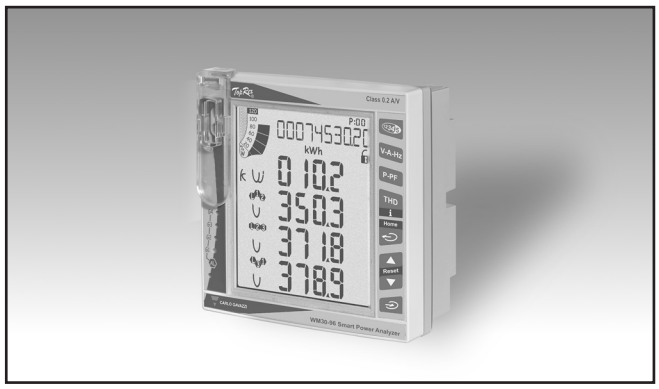
Energy Management
Smart Modular Power Analyzer
Type WM30 96



- **Communication protocol: MODBUS-RTU**
- **MODBUS TCP/IP Ethernet port (on request)**
- **BACnet-IP over Ethernet port (on request)**
- **BACnet MS/TP over RS485, BTL approved (on request)**
- **Profibus DP V0 port, PROFIBUS Nutzerorganisation e.V. approved (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 0.5S (kWh) according to EN62053-22**
- **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**
- **Run hours counter (8+2 DGT)**
- **Real time clock function**
- **Application adaptable display and programming procedure (Easyprog function)**
- **Universal power supply: 24-48 VDC/AC, 100-240 VDC/AC**
- **Front dimensions: 96x96 mm**
- **Front protection degree: IP65, NEMA4X, NEMA12**
- **One RS232 and RS485 port (on request)**

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, BACnet MS/TP or Profibus DP V0 communication ports, pulse and alarm outputs. Parameters programming and data reading can be easily performed by means of UCS (Universal Configuration Software).

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: 3x220(380)...3x400(690)V 1(2)A
V_{LN}: 220 to 400 V_{LN}
V_{LL}: 380 to 690 V_{LL}

AV5: 3x220(380)...3x400(690)V 5(6)A
V_{LN}: 220 to 400 V_{LN}
V_{LL}: 380 to 690 V_{LL}

AV6: 3x57.7(100)...3x133(230)V 5(6)A
V_{LN}: 57.7 to 133 V_{LN}
V_{LL}: 100 to 230 V_{LL}

AV7: 3x57.7(100)...3x133(230)V 1(2)A
V_{LN}: 57.7 to 133 V_{LN}
V_{LL}: 100 to 230 V_{LL}

System

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

Options

XX: none

Power supply

H: 100-240 +/-10% (90 to 255) VDC/AC (50/60 Hz)

L: 24-48 +/-15% (20 to 55) VDC/AC (50/60 Hz)

Communication

XX: none
S1: RS485/RS232 port
E2: Ethernet / Internet port
B1: BACnet (IP) over Ethernet
B3: BACnet (MS/TP) over RS485
P1: Profibus DP/V0 port

A Outputs

XX: none
O2: Dual channel static output
R2: Dual channel relay output

B Outputs

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

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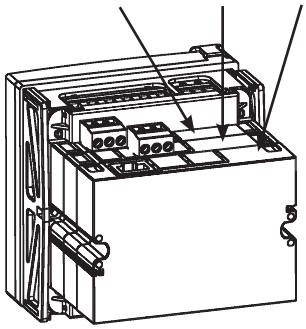
Position of modules and combination

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: AV4.3 • Power supply: H	WM30 AV4 3 H			
4		• Inputs/system: AV7.3 • Power supply: H	WM30 AV7 3 H			
		• Inputs/system: AV5.3 • Power supply: L	WM30 AV5 3 L			
		• Inputs/system: AV6.3 • Power supply: L	WM30 AV6 3 L			
		• Inputs/system: AV4.3 • Power supply: L	WM30 AV4 3 L			
		• Inputs/system: AV7.3 • Power supply: L	WM30 AV7 3 L			
5	Dual relay output (SPDT)	• 2-channel • Alarm or/and pulse output	M O R2	X		
6	Dual static output (AC/DC Opto-Mos)	• 2-channel • Alarm or/and pulse output	M O O2	X		
7	Dual analogue output (+20mADC)	• 2-channel	M O A2		X	
8	Dual analogue output (+10VDC)	• 2-channel	M O V2		X	
9	RS485 / RS232 port module	• Max. 115.2 Kbps	M C 485 232			X
10	Ethernet port module	• RJ45 10/100 BaseT	M C ETH			X
11	BACnet-IP port module	• Based on Ethernet bus	M C BAC IP			X
12	BACnet-MS/TP port module	• Over RS485	M C BAC MS			X
13	Profibus module	• Profibus DP V0 • Over RS485	M C P B			X

NOTE:

The position of the modules shall respect the sequence A-B-C. Possible arrangements are M, M-A, M-B, M-C, M-A-B, M-A-C, M-B-C and M-A-B-C where “M” is the basic module (WM30-96).

It is possible to use the WM30-96 without any additional module as a simple indicator.



