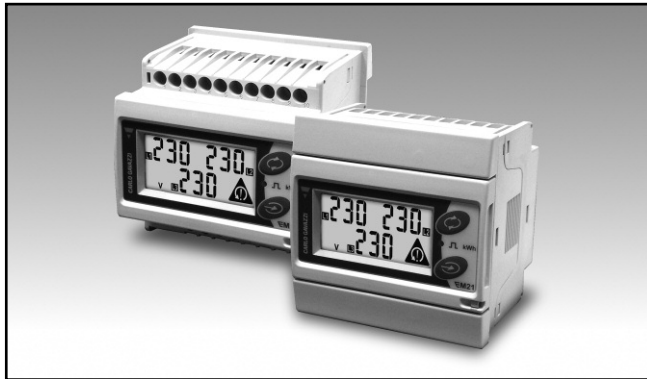


Energy Management Energy Meter Type EM21 72D



- Certified according to MID Directive (option PF only): see "how to order" below
- Not-certified version available (option X): see "how to order" on the next page.

- 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: V_{LL} , V_{LN} , A, PF
- Energy measurements: total kWh and kvarh
- TRMS measurements of distorted sine waves (voltages/currents)
- Self power supply
- Dimensions: 4-DIN modules and 72x72mm
- Protection degree (front): IP50
- Application adaptable display and programming procedure (Easyprog function)
- Easy connections management
- Detachable display
- Multi-use housing: for both DIN-rail and panel mounting applications

Product Description

Three-phase energy meter with removable front LCD display unit. The same unit can be used 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). Housing for DIN-rail mounting with IP50

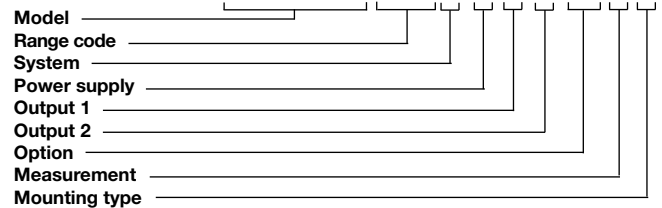
(front) protection degree. Current measurements carried out by means of external current transformers and voltage measurements carried out either by means of direct connection or by means of potential trans-

formers. EM21-72D 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.



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 EM21 72D AV5 3 X O X PF A D



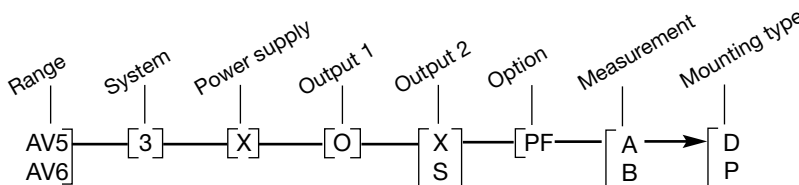
Type Selection

| Range codes | System | Power supply | Options |
|--|--|--|---|
| AV5: 400V _{LL} AC, 5(6)A (CT connection) AV6: 120/230V _{LL} AC 5(6)A (VT/PT and CT connections) | 3: 3-phase, 4-wire | X: Self power supply from 18V to 260VAC VLN, 50 Hz (connection VL1-N) | PF: 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. |
| Output 1 | Output 2 | Mounting type | |
| O: Single static output (opto-mosfet) | X: None S: RS485 port | D: DIN-rail mounting P: Panel mounting | |

Measurement

- A:** The power is always integrated -both in case of positive (imported) and negative (exported) power
- B:** only the positive (imported) power is integrated - no integration in case of negative (exported) power

NOTE: please check the availability of the needed code on the verification path diagram on left before order .

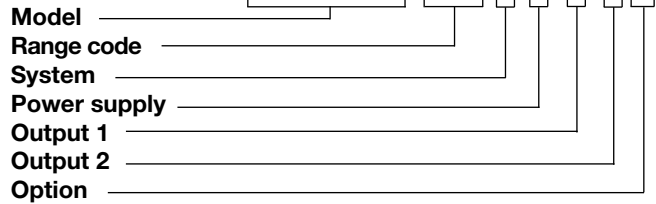




STANDARD

Not certified according to MID directive. Cannot be used for fiscal (legal) metrology.

