

Energy Management Energy Analyzer Type EM25 96



- Application adaptable display and programming procedure (Easyprog function)
- Easy connections management
- MID "annex MI-003" (Measuring Instruments Directive) compliant

- Class 1 (kWh) according to EN62053-21
- Class 2 (kvarh) according to EN62053-23
- Accuracy $\pm 0.1\%$ according to IEC60688 (current/voltage)
- Energy analyzer
- Instantaneous variables readout: 4 DGT
- Energies readout: 7+1 DGT
- System variables: VLL, VLN, Admd, VA, VAdmd, VAdmd max, W, Wdmd, Wdmd max, var, PF, Hz.
- Single phase variables: VLL, VLN, A, VA, W, var, PF
- Energy measurements: total kWh and kvarh
- Hour counter (6+2 DGT)
- TRMS measurements of distorted sine waves (volt-ages/currents)
- 24, 48, 115, 230VAC power supply
- 2 digital outputs for pulses (on request)
- Front dimensions: 96x96mm
- Protection degree (front): IP50
- RS485 serial output (on request) (MODBUS-RTU), iFIX SCADA compatibility

Product Description

Three-phase energy analyzer with built-in configuration joystick and LCD data displaying; particularly indicated for active and reactive energy metering and for cost allocation. Housing for panel mounting with IP50 (front) protection degree. External current and potential trans-

formers connection. Moreover the meter can be provided with digital outputs that can be used for pulse proportional to the active and reactive energy being measured. The RS485 communication port is available as an option.

How to order **EM25 96 AV5 3 D R2 XX**



Type Selection

Range codes	System	Power supply	Output
AV5: 230V _{LN} /400V _{LL} AC 5(10)A (VT/PT and CT connections) (*)	1: 1-phase, 2-wire; 3-phase, 3-wire balanced load (**)	A: 24VAC -15+10%, 50-60Hz	XX: none (*) R2: dual relay type for pulse outputs (*)
AV6: 120V _{LN} /208V _{LL} AC 5(10)A (VT/PT and CT connections) (*)	3: balanced and unbalanced load: 3-phase, 4-wire; 3-phase, 3-wire; 2-phase, 3-wire; 1-phase, 2-wire (*)	B: 48VAC -15+10%, 50-60Hz C: 115VAC -15+10%, 50-60Hz D: 230VAC -15+10%, 50-60Hz	S1: RS485 port (*)
			Options
			XX: none (*)

(*) as standard.
(**) on request.

Input specifications

Rated inputs	System type: 3	Type	LCD, h 9.5mm, green colour backlight
Current type	Galvanic insulation by means of built-in CT's AV5 and AV6: 1/5(10)A	Instantaneous variables read-out Energies	4 DGT Imported: Total/Partial/Tariff: 7+1DGT or 8DGT; Exported: Total/Partial/Tariff: 6+1DGT or 7DGT (with “-“ sign).
Current range (by CT)	AV5: 230/400VLL; AV6: 120/208VLL	Overload status	EEEE indication when the value being measured is exceeding the “Continuous inputs overload” (maximum measurement capacity)
Voltage by direct connection or VT/PT		Max. and Min. indication	Max. instantaneous variables: 9999; energies: 9 999 999.9 or 99 999 999. Min. instantaneous variables: 0; energies 0.0 or 0
Accuracy (Display + RS485) (@25°C ±5°C, R.H. ≤60%, 48 to 62Hz)	lb: see below, Un: see below	LEDs	Red LED (Energy consumption), 1000 imp./kWh/kvarh. Max frequency: 16Hz according to EN62052-11
AV5 model	In: 5A, I _{max} : 10A; Un: 160 to 480VLN (277 to 830VLL)	Measurements	See “List of the variables that can be connected to:” TRMS measurements of distorted wave forms.
AV6 model	In: 5A, I _{max} : 10A; Un: 40 to 144VLN (70 to 250VLL)	Method	By means of external CT's
Current	From 0.002I _n to 0.2I _n : ±(0.5% RDG +3DGT)	Coupling type	
AV5, AV6 models	From 0.2I _n to I _{max} : ±(0.5% RDG +1DGT).	Crest factor	≤3 (15A max. peak)
Phase-neutral voltage	In the range Un: ±(0,1% according to IEC60688)	Current Overloads	Continuous For 500ms
Phase-phase voltage	In the range Un: ±(0,1% according to IEC60688)	Voltage Overloads	10A, @ 50Hz 200A, @ 50Hz
Frequency	±0.1Hz (45 to 65Hz)	Continuous	1.2 Un
Active and Apparent power	±(1%RDG +2DGT)	For 500ms	2 Un
Power Factor	±[0.001+1%(1.000 - “PF RDG”)]	Input impedance	>1MΩ >1MΩ < 0.3VA
Reactive power	±(2%RDG +2DGT)	208VL-L (AV6)	
Energies	Class 1 according to EN62053-21 and MID Annex MI-003 Class B	400VL-L (AV5)	
	Class 2 according to EN62053-23	1/5(10) A (AV5-AV6)	
AV5, AV6 models	In: 5A, I _{max} : 10A; 0.1 In: 0.5A. Start up current: 10mA	Frequency	45 to 65 Hz
Energy additional errors		Joystick	For variable selection: programming of the instrument working parameters
Influence quantities	According to EN62053-21, EN62053-23		
Temperature drift	≤200ppm/°C		
Sampling rate	1600 samples/s @ 50Hz 1900 samples/s @ 60Hz		
Display refresh time	750 msec		
Display	3 lines (1 x 8 DGT; 2 x 4 DGT)		

