EM341 Installation and use instructions

65 A direct connection three-phase energy analyzer with Modbus and digital interface

General warnings

HAZARD: Live parts. Heart attack, burns and other injuries. Disconnect the power supply and load before installing the analyzer. Protect terminals with covers.
The energy analyzer should only be installed by qualified/authorized personnel.

These instructions are an integral part of the product. They should be consulted for all situations tied to installation and use. They should be kept within easy reach of operators, in a clean place and in good conditions.

Description

The analyzer measures active and reactive energy, summing (*easy connection* mode on) or separating imported energy from exported energy. It manages up to four energy tariffs using RTC and calendar. It is equipped with two digital outputs (pulse or alarm outputs) and an RS485 Modbus port. It measures three DIN modules, with backlit LCD display with sensitive touch screen areas for page scrolling and parameters setting.

Code key (analyzer side)

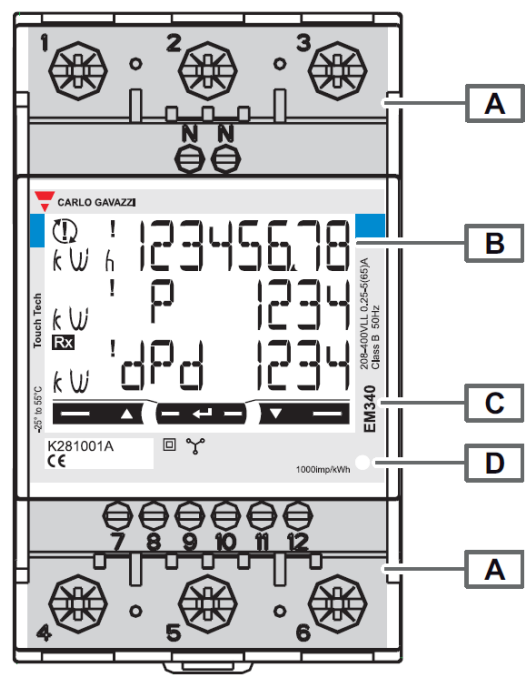| EM341-DIN	.	AVx	.	3	.	X	.	OS	.	X
Model		**AV2**: 208–400 V L-L ac, 5 (65) A, direct connection		Three or four-wire three-phase current system; two-phase current system, 3-wire		Self-powered (via measured voltage)		Output type: **OS**: dual digital output and Modbus RS485 port		No option included

Product

Fig. 1

Area	Description
A	Current and communication connection terminals.
B	Backlit LCD display with sensitive touch screen areas.
C	Model, feature summary and serial number.
D	LED: • blinking red: 1 pulse = 1 Wh. • orange on: total active power negative. Control only run if the imported and exported energies are measured separately (**Measure** = b).
-	Sealable terminal caps
-	In separate package, cap seals and additional current terminal caps

