Energy Management
Modular Smart Power Quality Analyzer
Type WM3-96

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- Class 0.5 (current/voltage)
- 32-bit µP-based modular smart power quality analyzer
- Graph display (128x64 dots)
- Front size: 96x96 mm
- Measurements of single phase and system variables: W, Wdmd, var, VA, VAdmd, PF, PFavg, V, A, An dmd (for all of them max. and min. values). Energies: kWh and kvarh on 4 quadrants.
- Neutral current measurement
- TRMS measurement of distorted waves (voltage/current)
- Current and voltage inputs with autoranging capability
- 4x4-dgt instantaneous variable read-out
- 4x9-dgt total energies read-out
- 4x6-dgt partial energies read-out
- 48 independent energy meters to be used as single, dual, multi-time energy management

- Display refresh time: 100 msec @ 50 Hz
- Harmonic distorsion analysis (FFT) up to 50th harmonic with both graph and numerical indication (of current and voltage)
- Harmonics source detection
- Optional RS232 + real time clock function with data logging of alarm and MIN/MAX events, monthly energy metering recording
- Degree of protection (front): IP 65
- Up to 4 optional alarm setpoints
- Up to 4 optional pulse outputs
- Up to 4 optional analogue outputs
- Optional serial RS 422/485 output
- Universal power supply: 18 to 60VAC/DC - 90 to 260 VAC/DC
- MODBUS RTU, JBUS, (N2 METASYS protocols on request)

Product Description

32-bit µP-based smart power quality analizer with a built-in configuration key-pad.
The housing is for panel mounting and ensures a degree of protection (front) of IP 65. The instrument is particularly indicated for those application where there is the need to control the power supply quality. The variables being displayed are more than 400.

Ordering Key

WM3-96AV53H XX XX XX XX X

- Model
- Range code
- System
- Power supply
- Slot A
- Slot B
- Slot C
- Slot D
- Options

Type Selection

Range code

AV5: 240/415 VAC - 1/5 AAC (max. 300 V (L-N)/ 520 V (L-L) - 6 A) (standard)
AV7: 400/690VAC - 1/5 AAC (max. 480V (L-N) / 830 V (L-L) / 6 A 1)

System

3: One phase, three-phase system (3 or 4 wires, balanced load)
Three phase system (3 or 4 wires, unbalanced load)

Power supply

L: 18 to 60VAC/DC 1)
H: 90 to 260VAC/DC

1) On request

Slot A (signal retransmission)

XX: None
A1: Single analogue output, 20mADC (standard)
A2: Single analogue output, ±5mADC 1)
A3: Single analogue output, ±10mADC 1)
A4: Single analogue output, ±20mADC 1)
B1: Dual analogue output, 20mADC (standard)
B2: Dual analogue output, ±5mADC 1)
B3: Dual analogue output, ±10mADC 1)
B4: Dual analogue output, ±20mADC 1)
V1: Single analogue output, 10VDC (standard)
V2: Single analogue output, ±1VDC 1)
V3: Single analogue output, ±5VDC 1)
V4: Single analogue output, ±10VDC 1)
W1: Dual analogue output, 10VDC (standard)
W2: Dual analogue output, ±1VDC 1)
W3: Dual analogue output, ±5VDC 1)
W4: Dual analogue output, ±10VDC 1)

Slot B (signal retransmission)

XX: None
B1: Dual analogue output, 20mADC (standard)
B2: Dual analogue output, ±5mADC 1)
B3: Dual analogue output, ±10mADC 1)
B4: Dual analogue output, ±20mADC 1)
W1: Dual analogue output, 10VDC (standard)
W2: Dual analogue output, ±1VDC 1)
W3: Dual analogue output, ±5VDC 1)
W4: Dual analogue output, ±10VDC 1)
S1: Serial port, RS485 multidrop, bidirectional 1)

Note:

Slot A + Slot B
Max 4 analogue outputs

Slot C + Slot D
max 4 digital outputs

Slot C (alarm or pulse out)

XX: None
R1: Single relay output, (AC1-8AAC, 250VAC) 1)
R2: Dual relay output, (AC1-8AAC, 250VAC) 1)
O1: Single open collector output (30V/100mADC) 1)
O2: Dual open collector output (30V/100mADC) 1)
D1: 3 digital inputs 1)

Slot D (alarm or pulse out)

XX: None
R2: Dual relay output, (AC1-8AAC, 250VAC) 1)
O2: Dual open collector output (30V/100mADC) 1)
O4: 4 open collector outputs (30V/100mADC) 1)

