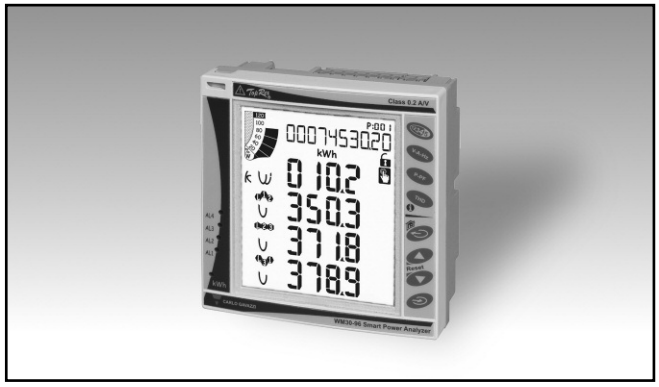
Energy Management Smart Modular Power Analyzer Type WM30 96

CARLO GAVAZZI



- Front protection degree: IP65, NEMA4X, NEMA12
- One RS232 or RS485 port (on request)
- Communication protocol: MODBUS-RTU, iFIX SCADA compatibility
- MODBUS TCP/IP Ethernet port (on request)
- BACNet-IP over Ethernet port (on request)
- Up to 2 digital outputs (pulse, alarm, remote control) (on request)
- Up to 4 freely configurable virtual alarms
- Up to 2 analogue outputs (+20mA, +10VDC) (on request)
- Class 0.5 (kWh) according to EN62053-22
- Class C (kWh) according to EN50470-3
- Class 2 (kvarh) according to EN62053-23
- Accuracy ±0.2% RDG (current/voltage)
- Instantaneous variables readout: 4x4 DGT
- Energies readout: 9+1 DGT
- System variables: VLL, VLN, A, VA, W, var, PF, Hz, Phase-sequence-asymmetry-loss.
- Single phase variables: VLL, VLN, AL, An (calculated), VA, W, var, PF
- Both system and single phase variables with average and max calculation
- Harmonic analysis (FFT) up to the 32nd harmonic (current and voltage)
- Energy measurements (imported/exported): total and partial kWh and kvarh
- Energy measurements according to ANSI C12.20 CA 0.5, ANSI C12.1 (revenue grade)
- Run hours counter (8+2 DGT)
- Real time clock function
- Application adaptable display and programming procedure (Easyprog function)
- Universal power supply: 18 to 60VAC/DC, 90 to 260AC/VDC
- Front dimensions: 96x96 mm

Product Description

Three-phase smart power analyzer with built-in advanced configuration system and LCD data displaying. Particularly recommended for the measurement of the main electrical variables. WM30 is based on a modular housing for panel mounting with IP65 (front) protection degree. Moreover, the analyzer can be provided with digital outputs that can be either for pulse proportional to the active and reactive energy being measured or/and for alarm outputs. The instrument can be equipped with the following modules: RS485/RS232, Ethernet, BACNet-IP communication ports, pulse and alarm outputs.

How to order

WM30-96 AV5 3 H R2 A2 S1 XX

- **Model**
- **Range code**
- **System**
- **Power Supply**
- **A Outputs**
- **B Outputs**
- **Communication**
- **Option**

Type Selection

Range codes

AV4: 400/690V_{LL} AC
1(2)A **(**)**
V_{LN}: 160V to 480V_{LN}
V_{LL}: 277V to 830V_{LL}

AV5: 400/690V_{LL} AC
5(6)A **(*)**
V_{LN}: 160V to 480V_{LN}
V_{LL}: 277V to 830V_{LL}

AV6: 100/208V_{LL} AC
5(6)A **(**)**
V_{LN}: 40V to 144V_{LN}
V_{LL}: 70V to 250V_{LL}

AV7: 100/208V_{LL} AC
1(2)A **(**)**
V_{LN}: 40V to 144V_{LN}
V_{LL}: 70V to 250V_{LL}

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

System

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

Power supply

H: 90 to 260V AC/DC (48 to 62Hz) **(*)**
L: 18 to 60VAC/DC (48 to 62Hz) **(**)**

A Outputs

XX: none **(*)**
O2: Dual channel static output **(*)**
R2: Dual channel relay output **(*)**

Options

XX: none

Communication

XX: none **(*)**
S1: RS485/RS232 port **(*)**
E2: Ethernet / Internet port **(**)**
BI: BACNet (IP) over Ethernet **(**)**

B Outputs

XX: none **(*)**
A2: Dual channel 20mA DC output **(*)**
V2: Dual channel 10V DC output **(*)**

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Position of modules and combination

Ref	Description	Main features	Part number	Pos. A	Pos. B	Pos. C
1	WM30 base provided with display, power supply, measuring inputs	• Inputs/system: AV5.3 • Power supply: H	WM30 AV5 3 H			
2		• Inputs/system: AV6.3 • Power supply: H	WM30 AV6 3 H			
3		• Inputs/system: AV5.3 • Power supply: L	WM30 AV5 3 L			
4		• Inputs/system: AV6.3 • Power supply: L	WM30 AV6 3 L			
5	Dual relay output (SPDT)	• 2-channel • Alarm or/and pulse output	M O R2 **(1)**	X		
6	Dual static output (AC/DC Opto-Mos)	• 2-channel • Alarm or/and pulse output	M O O2 **(1)**	X		
7	Dual analogue output (+20mADC)	• 2-channel	M O A2 **(2)**		X	
8	Dual analogue output (+10VDC)	• 2-channel	M O V2 **(2)**		X	
9	RS485 / RS232 port module	• Max. 115.2 Kbps	M C 485 232 **(3)**			X
10	Ethernet port module	• RJ45 10/100 BaseT	M C ETH **(3)**			X
11	BACNet-IP port module	• Based on Ethernet bus	M C BACnet-IP **(3)**			X

