

CARLO GAVAZZI

Automation Components

CARLO GAVAZZI

WM23-96

Power Quality Analyzer
Analizzatore di Qualità
della Rete

USER MANUAL
MANUALE ISTRUZIONI



Control

Modular system
Tecnologia modulare

WM23-96: Power Quality Analyzer

*Plug and play module system;
Harmonic analysis; Wmax and PFmin
storage. These are only a few among
many other functions performed by
your WM23-96. What's more, Carlo
Gavazzi means ISO9001 certification,
a working experience of many
decades and a widespread presence
all over the world. All this because
we want our customers to have the
top service and the top products.*

*Welcome in the Carlo Gavazzi world
and compliments for your smart
choice. Visit our website and
evaluate our range of products:
www.carlogavazzi.com*



THANK YOU FOR CHOOSING CARLO GAVAZZI
**Plug and Play
Modules**

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CARLO GAVAZZI
WM23-96, Power Quality Analyzer
FW rev. 01

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We suggest you to keep the original packing in case it is necessary to return the instrument to our Technical Service Department. In order to achieve the best results with your instrument, we recommend you to read this instruction manual carefully.

HOW TO USE THE SYMBOLS



Go to the page where the previous main subject is described.



Go to the page where the next main subject is described.



Go to the page where the subject written on the top of the current page starts.



Go to the page where the subject written on the top of the current page ends.



This symbol indicates a particularly important subject or information.



This symbol indicates that more details are given on the current subject.



Main menu



Frontal Panel Description



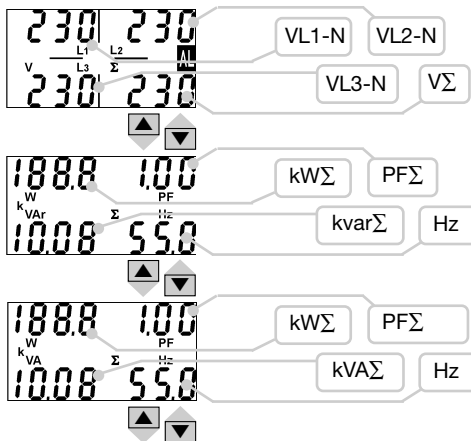
Back-lighted LCD Display.

Display previous page.

Display next page.

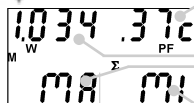
Access to programming or setting confirmation.

List and Description of Displayed Measuring Pages



Measuring pages

To begin with **5**

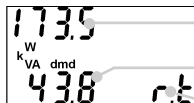


MWΣ Max

PFΣ Min

Max

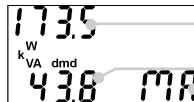
Min



kW dmd

kVA dmd

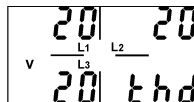
Serial communication status: r=Rx; t=Tx (only with serial comm. module inserted)



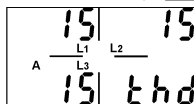
kW dmd, Max

kVA dmd, Max

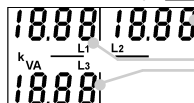
Max



Display total harmonic distortion for the single phase voltages expressed as %.



Display total harmonic distortion for the single phase currents expressed as %.



kVA L1

kVA L2

kVA L3

Index

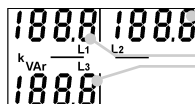
3

4

6

VT ratio

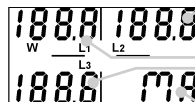
9



kvar L1

kvar L2

kvar L3



W L1 Max

W L2 Max

W L3 Max

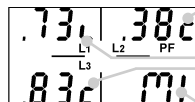
Max



W L1

W L2

W L3



PF L1 Min

PF L2 Min

PF L3 Min

Min

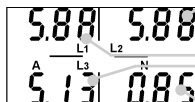


PF L1

PF L2

PF L3

PF Σ



A L1

A L2

A L3

Neutral current



Change password



Programming 7

380 380
 $\frac{L1-2}{L3-1} \Sigma$
 V

V L1-2

V L2-3

V L3-1

V Σ

AL 1
 V Σ

Display of alarm setting (AL1 and AL2 if both alarms have been set).
 Display of the variable connected to the alarm.

230 230
 $\frac{L1}{L3} \Sigma$
 V

The scrolling of the measuring pages is cyclic, at the end it returns back to the first page on the left.

Active alarm indicator.

230 230
 $\frac{L1}{L3} \Sigma$
 V

Access to the main menu

To access to the programming menus from the measuring and display phase, press the **[S]** key: when the instrument asks for the password, enter the correct PASS value by means of the $\blacktriangle$ and $\blacktriangledown$ keys; afterwards confirm by means of the **[S]** key. If the password is correct (when the instrument is new, the password is 0), the instrument goes to the main functions menu.

[S]

PASS .?
 0

[S]

$\blacktriangle$ $\blacktriangledown$

Access to the main menu



When the "AL" box (normally used for the alarm indication) is active during the programming phase, it means that the displayed value can be modified. This rule applies to all the programming menus.