Options

X: None
S: Serial RS232 + RTC
N: With N2 Metasys protocol
C: options: S+N

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Input Specifications

Number of inputs	
Current	2 (system: single phase) 6 (system: 3-phase)
Voltage	2 (system: single phase 4 (system: 3-phase)
Digital	3 free of voltage contacts for Wdmd, VAdmd, An dmd, PFavg synchronization Reading voltage/current: 17.5 to 25VDC/<8mA
Accuracy (display, RS232, RS485)	In: 5A, If.s.: 6A, start-up I: 15mA
Current (A_{L1}, A_{L2}, A_{L3})	±0.5% RDG (0.2 to1.2 In) ±5mA (0.02 to 0.2 In)
Current (A_n)	±1% RDG (0.2 to 1.2 In) @ 40 to 100 Hz
Voltage AV5 range:	±0.5% RDG (48 to 300 V_{L-N}) ±1% RDG (84 to 519 V_{L-L})
AV7 range:	±0.5% RDG (80 to 480 V_{L-N}) ±1% RDG (139 to 830 V_{L-L}) includes also: frequency, power supply and output load influences
Frequency	±0.1% RDG (40 to 440 Hz)
Active power (@ 25°C ± 5°C, R.H. ≤ 60%)	±0.5% (RDG + FS) (PF 0.5 L/C, 0.1 to 1.2 In, AV5 range) or ±1% RDG (PF 0.5 L/C, 0.1 to 1.2 In, AV5 range)
Reactive power (@ 25°C ± 5°C, R.H. ≤ 60%)	±0.5% (RDG + FS) (PF 0.5 L/C, 0.1 to 1.2 In, AV5 range) or ±1% RDG (PF 0.5 L/C, 0.1 to 1.2 In, AV5 range)
Apparent power (@ 25°C ± 5°C, R.H. ≤ 60%)	±0.5% (RDG + FS) (0.1 to 1.2 In, AV5 range) or ±1% RDG (0.1 to 1.2 In, AV5 range)
Energies (@ 25°C ± 5°C, R.H. ≤ 60%)	Active: class 1 according to EN61036 Reactive: class 2 according to EN61268 Ib: 5A, Imax: 6A 0.1Ib: 500mA Start up current: 20mA Un: 240V (AV5), 400V (AV7)
Harmonic distorsion (@ 25°C ± 5°C, R.H. ≤ 60%)	1% FS (FS: 100%) phase: ±2°; Imin: 0.1Arms; Imax: 15Ap; Umin: 50Vrms; Umax: 500Vp Sampling frequency 6400 samples/s @ 50Hz
Additional errors	
Humidity	≤ 0.3%RDG, 60% to 90% R.H.
Input frequency	≤ 0.4%RDG, 62 to 400 Hz
Magnetic field	≤ 0.5%RDG, @ 400 A/m
Temperature drift	≤ 200ppm/°C
Sampling rate	6400 samples/s @ 50Hz
Display	Graph LCD, 128x64pixel, back-lighted. Selectable read-out for the instantaneous variables: 4x4-dgt or $4x3^1/_2$-dgt Total Energies: 4x9-dgt; Partial: 4x6-dgt
Max. and min. indication	Max. 9999 (999,999,999), Min. -9999 (–999,999,999)
Measurements	Current, voltage, power, energy, harmonic distortion (see “Display pages” table). TRMS measurement of a distorted wave (voltage/current). Coupling type: Direct Crest factor: ≤3 (max. 15Ap/500Vp (V L-N) or 15Ap/800Vp (V L-N)
Ranges (impedances)	
AV5	58/100 V (>500 kΩ) - 1 AAC (≤ 0.3 VA) 58/100 V (>500 kΩ) - 5 AAC (≤ 0.3 VA) 240/415 V (>500 kΩ) - 1 AAC (≤ 0.3 VA) 240/415 V (>500 kΩ) - 5 AAC (≤ 0.3 VA)
AV7	100/170 V ((>500 kΩ) 1 AAC (≤ 0.3 VA) 100/170 V (>500 kΩ) - 5 AAC (≤ 0.3 VA) 400/690 V (>500 kΩ) - 1 AAC (≤ 0.3 VA) 400/690 V (>500 kΩ) - 5 AAC (≤ 0.3 VA)
Frequency range	40 to 440 Hz
Over-load protection	
Continuous: voltage/current	AV5: 300 V_{LN}/520 V_{LL}/6A AV7: 480 V_{LN}/830 V_{LL}/6A
For 1 s	
AV5	600 V_{LN}/1040 V_{LL}/120A
AV7	960 V_{LN}/1660 V_{LL}/120A
Keypad	4 keys: ”S” for enter programming phase and password confirmation, ”UP” and “DOWN” for value programming/function selection, page scrolling “F” for special functions

Output Specifications

Analogue outputs (on request)	
Number of outputs	Up to 4 (on request)
Accuracy	±0.2% FS (@ 25°C ±5°C, R.H. ≤60%)
Range	0 to 20 mADC, 0 to ±20 mADC 0 to ±10 mADC, 0 to ±5 mADC 0 to 10 VDC, 0 to ±10 VDC 0 to ±5 VDC 0 to ±1 VDC

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Output Specifications (cont.)

Scaling factor	Programmable within the whole range of retransmission; it allows the retransmission management of all values from: 0 to 20 mADC, 0 to ±20 mADC 0 to ±10 mADC, 0 to ±5 mADC 0 to 10 VDC, 0 to ±10 VDC 0 to ±5 VDC 0 to ±1 VDC
Variables to be retransmitted	All (see table“List of the variables that can be connected to:”...)
Response time	≤ 200 ms typical (filter excluded, FFT excluded 3 1/2 dgt indication)
Ripple	≤ 1% according to IEC 60688-1 and EN 60688-1
Temperature drift	200 ppm/°C
Load: 20 mA output	≤ 600 Ω
±20 mA output	≤ 550 Ω
±10 mA output	≤ 1100 Ω
± 5 mA output	≤ 2200 Ω
10 V output	≥ 10 kΩ
±10 V output	≥ 10 kΩ
± 5 V output	≥ 10 kΩ
± 1 V output	≥ 10 kΩ
Insulation	By means of optocouplers, 4000V_{RMS} output to measuring input 4000V_{RMS} output to supply input
RS422/RS485 output (**on request**)	Multidrop bidirectional (static and dynamic variables)
Connections	4 wires, max. distance 1200m, termination directly on the module
Addresses	1 to 255, selectable by key-pad
Protocol	MODBUS RTU /JBUS, (N2 METASYS on request)
Data (bidirectional)	
Dynamic (reading only)	All display variables (see also the table, “List of the variables that can be connected to”...)
Static (writing only)	All configuration parameters, reset of energy, activation of digital output Stored energy (EEPROM) max. 999.999.999 kWh/kvarh
Data format	1-start bit, 8-data bit, no parity/even parity, odd parity, 1 stop bit
Baud-rate	1200, 2400, 4800 and 9600 selectable bauds
Insulation	By means of optocouplers, 4000 V_{RMS} output to measuring inputs 4000 V_{RMS} output to supply input
RS232 output (on request)	Bidirectional (static and dynamic variables)
Connections	3 wires, max. distance 15m,
Data format	1-start bit, 8-data bit, no parity, 1-stop bit
Baud-rate	9600 bauds
Protocol	MODBUS (JBUS)
Other data	as for RS422/485
Digital outputs (on request)	Up to 4 outputs (combination of alarms and pulse outputs) The working of the outputs: pulse or alarm or both of them is fully programmable and is independent from the chosen output module. Outputs remotely controlled by the serial communication port
Pulse outputs (on request)	
Number of outputs	Up to 4, independent
Type	From 1 to 1000 programmable pulses for K-M-G Wh, K-M-G varh, open collector (NPN transistor) V_{ON} 1.2 VDC/ max. 100 mA V_{OFF} 30 VDC max. Outputs connectable to total and partial energy meters
Pulse duration	220 ms (ON), ≥ 220 ms (OFF) According to DIN43864
Insulation	By means of optocouplers, 4000 V_{rms} output to measuring input, 4000V_{rms} output to supply input.
Note	The outputs can be either open collector type or relay type (for this latter one see the characteristics mentioned in the ALARMS).
Alarms outputs (on request)	
Number of setpoints	Up to 4, independent
Alarm type	Up alarm, down alarm, up alarm with latch, down alarm with latch, phase assymetry, phase loss, neutral loss
Variables to be controlled	All (see table“List of the variables that can be connected to:”...)
Setpoint adjustment	0 to 100% of the electrical scale
Hysteresis	0 to 100% of the electrical scale
On-time delay	0 to 255 s
Relay status	Selectable, Normally de-energized, normally energized
Output type	Relay, SPDT AC 1-8A, 250VAC DC 12-5A, 24VDC AC 15-2.5A, 250VAC DC 13-2.5A, 24VDC
Min. response time	≤ 150 ms, filter excluded, FFT excluded, setpoint on-time delay: ”0s”
Insulation	4000 V_{RMS} output to measuring input, 4000V_{RMS} output to supply input
Note	The outputs can be either relay type or open collector type (for this latter one, see the characteristics mentioned in the PULSE OUTPUTS).

