

Energy Management Energy Analyzer Type EM210 MID

CARLO GAVAZZI



- Multi-use housing: for both DIN-rail and panel mounting applications
- MID “annex MI-003” (Measuring Instruments Directive) compliant
- Class B (kWh) according to EN50470-3
- Class 1 (kWh) according to EN62053-21
- Class 2 (kvarh) according to EN62053-23
- Accuracy ± 0.5 RDG (current/voltage)
- Energy meter
- Instantaneous variables readout: 3 DGT
- Energies readout: 7 DGT
- System variables: W, var, PF, Hz, Phase-sequence.
- Single phase variables: VLL, VLN, A, PF
- Energy measurements: total kWh (imported and exported); kvarh
- TRMS measurements of distorted sine waves (voltages/currents)
- Auxiliary power supply
- Dimensions: 4-DIN modules and 72x72mm
- Protection degree (front): IP50
- Application adaptable display and programming procedure (Easyprog function)
- Easy connections management

Product description

Three-phase energy meter with front LCD display unit. The device is available either as a DIN-rail mounting or a panel mounting energy meter. This general purpose three-phase energy meter is suitable for both active and reactive energy metering for

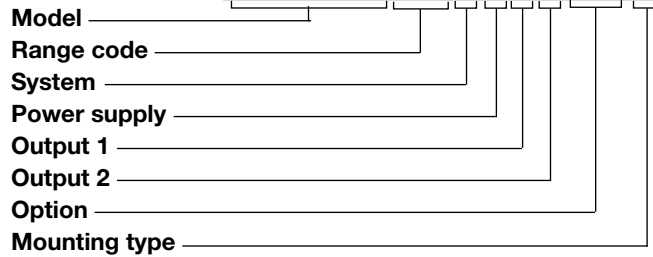
cost allocation but also for main electrical parameter measurement and retransmission (transducer function). Possibility to display also exported active energy (e.g. in case of regenerated energy in lifts or similar applications). Housing for DIN-

rail mounting with IP50 (front) protection degree. Current measurements carried out by means of external current transformers and voltage measurements carried out either by means of direct connection or by means of potential transformers.

EM210 is provided, as standard, with a pulsating output for active energy retransmission. In addition a 2-wire RS485 communication port is available as an option.

MID Certified according to MID Directive, Annex "B" + Annex "D" for legal metrology relevant to active electrical energy meters (see Annex MI-003 of MID). Can be used for fiscal (legal) metrology. Only the total active energy meter is certified according to MID.

How to order **EM210 72D AV5 3 H O X PFA D**



Type Selection

Range code	System	Power supply	Option
AV5: 230/400VLL AC, 5(6)A (CT connection)	3: balanced and unbalanced load: 3-phase, 4-wire; 3-phase, 3-wire (without N connection);	H: auxiliary power supply from 65 V to 400 V ac, 45 to 65 Hz	PFA: certified according to MID Directive, Annex "B" + Annex "D" for legal metrology relevant to active electrical energy meters (see Annex MI-003 of MID). Can be used for fiscal (legal) metrology. The power is always integrated -both in case of positive (imported) and negative (exported) power.
AV6: 120/230VLL AC 5(6)A (VT/PT and CT connections)			
Output 1	Output 2	Mounting type	
O: Single static output (opto-mosfet)	X: None S: RS485 port	D: DIN-rail mounting P: Panel mounting	
			PFB: Certified according to MID Directive, Annex "B" + Annex "D" for legal metrology relevant to active electrical energy meters (see Annex MI-003 of MID). Can be used for fiscal (legal) metrology. Only the positive (imported) power is integrated - no integration in case of negative (exported) power.

