Energy Management
Energy Analyzer
Type EM24 DIN

- **Application adaptable display and programming procedure (Easyprog function)**
- **Easy connections management**
- **Certified according to MID Directive (option PF only): see “how to order” below**
- **Other version available (not certified, option X and P): see “how to order” on the next page**

- **Class 1 (kWh) according to EN62053-21**
- **Class B (kWh) according to EN50470-3**
- **Class 2 (kvarh) according to EN62053-23**
- **Accuracy ±0.5 RDG (current/voltage)**
- **Energy analyzer**
- **Instantaneous variables readout: 4 DGT**
- **Energies/gas/water readout: 7+1 DGT**
- **System variables: VLL, VLN, Admd max, VA, VAdmd, VAdmd max, W, Wdmd, Wdmd max, var, PF, Hz, Phase-sequence.**
- **Single phase variables: VLL, VLN, A, VA, W, var, PF**
- **Energy measurements: total and partial kWh and kvarh or based on 4 different tariffs; single phase measurements**
- **Gas, cold water, hot water, kWh remote heating measurements**
- **Hour counter (6+2 DGT)**
- **TRMS measurements of distorted sine waves (voltages/currents)**
- **Self power supply (AV0-AV2-AV9 inputs)**
- **Auxiliary power supply (AV5-AV6 inputs)**
- **3 digital inputs for tariff selection, DMD synch or gas/ water (hot-cold) and remote heating metering (on request)**
- **2 digital outputs for pulses or for alarms or as a mix of them (on request)**
- **Dimensions: 4-DIN modules**
- **Protection degree (front): IP50**
- **RS485 serial output (on request) (MODBUS-RTU), iFIX SCADA compatibility**
- **Dupline communication capability (DP option)**

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 DIN-rail mounting with IP50 (front) protection degree. Direct connection up to 65A and by means of external current and potential transformers.

Moreover the meter can be provided with digital outputs that can be either for pulse proportional to the active and reactive energy being measured or for alarm outputs. In alternative the RS485 communication port and 3 digital inputs or Dupline port and 3 digital inputs are available as an option.

MID Certified according to MID Directive, Annex "B" + Annex "D" or Annex “B” + Annex “F” for legal metrology relevant to active electrical energy meters (see Annex MI-003 of MID). Can be used for fiscal (legal) metrology.

How to order

EM24 DIN AV5 3 X O2 PF

- **Model**
- **Range code**
- **System**
- **Power supply**
- **Inputs/Outputs**
- **Option**

Type Selection for MID version

Range codes

AV5: $400V_{LL}$ AC - 5(10)A (CT connection)
AV2: V_{LN}: 113V to $230V_{LN}$ V_{LL}: 230V to $400V_{LL}$ I: 10(65)A
AV9: $400V_{LL}$ AC - 10(65)A (direct connection)

System

3: 3-phase, 4-wire balanced load

Inputs/Outputs

XX: none
O2: dual open collector type (dual pulse or one pulse + one alarm or dual alarm)
IS: 3 digital inputs for tariff selection or Gas/Water/ remote heating metering plus RS485 port
DP: Dupline port plus 3 digital inputs for Gas/ water/ remote heating metering

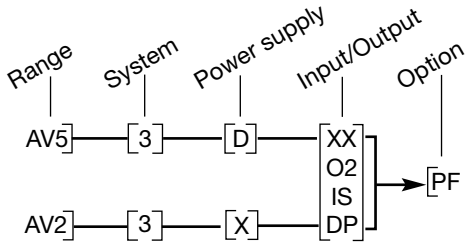
Power supply

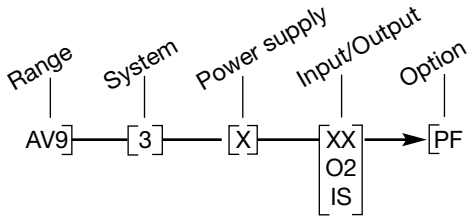
X: Self power supply (See “Power supply specifications”)
D: 115/230VAC (50Hz)

NOTE: please check the availability of the needed code on the verification path tables below before order .

Options

PF: Certified according to MID Directive, Annex "B" + Annex "D" or Annex “B” + Annex “F” for legal metrology relevant to active electrical energy meters (see Annex MI-003 of MID). Can be used for fiscal (legal) metrology.





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STANDARD

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

How to order

EM24 DIN AV5 3 X O2 X

- **Model**
- **Range code**
- **System**
- **Power supply**
- **Inputs/Outputs**
- **Option**

Type Selection for standard version

Range codes

AV5: 400V_{LL} AC - 1/5 (10)A (CT connection)
V_{LN}: 160 V to 480V_{LN}
V_{LL}: 277 V to 830V_{LL}

AV6: 208V_{LL} AC - 1/5(10)A (VT/PT and CT connections)
V_{LN}: 40V to 144V_{LN}
V_{LL}: 70V to 250V_{LL}

AV0: 208V_{LL} AC -10(65)A (direct connection) **(*)**
V_{LN}: 96V to 144V_{LN}
V_{LL}: 166V to 250V_{LL}

AV2: 400V_{LL}AC 10(65)A (direct connection) **(*)**
V_{LN}: 113V to 265V_{LN}
V_{LL}: 196V to 460V_{LL}

AV9: 400V_{LL} AC - 10(65)A (direct connection
V_{LN}: 184V to 276V_{LN}
V_{LL}: 318V to 480V_{LL}

System

1: 1-phase, 2-wire; 3-phase, 3-wire, 3-phase, 4-wire balanced load **(*)**

3: balanced and unbalanced load: 3-phase, 4-wire; 3-phase, 3-wire; 2-phase, 3-wire; 1-phase, 2-wire

(*) on request.

NOTE: please check the availability of the needed code on the verification path tables below before order.

