

Energy Management Power Analyzer Type WM2-DIN

CARLO GAVAZZI



- 3-dgt/6-dgt μ P-based indicator
- Manual or automatic scrolling of system and single phase: kW, kVA, PF, kWh, kVAh, I, V_{Δ} avg, VL1-N, VL2-N, VL3-N.
- TRMS measurement of distorted waves (voltage/current)
- All configuration functions selectable by built-in key-pad
- Password protection of programming parameters
- Degree of protection (front): IP 40
- Standard pulse output
- Optional serial RS 422/485 output
- MODBUS, JBUS protocol.

Product Description

μ P-based power analyzer with a built-in configuration key-pad. The power, PF, current and voltage are system and single phase measure-

ments and indications. The housing is easy to mount on DIN-rail and ensures a degree of protection (front) of IP 40.

Ordering Key

WM2-DINAV53DPX

Model _____
Range code _____
System _____
Power supply _____
1st output _____
2nd output _____

Type Selection

Range code	System	Power supply	1st output
AV5: 250/433 VAC - 5 AAC (max. 300 V (L-N)/ 520 V (L-L) - 6 A)	3: One phase, three-phase system, 3 or 4 wires, balanced load; three phase system, 3 or 4 wires, unbalanced load	A: 24 VAC, -15% +10%, 50/60 Hz ¹⁾ B: 48 VAC, -15%+10%, 50/60 Hz ¹⁾ C: 115 VAC, -15% +10%, 50/60 Hz ¹⁾ D: 230 VAC, -15% +10%, 50/60 Hz (standard)	P: Pulse, static, DC type (standard) 2nd output X: No output (standard) S: Serial output, RS 485 multidrop bidirectional ¹⁾

¹⁾ On request

Input Specifications

Accuracy (48 to 62 Hz)	Un: 250V (AV5), In: 5A	Power supply Magnetic field	$\pm 0.5\%$ RDG, -15 +10% p.s. < 0.1% f.s. @ 400 A/m
Voltage/current (@ 25°C $\pm$ 5°C, R.H. $\leq$ 60%)	$\pm 1\%$ f.s. (0 to 1.2 In, 0.5 to 1.2 Un)	Rated input Current	2 inputs (one/three-phase balanced load) 6 inputs (one/three-phase unbalanced load)
Energy (@ 25°C $\pm$ 5°C, R.H. $\leq$ 60%)	$\pm 1\%$ RDG (kWh) (hour time base) $\pm 2\%$ RDG (kvarh) (hour time base) (PF $\geq$ 0.7L/C, 0 to 1.2In, 0.5 to 1.2Un)	Voltage	2 inputs (one/three-phase balanced load) 4 inputs (one/three-phase unbalanced load)
Active power (@ 25°C $\pm$ 5°C, R.H. $\leq$ 60%)	$\pm 1\%$ f.s. (PF $\geq$ 0.7 L/C, 0 to 1.2 In, 0.5 to 1.2 Un)	Insulation	among the voltage and the current inputs: 2000Vrms; among the current inputs: 2000 Vrms
Reactive power (@ 25°C $\pm$ 5°C, R.H. $\leq$ 60%)	$\pm 1\%$ f.s. (PF $\geq$ 0.8 L/C, 0 to 1 In, 0 to 1 Un)	Temperature drift	± 250 ppm/°C
Power factor (PF) (@ 25°C $\pm$ 5°C, R.H. $\leq$ 60%)	$\pm 1\%$ f.s., PF $\geq$ 0.7 L/C, (0.6 to 1.2 In, 1 to 1.2 Un)	Display	Backlighted LCD, h 13mm, 3-dgt (instantaneous meas.) 6-dgt (energies)
Additional errors Humidity	< 0.3% f.s., 60% to 90% R.H.		

Input Specifications (cont.)

