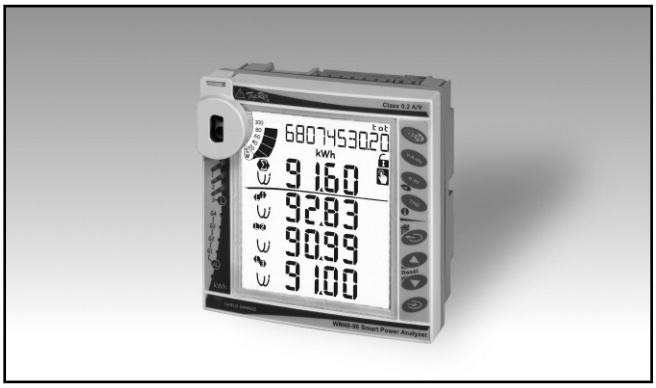
Energy Management
Smart Modular Power Analyzer
Type WM40 96

CARLO GAVAZZI



- Front dimensions: 96x96 mm
- Front protection degree: IP65, NEMA4x, NEMA12
- Optical front communication port (ANSI type 2)
- Up to one RS232 or RS485 port (on request)
- Communication protocol: MODBUS-RTU, iFIX SCADA compatibility
- MODBUS TCP/IP Ethernet port (on request)
- BACnet-IP over Ethernet port (on request)
- BACnet MS/TP over RS485 (on request)
- Up to 6 digital inputs for tariff selection, “dmd” synch, gas/water (hot-cold) and remote heating metering (on request)
- Up to 8 static outputs (pulse, alarm, remote control) (on request)
- Up to 6 relay outputs (pulse, alarm, remote control) (on request)
- Up to 16 freely configurable alarms with OR/AND logic linkable with up to either 4 relay outputs or up to 6 static outputs (on request)
- Up to 4 analogue outputs (+20mA, +10VDC) (on request)
- Class 0.5 (kWh) according to EN62053-22
- Class C (kWh) according to EN50470-3
- Class 2 (kvarh) according to EN62053-23
- Accuracy ±0.2% RDG (current/voltage)
- Instantaneous variables readout: 4x4 DGT
- Energies readout: 9+1 DGT
- System variables: VLL, VLN, A, VA, W, var, PF, Hz, phase-sequence, phase-asymmetry and phaseloss.
- Single phase variables: VLL, VLN, AL, An (calculated or real depending on the option), VA, W, var, PF
- Both system and singles phase variables with average, max and min calculation
- Direct neutral current measurement (on request)
- Harmonic analysis (FFT) up to the 32nd harmonic (current and voltage) with harmonics source detection
- Four quadrant energy measurements (imported/exported): total and partial kWh and kvarh (inductive and capacitive) or based on 4 different tariffs (on request)
- Energy measurements according to ANSI C12.20, CA 0.5, ANSI C12.1 (revenue grade)
- Gas, cold water, hot water, remote heating measurements (on request)
- Run hours counter (8+2 DGT)
- Real time clock function
- Data stamping of up to 10,000 events: alarm, min, max, digital input status, digital output status, resets, programming changing (on request)
- Application adaptable display and programming procedure (Easyprog function)
- Universal power supply:
  19 to 60VAC (48 to 62Hz) and 21.6 to 60VDC
  90 to 265VAC/VDC

Product Description

Three-phase smart power analyzer with built-in application configuration system and LCD data displaying.
Particularly recommended for the measurement of the main electrical variables.
WM40 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 total, partial and tariff energy being measured or/and for alarm outputs. The instrument is equipped with optical communication port, further I/O’s such as: RS485/RS232, Ethernet, BACnet-IP or BACnet MS/TP communication ports, pulse and alarm outputs and 6 digital inputs are available on request. Parameters programming and data reading can be easily performed by means of Wm40Soft.

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How to order

WM40-96 AV5 3 H R4 CT S1 XX

- **Model**: WM40-96
- **Range code**: AV5
- **System**: 3
- **Power Supply**: H
- **A Inputs/Outputs**: R4
- **B Inputs/Outputs**: CT
- **Communication and data stamping**: S1
- **Option**: XX

Type Selection

Range codes

AV4: 400/690V_{LL} AC 1(2)A **(**)** V_{LN}: 160V to 480V_{LN} V_{LL}: 277V to 830V_{LL}
AV5: 400/690V_{LL} AC 5(6)A **(*)** V_{LN}: 160V to 480V_{LN} V_{LL}: 277V to 830V_{LL}
AV6: 100/208V_{LL} AC 5(6)A **(**)** V_{LN}: 40V to 144V_{LN} V_{LL}: 70V to 250V_{LL}
AV7: 100/208V_{LL} AC 1(2)A **(**)** V_{LN}: 40V to 144V_{LN} V_{LL}: 70V to 250V_{LL}

System

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

Power supply

H: 90 to 260V AC/DC (48 to 62Hz) **(*)**
L: 19 to 60VAC (48 to 62Hz) 21.6 to 60VDC**(**)**

A Inputs/Outputs

XX: none **(*)**
R2: Dual channel relay output **(*)**
O2: Dual channel static output **(*)**
A2: Dual channel 20mADC output **(*)**
V2: Dual channel 10VDC output **(*)**
R4: Advanced six channel digital inputs + four channel relay outputs + OR/AND alarm logic management **(**)**
O6: Advanced six channel digital inputs + four channel static outputs + OR/AND alarm logic management **(**)**

B Inputs/Outputs

XX: none **(*)**
A2: Dual channel 20mADC output **(*)**
V2: Dual channel 10VDC output **(*)**
TP: One temperature and one process signal input **(**)**
CT: Direct neutral current measurement + One temperature and one process signal input **(**)**

Communication and data S.

XX: none **(*)**
S1: RS485/RS232 port **(*)**
S3: RS485/RS232 port with data stamping **(*)**
E2: Ethernet / Internet port **(**)**
E3: Ethernet / Internet port with data stamping **(**)**
B1: BACnet (IP) over Ethernet **(**)**
B2: BACnet (IP) over Ethernet with data stamping **(**)**
B3: BACnet (MS/TP) over RS485 **(**)**
B3: BACnet (MS/TP) over RS485 with data stamping **(**)**

Options

XX: none

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

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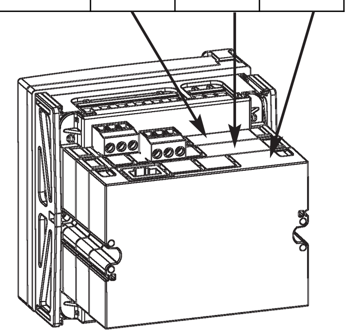
Position of modules and combination

Ref	Description	Main features	Part number	Pos. A	Pos. B	Pos. C
1	WM40 base provided with display, power supply, measuring inputs, optical front communication port.	• Inputs/system: AV5.3 • Power supply: H	WM40 AV5 3 H			
2		• Inputs/system: AV6.3 • Power supply: H	WM40 AV6 3 H			
3		• Inputs/system: AV4.3 • Power supply: H	WM40 AV4 3 H			
4		• Inputs/system: AV7.3 • Power supply: H	WM40 AV7 3 H			
5		• Inputs/system: AV5.3 • Power supply: L	WM40 AV5 3 L			
6		• Inputs/system: AV6.3 • Power supply: L	WM40 AV6 3 L			
7		• Inputs/system: AV4.3 • Power supply: L	WM40 AV4 3 L			
8		• Inputs/system: AV7.3 • Power supply: L	WM40 AV7 3 L			
9	Dual relay output (SPDT)	• 2-channel • Alarm or/and pulse output	M O R2 **(1)**	X		
10	Dual static output (AC/DC Opto-Mos)	• 2-channel • Alarm or/and pulse output	M O O2 **(1)**	X		
11	Dual analogue output (+20mADC)	• 2-channel	M O A2 **(2)**	X	X	
12	Dual analogue output (+10VDC)	• 2-channel	M O V2 **(2)**	X	X	
13	RS485 / RS232 port module	• Max. 115.2 Kbps	M C 485 232 **(3)**			X
14	Ethernet/TCP IP port module	• RJ45 10/100 BaseT	M C ETH **(3)**			X
15	BACnet-IP port module	• Based on Ethernet bus	M C BAC IP **(3)**			X
16	BACnet MS/TP port module	• Over RS485	M C BAC MS **(3)**			X
17	BACnet MS/TP port module	• Over RS485 • Data Stamping	M C BAC MS M **(3)**			X
18	Combined digital inputs and Relay outputs (SPDT)	• 6-input channels • 4-output channels • Complex tariff management • OR/AND logic management	M F I6 R4 **(4)**		X	
19	Combined digital inputs and Static outputs (AC/DC Opto-Mos)	• 6-input channels • 6-output channels • Complex tariff management. • OR/AND logic management	M F I6 O6 **(4)**		X	
20	RS485 / RS232 port module with integrated Memory	• Max. 115.2 Kbps • Data stamping	M C 485 232 M **(3)**			X
21	Ethernet port module with integrated Memory	• RJ45 10/100 BaseT • Data Stamping	M C ETH M **(3)**			X
22	BACnet over IP port module with integrated Memory	• Based on Ethernet bus • Data Stamping	M C BAC IP M **(3)**			X
23	Temperature + Process signal measure-ments (°C/°F)	• “Pt” type input • 20mA input	M A T P **(4)**		X	
24	Direct neutral current measurement + Tem-perature + Process signal measurements (°C/°F)	• As above + signal input like a common current input (CT ratio etc.)	M A T P N **(4)**		X	



NOTE: **(1)** Only one A type module per meter in a maximum combination of 3 total mixed modules on the same meter. **(2)** Only one A + B type module per meter in a maximum combination of 3 total mixed modules on the same meter. **(3)** Only one C type module per meter in a maximum combination of 3 total mixed modules on the same meter. **(4)** Only one “B” type module per meter in a maximum combination of 3 total mixed modules on the same meter.

