Multimeter

M1M 15

User manual

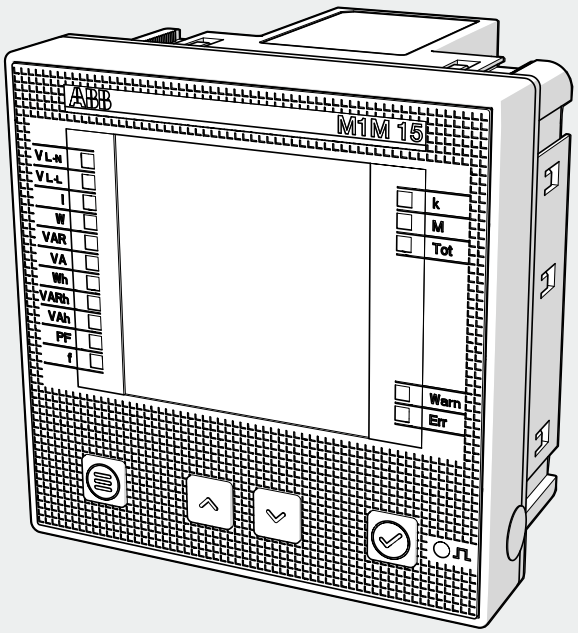

Table of Contents

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

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.

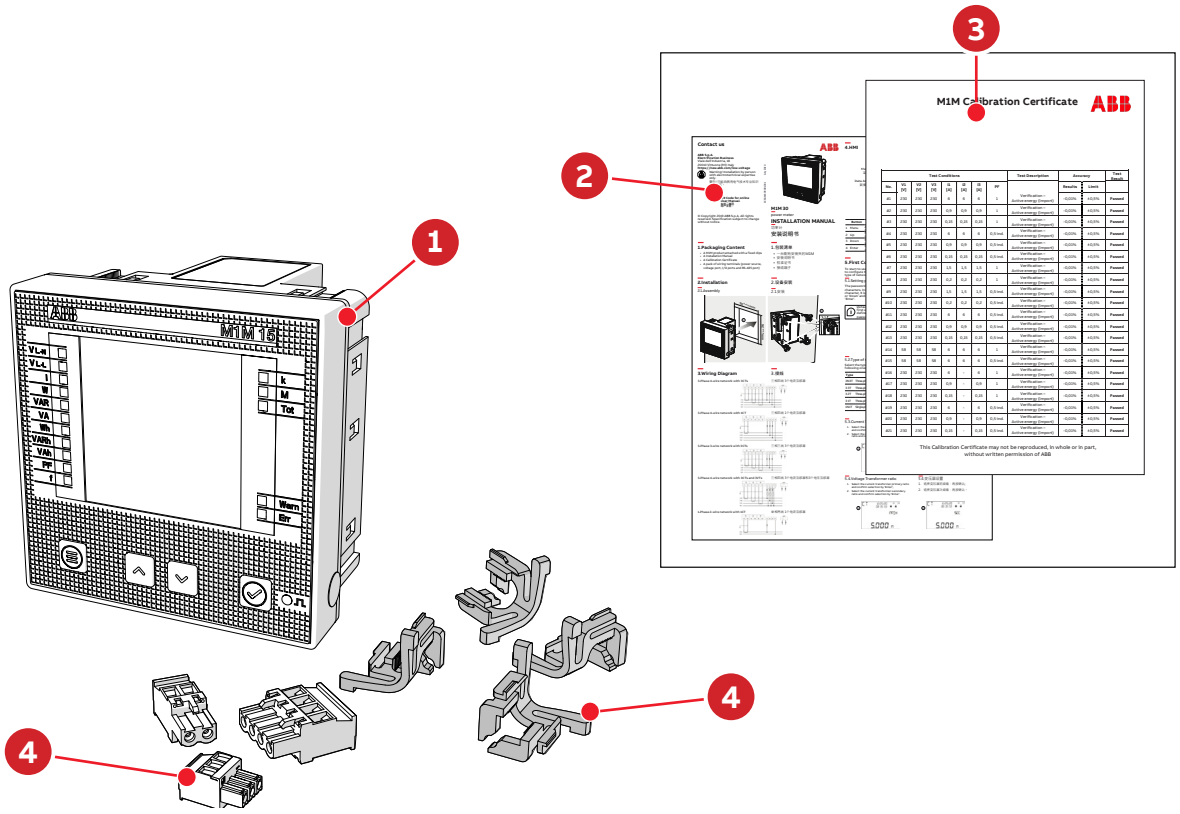
- This device must be installed exclusively by qualified personnel who have read all of the information relative to the installation.
- Check that the voltage supply and measurement are compatible with the range permitted by the device.
- Ensure that all current and voltage supplies are disconnected 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.
- 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 M1M 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 M1M.
- Switch off circuit breaker or switch before disconnecting from the auxiliary supply and voltage measurement or connecting to the auxiliary supply or voltage measurement.

1.5.Cyber Security Disclaimer

M1M 15 multimeter 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 M1M 15 multimeter 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 LV Installation Materials Co. Ltd. Beijing** 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 LV Installation Materials Co. Ltd. Beijing** 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.

2.Packaging contents



Packaging contents	
1	Multimeter M1M 15
2	Installation manual
3	Calibration certificate
4	Installation accessories (removable terminals, fixing clips)

The number and type of removable terminals in the package varies according to the different versions.

3.Technical characteristics

3.1.Description of the device

M1M series can help users accurately monitor energy efficiency while meeting their cost control requirement.

Conforming to the international electric energy metering and monitoring accuracy standards, all M1M series products are perfectly suitable for ABB electrical systems and solutions.

3.2.Main functionalities

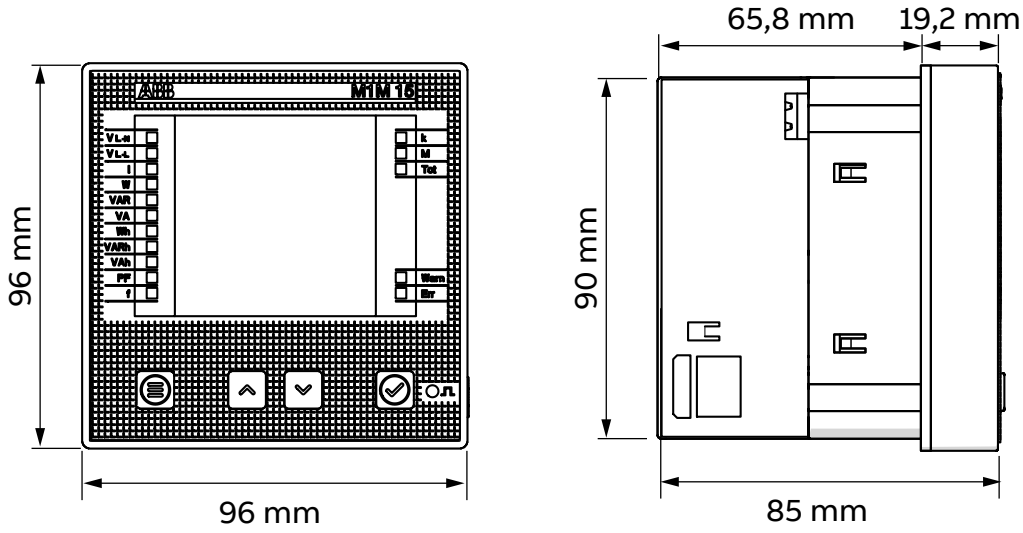
Real-time Measurement	
TRMS Current	•
TRMS Voltage	•
Frequency	•
Active, Reactive and Apparent Power	•
Power Factor	•

Energy	
Active, Reactive and Apparent Energy	•

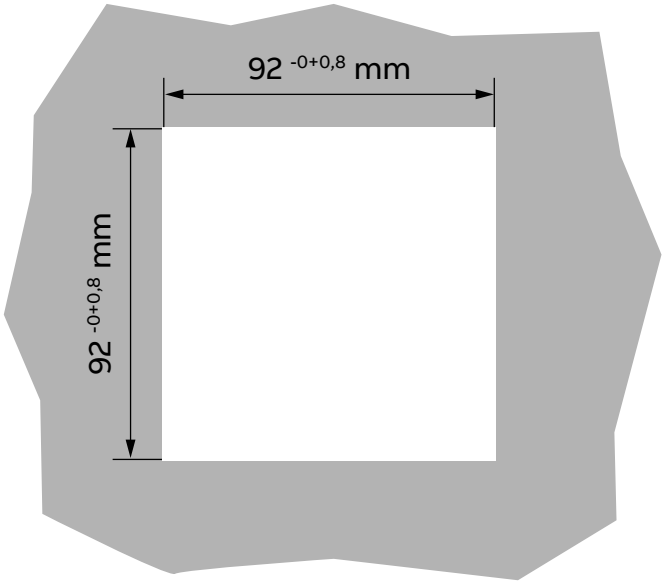
3.3.Versions

Product Name	**I/O**	**Communication protocol**
M1M 15	/	/
M1M 15 MODBUS	/	Modbus RTU

