CT ratio L1 L2 L3.
Please notice that if M4M 30 Rogowski is being used, no CT ratio has to be set for Rogowski coils.

___

6.6.VT ratio

M4M is capable to measure voltage via direct connection up to 400 VL-N (690V L-L), or via indirect connection by means of voltage transformers.

In order to configure the voltage transformer ratio it is needed to enter manually the values of both primary and secondary.

HOME → Configuration → **Installation** → **VT ratio**
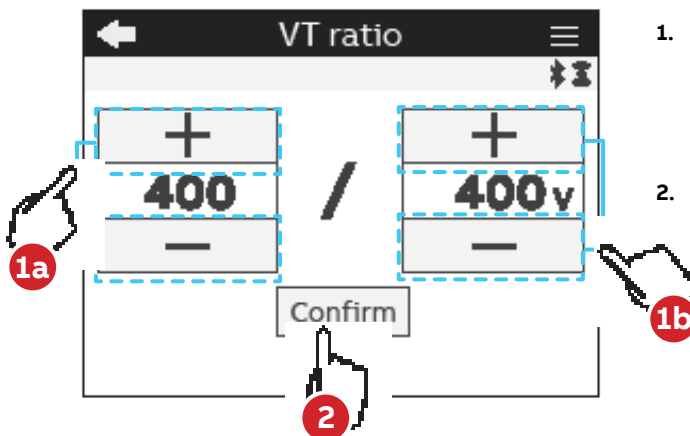
1. Scroll the numerical values available in either ascending or descending order until the required number is obtained; the **default values** are **400** for the primary and **400** for the secondary.
2. Press **Confirm** to confirm the modification.

ⓘ In case of direct insertion without voltage transformers (possible up to 400V L-N), please set VT ratio as 400/400 (default)

7.Configuration

In order to change any configuration of the device, it is mandatory to enter the password. The password is valid as soon as the user remains in the Configuration section and for max. 10 minutes. After quitting the Configuration section, it is needed to enter again the password.

(i) If the padlock icon is closed, it is needed to enter the password in order to modify any configuration.
If the padlock icon is open, it is possible to modify any configuration without entering any password.
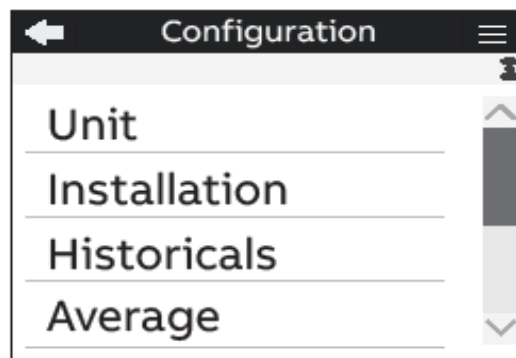
(i) Press ⬅ key in order to return to homepage.
If the user exits from the Configuration section, the device configuration is protected again and it is needed to re-enter the password.

7.1.Unit
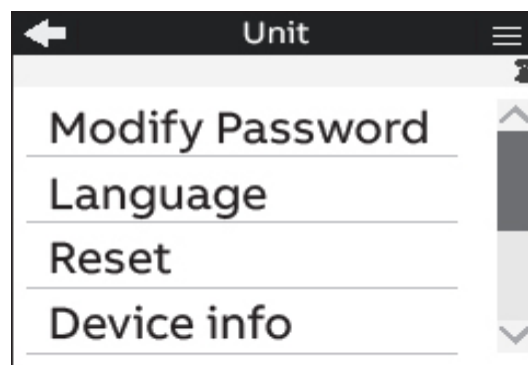
Menu	Description
Modify Password	Change the existing password.
Language	Change the language of the display.
Reset	Reset options for the meter.
Device info	Visualization of info related to the meter.
Date/Time	Change date and time on the device.
Brightness	Change the brightness of the display.
Energy Saving	Set energy saving mode for the display.
Logs	Visualization of audit log and system log.

Modify password menu

In order to modify the password:

HOME → Configuration → **Unit** → **Modify Password**
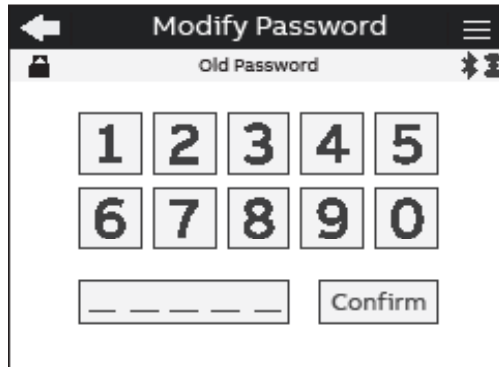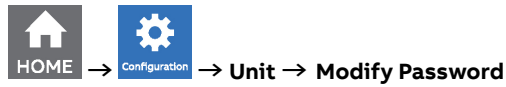
1. Dismiss the "Insert the old password" popup.
2. Enter the current password ("Old password" on the screen) and confirm the selection with Confirm;
3. Dismiss the "Insert a new password" popup;
4. Set the new password, that has to be different from the current password, and confirm the selection with Confirm;
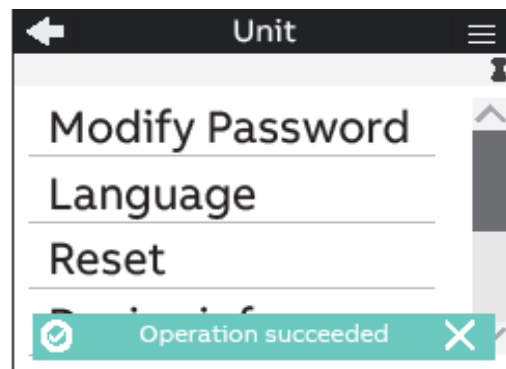
5. When the modification is completed the green popup bar "Operation succeeded" will appear.

ⓘ If a Factory reset is carried out, also the password is reset to default.

Language menu

It is possible to change the display language to one of the languages present in the device. (please refer to chapter "6.1.Language").

HOME → Configuration → **Unit** → **Language**

Reset menu

 HOME → Configuration → **Unit** → **Reset**
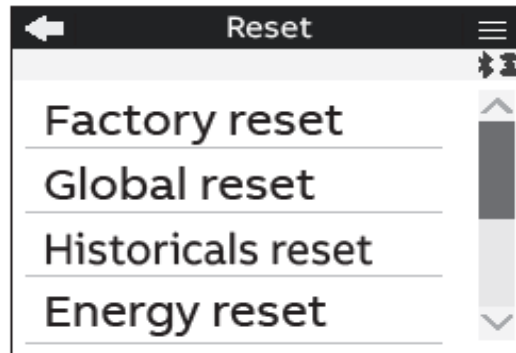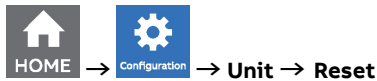
Type of reset	Description
Factory reset	Restore the device to the factory state except for the audit log. Up to 20 factory resets can be carried out over the product lifetime.
Global reset	Complete reset of the device except for the settings and the audit log
Historicals reset	Erase all historical data (Load Profile, Demands, Energy Snapshots and Energy Trend).
Avg/Min/Max reset	Reset the average, min and max data.
Energy reset	Erase all energy measurement accumulators. Up to 240 energy resets can be carried out over the product lifetime.
Notification reset	Erase all notifications (Alarms, Warnings, Errors).

Device Info menu

In this menu it is possible to visualize the main info related to the M4M network analyzer: FW version, FW CRC, product name and unique serial number.

It is highly recommended to update the firmware to the latest version for security and functionality reasons. Please check the ABB website and download the latest version of the firmware.

 In order to update the FW to the latest version (via Modbus RTU or Modbus TCP/IP) it is necessary to use ABB Software Ekip Connect 3.

Date/Time menu

During the first commissioning, it is highly recommended to configure the date and time on the network analyzer (please refer to chapter "6.3.Date and time").

 HOME → Configuration → **Unit** → **Date/Time menu**
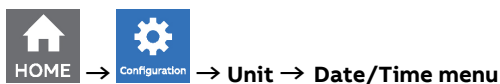
Brightness menu

In this menu it is possible to modify the display brightness during normal operation conditions.

HOME → Configuration → **Unit** → **Brightness**
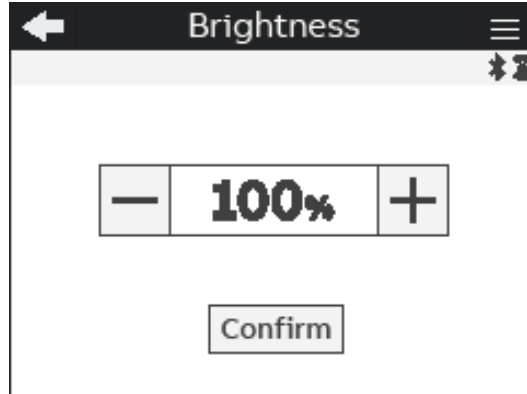
The default value is **100%** but it can differ from 1**0%** to **100%**.
The lifetime of the graphical display depends on the brightness of the display. It is highly recommended to limit the brightness level of the display in order to ensure a longer lifetime of the device.

Energy saving menu

In this menu it is possible to define the stand-by time and the stand-by brightness of the display in order to limit the device power consumption when not in operation conditions.

HOME → Configuration → **Unit** → **Energy saving**
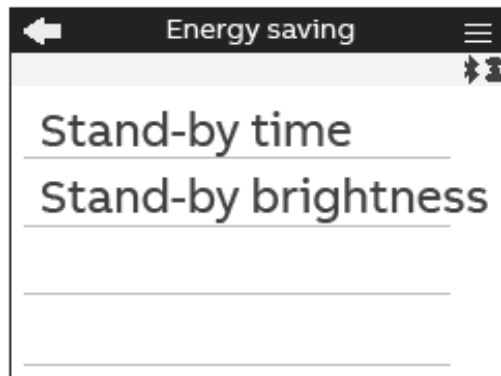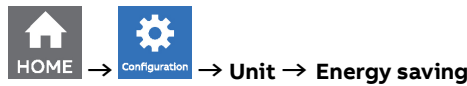
Menu	Description
Stand-by time	Set up the time after that the brightness decrease. The **default value is 3 minutes** but it can differ from 1 to 60 minutes.
Stand-by brightness	Set up the level of brightness when the device is in stand-by. The **default value is 40%** but it can differ from **0%** to **100%**.

The lifetime of the graphical display depends on its brightness and stand-by time.
It is highly recommended to limit the brightness level of the display in order to ensure a longer lifetime of the device.

Logs menu

The Audit Log stores an event after an attempt has been made to upgrade the firmware and/or CT ratio, VT ratio or Type of network is modified.

HOME → Configuration → **Unit** → **Logs**
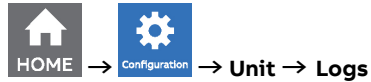
Each entry contains following data:

Data	Description
System info	Where general information about device from the moment of entry creation is presented.
Configuration	Where snapshot of CT/VT ratios and Type of network just right after a successfully performed operation is presented.
Energy	Where value of total imported active energy, imported active energy of L1-L3 and tariff 1-6 as well as total exported active energy from the moment of entry creation are presented.

7.2.Installation

HOME → Configuration → **Installation**
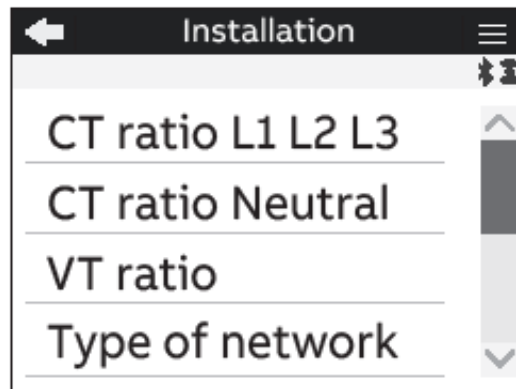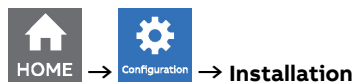
Menu	Description
Ct ratio L1 L2 L3	Set the ratio of current transformers for current measurement on Line 1, 2 and 3.
CT ratio Neutral	Set the ratio of current transformers for current measurement on neutral.
VT ratio	Set the ratio of voltage transformers for voltage measurement, if any.
Type of network	Set the type of network and number of wires on which the device is installed.
LED Source	Set the source for the frontal LED.

CT ratio L1 L2 L3 menu

During the first commissioning, it is highly recommended to configure the CT ratio L1, L2, L3 and Neutral (please refer to chapter "6.5.CT ratio").

