Power analyzers and Energy Meters
Multifunction indicator
Type WM12-96

- **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 XX

Model
Range code
System
Power supply
Option

Type Selection

Range codes

AV5: 400/660V_{L-L}/5(6)AAC
VL-N: 185 V to 460 V
VL-L: 320 V to 800 V
AV6: 100/208V_{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

System

3 : 1-2-3-phase, unbalanced load, with or without neutral

Power supply

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

Options

XX: None
SX: RS485 output

Input specifications

Rated inputs	
Current	3 (shunt)
Voltage	4
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
Current	0.25 to 6A: ±(0.5% FS +1DGT) 0.03A to 0.25A: ±7DGT
Neutral current	0.25 to 6A: ±(1.5% FS +1DGT) 0.09A to 0.25A: ±7DGT
Phase-phase voltage	±(1.5% FS +1 DGT)
Phase-neutral voltage	±(0.5% FS + 1 DGT)
Active and Apparent power, Power factor	0.25 to 6A: ±(1% FS +1DGT); 0.03A to 0.25A: ±(1% FS +5DGT)
Reactive power	0.25 to 6A: ±(2% FS +1DGT); 0.03A to 0.25A: ±(2% FS +5DGT)
Frequency	±0.1%Hz (48 to 62Hz)
Additional errors	
Humidity	≤0.3% FS, 60% to 90% RH
Temperature drift	≤ 200ppm/°C

Sampling rate	1400 samples/s @ 50Hz 1700 samples/s @ 60Hz
Display refresh time	700ms
Display	
Type	LED, 14mm
Read-out for the instant. var.	3x3 DGT
Measurements	Current, voltage, power, power factor, frequency TRMS measurement of distorted waves.
Coupling type	Direct
Crest factor	< 3, max 10A peak
Input impedance	
400/660V_{L-L} (AV5)	1 MΩ ±5%
100/208V_{L-L} (AV6)	453 KΩ ±5%
Current	≤ 0.02Ω
Frequency	48 to 62 Hz
Overload protection	
Continuos voltage/current	1.2 F.S.
For 500ms: voltge/current	2 Un/36A

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RS485 Serial Output Specifications

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

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 999, all data are protected
System selection	3-phase with neutral 3-phase without neutral 3-phase ARON 2-phase Single phase
Transformer ratio	
CT	1 to 999
VT	1.0 to 99.9
Filter	
Operating range	0 to 99.9% of the input electrical scale
Filtering coefficient	1 to 16
Filter action	Measurements, alarms, serial output (fundamental variables: V, A, W and their derived ones).

Displaying	Up to 3 variables per page
3-phase system with neutral	Page 1: V L1, V L2, V L3 Page 2: V L12, V L23, V L31 Page 3: A L1, A L2, A L3 Page 4: An Page 5: W L1, W L2, W L3 Page 6: PF L1, PF L2, PF L3 Page 7: var L1, var L2, var L3 Page 8: VA L1, VA L2, VA L3 Page 9: VA Σ, W Σ, var Σ Page 10: VA dmd, W dmd, Hz Page 11: Wdmd MAX Page 12: VL-L Σ, PF Σ Page 13: A MAX
Alarms	Programmable, for the VLΣ and An (neutral current). Note: the alarm is only visual, by means of LED on the front of the instrument.
Reset	Independent alarm (VLΣ, 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
Power consumption	24VAC -15 +10%, 50-60Hz 18 to 60VDC AC: 4.5 VA DC: 4W

General Specifications

Operating temperature	0 to +50°C (32 to 122°F) (RH < 90% non condensing at 40°C)
Storage temperature	-10 to +60°C (14 to 140°F) (RH < 90% non condensing at 40°C)
Installation category	Cat. III (IEC 60664, EN60664)
Insulation (for 1 minute)	4000VAC, 500VDC between mesuring inputs and power supply.
	500VAC/DC between mesuring inputs and RS485. 4000VAC, 500VDC between power supply and RS485
Dielectric strength	4000 VAC (for 1 min)
EMC	
Emissions	EN50084-1 (class A) residential environment, commerce and light industry

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General Specifications (cont.)

Immunity	EN61000-6-2 (class A) industrial environment.
Pulse voltage (1.2/50µs)	EN61000-4-5
Safety standards	IEC60664, EN60664
Approvals	CE, UL, CSA
Connections 5(6) A Max cable cross sect. area	Screw-type 2.5 mm^2
Housing	
Dimensions (WxHxD)	96 x 96 x 63 mm

Material	ABS self-extinguishing: UL 94 V-0
Mounting	Panel
Protection degree	Front: IP65 (standard) Connections: IP20
Weight	Approx. 400 g (pack. incl.)

Waveform of the signals that can be measured

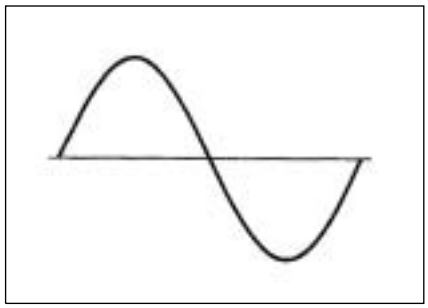

Figure D
Sine wave, undistorted
Fundamental content 100%
Harmonic content 0%
A_{rms} = 1.1107 | A |

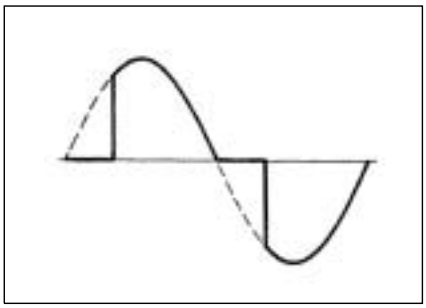

Figure E
Sine wave, indented
Fundamental content 10...100%
Harmonic content 0...90%
Frequency spectrum: 3rd to 16th harmonic
Additional error: <1% FS

