CARLO GAVAZZI

WM3-96

32bit μ-Processor based power quality analyser with modular housing for Plug and Play modules

FW rev. 12

Instruction manual: INDEX

How to use the symbols 4

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 starts.

This symbol indicates a particularly important subject or information.

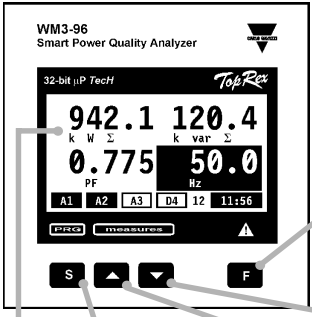
This symbol indicates that more details are given on the current subject.

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.

■ *Main programming parameters*

- Programming of the password
- Selection of the electrical system
- Programming of the CT ratio (up to 30,000 A)
- Programming of the VT ratio (up to 600kV)
- Selection of the variables for the MIN / MAX detection
- Programming of the calculation of the integration time period
- Tariff management
- Harmonic analysis enabling
- Clock adjustment (if present)
- Programming of the pulse output (if present)
- Programming of the serial and analogue outputs (if present)
- Programming of the digital filter.

Front panel description



Exit from the menu and cancel the choice you have made.
It allows you to access some functions relating to the displayed variables.

Scroll to the previous page.

Scroll to the next page.

Access to programming or settings' confirmation.

Alphanumeric indication by means of a 7-segment graphic LCD (128 x 64 dpi):
- of the programming parameters;
- of the measured variables;
- Total number of energy meters: 4 (9 digits); partial number of energy meters: 48 (6 digits);
- time periods: 4 programmable within 24 hours
- Programmable seasons: 3 within 12 months

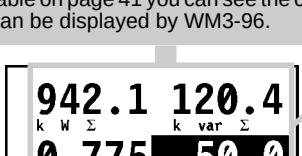
Display contrast adjustment

In order to get the best readability of the display, hold the keys ▲ and ▼ pressed simultaneously, until the desired readability is reached; the adjustment is cyclical.

The contrast can be adjusted only during the measuring phase (from page 00 to page 27).

Page “00”, Starting page

When the instrument is switched on, the main page of variable displaying is shown. This first page, called page "00", is the only one configurable by the user who can choose the variables to be displayed in the 4 displaying areas. In all the other pages (up to 27 depending on the instrument configuration), the type of variables displayed in the four displaying areas is automatically selected and cannot be changed. In the table on page 41 you can see the contents of all the pages that can be displayed by WM3-96.



The bottom part of the display, where the status of the digital outputs is indicated, is common to all the pages. If the outputs are not present, only an empty black rectangular frame is shown; if the outputs are present, the display will show a letter followed by a number. Four different letters may appear:

"P" Indicates a pulse output.

"A" Indicates an alarm output. In this case the letter can be white in a black background to indicate that the output is in alarm, or black in a white background to indicate that the output is not in alarm.

"D" Indicates a diagnostic output. This is a particular type of alarm that is activated when the neutral wire connection is missing. The alarm is active when the background is black, while the alarm is not active when the background is white.

"R" Remote control is activated (see Remote Control on page 34).

The number that follows the letter is the progressive number of the output (from 1 to 4).

8 Displaying of the variables

How to scroll the various pages

To scroll the various pages, use the ▲ and ▼ keys.

Pressing the S key in any one of the display pages, you access to the programming phase. The F key, on the contrary, has various functions depending on the selected page.

How the F key changes function depending on the display page

❑ *Pages from "00" to "13" (04 in single phase mode) Displaying of the variables*

F key enabled if the alarm latch function is activated, access to the reset of the latch alarms.

To reset the latch alarm press the F key; after that a message will appear "WILL YOU RESET THE LATCH ALARMS?": if you choose S you will enable the reset procedure, if you choose F there won't be any reset. The reset of the latch alarm is only available if the alarm event is finished.

❑ *Pages from "14" to "18" (from 05 to 09 in single phase mode). Displaying of the MIN and MAX values*

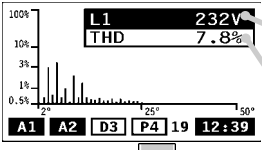
The F key is active, that means that you have access to the reset function of the "MIN" and "MAX" values. To reset the "MIN/MAX" recording, proceed as follows: enter the function by pressing the F key, after that a message will appear: "WILL YOU RESET MIN/MAX VALUES, WILL YOU CONTINUE?" If you choose S there won't be any reset, if you choose F the reset will not be made. The ▲ (moves from left to right) and ▼ (moves from right to left) keys allow you to select the value that you want to reset; to confirm the reset press the S key. To exit the function press the F key again.

❑ *Pages from "19" to "24" (10 to 11 in single phase mode)*

Displaying of the harmonic analysis

When the instrument is supplied, these pages are not enabled, see page 29 to enable them. The [F] key is active, access to the detailed analysis of the harmonics. After pressing the [F] key, a pointer appears along the horizontal axis (see figures below). To display the data relating to the single harmonics move along the histogram using the [▲] (moves from left to right) and [▼] (moves from right to left) keys. For each harmonic the instrument measures the % value with reference to the fundamental and the single harmonic angle between the "V" harmonic and the "A" harmonic of the same order.

SIMPLE ANALYSIS:

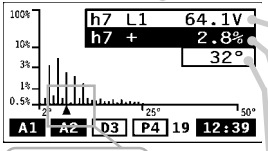


Line phase being measured (L1-L2-L3) and relevant voltage or current value

Total harmonic distortion and relevant value in percentage

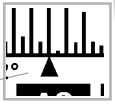
F

DETAILED ANALYSIS:



Harmonic order (h1 to h50) of the phase being measured (L1-L2-L3) and relevant absolute current or voltage value of the harmonic.

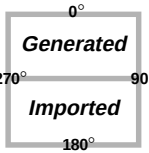
The pointer shows which harmonic is being measured



Harmonic order (from h1 to h50), relevant conventional sign (– or +) and value of the harmonic given in percentage.

Phase angle between the voltage and current harmonic of the same order: a phase angle between 0° and 90° and between 270° and 360° corresponds to a generated harmonic; an angle between 90° and 180° and between 180° and 270° corresponds to an imported harmonic.

Harmonics:



This angle is displayed only if the measurements are taken in a three-phase system with neutral.

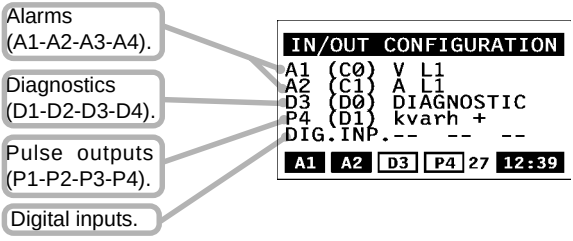
- *Pages relating to the energy meters*
- *Page "25" (12 in single phase mode)*
  Displaying of the total energy meters
  [F] key disabled.
- *Page "26" (13 in single phase mode)*
  Displaying of partial energies
  [F] key is active; modification of tariff/displayed period. By pressing the [F] key for the first time, the range relating to the season is highlighted. By using the [▲] and [▼] keys, it's possible to change the season displayed in that page. Pressing the [F] key another time, the range relating to the period is highlighted. Using the [▲] and [▼] keys, it's possible to change the tariff period within the displayed season. Pressing the [F] key for the third time, you go back to the measuring page. The changes of season and tariff period only refer to the displaying of the values stored in the corresponding season and period.

The changes carried out in this page do not have any influence on the method of tariff management of the instrument; they are only valid for display purposes.

❑ *Page "27" (14 in single phase mode)*

Displaying of instrument configuration

F key disabled. Page 27 shows the configuration of the main input (IN) and output (OUT) modules.



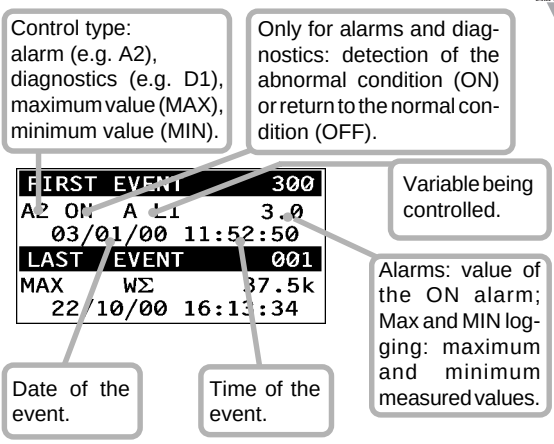
The letters and numbers between parenthesis are referred to the relevant slot, while the text on their right shows the variable referred to the output. With reference to the digital inputs (DIG.INP.), the ON/OFF status of each one of them is shown.

❑ *Displaying with access to the Pass Code*

❑ *Pass "1000": displaying of recorded events*

(Only if the RS232+RTC module is present)

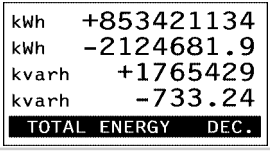
Press the S key: when the instrument asks you for the pass code PASS ? 0, set the value "1000"; if the RS232+RTC module is present, the instrument shows you the page where the events are displayed and where the instrument stores, in a chronological order, the alarms that have occurred until that moment. To go back to the variable page press the F key. The **last** event has always the number 1 while the number corresponding to the **first** event varies, depending on the number of events that have been previously stored. The figure on the following page explains you the meaning of the displayed information.



To reset all the events press the [S] key, to continue the reset procedure press the [S] key: to exit from the reset procedure press the [F] key.