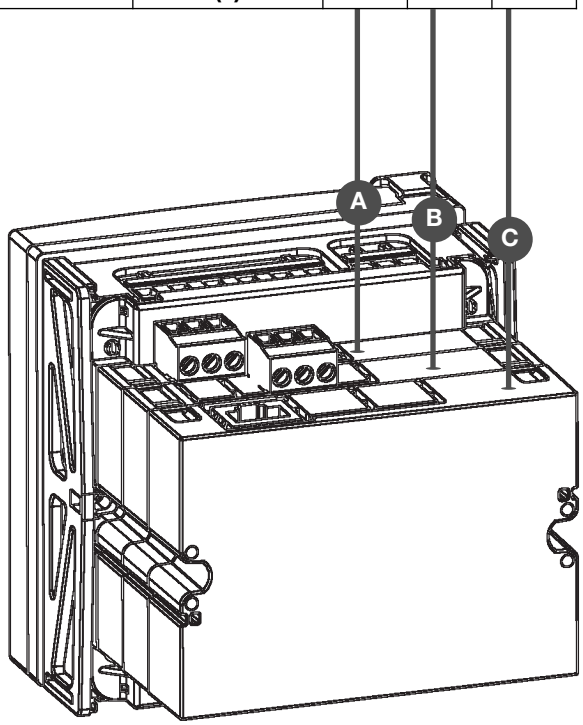
NOTE:

(1) Only one A type module per meter in a maximum combination of 3 total mixed modules on the same meter.
(2) Only one B type module per meter in a maximum combination of 3 total mixed modules on the same meter.
(3) Only one C type module per meter in a maximum combination of 3 total mixed modules on the same meter.

The B-C position is not mandatory, if to fulfil the application, module “A” is not necessary, then maybe just “B” can be mounted.

Another example: if modules “A” and “B” (anyone) are not needed, then just module “C” maybe be mounted. If “A” module is needed, it is mandatory to put it in “A” position.

When no modules are mounted, then WM30-96 becomes a simple indicator.



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Input specifications

Rated inputs	System type: 1, 2 or 3-phase
Current type	Galvanic insulation by means of built-in CT's
Current range (by CT)	AV5 and AV6: 5(6)A AV4 and AV7: 1(2)A
Voltage (by direct connection or VT/PT)	AV4, AV5: 400/690VLL; AV6, AV7: 100/208VLL
Accuracy (Display + RS485) (@25°C ±5°C, R.H. ≤60%, 48 to 62 Hz)	In: see below, Un: see below
AV4 model	In: 1A, Imax: 2A; Un: 160 to 480VLN (277 to 830VLL)
AV5 model	In: 5A, Imax: 6A; Un: 160 to 480VLN (277 to 830VLL)
AV6 model	In: 5A, Imax: 6A; Un: 40 to 144VLN (70 to 250VLL)
AV7 model	In: 1A, Imax: 2A; Un: 40 to 144VLN (70 to 250VLL)
Current AV4, AV5, AV6, AV7 models	From 0.01In to 0.05In: ±(0.5% RDG +2DGT) From 0.05In to Imax: ±(0.2% RDG +2DGT)
Phase-neutral voltage	In the range Un: ±(0,2% RDG +1DGT)
Phase-phase voltage	In the range Un: ±(0.5% RDG +1DGT)
Frequency	±0.1Hz (45 to 65Hz)
Active and Apparent power	0.01In to 0.05In, PF 1: ±(1%RDG+1DGT) From 0.05In to Imax PF 0.5L, PF1, PF0.8C: ±(0.5%RDG+1DGT)
Power Factor	±[0.001+0.5% (1.000 - "PF RDG")]
Reactive power	0.1In to Imax, senϕ 0.5L/C: ±(1%RDG+1DGT) 0.05In to 0.1In, senϕ 0.5L/C: ±(1.5%RDG+1DGT) 0.05In to Imax, senϕ 1: ±(1%RDG+1DGT) 0.02In to 0.05In, senϕ 1: ±(1.5%RDG+1DGT)
Active energy	Class 0.5 according to EN62053-22, ANSI C12.20 Class C according to EN50470-3.
Reactive energy	Class 1 according to EN62053-23, ANSI C12.1.
Start up current AV5, AV6	5mA
Start up current AV4, AV7	1mA

Energy additional errors	According to EN62053-22, ANSI C12.20,
Influence quantities	Class B or C according to EN50470-3, EN62053-23, ANSI C12.1
Total Harmonic Distortion (THD)	±1% FS (FS: 100%) AV4: Imin: 5mARMS; Imax: 15Ap; Umin: 30VRMS; Umax: 585Vp AV5: Imin: 5mARMS; Imax: 15Ap; Umin: 30VRMS; Umax: 585Vp AV6: Imin: 5mARMS; Imax: 15Ap; Umin: 30VRMS; Umax: 585Vp AV7: Imin: 5mARMS; Imax: 15Ap; Umin: 30VRMS; Umax: 585Vp
Temperature drift	≤200ppm/°C
Sampling rate	3200 samples/s @ 50Hz, 3840 samples/s @ 60Hz
Measurements	See "List of the variables that can be connected to:"
Method	TRMS measurements of distorted wave forms.
Coupling type	By means of CT's
Crest factor	AV5, AV6: ≤3 (15A max. peak) AV4, AV7: ≤3 (3A max. peak)
Current Overloads	
Continuous (AV5 and AV6)	6A, @ 50Hz
Continuous (AV4 and AV7)	2A, @ 50Hz
For 500ms (AV5 and AV6)	120A, @ 50Hz
For 500ms (AV4 and AV7)	40A, @ 50Hz
Voltage Overloads	
Continuous	1.2 Un
For 500ms	2 Un
Input impedance	
400VL-L (AV4 and AV5)	> 1.6MΩ
208VL-L (AV6 and AV7)	> 1.6MΩ
5(10)A (AV5 and AV6)	< 0.2VA
1(2)A (AV4 and AV7)	< 0.2VA
Frequency	40 to 440 Hz