Measuring pages

Synchronization

5

17

11

CnGPASS
0

S

CnGPASS
0

S

▲ ▼

Change Password

This function allows the operator to choose the desired password value (from 0 to 1000).

Choose the “CnG.PASS” function by means of the ▲ and ▼ keys, then press **S** to modify PASS, enter the desired value by means of the ▲ and ▼ keys and confirm the new value with the **S** key.

SyStEn
3P.n

S

SyStEn
3P.n

S

SyStEn
3P

S

▲ ▼

System

This function allows the operator to select the electrical system choosing between three-phase with neutral (3P.n) and three-phase without neutral (3P).

Choose by means of ▲ and ▼ the “SyStEn” function, press **S** to enter the menu; then, select the desired system by means of the ▲ and ▼ keys and confirm with **S**.

CT ratio
1

S

CT ratio

This function allows the user to select the value of the CT ratio. Example: if the CT primary (current transformer) has a current of 300A

Index

3

Dmd calculation

10

7

17

Ct.rAtio 0
1

[S] [▲] 12.21 [▼]

rESEt
no

rESEt
YES

[S] [▲] [▼]

and the secondary has a current of 5A, the CT ratio corresponds to 60 (obtained by carrying out the following calculation: $300/5$). Choose the "Ct.rAtio" function by means of the [▲] and [▼] keys; to enter the menu press [S]; then select the desired value by means of the [▲] and [▼] keys and confirm the new value with [S]. *In order to store the new value, carry out the reset (rESEt YES ▶ [S]).*

Vt.rAtio 0
10

[S]

Vt.rAtio 0
10

[S] [▲] 12.21 [▼]

rESEt
no

rESEt
YES

[S] [▲] [▼]

■ VT ratio

This function allows the user to select the value of the VT ratio. Example: if the primary of the connected VT (voltage transformer) is of 20kV and the secondary is 100V, the VT ratio will correspond to 200 (obtained by carrying out the following calculation: $20000/100$). Choose the "Vt.rAtio" function by means of the [▲] and [▼] keys; to enter the menu press [S], then select the desired value by means of the [▲] and [▼] keys and confirm it with [S]. *In order to store the new value, carry out the reset (rESEt YES ▶ [S]).*



By changing the VT and CT ratio, the energy meters are reset.

Main menu

7

Alarm output

13

7

17

P.int t
1 Min

[S]

P.int t
1 Min

[S]

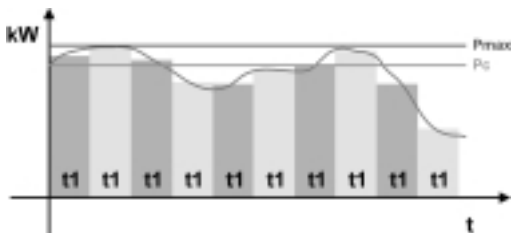
[▲] 12. [▼] 2.1

■ Dmd calculation

This function allows the user to select the integration time of the W, VA and var demand value (var only by means of RS485). To enter these functions select "P.int t" from the main menu by the [▲] and [▼] keys; to enter in the menu press [S]. Set the desired value by means of the [▲] and [▼] keys and confirm the new value with [S].



If for example, you select the value "15 minutes", the instrument calculates the demand value and updates the value every 15 minutes. See the diagram below.



Where: P_c is the contractual power
 t_1 is the selected integration period

■ Synchronization

The synchronization allows the instrument, by means of the digital inputs, to start the integration of the power dmd at the same time as the official watt-hour meter. Without digital input module, the reset and the start of the energy integra-

tion are carried out as soon as the instrument is switched off. When the DIGITAL INPUT module is installed, the synchronization starts as soon as one of the digital inputs changes status (contacts 2 and 3 of the digital input mod-

SYnC
YES

S

SYnC
YES

AL

SYnC
no

AL

S

▲ ▼

ule). Every subsequent change of status, resets and synchronizes again the calculation of the power dmd. It is possible to enable or disable the synchronization function managed by the digital inputs.

Choose the “SYnC” function by means of the ▼ and ▲ keys, to enter the menu press **S**; Then set “YES” to enable the function or “No” to disable the synchronization by means of the ▲ and ▼ keys and confirm with **S**.

thd
YES

S

thd
YES

AL

thd
no

AL

S

▲ ▼

■ Total Harmonic Distortion

This function allows the user to enable the FFT analysis (Fast Fourier Transform) and the display of the total harmonic distortion (see also “displayed measuring pages” on page 5). Choose the “thd” function by means of the ▼ and ▲ keys, to enter the menu press **S**; then choose if the function is to be enabled (YES) or disabled (NO) by means of the ▲ and ▼ keys and confirm with **S**.

