CARLO GAVAZZI
Automation Components

CARLO GAVAZZI

WM22-DIN: three-phase power analyzer

Harmonic analysis; Energy meters; Plug and play technique. These are only a few among many other functions performed by your WM22-DIN. What's more, Carlo Gavazzi means ISO9001 certification, a working experience of many decades and a wide-spread presence all over the world. All this because we want our customers to have the ***top service*** *and the* ***top products****.*
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EN61036
EN61268

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CARLO GAVAZZI
WM22 DIN, three-phase power analyzer.
FW rev. 02

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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.

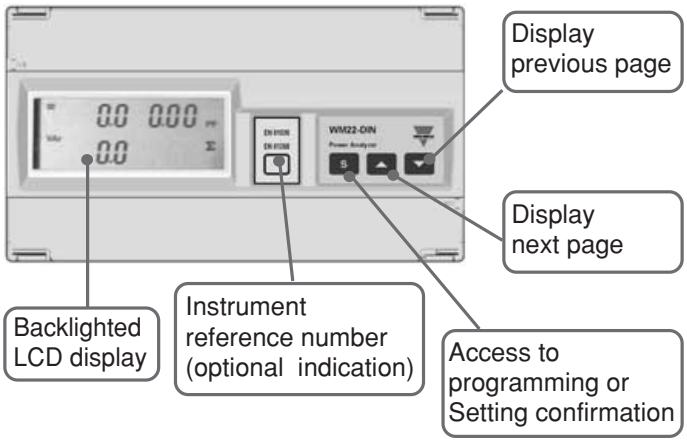
Go to the page where the subject written on the bottom of the current page finishes.

This symbol indicates a particularly important subject or information.

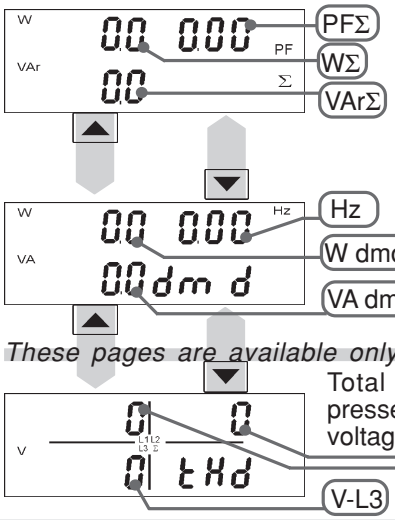
This symbol indicates that more details are given on the current subject.

4 To begin with

■ *Front panel description*



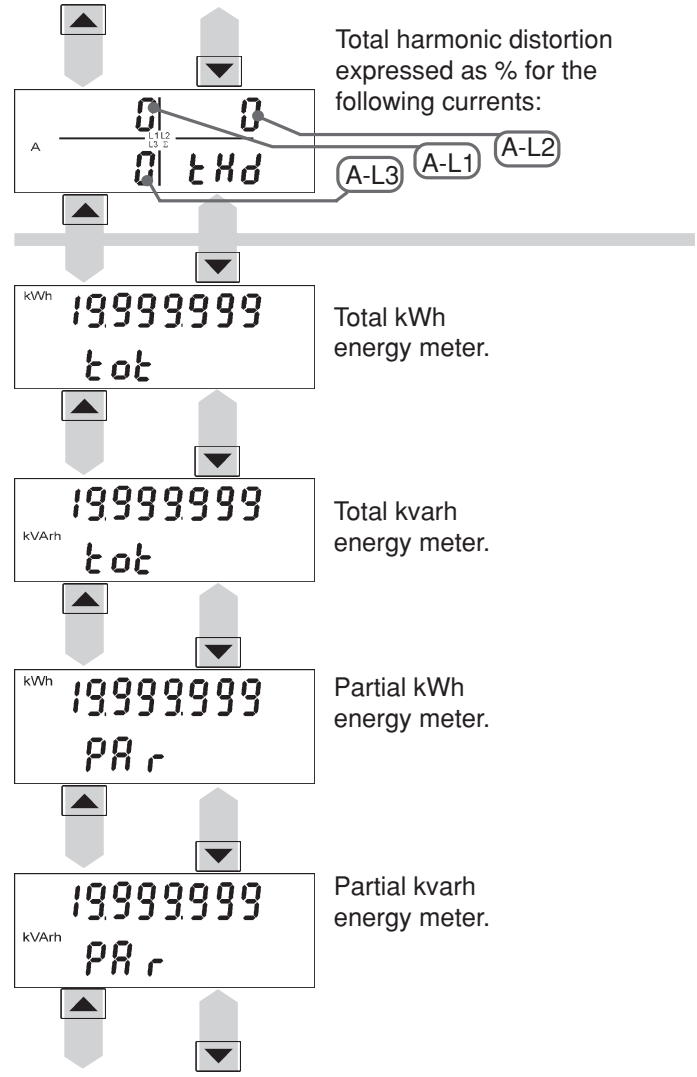
■ *List and description of the displayed measuring pages*



When the instrument is switched on, it shows the measuring page described on the left; to display the other pages, scroll them by means of the ▲ ▼ keys. This command is cyclic.

These pages are available only if THD is enabled.

Total harmonic distortion expressed as % for the following voltages:



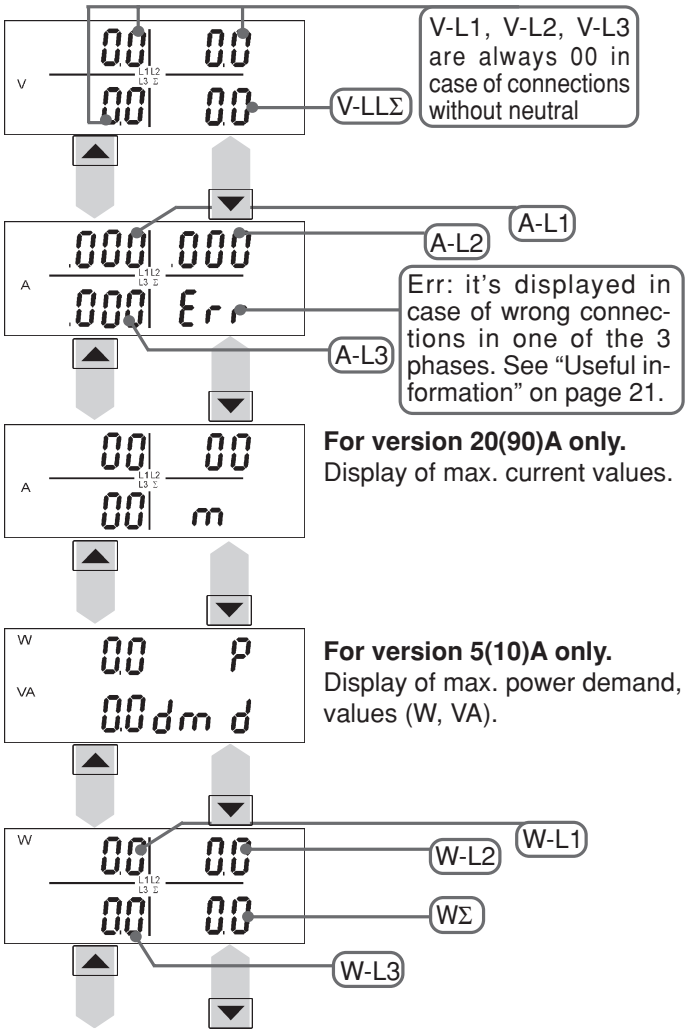
Total harmonic distortion expressed as % for the following currents:

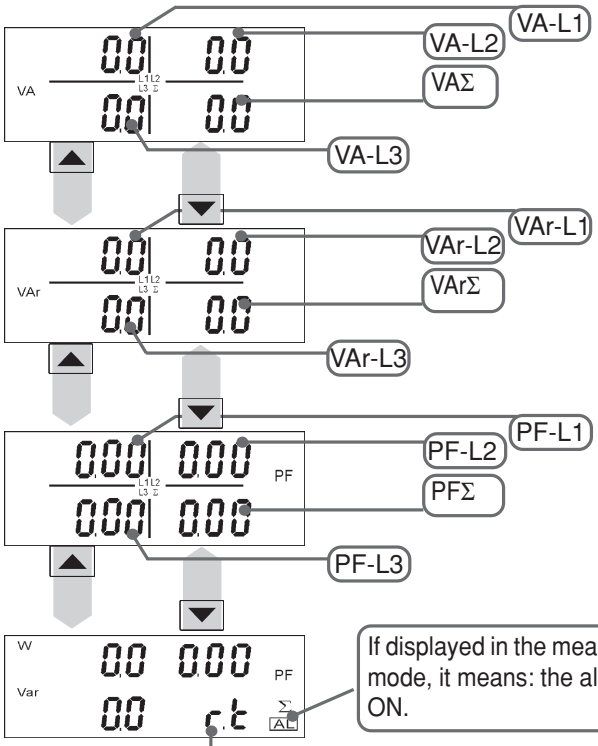
Total kWh energy meter.

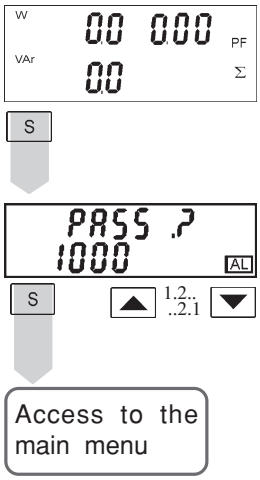
Total kvarh energy meter.

Partial kWh energy meter.

Partial kvarh energy meter.

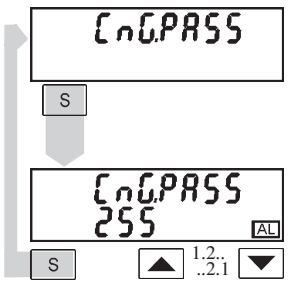

V
V-LLΣ
V-L1, V-L2, V-L3 are always 00 in case of connections without neutral
A
A-L1
A-L2
A-L3
Err: it's displayed in case of wrong connections in one of the 3 phases. See "Useful information" on page 21.
A
For version 20(90)A only.
Display of max. current values.
W
VA
For version 5(10)A only.
Display of max. power demand, values (W, VA).
W
W-L1
W-L2
WΣ
W-L3


VA
VA-L1
VA-L2
VAΣ
VA-L3
VAr
VAr-L1
VAr-L2
VArΣ
VAr-L3
PF
PF-L1
PF-L2
PFΣ
PF-L3
W
Var
PF
AL
If displayed in the measuring mode, it means: the alarm is ON.
If the serial port module RS422/485 is present, then “r” means that the instrument is receiving data, while “t” means that the instrument is transmitting data: this confirms that the serial module is working correctly and that also the wiring is correct.



■ *Access to the main menu*

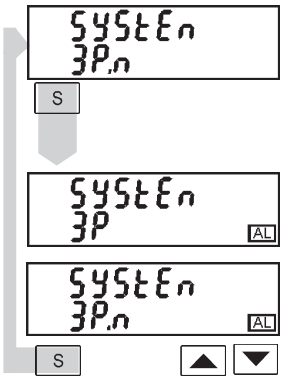
To access to the programming menus from the measuring and display phase, press the [S] key: when the instrument asks for the password, enter the correct PASS value by means of the [▲] and [▼] keys; afterwards confirm by means of the [S] key. If the password is correct (when the instrument is new, the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



■ *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.

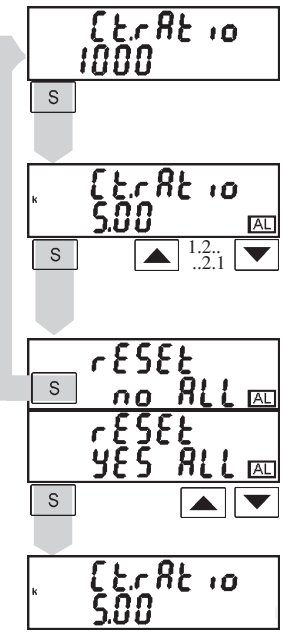
When the “AL” box (normally used for the alarm indication) is active during the programming phase, it means that the displayed value can be modified. This rule applies to all the programming menus.



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.

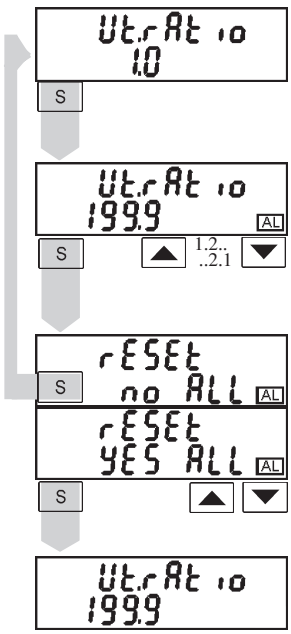


CT ratio

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 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.

The energy meters are reset by changing the CT ratio.

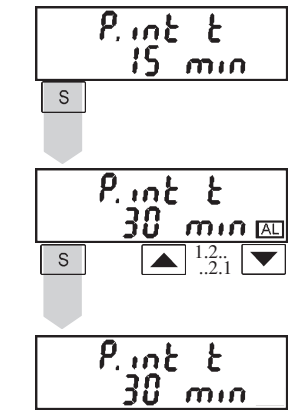


■ *VT ratio*

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.

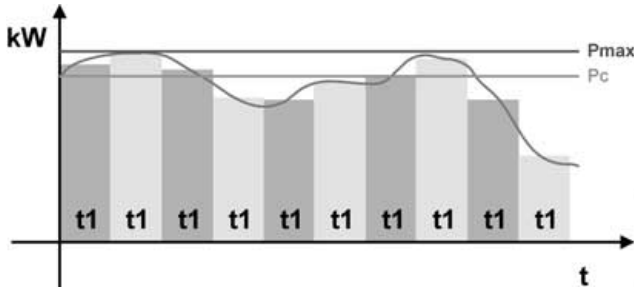
By changing the VT ratio, the energy meters are reset.



■ *Dmd calculation*

This function allows the user to select the integration time of the W, VA demand value. 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 minutes by means of the ▼ and ▲ keys and confirm the new value with S.