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Software Functions

Password	Numeric code of max. 3 digits; 2 protection levels of the programming data
1st level	Password “0”, no protection
2nd level	Password from 1 to 499, all data are protected
Transformer ratio	For CT up to 30000 A, For VT up to 600 kV
Scaling factor	
Operating mode	Electrical scale: compression/ expansion of the input scale to be connected to up to 4 analogue outputs.
Electrical range	Programmable within the whole measuring range
Filter	
Filter operating range	0 to 99.9% of the input electrical scale
Filtering coefficient	1 to 255
Filter action	Display, alarm, analogue and serial outputs (fundamental variables: V, A, W and their derived ones)
Event logging	Only with RS232 + RTC module. The alarms max/min values will be stored with time (hh:mm:ss) and date (dd:mm:yy) references Max. capacity: 480 events
Page Variables	Max. 4/page, one freely prog. page + 26 variable pages + according to the kind of period selection: up to 12 energy meter pages.
Display language	English, Italian, French, German, Spanish

Supply Specifications

AC/DC voltage	90 to 260VAC/DC (standard), 18 to 60VAC/DC (on request),
Power consumption	≤ 30VA/12W (90to 260V) ≤ 20VA/12W (18 to 60V)

General Specifications

Operating temperature	0 to +50°C (32 to 122°F) (R.H. < 90% non-condensing)
Storage temperature	-10 to +60°C (14 to 140°F) (R.H. < 90% non-condensing)
Insulation reference voltage	300 V_{RMS} to ground (AV5 input)
Insulation	4000 V_{RMS} between all inputs/ outputs to ground
Dielectric strength	4000 V_{RMS} for 1 minute
Noise rejection	
CMRR	100 dB, 48 to 62 Hz
EMC	EN 50081-2, EN 50082-2
Other standards	
Safety requirements:	IEC 61010-1, EN 61010-1
Product requirements:	IEC 60688-1, EN 60688-1
Product requirements	Energy measurements: EN61036, EN61268.
Pulse output:	DIN43864
Approvals	CE, UL, CSA
Connector	Screw-type, max. 2.5 mm^2 wires x 2
Housing	
Dimensions	96x96x140 mm
Material	ABS, self-extinguishing: UL 94 V-0
Degree of protection	Front: IP65, NEMA4x, NEMA12
Weight	Approx. 600 g (packing included)

Function Description

Input and output scaling capability
Working of the analogue outputs (y) versus input variables (x)

Figure A
The sign of measured quantity and output quantity remains the same. The output quantity is proportional to the measured quantity.

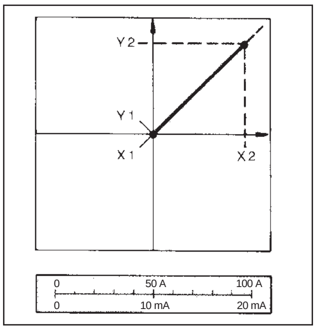


Figure B
The sign of measured quantity and output quantity changes simultaneously. The output quantity is proportional to the measured quantity.

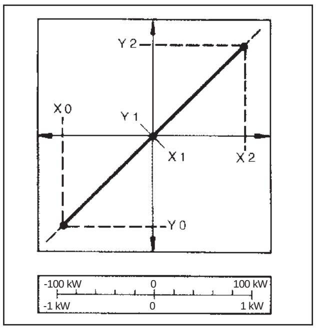


Figure C
The sign of measured quantity and output quantity remains the same. On the range X0...X1, the output quantity is zero. The range X1...X2 is delineated on the entire output range Y0 = Y1...Y2 and thus presented in strongly expanded form.

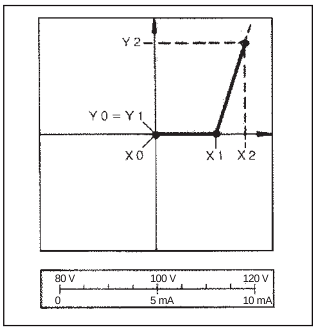


Figure D
The sign of measured quantity and output quantity remains the same. With the measured quantity being zero, the output quantity already has the value
Y1 = 0.2 Y2.
Live zero output.

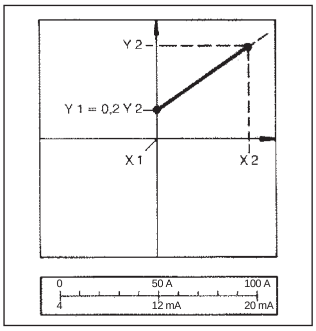


Figure E
The sign of the measured quantity changes but that of the output quantity remains the same. The output quantity steadily increases from value X1 to value X2 of the measured quantity.

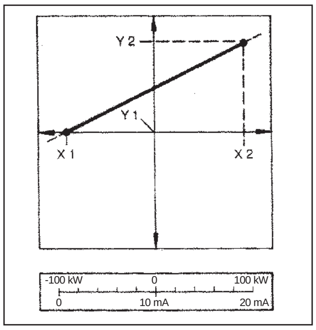
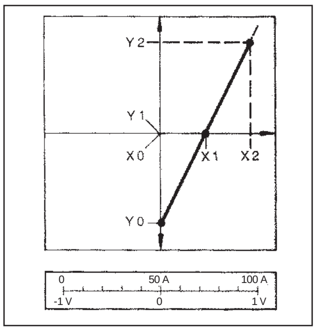


Figure F
The sign of the measured quantity remains the same, that of the output quantity changes as the measured quantity leaves range X0...X1 and passes to range X1...X2 and vice versa.



