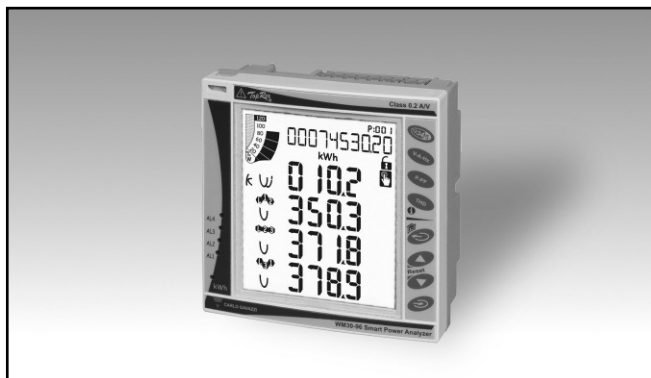


# Energy Management Smart Modular Power Analyzer Type WM30 96

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)
- BACnet MS/TP over RS485 (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)

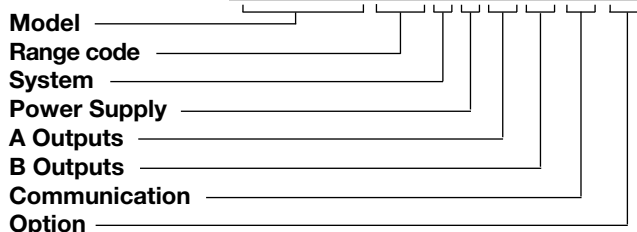
- Class 0.5 (kWh) according to EN62053-22
- Class C (kWh) according to EN50470-3
- Class 2 (kvarh) according to EN62053-23
- Accuracy  $\pm 0.2\%$  RDG (current/voltage)
- Instantaneous variables readout: 4x4 DGT
- Energies readout: 9+1 DGT
- System variables: VLL, VLN, A, VA, W, var, PF, Hz, Phase-sequence-asymmetry-loss.
- 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 or BACnet MS/TP communication ports, pulse and alarm outputs.

## How to order WM30-96 AV5 3 H R2 A2 S1 XX



## Type Selection

Range codes	System	Power supply	A Outputs
<b>AV4:</b> 400/690V <sub>LL</sub> AC 1(2)A (**) V <sub>LN</sub> : 160V to 480V <sub>LN</sub> V <sub>LL</sub> : 277V to 830V <sub>LL</sub>	<b>3:</b> balanced and unbalanced load: 3-phase, 4-wire; 3-phase, 3-wire; 2-phase, 3-wire; 1-phase, 2-wire (*)	<b>H:</b> 90 to 260V AC/DC (48 to 62Hz) (*) <b>L:</b> 18 to 60VAC/DC (48 to 62Hz) (**)	<b>XX:</b> none (*) <b>O2:</b> Dual channel static output (*) <b>R2:</b> Dual channel relay output (*)
<b>AV5:</b> 400/690V <sub>LL</sub> AC 5(6)A (*) V <sub>LN</sub> : 160V to 480V <sub>LN</sub> V <sub>LL</sub> : 277V to 830V <sub>LL</sub>	<b>Options</b> <b>XX:</b> none	<b>Communication</b> <b>XX:</b> none (*) <b>S1:</b> RS485/RS232 port (**) <b>E2:</b> Ethernet / Internet port (**) <b>B1:</b> BACnet (IP) over Ethernet (**) <b>B3:</b> BACnet (MS/TP) over RS485 (**)	<b>B Outputs</b> <b>XX:</b> none (*) <b>A2:</b> Dual channel 20mA DC output (*) <b>V2:</b> Dual channel 10V DC output (*)
<b>AV6:</b> 100/208V <sub>LL</sub> AC 5(6)A (**) V <sub>LN</sub> : 40V to 144V <sub>LN</sub> V <sub>LL</sub> : 70V to 250V <sub>LL</sub>			
<b>AV7:</b> 100/208V <sub>LL</sub> AC 1(2)A (**) V <sub>LN</sub> : 40V to 144V <sub>LN</sub> V <sub>LL</sub> : 70V to 250V <sub>LL</sub>			

(\*) as standard.

(\*\*) on request.

## 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	<ul style="list-style-type: none"> <li>Inputs/system: AV5.3</li> <li>Power supply: H</li> </ul>	WM30 AV5 3 H			
2		<ul style="list-style-type: none"> <li>Inputs/system: AV6.3</li> <li>Power supply: H</li> </ul>	WM30 AV6 3 H			
3		<ul style="list-style-type: none"> <li>Inputs/system: AV5.3</li> <li>Power supply: L</li> </ul>	WM30 AV5 3 L			
4		<ul style="list-style-type: none"> <li>Inputs/system: AV6.3</li> <li>Power supply: L</li> </ul>	WM30 AV6 3 L			
5	Dual relay output (SPDT)	<ul style="list-style-type: none"> <li>2-channel</li> <li>Alarm or/and pulse output</li> </ul>	M O R2 <b>(1)</b>	X		
6	Dual static output (AC/DC Opto-Mos)	<ul style="list-style-type: none"> <li>2-channel</li> <li>Alarm or/and pulse output</li> </ul>	M O O2 <b>(1)</b>	X		
7	Dual analogue output (+20mADC)	<ul style="list-style-type: none"> <li>2-channel</li> </ul>	M O A2 <b>(2)</b>		X	
8	Dual analogue output (+10VDC)	<ul style="list-style-type: none"> <li>2-channel</li> </ul>	M O V2 <b>(2)</b>		X	
9	RS485 / RS232 port module	<ul style="list-style-type: none"> <li>Max. 115.2 Kbps</li> </ul>	M C 485 232 <b>(3)</b>			X
10	Ethernet port module	<ul style="list-style-type: none"> <li>RJ45 10/100 BaseT</li> </ul>	M C ETH <b>(3)</b>			X
11	BACnet-IP port module	<ul style="list-style-type: none"> <li>Based on Ethernet bus</li> </ul>	M C BAC IP <b>(3)</b>			X
12	BACnet-MS/TP port module	<ul style="list-style-type: none"> <li>Over RS485</li> </ul>	M C BAC MS <b>(3)</b>			X