Output specifications

Digital outputs Pulse type Number of outputs Type Pulse duration	Up to 2, independent. Programmable from 0.01 to 1000 pulses per kWh/kvarh. Outputs connectable to the energy meters (Wh/varh) $\geq 100\text{ms} < 120\text{msec}$ (ON), $\geq 120\text{ms}$ (OFF), according to EN62052-31	Addresses Protocol Data (bidirectional) Dynamic (reading only) Static (reading and writing) Data format Baud-rate Driver input capability	247, selectable by means of the front joystick MODBUS/JBUS (RTU) System and phase variables: see table "List of variables..." All the configuration parameters. 1 start bit, 8 data bit, no parity, 1 stop bit 4800, 9600 bits/s 1/5 unit load Maximum 160 transceivers on the same bus, which can be expanded with signal amplifiers. By means of optocouplers, 4000 VRMS output to measuring input. 4000 VRMS output to power supply input
Relay output Physical outputs Purpose Type Electrical life Mechanical life Insulation	Max. 2 For pulse output. Relay, SPST type AC 1-5A @ 250VAC DC 12-5A @ 24VDC AC 15-1.5A @ 250VAC DC 13-1.5A @ 24VDC min. 2×10^5 operations 5×10^6 4000 VRMS outputs to measuring input. 4000 VRMS outputs to power supply input.	Insulation	
RS485 (on request) Type Connections	Multidrop, bidirectional (static and dynamic variables) 2-wire Max. distance 1000m (without amplifier) Termination directly on the instrument		

Software functions

Password	Numeric code of max. 4 digits; 2 protection levels of the programming data: Password "0", no protection;		maximum power being measured is 25 MW.
1st level	Password from 1 to 9999, all data are protected	Filter	
2nd level		Operating range	0 to 100% of the input display scale
System selection		Filtering coefficient	1 to 32
System 3-Ph.n unbalanced load	3-phase (4-wire); 3-phase (3-wire).	Filter action	Measurements, serial output (fundamental variables: V, A, W and their derived ones).
System 3-Ph.1 balanced load	3-phase (3-wire) one current and 3-phase to phase voltage measurements. 3-phase (4-wire) one current and one-phase (L1) to neutral voltage measurement.	Displaying	Up to 3 variables per page See « Display pages » 7 different set of variables available (see « Display pages ») according to the application being selected
System 2-Ph System 1-Ph	2-phase (3-wire). 1-phase (2-wire).	Reset	By means of the front joystick: - dmd and max. dmd; - total energies: kWh, kvarh
Transformer ratio		Easy connection function	For all the display selections, both energy and power measurements are independent of the current direction. The displayed energy is always "imported" with the only exception of "F" and "H" types (see "display pages" table). For these latter selections the energies can be either "imported" or "exported" depending on the current direction.
VT (PT)	1.0 to 999.9 / 1000 to 6000.		
CT	1.0 to 999.9 / 1000 to 9999 / 10.00k to 60.00k. The maximum power being measured cannot exceed 210 MW (calculated as maximum input voltage and current, see the "Accuracy" paragraph (on page 2). The maximum VT by CT ratio is 48600. If the currents and/or voltages being measured exceed their maximum limits, the display shows the error message "EEEE". For MID compliant applications the		