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Output specifications

Relay outputs (M O R2)	
Physical outputs	2 (max. one module per instrument)
Purpose	For either alarm output or pulse output
Type	Relay, SPDT type AC 1-5A @ 250VAC; AC 15-1.5A @ 250VAC DC 12-5A @ 24VDC; DC 13-1.5A @ 24VDC
Configuration	By means of the front key-pad
Function	The outputs can work as alarm outputs but also as pulse outputs, remote controlled outputs, or in any other combination.
Alarms	Up alarm and down alarm linked to the virtual alarms, other details see Virtual alarms
Min. response time	≤200ms, filters excluded. Set-point on-time delay: “0 s”.
Pulse	
Signal retransmission	Total: +kWh, -kWh, +kvarh, -kvarh. Partial: +kWh, -kWh, +kvarh, -kvarh.
Pulse type	The above listed variables can be connected to any output.
Pulse duration	Programmable from 0.001 to 10.00 kWh/kvarh per pulse. ≥100ms <120msec (ON), ≥120ms (OFF), according to EN62052-31
Remote controlled outputs	The activation of the outputs is managed through the serial communication port
Insulation	See “Insulation between inputs and outputs” table
Static outputs (M O O2)	Opto-Mos type
Physical outputs	2 (max. one module per instrument)
Purpose	For either pulse output or alarm output
Signal	V_{ON}:2.5VAC/DC/max.100mA V_{OFF}: 260VAC/DC max.
Configuration	By means of the front key-pad
Function	The outputs can work as alarm outputs but also as pulse outputs, remote controlled outputs, or in any other combination.
Alarms	Up alarm and down alarm linked to the virtual alarms, other details see Virtual alarms
Min. response time	≤200ms, filters excluded. Set-point on-time delay: “0 s”.
Pulse	
Signal retransmission	Total: +kWh, -kWh, +kvarh, -kvarh. Partial: +kWh, -kWh, +kvarh, -kvarh.
Pulse type	The above listed variables can be connected to any output.
Pulse duration	Programmable from 0.001 to 10.00 kWh/kvarh per pulse. ≥100ms < 120msec (ON), ≥120ms (OFF), according to EN62052-31
Remote controlled outputs	The activation of the outputs is managed through the serial communication port
Insulation	See “Insulation between inputs and outputs” table
20mA analogue outputs (M O A2)	
Number of outputs	2 (max. one module per instrument)
Accuracy (@ 25°C ±5°C, R.H. ≤60%)	±0.2%FS
Range	0 to 20mA
Configuration	By means of the front key-pad
Signal retransmission	The signal output can be connected to any instantaneous variable available in the table “List of the variables that can be connected to”.
Scaling factor	Programmable within the whole range of retransmission; it allows the retransmission management of all values from 0 to 20 mADC.
Response time	≤400 ms typical (filter excluded)
Ripple	≤1% (according to IEC 60688-1, EN 60688-1)
Total temperature drift	≤500 ppm/°C
Load	≤600Ω
Insulation	See “Insulation between inputs and outputs” table
10VDC analogue outputs (M O V2)	
Number of outputs	2 (max. one module per instrument)
Accuracy (@ 25°C ±5°C, R.H. ≤60%)	±0.2%FS
Range	0 to 10 VDC
Configuration	By means of the front key-pad

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Output specifications (cont.)

Signal retransmission	The signal output can be connected to any instantaneous variable available in the table “List of the variables that can be connected to”.
Scaling factor	Programmable within the whole range of retransmission; it allows the retransmission management of all values from 0 to 10VDC.
Response time	≤400 ms typical (filter excluded)
Ripple	≤1% (according to IEC 60688-1, EN 60688-1)
Total temperature drift	≤500 ppm/°C
Load	≥10kΩ
Insulation	See “Insulation between inputs and outputs” table
RS485/RS422 port (on request)	
Type	Multidrop, bidirectional (static and dynamic variables)
Connections	2-wire Max. distance 1000m, termination directly on the module
Addresses	247, selectable by means of the front key-pad
Protocol	MODBUS/JBUS (RTU)
Data (bidirectional)	
Dynamic (reading only)	System and phase variables: see table “List of variables...”
Static (reading and writing only)	All the configuration parameters.
Data format	1 start bit, 8 data bit, no/even/odd parity,1 stop bit
Baud-rate	Selectable: 9.6k, 19.2k, 38.4k, 115.2k bit/s
Driver input capability	1/5 unit load. Maximum 160 transceivers on the same bus.
Note	With the rotary switch (on the back of the basic unit) in lock position the modification of the programming parameters and the reset command by means of the serial communication is not allowed anymore. In this case just the data reading is allowed.
Insulation	See “Insulation between inputs and outputs” table
RS232 port (on request)	
Type	Bidirectional (static and dynamic variables)
Connections	3 wires. Max. distance 15m
Protocol	MODBUS RTU /JBUS
Data (bidirectional)	
Dynamic (reading only)	System and phase variables: see table “List of variables...”
Static (reading and writing only)	All the configuration parameters
Data format	1 start bit, 8 data bit, no/even/odd parity,1 stop bit
Baud-rate	Selectable: 9.6k, 19.2k, 38.4k, 115.2k bit/s
Note	With the rotary switch (on the back of the basic unit) in lock position the modification of the programming parameters and the reset command by means of the serial communication is not allowed anymore. In this case just the data reading is allowed.
Insulation	See “Insulation between inputs and outputs” table
Ethernet/Internet port (on request)	
Protocols	Modbus TCP/IP
IP configuration	Static IP / Netmask / Default gateway
Port	Selectable (default 502)
Client connections	Max 5 simultaneously
Connections	RJ45 10/100 BaseTX Max. distance 100m
Data (bidirectional)	
Dynamic (reading only)	System and phase variables: see table “List of variables...”
Static (reading and writing only)	All the configuration parameters.
Note	With the rotary switch (on the back of the basic unit) in lock position the modification of the programming parameters and the reset command by means of the serial communication is not allowed anymore. In this case just the data reading is allowed.
Insulation	See “Insulation between inputs and outputs” table
BACnet-IP (on request)	
Protocols	BACnet-IP (for measurement reading purpose) and Modbus TCP/IP (for measurement

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Output specifications (cont.)

	reading purpose and for programming parameter purpose)
IP configuration	Static IP / Netmask / Default gateway
BACnet-IP Port	Fixed: BAC0h
Modbus Port	Selectable (default 502)
Client connections	Modbus only: max 5 simultaneously
Connections	RJ45 10/100 BaseTX Max. distance 100m
Data	
Dynamic (reading only)	System and phase variables (BACnet-IP and Modbus): see table “List of variables...”
Static (reading and writing only)	
Note	All the configuration parameters (Modbus only). With the rotary switch (on the back of the basic unit) in lock position the modification of the programming parameters and the reset command by means of the serial communication is not allowed anymore. In this case just the data reading is allowed.
Insulation	See “Insulation between inputs and outputs” table

Energy meters

Meters	
Total	4 (9+1 digit)
Partial	4 (9+1 digit)
Pulse output	Connectable to total and/or partial meters
Energy meter recording	Storage of total and partial energy meters. Energy meter storage format (EEPROM) Min. -9,999,999,999.9 kWh/kvarh Max. 9,999,999,999.9 kWh/kvarh.

