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Energy Management Multifunction indicator Type WM12-96

CARLO GAVAZZI

- Accuracy ±0.5 F.S. (current/voltage)
- Multifunction indicator
- Display of instantaneous variables: 3x3 digit
- Variable system and phase measurements: W, W_{dmd}, var, VA, VA_{dmd}, PF, V, A, An, Hz
- A_{max}, $W_{dmd\ max}$ indication
- TRMS meas. of distorted sine waves (voltages/currents)
- Power supply: 24V, 48V, 115V, 230V, 50-60Hz; 18 to 60VDC
- Protection degree (front): IP65
- Front dimensions: 96x96mm
- Optional RS422/485 serial output
- Alarms (visual only) V_{LN}, An

Product Description

3-phase multifunction power indicator with built-in programming key-pad. Particularly recommended for displaying the main electrical variables.

Housing for panel mounting, (front) protection degree IP65 as standard, and optional RS485 serial output.

How to order

WM12-96 AV5 3 D X

- Model
- Range code
- System
- Power supply
- Option

Type Selection

Range codes	System	Power supply	Options
AV5: 380/660V_{L-L}/5(6)AAC VL-N: 185 V to 460 V VL-L: 320 V to 800 V **AV6:** 120/208V_{L-L}/5(6)AAC VL-N: 45 V to 145 V VL-L: 78 V to 250 V Phase current: 0.03A to 6A Neutral current: 0.09 to 6A	**3 :** 1-2-3-phase, unbalanced load, with or without neutral	**A:** 24VAC -15+10%, 50-60Hz **B:** 48VAC -15+10%, 50-60Hz **C:** 115VAC -15+10%, 50-60Hz **D:** 230VAC -15+10%, 50-60Hz **3:** 18 to 60VDC	**X:** None **S:** RS485 output

Input specifications

Rated inputs		Sampling rate	1400 samples/s @ 50Hz 1700 samples/s @ 60Hz
Current	3 (shunt)	**Display refresh time**	700ms
Voltage	4	**Display**	
Accuracy (display, RS485) (@25°C ±5°C, R.H. ≤60%)	with CT=1 and VT=1 AV5: 1150W-VA-var, FS:230VLN, 400VLL; AV6: 285W-VA-var, FS:57VLN, 100VLL	Type Read-out for the instant. var.	LED, 14mm 3x3 DGT
Current	0.25 to 6A: ±(0.5% FS +1DGT) 0.03A to 0.25A: ±7DGT	**Measurements**	Current, voltage, power, power factor, frequency TRMS measurement of distorted waves.
Neutral current	0.25 to 6A: ±(1.5% FS +1DGT) 0.09A to 0.25A: ±7DGT		
Phase-phase voltage	±(1.5% FS +1 DGT)	Coupling type Crest factor	Direct < 3, max 10A peak
Phase-neutral voltage	±(0.5% FS + 1 DGT)	**Input impedance**	
Active and Apparent power, Power factor	0.25 to 6A: ±(1% FS +1DGT); 0.03A to 0.25A: ±(1% FS +5DGT)	380/660V_{L-L} (AV5) 120/208V_{L-L} (AV6) Current	1 MΩ ±5% 453 KΩ ±5% ≤ 0.02Ω
Reactive power	0.25 to 6A: ±(2% FS +1DGT); 0.03A to 0.25A: ±(2% FS +5DGT)	**Frequency**	48 to 62 Hz
Frequency	±0.1%Hz (48 to 62Hz)	**Overload protection**	
Additional errors		Continuous voltage/current For 500ms: voltage/current	1.2 F.S. 2 Un/36A
Humidity	≤0.3% FS, 60% to 90% RH		
Temperature drift	≤ 200ppm/°C		

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RS485 Serial Output Specifications

RS422/RS485 (on request)		Data (bidirectional)	
Type	Multidrop bidirectional (static and dynamic variables)	Dynamic (reading only) Static (writing only)	System and phase variables All configuration parameters
		Data format	1 bit di start , 8 data bit,
Connections	2 or 4 wires, max. distance 1200m, termination directly on the instrument		no parity, 1 stop bit
		Baud-rate	9600 bit/s
Addresses	1 to 255, key-pad selectable		
Protocol	MODBUS/JBUS		