Input specification

Rated Input Current type	System type: 3 Not isolated (shunt inputs). Note: the external current transformers can be connected to earth individually.	Max. and Min. indication	Max. instantaneous variables: 999; energies: 9 999 999. Min. instantaneous variables: 0; energies 0.00.
Current range	In: primary current corresponding to 5 A secondary output. Imax: 1.2 In (6A secondary).	LEDs Red LED (Energy consumption)	0.001 kWh by pulse if CT ratio x VT ratio is <7; 0.01 kWh by pulse if CT ratio x VT ratio is ≥ 7.0 < 70.0; 0.1 kWh by pulse if CT ratio x VT ratio is ≥ 70.0 < 700.0; 1 kWh by pulse if CT ratio x VT ratio is ≥ 700.0.
Voltage (direct or by VT/PT)	AV5, MV5: 230/400VLL; 6A; Un: 160 to 240VLN (277 to 415VLL). AV6, MV6: 120/230VLL; 6A; Un: 57.7 to 144VLN (100 to 230VLL).	Max frequency	16Hz, according to EN50470-3.
Accuracy (Display + RS485) (@25°C ±5°C, R.H. ≤60%, 50Hz) Current	In: see below, Un: see below From 0.002In to 0.2In: ±(0.5% RDG +3DGT). From 0.2In to Imax: ±(0.5% RDG +1DGT). In the range Un: ±(0,5% RDG +1DGT).	Green LED (on the terminal blocks side)	for power on (steady) and communication status: RX-TX (in case of RS485 option only) blinking.
Phase-neutral voltage	In the range Un: ±(1% RDG +1DGT).	Measurements	See "List of the variables that can be connected to:" TRMS measurements of distorted wave forms.
Phase-phase voltage	In the range Un: ±(1% RDG +1DGT).	Method	By means of external CT's.
Frequency	Range: 45 to 65Hz; resolution: ±1Hz	Coupling type	
Active power	±(1%RDG +2DGT).	Crest factor	≤3 (15A max. peak).
Power Factor	±[0.001+1%(1.000 - "PF RDG")].	Current Overloads	
Reactive power	±(2%RDG +2DGT).	Continuous	1.2In, @ 50Hz.
Active energy	class B according to EN50470-1-3; class 1 according to EN62053-21.	For 500ms	20In, @ 50Hz.
Reactive energy	class 2 according to EN62053-23. Start up current: 10mA.	Voltage Overloads	
Energy additional errors Influence quantities	According to EN62053-21, EN50470-1-3, EN62053-23	Continuous	1.2 Un
Temperature drift	≤200ppm/°C.	For 500ms	2 Un
Sampling rate	1600 samples/s @ 50Hz, 1900 samples/s @ 60Hz	Current input impedance	
Display refresh time	1 second	AV5, AV6	< 0.3VA
Display	2 lines 1st line: 7-DGT or 3-DGT+3-DGT 2nd line: 3-DGT LCD, h 7mm.	Voltage input impedance	
Type	LCD, h 7mm.	AV5, AV6	>1000 k Ω
Instantaneous variables read-out	3-DGT.	Frequency	50 Hz.
Energies	Total: 5+2, 6+1 or 7DGT	Keypad	Two push buttons for variable selection and programming of the instrument working parameters.
Overload status	EEE indication when the value being measured is exceeding the "Continuous inputs overload" (maximum measurement capacity)		

Output specifications

Pulse output		Connections	2-wire max. distance 1000m, termination directly on the instrument.
Number of outputs	1	Addresses	247, selectable by means of the front keypad
Type	Programmable from 0.01 to 9.99 kWh per pulses.	Protocol	MODBUS/JBUS (RTU)
Pulse duration	Output connectable to the energy meter (+kWh) TOFF \geq 120ms, according to EN62052-31. TON selectable (30 ms or 100 ms) according to EN62053-31	Data (bidirectional)	System and phase variables: see table "List of variables..."
Output Load	Static: opto-mosfet. VON 2.5 VAC/DC, 70 mA max. VOFF 260 VAC/DC max.	Dynamic (reading only)	All the configuration parameters.
Insulation	By means of optocouplers, 4000 VRMS output to measuring inputs.	Static (reading and writing)	1 start bit, 8 data bit, no and even parity, 1 or 2 stop bit.
RS485		Data format	9.6, 19.2, 38.4, 57.6, 115.2 kbps.
Type	Multidrop, bidirectional (static and dynamic variables)	Baud-rate	1/5 unit load. Maximum 160 transceiver on the same bus.
		Driver input capability	By means of optocouplers, 4000 VRMS output to measuring input.
		Insulation	