How to order **EM21 72D AV5 3 X O X X**

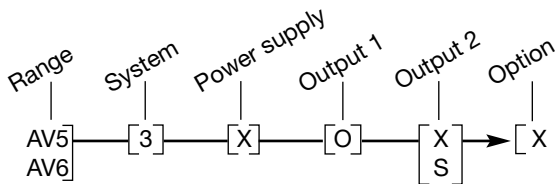


Type Selection

| Range codes | System | Power supply | Options |
|---|--|--|----------------|
| AV5: 400V _{LL} AC, 5(6)A or 1(6)A (*) (CT connection) | 3: balanced and unbalanced load: 3-phase, 4-wire; 3-phase, 3-wire; 2-phase, 3-wire; 1-phase, 2-wire | X: Self power supply from 18V to 260VAC VLN, 45 to 65 Hz (connection VL1-N) | X: none |
| AV6: 120/230V _{LL} AC 5(6)A or 1(6)A (*) (VT/PT and CT connections) | | | |

| Output 1 | Output 2 |
|--|--|
| O: Single static output (opto-mosfet) | X: None S: RS485 port |

(*) the range 1(6)A is available but not in compliance with the EN50470-3 standard.



NOTE: please check the availability of the needed code on the verification path diagram on left before order .

Input specifications

| | | | |
|---|--|--------------------------------|--|
| Rated inputs | System type: 3 | Energies | Imported Total: 5+2, 6+1 or 7DGT |
| Current type | Not isolated (shunt inputs). Note: the external current transformers can be connected to earth individually. | Overload status | EEE indication when the value being measured is exceeding the "Continuous inputs overload" (maximum measurement capacity) |
| Current range (by CT) | AV5 and AV6: 5(6)A. The "1(6)A" range is available but not in compliance with the EN50470-3 standard. | Max. and Min. indication | Max. instantaneous variables: 999; energies: 9 999 999. Min. instantaneous variables: 0; energies 0.00. |
| Voltage (direct or by VT/PT) | AV5: 400VLL; AV6: 120/230VLL | | |
| Accuracy (Display + RS485) (@25°C ±5°C, R.H. ≤60%, 50Hz) | In: see below, Un: see below | 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; 16Hz, according to EN50470-3 Green LED (on the terminal blocks side) for power on (steady) and communication status: RX-TX (in case of RS485 option only) blinking. |
| AV5 model | In: 5A, I _{max} : 6A; Un: 160 to 260VLN (277 to 450VLL). | Max frequency | 16Hz, according to EN50470-3 |
| AV6 model | In: 5A, I _{max} : 6A; Un: 40 to 144VLN (70 to 250VLL). | | |
| Current AV5, AV6 models | From 0.002In to 0.2In: ±(0.5% RDG +3DGT). From 0.2In to I _{max} : ±(0.5% RDG +1DGT). | Measurements | See "List of the variables that can be connected to:" TRMS measurements of distorted wave forms. By means of external CT's. |
| Phase-neutral voltage | In the range Un: ±(0,5% RDG +1DGT). | Method | |
| Phase-phase voltage | In the range Un: ±(1% RDG +1DGT). | Coupling type | |
| Frequency | Range: 50Hz; resolution: ±1Hz | Crest factor | In 5A: ≤3 (15A max. peak). |
| Active power | ±(1%RDG +2DGT). | Current Overloads | Continuous For 500ms |
| Power Factor | ±[0.001+1%(1.000 - "PF RDG")]. | Voltage Overloads | Continuous For 500ms |
| Reactive power | ±(2%RDG +2DGT). | Current input impedance | 5(6)A |
| Active energy | class B according to EN50470-1-3; class 1 according to EN62053-21. | Voltage input impedance | Self-power supply |
| Reactive energy | class 2 according to EN62053-23. In: 5A, I _{max} : 6A; 0.1 In: 0.5A. Start up current: 10mA. | Frequency | 50 ± 5Hz/60 ± 5Hz. |
| Energy additional errors | | Key-pad | Two push buttons for variable selection and programming of the instrument working parameters. |
| Influence quantities | According to EN62053-21, EN50470-1-3, EN62053-23 | | |
| Temperature drift | ≤200ppm/°C. | | |
| Sampling rate | 1600 samples/s @ 50Hz, 1900 samples/s @ 60Hz | | |
| Display refresh time | 1 second | | |
| Display | 2 lines 1 st line: 7-DGT, 2 nd line: 3-DGT or 1 st line: 3-DGT + 3-DGT, 2 nd line: 3-DGT. LCD, h 7mm. | | |
| Type | | | |
| Instantaneous variables read-out | 3-DGT. | | |