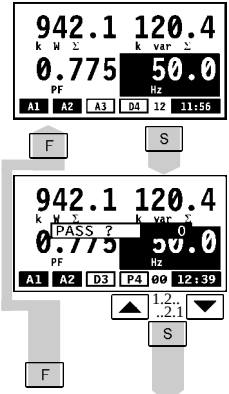
❑ *Pass "999": energy consumption storage (Only if the RS232+RTC module is present)*

The RS232+RTC module allows also the storage of the energy consumption of the previous two months. To enter this function, press the [S] key: when the instrument asks for the pass code [PASS ? 0], set the value "999": the instrument shows you the page where all the information are stored.



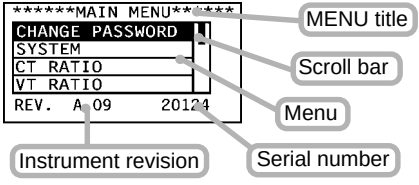
Use the ▲ and ▼ keys to show the partial values, to exit press the F key.

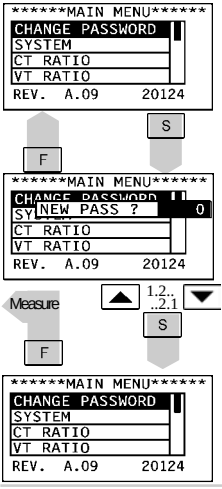
It is very important to verify that, every time the configuration of the instrument (modules and/or associated variables, electrical systems, etc.) changes, the setting of the parameters is according to the new configuration.



Access to the main menu

Press the S key to access to the programming menus from the measuring and displaying phase; when the instrument asks for it, enter the correct password value by means of the ▲ and ▼ keys; then confirm it pressing the S key again. If the password is correct (the default password is 0) you are allowed to access to the main menu of the programming phase. To reset your choice and go back to the measuring mode, press F.



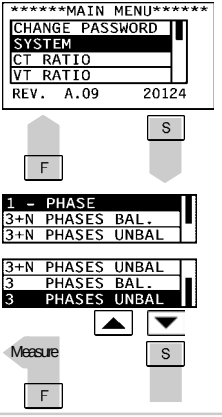


■ *Changing the password*

This function allows you to choose the desired password value (from 0 to 500).

Press the [S] key and when the new password value is required, enter the desired value by means of the [▼] and [▲] keys.

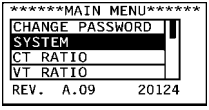
The instrument goes back to the main menu, as shown on the figure on the left. To reset your choices and go back to the main menu press [F].



■ *System*

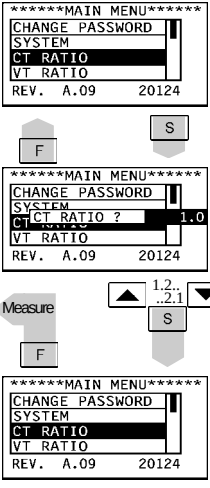
This function allows the user to select the type of electrical system by choosing among single phase (1-phase), balanced three-phase plus neutral (3+N phases bal.), unbalanced three-phase plus neutral (3+N phases unbal), three-phase balanced (3 phases bal) and three-phase unbalanced (3 phases unbal).

Choose the SYSTEM function by means of the [▼] and [▲] keys, press [S] to confirm; then select the desired system by means of the [▼] and [▲] keys and confirm with [S].



To reset the choice and go back to the main menu, press the F key.

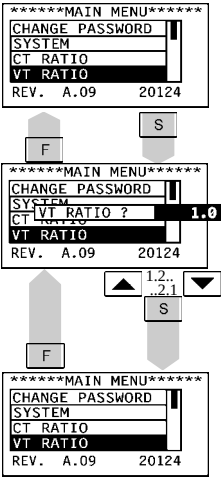
Changing the type of system, all the MIN/MAX values, the events and the partial energy meters are reset.



■ *CT ratio*

This function allows you to select the value of the CT ratio. Example: if the primary of the CT (current transformer) being connected is 300A and the secondary is 5A, the CT ratio corresponds to 60 (obtained from the calculation: 300/5). Choose the function CT RATIO by means of the ▼ and ▲ keys; press S to confirm, then select the desired value by means of the ▼ and ▲ keys and confirm with S. To reset the choice and go back to the main menu, press F.

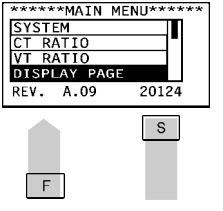
Note that when the CT ratio is changed all the MIN/MAX values, the events and the partial energy meters are reset.



■ *VT ratio*

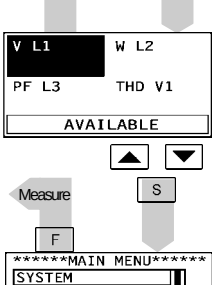
This function allows the user to select the multiplier value of the VT. Example: if the primary of the VT (voltage transformer) being connected is 20kV and the secondary is 100V, the VT ratio will be 200 (given by 20000/100). If there is no VT, the ratio will be "1.0".
Choose the function VT RATIO by means of [▼] and [▲]; to confirm press [S]; then select the desired value by the [▼] and [▲] keys and confirm with [S]. To reset your choice and go back to the main menu, press [F].

Changing the VT ratio, all the MIN/MAX values, all events and partial energy meters are reset.

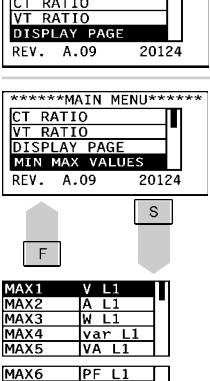


■ *Display page*

This function allows you to select the variables to be displayed on page 00. Choose the DISPLAY PAGE function by means of the [▼] and [▲] keys; press [S] to confirm, then select the desired section of the display using the [▼] and [▲] keys;

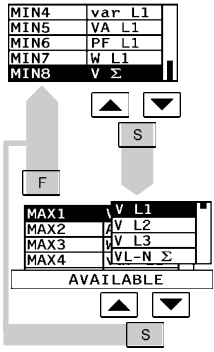


Press [S] ; select the variable to be displayed by means of the [▼] and [▲] keys and confirm it with [S]. To reset your choices and go back to the main menu press [F].



■ *MIN/MAX VALUES*

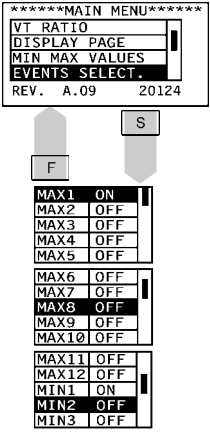
This function allows the user to associate some variables to the automatic recording of maximum values (from MAX1 to MAX12) and minimum values (from MIN1 to MIN8). To use this function, proceed as follows: select the MIN MAX VALUES function using the [▼] and [▲] keys and confirm it with [S].
A new window will appear showing you the list of available memory locations: select the locations using the [▼] and [▲] keys, starting from MAX1 for the maximum values and MIN1 for the minimum values. Press [S] to open the secondary menu with the list of the available variables to be selected.



Scroll the list of the variables using the ▼ and ▲ keys; once you have selected the desired variable, confirm it using S . To reset your choices and go back to the main menu, press F .

Once you have confirmed the selection, the following message will appear: "YOUR CHOICE WILL RESET THE VARIABLE, WILL YOU CONTINUE? YES/NO". Note: to enable the MIN/MAX recording function, read carefully the following paragraph, SELECTING THE EVENTS.

■ *Selecting the events*



This function allows the user to enable the events for data logging:

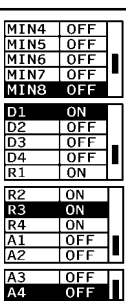
• **MAX** (logging of up to 12 different variables MAX1 to MAX12), see also: MIN MAX VALUES;

• **MIN** (logging of up to 8 different variables MIN1 to MIN8), see also MIN MAX VALUES;

• **D** "diagnostics" (logging of up to 4 alarms: from D1 to D4), see also: DIAGNOSTIC DIGITAL OUTPUTS

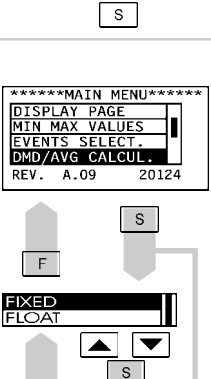
• **R** "remote control" (up to 4 remotely controllable outputs: from R1 to R4), see also REMOTE CONTROL DIGITAL OUTPUTS;

• **A** "alarms" (logging of up to 4 alarms: from A1 to A4), see also: ALARM DIGITAL OUTPUTS;



To use this function, select "EVENTS SELECT." from the main menu using the ▼ and ▲ keys and confirm it pressing S. Use the ▼ and ▲ keys to select where you want to enable the event (ON) or disable it (OFF). The function of the S ON-OFF-ON key is cyclical. To go back to the main menu press F.

■ *Average power calculation*



This function allows to select the calculation method of the W-VA-cosφ average value.
To enter these functions, select "AVERAGE CALCULATION" from the main menu by means of the ▼ and ▲ keys and confirm the selection pressing the S key.
You can now choose the average calculation method, that is you can choose between FIXED and FLOAT SELECTION using the ▼ and ▲ keys. Confirm your choice using the S key. Then, you can set the integration time period; again, use the ▼ and ▲ keys to set the desired value and confirm it with S.
To reset your choices and go back to the main menu, press F.

FIXED SELECTION: if, e.g., you set this value at 15 minutes, the instrument calculates and updates the average of the variables (W-VA-PF) every 15 minutes.

FLOAT SELECTION: if, e.g., you set this value at 15 minutes, the instrument at first calculates and updates the average of the variable (W-VA-PF) after 15 minutes and then every minute (fixed time).

See the diagram that shows the different operating methods (FIXED and FLOAT) on the following page.