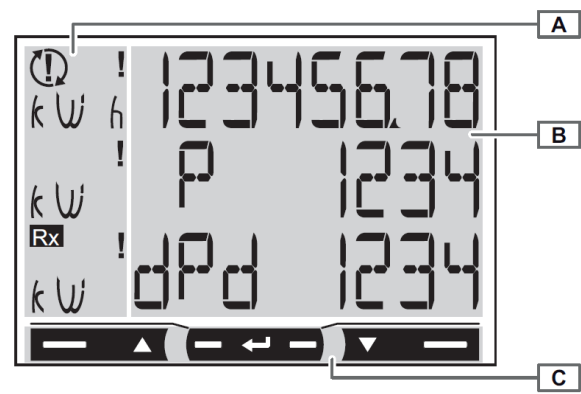# Display

Fig. 2

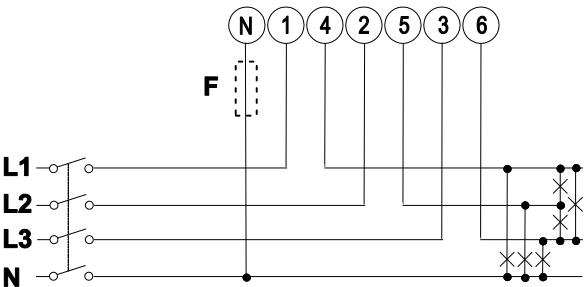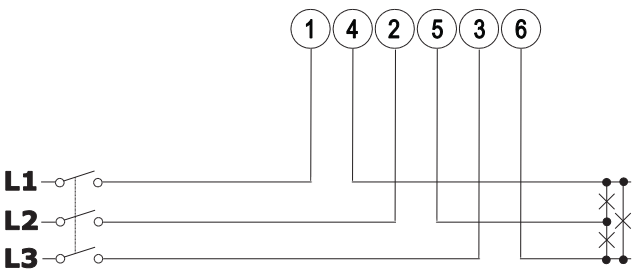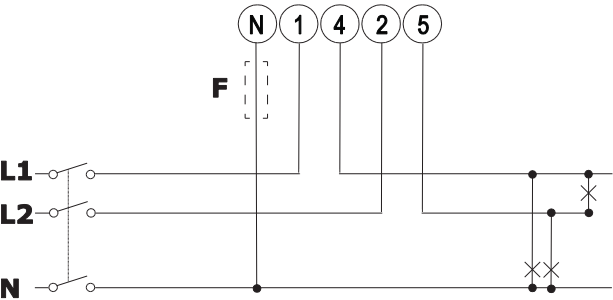| Area	Description
A	Unit of measure and signal area: ⟳ incorrect voltage connections ! specific to one phase, incorrect current direction ⇄ specific to one phase, incorrect voltage direction Rx Modbus command correctly received. Tx Modbus command correctly sent to master.
B	Area with specific section information
C	Command area

Connections

Connection diagrams

Fig. 3
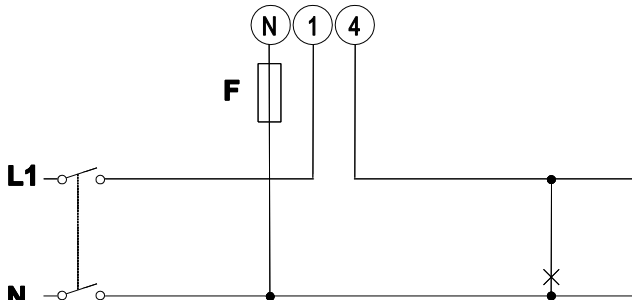

Fig. 4

Fig. 5

Fig. 6
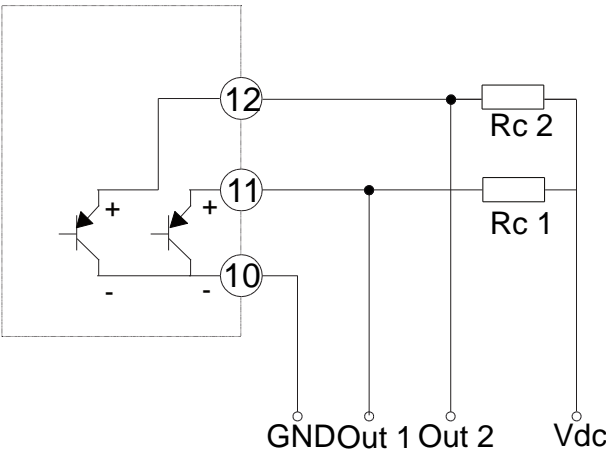
Fig. 7
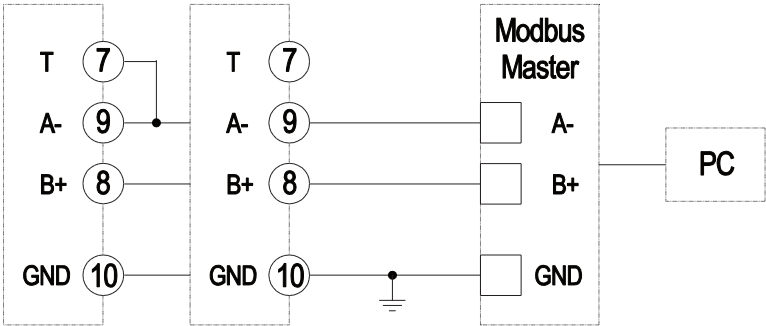
Fig. 8

Diagram	Description
Fig. 3	Three-phase system, 4-wire. 315 mA fuse (**F**), if required by local law.
Fig. 4	Three-phase system, 3-wire.
Fig. 5	Two-phase system, 3-wire. 315 mA fuse (**F**), if required by local law.
Fig. 6	One-phase system, 2-wire. 315 mA fuse (**F**), if required by local law.
Fig. 7	Dual digital output **Vdc**: external voltage (direct current) **Out 1**: digital output 1 (transistor PNP open collector) **Out 2**: digital output 2 (transistor PNP open collector) **GND**: ground (transistor PNP open collector) Open collector outputs: the load resistances (Rc 1 and Rc 2) must be designed so that the closed contact current is under 100 mA (V_{on} is equal to 1 V dc). DC voltage (V_{off}) must be less than or equal to 80 V.
Fig. 8	RS485 Modbus with Master *Note: additional instruments with RS485 are connected in parallel. The serial output must only be terminated on the last network device connecting terminals **A-** and **T**. For connections longer than 1000 m use a signal repeater. Maximum 247 transceivers on the same bus.*

Connection check

The analyzer checks whether connections are correct and signals any faults.
The check can be disabled using the **Install** parameter, *see "**Parameter menu**" on page 9*.