Software functions

Password	Numeric code of max. 3 digits; 2 protection levels of the programming data	Displaying 3-phase system with neutral	Up to 3 variables per page Page 1: V L1, V L2, V L3
1st level	Password "0", no protection		Page 2: V L12, V L23, V L31 Page 3: A L1, A L2, A L3 Page 4: An
2nd level	Password from 1 to 999, all data are protected		Page 5: W L1, W L2, W L3 Page 6: PF L1, PF L2, PF L3
System selection	3-phase with neutral 3-phase without neutral 3-phase ARON 2-phase Single phase		Page 7: var L1, var L2, var L3 Page 8: VA L1, VA L2, VA L3 Page 9: VA $\sum$, W $\sum$, var $\sum$ Page 10: VA dmd, W dmd, Hz Page 11: Wdmd MAX
Transformer ratio			Page 12: VL-L $\sum$, PF $\sum$
CT	1 to 999		Page 13: A MAX
VT	1.0 to 99.9		
Filter		Alarms	Programmable, for the VL$\sum$ and An (neutral current).
Operating range	0 to 99.9% of the input electrical scale		Note: the alarm is only visual, by means of LED on the front of the instrument.
Filtering coefficient	1 to 16		
Filter action	Measurements, alarms, serial output (fundamental variables: V, A, W and their derived ones).	Reset	Independent alarm (VL$\sum$, An) max: A, Wdmd

Power Supply Specifications

Auxiliary power supply	230VAC -15 +10%, 50-60Hz 115VAC -15 +10%, 50-60Hz 48VAC -15 +10%, 50-60Hz		24VAC -15 +10%, 50-60Hz 18 to 60VDC
		Power consumption	AC: 4.5 VA DC: 4W

General Specifications

Operating temperature	-5 to +50°C (23 to 122°F) (RH < 90% non condensing at 40°C)		500VAC/DC between measuring inputs and
Storage temperature	-30 to +60°C (-22 to 140°F) (RH < 90% non condensing at 40°C)	RS485.	4000VAC, 500VDC between power supply and RS485
Installation category	Cat. III (IEC 60664, EN60664)	Dielectric strength	4000 VAC (for 1 min)
Insulation (for 1 minute)	4000VAC, 500VDC between measuring inputs and power supply.	EMC	
		Emissions	EN50084-1 (class A) residential environment,

General Specifications (cont.)

	commerce and light industry
Immunity	EN61000-6-2 (class A) industrial environment.
Pulse voltage (1.2/50µs)	EN61000-4-5
Safety standards	IEC60664, EN60664
Approvals	CE, cULus
Connections 5(6) A Max cable cross sect. area	Screw-type 2.5 mm^2
Housing	

Dimensions (WxHxD) Material	96 x 96 x 63 mm ABS self-extinguishing: UL 94 V-0
Mounting	Panel
Protection degree	Front: IP65 (standard), NEMA4x, NEMA12 Connections: IP20
Weight	Approx. 400 g (pack. incl.)

Waveform of the signals that can be measured
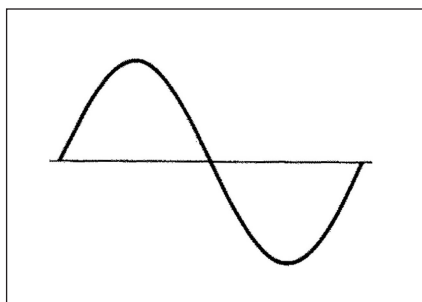
Figure A
Sine wave, undistorted
Fundamental content   100%
Harmonic content   0%
$A_{rms} =$ 1.1107 | $\overline{A}$ |
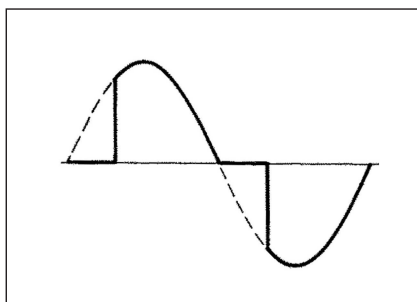
Figure B
Sine wave, indented
Fundamental content   10...100%
Harmonic content   0...90%
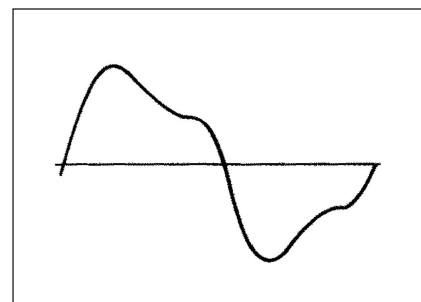Frequency spectrum: 3rd to 16th harmonic
Additional error: <1% FS

