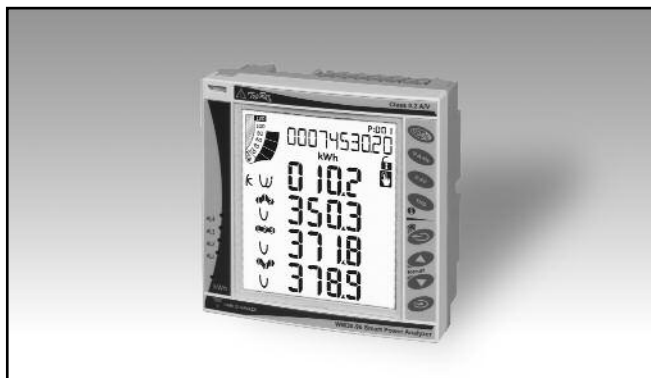


# Energy Management Smart Modular Power Analyzer Type WM30 96

CARLO GAVAZZI



- One RS232 and RS485 port (on request)
- 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)
- Ethernet/IP port, ODVA 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)

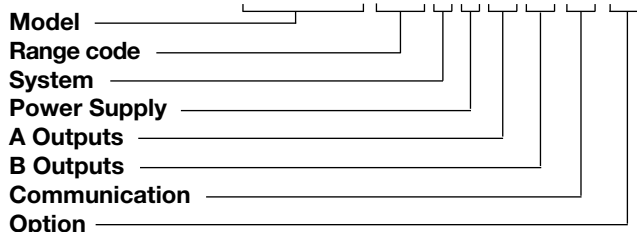
- Class 0.5 (kWh) according to EN62053-22
- Class C (kWh) according to EN50470-3
- Class 2 (kvarh) according to EN62053-23
- Accuracy  $\pm 0.2\%$  RDG (current/voltage)
- Instantaneous variables readout: 4x4 DGT
- Energies readout: 9+1 DGT
- System variables: VLL, VLN, A, VA, W, var, PF, Hz, Phase-sequence-asymmetry-loss.
- 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: 24-48 VDC/AC, 100-240 VDC/AC
- Front dimensions: 96x96 mm
- Front protection degree: IP65, NEMA4X, NEMA12

## 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. Parameters programming and data reading can be easily performed by means of WM3040Soft.

## 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<br>1(2)A<br>V <sub>LN</sub> : 160V to 480V <sub>LN</sub><br>V <sub>LL</sub> : 277V to 830V <sub>LL</sub> | <b>3:</b> balanced and unbalanced load:<br>3-phase, 4-wire;<br>3-phase, 3-wire;<br>2-phase, 3-wire;<br>1-phase, 2-wire | <b>H:</b> 100-240 +/-10% (90 to 255) VDC/AC (50/60 Hz)                                                                                                                                                                       | <b>XX:</b> none<br><b>O2:</b> Dual channel static output<br><b>R2:</b> Dual channel relay output                       |
| <b>AV5:</b> 400/690V <sub>LL</sub> AC<br>5(6)A<br>V <sub>LN</sub> : 160V to 480V <sub>LN</sub><br>V <sub>LL</sub> : 277V to 830V <sub>LL</sub> |                                                                                                                        | <b>L:</b> 24-48 +/-15% (20 to 55) VDC/AC (50/60 Hz)                                                                                                                                                                          |                                                                                                                        |
| <b>AV6:</b> 100/208V <sub>LL</sub> AC<br>5(6)A<br>V <sub>LN</sub> : 40V to 144V <sub>LN</sub><br>V <sub>LL</sub> : 70V to 250V <sub>LL</sub>   |                                                                                                                        |                                                                                                                                                                                                                              |                                                                                                                        |
| <b>AV7:</b> 100/208V <sub>LL</sub> AC<br>1(2)A<br>V <sub>LN</sub> : 40V to 144V <sub>LN</sub><br>V <sub>LL</sub> : 70V to 250V <sub>LL</sub>   | <b>Options</b><br><b>XX:</b> none                                                                                      | <b>Communication</b><br><b>XX:</b> none<br><b>S1:</b> RS485/RS232 port<br><b>E2:</b> Ethernet / Internet port<br><b>B1:</b> BACnet (IP) over Ethernet<br><b>B3:</b> BACnet (MS/TP) over RS485<br><b>E6:</b> Ethernet/IP port | <b>B Outputs</b><br><b>XX:</b> none<br><b>A2:</b> Dual channel 20mA DC output<br><b>V2:</b> Dual channel 10V DC output |

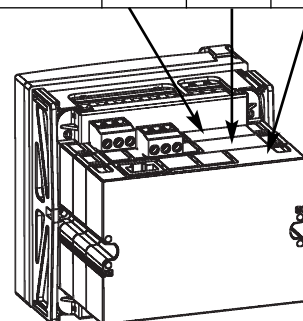
## Position of modules and combination

| 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: AV4.3</li> <li>Power supply: H</li> </ul> | WM30 AV4 3 H |        |        |        |
| 4   |                                                                 | <ul style="list-style-type: none"> <li>Inputs/system: AV7.3</li> <li>Power supply: H</li> </ul> | WM30 AV7 3 H |        |        |        |
|     |                                                                 | <ul style="list-style-type: none"> <li>Inputs/system: AV5.3</li> <li>Power supply: L</li> </ul> | WM30 AV5 3 L |        |        |        |
|     |                                                                 | <ul style="list-style-type: none"> <li>Inputs/system: AV6.3</li> <li>Power supply: L</li> </ul> | WM30 AV6 3 L |        |        |        |
|     |                                                                 | <ul style="list-style-type: none"> <li>Inputs/system: AV4.3</li> <li>Power supply: L</li> </ul> | WM30 AV4 3 L |        |        |        |
|     |                                                                 | <ul style="list-style-type: none"> <li>Inputs/system: AV7.3</li> <li>Power supply: L</li> </ul> | WM30 AV7 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       | 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       | X      |        |        |
| 7   | Dual analogue output (+20mADC)                                  | <ul style="list-style-type: none"> <li>2-channel</li> </ul>                                     | M O A2       |        | X      |        |
| 8   | Dual analogue output (+10VDC)                                   | <ul style="list-style-type: none"> <li>2-channel</li> </ul>                                     | M O V2       |        | X      |        |
| 9   | RS485 / RS232 port module                                       | <ul style="list-style-type: none"> <li>Max. 115.2 Kbps</li> </ul>                               | M C 485 232  |        |        | X      |
| 10  | Ethernet port module                                            | <ul style="list-style-type: none"> <li>RJ45 10/100 BaseT</li> </ul>                             | M C ETH      |        |        | X      |
| 11  | BACnet-IP port module                                           | <ul style="list-style-type: none"> <li>Based on Ethernet bus</li> </ul>                         | M C BAC IP   |        |        | X      |
| 12  | BACnet-MS/TP port module                                        | <ul style="list-style-type: none"> <li>Over RS485</li> </ul>                                    | M C BAC MS   |        |        | X      |
| 13  | Ethernet/IP                                                     | <ul style="list-style-type: none"> <li>Based on Ethernet</li> </ul>                             | M C E I      |        |        | 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.