Initial assumptions

The check is based on some initial assumptions on the system to be measured. Specifically, it is assumed that each system phase is characterized by:

- a load with PF>0.766 (<40°) power factor if inductive or PF>0.996 (<5°) if capacitive
- current at least equal to 10% rated current (65A)

Controls and signals

Following are the controls in the order in which they are run and corresponding signals:

Control	Description
Voltage order	of the involved phase
Current direction *	+ of the involved phase

NOTE *: control only run if the imported and exported energies are measured separately (**Measure** = b).
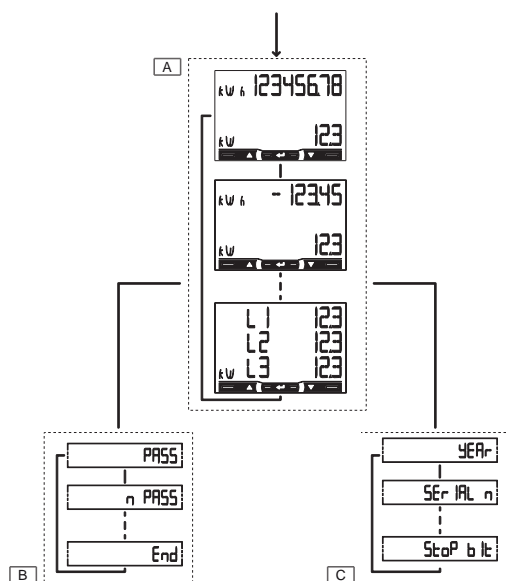
Using the analyzer

Menu map

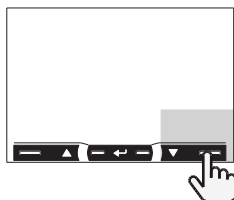| Area	Description
A	Measurement menu. Measurements displayed by default when turned on. Pages are characterized by the reference unit of measure.
B	Parameter menu. Parameter settings pages. Require login password.
C	Information menu. The pages display information and set parameters without having to enter a password.

Fig. 9

Commands

Fig. 10 **Fig. 11** **Fig. 12** **Fig. 13**
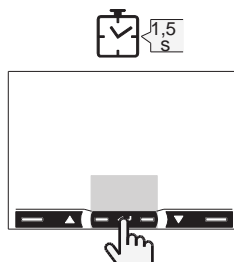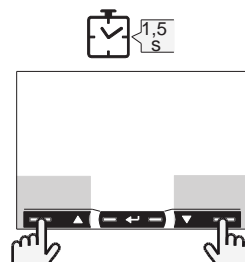
Navigation

*NOTE: after 120 s of disuse, the measurement page set in **HoME** is displayed and the command only works if touched twice. After first touch of the touch command area, the display back light turns on.*

Operation	Command
View the next page	**Fig. 10**
View the previous page	**Fig. 11**
Open the parameter menu	**Fig. 12**
Exit the parameter menu	**Fig. 12** (page END)
Open the information menu	**Fig. 13**
Exit the information menu	**Fig. 13**

Parameter settings

Operation	Command
Increase a parameter value	**Fig. 10**
View the next value option	**Fig. 10**
Decrease a parameter value	**Fig. 11**
View the previous value option	**Fig. 11**
Confirm a value	**Fig. 12**
Open the parameter settings page	**Fig. 12**
Quickly confirm the 0000 default password	**Fig. 13**

Setting a parameter
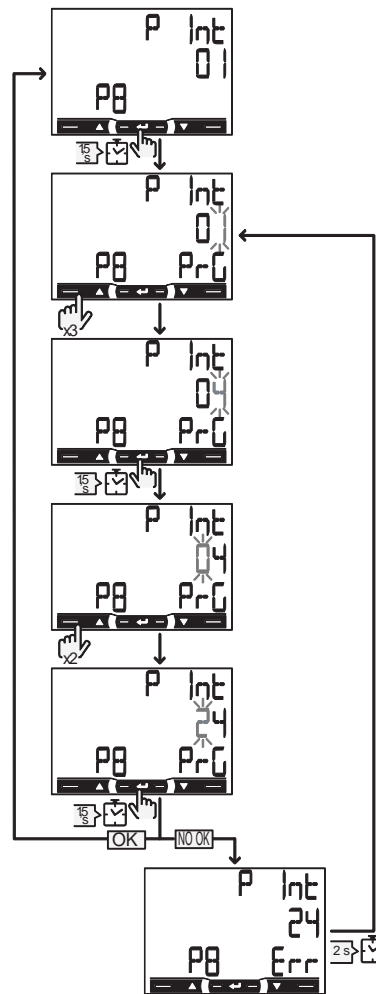
Fig. 14

Procedure example: how to set **P int**=24.

