Control

CARLO GAVAZZI

# WM5-96

*Smart Power Quality Analyzer*

# *Instruction manual*


ARM POWERED®

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CARLO GAVAZZI

# WM5-96

***Smart Power Quality Analyzer***

**WM5 96:**

- High accuracy (class 0.2 A/V);
- High calculation performances (ARM® technology) for a fast analysis of the signal (FFT up to the 63rd harmonics);
- high connection capabilities (RS485 115.2 kbps, RS232, front optical port).

WM5 96 is the state-of-the-art tecnological answer to your needs of power quality analysis.

Moreover, you can count on a ISO9001/VISION 2000 certified company structure, an experience of many years and a wide-spread presence both in Europe and all over the world. All this in order to guarantee the customer with a **top-quality service** and the best products.

Welcome in Carlo Gavazzi and our compliments for your choice. You can evaluate the complete range of our products on the CARLO GAVAZZI web-site:
**www.carlogavazzi.com/ac**

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Automation Components

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## Introduction



## Becoming aquainted with WM5



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## Installation



## Wiring diagrams



## Technical specifications

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. If the instrument is used in a manner not specified by the producer, the protection provided by the instrument may be impaired. Maintenance: to keep the instrument clean, use a slightly damp cloth; do not use any abrasives or solvents. We recommend to disconnect the instrument before cleaning it.

This symbol indicates a particularly important subject or information.

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

This symbol indicates a suggestion for the user.

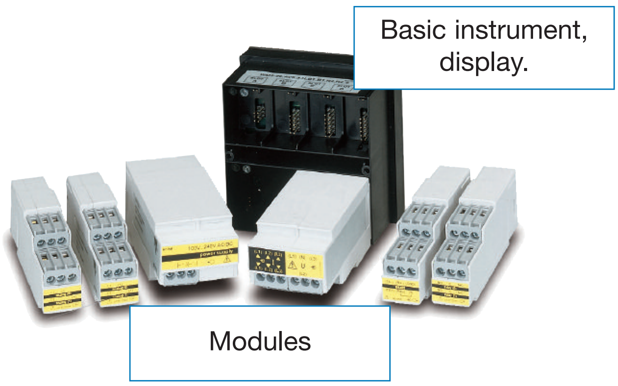
## WM5 96 philosophy, ARM® technology

WM5 96 is a brand new instrument with a high level of performances and connection capability. Actually, WM5 96 is a synergy of digital components that, coordinated by an ARM® processor, allows the user to perform class 0.2 measurements for current and voltage, the management of 3 serial ports, 8 analogue outputs, 12 digital inputs, 16 alarms and a complete and functional management of the energy meters tariffs. The ARM® -based microprocessors are used in the up-to-date technology such as the palmtop computers: this makes of WM596 a real computer at the service of the electrical parameters analysis and of the electrical tariff management, even the more complex one.

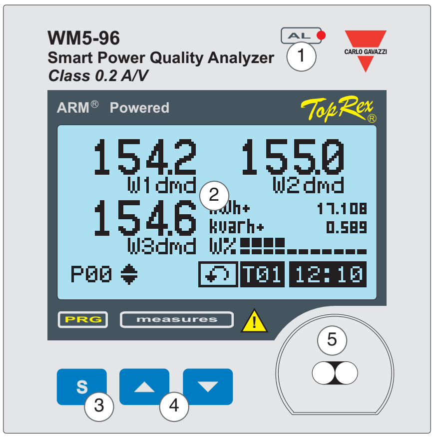
## Optical port and communication

The front optical port allows a fast and practical communication between PC and instrument. Thanks to the WM5Soft software it'll be possible to read the measurements and programm the instrument even if the latter is already installed on the electrical board.

WM5 thanks to its great flexibility allows to set in the menu (pls see the relevant section) also the modules being installed in the base (display module). In order to make the programming of the modules easier, it is advisable to note the identification code (ex. AO2050) and the relevant installation slots (A, B, etc.): we suggest to fill in the special module on the last page of this manual.

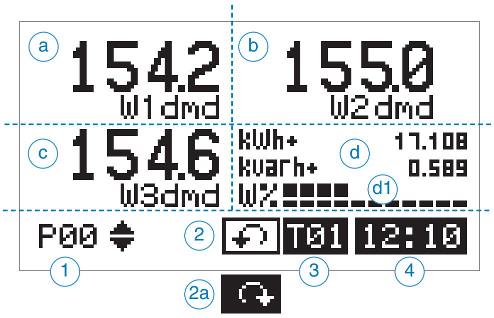


## Front Panel Description




1. When switched on, the alarm LED will be active (blinking for a virtual alarm, fixed light for a real alarm).
2. Graphic display.
3. This key allows the user to access programming (only page 00) or the details of the measurement.
4. Keys allowing the user to scroll the measuring pages, display the details relating to the measurements: dmM=dmd maximum value, dmd=avg value, max=maximum value, min=minimum value. In the page relating to the meters it's possible to read the value of the energy counted per month (JAN...DEC), per tariff (T01...T12) and per phase (L1, L2, L3). The contemporaneous pressure of these keys also allows the adjustment of the display
5. Optical communication port (standard ANSI).

## Main measuring page "00"



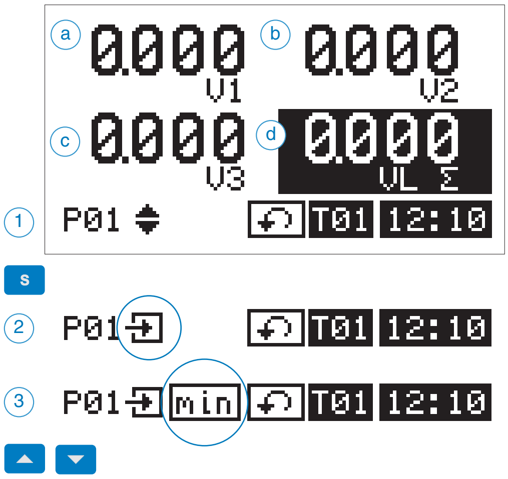

**When the instrument is switched on, the operating system will be loaded; this implies a short waiting time (during this phase the display shows a sand glass which will stop moving only when the loading phase is completed).** Then, the instrument will start measuring and will display the window on the left. This page, called "P00" page, is the only page which can be configured by the user who can choose, by means of the programming, which variables are to be displayed in the 3 sections (a, b, c) (see "display page" in the programming menu). The (d) section indicates the consumption of the measured energy (kWh and kvarh), a graphical indicator (d1) allows a quick reading of the % value relating to the active system power being used with reference to the installed power value previously set in the instrument. In the other measuring pages, the variable type displayed in the four sections (a, b, c, d) is pre-established and cannot be modified. The display of the lower part of the display is common to all measuring pages.

1. Shows the displayed measuring page, the displayed number will increase or decrease depending on the displayed page.
2. Shows the sequence of the phase rotation L1-L2-L3 or L3-L2-L1 (2a).
3. Shows the current tariff (T01, T02, T03, T04...T12) of the energy meters.
4. Shows the current time (only if this function has been enabled).

## Adjustment of display contrast

To have a clear reading in every condition of visibility, properly adjust the display contrast. Press the "▲▼" keys contemporaneously: the contrast starts increasing; release the keys when the display contrast has been properly adjusted.

## Measurements of instantaneous variables




The various measuring pages of WM5 96 display the necessary information for the quality analysis of the network. To scroll (1) the measuring pages, use the "▲▼" keys; to display the details of the measures, press the "S" key; to scroll the available details, use the "▲▼" keys (3); to exit the details displaying phase, press the "S" key.

The details for the instantaneous variables are the following:

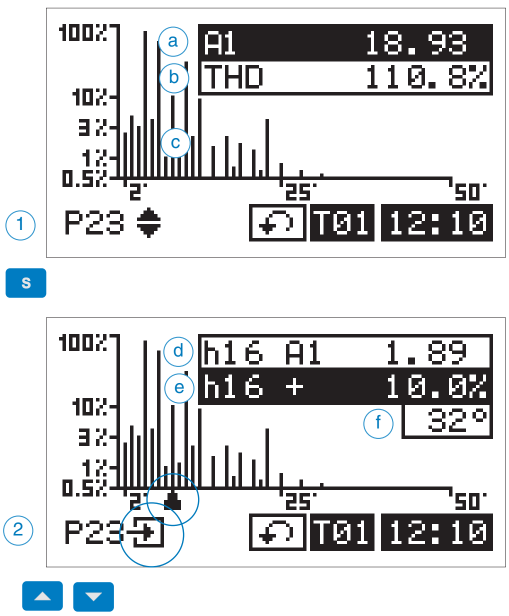
**dmM**= maximum dmd value,
**dmd**= dmd value,
**max**= maximum value,
**min**= minimum value.

For any information on the meaning of "dmd", see page 14.

**Reset of details.** Keeping the "S" key pressed for approx. 2 seconds, it's possible to reset each variable of the selected detail (dmM, dmd, max, min). The instrument displays a message confirming the user he has entered the reset mode: choose "YES" by means of the "▲▼" keys , confirm with the "S" key and then select the variable you want to reset by means of the "▲▼" keys, then press "S" to proceed with the reset; to exit the reset mode, keep the "S" key pressed for at least 2 seconds.