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Input specifications

Rated inputs	System type: 1, 2 or 3-phase
Input 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: 3x220(380)...3x400(690)V AV6, AV7: 3x57.7(100)...3x133(230)V
Accuracy (Display + RS485) (@23°C ±2°C,	0.01In=0.05A (AV5, AV6 - kWh, PF=1) 0.01In=0.01A (AV4, AV7 - kWh, PF=1) 0.05In=0.25A (AV5, AV6 - kWh, PF=1) 0.05In=0.05A (AV4, AV7 - kWh, PF=1)
	In: see below, Un: see below
AV4 model	In: 1A, Imax: 2A; Un: 220 to 400VLN (380 to 690VLL)
AV5 model	In: 5A, Imax: 6A; Un: 220 to 400VLN (380 to 690VLL)
AV6 model	In: 5A, Imax: 6A; Un: 57.7 to 133VLN (100 to 230VLL)
AV7 model	In: 1A, Imax: 2A; Un: 57.7 to 133VLN (100 to 230VLL)
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)
Voltage tolerance	Un -20%, Un +15%
Frequency	From 40 to 65 Hz ±(0.02% RDG + 1 DGT), From 65 to 340 Hz ±(0.05% RDG + 1 DGT). From 340 to 440 Hz ±(0.1% RDG + 1 DGT)
Active and Apparent power	From 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	From 0.02In to 0.05In, senφ 1: ±(1.5%RDG+1DGT) From 0.05In to Imax, senφ 1: ±(1%RDG+1DGT) From 0.05In to 0.1In, senφ 0.5L/C: ±(1.5%RDG+1DGT) From 0.1In to Imax, senφ 0.5L/C: ±(1%RDG+1DGT)
Active energy	Class 0.5S according to EN62053-22, ANSI C12.20
Reactive energy	Class 2 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	According to EN62053-23, ANSI C12.1
Total Harmonic Distortion (THD)	±1% FS (FS: 100%) AV4: Imin: 5mARMS; Imax: 3A; Umin: 30VRMS; Umax: 679Vp AV5: Imin: 5mARMS; Imax: 15Ap; Umin: 30VRMS; Umax: 679Vp AV6: Imin: 5mARMS; Imax: 15Ap; Umin: 30VRMS; Umax: 204Vp AV7: Imin: 5mARMS; Imax: 3A; Umin: 30VRMS; Umax: 204Vp
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(6)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. 1 module per instrument)
Purpose	For either alarm output or pulse output
Type	Relay, SPDT type AC 1-5A @ 250VAC; AC 15-1.5A @ 250VAC
Configuration	By means of the front key-pad or UCS software
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	Programmable from 0.001 to 10.00 kWh/kvarh per pulse.The above listed variables can be connected to any output.
Pulse duration	30 ms (ON), ≥30 ms (OFF), according to EN62053-31
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. 1 module per instrument)
Purpose	For either pulse output or alarm output
Signal	V_{ON}: 2.5VAC/DC/max.100mA V_{OFF}: 42VDC max.
Configuration	By means of the front key-pad or UCS software
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	Programmable from 0.001 to 10.00 kWh/kvarh per pulse.The above listed variables can be connected to any output.
Pulse duration	30 ms (ON), ≥30 ms (OFF), according to EN62053-31
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 per module (max. 1 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 or UCS software
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.
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. 1 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 or UCS software
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;
Response time	≤400 ms typical (filter excluded)
Ripple	≤1% (according to IEC 60688, EN 60688)
Total temperature drift	≤350 ppm/°C
Load	≥10kΩ
Insulation	See “Insulation between inputs and outputs” table

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Output specifications (cont.)

RS485 (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 to write object description) and Modbus TCP/IP (for measurement reading purpose and for programming parameter purpose)
BACnet-IP	
IP configuration	Static IP / Netmask / Default gateway
Port	Fixed: BAC0h
Device object instance	0 to 9999 selectable by key-pad 0 to 2^22-2 = 4.194.302, selectable by programming software or by BACnet.
Supported services	“I have”, “I am”, “Who has”, “Who is”, “Read (multiple) Property”
Supported objects	Type 2 (analogue value, including COV property), Type 5 (binary-value for up to 4 virtual alarm re-transmission) Type 8 (device)
IP configuration	Static IP / Netmask / Default gateway
Modbus TCP/IP	See “Ethernet/Internet port” above
Client connections	Modbus only: max 5 simultaneously
Connections	RJ45 10/100 BaseTX Max. distance 100m

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Output specifications (cont.)

Data	
Dynamic (reading only)	System and phase variables (BACnet-IP and Modbus): see table “List of variables”
Static (reading and writing only)	All the configuration parameters (Modbus only)
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 MS/TP (on request)	
Available ports	2: RS485 and Ethernet
RS485 port	
Type	Multidrop, mono-directional (dynamic variables)
Connections	2-wire Max. distance 1000m, termination directly on the module
Device object instance	0 to 9999 selectable by key-pad 0 to 2^22-2 = 4.194.302, selectable by programming software or by BACnet.
Protocol	BACnet MS/TP (for measurement reading purpose and to write object description)
Supported services	“I have”, “I am”, “Who has”, “Who is”, “Read (multiple) Property”
Supported objects	Type 2 (analogue value, including COV property), Type 5 (binary-value for up to 4 virtual alarm re-transmission) Type 8 (device)
Data (mono-directional)	
Dynamic	System and phase variables: see table “List of variables...”
Static	Not available
Data format	1 start bit, 8 data bit, no parity,1 stop bit
Baud-rate	Selectable: 9.6k, 19.2k, 38.4k or 76.8k kbit/s
Driver input capability	1/5 unit load. Maximum 160 transceivers on the same bus.
MAC addresses	Selectable: 0 to 127

Ethernet port	
Protocol	Modbus TCP/IP (for programming parameter purpose)
IP configuration	Static IP / Netmask / Default gateway
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: see table “List of variables...”
Static (reading and writing only)	All the configuration parameters (Modbus only).
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
Approval	BTL
Profibus (MCPB)	
Available ports	2: USB and Profibus DP V0
USB	
Purpose	Programmable parameters setting
Connector	USB micro B
Protocol	Modbus RTU
Data format	1 start bit, 8 data bit, no parity,1 stop bit
Baudrate	autorange depending on the master (max 115200 bps)
Address	1
Profibus	
Purpose	Data reading (12 programmable profiles realtime selectable); remote output control; remote tariff control;
Modules Selectable:	output up to 4 bytes, input up to 62 words
Data format (profiles)	totalizers : FLOAT or INT32; electrical variables: FLOAT or INT16; status variables : UINT16
Connector	RS485 DB9

Output specifications (cont.)