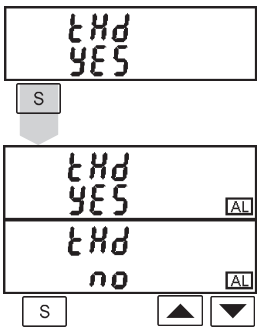
If for example, you select the value “15 minutes”, the instrument calculates the demand value and updates the value every 15 minutes. See the diagram below.



Where: Pc is the contractual power
t1 is the selected integration period

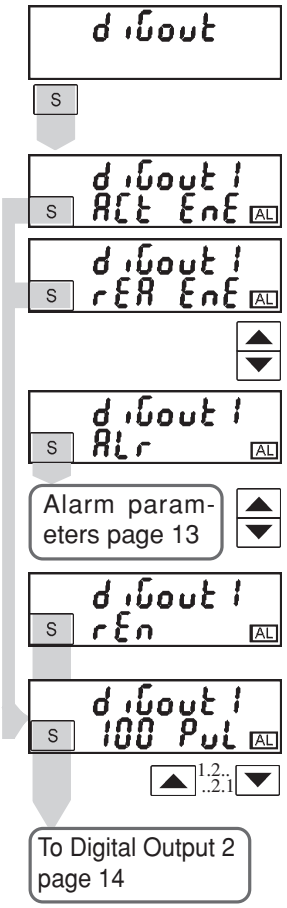
SYNCHRONIZATION OF THE POWER DEMAND CALCULATION

The beginning of the synchronization and as a consequence the start of the integration time counting are carried out when the instrument switches on (W dmd and VA dmd).



■ *Total Harmonic Distortion*

This function allows the user to enable the FFT analysis and the display of the total harmonic distortion (see also “displayed measuring pages” on page 4). 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].



■ *Digital Outputs*

❑ *Digital Output 1*

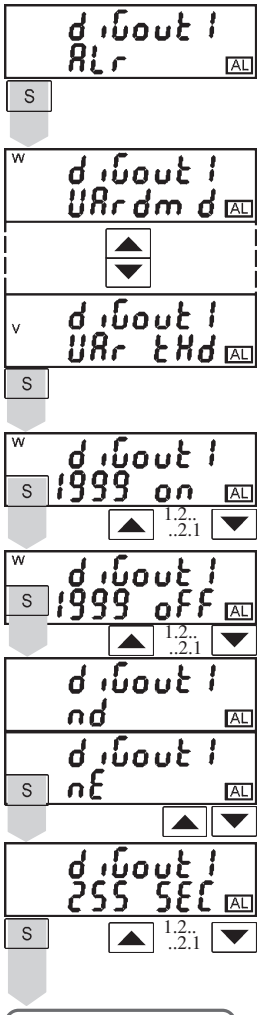
This function enables to set the parameters of the open collector digital outputs. Choose the “diGout” function by means of the ▼ and ▲ keys, to enter the menu press S. Then, you may set the following parameters:

ACt EnE: enable the retransmission of the active energy by means of pulses, confirm with S and then set the number of pulses (see table on page 21) by means of the ▼ and ▲ keys and confirm the value with S ;

rEA EnE: enable the retransmission of the reactive energy by means of pulses, confirm it with S and then set the number of pulses (see table on page 21) by means of the ▼ and ▲ keys and confirm the value with S ;

ALr: access to the alarm function (see alarm digital output on page 13): confirm with S to enter the relevant menu;

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



To digital output on page 14.

❑ *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, you may set the following parameters:

VAr: choose the variable to be associated to the alarm activation by means of the ▼ and ▲ keys and confirm with S (see also the table on page 23);

Set-on: on-alarm set-point, it's the 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: off-alarm set-point, it's the 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.

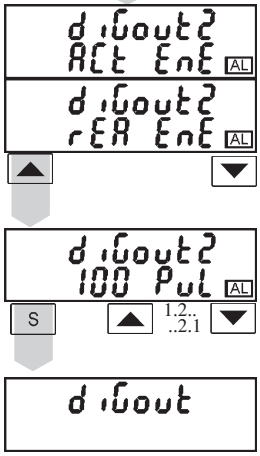
nE: normally energized output when there is no alarm.

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

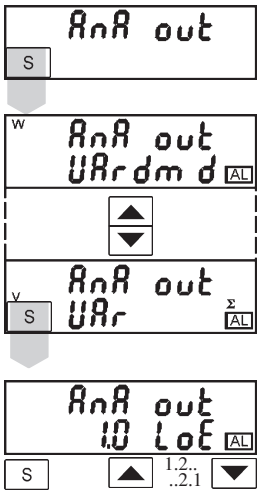
From digital output 1, rEn,PuL,SEC page 12

❑ *Digital output 2*

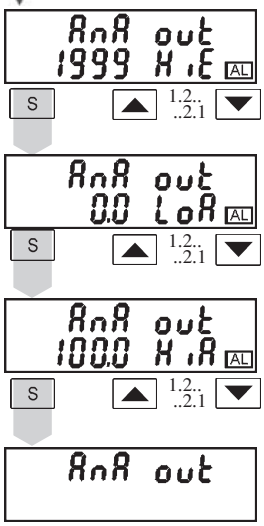


ACt EnE: enables the retransmission of the active energy by means of pulses; confirm with [S] and afterwards set the number of pulses (see table on page 21) by means of the [▼] and [▲] keys and confirm the value with [S];
rEA EnE: enable the retransmission by means of pulses of the reactive energy, confirm it with [S] and then set the number of pulses (see table on page 21) by means of the [▼] and [▲] keys and confirm the value with [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 23) 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

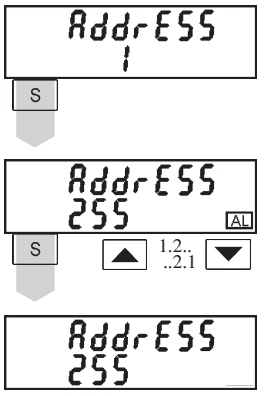


input range. Select the desired value by means of the ▼ and ▲ keys and confirm it with S .

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 S.

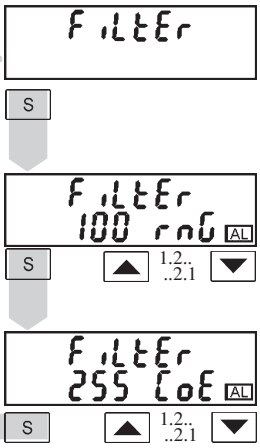
HiA: % value of the full scale of the output range (0-20mA, 0-10V) that is generated by the maximum measured value (HiE).