Power supply specifications

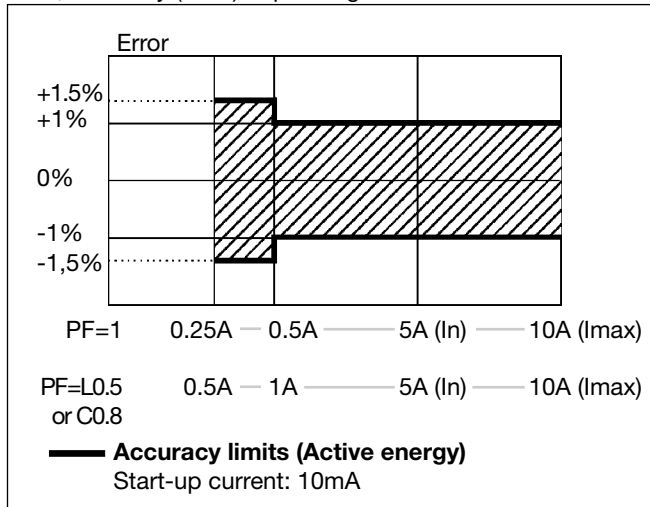
Auxiliary power supply	A: 24VAC -15 +10%, 50-60Hz B: 48VAC -15 +10%, 50-60Hz C: 115VAC -15 +10%, 50-60Hz D: 230VAC -15 +10%, 50-60Hz	Power consumption	AC: 6VA DC: 3.5 W
-------------------------------	--	--------------------------	----------------------

General specifications

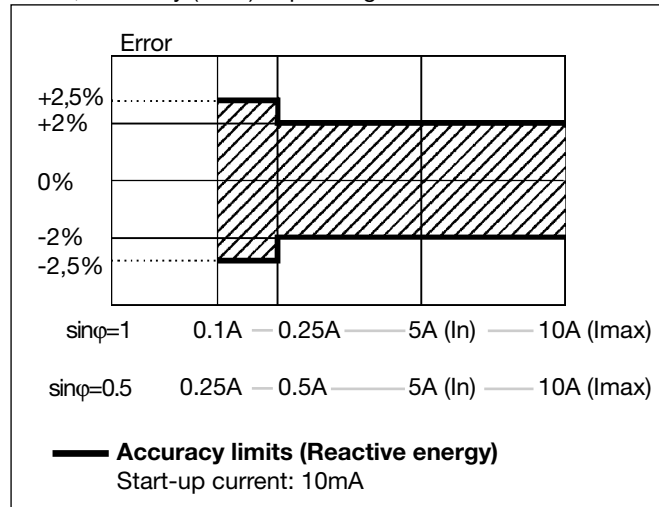
Operating temperature	-25°C to +55°C (-13°F to 131°F) (R.H. from 0 to 90% non-condensing @ 40°C) according to EN62053-21 and EN62053-23	Immunity to conducted disturbances	10V/m from 150KHz to 80MHz
Storage temperature	-30°C to +70°C (-22°F to 140°F) (R.H. < 90% non-condensing @ 40°C) according to EN62053-21 and EN62053-23	Surge	On current and voltage measuring inputs circuit: 4kV;
Installation category	Cat. III (IEC60664, EN60664)	Radio frequency suppression	According to CISPR 22
Insulation (for 1 minute)	4000 VRMS between measuring inputs and power supply. 4000 VRMS between power supply and RS485 digital outputs	Standard compliance	
Dielectric strength	4000 VRMS for 1 minute	Safety	IEC60664, IEC61010-1 EN60664, EN61010-1 EN62052-11 EN62053-21, EN62053-23. MID "annex MI-003"
Noise rejection CMRR	100 dB, 48 to 62 Hz	Metrology	DIN43864, IEC62053-31 CE
EMC	According to EN62052-11	Pulse output	
Electrostatic discharges	15kV air discharge;	Approvals	
Immunity to irradiated	Test with current: 10V/m from 80 to 2000MHz;	Connections	Screw-type
Electromagnetic fields	Test without any current: 30V/m from 80 to 2000MHz;	Cable cross-section area	Max. 1.5 mm ²
Burst	On current and voltage measuring inputs circuit: 4kV	Housing	
		Dimensions (WxHxD)	96 x 96 x 63 mm
		Material	ABS, self-extinguishing: UL 94 V-0
		Mounting	Panel mounting
		Protection degree	
		Front	IP50
		Screw terminals	IP20
		Weight	Approx. 400 g (packing included)