Protocol	Profibus DP V0 slave
Baudrate	9.6 k to 12 Mbps (9.6, 19.2, 45.45, 93.75, 187.5, or 500 kbps; 1.5, 3, 6, or 12 Mbps)
Address	2-125 (default 126)
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. In this case just the data reading is allowed.
Insulation	See “Insulation between inputs and outputs” table
Approval	PROFIBUS Nutzerorganisation e.V.

Energy meters

Meters	
Total	4 (8+2, 9+1, 10 digit)
Partial	4 (8+2, 9+1, 10 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 kWh/kvarh
	Max. 9,999,999,999 kWh/kvarh.
Type	
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	≤ 250 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: 8+2DGT, 9+1DGT or 10DGT; Exported Total/Partial: 8+2DGT, 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: 9 999 999 999. Min. instantaneous variables: 0.000; energies 0.00
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 EN 62052-11
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 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).
Maximum CT ratio x VT ratio	9999 x 9999
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).

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Main functions (cont.)

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 100% of the display scale
On-time delay	0 to 255s
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 12H AM/PM format.
Date format	Day-month-year with selectable DD-MM-YY or MM-DD-YY format.
Battery life	10 years
Easy programming function	The displayed energy is always “imported” with the only exception of “C”, “D”, “E” 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, 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, 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	
Immunity and emissions	According to EN62052-11
Standard compliance	
Safety	IEC60664, IEC61010-1 EN60664, EN61010-1 EN62052-11.
Metrology	EN62053-22, EN62053-23.
Pulse output	IEC62053-31
Approvals	Eligible System performance Meter for Go Solar California, CE, cULus “Listed”
Connections	Screw-type
Cable cross-section area	max. 2.5 mm². min./max. screws tightening torque: 0.4 Nm / 0.8 Nm. Suggested screws tightening torque: 0.5 Nm

General specifications (cont.)

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	Polycarbonate/ABS/Nylon PA66, self-extinguishing: UL 94 V-0

Mounting	Panel mounting
Protection degree	
Front	IP65, NEMA4x, NEMA12
Screw terminals	IP20
Weight	Approx. 420 g (packing included)

Insulation between inputs and outputs

	Power Supply (H o L)	Mesuring inputs	Relay output (MOR2)	Static ouput (MOO2)	Serial port	Ethernet port	Analogue outputs
Power Supply (H o L)	-	4kV	4kV	4kV	4kV	4kV	4kV
Mesuring inputs	4kV	-	4kV	4kV	4kV	4kV	4kV
Relay output (MOR2)	4kV	4kV	2kV	-	4kV	4kV	4kV
Static ouput (MOO2)	4kV	4kV	-	2kV	4kV	4kV	4kV
Serial port	4kV	4kV	4kV	4kV	-	-	4kV
Ethernet port	4kV	4kV	4kV	4kV	-	-	4kV
Analogue outputs	4kV	4kV	4kV	4kV	4kV	4kV	4kV(1)

(1): respect another module 4kV, in the same module 0kV.
-: combination 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 (1P)	2-ph. sys (2P)	3-ph. 3-wire balanced sys (3P.1)	3-ph. 2-wire balanced sys (3P.2)	3-ph. 3-wire unbal. sys (3P)	3-ph. 4-wire unbal. sys (3P.n)	Notes
1	VL-N sys	O	X	X	X	#	X	sys= system= ∑
2	VL1	X	X	X	X	#	X	
3	VL2	O	X	H	H	#	X	(H)=VL1
4	VL3	O	O	H	H	#	X	(H)=VL1
5	VL-L sys	O	#	X	X	X	X	sys= system= ∑
6	VL1-2	#	X	X	P	X	X	(P)=VL1*1.73
7	VL2-3	#	O	X	P	X	X	(P)=VL1*1.73
8	VL3-1	#	O	X	P	X	X	(P)=VL1*1.73
9	Asys	O	X	O	O	X	X	
10	An	#	X	O	O	O	X	
11	AL1	X	X	X	X	X	X	
12	AL2	O	X	K	R	X	X	(R)=AL1
13	AL3	O	O	K	R	X	X	(R)=AL1
14	VA sys	X	X	X	X	X	X	sys= system= ∑
15	VA L1	X	X	X	X	O	X	
16	VA L2	O	X	U	U	O	X	(U)=VAL1
17	VA L3	O	O	U	U	O	X	(U)=VAL1
18	var sys	X	X	X	X	X	X	sys= system= ∑
19	var L1	X	X	X	X	O	X	
20	var L2	O	X	V	V	O	X	(V)=VARL1
21	var L3	O	O	V	V	O	X	(V)=VARL1
22	W sys	X	X	X	X	X	X	sys= system= ∑
23	WL1	X	X	X	X	O	X	
24	WL2	O	X	S	S	O	X	(S)=WL1
25	WL3	O	O	S	S	O	X	(S)=WL1
26	PF sys	X	X	X	X	X	X	sys= system= ∑
27	PF L1	X	X	X	X	O	X	
28	PF L2	O	X	T	T	O	X	(T)=PFL1
29	PF L3	O	O	T	T	O	X	(T)=PFL1
30	Hz	X	X	X	X	X	X	
31	Phase seq.	O	X	X	X	X	X	
32	Asy VLL	O	O	X	O	X	X	Asymmetry
33	Asy VLN	O	X	O	O	O	X	Asymmetry
34	Run Hours	X	X	X	X	X	X	
35	kWh (+)	X	X	X	X	X	X	Total
36	kvarh (+)	X	X	X	X	X	X	Total (1)
37	kWh (+)	X	X	X	X	X	X	Partial
38	kvarh (+)	X	X	X	X	X	X	Partial (1)
39	kWh (-)	X	X	X	X	X	X	Total
40	kvarh (-)	X	X	X	X	X	X	Total (1)
41	kWh (-)	X	X	X	X	X	X	Partial
42	kvarh (-)	X	X	X	X	X	X	Partial (1)
43	A L1 THD	X	X	X	X	X	X	
44	A L2 THD	O	X	F	F	X	X	(F)=AL1THD (F)=AL1THD
45	A L3 THD	O	O	F	F	X	X	
46	V L1 THD	X	X	X	X	O	X	(G)=VL1THD
47	V L2 THD	O	X	X	G	O	X	(G)=VL1THD
48	V L3 THD	O	O	X	G	O	X	
49	V L1-2 THD	X	X	X	#	X	X	
50	V L2-3 THD	O	X	X	#	X	X	
51	V L3-1 THD	O	O	X	#	X	X	