3.4.Overall dimensions



IEC 61554



3.5.Technical data

Auxiliary power supply	
Voltage	100-230 V AC/DC ±15%
Frequency	50 - 60Hz ±5%
Power consumption	5VA max
Installation category	CAT III 300V class per IEC 61010-1 edition 3
Protection fuse	T1 A-277 VAC

Measurement Accuracy	
IEC 61557-12	IEC 61557-12 PMD/S/K55/1
Active energy	IEC 61557-12 Class 1
Reactive energy	IEC 61557-12 Class 2
Active power	IEC 61557-12 Class 1
Reactive power	IEC 61557-12 Class 2
Apparent power	IEC 61557-12 Class 2
Voltage	IEC 61557-12 Class 1
Current	IEC 61557-12 Class 1
Frequency	IEC 61557-12 Class 0.1

Voltage Measurement inputs	
Voltage Range	80-265 VAC(L-N)
Type	Single-phase, three-phase (3P, 3P+N)
Rated frequency	50Hz or 60Hz
Protection fuse	T1 A-277 VAC

Current measurement inputs	
Current input mode	Indirect insertion with CT
Rated current at secondary side of CT	1A or 5A
Range without accuracy derating	50mA-6A

Mechanical properties	
Overall Dimensions	96 mm x 96 mm x 85 mm
IP degree of protection (IEC 60529)	Front: IP51
	Enclosure: IP20
Max. weight	315g

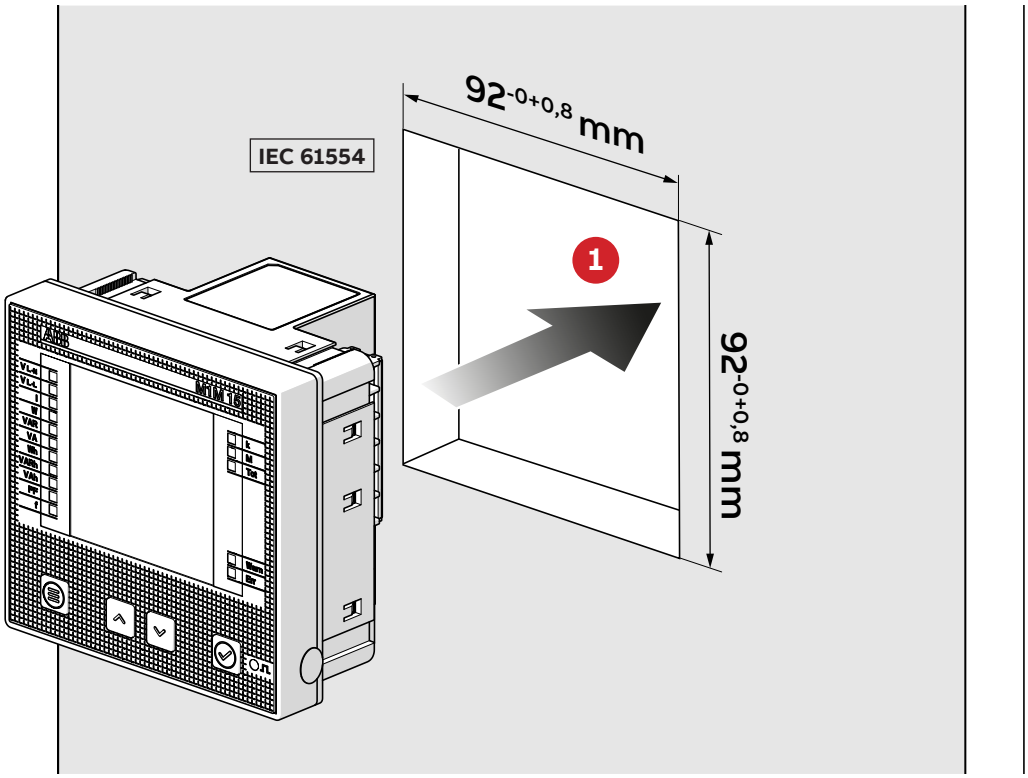
Climatic conditions	
Operating temperature	-5 to 55 °C (K55 IEC61557-12)
Storage temperature	-25 to 70 °C (K55 IEC61557-12)
Environment	It is prohibited to use in the environment containing H2S, Cl2, NH3 and other harmful gases

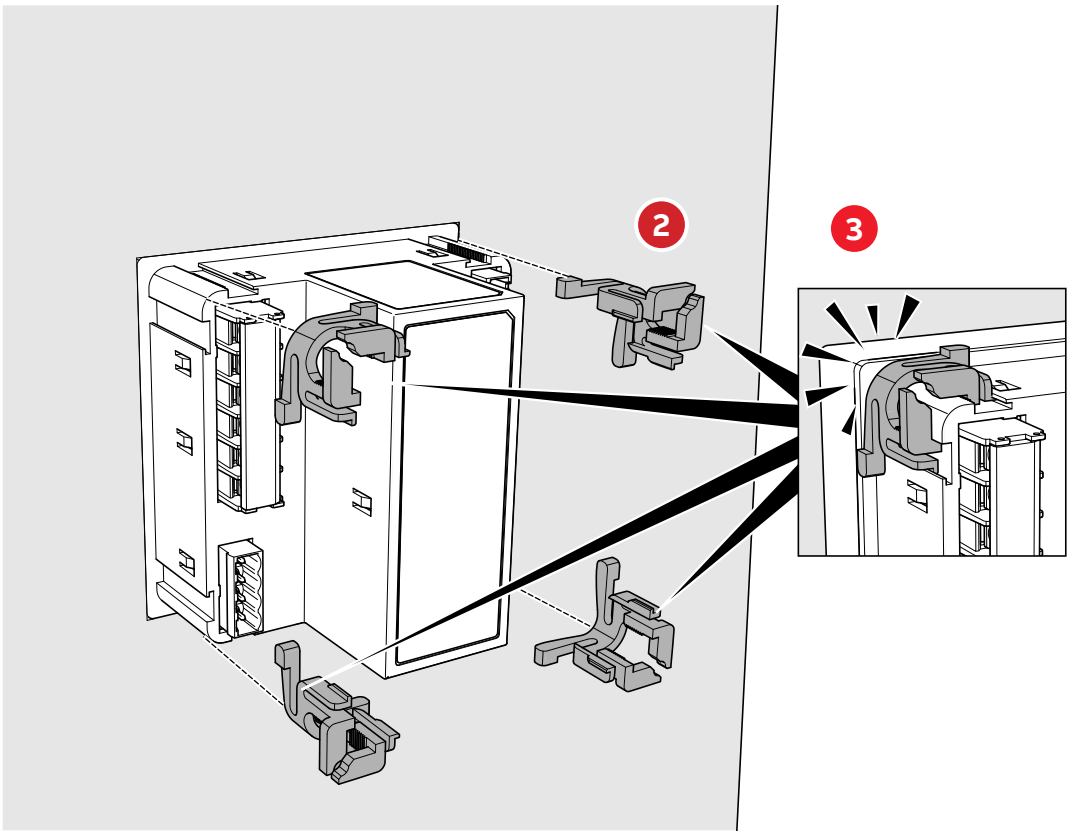
Communication protocol	
Modbus RTU	**M1M 15 MODBUS**
Communication interface	RS485 with optical isolation
Baud rate	9.6, 19.2, 38.4, 57.6, 115.2 kbps
Parity number	Odd (1 stop bit), Even (1 stop bit), None (1 or 2 stop bits)
Address	1-247
Connector	3 pole terminal

Standards	
Power metering and monitoring devices (PMD)	IEC 61557-12
EMC	IEC 61326-1
Electrical safety	IEC 61010-1