[HOME] → [Configuration] → **Installation** → **CT ratio L1 L2 L3**
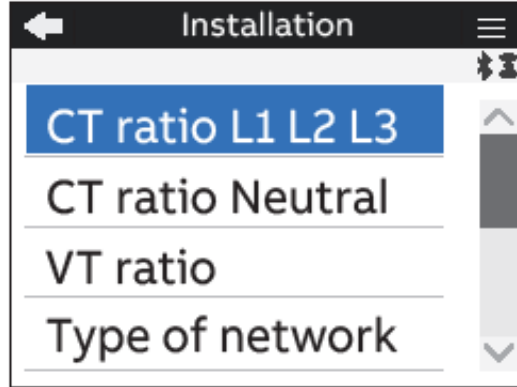
CT ratio Neutral menu

In first commissioning it is mandatory to configure the CT ratio L1, L2, L3 and Neutral (please refer to chapter "6.5.CT ratio").

[HOME] → [Configuration] → **Installation** → **CT ratio Neutral**
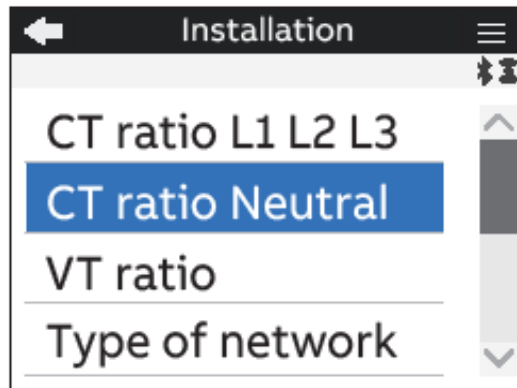
VT ratio menu

During the first commissioning it is mandatory to configure the VT ratio (please refer to chapter "6.6.VT ratio").

[HOME] → [Configuration] → **Installation** → **VT ratio**
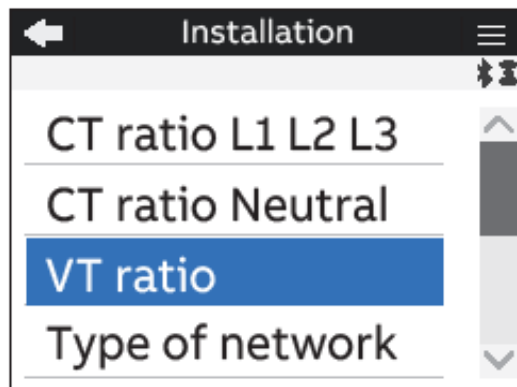
Type of network menu

During the first commissioning, it is highly recommended to configure the Type of network (please refer to chapter "6.4.Type of network").

 HOME → Configuration → **Installation** → **Type of network**
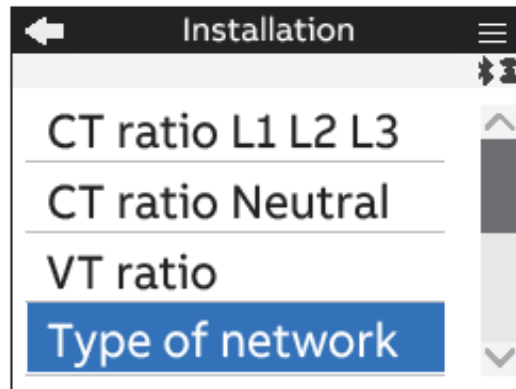
LED Source menu

It is possible to choose the source of LED among the following options: Active, Reactive ad Apparent energy.

 HOME → Configuration → **Installation** → **LED Source**
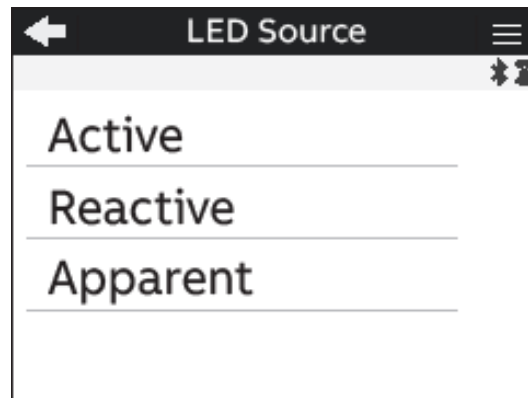
Option	Description
Active	Flashes in proportion to the active energy measured.
Reactive	Flashes in proportion to the reactive energy measured.
Apparent	Flashes in proportion to the apparent energy measured.

—
7.3.Historicals

In this section it is possible to carry out configurations related to Historicals functionalities. Historicals functionalities allow to store measurements (instantaneous snapshots, demand values) inside the device flash memory.

HOME → Configuration → **Historicals**
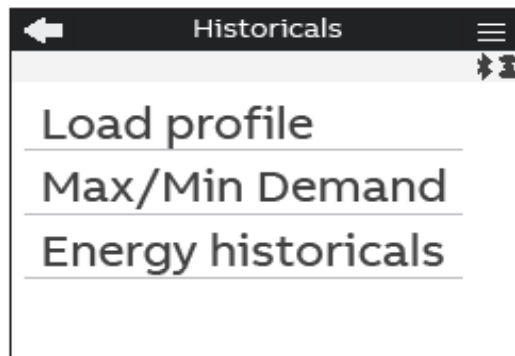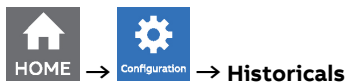
Menu	Description
Load profile	Configuration for the Load profile feature in Historicals.
Max/Min Demand	Configuration for the Max/min demand feature in Historicals.
Energy historicals	Common configuration for Energy - Snapshots and Energy - Trends features in Historicals.

Load profile menu

Load profile functionality allows to calculate the demand value of main real time measured quantities like voltage, current, power and THD, calculated over a specific time interval. These demand values are then visualized in a load profile curve in order to check the trend of the real time quantities.

At the end of each time interval, the average value of defined quantities is stored into the memory with timestamp. Up to 25 parameters, thus up to 25 channels of flash memory can be configured.

For the visualization of load profiles as configured in this section, please refer to "9.1.Load profile".
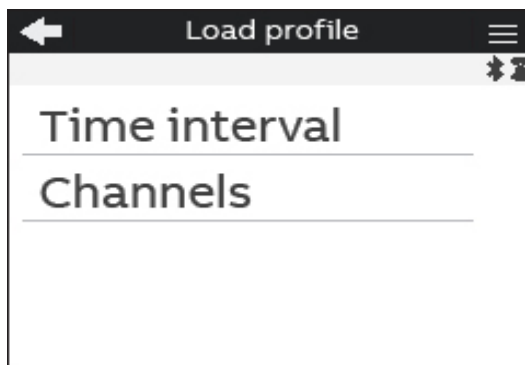
HOME → Configuration → **Historicals** → **Load profile**

Menu	Description
Time interval	Time interval used for calculation of demand values that will be stored into the memory with timestamp.
Channels	Available channels in load profile. Each channel can be configured to a defined parameter.

ⓘ Please note that M4M allows to store 1 year of load profiles with time interval of 30 min. for 25 parameters (25 channels of memory).

• **Time interval**

The time interval is in common for all the load profile channels. For this reason, this configuration has to be done only once.

The demand calculation will take place over the time interval defined. The interval will start in the moment of selection and the following one will start after the time interval is over.

Select the time interval among one of the following options: 1, 2, 5, 10, 15 (default value), 30, 60 minutes.

HOME → Configuration → **Historicals** → **Load profile** → **Time interval**
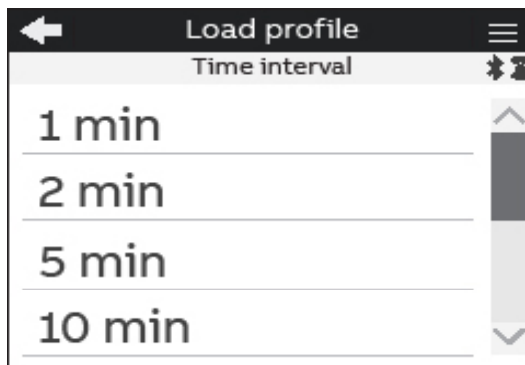
• **Channels**

It is possible to configure each channel to one of the following parameters, allowing to store one parameter in each channel. Up to 25 parameters can be selected and stored. Default parameters are already configured and defined in the M4M for each channel, see details below.

HOME → Configuration → **Historicals** → **Load profile** → **Channels**

Channels parameters	Channels parameters
Active Power Imp. Tot. (CH1 default value)	Voltage L1 (CH13 default value)
Active Power Imp. L1 (CH2 default value)	Voltage L2 (CH14 default value)
Active Power Imp. L2 (CH3 default value)	Voltage L3 (CH15 default value)
Active Power Imp. L3 (CH4 default value)	Voltage L1-L2 (CH16 default value)
Reactive Power Imp. Tot. (CH5 default value)	Voltage L2-L3 (CH17 default value)
Reactive Power Imp. L1 (CH6 default value)	Voltage L1-L3 (CH18 default value)
Reactive Power Imp. L2 (CH7 default value)	Current L1 (CH19 default value)
Reactive Power Imp. L3 (CH8 default value)	Current L2 (CH20 default value)
Apparent Power Imp. Tot. (CH9 default value)	Current L3 (CH21 default value)
Apparent Power Imp. L1 (CH10 default value)	Current N. (CH22 default value)
Apparent Power Imp. L2 (CH11 default value)	THD Voltage L1
Apparent Power Imp. L3 (CH12 default value)	THD Voltage L2
Active Power Exp. Tot.	THD Voltage L3
Active Power Exp. L1	THD Voltage L1-L2
Active Power Exp. L2	THD Voltage L2-L3
Active Power Exp. L3	THD Voltage L3-L1
Reactive Power Exp. Tot.	THD Current L1 (CH23 default value)
Reactive Power Exp. L1	THD Current L2 (CH24 default value)
Reactive Power Exp. L2	THD Current L3 (CH25 default value)
Reactive Power Exp. L3	THD Current N
Apparent Power Exp. Tot.	Power Factor Tot.
Apparent Power Exp. L1	Power Factor L1
Apparent Power Exp. L2	Power Factor L2
Apparent Power Exp. L3	Power Factor L3

Max/Min Demand menu

Max/min demand functionality is used to measure and store in the product flash memory the maximum and minimum demand values referred to a specific time period (day, week, month) of main real time measured. Demand values are calculated over a specific time interval (from 1 to 60 minutes). When the last interval of an ongoing period has finished, the maximum and/or minimum values are stored together with the timestamps, and a new period starts. Therefore, within the defined time period M4M will provide the max/min demand values calculated over the time interval. It is possible to store also the 2nd and the 3rd max/min. Max/min demand functionality allows to store up to the 3 highest and/or lowest demand values per each parameter. Up to 25 parameters, thus up to 25 channels of flash memory can be configured.
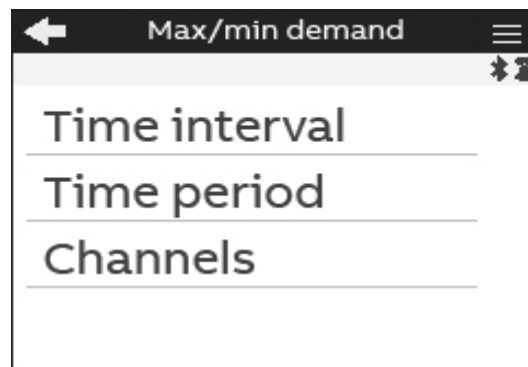
HOME $\rightarrow$ Configuration $\rightarrow$ **Historicals** $\rightarrow$ **Max/min demand**

Menu	Description
Time interval	Time interval used for calculation of demand values that will be stored into the memory with timestamp.
TIme period	Time period over which max and/or min values are evaluated and then stored.
Channels	Available channels in max/min demand. Each channel can be configured to a defined parameter.

Please note that M4M allows to store 1 year of 3 highest and 3 lowest demand values with time interval of 30 min. and time period of day for 25 parameters (25 channels of memory).

• **Time interval**

The time interval is in common for all the max/min demand channels. For this reason, this configuration has to be done only once. Average values can either be calculated with sliding demand or no sliding.
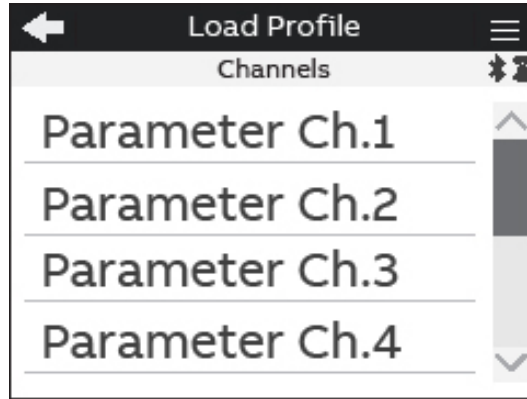
The demand calculation will take place over the time interval defined. The interval will start in the moment of selection and the following one will start after the time interval is over.