VT ratio

9

Serial port

15

7

17



diGout

S

diGout1
rEn

S

Σ

PF AL

▲ ▼

diGout1
ALr

AL

S

Alarm digital
output

Digital output 2
on page 14

diGout1
ALr

AL

S

diGout1
VAr

PF AL

S

▲ ▼

■ Digital Outputs

□ Digital Output 1

This function enables to set the parameters of the digital outputs. Choose the “diGout” function by means of the ▲ and ▼ keys, to enter the menu press **S**. Then, set one of the following parameters: **ALr**: access to the alarm function (see alarm digital output) confirm with **S** to enter the relevant menu;

rEn: enable the activation of the output by means of the serial communication, confirm with **S** to enable the function.

□ Alarm Digital Output

This function allows the user to set the parameters of the alarm digital output. Choose the “diGout1-ALr” function by means of the ▲ ▼ keys: to enter the menu press **S**. Then, set one of the following parameters:

VAr: choose the variable to be associated to the alarm activation by means of the ▲ and ▼ keys and confirm with **S** ;

Main menu

Analogue output

7

7

17

14

Backward

Forward

d i b o u t 1
PF AL
Σ
1111 r n G

S ▲ ▼

d i b o u t 1
PF AL
Σ
000 o n

S ▲ 1.2.2.1 ▼

d i b o u t 1
PF AL
Σ
000 o f f

S ▲ 1.2.2.1 ▼

d i b o u t 1
PF AL
Σ
n d

d i b o u t 1
PF AL
Σ
n E

S ▲ ▼

d i b o u t 1
PF AL
Σ
255 s e c

S ▲ 1.2.2.1 ▼

Digital Output 2
on page 14

rnG: select the position of the digital point;

Set-on: activation set-point, value of the variable over which the alarm is activated. Select the value of the variable by means of the ▲ and ▼ keys and confirm with **S**;

Set-off: deactivation set-point, value of the variable over which the alarm is deactivated. Select the value of the variable by means of the ▲ and ▼ keys and confirm it with **S**;

nd: normally de-energized output when there is no alarm.

nE: normally energized output when there is no alarm.

Select the output status by means of the ▲ and ▼ keys and confirm it with **S**;

SEC: delay time at the activation of the alarm output. Choose the value of the delay time in seconds by means of the ▲ and ▼ keys (up to 255 seconds) and confirm with **S**.

14 Programming

d iGout2

S

d iGout2 AL
ALr

d iGout2 PF AL
Σ
rEn

S

▲ ▼

□ Digital Output 2

ALr: access to the alarm function (see alarm digital output on page 12) confirm with **S** to enter the relevant menu;

rEn: enable the activation of the output by means of the serial communication, confirm with **S** to enable the function.

AnA out

S

AnA out AL
k_{VAR} Σ
UAr

S

▲ ▼

AnA out AL
k_{VAR} Σ
1111 rno

S

▲ ▼

■ Analogue output

From the main menu select “AnA out” by means of the **▲** and **▼**

keys; to enter the menu press **S**:

VAR: variable to be associated to the output, choose among those available (see on page 20) by means of the **▲** and **▼** keys

and confirm the selection with **S**

LoE: minimum value of the variable input range. Select the desired value by means of the **▲** and **▼** keys and confirm it with **S**.

HiE: maximum value of the variable input range. Select the desired value by means of the **▲** and **▼**

keys and confirm it with .

LoA: % value of the zero of the output range (0-20mA, 0-10V) that is generated by the minimum measured value (LoE). Select the

desired value by means of the and keys and confirm it with .

HiA: % value of the full scale of the output range (0-20mA, 0-10V) that is generated by the maximum measured value (HiE).

Select the desired value by means of the and keys and confirm it with .

See also “Example 1” in useful information on page 18.

■ RS422/485 Serial port address

Select “AddrESS” from the main menu by means of the and keys; to enter the menu press , then set the desired address value (from 1 to 255) by means of the and keys and confirm it with .

16 Programming

F i l t E r

S

F i l t E r
0 r n G

S

▲ 1.2 ▼
2.1

F i l t E r
1 C o E

S

▲ 1.2 ▼
2.1

Digital Filter

Select “FiLtEr” by means of the ▲ and ▼ keys: to enter the menu press [S]. Select the parameters to be set with the ▲ and ▼ keys, to enter the menu press [S].

There are two parameters:

- **rnG**, to set the operating range of the digital filter. The value is expressed as % of the full scale value: set the desired value (from 0 to 100%) by means of the ▲ and ▼ keys and confirm it with [S];
- **Coe**, to set the filtering coefficient of

the instantaneous measurements, set the desired value (from 1 to 16) by means of the ▲ and ▼ keys and confirm it with [S]. By increasing the value both the stability and the settling time of the measurements are increased. **See also “Example 2” in Useful Information on page 19.**

E n d
r.00

S

To measur-
ing mode

Instrument
revision

End of programming

Use it to exit from programming and go back to the measuring mode. Select “End” from the main menu by means of the ▼ and ▲ keys, confirm it with [S].

Synchronization

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Useful information

18

7

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Reset of min values

Select "rESEt MI" from the main menu by means of the   keys, then confirm with . When the instrument asks for the reset, choose, by means of the   keys: "no MI" to avoid the reset or "YES MI" to confirm it.