Accuracy

kWh, accuracy (RDG) depending on the current



kvarh, accuracy (RDG) depending on the current



MID "Annex MI-003" compliance

Accuracy

AV5-AV6 models

$0.9 U_n \leq U \leq 1.1 U_n$;
 $0.98 f_n \leq f \leq 1.02 f_n$;
 f_n : 50 or 60Hz;
 $\cos\phi$: 0.5 inductive to 0.8
 capacitive.
 Class B
 I_{st} : 0.01A;
 I_{min} : 0.05A;

Operating temperature

EMC compliance

I_{tr} : 0.25A;
 I_n : 5A;
 I_{max} : 10A

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

E2

Used calculation formulas

Phase variables

Instantaneous effective voltage

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

Instantaneous active power

$$W_1 = \frac{1}{n} \cdot \sum_{i=1}^n (V_{1N})_i \cdot (A_i)_i$$

Instantaneous power factor

$$PF = \frac{W_1}{VA_1}$$

Instantaneous effective current

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

Instantaneous apparent power

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

Instantaneous reactive power

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

Where: **n**= sample number

System variables

Equivalent three-phase voltage

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

Three-phase reactive power

$$\text{var}_{\Sigma} = (\text{var}_1 + \text{var}_2 + \text{var}_3)$$

Three-phase active power

$$W_{\Sigma} = W_1 + W_2 + W_3$$

Three-phase apparent power

$$VA_{\Sigma} = \sqrt{W_{\Sigma}^2 + \text{var}_{\Sigma}^2}$$

Three-phase power factor (TPF)

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

Energy metering

$$kWh_1 = \int_{t_1}^{t_2} P_1(t) dt \cong \Delta t \sum_{j=n_1}^{n_2} P_1(j)$$

$$kvarh_1 = \int_{t_1}^{t_2} Q_1(t) dt \cong \Delta t \sum_{j=n_1}^{n_2} Q_1(j)$$

Where:

P= active power;

Q= reactive power;

t₁, **t₂** =starting and ending time points
of consumption recording;

n_j= time unit;

Δt= time interval between two succes-
sive 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”)

No	Variable	1-phase system	2-phase system	3-ph. 4-wire balanced sys.	3-ph. 4-wire unbal. sys.	3 ph. 3-wire bal. sys.	3 ph. 3-wire unbal. sys.	Notes
1	V L-N sys	o	x	x	x	x	x	sys=system
2	V L1	x	x	x	x	x	x	
3	V L2	o	x	x	x	x	x	
4	V L3	o	o	x	x	x	x	
5	V L-L sys	o	x	x	x	x	x	sys=system
6	V L1-2	o	x	x	x	x	x	
7	V L2-3	o	o	x	x	x	x	
8	V L3-1	o	o	x	x	x	x	
9	A dmd max	o	x	x	x	x	x	Highest “dmd” current among the phases (1)
10	A L1	x	x	x	x	x	x	
11	A L2	o	x	x	x	x	x	
12	A L3	o	o	x	x	x	x	
13	VA sys	x	x	x	x	x	x	sys=system
14	VA sys dmd	x	x	x	x	x	x	sys=system (1)
15	VA L1	x	x	x	x	x	x	
16	VA L2	o	x	x	x	x	x	
17	VA L3	o	o	x	x	x	x	
18	var sys	x	x	x	x	x	x	sys=system
19	var L1	x	x	x	x	x	x	
20	var L2	o	x	x	x	x	x	
21	var L3	o	o	x	x	x	x	
22	W sys	x	x	x	x	x	x	sys=system
23	W sys dmd	x	x	x	x	x	x	sys=system (1)
24	W L1	x	x	x	x	x	x	
25	W L2	o	x	x	x	x	x	
26	W L3	o	o	x	x	x	x	
27	PF sys	x	x	x	x	x	x	
28	PF L1	x	x	x	x	x	x	
29	PF L2	o	x	x	x	x	x	
30	PF L3	o	o	x	x	x	x	
31	Hz	x	x	x	x	x	x	
32	Hours	x	x	x	x	x	x	
33	kWh (+)	x	x	x	x	x	x	Total
34	kvarh (+)	x	x	x	x	x	x	Total
35	kWh (-)	x	x	x	x	x	x	Total
36	kvarh (-)	x	x	x	x	x	x	Total

