EMS

Energy management system

24/10/2025

Contents

This manual

Information property

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Safety messages

The following section describes the warnings related to user and device safety included in this document:

CAUTION! Indicates a risky situation which, if not avoided, may cause data loss.

IMPORTANT: provides essential information on completing the task that should not be neglected.

NOTICE Indicates obligations that if not observed may lead to damage to the device.

General warnings

This manual is an integral part of the product and accompanies it for its entire working life. It should be consulted for all situations tied to configuration, use and maintenance. For this reason, it should always be accessible to operators.

NOTICE: no one is authorized to open the device. This operation is reserved exclusively for CARLO GAVAZZI technical service personnel.
Protection may be impaired if the instrument is used in a manner not specified by the manufacturer.

Service and warranty

In the event of malfunction, fault, requests for information or to purchase accessory modules, contact the CARLO GAVAZZI branch or distributor in your country.

Installation and use of analyzers other than those indicated in the provided instructions void the warranty.

EMS

Introduction

EMS is an all-in-one smart meter, gateway, webserver and controller. It is an energy analyser that can monitor one three phase load (or 3 single-phase loads), expandable to 10 three-phase loads via ESY bus add-ons.

Description
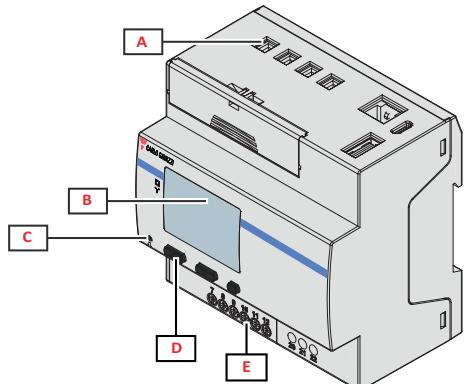
Figure 1 EMSAV5/MV5
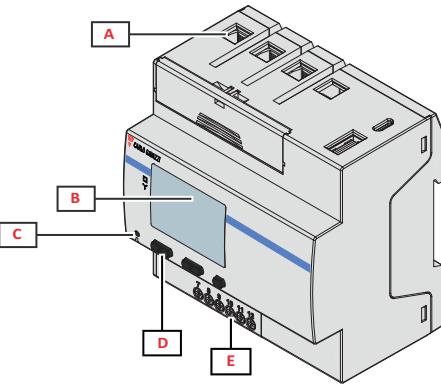
Figure 2 EMSAV2

Area	Description
A	Voltage inputs
B	Display
C	LED
D	Browsing and configuration buttons
E	Digital input, digital output and communication connections

Available versions

Part number	Connection	Output
EMS10AV5O1X	5 A CT connection	Digital output
EMS10AV5S1X	5 A CT connection	RS485 Modbus RTU
EMS10MV5O1X	333 mV CT connection	Digital output
EMS10MV5S1X	333 mV CT connection	RS485 Modbus RTU
EMS10AV2O1X	Direct connection up to 65 A	Digital output
EMS10AV2S1X	Direct connection up to 65 A	RS485 Modbus RTU

Commissioning

Power on

At switch-on, the device displays the following pages:
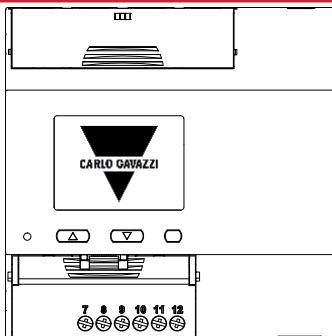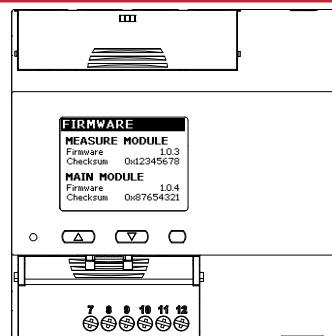
Figure 3 *Logo*	***Figure 4*** *Firmware information*

QUICK SETUP menu
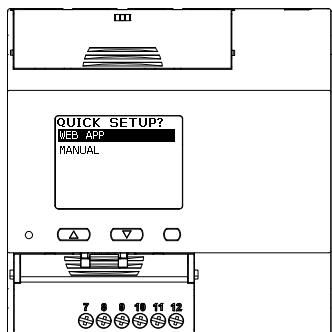
Figure 5 *Quick setup starting page*

Action	Description
WEB APP	Run the Quick setup procedure via Web App
MANUAL	Run the Quick setup procedure via display

This procedure is available when the instrument is switched on and can be run using

- Web App, it requires a Wi-Fi connection,
- Display, using the buttons and following the procedure on the screen.