Software functions

Password	Numeric code of max. 3 DGT; 2 protection levels of the programming data:	Displaying	Up to 3 variables per page.
1st level	Password "0", no protection;	Easy connection function	Wrong phase detection and displaying. For all the display selections (except "D" and "E") the current, power and energy measurement are independent on the current direction.
2nd level	Password from 1 to 999, all data are protected.		
System selection			
System 3-Ph.n unbalanced load	3-phase (4-wire) 3-phase (3-wire) without neutral connection.		
Transformer ratio			
VT (PT) ratio	1.0 to 99.9 / 100 to 999		
CT	1.0 to 99.9 / 100 to 999 The max CTxVT product for AV5 models is 525, for AV6 models is 908.		

General specifications

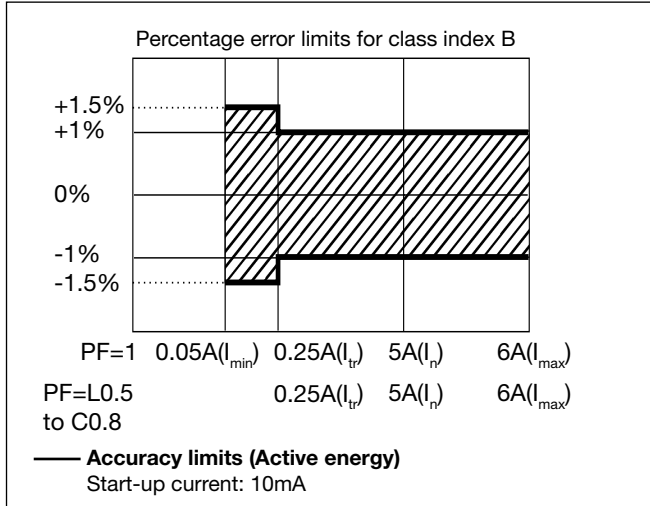
Operating temperature	-25°C to +55°C (-13°F to 131°F) (R.H. from 0 to 90% non-condensing) according to EN62053-21 and EN62053-23.	Surge	On current and voltage measuring inputs circuit: 6kV; According to CISPR 22
Storage temperature	-30°C to +70°C (-22°F to 158°F) (R.H. < 90% non-condensing) according to EN62053-21 and EN62053-23)	Radio frequency suppression	According to CISPR 22
Overvoltage category	Cat. III	Standard compliance	
Insulation (for 1 minute)	4000 VRMS between measuring inputs and digital output.	Safety	EC60664, IEC61010-1 EN60664, EN61010-1 EN62052-11
Dielectric strength	4000VAC RMS for 1 minute	Metrology	EN62053-21, EN62053-23, EN50470-3
Noise rejection CMRR	100 dB, 48 to 62 Hz	Pulse output Approvals	DIN43864, IEC62053-31 CE, cULus listed, MID
EMC	According to EN62052-11 15kV air discharge.	Connections	Screw type 2.4 x 3.5 mm Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm
Electrostatic discharges	Test with current: 10V/m from 80 to 2000MHz	Housing	
Immunity to irradiated electromagnetic fields	Test without any current: 30V/m from 80 to 2000MHz;	Dimensions (WxHxD)	72 x 72 x 65 mm
Burst	On current and voltage measuring inputs circuit: 4kV	Material	Noryl, PA66 self-extinguishing: UL 94 V-0
Immunity to conducted disturbances	10V/m from 150kHz to 80Mhz	Mounting	Panel or DIN-rail
		Protection degree	
		Front	IP50
		Screw terminals	IP20
		Weight	Approx. 400g (packing included)