*NOTE: the first displayed value is the current one. Settings are applied when the value is confirmed. The value is being edited if **Prg** appears, the set value is out of range if **Err** appears. After 120 s of disuse on a value being set, the title page is displayed (**P int** in the figure) and **Prg** disappears. After further 120 s, the measurement page set in **HoME** returns.*
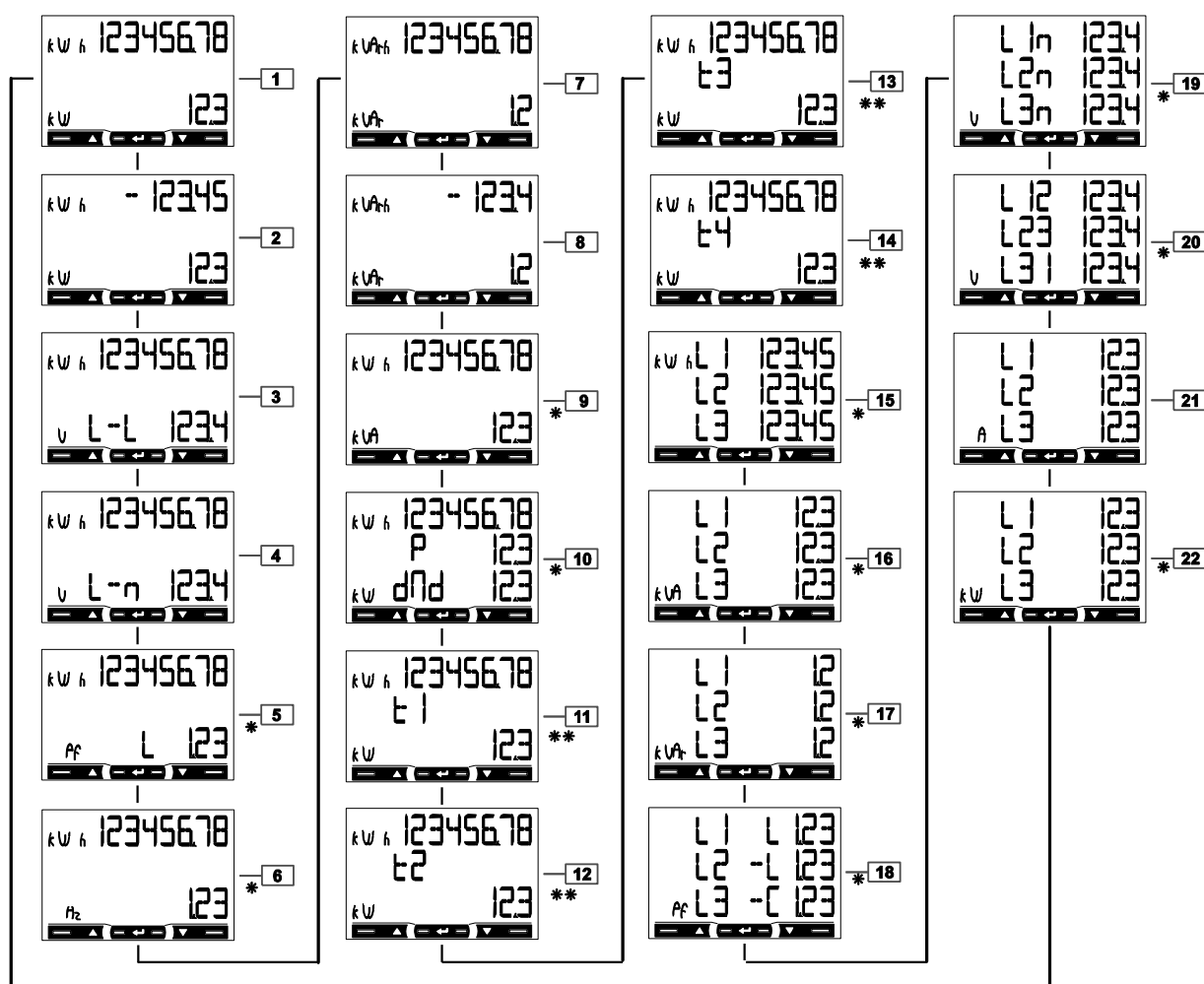
Measurement menu

Fig. 15

*NOTE *: only displayed if full display mode is set (**Mode** = Full).*
*NOTE **: only displayed if tariff is enabled (**Tariff** = Yes).*
To navigate in the menu, *see "**Commands**" on page 5*.