Select the desired value by means of the ▼ and ▲ keys and confirm it with S. **See also "Example 1" in useful information on page 19.**



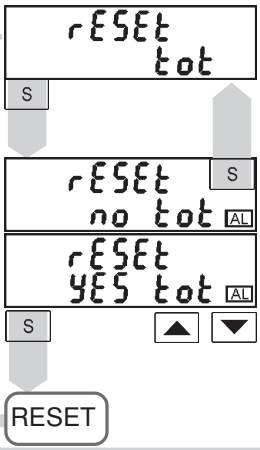
■ *RS422/485 Serial port address*

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



■ *Digital Filter*

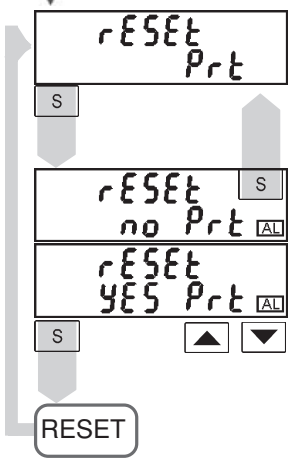
Select “FiLtEr” by means of the ▼ and ▲ keys: to enter the menu press S. Select the parameters to be set with the ▼ and ▲ keys, to enter the menu press S.
There are two parameters:
- rnG, to set the operating range of the digital filter. The value is expressed as % of the full scale value: set the desired 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 20.**



■ *Reset of Total meters*

Select “rESEt tot” from the main menu by means of the ▲ and ▼ keys, confirm with S: when the instrument asks for the reset, you can choose, by means of the ▲ and ▼ keys:
- “no tot” to avoid the reset or
- “YES tot” to confirm it.

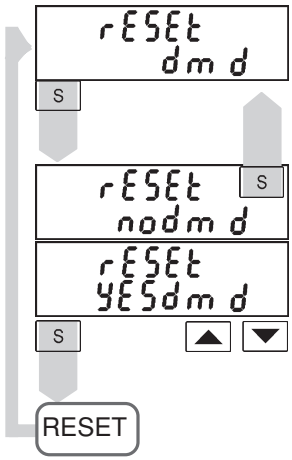
Then, press S to carry out the command.



■ *Reset of partial meters*

Select “rESEt Prt” from the main menu by means of the ▲ and ▼ keys, confirm with S; when the instrument asks for the reset, you can choose, by means of the ▲ and ▼ keys:
- “no Prt” to avoid the reset or
- “YES Prt” to confirm it;

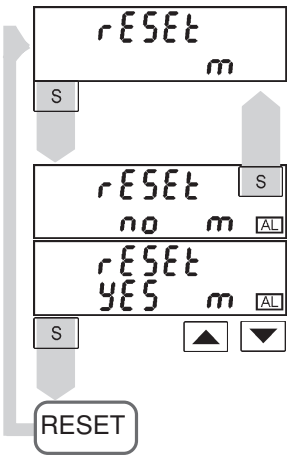
Then, press S to carry out the command.



■ *Only in the 5(10)A version*
Reset of the maximum values of the dmd powers

Select “rESEt dmd” from the main menu by means of the ▲ and ▼ keys, confirm with S; when the instrument asks for the reset, you can choose, by means of the ▲ and ▼ keys:
- “no dmd” to avoid the reset or
- “YES dmd” to confirm it;

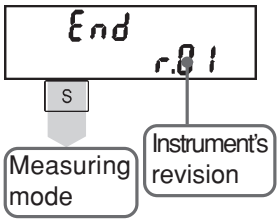
Then, press S to carry out the command.



■ *Only in the version 20(90)A. Reset of the maximum current values*

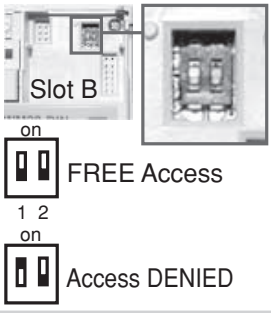
Select “rESEt m” from the main menu by means of the ▲ and ▼ keys, confirm it with S; when the instrument asks for the reset, you can choose, by means of the ▲ and ▼ keys:
- “no m” to avoid the reset or “YES m” to confirm it

Then, press S to carry out the command.



■ *End of programming*

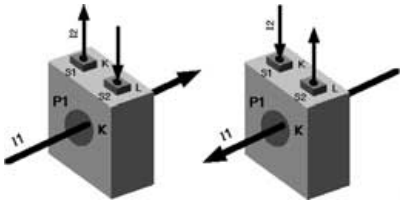
Use it to exit from programming and go back to the measuring mode. Select “End” from the main menu by means of the ▲ and ▼ keys, confirm it with S.



■ *How to prevent the programming by key-pad*

It’s possible to prevent access to programming by modifying the dip-switch under slot B. Set dip-switch 1 in position ON to inhibit programming; Set dip-switch 1 in position OFF to enable programming again.

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 AO2920 (from 0 to 20mA), the instrument must be set as follows:

- **VAr**: (variable), WΣ (system active power)
- **LoE**: (minimum electrical scale) 0.0 K; the K and M multiples 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 = (4mA/ 20mA)*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 = (20mA/20mA)*100 =100%

Example 2 "Use of digital filter": it's necessary to stabilize the displayed value of the V_{L1-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 ±1.3% of the variable's rated value, calculated as follows:
  (228-222)/2=±3V, then *±3*100/231V*=±**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.

■ *CT and VT programming; Open collector Pulse Digital Output Table*

The CT is programmable from 1 to 5000, the VT is programmable from 1.0 to 199.9 and from 200 to 1999 (CT*VT ratio limited to 5000). The CT must be programmed before the VT because the programming of VT depends on the CT value: if the CT is modified, then the VT value can automatically satisfy the expression: CT*VT≤5000. If the CT or VT values are modified, then the display resolution of the variables and of the "pul" (pulses) parameter changes automatically according to the table on the following page.
When the CT or VT value is modified, then the energy meters

are reset (after an alert message for confirmation). The resolution of the energy meters is 0.1k (Wh/varh) with maximum indication 19999999k (display from 0.0k to 1999999.9k and from 2000000k to 19999999k). Once the limit of 19999999k is reached, the meters are automatically reset.

WM22 version 5(10) A				
CT ratio* VT ratio		Range (pulses / kWh / kvarh)		
From	To	From	To	
1.0	5.0	1	100	Pulses/kWh/kvarh
5.1	50.0	0.1	10.0	Pulses/kWh/kvarh
50.1	500.0	0.01	1.00	Pulses/kWh/kvarh
500.1	5000.0	1	100	Pulses/kWh/kvarh
WM22 version 20(90)A excluded version 660VAC				
CT ratio * VT ratio		Range (pulses/ kWh/ kvarh)		
From	To	From	To	
1.0	5.0	1	100	Pulses/kWh/kvarh
WM22 version 20(90)A only version 660VAC				
CT ratio * VT ratio		Range (pulses / kWh/ kvarh)		
From	To	From	To	
5.1	50.0	0.1	10.0	Pulses/kWh/kvarh

■ *The "Err" message in the currents page*

The instrument takes the measure only for quadrants 1 and 4 (consumed energy). The active energy is obtained by integrating only the sum of the active powers phase on quadrants 1 and 4. Any active powers in quadrants 2 and 3 are forced to zero and the message "Err" is displayed on the current page to indicate a wrong connection. For the phases with active power in quadrants 2 and 3 also the reactive and the apparent powers are forced to zero. The single phase "var" indication is

always without sign. The “L” or “C” type are displayed with the PF phase variables. The total system “var’s” are obtained by summing algebraically the single phase “var’s” (“L” type “var’s” are considered positive, “C” type “var’s” are considered negative). The system’s PF shows the “L” or “C” sign depending on the result of the algebraic sum of the single phase “var’s”.