Note:

- *if Quick setup is completed through Web App, it will be available on the display only after a RESET command;*
- *the available parameters during the Quick setup depend on the model.*

Quick setup via Web App

***Figure 6** QUICK SETUP via Web App*

To start the Quick setup via Web App, you must first select this option from the device display. Once confirmed, the display will show two screens in sequence:

- the first one with the Wi-Fi credentials of the device (SSID and password), and

- the second one with the web address to access the set up page.

Both screens include a QR code for easy connection. The set up can be completed from either a PC or a mobile device

The following table reports all the parameters available via Web App:

Parameter	Sub-parameter	Description	Values	Default values	Notes
IP settings	Hostname	Name of the device in the network	-	-	-
	IP address	Use a DHCP automatic address or a manually inserted one	Get an IP address Automatically (DHCP)	Get an IP address Automatically (DHCP)	-
			Use the following IP Address		
	DNS server address	Use an automatic address or a manually inserted one	Get DNS Server address automatically	Get DNS Server address automatically	-
			Use the following DNS server addresses		
Date and time	EMS date and time	Current date and time	-	-	-
	Time zone	Timezone of the device installation	-	-	-
	Enable NTP	Activation/deactivation of NTP	-	-	-

Parameter	Sub-parameter	Description	Values	Default values	Notes
Measure settings	Main Load	Selection of the electrical system	1P	3P.N	-
			2P		
			3P		
			3P.N		
	Load description	Description of the load selected	-	-	-
	Primary current	Current transformation ratio value	1-2000	1	AV5 MID models only
	CT Ratio	Primary current value	10-10000	10	MV5 MID models only
	CT orientation	Define the current flow direction	-	-	-
	Measurement mode	Select the measurement mode	Easy connection	Easy connection	-
			Bidirectional type 1		
			Bidirectional type 2		
	Digital input function	Define the function of the digital input	Tariff management	Tariff management	-
			Remote		
			Partial meter start/stop		
			Partial meter reset		
	Start-up current for run hour counter (mA)	threshold for run hour meter start in mA	1-100000	1	-
Display	Security password	Define the password to access the protected information on the display	1-999999	1	-
Preview	Main load real-time	Shows a preview of some real-time variables	-	-	-
	Connection status	Shows the actual status of the communications	-	-	-

Quick setup via Display

It allows the fast and immediate set up of some parameters, that strictly depend on the model.
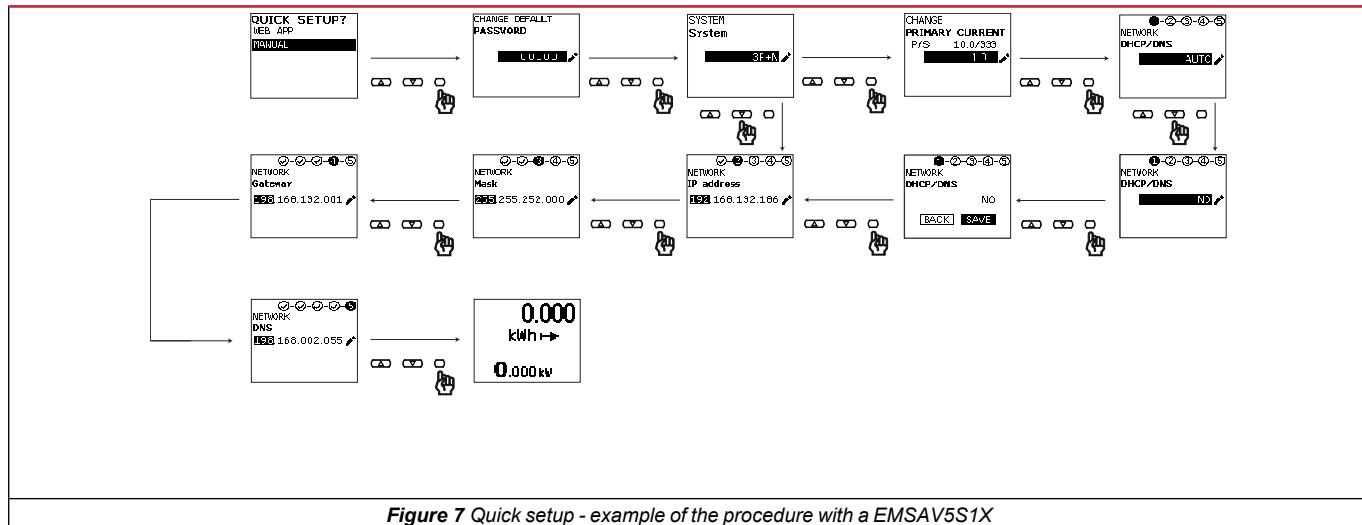