Inputs/Outputs

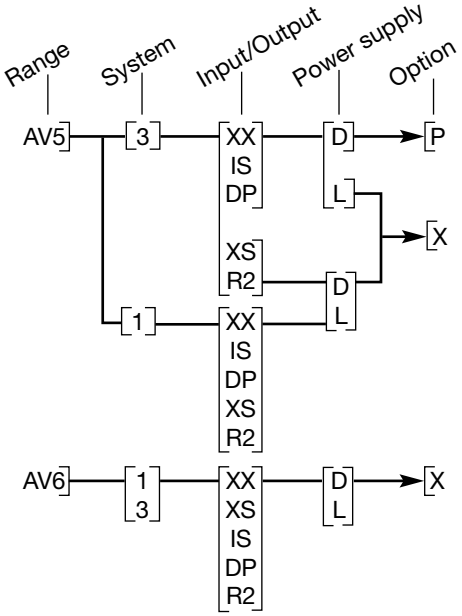
XX: none
O2: dual open collector type (dual pulse or one pulse + one alarm or dual alarm)
R2: dual relay type (functions as per "O2") **(*)**
XS: RS485 port **(*)**
IS: 3 digital inputs for tariff selection or Gas/ water/ remote heating metering plus RS485 port
DP: Dupline port plus 3 digital inputs for Gas / water / remote heating metering

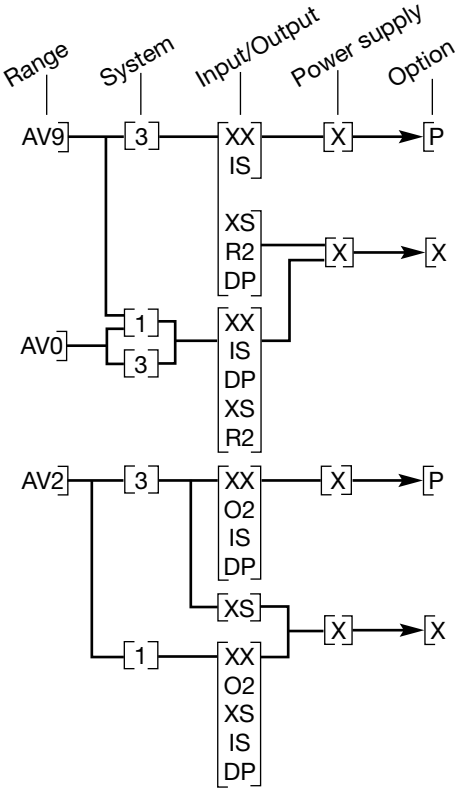
Power supply

X: Self power supply (See "Power supply specifications")
L: 18 to 60VAC/DC (48 to 62Hz) **(*)**
D: 115/230 VAC (48 to 62Hz)

Options

X: none
P: Bearing EC. "Type examination" (annex B of MID) relevant to active electrical energy meters (see Annex MI-003).





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Input specifications

Rated inputs	System type: 3-phase
Current type	Galvanic insulation by means of built-in CT's (AV5 and AV6 models). By direct connection (AV0, AV2 and AV9)
Current range (by CT)	AV5 and AV6: 1/5(10)A
Current range (direct)	AV0: 10(65)A; AV2: 10(65)A; AV9: 10(65)A
Voltage	AV5: 400 VLL
Voltage	AV0: 120VLN/208 VLL AV2: 230/400 VLL AV9: 400 VLL
Voltage by VT/PT	AV6: 120VLN/208 VLL
Accuracy (Display + RS485) (@25°C ±5°C, R.H. ≤60%, 48 to 62Hz)	Ib: see below, Un: see below
AV5 model	In: 5A, Imax: 10A; Un: 160 to 480VLN (277 to 830VLL)
AV6 model	In: 5A, Imax: 10A; Un: 40 to 144VLN (70 to 250VLL)
AV0 model	Ib: 10A, Imax: 65A; Un: 96 to 144VLN (166 to 250VLL)
AV2 model	Ib: 10A, Imax: 65A, Un: 113 to 265VLN (196 to 460VLL)
AV9 model	Ib: 10A, Imax: 65A; Un: 184 to 276VLN (318 to 480VLL)
Current	
AV5, AV6 models	From 0.002In to 0.2In: ±(0.5% RDG +3DGT) From 0.2In to Imax: ±(0.5% RDG +1DGT).
AV0, AV2, AV9 models	From 0.004Ib to 0.2Ib: ±(0.5% RDG +3DGT) From 0.2Ib to Imax: ±(0.5% RDG +1DGT).
Phase-neutral voltage	In the range Un: ±(0,5% RDG +1DGT)
Phase-phase voltage	In the range Un: ±(1% RDG +1DGT)
Frequency	±0.1Hz (45 to 65Hz)
Active and Apparent power	±(1%RDG +2DGT)
Power Factor	±[0.001+1%(1.000 - "PF RDG")]
Reactive power	±(2%RDG +2DGT)
Active energy	Class 1 according to EN62053-21 and MID Annex MI-003 Class B according to EN50470-3
Reactive energy	Class 2 according to EN62053-23
AV5, AV6 models	In: 5A, Imax: 10A; 0.1 In: 0.5A, Start up current: 10mA
AV0, AV2, AV9 models	Ib: 10A, Imax: 65A; 0.1 Ib: 1.0A Start up current: 40mA
Energy additional errors	
Influence quantities	According to EN62053-21, EN50470-3, EN62053-23
Temperature drift	≤200ppm/°C
Sampling rate	1600 samples/s @ 50Hz 1900 samples/s @ 60Hz
Display refresh time	750 ms
Display	3 lines (1 x 8 DGT; 2 x 4 DGT)
Type	LCD, h 7mm
Instantaneous variables read-out	4 DGT
Energies	Imported Total/Partial/ Tariff: 7+1DGT or 8DGT; Exported Total/Partial/ Tariff: 6+1DGT or 7DGT (with "-" sign)
Overload status	EEEE indication when the value being measured is exceeding the "Continuous inputs overload" (maximum measurement capacity)
Max. and Min. indication	Max. instantaneous variables: 9999; energies: 9 999 999.9 or 99 999999. Min. instantaneous variables: 0.000; energies 0.0
LEDs	Red LED (Energy consumption)
AV5, AV6 models	0.001 kWh/kvarh by pulse if CT ratio by VT ratio is ≤7; 0.01 kWh/kvarh by pulse if CT ratio x VT ratio is > 7.1 ≤ 70.0; 0.1 kWh/kvarh pulse if CT ratio x VT ratio is > 70.1 ≤ 700.0; 1 kWh/kvarh by pulse if CT ratio x VT ratio is > 700.1;
AV0, AV2, AV9 models	0.001kWh/kvarh by pulse
Max frequency	16Hz, according to EN50470-3
Measurements	See "List of the variables that can be connected to:"
Method	TRMS measurements of distorted wave forms.
Coupling type	Direct for AV0, AV2 and AV9 models. By means of external CT's for AV5 and AV6
Crest factor	Ib 10A ≤4 (91A max. peak) In 5A ≤3 (15A max. peak)
Current Overloads	
Continuous	1/5(10) A: 10A, @ 50Hz 10(65) A: 65A, @ 50Hz
For 500ms	1/5(10) A: 200A, @ 50Hz
For 10ms	10(65) A: 1920A max, @ 50Hz
Voltage Overloads	
Continuous	1.2 Un
For 500ms	2 Un
Input impedance	
208VL-L (AV6)	>1600KΩ
208VL-L (AV0)	Refer to "Power Consumption"
230/400VL-L (AV2)	Refer to "Power Consumption"
400VL-L (AV5)	>1600KΩ
400VL-L (AV9)	Refer to "Power Consumption"
1/5(10)A (AV5-AV6)	< 0.3VA
10(65)A (AV0-AV2-AV9)	< 4VA
Frequency	45 to 65 Hz
Joystick	For variable selection and programming of the instrument working parameters