(x) = available

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

(1) Max. value with data storage

Display pages

Sel. pos.	No	1st variable (1st line)	2nd variable (2nd line)	3rd variable (3rd line)	Note	Applications							
						A	B	C	E	F	G	H	
	1	Total kWh (+)	W sys dmd	W sys dmd max		x	x	x	x	x	x	x	x
	2	Total kvarh (+)	VA sys dmd	VA sys dmd max			x	x		x	x	x	
	3	Total kvarh (-)	VA sys dmd	VA sys dmd max						x			x
	4	Total kWh (-)	W sys dmd	W sys dmd max					x	x			x
	5	Hours	W sys	PF sys					x	x	x	x	
	6	Hours	var sys	Hz sys					x	x	x	x	
	7	W L1	W L2	W L3					x		x	x	
	8	VA L1	VA L2	VA L3							x	x	
	9	var L1	var L2	var L3							x	x	
	10	PF L1	PF L2	PF L3							x	x	
	11	V L1	V L2	V L3			x		x		x	x	
	12	V L1-2	V L2-3	V L3-1							x	x	
	13	A L1	A L2	A L3					x		x	x	
	14	CT ratio	Value of CT	System		x	x	x	x	x	x	x	x
	15	VT/PT ratio	Value of VT	Connection		x	x	x	x	x	x	x	x
	16	Pulse 1 status	Output pulse			x	x	x	x	x	x	x	x
	17	Pulse 2 status	Output pulse			x	x	x	x	x	x	x	x
	18	Serial port	Address	RS485 status		x	x	x	x	x	x	x	x
0	Selector position which can be linked to any of the variable combinations listed above (No. from 1 to 13)												
1	Selector position which can be linked to any of the variable combinations listed above (No. from 1 to 13)												
2	Selector position which can be linked to any of the variable combinations listed above (No. from 1 to 13)												
3	Selector position which can be linked to any of the variable combinations listed above (No. from 1 to 13)												

Additional available information on the display

Type	1st line	2nd line	3rd line
Meter information pag.1	CT ratio	Value of CT ratio	System (1-2-3-phase)
Meter information pag. 2	PT ratio	Value of PT ratio	Connection (2-3-4-wire)
In case of puls output pag. 3/4	Alarm output 1 or 2 variable link (kWh/kvarh)	Output pulse weight (pulse/kWh/kvarh)	
In case of communication port pag.3	Serial port	Address	RS485 status (RX-TX)

List of selectable applications

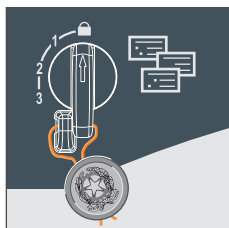
	Description	Notes
A	Basic domestic	Main energy metering
B	Shopping centres	Main energy metering
C	Advanced domestic	Main energy metering (total and based on tariff), gas and water metering
E	Solar	Energy meter with some basic power analyzer functions
F	Industrial	Main energy metering
G	Advanced industrial	Energy metering and power analysis
H	Advanced industrial for power generation	Complete energy metering and power analysis

Insulation between inputs and outputs

	Measuring Inputs	Relay output	Comm. port	Auxiliary power supply
Measuring Inputs	-	4kV	4kV	4kV
Relay output	4kV	-	-	4kV
Comm. port	4kV	-	-	4kV
Aux. power supply	4kV	4kV	4kV	-

NOTE: all the models have, mandatory, to be connected to external current transformers because the insulation among the current inputs is just functional (100VAC).

Tamper proof and display page selection



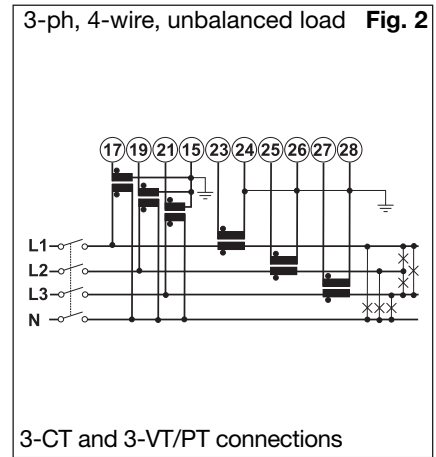
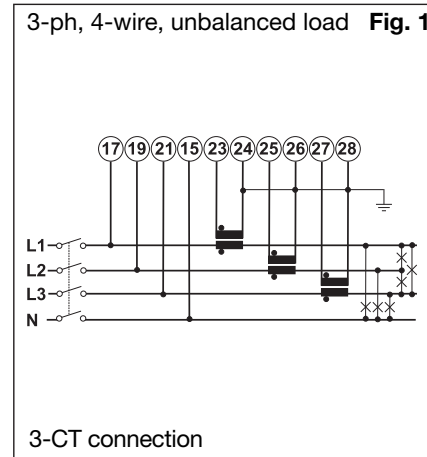
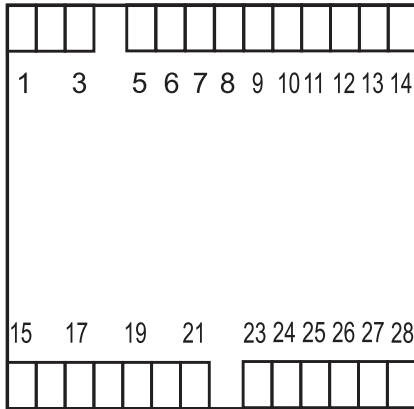
Lock of programming with seal.
Selection of up to 4 main pages
(programmable by the user).