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



## Input specifications

|                                                                        |                                                                                                                                                                |                                        |                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Rated inputs</b>                                                    | System type: 1, 2 or 3-phase<br>Galvanic insulation by means of built-in CT's<br>AV5 and AV6: 5(6)A<br>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                                                                                                                                                             |
| Input type                                                             |                                                                                                                                                                | Influence quantities                   |                                                                                                                                                                                                                                                               |
| Current range (by CT)                                                  |                                                                                                                                                                | <b>Total Harmonic Distortion (THD)</b> | ±1% FS (FS: 100%)<br>AV4: Imin: 5mARMS; Imax: 3A; Umin: 30VRMS; Umax: 679Vp<br>AV5: Imin: 5mARMS; Imax: 15Ap; Umin: 30VRMS; Umax: 679Vp<br>AV6: Imin: 5mARMS; Imax: 15Ap; Umin: 30VRMS; Umax: 204Vp<br>AV7: Imin: 5mARMS; Imax: 3A; Umin: 30VRMS; Umax: 204Vp |
| Voltage (by direct connection or VT/PT)                                | AV4, AV5: 400/690VLL;<br>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)<br>AV4, AV7: ≤3 (3A max. peak)                                                                                                                                                                                                   |
| Current AV4, AV5, AV6, AV7 models                                      | From 0.01In to 0.05In: ±(0.5% RDG +2DGT)<br>From 0.05In to Imax: ±(0.2% RDG +2DGT)<br>In the range Un: ±(0,2% RDG +1DGT)<br>In the range Un: ±(0.5% RDG +1DGT) | <b>Current Overloads</b>               |                                                                                                                                                                                                                                                               |
| Phase-neutral voltage                                                  | ±0.01Hz (45 to 65Hz) from 0.01In to 0.05In, PF 1: ±(1%RDG+1DGT)                                                                                                | Continuous (AV5 and AV6)               | 6A, @ 50Hz                                                                                                                                                                                                                                                    |
| Phase-phase voltage                                                    | From 0.05In to Imax PF 0.5L, PF1, PF0.8C: ±(0.5%RDG+1DGT)                                                                                                      | Continuous (AV4 and AV7)               | 2A, @ 50Hz                                                                                                                                                                                                                                                    |
| Frequency                                                              | ±[0.001+0.5% (1.000 - "PF RDG")]                                                                                                                               | For 500ms (AV5 and AV6)                | 120A, @ 50Hz                                                                                                                                                                                                                                                  |
| Active and Apparent power                                              | From 0.05In to 0.1In, senφ 0.5L/C: ±(1.5%RDG+1DGT)                                                                                                             | For 500ms (AV4 and AV7)                | 40A, @ 50Hz                                                                                                                                                                                                                                                   |
| Power Factor                                                           | From 0.02In to 0.05In, senφ 1: ±(1.5%RDG+1DGT)                                                                                                                 | <b>Voltage Overloads</b>               |                                                                                                                                                                                                                                                               |
| Reactive power                                                         | From 0.05In to Imax, senφ 1: ±(1%RDG+1DGT)                                                                                                                     | Continuous                             | 1.2 Un                                                                                                                                                                                                                                                        |
|                                                                        | From 0.05In to 0.1In, senφ 0.5L/C: ±(1.5%RDG+1DGT)                                                                                                             | For 500ms                              | 2 Un                                                                                                                                                                                                                                                          |
|                                                                        | From 0.1In to Imax, senφ 0.5L/C: ±(1%RDG+1DGT)                                                                                                                 | <b>Input impedance</b>                 |                                                                                                                                                                                                                                                               |
| Active energy                                                          | Class 0.5 according to EN62053-22, ANSI C12.20                                                                                                                 | 400VL-L (AV4 and AV5)                  | > 1.6MΩ                                                                                                                                                                                                                                                       |
|                                                                        | Class C according to EN50470-3.                                                                                                                                | 208VL-L (AV6 and AV7)                  | > 1.6MΩ                                                                                                                                                                                                                                                       |
| Reactive energy                                                        | Class 2 according to EN62053-23, ANSI C12.1.                                                                                                                   | 5(6)A (AV5 and AV6)                    | < 0.2VA                                                                                                                                                                                                                                                       |
| Start up current AV5, AV6                                              | 5mA                                                                                                                                                            | 1(2)A (AV4 and AV7)                    | < 0.2VA                                                                                                                                                                                                                                                       |
| Start up current AV4, AV7                                              | 1mA                                                                                                                                                            | <b>Frequency</b>                       | 40 to 440 Hz                                                                                                                                                                                                                                                  |

## Output specifications

### Relay outputs (M O R2)

|                           |                                                                                                                                     |                                                             |                                                                                                                                                                                        |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Physical outputs          | 2 (max. 1 module per instrument)                                                                                                    |                                                             | to 10.00 kWh/kvarh per pulse. The above listed variables can be connected to any output. $\geq 100\text{ms} < 120\text{msec}$ (ON), $\geq 120\text{ms}$ (OFF), according to EN62052-31 |
| Purpose                   | For either alarm output or pulse output                                                                                             | Pulse duration                                              |                                                                                                                                                                                        |
| Type                      | Relay, SPDT type<br>AC 1-5A @ 250VAC; AC 15-1.5A @ 250VAC                                                                           | Remote controlled outputs                                   | The activation of the outputs is managed through the serial communication port<br>See "Insulation between inputs and outputs" table                                                    |
| 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.            | Insulation                                                  |                                                                                                                                                                                        |
| Alarms                    | Up alarm and down alarm linked to the virtual alarms, other details see Virtual alarms                                              | <b>20mA analogue outputs (M O A2)</b>                       |                                                                                                                                                                                        |
| Min. response time        | $\leq 200\text{ms}$ , filters excluded. Set-point on-time delay: "0 s".                                                             | Number of outputs                                           | 2 per module (max. 1 module per instrument)                                                                                                                                            |
| Pulse                     |                                                                                                                                     | Accuracy (@ 25°C $\pm 5^\circ\text{C}$ , R.H. $\leq 60\%$ ) | $\pm 0.2\%$ FS                                                                                                                                                                         |
| Signal retransmission     | Total: +kWh, -kWh, +kvarh, -kvarh.<br>Partial: +kWh, -kWh, +kvarh, -kvarh.                                                          | Range                                                       | 0 to 20mA                                                                                                                                                                              |
| Pulse type                | Programmable from 0.001 to 10.00 kWh/kvarh per pulse. The above listed variables can be connected to any output.                    | Configuration                                               | By means of the front key-pad                                                                                                                                                          |
| Pulse duration            | $\geq 100\text{ms} < 120\text{msec}$ (ON), $\geq 120\text{ms}$ (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".                                              |
| Remote controlled outputs | The activation of the outputs is managed through the serial communication port<br>See "Insulation between inputs and outputs" table | Scaling factor                                              | Programmable within the whole range of retransmission.                                                                                                                                 |
| Insulation                |                                                                                                                                     | Response time                                               | $\leq 400\text{ ms}$ typical (filter excluded)                                                                                                                                         |
|                           |                                                                                                                                     | Ripple                                                      | $\leq 1\%$ (according to IEC 60688-1, EN 60688-1)                                                                                                                                      |
|                           |                                                                                                                                     | Total temperature drift                                     | $\leq 500\text{ ppm}/^\circ\text{C}$                                                                                                                                                   |
|                           |                                                                                                                                     | Load                                                        | $\leq 600\Omega$                                                                                                                                                                       |
|                           |                                                                                                                                     | Insulation                                                  | See "Insulation between inputs and outputs" table                                                                                                                                      |