Select the time interval among one of the following options: 1, 2, 5, 10, 15 (default value), 30, 60 minutes.

After the configuration of time interval, it is needed to select the time sub-interval

HOME → **Configuration** → **Historicals** → **Max/min demand** → **Time interval**

Menu	Description
No sliding	After the configuration of time interval, in case **no sliding demand** is needed, please configure the time sub-interval as no sliding. If no sliding is selected the average will be calculated over the intervals **01:00 - 01:15**, **01:15 - 01:30**, **01:30 - 01:45** etc…
1 min	After the configuration of time interval, in case of sliding demand it is needed to setup a sub-interval, with measured interval that will slide forward one sub interval at a time. The sub-interval must always be smaller than the time interval the time interval must be evenly divisible with the sub-interval. If for example an interval of 15 minutes and a sub-interval of 1 minute is selected the average will be measured over the intervals 01:00 - 01:15, 01:01 - 01:16, 01:02 - 01:17 etc…
2 min	
5 min	
10 min	
15 min (default value)	
30 min	
60 min	

• **Time period**

The time period is in common for all the max/min demand channels. For this reason, this can configuration has to be done only once.

The time period represents the timeframe over which the max/min demand values are evaluated and then stored. When the last interval of an ongoing period has finished, the max and/or min values are stored, and a new period starts.

Select the time period among one of the following options: day (default value), week, month

HOME → Configuration → **Historicals → Max/min demand → Time period**
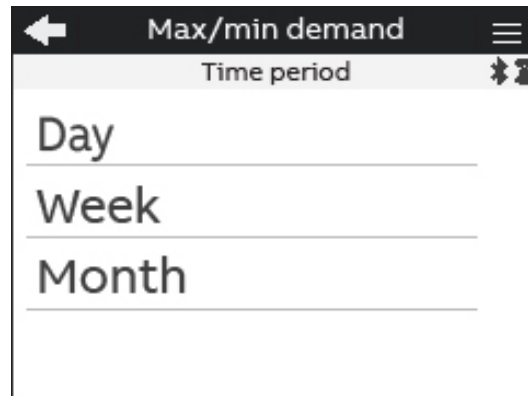
Menu	Description
Day (default value)	If day is chosen the starting point for evaluation of max and min will be now and the ending point will be 00:00 (time period ends and restarts at 00:00).
Week	If week is chosen, a start day of the period has to be chosen. Options are: Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, and Sunday.
Month	If month is chosen the starting point will be now and the ending point will be the first of next month at 00:00 (time period ends and restarts on the 1st).

The time period and time interval are common for all the max/min demand channels. For this reason, the configuration of time period and time interval are applied to all the channels.

In order to complete the configuration it is needed to press confirm to related pop-up.

• **Channels**

It is possible to link each channel to one of the following parameters, allowing to store one parameter in each channel. Up to 25 parameters can be selected and stored. Default parameters are already setup in the M4M for each channel, see details below.

HOME → **Configuration** → **Historicals** → **Max/min demand** → **Channels**

Channels parameters	Channels parameters
Active Power Imp. Tot. (CH1 default value)	Voltage L1 (CH13 default value)
Active Power Imp. L1 (CH2 default value)	Voltage L2 (CH14 default value)
Active Power Imp. L2 (CH3 default value)	Voltage L3 (CH15 default value)
Active Power Imp. L3 (CH4 default value)	Voltage L1-L2 (CH16 default value)
Reactive Power Imp. Tot. (CH5 default value)	Voltage L2-L3 (CH17 default value)
Reactive Power Imp. L1 (CH6 default value)	Voltage L1-L3 (CH18 default value)
Reactive Power Imp. L2 (CH7 default value)	Current L1 (CH19 default value)
Reactive Power Imp. L3 (CH8 default value)	Current L2 (CH20 default value)
Apparent Power Imp. Tot. (CH9 default value)	Current L3 (CH21 default value)
Apparent Power Imp. L1 (CH10 default value)	Current N. (CH22 default value)
Apparent Power Imp. L2 (CH11 default value)	THD Voltage L1
Apparent Power Imp. L3 (CH12 default value)	THD Voltage L2
Active Power Exp. Tot.	THD Voltage L3
Active Power Exp. L1	THD Voltage L1-L2
Active Power Exp. L2	THD Voltage L2-L3
Active Power Exp. L3	THD Voltage L3-L1
Reactive Power Exp. Tot.	THD Current L1 (CH23 default value)
Reactive Power Exp. L1	THD Current L2 (CH24 default value)
Reactive Power Exp. L2	THD Current L3 (CH25 default value)
Reactive Power Exp. L3	THD Current N
Apparent Power Exp. Tot.	Power Factor Tot.
Apparent Power Exp. L1	Power Factor L1
Apparent Power Exp. L2	Power Factor L2
Apparent Power Exp. L3	Power Factor L3

ⓘ After configuring the parameter, for each channel it is possible to configure whether to store only maximum values, only minimum values or both maximum and minimum values.
Configure the max/min type among one of the following options: **Max, Min** or **Max and Min**.

Energy Historicals menu

Configuration of energy historicals is linked to two different functionalities: Energy Snapshots allows to obtain instantaneous energy snapshots taken in each time interval, and Energy Trend allows to obtain the difference between the energy values at the end and at the beginning of each time interval. At the end of a defined time interval, up to 20 energy parameters are stored together with the timestamp.

For the visualization of Energy consumption cumulative as configured in this section, please refer to "9.3.Energy Snapshots".

For the visualization of Energy consumption trend as configured in this section, please refer to "9.4.Energy Trend".

HOME → Configuration → **Historicals → Energy historicals**
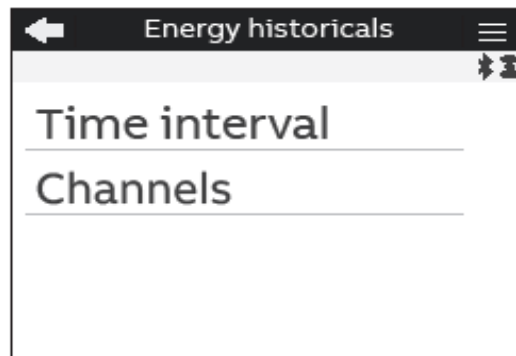
Menu	Description
Time interval	Time interval selected for storage of energy values.
Channel	Channels of memory of the device, allowing to store a defined parameter in each channel.

• **Time interval**

The time interval is in common for all the channels of memory. For this reason, this can configuration has to be done only once.

 HOME → Configuration → **Historicals** → **Energy historicals** → **Time interval**

Menu	Description
1 hour	The snapshot will take place now and the following one will be after 1 hour.
6 hours	The snapshot will take place now and the following one will be after 6 hours.
12 hours	The snapshot will take place now and the following one will be after 12 hours.
Day (default value)	The snapshot will take place now and the following one will be at 00:00.
Week	It is needed to indicate when the demand period ends between these following options: Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, and Sunday.
Month	The snapshot will take place now and the following one will be at the first of next month at 00:00.

• **Channels**

It is possible to link each channel to one of the following parameters, allowing to store one parameter in each channel. Up to 20 parameters can be selected and stored. Default parameters are already setup in the M4M for each channel, see details below.

HOME → Configuration → **Historicals** → **Energy historicals** → **Channels**

Channels parameters	Channels parameters
Active Energy Import Total (CH1 default value)	Active Energy Export Tariff 3
Active Energy Export Total (CH2 default value)	Active Energy Export Tariff 4
Active Energy Import L1 (CH4 default value)	Active Energy Export Tariff 5
Active Energy Import L2 (CH5 default value)	Active Energy Export Tariff 6
Active Energy Import L3 (CH6 default value)	Reactive Energy Import Tariff 1
Active Energy Export L1 (CH7 default value)	Reactive Energy Import Tariff 2
Active Energy Export L2 (CH8 default value)	Reactive Energy Import Tariff 3
Active Energy Export L3 (CH9 default value)	Reactive Energy Import Tariff 4
Reactive Energy Import Total (CH10 default value)	Reactive Energy Import Tariff 5
Reactive Energy Export Total (CH11 default value)	Reactive Energy Import Tariff 6
Reactive Energy Import L1 (CH13 default value)	Reactive Energy Export Tariff 1
Reactive Energy Import L2 (CH14 default value)	Reactive Energy Export Tariff 2
Reactive Energy Import L3 (CH15 default value)	Reactive Energy Export Tariff 3
Reactive Energy Export L1 (CH16 default value)	Reactive Energy Export Tariff 4
Reactive Energy Export L2 (CH17 default value)	Reactive Energy Export Tariff 5
Reactive Energy Export L3 (CH18 default value)	Reactive Energy Export Tariff 6
Apparent Energy Import Total (CH19 default value)	Active Energy Net Total (CH3 default value)
Apparent Energy Export Total (CH20 default value)	Active Energy Net L1
Apparent Energy Import L1	Active Energy Net L2
Apparent Energy Import L2	Active Energy Net L3
Apparent Energy Import L3	Reactive Energy Net Total (CH12 default value)
Apparent Energy Export L1	Reactive Energy Net L1
Apparent Energy Export L2	Reactive Energy Net L2
Apparent Energy Export L3	Reactive Energy Net L3
Resettable Active Energy Import Total	Apparent Energy Net Total
Resettable Active Energy Export Total	Apparent Energy Net L1
Resettable Reactive Energy Import Total	Apparent Energy Net L2
Resettable Reactive Energy Export Total	Apparent Energy Net L3
Active Energy Import Tariff 1	Active Energy CO2
Active Energy Import Tariff 2	Active Energy Currency
Active Energy Import Tariff 3	Energy Counter Input 1
Active Energy Import Tariff 4	Energy Counter Input 2
Active Energy Import Tariff 5	Energy Counter Input 3
Active Energy Import Tariff 6	Energy Counter Input 4
Active Energy Export Tariff 1	Energy Counter Input 5
Active Energy Export Tariff 2	Energy Counter Input 6

—
7.4.Input / output

In this section it is possible to configure I/O slots of the meter.

The number and type of I/O on the M4M network analyzer varies according to the different product versions. Please refer to the table in "3.3.Versions" for the detail of I/O types per each M4M.

HOME → Configuration → **I/O**
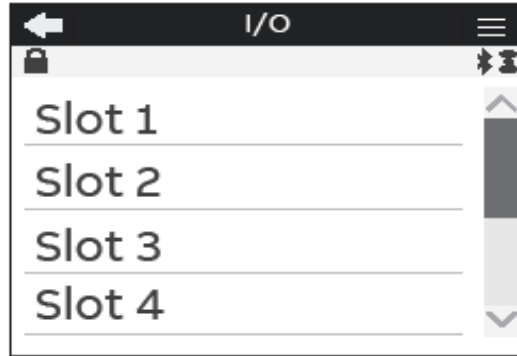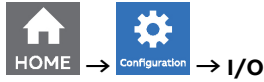
Each programmable I/O slot con be configured as follow:

Input type:	Output type:
Pulse input	Alarm output
Tariff input	Communication output
	Pulse output
	Output ON
	Output OFF

- **Input**

  Each programmable I/O can be configured as **Pulse Input** or **Tariff Input**.

  Selecting **Pulse Input**, the device counts detected pulses connected to input port, that should last at least 30ms. It is needed to consecutively set a pulse ratio associated to the pulse counter, and then a unit of measurement to be associated to the pulses.

Setting page	Description
1. Pulse ratio	Manual value between 1 and 999999.
2. Unit	No unit, Wh, kWh, MWh, Varh, kVarh, MVarh, VAh, kVAh, MVAh, gal, BTU, L, m^3, MCF, lbs, kg, klbs, Therm.

Selecting **Tariff Input** allows to manage the tariffs via inputs. Only I/O1, I/O2 and I/O3 can be used for Tariff inputs. It is mandatory to select Tariff source as "Input" inside Configuration -> Installation -> Tariffs. Please see chapter "7.7.Tariffs" for relationship between tariffs and input status.

Setting page	Slots to be configured as Tariff input
Up to 2	I/O1
Up to 4	I/O1, I/O2
Up to 6	I/O1, I/O2, I/O3

• Digital Output

Each programmable I/O can be configured as **Alarm output**, **Communication output**, **Pulse output**, **Output ON** or **Output OFF**.