The B-C position is not mandatory, if to fulfil the application, module “A” is not necessary, then maybe just “B” can be mounted. Another example: if modules “A” and “B” (anyone) are not needed, then just module “C” maybe be mounted. If “A” module is needed, it is mandatory to put it in “A” position. **When no modules are mounted, then WM40-96 becomes a simple indicator.**

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Input specifications

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

Energy additional errors	
Influence quantities	According to EN62053-22, ANSI C12.20, Class B or C according to EN50470-3, EN62053-23, ANSI C12.1
Total Harmonic Distortion (THD)	±1% FS (FS: 100%) Phase: ±2°; Imin: 5mA RMS; Imax: 15Ap; Umin: 30VRMS; Umax: 585Vp Detection of imported and exported harmonics.
Total Demand Distortion (TDD)	±1% FS (FS: 100%) Imin: 5mA RMS; Imax: 15Ap; Umin: 30VRMS; Umax: 585Vp
K-Factor and factor K	±(0.5%RDG+1DGT)
Temperature drift	≤200ppm/°C
Sampling rate	3200 samples/s @ 50Hz, 3840 samples/s @ 60Hz
Measurements	See "List of the variables that can be connected to:"
Method	TRMS measurements of distorted wave forms.
Coupling type	By means of CT's
Crest factor	AV5, AV6: ≤3 (15A max. peak) AV4, AV7: ≤3 (3A max. peak)
Current Overloads	
Continuous (AV5 and AV6)	6A, @ 50Hz/60Hz
Continuous (AV4 and AV7)	2A, @ 50Hz/60Hz
For 500ms (AV5 and AV6)	120A, @ 50Hz/60Hz
For 500ms (AV4 and AV7)	40A, @ 50Hz/60Hz
Voltage Overloads	
Continuous	1.2 Un
For 500ms	2 Un
Input impedance	
400VL-L (AV4 and AV5)	> 1.6MΩ
208VL-L (AV6 and AV7)	> 1.6MΩ
5(10)A (AV5 and AV6)	< 0.2VA
1(2)A (AV4 and AV7)	< 0.2VA
Frequency	40 to 440 Hz

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Output specifications

Relay outputs (M O R2)	
Physical outputs	2 (max. one module per instrument)
Purpose	For either alarm output or pulse output
Type	Relay, SPDT type AC 1-5A @ 250VAC; AC 15-1A @ 250VAC DC 12-5A @ 24VDC; DC 13-1.5A @ 24VDC
Configuration	By means of the front key-pad
Function	The outputs can work as alarm outputs but also as pulse outputs, remote controlled outputs, or in any other combination.
Alarms	Up alarm and down alarm linked to the virtual alarms, other details see Virtual alarms
Min. response time	≤200ms, filters excluded. Set-point on-time delay: "0 s".
Pulse	
Signal retransmission	Total: +kWh, -kWh, +kvarh, -kvarh. Partial: +kWh, -kWh, +kvarh, -kvarh.
Pulse type	The above listed variables can be connected to any output.
Pulse duration	Programmable from 0.001 to 10.00 kWh/kvarh per pulse. ≥100ms <120msec (ON), ≥120ms (OFF), according to EN62052-31
Remote controlled outputs	The activation of the outputs is managed through the serial communication port
Insulation	See "Insulation between inputs and outputs" table
Static outputs (M O O2)	Opto-Mos type
Physical outputs	2 (max. one module per instrument)
Purpose	For either pulse output or alarm output
Signal	V_{ON}:2.5VAC/DC/max.100mA V_{OFF}: 260VAC/DC max.
Configuration	By means of the front key-pad
Function	The outputs can work as alarm outputs but also as pulse outputs, remote controlled outputs, or in any other combination.
Alarms	Up alarm and down alarm linked to the virtual alarms, other details see Virtual alarms
Min. response time	≤200ms, filters excluded. Set-point on-time delay: "0 s".
Pulse	
Signal retransmission	Total: +kWh, -kWh, +kvarh, -kvarh. Partial: +kWh, -kWh, +kvarh, -kvarh.
Pulse type	The above listed variables can be connected to any output.
Pulse duration	Programmable from 0.001 to 10.00 kWh/kvarh per pulse. ≥100ms < 120msec (ON), ≥120ms (OFF), according to EN62052-31
Remote controlled outputs	The activation of the outputs is managed through the serial communication port
Insulation	See "Insulation between inputs and outputs" table

20mA analogue outputs (M O A2)	
Number of outputs	2 (max. one module per instrument)
Accuracy (@ 25°C ±5°C, R.H. ≤60%)	±0.2%FS
Range	0 to 20mA
Configuration	By means of the front key-pad
Signal retransmission	The signal output can be connected to any instantaneous variable available in the table "List of the variables that can be connected to".
Scaling factor	Programmable within the whole range of retransmission; it allows the retransmission management of all values from 0 to 20 mADC.
Response time	≤400 ms typical (filter excluded)
Ripple	≤1% (according to IEC 60688-1, EN 60688-1)
Total temperature drift	≤500 ppm/°C
Load	≤600Ω
Insulation	See "Insulation between inputs and outputs" table

10VDC analogue outputs (M O V2)	
Number of outputs	2 (max. one module per instrument)
Accuracy (@ 25°C ±5°C, R.H. ≤60%)	±0.2%FS
Range	0 to 10 VDC

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Output specifications (cont.)

Configuration	By means of the front key-pad
Signal retransmission	The signal output can be connected to any instantaneous variable available in the table “List of the variables that can be connected to”.
Scaling factor	Programmable within the whole range of retransmission; it allows the retransmission management of all values from 0 to 10VDC.
Response time	≤400 ms typical (filter excluded)
Ripple	≤1% (according to IEC 60688-1, EN 60688-1)
Total temperature drift	≤350 ppm/°C
Load	≥10kΩ
Insulation	See “Insulation between inputs and outputs” table
RS485/232 serial port (M C 485 232 on request)	
RS485	
Type	Multidrop, bidirectional (static and dynamic variables)
Connections	2-wire Max. distance 1000m, termination directly on the module
Addresses	247, selectable by means of the front key-pad
Protocol	MODBUS/JBUS (RTU)
Data (bidirectional)	
Dynamic (reading only)	System and phase variables: see table “List of variables...”
Static (reading and writing only)	All the configuration parameters.
Data format	1 start bit, 8 data bit, no/even/odd parity,1 stop bit
Baud-rate	Selectable: 9.6k, 19.2k, 38.4k, 115.2k bit/s
Driver input capability	1/5 unit load. Maximum 160 transceivers on the same bus.
Note	With the rotary switch (on the back of the basic unit) in lock position the modification of the programming parameters and the reset command by means of the serial communication is not allowed anymore. In this case just the data reading is allowed.
Insulation	See “Insulation between inputs and outputs” table
RS232 port (on request)	
Type	Bidirectional (static and dynamic variables)
Connections	3 wires. Max. distance 15m
Protocol	MODBUS RTU /JBUS
Data (bidirectional)	
Dynamic (reading only)	System and phase variables: see table “List of variables...”
Static (reading and writing only)	All the configuration parameters
Data format	1 start bit, 8 data bit, no/even/odd parity,1 stop bit
Baud-rate	Selectable: 9.6k, 19.2k, 38.4k, 115.2k bit/s
Note	With the rotary switch (on the back of the basic unit) in lock position the modification of the programming parameters and the reset command by means of the serial communication is not allowed anymore. In this case just the data reading is allowed.
Insulation	See “Insulation between inputs and outputs” table
Module with data stamping and event recording memory (M C 485 232 M)	
Event stamping	
Type of data	Alarm, min, max, digital input status, digital output status as remote control, resets.
Stamping format	Date (dd:MM:yy) and hour (hh:mm:ss) reference.
Number of events	Up to 10,000
Data management type	FIFO
Data stamping	
Type of data	Any measured variable can be stored in the memory.
Stamping format	Date (dd:MM:yy) and hour (hh:mm:ss) reference.
Number of variables	Up to 20 different type of variables can be stored.
Time interval	From 1 minute up to 60 minutes.
Data management type	FIFO
Memory type	Data flash
Ethernet/Internet port (M C ETH on request)	
Protocols	Modbus TCP/IP
IP configuration	Static IP / Netmask / Default gateway

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Output specifications (cont.)

Port	Selectable (default 502)
Client connections	Max 5 simultaneously
Connections	RJ45 10/100 BaseTX Max. distance 100m
Data (bidirectional)	
Dynamic (reading only)	System and phase variables: see table “List of variables...”
Static (reading and writing only)	All the configuration parameters.
Note	With the rotary switch (on the back of the basic unit) in lock position the modification of the programming parameters and the reset command by means of the serial communication is not allowed anymore. In this case just the data reading is allowed.
Insulation	See “Insulation between inputs and outputs” table
Module with data stamping and event recording memory (M C ETH M)	
Event stamping	
Type of data	Alarm, min, max, digital input status, digital output status as remote control, resets.
Stamping format	Date (dd:MM:yy) and hour (hh:mm:ss) reference.
Number of events	Up to 10,000
Data management type	FIFO
Data stamping	
Type of data	Any measured variable can be stored in the memory.
Stamping format	Date (dd:MM:yy) and hour (hh:mm:ss) reference.
Number of variables	Up to 20 different type of variables can be stored.
Time interval	From 1 minute up to 60 minutes.
Data management type	FIFO
Memory type	Data flash
BACnet-IP (M C BAC IP on request)	
Protocols	BACnet-IP (for measurement reading purpose) and Modbus TCP/IP (for measurement reading purpose and for programming parameter purpose)
IP configuration	Static IP / Netmask / Default gateway
BACnet-IP Port	Fixed: BAC0h
Modbus Port	Selectable (default 502)

Client connections	Modbus only: max 5 simultaneously
Connections	RJ45 10/100 BaseTX Max. distance 100m
Data	
Dynamic (reading only)	System and phase variables (BACnet-IP and Modbus): see table “List of variables...”
Static (reading and writing only)	All the configuration parameters (Modbus only).
Note	With the rotary switch (on the back of the basic unit) in lock position the modification of the programming parameters and the reset command by means of the serial communication is not allowed anymore. In this case just the data reading is allowed.
Insulation	See “Insulation between inputs and outputs” table
Module with data stamping and event recording memory (M C BAC IP M)	
Event stamping	
Type of data	Alarm, min, max, digital input status, digital output status as remote control, resets.
Stamping format	Date (dd:MM:yy) and hour (hh:mm:ss) reference.
Number of events	Up to 10,000
Data management type	FIFO
Data stamping	
Type of data	Any measured variable can be stored in the memory.
Stamping format	Date (dd:MM:yy) and hour (hh:mm:ss) reference.
Number of variables	Up to 20 different type of variables can be stored.
Time interval	From 1 minute up to 60 minutes.
Data management type	FIFO
Memory type	Data flash
BACnet MS/TP (on request)	
Available ports	2: RS485 and Ethernet
RS485 port	
Type	Multidrop, mono-directional (dynamic variables)
Connections	2-wire Max. distance 1000m, termination directly on the module
Device object instance	0 to 2^22-2 = 4.194.302, selectable by means of programming software only
Protocol	BACnet MS/TP (for

Output specifications (cont.)

	measurement reading purpose)
Supported services	"I have", "I am", "Who has", "Who is", read property
Supported objects	Type 2 (analogue value), Type 8 (device)
Data (mono-directional)	
Dynamic	System and phase variables: see table "List of variables..."
Static	Not available
Data format	1 start bit, 8 data bit, no parity,1 stop bit
Baud-rate	Selectable: 9.6k, 19.2k, 38.4k kbit/s
Driver input capability	1/5 unit load. Maximum 160 transceivers on the same bus.
MAC addresses	Selectable: 0 to 127
Ethernet port	
Protocol	Modbus TCP/IP (for programming parameter purpose)
IP configuration	Static IP / Netmask / Default gateway
Modbus Port	Selectable (default 502)
Client connections	Modbus only: max 5 simultaneously
Connections	RJ45 10/100 BaseTX Max. distance 100m
Data	
Dynamic (reading only)	System and phase variables: see table "List of variables..."
Static (reading and writing only)	All the configuration parameters (Modbus only).
Note	With the rotary switch (on the back of the basic unit) in lock position the modification of the programming parameters and the reset command by means of the serial communication is not allowed anymore. In this case just the data reading is allowed.
Insulation	See "Insulation between

Relay Output and Digital Input (M F I6 R4 on request)

Relay Outputs

Physical outputs	4 (max. one module per instrument)
Purpose	For either pulse output or alarm output
Type	Relay, SPST type AC 1-5A @ 250VAC; AC 15-1A @ 250VAC
Configuration	Only by means of the programming software WM40Soft. In this latter case using either the serial communication port or the front optical port.
Function	The outputs can work as advanced alarm outputs and as remote controlled outputs, or in any other combination.
Standard alarm modes	Up alarm, down and window alarm. There is also the possibility to remote the control of the outputs: the activation of the outputs is managed through the serial communication port (in this case the local alarms are disabled).
Advanced alarm modes	"OR" or "AND" or "OR+AND" functions (see "Alarm parameter and logic" page). Freely programmable on up to 16 alarms.
Controlled variables	The alarms can be connected to any variable available in the table "List of the variables that can be connected to"
Set-point adjustment	From 0 to 100% of the display scale
Hysteresis	From 0 to full scale
On-time delay	0 to 9999s
Output status	Selectable: normally de-energized or normally energized
Min. response time	≤200ms, filters excluded. Set-point on-time delay: "0 s".