### Static outputs (M O O2)

|                       |                                                                                                                          |                                                    |                                                                                                                                           |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Physical outputs      | Opto-Mos type<br>2 (max. 1 module per instrument)                                                                        | <b>10VDC analogue outputs (M O V2)</b>             |                                                                                                                                           |
| Purpose               | For either pulse output or alarm output                                                                                  | Number of outputs                                  | 2 (max. 1 module per instrument)                                                                                                          |
| Signal                | $V_{\text{ON}}$ : 2.5VAC/DC/max. 100mA<br>$V_{\text{OFF}}$ : 42VDC max.                                                  | Accuracy (@ 25°C $\pm 5^\circ\text{C}$ , R.H. 60%) | $\pm 0.2\%$ FS                                                                                                                            |
| Configuration         | By means of the front key-pad                                                                                            | Range                                              | 0 to 10 VDC                                                                                                                               |
| Function              | The outputs can work as alarm outputs but also as pulse outputs, remote controlled outputs, or in any other combination. | Configuration                                      | By means of the front key-pad                                                                                                             |
| Alarms                | Up alarm and down alarm linked to the virtual alarms, other details see Virtual alarms                                   | 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". |
| Min. response time    | $\leq 200\text{ms}$ , filters excluded. Set-point on-time delay: "0 s".                                                  | Scaling factor                                     | Programmable within the whole range of retransmission;                                                                                    |
| Pulse                 |                                                                                                                          | Response time                                      | $\leq 400\text{ ms}$ typical (filter excluded)                                                                                            |
| Signal retransmission | Total: +kWh, -kWh, +kvarh, -kvarh.<br>Partial: +kWh, -kWh, +kvarh, -kvarh.                                               | Ripple                                             | $\leq 1\%$ (according to IEC 60688, EN 60688)                                                                                             |
| Pulse type            | Programmable from 0.001                                                                                                  | Total temperature drift                            | $\leq 350\text{ ppm}/^\circ\text{C}$                                                                                                      |
|                       |                                                                                                                          | Load                                               | $\geq 10\text{k}\Omega$                                                                                                                   |
|                       |                                                                                                                          | Insulation                                         | See "Insulation between inputs and outputs" table                                                                                         |

## Output specifications (cont.)

|                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>RS485 (on request)</b><br>Type<br>Connections<br>Addresses<br>Protocol<br>Data (bidirectional)<br>Dynamic (reading only)<br>Static (reading and writing only)<br>Data format<br>Baud-rate<br>Driver input capability<br>Note<br>Insulation | Multidrop, bidirectional (static and dynamic variables)<br>2-wire<br>Max. distance 1000m, termination directly on the module<br>247, selectable by means of the front key-pad<br>MODBUS/JBUS (RTU)<br>System and phase variables: see table "List of variables..."<br>All the configuration parameters.<br>1 start bit, 8 data bit, no/even/odd parity, 1 stop bit<br>Selectable: 9.6k, 19.2k, 38.4k, 115.2k bit/s<br>1/5 unit load. Maximum 160 transceivers on the same bus.<br>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.<br>See "Insulation between inputs and outputs" table | <b>Ethernet/Internet port (on request)</b><br>Protocols<br>IP configuration<br>Port<br>Client connections<br>Connections<br>Data (bidirectional)<br>Dynamic (reading only)<br>Static (reading and writing only)<br>Note<br>Insulation | Modbus TCP/IP<br>Static IP / Netmask / Default gateway<br>Selectable (default 502)<br>Max 5 simultaneously<br>RJ45 10/100 BaseTX<br>Max. distance 100m<br>System and phase variables: see table "List of variables..."<br>All the configuration parameters.<br>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.<br>See "Insulation between inputs and outputs" table                                                                                                                                                   |
| <b>RS232 port (on request)</b><br>Type<br>Connections<br>Protocol<br>Data (bidirectional)<br>Dynamic (reading only)<br>Static (reading and writing only)<br>Data format<br>Baud-rate<br>Note<br>Insulation                                    | Bidirectional (static and dynamic variables)<br>3 wires. Max. distance 15m<br>MODBUS RTU /JBUS<br>System and phase variables: see table "List of variables..."<br>All the configuration parameters<br>1 start bit, 8 data bit, no/even/odd parity, 1 stop bit<br>Selectable: 9.6k, 19.2k, 38.4k, 115.2k bit/s<br>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.<br>See "Insulation between inputs and outputs" table                                                                                                                                                                  | <b>BACnet-IP (on request)</b><br>Protocols<br>BACnet-IP<br>IP configuration<br>Port<br>Device object instance<br>Supported services<br>Supported objects<br>IP configuration<br>Modbus TCP/IP<br>Client connections<br>Connections    | BACnet-IP (for measurement reading purpose and to write object description) and Modbus TCP/IP (for measurement reading purpose and for programming parameter purpose)<br>Static IP / Netmask / Default gateway<br>Fixed: BAC0h<br>0 to 9999 selectable by key-pad 0 to 2 <sup>22</sup> -2 = 4.194.302, selectable by programming software or by BACnet.<br>"I have", "I am", "Who has", "Who is", "Read (multiple) Property"<br>Type 2 (analogue value, including COV property), Type 5 (binary-value for up to 16 virtual alarm re-transmission) Type 8 (device)<br>Static IP / Netmask / Default gateway<br>See "Ethernet/Internet port" above<br>Modbus only: max 5 simultaneously<br>RJ45 10/100 BaseTX Max. distance 100m |