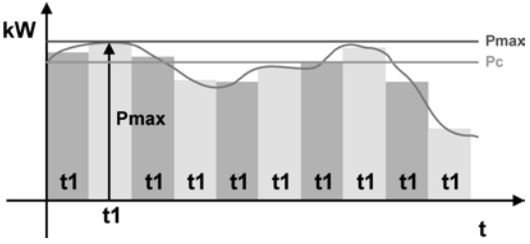
SYNCHRONIZATION OF THE FIXED OR FLOAT CALCULATION

The synchronization of the FIXED or FLOAT calculation can be carried out in three different ways:

- without the DIGITAL INPUT and RS232 + RTC modules: the reset and the beginning of the synchronization is carried out as soon as the instrument is powered on;
- with the installed DIGITAL INPUT module: the synchronization begins when the digital input modules change state (from ON to OFF or from OFF to ON). Any following change of state will make the synchronization reset and start all over again;
- with the RS232+RTC module: the synchronization begins at the exact hour that follows the switch on of the instrument (E.g.: if the instrument is switched on at 10:25, the synchronization begins at 11:00).

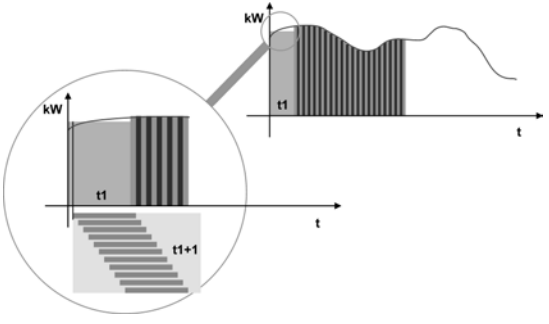
In case both modules are installed (that is digital inputs and RS232+RTC) the priority will be given to the Digital Input modules.

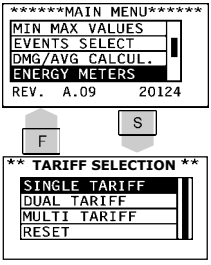
FIXED AVERAGE CALCULATION



Where: Pmax is the maximum measured power
Pc is the contractual power,
t1 is the selected average period

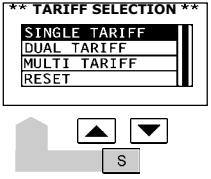
FLOAT AVERAGE CALCULATION





■ Access to the Energy Meters Management Menu

This function allows you to choose the type of management of the energy meters. Select "ENERGY METERS" from the main menu by means of the ▼ and ▲ keys; confirm with S to access the specific secondary menu.



❑ *Single tariff*

This function sets the Energy meters according to a single tariff which is the same for the whole year.
Select SINGLE TARIFF by means of the ▼ and ▲ keys and confirm your choice with S.

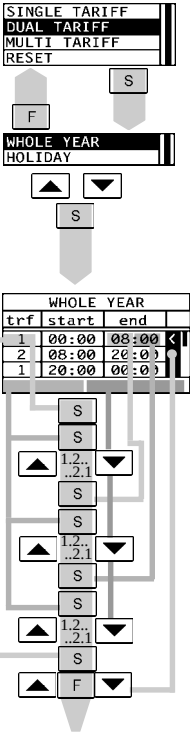
When you change the type of management, and after the choice is confirmed, the instrument resets the meters and a buzzer sounds.

❑ *Dual tariff management of the meters: whole year*

This selection manages the energy meters with two different tariffs per day and two periods per year. Select DUAL TARIFF from the energy meters menu by means of the ▼ and ▲ keys and confirm with S. Select WHOLE YEAR and confirm with S to enter the relevant menu; now you can enter the programming of the daily period as follows:

1- press S: the first box (trf=tariff) is highlighted;

2- press S again: the TARIFF box will appear on the lower part of the display; now you can choose the tariff (from 1 to 4, e.g.: 1) by means of the ▼ and ▲ keys;



Proceed with the same principle for the following rows. To exit any item use always [F].

3- press the [S] key again; the "end-tariff" hour is highlighted;

4- press the [S] key again; the HOURS box will appear on the lower part of the display; now you can choose the hours - e.g. 8 - by means of the [▼] and [▲] keys.

5- press the [S] key again; the "end tariff" minutes will be highlighted;

6-press the [S] key again: the MINUTES box will appear on the lower part of the display; now you can set the minutes - e.g. 10 - by means of the and [▼] and [▲] keys.

7-after the confirmation of the last setting, press [S] and you are back to the selection of the first "trf" parameter you have highlighted.

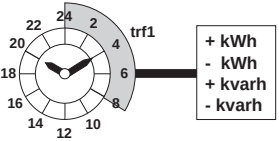
The "starting hour" of the following line becomes equal to the "end hour" you have just selected. Only when the "trf" parameter is highlighted, you can scroll the parameters and modify them:

use the [S] key to access to the parameter; use the [▲] key to move from left to right and the [▼] key to move from right to left.

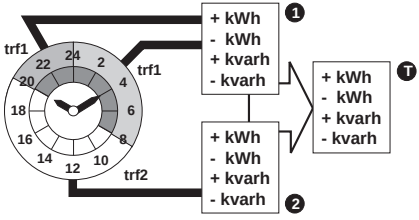
8- Press [F] to exit the programming of the parameters of the relevant row (no boxes are to be highlighted);

9- press [▲] and [▼] to select one of the other programming lines; the pointer on the right shows the line where the user can modify the parameters (points from 1 to 7).

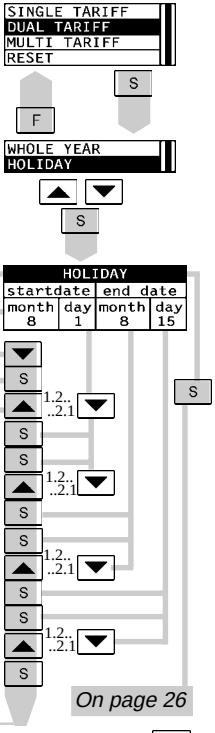
a) the day can be divided into up to 8 different periods connected to up to 4 different tariffs according to the following working principle:



The measured energy (partial energy) is placed in TARIFF 1 when the time period is from midnight to e.g. 8:00am, in TARIFF 2 when the time period is from 8:00a.m. to 08:00p.m. and again in TARIFF1 when the time period is from 08:00p.m. to midnight. The total measured energy is the result of the sum of all the partial measures as shown in the figure below:



b) the starting point of the first time period is always 24:00 (midnight) and cannot be changed;
c) the starting point of the following period is always the end hour of the previous time period;
d) the daily loop is closed by setting 24:00 as last hour of the last time period (to follow this procedure see point 4 on the previous page), confirm the setting by pressing [S] and [F] to go back to the TARIFF SELECTION menu.



To reset, press F .

❑ *PROGRAMMING THE HOLIDAY PERIOD*

To program the HOLIDAY period, proceed in the following way.

10- Choose HOLIDAY in the SEASON menu by means of the ▲ and ▼ keys and confirm with S: the HOLIDAY menu will be displayed (see figure on the left);

11-press ▼: the month corresponding to the start date will be highlighted;

12-press S: the box for setting the month will be enabled;

13-use ▲ and ▼ to select the desired month (from 1 to 12);

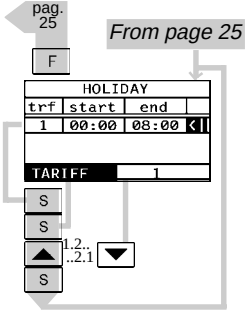
14-press the S key to confirm the selection and move to the next parameter: day setting;

15-press the S key again to open the box where the day is to be set;

16-use the ▲ and ▼ keys to select the desired day (from 1 to 31 depending on the previously selected month);

17-press the S key to confirm the selection and move to the next parameter.

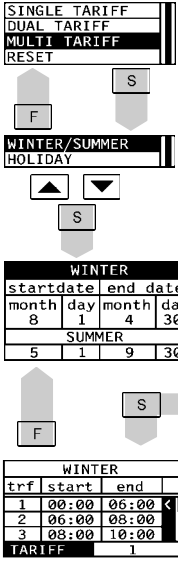
To program the “end date” follow the same procedure described above from No. 11 to No. 16. After confirming the “end” day by means of the [S] key, the HOLIDAY box is highlighted to indicate the conclusion of the HOLIDAY period programming cycle. You can also use the [▲] (moves from right to left) and [▼] (moves from left to right) keys to scroll along the available parameters.



It’s possible to choose the tariff to be associated to the HOLIDAY period according to the following procedure: starting from the box on the previous page, number 10, press the [S] key again: the instrument will display the box shown on the left. Press [S]: the box of the “trf” value is highlighted; press the [S] key again: the instrument will display on the lower section the box where the tariff is to be set. Select the desired tariff (from 1 to 4) by means of the [▲] and [▼] keys and confirm it with [S]. To reset your choices and/or exit the menus, use the [F] key.

❑ *MULTI TARIFF*

This function allows the management of the meters according to many periods per day and three periods per year: WINTER, SUMMER and HOLIDAY.

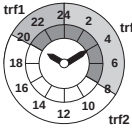


To program the parameters relating to the winter season, simply follow the same procedure (holidays) described on page 25 from No. 11 to No. 17. The parameters of the SUMMER season are automatically set by the instrument as a difference between the previous two periods of the Year.

To enable the setting of the daily time periods, press [S] when the WINTER or SUMMER seasons are highlighted. The following settings are the same as the ones described from No. 1 to No. 9 on page 22 and 23. To reset your choices and/or go back to the previous menus, use the [F] key. To program the HOLIDAY period, follow the procedure on page 25 from No. 11 to No. 17.