Digital inputs

Number of inputs	6 (voltage-free contacts)
Purpose	Contact status reading. "dmd" measurements synchronisation and clock synchronisation. Energy tariff selection. Utility meter counters. Trip counter. Remote input disable. Interfacing with watt-hour meters (+kWh, +kvarh, -kWh, -kvarh).
Input frequency	20Hz max, duty cycle 50%
Prescaler adjustment	From 0.1 to 999.9 m^3 or kWh/pulse
Open Contact voltage	≤3.3VDC
Closed Contact current	<1mADC
Contact resistance	≤300Ω closed contact ≥50kΩ open contact
Input voltage	0 to 0.5VDC LO 2.4 to 25VDC HI

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Output specifications (cont.)

Working mode	• Total and partial energy meters (kWh and kvarh) without digital inputs; • Total and partial energy meters (kWh and kvarh) managed by time periods (t1-t2-t3-t4-t5-t6), W dmd synchronisation (the synchronisation is made every time the tariff changes) and GAS (m^3) or WATER (hot/cold/m^3) or remote heating (kWh) meters; • Total and partial energy meters (kWh and kvarh) managed by time periods (t1-t2), W dmd synchronisation (the synchronisation is made independently of the tariff selection) and GAS (m^3) or WATER (hot/cold/m^3) or remote heating (kWh) meters; • Total energy (kWh, kvarh) and GAS, WATER (hot-cold m^3) and remote heating meters (3 choices only). • Remote alarm reset. • Remote input channel disable. • Trip counter of installation protection. • Direct measurements for the power quality analysis (LV or MV/HV connection); • Indirect energy and power measurements by means of watt-hour meters (LV or MV/HV connection); • Direct measurements for the instantaneous variables (LV connection) and indirect measurements for the energy variables (LV or MV/HV).
Insulation	By means of opto-mos See “Insulation between inputs and outputs” table.
Static Output and Digital Input (M F I6 O6 on request)	
Static Outputs	
Physical outputs	6 (max. one module per instrument)
Purpose	For either pulse output or alarm output
Type of outputs	Opto-Mos
Signal	VON: 2.5VDC/max.100mA VOFF: 42VDC
Function	The outputs can work as pulse outputs, but also as alarm outputs, remote controlled outputs, or in any other combination.
Signal retransmission	Total: +kWh, -kWh, +kvarh, -kvarh. Partial: +kWh, -kWh, +kvarh, -kvarh Tariff: +kWh, -kWh, +kvarh, -kvarh. The available variables can be linked to any output.
Pulse type	Programmable from 0.001 to 10.00 kWh/kvarh per pulse. Outputs connectable to the energy meters (kWh/kvarh)
Pulse duration	≥100ms <120ms (ON), ≥120ms (OFF), according to EN62052-31
Advanced tariff management	
No. of tariffs	Up to 6
No. of total energies	Up to 4 (+kWh, -kWh, +kvarh, -kvarh)
Data format	9-DGT for Total and partial/tariff, gas and water metering.
Digital inputs	
Number of inputs	6 (voltage-free contacts)
Purpose	Contact status reading. “dmd” measurements synchronisation and clock synchronisation. Energy tariff selection. Utility meter counters. Trip counter. Remote input. Interfacing with watt-hour meters (+kWh, +kvarh, -kWh, -kvarh).
Input frequency	20Hz max, duty cycle 50%
Prescaler adjustment	From 0.1 to 999.9 m^3 or kWh/pulse
Open Contact voltage	≤3.3VDC
Closed Contact current	<1mADC
Contact resistance	≤300Ω closed contact ≥50kΩ open contact
Input voltage	0 to 0.5VDC LO 2.4 to 25VDC HI
Working mode	• Total and partial energy meters (kWh and kvarh) without digital inputs; • Total and partial energy meters (kWh and kvarh) managed by time periods

Output specifications (cont.)

	(t1-t2-t3-t4-t5-t6), W dmd synchronisation (the synchronisation is made every time the tariff changes) and GAS (m^3) or WATER (hot/cold/m^3) or remote heating (kWh) meters; • Total and partial energy meters (kWh and kvarh) managed by time periods (t1-t2), W dmd synchronisation (the synchronisation is made independently of the tariff selection) and GAS (m^3) or WATER (hot/cold/m^3) or remote heating (kWh) meters; • Total energy (kWh, kvarh) and GAS, WATER (hot-cold m^3) and remote heating meters (3 choices only). • Remote alarm reset. • Remote input channel status. • Trip counter of installation protection. • Direct measurements for the power quality analysis (LV or MV/HV connection); • Indirect energy and power measurements by means of watt-hour meters (LV or MV/HV connection); • Direct measurements for the instantaneous variables (LV connection) and indirect measurements for the energy variables (LV or MV/HV).
Insulation	By means of opto-mos See “Insulation between inputs and outputs” table.
Temperature and Process signal inputs (M A T P on request)	
Temperature signal	
Number of inputs	1
Accuracy (Display + RS485)	See table “Temperature input characteristics”
Temperature drift	≤150ppm/°C
Temperature probe	Pt100, Pt1000
Number of wires	2 or 3-wire connection
Wire compensation	Up to 10Ω
Engineering unit	Selectable °C o °F
Process signal	
Number of inputs	1
Accuracy (Display + RS485)	±(0,1%RDG+1DGT) da 0% a 25% FS; ±(0,1%RDG+2DGT) da 25% a 110% FS.
Temperature drift	≤150ppm/°C
Process signal input	-20mA to +20mADC
Signal overload	Continuous: 50mADC For 1 s.: 150mADC
Input impedance	≤22Ω (<12Ω)
Min. and Max. indication	-9999 to +9999 fully programmable scaling with decimal point positioning.
Module with true neural current input (M A T P N)	In: 1A
Accuracy (Display + RS485)	From 0.002In to 0.2In: ±(0.2% RDG +1DGT) From 0.2In to 1.2In: ±(0.2% RDG +1DGT)
Temperature drift	≤150ppm/°C
Measuring input type	To be connected to external current transformer
Transformer ratio	Up to 10kA (10,000 max)
Crest factor	≤3 (3A max. peak)
Current Overloads	
Continuous	1.2A, @ 50Hz
For 500ms	10A, @ 50Hz
Input impedance	0.5Ω
Frequency	45 to 65 Hz

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Temperature input characteristics

Probe	Range	Accuracy	Min Indication	Max Indication
Pt100	-60.0°C to +300.0°C	±(0.5%RDG +5DGT)	- 60.0	+ 300.0
Pt100	-76°F to+572°F	±(0.5%RDG +5DGT)	- 76.0	+ 572.0
Pt1000	-60.0°C to +300.0°C	±(0.5%RDG +5DGT)	- 60.0	+ 300.0
Pt1000	-76°F to+572°F	±(0.5%RDG +5DGT)	- 76.0	+ 572.0

Tariff energy meters and time period management

NOTE: only in case of M F I6 R4 and M F I6 O6 modules.

Meters	
Total	4 (up to 10 digit)
Partial	72 (up to 10 digit)
Tariffs	Up to 6
Time periods	Up to 3 year
Pulse output	Connectable to total and/or partial meters
Storage	Consumption history by storing the monthly energy meters (12 previous months) into the EEPROM. Storage of total and partial energy meters. Energy meter storage format (EEPROM) Min. -9,999,999,999.9 kWh/kvarh Max. 9,999,999,999.9 kWh/kvarh
Energy Meters	Base on digital inputs and clock management
"Total" energy meters	+kWh, +kvarh, -kWh, -kvarh.
"Standard Period" energy meters	Up to 2 may split into "P1" and "P2" which can be set by month and year each.
"Holiday Period" energy meters	Up to 10 for this specific function s may split into "H1 … H10". As per standard period management every single one can be set by month and year.
"Tariff" energy meters	Up to 6 per period (P1/P2 and H1 … H10). Every tariff is daily based and is called "t1" … "t6". The single tariff can be set as "Hours and minutes". Every single tariff "t" may has an independent start and stop which may be different also from period to period "P1 and P2". Every single tariff manages an independent energy meter which is split according the measured energy in: +Wh, -Wh, +varh, -varh.
Partial energy meters	+kWh, +kvarh, -kWh, -kvarh (basic unit without any module)

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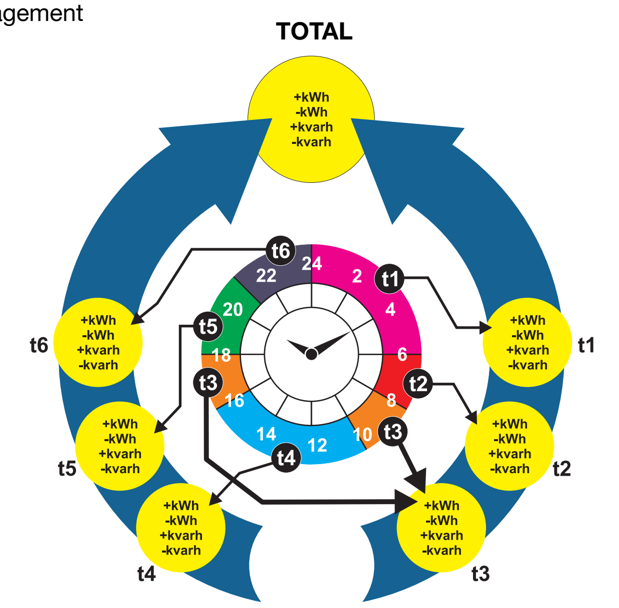
Tariff energy meters overall working scheme

NOTE: only in case of M F I6 R4 and M F I6 O6 modules.

Daily management

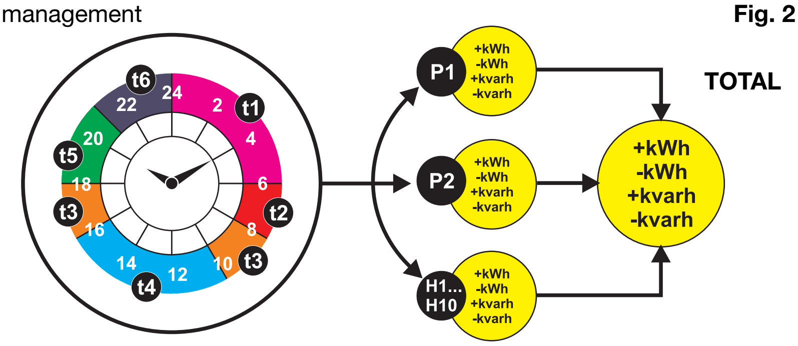
Fig. 1



Where t1 to t6 are the “Tariffs”.