Selecting **Alarm output**, the output can be associated to a simple alarm or to a complex alarm. Please note that it is mandatory to set up a single alarm or a complex alarm prior to setting an output as Alarm output. In case no alarms have been set up, an information pop-up will appear to inform that no alarm is set, with an hyperlink to the Alarm settings. For alarm settings, please refer to chapter "7.5.Alarms" and "7.6.Complex alarms".

Selecting **Comm. output**, the output status is controlled directly via bus.

Selecting **Pulse output**, the output is set as a pulse generator associated with a measured parameter. It is needed to consecutively set a measured parameter associated to the pulse output, the pulse ratio and the pulse length.

Setting page	Description
Parameter	Total Active Import Energy, Total Active Export Energy, Net Active Energy, Total Reactive Import Energy, Total Reactive Export Energy, Net Reactive Energy, Total Apparent Import Energy, Total Apparent Export Energy, Net Apparent Energy.
Pulse ratio	Default values: 10/100/1000/5000 pulses for each kWh/kvarh/kVAh or 10/50/100 pulses for each Wh/varh/VAh. Manual between 1 and 999999 pulses for each kWh/kvarh/kVAh or pulses for each MWh/Mvarh/MVAh.
Length	Manual value between 10 and 990ms.

Selecting **Output ON**, the output status is always set High.

Selecting **Output OFF**, the output status is always set Low.

• Analog output

Slots 7 and 8 of the I/O menu for M4M 30 I/O contain analog outputs that can be used to associate a measured parameter to a current output value.

It is possible to define the parameter to be associated to the analogue output, as well as minimum and maximum measured values to be linked to the output span.

| Menu	Description
Output span	0 - 20mA or 4 - 20mA
Parameter	Voltage L1, L2 and L3, Voltage L1-L2, L2-L3, L1-L3, Total Current, Current L1, L2, L3, Current Neutral, Total Active Power, L1 Active Power, L2 Active Power, L3 Active Power, Total Reactive Power, L1 Reactive Power, L2 Reactive Power, L3 Reactive Power, Total Apparent Power, L1 Apparent Power, L2 Apparent Power, L3 Apparent Power, THD Voltage L1, L2, L3, L1-L2, L2-L3, L1-L3, THD Current L1, L2, L3, N, Unbalance L-L, L-N, Unbalance Current, Frequency, Total PF, PF L1, L2, L3.
Min. value	Manual value of the measured parameter, to be associated to 0mA or 4mA (minimum).
Max. value	Manual value of the measured parameter, to be associated to 20mA (maximum).

—
7.5.Alarms

In this section it is possible to configure the single alarms, allowing to monitor certain value selected from a list of parameters.

HOME → Configuration → **Alarms**

When specific conditions are met, alarms is turned on or off. Triggering of alarms can be registered in the devices notifications log, in the alarms section. In addition to that, they can be set up to control digital outputs of the device. In order to set an output as alarm output, please refer to chapter "7.4.Input / output".

There are two types of alarms available on M4M: simple alarms and complex alarms. For complex alarms, please refer to chapter "7.6.Complex alarms".

Up to 25 simple alarms can be configured in the device. The following graph explains how the alarm features work in relationship to threshold, delay, hysteresis.
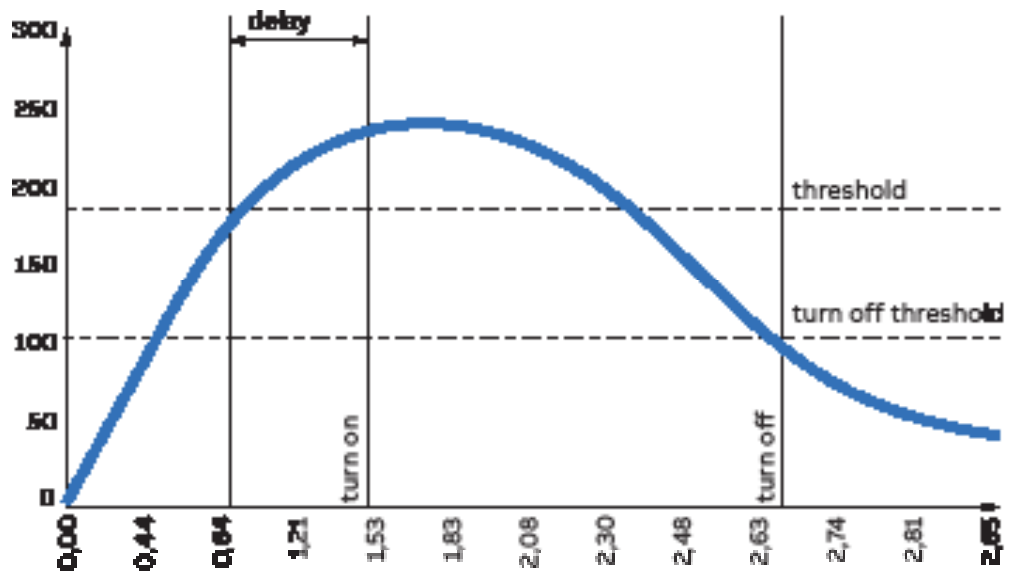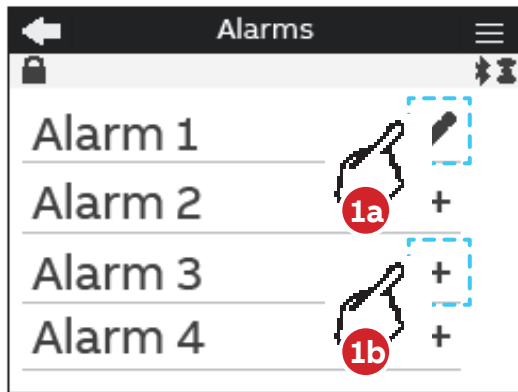

How the alarm is turned on: Whenever measured value crosses threshold for a time that is higher than the defined delay, timer is set and starts counting down delay. If count down is finished and the value have not crossed back the threshold, alarm is turned on. At this point, according to configuration, alarms trip is registered in the notifications log (alarm section) and/or alarm output is set High.

How the alarm is turned off: The alarm state is held until the value crosses turn off threshold, which is the difference between the threshold and the threshold hysteresis. Crossing turn off threshold results in turning off the alarm, thus digital output is turned off or/and it is registered in the notifications log (alarm section).

In order to set an alarm, it is needed to define the parameter associated to the alarm, the alarm type (cross up over threshold, or cross down under threshold), the threshold value for the parameter, the activation delay and the hysteresis for the turn off threshold.

| Setting	Description
Parameter	Voltage (L1, L2, L3, L1-L2, L2-L3, L1-L3), Current (total, L1, L2, L3, neutral, ground), Active Power (total, L1, L2, L3), Reactive Power (total, L1, L2, L3), Apparent Power (total, L1, L2, L3), THD Voltage (L1, L2, L3, L1-L2, L2-L3, L1-L3), THD Current (L1, L2, L3, neutral), Unbalance Voltage (L-L, L-N), Unbalance Current, Frequency, Power Factor (total, L1, L2, L3), Count down Timer.
Alarm Type	Cross up or Cross down.
Threshold	Manual entry from 0 to 999k.
Delay	Manual entry from 0s to 900s.
Hysteresis	Manual entry from from 0% to 40%.
Logs	Enable or Disable the logging of alarms inside notifications.

1a. In case an alarm has been set, it will present an edit symbol (✎) in the list of alarms. A tap on an alarm with edit symbol allows to edit an existing alarm.

1b. In case an alarm is not completely set, it will present a "+" in the list of alarms. A tap on an alarm with "+" allows to create a new alarm.

7.6. Complex alarms

In this section it is possible to configure the complex alarms, allowing to combine simple alarm into single entity through specific logics.

Up to 4 complex alarms can be configured on the device. It is possible to create an alarm logic that will allow the alarm activation only in case specific conditions take place.

Each complex alarm can be linked to up to 4 simple alarms, selected along with OR / AND logical operator. When OR is selected alarm will be tripped every time one of the conditions of the equation will turn positive; when AND is selected alarm will be tripped every time all the conditions of the equation will turn positive. Complex alarm trip can be registered in the notifications (alarm section) and/or alarm output is set High. Once logical equation will turn negative again, complex alarm is turned off, thus digital output is turned off or/and it is registered in the notifications log (alarm section).
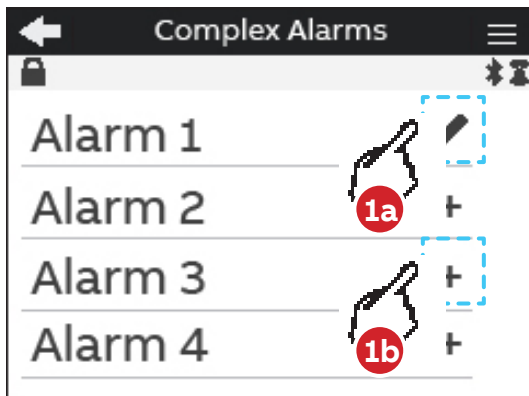
1a. In case an alarm has been set, it will present an edit symbol (✎) in the list of alarms. A tap on an alarm with edit symbol allows to edit an existing alarm.

1b. In case an alarm is not completely set, it will present a "+" in the list of alarms. A tap on an alarm with "+" allows to create a new alarm.

—
7.7.Tariffs

In this section it is possible to configure up to six tariffs to monitor consumption in different time frames. It is possible to control activation via: clock, setting up to three input channels and settings sent via bus.

 HOME → Configuration → **Tariffs**
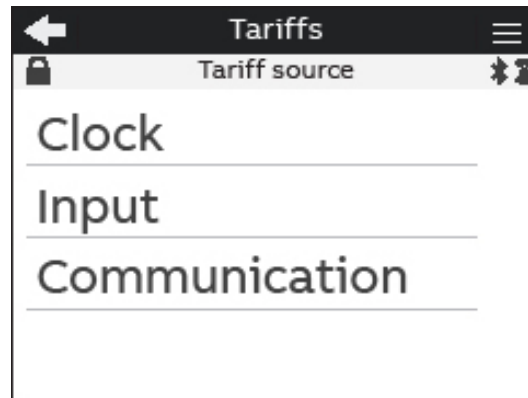
Menu	Description
Clock	Up to 6 tariffs can be defined according to specific timebands, driven by the device Real Time Clock.
Input	Based on the number of I/O that are set as Tariff Inputs (from 1 to 3) that are set up from the Input menu (please refer to chapter "7.4.Input / output"), 2, 4 or 6 tariffs can be activated.
Communication	It is possible control directly the activation of the individual tariffs. Multiple configuration settings cannot be used.

• **Clock**

HOME → **Configuration** → **Tariffs** → **Clock**

Selecting Clock, it is possible to define when the different tariffs are active, according to specific day and hour, driven by Real Time Clock.

After selecting a tariff (6 tariffs available), it is needed to configure the type of day of the tariff - during the week or during the weekend.

Select the day type among one of the following options: None, Weekday, Weekend. In order to disable a tariff, please select None.

If weekday or weekend is chosen, then the tariff will be enabled during the weekdays or during the weekend, and it is needed to select the start hour of the tariff. Configure the start hour in the format hh:mm.

> Each tariff is kept active until the next tariff is activated, thus to define the end hour of each tariff set it as the start hour of the following tariff in the same day type.

• **Input**

HOME → **Configuration** → **Tariffs** → **Input**

Selecting Input, the activation of the tariffs will follow the following table:

Input 1	Input 2	Input 3	Tariff
OFF	OFF	OFF	= T1
ON	OFF	OFF	= T2
OFF	ON	OFF	= T3
ON	ON	OFF	= T4
OFF	OFF	ON	= T5
ON	OFF	ON	= T6

> Please see chapter "7.4 Inputs / Outputs" for further details on how to setup an I/O slot as Tariff input.

• **Communication**

Selecting Communication, the activation of the tariffs is controlled by bus.

It is possible control directly the activation of the individual tariffs. Multiple configuration settings cannot be used.

HOME → **Configuration** → **Tariffs** → **Communication**

> See Modbus communication manual for details on how to read Tariff via communication.

—
7.8.Communication

HOME → Configuration → **Communication**

Communication menu allow to set all the parameters related to the communication protocol available for a specific product version. The embedded communication protocol varies according to the different product versions. Please refer to "3.3. Versions" for the details on the embedded communication protocols.

Based on product version following configuration menus are available:

Bluetooth (all M4M 30 product versions)

Bluetooth communication protocol is available on all product version and allow to read data via EPiC Mobile from M4M and carry out basic configuration.