The periods WINTER and SUMMER are conventional seasons mainly used to manage in the best way the different energy costs during the year. The reminds from letter a) to d) are also valid for the MULTI TARIFF function.The next page shows a few examples of programming the various time periods.

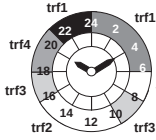
DUAL TARIFF management



WHOLE YEAR			
trf	start	end	
1	00:00	08:00	<
2	08:00	20:00	
1	20:00	00:00	
TARIFF		1	

As you can see on the figure above, there is a daily division into three periods with two different tariffs.

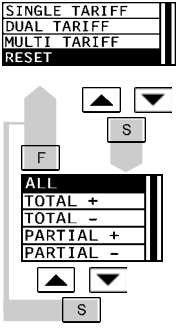
MULTI TARIFF management



WINTER			
trf	start	end	
1	00:00	06:00	<
2	06:00	08:00	
3	08:00	10:00	
TARIFF		1	

WINTER			
trf	start	end	
2	10:00	16:00	<
3	16:00	18:00	
4	18:00	21:00	
1	21:00	00:00	
TARIFF		2	

On the picture above you can see four different tariffs which are coupled to seven different periods of the day.



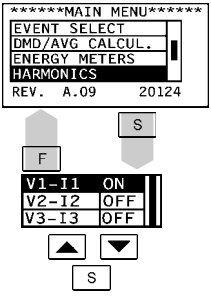
❑ *Reset of the Energy meter*

The "RESET" menu allows you to reset the energy meters. Press [S] to enter the menu, then use [▲] and [▼] to select the type of reset you prefer. Confirm the selection by means of the [S] key: the instrument displays the following message: PAY ATTENTION, ALL THE METERS WILL BE RESET!! WILL YOU CONTINUE?

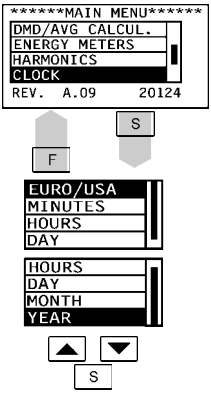
To conclude the RESET procedure, press [S]; to go back to the TARIFF SELECTION menu, press [F].

The reset procedure allows the user to choose among the following different choices:
ALL: reset of all the energy meters (imported/ exported energies);
TOTAL + : reset of the imported energy meters (+kWh, +kvarh);
TOTAL - : reset of the exported energy meters (-kWh, -kvarh);
PARTIAL + : reset of the partial imported energy meters (+kWh, +kvarh);
PARTIAL - : reset of the partial exported energy meters (-kWh, -kvarh).

■ *HARMONIC ANALYSIS*



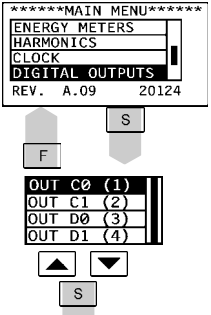
This function enables the display of the windows relating to the harmonic analysis.
Press [S] to enter the menu; then, use the [▲] and [▼] keys to select the phase where you want to enable the harmonic analysis. The [S] key allows the user to enable (ON) or disable (OFF) the displaying (the function is cyclical: ON-OFF-ON). To go back to the main menu, press [F].



■ *Clock setting*

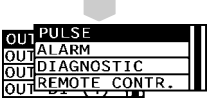
This function enables the user to set the data relating to date and time. Select CLOCK from the main menu by means of the ▼ and ▲ keys; then press S to enter the menu. Choose the desired function by means of the ▼ and ▲ keys; Enter the desired secondary menu with S. Then set the desired value by means of the ▼ and ▲ keys and confirm the value with S. To reset the choices and go back to the main menu, press F.

The EURO/USA function allows the user to display the date and time according to the EUROPEAN (EURO, date: day/month/year; time: 24 hours) or AMERICAN (USA, date: month/day/year; time: 12 hours / AM and PM) format.

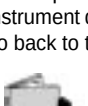


■ *Digital outputs*

This function enables the user to connect the type of digital output to the slot at the beginning. The instrument indicates if the module is not in the slot with the message "NOT AVAILABLE"; whereas if the module is in the slot, the instrument automatically goes to the digital output menu, where the user can set four different types of output:
PULSE OUTPUT, ALARM OUTPUT,

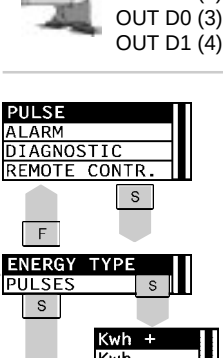


DIAGNOSTIC OUTPUT, REMOTE CONTROL OUTPUT. To enter these functions, choose DIGITAL OUTPUT from the main menu using the ▼ and ▲ keys, then confirm with S. The instrument shows a window where the various slots (OUT C0, OUT C1, etc.) and output channels (1, 2, etc.) are shown. Select the desired slot using the ▼ and ▲ keys and confirm with S to enter the output function menu (if the module is not in the slot, the instrument displays NOT AVAILABLE). To reset the choices and go back to the main menu, press F.



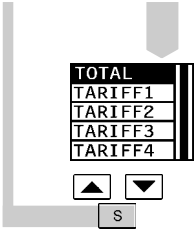
The meaning of the symbols on the display is the following:

OUT C0 (1): digital output, SLOT C0, channel 1
OUT C1 (2): digital output, SLOT C1, channel 2
OUT D0 (3): digital output, SLOT D0, channel 3
OUT D1 (4): digital output, SLOT D1, channel 4



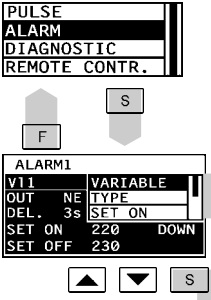
❑ *Pulse output*

This function allows the user to set the parameters of the pulse output. The output can be connected to a specific energy and this energy can be connected to the desired tariff. The measured energy is re-transmitted by means of the pulse output (the pulses/energy ratio of which is programmable). Use ▼ and ▲ to select PULSES from the list of available outputs; then confirm with S and choose from the submenu ENERGY TYPE the energy that you want to be retransmitted, using ▼ and ▲:



consumed active energy (kWh +), generated active energy (kWh -), consumed reactive energy (kvarh +), generated reactive energy (kvarh -), press the "S" key to open the menu of energy/pulse output management. There are five possible selections: TOTAL, output connected to the total energy meter; TARIFF, output connected to the desired tariff type.
Confirm with S and go back to the digital output menu. To reset the choices and go back to the main menu, press F.

The multiplyer of the measuring unit (kW,MW) automatically changes according to the CT or VT ratio set by the user.



❑ *Alarms*

This function allows the activation of a static or relay output when an alarm condition is detected. Select ALARM from the DIGITAL OUTPUT menu by means of the ▼ and ▲ keys, then press S to enter the display window of all the alarm parameters:

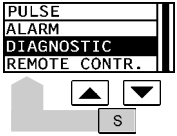
Select the desired variable by means of the ▼ and ▲ keys, press S to confirm and enter the submenus dedicated to the various parameters:

•**VARIABLE:** variables to be connected to the alarm: you can

choose among all the available ones (see on page 43); scroll the variables by means of the [▼] and [▲] keys and confirm the selection with [S]. The availability (or non-availability) of the variable is clearly indicated on the display.

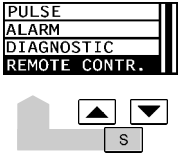
- **TYPE**: type of alarm: up alarm (UP); down alarm (DOWN); up alarm with latch (UP L): in this case the reset of the output can only be manual; down alarm with latch (D.L.): in this case the reset of the output can only be manual; down alarm with disabling at power ON (D.DO). Choose the desired alarm type by means of the [▼] and [▲] keys and confirm it with [S].
- **SET ON:** ON-alarm set-point. Select the value of the variable by means of the [▼] and [▲] keys and confirm it with [S].
- **SET OFF**: OFF-alarm set-point. Select the value of the variable by means of the [▼] and [▲] keys and confirm it with [S].
- **OUT:** normally energized alarm (NE) or normally de-energized alarm (ND). Choose the desired function by means of the [▼] and [▲] keys and confirm it with [S].
- **DELAY:** delay on alarm activation. Select the desired delay value in seconds by means of the [▼] and [▲] keys and confirm it with [S].

Only in case of controls of the power variables, it's necessary to select the resolution (position of the decimal point) of the alarm set-point's value.



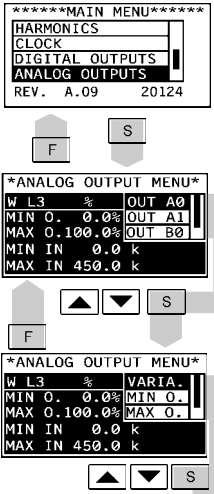
❑ *Diagnostic*

In a 3-phase unbalanced-load system, this function controls the presence of the neutral connection. If the connection to the neutral is not detected, the instrument activates an alarm. Select "DIAGNOSTIC" by means of the ▲ and ▼ keys, then press S to confirm it. To reset your choice and go back to the main menu, press F.



❑ *Remote control*

This function enables the control of the digital outputs by means of the RS485/RS232 communication port instead of using the instrument's alarm. The outputs can be activated by a PC or PLC by sending special commands. Select the REMOTE CONTR. function by means of the ▲ and ▼ keys and confirm pressing the S key: the instrument will go back to the digital output menu. To reset your choice and go back to the main menu, press F.