Year management

Fig. 2



Where P1 and P2 are the “Standard Periods” and H1 … H10 Holiday periods which are identified by a defined day (non working day), by a vacation period or by a season period.

Note: the displaying of every single energy tariff is relevant only to the period being used. Other periods are available through the communication port.

Energy meters

Meters	
Total	4 (10 digit)
Partial	4 (10 digit)
Pulse output	Connectable to total and/or partial meters
Energy meter recording	Storage of total and partial energy meters. Energy meter storage format (EEPROM) Min. -9,999,999,999.9 kWh/kvarh Max. 9,999,999,999.9 kWh/kvarh.

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

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Management of the digital inputs

NOTE: only in case of M F I6 R4 and M F I6 O6 modules.

Function	Note	Digital inputs					
		1	2	3	4	5	6
Synch (dmd)	(1)	YES					
Tariff change	(2)	YES	YES	YES			
Hot Water	(3)				YES	YES	YES
Cold Water	(3)				YES	YES	YES
Gas	(3)				YES	YES	YES
Remote heating	(3)				YES	YES	YES
Remote alarm reset	(4)				YES		
Trip counter of protection	(5)				YES		
Remote input channel status	(6)	YES	YES	YES	YES	YES	YES
kWh counting (-)	(7)			YES			
kWh counting (+)	(7)				YES		
kvarh counting (+)	(7)					YES	

Note: every single digital input can be configured according to the table above.
(1) At each status change (from OFF to ON) it synchronises the DMD calculation made by the meter with a digital signal coming from the Utility or other source. It also synchronises the clock to the multiple of the integration time (which is selectable as either database of data-logging function or Load profile) nearer to the current time.
(2) It is used to select by means of the logic of three inputs up to 6 different tariffs: t1-t2-t3-t4-t5-t6. Every time the tariff changes, it starts also the synchronisation of the "dmd" calculation.
(3) It is used to count the pulses coming from different Utility meters like: cold water, hot water, gas and remote heating.
(4) It is used to remotely reset the alarms.
(5) It is used to count how many times an external protection device trips.
(6) This function is available only in case of serial communication. It allows to detect the status of the digital input. The status is displayed on the display as well.
(7) The energy is metered by means of pulses coming from a watt-hour meter. This meter can be provided with up to 3 outputs (for imported active and reactive energy and for exported active energy). Note: the pulses counted from the watt-hour meter replaces the standard measurement of energy and the relevant displaying (total, partial and tariff), all other measurements (eg: V-A-W-VA-var, THD and so on) are still performed and displayed.

Harmonic distortion analysis

Analysis principle	FFT
Harmonic measurement	
Current	Up to the 32nd harmonic
Voltage	Up to the 32nd harmonic
Type of harmonics	THD (VL1 and VL1-N) THD odd (VL1 and VL1-N) THD even (VL1 and VL1-N) TDD The same for the other phases: L2, L3. THD (AL1) THD odd (AL1) THD even (AL1) The same for the other phases: L2, L3.
Harmonic phase angle	The instrument measures the angle between the single harmonic of "V" and the single harmonic of "I" of the same order. According to the value of the electrical angle, it is possible to know if the distortion is absorbed or generated. Note: if the system has 3 wires the angle cannot be measured.
Harmonic details	The harmonic spectrum so to built-up a graph is available only by means of the serial communication.

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Event logging, data logging and load profiling

NOTE: only in case of M C 485 232 M, M C ETH M and M C BAC IP M modules

Event logging	Only with communication module provided with data memory.
Data displaying	The data are available on the display limited to the last 99 events. All events can be both checked and downloaded using any available communication port in combination with WM40Soft software.
Function enabling	Activation: NO/YES
Stored data type	Alarms, max./min.
Number of events	Max. 10,000
Data reset	All events can be reset manually
Data format	Event, date (dd:mm:yy) and time (hh:mm:ss)
Storage method	FIFO
Memory type	Flash
Memory retention time	10 years
Data logging	Only with communication module provided with data memory.
Data displaying	The data are not available on the display but they can be both checked and downloaded using any available communication port in combination with WM40Soft software.
Function enabling	Activation: NO/YES
Stored data type	All variables.
Storage interval	Programmable from 1 min. to 60 min.; all instantaneous variables can be selected
Sampling management	The sample stored within the selected time interval results from the continuous average of the measured values. The average is calculated (min. sample) with an interval within two following measurements of approx. 100 ms.
Storage duration	Before overwriting, see “Historical data storing time table.
Number of variables	See “Historical data storing time table”.
Data format	Variable, date (dd:mm:yy) and time (hh:mm:ss)
Storage method	FIFO
Memory type	Flash
Memory size	4Mb
Memory retention time	10 years
Load profiling	Only with communication module provided with data memory.
Data displaying	The data are not available on the display but they can be both checked and downloaded using any available communication port in combination with WM40Soft software.
Function enabling	Activation: NO/YES
Storage interval	Selectable: 5-10-15-20-30-60 minutes of Wdmd and VAdmd.
Storage duration	Before overwriting, 100 weeks: with recording interval of 5min; 300 weeks: with storing interval of 15min.
Data format	Wdmd variable value, minutes, day, month.
Data synchronisation	Based on internal clock
Other characteristics	As per Event and Data logging.

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Display, LED's and commands

Display refresh time	≤ 100 ms
Display	4 lines, 4-DGT, 1 lines, 10-DGT
Type	LCD, dual colour backlight (selectable)
Digit dimensions	4-DGT: h 11 mm; 10-DGT: h 7 mm
Instantaneous variables read-out	4-DGT
Energies variables read-out	Imported Total/Partial/Tariff: 8+2DGT, 9+1DGT or 10DGT; Exported Total/Partial/ Tariff: 8+2DGT, 9+1DGT or 10DGT (with "-" sign).
Gas-water-remote heating read-out	8+2DGT, 9+1DGT or 10DGT
Run Hours counter	8+2 DGT (99.999.999 hours and 59 minutes max)
Overload status	EEEE indication when the value being measured is exceeding the "Continuous inputs overload" (maximum measurement capacity)
Max. and Min. indication	Max. instantaneous variables: 9999; energies: 9 999 999 99.9 or 9 999 999 999. Min. instantaneous variables: 0.000; energies 0.0
Front position LEDs	
Bar-graph	Three groups of 3-LED (green-red) split by phase L1-L2-L3 and level of measurement. The full scale (100%) is referred to a programmable value which is corresponding to the variable being measured and displayed by the instrument at the time.
Virtual alarms	4 red LED available in case of virtual alarm (ALG1-AL G2-AL G3-AL G4), every LED groups 4 alarms. Note: the real alarm is just the activation of the proper static or relay output if the proper module is available.
Energy consumption kWh pulsating	Red LED (only kWh) 0.001 kWh/kvarh by pulse if the Ct ratio by VT ratio is ≤7 0.01 kWh/kvarh by pulse if the Ct ratio by VT ratio is ≥7.1 ≤70.0 0.1 kWh/kvarh by pulse if the Ct ratio by VT ratio is ≥70.1 ≤700.0 1 kWh/kvarh by pulse if the Ct ratio by VT ratio is ≥700.1 ≤7000 10 kWh/kvarh by pulse if the Ct ratio by VT ratio is ≥7001 ≤70.00k 100 kWh/kvarh by pulse if the Ct ratio by VT ratio is >70.01k Max frequency: 16Hz, according to EN50470-1
Back position LEDs	
On the base	Green as power-on
On the communication modules	Two LEDs: one for TX (green) and one for RX (amber).
Key-pad	For variable selection, programming of the instrument working parameters reset, "dmd", "max", total energy and partial energy and event.

Main functions

Password	Numeric code of max. 4 digits; 2 protection levels of the programming data:
1st level	Password "0", no protection;
2nd level	Password from 1 to 9999, all data are protected
System selection	
System 3-Ph.n unbalanced load	3-phase (4-wire)
System 3-Ph. unbalanced load	3-phase (3-wire), three currents and 3-phase to phase voltage measurements, or in case of Aaron connection two currents (with special wiring on screw terminals) and 3-phase to phase voltage measurements.
System 3-Ph.1 balanced load	3-phase (3-wire), one current and 3-phase to phase voltage measurements 3-phase (4-wire), one current and 3-phase to neutral voltage measurements.
System 3-Ph.2 balanced load	3-phase (2-wire), one current and 1-phase (L1) to neutral voltage measurement.
System 2-Ph	2-phase (3-wire)
System 1-Ph	1-phase (2-wire)

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Main functions (cont.)

Transformer ratio	
VT (PT)	1.0 to 999.9 / 1000 to 9999.
CT	1.0 to 999.9 / 1000 to 9999 (up to 10kA in case of CT with 1A secondary current and up to 50kA in case of CT with 5A secondary current).
Filter	
Operating range	Selectable from 0 to 100% of the input display scale
Filtering coefficient	Selectable from 1 to 32
Filter action	Measurements, analogue signal retransmission, serial communication (fundamental variables: V, A, W and their derived ones).
Displaying	
Number of variables	Up to 5 variables per page. See “Front view”. Many different set of variables available (see “Display pages”) according to the application being selected. One page is freely programmable as combination of variables.
Backlight	The backlight time is programmable from 0 (always on) to 255 minutes
Virtual alarms	
Working condition	In case of basic unit or with the addition of M O R2 or M O O2 digital output modules.
No. of alarms	Up to 16
Working mode	Up alarm and down alarm.
Controlled variables	The alarms can be connected to any instantaneous variable available in the table “List of the variables that can be connected to”.
Set-point adjustment	From 0 to 100% of the display scale
Hysteresis	From 0 to full scale
On-time delay	0 to 9999s
Min. response time	≤ 200ms, filters excluded. Set-point on-time delay: “0 s”.
Alarm highlight	In case of alarm and if the relevant function is enabled, the display changes the colour from white backlight to blue backlight or to another available colour combination (fore more details see “Working mode of the display in a normal/abnormal condition”)
Reset	By means of the front key-pad or the configuration software. It is possible to reset the following data: - all the min, max, dmd, and dmd-max values. - total energies: kWh, kvarh; - partial energies and tariffs: kWh, kvarh; - gas, water and remote heating; - latch alarms; - all the events; - all the load profiling; - all data logging
Harmonic analysis	Up to the 32nd harmonics on current and voltage including also “odd” and “even” THD. In case of communication module availability (any type) every single harmonic is available in the communication protocol completed with all necessary information so to built-up the single current and voltage waveform using a proper software.
Clock	
Functions	Universal clock and calendar.
Time format	Hour: minutes: seconds with selectable 24 hours or AM/PM format.
Date format	Day-month-year with selectable DD-MM-YY or MM-DD-YY format.
Battery life	10 years
Easy connection function	For all the display selections, both energy and power measurements are independent from the current direction. The displayed energy is always “imported” with the only exception of “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.