Thanks to the powerful calculation capabilities of the ARM® technologies, WM5 96 allows an accurate analysis of the harmonics up to the 63rd.

## THD Measurements




**a** Voltage or current value referred to the relevant measured phase. (V1, V2, V3, A1, A2, A3).

**b** Total harmonic distorsion expressed as a percentage value.

**c** Histogram of the harmonics. To display the details of the harmonics, press the "S" key (2).

An arrow is displayed on the horizontal axis of the graph to identify the harmonics being examined. To scroll the harmonics one by one, use the "▲▼" keys (2).

**d** Harmonic order (from h1 to h 63), for single phase and the relevant absolute voltage or current value.

**e** Harmonic order (from h1 to h63), the detected conventional sign (-,o,+) and its relevant value expressed as a percentage.

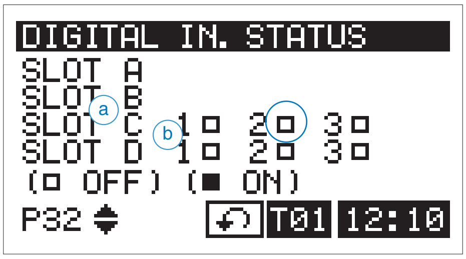
**f** Phase angle between the fundamental and the voltage and current harmonic of the same order: angle between 0° and 90° and between 270° and 360° corresponds to a generated harmonic, an angle between 90° and 180° and between 180° and 270° corresponds to an imported harmonic.

To exit the display of measurement details, press the "S" key.

**Note:** The display of histograms is available only up to the $50^{th}$ harmonic (h50). For the other harmonics from h51 to h63 only the numeric values are available.

⚠ The phase angle (f) between the fundamental and the voltage and current harmonic of the same order will be displayed only if the measurements are taken in a three-phase system with neutral.

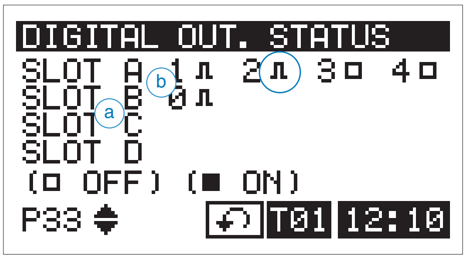
## Digital input status




This page displays the status of the digital inputs (b) (0, 1, 2) corresponding to each slot (a). The "■" symbol will be shown on the right of a close contact, while the "□" symbol will be shown on the right of an open contact, if the digital input is set as "Totalizer" the symbol "⎍" will be displayed.

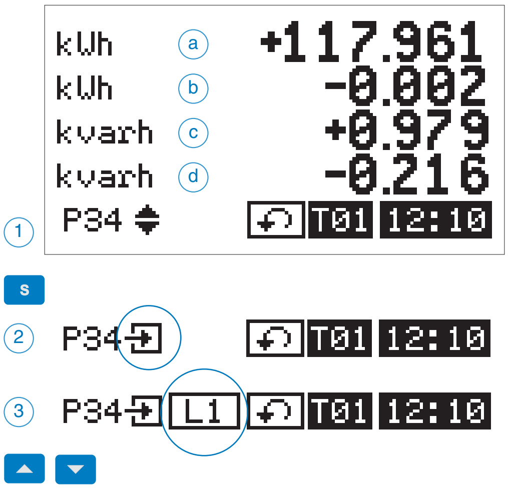
It's possible to display the values of the cofigurated totalizer (GAS, Water...) by keeping the "S" key pressed, and scroll the details by keeping the "▲▼" keys pressed.
To exit the display of the measurement details press the "s" key.

## Digital output status




This page displays the status of the digital outputs (b) (0, 1, 2, 3) corrsponding to each slot (a). If the contact or contacts are ON, the "■" symbol will be displayed. If the contact or contacts are OFF, the "□" symbol will be displayed. If the digital output is set as "pulse output", then the symbol "⎍" will be displayed. The detail function is not available in this page.

## Energy meter page




This page displays the imported kWh (a), exported kWh (b), imported kvarh (c) and exported kvarh (d) energy meters. It's possible to enter the details of the meters by keeping the "S" key pressed (2), and scroll the details by keeping the "▲▼" keys pressed (3).

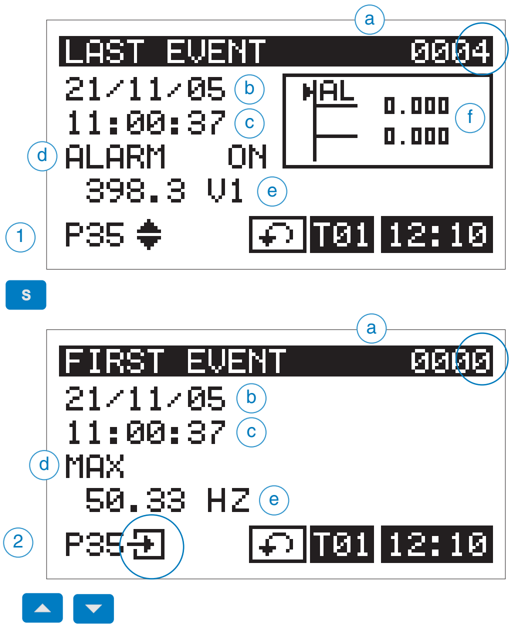
The countings of the energies can be scrolled divided by:

**month** (JAN...DEC),
**tariff** (T01...T12),
**phase** (L1, L2, L3).

To exit the display of the measurement details press the "s" key.

To enter the details of the meters starting from the division by phase, press the "▲" key first, to start from the division by month, press the "▼" key first.

## Logged events page



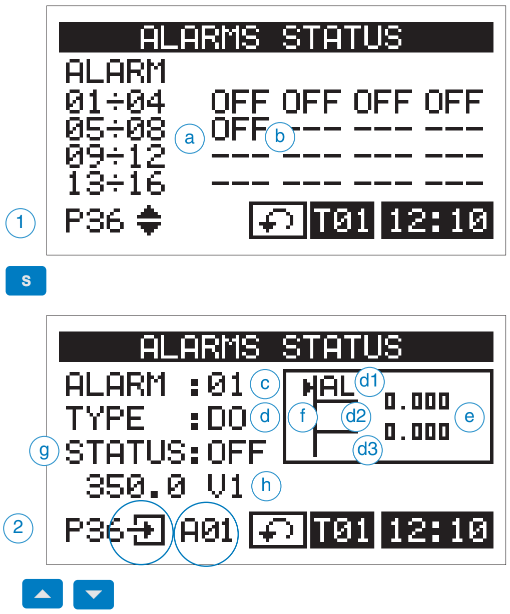

Thanks to the great logging capability of WM5 96, it's possible to log a great number of events and manage their displaying, one by one. The page always displays the last logged event which is given a progressive number (a). The page is complete with all the important information relevant to the logged event: date (b), time (c), type of event (alarm, min, max, etc.) (d), variable relevant to the event (e). Should the alarm refer to an alarm, a window (f) summing up all the set-point information (see also following paragraph "alarm status page").

To display all the logged events one by one, press the "S" (2) key, and scroll the events with the "▲▼".keys.

To exit the detailed display of the events, press the "S" key.

To display the first logged event, press, first press the "▲" key.

## Alarm status page




Thanks to this page, it's possible to have the complete control of the set alarms: ON if enabled, OFF if disabled. For the alarms which are not enabled, the display shows two horizontal hiphens. The column under the "ALARM" indication identifies the alarm group, for example 01 to 04 represents the group of the first 4 alarms (from 1 to 4) and their status indicated on the right.

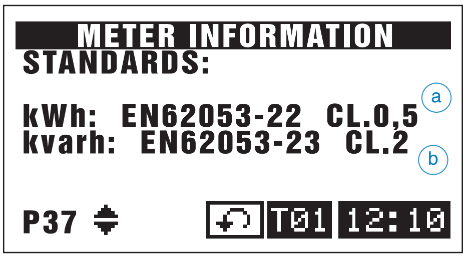
Press the "S" key to display the details (2) of each set alarm (c) (from 1 to 16):
the values of the programmed set points (e),
the alarm type (d): UP alarm if the "AL" symbol is in the (d1) position as shwon in the figure on the right, WINDOW alarm if the "AL" symbol is in the (d2) position or DOWN alarm if the "AL" symbol is in the (d3) position. Moreover, the display shows the alarm status (g) which can be ON or OFF and the value of the alarm variable (h).

To go from one alarm to the other, use the "▲▼" keys. To exit the display of the alarm status press the "S" key.

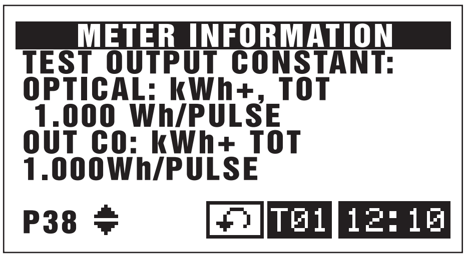
Further information on the alarms and the set-point adjustment is given in the "alarms programming" section of this manual.