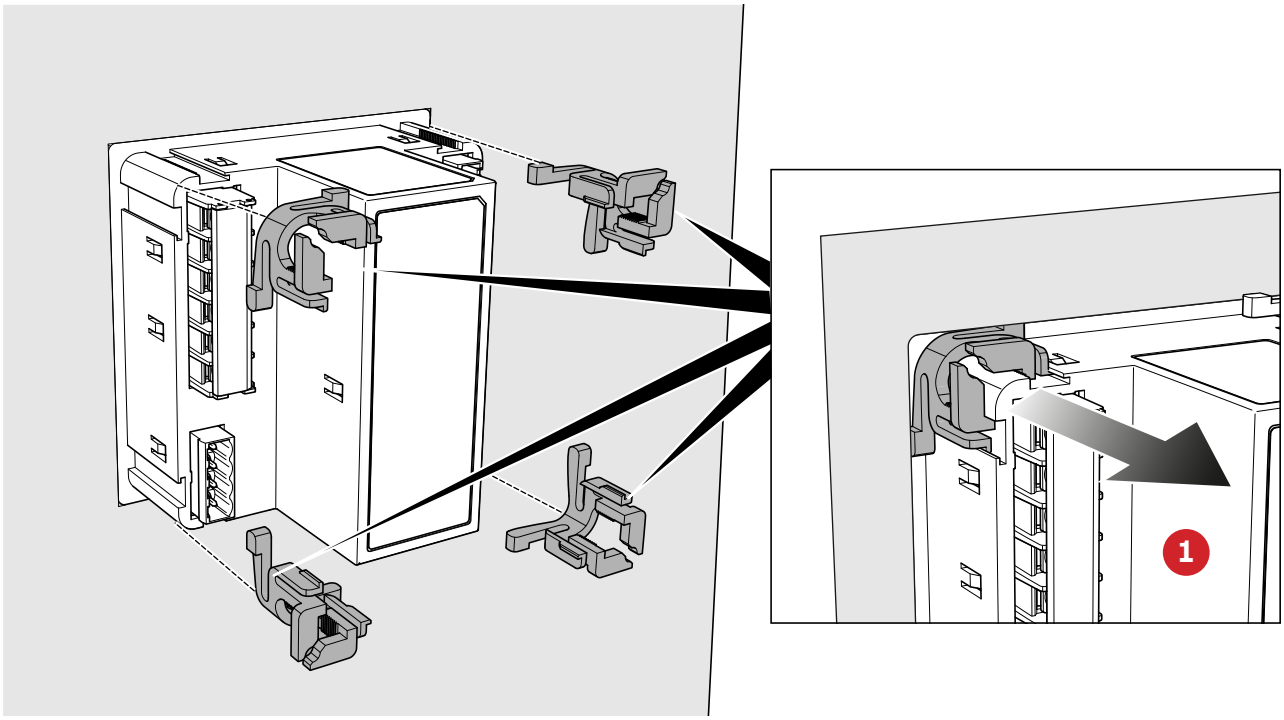
4.Installation

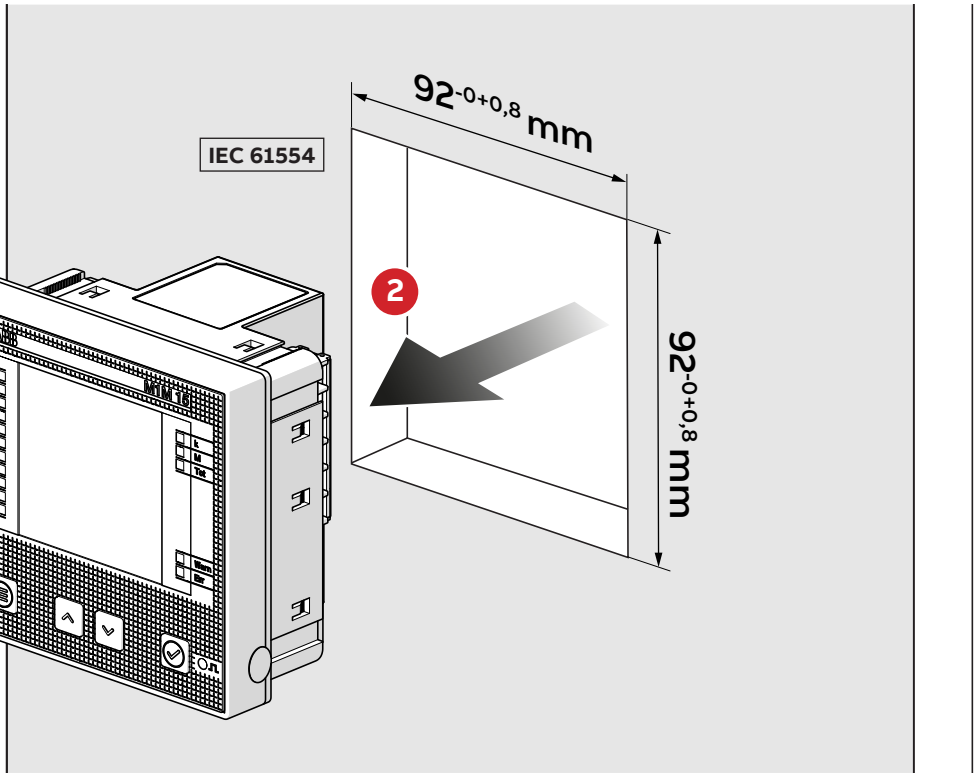
4.1.Assembly





4.2.Disassembly





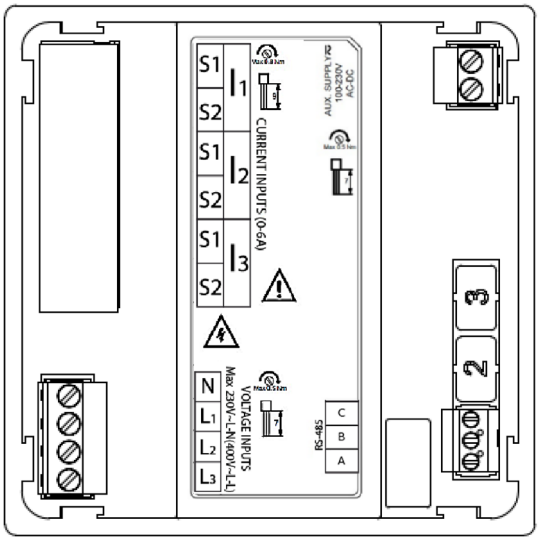
4.3.Wiring diagrams

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.

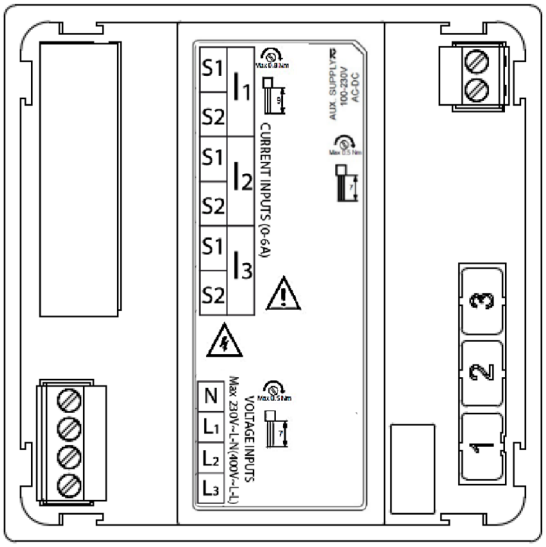
The installation and the cabling of the device must be carried out by qualified personnel.

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.

- M1M 15 MODBUS



- M1M 15



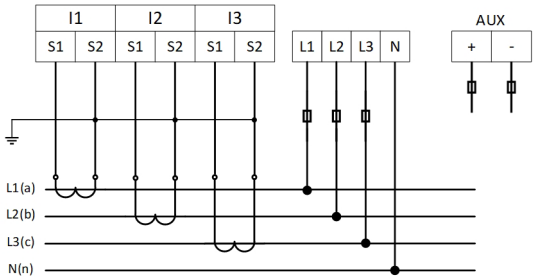
Type of network

M1M 15 can be used on different type of network (please refer to chapter **“7.Configuration (CONF)”** for the configuration on the device).

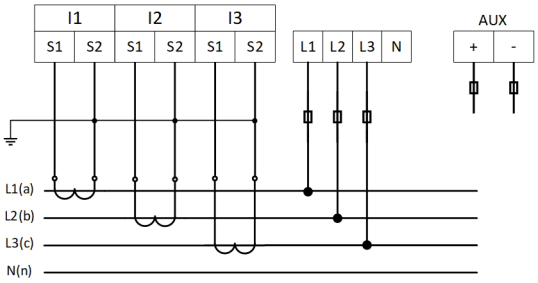
According to the type of network that has been chosen, the parameters visualized on the device HMI change.