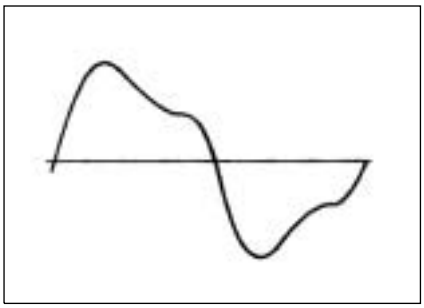

Figure F
Sine wave, distorted
Fundamental content 70...90%
Harmonic content 10...30%
Frequency spectrum: 3rd to 16th harmonic
Additional error: <0.5% FS

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

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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

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

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

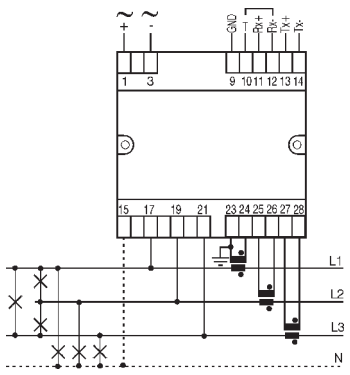
$$\cos\phi_\Sigma = \frac{W_\Sigma}{VA_\Sigma}$$

Neutral current

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

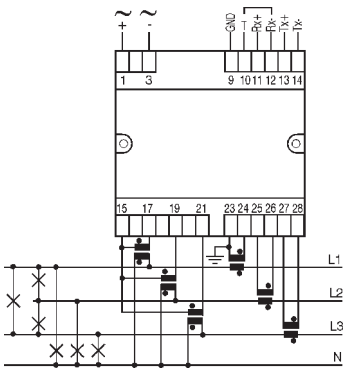
Wiring diagrams

Fig. 1



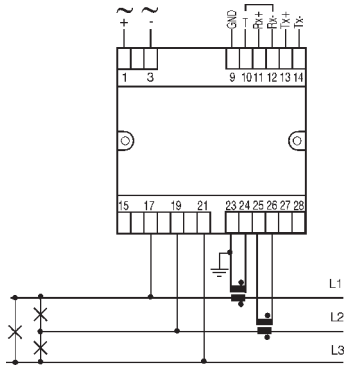
CT connection

Fig. 2



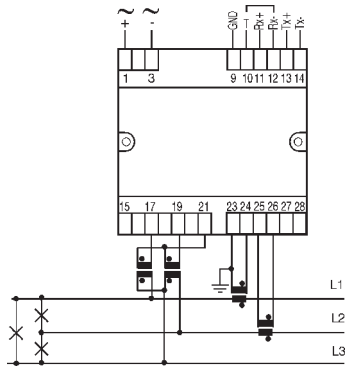
3CT and 3VT connection

Fig. 3



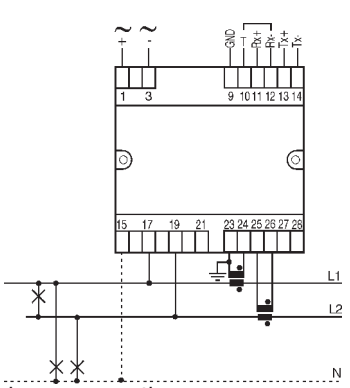
ARON connection

Fig. 4



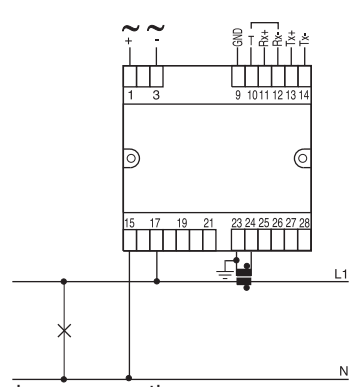
ARON and VT connection

Fig. 5



2-phase connection

Fig. 6

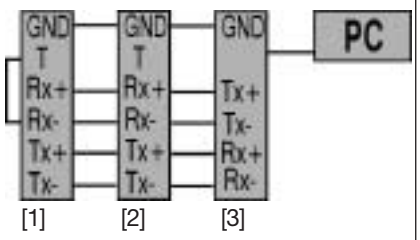


1-phase connection

NOTE: the current inputs can be connected to the lines ONLY by means of current transformers. The direct connection is not allowed.

Serial Port wiring diagram

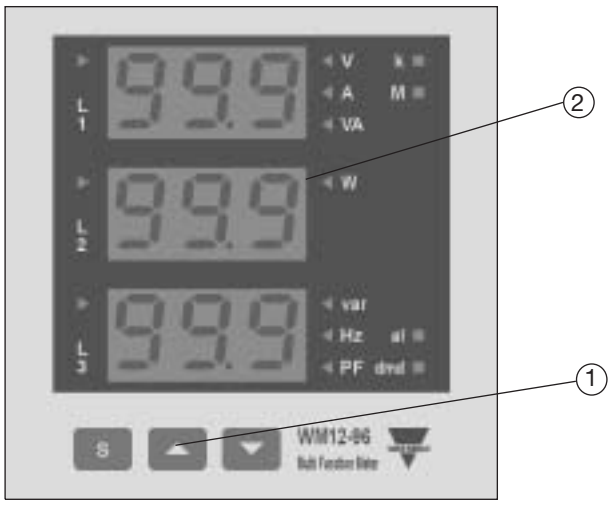
RS485 serial connection Fig. 7



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

4-wire connection

Front Panel Description



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

   S

   Key to enter programming and confirm selections;

   ▲ ▼

   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