Then, press  to carry out the command.

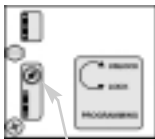
Reset of max values

Select "rESEt MA" from the main menu by means of the   keys, then confirm with . When the instrument asks for the reset, choose, by means of the   keys: "no MA" to avoid the reset or "yes MA" to confirm it.

Then, press  to carry out the command.



■ How to prevent the programming by key-pad



It is possible to prevent any access to programming by keypad by modifying the selector under the power supply slot (see the drawing on the left), or closing the contact number 1 of the digital input module, when present.

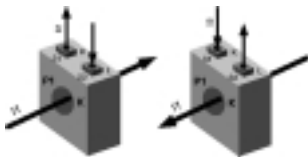
Selector: turn the selector with a little screwdriver.



- **Free** programming.
- **Lock** programming.



The variables measured by the instrument are correct if the polarities of the inputs have been observed (as shown in the figure below); if not, measuring and retransmission errors may occur due to the wrong direction of the current flowing in the primary / secondary of the connected current transformer.



■ Setting Examples

Example 1 “Analogue output”: take the measure of a power consumed up to 100kW, and retransmit it with a signal from 4 to 20 mA; the module to be used is AO1050 or AO1026 (single or dual output from 0 to 20mA), the instrument must be set as follows:

- VAr: (variable), $W\Sigma$ (system active power)
- LoE: (minimum electrical scale) 0.0 K; the K and M mul-

tiples are automatically selected by the instrument according to the selected VT and CT values;

- HiE: (maximum electrical scale) 100.0 K; the K and M multiples are automatically selected by the instrument according to the selected VT and CT values;
- LoA: (minimum electrical scale of the analogue output) 20.0% for 4mA, the calculation to be carried out is: (minimum output value/ full scale output value)*100 = $(4\text{mA}/20\text{mA}) \cdot 100 = 20\%$
- HiA: (maximum electrical scale of the analogue output) 100.0% for 20mA, the calculation to be carried out is: (maximum output value / full scale output value)*100 = $(20\text{mA}/20\text{mA}) \cdot 100 = 100\%$

Example 2 “Use of digital filter”: it’s necessary to stabilize the displayed value of the VL1-N variable that varies between 222V and 228V. The parameters of the digital filter are to be set as follows:

- rnG: the variable varies within the average value, the amplitude of which is equal to $\pm 1.3\%$ of the variable’s rated value, calculated as follows:

$(228-222)/2 = \pm 3\text{V}$, then $\pm 3 \cdot 100 / 231\text{V} = \pm 1.3\%$ where 231V is the phase-neutral rated value of a 400V input range). The “range” parameter, that corresponds to the action range of the digital filter, is set at a value which is slightly higher than the percentage amplitude of the fluctuation: e.g. 2%.

- CoE: if the new value acquired by the instrument is within the filter’s action range, then the new displayed value is calculated by summing algebraically to the previous value the variation divided by the filtering coefficient. As a consequence, a value which is higher than this coefficient implies a longer settling time and therefore improves the stability. The latter can also be improved by increasing the filtering coefficient: the admitted values are within 1 and 16. Enter the value in consecutive attempts until you reach the desired stability.

What is ASY

The ASY variable allows the user to control the symmetry of the delta voltages (for systems without neutral) and star voltages (for systems with neutral). The variable is calculated according to the following formula:

$$ASY = \frac{V_{\max} - V_{\min}}{V_{\text{avg}}} * 100$$

Where: $V_{\max}$ is the max. value among VL1-N, VL2-N, VL3-N
 $V_{\min}$ is the min. value among VL1-N, VL2-N, VL3-N
 V_{avg} is the average: $(VL1-N, VL2-N, VL3-N)/3$

The variable is not displayed by the instrument, but it can be retransmitted by the analogue or RS422 / 485 output and can be controlled by means of the alarm.

Retransmitted Variables

N°	Variable	Three-phase with neutral	Three-phase without neutral	Note
1	V L-NΣ	x		Σ = system
2	V L-LΣ	x	x	Σ = system
3	WΣ	x	x	Σ = system
4	varΣ	x	x	Σ = system
5	VAΣ	x	x	Σ = system
6	PFΣ	x	x	Σ = system
7	THD V	x	x	if FFT activated
8	THD A	x	x	if FFT activated
9	A n	x		
10	VA dmd	x	x	
11	W dmd	x	x	
12	ASY	x	x	asymmetry
13	All the instantaneous variables (powers, currents, voltages)			

■ Alarm digital output

The activation of the alarm can be UP or DOWN depending on how the ON and OFF parameters have been set, as per the following table:

ON-OFF VALUES STATUS	ALARM TYPE
ON $\geq$ OFF	UP
ON $<$ OFF	DOWN

■ Displaying of programming menu



It may be useful to know that the menus displayed by the instrument depend on its configuration; e.g.: the instrument will not display the menu relevant to the digital outputs if the optional module is not inserted.