Below the wiring diagrams are shown:

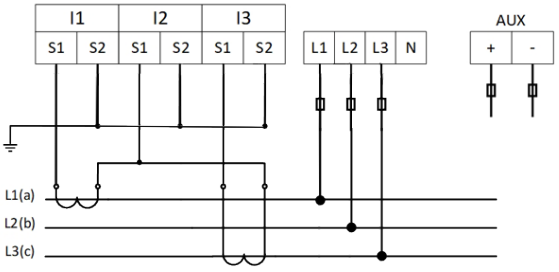
- 3-phase 4-wire network with 3CTs (3N3T)



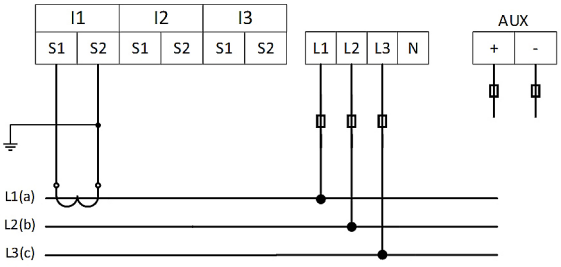
- 3-phase 3-wire network with 3CTs (3 3T)



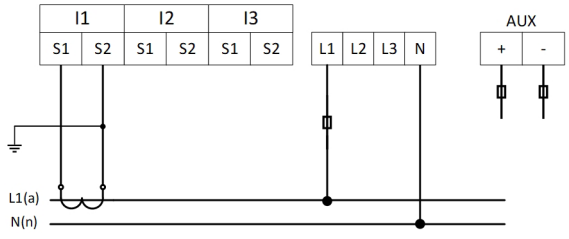
- 3-phase 3-wire network with 2CTs (3 2T)



- 3-phase 3-wire network with 1CT (3 1T)



- 1-phase 2-wire network with 1CT (1N1T)



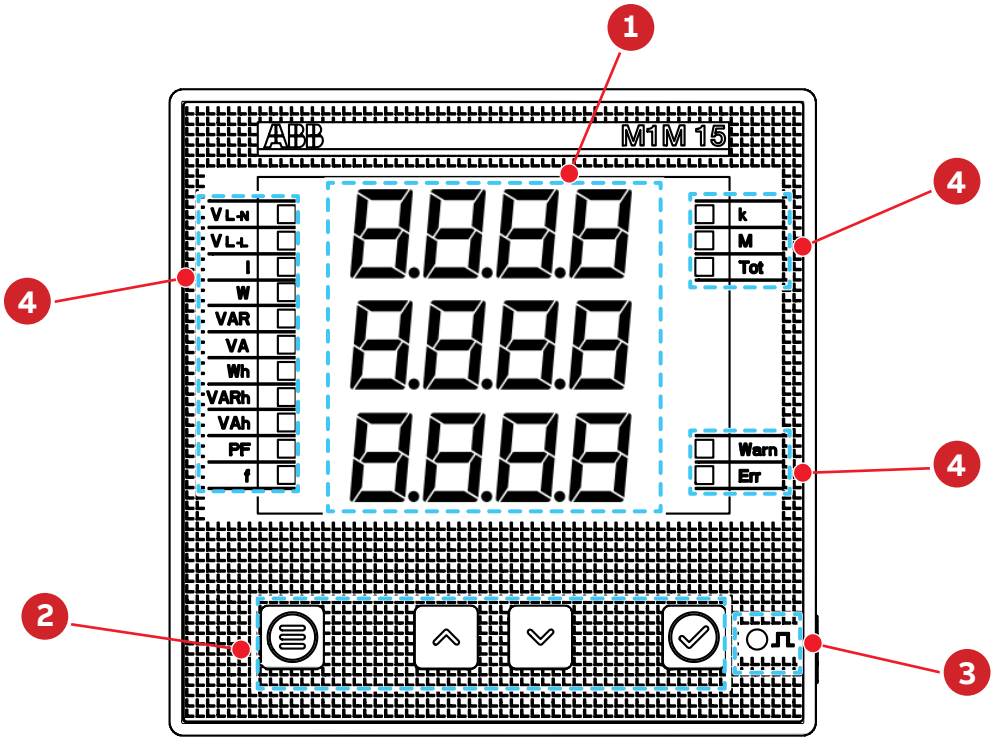
5.Access to device

This chapter gives a detailed introduction of the device's HMI, including how to read data and configure related parameters.

5.1.Display

Front panel

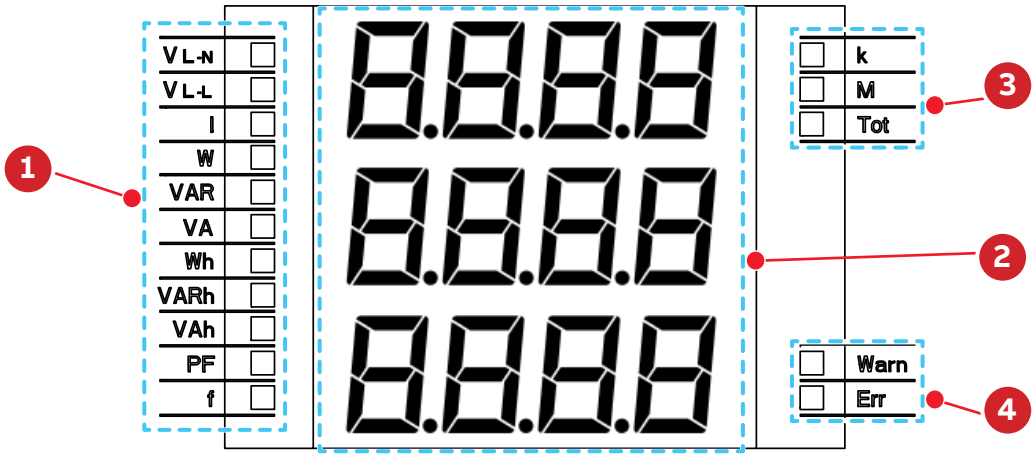
The front panel of M1M is shown below:



Operator panel	
1	Display
2	Function buttons
3	Energy pulse LED
4	LEDs for indication of parameters

Display content

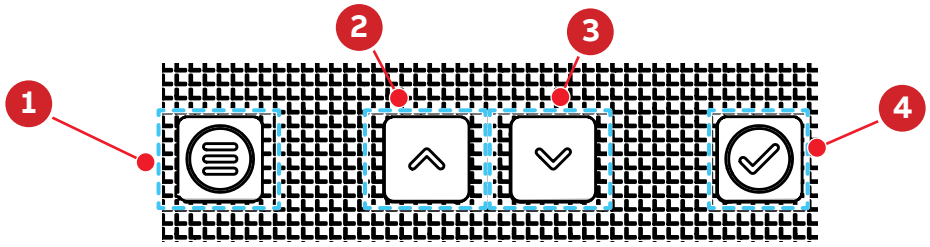
Display is divided into 4 different areas, as shown in the figure below:



N	Area	Description
1	Parameters	Indication of electrical parameters
2	Measurements	Specific measured value
3	Magnitude	Indication of unit magnitude (k, M) or total parameters (Tot)
4	Notifications	Indication of warnings and errors

5.2.Buttons

Each M1M is provided with 4 pushbuttons as per below picture:



Functions of each button might change according to the displayed page on the meter. See below for a complete description:

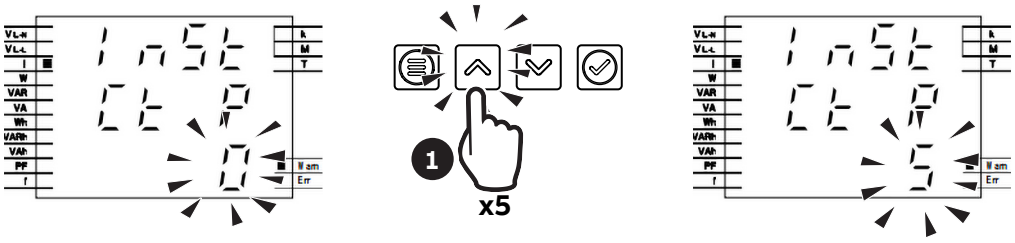
#	Button	Functions
1	Menu	Go to the main menu; go back; or return to the default screen
2	Up	Page up and enter numerical value in cyclic and ascending way and decimal point; and when pressed continuously, page is up continuously or numerical value ascends automatically
3	Down	Page down and move to higher-order numerical value and confirm the decimal point; and when pressed continuously, page is down or numerical value moves to higher order continuously until zero clearing
4	Enter	Go to the next menu, confirm the numerical value or option input, and read the average of the parameter measurements

5.3.Data entry

Some of the pages require the entry of numerical characters (0-9) in the Configuration mode. In these cases the display will show an active field identified by a flashing number.