Decimal point position	Instantaneous measurements: Automatic selection according to the current transformer ratio of the CT being connected (max. indication - single phase): CT ratio ≤ 5 : 11.11 (25.00A) CT ratio ≤ 50.0 : 111.1 (250.0A) CT ratio ≤ 500.0 : 1111 (2500A) CT ratio ≤ 999.9 : 11110 (6000A) Energy measurements: max. resolution: 1 Wh/1 VARh min. resolution: 1 kWh/1 kVARh		Coupling type: Direct Crest factor: ≥ 3
		Ranges (impedances)	250 V/433 V ($\geq 1 \text{ M}\Omega$) 5 AAC ($\leq 0.3 \text{ VA}$ / $\leq 0.1 \Omega$)
		Frequency range	48 to 62 Hz
		Over-load protection Continuous: voltage/current For 1 s Voltage: Current:	Un: 250 (AV5), In: 5A 1.2 Un/In 2 Un 20 In
Max. and min. indication		Keyboard	4 keys: "ΔV": - to enter programming phase and password confirmation; - for value programming and basic measurement scrolling. "L": - for confirmation of new programmed values and going ahead to the next programming step, - single phase measurement scrolling. "R": - for the reset of the partial counted active and/or reactive energy.
Voltage	Max. 600 min. 0		
Current (CT ratio = 1)	Max. 6.00 min. 0.00		
PF	Max. 1.00 min. 0.00		
Power (CT ratio = 1)	Max. 5.40 min. 0.00		
Active energy	Max. 999999 min. -199999		
Reactive energy	Max. 999999 min. 0		
Sampling rate	3 times / second		
Measurements			
System variables	kW, kVAR, PF, VL-L, A, kWh, kvarh		
Total energies	kWh, kvarh		
Partial energies	(the meters are reset automatically when the values reach 14999*CT ratio)		
Single phase variables	kW, kVAR, PF, VL-N, A		
Measurement method	TRMS measurement of a distorted voltage/current wave		

Output Specifications

Pulse output		Data (bidirectional)	
Type	From 0.1 to 999.9 programmable pulses for kWh, kVARh, open collector (NPN transistor) VON 0.6 VDC/ max. 4 mA VOFF 26 VDC max.	Dynamic (reading only)	System variables: P, Q, PF, VL-L, energies, Single phase variables: PL1, QL1, PFL1, VL1-N, AL1, PL2, QL2, PFL2, VL2-N, AL2, PL3, QL3, PFL3, VL3-N, AL3 All programming data, reset of energy: - partial kWh - partial kVARh - total kWh - total kVARh
Pulse duration	200 ms (ON), ≥ 200 ms (OFF)		
Insulation	By means of optocouplers, 4000 Vrms output to measuring input, 4000 Vrms output to supply input.	Static (writing only)	Stored energy (EEPROM) ≤ 999999 kWh ≤ 999999 kVARh
Serial output (on request)			
Type	RS422/RS485; Multidrop bidirectional (static and dynamic variables)	Data format	1-start bit, 8-data bit, no parity/even parity, 1 stop bit
Connections	4 wires, max. distance 1200m, termination and/or line bias by means of DIP-switches directly on the instrument	Baud-rate	1200, 2400, 4800 and 9600 selectable bauds
Addresses	255, selectable by key-pad	Insulation	By means of optocouplers, 4000 Vrms output to measuring inputs, 4000 Vrms output to supply input
Protocol	MODBUS/JBUS		

Software Functions

Password		Numeric code of max. 3 digits; 2 protection levels of the programming data Password "0", no protection Password from 1 to 255, all data are protected		
	1st level 2nd level			
Measurement scrolling	System:	Active power (kW), reactive power (kVA _r), power factor (cos φ), current (A), average phase-phase voltage (V) total and partial active energy (kWh), total and partial reactive energy (kVA _r h) Partial energy meters: the counters of kWh and kVA _r h are automatically reset when the energy reaches the value	Single phase:	(14999*CT). Example: the CT is a 100A/5A so the ratio is 20, consequently the maximum counted energy is 299980 kWh or kVA _r h. Active power (kW), reactive power (kVA _r), power factor (cos φ), current (A), phase-neutral voltage (V)
			Transformer ratio	For CT up to 5000 A
			Programmable ratio	0.1 to 999.9
			Digital Filter	
			Filter operating range	0 to 100% of the input electrical scale
			Filtering coefficient	1 to 64
			Filter action	On the display and on the variable being transmitted by the serial communication port.