General measurement pages

Page	Description
1	• Total imported active energy** • Total active power
2	• Total exported active energy*** • Total active power
3	• Total imported active energy** • System phase-phase voltage
4	• Total imported active energy** • System phase-neutral voltage
5	• Total imported active energy** • Power factor (**L** = inductive, **C** = capacitive)
6	• Total imported active energy** • Frequency

Page	Description
7	• Total imported reactive energy** • Total reactive power
8	• Total exported reactive energy*** • Total reactive power
9	• Total imported active energy** • Total apparent power
10	• Total imported active energy** • Requested average power (P = demand) calculated for the set interval. The value remains the same for the entire interval. It is = 0 during the first start up interval. • Maximum requested power (**dMd** = Peak demand) reached since last reset
11	• Active energy imported with tariff 1 (t1). Displayed if tariff management is on (Tariff = on). • Active power
12	• Active energy imported with tariff 2 (t2). Displayed if tariff management is on (Tariff = on). • Active power
13	• Active energy imported with tariff 3 (t3). Displayed if tariff management is on (Tariff = on). • Active power
14	• Active energy imported with tariff 4 (t4). Displayed if tariff management is on (Tariff = on). • Active power

*NOTE **: If easy connection is on (**Measure** = A), it indicates total energy without considering the direction.*

*NOTE***: displays whether imported and exported energy are measured separately (**Measure** = b).*

Single phase measurement pages

NOTE: the phase measurement pages and indicated information for each depend on the type of system analyzed.

Page	Description
15	Imported active energy. *If **easy connection** is on (Measure = A), it indicates total energy without considering the direction.*
16	Apparent power
17	Imported reactive energy
18	Power factor (**L** = inductive, **C** = capacitive)
19	Phase-neutral voltage
20	Phase-phase voltage
21	Current
22	Active power

Measurement faults

If the measured signal exceeds the admitted analyzer limits, a specific message appears:

• **EEE** blinking: the measured value is out of limits
• **EEE** on: the measurement depends on a value that is out of limits

NOTE: active and reactive energy measurements are displayed but do not change.
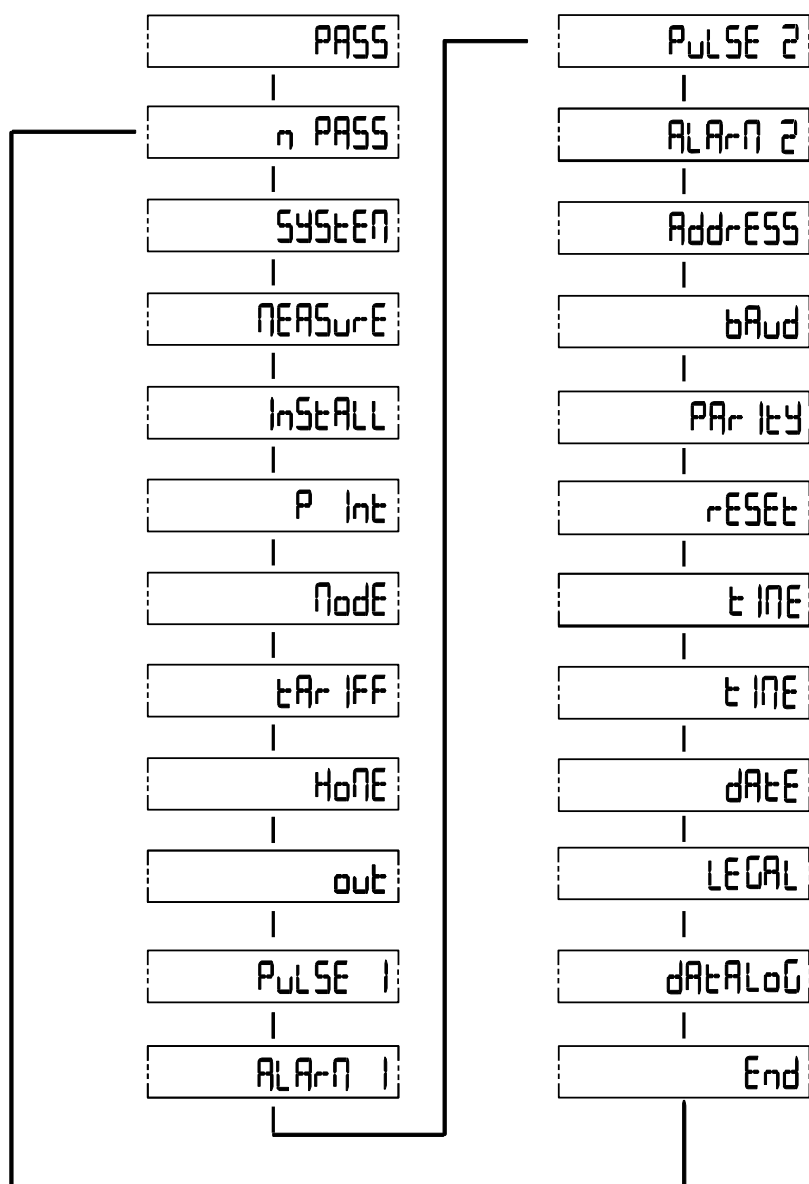
Parameter menu