■ *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:

$$ASY = \frac{Vmax - Vmin}{Vavg} * 100$$

Where: Vmax is the max. value among VL1-N, VL2-N, VL3-N
Vmin is the min. value among VL1-N, VL2-N, VL3-N
Vavg is the average: (VL1-N, VL2-N, VL3-N)/3

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

■ *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 OFF	UP
ON < OFF	DOWN

List of the variables

Variables that can be retransmitted by means of an analogue output or controlled by means of an alarm output.

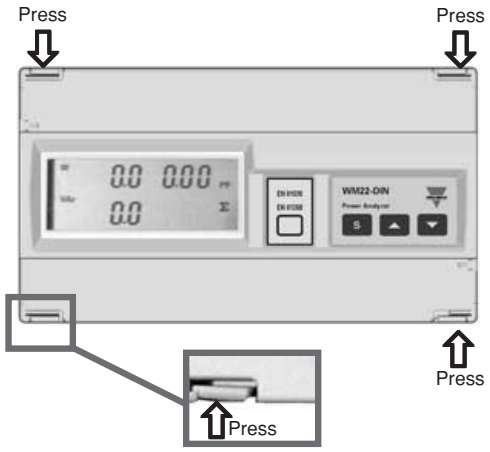
W dmd	Active power demand
VA dmd	Apparent power demand
V Σ	System voltage
PF Σ	System power factor
V tHd	Voltage total harmonic distortion
A tHd	Current total harmonic distortion
ASY	Asymmetry
W Σ	System active power
VA Σ	System apparent power
VAr Σ	System reactive power

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 mounted.

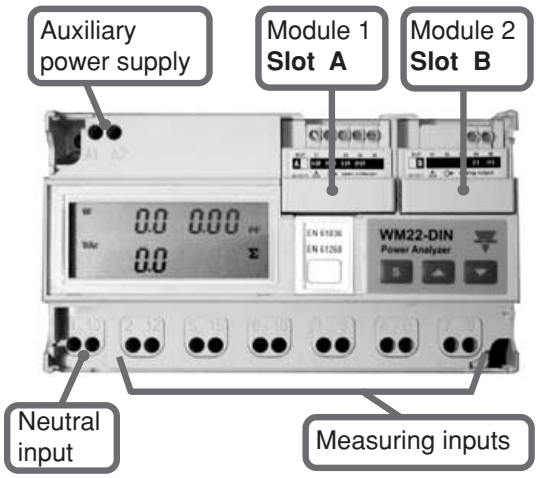
IT IS IMPORTANT that the instrument is switched off when you plug-in or disconnect the modules.

For SAFETY reasons, in the 20 (90)A version, the tightening torque value of the current terminals must be within 2Nm and 6Nm.

■ How to remove the front cover



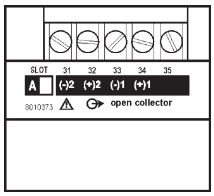
To remove the front cover of WM22, press contemporaneously the four release levers at the four angles of the instrument as shown above.



■ The possible module combinations

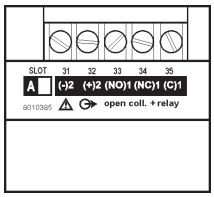
MODULE DESCRIPTION	SELF-SUPPLIED	AUXILIARY POWER SUPPLY	
	A	A	B
AO2900 open collector output (pulse, alarm or remote)	✓	✓	
AO2910 relay output + open coll. output	✓	✓	
AO2920 / AO2921 analogue output			✓
RS422/485 AR 2950 serial port			✓

AO 2900



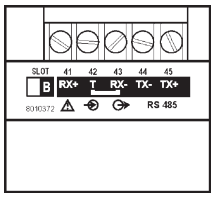
OPEN COLLECTOR OUTPUT

AO 2910

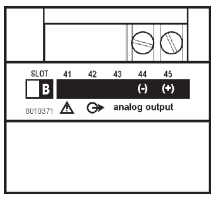


RELAY OUTPUT + OPEN COLLECTOR OUTPUT

NOTE: during programming, output 1 is connected to «diGout 1» (digital output 1) and output 2 is connected to «diGout 2» (digital output 2).

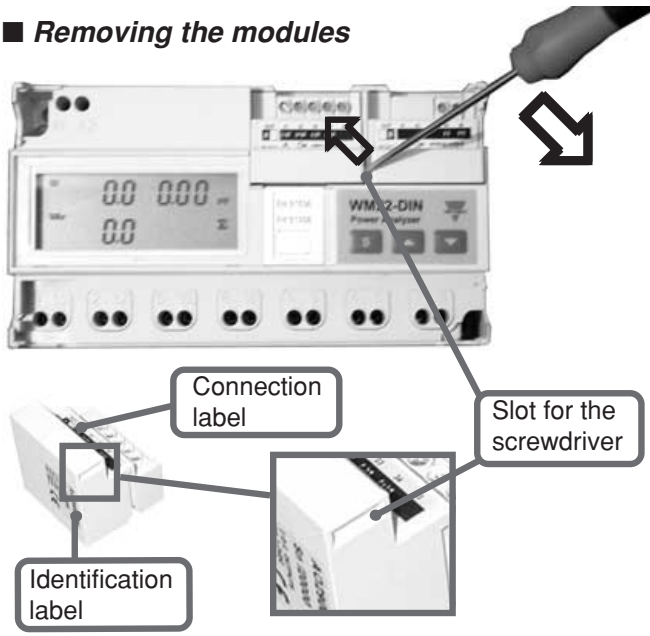


RS422/ 485 SERIAL PORT AR 2950

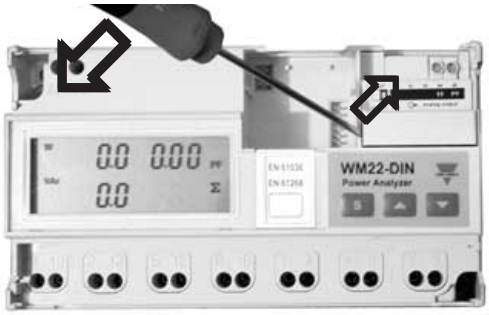


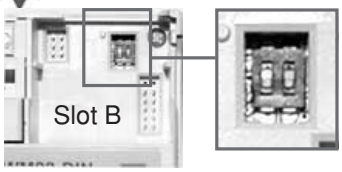
ANALOGUE OUTPUT
AO 2920: 0-20 mA
AO 2921: 0-10 VDC

■ *Removing the modules*



To remove the modules, use a screwdriver. Insert the screwdriver in the slot on the side of the removable modules, as indicated in the figure above. Use the screwdriver as a lever to take out the module. For the second module follow the same procedure.





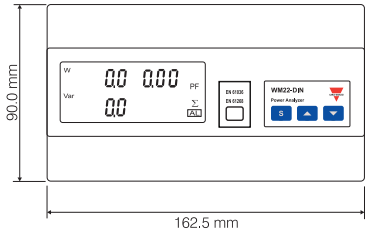
Access to programming: ALLOWED.