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Output specifications

Digital outputs	
Pulse type	
Number of outputs	Up to 2, independent. Programmable from 0.001 to 10.00kWh/kvarh by pulse.
Type	Outputs connectable to the energy meters (kWh/kvarh)
Pulse duration	≥100ms < 120msec (ON), ≥120ms (OFF), according to EN62053-31
Alarm type	
Number of outputs	Up to 2, independent
Alarm modes	Up alarm, down alarm (see the table “List of the variables that can be connected to”)
Set-point adjustment	From 0 to 100% of the display scale
Hysteresis	From 0 to full scale
On-time delay	0 to 255s
Output status	Selectable; normally de-energized or normally energized
Min. response time	≤ 700ms, filter excluded, set-point on-time delay: “0 s”
Note	The 2 digital outputs can also work as a dual pulse output, dual alarm output, one pulse output and one alarm output.
Static output	
Purpose	For pulse output or alarm output
Signal	V_{ON} 1.2 VDC/ max. 100 mA V_{OFF} 30 VDC max.
Insulation	By means of optocuplers, 4000 VRMS output to measuring inputs, 4000 VRMS output to power supply input.
Relay output	
Purpose	For alarm output or pulse output
Type	Relay, SPST type AC 1-5A @ 250VAC DC 12-5A @ 24VDC AC 15-1.5A @ 250VAC DC 13-1.5A @ 24VDC
Insulation	4000 VRMS output to measuring input 4000 VRMS output to power supply input.
Note	The meters equipped with the relay outputs (“AV0” and “AV9” models with “R2” option) work even if VL3 is missing (VL1, VL2 and neutral have to be available)(see table “working mode notes”)
RS485	
Type	Multidrop, bidirectional (static and dynamic variables)
Connections	2-wire Max. distance 1000m
Addresses	247, selectable by means of the front joystick
Protocol	MODBUS/JBUS (RTU)
Data (bidirectional)	
Dynamic (reading only)	System and phase variables: see table “List of variables...”
Static (reading and writing)	All the configuration parameters.
Data format	1 start bit, 8 data bit, no parity,1 stop bit
Baud-rate	4800, 9600 bit/s
Driver input impedance	1/5 unit load Maximum 160 transceivers on the same bus.
Insulation	By means of optocouplers, 4000 VRMS output to measuring input, 4000 VRMS output to power supply input.
Note:	The meters equipped with the communication port (“AV0” and “AV9” models with “XS” and “IS” options) work even if VL3 is missing (VL1, VL2 and neutral have to be available)(see table “working mode notes”)

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Dupline specifications

Counters	
Used Dupline function	Multiplexer for counter values
Number of counters	6 per instrument 128 per network
Counter range	0... 99 999 999
Used channels	B to F
Multiplexer	B2 to B8
Reset	B1
Value	C1 to F8
Counter reset	Enable/disable function for all the counters
Available counters	kWh tot, -kWh tot, kvarh tot, -kvarh tot, kWh t1, kWh t2, kWh L1, kWh L2, kWh L3, counter dig. in. 1, counter dig. in. 2, counter dig. in. 3, hour counter.
Analogue variables	
Used Dupline function	Multiplexer for analogue values
Number of variables	8 per instrument 80 per network
Dupline data format	3 1/2 DGT BCD
Full scale value	Selectable from 1.999 to 1999M
Used channels	depending on the number of variables
Multiplexer	A1 to A4
Value	G1 to H8 (1st group of 16 variables) I1 to J8 (2nd group of 16 variables) K1 to L8 (3th group of 16 variables) M1 to N8 (4th group of 16 variables) O1 to P8 (5th group of 16 variables)
Available variables	All, except for the “max” variables
Synchro/Tariff input	
Used Dupline functions	Monostable (push-button) Realtime
Used channels	A5
Working mode	Selectable: • none • Wdmd synchronization • total and partial energy meter (kWh, kvarh) managed by time periods (t1-t2).
Alarms	
Used Dupline function	Monostable (push-button)
Used channells	Selectable (A1 to P8). No control that the selected channels are not used for counters or analog variables.
Number of alarms	2 per instrument
Alarm modes	Up alarm, down alarm (see the table “List of the variables that can be connected to”)
Set-point adjustment	From 0 to 100% of the display scale
Hysteresis	From 0 to full scale
On-time delay	0 to 255s
Output status	Normally energised
Available variables	All, except for the “max” variables

Digital input specifications

Number of inputs	3
Input frequency	20Hz max, duty cycle 50%
Prescaler adjustment	From 0.1 to 999.9 m^3 or kWh per pulse
Contact measuring voltage	5VDC +/- 5%
Contact measuring current	10mA max
Input impedance	680Ω
Contact resistance	≤100Ω, closed contact ≥500kΩ, open contact
Working modes (DP version excluded)	Selectable: • total and partial energy meters (kWh and kvarh) without digital inputs; • total and partial energy meters (kWh and kvarh) managed by time periods (t1-t2-t3-t4), W dmd synchronisation (the synchronisation is made every time the tariff changes) and GAS (m^3) or WATER (hot-cold m^3) or remote heating (kWh) meters; • total and partial energy meters (kWh and kvarh) managed by time periods (t1-t2), W dmd synchronisation (the synchronisation is made independently from the tariff selection) and GAS (m^3) or WATER (hot-cold m^3) or remote heating (kWh) meters; • total energy (kWh, kvarh) and GAS, WATER (hot-cold m^3) and remote heating meters (3 choices only).
Working modes (DP version only)	Selectable: • GAS (m^3) or WATER (hot-cold m^3) or remote heating (kWh) meters
Note	The energy metering is only made by means of the analogue inputs.
Insulation	By means of optocouplers, 4000 VRMS digital inputs to measuring inputs, 4000 VRMS digital inputs to power supply input.