Figure 7 Quick setup - example of the procedure with a EMSAV5S1X

The following table reports all the parameters available via Display:

Page title	Sub-menu	Description	Values	Default values	Notes
CHANGE DEFAULT PASWORD	-	Password value configuration	000000-999999	000000	With 000000 the password is considered disabled, so it is possible to access directly to SETTINGS and RESET menu and their functions
SYSTEM	-	Electrical system	3P+N 3P 2P 3x1P 1P	3P+N	-
PRIMARY CURRENT	-	Primary current value	10-10000	10	MV5 models only
CT Ratio	-	Current transformation ratio value	1-2000	10	AV5 models only
ETHERNET	DHCP	Activation/deactivation of the Ethernet DHCP service	Enable/Disable	Disable	-
	IP Address	Ethernet IP address value	xxx.xxx.xxx.xxx	-	
	Mask	Ethernet subnet mask	xxx.xxx.xxx.xxx	-	
	GTW	Ethernet gateway	xxx.xxx.xxx.xxx	-	
	NTP Server	Activation/deactivation of the NTP service	Enable/Disable	Disable	

Note: Wi-Fi parameters can only be set up using Web App.

WIRING CHECK menu (Non-MID models only)

Figure 8 *WIRING CHECK starting page*
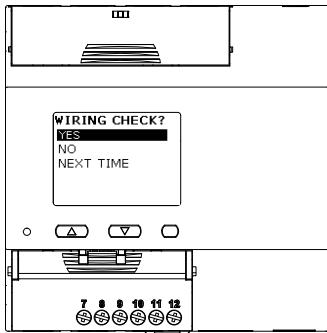
Action	Description
YES	Run the Wiring check procedure
NO	Skip the procedure and no longer display WIRING CHECK menu at power on and drives to the Homepage
NEXT TIME	skip the procedure and display the QUICK SETUP menu at the next switch-on, it drives directly to the Homepage

The Wiring check function allows to check and correct the connections. For it to work properly, the following three conditions must be met:

- the set system must be "3P+N",
- all voltages must be connected,
- All currents must be greater than zero, with an offset ranging between a 45° lag and a 15° lead (power factor > 0.7 inductive or > 0.96 capacitive)

Table below report the available procedures:

| Page title	Sub-menu	Description	Values	Default values	Notes
VOLTAGE CHECK	-	Checking errors in voltage connections	-	-	-
CURRENT CHECK	-	Checking errors in current connections	-	-	-
SHOW AGAIN	-	Display again the information about wiring check	Yes	No	-
			No		
			Next time		

During operation, if a wiring error is detected the alarm icon will light up. If the three conditions fail to be met, the following indications shall be displayed in the WIRING CHECK info page:

- V MISSING: at least one voltage is missing,
- I MISSING: at least one current is missing,
- PF OUT OF RANGE: the current-voltage offset is out of range.

Use

Interface

Push buttons
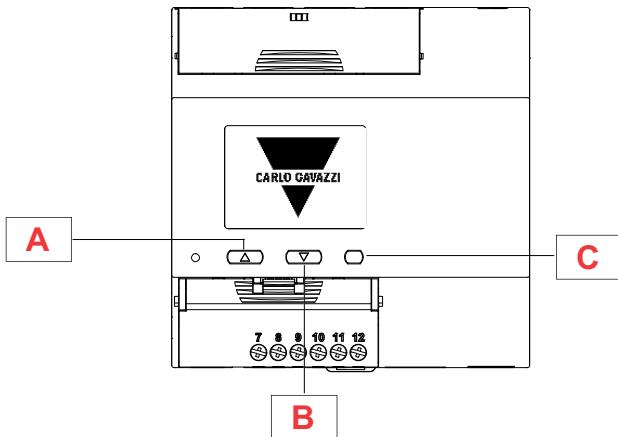
| Button	Action
A	UP
B	DOWN
C	CONFIRMATION

Figure 9 *Front of the device*

General overview

EMS is organized into two menus:

- Measurement pages: pages allowing to display the energy meters and the other electrical variables;
- Main menu, divided into two sub-menus:
  - SETTINGS: pages allowing to set the parameters,
  - INFO: pages displaying general information.