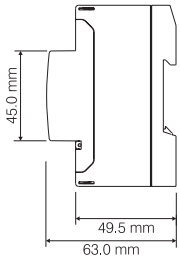
Access to programming: DENIED.

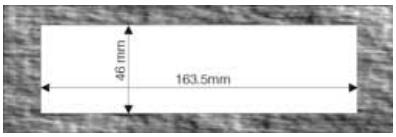
To configure the instrument correctly, it is important to verify that dip-switch 1 is in position OFF.

WARNING: DANGEROUS VOLTAGES.
The connectors in the optional slots and the screws of the terminals are live if the instrument or the connected load are powered on.

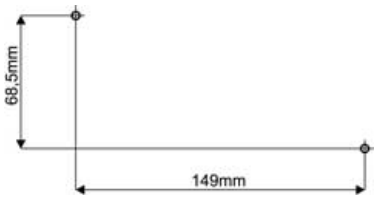
■ *Dimensions and panel cut-out*





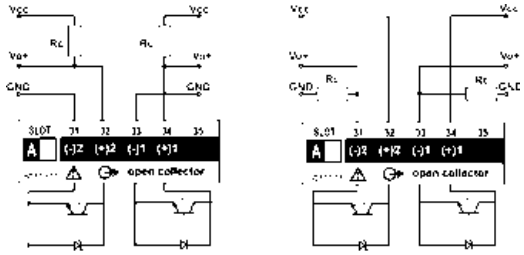


Dimensions for panel-cut-out

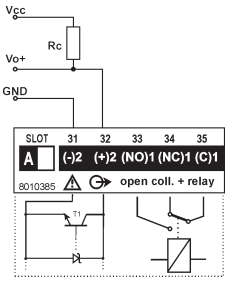


Hole distances dimensions for panel mounting

■ *Open collector output connections*



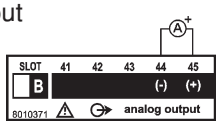
The grounds of the open collector outputs are separate, so that it's possible to carry out two different connections for the same module. The load resistance (Rc) must have a value that makes the short-circuit current lower than 100mA, the VDC voltage must be lower than or equal to 30V.



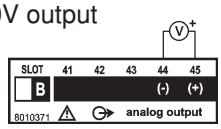
Module AO2910

■ *Analogue output connections*

0-20mA output

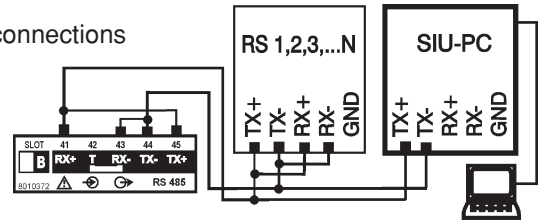


0-10V output

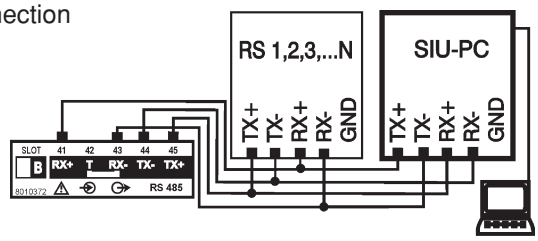


■ *RS422/ 485 Serial port connections*

2-wire connections



4-wire connection



The termination of the serial port is carried out only on the last instrument of the network, by means of a jumper connection between (RX-) and (T).

■ *Electrical diagrams - 90 A version*

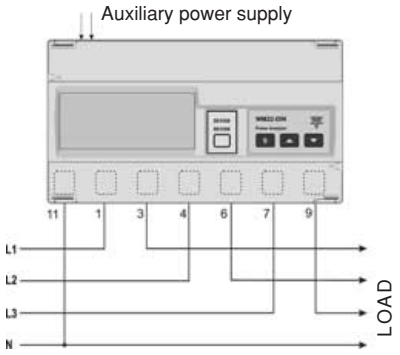


Fig.1: Direct connection with neutral (3-phase system).
Unbalanced load.

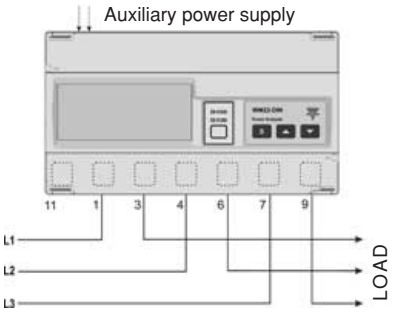


Fig.2: Direct connection without neutral (3-phase system).
Unbalanced load.

Self power-supply

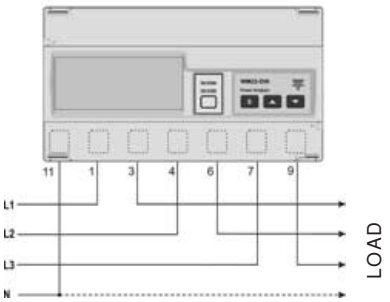


Fig.3: direct connection with/without neutral.
Unbalanced load.
Note: the neutral in the self-supplied version must always be connected to the instrument.

■ 5 A Version Electrical Diagrams

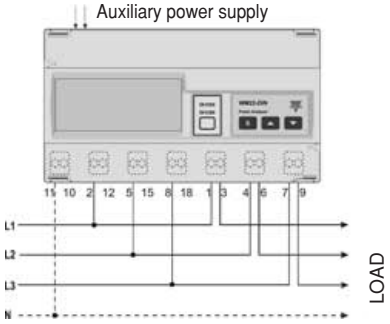


Fig.4: 3-phase direct connection with/without neutral.
Unbalanced load.

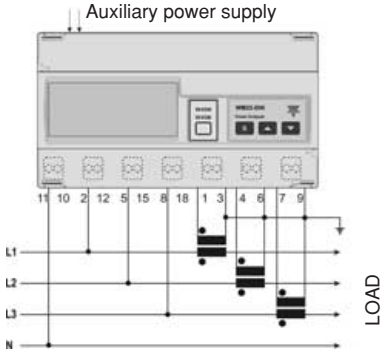


Fig.5: 3-phase CT connection with neutral
Unbalanced load.

In the **DUAL PHASE SYSTEMS** both the voltage inputs and the current inputs of phase 1 and 2 must be connected and the system parameter must be programmed like “3P.n”. Phase 3 must not be connected.
The parameters of phase 3 are displayed at 0, the system voltage variable and the asymmetry control are not correct.

■ *5 A Version Electrical Diagrams*

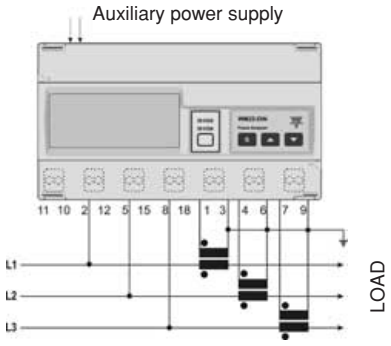


Fig.6: 3-phase CT connection without neutral. Unbalanced load.