Supply Specifications

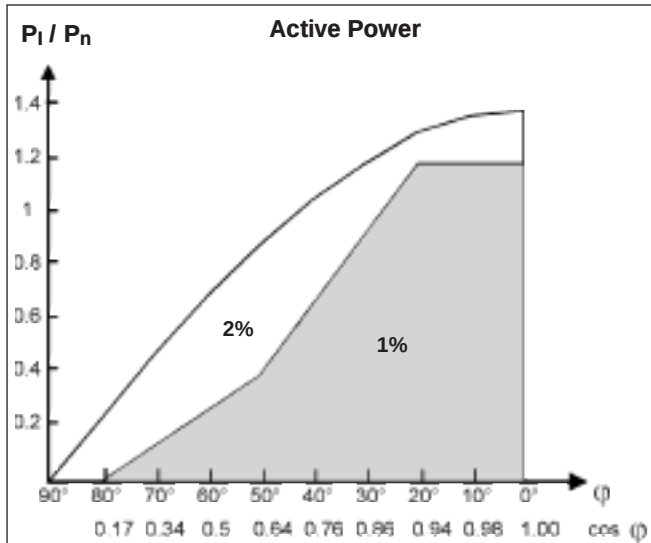
AC voltage	230 VAC (standard), -15%+10% 50/60 Hz 24 VAC, 48 VAC, 115 VAC (on request), -15%+10% 50/60 Hz	Power consumption	≤ 7 VA
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General Specifications

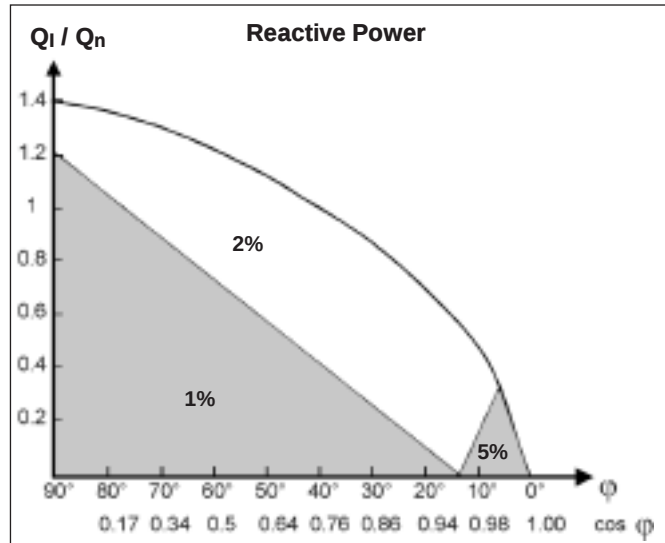
Operating temperature	0° to +50°C (32° to 122°F) (R.H. < 90% non-condensing)	Safety standards	IEC 61010-1, EN 61010-1
Storage temperature	-10° to +60°C (14° to 140°F) (R.H. < 90% non-condensing)	Connector	Screw-type, max. 2.5 mm ² wires
Insulation reference voltage	300 Vrms to ground	Housing	
Insulation	4000 Vrms between all inputs/outputs to ground	Dimensions	6 DIN modules, 58.5 x 89 x 107 mm
Dielectric strength	4000 Vrms for 1 minute	Material	ABS, self-extinguishing: UL 94 V-0
Noise rejection		Degree of protection	Front: IP40
CMRR	100 dB, 48 to 62 Hz	Weight	Approx. 500 g (packing included)
EMC	EN 50081-2, EN 50082-2	Approval	CE

Mode of Operation

Accuracy class of the instrument as a relation of P_I/P_n and PF



Test conditions:
 $V = 0.8$ to $1.2 U_n$,
 $I = 0.1$ to $1.2 I_n$,
 $f = 48$ to 62 Hz



Test conditions:
 $V = 0.8$ to $1.2 U_n$,
 $I = 0.1$ to $1.2 I_n$,
 $f = 48$ to 62 Hz

Input	Star voltage	Delta voltage	Current
AV5	U_n : 230 V	U_n : 398 V	I_n : 5 A

P_I/Q_I (installation power)

One phase system:

$$P_I = U_I \cdot I_I \cdot \cos \varphi$$

$$Q_I = U_I \cdot I_I \cdot \sin \varphi$$

Three phase, 3-wire system:

$$P_I = \sqrt{3} \cdot U_I \cdot I_I \cdot \cos \varphi$$

$$Q_I = \sqrt{3} \cdot U_I \cdot I_I \cdot \sin \varphi$$

Three phase, 4-wire system:

$$P_I = 3 \cdot U_I \cdot I_I \cdot \cos \varphi$$

$$Q_I = 3 \cdot U_I \cdot I_I \cdot \sin \varphi$$

where:

U_I = the real star voltage of the electrical system being measured.