Output specifications

| | | | |
|---|--|---|--|
| Pulse output Number of outputs Type Pulse duration Output Load Insulation | 1 Programmable from 0.01 to 9.99 kWh per pulses. Output connectable to the energy meters (kWh) $T_{OFF} \geq 120$ ms, according to EN62052-31. T_{ON} selectable (30 ms or 100 ms) according to EN62053-31 Static: opto-mosfet. V_{ON} 2.5 VAC/DC max. 70 mA, V_{OFF} 260 VAC/DC max. By means of optocouplers, 4000 VRMS output to measuring inputs. | Connections Addresses Protocol Data (bidirectional) Dynamic (reading only) Static (reading and writing) Data format Baud-rate Driver input capability | 2-wire. Max. distance 1000m, termination directly on the instrument. 247, selectable by means of the front keypad 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. 9600 bits/s. 1/5 unit load. Maximum 160 transceiver on the same bus. By means of optocouplers, 4000 VRMS output to measuring input. |
| RS485 Type | Multidrop, bidirectional (static and dynamic variables) | Insulation | |

Software functions

| | | | |
|---|---|--|--|
| Password 1st level 2nd level Programming lock | Numeric code of max. 3 DGT; 2 protection levels of the programming data: Password "0", no protection; Password from 1 to 999, all data are protected By means of potentiometer (back-side of the display module) it is possible to lock the access to all the configuration parameters. | Transformer ratio VT (PT) CT | 1.0 to 99.9 / 100 to 999 / 1.0 to 99.9 / 100 to 999. The max CTxVT product for AV6 models is 2421 (X option) or 908 (PF option). The max CT ratio for MID applications (PF option) is 525. |
| System selection System 3-Ph.n unbalanced load System 3-Ph.1 balanced load | 3-phase (4-wire) 3-phase (3-wire) • 3-phase (3-wire) one current and 3-phase to phase voltage measurements. Note: the phase to phase voltage is calculated multiplying by 1.73 the virtual phase to neutral voltage. • 3-phase (4-wire) one current and 3-phase to neutral voltage measurements. Note: the phase to phase voltage is calculated multiplying by 1.73 the virtual phase to neutral voltage. • 3-phase (2-wire) one current and 1-phase (L1) to neutral voltage measurement. | Displaying Reset Easy connection function | Up to 3 variables per page. See « Display pages », 3 different set of variables available (see « Display pages ») according to the metering function being selected. By means of the front keypad: total energies (kWh, kvarh). Wrong phase detection and displaying. For all the display selections (except "D") the current, power and energy measurement are independent on the current direction. |
| System 2-Ph System 1-Ph | 2-phase (3-wire) 1-phase (2-wire) | | |

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. | Surge | On current and voltage measuring inputs circuit: 6kV; |
| Storage temperature | -30°C to +70°C (-22°F to 158°F) (R.H. < 90% non-condensing @ 40°C) according to EN62053-21 and EN62053-23. | Radio frequency suppression | According to CISPR 22 |
| Installation category | Cat. III (IEC60664, EN60664). | Standard compliance | |
| Insulation (for 1 minute) | 4000 VRMS between measuring inputs and digital output. | Safety | IEC60664, IEC61010-1 EN60664, EN61010-1 EN62052-11 |
| Dielectric strength | 4000 VRMS 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 (PF option only) |
| EMC | According to EN62052-11 | Connections | Screw-type |
| Electrostatic discharges | 15kV air discharge; | Cable cross-section area | 2.4 x 3.5 mm |
| Immunity to irradiated | Test with current: 10V/m from 80 to 2000MHz; | Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm | |
| Electromagnetic fields | Test without any current: 30V/m from 80 to 2000MHz; | Housing | |
| Burst | On current and voltage measuring inputs circuit: 4kV | Dimensions (WxHxD) | 72 x 72 x 65 mm |
| Immunity to conducted disturbances | 10V/m from 150KHz to 80MHz | Material | Noryl PA66, self-extinguishing: UL 94 V-0 Panel and DIN-rail |
| | | Mounting | |
| | | Protection degree | |
| | | Front | IP50 |
| | | Screw terminals | IP20 |
| | | Weight | Approx. 400 g (packing included) |

Power supply specifications

| | | | |
|--------------------------|--|--------------------------|---------|
| Self power supply | 18 to 260VAC (48-62Hz). Across input "VL1" and "N" | Power consumption | ≤2VA/1W |
|--------------------------|--|--------------------------|---------|