HOME → Configuration → **Communication** → **Bluetooth**
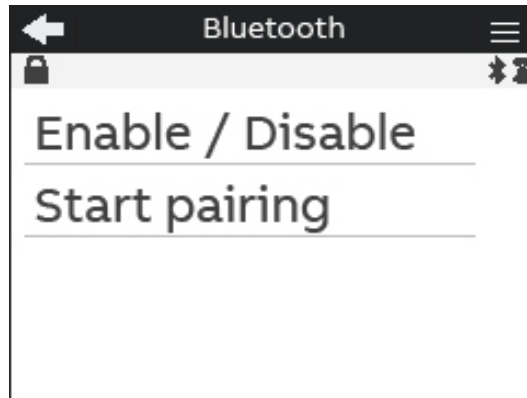
Menu	Description
Enable/Disable	Enable / disable bluetooth communication. Disabled by default.
Start paring	Starts the paring, only if Bluetooth communication is enabled.

(i)   When the Bluetooth communication is enabled, the communication active symbol ✱ appears

When Start pairing is selected, in order to complete the pairing with EPiC Mobile, due to Cybersecurity reasons it is needed to enter a passkey on your smartphone. The following screen will appear, followed by a passkey randomly generated by M4M.
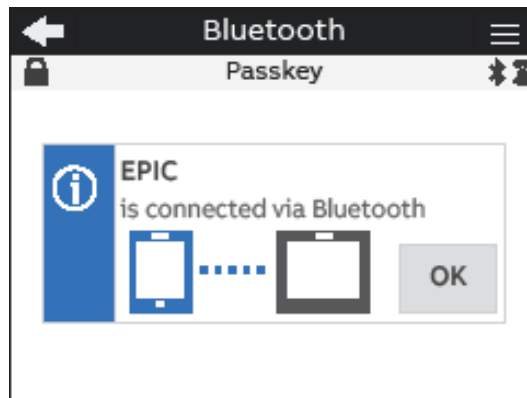
Please follow the instructions on EPiC Mobile to complete the pairing. Once the pairing is completed, a confirmation pop-up will appear on the device as per below picture:
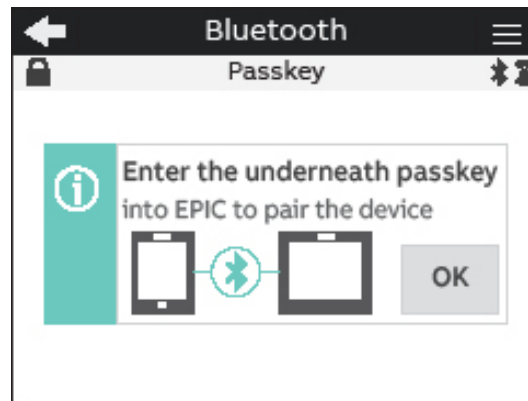
MODBUS RTU (M4M 30 Modbus, M4M 30 I/O, M4M 30 Rogowski product versions)

This section is available on all the M4M 30 product versions with Modbus RTU embedded communication.

HOME → **Configuration** → **Communication** → **Modbus RTU**

Menu	Description
Address	From 1 to 247
Baud rate	9600, 19200, 38400, 57600, 115200
Parity	Even, Odd, None

ⓘ See Modbus communication manual for details on Modbus communication protocol and communication map.

MODBUS TCP/IP (M4M 30 Ethernet product version)

This section is available on all the M4M 30 product versions with Modbus RTU embedded communication.

HOME → **Configuration** → **Communication** → **Modbus TCP/IP**

Menu	Description
DHCP	Enable / Disable (disabled by default)
IP address	192.168.1.12 (by default)
Subnet mask	255.255.255.0 (by default)
Gateway	192.168.1.1 (by default)
TCP port	502 (by default)

If DHCP is disabled, the values of above configurations (IP address, subnet mask, gateway, TCP port) are the default ones. In this case, it is possible to modify each of above configurations.

If DHCP is enabled, it is not needed to enter the above configurations as they are automatically set.

ⓘ See Modbus communication manual for details on Modbus communication protocol and communication map.

PROFIBUS (M4M 30 Profibus product version)

This section is available on M4M 30 Profibus with Profibus DP-V0 embedded communication.

HOME → Configuration → **Communication → Profibus**

Menu	Description
Address	From 1 to 126

If DHCP is disabled, the values of above configurations (IP address, subnet mask, gateway, TCP port) are the default ones. In this case, it is possible to modify each of above configurations.

If DHCP is enabled, it is not needed to enter the above configurations as they are automatically set.

ⓘ See Profibus communication manual for details on Profibus communication protocol and communication map.

BACNET (M4M 30 Bacnet product version)

This section is available on M4M 30 Bacnet with BACnet/IP embedded communication.

HOME → Configuration → **Communication → BACnet**

Parameter	Range	Default value	Comments
DHCP	enabled/disabled	disabled	
IP address	0.0.0.0-255.255.255.255	192.168.1.12	This address must create valid Network prefix and Host address with combination of subnet mask, accordingly to IPv4 subnetting. Additionally some ranges according to IANA organization are excluded from valid values: (127.0.0.0-127.0.0.255), (224.0.0.0-239.255.255.255) and 255.255.255.255.
Subnet mask	128.0.0.0-255.255.255.254	255.255.255.0	It must be valid according to IPv4 subnetting.
Gateway	0.0.0.0-255.255.255.255	192.168.1.1	This address follows the same restrictions as IP address of device.
UDP port	0-65535	47808	
Device instance	0-4194302	228	This ID must be unique across BACnet network.
BBMD	enabled/disabled	disabled	
BBMD IP address	0.0.0.0-255.255.255.255	0.0.0.0	
BBMD UDP port	0-65535	47808	
BBMD TTL	0-65535	0	
Ekip Connect mode	enabled/disabled	disabled	

Ekip Connect mode item shall be used only for FW upgrade via Ekip Connect desktop. When Ekip Connect mode is enabled, the device reboots and waits for FW upgrade. At the end of the firmware upgrade operation the device will reboot with the updated firmware. Once the device has rebooted, ensure that Ekip connect mode parameter is disabled.

If DHCP is disabled, the values of above configurations are the default ones. In this case, it is possible to modify each of above configurations.

If DHCP is enabled, it is not needed to enter the above configurations as they are automatically set.

ⓘ See BACnet communication manual for details on BACnet communication protocol and communication map.

7.9.Other settings

In this menu it is possible to configure the time interval for average values calculation, timers settings, energy conversion parameters.

HOME → Configuration → **Other settings**
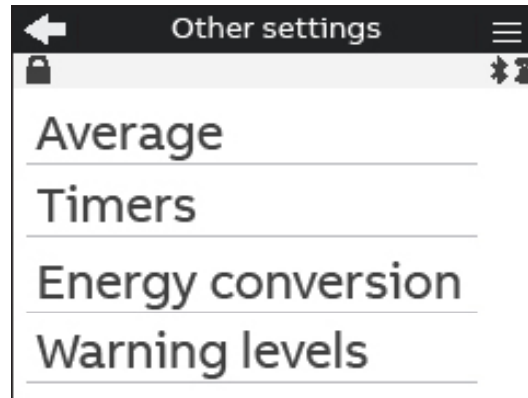
Menu	Description
Average	Configuration of time interval for Average values.
Timers	Configuration of count-down timer and timer reset.
Energy conversion	Configuration of conversion factors for energy.
Warning levels	Configuration of warning level for single harmonics.

Average menu

In this menu it is possible to configure the time interval used for calculation of average parameters that can be read out in Data reading -> Average. For the data reading of average values please refer to chapter "8.4.Average"

For the configuration of demand values related to the flash memory, please refer to chapter "7.3.Historicals"

HOME → Configuration → **Other setting → Average**
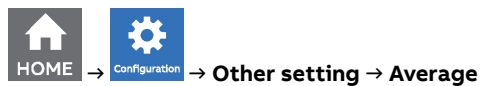
Setting	Description
Time interval	Manual entry from 1 to 60m. Default: 15m

Timers menu

In this menu it is possible to configure the count-down timer, used for maintenance notification, and the timers reset.

For the data reading of timers values please refer to chapter "8.9.Timers".

HOME → **Configuration** → **Other settings** → **Timers**
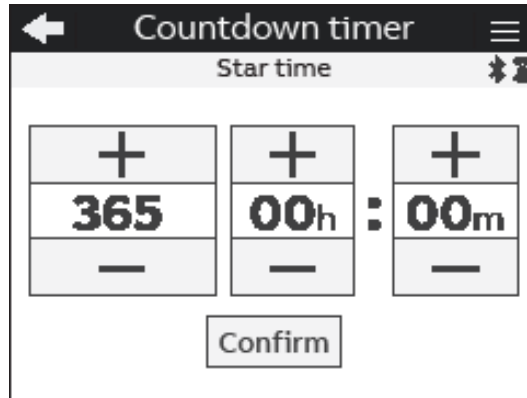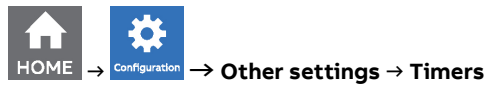
Menu	Description
Count-down timer	Used for the count of the system operating time.
Timers reset	Reset of the count-down timer.

> **i** If countdown timer menu is chosen, the screen above will appear, allowing to manually enter the value in the format days: hours: minutes.

Energy conversion menu

In this menu it is possible to configure the conversion factors in order to associate the consumption of active energy to the local currency or to CO2.

For the data reading of converted values please refer to chapter "8.2.Energy".

HOME → **Configuration** → **Other settings** → **Energy conversion**
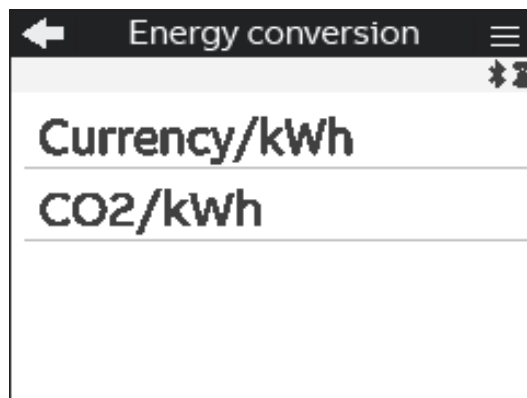
Menu	Description
Currency/kWh	Currency conversion factor that allows to display the equivalent of active 3-phase energy in local currency. Factor has to be defined as currency/kWh.
CO2/kWh	CO_2 conversion factor that allows to display the equivalent of active 3-phase energy in CO_2. Factor has to be defined as kg CO_2/kWh.

Warning levels menu

In this menu it is possible to configure the limit value for single harmonics (% of the fundamental) that can be then displayed in the harmonics graphs. Once the warning level threshold is exceeded, the visualization of the harmonic graph bar will turn to orange color.

 → → **Other settings** → **Warning levels**
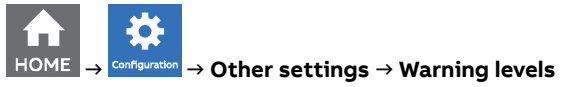
The limits can be configured for Line-Neutral Voltage, Line-Line Voltage, Currents.

For the visualization of harmonic graphs please refer to chapter "10.3.Harmonics".

8.Data Reading

Data reading section allows to visualize all the parameters measured by M4M.
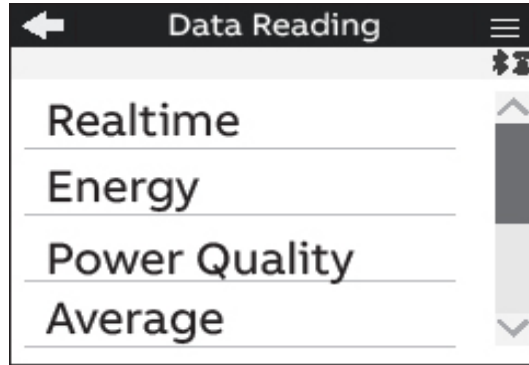
Press to return to the home page.

8.1.Realtime

HOME → Data Reading → **Realtime**

Visualization page	Description
Summary	3-phase voltage (line to line), 3-phase current, total active power.
Line-Neutral voltage	Line to neutral voltage per phase and 3-phase line to line voltage.
Line-Line voltage	Line to line voltage per phase and 3-phase line to line voltage.
Current (L1,L2,L3)	Current per phase and 3-phase current.
Current (N)	Neutral phase and 3-phase current.
Active Power	Active power per phase and total.
Reactive power	Reactive power per phase and total.
Apparent power	Apparent power per phase and total.
Frequency	System frequency.

Move with ⟨ ⟩ keys to navigate among the visualization pages.