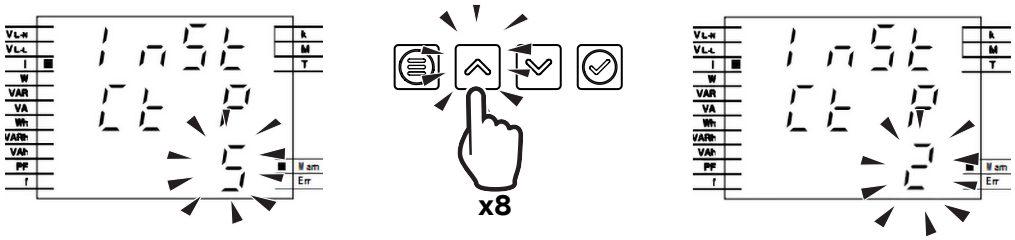
Data entry procedure

The data entry procedure is as follows:



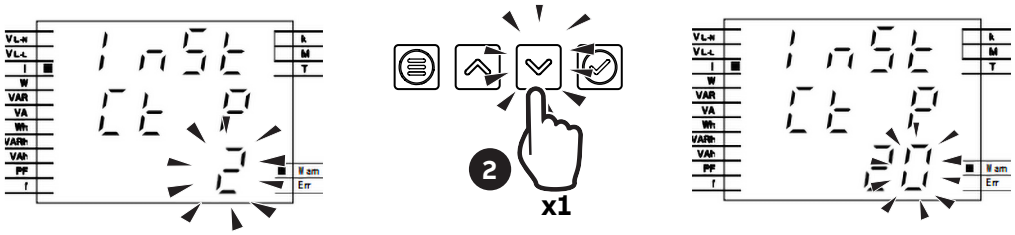
1. Press “Up” to increase the numerical characters from 0 to 9, until the required character is obtained.

• How to: Go back to a previous number



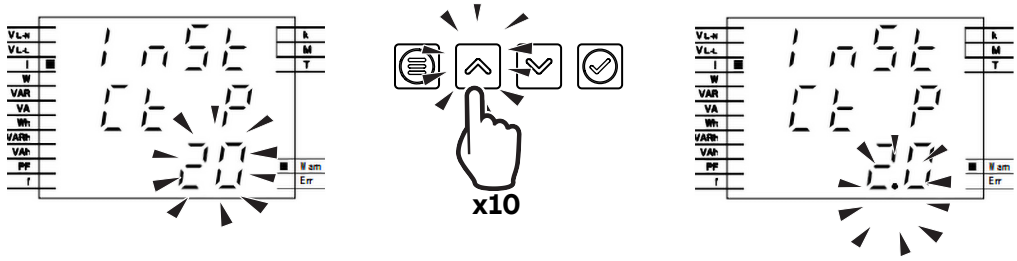
If during the data entry the desired number is exceeded by mistake, it is needed to increase the displayed number until data entry starts again from 0.

• Add a second digit



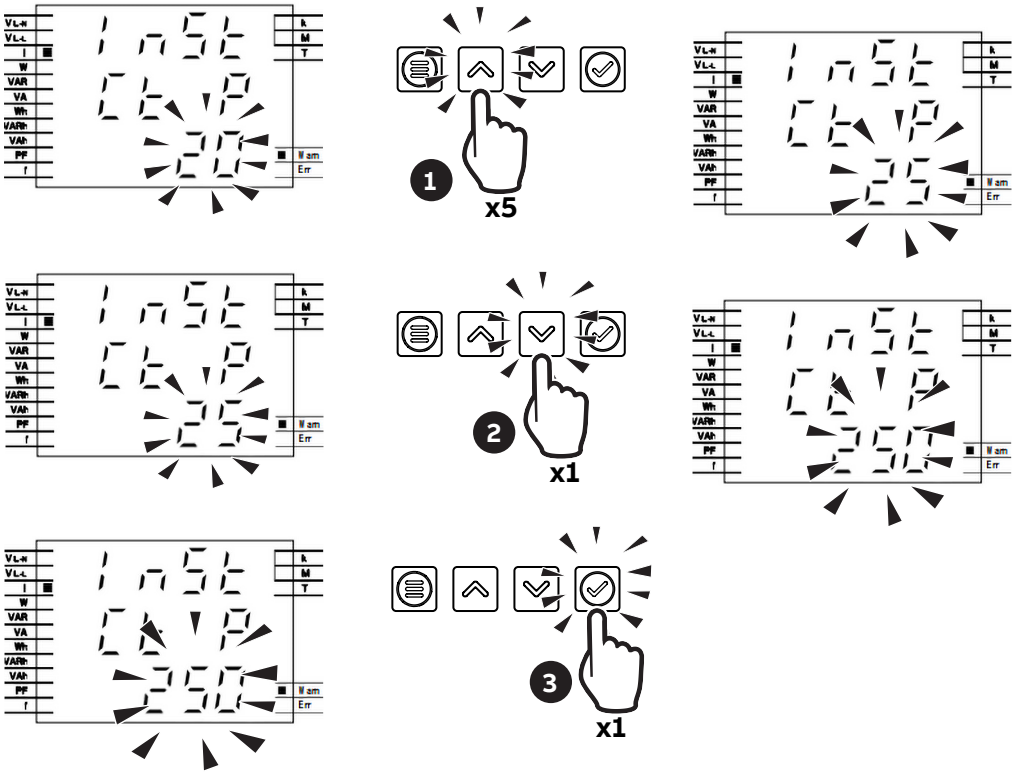
2. Press “Down” to move the cursor in order to add a second digit to the number;

• **How to: Enable the comma**



Some device configurations allow entering the comma. Comma can be displayed by increasing the number with “Up” , after character 9 and before data entry starts again from character 0.

• **Confirm number**

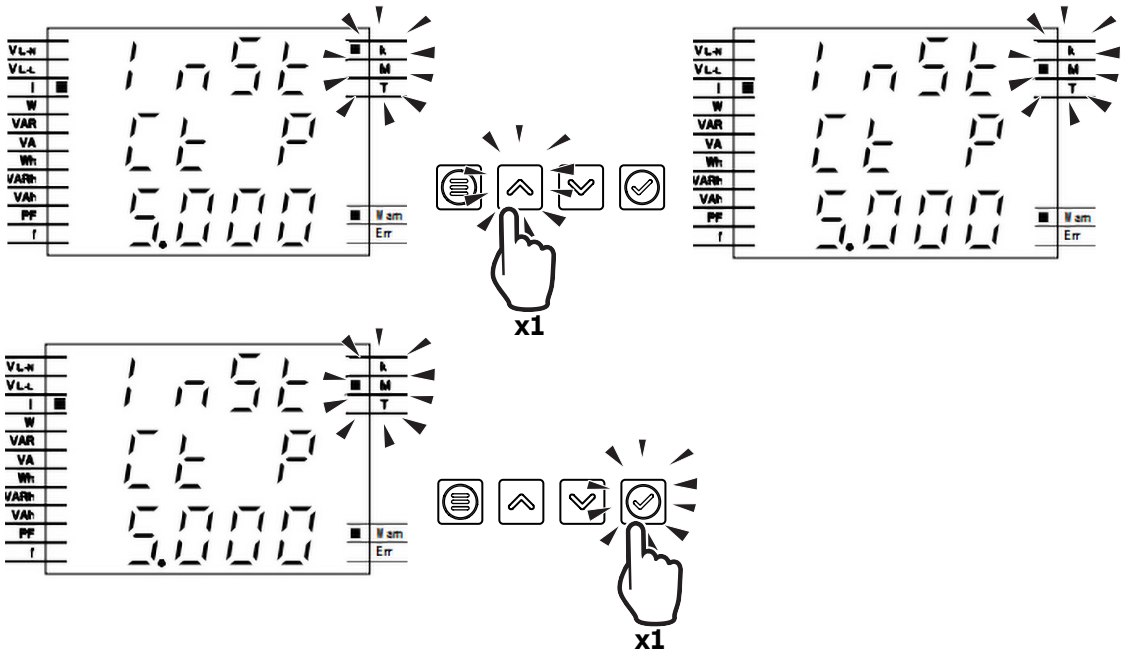


3. Repeat the operations described in steps **1** and **2** until the desired number is obtained, press “Enter” to confirm the number.