Power supply specifications

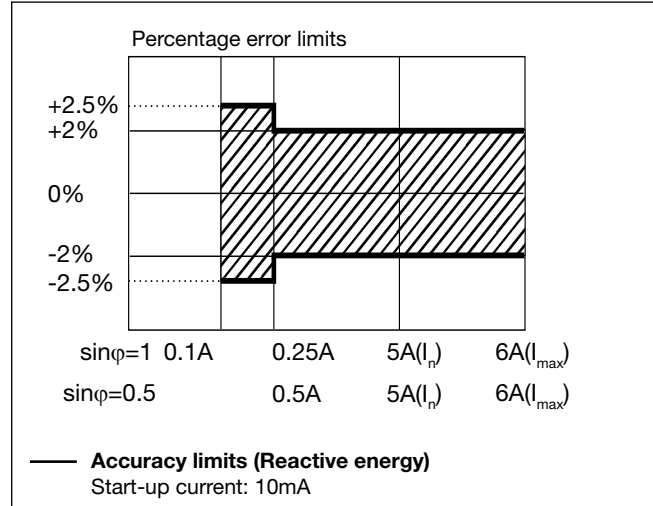
Auxiliary power supply	65 to 400Vac -20%/+15% (45-65Hz)	Power consumption	≤2VA/1W
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Accuracy AV5, AV6 (According to EN50470-3 and EN62053-23)

kWh, accuracy (RDG) depending on the current



kvarh, accuracy (RDG) depending on the current



MID "Annex MI-003" compliance

Accuracy Purpose

0.9 Un ≤ U ≤ 1.1 Un;
0.98 fn ≤ f ≤ 1.02 fn;
fn: 50Hz;
cosφ: 0.5 inductive to 0.8 capacitive.
Class B I st: 0.01A; I min: 0.05A; I tr: 0.25A; I n: 5A
I max: 6A.

Operating temperature

-25°C to +55°C (-13°F to 131°F) (R.H. from 0 to 90% non-condensing @ 40°C)

EMC compliance

E2

Mechanical compliance

M2

Protection degree

in order to achieve the protection against dust and water required by the norms harmonized to MID, the meter must be used only installed in IP51 (or better) cabinets.

Insulation between inputs and outputs

	Measuring input	Opto-Mosfet output	Communication port	Auxiliary supply
Measuring inputs	-	4kV	4kV	4kV
Opto-Mosfet output	4kV	-	-	4kV
Communication port	4kV	-	-	4kV
Self power supply	4kV	4kV	4kV	-

NOTE: all the models have, mandatorily, to be connected to external current transformers.

Used calculation formulas

Phase variables

Instantaneous effective voltage

$$V_{1N} = \sqrt{\frac{1}{n} \cdot \sum_1^n (V_{1N})_i^2}$$

Instantaneous active power

$$W_1 = \frac{1}{n} \cdot \sum_1^n (V_{1N})_i \cdot (A_1)_i$$

Instantaneous power factor

$$\cos\varphi_1 = \frac{W_1}{VA_1}$$

Instantaneous effective current

$$A_1 = \sqrt{\frac{1}{n} \cdot \sum_1^n (A_1)_i^2}$$

Instantaneous apparent power

$$VA_1 = V_{1N} \cdot A_1$$

Instantaneous reactive power

$$\text{var}_1 = \sqrt{(VA_1)^2 - (W_1)^2}$$

System variables

Equivalent three-phase voltage

$$V_\Sigma = \frac{V_1 + V_2 + V_3}{3} \cdot \sqrt{3}$$

Three-phase power factor

$$\cos\varphi_\Sigma = \frac{W_\Sigma}{VA_\Sigma}$$

Energy metering

$$k \text{ var hi} = \int_{t_1}^{t_2} Qi(t) dt \cong \Delta t \sum_{n1}^{n2} Qnj$$

$$kWhi = \int_{t_1}^{t_2} Pi(t) dt \cong \Delta t \sum_{n1}^{n2} Pnj$$

Where:

i= considered phase (L1, L2 or L3)
P= active power; **Q**= reactive power;
t1, t2=starting and ending time points of consumption recording; **n**= time unit; Δt = time interval between two successive power consumptions;
n1, n2= starting and ending discrete time points of consumption recording

List of the variables that can be connected to:

- RS485 communication port
- Pulse outputs (only “energies”)