Software functions

Password	Numeric code of max. 4 digits; 2 protection levels of the programming data:
1st level	Password “0”, no protection
2nd level	Password from 1 to 9999, all data are protected
System selection	
System 3-P.n unbalanced load	3-phase (4-wire)
System 3-P unbalanced load	3-phase (3-wire)
System 3-P.1 (only AV5 and AV6) balanced load	3-phase (3-wire) one current and 3-phase to phase voltage measurements
	3-phase (4-wire) one current and 1-phase (L1) to neutral voltage measurement
System 2-P	2-phase (3-wire)
System 1-P	1-phase (2-wire)
Transformer ratio	
VT (PT)	1.0 to 999.9 / 1000 to 6000 (only AV5 and AV6)
CT	1.0 to 999.9 / 1000 to 9999 / 10.00k to 60.00k (only AV5 and AV6). The maximum power being measured cannot exceed 210 MW (calculated as maximum input voltage and current, see the “Accuracy” paragraph before). The maximum VT by CT ratio is 48600. For MID complaint applications the maximum power being measured is 25MW.

Filter	
Operating range	0 to 100% of the input display scale
Filtering coefficient	1 to 32
Filter action	Measurements, serial output (fundamental variables: V, A, W and their derived ones).
Displaying	Up to 3 variables per page (see « Display pages ») 8 different set of variables available (see « Display pages ») according to the application being selected
Reset	By means of the front joystick: - dmd and dmd max; - total energies (kWh and kvarh) and gas/water; - partial energies and tariffs: kWh, kvarh
Easy connection function	
AV0, AV2 and AV9 models	Automatic phase sequence detection with current and voltage synchronisation.
AV5-AV6-AV0-AV2-AV9 models	For all the display selections, both energy and power measurements are independent from the current direction. The displayed energy is always “imported” with the only exception of “F” and “H” types (see “display pages” table). For those latter selections the energies can be either “imported” or “exported” depending on the current direction.

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, EN50470-1 and EN62053-23
Storage temperature	-30°C to +70°C (-22°F to 158°F) (R.H. < 90% non-condensing @ 40°C) according to EN62053-21, EN50470-1 and EN62053-23
Installation category	Cat. III (IEC60664, EN60664)
Insulation (for 1 minute)	4000 VRMS between measuring inputs and power supply 4000 VRMS between power supply and RS485/digital output

Dielectric strength	4000 VRMS for 1 minute
Noise rejection CMRR	100 dB, 48 to 62 Hz
EMC	According to EN62052-11
Electrostatic discharges	15kV air discharge
Immunity to irradiated electromagnetic fields	Test with current: 10V/m from 80 to 2000MHz Test without any current: 30V/m from 80 to 2000MHz
Burst	On current and voltage measuring inputs circuit: 4kV
Immunity to conducted disturbances	10V/m from 150KHz to 80MHz
Surge	On current and voltage measuring inputs circuit: 4kV; on “L” auxiliary power supply input: 1kV
Radio frequency suppression	According to CISPR 22

General specifications (cont.)

Standard compliance	
Safety	IEC60664, IEC61010-1 EN60664, EN61010-1 EN62052-11.
Metrology	EN62053-23, EN50470-3. MID "annex MI-003"
Pulse output	DIN43864, IEC62053-31
Approvals	CE, cULus listed (AV5, AV6, options only) MID (PF option only)
Connections	Screw-type
Cable cross-section area AV0-AV2-AV9 models	Max. 16 mm^2; Min. 2.5 mm^2 (measuring inputs); Min./Max. screws tightening torque: 1.7 Nm / 3 Nm Other inputs: 1.5 mm^2
	Screws tightening torque: 0.5 Nm
Cable cross-section area AV5-AV6 models	Max. 1.5 mm^2 Screws tightening torque: 0.5 Nm
Housing DIN	
Dimensions (WxHxD)	71 x 90 x 64.5 mm
Material	Nylon PA66, self-extinguishing: UL 94 V-0
Mounting	DIN-rail
Protection degree	
Front	IP50
Screw terminals	IP20
Weight	Approx. 400 g (packing included)

Power supply specifications

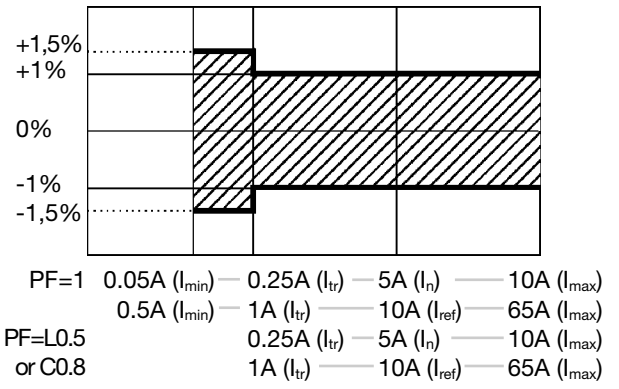
Self supplied version	AV9-AV0 models "XX" and "O2" options only: -20% +15%, 48-62Hz. "R2", "XS" and "IS" options only: -15% +10%, 48-62Hz. AV2 model: "XX", "O2", "IS" and "DP" options: -15% +15%, 48-62Hz. In case of 3-phase system, 4-wire connection: 113 to 265V. In case of 3-phase system, 3-wire connection: 196 to 460V.
Note	The instruments provided with "IS" and "R2" options work only if all the voltage inputs are connected (3-phase and neutral) if a 1-phase connection has to be performed the L1 and L2 voltage inputs have to be short circuited. The instrument provided with "O2" option, working in a 3-phase system with neutral may work also if one or two phases are missing.
Auxiliary power supply	AV5-AV6 modules: L: 18 to 60VAC/DC; D: 115VAC/230VAC (48 to 62Hz)
Power consumption	
AV9-AV2-AV0 models	≤ 20VA/1W
AV9-AV2-AV0 models (IS and DP option only)	≤ 12VA/2W
AV5-AV6 models	≤ 2VA/2W

Working mode notes (only "Self power supply" version)