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General specifications

Operating temperature	-25°C to +55°C (-13°F to 131°F) (R.H. from 0 to 90% non-condensing @ 40°C) according to EN62053-21, EN50470-1 and EN62053-23
Storage temperature	-30°C to +70°C (-22°F to 158°F) (R.H. < 90% non-condensing @ 40°C) according to EN62053-21, EN50470-1 and EN62053-23
Installation category	Cat. III (IEC60664, EN60664)
Insulation (for 1 minute)	See “Insulation between inputs and outputs” table
Dielectric strength	4kVAC RMS for 1 minute
Noise rejection CMRR	100 dB, 48 to 62 Hz
EMC	According to EN62052-11
Electrostatic discharges	15kV air discharge
Immunity to irradiated	Test with current: 10V/m from 80 to 2000MHz
Electromagnetic fields	Test without any current: 30V/m from 80 to 2000MHz
Burst	On current and voltage measuring inputs circuit: 4kV
Immunity to conducted disturbances	10V/m from 150KHz to 80MHz
Surge	On current and voltage measuring inputs circuit: 4kV; on “L” auxiliary power supply input: 1kV
Radio frequency suppression	According to CISPR 22

Standard compliance	
Safety	IEC60664, IEC61010-1 EN60664, EN61010-1 EN62052-11.
Metrology	EN62053-21, EN62053-23, EN50470-3. MID ”annex MI-003”
Pulse output	DIN43864, IEC62053-31
Approvals	CE, cULus “Listed” (CuLus: max. 40°C, all modules i n all combinations)
Connections	Screw-type
Cable cross-section area	max. 2.5 mm^2. min./max. screws tightening torque: 0.4 Nm / 0.8 Nm. Suggested screws tightening torque: 0.5 Nm
Housing DIN	
Dimensions (WxHxD)	Module holder: 96x96x50mm. “A” and “B” type modules: 89.5x63x16mm. “C” type module: 89.5x63x20mm.
Max. depth behind the panel	With 3 modules (A+B+C): 81.7 mm
Material	ABS, self-extinguishing: UL 94 V-0
Mounting	Panel mounting
Protection degree	
Front	IP65, NEMA4x, NEM12
Screw terminals	IP20
Weight	Approx. 400 g (packing included)

Power supply specifications

Auxiliary power supply	H: 90 to 265VAC/DC; L: 19 to 60VAC/DC (48 to 62Hz)
Auxiliary power supply according to UL	100 to 240VAC +10% -15% 100 to 240VDC +10% -20% 24 to 48VAC +10% -15% 24 to 48VDC +10% -20%

Power consumption	AC: 20 VA; DC: 10 W

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Insulation between inputs and outputs

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

NOTE: in the table "NA" means combination of modules not allowed. 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 "totalizers" and "run hour counter"
- Pulse outputs (only "energies")
- Alarm outputs ("totalizers" , "hour counter" and "max" excluded)

No	Variable	1-ph. sys	2-ph. sys	3-ph. 3/4-wire balanced sys	3-ph. 2-wire balanced sys	3-ph. 3-wire unbal. sys	3-ph. 4-wire unbal. sys	Notes
1	VL-N sys	O	X	X	X	#	X	sys= system= Σ (1)(2)(3)
2	VL1	X	X	X	X	#	X	(1)(2)(3)
3	VL2	O	X	H	H	#	X	(1)(2)(3), (H)=VL1
4	VL3	O	O	H	H	#	X	(1)(2)(3), (H)=VL1
5	VL-L sys	#	X	X	X	X	X	sys= system= Σ (1)
6	VL1-2	#	X	X	P	X	X	(1)(2)(3), (P)=VL1*1.73
7	VL2-3	#	O	X	P	X	X	(1)(2)(3), (P)=VL1*1.73
8	VL3-1	#	O	X	P	X	X	(1)(2)(3), (P)=VL1*1.73
9	AL1	X	X	X	X	X	X	(1)(2)(3)
10	AL2	O	X	R	R	X	X	(1)(2)(3), (R)=AL1
11	AL3	O	O	R	R	X	X	(1)(2)(3), (R)=AL1
12	VA sys	O	X	X	X	#	X	sys= system= Σ (1)(2)(3)
13	VA L1	X	X	X	X	#	X	(1)(2)(3)
14	VA L2	O	X	X	X	#	X	(1)(2)(3)
15	VA L3	O	O	X	X	#	X	(1)(2)(3)
16	var sys	O	X	X	X	#	X	sys= system= Σ (1)(2)(3)
17	var L1	X	X	X	X	#	X	(1)(2)(3)
18	var L2	O	X	X	X	#	X	(1)(2)(3)
19	var L3	O	O	X	X	#	X	(1)(2)(3)
20	W sys	O	X	X	X	X	X	sys= system= Σ (1)(2)(3)
21	WL1	X	X	X	X	#	X	(1)(2)(3)
22	WL2	O	X	S	S	#	X	(1)(2)(3), (S)=WL1
23	WL3	O	O	S	S	#	X	(1)(2)(3), (S)=WL1
24	PF sys	O	X	X	X	#	X	sys= system= Σ (1)
25	PF L1	X	X	X	X	#	X	(1)(2)(3)
26	PF L2	O	X	T	T	#	X	(1)(2)(3), (T)=PFL1
27	PF L3	O	O	T	T	#	X	(1)(2)(3), (T)=PFL1
28	Hz	X	X	X	X	X	X	(1)(2)(3)
29	Phase seq.	O	O	X	O	X	X	

(X) = available; (O) = not available (variable not available on the display); (#) Not available (the relevant page is not displayed) (1) Min. and Max. and average value with data storage; (2) "dmd" calculation and data storage; (3) "dmd-max" calculation and data storage; (5) On 4 quadrants (ind/cap); (6) C1, C2 and C3 may be set as either cold water, hot water, remote heating or gas depending on the input configuration.

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List of the variables that can be connected to (cont.):

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

No	Variable	1-ph. sys	2-ph. sys	3-ph. 3/4-wire balanced sys	3-ph. 2-wire balanced sys	3-ph. 3-wire unbal. sys	3-ph. 4-wire unbal. sys	Notes
30	Asy VLL	O	X	X	O	X	X	Asymmetry
31	Asy VLN	O	O	O	O	O	X	Asymmetry
32	Run Hours	X	X	X	X	X	X	
33	kWh (+)	X	X	X	X	X	X	Total
34	kvarh (+)	X	X	X	X	#	X	Total (5)
35	kWh (+)	X	X	X	X	X	X	Partial or by tariff
36	kvarh (+)	X	X	X	X	#	X	Partial or by tariff (5)
37	kWh (-)	X	X	X	X	X	X	Total
38	kvarh (-)	X	X	X	X	#	X	Total (5)
39	kWh (-)	X	X	X	X	X	X	Partial
40	kvarh (-)	X	X	X	X	#	X	Partial (5)
41	C1 (input 4)	X	X	X	X	X	X	Total (6)
42	C2 (input 5)	X	X	X	X	X	X	Total (6)
43	C3 (input 6)	X	X	X	X	X	X	Total (6)
44	Trip counter							Total
45	kWh Water	X	X	X	X	X	X	Total
46	A L1 THD	X	X	X	X	X	X	(2) (3) (4)
47	A L2 THD	O	X	F	F	X	X	(2)(3)(4), (F)=AL1THD
48	A L3 THD	O	O	F	F	X	X	(2)(3)(4), (F)=AL1THD
49	V L1 THD	X	X	X	X	#	X	(2)(3)(4)
50	V L2 THD	O	X	X	G	#	X	(2)(3)(4), (G)=VL1THD
51	V L3 THD	O	O	X	G	#	X	(2)(3)(4), (G)=VL1THD
52	V L1-2 THD	#	X	X	#	X	X	(2) (3) (4)
53	V L2-3 THD	#	O	X	#	X	X	(2) (3) (4)
54	V L3-1 THD	#	O	X	#	X	X	(2) (3) (4)
55	A L1 TDD	X	X	X	X	X	X	(2) (3) (4)
56	A L2 TDD	O	X	X	X	X	X	(2) (3) (4)
57	A L3 TDD	O	O	X	X	X	X	(2) (3) (4)
58	K-Factor	O	O	X	X	X	X	(2) (3) (4)

(X) = available; (O) = not available (variable not available on the display); (#) Not available (the relevant page is not displayed); (2) “dmd” calculation and data storage; (3) “dmd-max”calculation and data storage; (4) Odd and Even THD’s;

List of selectable applications

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

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Display pages

No	Line 1 Variable Type	Line 2 Variable Type	Line 3 Variable Type	Line 4 Variable Type	Line 5 Variable Type	Note	Applications						
							A	B	C	D	E	F	G
0	Total kWh (+)						x	x	x	x	x	x	x
1	Total kvarh (+)						x	x	x		x	x	x
2	Total kWh (-)								x	x	x		x
3	Total kvarh (-)								x		x		x
4	kWh (+) partial							x	x		x	x	x
5	kvarh (+) part.							x	x		x	x	x
6	kWh (-) partial								x		x		x
7	kvarh (-) part.								x		x		x
8	Run Hours (99999999.99)								x	x	x	x	x
9	kWh (+) t1								x		x		x
10	kvarh (+) t1								x		x		x
11	kWh (-) t1								x		x		x
12	kvarh (-) t1								x		x		x
13	kWh (+) t2								x		x		x
14	kvarh (+) t2								x		x		x
15	kWh (-) t2								x		x		x
16	kvarh (-) t2								x		x		x
17	kWh (+) t3								x		x		x
18	kvarh (+) t3								x		x		x
19	kWh (-) t3								x		x		x
20	kvarh (-) t3								x		x		x
21	kWh (+) t4								x		x		x
22	kvarh (+) t4								x		x		x
23	kWh (-) t4								x		x		x
24	kvarh (-) t4								x		x		x
25	kWh (+) t5								x		x		x
26	kvarh (+) t5								x		x		x
27	kWh (-) t5								x		x		x
28	kvarh (-) t5								x		x		x
29	kWh (+) t6								x		x		x
30	kvarh (+) t6								x		x		x
31	kWh (-) t6								x		x		x
32	kvarh (-) t6								x		x		x
33	C1					(5)		x	x		x		x
34	C2					(5)		x	x		x		x
35	C3					(5)		x	x		x		x
36		VLN ∑	VL1	VL2	VL3	(1) (2) (3)				x	x	x	x
37		VLL ∑	VL1-2	VL2-3	VL3-1	(1) (2) (3)				x	x	x	x
38		An	AL1	AL2	AL3	(1) (2) (3)				x	x	x	x
39		Hz	"ASY"	VLL sys (% asy)	VLN sys (% asy)	(1) (2) (3)				x	x	x	x
40		W ∑	WL1	WL2	WL3	(1) (2) (3)				x	x	x	x
41		var ∑	var L1	var L2	var L3	(1) (2) (3)					x	x	x
42		PF ∑	PF L1	PF L2	PF L3	(1) (2) (3)					x	x	x
43		VA ∑	VA L1	VA L2	VA L3	(1) (2) (3)					x	x	x
44				Process sig.	Temperature	(1) (2) (3)						x	x
45			THD V1	THD V2	THD V3	(1) (2) (3)						x	x
46			THD V12	THD V23	THD V31	(1) (2) (3)						x	x
47			THD A1	THD A2	THD A3	(1) (2) (3)						x	x
48			THD V1 odd	THD V2 odd	THD V3 odd	(1) (2) (3)						x	x
49			THD V12 odd	THD V23 odd	THD V31 odd	(1) (2) (3)						x	x
50			THD A1 odd	THD A2 odd	THD A3 odd	(1) (2) (3)						x	x
51			THD V1 even	THD V2 even	THD V3 even	(1) (2) (3)						x	x
52			THD V12 even	THD V23 even	THD V31 even	(1) (2) (3)						x	x
53			THD A1 even	THD A2 even	THD A3 even	(1) (2) (3)						x	x
54			TDD A1	TDD A2	TDD A3	(1) (2) (3)						x	x
55			k-FACT L1	k-FACT L2	k-FACT L3	(1) (2) (3)						x	x

(1) Also Minimum value (no EEPROM storage). (2) Also Maximum value (no EEPROM storage). (3) Also Average (dmd) value (no EEPROM storage). (5) C1, C2 and C3 may be set as either cold water, hot water, remote heating or gas depending on the digital inputs configuration.