(X) = available; (O) = not available (variable not available); (#) Not available (the relevant page is not displayed)
(1): On 4 quadrants (ind/cap)

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Power supply specifications

Auxiliary power supply

H: 100-240 +/-10% (90 to 255) VDC/AC (50/60 Hz);
L: 24-48 +/-15% (20 to 55) VDC/AC (50/60 Hz)

Power consumption

AC: 20 VA;
DC: 10 W

List of selectable applications

	Description	Notes
A	Cost allocation	Imported energy metering (Easy connection)
B	Cost control	Imported and partial energy metering (Easy connection)
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 (Easy connection)
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	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 ∑	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
b	14	a/Phase seq.	A ∑	AL1	AL2	AL3	(1) (2)				x	x	x	x
c	15	a/Phase seq.	W ∑	WL1	WL2	WL3	(1) (2)				x	x	x	x
c	16	a/Phase seq.	var ∑	var L1	var L2	var L3	(1) (2)					x	x	x
c	17	a/Phase seq.	PF ∑	PF L1	PF L2	PF L3	(1) (2)					x	x	x
c	18	a/Phase seq.	VA ∑	VA L1	VA L2	VA L3	(1) (2)					x	x	x
d	19	a/Phase seq.		THD V1	THD V2	THD V3	(1) (2)						x	x
d	20	a/Phase seq.		THD V12	THD V23	THD V31	(1) (2)						x	x
d	21	a/Phase seq.		THD A1	THD A2	THD A3	(1) (2)						x	x

Note: the table refers to system 3P.n.
(1) Also maximum value storage (no EEPROM storage).
(2) Also average (dmd) value (no EEPROM storage).

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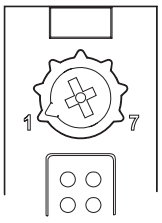
Additional available information on the display

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

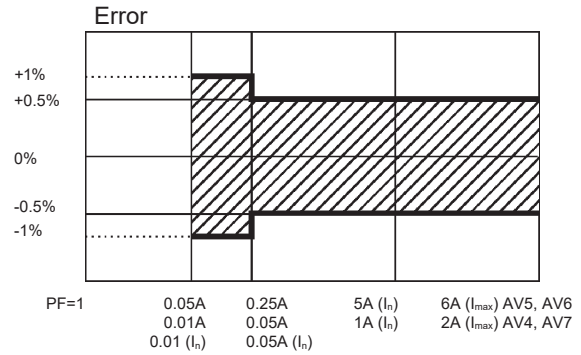
Back protection rotary switch

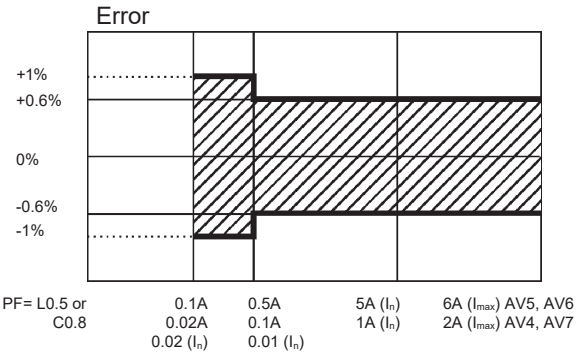


Function	Rotary switch position	Description
Unlok	1	All programming parameters are freely modifiable by means of the front key-pad and by means of the communication port.
Lock	7	The key-pad, as far as programming is concerned and the data through the serial communication cannot be changed (no writing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

Accuracy (According to EN62053-22 and EN62053-23)