Figure C
Sine wave, distorted
Fundamental content   70...90%
Harmonic content   10...30%
Frequency spectrum: 3rd to 16th harmonic
Additional error: <0.5% FS

Display pages

Display variables in 3-phase systems (in a 3-phase system with neutral)

No	1st variable	2nd variable	3rd variable	Note
1	V L1	V L2	V L3	
2	V L12	V L23	V L31	Decimal point blinking on the right of the display
3	A L1	A L2	A L3	
4	An	AL.n		AL.n if neutral current alarm is active
5	W L1	W L2	W L3	Decimal point blinking on the right of the display if generated power
6	PF L1	PF L2	PF L3	
7	VAR L1	VAR L2	VAR L3	Decimal point blinking on the right of the display if generated power
8	VA L1	VA L2	VA L3	
9	VA system	W system	VAR system	
10	VA dmd (system)	W dmd (system)	Hz (system)	dmd = demand (integration time selectable from 1 to 30 minutes)
11		W dmd MAX		Maximum sys power demand
12	V LL system	AL.U	PF system	AL.U= is activated only if one of VLN is not within the set limits
13	A MAX			max. current among the three phases

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

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

Instantaneous effective current

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

F1= 315mA

Instantaneous apparent power

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

Instantaneous reactive power

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

System variables

Equivalent 3-phase voltage

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

3-phase reactive power

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

3-phase active power

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

3-phase apparent power

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

3-phase power factor

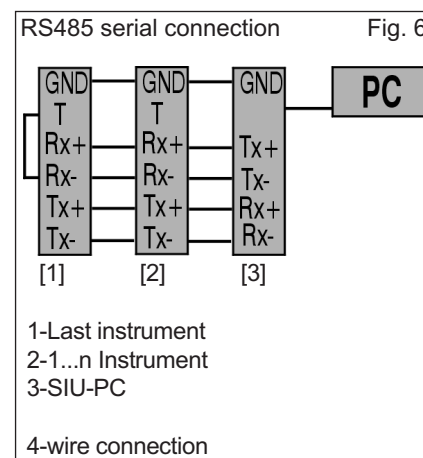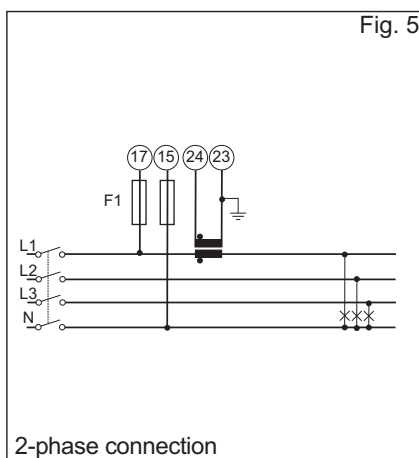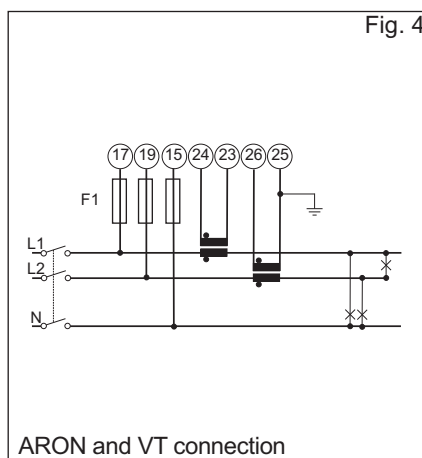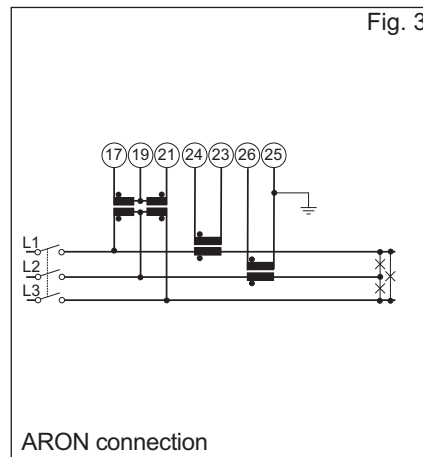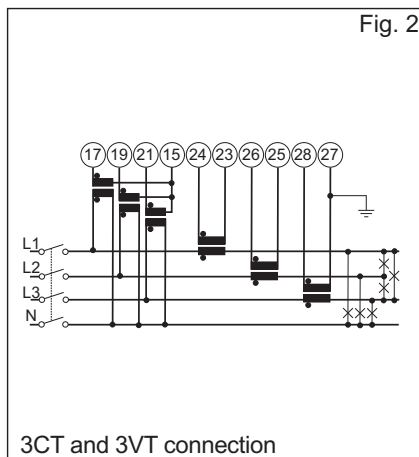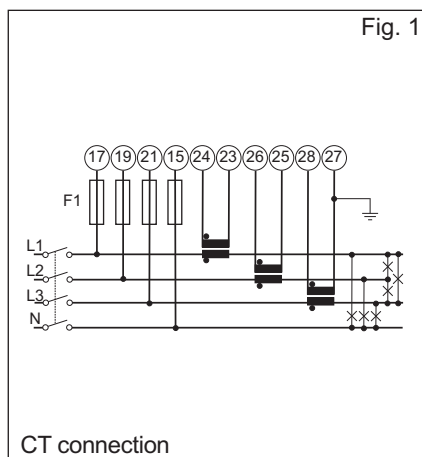$$\cos\phi_\Sigma = \frac{W_\Sigma}{VA_\Sigma}$$