Mode of Operation

Waveform of the signals that can be measured

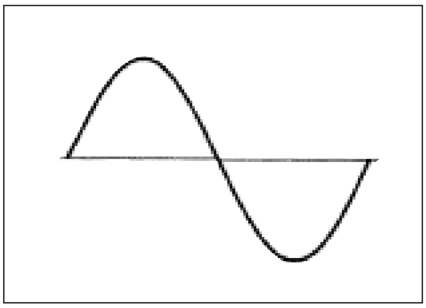


Figure G
Sine wave, undistorted

Fundamental content	100%
Harmonic content	0%
A_{rms} =	$1.1107\,\lvert \overline{A} \rvert$

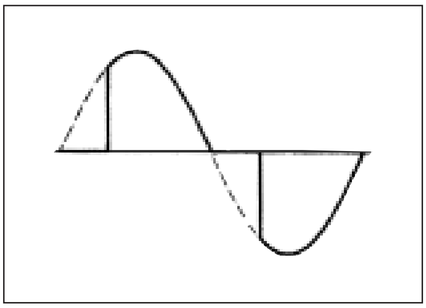


Figure H
Sine wave, indented

Fundamental content	10...100%
Harmonic content	0...90%

Frequency spectrum 3rd to 50th harmonic

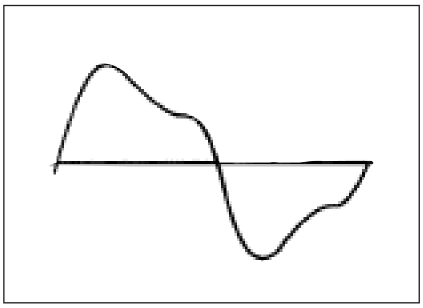


Figure I
Sine wave, distorted

Fundamental content	70...90%
Harmonic content	10...30%

Frequency spectrum 3rd to 50th harmonic

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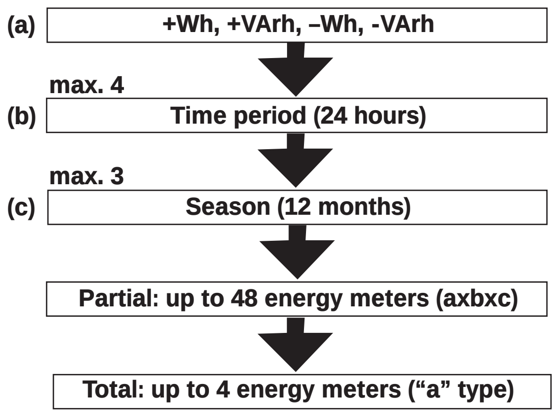
Harmonic distortion analysis

Analysis principle	FFT
Harmonic measurement Current Voltage	 Up to 50th harmonic Up to 50th harmonic
Type of harmonics	THD (VL1) THD odd (VL1) THD even (VL1) and also for the other phases: L2, L3. THD (IL1) THD odd (IL1) THD even (IL1) and also 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	For every THD page it is possible to see the harmonic order.
Display pages	The harmonics content is displayed as a graph showing the whole harmonic spectrum. The information is given also as numerical information: THD in % / RMS value THD odd in % / RMS value THD even in % / RMS value single harmonic in % / RMS value
Others	The harmonic distortion can be measured in 2-wire, 3-wire or 4-wire systems. Tw: 0.02

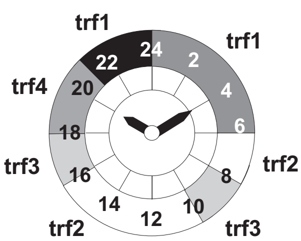
Energy time period management

Time periods	Selectable: single time, dual time and multi-time
Single time Number of energy meters	 Total: 4 (9-digit) (no partial meters)
Dual time Number of energy meters Time periods	 Total: 4 (9-digit) Partial: 8 (6-digit) 2, programmable within 24 hours
Multi time Number of energy meters Time periods Time seasons	 Total: 4 (9-digit) Partial: 48 (6-digit) 4, programmable within 24 hours 3, programmable within 12 months
Pulse outputs	Connectable to total and partial energy meters (Single time, dual time, multi time periods)
Energy metering recording	Energy consumption story, recording of energy metering by months, oldest data: 2 months before current month. Recording of total and partial energy metering

Management concept (multi-time)



Example of Multi-time energy metering



WINTER		
trf	start	end
1	00:00	06:00
2	06:00	08:00
3	08:00	10:00
TARIFF		1

WINTER		
trf	start	end
2	10:00	16:00
3	16:00	18:00
4	18:00	21:00
1	21:00	00:00
TARIFF		1

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Display pages

Variables that can be displayed in case of a three-phase system, 4-wire connection.

No	1st variable	2nd variable	3rd variable	4th variable	Note
	Selectable	Selectable	Selectable	Selectable	
1	V L1	V L2	V L3	V L-N sys	Sys = Σ
2	V L1-2	V L2-3	V L3-1	V L-L sys	Sys = Σ
3	A L1	A L2	A L3	A n	
4	W L1	W L2	W L3	W sys	Sys = Σ
5	var L1	var L2	var L3	var sys	Sys = Σ
6	VA L1	VA L2	VA L3	VA sys	Sys = Σ
7	PF L1	PF L2	PF L3	PF sys	
8	V L1	A L1	PF L1	W L1	
9	V L2	A L2	PF L2	W L2	
10	V L3	A L3	PF L3	W L3	
11	V L-L sys	PF sys	var sys	W sys	Sys = Σ
12	A n	PF sys	Hz	W sys	Sys = Σ
13	A n dmd	VA dmd	PF avg	W dmd	dmd=demand, avg=average
14	(MAX1)	(MAX2)	(MAX3)	(MAX4)	The MAX value can be one of the above mentioned (No. 1 to No. 13)
15	(MAX5)	(MAX6)	(MAX7)	(MAX8)	
16	(MAX9)	(MAX10)	(MAX11)	(MAX12)	
17	(MIN1)	(MIN2)	(MIN3)	(MIN4)	The MIN value can be one of the above mentioned (No. 1 to No. 13)
18	(MIN5)	(MIN6)	(MIN7)	(MIN8)	
19	Histogram FFT V1 (THD, TADo, THDe, Single harmonic)				Only if analysis V1-A1 is activated
20	Histogram FFT A1 (THD, TADo, THDe, Single harmonic)				Only if analysis V1-A1 is activated
21	Histogram FFT V2 (THD, TADo, THDe, Single harmonic)				Only if analysis V2-A2 is activated
22	Histogram FFT A2 (THD, TADo, THDe, Single harmonic)				Only if analysis V2-A2 is activated
23	Histogram FFT V3 (THD, TADo, THDe, Single harmonic)				Only if analysis V3-A3 is activated
24	Histogram FFT A3 (THD, TADo, THDe, Single harmonic)				Only if analysis V3-A3 is activated
25	KWh + TOT	KWh – TOT	Kvar+ TOT	Kvar– TOT	
26	KWh+	KWh–	Kvar+	Kvar–	Partial energy meters