N°	Variable	3-ph. 3,4-wire unbalanced system	Notes
1	kWh	x	Total (2)
2	kvarh	x	Total (3)
3	V L-N sys (1)	x	sys=system (Σ)
4	V L1	x	
5	V L2	x	
6	V L3	x	
7	V L-L sys (1)	x	sys=system (Σ)
8	V L1-2	x	
9	V L2-3	x	
10	V L3-1	x	
11	A L1	x	
12	A L2	x	
13	A L3	x	
14	VA sys (1)	x	sys=system (Σ)
15	VA L1 (1)	x	
16	VA L2 (1)	x	
17	VA L3 (1)	x	
18	var sys	x	sys=system (Σ)
19	var L1 (1)	x	
20	var L2 (1)	x	
21	var L3 (1)	x	
22	W sys	x	sys=system (Σ)
23	W L1 (1)	x	
24	W L2 (1)	x	
25	W L3 (1)	x	
26	PF sys	x	sys=system (Σ)
27	PF L1	x	
28	PF L2	x	
29	PF L3	x	
30	Hz	x	
31	Phase sequence	x	

(x) = available

(o) = not available (zero indication on the display)

(1) = Variable available only through the serial communication port RS485

(2) = also kWh- (exported) with application E (see next table)

(3) = sum (not algebraic) of kvarh imported and exported with application F (see next table)

Display pages

No	1st variable (1st half-line)	2nd variable (2nd half-line)	3rd variable (2nd line)	Note	Applications					
					A	B	C	D	E	F
	Phase sequence			The phase sequence triangle appears in any page only if there is a phase reverse	x	x	x	x	x	x
1	Total kWh		W sys		x	x	x	x	x	x
1b	Total kWh (-)		"NEG"	Exported active energy					x	
2	Total kvarh		kvar sys			+	+	+	+	T
3		PF sys	Hz	Indication of C, -C, L, -L depending on the quadrant		x	x	x	x	x
4	PF L1	PF L2	PF L3	Indication of C, -C, L, -L depending on the quadrant			x	x	x	x
5	A L1	A L2	A L3				x	x	x	x
6	V L1-2	V L2-3	V L3-1				x	x	x	x
7	V L1	V L2	V L3				x	x	x	x

Notes: x = available

+ = only positive kvarh is measured (kvar sys is the algebraic sum of the phase kvar)

T = positive and negative kvarh are summed and measured in the same kvarh meter

(kvarsys is the sum of the absolute values of each phase kvar). The phase kvar are displayed with the correct sign.

Additional available information on the display

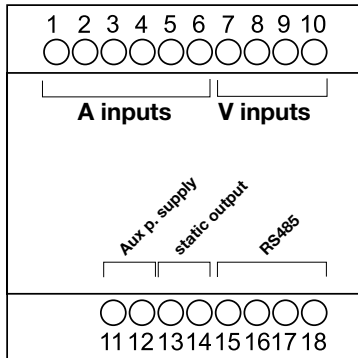
Type	1st line	2nd line	Note
Meter information 1	Y. 2007	r.A0	Year of production and firmware release
Meter information 2	value	LEd (kWh)	KWh per pulse of the LED
Meter information 3	SYS [3P.n]	value	System type and connection type
Meter information 4	Ct rAt.	value	Current transformer ratio
Meter information 5	Ut rAt.	value	Voltage transformer ratio
Meter information 6	PuLSE (kWh)	value	Pulse output: kWh per pulse
Meter information 7	Add	value	Serial communication address
Meter information 8	value	Sn	Secondary address (M-bus protocol)