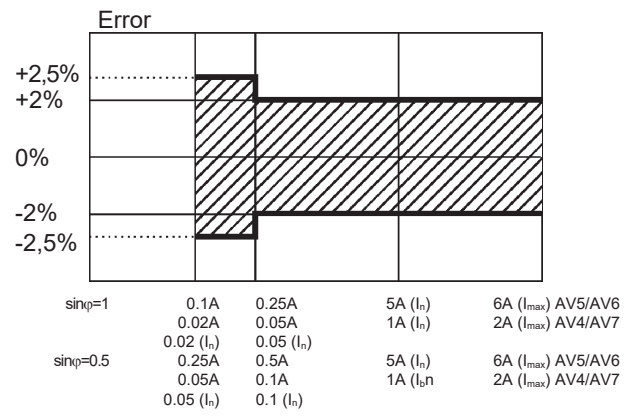
kWh, accuracy (RDG) depending on the current





Class 0.5S accuracy limits (Active energy)
Start-up current: 5mA (AV5-AV6), 1mA (AV4-AV7)

kvarh, accuracy (RDG) depending on the current



Class 2 accuracy limits (Reactive energy)
Start-up current: 5mA (AV5-AV6), 1mA (AV4-AV7)

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UCS parameter progr. and var. reading software

UCS Software

Multi-language software (Italian, English, French, German, Danish, Czech, Chinese, Spanish) for variable reading, and parameters programming (both online and offline). The program runs under Windows 7 and following versions.

Working mode

Four different working modes can be selected:
- management of local RS232 (MODBUS);
- management of local optical port (MODBUS)
- management of a local RS485 network (MODBUS);
- managed via TCP port

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

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

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

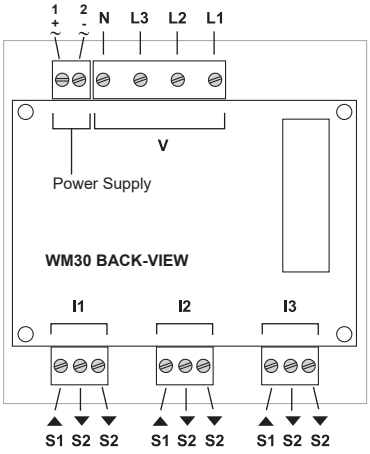
$$k\,\mathrm{var}hi = \int_{t1}^{t2} Qi(t)dt \cong \Delta t \sum_{n1}^{n2} Qnj$$

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

Where:

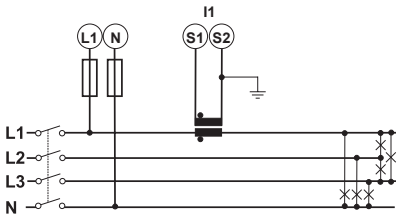
i= considered phase (L1, L2 or L3)
P= active power; **Q**= reactive power; $\mathbf{t_1}$, $\mathbf{t_2}$ =starting and ending time points of consumption recording; **n**= time unit Δ;Δ**t**= time interval between two successive power consumptions; $\mathbf{n_1}$, $\mathbf{n_2}$ = starting and ending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

Wiring diagrams



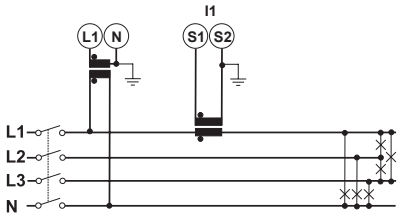
System type selection: 3-Ph.2

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



1-CT connection F=315 mA [T]

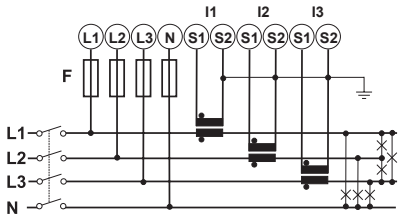
3-ph, 2-wire, balanced load **Fig. 2**



1-CT and 1-VT/PT connections

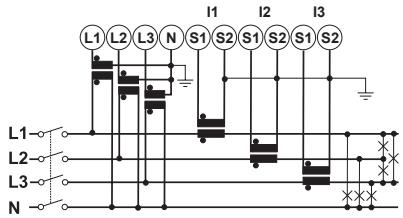
System type selection: 3-Ph.n

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



3-CT connection F=315 mA [T]

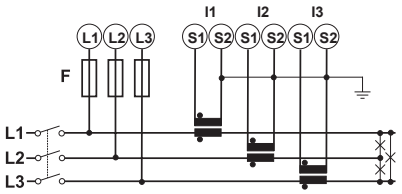
3-ph, 4-wire, unbalanced load **Fig. 4**



3-CT and 3-VT/PT connections

System type selection: 3-Ph

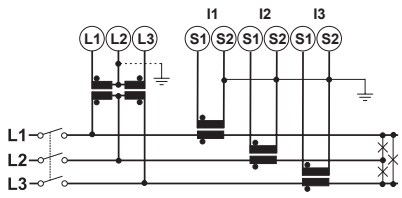
3-ph, 3-wire, unbalanced load **Fig. 5**



3-CT connection F=315 mA [T]

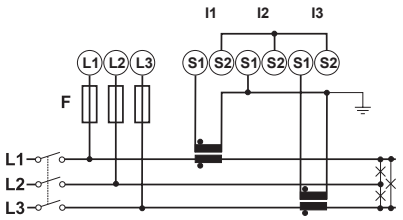
System type selection: 3-Ph (cont.)