### NOTE:

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

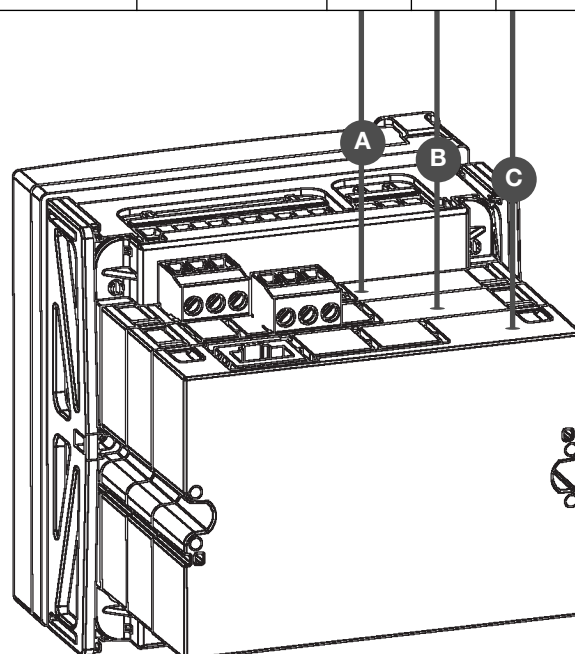
**(2)** Only one B type module per meter in a maximum combination of 3 total mixed modules on the same meter.

**(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.**



## Input specifications

<b>Rated inputs</b>	System type: 1, 2 or 3-phase Galvanic insulation by means of built-in CT's AV5 and AV6: 5(6)A AV4 and AV7: 1(2)A	<b>Energy additional errors</b>	According to EN62053-22, ANSI C12.20, Class B or C according to EN50470-3, EN62053-23, ANSI C12.1
Current type		Influence quantities	
Current range (by CT)		<b>Total Harmonic Distortion (THD)</b>	±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
Voltage (by direct connection or VT/PT)	AV4, AV5: 400/690VLL; AV6, AV7: 100/208VLL	<b>Temperature drift</b>	≤200ppm/°C
<b>Accuracy</b> (Display + RS485) (@25°C ±5°C, R.H. ≤60%, 48 to 62 Hz)	In: see below, Un: see below	<b>Sampling rate</b>	3200 samples/s @ 50Hz, 3840 samples/s @ 60Hz
AV4 model	In: 1A, Imax: 2A; Un: 160 to 480VLN (277 to 830VLL)	<b>Measurements</b>	See "List of the variables that can be connected to:"
AV5 model	In: 5A, Imax: 6A; Un: 160 to 480VLN (277 to 830VLL)	Method	TRMS measurements of distorted wave forms.
AV6 model	In: 5A, Imax: 6A; Un: 40 to 144VLN (70 to 250VLL)	Coupling type	By means of CT's
AV7 model	In: 1A, Imax: 2A; Un: 40 to 144VLN (70 to 250VLL)	<b>Crest factor</b>	AV5, AV6: ≤3 (15A max. peak) AV4, AV7: ≤3 (3A max. peak)
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) In the range Un: ±(0,2% RDG +1DGT) In the range Un: ±(0.5% RDG +1DGT)	<b>Current Overloads</b>	
Phase-neutral voltage	±0.1Hz (45 to 65Hz) 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)	Continuous (AV5 and AV6)	6A, @ 50Hz
Phase-phase voltage	±[0.001+0.5% (1.000 - "PF RDG")]	Continuous (AV4 and AV7)	2A, @ 50Hz
Frequency	0.1In to Imax, senφ 0.5L/C: ±(1%RDG+1DGT)	For 500ms (AV5 and AV6)	120A, @ 50Hz
Active and Apparent power	0.05In to 0.1In, senφ 0.5L/C: ±(1.5%RDG+1DGT)	For 500ms (AV4 and AV7)	40A, @ 50Hz
Power Factor	0.01In to 0.05In, senφ 1: ±(1%RDG+1DGT)	<b>Voltage Overloads</b>	
Reactive power	0.02In to 0.05In, senφ 1: ±(1.5%RDG+1DGT)	Continuous	1.2 Un
Active energy	Class 0.5 according to EN62053-22, ANSI C12.20	For 500ms	2 Un
Reactive energy	Class C according to EN50470-3.	<b>Input impedance</b>	
Start up current AV5, AV6	Class 1 according to EN62053-23, ANSI C12.1.	400VL-L (AV4 and AV5)	> 1.6MΩ
Start up current AV4, AV7	5mA	208VL-L (AV6 and AV7)	> 1.6MΩ
	1mA	5(10)A (AV5 and AV6)	< 0.2VA
		1(2)A (AV4 and AV7)	< 0.2VA
		<b>Frequency</b>	40 to 440 Hz