List of selectable applications

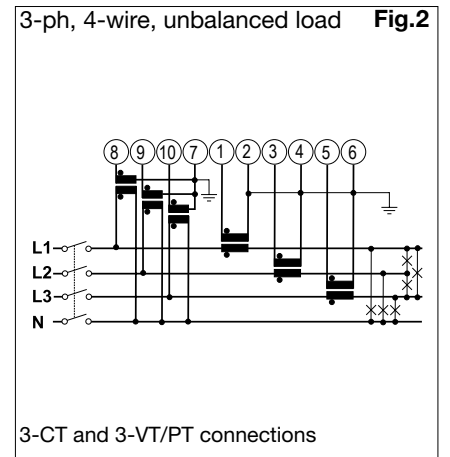
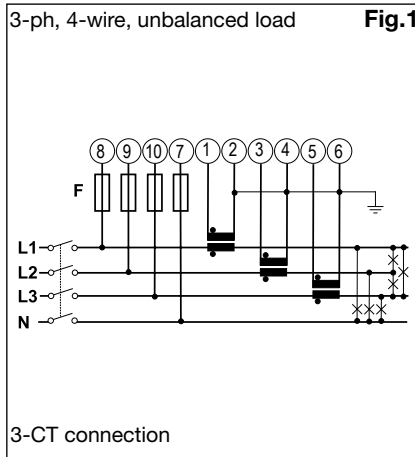
	Description	Notes	Option
A	Active energy meter	Active energy measurement with some minor parameters, easy connection	PFA
B	Active and reactive energy meter	Active and reactive energy measurement with some minor parameters, easy connection	PFA
C	Full set of variables	Full set of available variables can be displayed, easy connection	PFA
D	Full set of variables +	Full set of available variables can be displayed, bidirectional	PFB
E	Full set of variables +	Full set of variables with exported (negative) kWh meter, bidirectional	PFB
F	Full set of variables	Full set of variables with algebraic sum of positive and negative reactive energy, easy connection	PFA

Notes: only in “D” and “E” applications (PFB option) the actual direction of the current is considered.

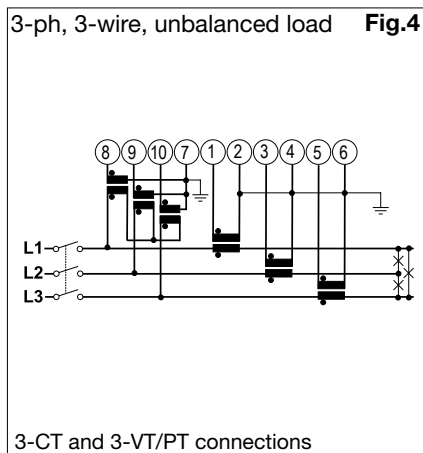
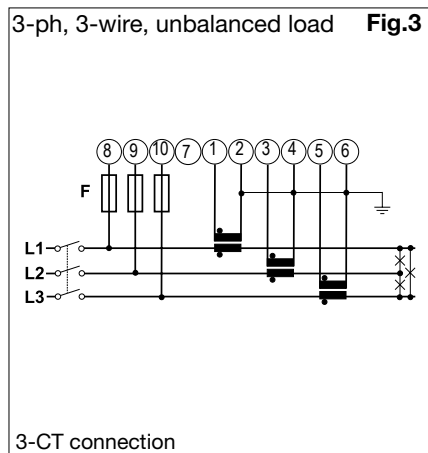
Wiring diagrams



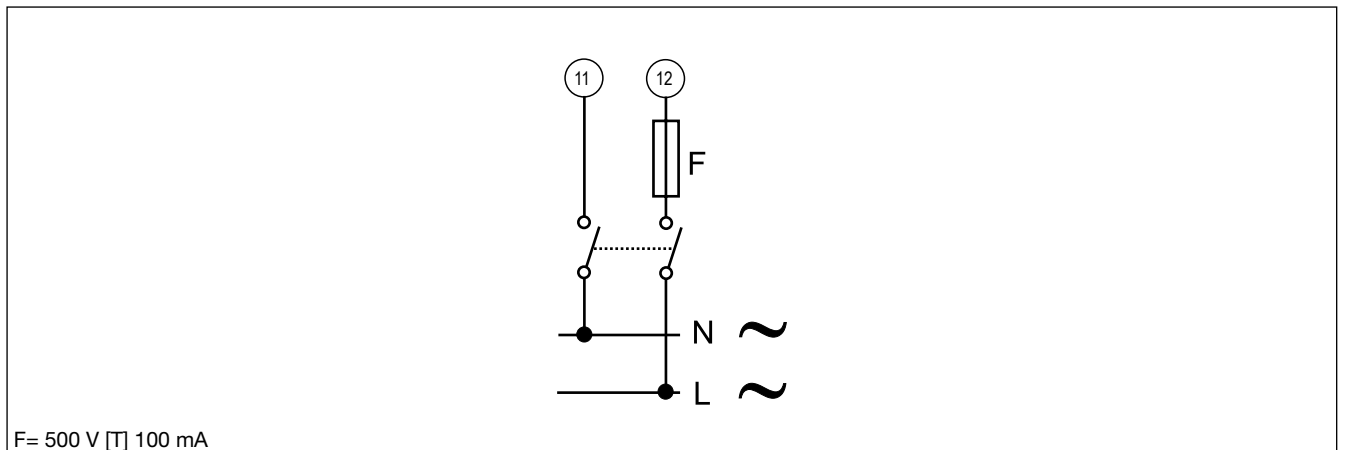
(6A) Self power supply, system type selection: 3P.n