Neutral current

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

Wiring diagrams

Fig. 1

CT connection

Fig. 2

3CT and 3VT connection

Fig. 3

ARON connection

Fig. 4

ARON and VT connection

Fig. 5

2-phase connection

RS485 serial connection   Fig. 6

[1]   [2]   [3]

1-Last instrument
2-1...n Instrument
3-SIU-PC

4-wire connection
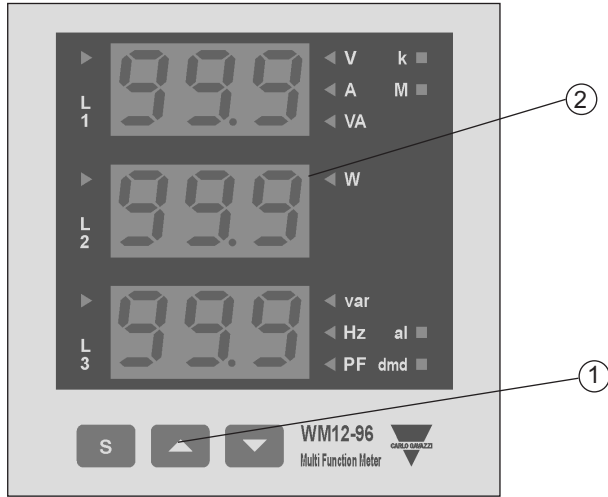
NOTE: the current inputs can be connected to the lines ONLY by means of current transformers. The direct connection is not allowed.
ATTENTION: Only one ammeter input can be connected to earth, as shown in the electrical diagrams.

Front Panel Description

1. Key-pad
   To program the configuration parameters and the display of the variables.

   $\boxed{S}$

   Key to enter programming and confirm selections;

   $\boxed{\blacktriangle}$ $\boxed{\blacktriangledown}$
   Keys to:
   - programme values;
   - select functions;
   - display measuring pages.

2. Display
   LED-type with alphanumeric indications to:
   - display configuration parameters;
   - display all the measured variables.

Dimensions and Panel Cut-out

96mm

96mm

96mm

61.4mm

15.4mm

91mm