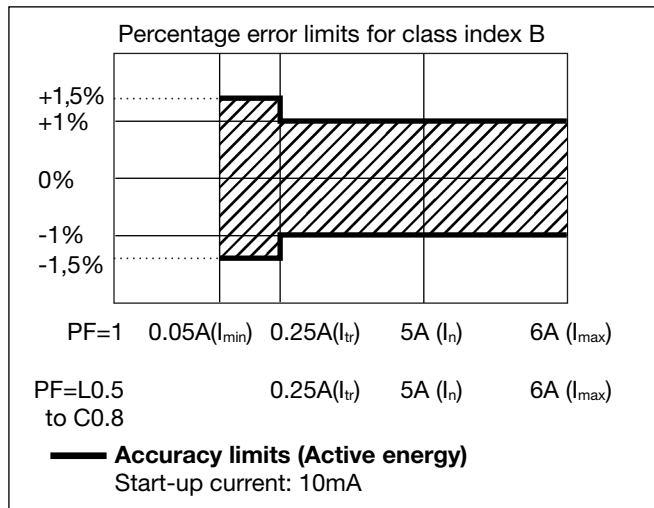
Insulation between inputs and outputs

| | Measuring Inputs | Opto-Mosfet output | Communication port | Self power supply |
|--------------------|------------------|--------------------|--------------------|-------------------|
| Measuring Inputs | - | 4kV | 4kV | 0kV |
| Opto-Mosfet output | 4kV | - | - | 4kV |
| Communication port | 4kV | - | - | 4kV |
| Self power supply | 0kV | 4kV | 4kV | - |

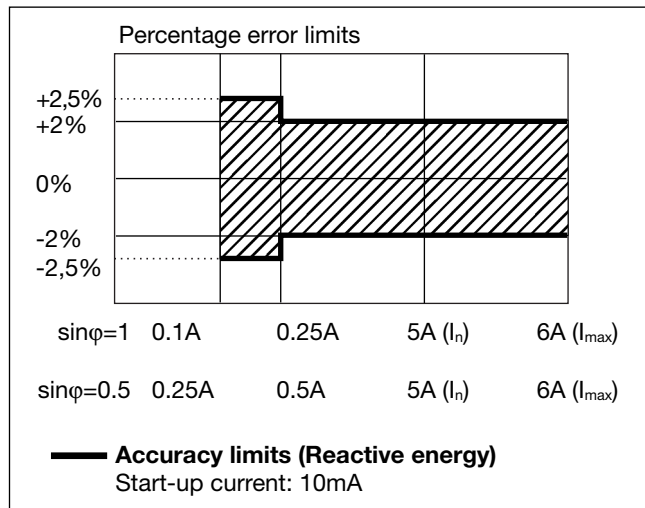
NOTE: all the models have, mandatorily, to be connected to external current transformers.

Accuracy (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 (PF option only)

Accuracy

0.9 $U_n \leq U \leq 1.1 U_n$;
0.98 $f_n \leq f \leq 1.02 f_n$;
 f_n : 50Hz;
 $\cos\phi$: 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.

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.

Operating temperature

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

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

$$\cos\phi_1 = \frac{W_1}{VA_1}$$

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

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

Voltage asymmetry

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

$$\cos\phi_\Sigma = \frac{W_\Sigma}{VA_\Sigma} \quad (\text{TPF})$$

Energy metering

$$k \text{ var hi} = \int_{t_1}^{t_2} Q_i(t) dt \cong \Delta t \sum_{n_1}^{n_2} Q_{nj}$$

$$kWh_i = \int_{t_1}^{t_2} P_i(t) dt \cong \Delta t \sum_{n_1}^{n_2} P_{nj}$$

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”)

| No | Variable | 1-ph. sys. | 2-ph. sys. | 3-ph. 4-wire balanced system | 3-ph. 3-wir balanced system | 3-ph. 4-wire unbalanced system | 3-ph. 3-wir unbalanced system | Notes |
|----|----------------|------------|------------|------------------------------|-----------------------------|--------------------------------|-------------------------------|----------------|
| 1 | kWh | x | x | x | x | x | x | Total |
| 2 | kvarh | x | x | x | x | x | x | Total |
| 3 | V L-N sys (1) | o | x | x | x | x | x | sys=system (Σ) |
| 4 | V L1 | x | x | x | x | x | x | |
| 5 | V L2 | o | x | x | x | x | x | |
| 6 | V L3 | o | o | x | x | x | x | |
| 7 | V L-L sys (1) | o | x | x | x | x | x | sys=system (Σ) |
| 8 | V L1-2 | o | x | x | x | x | x | |
| 9 | V L2-3 | o | o | x | x | x | x | |
| 10 | V L3-1 | o | o | x | x | x | x | |
| 11 | A L1 | x | x | x | x | x | x | |
| 12 | A L2 | o | x | x | x | x | x | |
| 13 | A L3 | o | o | x | x | x | x | |
| 14 | VA sys (1) | x | x | x | x | x | x | sys=system (Σ) |
| 15 | VA L1 (1) | x | x | x | x | x | x | |
| 16 | VA L2 (1) | o | x | x | x | x | x | |
| 17 | VA L3 (1) | o | o | x | x | x | x | |
| 18 | var sys | x | x | x | x | x | x | sys=system (Σ) |
| 19 | var L1 (1) | x | x | x | x | x | x | |
| 20 | var L2 (1) | o | x | x | x | x | x | |
| 21 | var L3 (1) | o | o | x | x | x | x | |
| 22 | W sys | x | x | x | x | x | x | sys=system (Σ) |
| 23 | W L1 (1) | x | x | x | x | x | x | |
| 24 | W L2 (1) | o | x | x | x | x | x | |
| 25 | W L3 (1) | o | o | x | x | x | x | |
| 26 | PF sys | x | x | x | x | x | x | sys=system (Σ) |
| 27 | PF L1 | x | x | x | x | x | x | |
| 28 | PF L2 | o | x | x | x | x | x | |
| 29 | PF L3 | o | o | x | x | x | x | |
| 30 | Hz | x | x | x | x | x | x | |
| 31 | Phase sequence | o | o | x | x | x | x | |