## Output specifications (cont.)

|                                   |                                                                                                                                                                                                                                                                                                         |                                   |                                                                                                                                                                                                                                                                                                          |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data<br>Dynamic (reading only)    | System and phase variables (BACnet-IP and Modbus); see table "List of variables"                                                                                                                                                                                                                        | Connections                       | simultaneously RJ45 10/100 BaseTX Max. distance 100m                                                                                                                                                                                                                                                     |
| 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. | Data<br>Dynamic (reading only)    | System and phase variables: see table "List of variables..."                                                                                                                                                                                                                                             |
| Note                              |                                                                                                                                                                                                                                                                                                         | 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. |
| Insulation                        | See "Insulation between inputs and outputs" table                                                                                                                                                                                                                                                       | Note                              |                                                                                                                                                                                                                                                                                                          |
| <b>BACnet MS/TP (on request)</b>  |                                                                                                                                                                                                                                                                                                         | Insulation                        | See "Insulation between inputs and outputs" table                                                                                                                                                                                                                                                        |
| Available ports                   | 2: RS485 and Ethernet                                                                                                                                                                                                                                                                                   | Approval                          | BTL                                                                                                                                                                                                                                                                                                      |
| RS485 port                        |                                                                                                                                                                                                                                                                                                         | <b>Ethernet/IP (on request)</b>   |                                                                                                                                                                                                                                                                                                          |
| Type                              | Multidrop, mono-directional (dynamic variables)                                                                                                                                                                                                                                                         | Protocols                         | Ethernet/IP (for measurement reading purpose) and Modbus TCP/IP (for programming parameter purpose)                                                                                                                                                                                                      |
| Connections                       | 2-wire Max. distance 1000m, termination directly on the module                                                                                                                                                                                                                                          | IP configuration                  | Static IP / Netmask / Default gateway                                                                                                                                                                                                                                                                    |
| Device object instance            | 0 to 9999 selectable by key-pad                                                                                                                                                                                                                                                                         | Modbus Port                       | Selectable (default 502)                                                                                                                                                                                                                                                                                 |
| Protocol                          | 0 to 2 <sup>22</sup> -2 = 4.194.302, selectable by programming software or by BACnet.                                                                                                                                                                                                                   |                                   | Modbus only: max 5 simultaneously RJ45 10/100 Base TX                                                                                                                                                                                                                                                    |
| Supported services                | BACnet MS/TP (for measurement reading purpose and to write object description)                                                                                                                                                                                                                          | Ethernet/IP port                  | Max distance 100m                                                                                                                                                                                                                                                                                        |
| Supported objects                 | "I have", "I am", "Who has", "Who is", "Read (multiple) Property"                                                                                                                                                                                                                                       | Topology                          | Star                                                                                                                                                                                                                                                                                                     |
|                                   | Type 2 (analogue value, including COV property), Type 5 (binary-value for up to 16 virtual alarm re-transmission) Type 8 (device)                                                                                                                                                                       | Level                             | RJ45 standard                                                                                                                                                                                                                                                                                            |
| Data (mono-directional)           |                                                                                                                                                                                                                                                                                                         | Connection                        | Max distance 100m                                                                                                                                                                                                                                                                                        |
| Dynamic                           | System and phase variables: see table "List of variables..."                                                                                                                                                                                                                                            | Messaging                         | Commercial level                                                                                                                                                                                                                                                                                         |
| Static                            | Not available                                                                                                                                                                                                                                                                                           | Supported features                | Connection establishment: target                                                                                                                                                                                                                                                                         |
| Data format                       | 1 start bit, 8 data bit, no parity, 1 stop bit                                                                                                                                                                                                                                                          |                                   | Class 1 and class 3 messaging                                                                                                                                                                                                                                                                            |
| Baud-rate                         | Selectable: 9.6k, 19.2k, 38.4k or 76.8k kbit/s                                                                                                                                                                                                                                                          |                                   | ACD (Address Conflict Detection)                                                                                                                                                                                                                                                                         |
| Driver input capability           | 1/5 unit load. Maximum 160 transceivers on the same bus.                                                                                                                                                                                                                                                |                                   | UCMM                                                                                                                                                                                                                                                                                                     |
| MAC addresses                     | Selectable: 0 to 127                                                                                                                                                                                                                                                                                    | Data                              | List service 0x0004                                                                                                                                                                                                                                                                                      |
| Ethernet port                     |                                                                                                                                                                                                                                                                                                         | Dynamic (reading only)            | List identity 0x0063                                                                                                                                                                                                                                                                                     |
| Protocol                          | Modbus TCP/IP (for programming parameter purpose)                                                                                                                                                                                                                                                       | Static (reading and writing only) | Register session 0x0065                                                                                                                                                                                                                                                                                  |
| IP configuration                  | Static IP / Netmask / Default gateway                                                                                                                                                                                                                                                                   |                                   | Unregister session 0x0066                                                                                                                                                                                                                                                                                |
| Modbus Port                       | Selectable (default 502)                                                                                                                                                                                                                                                                                | Insulation                        | Send RR data 0x006F                                                                                                                                                                                                                                                                                      |
| Client connections                | Modbus only: max 5                                                                                                                                                                                                                                                                                      | Approval                          | Send Unit Data 0x0070                                                                                                                                                                                                                                                                                    |
|                                   |                                                                                                                                                                                                                                                                                                         |                                   | System and phase variables (Ethernet/IP): see Ethernet/IP protocol document                                                                                                                                                                                                                              |
|                                   |                                                                                                                                                                                                                                                                                                         |                                   | All the configuration parameters (Modbus TCP only)                                                                                                                                                                                                                                                       |
|                                   |                                                                                                                                                                                                                                                                                                         |                                   | See "Insulation between inputs and outputs" table                                                                                                                                                                                                                                                        |
|                                   |                                                                                                                                                                                                                                                                                                         |                                   | Ethernet IP conformance tested (ODVA)                                                                                                                                                                                                                                                                    |

## Energy meters

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

## Harmonic distortion analysis

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

## Display, LED's and commands

|                                  |                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Display refresh time</b>      | ≤ 250 ms                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Display</b>                   | 4 lines, 4-DGT, 1 lines, 10-DGT                                                                                                                                                     | Energy consumption kWh pulsating                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Type                             | LCD, single colour backlight                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Digit dimensions                 | 4-DGT: h 9.5mm; 10-DGT: h 6.0mm                                                                                                                                                     | Red LED (only kWh)<br>0.001 kWh/kvarh by pulse if the Ct ratio by VT ratio is ≤7<br>0.01 kWh/kvarh by pulse if the Ct ratio by VT ratio is ≥7.1 ≤70.0<br>0.1 kWh/kvarh by pulse if the Ct ratio by VT ratio is ≥70.1 ≤700.0<br>1 kWh/kvarh by pulse if the Ct ratio by VT ratio is ≥700.1 ≤7000<br>10 kWh/kvarh by pulse if the Ct ratio by VT ratio is ≥7001 ≤70.00k<br>100 kWh/kvarh by pulse if the Ct ratio by VT ratio is >70.01k<br>Max frequency: 16Hz, according to EN50470-1 |
| Instantaneous variables read-out | 4-DGT                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Energies variables read-out      | Imported Total/Partial: 8+2DGT, 9+1DGT or 10DGT;<br>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 0.0                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <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. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                  | <b>Back position LEDs</b>                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                  | On the base<br>On the communication modules                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                  | <b>Key-pad</b>                                                                                                                                                                      | Green as power-on<br>Two LEDs: one for TX (green) and one for RX (amber).<br><br>For variable selection, programming of the instrument working parameters, “dmd”, “max”, total energy and partial energy Reset                                                                                                                                                                                                                                                                        |