Easy access to specific display pages.

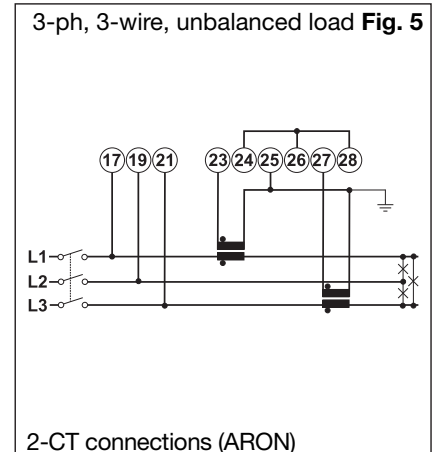
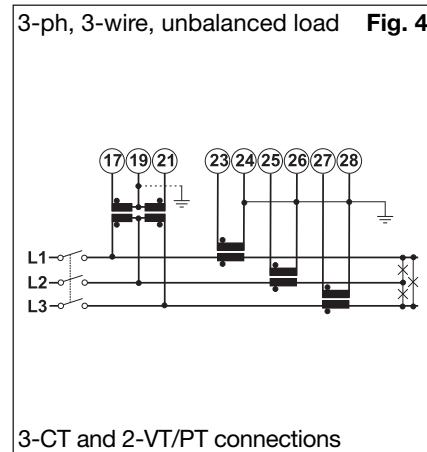
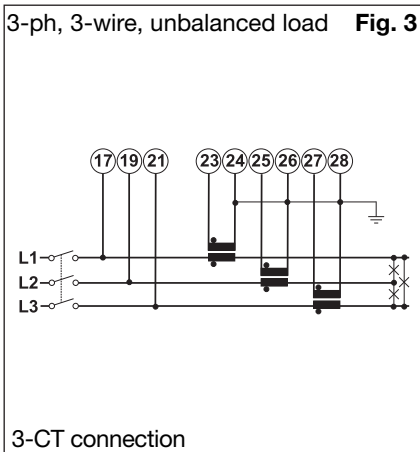


Wiring diagrams

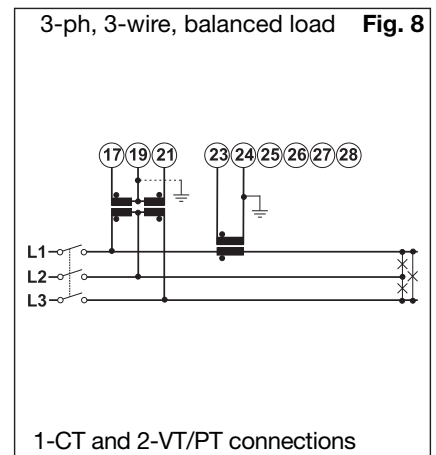
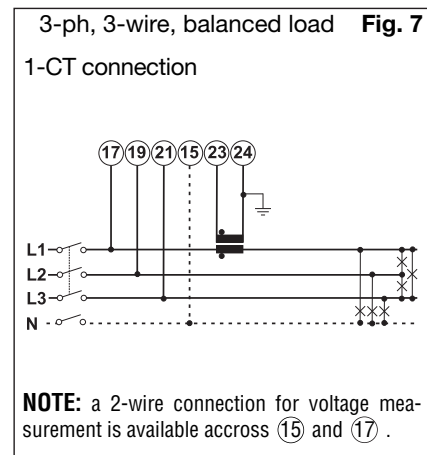
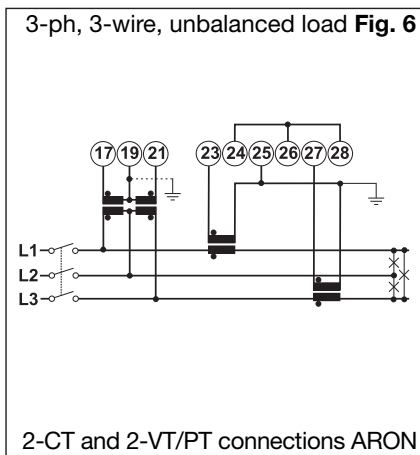
System type selection: 3P.n