(x) = available

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

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

Display pages

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

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

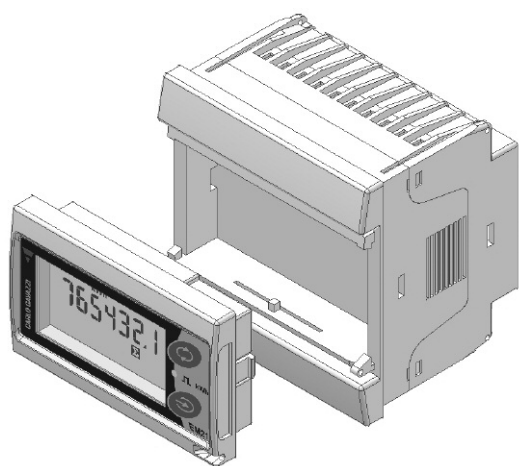
| | Description | Notes |
|----------|-------------------------------------|---|
| A | Active energy meter ** | Active energy measurement with some minor parameters |
| B | Active and reactive energy meter ** | Active and reactive energy measurement with some minor parameters |
| C | Full set of variables ** | Full set of available variables can be displayed (default selection, except PFB option) |
| D | Full set of variables ** | Full set of available variables can be displayed * (default in PFB option) |

Notes:

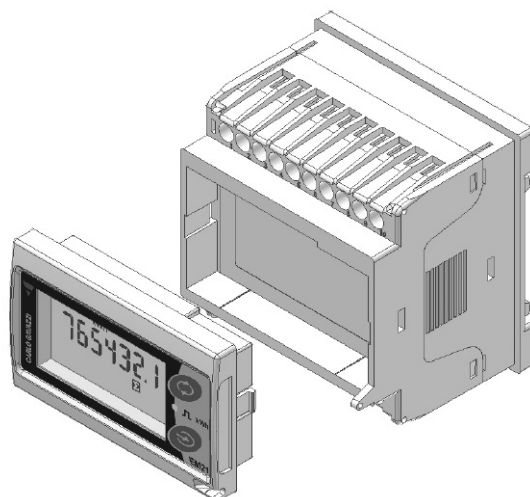
* Only in "D" application the actual direction of the current is considered.

** Not available with option PF A. ** Not available with option PF B.

One instrument with double mounting capability

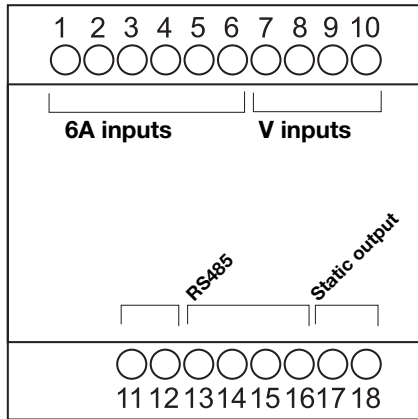


By means of the patented detachable display it is possible to configure the same instrument either as a panel mounting meter or...

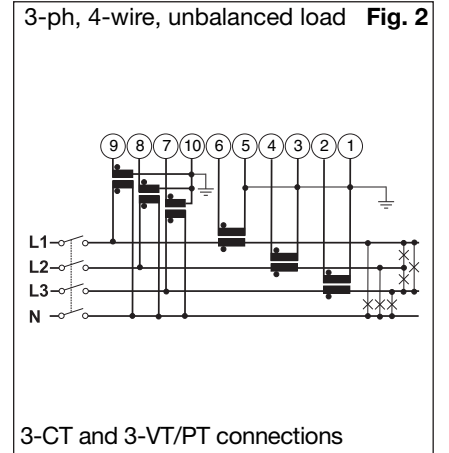
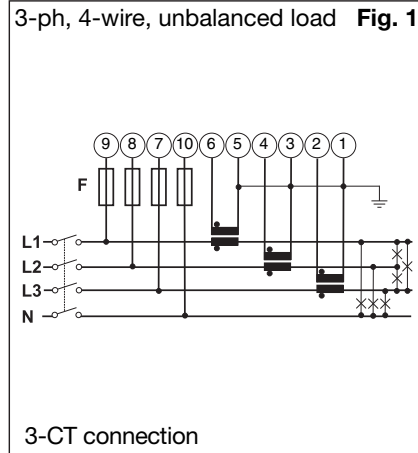


... as DIN-rail mounting meter.