I = the maximum phase current of the electrical system being measured.

$\cos \varphi$ = the average $\cos \varphi$ of the electrical system being measured.

P_n/Q_n (rated power of the instrument):

One phase system:

$$P_n = Q_n = U_n \cdot I_n \cdot CT(\text{ratio})$$

Three phase, 3-wire system:

$$P_n = Q_n = \sqrt{3} \cdot U_n \cdot I_n \cdot CT(\text{ratio})$$

Three phase, 4-wire system:

$$P_n = Q_n = 3 \cdot U_n \cdot I_n \cdot CT(\text{ratio})$$

where:

U_n = the rated input voltage of WM2-DIN.

I_n = the rated input current of WM2-DIN.

$CT(\text{ratio})$ = the value of the current transformer ratio.

Example 1:

Model AV5.3 (3-wire system).

$U_I = 380$ V (delta voltage)

$I_I = 265$ A (single phase current)

$\cos \varphi = 0.85$ (system power factor) ($CT=300A$)

$U_n = 398$ V

$I_n = 5$ A

$$CT(\text{ratio}) = \frac{300}{5} = 60$$

$$P_I = \sqrt{3} \cdot U_I \cdot I_I \cdot \cos \varphi$$

$$= \sqrt{3} \cdot 380 \cdot 265 \cdot 0.85$$

$$= 148.07 \text{ kW}$$

$$P_n = \sqrt{3} \cdot U_n \cdot I_n \cdot CT(\text{ratio})$$

$$= \sqrt{3} \cdot 398 \cdot 5 \cdot 60$$

$$= 206.56 \text{ kW}$$

$$\frac{P_I}{P_n} = \frac{148.07}{206.56} = 0.716$$

Example 2:

Model AV5.3 (4-wire system).

$U_I = 220$ V

$I_I = 110$ A ($CT=300A$)

$\cos \varphi = 0.85$ ($\sin \varphi = 0.52$)

$U_n = 230$ V

$I_n = 5$ A

$$CT(\text{ratio}) = \frac{300 A}{5 A} = 60$$

$$Q_I = 3 \cdot U_I \cdot I_I \cdot \sin \varphi$$

$$= 3 \cdot 220 \cdot 110 \cdot 0.52$$

$$= 37.75 \text{ Kvar}$$

$$Q_n = 3 \cdot U_n \cdot I_n \cdot CT(\text{ratio})$$

$$= 3 \cdot 230 \cdot 5 \cdot 60$$

$$= 207 \text{ Kvar}$$

$$\frac{P_I}{P_n} = \frac{37.75}{207} = 0.183$$

In both examples the accuracy of the measurement is 1% f.s. when considering the changing of the measured voltage from $0.9 U_n$ to $1 U_n$ and the measured current from $0.1 I_n$ to $0.9 I_n$ with a $\cos \varphi$ of 0.85 ($\sin \varphi$ 0.52).

Mode of Operation (cont.)

Waveform of the signals that can be measured

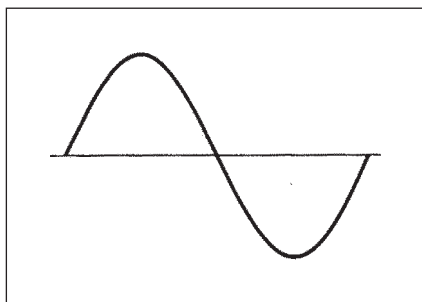


Figure G

Sine wave, undistorted

Fundamental content 100%
 Harmonic content 0%
 $A_{rms} = 1.1107 \cdot |\bar{A}|$

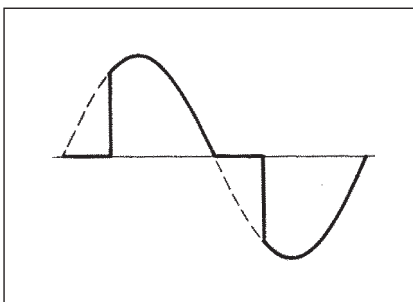


Figure H

Sine wave, indented

Fundamental content 10...100%
 Harmonic content 0...90%
 Frequency spectrum 3rd to 16th harmonic
 Required result: additional error < 1%