■ *Analogue outputs*

Select ANALOG OUTPUTS from the main menu by means of the ▲ and ▼ keys; confirm it with S to enter the various parameters:

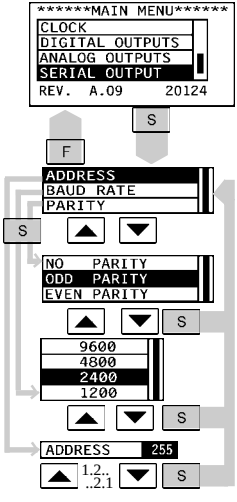
OUT A0: Analogue output, SLOT A0, channel 1;
OUT A1: Analogue output, SLOT A1, channel 2;
OUT B0: Analogue output, SLOT B0, channel 3;
OUT B1: Analogue output, SLOT B1, channel 4.

Select the desired parameter by means of the ▲ and ▼ keys and confirm with S to enter the relevant submenus:

- **VARIA**: variable to be connected to the output; choose among the available ones (see on page 43) by means of the ▼ and ▲ keys and confirm the selection with S. The availability (or non-availability) of the variable is clearly indicated on the display.
- **MIN O**: value expressed as % of the "zero" of the output range (0-20mA, 0-10V, etc.) that is generaged by the minimum measured value (Min In). Select the desired value by means of the ▼ and ▲ keys and confirm it with S.
- **MAX O:** value expressed as % of the full scale of the output range (0-20mA, 0-10V, etc.) that is generated by the measured value (Max In). Select the desired value by means of the ▼ and ▲ keys, and confirm it with S.

- **MIN IN:** minimum value of the variable input range. Select the desired value by means of the ▼ and ▲ keys and confirm it with S.
- **MAX IN:** maximum value of the variable input range. Select the desired value by means of the ▼ and ▲ keys and confirm it with S. To exit from any of the menus, press F. For further information, see examples No. 1 and 2 on page 38/39. For the resolution of the value to be retransmitted, see the note on page 33.

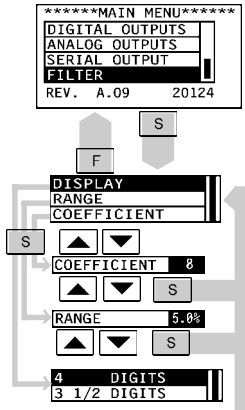
Every time a new selection of the variable connected to the analogue output is made, it is important to check and if necessary program again all the relevant parameters.



■ *Serial output*

This function allows the user to set the parameters of the serial output. Select SERIAL OUTPUT from the main menu by means of the ▼ and ▲ keys and confirm it with S. Select the function you want to set from one of the submenus by means of the ▼ and ▲ keys and confirm it with S. The configurable parameters are the following:

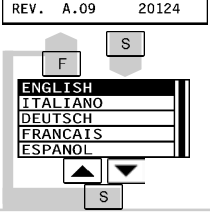
- Instrument **ADDRESS**: from 1 to 255.
- **BAUD RATE**: 1200, 2400, 4800 and 9600 bit/s.
- **PARITY**: no parity, even parity and odd parity. To exit from one of the menus or cancel a selection, press F.



Digital filter

Select FILTER by means of ▼ and ▲ and confirm with S. Select the function to be set from one of the submenus by means of the ▼ and ▲ keys and confirm it with S. You can choose among the following 3 selections:

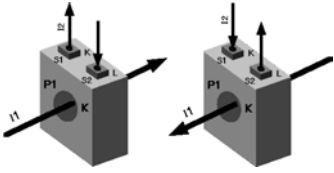
- **DISPLAY**: to select the display of the measurements of the instantaneous variables at 4-digit (max 9999) or 3 $^1/_2$-digit (max 1999)
- **RANGE**, to set the operating range of the digital filter. The value is expressed as % of the full scale value.
- **COEFFICIENT**, to set the filtering coefficient of the instantaneous measurements. Increasing the value, also the stability and the settling time of the measurements are increased. Once one of the three parameters has been selected, set the desired value by means of the ▲ and ▼ keys and confirm it with S. To exit the "FILTER" menu, press F. **For any other info, see "Useful info, Ex. 2 on page 40).**



Language

Select LANGUAGE from the main menu by means of the ▼ and ▲ keys and confirm with S. Select the language to be set from the submenu with the ▼ and ▲ keys and confirm the selection with S. To exit from any of the menus or cancel a selection, press F.

The variables measured by the instrument are correct if the inputs have been connected according to the right polarities (see figure below). Should the connection not be conforming to the right polarities, measuring and retransmission errors may occur, both due to the wrong direction of the current flowing in the primary/secondary of the ammeter transformer being connected.



It is however possible to measure and retransmit currents/ powers according to the direction of their flow using correctly the parameters "MIn U./Max U." and "Min IN/Max IN".

Example 1: it's necessary to measure a consumed active power up to 100kW considering that it may either be consumed or generated by the system and retransmitted with a 4 to 20mA signal; the module to be used is AO1026 (2x from 0 to 20 mA) or AO1050 (1x from "MIn U./Max U." and "Min IN/ Max IN".0 to 20 mA) that is to be set as follows:

- **VARIA**.: WΣ (active system power)
- **MIN U**.: 20,0% corresponds to 4mA, the calculation formula is: (100* min. output)/ fullscale output = 100*4mA/20mA= 20%
- **MAX U**.: 100,0% corresponds to 20mA, the calculation formula is: (100* max. output)/ fullscale output= 100*20mA/ 20mA=100%
- **MIN IN**: 0,0 K;the K,M and G multipliers are automatically selected by the instrument depending on the selected VT and CT value;
- **MAX IN**: 100,0 K; the K,M and G multipliers are automatically

selected by the instrument depending on the selected VT and CT value;

Example 2: it's necessary to measure both the consumed active power and the generated active power up to 100kW and retransmit it with a signal from –10 to 10V; the module to be used is AO1033 (2x ±10VCC) or AO1057 (1x ±10VCC). The parameters may be set as follows:

- **VARIA**.: WΣ (active system power)
- **MIN U**.: 0,0% corresponds to -10V; the calculation formula is: (100* min. output) / fullscale output = 100*0V / 20V = 0%; in this case the whole range of the analogue output is to be considered for the calculation, therefore -10 +10 = 20V.
- **MAX U**.: 100,0% corresponds to 10V, the calculation to be carried out is: (100*maximum output)/fullscale output=100*20V/20V=100%
- **MIN IN**: -100K; K,M and G multipliers are automatically selected by the instrument depending on the selected VT and CT value;
- **MAX IN**: 100,0 K; the K,M and G multipliers are automatically selected by the instrument depending on the selected VT and CT value; Therefore, when the power is equal to -100kW, the output will be -10V, when the power is 0, the output will be 0V and when the power is 100kW, the output will be +10V.

Example 3: it's necessary to retransmit the whole range of the values admitted for the PF with a signal from 0 to 20mA. Pay attention to the fact that the variable PF can correspond to the values included between C 0,00 and L 0,00 (for each phase); once these values are retransmitted, they will change into 0 and 20mA. When the PF will correspond to a value equal to 1 being at the centre between C0,00 and L0,00, the output value will correspond to the centre of its scale, that is 10mA. As a consequence, the instrument is to be set as follows:

- **VARIA**: PF L1 (or L2 or L3);

- **MIN U**.: 0,0%
- **MAX U**.: 100%
- **MIN IN**: C 0,000; the values entered with a negative sign correspond to C, those entered with a positive sign correspond to L;
- **MAX IN**: L 0,001; the values entered with a negative sign correspond to C, those entered with a positive sign correspond to L; we have chosen to limit "0,001" as minimum value to be set for L , in order to avoid any undesired oscillation of the outputs.

Example 4: it's necessary to stabilize the value of the displayed variable "VL1-N", that varies from 222.0V and 224.0V, continuing to have an indication of 4 digits. The parameters of the digital filter must be set as follows:

- **DISPLAY:** 4 digits
- **RANGE:** the variable may have variations within the average amplitude value equal to ±0.4% of the full scale of the variable (±0.4/100*250V= ±1V). The parameter "range" that is the action range of the digital filter, will be set at a value which is slightly higher than the percentage amplitude of the fluctuation: e.g.: 0.5%.
- **COEFFICIENT:** if the new value acquired by the instrument is within the action range of the filter, the new displayed value is calculated by summing (algebraically) to the previous value the variation divided by the filtering coefficient. As a consequence, a higher value of this coefficient results in a higher settling time, that means a higher stability. The best result is generally obtained by setting the filtering coefficient at a value equal to at least 10 times the value of the range parameter. In the example: 0,5*10=5. To enhance the stability, you may also increase the filtering coefficient (values within 1 and 255 only).

What is ASY

The ASY variable allows to control the symmetry of the star / delta voltages (for systems without neutrals) and star voltages (for systems with neutral). The variable is calculated as follows:

$$ASY_L = 100\frac{[MAX(V_{L1-2}, V_{L2-3}, V_{L3-1}) - MIN(V_{L1-2}, V_{L2-3}, V_{L3-1})]}{V_{L-L}}$$

$$ASY_{L-N} = 100\frac{[MAX(V_{L1}, V_{L2}, V_{L3}) - MIN(V_{L1}, V_{L2}, V_{L3})]}{V_{L-N\Sigma}}$$

where the first formula is to be applied with delta systems, while the minimum value calculated between the two is to be used for the star systems.

It's very important, as a general rule, to plug in and extract the optional modules only when the instrument is switched off.

LIST OF THE DISPLAYED VARIABLE PAGES

N ∞	1st variable	2nd variable	3rd variable	4th variable
00	selectable	selectable	selectable	selectable
01	VL1	VL2	VL3	VL-N Σ
02	VL1-2	VL2-3	VL3-1	VL-L Σ
03	AL1	AL2	AL3	An
04	WL1	WL2	WL3	W Σ
05	var L1	var L2	var L3	var Σ
06	VA L1	VA L2	VA L3	VA Σ
07	PF L1	PF L2	PF L3	PF Σ

The configuration shown in the tables above is only valid for connections to 3-phase systems with neutral. In case of any other system, the type and quantity of the displayed variables will vary.