Energy Meters	
Total energy meters	+kWh, +kvarh, -kWh, -kvarh
Partial energy meters	+kWh, +kvarh, -kWh, -kvarh

Harmonic distortion analysis

Analysis principle	FFT
Harmonic measurement	
Current	Up to the 32nd harmonic
Voltage	Up to the 32nd harmonic
Type of harmonics	THD (VL1 and VL1-N) The same for the other phases: L2, L3. THD (AL1) The same for the other phases: L2, L3.

System	The harmonic distortion can be measured in 3-wire or 4-wire systems. Tw: 0.02 sec@50Hz without filter

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Display, LED's and commands

Display refresh time	≤ 100 ms
Display	4 lines, 4-DGT, 1 lines, 10-DGT
Type	LCD, single colour backlight
Digit dimensions	4-DGT: h 9.5mm; 10-DGT: h 6.0mm
Instantaneous variables read-out	4-DGT
Energies variables read-out	Imported Total/Partial: 9+1DGT or 10DGT; Exported Total/Partial: 9+1DGT or 10DGT (with "-" sign).
Run Hours counter	8+2 DGT (99.999.999 hours and 59 minutes max)
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 99.9 or 9 999 999 999. Min. instantaneous variables: 0.000; energies 0.0
Front position LEDs	
Virtual alarms	4 red LED available in case of virtual alarm (AL1-AL2-AL3-AL4). Note: the real alarm is just the activation of the proper static or relay output if the proper module is available.
Energy consumption kWh pulsating	Red LED (only kWh) 0.001 kWh/kvarh by pulse if the Ct ratio by VT ratio is ≤7 0.01 kWh/kvarh by pulse if the Ct ratio by VT ratio is ≥7.1 ≤70.0 0.1 kWh/kvarh by pulse if the Ct ratio by VT ratio is ≥70.1 ≤700.0 1 kWh/kvarh by pulse if the Ct ratio by VT ratio is ≥700.1 ≤7000 10 kWh/kvarh by pulse if the Ct ratio by VT ratio is ≥7001 ≤70.00k 100 kWh/kvarh by pulse if the Ct ratio by VT ratio is >70.01k Max frequency: 16Hz, according to EN50470-1
Back position LEDs	
On the base	Green as power-on
On the communication modules	Two LEDs: one for TX (green) and one for RX (amber).
Key-pad	For variable selection, programming of the instrument working parameters, "dmd", "max", total energy and partial energy Reset

Main 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-Ph.n unbalanced load	3-phase (4-wire)
System 3-Ph. unbalanced load	3-phase (3-wire), three currents and 3-phase to phase voltage measurements, or in case of Aaron connection two currents (with special wiring on screw terminals) and 3-phase to phase voltage measurements.
System 3-Ph.1 balanced load	3-phase (3-wire), one current and 3-phase to phase voltage measurements
System 3-Ph.n balanced load	3-phase (4-wire), one current and 3-phase to neutral voltage measurements.
System 3-Ph.2 balanced load	3-phase (2-wire), one current and 1-phase (L1) to neutral voltage measurement.
System 2-Ph	2-phase (3-wire)
System 1-Ph	1-phase (2-wire)
Transformer ratio	
VT (PT)	1.0 to 999.9 / 1000 to 9999.
CT	1.0 to 999.9 / 1000 to 9999 (up to 10kA in case of CT with 1A secondary current and up to 50kA in case of CT with 5A secondary current).

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Main functions (cont.)

Filter	
Operating range	Selectable from 0 to 100% of the input display scale
Filtering coefficient	Selectable from 1 to 32
Filter action	Measurements, analogue signal retransmission, serial communication (fundamental variables: V, A, W and their derived ones).
Displaying	
Number of variables	Up to 5 variables per page. See “Front view”. 7 different set of variables available (see “Display pages”) according to the application being selected. One page is freely programmable as combination of variables.
Backlight	The backlight time is programmable from 0 (always on) to 255 minutes
Virtual alarms	
Working condition	In case of basic unit or with the addition of M O R2 or M O O2 digital output modules.
No. of alarms	Up to 4
Working mode	Up alarm and down alarm.
Controlled variables	The alarms can be connected to any instantaneous variable available in 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 9999s
Min. response time	≤ 200ms, filters excluded. Set-point on-time delay: “0 s”.
Reset	By means of the front key-pad. It is possible to reset the following data: - all the max and dmd values. - total energies: kWh, kvarh; - partial energies: kWh, kvarh
Harmonic analysis	Up to the 32nd harmonics on current and voltage
Clock	
Functions	Universal clock and calendar.
Time format	Hour: minutes: seconds with selectable 24 hours or AM/PM format.
Date format	Day-month-year with selectable DD-MM-YY or MM-DD-YY format.
Battery life	10 years
Easy connection function	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 “D”, “F” and “G” 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)	See “Insulation between inputs and outputs” table
Dielectric strength	4kVAC RMS 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	Test with current: 10V/m from 80 to 2000MHz
Electromagnetic fields	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

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General specifications (cont.)