To display the details of the 01 alarm, press the "▲" key first.

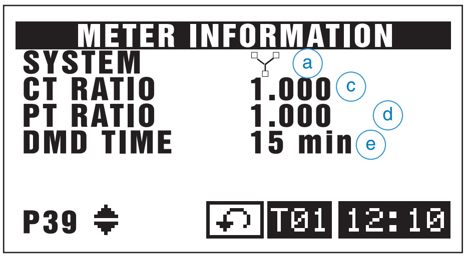
## Info pages



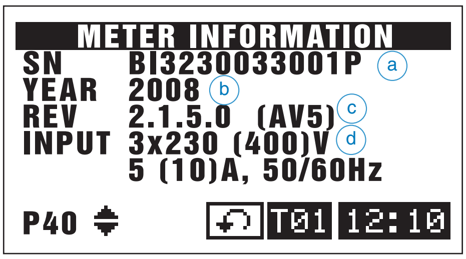
1



2



3

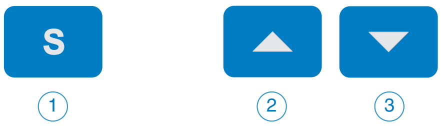


4

The last pages in the “display” mode show the main information relating to the programming of the instrument. These data are also available when the instrument is completely sealed.
The first of the 4 pages (1) only the standards to which the instrument refers (a, b) are displayed.
In the 2nd page (2) the output specifications of the (infrared light) optical port and open-collector output (C0) are displayed if these are used to retransmit the energy.
In the 3rd page (3) the following data are displayed: system measurement (a) the example figure shows the 3 phase 4 wire symbol, CT and PT ratio selected (c, d) and the DMD time selected (e).
In the 4th page (4) the following data are displayed: serial number of the instrument (a), production year (b), firmware release (c), measuring input specifications, (d).


WM5-96
Smart Power Quality Analyzer
Class 0.2 A/V
AL
CARLO GAVAZZI
ARM® Powered
TopRex®
154.2
W1dmd
155.0
W2dmd
154.6
W3dmd
kWh+
kvarh+
17.108
0.589
W%
P00
AL
T01
01:13
PRG
measures
S

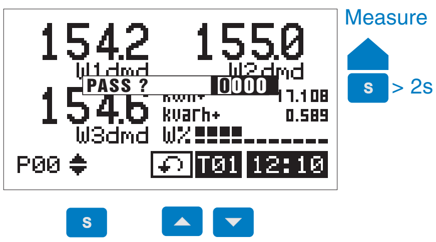
## Programming keypad




The “S” (1) key is used to enter programming, confirm the selected or modified data and go back to the previous data if pressed for at least 2 seconds. The “▲▼” keys at N. 6 are used to scroll the menus and modify the selected values/data. To modify the values proceed as follows: the “▲” (2) key increases in a cyclical way the selected digit from 0 to 9, to move to the next digit, use the “▼” (3) key, also in this case the system is cyclical.

Example, enter the value 213: starting situation 000, press “▲” twice to increase the number up to 2, then press “▼” to go on to the next digit (on the right); the instrument displays 200, press “▲” once to increase the number to 1, then press “▼” to go on to the next digit (on the right); the instrument displays 210, press “▲” three times to increase the digit to 3, press “S” to confirm the value. If you do not want to confirm the value, but only to modifiy it, press the “▼” key.

## Resets




By means of a single command and only from the “P00” page, you can carry out the reset of all the min. and max. values, the dmd and dmd max values, the reset of all the logged events and of the alarms with latch. To carry out this reset command you have to enter some numeric codes: press the “S” key, the instrument displays the “PASS?” indication. Enter by means of the “▲▼” keys the following numeric codes depending on the reset you want to carry out.

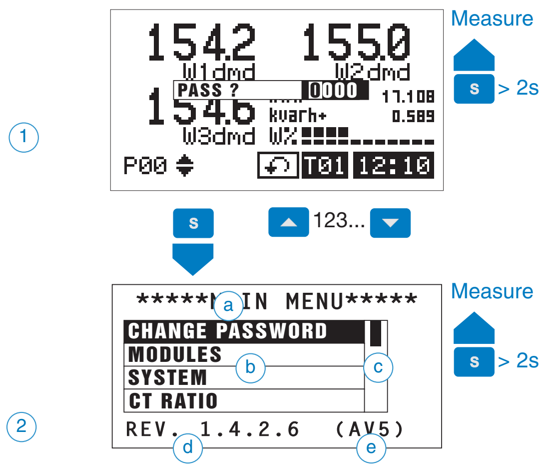
5784= reset of all the minimum and maximum values;

5785= reset of all the “dmd” and “dmM” (dmd max) values;

7239= reset of all the “events”;

9288= reset of the alarms with latch.

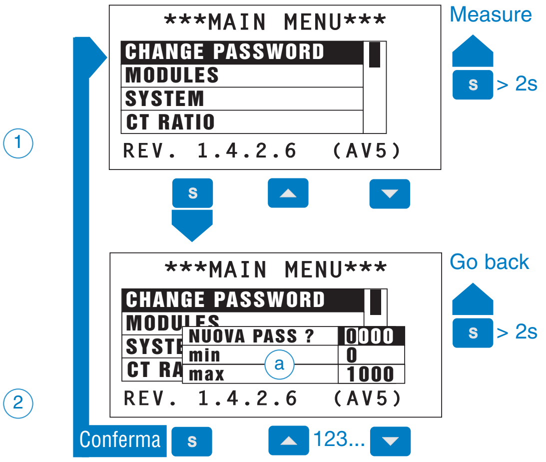
## Access to programming




To access the programming menus from the measuring and display phase, press the “S” key (only from the “P00” page), when the password “PASS?” is requested, enter the correct PASSWORD value by means of the “▲▼” keys, then confirm by pressing the “S” key again. If the PASSWORD is correct (for all instruments the PASS value when they leave the factory is “0”), the instrument will enter the main menu.
To cancel the choice and go back to the measuring mode, press the “S” key for at least 2 seconds.

- a Menu title.
- b Menu.
- c Scroll bar.
- d Firmware revision of the instrument.
- e Type of measuring analogue output being mounted on the instrument.

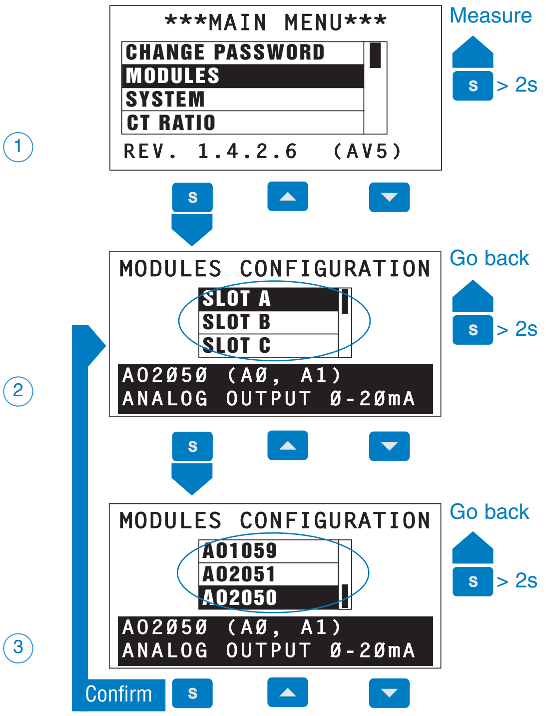
## Change password




This function allows the user to modify the PASS value with a new value (from 0 to 1000). Press the “S” key and when the instruments requires a new PASS (2) enter the desired value by means of the “▲ ▼” keys and confirm the new value with the “S” key. The instrument goes back to the main menu.

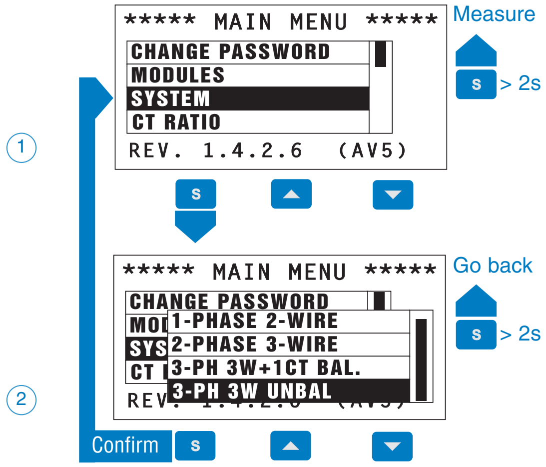
(a) The instrument shows the maximum and minimum limit of the value available for the password.

## Modules




The WM5 96 does not support the automatic acknowledgment of the installed modules, therefore this information must be entered using the “MODULES” menu. Choose by means of the “▲▼” keys the modules menu, press “S” to confirm and then select by the “▲▼” keys the relevant slot A, B, C, D or E (where slot A is the first on the top right, watching it from the front of the instrument, and slot E refers to the central housing). Confirm the highlighted slot with the “S” key and then select the code of the module (the code is written on the module itself): the instrument will also display a brief description of the selected code. The code of the module is placed on the side label of the module itself. To confirm the code of the selected module, press the “S” key.