—
8.2.Energy

 HOME → Data Reading → **Energy**
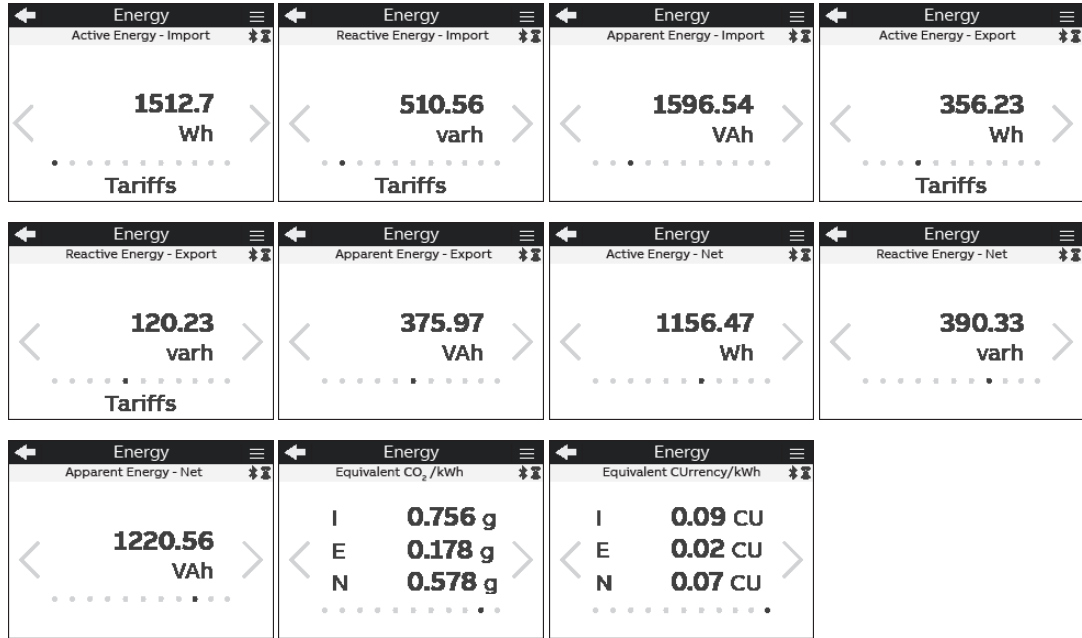
Visualization page	
Active Energy - Import	Total imported active energy in Wh/kWh/MWh.
Reactive energy - Import	Total imported reactive energy in varh/kvarh/Mvarh.
Apparent energy - Import	Total imported apparent energy in VAh/kVAh/MVAh.
Active Energy - Export	Total exported active energy in Wh/kWh/MWh.
Reactive Energy - Export	Total exported reactive energy in varh/kvarh/Mvarh.
Apparent Energy - Export	Total exported apparent energy in VAh/kVAh/MVAh.
Active Energy - Net	Net value of active energy import/export total in Wh/kWh/MWh.
Reactive Energy - Net	Net value of reactive energy import/export total in varh/kvarh/Mvarh.
Apparent Energy - Net	Net value of apparent energy import/export total in VAh/kVAh/MVAh.
Equivalent CO2/kWh	CO2 emission linked to imported (I), exported (E) and net energy. To set the conversion factor go to Configuration - Other settings - Energy conversion.
Equivalent Currency/kWh	Currency linked to imported (I), exported (E) and net energy. To set the conversion factor go to Configuration - Other settings - Energy conversion.

(i) Move with ⟨ ⟩ keys to change the parameters visualization.
Refer to next chapter for tariff pages.

Tariffs

HOME → Data Reading → **Energy** → **Tariffs**

Move with [<] [>] keys to navigate among the visualization pages.

Press [←] to return to the home page.

—
8.3.Power Quality

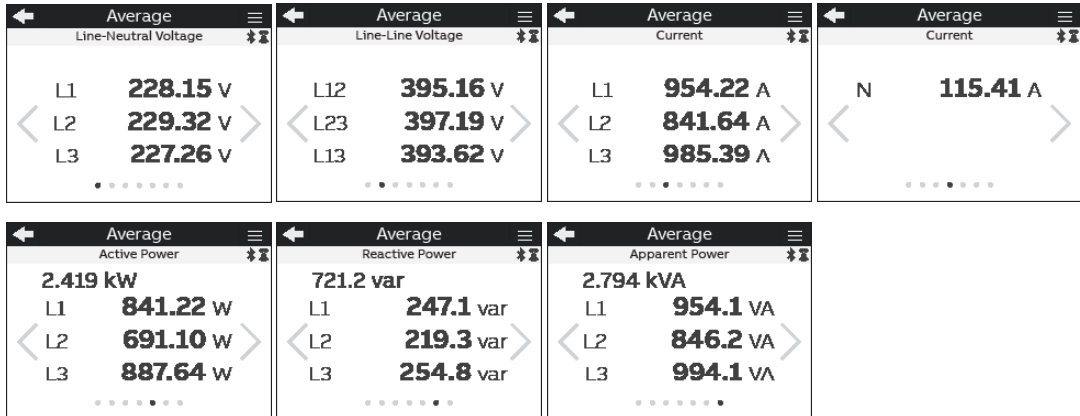**HOME** → Data Reading → **Power Quality**
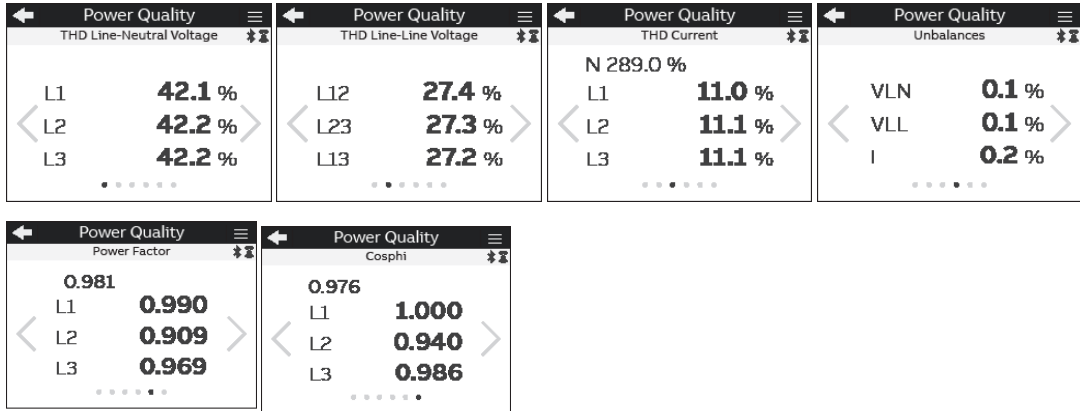
Visualization page	Description
THD Line-Neutral voltage	Per phase line to neutral voltage THD values.
THD Line-Line voltage	Per phase line to line voltage THD values.
THD Current	Total and per phase current THD values.
Unbalances	Unbalances values for line to neutral voltage (VLN), line to line voltage (VLL) and current (I).
Power Factor	Total and per phase power factor.
Cosphi	Total and per phase cosphi (displacement factor).

ⓘ   Move with ⟨ ⟩ keys to navigate among the visualization pages.

—
8.4.Average

 HOME → **Data Reading** → **Average**

Visualization page	Description
Average Line-Neutral Voltage	Average per phase line to neutral voltage calculated for a defined period of time (default: 15 minutes).
Average Line-Line Voltage	Average per phase line to line voltage calculated for a defined period of time (default: 15 minutes).
Average Current (L1, L2, L3)	Average per phase calculated for a defined period of time (default: 15 minutes).
Average Current (N)	Average neutral and ground calculated for a defined period of time (default: 15 minutes).
Average Active Power	Average calculated for a defined period of time (default: 15 minutes).
Average Reactive Power	Average calculated for a defined period of time (default: 15 minutes).
Average Apparent Power	Average calculated for a defined period of time (default: 15 minutes).

Average values are calculated on the average time. See chapter "7.9.Other settings" for the configuration of average time.

 Move with [<] [>] keys to navigate among the visualization pages.

—
8.5.Min Value

HOME → Data Reading → **Min Value**

Min Value	Min Value	Min Value	Min Value
Line-Neutral voltage	Line-Line voltage	Current	Current
L1 **2.422** V	L12 **0.238** V	L1 **5.122** A	N **2.247** A
L2 **2.527** V	L23 **0.550** V	L2 **4.203** A	
L3 **1.989** V	L13 **0.643** V	L3 **5.237** A	

Min Value	Min Value	Min Value
Active Power	Reactive power	Apparent Power
33.442 W	**8.520** var	**36.72** VA
L1 **12.405** W	L1 **3.213** var	L1 **12.68** VA
L2 **10.621** W	L2 **1.374** var	L2 **11.02** VA
L3 **10.416** W	L3 **3.934** var	L3 **13.02** VA

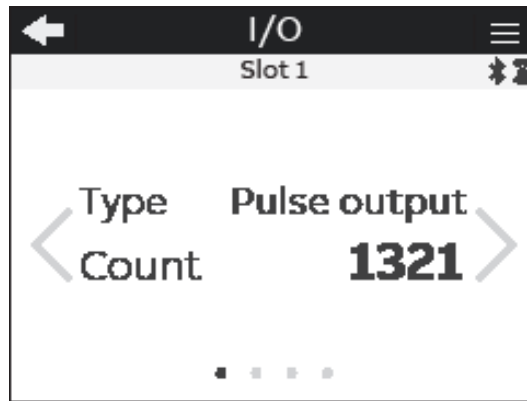| Visualization page	Description
Minimum Line-Neutral Voltage	Minimum per phase line to neutral voltage measured value.
Minimum Line-Line Voltage	Minimum per phase line to line voltage measured value.
Minimum Current (L1, L2, L3)	Minimum per phase measured current.
Minimum Current (N)	Minimum neutral measured current.
Minimum Average Active Power	Minimum average value measured in a defined period of time (default: 15 minutes).
Minimum Average Reactive Power	Minimum average value measured in a defined period of time (default: 15 minutes).
Minimum Average Apparent Power	Minimum average value measured in a defined period of time (default: 15 minutes).

(i) **Minimum values** are the minimum since latest reset of maximum/minimum values.
Move with [<] [>] keys to navigate among the visualization pages.

—
8.6.Max Value

HOME → Data Reading → **Max Value**

Max Value — Line-Neutral voltage	Max Value — Line-Line voltage	Max Value — Current	Max Value — Current
L1 **230.05** V L2 **231.14** V L3 **228.68** V	L12 **399.87** V L23 **398.73** V L13 **397.45** V	L1 **3.120** A L2 **1.951** A L3 **4.502** A	N **0.941** kA

Max Value — Active Power	Max Value — Reactive Power	Max Value — Apparent Power
624.55 kW L1 **210.01** kW L2 **205.65** kW L3 **208.93** kW	**104.5 kvar** L1 **35.24** kvar L2 **36.78** kvar L3 **32.43** kvar	**662.6 kVA** L1 **220.9** kVA L2 **220.9** kVA L3 **220.8** kVA

Visualization page	Description
Maximum Line-Neutral Voltage	Maximum per phase line to neutral voltage measured value.
Maximum Line-Line Voltage	Maximum per phase line to line voltage measured value.
Maximum Current (L1, L2, L3)	Maximum per phase measured current.
Maximum Current (N)	Maximum neutral measured current.
Maximum Average Active Power	Maximum average value measured in a defined period of time (default: 15 minutes).
Maximum Average Reactive Power	Maximum average value measured in a defined period of time (default: 15 minutes).
Maximim Average Apparent Power	Maximum average value measured in a defined period of time (default: 15 minutes).

(i) **Maximum values** are the maximum since latest reset of maximum/minimum values.
Move with ⟨ ⟩ keys to navigate among the visualization pages.

—
8.7.I/O

The number and type of I/O on the M4M network analyzer varies according to the different product versions. Please refer to the table in "3.3 Versions" for the detail of I/O types per each M4M.

For each I/O specific information is shown according to the I/O type. Below an example for I/O set as pulse output:

Info Visualization	Description
Type	How I/O slot has been configured.
Count	Number of pulses counted by the I/O. It is only available if the I/O slot has been configured as Pulse input or Pulse output.
State	Status of the I/O. It is only available if the I/O slot has been configured as Tariff input, Pulse Output, Output ON, Output OFF or Comm. output.

Move with ⟨ ⟩ keys to navigate among the visualization pages.