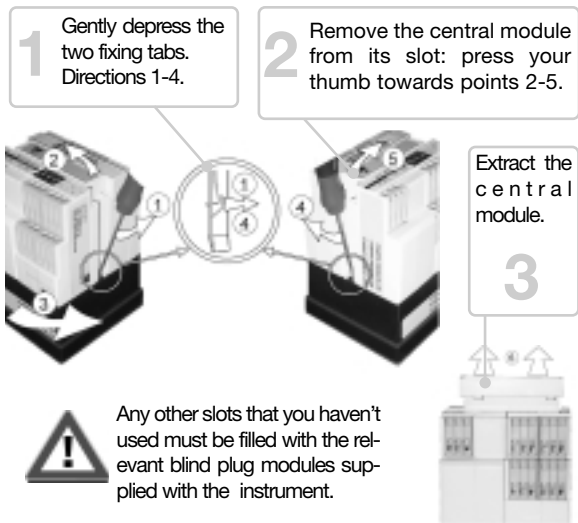
IT IS IMPORTANT that the instrument is switched off when you plug-in or disconnect the modules.

■ Preliminary operations

Before switching the instrument on, make sure that the power supply voltage corresponds to what is shown on the side label of the relevant module.

■ Before mounting the modules

To know in which slot every module is to be mounted, refer to the figure on page 24. For a correct mounting of the instrument, insert the modules in the relevant slots, then, at the end, enter the central module, which can be a blind type module or an RS232 communication module. The central module will help fixing also the other modules in the relevant slots. To remove the modules use a screwdriver as shown in the picture below.



Reset of min and max values

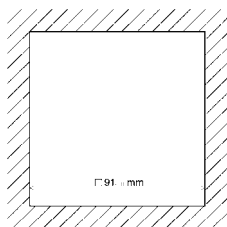
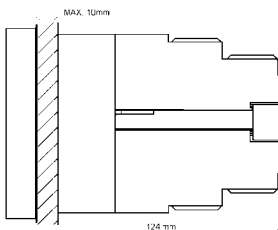
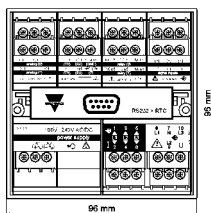
17

Available Modules

24

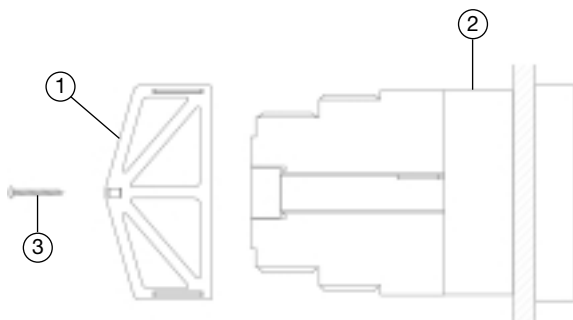
31

Overall dimensions and panel cut-out



Mounting

Insert the instrument (holding its front) and fasten it (from the back) by fixing the two lateral brackets (1) (supplied with the instrument) to the appropriate location (2), using the two screws (3) supplied with the instrument.



Useful information

21

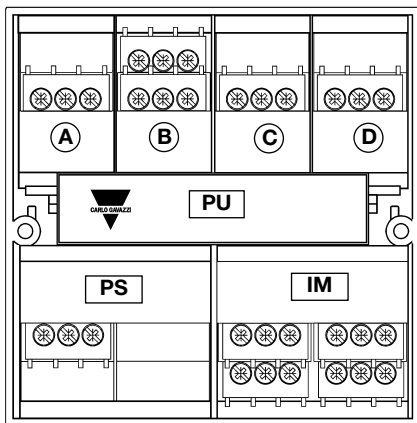
Optional module connections

22

31

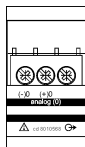
27

Position of the slots and relevant modules



Available modules

Analogue output modules



Single analogue output

AO1050 (20mADC)

AO1051 (10VDC)

AO1052 (± 5 mADC)

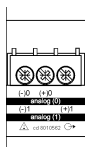
AO1053 (± 10 mADC)

AO1054 (± 20 mADC)

AO1055 (± 1 VDC)

AO1056 (± 5 VDC)

AO1057 (± 10 VDC)



Dual analogue output

AO1026 (20mADC)

AO1027 (10VDC)

AO1028 (± 5 mADC)

AO1029 (± 10 mADC)

AO1030 (± 20 mADC)

AO1031 (± 1 VDC)

AO1032 (± 5 VDC)

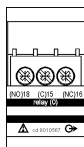
AO1033 (± 10 VDC)

Useful information

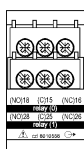
Power supply modules

DESCRIPTION	A	B	C	D	PU	PS	IM
Single analogue output	✓						
Double analogue output	✓						
RS485 Serial port		✓					
RS232 Serial port					✓		
Single relay output			✓	✓			
Single open coll. output			✓	✓			
Dual relay output			✓	✓			
Dual open coll. output			✓	✓			
3 digital inputs			✓				
3 digital inputs+AUX			✓				
Power supply						✓	
Inputs							✓