Radio frequency suppression	supply input: 1kV According to CISPR 22
Standard compliance	
Safety	IEC60664, IEC61010-1 EN60664, EN61010-1 EN62052-11.
Metrology	EN62053-21, EN62053-23, EN50470-3. MID ”annex MI-003”
Pulse output	DIN43864, IEC62053-31
Approvals	CE, cULus “Listed”
Connections	Screw-type
Cable cross-section area	max. 2.5 mm^2. min./max. screws tightening torque: 0.4 Nm / 0.8 Nm. Suggested screws tightening torque: 0.5 Nm

Housing DIN	
Dimensions (WxHxD)	Module holder: 96x96x50mm. “A” and “B” type modules: 89.5x63x16mm. “C” type module: 89.5x63x20mm.
Max. depth behind the panel	With 3 modules (A+B+C): 81.7 mm
Material	ABS, self-extinguishing: UL 94 V-0
Mounting	Panel mounting
Protection degree	
Front	IP65, NEMA4x, NEM12
Screw terminals	IP20
Weight	Approx. 400 g (packing included)

Power supply specifications

Auxiliary power supply	H: 90 to 260VAC/DC; L: 18 to 60VAC/DC (48 to 62Hz)
Power consumption	AC: 6 VA; DC: 3.5 W

Insulation between inputs and outputs

	Measuring Inputs	Relay outputs	Static Outputs	Communication port	Analogue Outputs	Auxiliary power supply
Measuring Inputs	-	4kV	4kV	4kV	4kV	4kV
Relay outputs	4kV	2kV	NA	4kV	4kV	4kV
Static Outputs	4kV	NA	2kV	4kV	4kV	4kV
Communication port	4kV	4kV	4kV	-	4kV	4kV
Analogue Outputs	4kV	4kV	4kV	4kV	0kV	4kV
Aux. power supply	4kV	4kV	4kV	4kV	4kV	-

NOTE: in the table “NA” means combination of modules not allowed.
NOTE: all the models have, mandatory, to be connected to external current transformers because the isolation among the current inputs is just functional (100VAC).

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List of the variables that can be connected to:

- Communication port (all listed variables)
- Analogue outputs (all variables with the only exclusion of “energies” and “run hour counter”
- Pulse outputs (only “energies”)
- Alarm outputs (“energies” , “hour counter” and “max” excluded)

No	Variable	1-ph. sys	2-ph. sys	3-ph. 3/4-wire balanced sys	3-ph. 2-wire balanced sys	3-ph. 3-wire unbal. sys	3-ph. 4-wire unbal. sys	Notes
1	VL-N sys	O	X	X	X	#	X	sys= system= ∑ (1)
2	VL1	X	X	X	X	#	X	(1)
3	VL2	O	X	X	X	#	X	(1)
4	VL3	O	O	X	X	#	X	(1)
5	VL-L sys	O	X	X	X	X	X	sys= system= ∑ (1)
6	VL1-2	#	X	X	X	X	X	(1)
7	VL2-3	#	O	X	X	X	X	(1)
8	VL3-1	#	O	X	X	X	X	(1)
9	AL1	X	X	X	X	X	X	(1)
10	AL2	O	X	X	X	X	X	(1)
11	AL3	O	O	X	X	X	X	(1)
12	VA sys	X	X	X	X	#	X	sys= system= ∑ (1)
13	VA L1	X	X	X	X	#	X	(1)
14	VA L2	O	X	X	X	#	X	(1)
15	VA L3	O	O	X	X	#	X	(1)
16	var sys	X	X	X	X	#	X	sys= system= ∑ (1)
17	var L1	X	X	X	X	#	X	(1)
18	var L2	O	X	X	X	#	X	(1)
19	var L3	O	O	X	X	#	X	(1)
20	W sys	X	X	X	X	X	X	sys= system= ∑ (1)
21	WL1	X	X	X	X	#	X	(1)
22	WL2	O	X	X	X	#	X	(1)
23	WL3	O	O	X	X	#	X	(1)
24	PF sys	X	X	X	X	#	X	sys= system= ∑ (1)
25	PF L1	X	X	X	X	#	X	(1)
26	PF L2	O	X	X	X	#	X	(1)
27	PF L3	O	O	X	X	#	X	(1)
28	Hz	X	X	X	X	X	X	(1)
29	Phase seq.	O	X	X	X	X	X	
30	Asy VLL	O	O	X	X	X	X	Asymmetry
31	Asy VLN	O	O	X	X	O	X	Asymmetry
32	Run Hours	X	X	X	X	X	X	
33	kWh (+)	X	X	X	X	X	X	Total
34	kvarh (+)	X	X	X	X	#	X	Total
35	kWh (+)	X	X	X	X	X	X	Partial
36	kvarh (+)	X	X	X	X	#	X	Partial
37	kWh (-)	X	X	X	X	X	X	Total
38	kvarh (-)	X	X	X	X	#	X	Total
39	kWh (-)	X	X	X	X	X	X	Partial
40	kvarh (-)	X	X	X	X	#	X	Partial
41	A L1 THD	X	X	X	X	X	X	(1)
42	A L2 THD	O	X	X	X	X	X	(1)
43	A L3 THD	O	O	X	X	X	X	(1)
44	V L1 THD	X	X	X	X	O	X	(1)
45	V L2 THD	O	X	X	X	O	X	(1)
46	V L3 THD	O	O	X	X	O	X	(1)
47	V L1-2 THD	X	X	X	X	X	X	(1)
48	V L2-3 THD	O	X	X	X	X	X	(1)
49	V L3-1 THD	O	O	X	X	X	X	(1)

(X) = available; (O) = not available (variable not available on the display); (#) Not available (the relevant page is not displayed) (1) Max. value with data storage

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List of selectable applications

	Description	Notes
A	Cost allocation	Imported energy metering
B	Cost control	Imported and partial energy metering
C	Complex cost allocation	Imported/exported energy (total and partial)
D	Solar	Imported and exported energy metering with some basic power analyzer function
E	Complex cost and power analysis	Imported/exported energy (total and partial) and power analysis
F	Cost and power quality analysis	Imported energy and power quality analysis
G	Advanced energy and power analysis for power generation	Complete energy metering and power quality analysis