## Output specifications

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

## 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".	Protocol Data (bidirectional) Dynamic (reading only)	MODBUS RTU /JBUS
Scaling factor	Programmable within the whole range of retransmission; it allows the retransmission management of all values from 0 to 10VDC.	Static (reading and writing only)	System and phase variables: see table "List of variables..."
Response time	≤400 ms typical (filter excluded)	Data format	All the configuration parameters 1 start bit, 8 data bit, no/even/odd parity, 1 stop bit
Ripple	≤1% (according to IEC 60688-1, EN 60688-1)	Baud-rate	Selectable: 9.6k, 19.2k, 38.4k, 115.2k bit/s
Total temperature drift	≤500 ppm/°C	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.
Load	≥10kΩ		
Insulation	See "Insulation between inputs and outputs" table		
<b>RS485 (on request)</b>			
Type	Multidrop, bidirectional (static and dynamic variables)	Insulation	See "Insulation between inputs and outputs" table
Connections	2-wire Max. distance 1000m, termination directly on the module	<b>Ethernet/Internet port (on request)</b>	
Addresses	247, selectable by means of the front key-pad	Protocols IP configuration	Modbus TCP/IP Static IP / Netmask / Default gateway
Protocol	MODBUS/JBUS (RTU)	Port	Selectable (default 502)
Data (bidirectional)		Client connections	Max 5 simultaneously
Dynamic (reading only)	System and phase variables: see table "List of variables..."	Connections	RJ45 10/100 BaseTX Max. distance 100m
Static (reading and writing only)	All the configuration parameters.	Data (bidirectional) Dynamic (reading only)	System and phase variables: see table "List of variables..."
Data format	1 start bit, 8 data bit, no/even/odd parity, 1 stop bit	Static (reading and writing only)	All the configuration parameters.
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.
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
Insulation	See "Insulation between inputs and outputs" table	<b>BACnet-IP (on request)</b>	
<b>RS232 port (on request)</b>		Protocols	BACnet-IP (for measurement reading purpose) and Modbus TCP/IP (for measurement reading purpose and for programming parameter purpose)
Type	Bidirectional (static and dynamic variables)		
Connections	3 wires. Max. distance 15m		



## Output specifications (cont.)

IP configuration	Static IP / Netmask / Default gateway	Data (mono-directional)	System and phase variables: see table "List of variables..."
BACnet-IP Port	Fixed: BAC0h	Dynamic	Not available
Modbus Port	Selectable (default 502)	Static	1 start bit, 8 data bit, no parity, 1 stop bit
Client connections	Modbus only: max 5 simultaneously	Data format	Selectable: 9.6k, 19.2k, 38.4k kbit/s
Connections	RJ45 10/100 BaseTX	Baud-rate	1/5 unit load. Maximum 160 transceivers on the same bus.
Data	Max. distance 100m	Driver input capability	Selectable: 0 to 127
Dynamic (reading only)	System and phase variables (BACnet-IP and Modbus): see table "List of variables..."	MAC addresses	Modbus TCP/IP (for programming parameter purpose)
Static (reading and writing only)	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.	Ethernet port Protocol	Static IP / Netmask / Default gateway
Note	See "Insulation between inputs and outputs" table	IP configuration	Selectable (default 502)
Insulation		Modbus Port	Modbus only: max 5 simultaneously
<b>BACnet MS/TP (on request)</b>		Client connections	RJ45 10/100 BaseTX Max. distance 100m
Available ports	2: RS485 and Ethernet	Connections	System and phase variables: see table "List of variables..."
RS485 port		Data	
Type	Multidrop, mono-directional (dynamic variables)	Dynamic (reading only)	
Connections	2-wire Max. distance 1000m, termination directly on the module	Static (reading and writing only)	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.
Device object instance	0 to $2^{22}-2 = 4.194.302$ , selectable by means of programming software only	Note	See "Insulation between inputs and outputs" table
Protocol	BACnet MS/TP (for measurement reading purpose)	Insulation	
Supported services	"I have", "I am", "Who has", "Who is", "Read Property"		
Supported objects	Type 2 (analogue value), Type 8 (device)		

## Energy meters

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

## Harmonic distortion analysis

<b>Analysis principle</b>	FFT	<b>System</b>	<p>The same for the other phases: L2, L3. The harmonic distortion can be measured in 3-wire or 4-wire systems. Tw: 0.02 sec@50Hz without filter</p>
<b>Harmonic measurement</b>			
Current	Up to the 32nd harmonic		
Voltage	Up to the 32nd harmonic		
<b>Type of harmonics</b>	THD (VL1 and VL1-N) The same for the other phases: L2, L3. THD (AL1)		

## Display, LED's and commands

<b>Display refresh time</b>	≤ 100 ms	<b>Energy consumption</b> kWh pulsating	<p>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 &gt;70.01k Max frequency: 16Hz, according to EN50470-1</p>
<b>Display</b>	4 lines, 4-DGT, 1 lines, 10-DGT		
Type	LCD, single colour backlight	<b>Back position LEDs</b> On the base On the communication modules	<p>Green as power-on Two LEDs: one for TX (green) and one for RX (amber).</p>
Digit dimensions	4-DGT: h 9.5mm; 10-DGT: h 6.0mm		
Instantaneous variables read-out	4-DGT	<b>Key-pad</b>	<p>For variable selection, programming of the instrument working parameters, "dmd", "max", total energy and partial energy Reset</p>
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		
<b>Front position LEDs</b>			
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.		