Additional available information on the display

No	8 Line 1	Line 2	Line 3	Line 4	Line 5	Applications						
						A	B	C	D	E	F	G
1	Lot n. (text) xxxx	Yr. (text) xx	rEL	X.xx	1...60 (min) “dmd”	x	x	x	x	x	x	x
2	Conn. xxx.x (3ph.n/3ph/3ph.1/ 3ph.2/1ph/2ph)	CT.rA (text)	1.0 … 99.99k	PT.rA (text)	1.0...9999	x	x	x	x	x	x	x
3	LED PULSE (text) kWh	xxxx kWh per pulse				x	x	x	x	x	x	x
4	PULSE out1 (text) kWh/kvarh	xxxx kWh/kvarh per pulse	+/- tot/PAr/ tAr 1-2-3-4			x	x	x	x	x	x	x
5	PULSE out2 (text) kWh/kvarh	xxxx kWh/kvarh per pulse	+/- tot/PAr/ tAr 1-2-3-4			x	x	x	x	x	x	x
6	PULSE out3 (text) kWh/kvarh	xxxx kWh/kvarh per pulse	+/- tot/PAr/ tAr 1-2-3-4			x	x	x	x	x	x	x
7	PULSE out4 (text) kWh/kvarh	xxxx kWh/kvarh per pulse	+/- tot/PAr/ tAr 1-2-3-4			x	x	x	x	x	x	x
8	PULSE out5 (text) kWh/kvarh	xxxx kWh/kvarh per pulse	+/- tot/PAr/ tAr 1-2-3-4			x	x	x	x	x	x	x
9	PULSE out6 (text) kWh/kvarh	xxxx kWh/kvarh per pulse	+/- tot/PAr/ tAr 1-2-3-4			x	x	x	x	x	x	x
10	PULSE out7 (text) kWh/kvarh	xxxx kWh/kvarh per pulse	+/- tot/PAr/ tAr 1-2-3-4			x	x	x	x	x	x	x
11	PULSE out8 (text) kWh/kvarh	xxxx kWh/kvarh per pulse	+/- tot/PAr/ tAr 1-2-3-4			x	x	x	x	x	x	x
12	Remote out.	Out 1 (text)	on/oFF	Out 2 (text)	on/oFF	x	x	x	x	x	x	x
13	Remote out.	Out 3 (text)	on/oFF	Out 4 (text)	on/oFF	x	x	x	x	x	x	x
14	Remote out.	Out 5 (text)	on/oFF	Out 6 (text)	on/oFF	x	x	x	x	x	x	x
15	Remote out.	Out 7 (text)	on/oFF	Out 8 (text)	on/oFF	x	x	x	x	x	x	x
16	AL1 OUTx NE/ND	Variable link L 1/2/3	Set1	Set2	(Measurement)				x	x	x	x
17	AL2 OUTx NE/ND	Variable link L 1/2/3	Set1	Set2	(Measurement)				x	x	x	x
18	AL3 OUTx NE/ND	Variable link L 1/2/3	Set1	Set2	(Measurement)				x	x	x	x
19	AL4 OUTx NE/ND	Variable link L 1/2/3	Set1	Set2	(Measurement)				x	x	x	x
20	AL5 OUTx NE/ND	Variable link L 1/2/3	Set1	Set2	(Measurement)				x	x	x	x
21	AL6 OUTx NE/ND	Variable link L 1/2/3	Set1	Set2	(Measurement)				x	x	x	x
22	AL7 OUTx NE/ND	Variable link L 1/2/3	Set1	Set2	(Measurement)				x	x	x	x
23	AL8 OUTx NE/ND	Variable link L 1/2/3	Set1	Set2	(Measurement)				x	x	x	x
24	AL9 OUTx NE/ND	Variable link L 1/2/3	Set1	Set2	(Measurement)				x	x	x	x
25	AL10 OUTx NE/ND	Variable link L 1/2/3	Set1	Set2	(Measurement)				x	x	x	x
26	AL11 OUTx NE/ND	Variable link L 1/2/3	Set1	Set2	(Measurement)				x	x	x	x
27	AL12 OUTx NE/ND	Variable link L 1/2/3	Set1	Set2	(Measurement)				x	x	x	x
28	AL13 OUTx NE/ND	Variable link L 1/2/3	Set1	Set2	(Measurement)				x	x	x	x
29	AL14 OUTx NE/ND	Variable link L 1/2/3	Set1	Set2	(Measurement)				x	x	x	x
30	AL15 OUTx NE/ND	Variable link L 1/2/3	Set1	Set2	(Measurement)				x	x	x	x
31	AL16 OUTx NE/ND	Variable link L 1/2/3	Set1	Set2	(Measurement)				x	x	x	x
32	Analogue 1	Hi:E	0.0 ... 9999	Hi.A	0.0 ... 100.0%				x	x	x	x
33	Analogue 2	Hi:E	0.0 ... 9999	Hi.A	0.0 ... 100.0%				x	x	x	x
34	Analogue 3	Hi:E	0.0 ... 9999	Hi.A	0.0 ... 100.0%				x	x	x	x
35	Analogue 4	Hi:E	0.0 ... 9999	Hi.A	0.0 ... 100.0%				x	x	x	x
36	Optical	bdr (text)	9.6/19.2/ 38.4/115.2			x	x	x	x	x	x	x
37	COM port	Add (text)	xxx (address)	bdr (text)	9.6/19.2/ 38.4/115.2	x	x	x	x	x	x	x
38	IP address	XXX	XXX	XXX	XXX	x	x	x	x	x	x	x
39	xx.xx.xx xx:xx	Date	Time			x	x	x	x	x	x	x
40	Event page Date Time								x	x	x	x

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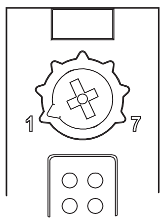
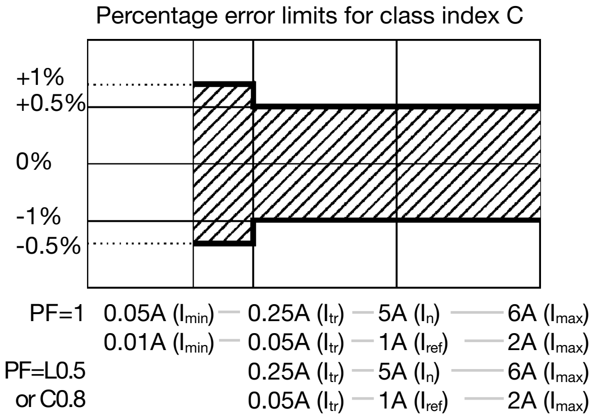
Back protection rotary switch



Function	Rotary switch position	Description
Unlock	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.

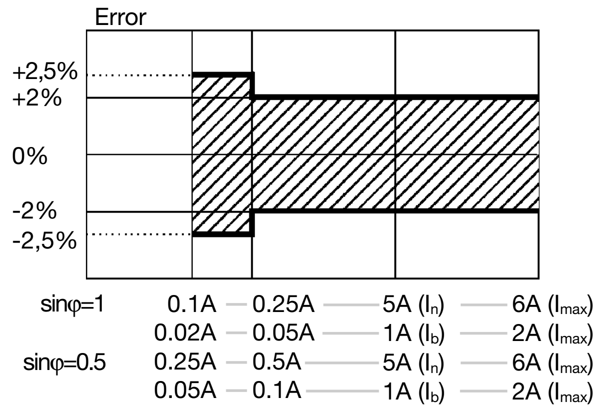
Accuracy (According to EN50470-3 and EN62053-23)

kWh, accuracy (RDG) depending on the current



Accuracy limits (Active energy)
Start-up current: 5mA (AV5-6), 1mA (AV4-7)

kvarh, accuracy (RDG) depending on the current



Accuracy limits (Reactive energy)
Start-up current: 5mA (AV5-6), 1mA (AV4-7)

Used calculation formulas

Phase variables

Instantaneous effective voltage

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

Instantaneous active power

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

Instantaneous power factor

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

Instantaneous effective current

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

Instantaneous apparent power

$$VA_1 = V_{1N} \cdot A_1$$

Instantaneous reactive power

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

System variables

Equivalent three-phase voltage

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

Voltage asymmetry

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

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

Three-phase reactive power

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

Three-phase active power

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

Three-phase apparent power

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

Total harmonic distortion

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

Three-phase power factor (TPF)

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

Energy metering

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

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

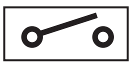
Where:

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

Wm40Soft parameter progr. and var. reading software

Wm40Soft	Multi-language software (Italian, English, French, German, Spanish) for variable reading, instrument calibration and parameters programming.The program runs under Windows 98/98SE/2000/NT/XP/Vista
Working mode	Three different working modes can be selected: - management of local RS232 (MODBUS); - management of local optical port (MODBUS); - management of a local RS485 network (MODBUS);
Data Storing	In pre-formatted XLS files (Excel data base).
Data Transfer	Manual or automatic at programmable intervals.

Alarm parameters and logic (programmable only by means of

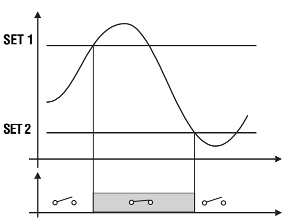


Each symbol includes all the settings described in the “alarm” paragraph and listed on the right:

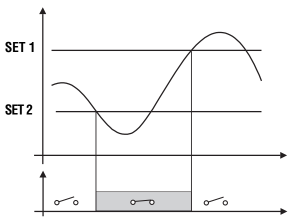
- Enable.
- Variable
- Type
- Latch
- Disable

- Set 1
- Set 2
- OUT
- Delay on. Delay off.
- Function (and/or)

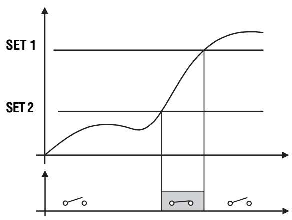
A, B, C... up to 16 locks to control parameters.