8.8.Notifications

 → → **Notifications**
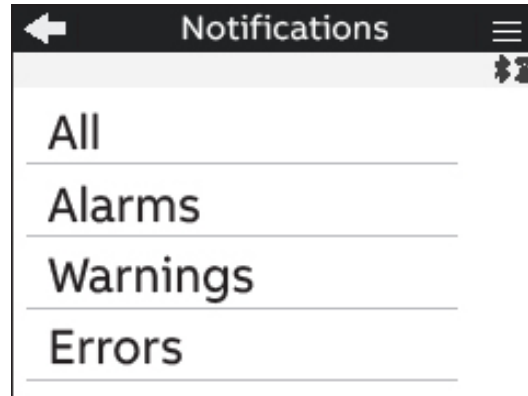
Menu item	Description
All	All alarms, warnings, errors displayed in chronological order (latest first).
Alarms	User settable, related to specific parameters, threshold, etc.
Warnings	Related to installation conditions and device settings.
Errors	Related to the device and to its self-diagnostics.

(i) Please refer to chapters "7.5.Alarms" and "7.6.Complex alarms" for details on how to set the alarms on M4M.

All
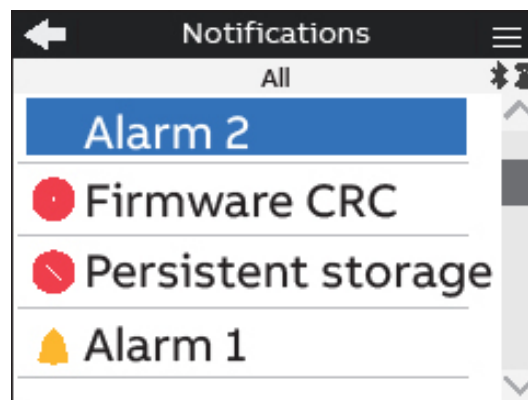
 → → **Notifications** → **All**

Symbol	Description
	Alarms.
	Warnings.
	Errors.

(i) When one of the notifications is selected, the timestamp of the notification will be shown, indicating date and time of the alarm, warning or error.

Alarms

HOME → Data Reading → **Notifications** → **Alarms**
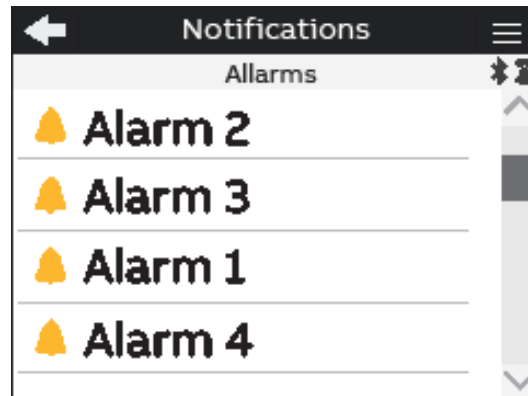
ℹ️ If one of the alarms is selected, timestamp (Day, Hour) will be shown. Day format is YYYY:MM:DD, time format is hh:mm:ss.

Warnings

HOME → Data Reading → **Notifications** → **Warnings**
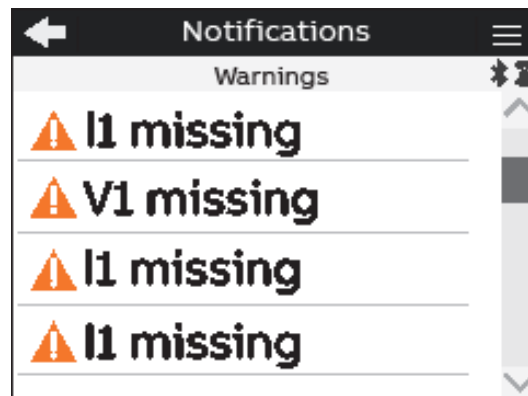
ℹ️ If one of the warnings is selected, timestamp (Day, Hour) will be shown. Day format is YYYY:MM:DD, time format is hh:mm:ss.

Errors

 HOME → Data Reading → **Notifications** → **Errors**

8.9. Timers

 HOME → Data Reading → **Timers**
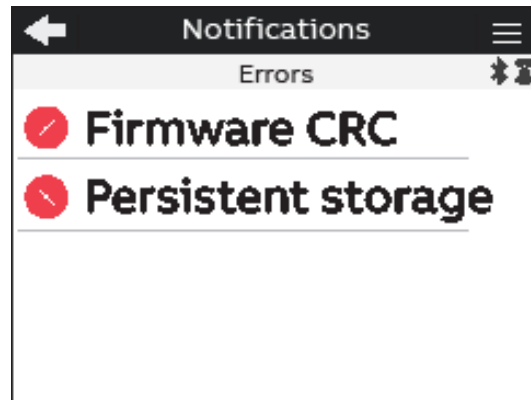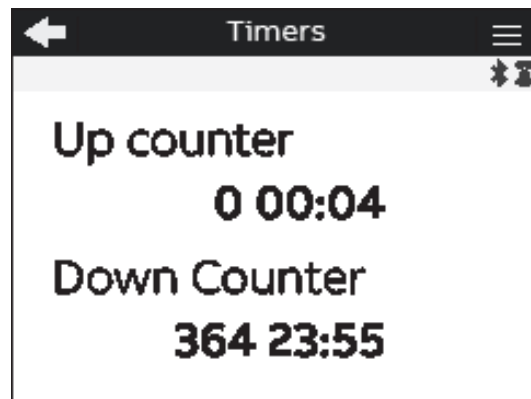
Menu	Description
Up counter	Represents the timer count up of the device lifetime since the power up.
Down counter	Represents the timer count down for the device maintenance.

9.Historicals

In the Historicals section it is possible to read out the parameters stored in the device flash memory (32 MB).

Each feature has a predefined number of parameters that can be stored in each channel of flash memory. It is possible to configure the historical functionalities and the different channels.

For further details on how to configure the Historicals functionalities, please refer to the chapter "7.3.Historicals".
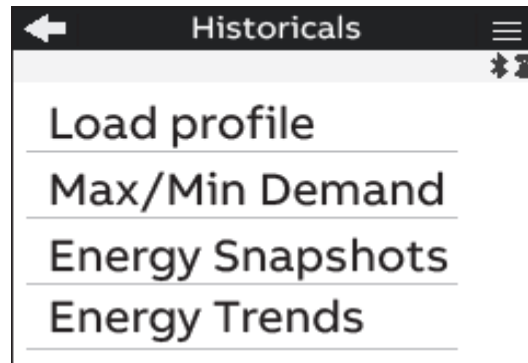
Press ⬅ key in order to return to homepage.

9.1.Load profile

Visualization of load profile curves for 25 different parameters.

Each page shows the graph of the latest 48 demand values for the selected parameter stored in a channel. The bottom part shows what parameter is configured in the channel and what is the time interval used for demand calculation of average values.

By clicking on the buttons on the bottom part of the display you can directly go to the setting page to change the parameters to be stored and the time interval. Please notice that each modification settings will erase the load profiles stored data inside M4M.
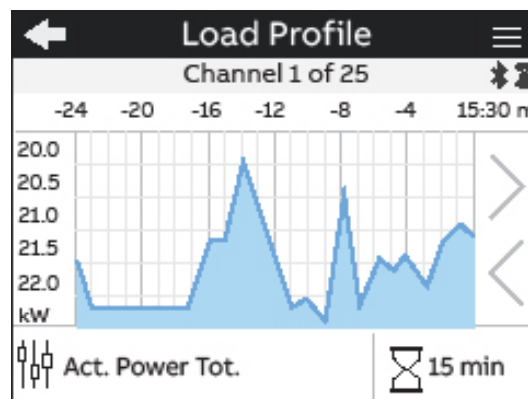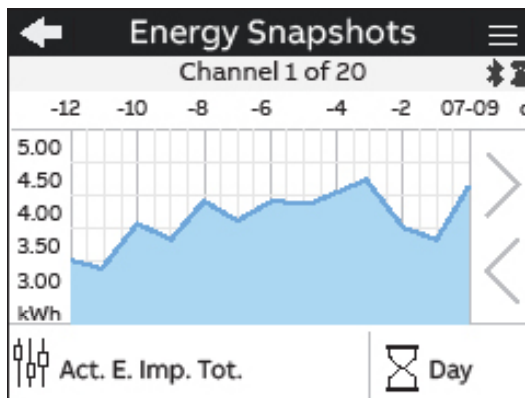
→ **Load profile**

Move with ⟨ ⟩ keys to navigate through the different parameters stored in the device. Every channel holds a configurable parameter, 25 channels are present..

9.2.Max/min demand

Visualization of the maximum and minimum values for 25 different parameters.

Select a time period to view in the list of the available periods. Each page shows up to 3 levels of max and/or 3 levels of min demand values linked to the channel of memory, according to the configuration that has been carried out. The bottom part shows on the left a link to the parameters configuration, in the center the time period (e.g. Day) over which max and min are evaluated, and the time interval and sub-interval (e.g. 15/5 min), that specify the interval used for demand values calculation.

By clicking on the buttons on the bottom part of the display you can directly go to the setting page to change the parameters to be stored, the time period and the time interval. Please notice that each modification settings will erase the max/min demand stored data inside M4M.
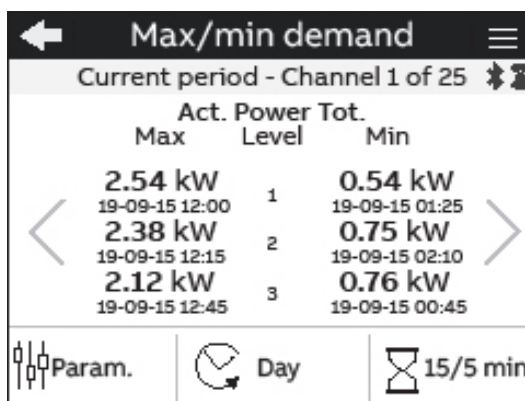
HOME → Historicals → **Max/min demand**

Move with < > keys to navigate through the different parameters stored in the device. Every channel holds a configurable parameter, 25 channels are present.

9.3.Energy Snapshots

Visualization of energy graphs showing the energy consumption curve for 20 different parameters.

Each page shows the graph of the latest 12 stored energy snapshots taken according to the defined time interval. The bottom part shows what parameter is linked to the channel and what is the time interval used to take each snapshot.

By clicking on the buttons on the bottom part of the display you can directly go to the setting page to change the parameters to be stored and the time interval. Please notice that each modification settings will erase the Energy Snapshots stored data inside M4M.

HOME → Historicals → **Energy Snapshots**

Move with < > keys to navigate through the different parameters stored in the device. Every channel holds a configurable parameter, 20 channels are present.

—
9.4.Energy Trend

Visualization of energy trends graphs for 20 different parameters.

Each page shows the graph of the latest 12 stored energy values in the defined time interval (differences between value at the end and at the beginning of time interval). The bottom part shows what parameter is linked to the channel and what is the time interval used to take the two snapshots for the trend definition.

By clicking on the buttons on the bottom page you can directly go to the setting page to change the configuration. Please notice that each modification settings will erase the Energy Trend stored data inside M4M.

[HOME] → [Historicals] → **Energy Trend**
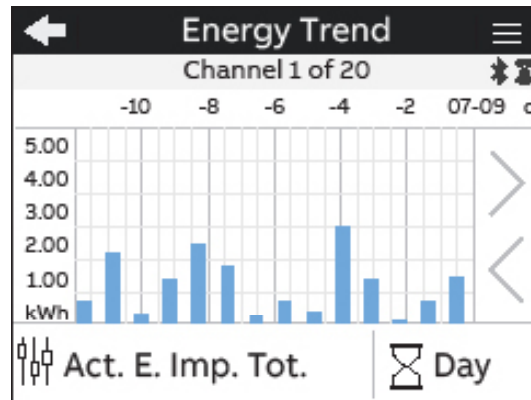
Move with [<] [>] keys to change the parameter. It is possible move among a list of channels, up to 20 parameters (Parameter Ch.1, Parameter Ch.2, etc…).

10.Graphs

In the Graphs section it is possible to visualize the main parameters measured by M4M in a graphical view.
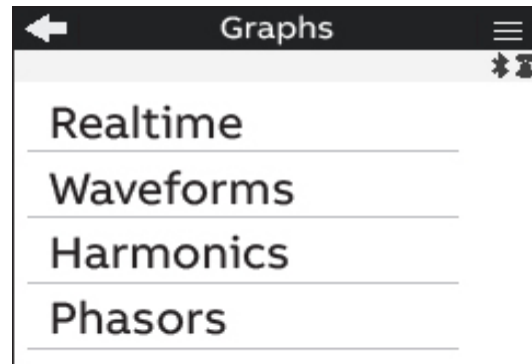
Press to return to the home page.