Display pages

Var Type	No	Line 1 Variable Type	Line 2 Variable Type	Line 3 Variable Type	Line 4 Variable Type	Line 5 Variable Type	Note	Applications						
								A	B	C	D	E	F	G
	0	Total kW (+)	Programmable					x	x	x	x	x	x	x
a	1	Total kW (+)	b, c, d	b, c, d	b, c, d	b, c, d		x	x	x	x	x	x	x
a	2	Total kvarh (+)	b, c, d	b, c, d	b, c, d	b, c, d		x	x	x	x	x	x	x
a	3	Total kWh (-)	b, c, d	b, c, d	b, c, d	b, c, d				x	x	x		x
a	4	Total kvarh (-)	b, c, d	b, c, d	b, c, d	b, c, d				x	x	x		x
a	5	kWh (+) partial	b, c, d	b, c, d	b, c, d	b, c, d			x	x		x	x	x
a	6	kvarh (+) part.	b, c, d	b, c, d	b, c, d	b, c, d			x	x		x	x	x
a	7	kWh (-) partial	b, c, d	b, c, d	b, c, d	b, c, d				x		x		x
a	8	kvarh (-) part.	b, c, d	b, c, d	b, c, d	b, c, d				x		x		x
a	9	Run Hours (99999999.99)	b, c, d	b, c, d	b, c, d	b, c, d				x	x	x	x	x
b	10	a/Phase seq.	VLN ∑	VL1	VL2	VL3	(1) (2)				x	x	x	x
b	11	a/Phase seq.	VLN ∑	VL1-2	VL2-3	VL3-1	(1) (2)				x	x	x	x
b	12	a/Phase seq.	An	AL1	AL2	AL3	(1) (2)				x	x	x	x
b	13	a/Phase seq.	Hz	“ASY”	VLL sys (% asy)	VLL sys (% asy)	(1) (2)				x	x	x	x
c	14	a/Phase seq.	W ∑	WL1	WL2	WL3	(1) (2)				x	x	x	x
c	15	a/Phase seq.	var ∑	var L1	var L2	var L3	(1) (2)					x	x	x
c	16	a/Phase seq.	PF ∑	PF L1	PF L2	PF L3	(1) (2)					x	x	x
c	17	a/Phase seq.	VA ∑	VA L1	VA L2	VA L3	(1) (2)					x	x	x
d	18	a/Phase seq.		THD V1	THD V2	THD V3	(1) (2)						x	x
d	19	a/Phase seq.		THD V12	THD V23	THD V31	(1) (2)						x	x
d	20	a/Phase seq.		THD A1	THD A2	THD A3	(1) (2)						x	x

(1) Also maximum value storage.
(2) Also average (dmd) value storage.

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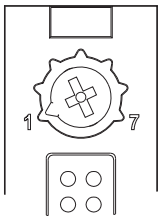
Additional available information on the display

No	Line 1	Line 2	Line 3	Line 4	Line 5	Note	Applications						
							A	B	C	D	E	F	G
1	Lot n. (text) xxxx	Yr. (text) xx	SYS (text)	x (1/2/3)	1...60 (min) “dmd”		x	x	x	x	x	x	x
2	Conn. xxx.x (3ph.n/3ph/3ph./ 3ph.2/1ph/2ph)	CT.rA (text)	1.0 … 99.99k	PT.rA (text)	1.0...9999		x	x	x	x	x	x	x
3	LED PULSE (text) kWh	xxxx kWh per pulse					x	x	x	x	x	x	x
4	PULSE out1 (text) kWh/kvarh	xxxx kWh/kvarh per pulse	+/- tot/PAr				x	x	x	x	x	x	x
5	PULSE out2 (text) kWh/kvarh	xxxx kWh/kvarh per pulse	+/- tot/PAr				x	x	x	x	x	x	x
6	Remote out	out1 (text)	on/oFF	Out2 (text)	on/oFF		x	x	x	x	x	x	x
7	Alarm 1 nE/nd	None / out 1 / out 2	Set 1	Set 2	(measurement)					x	x	x	x
8	Alarm 2 nE/nd	None / out 1 / out 2	Set 1	Set 2	(measurement)					x	x	x	x
9	Alarm 3 nE/nd	None / out 1 / out 2	Set 1	Set 2	(measurement)					x	x	x	x
10	Alarm 4 nE/nd	None / out 1 / out 2	Set 1	Set 2	(measurement)					x	x	x	x
11	Analogue 1	Hi:E	0.0 ... 9999	Hi.A	0.0 ... 100.0%					x	x	x	x
12	Analogue 2	Hi:E	0.0 ... 9999	Hi.A	0.0 ... 100.0%					x	x	x	x
13	COM port	None / out 1 / out 2	xxx (address)	bdr (text)	9.6/19.2/ 38.4/115.2		x	x	x	x	x	x	x
14	IP address	XXX	XXX	XXX	XXX		x	x	x	x	x	x	x

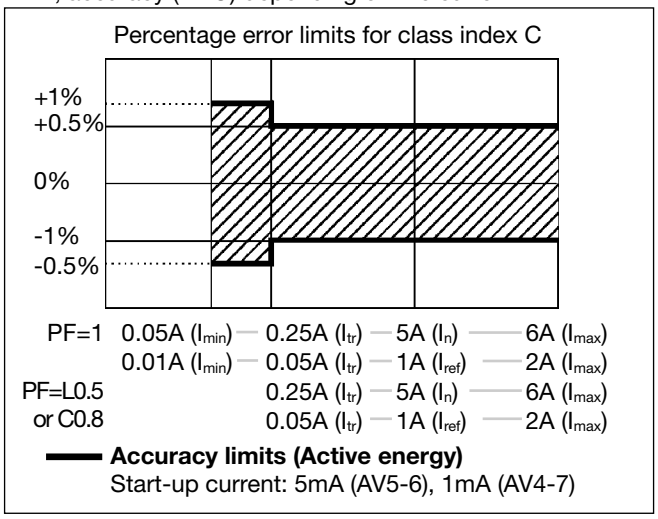
Back protection rotary switch



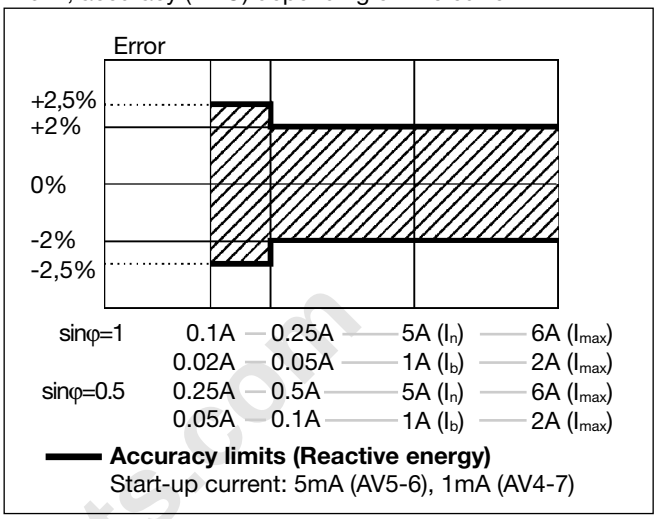
Function	Rotary switch position	Description
Unlok	1	All programming parameters are freely modifiable by means of the front key-pad and by means of the communication port.
Lock	7	The key-pad, as far as programming is concerned and the data through the serial communication cannot be changed (no writing into meter allowed). Data reading is allowed.