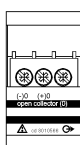
Open collector digital output modules



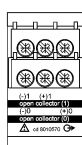
AO1058
Single relay
output



AO1035
Dual relay
output



AO1059
Single open
collector
output



AO1036
Dual open
collector
output

Mounting

23

Serial port connections

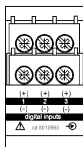
31

29

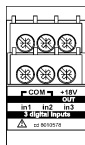
22

26 Installation

Digital input modules

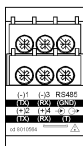


AQ1038
3 digital
inputs



AQ1042
3 digital
inputs + aux

Serial port modules

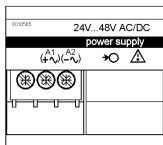


AR1034
RS485 serial
port



AR1039
RS232 serial port

Power supply modules



AP1020
90-260 VAC/DC Power supply

- AP1021**
18-60VAC/DC Power supply
- AP1025**
24VAC Power supply
- AP1024**
48VAC Power supply
- AP1023**
115VAC Power supply
- AP1022**
230VAC Power supply

Useful information

21

Serial port connections

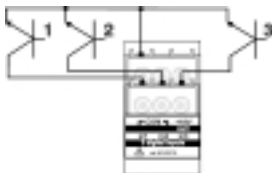
22

31

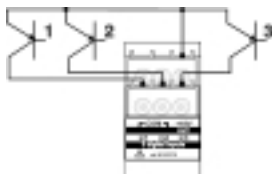
28

Optional module connections

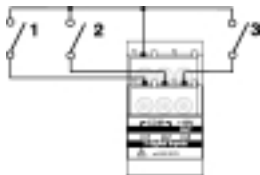
Digital inputs



Connection by
NPN transistor.
AQ1042 Digital
input module



Connection by
PNP transistor.
AQ1042 Digital
input module



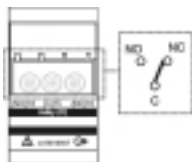
Connection by
contacts.
AQ1042 Digital
input module



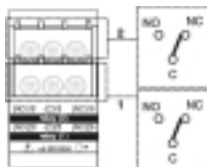
Connection by
contacts.
AQ1038 Digital
input module



Relay outputs

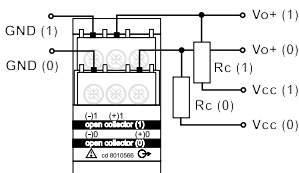


AO1058
single relay output



AO1035
dual relay output

Open collector outputs

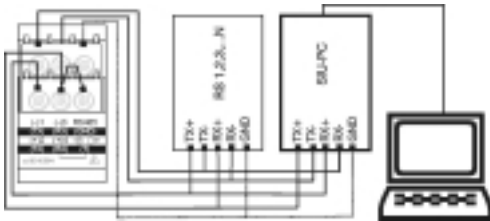


AO1059 single open collector
output

AO1036 dual open collector
output

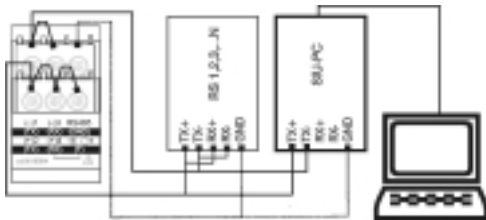
This diagram is valid also for the open collector modules with a lower number of outputs. The value of the load resistances (R_c) must be chosen so that the short-circuit current is lower than 100mA; the VDC voltage must be lower than or equal to 30 VDC.

RS485/422 serial port (AR1034)



4-wire connection.

Additional devices provided with RS422/RS485 (that is RS 1,2,3...N) are connected in parallel.



2-wire connection. Additional devices provided with RS422/RS485 (that is RS 1, 2, 3 ...N) are connected in parallel.

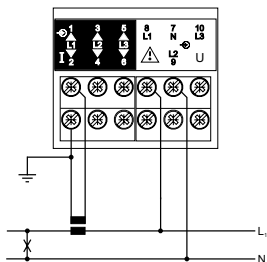


The termination of the serial output is carried out only on the last instrument of the network, by means of a jumper between (Rx+) and (T). We recommend you to use the 4-wire connection: by means of the serial port the data are exchanged faster.