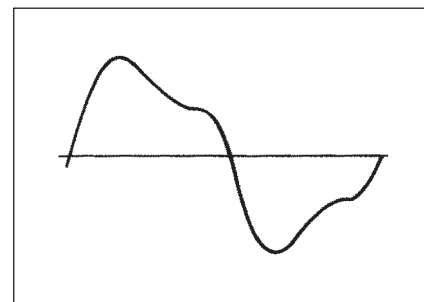


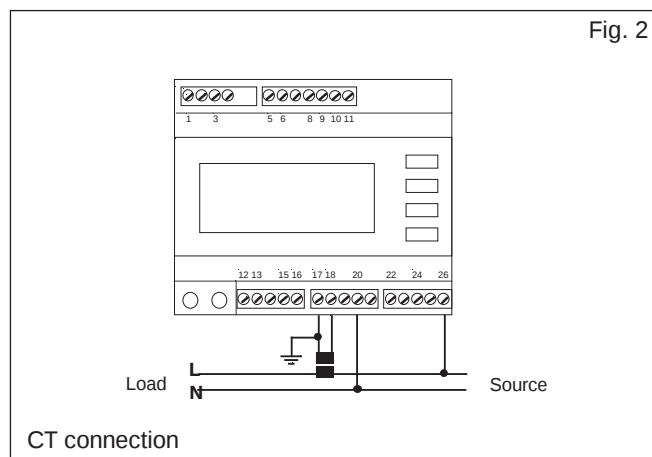
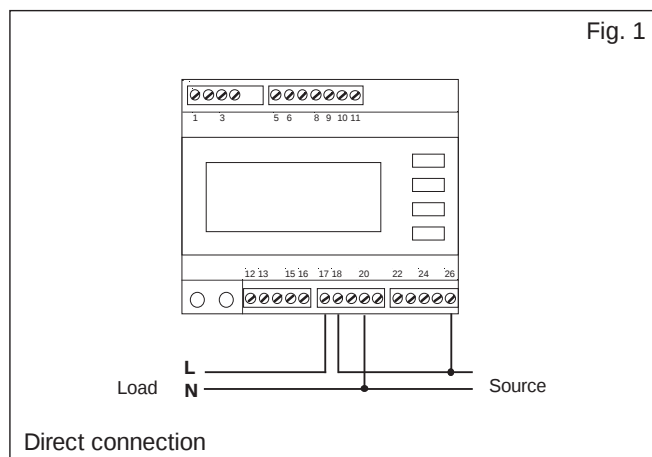
Figure I

Sine wave, distorted

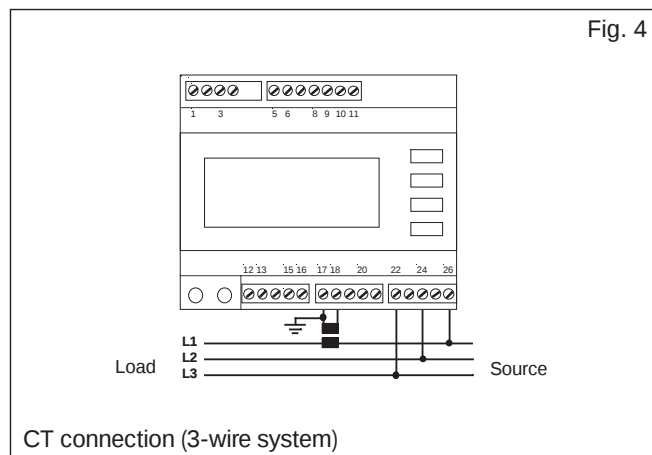
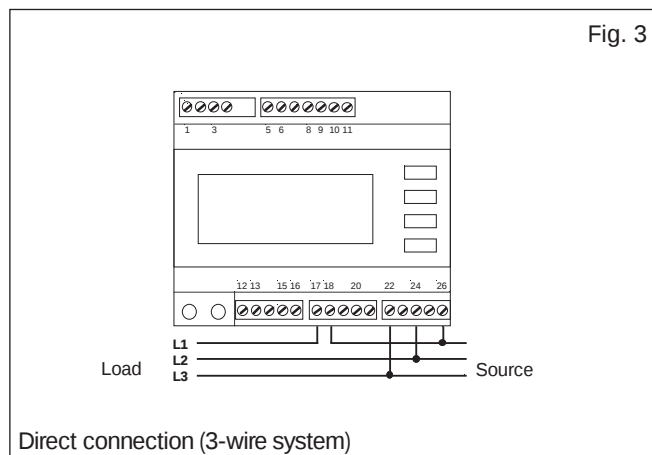
Fundamental content 70...90%
 Harmonic content 10...30%
 Frequency spectrum 3rd to 15th harmonic
 Required result: additional error < 0.5%