List of the available variables:

V L1	An	VA L3	THD_{II} V2	THD A3
V L2	W L1	VA∑	THD_{I} V2	THD_{II} A3
V L3	W L2	PF L1	THD V3	THD_{I} A3
VL-N∑	W L3	PF L2	THD_{II} V3	An dmd
V L1-2	W ∑	PF L3	THD_{I} V3	VA dmd
V L2-3	var L1	PF ∑	THD A1	PF avg
V L3-1	var L2	Hz	THD_{II} A1	W dmd
V ∑	var L3	THD V1	THD_{I} A1	ASY
A L1	var ∑	THD_{II} V1	THD A2	
A L2	VA L1	THD_{I} V1	THD_{II} A2	
A L3	VA L2	THD V2	THD_{I} A2	

The availability of the variables depends on the type of electrical system being selected.

■ *INSTALLATION*

❑ *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. Example:
AP1020, Universal power supply
input range: ***100V...240V DC/AC (50Hz -60Hz)***
power consumption: ***12W / 30VA 1 PHASE***
serial number: ***S/N 002700/20345***

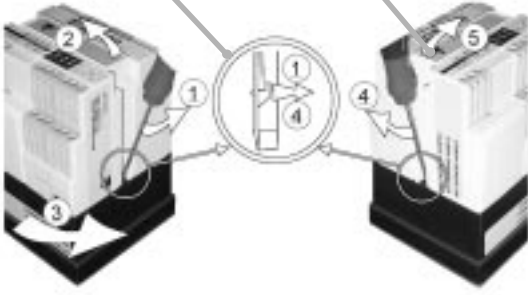
❑ *Before mounting the modules*

Each module (input, output and power supply) must be mounted in the proper slot: each module has been conceived to be mounted in one slot only. To know in which slot every module is to be mounted, refer to the figure on page 45.

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 RS232communication 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:

1 Gently depress the two fixing tabs. Direction 1-4.

2 Remove the central module from its slot: press your thumb towards points 2-5.

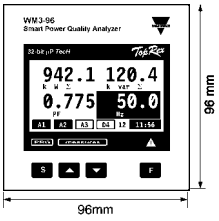


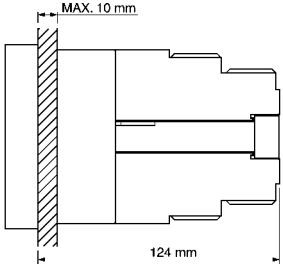
3 Extract the central module

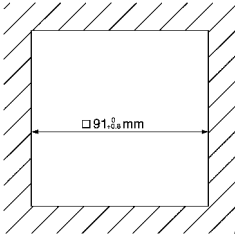
Take out the other modules.

Any other slots that you haven't used must be filled with the relevant blind plug modules supplied with the instrument.

❑ *Overall dimensions and panel cut-out*

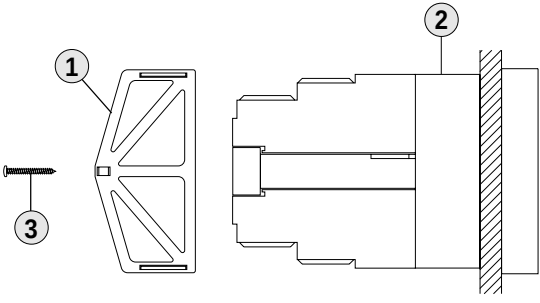




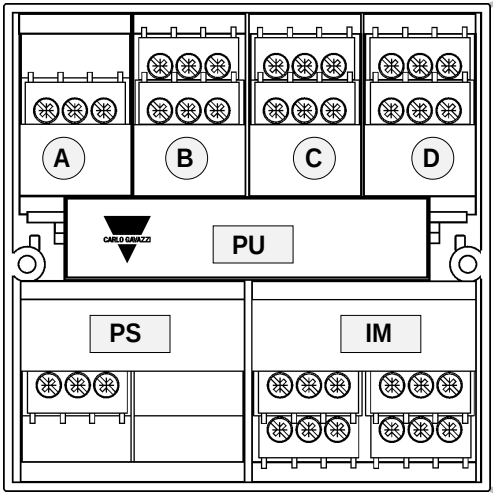


❑ *Mounting*

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.

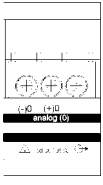


Position of the slots and relevant modules



Available modules

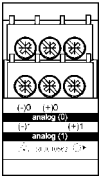
Analogue output modules



Single output

AO1050 (20mADC)
AO1051 (10VDC)
AO1052 (±5mADC)
AO1053 (±10mADC)
AO1054 (±20mADC)
AO1055 (±1VDC)
AO1056 (±5VDC)
AO1057 (±10VDC)

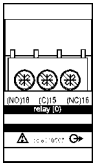
DESCRIPTION	A	B	C	D	PU	PS	IM
Single analog output	✔	✔					
Dual analog output	✔	✔					
RS485 serial output		✔					
RS232 serial output					✔		
Single relay output			✔	✔			
Dual relay output			✔	✔			
Single open collector output			✔	✔			
Dual open collector output			✔	✔			
4 open collector outputs				✔			
Digital inputs			✔				
Power supply						✔	
Inputs							✔



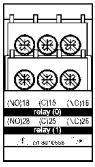
Dual output

AO1026 (20mADC)
AO1027 (10VDC)
AO1028 (±5mADC)
AO1029 (±10mADC)
AO1030 (±20mADC)
AO1031 (±1VDC)
AO1032 (±5VDC)
AO1033 (±10VDC)

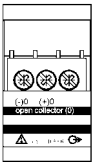
❑ *Digital output modules*



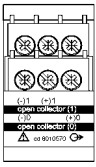
AO1058
Single relay output



AO1035
Dual relay output

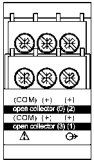


AO1059
Single open collector output

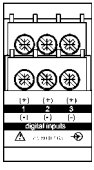


AO1036
Dual open collector output

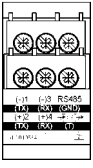
❑ *Other input/output modules*



AO1037
4 open collector outputs



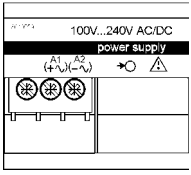
AQ1038
3 digital inputs



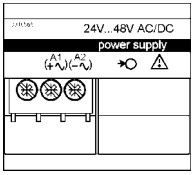
AR1034
RS485 Serial output

AR1039
RS232 + RTC output

❑ *Power supply modules*



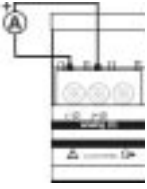
AP1020
90 - 260 VAC/DC
power supply

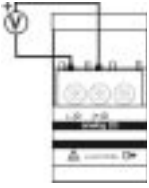


AP1021
18 - 60 VAC/DC
power supply

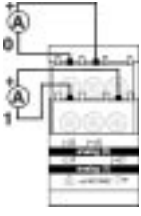
■ *Connection of optional modules*

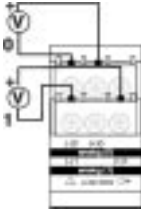
❑ *mA/V single analogue outputs*



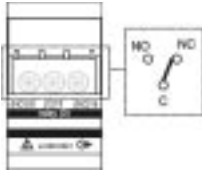


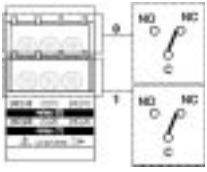
❑ *mA/V dual analogue outputs*



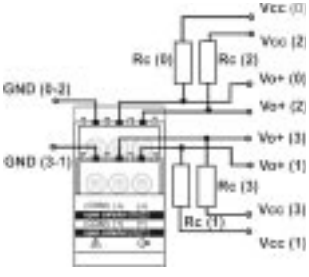


❑ *Single and double relay outputs*



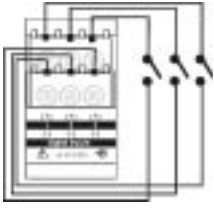


❑ *Open collector outputs*

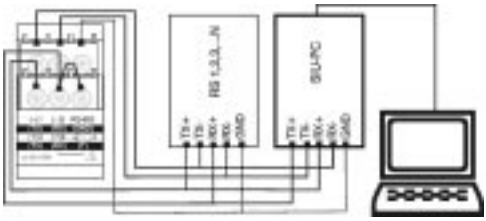


This diagram is valid also for the open collector modules with a lower number of outputs. The value of the load resistances (Rc) must be chosen so that the short-circuit current is lower than 100mA; the VDC voltage must be lower than or equal to 30VDC.

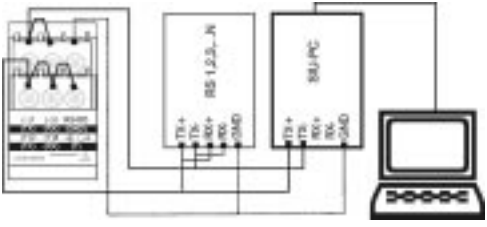
❑ *Digital inputs*



❑ *RS485 Serial outputs*



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

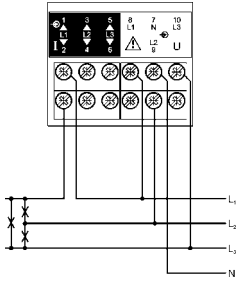


2-wire connection. Additional devices provided with RS485 (that is RS 1,2,3,...N) are connected in parallel.