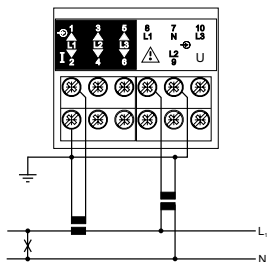


■ Electrical diagrams

□ Single-phase connection

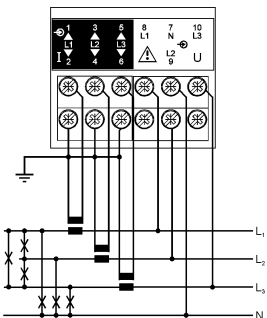


CT connections

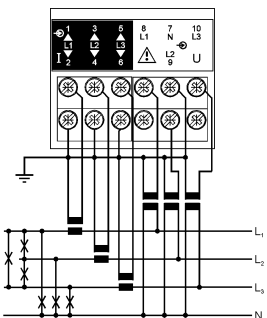


CT and VT connections

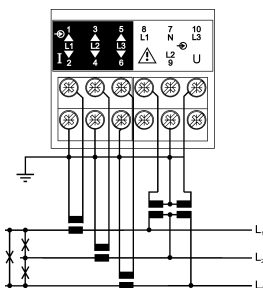
□ Three-phase, 4-wire, unbalanced load



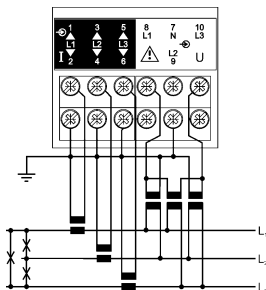
CT connections
(4-wire system)



CT and VT connections
(4-wire system)

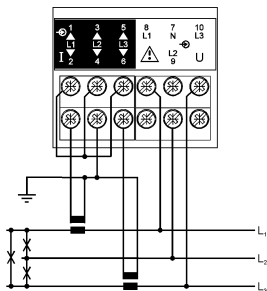


CT and VT connections
(3-wire system)

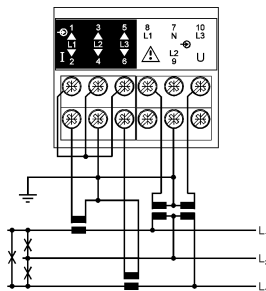


3 CT and 3 VT connections
(3-wire system)

☐ *ARON connection, 3-phase, 3-wire, unbalanced load*



CT connections
(3-wire system) ARON



CT and VT connections
(3-wire system) ARON



■ **Number of inputs**

Current: 3

Voltage: 4

■ **Accuracy**

(display, RS422/RS485) $I_n=5A$; $P_n= I_n^* U_n$

UN: FS ranges AV4-5-6-7

Current: $\pm 0.5\% I_n + 2DGT$

Phase-neutral voltage: $\pm 1\% U_n + 2DGT$

Phase-phase voltage: $\pm 0.5\% U_n + 2DGT$

Frequency: $\pm 0.1\% Hz$

Active power (@ $25^\circ C \pm 5^\circ C$, R.H. $\leq 60\%$): $\pm 1\% P_n + 2DGT$

Reactive Power (@ $25^\circ C \pm 5^\circ C$, R.H. $\leq 60\%$): $\pm 2\% P_n + 2DGT$

Apparent power (@ $25^\circ C \pm 5^\circ C$, R.H. $\leq 60\%$): $\pm 1\% P_n + 2DGT$

Harmonic distortion:

(@ $25^\circ C \pm 5^\circ C$, R.H. $\leq 60\%$): $\pm (3\% \text{ up to the 16th harmonic})$

■ **Additional errors**

Humidity: $\leq 0.3\%$ FS from 60% to 90% H.R.

■ **Temperature drift**

$\leq 200ppm/^\circ C$

■ **Display**

Type: LCD, 70x 38 mm, back lighted

Display of instantaneous variables: 4 x 3 1/2 digit

■ **Measurements**

Current, voltage, power, power factor, frequency, harmonic distortion. TRMS measurement of a distorted wave.

Coupling type: direct

■ **Input impedance**

AV4: 208VLL 5(6)AAC (AV4): >200 k Ω

AV5: 400VLL 5(6)AAC (AV5): >900 k Ω

AV6: 100VLL 5(6)AAC (AV6): >200 k Ω

AV7: 660VLL 5(6)AAC (AV7): >900 k Ω

■ **Frequency**

50 to 60 Hz

■ **Harmonic analysis**

Analysis principle: FFT

Harmonic measurement: Current, Up to 16th harmonic

Voltage: Up to 16th harmonic

Type of harmonics: THD VL1, THD VL2, THD VL3, THD AL1, THD AL2, THD AL3

Display pages: THD %

System: The harmonic distortion can be measured in both 3-wire or 4-wire systems.

■ **Interface modules technical features**

Analogue Outputs (on request)

Number of outputs: 1 (+1 redundant)

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

Accuracy: $\pm 0.2\%$ F.S.

Temperature drift: ≤ 500 ppm/ $^{\circ}$ C

Scaling factor: Programmable within the whole range of retransmission; it allows the retransmission of all values within the min and max relevant to the used module.

Response time: 900 ms (FFT filter excluded)

Ripple: $\leq 1\%$

Load: $20 \text{ mADC} \leq 600 \Omega$; $\pm 20 \text{ mADC} \leq 550 \Omega$; $\pm 10 \text{ mADC} \leq 1100 \Omega$; $\pm 5 \text{ mADC} \leq 2200 \Omega$; $10 \text{ VDC} \geq 10 \text{ k}\Omega$; $\pm 10 \text{ VDC} \geq 10 \text{ k}\Omega$; $\pm 5 \text{ VDC} \geq 10 \text{ k}\Omega$; $\pm 1 \text{ VDC} \geq 10 \text{ k}\Omega$

Insulation: by means of optocouplers, $4000 V_{\text{RMS}}$ output to measuring input $4000 V_{\text{RMS}}$ output to power supply input.