System type selection: 3P.n

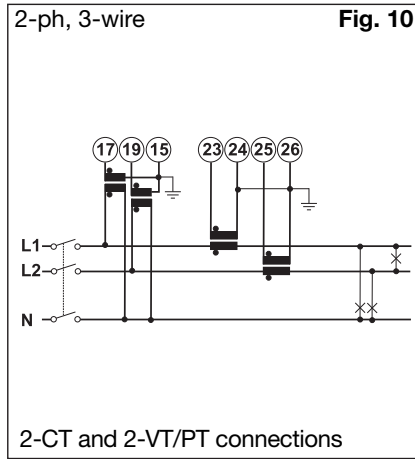
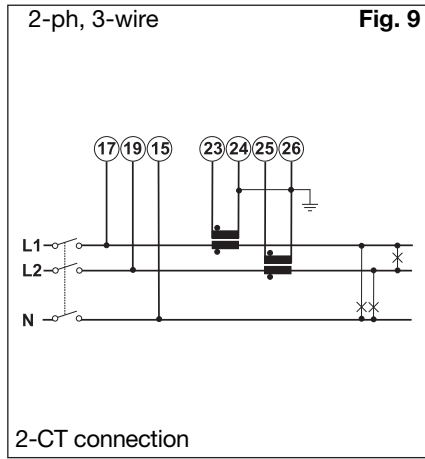