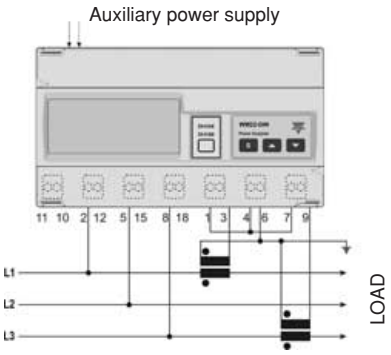


Fig.7: 3-phase ARON CT connection without neutral. Unbalanced load.

■ 5A Version Electrical Diagrams

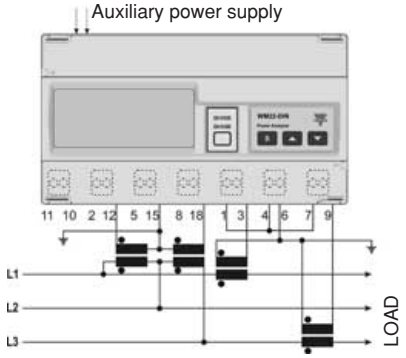


Fig. 8: ARON CT and VT connection without neutral (3-phase system).
Unbalanced load.

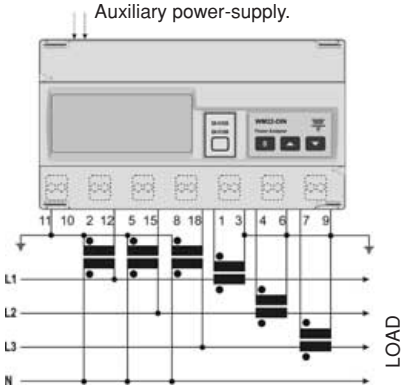


Fig.9: CT and VT connection with neutral (3-phase systems).
Unbalanced load.

■ 5 A Version Electrical Diagrams

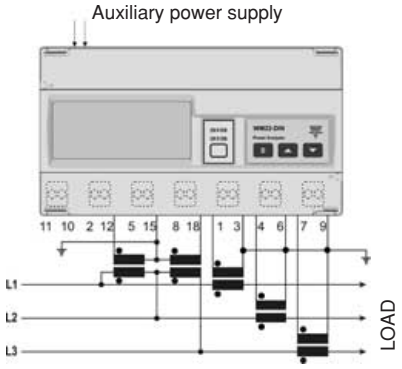


Fig.10: CT and VT connection without neutral (3-phase system). Unbalanced load.

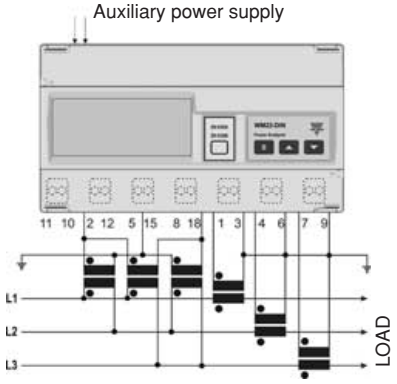


Fig.11: CT and VT connection without neutral (3-phase system). Unbalanced load.

Number of inputs

Current: 3

Voltage: 4

Accuracy

Display, RS422/485 Ib: 5A, Imax: 10A; Ib: 20A, Imax: 90A.
Current: from 0.003Ib to 0.2Ib: ±(0.5%RDG +3DGT); from 0.2Ib to Imax: ±(0.5% RDG +1DGT).
Voltage: in the range Un: ±(0.5% RDG +1DGT).
Frequency: ±0.1% RDG (50 to 60 Hz).
Active power (@ 25°C ± 5°C, R.H. ≤ 90%): ±1% RDG ±1DGT (PF 1, 0.1 Ib to Imax, in the range Un; PF 0.5L, PF 0.8C, 0.2Ib to Imax, in the range Un).
Reactive power (@ 25°C ± 5°C, R.H. ≤ 90%): ±2% RDG ±1DGT (senφ 1, 0.05Ib to Imax, in the range Un; senφ 0.5L, senφ 0.5C, 0.1Ib to Imax, in the range Un).
Apparent power (@ 25°C ± 5°C, R.H. ≤ 90%): ±1%RDG ±1dgt (PF 1, 0.1Ib to Imax, in the range Un).
Energies (@ 25°C ± 5°C, R.H. ≤ 90%): Class 1 according to EN61036, class 2 according to EN61268.
Measuring inputs: Ib: 5A, Imax: 10A; 0.1Ib: 500mA; start-up current: 20mA Un: see “Rated input ” page 36.
Ib: 20A, Imax: 90A; 0.1Ib: 2A; start-up current: 80mA; Un: see “Rated input voltages” page 36.
Harmonic distortion: ±3% F.S. (F.S.: 100%); (@ 25°C ±5°C, H.R. ≤ 90%) up to the 7th harmonic; Un: see “Rated input voltages” page 36; Ib 5A, Imin: 500mA, Imax: 15Ap; Ib 20A, Imin: 2A, Imax: 127Ap.

Additional errors

According to EN61036, EN61268
Wave form: <1% (3rd harmonic: 10%).
Voltage asymmetry: < 0.5% (with reference to Un).
Magnetic induction: 0 (up to 0.5 mT).

HF electromagnetic fields: < 1%
Influence of accessories: 0

■ *Temperature drift*

≤ 200ppm/°C

■ *Sampling*

1000 samples/s at 50Hz

■ *Display*

Type: Back-lighted LCD.
Display of instantaneous variables: 4x3 1/2 DGT.

Energies : Totals: 1x7 1/2 DGT; Partials: 1x7 1/2 DGT.

■ *Maximum and minimum indication*

Max. 1999 (19999999), Min. 0.

■ *Measurements*

Current, voltage, power, energy, power factor, frequency, harmonic distortion (see display specifications).
TRMS measurement of distorted wave forms.
Coupling: direct.

■ *Crest factor*

Ib 5A : ≤3 (15A peak max.).
Ib 20A: ≤6 (127A peak max).

■ *Current overload*

5(10) A, for 10ms:	300 A max, at 50Hz
5(10) A, for 500ms:	200 A max, at 50Hz
5(10) A, permanent:	10A, at 50Hz
20(90) A, for 10ms:	2700A max, at 50Hz
20(90) A, permanent:	90A, at 50Hz

■ *Voltage overload*

Permanent: 1.2 Un.
For 1s: 2 Un.

Rated input voltages (Un)/range

AV0-AV4: 208V_{L-L} / -20% ≤ Un ≤ + 20%
AV8: 208V_{L-L} / -20% ≤ Un ≤ + 15%
AV1-AV5-AV9: 400V_{L-L} / -20% ≤ Un ≤ + 15%
AV3-AV7: 660V_{L-L} / -30% ≤ Un ≤ + 15%
AV6: 100V_{L-L} / -20% ≤ Un ≤ + 20%

Input impedance

AV1-AV5-AV9: 400V_{L-L}	> 720kΩ
AV0-AV4-AV8: 208V_{L-L}	> 720kΩ
AV3-AV7: 660V_{L-L}	> 1.97MΩ
AV6: 100V_{L-L}	> 400kΩ
AV4-AV5-AV6-AV7: 5(10) A	< 0.3VA
AV0-AV1-AV3-AV8-AV9: 20(90) A	< 4VA

Frequency

50 to 60 Hz

Harmonic analysis

Algorithm: FFT
Harmonic order: current: up to the 7th harmonic;
voltage: up to the 7th harmonic.
Harmonic distortion: THD (V_{L1}), THD (V_{L2}), THD (V_{L3}), THD (A_{L1}) , THD (A_{L2}), THD (A_{L3}).
Display: THD %
System: the harmonic distortion can be measured both on 3-wire systems and on 4-wire systems.