Wiring Diagrams

Single phase input connections



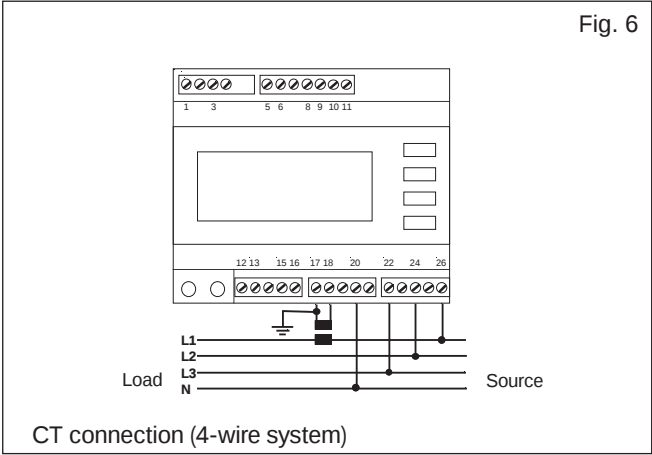
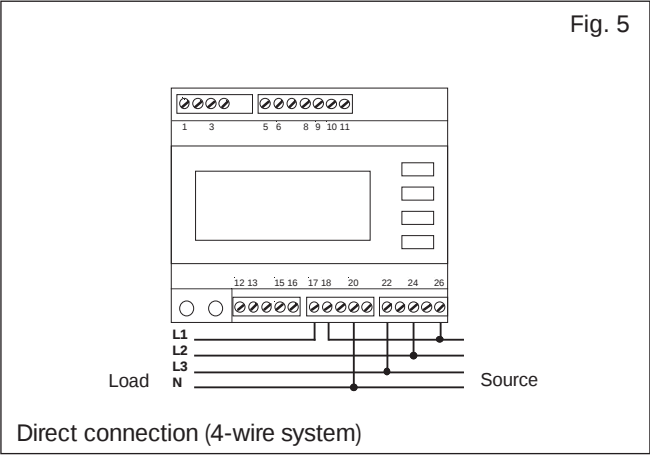
Three phase/3-wire input connections - Balanced loads



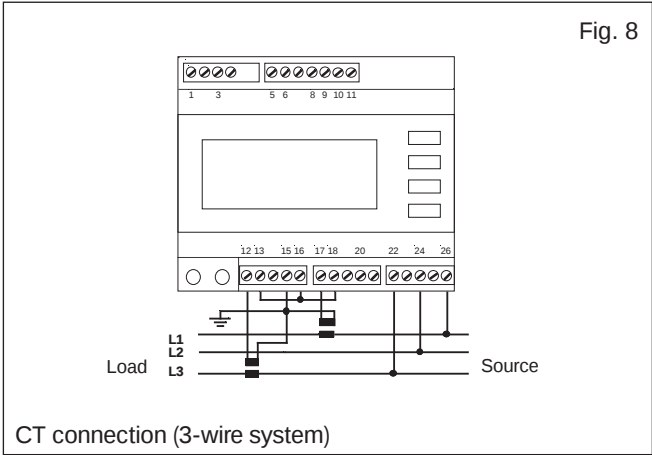
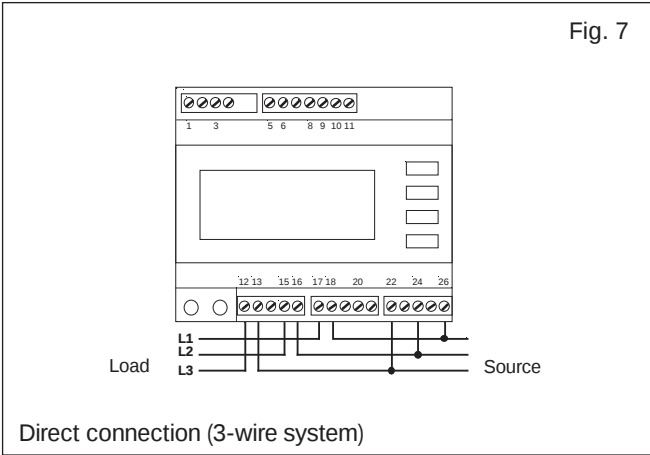


Wiring Diagrams (cont.)