Fig. 16

To navigate in the menu, *see "**Commands**" on page 5*. Default values are underlined in the table.

Page	Code	Description	Values
PASS	**P1**	Enter current password	From 0000 to 9999
n PASS	**P2**	Change password	From 0000 to 9999
SyStEM	**P3**	System type	3Pn, 3P, 2P, 1P
MEASurE	**P6**	Measurement type	A/b
InStALL	**P7**	Wrong connection detection function	Yes/No
P Int	**P8**	Integration time for kW dmd calculation	1 to 30 min
ModE	**P9**	Set of variables on display	Full/Easy
tArIFF**	**P10**	Tariff enabling	Yes/No
HoME	**P11**	Home page selection	0 to 25
out	**P12**		
out 1	**P12-1**	Output 1 function	kWh+, kWh-, kWhL1 or Alarm 1
out 2	**P12-2**	Output 2 function	kWh+, kWh-, kWhL2 or Alarm 2

Page	Code	Description	Values
PuLSE 1	P13		
PuLSE 1	P13-1	Pulse ON duration of output 1	30 or 100 ms
PuLSE 1	P13-2	Pulse rate of output 1 (pulses/kWh)	10 to 500 (if duration is 100 ms) or to 2000 (if duration is 30 ms)
tESt P 1	P13-3	Simulated power consumption	0 to 40 kW
tESt 1	P13-4	Activation of the pulse output test	Yes/No
ALArM 1	P15		
ALArM1	P15-1	Selection of the variable of output 1	All possible variables
SEt 1	P15-2	Activation setpoint of output 1	All possible variables values
SEt 2	P15-3	Deactivation setpoint of output 1	All possible variables values
dELAy	P15-4	On-time delay (delay of activation) of output 1	1-255
StAtuS	P15-5	Status of output 1 when no alarm condition	nE or nd *
PuLSE 2	P14		
PuLSE 2	P14-1	Pulse ON duration of output 2	30 or 100 ms
PuLSE2	P13-2	Pulse rate of output 1 (pulses/kWh)	10 to 500 (if duration is 100 ms) or to 2000 (if duration is 30 ms)
tESt P 2	P14-3	Simulated power consumption	0 to 40 kW
tESt 2	P14-4	Activation of the pulse output test	Yes/No
ALArM 2	P16		
ALArM2	P16-1	Selection of the variable of output 2	All possible variables
SEt 1	P16-2	Activation setpoint of output 2	All possible variables values
SEt 2	P16-3	Deactivation setpoint of output 2	All possible variables values
dELAy	P16-4	On--time delay (delay of activation) of output 2	1-255
StAtuS	P16-5	Status of output 2 when no alarm condition	nE or nd *
AddrESS	P18	Modbus serial address	1 to 247
bAud	P20	Modbus baud rate	9.6/19.2/38.4/ 57.6/ 115.2 kbps
PArIty	P21		
PArIty	P21-1	Modbus parity	No/even
StoP bIt	P21-2	Stop bit (in case of no parity only)	1 to 2
rESEt	P22	Reset of tariff meters and kW dmd peak and of the kWh/kvarh partial meter	Yes/No
tIME	P23	Time/date format	EuR/uS
tIME	P24	Time setting: hours, minutes	0.00 to 23.59
dAtE	P25	Date setting: date, month and year	1-1-00 to 31-12-99
LEGAL	P26	Automatic legal/solar time enabling	No/ISr***
dAtALoG	P27	Datalog type	Total/Tariff
End	P28	Exit to measuring mode	

Note: after the confirmation of a new parameter value, the value is stored in the memory without the need to exit the programming mode.