Measurement pages EMS

Figure 10 *Scheme of the Measurement pages sections of the EMS*
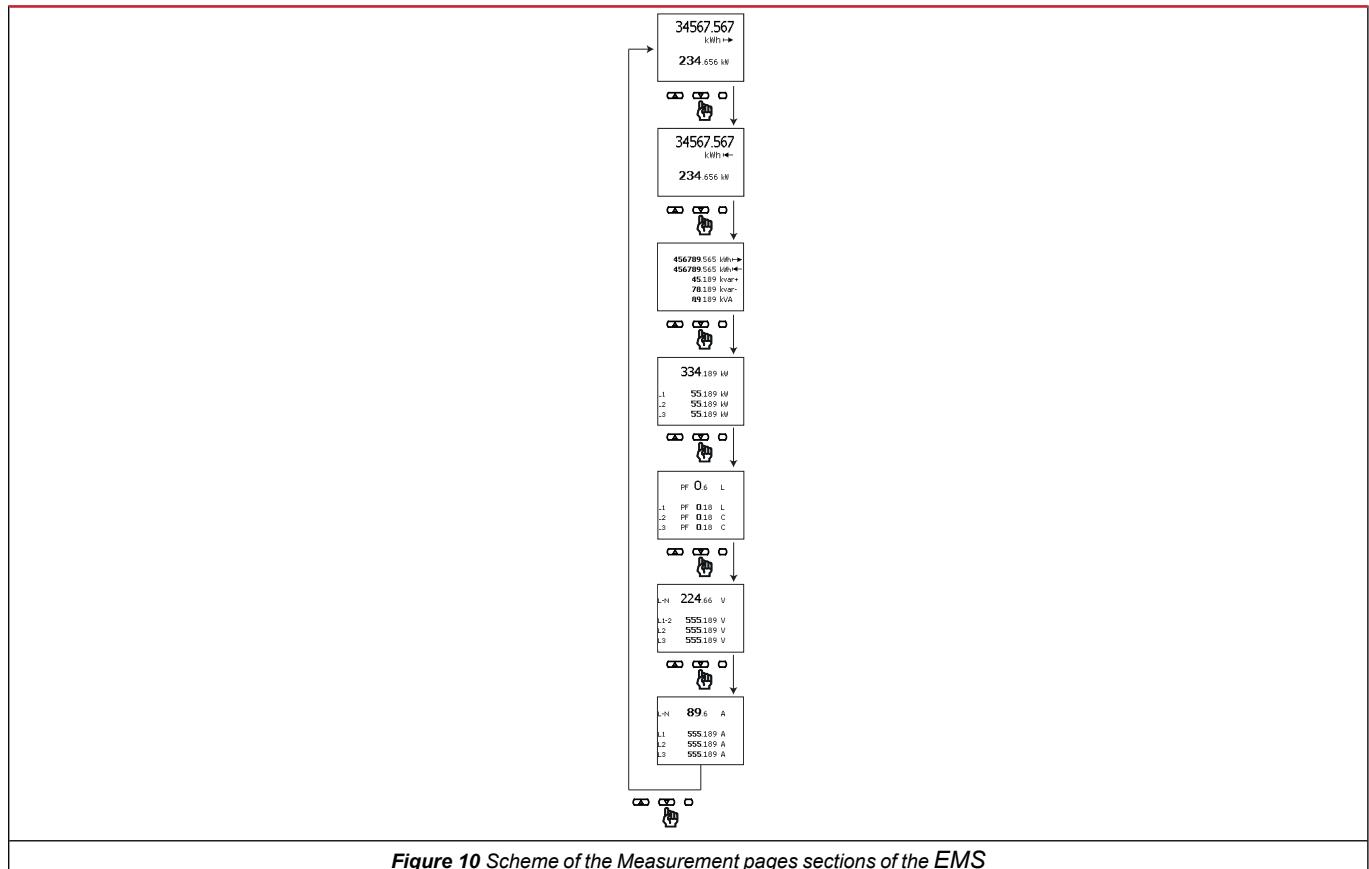
Measurement pages display real-time measurement parameters on the EMS. These pages allow the user to monitor key data directly from the device's integrated display. Each page is designed to present a specific set of values, with information updated automatically in real time. The following table provides a list of available measurement pages and their descriptions:

List of available Measurement pages

The displayed pages depend on the selected system.