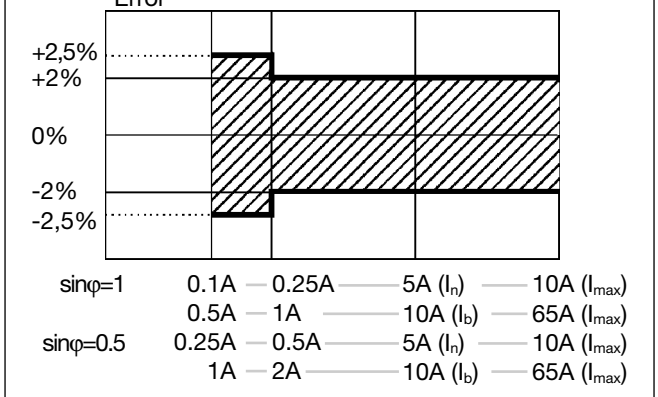
Output	Model	Note
Open collector output	"AV0" and "AV9" models with "O2" option	The meter works even if up to two voltages "phase to neutral" are missing or if one voltage "phase to phase" is missing.
Relay output	"AV0" and "AV9" models with "R2" option	The neutral wire has always to be available. The meter works even if "Phase 3" is missing but, mandatorily, both "phase 1" and "Phase 2" have to be available.
RS485 port	"AV0" and "AV9" models with "XS" and "IS" options	
Dupline port	"AV2" model with "DP" option	The meter works even if up to two voltages "phase to neutral" are missing or if one voltage "phase to phase" is missing.
Relay output	"AV2" model with "R2" option	
RS485 port	"AV2" model with "XS", "IS" options	

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 (option PF only)

Accuracy	0.9 Un ≤ U ≤ 1.1 Un; 0.98 fn ≤ f ≤ 1.02 fn; fn: 50; cosφ: 0.5 inductive to 0.8 capacitive.
AV2-AV9 models	Class B. I st: 0.04A; I min: 0.5A; I tr: 1A; I ref: 10A; I max: 65A.
AV5 models	Class B. I st: 0.01A; I min: 0.05A; I tr: 0.25A; I ref: 5A; I max: 10A.
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.

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

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

System variables

Equivalent three-phase voltage

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

Voltage asymmetry

$$ASY_{LL} = \frac{(V_{LL\max} - V_{LL\min})}{V_{LL\,\Sigma}}$$

$$ASY_{LN} = \frac{(V_{LN\max} - V_{LN\min})}{V_{LN\,\Sigma}}$$

Three-phase reactive power

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

Three-phase active power

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

Three-phase apparent power

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

Three-phase power factor (TPF)

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

Energy metering

$$k\,\mathrm{var}hi = \int_{t1}^{t2} Qi(t)dt \cong \Delta t \sum_{n1}^{n2} Qnj$$

$$kWhi = \int_{t1}^{t2} Pi(t)dt \cong \Delta t \sum_{n1}^{n2} Pnj$$

Where:

i= considered phase (L1, L2 or L3)
P= active power; **Q**= reactive power;
$\mathbf{t_1}$, $\mathbf{t_2}$ =starting and ending time points of consumption recording; **n**= time unit;**Δt**= time interval between two successive power consumptions;
$\mathbf{n_1}$, $\mathbf{n_2}$ = starting and ending discrete time points of consumption recording

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List of the variables that can be connected to:

- RS485 communication port
- Alarm outputs (“max” variable”, “energies” and “hour counter” excluded)
- Pulse outputs (only “energies”)
- Dupline bus

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	#	sys=system
2	V L1	x	x	x	x	x	#	
3	V L2	o	x	x	x	x	#	
4	V L3	o	o	x	x	x	#	
5	V L-L sys	o	x	x	x	x	x	sys=system
6	V L1-2	#	x	x	x	x	x	
7	V L2-3	#	o	x	x	x	x	
8	V L3-1	#	o	x	x	x	x	
9	A dmd max	o	x	x	x	x	x	Highest “dmd” current among the phases (1)(2)
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	#	
16	VA L2	o	x	x	x	x	#	
17	VA L3	o	o	x	x	x	#	
18	var sys	x	x	x	x	x	#	sys=system
19	var L1	x	x	x	x	x	#	
20	var L2	o	x	x	x	x	#	
21	var L3	o	o	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	#	
25	W L2	o	x	x	x	x	#	
26	W L3	o	o	x	x	x	#	
27	PF sys	x	x	x	x	x	x	
28	PF L1	x	x	x	x	x	#	
29	PF L2	o	x	x	x	x	#	
30	PF L3	o	o	x	x	x	#	
31	Hz	x	x	x	x	x	x	
32	Phase seq.	o	x	x	x	x	x	
33	Hours	x	x	x	x	x	x	
34	kWh (+)	x	x	x	x	x	x	Total or by user
35	kvarh (+)	x	x	x	x	x	#	Total or by user
36	kWh (+)	x	x	x	x	x	x	Partial or by tariff
37	kvarh (+)	x	x	x	x	x	#	Partial or by tariff
38	kWh (-)	x	x	x	x	x	x	Total
39	kvarh (-)	x	x	x	x	x	#	Total
40	m^3 Gas	x	x	x	x	x	x	Total
41	m^3 Cold H_2O	x	x	x	x	x	x	Total
42	m^3 Hot H_2O	x	x	x	x	x	x	Total
43	kWh H_2O	x	x	x	x	x	x	Total

(x) = available
(o) = not available (zero indication on the display)
(#) = not available (the relevant page is not displayed)
(1) = max. value with data storage
(2) = not available with the “DP” option