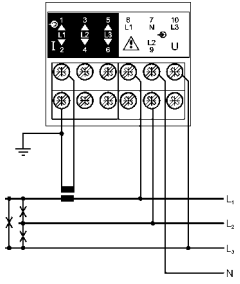
The termination of the serial output is carried out only on the last instrument of the network, by means of a jumper between (Rx+) and (T).

■ Electrical connection diagrams

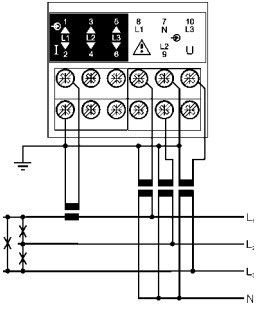
❑ Three-phase connections, Balanced load



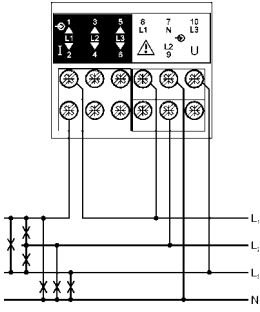
Direct connection
(3-wire system)



CT connection
(3-wire system)

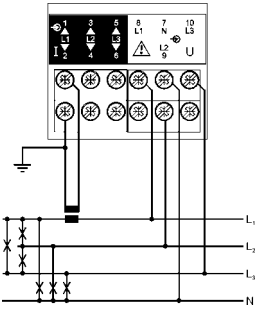


CT and VT connection
(3-wire system)

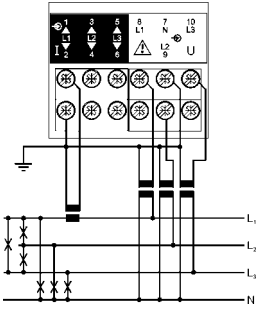


Direct connection
(4-wire connection)

❑ *Three phase, Balanced load*

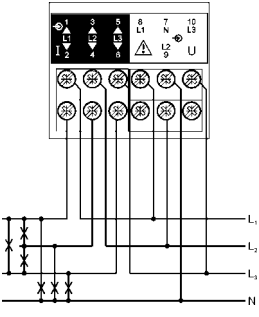


CT connections
(4-wire system)

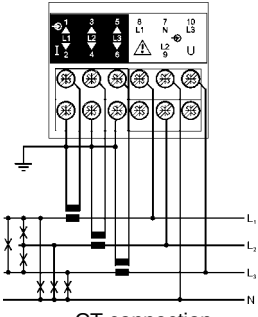


CT and VT connections
(4-wire system)

❑ *Three-phase, 4 wires - Unbalanced load*

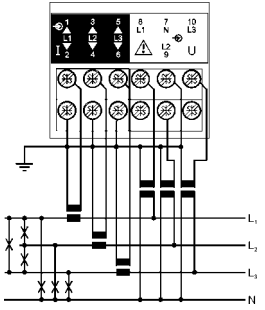


Direct connection
(4-wire system)

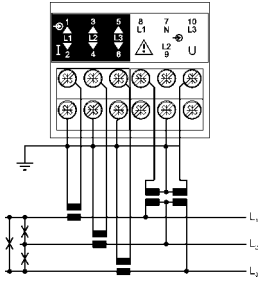


CT connection
(4-wire system)

❑ *3/4-wire three-phase connections, Unbalanced load*

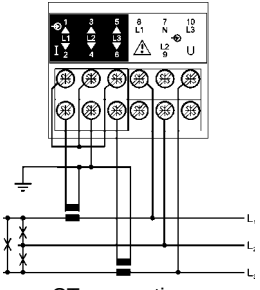


CT and VT connection
(4-wire system)

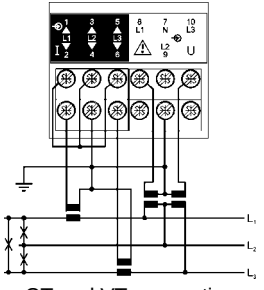


CT and VT connection
(3-wire system)

❑ *3-phase / 3-wires ARON connection*
Unbalanced load

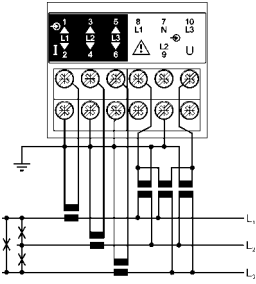


CT connection
(3-wire system)



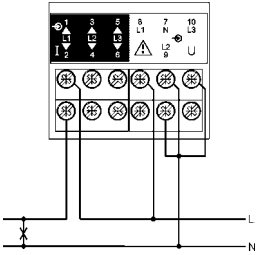
CT and VT connection
(3-wire system)

❑ *3-phase / 3-wires conn.*



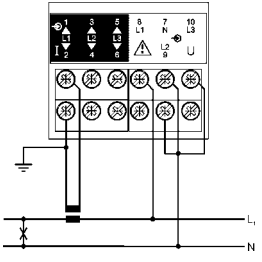
3 CT and 3 VT connection
(3-wire system)

❑ *Single-phase conn.*

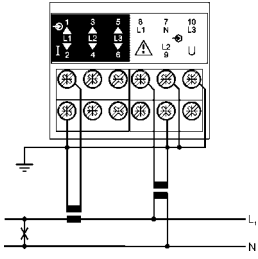


Direct connection

❑ *Single-phase connection*



CT connection



CT and VT connections

General features

- Modular housing for Plug and Play modules
- IP65 protection degree
- 32-bit μ-processor based indicator and controller
- TRMS measurements
- Back-lighted graphic LCD display (128 x 64 dots)
- 4 x 4 dgt read-out (instantaneous variables)
- 4 x 9 dgt read-out (total energies), 4 x 6 dgt (partial energies)
- 4 independent total energy meters (Wh, varh)
- Up to 48 independent partial energy meters (Wh,varh)
- Harmonic analysis up to the 50th harmonic with histogram indication
- Up to 8 simultaneous outputs: pulses, alarm, analogue output and serial communication port
- According to: EN61010-1(safety); accuracy: EN60688-1, EN61036, EN61268.

Input specifications

NUMBER OF INPUTS:

- Current: 6
- Voltage: 4
- Digital: 3 free of voltage contacts for synchronization of W-VA-A measurements. Reading/voltage: <8mA/ 17.5V to 25VDC

ACCURACY (display, RS485, RS232)

Vn: 240VL-N, Uf.s. 300VL-N; In: 5A, max 6A

- Current: ±0.5% rdg (0.2 to 1.2 In) ±5mA (0.02 to 0.2 In)
- Neutral current: ±1% rdg (0.2 to 1.2 In) @40 to 100Hz
- Voltage: Range AV5: ±0.5% rdg (48 to 300 V_{L-N})
  Range AV7: ±0.5% rdg (80 to 480 V_{L-N})
  Included frequency, power supply and output load influences.
- Frequency: ±0.1% rdg (40 to 440 Hz).
- Active power (@25°C ±5°C, R.H. ≤60% non-condensing): ±0.5% (rdg + f.s.) (cosφ 0.5 L/C, 0.1 to 1.2 In, range AV5) or ±1% rdg (cosφ 0.5 L/C, 0.1 to 1.2 In, range AV5).

- Reactive power (@25°C ±5°C, R.H. ≤60% non-condensing): ±0.5% (rdg + f.s.) (cosφ 0.5 L/C, 0.1 to 1.2 In, range AV5) or ±1% rdg (cosφ 0.5 L/C, 0.1 to 1.2 In, range AV5).
- Apparent power (@25°C ±5°C, R.H. ≤60% non-condensing): ±0.5% (rdg + f.s.) (0.1 to 1.2 In, range AV5) or ±1% rdg (0.1 to 1.2 In, range AV5).
- Energies (@25°C ±5°C, R.H. ≤60% non-condensing): class 1 according to EN61036 and EN61268. Ib: 5A, Imax: 6A, 0.1 Ib: 500mA; start up current: 20mA; Un: 240V (AV5), 400V (AV7).
- Harmonic distortion (@25°C ±5°C, R.H. ≤60% non-condensing):
  1% f.s. (f.s.:100%); phase: ±2°; Imin: 0.1Arms; Imax: 15Ap; Vmin: 50Vrms; Cmax: 500Vp; sampling frequency 6400Hz @ 50Hz

ADDITIONAL ERRORS:
- Humidity: ≤0.3% rdg, 60% to 90% R.H.
- Magnetic field: ≤0.5% rdg, @ 400 A/m.
- Input frequency: ≤0.4% rdg, 62 to 400 Hz.

TEMPERATURE DRIFT: ≤200ppm/°C
SAMPLING RATE: 6400Hz @ 50Hz
DISPLAY:
Graphic, back-lighted LCD, 128x64 dots.
Selectable read-out for the instantaneous variables: 4 x 4 dgts or 4 x $3^1/_2$ dgts.
Total energies: 4 x 9 dgts; Partial energies: 4 x 6 dgts
MAX. AND MIN. INDICATION:
Max. 9.999 (999.999.999), Min. -9.999 (-999.999.999)
MEASUREMENTS:
Current, voltage, power, energy, harmonic distortion (see list of the displayed pages/variables). TRMS measurement of a distorted sine wave voltage/current;
Connection type: direct
Crest factor: ≤ 3 max. 15Ap/500Vp (VL-N) or 15Ap/800Vp (VL-N)

RANGE (IMPEDANCE):
- AV5:
  58V/100V (>500kΩ) - 1ADC (≤0.3VA)
  58V/100V (>500kΩ) - 5ADC (≤0.3VA)
  240V/415V (>500kΩ) - 1ADC (≤0.3VA)
  240V/415V (>500kΩ) - 5ADC (≤0.3VA)
- AV7:
  100/170V (>500kΩ) - 1ADC (0.3VA)
  110/170V (>500kΩ) - 5ADC (0.3VA)
  400/690V (>500kΩ) - 1ADC (0.3VA)
  400/690V (>500kΩ) - 5ADC (0.3VA)

FREQUENCY RANGE: 40 to 440 Hz

Overload protection

- Continuous: voltage/current
  AV5: $300V_{LN}/520V_{LL}/6A$;
  AV7: $480V_{LN}/830V_{LL}/6A$
- For 1s: voltage/current
  AV5: $600V_{LN}/1040V_{LL}/120A$;
  AV7: $960V_{LN}/1660V_{LL}/120A$

Keypad

Four keys: [S] to enter the programming phase and confirm the password, "UP" [▲] and "DOWN" [▼] to program the values / select the functions and scroll the pages, [F] for special functions.