Page ID	Displayed measurements	Description
1	kWh+ TOT	Imported active energy (TOTAL)
	kW	System active power
2	kWh- TOT	Exported active energy (TOTAL)
	kW	System active power
3	kWh+ TOT	Imported active energy (TOTAL)
	kWh- TOT	Exported active energy (TOTAL)
	kvarh+	Imported reactive energy
	kvarh-	Exported active energy
	kVAh	System apparent energy
4	kW	System active power
	kW L1	Phase 1 active power
	kW L2	Phase 2 active power
	kW L3	Phase 3 active power
5	PF	System power factor
	PF1	Phase 1 power factor
	PF2	Phase 2 power factor
	PF3	Phase 3 power factor
6	V LN	-
	V L1	Phase 1 voltage
	V L2	Phase 2 voltage
	V L3	Phase 3 voltage
7	A N	Neutral current
	A L1	Phase 1 current
	A L2	Phase 2 current
	A L3	Phase 3 current

Note: if one - phase is selected as measurement in the SYSTEM menu, information about L2 and L3 will not appear.

Measurement pages function

The display behaviour of Measurement pages is managed through its main function: Home Page. These function define how and when the main page is shown.

Home page

The Home Page function defines a default measurement page that is both the initial screen when navigating the device and the page automatically displayed after a period of inactivity when navigating the menu (300 seconds).

Default Home page

By default, the Home Page corresponds to the page that displays active imported energy (kWh+ TOT) and total active power (kW).

Menu section

The menu is accessible by using the button CONFIRMATION from the Measuring pages section; it consists of 2 sub-menus, which are described below. In general:

- In this section of the menu there are no icons,
- Modbus commands are inhibited during the navigation of SETTINGS menu and Web App,
- Web App settings modification are not allowed during the navigation of the SETTINGS menu on the display.

SETTINGS menu
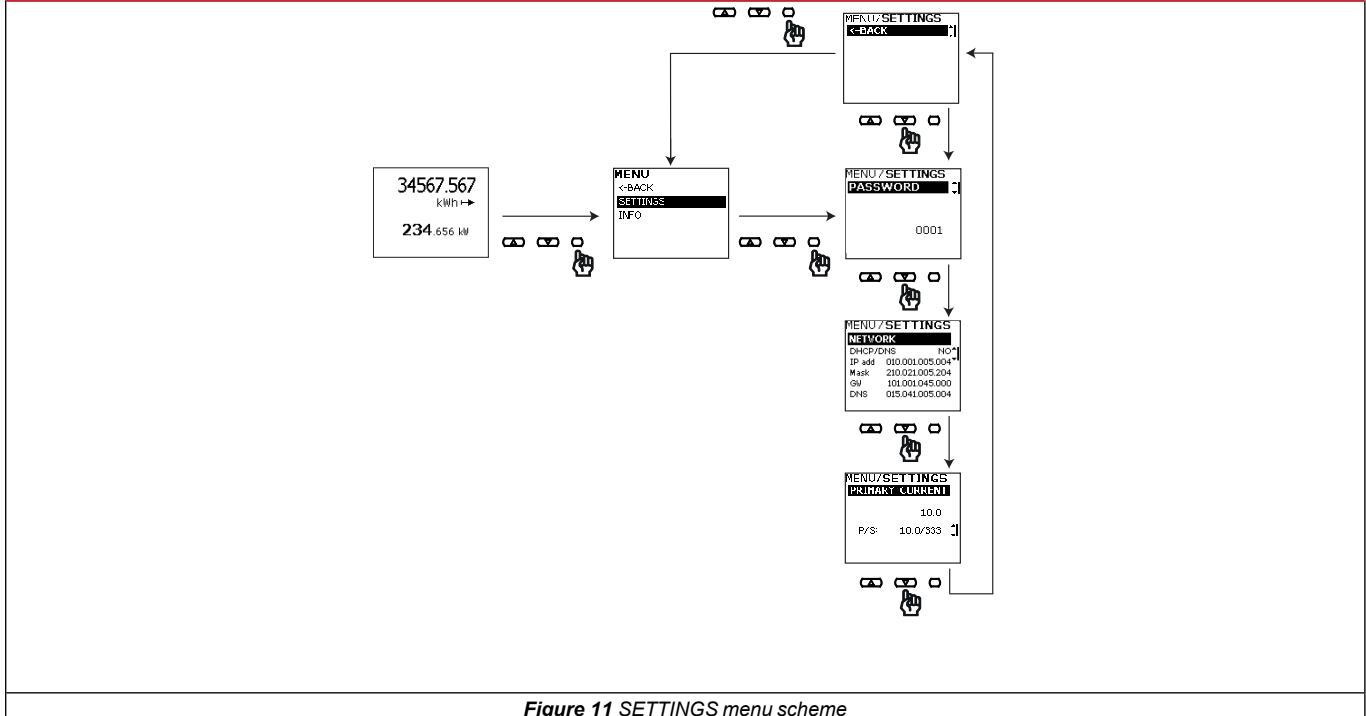
Figure 11 *SETTINGS menu scheme*

The SETTINGS menu allows to set up the value of some parameters (see the table below for a complete list). If the password is not 000000, it is required to access this submenu. If it is set to 000000, the menu is not protected.