## Main functions

<b>Password</b>	Numeric code of max. 4 digits; 2 protection levels of the programming data:	<b>System 3-Ph.1 balanced load</b>	<p>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. 3-phase (3-wire), one current and 3-phase to</p>
1st level	Password "0", no protection;		
2nd level	Password from 1 to 9999, all data are protected		
<b>System selection</b>			
System 3-Ph.n unbalanced load	3-phase (4-wire)		
System 3-Ph. unbalanced load	3-phase (3-wire), three		

## Main functions (cont.)

System 3-Ph.2 balanced load	phase voltage measurements 3-phase (4-wire), one current and 3-phase to neutral voltage measurements. 3-phase (2-wire), one current and 1-phase (L1) to neutral voltage measurement.	Set-point adjustment	instantaneous variable available in the table "List of the variables that can be connected to". From 0 to 100% of the display scale From 0 to full scale 0 to 9999s ≤ 200ms, filters excluded. Set-point on-time delay: "0 s".
System 2-Ph System 1-Ph	2-phase (3-wire) 1-phase (2-wire)	Hysteresis On-time delay Min. response time	
<b>Transformer ratio</b> VT (PT)	1.0 to 999.9 / 1000 to 9999.	<b>Reset</b>	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
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).	<b>Harmonic analysis</b>	Up to the 32 <sup>nd</sup> harmonics on current and voltage
<b>Filter</b> Operating range	Selectable from 0 to 100% of the input display scale	<b>Clock</b> Functions Time format	Universal clock and calendar. Hour: minutes: seconds with selectable 24 hours or AM/PM format.
Filtering coefficient	Selectable from 1 to 32	Date format	Day-month-year with selectable DD-MM-YY or MM-DD-YY format.
Filter action	Measurements, analogue signal retransmission, serial communication (fundamental variables: V, A, W and their derived ones).	Battery life	10 years
<b>Displaying</b> 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.	<b>Easy connection function</b>	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.
Backlight	The backlight time is programmable from 0 (always on) to 255 minutes		
<b>Virtual alarms</b> 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		

## General specifications

<b>Operating temperature</b>	-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
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## General specifications (cont.)

<b>Storage temperature</b>	-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	<b>Metrology</b>	EN62053-21, EN62053-23, EN50470-3. MID "annex MI-003" DIN43864, IEC62053-31
<b>Installation category</b>	Cat. III (IEC60664, EN60664)	<b>Pulse output</b>	
<b>Insulation (for 1 minute)</b>	See "Insulation between inputs and outputs" table	<b>Approvals</b>	Eligible System performance Meter for Go Solar California, CE, cULus "Listed"
<b>Dielectric strength</b>	4kVAC RMS for 1 minute	<b>Connections</b>	Screw-type max. 2.5 mm <sup>2</sup> . min./max. screws tightening torque: 0.4 Nm / 0.8 Nm. Suggested screws tightening torque: 0.5 Nm
<b>Noise rejection CMRR</b>	100 dB, 48 to 62 Hz	Cable cross-section area	
<b>EMC</b>	According to EN62052-11	<b>Housing DIN</b>	
Electrostatic discharges	15kV air discharge	Dimensions (WxHxD)	
Immunity to irradiated	Test with current: 10V/m from 80 to 2000MHz		Module holder: 96x96x50mm.
Electromagnetic fields	Test without any current: 30V/m from 80 to 2000MHz		"A" and "B" type modules: 89.5x63x16mm.
Burst	On current and voltage measuring inputs circuit: 4kV		"C" type module: 89.5x63x20mm.
Immunity to conducted disturbances	10V/m from 150KHz to 80MHz	Max. depth behind the panel	With 3 modules (A+B+C): 81.7 mm
Surge	On current and voltage measuring inputs circuit: 4kV; on "L" auxiliary power supply input: 1kV	Material	ABS, self-extinguishing: UL 94 V-0
Radio frequency suppression	According to CISPR 22	Mounting	Panel mounting
<b>Standard compliance</b>	IEC60664, IEC61010-1	<b>Protection degree</b>	IP65, NEMA4x, NEMA12
Safety	EN60664, EN61010-1 EN62052-11.	Front Screw terminals	IP20
		<b>Weight</b>	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
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## Insulation between inputs and outputs

	Measuring Inputs	Relay outputs	Static Outputs	Communication port	Analogue Out-puts	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).