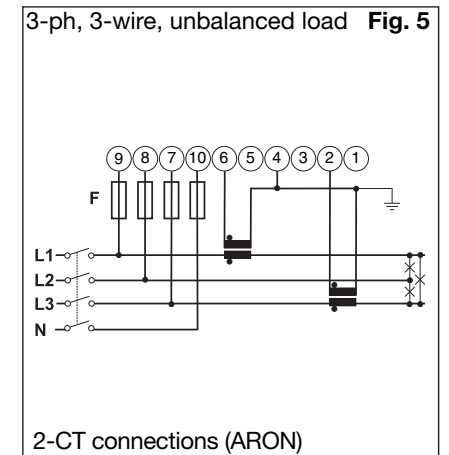
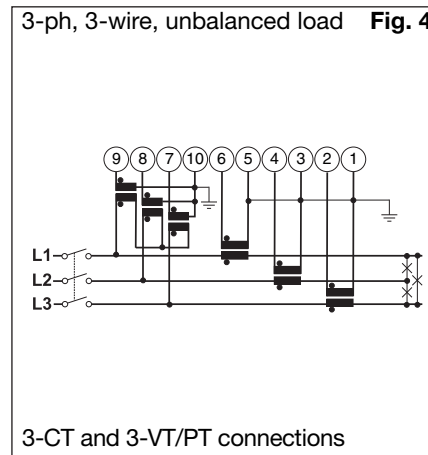
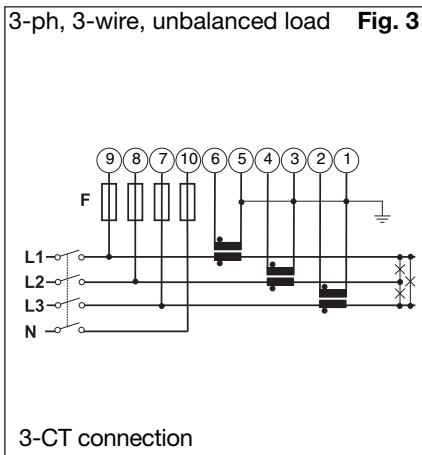
Wiring diagrams



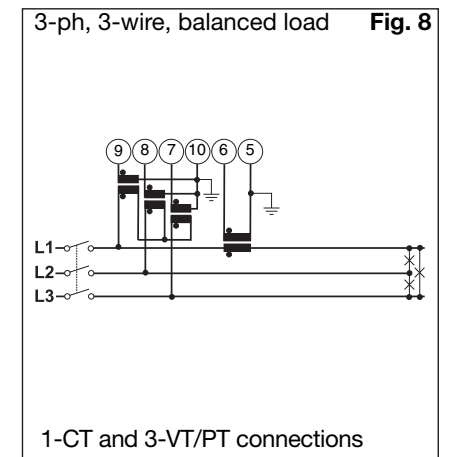
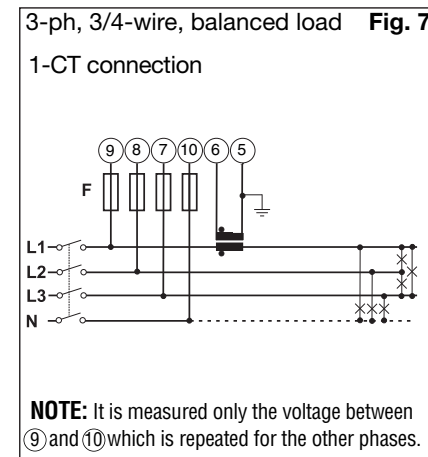
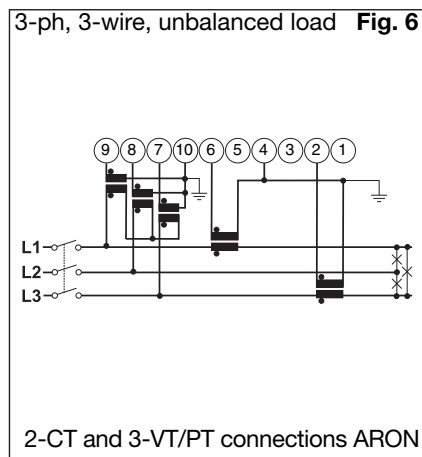
(6A) Self power supply, system type selection: 3P.n