Output specifications

ANALOGUE OUTPUTS (on request):
- Number of outputs: up to 4 (on request)
- Accuracy: ±0.2% f.s.; (@ 25°C ±5°C, R.H. ≤60% non-condensing)
- Range: 0 to 20mADC, 0 to ±20mADC,

0 to ±10mADC, 0 to ±5mADC, 0 to 10VDC,
0 to ±10VDC, 0 to ±5VDC, 0 to ±1VDC.

- Scaling factor: programmable within the whole range of retransmission; it allows the retransmission management of all values from:
  0 to 20mADC, 0 to ±20mADC, 0 to ±10mADC,
  0 to ±5mADC, 0 to 10VDC, 0 to ±10VDC,
  0 to ±5VDC, 0 to ±1VDC
- Response time: ≤200ms typical (filter excluded, FFT excluded, $3^1/_2$ dgt indication)
- Ripple: ≤1% according to IEC60688-1 and EN60688-1
- Temperature drift: 200 ppm/°C
- Load:
  0 to 20mADC: ≤ 600Ω; 0 to ±20mADC: ≤ 550Ω
  0 to ±10mADC: ≤ 1100Ω; 0 to ±5mADC: ≤ 2200Ω
  0 to 10VDC: ≥10kΩ; 0 to ±10VDC: ≥10kΩ
  0 to ±5VDC: ≥10kΩ; 0 to ±1VDC: ≥10kΩ
  Insulation: by means of optocouplers, 4000 Vrms between output and measuring inputs, 4000 Vrms between output and power supply inputs.

RS422/RS485 SERIAL OUTPUT (on request):

- Type: bidirectional multidrop (static and dynamic variables).
- Connections: 2 or 4 wires, max. distance 1200m, termination directly on the module.
- Addresses: from 1 to 255, key-pad programmable.
- Protocol: MODBUS/JBUS

Data (bidirectional):
Dynamic (reading only)
System variables: P,P_{AVG},S, Q, cosφ, V_{L-L}, f, THD energies, status of digital inputs and status of the alarm output.
Single phase variables:
P_{L1}, S_{L1}, Q_{L1}, $\cos\varphi_{L1}$, V_{L1}, A_{L1}, THD_{L1}, P_{L2}, S_{L2}, Q_{L2}, $\cos\varphi_{L2}$, V_{L2}, A_{L2}, THD_{L2}, P_{L3}, S_{L3}, Q_{L3}, $\cos\varphi_{L3}$, V_{L3}, A_{L3}, THD_{L3}
Static (writing only)
All programming data, reset of energies, activation of the static output.

- Stored energy (EEPROM): max 999.999.999 kWh/kvarh
- Data format: 1 start bit, 8 data bit, no parity/even parity/odd parity, 1 stop bit
- Baud-rate: 1200, 2400, 4800 and 9600 baud,
- Insulation: by means of optocouplers,
  4000 Vrms between output and measuring inputs,
  4000 Vrms between output and power supply inputs

RS232 SERIAL OUTPUT (on request):

- Type: bidirectional (static and dynamic variables).
- Connections: 3 wires, maximum distance 15m
- Data format: 1 start bit, 8 data bit, no parity, 1stop bit
- Baud-rate: 9600 bauds
- Protocol: MODBUS (JBUS)
- Other data: as per RS485/RS422

DIGITAL OUTPUTS: (on request)
The working of the outputs (pulse, alarm or both) is fully programmable and is independent of the output module that has been chosen.

PULSE OUTPUT: (on request)

- Number of outputs: up to 4 (on request)
- Type: 1 to 1000 programmable pulses for k-M-G Wh, k-M-G varh, open collector (NPN transistor)
- VON 1.2VDC / max. 100mA; VOFF 30VDC max.
- Pulse duration: 220ms (ON), ≥220ms (OFF) according to DIN43864.
- Insulation: by means of optocouplers, 4000 Vrms output to measuring inputs, 4000 Vrms output to power supply inputs
- Note: the outputs can be either open collector type or relay type (for this latter one see the characteristics mentioned in the ALARMS).

ALARMS: (on request)
- Number of outputs: up to four, independent
- Alarm type: up alarm, down alarm, up alarm with latch, down alarm with latch, phase asymmetry, phase loss, neutral loss.
- Set-point adjustment: 0 to 100% of the electrical scale
- Hysteresis: 0 to 100% of the electrical scale
- On time delay: 0 to 255s
- Relay status: selectable, normally close or normally open.
- Output type: relay, SPDT; AC 1-8A, 250VAC; DC 12-5A, 24VDC; AC 15-2.5A, 250VAC; DC 13-2.5A, 24VDC.
- Min. response time: ≤150ms, filter excluded, set-point on-time delay: 0
- Insulation: 4000 Vrms output to measuring inputs, 4000 Vrms output to power supply input.
- Note: the outputs can be either relay type or open collector type (for the latter type of output see the features mentioned in the PULSE OUTPUT paragraph).

■ *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 499, all data are protected.

MEASUREMENT SELECTION: see the relevant table.
TRANSFORMER RATIO:
for CT up to 30,000A; for VT up to 600kV.
SCALING FACTOR:
Operating mode:
- Electrical scale: compression/expansion of the input scale to be connected to up to 4 analogue outputs.
- Operating range: programmable within the whole measuring range.

DIGITAL FILTER:
- Operating range: 0 to 99.9% of the input scale
- Filtering coefficient: 1 to 255
- Filter action: alarms, serial and analogue outputs (fundamental variables: V, A, W and their derived ones).

EVENT LOGGING: only with the module RS232+RTC module. The max./min. values of the selected variables and the alarm status are stored with reference to date (dd:mm:yy) and time (hh:mm:ss). Max. capacity: 480 events.
VARIABLE PAGES: 4 variables per page; up to 27 pages, one of which is completely programmable.

■ *Harmonic Distortion Analysis*

ANALYSIS PRINCIPLE: FFT
HARMONIC MEASUREMENT:
- Current: up to the 50th harmonic
- Voltage: up to the 50th harmonic

TYPE OF HARMONICS:
- THD (VL1); THD odd (VL1); THD even (VL1); the same for the other phases: L2 and L3.
- THD (AL1); THD odd (AL1); THD even (AL1); the same for the other phases: L2 and L3.

HARMONIC PHASE ANGLE:
- The instrument measures the angle between the single harmonics of “V” and the single harmonics of “A” expressed as “°”, making it possible to understand if the harmonics are generated or imported.

On three-wire systems, the angle cannot be measured.

HARMONIC DETAILS
For each THD page, it's possible to see the order of the harmonics.
DISPLAY PAGES
The harmonic content is displayed as a graph showing the whole harmonic spectrum.
The information is given also as numerical data:
THD in % / RMS value
THD odd in % / RMS value
THD even in %/ RMS value
OTHERS
The harmonic distortion can be measured both in 3-wire or 4-wire systems. Tw: 0.02s

■ *Energy management*

TIME PERIODS:
Selectable: single time, dual time and multitime.
SINGLE TIME:
Energy meters:
total: 4 (9 digits); no partial meters
DUAL TIME:
- Energy meters:
  total: 4 (9 digits); partial: 8 (6 digits)
- Time periods:
  2, programmable within 24 hours

MULTI-TIME:
- Number of energy meters:
  total: 4 (9 digits); partial: 48 (6 digits)
- Time periods: 4, programmable within 24 hours
- Time seasons: 3, programmable within 12 months

Power supply specifications

AC VOLTAGE:
18 - 60 VDC/AC (on request); 90 - 260 VDC/AC (standard)
POWER CONSUMPTION:
≤30VA / 12W (90-260V); ≤20VA / 12W (18-60V)

General specifications

OPERATING TEMPERATURE:
from 0 to +50°C (R.H. <90% non-condensing)
STORAGE TEMPERATURE:
from -10 to +60°C (R.H.<90% non-condensing).
INSULATION REFERENCE VOLTAGE:
300 VRMS to earth
INSULATION: 4000 VRMS between inputs/outputs and earth
DIELECTRIC STRENGTH: 4000 VRMS for 1 minute
COMMON MODE REJECTION (CMRR): 100dB, from 48 to 62 Hz
EMC: EN 50081-2, EN 50082-2
OTHER STANDARDS:
- Safety: IEC 61010-1, EN 61010-1
- Product: IEC 60688-1, EN 60688-1,
- Energy measurement: EN61036, EN61268.
- Pulse output: DIN43864

APPROVALS:
CE, UL, CSA
CONNECTIONS:
Screw-type, max 2.5 mm^2 x 2 conductors
HOUSING:
Dimensions: 96 x 96 x 140mm
Material: ABS, self-extinguishing: UL 94 V-0
DEGREE OF PROTECTION: Front: IP 65
WEIGHT: 600 g approx (packing included)