SETTINGS menu parameters

The table below shows a complete list of parameters and values that are available on SETTINGS menu via display.

| Page title	Sub-menu	Description	Values	Default values	Note
PASSWORD	-	Password enabling for the SETTINGS	1-999999	0 (Not protected)	-
NETWORK	DHCP/DNS	Activation/deactivation of the Ethernet DHCP service	NO	AUTO	-
			AUTO		
	IP add	Network IP address value	xxx.xxx.xxx.xxx	-	
	Mask	Network subnet mask	xxx.xxx.xxx.xxx	-	
	GW	Network gateway	xxx.xxx.xxx.xxx	-	
	DNS	Domain name system	-	-	
SYSTEM	-	System	3P+N	3P+N	-
			3P		
			2P		
			1P		
CT RATIO	-	(CT) current transformer ratio	1-2000	1	Non-MID, AV5 models only
PRIMARY CURRENT	-	Primary current	10-10000	10	Non-MID, MV5 models only
RS485	ADDRESS	Address value	1-247	1	S1 models only
	PARITY	Parity value	NO	NO	
			EVEN		
	BAUDRATE	Baudrate value	9.6 kbps	9.6 kbps	
			19.2 kbps		
			38.4 kbps		
			57.6 kbps		
			115.2 kbps		
	STOP BIT	Stop bit value	1-2	1	
BACK	-	Exit	-	-	-

INFO menu display
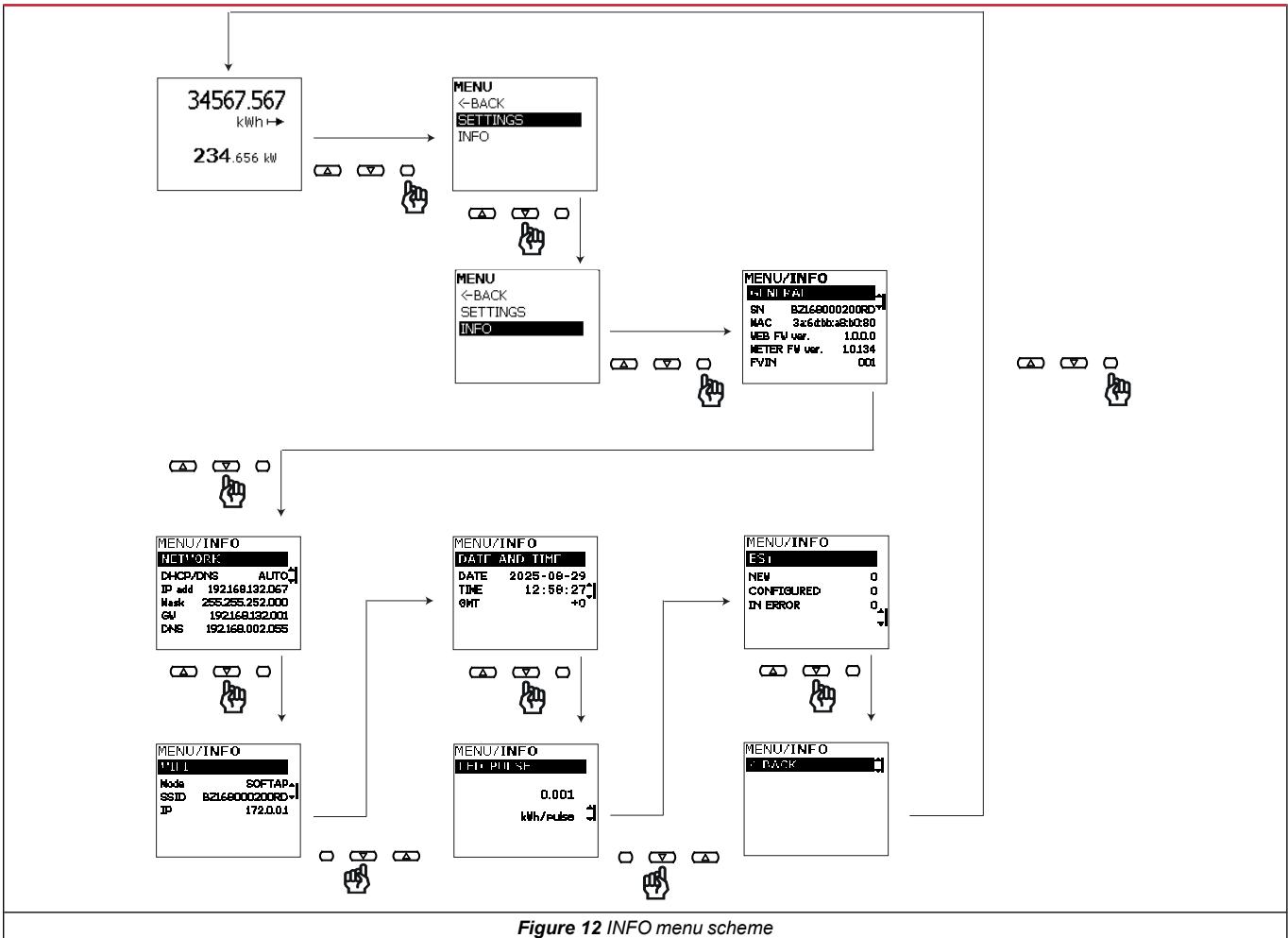
Figure 12 INFO menu scheme