- **How to: Enter the magnitude**

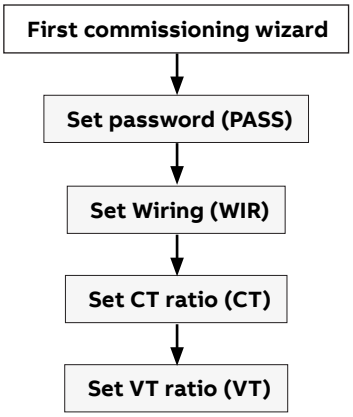
Some device configurations allow entering the magnitude (k, M).

Once the number has been entered as after step 3, keys “Up” and “Down” allow enabling the magnitude “K” (kilo) or not. Press “Enter” to confirm the magnitude. Follow the steps below when the buttons are used to enter numbers:



6.First commissioning

When the device is started up for the first time, the basic parameters need to be set, and the wizard program will guide the user to configure the device by following the steps below:



6.1.Password for the first use (PASS)

A password can be set by the user to protect the Configuration menu and avoid any unwanted modification to the device settings.

At the first use it is mandatory to define a password.

The password comprises 4 digits, and Button “Up” and Button “Down” can be used to enter numbers, and Button “Enter” can be used to confirm the user’s settings and Button “Menu” used to drop the user’s settings.

In order to disable the password, please set the new password as **0000**.

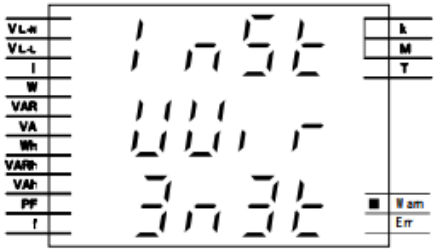
The password can be changed this way:

1. go to **CONF/UNIT/PASS**,
2. press “Enter” to start changing password.

6.2.Wiring (WIR)

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

> CONF > INST > WIR



1. Scroll the list of fields “Up” or “Down”
2. Select one option by pressing “Enter”

Type	Description
3N3T	Three-phase, four-wire and 3 CTs
3 3T	Three-phase, three-wire and 3 CTs
3 2T	Three-phase, three-wire and 2 CTs
3 1T	Three-phase, three-wire and 1 CT
1N1T	Single-phase, two-wire and 1 CT

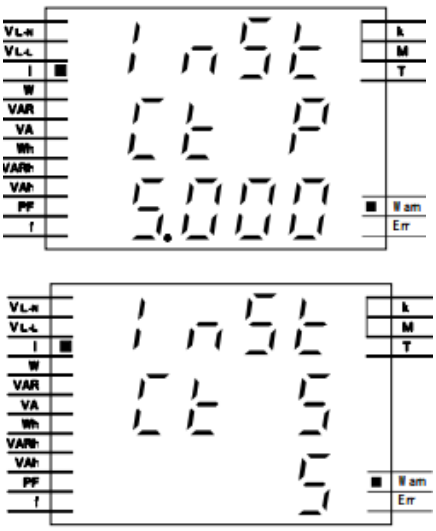
6.3.CT ratio (Ct P, Ct S)

M1M is capable to measure current only via indirect connection by means of current transformers CTs.../5A or .../1A.

It is needed to set the transformation ratio of the installed current transformers.

In order to configure the current transformers ratio it is possible to set the primary (Ct P) and secondary (Ct S) of the current transformer.

> CONF > INST > Ct P > Ct S



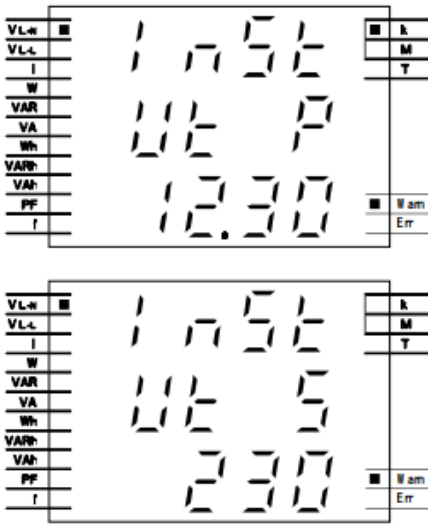
1. When the number of the primary CT is set, press Button “Enter”
2. Use Button “Up” and Button “Down” to select the magnitude
3. Press button “Enter” to confirm the setting of the primary CT
4. Press button “Down” to go to the setting of the secondary CT
5. Select the secondary CT among 1 and 5A
6. Press button “Enter” to confirm the setting of the secondary CT

6.4.VT ratio (Vt P, Vt S)

M1M is capable to measure voltage via direct connection up to 265 VL-N, 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 (Vt P) and secondary (Vt S).

› CONF › INST › Ut P › Ut S



1. When the number of the primary VT is set, press Button “Enter”
2. Use Button “Up” and Button “Down” to select the magnitude
3. Press button “Enter” to confirm the setting of the primary VT
4. Press button “Down” to go to the setting of the secondary VT
5. When the number of the secondary VT is set, press Button “Enter”
6. Press button “Enter” to confirm the setting of the secondary VT

In case of direct insertion without voltage transformers, please set VT ratio as 230/230 (default)

7.Configuration (CONF)

When entering the CONF section, 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. 5 minutes of idle. After quitting the Configuration section, it is needed to enter again the password.

In order to read only the configurations, it is possible to simultaneously press “Enter” and “Up” buttons.

In case of wrong entering of the password for three times in a row, user will have to wait for 5 minutes until he can enter the password once again.

CONF includes the following menus:

Menu	Description
UNIT	Settings related to the device itself
INST	Settings related to the installation conditions
I/O	Settings related to the pulse LED
COMM	Settings related to the embedded communication protocols of the M1M version

7.1.Unit (UNIT)

UNIT includes the following sub-menus:

Menu	Description
PASS	Change the existing password
REST	Full or partial reset of the meter
INFO	Device information

Modify password (PASS)

PWD shares the same interface and setting way with password setting. For details, see **"6.1.Password for the first use (PASS)"**.

> CONF > UNIT > PASS

Reset (REST)

> CONF > UNIT > RESET

If the user selects "YES" and presses Button "Enter", all parameters will be reset, i.e. restoring all parameters to their factory default.

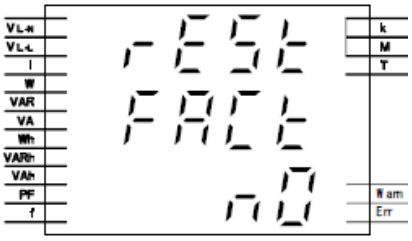
RESET sub-menu includes the following pages:

Menu	Description
RESET FACT	Reset factory settings
RESET ENRG	Clear energy value
RESET NOTF	Clear notifications

- **RESET FACT**

Reset Factory settings restores parameters to default values, including communication parameters, notifications, etc.

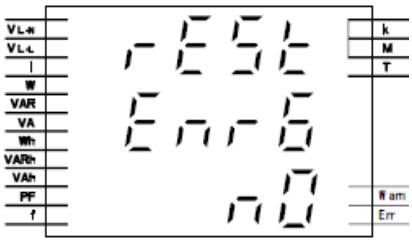
> CONF > UNIT > RESET > FACT



- **RESET ENRG**

Reset energy will clear the energy to 0.

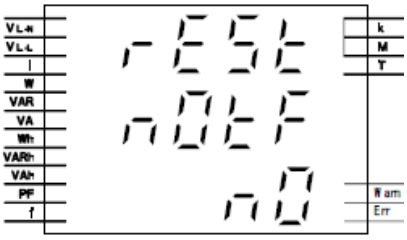
> CONF > UNIT > RESET > ENRG



- **RESET NOTF**

All notifications will be cleared after the Reset Notification, including alarms, warnings, and faults.

> CONF > UNIT > RESET > NOTF

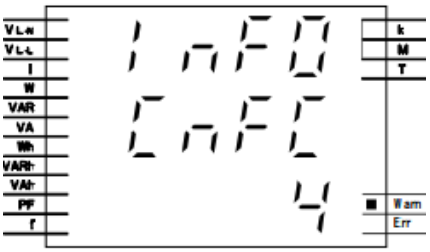


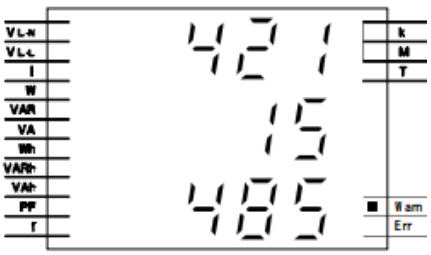
If the user selects “YES” and presses Button “Enter”, all parameters will be reset, i.e. restoring all parameters to their factory default.