## Main functions

|                                  |                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Password</b>                  | Numeric code of max. 4 digits; 2 protection levels of the programming data: Password "0", no protection;                                                                                                             | (always on) to 255 minutes                                                                                                                                                                                                                                                                                                                                       |
| 1st level                        | Password from 1 to 9999, all data are protected                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                  |
| 2nd level                        |                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                  |
| <b>System selection</b>          |                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                  |
| System 3-Ph.n unbalanced load    | 3-phase (4-wire)                                                                                                                                                                                                     | In case of basic unit or with the addition of M O R2 or M O O2 digital output modules.                                                                                                                                                                                                                                                                           |
| 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.          | Up to 4                                                                                                                                                                                                                                                                                                                                                          |
|                                  | 3-phase (3-wire), one current and 3-phase to phase voltage measurements                                                                                                                                              | Up alarm and down alarm. The alarms can be connected to any instantaneous variable available in the table "List of the variables that can be connected to".                                                                                                                                                                                                      |
| System 3-Ph.1 balanced load      | 3-phase (4-wire), one current and 3-phase to neutral voltage measurements.                                                                                                                                           | From 0 to 100% of the display scale                                                                                                                                                                                                                                                                                                                              |
|                                  | 3-phase (2-wire), one current and 1-phase (L1) to neutral voltage measurement.                                                                                                                                       | From 0 to 100% of the display scale                                                                                                                                                                                                                                                                                                                              |
| System 3-Ph.2 balanced load      | 2-phase (3-wire)                                                                                                                                                                                                     | 0 to 255s                                                                                                                                                                                                                                                                                                                                                        |
| System 2-Ph                      | 1-phase (2-wire)                                                                                                                                                                                                     | ≤ 200ms, filters excluded.                                                                                                                                                                                                                                                                                                                                       |
| System 1-Ph                      |                                                                                                                                                                                                                      | Set-point on-time delay: "0 s".                                                                                                                                                                                                                                                                                                                                  |
| <b>Transformer ratio</b>         |                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                  |
| 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).                                                                             |                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Filter</b>                    |                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                  |
| 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).                                                                                          |                                                                                                                                                                                                                                                                                                                                                                  |
| <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. |                                                                                                                                                                                                                                                                                                                                                                  |
| Backlight                        | The backlight time is programmable from 0                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Virtual alarms</b>            |                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                  |
| Working condition                |                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                  |
| No. of alarms                    |                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                  |
| Working mode                     |                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                  |
| Controlled variables             |                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                  |
| Set-point adjustment             |                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                  |
| Hysteresis                       |                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                  |
| On-time delay                    |                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                  |
| Min. response time               |                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Reset</b>                     |                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                  |
|                                  |                                                                                                                                                                                                                      | By means of the front keypad. It is possible to reset the following data:                                                                                                                                                                                                                                                                                        |
|                                  |                                                                                                                                                                                                                      | - all the max and dmd values.                                                                                                                                                                                                                                                                                                                                    |
|                                  |                                                                                                                                                                                                                      | - total energies: kWh, kvarh;                                                                                                                                                                                                                                                                                                                                    |
|                                  |                                                                                                                                                                                                                      | - partial energies: kWh, kvarh                                                                                                                                                                                                                                                                                                                                   |
| <b>Harmonic analysis</b>         |                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                  |
|                                  |                                                                                                                                                                                                                      | Up to the 32 <sup>nd</sup> harmonics on current and voltage                                                                                                                                                                                                                                                                                                      |
| <b>Clock</b>                     |                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                  |
| 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                                                                                                                                                                                                                                                                                                                                                         |
| <b>Easy programming 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 "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

|                                    |                                                                                                                              |                             |                                                                                                                                       |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <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 | <b>Standard compliance</b>  |                                                                                                                                       |
| <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         | Safety                      | IEC60664, IEC61010-1 EN60664, EN61010-1 EN62052-11.                                                                                   |
| <b>Installation category</b>       | Cat. III (IEC60664, EN60664)                                                                                                 | Metrology                   | EN62053-22, EN62053-23, EN50470-3.                                                                                                    |
| <b>Insulation (for 1 minute)</b>   | See "Insulation between inputs and outputs" table                                                                            | Pulse output                | DIN43864, IEC62053-31                                                                                                                 |
| <b>Dielectric strength</b>         | 4kVAC RMS for 1 minute                                                                                                       | <b>Approvals</b>            | Eligible System performance Meter for Go Solar California, CE, cULus "Listed"                                                         |
| <b>Noise rejection CMRR</b>        | 100 dB, 48 to 62 Hz                                                                                                          | <b>Connections</b>          |                                                                                                                                       |
| <b>EMC</b>                         |                                                                                                                              | Cable cross-section area    | 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 |
| Electrostatic discharges           | According to EN62052-11 15kV air discharge                                                                                   | <b>Housing DIN</b>          |                                                                                                                                       |
| Immunity to irradiated             | Test with current: 10V/m from 80 to 2000MHz                                                                                  | Dimensions (WxHxD)          | Module holder: 96x96x50mm. "A" and "B" type modules: 89.5x63x16mm. "C" type module: 89.5x63x20mm.                                     |
| Electromagnetic fields             | Test without any current: 30V/m from 80 to 2000MHz                                                                           | Max. depth behind the panel | With 3 modules (A+B+C): 81.7 mm                                                                                                       |
| Burst                              | On current and voltage measuring inputs circuit: 4kV                                                                         | Material                    | ABS/Nylon PA66, self-extinguishing: UL 94 V-0                                                                                         |
| Immunity to conducted disturbances | 10V/m from 150KHz to 80MHz                                                                                                   | Mounting                    | Panel mounting                                                                                                                        |
| Surge                              | On current and voltage measuring inputs circuit: 4kV; on "L" auxiliary power supply input: 1kV                               | <b>Protection degree</b>    |                                                                                                                                       |
| Radio frequency suppression        | According to CISPR 22                                                                                                        | Front Screw terminals       | IP65, NEMA4x, NEMA12 IP20                                                                                                             |
|                                    |                                                                                                                              | <b>Weight</b>               | Approx. 420 g (packing included)                                                                                                      |

## Insulation between inputs and outputs

|                      | Power Supply (H o L) | Mesuring inputs | Relè 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                |
| Relè 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 <sup>(1)</sup> |

(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).

## 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.<br>sys | 2-ph.<br>sys | 3-ph. 3/4-wire<br>balanced sys | 3-ph. 2-wire<br>balanced sys | 3-ph. 3-wire<br>unbal. sys | 3-ph. 4-wire<br>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                          | 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  | 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            | X                              | X                            | X                          | X                          |                       |
| 13 | AL3        | O            | O            | X                              | X                            | X                          | X                          |                       |
| 14 | VA sys     | X            | X            | X                              | X                            | X                          | X                          | sys= system= $\Sigma$ |
| 15 | VA L1      | X            | X            | X                              | X                            | #                          | X                          |                       |
| 16 | VA L2      | O            | X            | X                              | X                            | #                          | X                          |                       |
| 17 | VA L3      | O            | O            | X                              | X                            | #                          | X                          |                       |
| 18 | var sys    | X            | X            | X                              | X                            | X                          | X                          | sys= system= $\Sigma$ |
| 19 | var L1     | X            | X            | X                              | X                            | #                          | X                          |                       |
| 20 | var L2     | O            | X            | X                              | X                            | #                          | X                          |                       |
| 21 | var L3     | O            | O            | X                              | X                            | #                          | X                          |                       |
| 22 | W sys      | X            | X            | X                              | X                            | X                          | X                          | sys= system= $\Sigma$ |
| 23 | WL1        | X            | X            | X                              | X                            | #                          | X                          |                       |
| 24 | WL2        | O            | X            | X                              | X                            | #                          | X                          |                       |
| 25 | WL3        | O            | O            | X                              | X                            | #                          | X                          |                       |
| 26 | PF sys     | X            | X            | X                              | X                            | X                          | X                          | sys= system= $\Sigma$ |
| 27 | PF L1      | X            | X            | X                              | X                            | #                          | X                          |                       |
| 28 | PF L2      | O            | X            | X                              | X                            | #                          | X                          |                       |
| 29 | PF L3      | O            | O            | X                              | X                            | #                          | X                          |                       |
| 30 | Hz         | X            | X            | X                              | X                            | X                          | X                          |                       |
| 31 | Phase seq. | O            | X            | X                              | X                            | X                          | X                          |                       |
| 32 | Asy VLL    | O            | O            | X                              | X                            | X                          | X                          | Asymmetry             |
| 33 | Asy VLN    | O            | X            | #                              | 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                 |
| 37 | kWh (+)    | X            | X            | X                              | X                            | X                          | X                          | Partial               |
| 38 | kvarh (+)  | X            | X            | X                              | X                            | X                          | X                          | Partial               |
| 39 | kWh (-)    | X            | X            | X                              | X                            | X                          | X                          | Total                 |
| 40 | kvarh (-)  | X            | X            | X                              | X                            | X                          | X                          | Total                 |
| 41 | kWh (-)    | X            | X            | X                              | X                            | X                          | X                          | Partial               |
| 42 | kvarh (-)  | X            | X            | X                              | X                            | X                          | X                          | Partial               |
| 43 | A L1 THD   | X            | X            | X                              | X                            | X                          | X                          |                       |
| 44 | A L2 THD   | O            | X            | X                              | X                            | X                          | X                          |                       |
| 45 | A L3 THD   | O            | O            | X                              | X                            | X                          | X                          |                       |
| 46 | V L1 THD   | X            | X            | X                              | X                            | O                          | X                          |                       |
| 47 | V L2 THD   | O            | X            | X                              | X                            | O                          | X                          |                       |
| 48 | V L3 THD   | O            | O            | X                              | X                            | O                          | X                          |                       |
| 49 | V L1-2 THD | X            | X            | X                              | X                            | X                          | X                          |                       |
| 50 | V L2-3 THD | O            | X            | X                              | X                            | X                          | X                          |                       |
| 51 | 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)