Note *: nE= normally energised (status=ON when no alarm); nd= normally de-energised (status=OFF when no alarm)
Note **: if tariff is enabled, the relevant parameters shall be programmed via serial port.
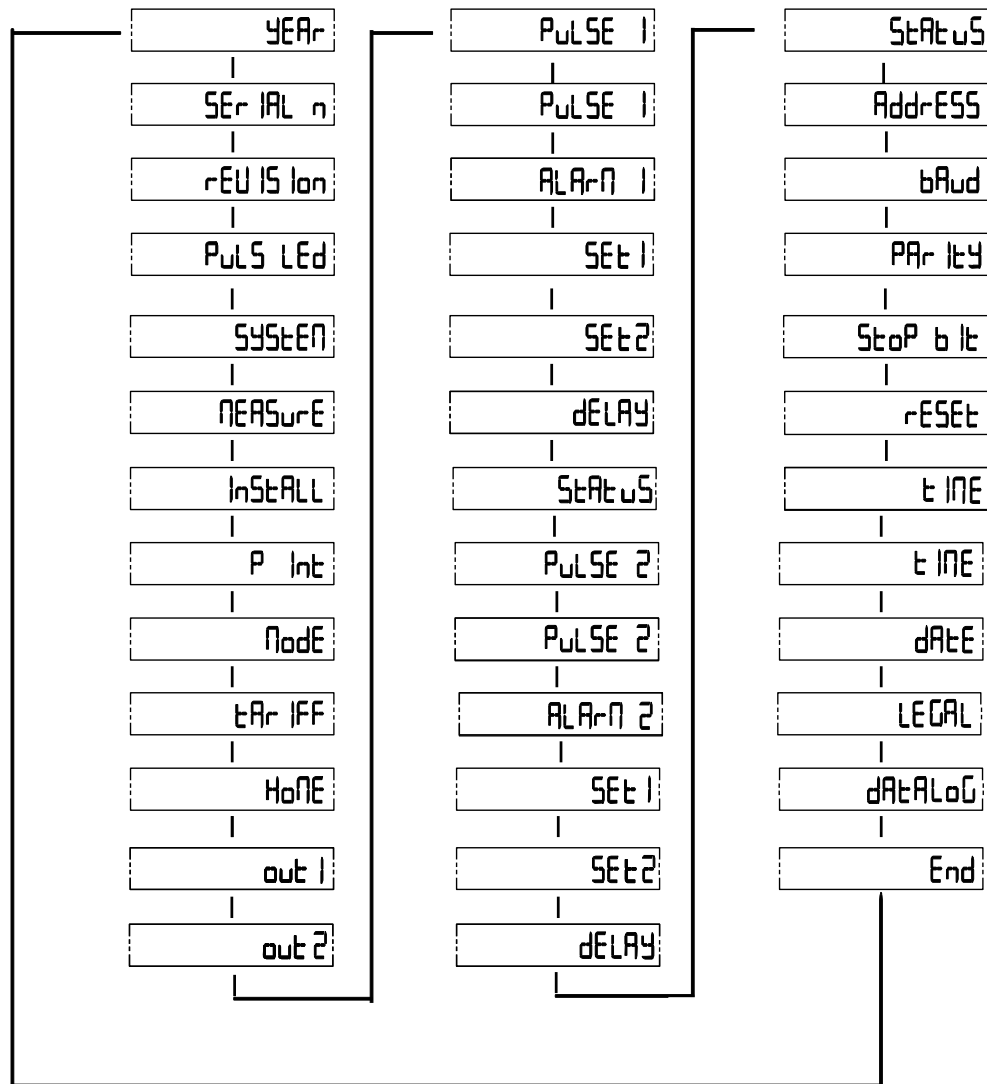*Note ***: Israeli rule for legal/solar time change is implemented.*

Information menu

Fig. 17

To navigate in the menu, *see "**Commands**" on page 5*.