Device info (INFO)

INFO includes firmware version, product model and peripheral functions, etc.

> CONF > UNIT > INFO





Menu	Description
APP	Firmware version
CNFC	Parameter configuration counter
15	Product model and peripheral functions

7.2.Installation (INST)

INST includes the following sub-menus:

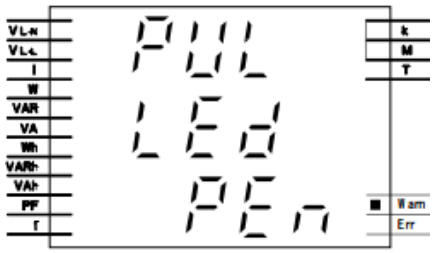
Menu	Description
WIR	Set the type of network and number of wires on which the device is installed
CT	Set the ratio of current transformers for current measurement
VT	Set the ratio of voltage transformers for voltage measurement, if any

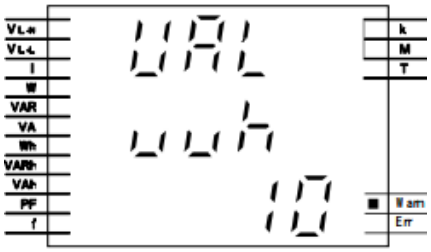
The three items must be set during the first startup. For details, see **“6.2.Wiring (WIR)”**, **“6.3.CT ratio (Ct P, Ct S)”** and **“6.4.VT ratio (Vt P, Vt S)”**.

7.3.I/O LED pulse (PUL)

I/O includes selection of energy variables of panel LED indicator and energy pulse ratio.

> CONF > IO > PUL





The output energy variables of LED indicator include:

Electricity Variable	Description
PEN	Active energy
QEN	Reactive energy
OFF	Off

The setting range of pulse output ratio is: 0.001 ... 9999. The formula guiding this parameter setting is:
1 pulse = **X** Wh (varh/VAh)
X is the set number.

7.4.Communication (COM)

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 menu is available:

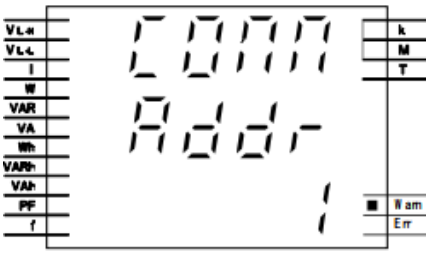
Communication Protocol	Parameter	Description
Modbus RTU	ADDR	Bus address
	BAUD	Baud rate
	BYTE	Byte format

Modbus RTU (M1M 15 Modbus)

- **Address (ADDR)**

For the devices that adopt the Modbus RTU protocol, a unique address on the bus needs to be set.

> CONF > COMM > Addr



The address range is 1-247.

- **Baud rate (BR)**

BR represents data transmission baud rate. The higher the BR, the faster the data transmission.

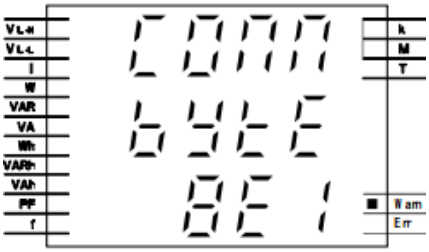
> CONF > COMM > br

The optional Baud rates include 9600, 19200, 38400, 57600 and 115200 bps.

- **Byte format (BYTE)**

BYTE comprises three parts – bits per byte, parity bit and stop bit.

> CONF > COMM > BYTE



The optional byte formats include:

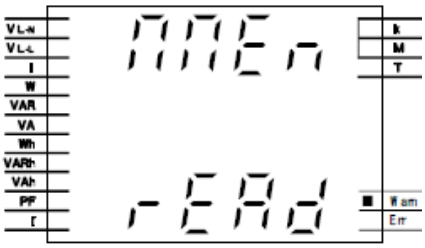
BYTE	Description
8E1	8 even parity bits and 1 stop bit
8O1	8 odd parity bits and 1 stop bit
8N1	8 No Parity bits and 1 stop bit
8N2	8 No Parity bits and 2 stop bits

8.Data reading (READ)

READ section allows to visualize all the parameters measured by M1M.

Specifically, it includes the following menus:

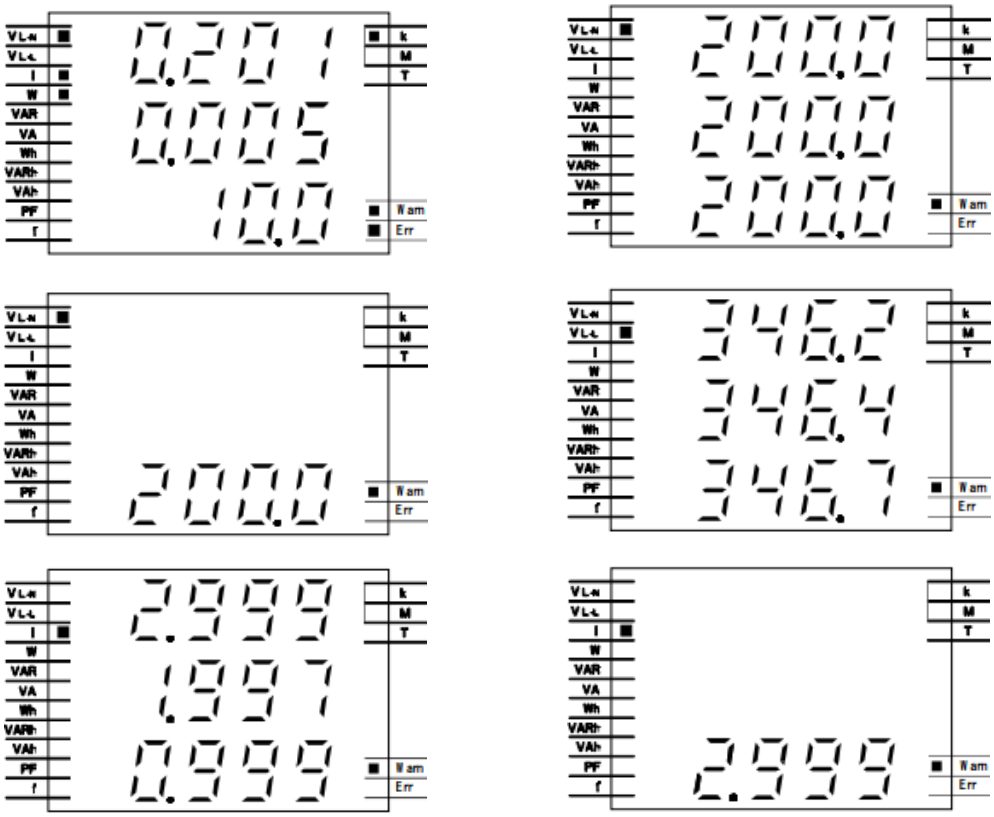
Menu	Description
REAL	Real-time measurements
ENRG	Energy measurements
P QT	Power quality
NOTF	Notification message