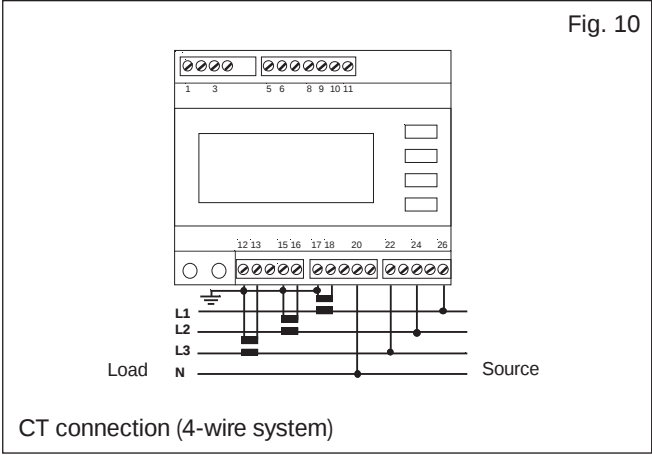
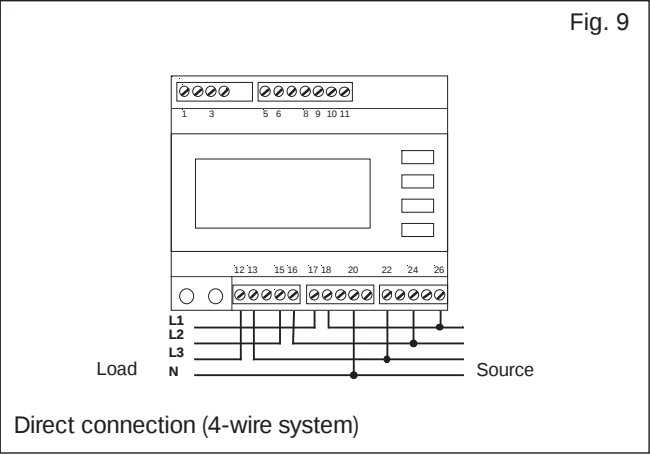
Three phase, 4-wire input connections - Balanced loads



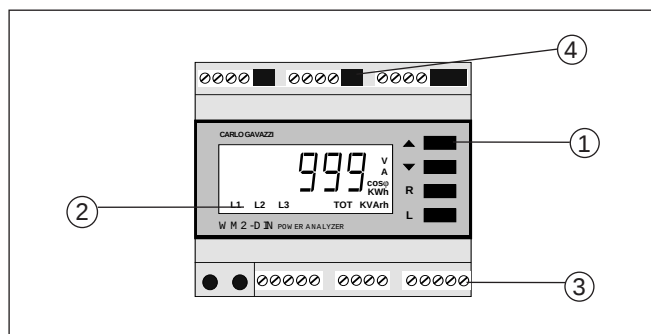
Three-phase, 3-wire input ARON connections - Unbalanced load



Three phase, 4-wire input connections - Unbalanced load



Front Panel Description



1. Key-pad

Set-up and programming procedures are easily controlled by the 4 pushbuttons.

"▲" and "▼"

- To scroll all the basic measurements (system variables)
- To increase or decrease programming values

- To enter into the programming procedure and select programming functions together with the "L" key.

"L":

To scroll all the single phase variable of each basic measurement

"R":

To reset the partial counted energies (kWh, kVARh).

2. Display

Instantaneous measurements:

- 3-digit (maximum read-out 999)

Energies:

- 6-digit (maximum read-out 999999).