(6A) System type selection: 3P.n



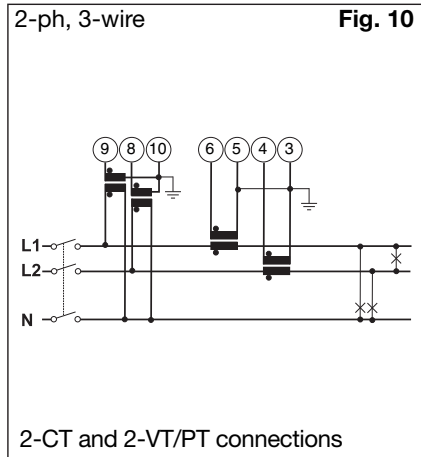
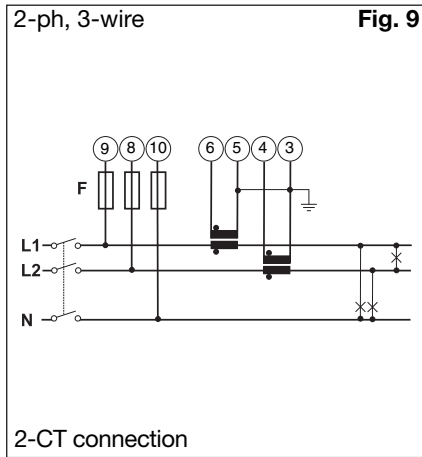
(6A) Self power supply, system type selection: 3P.1



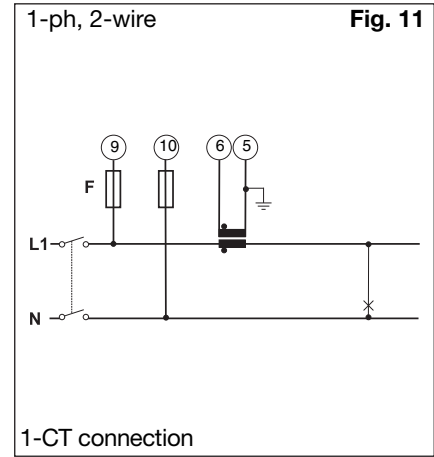
NOTE: For a correct power supply of the instrument, the neutral must always be connected.

Wiring diagrams

(6A) System type selection: 2P

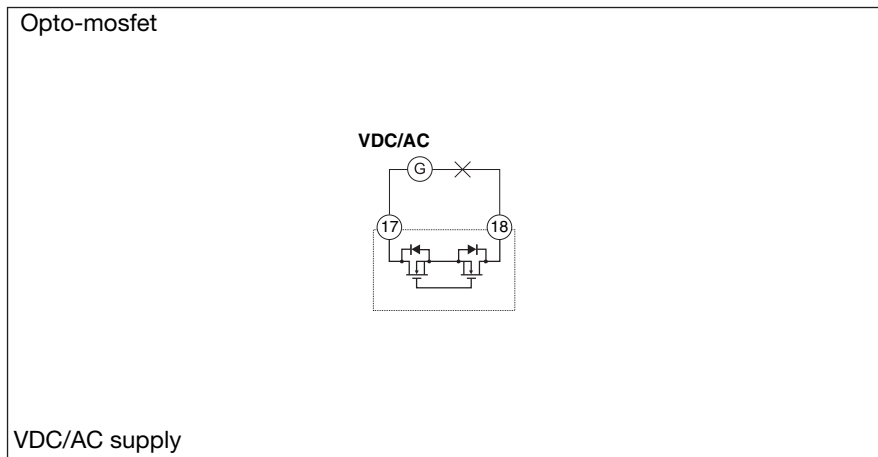
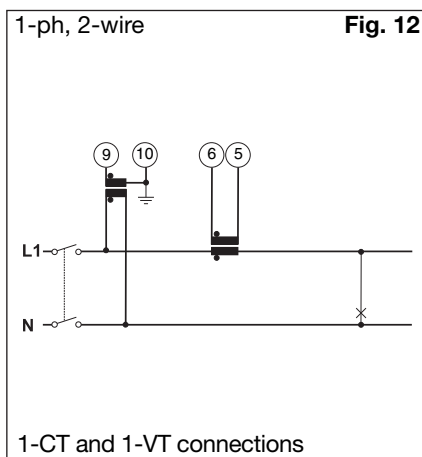