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



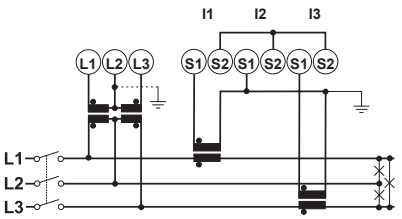
3-CT and 2-VT/PT connections

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



2-CT connections (ARON) F=315 mA [T]

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

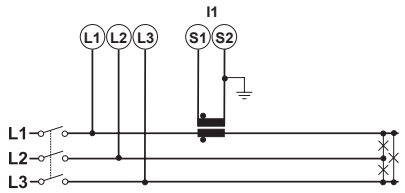


2-CT and 2-VT/PT connections ARON

Wiring diagrams

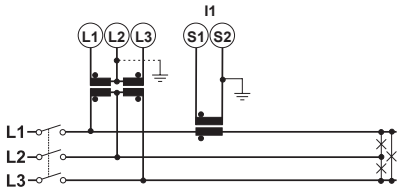
System type selection: 3-Ph.1

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



1-CT connections F=315 mA [T]

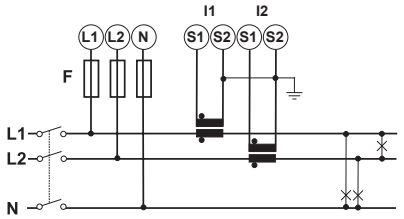
3-ph, 3-wire, balanced load **Fig. 10**



1-CT and 2-VT/PT connections

System type selection: 2-Ph

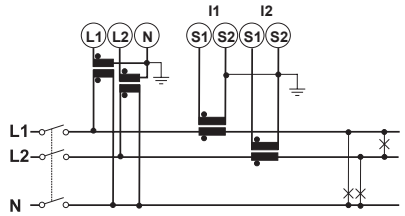
2-ph, 3-wire **Fig. 11**



2-CT connection F=315 mA [T]

System type selection: 2-Ph (cont.)

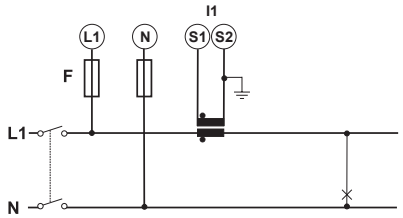
2-ph, 3-wire **Fig. 12**



2-CT and 2-VT/PT connections

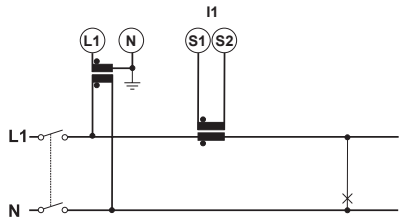
System type selection: 1-Ph

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



1-CT connection F=315 mA [T]

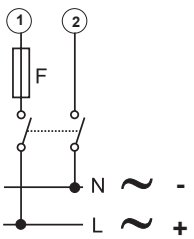
1-ph, 2-wire **Fig. 14**



1-CT and 1-VT/PT connections

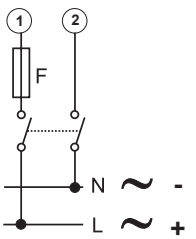
Power Supply

90 to 260VAC/DC (H option) **Fig. 15**



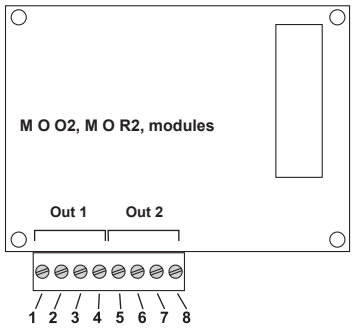
F= 250V [T] 630mA

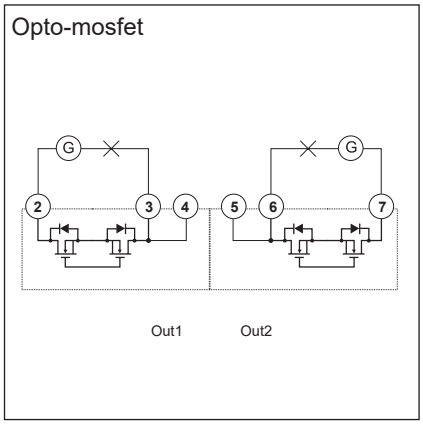
18 to 60VAC/DC (L option) **Fig. 16**

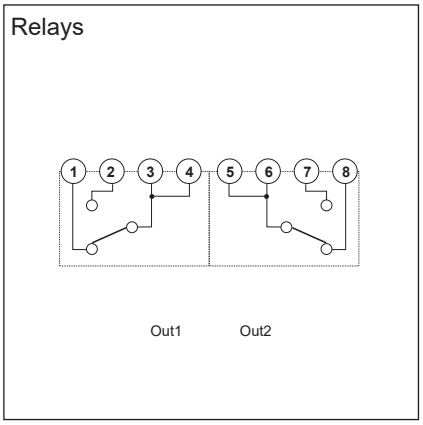


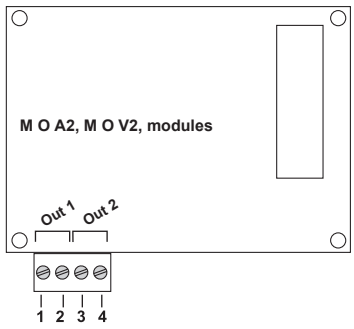
F= 250V [T] 3,15A

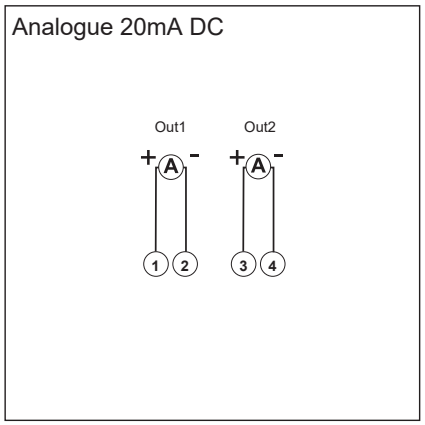
Static, relay and analogue outputs wiring diagrams