—
10.1.Realtime

Bargraphs showing in an intuitive way the realtime values of voltage, current and power. The graphs are automatically scaled according to the values that are measured in realtime.

 HOME → Graphs → **Realtime**
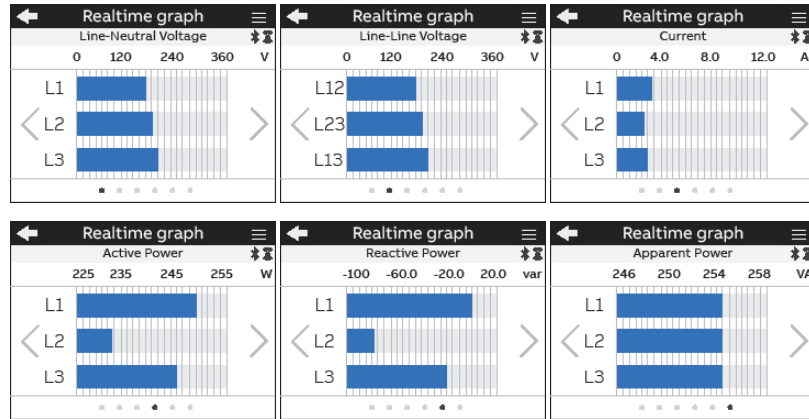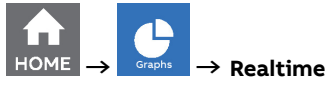
Graph
Line-Neutral voltage
Line-Line voltage
Current
Active Power
Reactive Power
Apparent Power

10.2.Waveforms

Waveforms consists in storing signal samples over 2 line cycles for voltage and current. This functionality provides a realtime snpashot of network condition.

HOME → Graphs → **Waveforms**
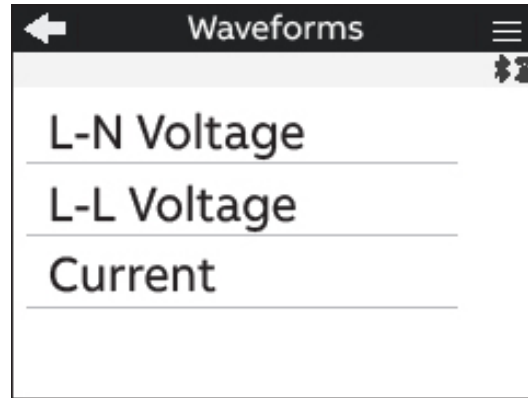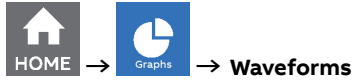
Waveforms	Description
L-N Voltage	Visualization of waveform graphs for line to neutral voltage per each phase.
L-L Voltage	Visualization of waveform graphs for line to line voltage per each line.
Current	Visualization of waveform graphs for phase current.

L-N Voltage waveforms

HOME → Graphs → **Waveforms** → **L-N Voltage**
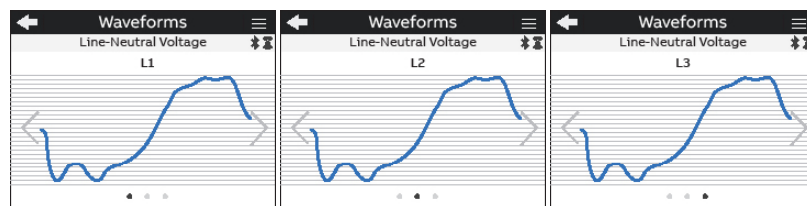
Graphs
Line-Neutral Voltage (L1)
Line-Neutral Voltage (L2)
Line-Neutral Voltage (L3)

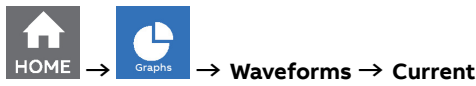ⓘ Move with ⟨ ⟩ to change the line to neutral voltage (L1,L2,L3) .

L-L Voltage Waveforms
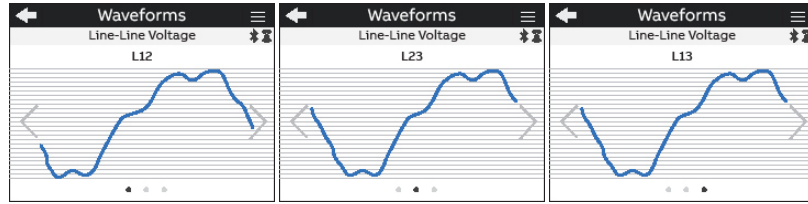
HOME → Graphs → **Waveforms** → **L-L Voltage**

Graphs
Line-Line Voltage (L12)
Line-Line Voltage (L23)
Line-Line Voltage (L31)

(i) Move with [<] [>] to change the line to line voltage (L12, L23, L31).

Current waveforms

HOME → Graphs → **Waveforms** → **Current**
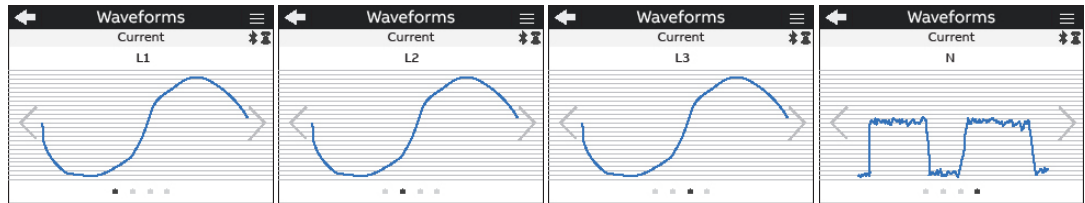
Graphs
Current (L1)
Current (L2)
Current (L3)
Current (N)

(i) Move with [<] [>] to change the phase current (L1,L2,L3,N).

—
10.3.Harmonics

Harmonics are integer multiples of the fundamental frequency of the power system. Harmonics are used to identify if the supplied system power meets required power quality standards, or if non-linear loads are affecting your power system.

Power system harmonics can cause current flow on the neutral conductor, and damage to equipment such as increased heating in electric motors.

Measurement of the harmonics is done sequentially, one at a time, over a number of line cycles. Each harmonics is calculated according to:

$$I_n/I_f \cdot 100\%$$

where I_f is the fundamental current and I_n is the current for harmonics with number n.

M4M 30 provides harmonic distortion metering up to the 40th harmonic, which are available on communication protocol.

On the HMI in this section it is possible to visualize the first 15 harmonics as graphs, where the vertical axis of the harmonics graph indicates the harmonic's magnitude as a percentage of the fundamental harmonic, and is scaled based on the largest harmonic displayed.

See section "7.9.Other settings" for the configuration of harmonics warning level.
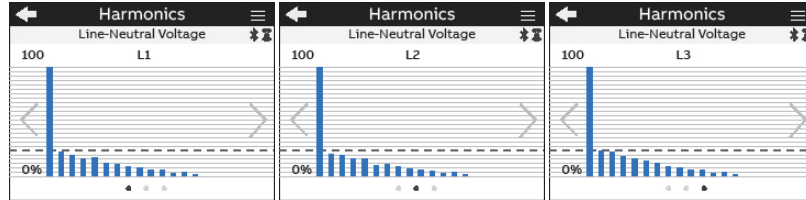
HOME → Graphs → **Harmonics**
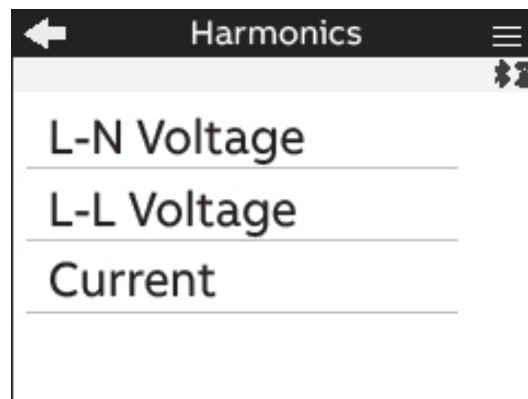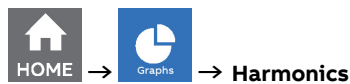
Harmonics Graphs	Description
L-N Voltage	Line-to-neutral voltage harmonics graphs, including fundamental harmonic and harmonics from 2nd to 15th.
L-L Voltage	Line-to-line voltage harmonics graphs, including fundamental harmonic and harmonics from 2nd to 15th.
Current	Current harmonics graphs, including fundamental harmonic and harmonics from 2nd to 15th.

Line-Neutral Voltage harmonics

The vertical axis of the harmonics graph indicates the harmonic's magnitude as a percentage of the fundamental harmonic, and is scaled based on the largest harmonic displayed.

 HOME → Graphs → **Harmonics** → **L-N Voltage**

Graphs
Line-Neutral Voltage (L1)
Line-Neutral Voltage (L2)
Line-Neutral Voltage (L3)

(i) Move with [<] [>] to change the line to neutral voltage harmonics graphs visualization (L1,L2,L3).

### Line-Line Voltage harmonics

 HOME → Graphs → **Harmonics** → **L-L Voltage**
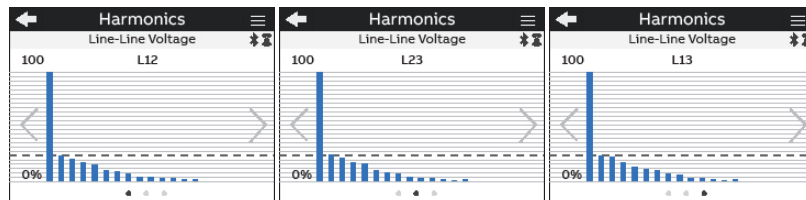
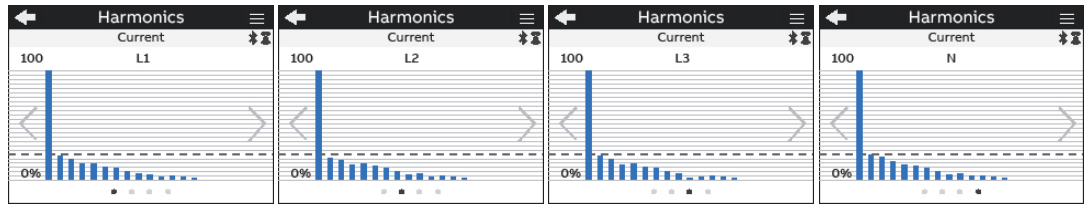| Graphs |
|---|
| Line-Line Voltage (L12) |
| Line-Line Voltage (L23) |
| Line-Line Voltage (L31) |

(i) Move with [<] [>] to change the Line to Line voltage harmonics visualization (L12, L23, L31).
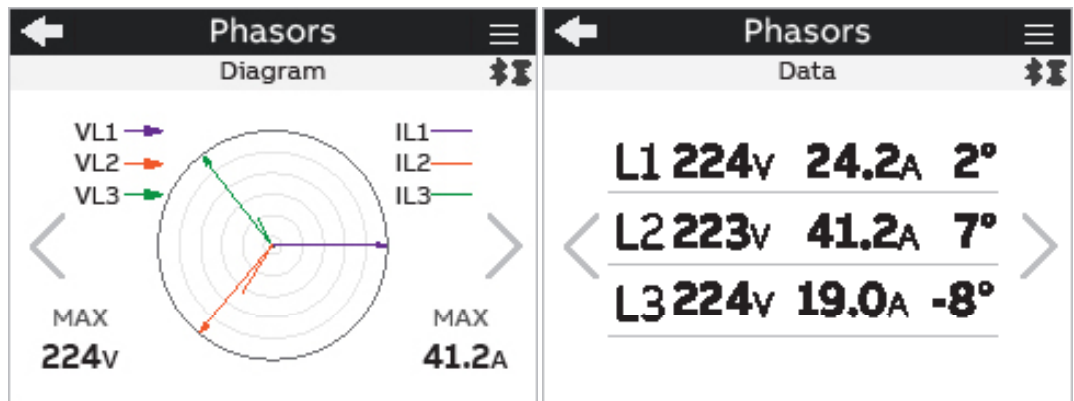
Current harmonics

HOME → Graphs → **Harmonics** → **Current**

Graph
Current (L1)
Current (L2)
Current (L3)
Current (N)

ⓘ Move with [<] [>] to change the current harmonics graphs visualization (L1,L2,L3,N).

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10.4. Phasors

HOME → Graphs → **Phasors**

Visualization pages	Description
Diagram	Phase relationship of voltage and current for each phase. Voltages are displayed with arrows and currents with solid lines.
Data	Value of voltage and current for each phase, together with the angle between the phasors.

ⓘ Move with [<] [>] to navigate among the pages.