Page	Code	Description
yEAr	**Info 1**	Year of production
SErIAL n	**Info 2**	Serial number
rEVISIon	**Info 3**	Firmware revision
PuLS LEd	**Info 4**	Pulse rate of frontal LED (pulse/kWh)
SyStEM	**P3**	System type
MEASurE	**P6**	Measurement type
InStALL	**P7**	Wrong connection detection function
P Int	**P8**	Integration time for kW dmd calculation
ModE	**P9**	Set of variables on display
tArIFF	**P10**	Tariff enabling and tariff enabled
HoME	**P11**	Home page
out 1	**P12-1**	Output 1 function
out 2	**P12-2**	Output 2 function
PuLSE 1	**P13-1**	Pulse ON duration of output 1

Page	Code	Description
PuLSE 1	**P13-2**	Pulse rate of output 1 (pulses/kWh)
ALArM1	**P15-1**	Variable of output 1
SEt 1	**P15-2**	Activation setpoint of output 1
SEt 2	**P15-3**	Deactivation setpoint of output 1
dELAy	**P15-4**	On--time delay (delay of activation) of output 1
StAtuS	**P15-5**	Status of output 1 when no alarm condition
PuLSE 2	**P14-1**	Pulse ON duration of output 2
PuLSE 2	**P13-2**	Pulse rate of output 1 (pulses/kWh)
ALArM2	**P16-1**	Variable of output 2
SEt 1	**P16-2**	Activation setpoint of output 2
SEt 2	**P16-3**	Deactivation setpoint of output 2
dELAy	**P16-4**	On--time delay (delay of activation) of output 2
StAtuS	**P16-5**	Status of output 2 when no alarm condition
AddrESS	**P18**	Modbus serial address
bAud	**P20**	Modbus baud rate
PArIty	**P21-1**	Modbus parity
StoP bIt	**P21-2**	Stop bit (in case of no parity only)
tIME	**P23**	Time/date format
tIME	**P24**	Time: hours, minutes
dAtE	**P25**	Date: date, month and year
LEGAL	**P26**	Automatic legal/solar time enabling
dAtALoG	**P27**	Datalog type

Features

Electrical specifications

Power	**Self-powered (via measured voltage)**
Consumption	**≤ 1 W, ≤ 10 VA**
Base current	**5 A**
Maximum current (continuing)	**65 A**
Minimum current	**0.25 A**
Start up current	**0.02 A**
Working voltage	**AV2: 208-400 V L-L ac**
Frequency	**45-65 Hz**
Accuracy class	**Active energy:** • **Class 1 (EN62053-21)** • **Class B (EN50470-3)** **Reactive energy:** • **Class 2 (EN62053-23)**

Environmental specifications

Working temperature	**From −25 to +65 °C/ from −13 to +131 °F**
Storage temperature	**From −30 to +80 °C/ from −22 to +176 °F**

Output specifications

Digital outputs	**Dual digital output (pulse/alarm)**
Modbus RS485 port output	**Modbus RTU protocol**

NOTE: to set output parameters, see Parameters menu (Fig. 17).

LED specifications

Pulse weight	**1000 impulses/kWh (EN50470-3, EN62052-11)**
Duration	**90 ms**
Color	**Red and orange**

General features

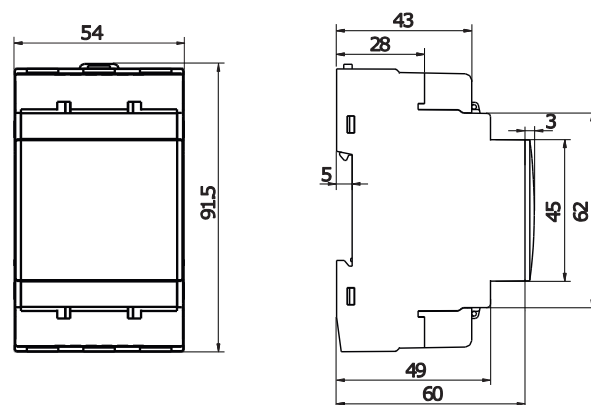|	
Terminals	**1–6:** section 2.5-16 mm2, torque 2.8 Nm **7–12, N:** section 1.5 mm2, torque 0.4 Nm
Protection grade	Front: IP51, terminals (cable input): IP20
Dimensions	See Fig. 18

Fig. 18

Cleaning

use a slightly dampened cloth to clean the instrument display; do not use abrasives or solvents.

Service and warranty

In the event of malfunction, fault or for information on the warranty, contact the CARLO GAVAZZI branch or distributor in your country.

Conformity

NOTE: for updated information www.gavazziautomation.com.

$C\mathcal{E}$

- **2004/108/EC**
- **IEC62052-11**
- **IEC 60417-5172**
- **IP51**

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