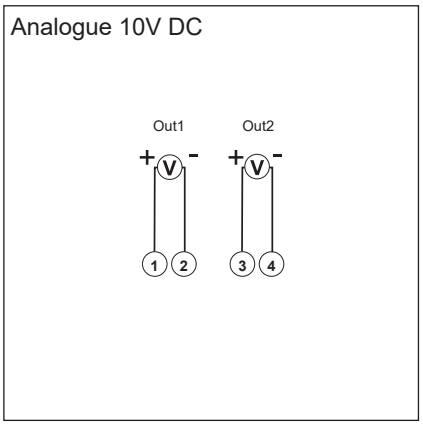




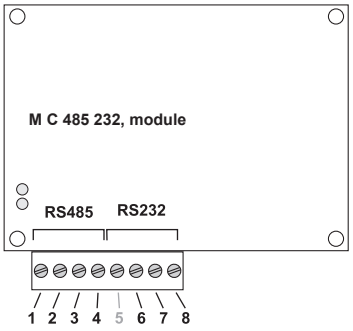


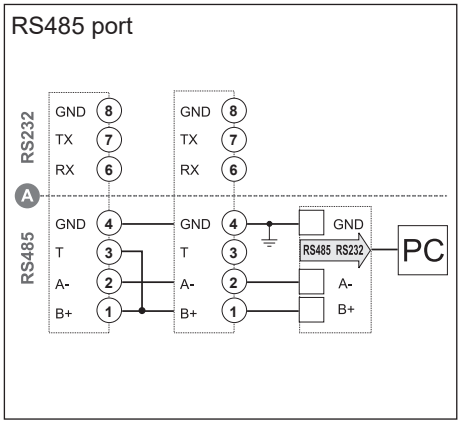


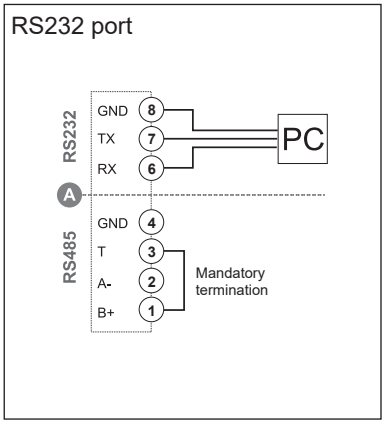




RS485 and RS232 wiring diagrams

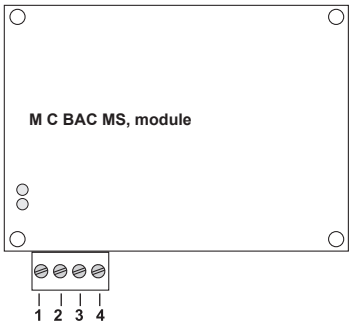


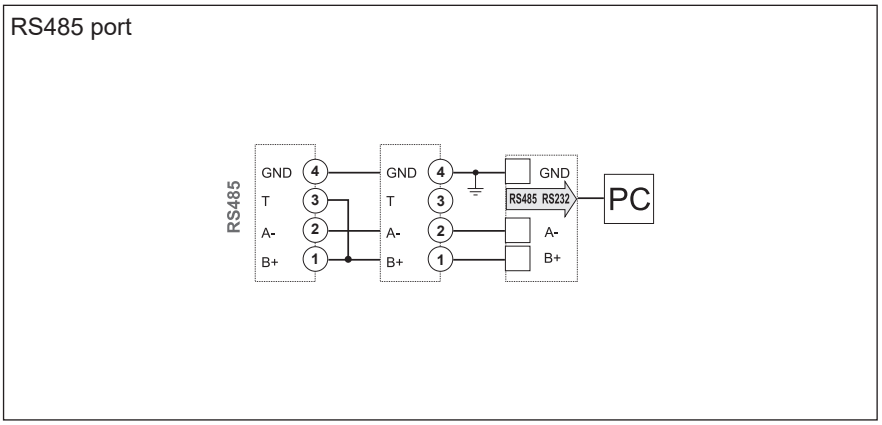




NOTE. RS485: additional devices provided with RS485 are connected in parallel. The termination of the serial output is carried out only on the last instrument of the network, by means of a jumper between (B+) and (T). The communication RS232 and RS485 ports **can't be** connected and used simultaneously.

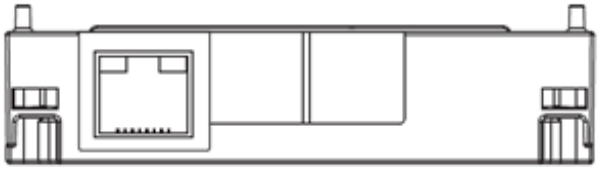
RS485 wiring diagram of Bacnet module





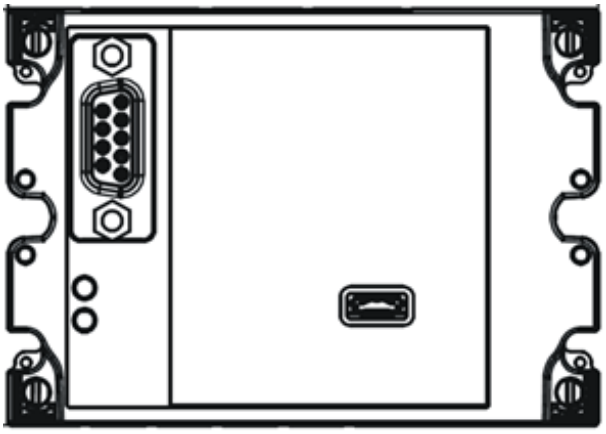
NOTE. RS485: additional devices provided with RS485 are connected in parallel. The termination of the serial output is carried out only on the last instrument of the network, by means of a jumper between (B+) and (T).