## 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= $\Sigma$
2	VL1	X	X	X	X	#	X	
3	VL2	O	X	X	X	#	X	
4	VL3	O	O	X	X	#	X	
5	VL-L sys	O	X	X	X	X	X	sys= system= $\Sigma$
6	VL1-2	#	X	X	X	X	X	
7	VL2-3	#	O	X	X	X	X	
8	VL3-1	#	O	X	X	X	X	
9	AL1	X	X	X	X	X	X	
10	AL2	O	X	X	X	X	X	
11	AL3	O	O	X	X	X	X	
12	VA sys	X	X	X	X	#	X	sys= system= $\Sigma$
13	VA L1	X	X	X	X	#	X	
14	VA L2	O	X	X	X	#	X	
15	VA L3	O	O	X	X	#	X	
16	var sys	X	X	X	X	#	X	sys= system= $\Sigma$
17	var L1	X	X	X	X	#	X	
18	var L2	O	X	X	X	#	X	
19	var L3	O	O	X	X	#	X	
20	W sys	X	X	X	X	X	X	sys= system= $\Sigma$
21	WL1	X	X	X	X	#	X	
22	WL2	O	X	X	X	#	X	
23	WL3	O	O	X	X	#	X	
24	PF sys	X	X	X	X	#	X	sys= system= $\Sigma$
25	PF L1	X	X	X	X	#	X	
26	PF L2	O	X	X	X	#	X	
27	PF L3	O	O	X	X	#	X	
28	Hz	X	X	X	X	X	X	
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	
42	A L2 THD	O	X	X	X	X	X	
43	A L3 THD	O	O	X	X	X	X	
44	V L1 THD	X	X	X	X	O	X	
45	V L2 THD	O	X	X	X	O	X	
46	V L3 THD	O	O	X	X	O	X	
47	V L1-2 THD	X	X	X	X	X	X	
48	V L2-3 THD	O	X	X	X	X	X	
49	V L3-1 THD	O	O	X	X	X	X	

(X) = available; (O) = not available (variable not available on the display); (#) Not available (the relevant page is not displayed)

## List of selectable applications

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

## Display pages

Var Type	No	Line 1	Line 2	Line 3	Line 4	Line 5	Note	Applications						
		Variable Type	Variable Type	Variable Type	Variable Type	Variable Type		A	B	C	D	E	F	G
	0	Home page	Programmable					x	x	x	x	x	x	x
a	1	Total kWh (+)	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 $\Sigma$	VL1	VL2	VL3	(1) (2)				x	x	x	x
b	11	a/Phase seq.	VLN $\Sigma$	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 $\Sigma$	WL1	WL2	WL3	(1) (2)				x	x	x	x
c	15	a/Phase seq.	var $\Sigma$	var L1	var L2	var L3	(1) (2)					x	x	x
c	16	a/Phase seq.	PF $\Sigma$	PF L1	PF L2	PF L3	(1) (2)					x	x	x
c	17	a/Phase seq.	VA $\Sigma$	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

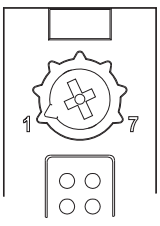
(1) Also maximum value storage (no EEPROM storage).

(2) Also average (dmd) value (no EEPROM storage).

## Additional available information on the display

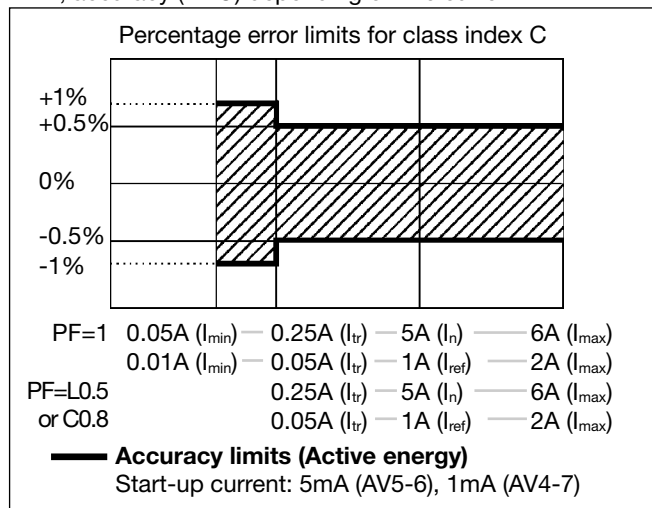
No	Line 1	Line 2	Line 3	Line 4	Line 5	Note	Applications						
							A	B	C	D	E	F	G
1	Lot n. (text) xxxx	Yr. (text) xx	SYS (text)	x (1/2/3)	1...60 (min) "dmd"		x	x	x	x	x	x	x
2	Conn. xxx.x (3ph.n/3ph/3ph./ 3ph.2/1ph/2ph)	CT.rA (text)	1.0 ... 99.99k	PT.rA (text)	1.0...9999		x	x	x	x	x	x	x
3	LED PULSE (text) 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

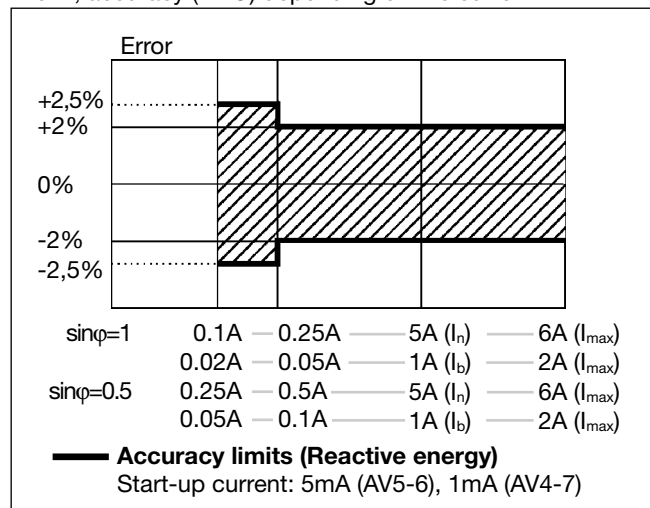
	Function	Rotary switch position	Description
	Unlok	1	All programming parameters are freely modifiable by means of the front key-pad and by means of the communication port.
	Lock	7	The key-pad, as far as programming is concerned and the data through the serial communication cannot be changed (no writing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