System type selection: 3P.1

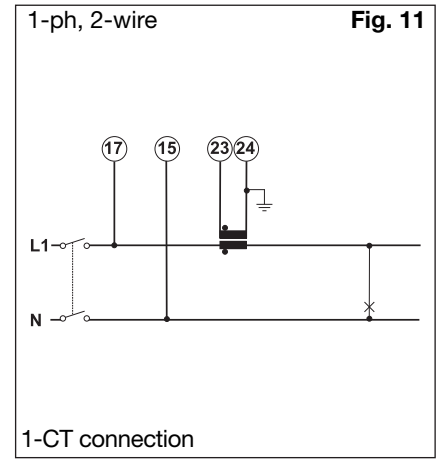


Wiring diagrams

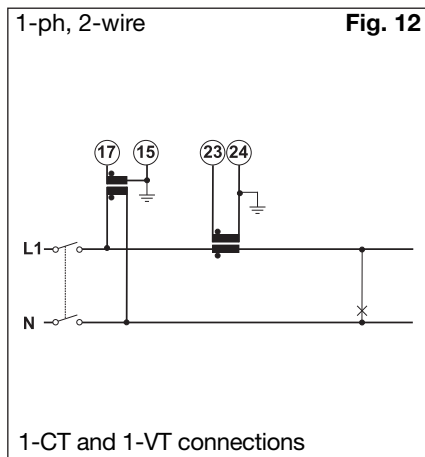
System type selection: 2P



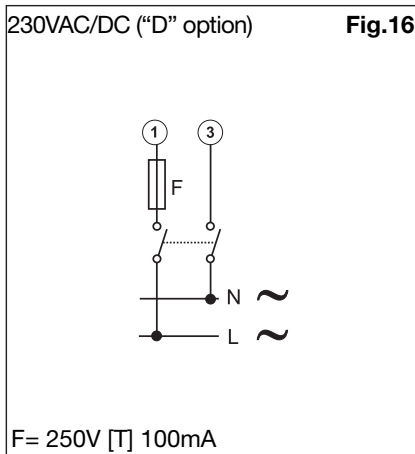
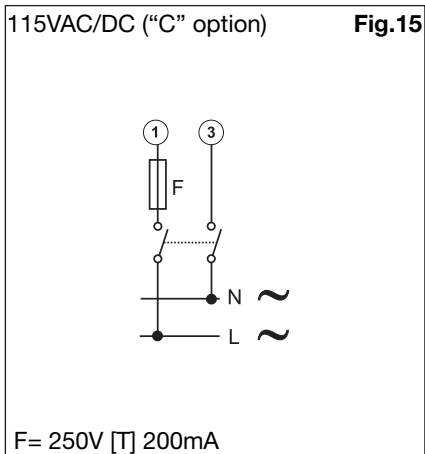
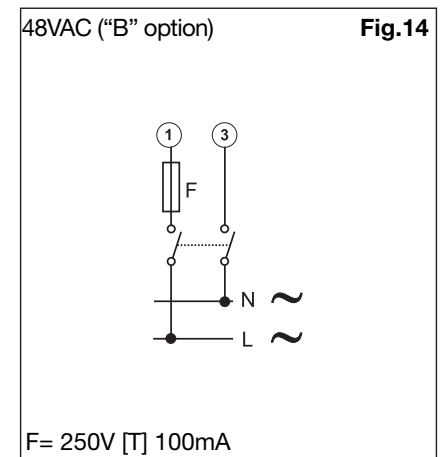
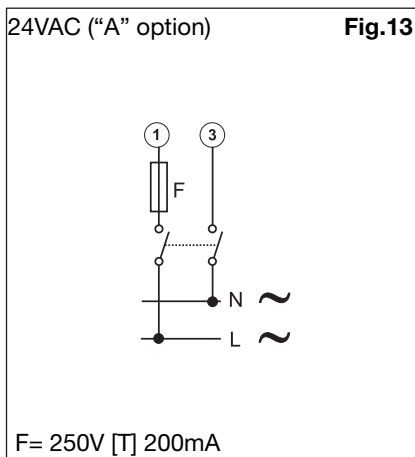
System type selection: 1P



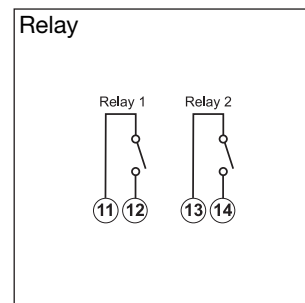
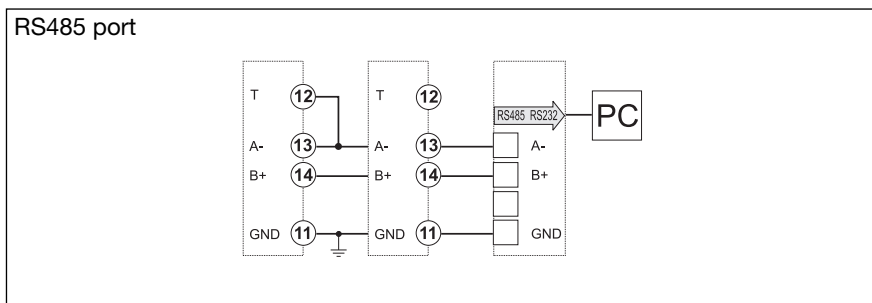
System type selection: 1P



Auxiliary power supply wiring diagrams

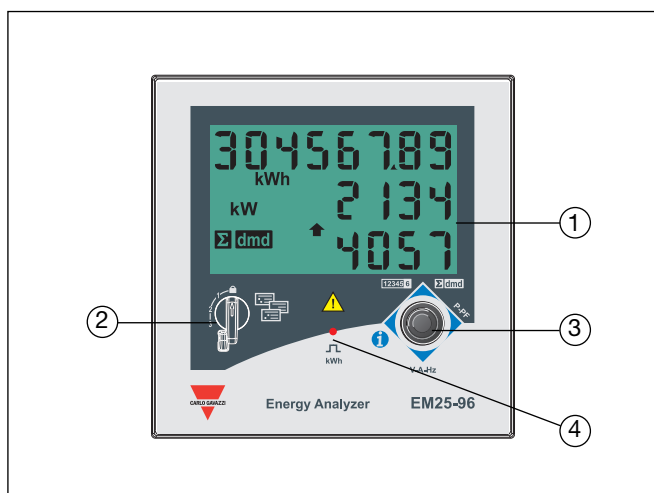


RS485 and relay outputs wiring diagrams



RS485 NOTE: additional devices provided with RS485 are connected in parallel. The termination of the serial output is carried out only on the last instrument of the network, by means of a jumper between (A-) and (T).

Front panel description



1. **Display**
LCD-type with alphanumeric indications to:
 - display configuration parameters;
 - display all the measured variables.
2. **Selector**
To select the desired display pages and to lock the programming.
3. **Joystick**
To program the configuration parameters and scroll the variables on the display.
4. **LED**
Red LED blinking proportional to the energy being measured.

Dimensions and Panel Cut-out