Ethernet and BACnet-IP connections



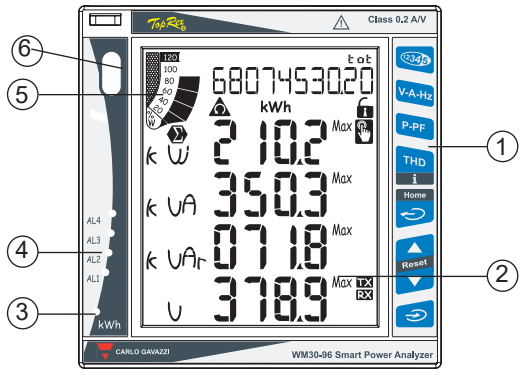
Connection to Ethernet or BACnet modules using the RJ45 connector.

Profibus module connections



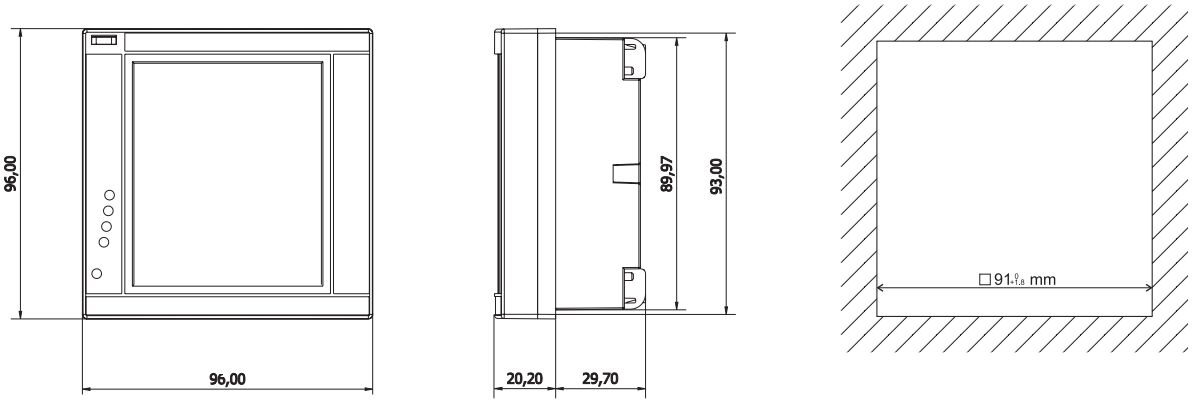
Connection to the Profibus module using USB micro type B (Modbus RTU) and RS485 DB9 (Profibus DP-V0).

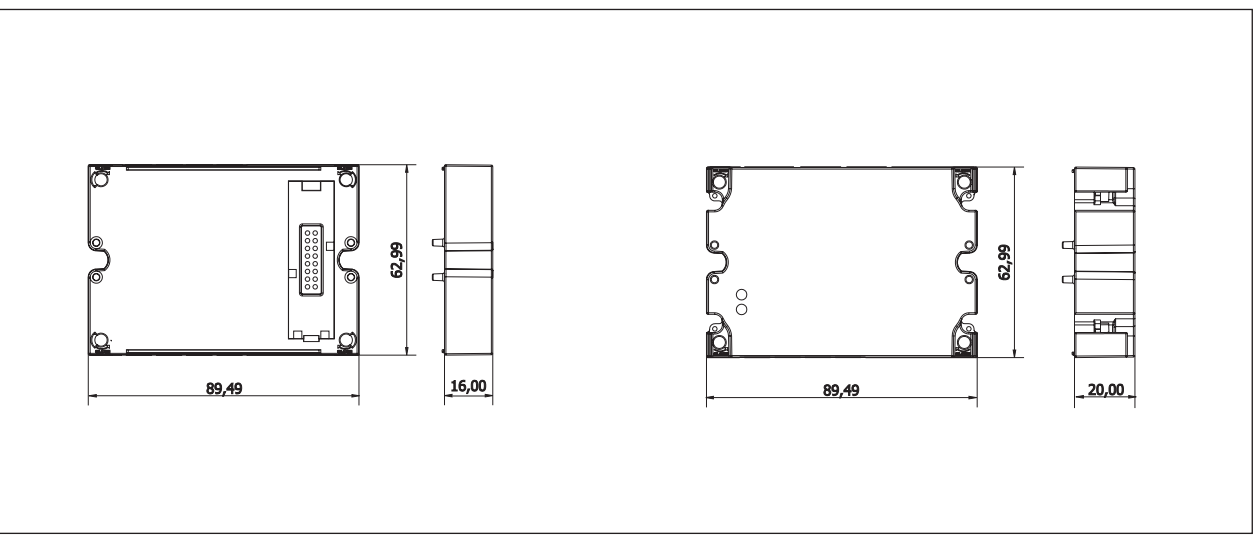
Front panel description



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.
6. **Optical communication port**
   To program the working parameters and to read the measurements.

Dimensions and Panel cut-out





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