Accuracy (According to EN50470-3 and EN62053-23)

kWh, accuracy (RDG) depending on the current



kvarh, accuracy (RDG) depending on the current



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

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

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

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

Three-phase active power

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

Three-phase apparent power

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

Total harmonic distortion

$$THD_N = 100 \frac{\sqrt{\sum_{n=2}^{N} |X_n|^2}}{|X_1|}$$

Three-phase power factor (TPF)

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

Energy metering

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

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

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;Δ**t**= 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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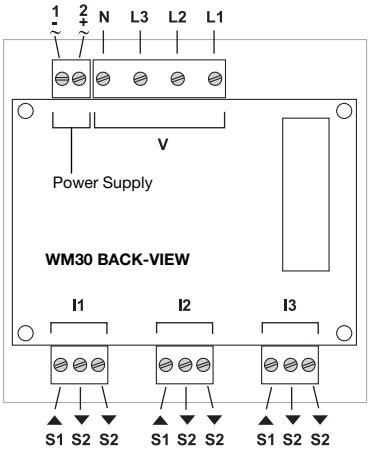
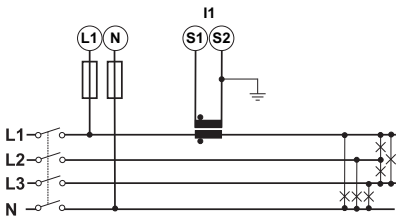
Wiring diagrams



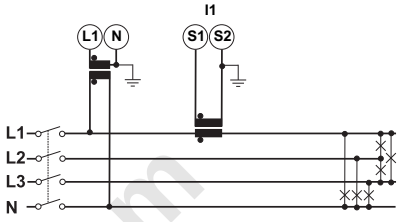
System type selection: 3-Ph.2

3-ph, 2-wire, balanced load **Fig. 1**



1-CT connection

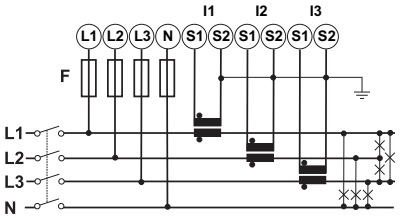
3-ph, 2-wire, balanced load **Fig. 2**



1-CT and 1-VT/PT connections

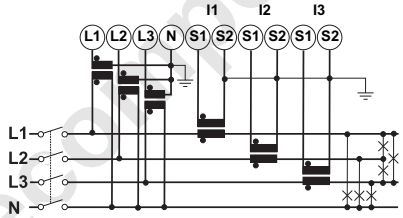
System type selection: 3-Ph.n

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



3-CT connection

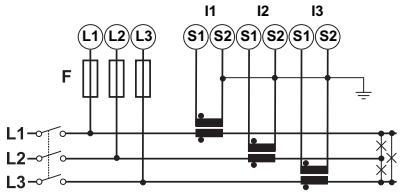
3-ph, 4-wire, unbalanced load **Fig. 4**



3-CT and 3-VT/PT connections

System type selection: 3-Ph

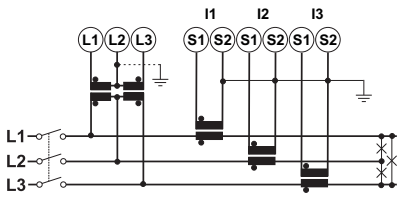
3-ph, 3-wire, unbalanced load **Fig. 5**



3-CT connection

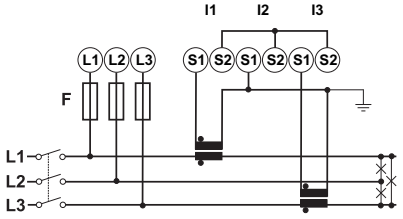
System type selection: 3-Ph (cont.)

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



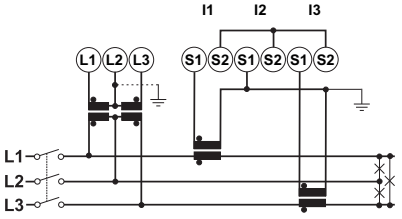
3-CT and 2-VT/PT connections

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



2-CT connections (ARON)

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



2-CT and 2-VT/PT connections ARON

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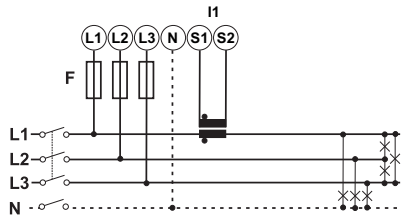
Wiring diagrams

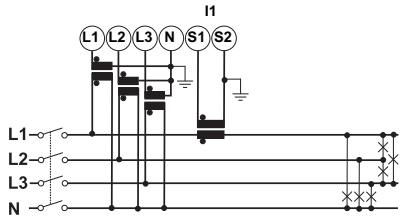
System type selection: 3-Ph.1

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



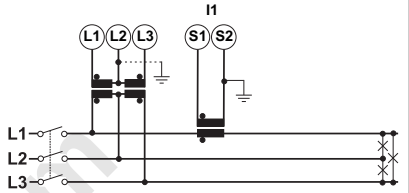
1-CT connections

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



1-CT and 3-VT/PT connections

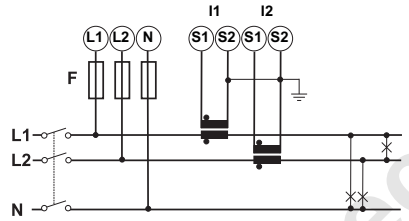
3-ph, 3-wire, balanced load **Fig. 11**



1-CT and 2-VT/PT connections

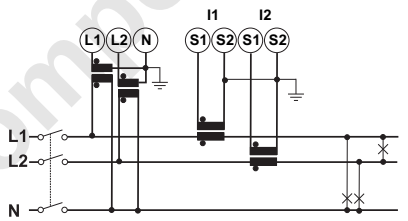
System type selection: 2-Ph

2-ph, 3-wire **Fig. 12**



2-CT connection

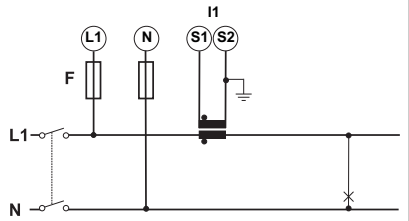
2-ph, 3-wire **Fig. 13**



2-CT and 2-VT/PT connections

System type selection: 1-Ph

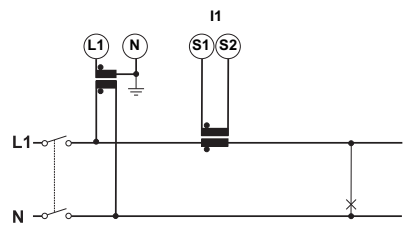
1-ph, 2-wire **Fig. 14**



1-CT connection

System type selection: 1-Ph (cont.)