Used Calculation Formulas

Formulas being used for single-phase measurements

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

$$\cos\phi_1 = \frac{W_1}{VA_1}$$

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

$$VAr_1 = \sqrt{(VA_1)^2 - (W_1)^2}$$

Formulas being used for 3-phase measurements

Equivalent three-phase voltage

$$V_\Sigma = \frac{V_{12} + V_{23} + V_{31}}{3}$$

Three-phase reactive power

$$VAr_\Sigma = (VAr_1 + VAr_2 + VAr_3)$$

Neutral current

$$An = \overline{A}_{L1} + \overline{A}_{L2} + \overline{A}_{L3}$$

Three-phase active power

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

Three-phase apparent power

$$VA_\Sigma = \sqrt{W_\Sigma^2 + VAr_\Sigma^2}$$

Equivalent three-phase power factor

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

Total harmonic distortion

$$THD_i = \frac{\sqrt{\sum_{n,n\neq 1} T_{n,i}^2}}{T_{1,i}}$$

Harmonic values:
THDi-THD of parameter T at phase i

Tn,i - value of parameter T at the n'th harmonic of phase i

Energy metering

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

$$kVarh_i = \int_{t_1}^{t_2} Q_i(t)\,dt \cong \Delta t \sum_{n_1}^{n_2} Q_{n,i}$$

kWh_i = total consumed active energy at phase i

$kVArh_i$ = total consumed reactive energy at phase i

$P_i(t)$ = total RMS active power at phase i of time t

$Q_i(t)$ = total RMS reactive power at phase i of time t

t_1 t_2 = starting and ending time points of consumption recording

$P_{n,i}$ = total RMS active power at phase i of discrete time n

$Q_{n,i}$ = total RMS reactive power at phase i of discrete time n

Δt = time interval between two successive power consumptions

n1, n2 = starting and ending discrete time points of consumption recording

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List of the variables that can be connected to:

- max/min variable detection;
- analogue outputs;
- alarm outputs.

No	Variable	1-phase Sys.	3-ph. + N Bal. Sys.	3-ph. + N Unbal. Sys.	3-ph. Bal. Sys.	3-ph. Unbal. Sys.	Note
1	V L1	o	x	x	o	o	
2	V L2	o	x	x	o	o	
3	V L3	o	x	x	o	o	
4	V L-N sys	o	x	x	o	o	Sys = Σ
5	V L1-2	x	x	x	x	x	
6	V L2-3	o	x	x	x	x	
7	V L3-1	o	x	x	x	x	
8	V L-L sys	o	x	x	x	x	Sys = Σ
9	A L1	x	x	x	x	x	
10	A L2	o	x	x	x	x	
11	A L3	o	x	x	x	x	
12	A n	o	x	x	o	o	Neutral current
13	W L1	x	x	x	o	o	
14	W L2	o	x	x	o	o	
15	W L3	o	x	x	o	o	
16	W sys	o	x	x	x	x	Sys = Σ
17	var L1	x	x	x	o	o	
18	var L2	o	x	x	o	o	
19	var L3	o	x	x	o	o	
20	var sys	o	x	x	x	x	Sys = Σ
21	VA L1	x	x	x	o	o	
22	VA L2	o	x	x	o	o	
23	VA L3	o	x	x	o	o	
24	VA sys	o	x	x	x	x	Sys = Σ
25	PF L1	x	x	x	o	o	
26	PF L2	o	x	x	o	o	
27	PF L3	o	x	x	o	o	
28	PF sys	o	x	x	x	x	Sys = Σ
29	Hz	x	x	x	x	x	
30	THD V1	x	x	x	x	x	if FFT V1-A1 is activated
31	THDo V1	x	x	x	x	x	if FFT V1-A1 is activated
32	THDe V1	x	x	x	x	x	if FFT V1-A1 is activated
33	THD V2	o	x	x	x	x	if FFT V2-A2 is activated
34	THDo V2	o	x	x	x	x	if FFT V2-A2 is activated
35	THDe V2	o	x	x	x	x	if FFT V2-A2 is activated
36	THD V3	o	x	x	x	x	if FFT V3-A3 is activated
37	THDo V3	o	x	x	x	x	if FFT V3-A3 is activated
38	THDe V3	o	x	x	x	x	if FFT V3-A3 is activated
39	THD A1	x	x	x	x	x	if FFT V1-A1 is activated
40	THDo A1	x	x	x	x	x	if FFT V1-A1 is activated
41	THDe A1	x	x	x	x	x	if FFT V1-A1 is activated
42	THD A2	o	x	x	x	x	if FFT V2-A2 is activated
43	THDo A2	o	x	x	x	x	if FFT V2-A2 is activated
44	THDe A2	o	x	x	x	x	if FFT V2-A2 is activated
45	THD A3	o	x	x	x	x	if FFT V3-A3 is activated
46	THDo A3	o	x	x	x	x	if FFT V3-A3 is activated
47	THDe A3	o	x	x	x	x	if FFT V3-A3 is activated
48	A n dmd	x	x	x	x	x	Integration time programmable from 1 to 30 minutes
49	VA dmd	x	x	x	x	x	Integration time prog. from 1 to 30 min.
50	PF avg	x	x	x	x	x	Integration time prog. from 1 to 30 min.
51	W dmd	x	x	x	x	x	Integration time prog. from 1 to 30 min.
52	ASY	o	x	x	x	x	Integration time prog. from 1 to 30 min.

Note: (x) stands for an “available” variable, (o) stands for a “not-available” variable.

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The available modules

Type	N. of channels	Ordering code
WM3-96 base		AD 1016H
WM3-96 N2 METASYS base		AD 1016HN2
AV5.3 measuring inputs		AQ 1018
AV7.3 measuring inputs		AQ 1019
18-60VAC/DC power supply		AP1021
90-260VAC/DC power supply		AP1020
20mADC analogue output	1	AO1050
10VDC analogue output	1	AO1051
±5mADC analogue output	1	AO1052
±10mADC analogue output	1	AO1053
±20mADC analogue output	1	AO1054
±1VDC analogue output	1	AO1055
±5VDC analogue output	1	AO1056
±10VDC analogue output	1	AO1057
20mADC analogue output	2	AO1026
10VDC analogue output	2	AO1027
±5mADC analogue output	2	AO1028
±10mADC analogue output	2	AO1029
±20mADC analogue output	2	AO1030
±1VDC analogue output	2	AO1031
±5VDC analogue output	2	AO1032
±10VDC analogue output	2	AO1033
RS485 output	1	AR1034
Relay output	1	AO1058
Relay output	2	AO1035
Open collector output	1	AO1059
Open collector output	2	AO1036
Open collector output	4	AO1037
Digital inputs	3	AQ1038
RS232 output + RTC (1)	1	AR1039

The possible module combinations

Basic unit	Slot A	Slot B	Slot C	Slot D
Single analogue output	●			
Dual analogue output	●	●		
RS485 input/output		●		
Single relay output (*)			●	
Single open collector out (*)			●	
Dual relay output (*)			●	●
Dual open coll. out (*)			●	●
4 open coll. output (*)				●
3 digital inputs			●	
Basic unit	**Slot E**			
RS232 input/output + RTC	●			

(*) alarm or pulse

METASYS. COMPATIBLE

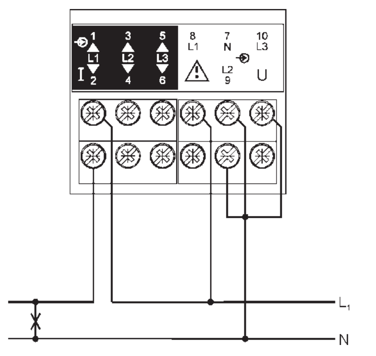
N2-Open Metasys protocol full compatibility (available on request).