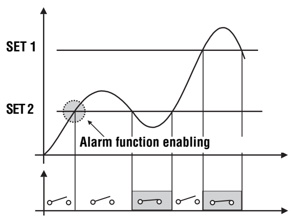
UP alarm



DOWN alarm

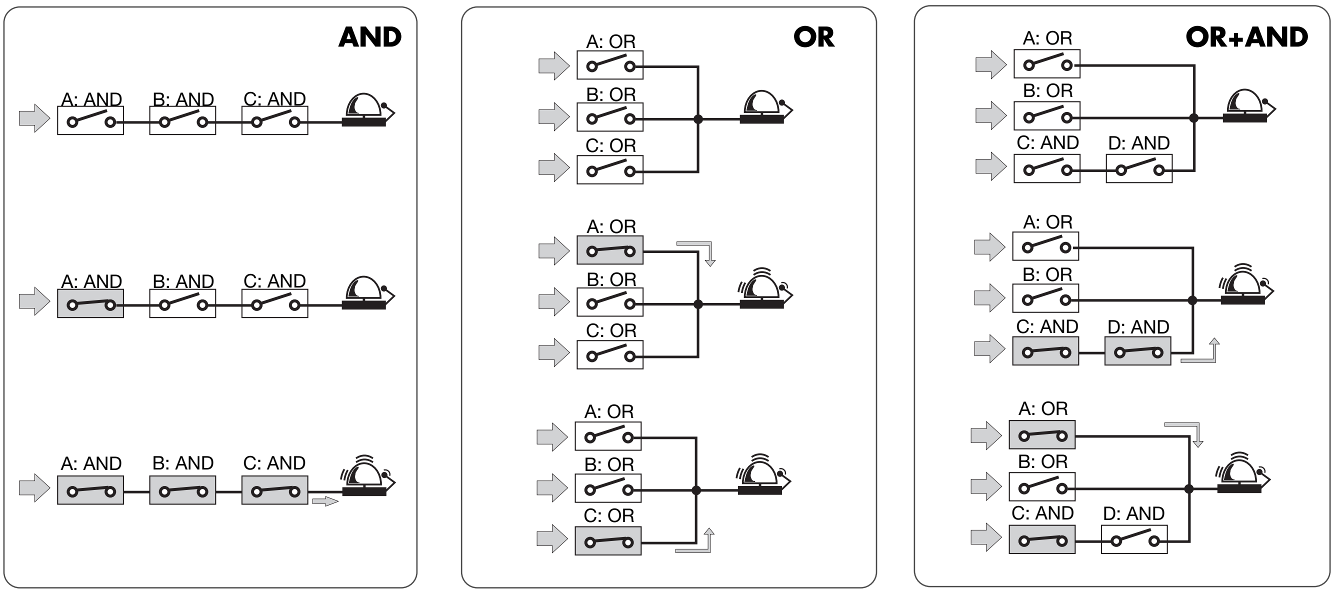


In-window alarm
Alarm is on when the value is between SET 1 and SET 2



Ext. window alarm with disabling at power on
Alarm is on when value exceeds SET 1 or goes below SET 2

Example of AND/OR logic alarm:



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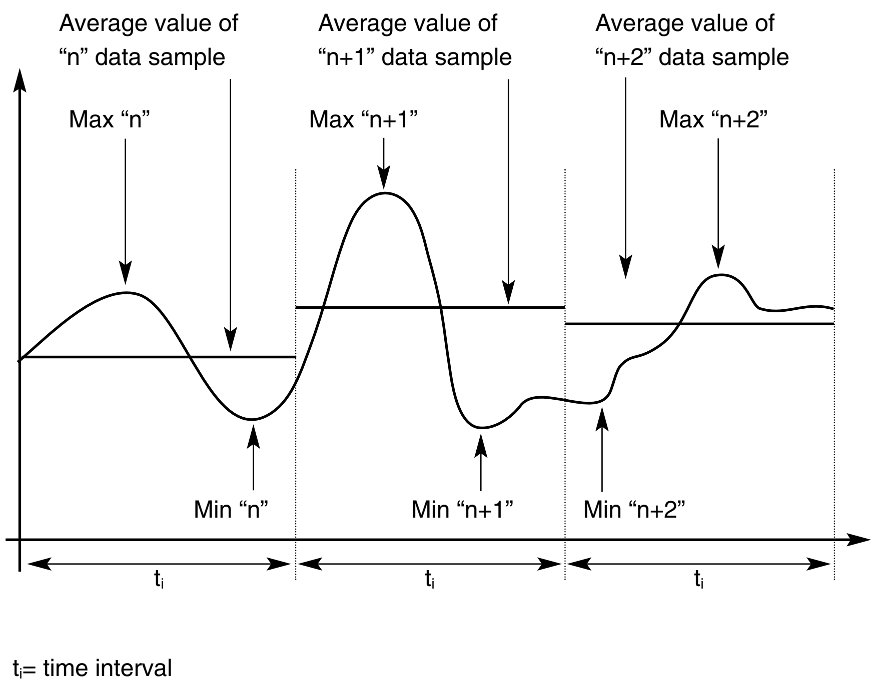
Historical data storing time table

Time interval (minutes)	4 selected variables			8 selected variables			12 selected variables			20 selected variables		
	Data storing time			Data storing time			Data storing time			Data storing time		
	Days	Week	Year	Days	Week	Year	Days	Week	Year	Days	Week	Year
1	32	5	-	19	3	-	15	2	-	8	1	-
5	161	23	-	97	14	-	73	10	-	40	6	-
10	323	46	-	194	28	-	145	21	-	81	12	-
15	484	69	1.3	291	42	-	218	31	-	121	17	-
20	646	92	1.8	388	55	1.1	291	42	-	161	23	-
30	969	138	2.7	581	83	1.6	436	62	1.2	242	35	-
45	1453	208	4	872	125	2.4	654	93	1.8	363	52	1
60	1938	277	5.3	1163	166	3.2	872	125	2.4	484	69	1.3

The working of data logging



t_i= time interval

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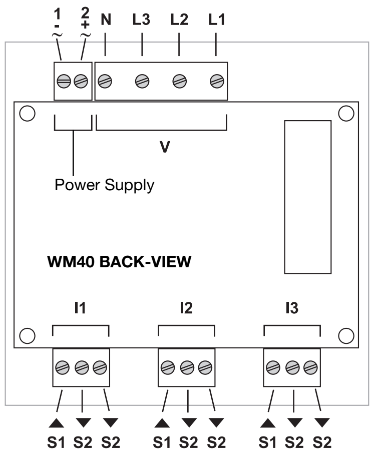
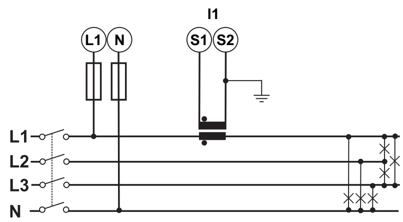
Wiring diagrams



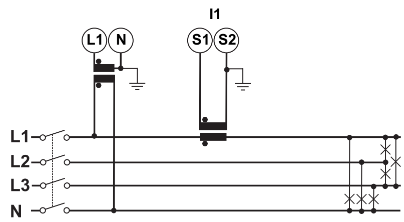
System type selection: 3-Ph.2

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



1-CT connection

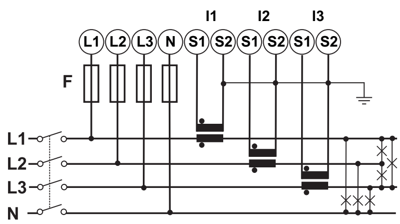
3-ph, 2-wire, balanced load **Fig. 2**



1-CT and 1-VT/PT connections

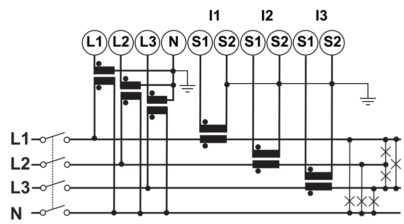
System type selection: 3-Ph.n

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



3-CT connection

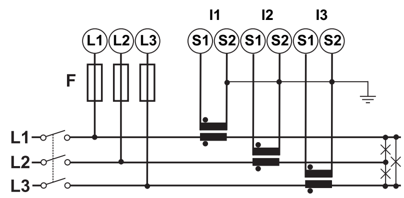
3-ph, 4-wire, unbalanced load **Fig. 4**



3-CT and 3-VT/PT connections

System type selection: 3-Ph

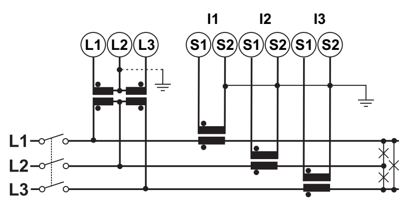
3-ph, 3-wire, unbalanced load **Fig. 5**



3-CT connection

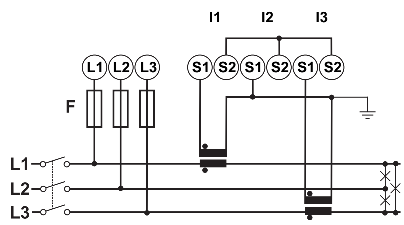
System type selection: 3-Ph (cont.)

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



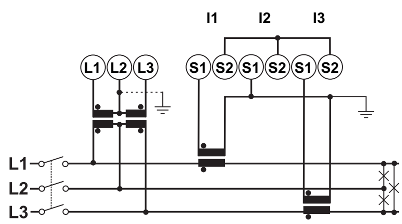
3-CT and 2-VT/PT connections

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



2-CT connections (ARON)

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



2-CT and 2-VT/PT connections ARON

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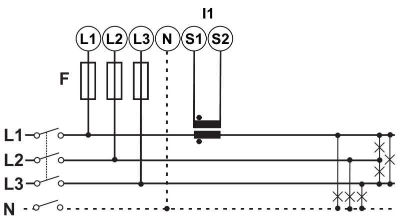
Wiring diagrams

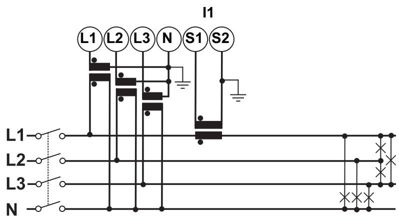
System type selection: 3-Ph.1

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



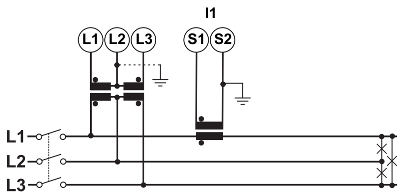
1-CT connections

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



1-CT and 3-VT/PT connections

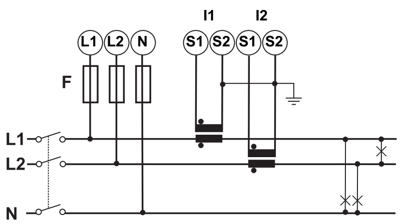
3-ph, 3-wire, balanced load **Fig. 11**



1-CT and 2-VT/PT connections

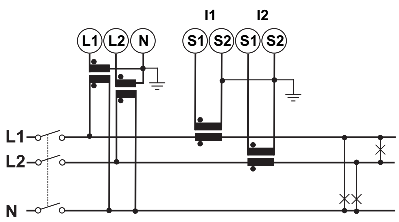
System type selection: 2-Ph

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



2-CT connection

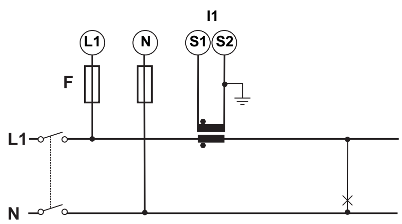
2-ph, 3-wire **Fig. 13**



2-CT and 2-VT/PT connections

System type selection: 1-Ph

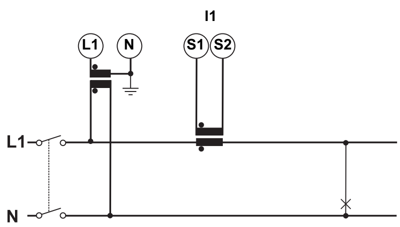
1-ph, 2-wire **Fig. 14**



1-CT connection

System type selection: 1-Ph (cont.)