RS422/RS485 (on request). Module: AR 1034

Type: Multidrop, bidirectional (static and dynamic variables)

Connections: 2 or 4 wires, max. distance 1200m, termination directly on the instrument

Addresses: 1 to 255, selectable by key-pad

Protocol: MODBUS/JBUS (RTU)

Data (bidirectional):

Dynamic (reading only): system and phase variables

Static (reading/writing): all the configuration parameters, activation of the static output.

Data format: 1 start bit, 8 data bit, no parity, 1 stop bit

Baud-rate: 9600 bit/s.

Insulation: by means of optocouplers, $4000 V_{\text{RMS}}$ output to measuring input, $4000 V_{\text{RMS}}$ output to power supply input

RS232 (on request) - **module** AR1039 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 (RTU)

Digital outputs (on request) AO1059/AO1036 module

To be used as alarm or remote control.

Alarm outputs

Number of outputs: up to 2, independent

Alarm type: Up alarm, down alarm

Controlled variables: V_{Σ} , $V_{n\Sigma}$, PF_{Σ} , W_{Σ} , VA_{Σ} , var_{Σ} , W_{dmd} , VA_{dmd} , A_n , ASY (asymmetry), THD V LN (the highest value among the three phases) THD A (the highest values among the three phases);

On-time delay: 0 to 255s

Output type: SPDT relay AC 1-8A @ 250VAC, DC 12-5A @ 24VDC, AC 15-2.5A @ 250VAC, DC 13-2.5A @ 24VDC

Insulation: by means of optocouplers, 4000 V_{RMS} output to measuring input, 4000 V_{RMS} output to supply input; insulation between the two outputs: functional.

■ Software 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 255, all data are protected.

Transformer ratio: CT from 1 to 5000

VT from 1.0 to 100.0 where, $CT \times VT \leq 10000$ max

Power dmd: Integration time programmable from 1 to 30 min

Filter: filter operating range from 0 to 100% 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).

Display up to 4 variables per page (3-phase with neutral system):

Page 1: V L1, V L2, V L3, V LN Σ

Page 2: V L12, V L13, V L31, V_{Σ}

Page 3: A L1, A L2, A L3, A_n

Page 4: PF L1, PF L2, PF L3, PF_{Σ}

Page 5: PF L1(min), PF L2(min), PF L3(min),

Page 6: W L1, W L2, W L3

Page 7: W L1(max), W L2(max), W L3(max),

Page 8: var L1, var L2, var L3



Page 9: VA L1, VA L2, VA L3

Page 10: AL1

Page 11: AL2

Page 12: $W\Sigma$, $PF\Sigma$, $var\Sigma$, Hz

Page 13: $W\Sigma$, $PF\Sigma$, $VA\Sigma$, Hz

Page 14: $W\Sigma$ (max), $PF\Sigma$ (min)

Page 15: W dmd, VA dmd, r.t.

Page 16: W dmd (max), VA dmd (max)

Page 17: THD VL1, THD VL2, THD VL3

Page 17: THD AL1, THD AL2, THD AL3

■ Power supply specifications

AC voltage: 90 to 260 VDC/VAC, 18 to 60VDC/VAC, 24 VAC - 15+10% 50-60Hz, 48 VAC -15+10% 50-60Hz, 115VAC - 15+10% 50-60Hz, 230 VAC -15+10% 50-60Hz

■ 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)

Installation category Cat. III (IEC 664)

Key-pad lock: by means of selector placed behind the display or by means of contact (in case of presence of the module 3 input contacts)

Insulation: 4000 VRMS between all inputs/outputs to ground

Dielectric strength: 4000 VRMS for 1 minute

EMC

Emissions: EN50082-1 (class A) residential, commercial and light industry environment

Immunity: EN 61000-6-2 (class A) industrial environment

Other standards

Safety: IEC 61010-1, EN 61010-1

Product: IEC 60688-1, EN 60688-1

Approvals: CE

Connections 5(6)A: Screw-type, max 2.5 mm² wires (2 x 1.5mm²)

Housing

Dimensions: 96x96x140 mm

Material: ABS, NORYL, PC (front) self-extinguishing: UL 94 V-0

Protection degree: Front: IP65; Connections: IP20

Weight: Approx. 400 g (packing incl.)

Nota: Some pictures have been digitally modified and may not correspond to the instrument in all its details.

Company name:

Password:

CT ratio:TV:

System:

Serial address:

Integration time, min:

Alarm set point:ON:OFF:

Alarm set point:ON:OFF:

Analogue output:

Slot A: Slot B:

Slot C: Slot D:

Programming lock: ON ☐ OFF ☐

NOTE:

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