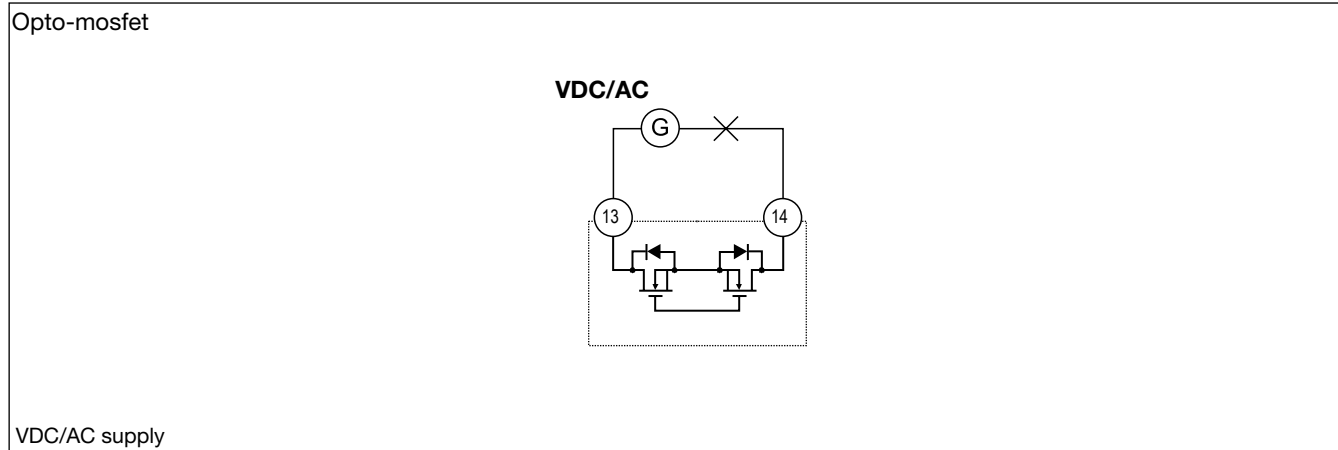
(6A) System type selection: 3P



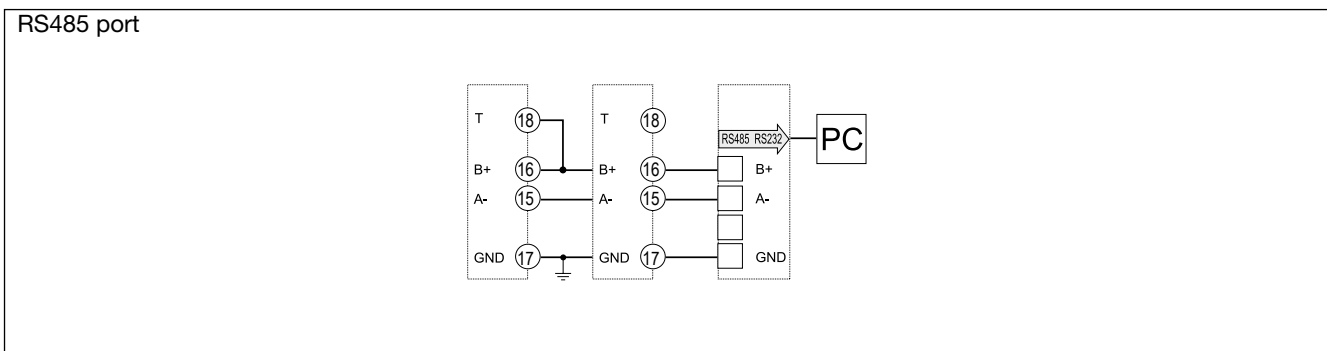
Auxiliary power supply



Static output wiring diagram

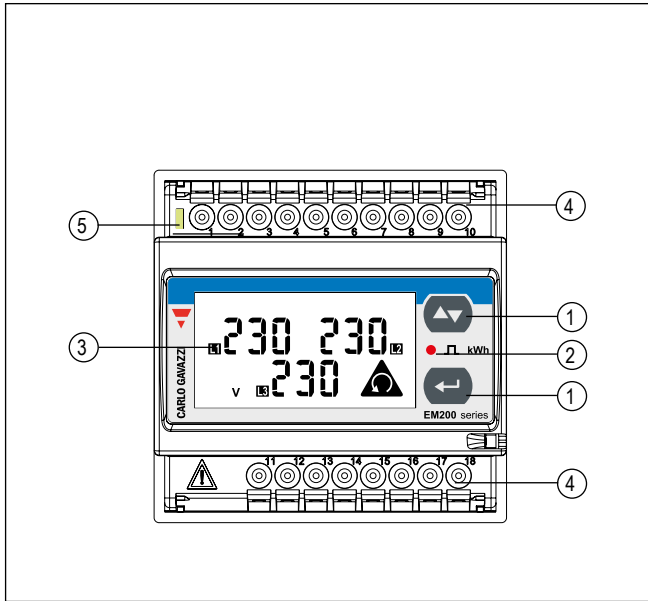


RS485 port wiring diagram



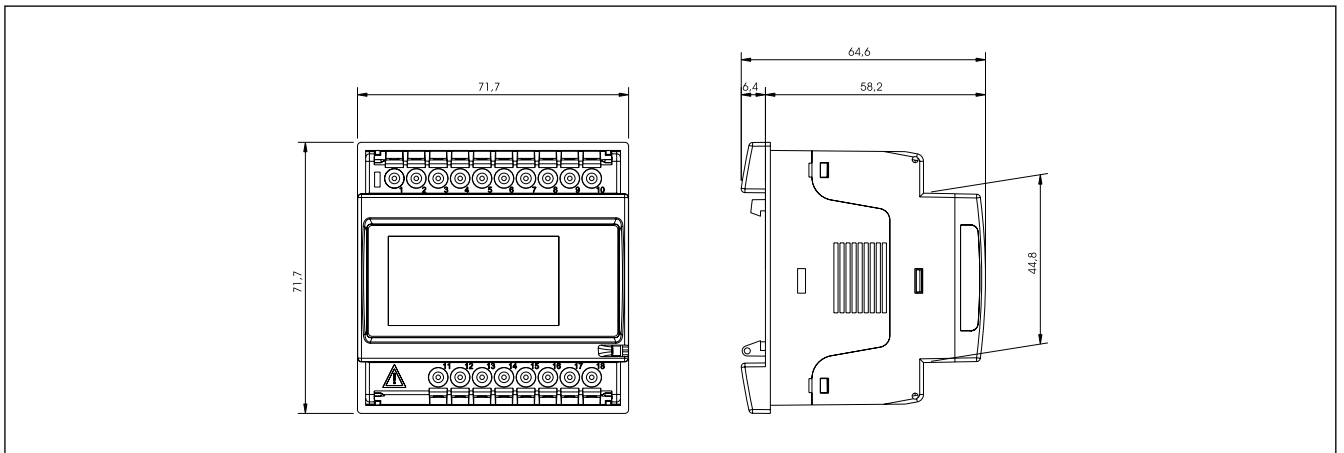
RS485 NOTE: additional devices provided with RS485 are connected as per the picture above. The termination of the serial output is carried out only on the last instrument of the network, by means of a jumper between (B+) and (T).

Front panel description



1. **Keypad**
To program the configuration parameters and scroll the variables on the display.
2. **Pulse output LED**
Red LED blinking proportional to the energy being measured.
3. **Display**
LCD-type with alphanumeric indications to display all the measured variables.
4. **Connections**
Screw terminal blocks for instrument wiring.
5. **Green LED**
Lit when power supply is available.

Dimensions (DIN configuration)



Dimensions and panel cut out (72x72 panel mounting configuration)