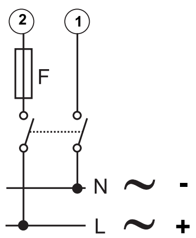
1-ph, 2-wire **Fig. 15**



1-CT and 1-VT/PT connections

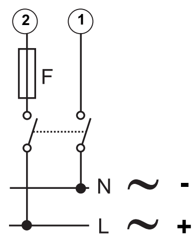
Power Supply

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



F= 250V [T] 630mA

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



F= 250V [T] 3,15A

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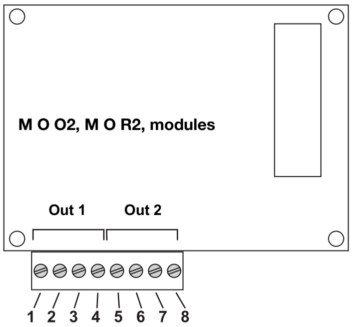
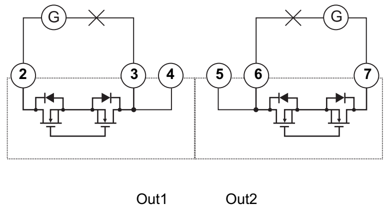
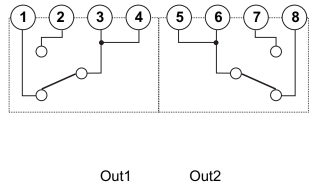
Static, relay, analogue out. and digital in. wiring diagrams

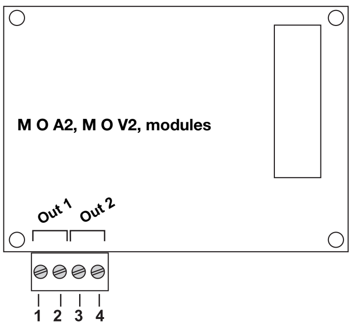


Opto-mosfet

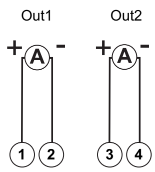


Relays

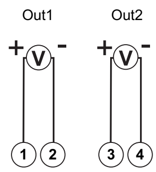


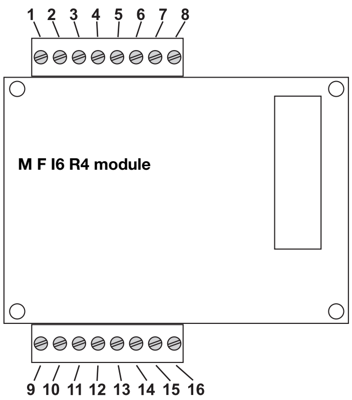


Analogue 20mA DC

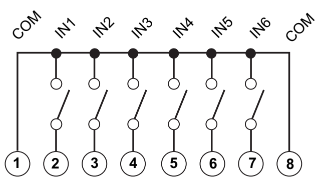


Analogue 10V DC

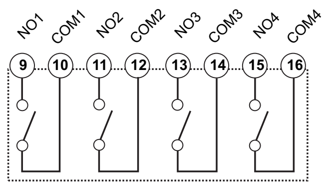


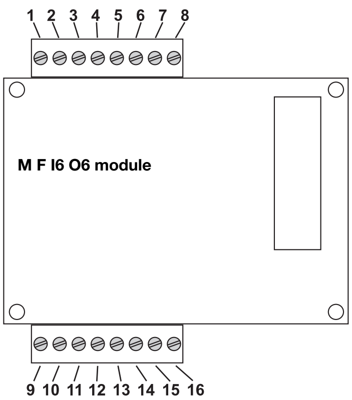


6 Digital inputs

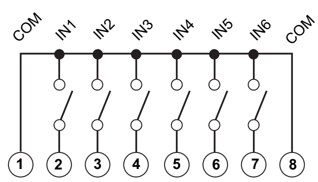


4 Relay outputs

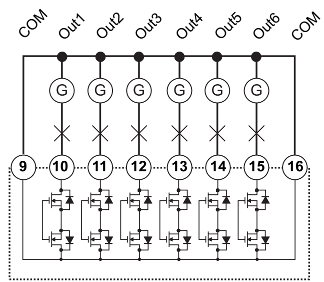




6 Digital inputs



6 Opto-mosfet outputs



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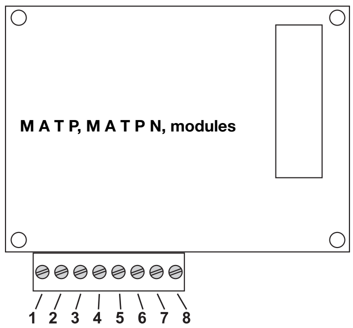
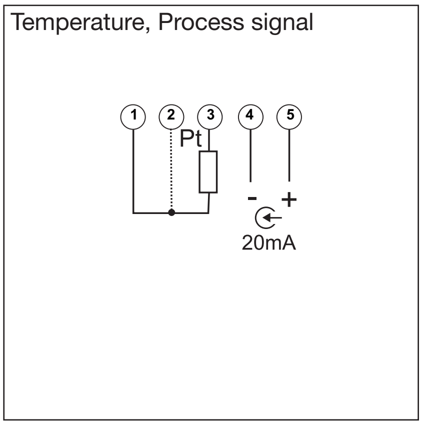
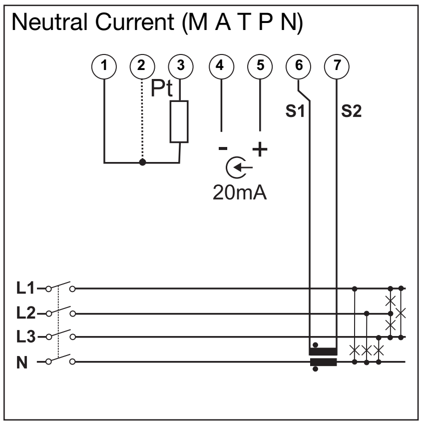
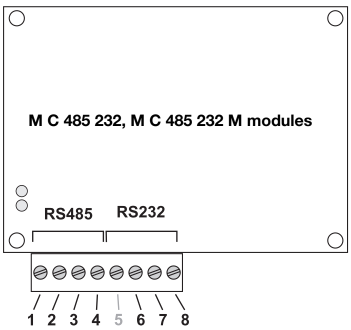
Temperature, process signal and true In wiring diagrams

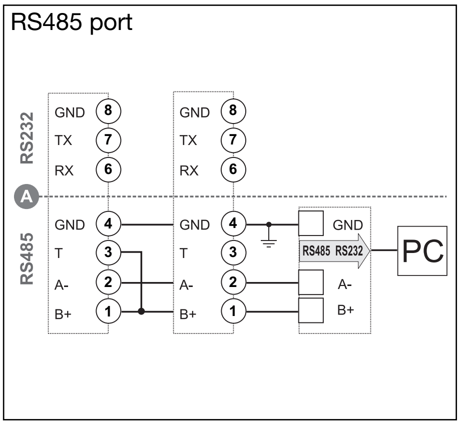


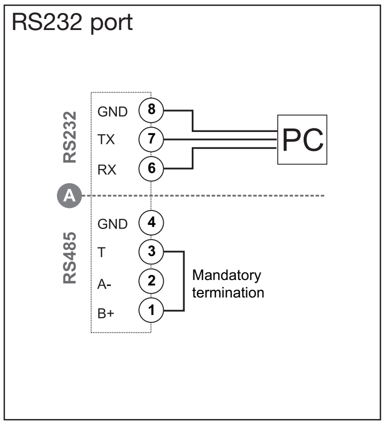




RS485 and RS232 wiring diagrams

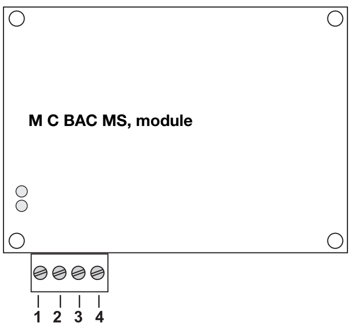


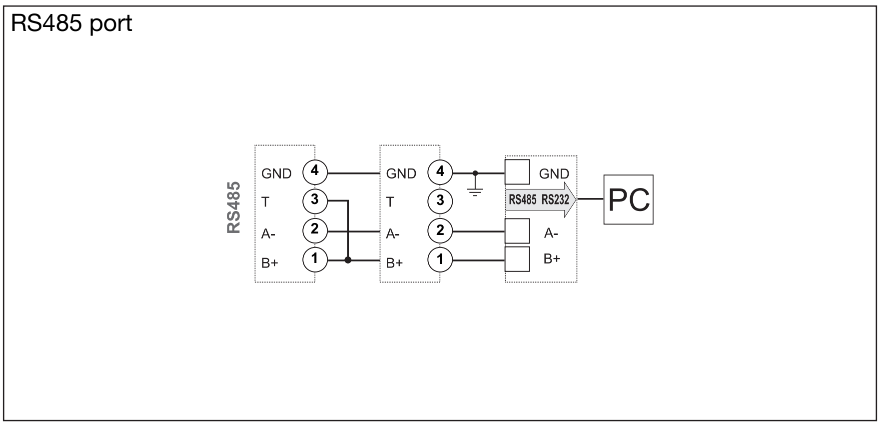




NOTE. RS485: additional devices provided with RS485 are connected in parallel. The termination of the serial output is carried out only on the last instrument of the network, by means of a jumper between (B+) and (T). A: the communication RS232 and RS485 ports **can't be** connected and used simultaneously.

RS485 wiring diagram of Bacnet module





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).

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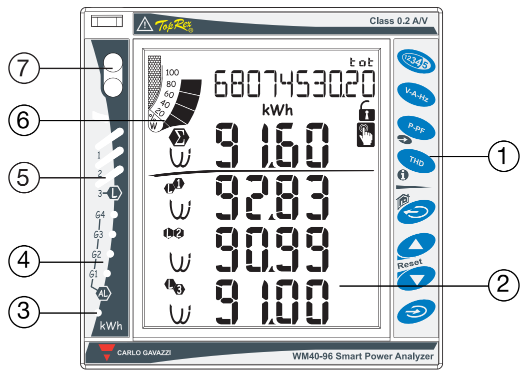
Front panel description



1. **Key-pad**
   To program the configuration parameters and scroll the variables on the display.
2. **Display**
   LCD-type with alphanumeric indications to:
   - display configuration parameters;
   - display all the measured variables.
3. **kWh LED**
   Red LED blinking proportional to the energy being measured.
4. **Alarm LED's**
   Red LED's light-on when virtual alarms are activated.
5. **Multiple bar-graph**
   To show at a glance the status of the single phases L1-L2-L3.
6. **Main bar-graph**
   To display the power consumption versus the installed power.
7. **Optical communication port**
   To program the working parameters, to read the measurements and to download the stored data.

Dimensions and Panel cut-out