## System

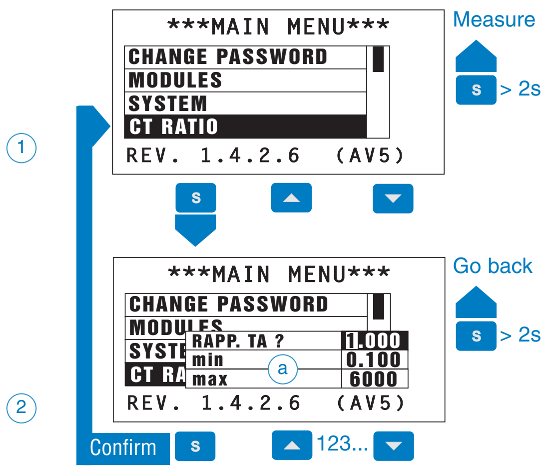



This function allows the user to select the type of electrical system choosing among:

**1-** single phase 2 wires (1-PHASE 2-WIRE),
**2-** dual phase 3 wires (2-PHASE 3-WIRE),
**3-** three phase 3 wires and 1 CT balanced load (3-PH 3W+1CT BAL.),
**4-** three phase 3 wires unbalanced load (3-PH 3W UNBAL.),
**5-** three phase 4 wires unbalanced load (3-PH 4W UNBAL.).

Choose by means of the "▲▼" key the SYSTEM function (1), press the "S" key to confirm, then select by means of the "▲▼" keys the desired system (2) and confirm the selection with the "S" key.

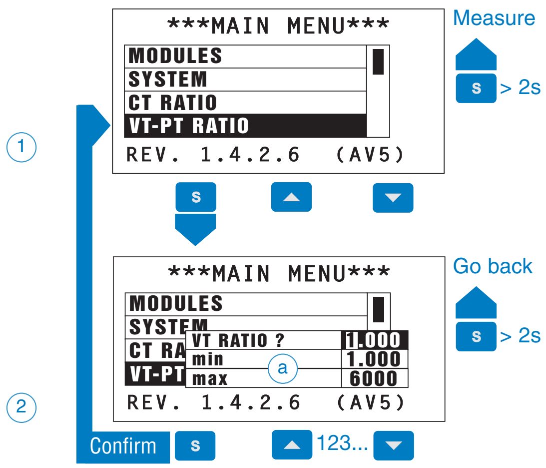
## CT ratio




This function allows the user to select the value of the CT ratio (primary/secondary ratio of the current transformer being used). Example: if the CT primary (current transformer) has a current of 300A and the secondary a current of 5A, the CT ratio corresponds to 60 (obtained using the following calculation: 300/5). Choose the CT RATIO function (1) by means of the "▲▼" keys and confirm the selection with the "S" key. Then select the desired value by means of the "▲▼" keys (2) and confirm the value with "S".

a The instrument displays the maximum and the minimum value available for the CT ratio.

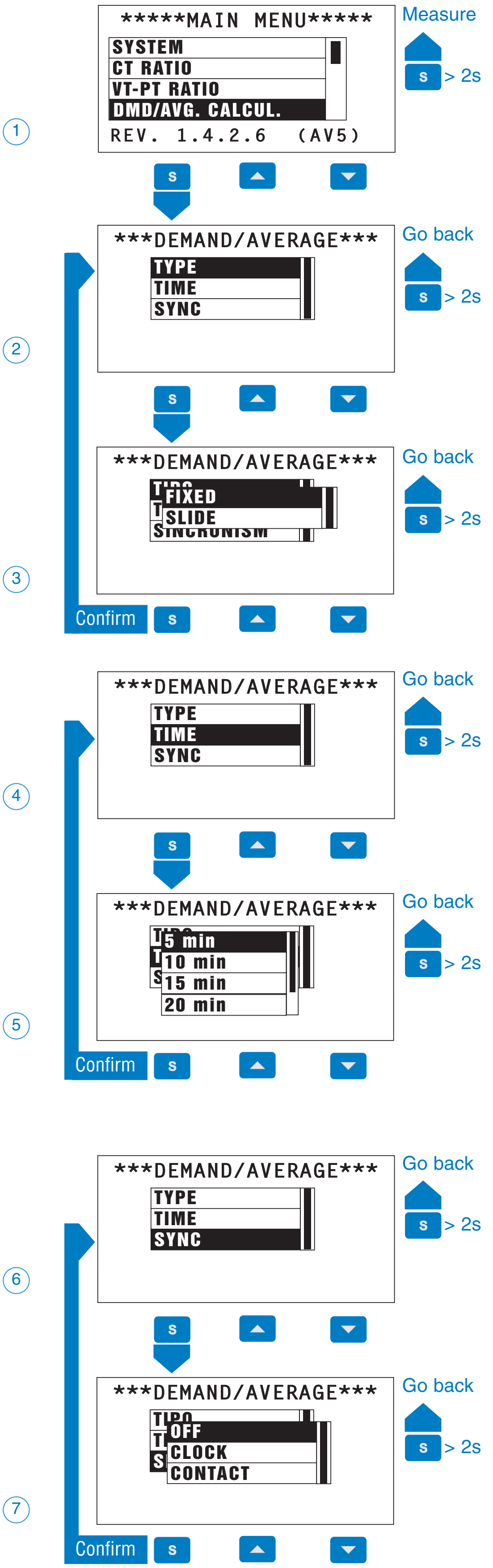
## VT ratio




This function allows you to select the value of the VT-PT ratio (primary/secondary ratio of the voltage transformer being used). Example: if the primary of the connected VT (voltage transformer) is 20kV and the secondary is 100V, then the VT-PT ratio corresponds to 200 (obtained carrying out the following calculation: 20000/100). Choose the VT-PT RATIO function (1) by means of the "▲▼" key and confirm the selection with "S". Then select by means of the "▲▼" key the desired value (2) and confirm the value with the "S" key.

a The instrument displays the maximum and minimum value available for the VT-PT ratio.

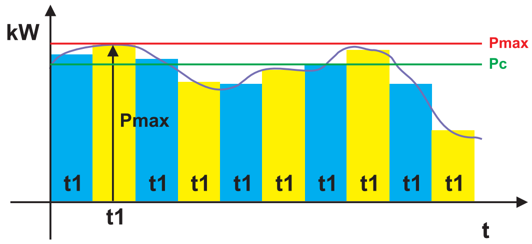
## DMD/AVG calculation




This function allows the user to select the calculation method of the DMD/AVG value of the selected variable. To access these functions select DMD/AVG CALCUL. from the main menu by means of the "▲ ▼" keys and confirm the selection with "S" (1).

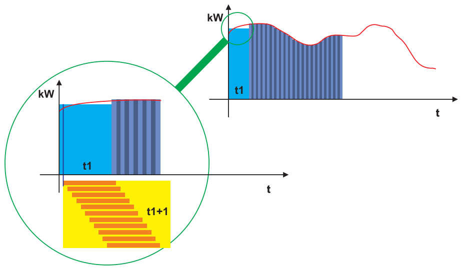
**TYPE** (2): select the type of calculation mode to be used for the DMD/AVG calculation: FIXED or SLIDE (3). Select the desired type (3) by means of the "▲ ▼" keys and confirm with "S".

**TIME** (4): select the time interval for the DMD/AVG calculation (5, 10, 15, 20, 30, 60 minutes). Select the desired time (5) by means of the "▲ ▼" keys and confirm with "S".




Where:
**Pmax** is the maximum power,
**Pc** is the contractual power,
**t1** is the selected time period for the calculation of the AVG/DMD value.

**FIXED SELECTION:** if, for example, a time interval of 15 minutes has been selected, the instrument will calculate the AVD/DMD value of the measured variable and updates its value every 15 minutes.




**SLIDING SELECTION:** if for example a time interval of 15 minutes has been selected, the instrument calculates the AVG/DMD value and updates its value at the beginning after the first 15 values and then after every minute, thus generating a window whose width is of 15 minutes and that moves forward every minute.

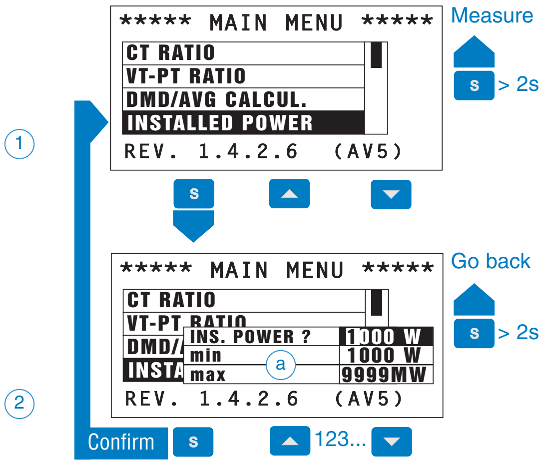
**SYNCHRONISM** (6): select the synchronization mode, that is the method that controls the calculation method of the average/demand according to the selected time. Select the type of desired synchronism (7) by means of the "▲ ▼" keys and confirm with "S".