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

Instantaneous active power

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

Instantaneous power factor

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

Instantaneous effective current

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

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

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

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

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

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

Three-phase power factor

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

### Energy metering

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

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

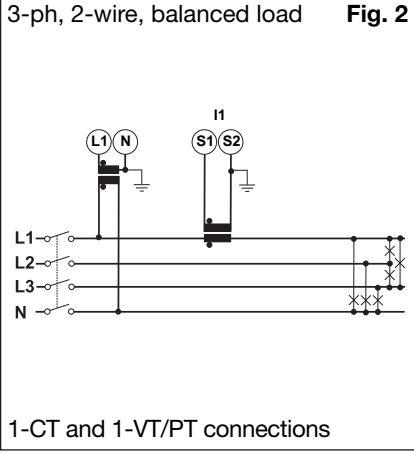
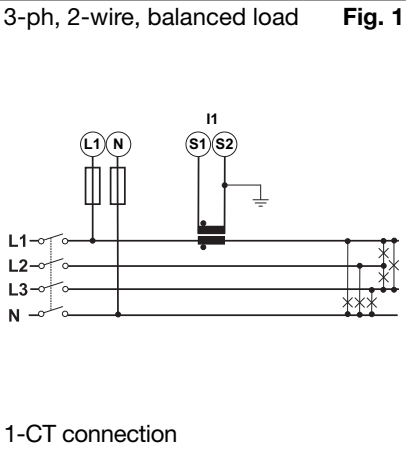
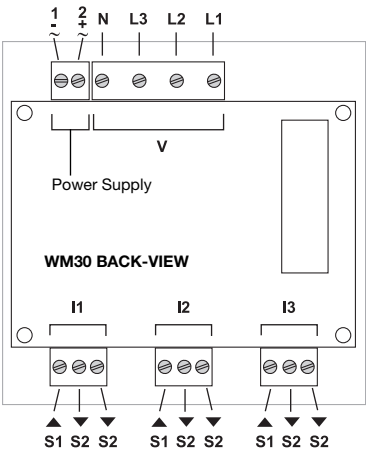
Where:

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

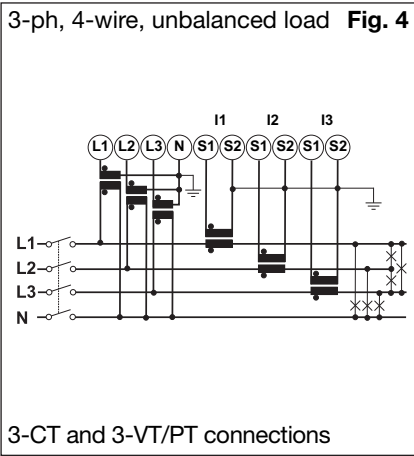
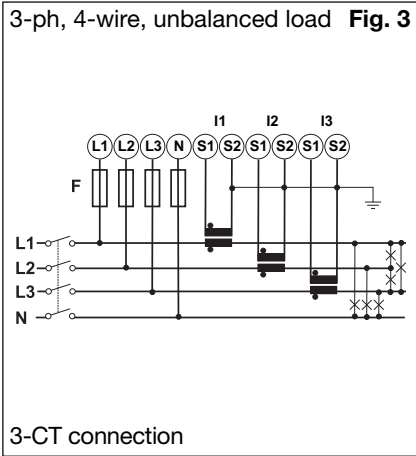


Wiring diagrams

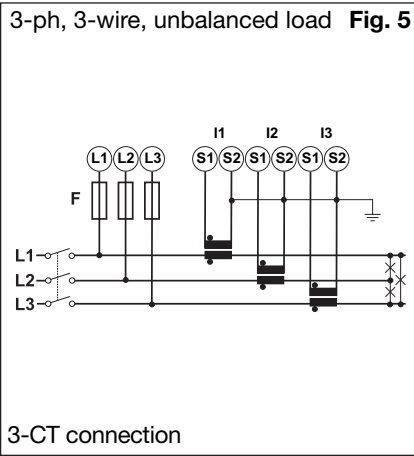
System type selection: 3-Ph.2



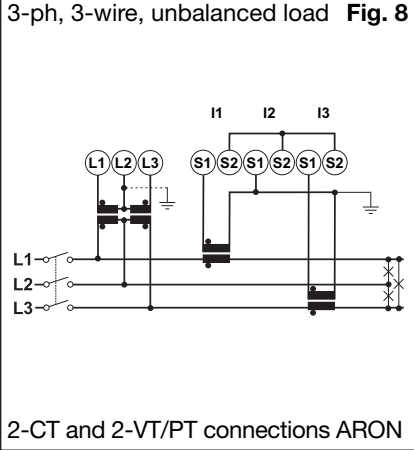
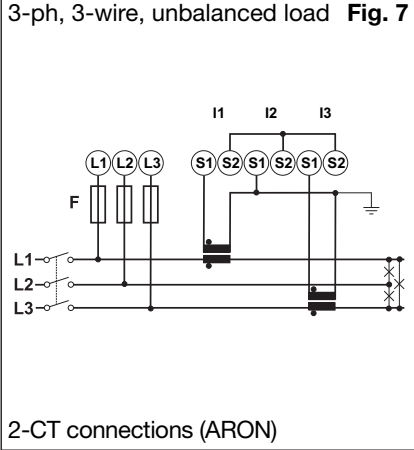
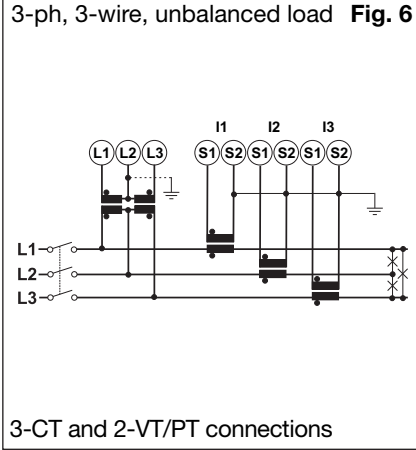
System type selection: 3-Ph.n