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Display pages

Sel. pos.	No	1st variable (1st line)	2nd variable (2nd line)	3rd variable (3rd line)	Note	Applications							
						A	B	C	D	E	F	G	H
	1	Phase seq.	VLN sys	Hz		7	7	7		7	7	7	7
	2	Phase seq.	VLL sys	Hz							x	x	x
	3	Total kWh (+)	W sys dmd	W sys dmd max		x	x	x		x	x	x	x
	4	kWh (+)	A dmd max	(text) “PArt”	“PArt” = Partial kWh (+)						x	x	x
	5	Total kvarh (+)	VA sys dmd	VA sys dmd max			7	7			7	7	7
	6	kvarh (+)	VA sys	(text) “PArt”	“PArt” = Partial kvarh (+)						7	7	7
	7	Totalizer 1 (2)	W sys	(text) (3)	(1)			x			x	x	x
	8	Totalizer 2 (2)	W sys	(text) (3)	(1)			x			x	x	x
	9	Totalizer 3 (2)	W sys	(text) (3)	(1)			x			x	x	x
	10	kWh (+)	t1 tariff (4)	W sys dmd	(1) digital input enabled			x			x	x	x
	11	kWh (+)	t2 tariff (4)	W sys dmd	(1) digital input enabled			x			x	x	x
	12	kWh (+)	t3 tariff (4)	W sys dmd	(1) digital input enabled			5			5	5	5
	13	kWh (+)	t4 tariff (4)	W sys dmd	(1) digital input enebled			5			5	5	5
	14	kvarh (+)	t1 tariff (4)	W sys dmd	(1) digital input enabled			7			7	7	7
	15	kvarh (+)	t2 tariff (4)	W sys dmd	(1) digital input enabled			7			7	7	7
	16	kvarh (+)	t3 tariff (4)	W sys dmd	(1) digital input enabled			5,7			5,7	5,7	5,7
	17	kvarh (+)	t4 tariff (4)	W sys dmd	(1) digital input enabled			5,7			5,7	5,7	5,7
	18	kWh (+) X	W X	User X	(1) specific function enabled				x				
	19	kWh (+) Y	W Y	User Y	(1) specific function enabled				x				
	20	kWh (+) Z	W Z	User Z	(1) specific function enabled				x				
	21	Total kvarh (-)	VA sys dmd	VA sys dmd max							7		7
	22	Total kWh (-)	W sys dmd	W sys dmd max						x	x		x
	23	Hours	W sys	PF sys						x	x	x	x
	24	Hours	var sys	PF sys						7	7	7	7
	25	var L1	var L2	var L3								7	7
	26	VA L1	VA L2	VA L3								7	7
	27	PF L1	PF L2	PF L3								7	7
	28	W L1	W L2	W L3						7		7	7
	29	A L1	A L2	A L3						x		x	x
	30	V L1-2	V L2-3	V L3-1								6	6
	31	V L1	V L2	V L3			7		7	7		7	7
0	Selector position which can be linked to any of the variable combinations listed above (No. from 1 to 31)												
1	Selector position which can be linked to any of the variable combinations listed above (No. from 1 to 31)												
2	Selector position which can be linked to any of the variable combinations listed above (No. from 1 to 31)												
3	Selector position which can be linked to any of the variable combinations listed above (No. from 1 to 31) In this position the front LED blinks proportionally to the reactive energy (kvarh) being measured												

(1) The page is available according to the enabled measurement.
(2) m^3 Gas, m^3 Water, kWh remote heating.
(3) Hot and Cold (water), GAS.
(4) The active tariff is displayed with an “A” before the “t1-t2-t3-t4” symbols.
(5) These pages are not available in case of Dupline system.
(6) Pages not available in case of 1-phase sysem (1P selection).
(7) Pages not available in case of 3-phase unbalanced system (3P selection).

Note: in case of alarm the whole display blinks. The blinking stops when either the selector or the joystick are used. The display starts to blink again after 60 seconds of the last command being used. There is a time-out of 60s that brings the scrolled page to the default one (selectable according to the table given above).

Additional available information on the display

Type	1st line	2nd line	3rd line
Meter information	Firmware revision	YEAr (text)	Year of production
Meter information	PuLSE (text)	LEd (text)	Numb. of kWh per pulse
Meter information	System (1-2-3-phase)	Connection (2-3-4-wire)	dmd (time)
Meter information	VT/PT ratio		
Meter information (AV5-6)	Ct rAtio (text)	1.0 ... 60.0k	
Meter information (AV5-6)	UT rAtio (text)	1.0 ...6.0k	
In case of communication port	SEriAL (text)	Address number	RS485 status (RX-TX)
In case of Dupline port	Dupline (text) or EM24 (text)	OK ... err	

List of selectable applications

	Description	Notes
A	Basic domestic	Mainly energy metering
B	Shopping centres	Mainly energy metering
C	Advanced domestic	Mainly energy metering (total and based on tariff), gas and water metering
D	Multi domestic (also camping and marinas)	Mainly energy metering (3 by single phase)
E	Solar	Energy meter with some basic power analyzer functions
F	Industrial	Mainly 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 outputs	Open collector outputs	Comm. port and digital inputs	Dupline	Self power supply	Auxiliary power supply
Measuring Inputs	-	4kV	4kV	4kV	4kV	0kV	4kV
Relay outputs	4kV	-	-	-	-	4kV	4kV
Open collector outputs	4kV	-	-	-	-	4kV	4kV
Comm. port and digital inputs	4kV	-	-	-	-	4kV	4kV
Dupline	4kV	-	-	-	-	4kV	4kV
Self power supply	0kV	4kV	4kV	4kV	4kV	-	-
Aux. power supply	4kV	4kV	4kV	4kV	4kV	-	-

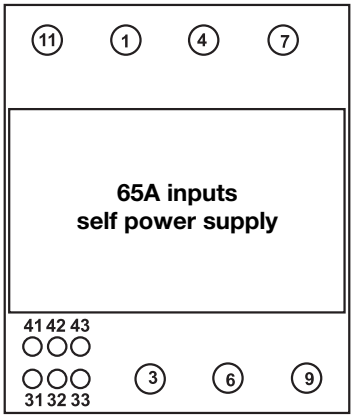
NOTE: all the models with auxiliary power supply have, mandatorily, to be connected to external current transformers because the isolation among the current inputs is just functional (100VAC).

Tamper proof accessory kit

The “tamper proof” kit is available with the “P” option (two screw protection covers).

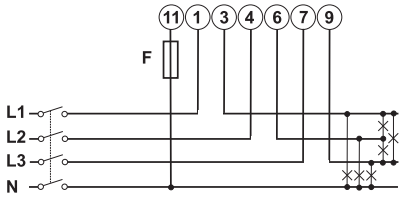
The instrument can be sealed in three points:
- Upper cover;
- Lower cover;
- Front selector (to lock the instrument programming);

Wiring diagrams



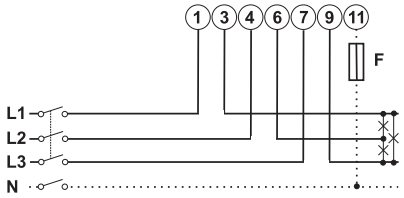
(65A) System type selection: 3P.n

3-ph, 4-wire, unbal./bal. load **Fig.1**



(65A) System type selection: 3P

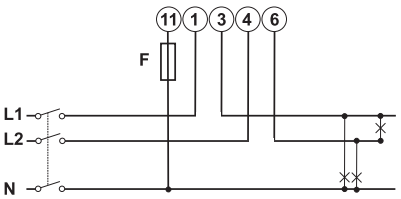
3-ph, 3-wire, unbal./bal. load **Fig. 2**



The neutral connection is mandatory with "IS" or "R2" options.