**OFF** (7): the synchronization calculation starts when you switch the instrument on.

**CLOCK** (7): the synchronization starts as soon as the first selected integration time multiple expires. Example: by setting the integration time at 10 minutes and the current time at 10:25, the synchronization will start at 10:30.

**CONTACT** (7): the synchronization starts at the status modification (from ON to OFF or from OFF to ON) of one of the digital inputs programmed such as SYNCHRONIZATION or TARIFF (see "DIGITAL INPUTS"). A consequent status change produces the reset and then again the starting up of the synchronization.

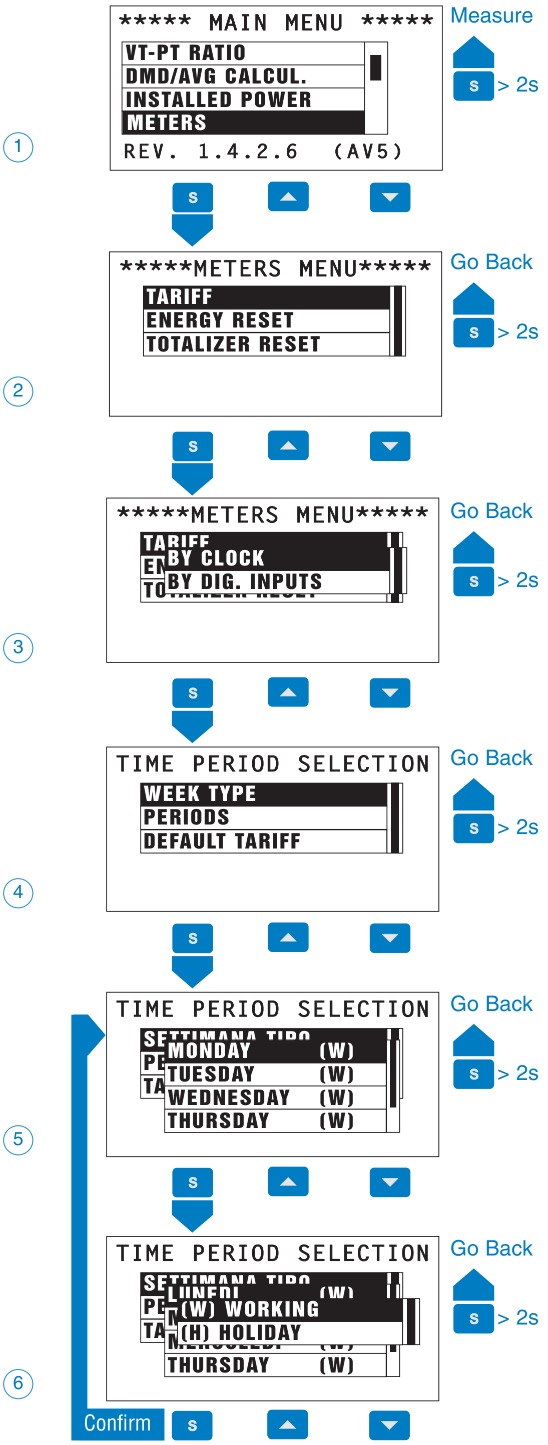
## Installed power




This menu allows you to set a power value (installed power) that, in the measuring phase, will represent 100% of the graph indicator “W%” present in the “P00” page (in the fourth quadrant).
Select INS. POWER ? (1) by means of the “▲▼” keys and confirm with the “S” key. Then enter the full scale value by means of the “▲ ▼” keys and confirm with “S”.

a The instrument shows the maximum and minimum limit of the value available for the full scale of the W% graph.

## Meters Menu




This menu allows the user to select/set all the parameters of the energy meters. From the main menu, select METERS by means of the "▲▼" keys and confirm with the "S" key to enter the METERS menu. Then choose by means of the "▲▼" keys if entering the programming of the TARIFF (2) or entering the "ENERGY RESET" menu to reset the meters (16); confirm the selection with S".

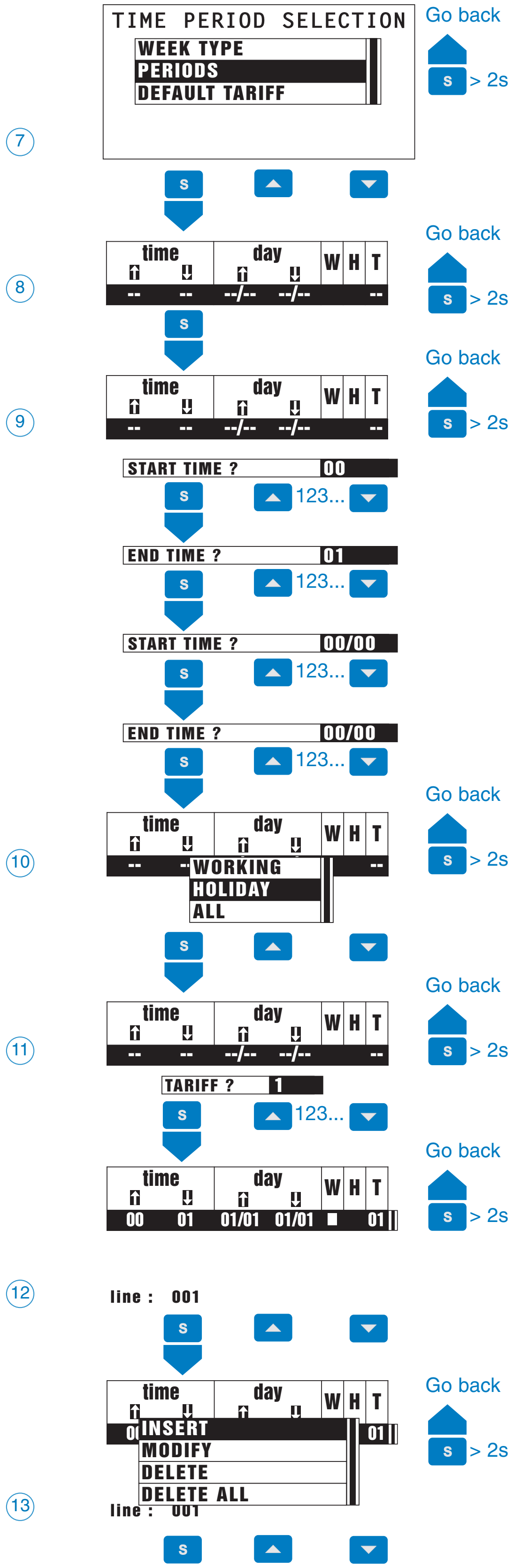
**TARIFF** (3): the instrument identifies two operating modes.

**BY DIG. INPUTS** (by digital inputs) (3): the instrument manages the tariff changes by means of the status changes of the digital inputs programmed as TARIFF (see the section dedicated to the digital inputs). Select BY DIG. INPUTS by means of the "▲▼" keys and confirm with the "S" key.

**BY CLOCK** (3): the instrument manages the tariffs by means of the clock integrated in the RS232 serial module. Select BY CLOCK by means of the "▲▼" keys and confirm with the "S" key, then set the following additional parameters:

**WEEK TYPE** (4): set the WEEK TYPE where for each day you can select if it's to be considered a working day or a holiday. The setting of the week type is very useful to simplify the following programming of the periods.
Select WEEK TYPE with the "▲▼" keys and confirm with the "S" key: you enter the window with the list of days (5), select the desired day with the "▲▼" keys and confirm with the "S" key, then choose by means of the "▲▼" keys if the day is to be considered as a (W) WORKING day or as a (H) HOLIDAY (6), and confirm with the "S" key. Proceed as above described with the remaining days. To conclude the operation and go back to step number (4), press the "S" for at least 2 seconds.

**Warning:** for the management of the tariffs with the "BY CLOCK" option, when counting the energy with WM5, the AR1039 (RS232 + RTC) option is to be installed. The tariff management "BY CLOCK" is however possible also without this module, but in this case the "CLOCK" function, instead of the "METERS" function is to be selected, and then the subfunction "WITHOUT BACKUP": in this case, remember that if, for any reason, the instrument is switched off, the current DATE and TIME will not be stored. These data will have to be set again every time the instrument is switched on.