System type selection: 3-Ph



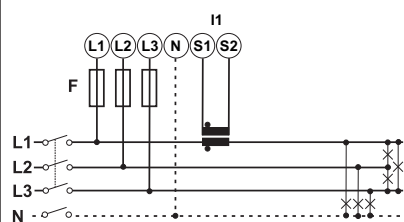
System type selection: 3-Ph (cont.)



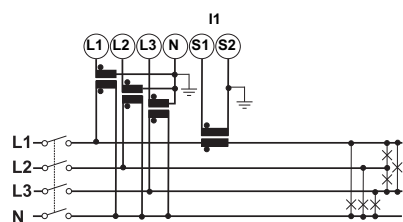


## Wiring diagrams

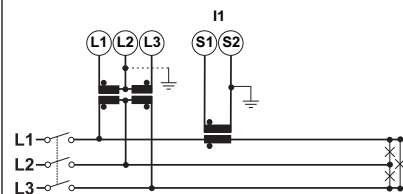
### System type selection: 3-Ph.1

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

1-CT connections

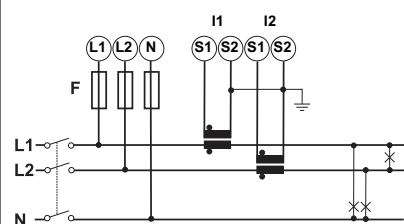
3-ph, 3-wire, balanced load **Fig. 10**

1-CT and 3-VT/PT connections

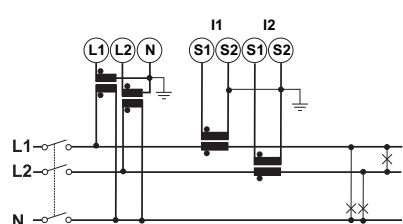
3-ph, 3-wire, balanced load **Fig. 11**

1-CT and 2-VT/PT connections

### System type selection: 2-Ph

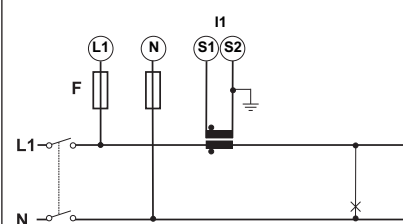
2-ph, 3-wire **Fig. 12**

2-CT connection

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

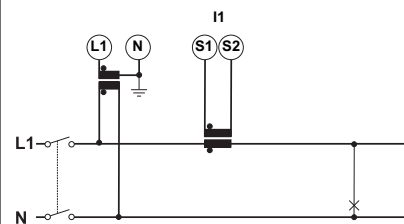
2-CT and 2-VT/PT connections

### System type selection: 1-Ph

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

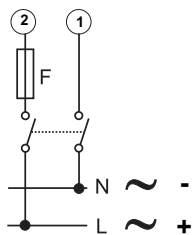
1-CT connection

### System type selection: 1-Ph (cont.)

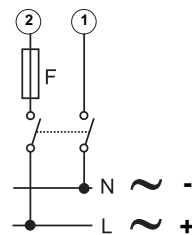
1-ph, 2-wire **Fig. 15**

1-CT and 1-VT/PT connections

### Power Supply

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