INFO menu shows some relevant information about the meter (see the table below for a detailed list of the available parameters). It doesn't require any password to access.

INFO menu parameters

The table below shows a complete list of parameters and values that are available on INFO menu via display.

Page title	Information	Description
General	Serial number	Information about production serial number
	MAC Add 1 (ETH0)	Unique identifier of the Eth0 network interface
	WEB FW version	Information about Firmware
	Meter FW version	Metering board Firmware version
	FVIN	Firmware Version Identification Number
NETWORK	DHCP/DNS	Information about the network DHCP/DNS service
	IP	Information about network IP address value
	Mask	Information about network subnet mask address value
	GW	Information about network gateway address value
	DNS	Information about network DNS service
Wi-Fi	Mode	Information about Wi-Fi mode (it could be: OFF, 1-to1 or Station)
	SSID	The name of a Wi-Fi network
	IP	IP address
Date and time	Date	Information about clock current date
	Time	Information about clock current time
	GMT	Information about the selected time zone
LED Pulse	value in kWh / pulse	Information about LED constant
RS485 (S1 version only)	Address	Modbus address value
	Parity	Parity value
	Baudrate	Baudrate vaule
	Stop bit	Stop bit value
ESY BUS	NEW	Bus status diagnostic: number of ESY modules connected but not configured
	CONFIGURED	Bus status diagnostic: number of ESY modules configured
	IN ERROR	Bus status diagnostic: number of ESY modules configured but in error

Password manager
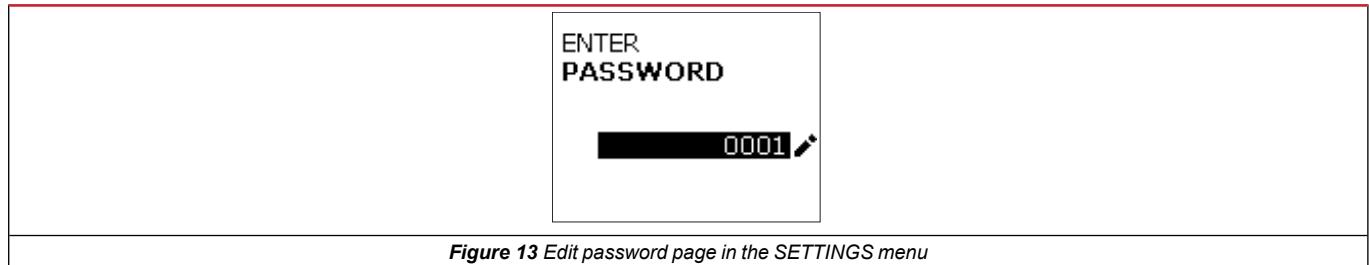
Figure 13 Edit password page in the SETTINGS menu

The password is used to protect access to the SETTINGS submenu and it must be entered if enabled.

During the Quick setup, the user is prompted to set a password, which will later be required to modify parameters. The password can either be defined immediately or disabled (000000 value, default option), ensuring this choice is made from the very first power on.

Once set, the password can be changed/retrieve at any time using UCS software, Modbus, or Web App.