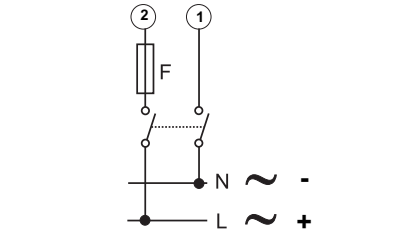
1-ph, 2-wire **Fig. 15**



1-CT and 1-VT/PT connections

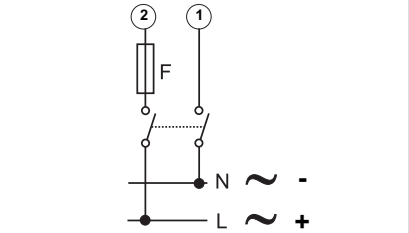
Power Supply

90 to 260VAC/DC (H option) **Fig. 16**



F= 250V [T] 630mA

18 to 60VAC/DC (L option) **Fig. 17**



F= 250V [T] 3,15A

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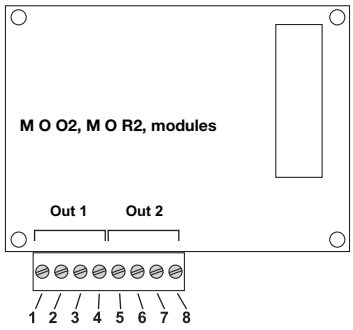
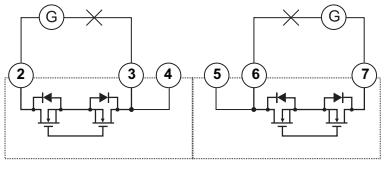
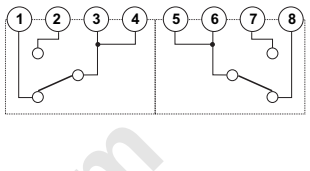
Static, relay and analogue outputs wiring diagrams

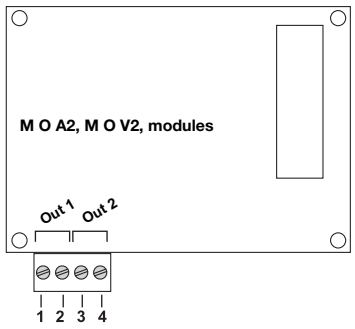


Opto-mosfet

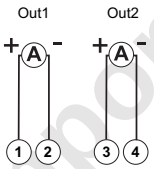


Relays

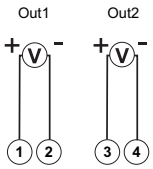




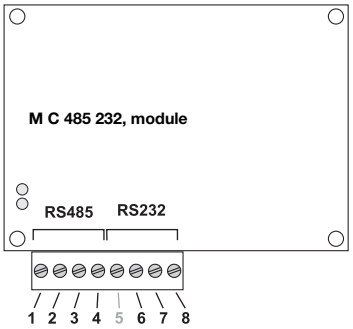
Analogue 20mA DC



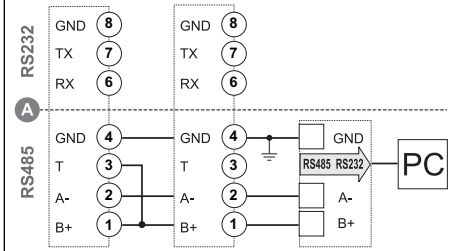
Analogue 10V DC



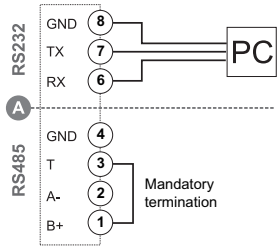
RS485 and RS232 wiring diagrams



RS485 port



RS232 port



NOTE. RS485: 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 (B+) and (T). Ⓐ: the communication RS232 and RS485 ports **can't be** connected and used simultaneously.

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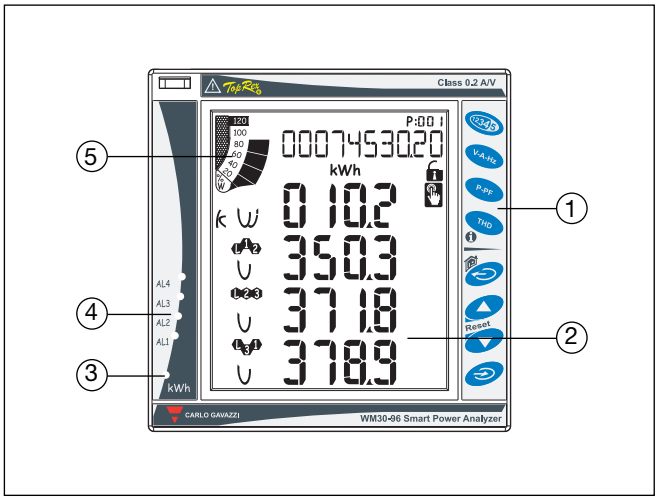
Front panel description



1. **Key-pad**
   To program the configuration parameters and scroll the variables on the display.
2. **Display**
   LCD-type with alphanumeric indications to:
   - display configuration parameters;
   - display all the measured variables.
3. **kWh LED**
   Red LED blinking proportional to the energy being measured
4. **Alarm LED's**
   Red LED's light-on when virtual alarms are activated.
5. **Main bar-graph**
   To display the power consumption versus the installed power.

Dimensions and Panel cut-out