(6A) System type selection: 1P

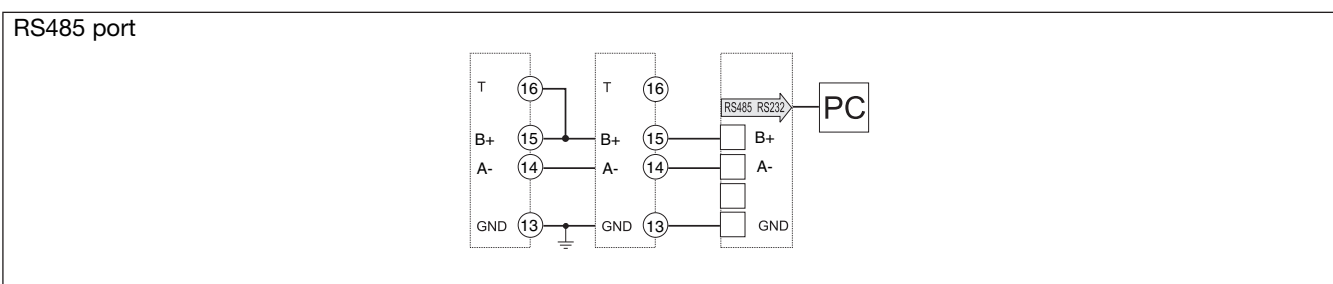


Static output wiring diagram

(6A) System type selection: 1P

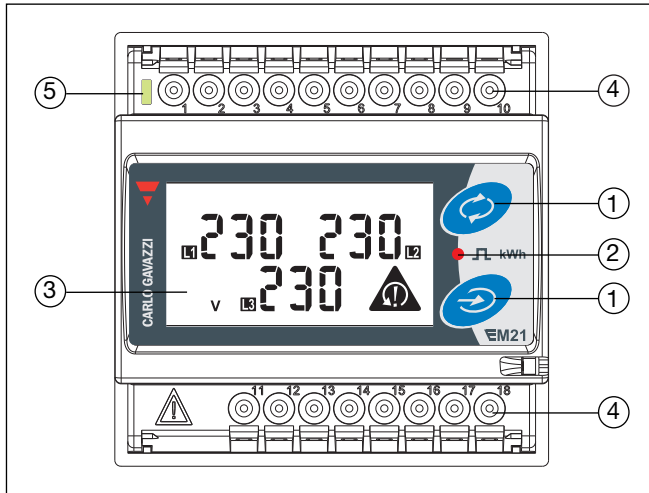


RS485 port wiring diagram



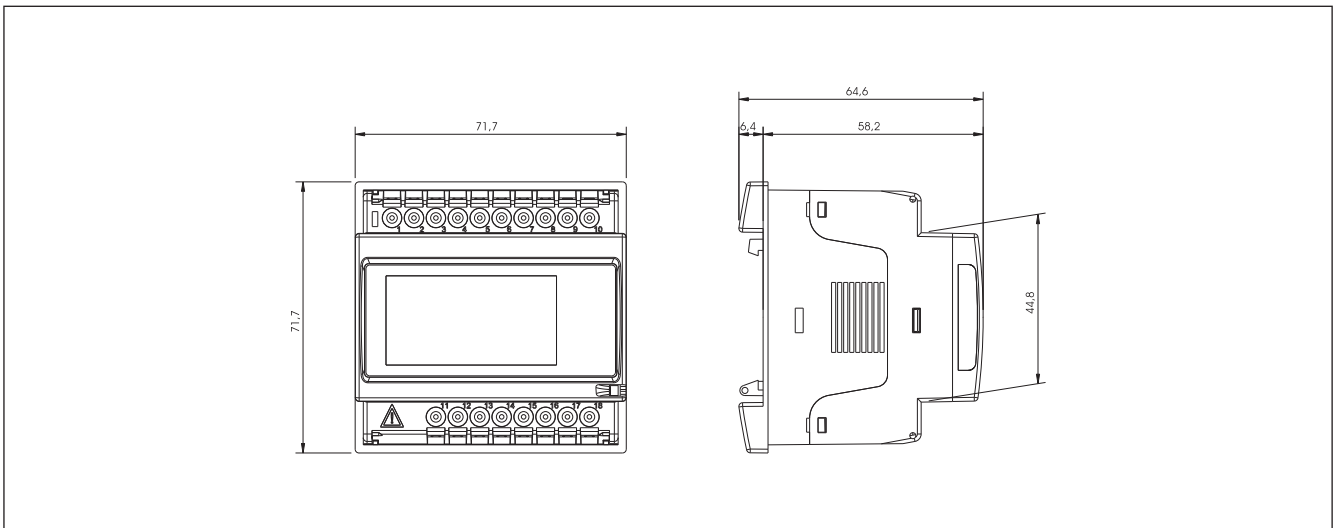
RS485 NOTE: additional devices provided with RS485 are connected as per the picture above. The termination of the serial output is carried out only on the last instrument of the network, by means of a jumper between (B+) and (T).

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)