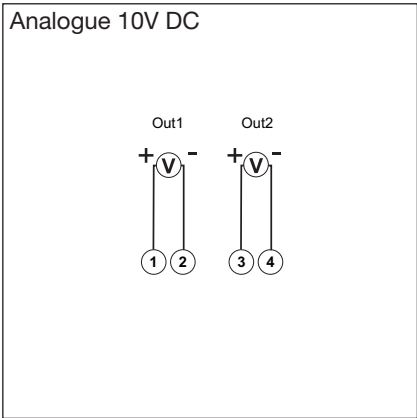
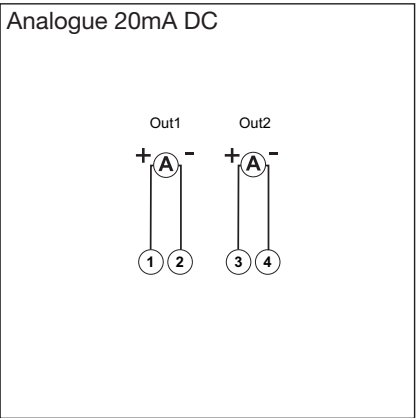
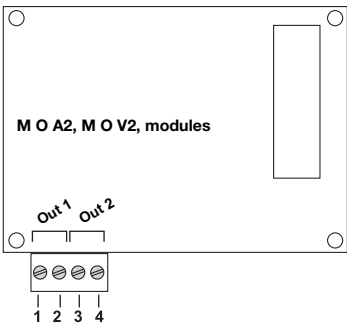
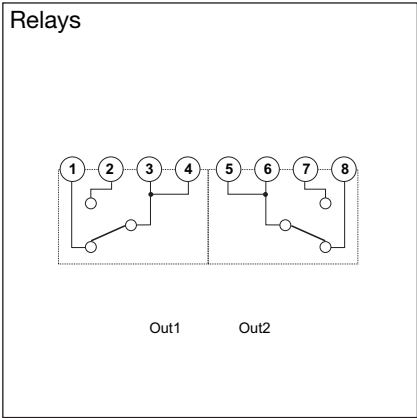
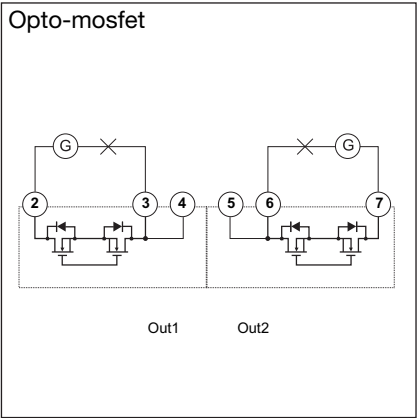
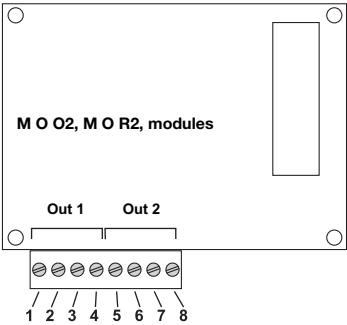
F= 250V [T] 630mA

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

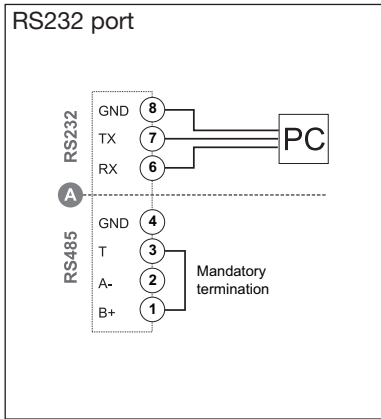
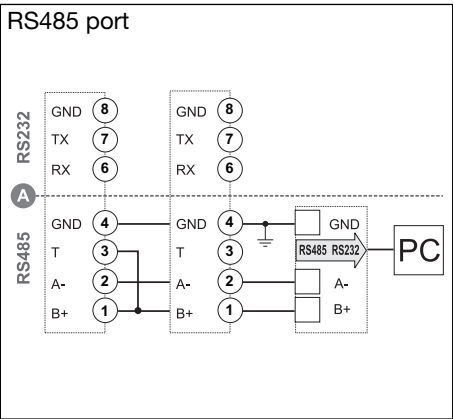
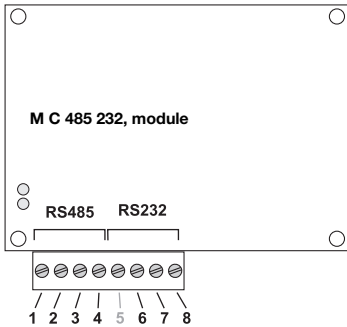
F= 250V [T] 3,15A



Static, relay and analogue outputs wiring diagrams

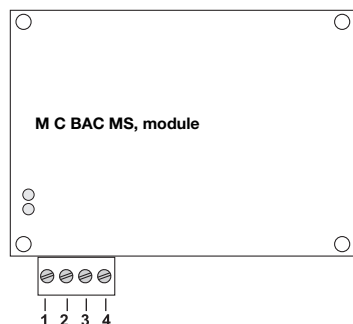


RS485 and RS232 wiring diagrams

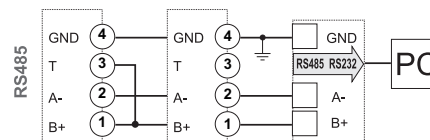


**NOTE.** RS485: additional devices provided with RS485 are connected in parallel. The termination of the serial output is carried out only on the last instrument of the network, by means of a jumper between (B+) and (T). **A**: the communication RS232 and RS485 ports **can't be** connected and used simultaneously.

## RS485 wiring diagram of Bacnet module

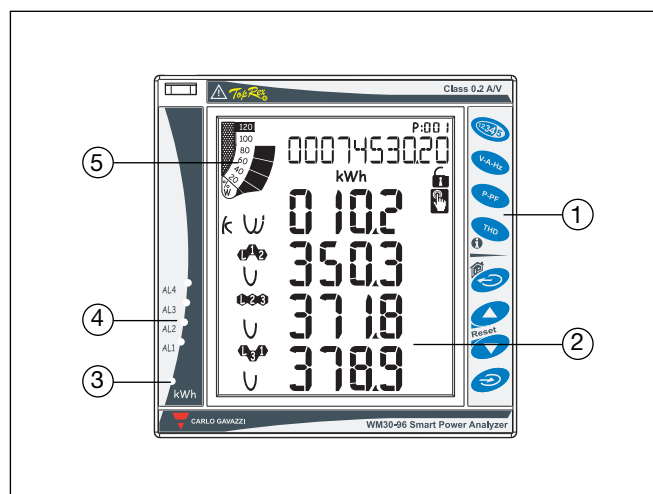


RS485 port



**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).

## 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