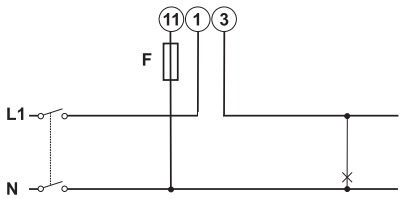
(65A) System type selection: 2P

2-ph, 3-wire, unbal./bal. load **Fig. 3**

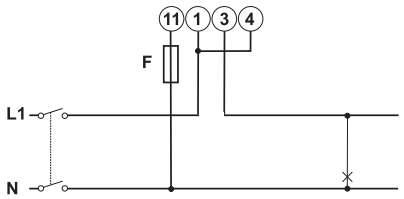


(65A) System type selection: 1P

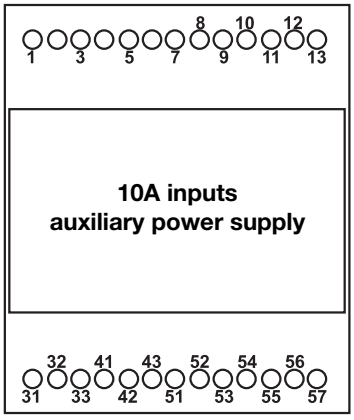
1-ph, 2-wire, "O2" option **Fig. 4**



1-ph, 2-wire, "IS" and "R2" option **Fig. 5**

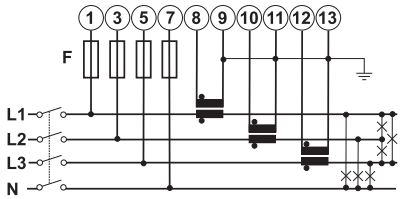


Note: the jumper between screw terminals "1" and "4" is not needed in case of "AV2" input range.



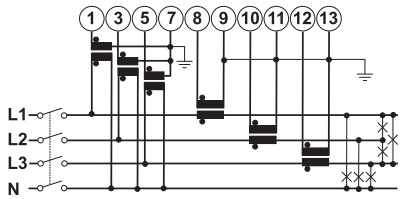
(10A) System type selection: 3P.n

3-ph, 4-wire, unbalanced load **Fig. 6**



3-CT connection

3-ph, 4-wire, unbalanced load **Fig. 7**



3-CT and 3-VT/PT connections

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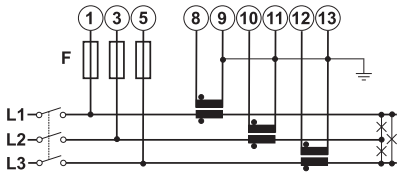
Wiring diagrams

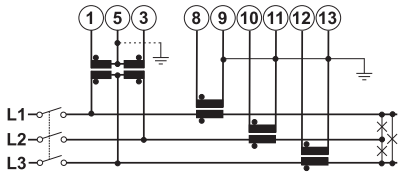
(10A) System type selection: 3P.n

3-ph, 3-wire, unbalanced load **Fig. 8**



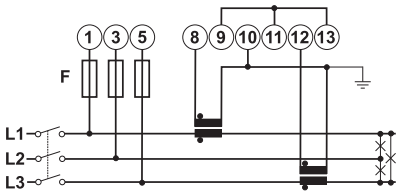
3-CT connection

3-ph, 3-wire, unbalanced load **Fig. 9**



3-CT and 2-VT/PT connections

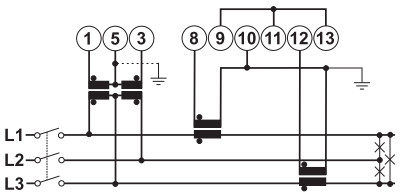
3-ph, 3-wire, unbalanced load **Fig. 10**



2-CT connections (ARON)

(10A) System type selection: 3P.1

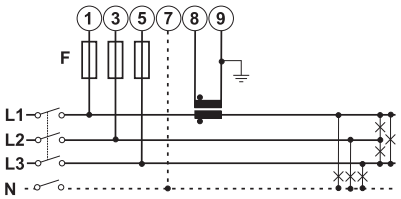
3-ph, 3-wire, unbalanced load **Fig. 11**



2-CT and 2-VT/PT connections ARON

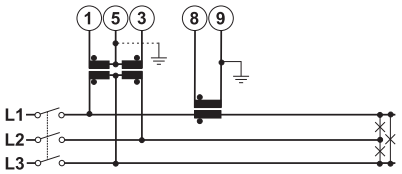
3-ph, 3-wire, balanced load **Fig. 12**

1-CT connection



NOTE: a 2-wire connection for voltage measurement is available accross ① and ⑦ .