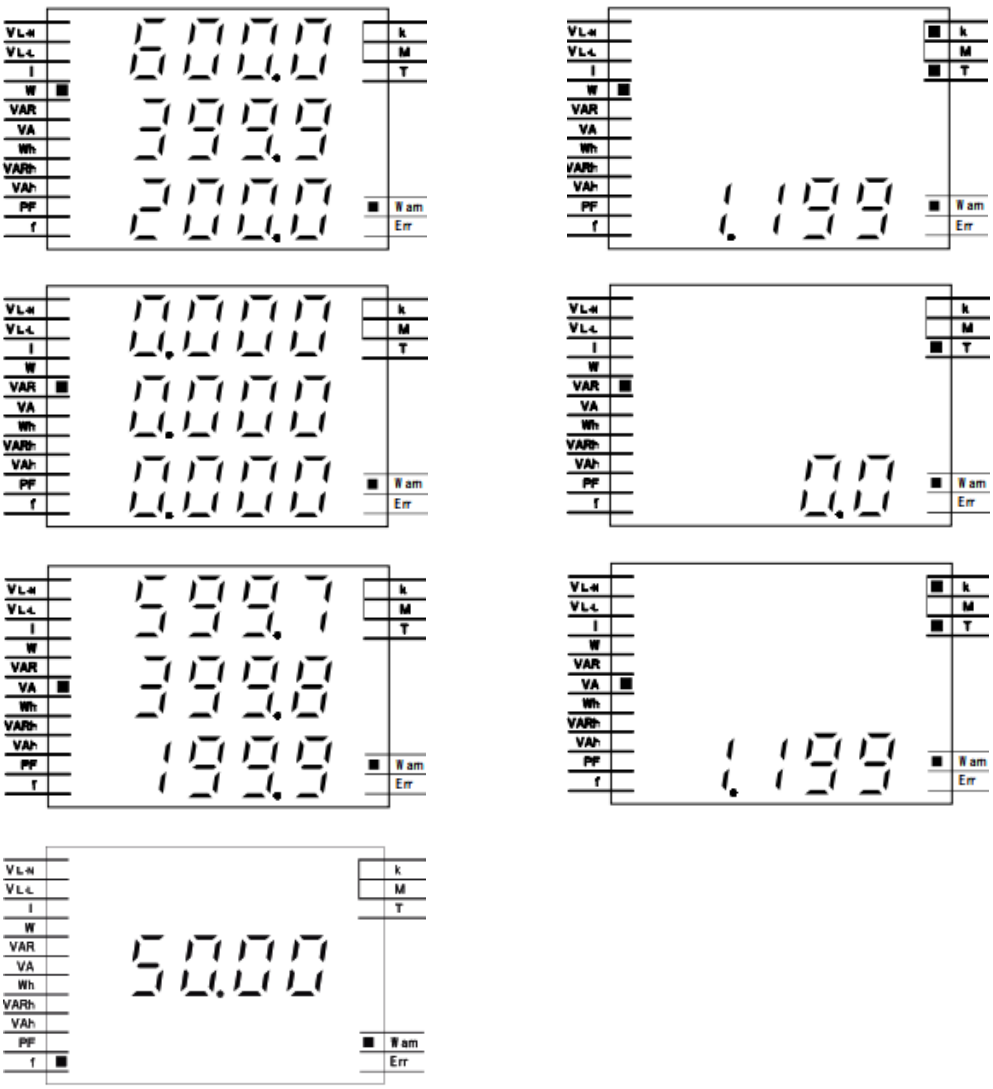


8.1.Realtime (REAL)

REAL means the real-time data of the current electric energy, including the following items:

› rEAd › REAL





REAL	Description
SUMM	Summary data, including total three-phase voltage, three-phase current and active power
VLN	Phase voltage; when WIRI is selected as “3 3T”, “3 2T” or “3 1T”, this data is absent
VLL	Line voltage
I	Current
P	Per phase active power; when WIRI is selected as “1N1T”, this data is absent
Q	Per phase reactive power; when WIRI is selected as “1N1T”, this data is absent
S	Per phase apparent power; when WIRI is selected as “1N1T”, this data is absent
PT	Total active power
QT	Total reactive power
ST	Total apparent power
F	Frequency

8.2.Energy (ENRG)

> READ > ENRG



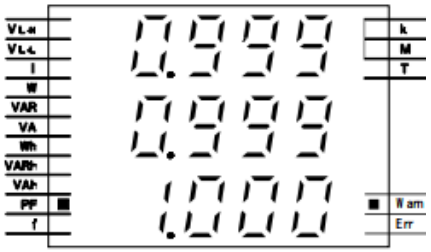


ENRG means the current energy data, including the following items:

ENRG	Description
+PEN	Total imported active energy
-PEN	Total exported active energy
+QEN	Total imported reactive energy
-QEN	Total exported reactive energy
SEN	Apparent energy

Power Quality (P QT)

> READ > P QT




PWQT means the current power quality data, including the following items:

PWQT	Description
PF	Power factor; when WIRI is selected as “3 3T”, “3 2T”, “3 1T” or “1N1T”, this data is absent
PFT	Total power factor

8.3.Notifications (NOTF)

NOTF includes the following items:

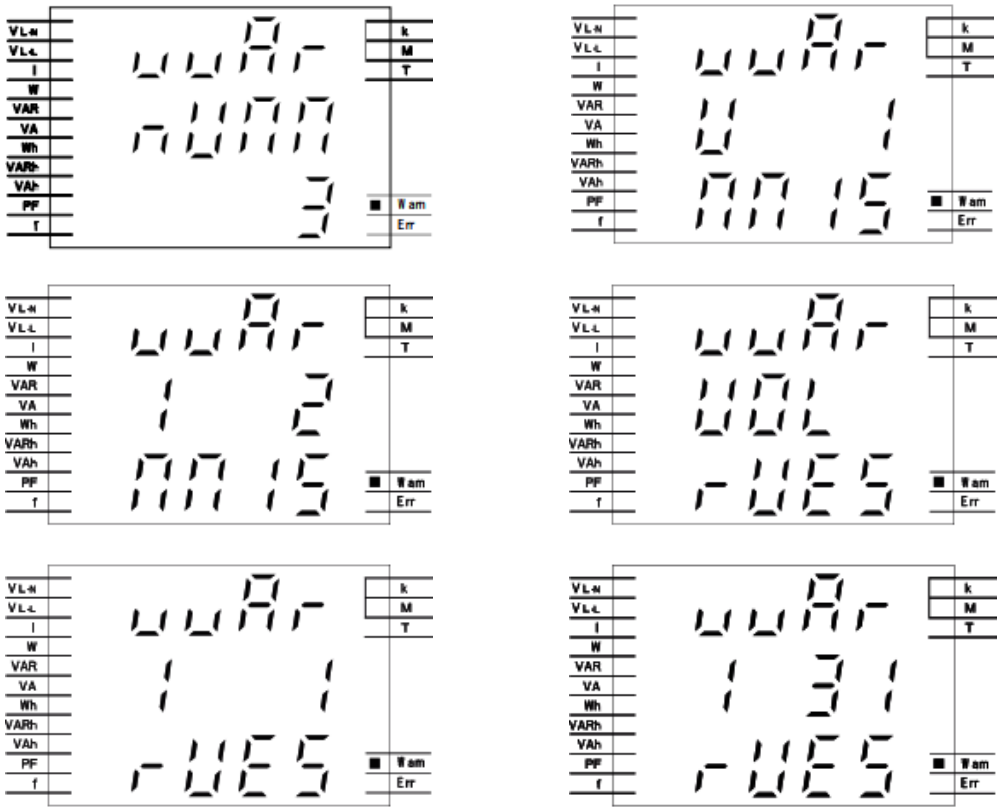
Menu	Description
WAR	Warnings list, related to installation conditions and device settings.
ERR	Errors list, related to the device and to its self-diagnostics.

Warnings (WAR)

Warnings are generated when the device detects the operating conditions. When there is a WARN notification, the warn indicator will be on; and when the user checks all warn messages, the warn indicator will be off.

Warnings comprise warn count and specific warn message.

> RED > NOTF > WAR



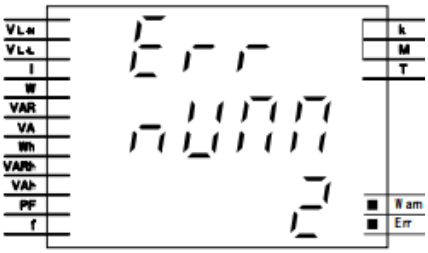
Warning	Definition
VOL REVES	Voltage Reverse
U1 MISS	Voltage 1 Missing
U2 MISS	Voltage 2 Missing
U3 MISS	Voltage 3 Missing
I1 MISS	Current 1 Missing
I2 MISS	Current 2 Missing
I3 MISS	Current 3 Missing
I1 REVES	Current 1 Reverse
I2 REVES	Current 2 Reverse
I3 REVES	Current 3 Reverse
I12 REVES	Current 1 with 2 Reverse
I23 REVES	Current 2 with 3 Reverse
I31 REVES	Current 3 with 1 Reverse

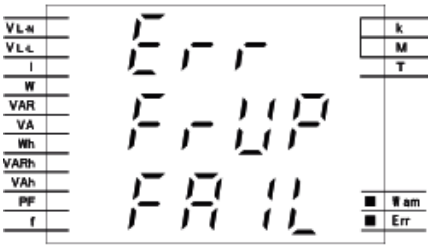
Errors (ERR)

Errors are generated when the device detects operating conditions. When there is an ERROR notification, the error indicator will be on and it will not be off until the error is solved.

Errors comprise error count and specific error message.

> READ > NOTF > ERR





Error	Definition
UNCONFIG	EEPROM Missing
FWUP FAIL	Firmware update Failure (only M1M with communication)
REPROVED	Product not Approved

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