(1) The RS232 communication port works as alternative of the RS485 module.

Wiring Diagrams

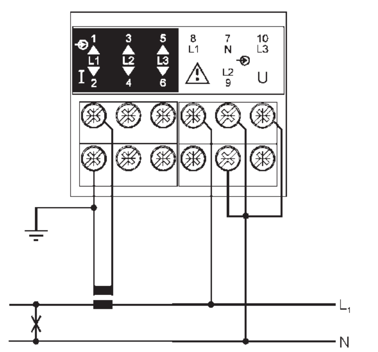
Single phase input connections

Fig. 1



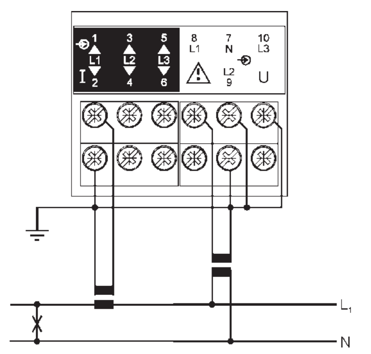
Direct connection

Fig. 2



CT connection

Fig. 3



CT and VT connection

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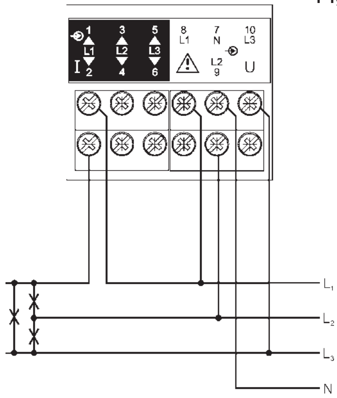
Wiring Diagrams (cont.)

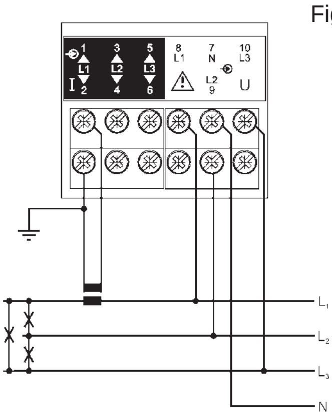
Three-phase wire input connections - Balanced loads

Fig. 4



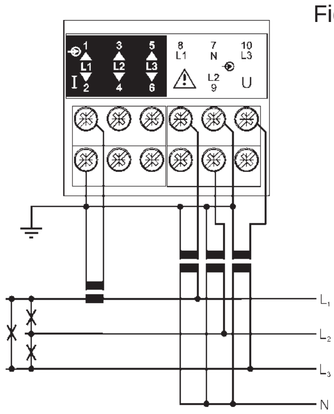
Direct connection (3-wire system)

Fig. 5



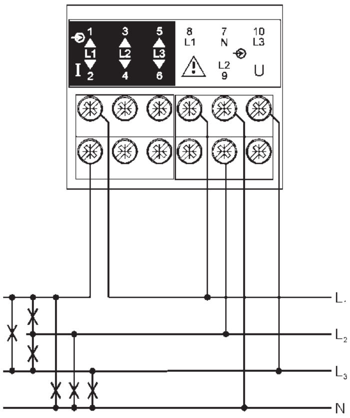
CT connection (3-wire system)

Fig. 6



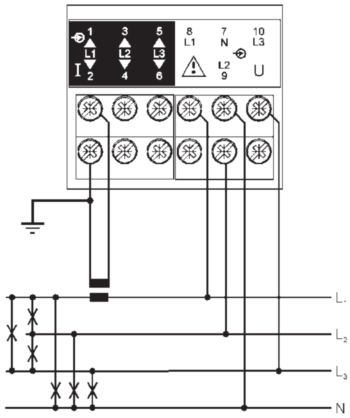
CT and VT connection (3-wire system)

Fig. 7



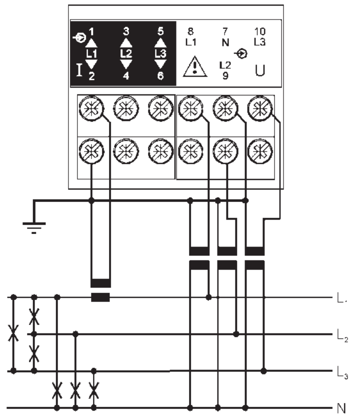
Direct connection (4-wire system)

Fig. 8



CT connection (4-wire system)

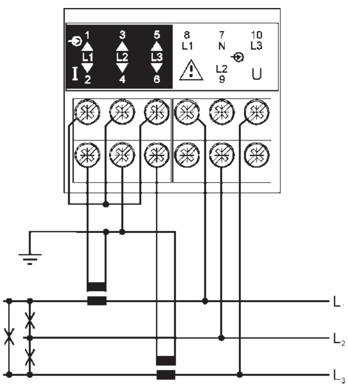
Fig. 9



CT and VT connection (4-wire system)

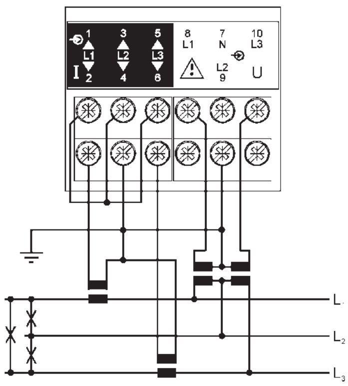
Three-phase, 3-wire ARON input connections - Unbalanced loads

Fig. 10



CT connection (3-wire system)