Alphanumeric indication by means of LCD display for:

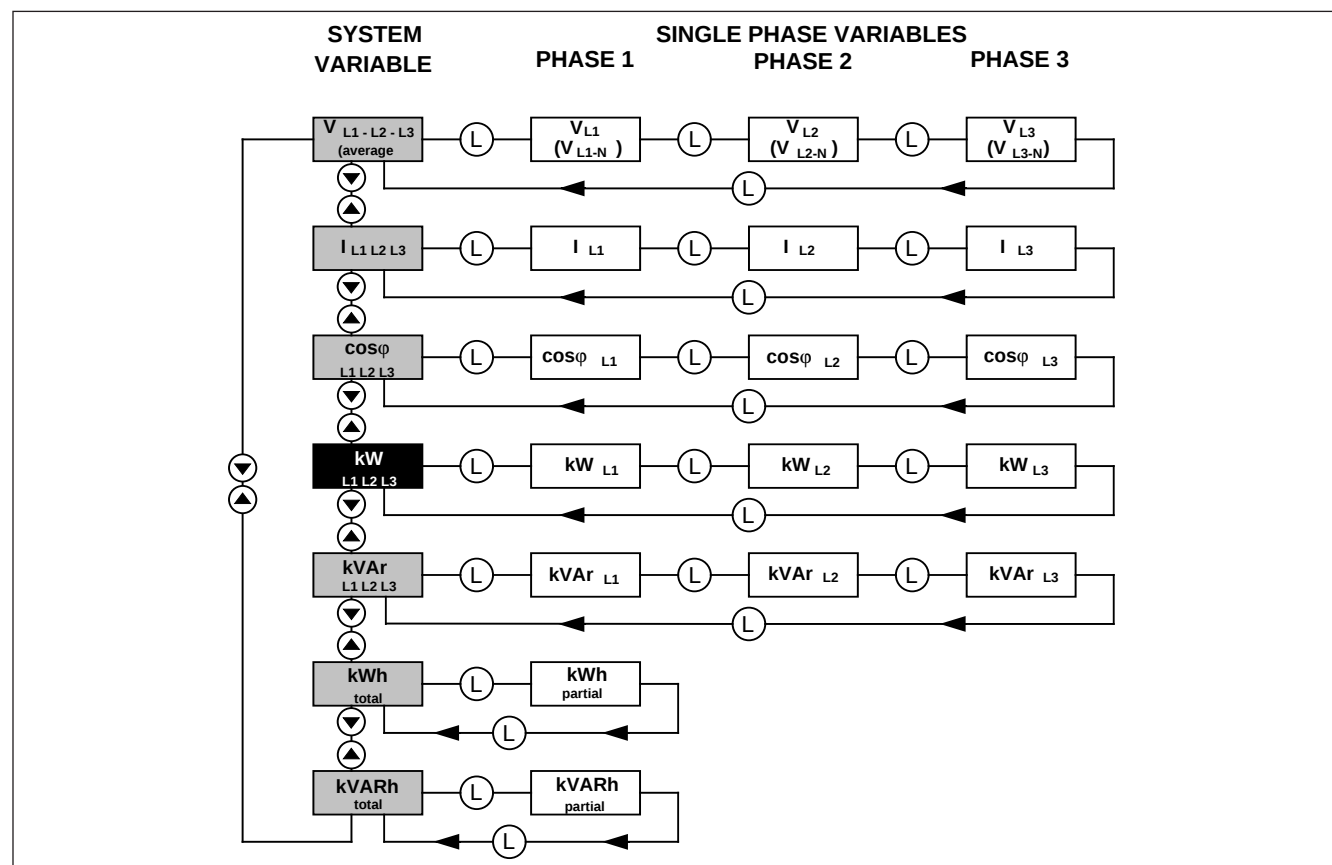
- Displaying the configuration parameters
- All the measured variables.

3. Connection terminal blocks

4. Dip-switch

- For the selection of 2/4 wire connection, line biasing and/or line termination (only in case of RS 485 option)

Sequence of the variables on the display



Terminal boards

Upper terminal board

☐ 230 Vac	☐ SERIAL OUTPUT	RX- RX+ TX- TX+
☐ 115 Vac	☐ PULSE OUTPUT	- +
	☐ RELAY OUTPUT	
1 3	5 6	8 9 10 11

Lower terminal board

12 13	15 16	17 18	20	22	24	26
L3	L2	L1	N	L3	L2	L1
	I		U		3N-3E	
	I	L1	N		L1	
	I		U		3-1E 3N-1E	

Dimensions