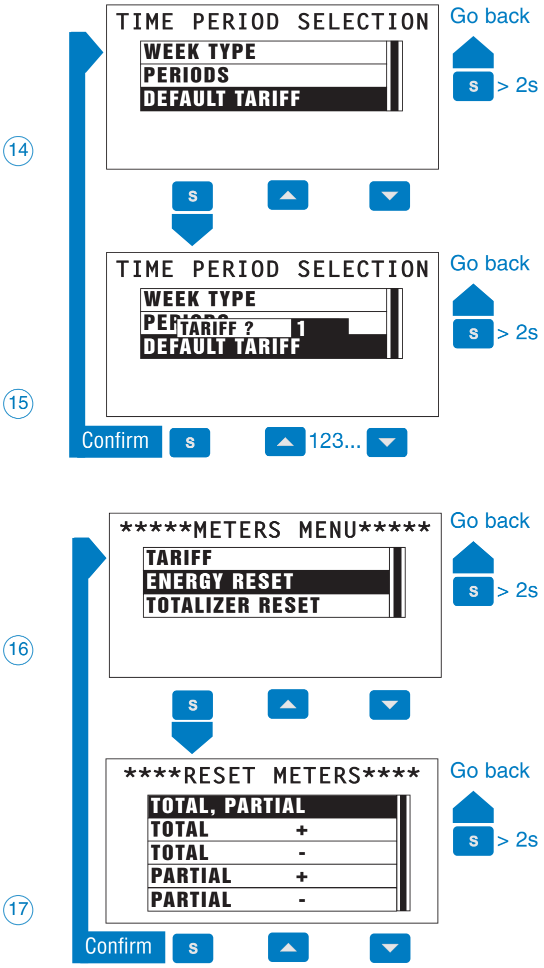

**PERIODS** (7): set the periods to which the tariffs are to be coupled. It's possible to divide each day into up to 24 periods. Up to 100 lines of period selection can be entered. Select PERIODS by means of the "▲▼" keys and confirm with the "S" key: a table (8) will be displayed which will be empty at the beginning and where the various programmed periods are to be entered. To set the START TIME of the period (9), press the "S" key; then, by means of the "▲▼" keys, select the time from 00 (00 AM) to 23 (11 PM); press "S" to confirm the selected time and go to the setting of the "END TIME": select the desired time by means of the "▲▼" keys, then press "S". Afterwards, set the START DATE of the period by means of the "▲▼" keys and confirm with the "S" key, then set the END DATE of the period by means of the "S" keys and confirm with "S". Once the time data have been set, the instrument will display a window (10) from which the period type can be selected, that is either WORKING, HOLIDAY or ALL (the ALL selection will not make any difference between WORKING day and HOLIDAY, that is the default TARIFF will be applied): select the desired mode by means of the "▲▼" keys and confirm with "S". As last setting, choose the TARIFF (11) to be coupled to the period, use the "▲▼" keys to select the desired tariff from 1 to 12 and confirm with the "S" key (up to 12 tariff if the management is carried out by means of internal clock, up to 4 tariffs if the management is carried out by means of the digital inputs).
A new line (12) relevant to the period which has just been programmed will be added to the table: it'll be possible to add up to 99 further lines. The following options (13) are also possible:

**INSERT:** enter a new line (new period); follow the instructions given from step (9) to step (11).

**MODIFY:** modify an existing period. Select the period to be modified by means of the "▲▼" keys, press the "S" key to display the relevant window (13), then choose MODIFY by means of the "▲▼" keys and confirm the choice with the "S" key. Afterwards follow the setting procedure as described from step (9) to step (11).

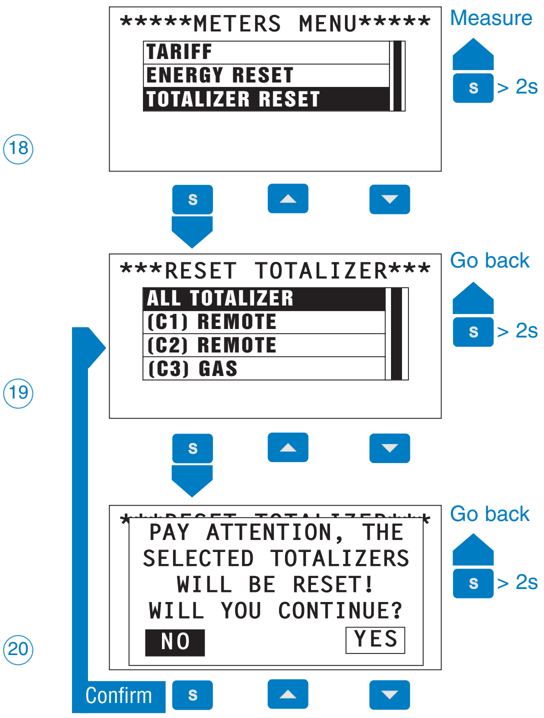
**DELETE:** delete an existing period. Select the period to delete with the "▲▼" keys, press the "S" key to display the relevant window (13) then choose DELETE by means of the "▲▼" keys and confirm with the "S" key. Before deleting the period, the instrument displays the following message: PAY ATTENTION, CURRENT LINE WILL BE DELETED!!!! WILL YOU CONTINUE? Choose YES to execute the command or NO to cancel the deleting.

**DELETE ALL:** delete all the existing periods. Press the "S" key to display the relevant window (13), then choose DELETE ALL by means of the "▲▼" and confirm with the "S" key. Before deleting all the periods, the instrument displays the following message: PAY ATTENTION, ALL LINES WILL BE DELETED!!! WILL YOU CONTINUE? Choose YES to execute the command or NO to cancel the deleting.




**DEFAULT TARIFF** (14): it is the tariff (from 1 to 12) which will be coupled to the meters if no other programming is made or for the days (periods) set as non-working. Select DEFAULT TARIFF with the "▲▼" keys and confirm with the "S" key. Then set by means of the "▲▼" keys the tariff (15) that will be set as DEFAULT TARIFF, and confirm with "S".

**ENERGY RESET** (16): reset the ENERGY METERS choosing among:
TOTAL, PARTIAL: resets all energy meters, both total and partial.
TOTAL +: resets the total meters of imported energy.
TOTAL -: resets the total meters of exported energy.
PARTIAL +: resets the partial meters of imported energy.
PARTIAL -: resets the partial meters of exported energy. To reset the meters, select ENERGY RESET from the METERS MENU (16) by means of the "▲▼" keys and confirm with "S"; then select the type of RESET to be carried out by means of the "▲▼" keys and confirm with "S". Before carrying out the selected reset, the instrument displays the following message: PAY ATTENTION, THE SELECTED METERS WILL BE RESET! WILL YOU CONTINUE?: choose YES to proceed with the reset or NO to cancel it.




**TOTALIZER RESET** (18): reset the TOTALIZERS choosing among:
ALL TOTALIZER (19): reset all the totalizers.
The other strings identify the totalizers set before that you want to reset individually (GAS, HOT H2O, COLD H2O, REMOTE HEATING).
To reset the totalizers, select TOTALIZER RESET from the METERS MENU (20) by means of the "▲▼" keys and confirm with "S"; then select the type of RESET to be carried out by means of the "▲▼" keys and confirm with "S". Before carrying out the selected reset, the instrument displays the following message: PAY ATTENTION, THE SELECTED TOTALIZERS WILL BE RESET! WILL YOU CONTINUE?: choose YES to proceed with the reset or NO to cancel it.

## Programming example of the tariff parameters

> ⚠ In the “time periods” table you have at least 100 selection rows available.

Let’s for example take into consideration the following tariff plan decided by the energy supplier for December.
The working week is from Monday to Friday, while the weekend is made by Saturday and Sunday. During the working days there are two different tariffs with the following time periods: TARIFF 4 (T4) from 8 am to 5 pm, and TARIFF 3 from 5 pm to 8 am., while during the week end there is only one time period and therefore a single TARIFF (T2).
The first thing to do is to program the week type (4 - 6), the working days will be indicated as follows: Monday (W), Tuesday (W), Wednesday (W), Thursday (W), Friday (W). While the weekend (Holidays) will be indicated as: Saturday (H), Sunday (H). As a consequence, the time periods relating to the working weeks will be divided into the following lines (8 - 13):
**First line:** START TIME = 00, END TIME = 8, START DATE = 01/12, END DATE = 31/12, then select “WORKING” and TARIFF “3”.
**Second line:** START TIME = 8, END TIME = 17, START DATE = 01/12, END DATE = 31/12, then select “WORKING” and TARIFF “4”.
**Third line:** START TIME = 17, END TIME = 24, START DATE = 01/12, END DATE = 31/12, then select “WORKING” and TARIFF“3”. Moreover, a 4th line will be necessary to identify the NON-WORKING days other than the week end (Saturday and Sunday): for example December 25th and 26th.
**Fourth line:** START TIME = 00, END TIME = 24, START DATE = 25/12, END DATE = 26/12, then select “HOLIDAY” and TARIFF “2”.

| time | | day | | W | H | T |
|---|---|---|---|---|---|---|
| ↑ | ↓ | ↑ | ↓ | | | |
| 00 | 08 | 01/12 | 31/12 | ■ | | 03 |
| 08 | 17 | 01/12 | 31/12 | ■ | | 04 |
| 17 | 24 | 01/12 | 31/12 | ■ | | 03 |
| 00 | 24 | 25/12 | 26/12 | | ■ | 02 |

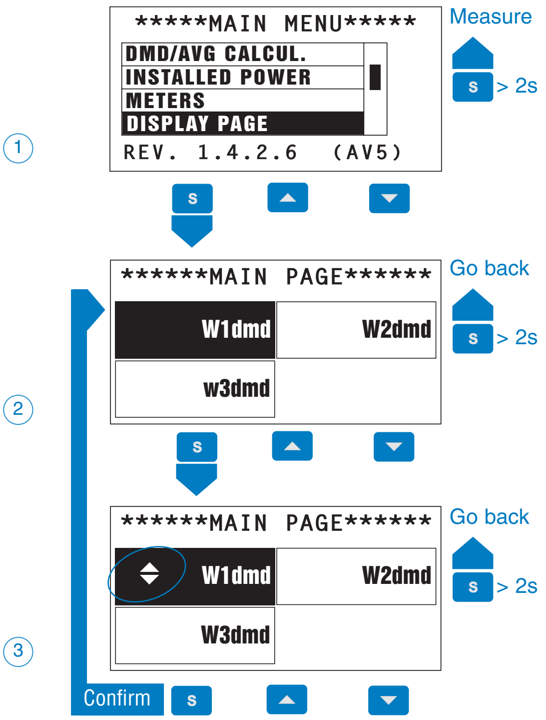
line : 004

The periods are now programmed and the instrument will display the window on the left.