Note:

- *setting modification via Web App is not protected by the password;*

- *With 000000 the password is considered disabled, so it is possible to access directly to SETTINGS its functions.*

Input, output and communication

Digital input

The digital input can perform four functions:

Function	Description	
Tariff management	Digital input used to manage the tariff	
	Digital input status	**Tariff**
	Open	Tariff 1
	Closed	Tariff 2
Remote status	Digital input is used to check the status via Modbus.	
	Digital input status	**Register 300h**
	Open	0
	Closed	1
Partial meter reset	Digital input is used to enable/disable the reset of partial meters	
	Digital input status	**Action**
	Open	No action
	Closed	After 3 seconds, reset partial meters
Partial meters start/stop	Digital input is used to enable/disable the increasing of partial meters	
	Digital input status	**Partial meter**
	Open	Disabled (in pause)
	Closed	Enabled

Digital output (version O1)

The digital output can perform two functions:

Function	Description	Value
Alarm	Output associated with the alarm	0 = Output OFF 1= Output On

Modbus RTU port (version S1)

Modbus RTU communication port is used to transmit data to a Modbus master.

For further information about Modbus RTU communication refer to the communication protocol.

The table below reports the link to access the serial protocol.

Document	Where to find it
Modbus communication protocol	https://www.gavazziautomation.com/fileadmin/images/PIM/OTHERSTUFF/COMPRO/EMS_CPP.pdf

Essential information

LCD display

Backlight

EMS is equipped with a backlight system, that can be activated in the SETTINGS menu via Display, Modbus or Web App.

Display icons description

The table reports the icons that can appear on the screen:

Symbol	Description
ⓘ	Wiring check issue
⚠	At least an alarm is active (physical or virtual)
V↑	Voltage overrange, the measured value is still displayed
A↑	Current overrange, the measured value is still displayed
Esy!	Communication error with at least an ESY module in the configuration
⏚	Modbus communication (slave)

WIRING CHECK function

Introduction

The WIRING CHECK function allows to check and correct the connections.
For it to work properly, the following three conditions must be met:

1. the set system must be "3P+N",
2. all voltages must be connected,
3. All currents must be greater than zero, with an offset ranging between a 45° lag and a 15° lead (power factor > 0.7 inductive or > 0.96 capacitive)

Display check

During operation, if a wiring error is detected the alarm icon will light up.
If the three conditions fail to be met, the following indications shall be displayed in the WIRING info page:

- V MISSING: at least one voltage is missing
- I MISSING: at least one current is missing
- PF OUT OF RANGE: the current-voltage offset is out of range.

Tariff management

Tariff management via digital input

To manage tariffs using the digital input set the function of the digital input as tariff (via Web App). The current tariff depends on the status of the input

Digital input status	Tariff
Open	Tariff 1
Closed	Tariff 2

Run-hour meters

EMS provides 3 run-hour meters:

Run-hour meter	Increases...
Run hour meter (kWh+)	when the power is positive and the current is above I_{tr}.
Run hour meter (kWh-)	when the power is negative and the current is above I_{tr}.
Run hour meter (ON time)	always when the device is ON.

Note: I_{tr} *(threshold current) value can be changed from the Web App settings.*

Maintenance and disposal

Troubleshooting

Note: in case of other malfunctions or of any failure, please contact the CARLO GAVAZZI branch or the distributor for your country

Problem	Cause	Possible solution
The 'EEEE' indication is displayed instead of a measurement	The analyser is not used within the prescribed measuring range; as a consequence, the measurement exceeds the maximum permitted value or is the result of a calculation with at least one measurement in error.	Uninstall the analyser
	The analyser has just been switched on and the interval defined for the calculation of the average power values (default: 15 min) has not expired yet.	Wait. If you wish to change the interval, access the Dmd page of the Settings menu
The displayed values are not the expected ones	Electrical connections are incorrect	Verify the connections
	The current transformer settings are incorrect	Check the set current transformer ratio

Alarms

Problem	Cause	Possible solution
An alarm is triggered, but the measurement has not exceeded the threshold value	The value with which the alarm variable is calculated is in error	Check the set current transformer parameters
The alarm is not activated and deactivated as expected	The alarm settings are incorrect	Check the alarm parameters

Communication problems

Problem	Cause	Possible solution
No communication can be established with the analyser	Communication settings are incorrect	Check the set parameters
	Communication connections are incorrect	Verify the connections
	The settings of the communication device (third-party PLC or software) are incorrect	Check the communication with the Web App

Cleaning

To keep the display clean, use a slightly wet cloth. Never use abrasives or solvents.

Responsibility for disposal

Dispose of the unit by separately collecting its materials and bringing them to the facilities specified by government authorities or by local public bodies. Proper disposal and recycling will help preventing potentially harmful consequences for the environment and for people.

Symbols

The table describes all the symbols that you can find in the documents and on the product.

Symbol	Description
	Dangerous voltage
	Danger, live parts
	Caution
	Provides essential information on completing the task that should not be neglected
	Manual symbol
	Safety sign notice
	The product is not to be discarded with normal household waste
	Single phase
	Three phase
	Double insulation

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