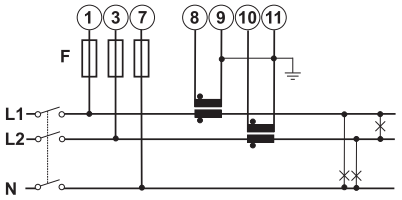
3-ph, 3-wire, balanced load **Fig. 13**



1-CT and 2-VT/PT connections

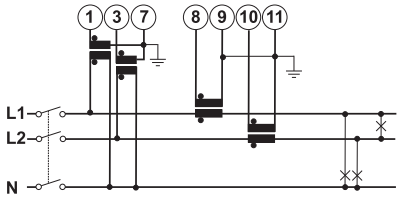
(10A) System type selection: 2P

2-ph, 3-wire **Fig. 14**



2-CT connection

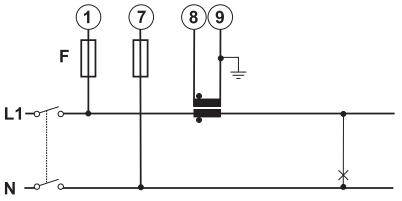
2-ph, 3-wire **Fig. 15**



2-CT and 2-VT/PT connections

(10A) System type selection: 1P

1-ph, 2-wire **Fig. 16**

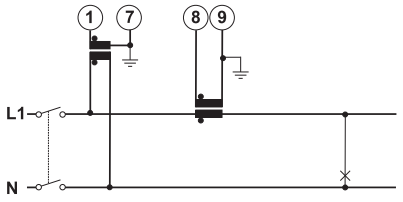


1-CT connection

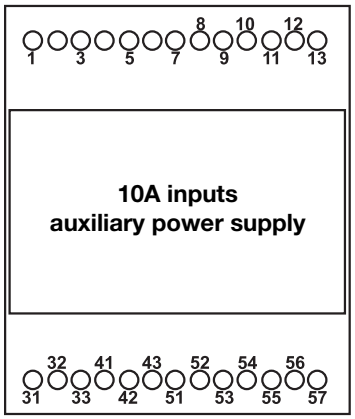
Wiring diagrams

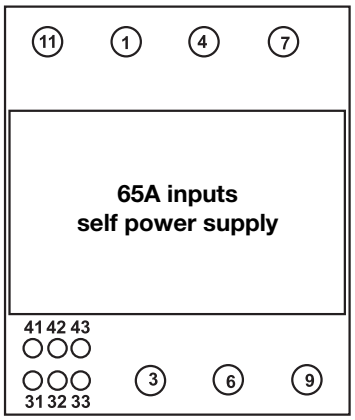
(10A) System type selection: 1P

1-ph, 2-wire **Fig. 17**



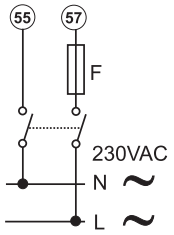
1-CT and 1-VT connections





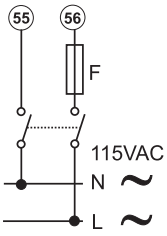
Power supply wiring diagrams (auxiliary power supply)

230VAC (“D” option)



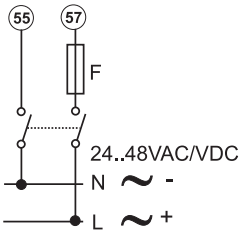
F= 250V [T] 50mA

115VAC (“D” option)



F= 250V [T] 100mA

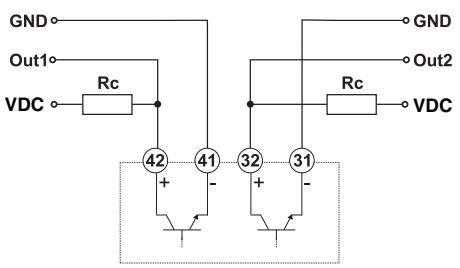
24 to 48VAC/DC (“L” option)



F= 250V [T] 200mA

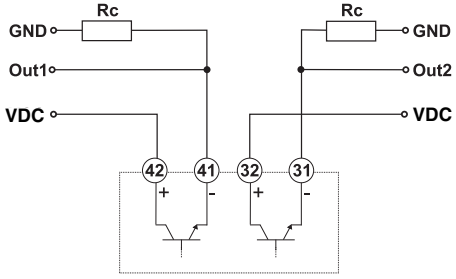
Open collector and relay outputs wiring diagrams

Open Collector



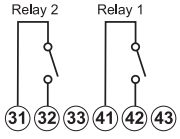
GND reference

Open Collector



VDC reference

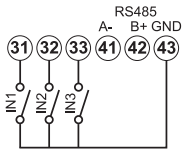
Relay



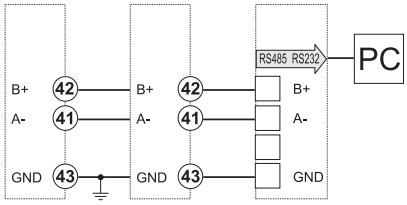
The load resistances (RC) must be designed so that the close contact current is lower than 100mA; the VDC voltage must be lower than or equal to 30VDC.

Digital inputs, RS485 and Dupline ports wiring diagrams

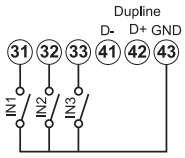
Digital Inputs and RS485



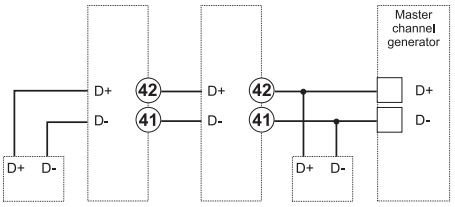
RS485 port



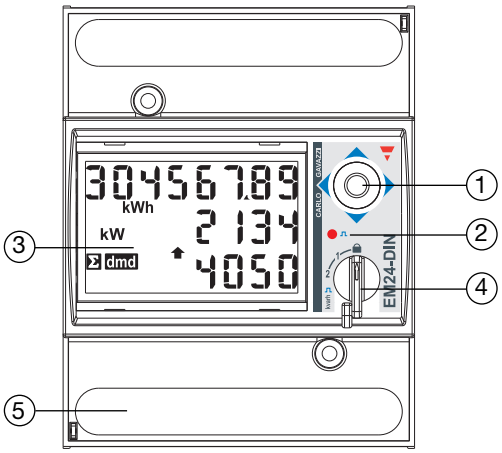
Digital Inputs and Dupline

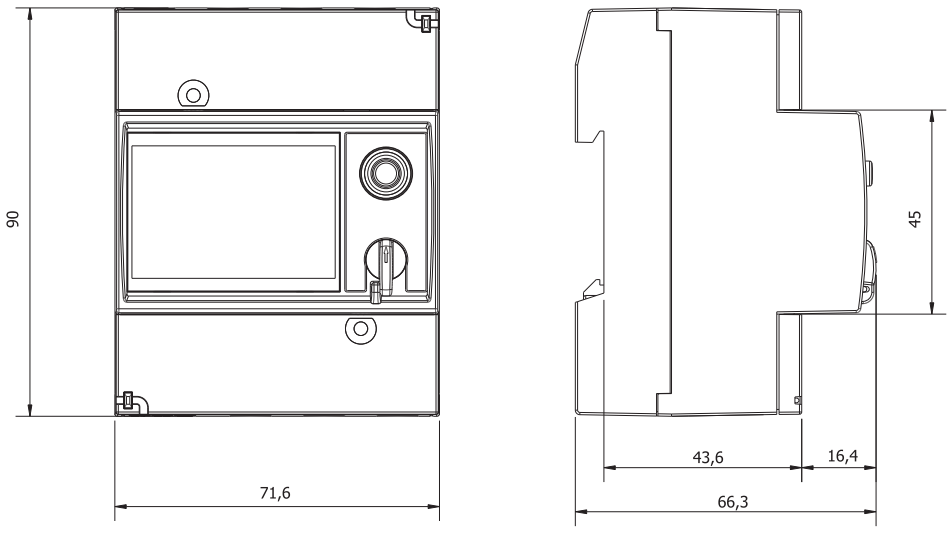


Dupline port



Front panel description



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

Dimensions