The periods programmed as above only refer to the month of December, therefore it’s necessary to set a tariff referring to the remaining time period, which will be referred to as “T1”. In this case you can refer to the default tariff (14) set as TARIFF “1”, so that the instrument will automatically refer to TARIFF “T1” when no other programming is present.

| ENERGY SUPPLIER | | | | | SETTING WM5 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Month | Week | Time | Type | Selected Tariff | Start time | End time | Start date | End date | Type | Tariff |
| DECEMBER | from MONDAY to FRIDAY | from 8 to 17 | Working | 4 | 00 | 08 | 01/12 | 31/12 | W | 3 |
| | | from 17 to 8 | | 3 | 8 | 17 | 01/12 | 31/12 | W | 4 |
| | | | | | 17 | 24 | 01/12 | 31/12 | W | 3 |
| | from SATURDAY to SUNDAY | H24 | Holiday | 2 | 00 | 24 | 25/12 | 26/12 | H | 2 |
| Rest of the year | All | H24 | -- | 1 | Default tariff 1 | | | | | |

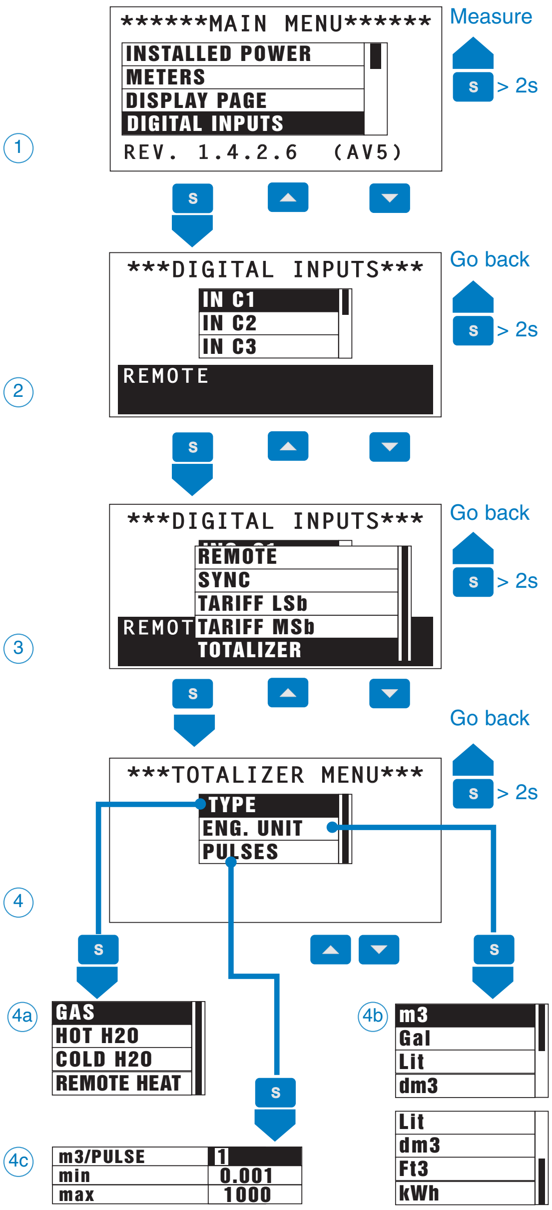
## Display Page




This function allows the user to select the variables to be displayed on page 00. Choose the DISPLAY PAGE function (1) by means of the "▲▼" keys and confirm with "S", then by means of the "▲▼" keys select the display line where the selected variable (2) is to be displayed and press "S". Afterwards select the variable to be displayed by means of the "▲▼" keys among those displayed by the instrument (3) and confirm with "S".

**NOTE:** only the page "00" can be free configured.

## Digital Inputs




This function allows the operating modes selection of the digital inputs. Choose the function DIGITAL INPUTS (1) by means of the "▲ ▼" keys and confirm with the "S" key. (2) Select the digital input (ex.: A1=digital input 1 of slot A) by means of the "▲▼" keys, the instrument displays the function of the selected input (the inputs are set on REMOTE as default), press "S" to confirm the selected digital input. (3) From the list, select the operating mode to be coupled to the selected digital input by means of the "▲▼" keys, the functions are:

**REMOTE** (3): the status of the digital inputs is displayed from the instrument and retrasmitted (if requested) by the serial communication.

**SYNC (SYNCHRONISM)** (3): synchronises the calculation of the "dmd" power by means of an external signal.

**TARIFF LSb and MSb** (3): This function allows the digital inputs to control the tariffs in the energy metering. The combination of the input status manages the tariff change as specified in the table (18-1). If only the "MSb" (one digital input only) is selected, then the energy metering is possible with a maximum of 2 tariffs: the tariff change will only be possible between tariff 1 and tariff 3. If only the "LSb" is selected, then the tariff change occurs only between tariff 1 and tariff 2. The use of both digital inputs (MSb + LSb) allows the management of tariffs 1, 2, 3 and 4. Press "S" to confirm the selection. Proceed, if necessary, with the configuration of the other digital inputs.

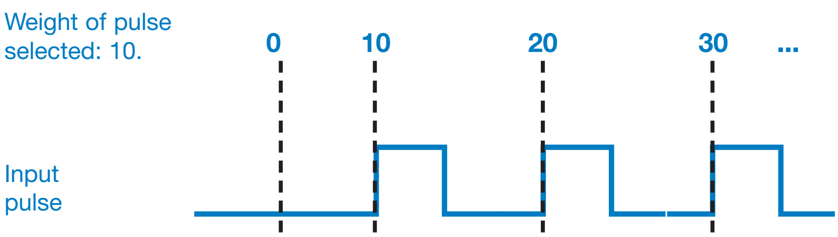
| MSb | LSb | Tariff |
|---|---|---|
| off | off | 1 |
| off | on | 2 |
| on | off | 3 |
| on | on | 4 |

(18-1)

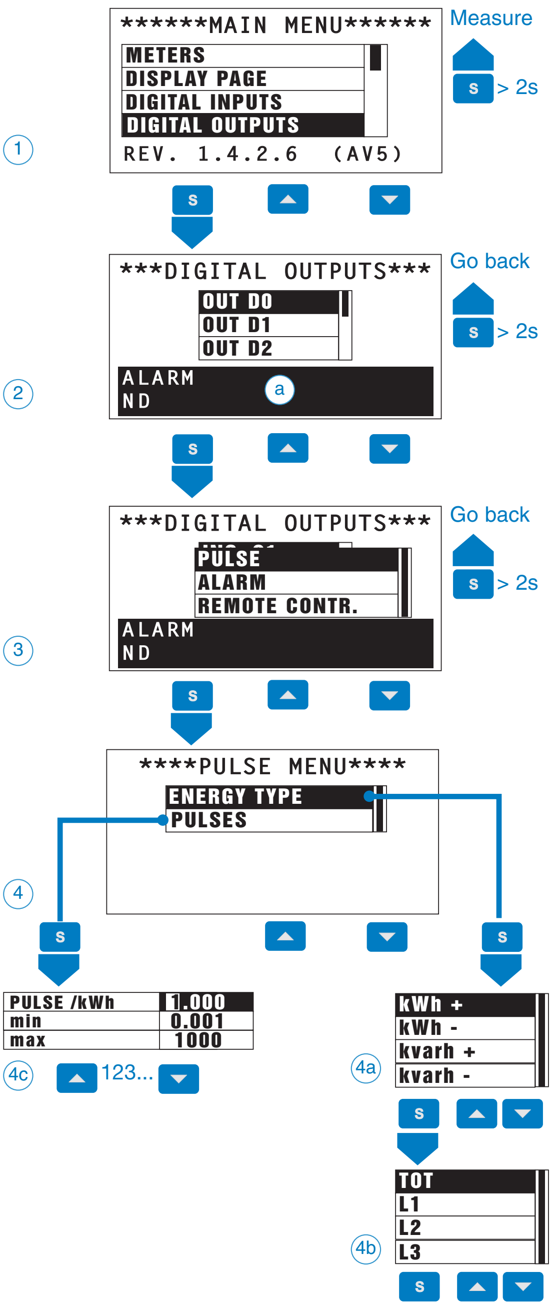
**TOTALIZERS** (3): This function allows the digital inputs to totalize the gas, water (hot or cold) and the remote heating. From the totalizer menu select: TYPE (4), to choose what the instrument has to totalize (4a) GAS, HOT H2O (hot water), COLD H2O (cold water) or REMOTE HEAT: in this case the WM5 counts the hot water by the digital input through an external water counter but on the display the relevant value is reported in "kWh".

ENG. UNIT (4b), to choose the correct engeegniring unit (4b) to associate to the totalizer selected before.