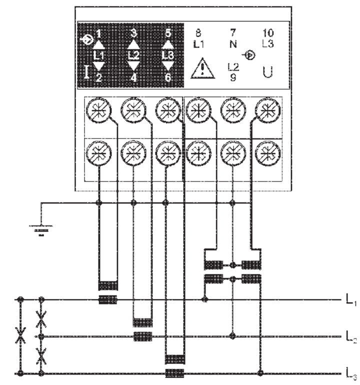
Fig. 11



CT and VT connection (3-wire system)

Three-phase, 3-wire input connections - Unbalanced loads

Fig. 12



CT and VT connection (3-wire system)

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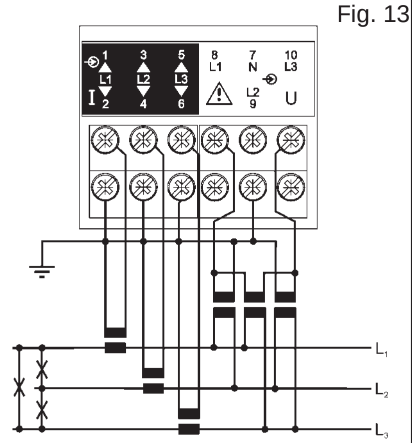
Wiring Diagrams (cont.)

Three-phase three-wire input connections
Unbalanced load

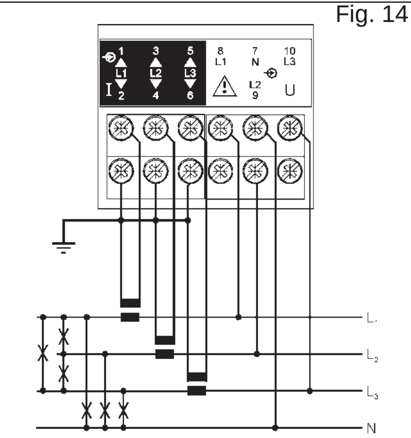
Three-phase four-wire input connections - Unbalanced load

Fig. 13



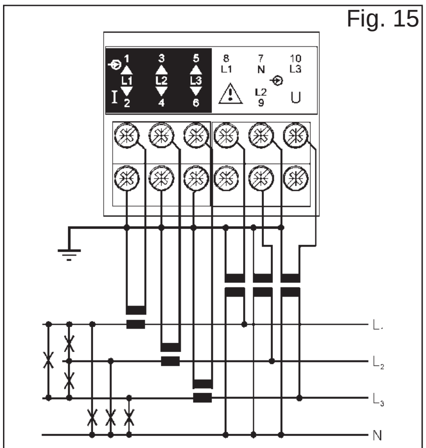
CT connection (3-wire system)

Fig. 14



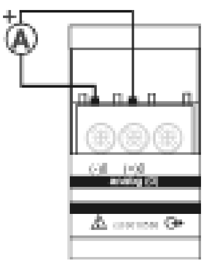
CT connection (4-wire system)

Fig. 15

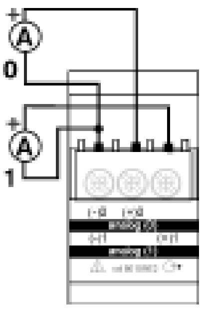


CT and VT connection (4-wire system)

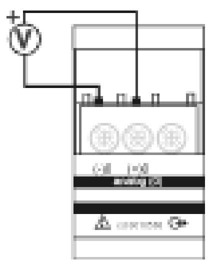
Wiring diagrams (optional modules)



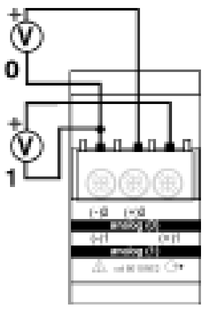
AO1050
1 analogue
output (mA)



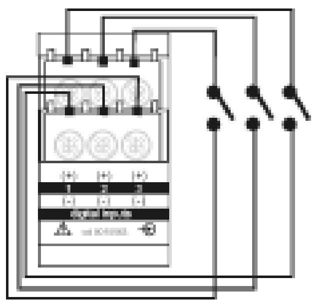
AO1026
2 analogue
outputs (mA)



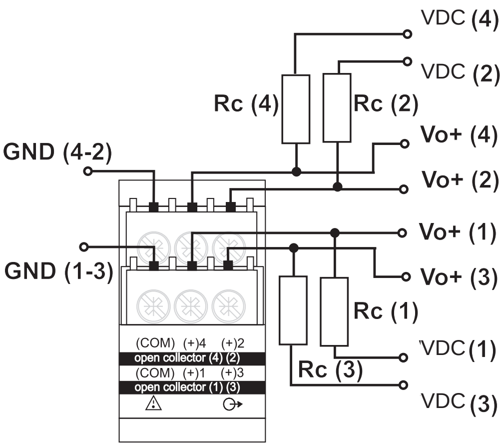
AO1051
1 analogue
output (V)



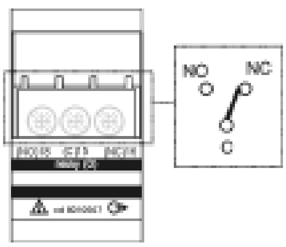
AO1027
2 analogue
outputs (V)



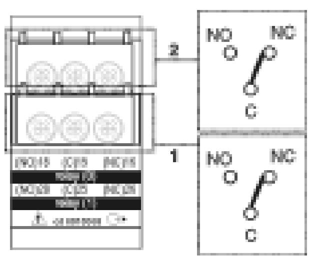
AO1038
3 digital inputs



AO1037



AO1058
1 relay output



AO1035
2 relay outputs

4 open collector outputs: The load resistance (Rc) must be designed so that the closed contact current is lower than 100mA; the VDC voltage must be lower than or equal to 30V.
VDC: power supply voltage output. Vo+: positive output contact (open collector transistor). GND: ground output contact (open collector transistor).

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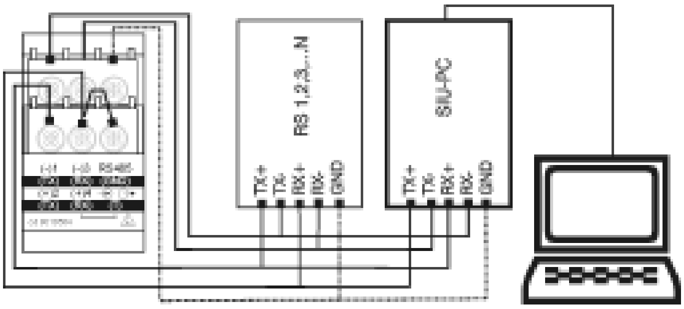
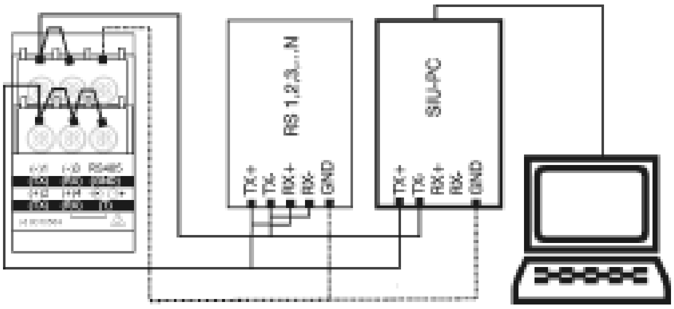
Wiring diagrams (optional modules, cont.)