## 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                                                                         |
|----------|---------------------------------------------------------|-------------------------------------------------------------------------------|
| <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 |
| b        | 14 | a/Phase seq.            | A $\Sigma$    | AL1           | AL2             | AL3             | (1) (2) |              |   |   | x | x | x | x |
| c        | 15 | a/Phase seq.            | W $\Sigma$    | WL1           | WL2             | WL3             | (1) (2) |              |   |   | x | x | x | x |
| c        | 16 | a/Phase seq.            | var $\Sigma$  | var L1        | var L2          | var L3          | (1) (2) |              |   |   |   | x | x | x |
| c        | 17 | a/Phase seq.            | PF $\Sigma$   | PF L1         | PF L2           | PF L3           | (1) (2) |              |   |   |   | x | x | x |
| c        | 18 | a/Phase seq.            | VA $\Sigma$   | 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.

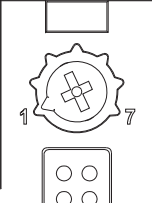
(1) Also maximum value storage (no EEPROM storage).

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

## Additional available information on the display

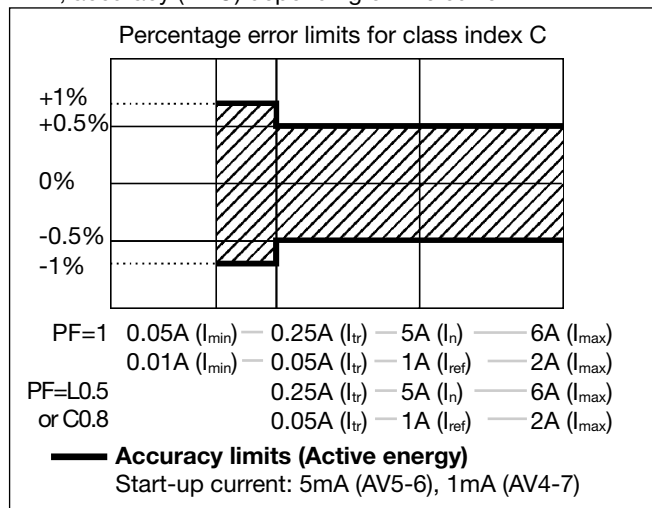
| No | Line 1                                            | Line 2                      | Line 3         | Line 4       | Line 5                  | Note | Applications |   |   |   |   |   |   |
|----|---------------------------------------------------|-----------------------------|----------------|--------------|-------------------------|------|--------------|---|---|---|---|---|---|
|    |                                                   |                             |                |              |                         |      | 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<br>(3ph.n/3ph/3ph./<br>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)<br>kWh                           | xxxx kWh per<br>pulse       |                |              |                         |      | x            | x | x | x | x | x | x |
| 4  | PULSE out1<br>(text) kWh/kvarh                    | xxxx kWh/kvarh<br>per pulse | +/- tot/PAr    |              |                         |      | x            | x | x | x | x | x | x |
| 5  | PULSE out2<br>(text) kWh/kvarh                    | xxxx kWh/kvarh<br>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 /<br>out 2     | Set 1          | Set 2        | (measurement)           |      |              |   |   | x | x | x | x |
| 8  | Alarm 2 nE/nd                                     | None / out 1 /<br>out 2     | Set 1          | Set 2        | (measurement)           |      |              |   |   | x | x | x | x |
| 9  | Alarm 3 nE/nd                                     | None / out 1 /<br>out 2     | Set 1          | Set 2        | (measurement)           |      |              |   |   | x | x | x | x |
| 10 | Alarm 4 nE/nd                                     | None / out 1 /<br>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 /<br>out 2     | xxx (address)  | bdr (text)   | 9.6/19.2/<br>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

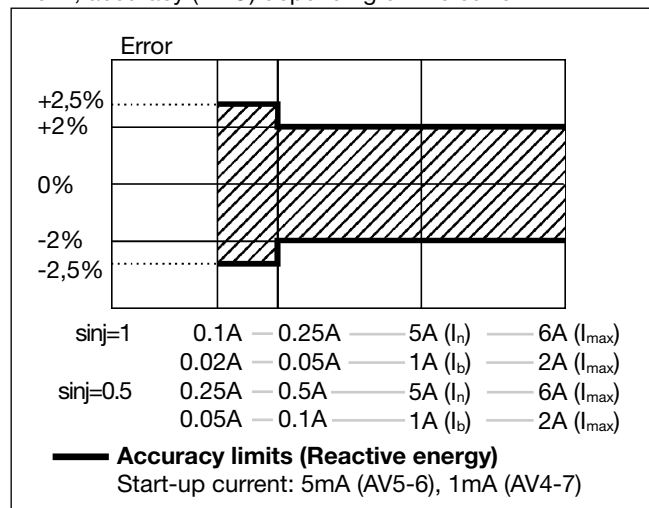
|  | Function | Rotary switch position | Description                                                                                                                                                               |
|-------------------------------------------------------------------------------------|----------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                     | 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**



## WM3040Soft parameter progr. and var. reading software

### WM3040Soft

Multi-language software (Italian, English, French, German, Spanish) for variable reading, instrument calibration and parameters programming. The program runs under Windows XP/Vista/7

### Working mode

Three different working modes can be selected:

- management of local RS232 (MODBUS);
- management of a local RS485 network (MODBUS);
- managed via TCP port

## Used calculation formulas

### Phase variables

Instantaneous effective voltage

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

Instantaneous active power

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

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

$$VA_1 = V_{IN} \cdot A_1$$

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

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

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:

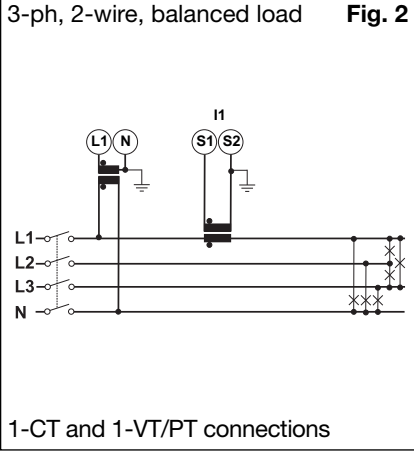
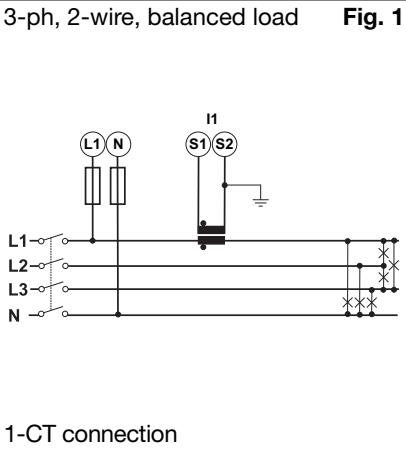
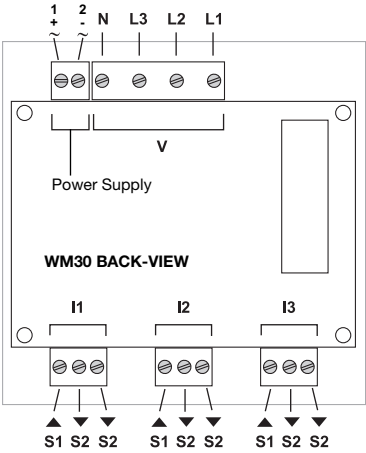
i= considered phase (L1, L2 or L3)  
**P**= active power; **Q**= reactive power;  
**t<sub>1</sub>**, **t<sub>2</sub>**=starting and ending time points of consumption recording; **n**= time unit **Δt**; **t**= time interval between two successive power consumptions;  
**n<sub>1</sub>**, **n<sub>2</sub>**= starting and ending discrete time points of consumption recording



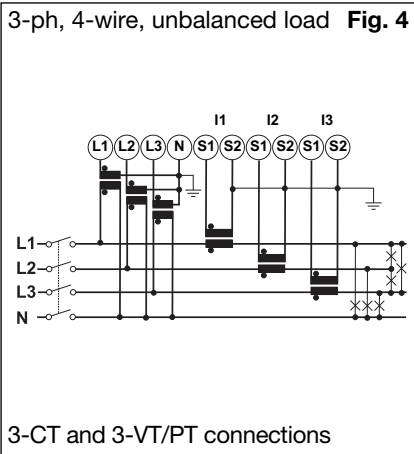
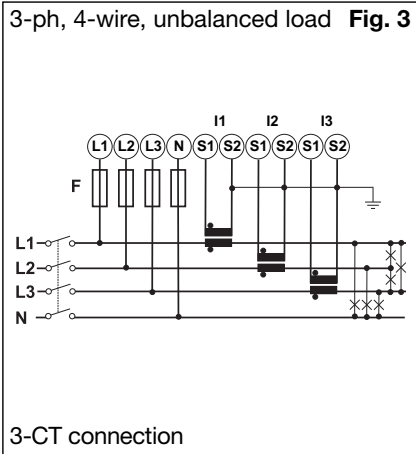


Wiring diagrams

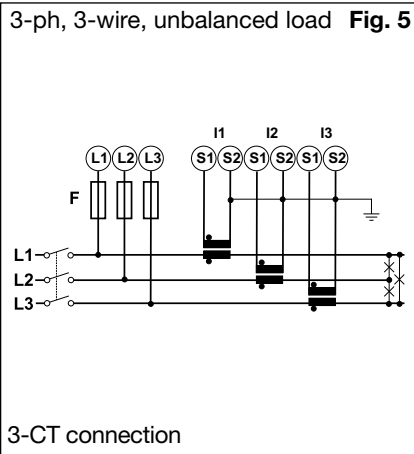
System type selection: 3-Ph.2



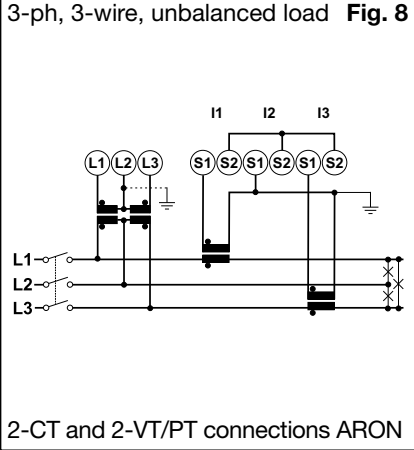
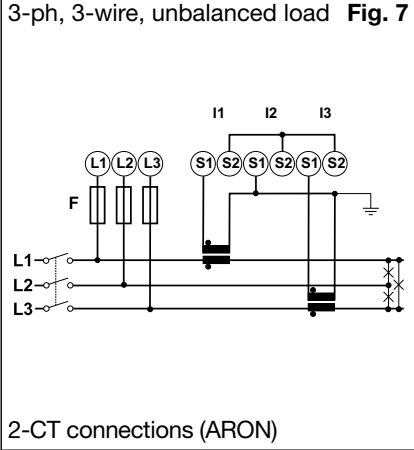
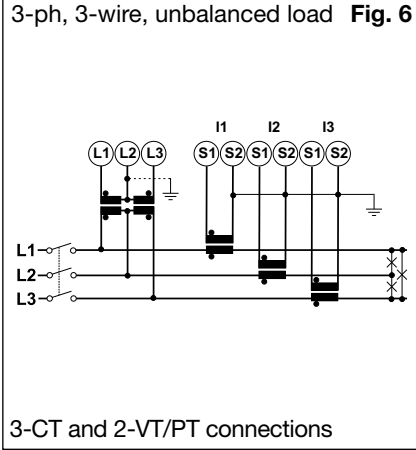
System type selection: 3-Ph.n



System type selection: 3-Ph

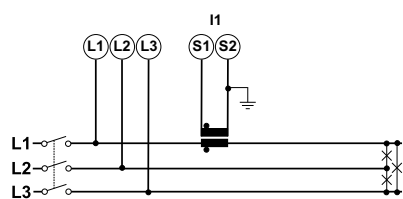


System type selection: 3-Ph (cont.)