Output modules technical features

Analogue outputs (on request).
Number of outputs: 1.
0 to 20 mADC: (module AO2920 slot B, only for versions with auxiliary power supply).
0 to 10VDC: (module AO2921 slot B, only for versions with auxiliary power supply).
Accuracy: ±0.5% F.S.
Temperature drift: < 300 ppm/ °C

Scaling factor: programmable within the whole retransmission range; it allows the retransmission of all the values within: 0 and 20 mADC, 0 and 10 VDC.
Response time: system variables V, W, VA, var, cosφ
FFT off, filter off: 900ms; FFT on, filter on: 1.4s;
variables THD-V, THD-A Filter off: 3s;
Ripple: ≤ 1% acc. to IEC 60688-1, EN 60688-1.
Load: 20 mADC: ≤ 500 Ohm; 10 VDC: ≥ 10 kOhm.
Insulation: by means of optocouplers, 2000 Vrms between output and measuring input, 2000 Vrms between output and power supply input.

RS422/RS485 (on request).
Module AR2950.
Type: Bidirectional multidrop (static and dynamic variables).
Connections: 2 or 4 wires, max. distance 1200m, termination directly on the instrument.
Addresses: 255, key-pad selectable.
Protocol: MODBUS/JBUS.
Data (bidirectional): dynamic (reading only); system and phase variable: see "display" on page 39.
Static (writing only): all the configuration parameters, energy reset, activation of static output; energy storing (EEPROM) max. 19.999.999kWh/kvarh.
Data format: 1 start bit; 8 data bit; no parity, 1 stop bit.
Baud-rate: 9600 bit/s.
Insulation: by means of optocouplers, 2000 Vrms between output and measuring inputs, 2000 Vrms between output and power supply input.

Digital outputs (on request).
Module AO2900.
Digital outputs can be used as alarm, for energy retransmission or remote static outputs.
Three operating modes are selectable:
- dual pulse output (kWh and kvarh);

- one alarm output and one pulse output (kWh or kvarh)
- one output remotely controlled by means of the serial communication and one pulse output (kWh or kvarh)

Pulse outputs: number of outputs: 2; number of pulses from 0.01 to 100 pulses programmable depending on the selected CT and VT ratio.
Type: open collector (NPN transistor); V_{ON} 1.2 VDC max. 100mA; V_{OFF} 30 VDC max.
Pulse duration: 220 ms (ON); ≥ 220 ms (OFF), according to DIN43864.
Insulation: by means of optocouplers, 2000Vrms between outputs and measuring input, 2000 Vrms between output and power supply input; insulation between the two outputs: functional.
Alarm output
Number of outputs: 1
Alarm type: up or down, phase asymmetry, phase loss.
Set-point: can be modified from 0 to 100% of the electrical scale.
Hysteresis: can be modified from 0 to 100% of the electrical scale.
Activation time delay: programmable from 0 to 255 sec.
Response time: system variables V, W, VA, var, cosφ (PF), FFT off, filter off: 700ms; FFT on, filter on: 1.2s;THD-V, THD-A variables, Filter off: 3s;
Type: open collector (NPN transistor); V_{ON} 1.2 VDC / max. 100 mA; V_{OFF} 30 VDC max. Relay (AO2910) AC1, AC15: 1AAC @ 250VAC
Insulation: by means of optocouplers, 2000 Vrms
between output and measuring input, 2000 Vrms between output and power supply input; insulation between the two outputs: functional. Only AO2910: 2000 Vrms.

■ *Software functions*

Password: numerical code of max 3 digits; 2 protection levels of the programming data: 1st level:
Password = “0”, no protection; 2nd level: Password from 1 to 1000, all data are protected.

System selection: three-phase with neutral, three-phase without neutral.
Transformer ratio: CT from 1 to 5000; VT from 1.0 to 199.9 and from 200 to 1999.
Scaling factor. Operating mode: compression/expansion of the measuring range that can be connected to the analogue output; measuring range: programmable within the whole electrical range.
Filter. Operating range: from 0 to 99.9% of the input electrical scale; filtering coefficient: from 1 to 16; filter action: alarm, analogue and serial output (fundamental variables: V, A, W and derived variables).
Display: up to 4 variables/page.

System variables	Page 1: W-var-PF (cosφ)
	Page 2: W med - VA med - Hz
Single phase variables	Page 3: THD-V
	Page 4: THD-A
System variables	Page 5: kWh total
	Page 6: kvarh total
	Page 7: kWh partial
	Page 8: kvarh partial
Single phase variables	Page 9: V_{L-N}
	Page 10: A
20(90) A	Page 11a: A_{MAX}
5(10) A	Page 11b: $W_{dmd\ MAX}$ $VA_{dmd\ MAX}$
	Page 12: W
	Page 13: VA
	Page 14: var
	Page 15: PF (cosφ)

■ *Power supply features*

Self-supplied version: 400V_{L-L} -20% +15%, 50-60Hz; 208V_{L-L} -20% +15% , 50-60Hz.
Auxiliary power supply: 230V -15 +10%, 50-60Hz; 115V -15 +10%, 50-60Hz; 48VAC -15 +10%, 50-60Hz; 24VAC -15 +10%, 50-60Hz.
Energy consumption: ≤ 7VA.

40 Technical features

■ *General features*

Operating temperature: 0 to +55°C (R.H. < 90% non condensing at 40°C).
Storage temperature: -20 to +60°C (R.H. < 90% non condensing at 40°C).
Installation category: Cat. III (IEC 664).
Insulation: 2000 Vrms between inputs/outputs and earth.
Dielectric strength: 4000 Vrms for 1 minute.
Rejection: CMRR 100 dB, 48 to 62 Hz.
EMC: burst: 4kV/level 4 (EN61000-4-4); radiated electromagnetic fields: 10V/m 26-1000MHz (EN61000-4-3); electrostatic discharges: 15kV (EN61000-4-2); radio frequency emissions according to the limits of CISPR 14 and CISPR 22; pulse voltage (1.2/50µs): 8kV (EN61000-4-5).
Standards: safety IEC60664-1; energy metrology measurement: EN61036, EN61268; pulse output: DIN43864.
Approvals: CE.
Connections 5 (10) A: screw-type, max. cable cross sectional area 4 mm^2.
Connections 20 (90) A: screw-type, min./max cable cross sectional area 6 mm^2 / 35 mm^2; min./max. tightening torque (90A inputs) from 2 Nm to 6 Nm.
Housing
Dimensions 162.5 x 90 x 63 mm.
Material: ABS, NORYL, PC self-extinguishing: UL 94 V-0.
Mounting: DIN-rail and wall mounting.

Protection degree:	front: IP40;
	connections: IP20;
Weight:	800 g approx. (packing included).

Note: *the pictures in this manual show a WM22-DIN, version 5(10)A.*