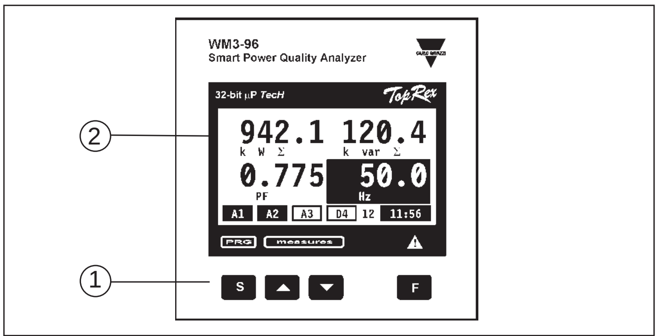


RS422/485 4-wires connection: additional devices provided with RS422/485 (that is RS 1, 2, 3...N) are connected in parallel.
The termination of the serial output is carried out only on the last instrument of the network, by means of a jumper between (Rx+) and (T).



RS422/485 2-wires connection: additional devices provided with RS422/485 (that is RS 1, 2, 3...N) 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 (Rx+) and (T).

Front Panel Description



1. **Key-pad**
   Set-up and programming procedures are easily controlled by the 4 pushbuttons.
   - "S" for enter programming phase and password confirmation,

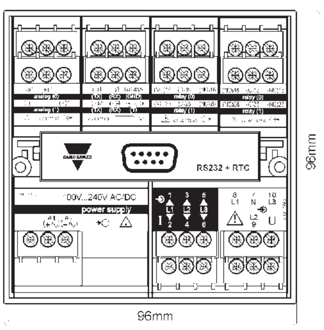
▲ ▼
- for value programming/function selection, page scrolling
- "F" for special functions

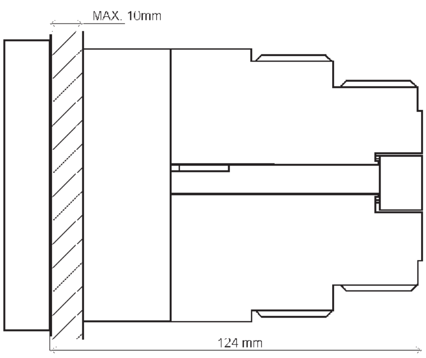
2. **Display**
   Istantaneous measurements:
   - 4-digit (maximum read-out 9999)

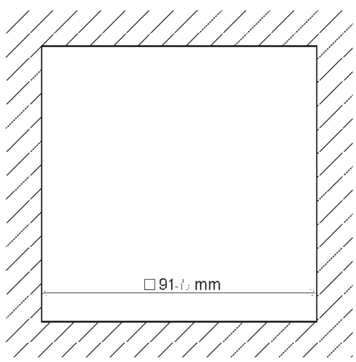
   Energies:
   - 9-digit (maximum read-out 999999999).

   Alphanumeric indication by means of LCD display for:
   - Displaying the configuration parameters
   - All the measured variables.

Dimensions







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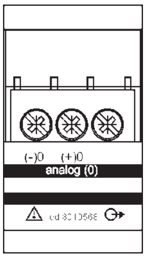
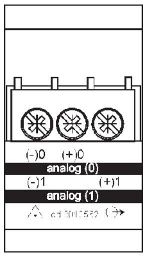
Terminal boards

Single analogue output modules



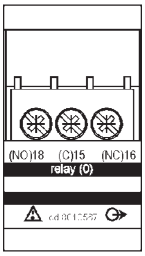
AO1050 (20mADC)
AO1051 (10VDC)
AO1052 (±5mADC)
AO1053 (±10mADC)
AO1054 (±20mADC)
AO1055 (±1VDC)
AO1056 (±5VDC)
AO1057 (±10VDC)

Dual analogue outputs

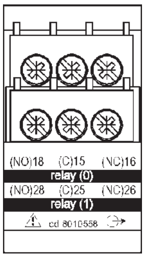


AO1026 (20mADC)
AO1027 (10VDC)
AO1028 (±5mADC)
AO1029 (±10mADC)
AO1030 (±20mADC)
AO1031 (±1VDC)
AO1032 (±5VDC)
AO1033 (±10VDC)

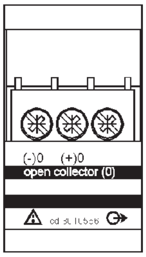
Digital output modules



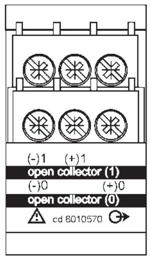
AO1058
Single relay output



AO1035
Dual relay output

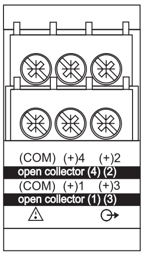


AO1059
Single open collector output

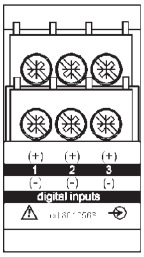


AO1036
Dual open collector output

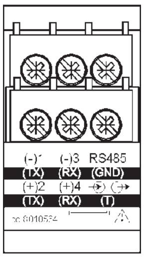
Other input/output modules



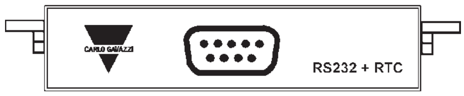
AO1037
4 open collector outputs



AQ1038
3 Digital inputs

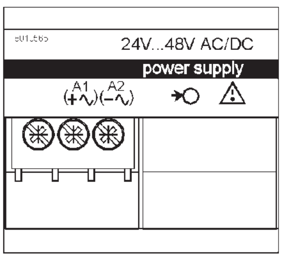


AR1034
RS485 port

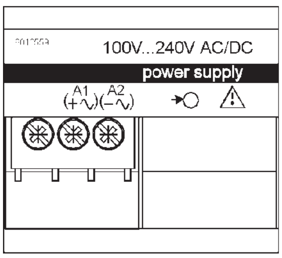


AR1039
RS232 port + RTC

Power supply modules



AP1021
18-60VAC/DC power supply



AP1020
90-260 VAC/DC power supply