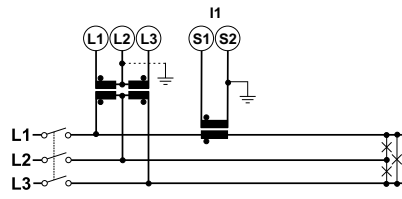


## Wiring diagrams

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

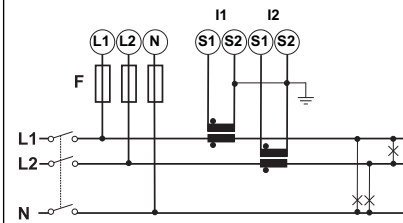
3-ph, 3-wire, balanced load **Fig. 9**

1-CT connections

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

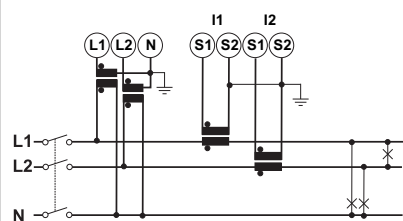
1-CT and 2-VT/PT connections

### System type selection: 2-Ph

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

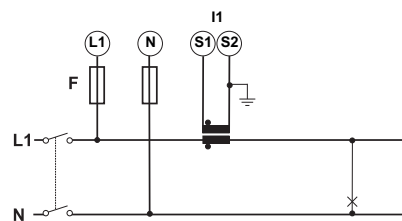
2-CT connection

### System type selection: 2-Ph (cont.)

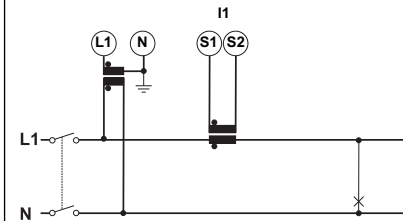
2-ph, 3-wire **Fig. 12**

2-CT and 2-VT/PT connections

### System type selection: 1-Ph

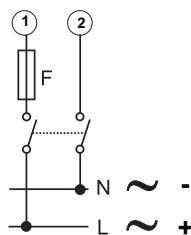
1-ph, 2-wire **Fig. 13**

1-CT connection

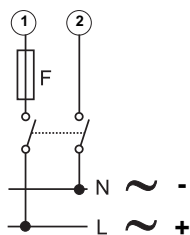
1-ph, 2-wire **Fig. 14**

1-CT and 1-VT/PT connections

### Power Supply

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

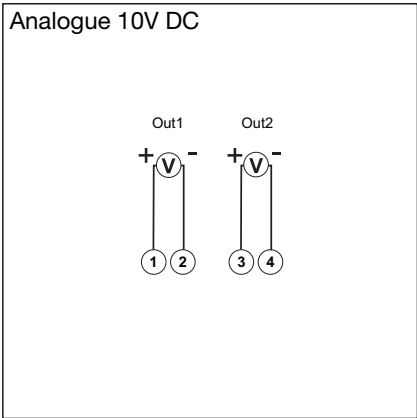
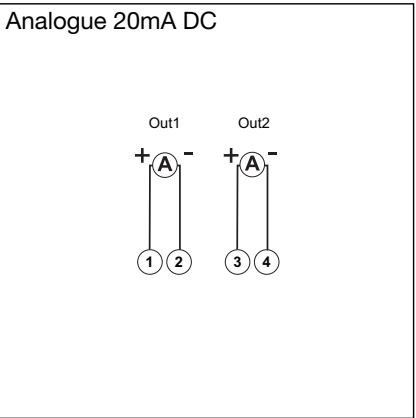
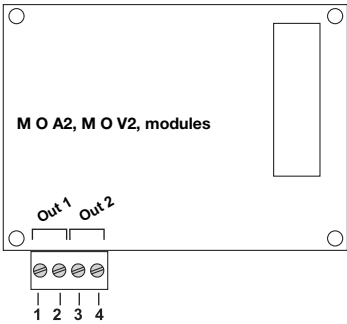
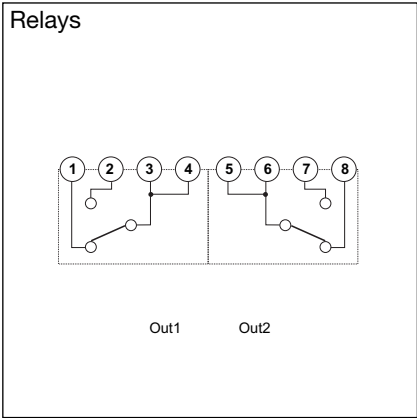
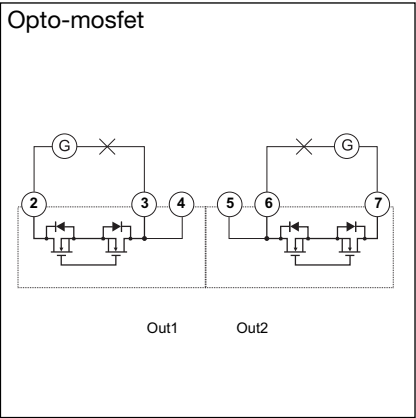
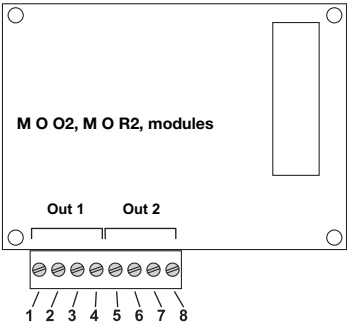
F= 250V [T] 630mA

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

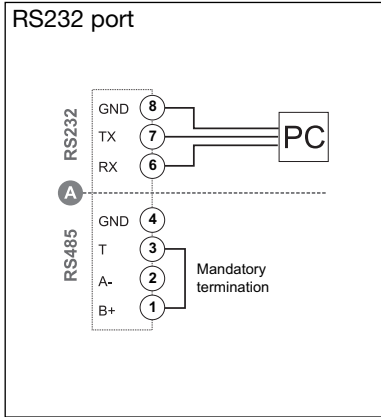
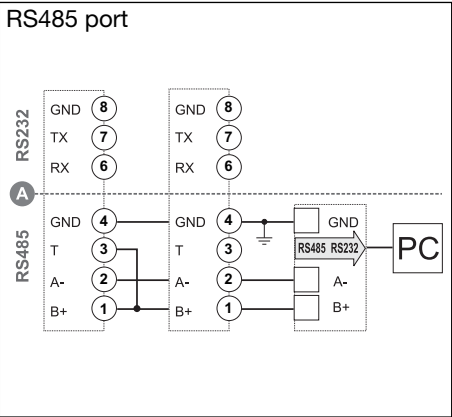
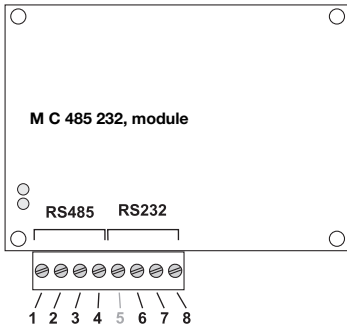
F= 250V [T] 3,15A



Static, relay and analogue outputs wiring diagrams

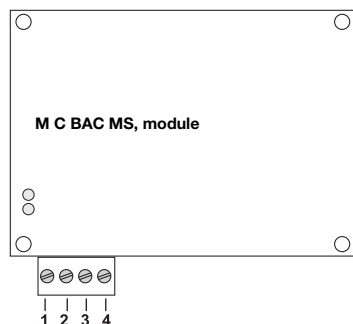


RS485 and RS232 wiring diagrams

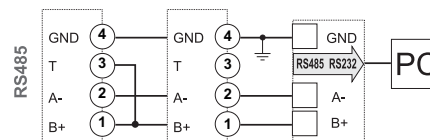


**NOTE.** RS485: additional devices provided with RS485 are connected in parallel. The termination of the serial output is carried out only on the last instrument of the network, by means of a jumper between (B+) and (T). **A**: the communication RS232 and RS485 ports **can't be** connected and used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

## RS485 wiring diagram of Bacnet module

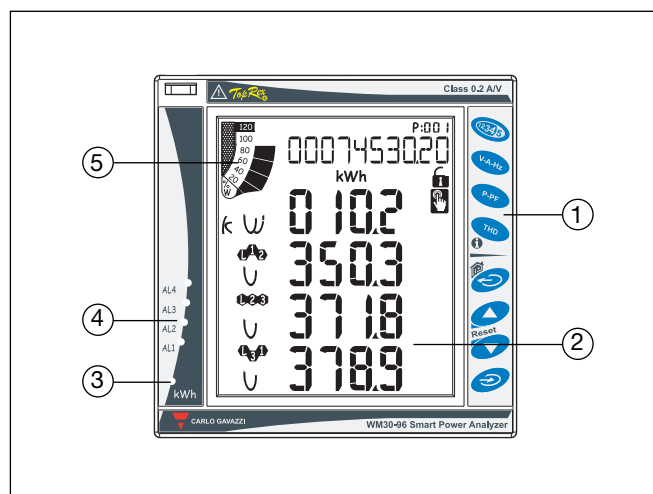


RS485 port



**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