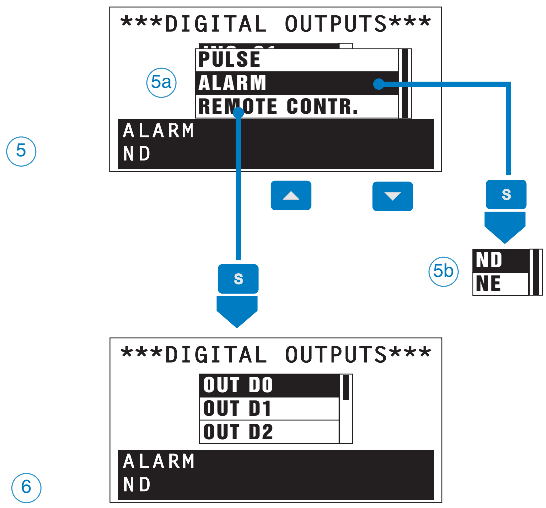
PULSES (4c), to set the pulse weigth (4c), that is for each input pulse the totalizer increases in the chosen value.



## Digital outputs




This function allows the selected function to be coupled to the selected digital output: pulse, alarm, remote control. Select the DIGITAL OUTPUT function (1) by means of the "▲▼" keys and confirm with "S". (2) Select the digital output (ex.: D0=digital output 0 of slot D) by means of the "▲▼" keys, the instrument displays the function of the selected output (a), press "S" to confirm the selected digital output (3) select the operating mode to be coupled to the selected digital output by means of the "▲▼" keys. The functions are the following:
**PULSE** (3): the measured energy is retransmitted by the digital output by means of pulses. Choose the PULSE function by means of the "▲▼" keys and confirm with "S". Then select the type of energy to be retransmitted: select ENERGY TYPE by means of the "▲▼" keys and confirm with "S", the instrument displays the list of energies (4a), (kWh +, kWh-, kvarh +, kvarh-): select the desired energy by means of the "▲▼" keys and confirm with the "S" key: for each energy it's possible to retransmit the total energy metering (TOT) or the tariffs from T1 to T12 (4b), choose the desired energy detail by means of the "▲▼" keys and confirm with the "S" key. At the end of the procedure, the value of the pulse associated to the energy measured by the instrument is to be decided, that is the number of pulses generated by the digital output for each measured kWh+ (or kWh- or kvarh+ or kvarh-). Choose PULSES (4) by means of the "▲▼" keys and confirm with the "S" key, then (4c) set the desired value of the pulses by means of the "▲▼" keys, confirm the value with the "S" key.




**ALARM** (5): the digital output is enabled only if the expected alarm status occurs. Select the ALARM function by means of the "▲▼" keys and confirm with the "S" keys (5a).Then select "ND" (normally de-energized relay) or "NE" (normally energized relay) (5b) by means of the "▲▼" keys. To program the values of the set-points refer to the "alarm" menu.
**REMOTE CONTR.** (5): the digital output can be enabled by means of a command sent by means of serial port. Select the REMOTE CONTR. function by means of the "▲▼" keys, then press the "S" key to confirm.

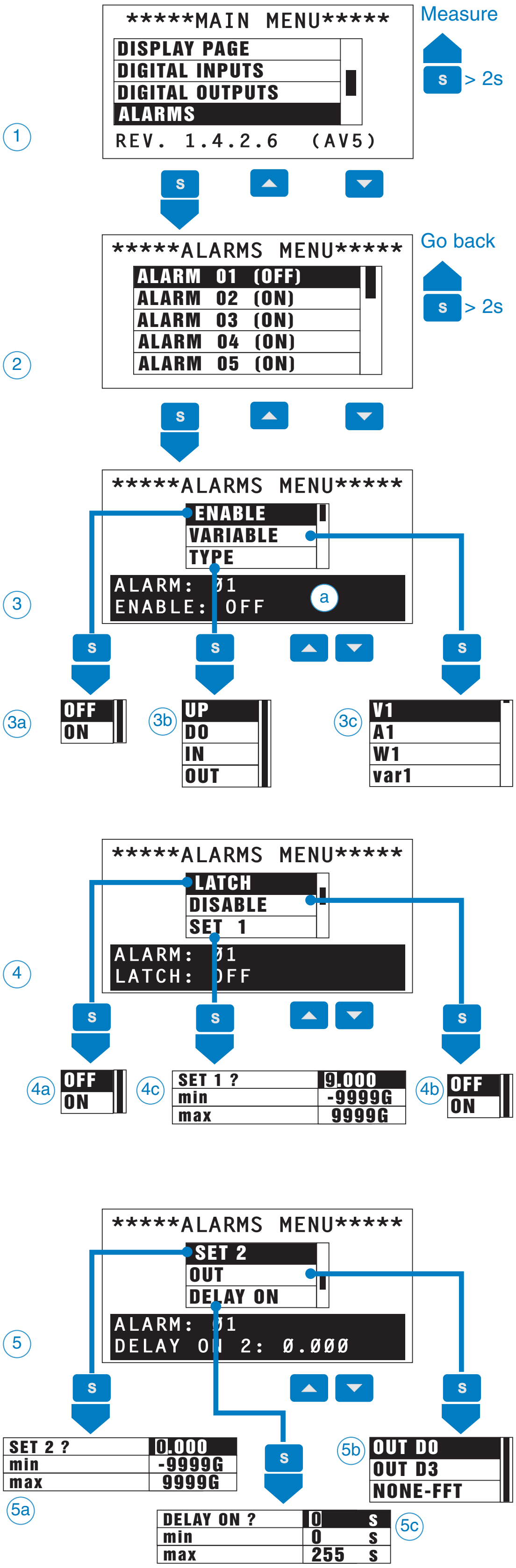
Proceed, if necessary, with the configuration of the other digital outputs (6).

The digital outputs highlighted in the below mentioned table, are subject to a self test that implies their brief activation when the instrument is switched on. Their use as pulse outputs is therefore not recommended.

| Code | Description | Slot A | | | | Slot B | | | | Slot C | | | | Slot D | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A01058 | 1 relay output | **A0** | | | | B0 | | | | C0 | | | | D0 | | | |
| A01059 | 1 open coll. output | **A0** | | | | B0 | | | | C0 | | | | D0 | | | |
| A01035 | 2 relay outputs | **A0** | **A1** | | | B0 | **B1** | | | C0 | C1 | | | D0 | D1 | | |
| A01036 | 2 open coll. outputs | **A0** | **A1** | | | B0 | **B1** | | | C0 | C1 | | | D0 | D1 | | |
| A01037 | 4 open coll. outputs | **A1** | **A2** | **A3** | **A4** | **B1** | **B2** | B3 | **B4** | **C1** | **C2** | C3 | C4 | **D1** | **D2** | D3 | D4 |

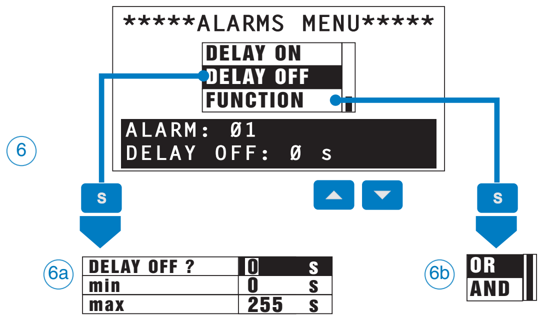
(19-1)

## Alarm




This function allows you to set the alarm parameters. The instrument is able to manage up to 16 alarms (real or virtual). Select the ALARMS function (1) by means of the "▲▼" keys and confirm with "S". Then select the alarm to be programmed (2) by means of the "▲▼" keys and confirm with the "S" key, then set the following parameters:

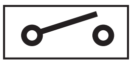
**ENABLE** (3): enable (ON) or disable (OFF) the alarm; the instrument display the existing programming (a). Select the ENABLE function (3) by means of the "▲▼" keys and confirm with the "S" key. Then select ON (3a) to enable or OFF (3a) to disable the alarm by means of the "▲▼" keys, then confirm with the "S" key.
**VARIABLE** (3): set the variable to be coupled to the alarm. Select the VARIABLE submenu (3) by means of the "▲▼" keys and confirm with the "S" key. Then select the variable to be coupled to an alarm (the list of variables depends on the selected system) (3c) by means of the "▲▼" keys, then select with the "S" key.
**TYPE** (3): set the operating mode of the alarm. UP: up alarm, the alarm will be enabled if the measured value exceeds the set-point. DO: down alarm, the alarm will be enabled if the measured value goes below the set point. IN: internal window alarm, the alarm will be activated if the value is brtween the two set points. OUT: the alarm will be activated if the value is outside the two set points. See details on next page "Logic and alarm parameters". Choose the TYPE (3) function by means of the "▲▼" and confirm with "S". Then, select by means of the "▲▼" keys the desired alarm mode (3b) and confirm with "S".
**LATCH** (4): set the latch function. The alarm will remain ON even if the cause that has generated it is not present any more. The alarm can be reset only manually after the user has noticed it. Choose the LATCH function by means of the "▲▼" keys and confirm with "S". Then select ON (4a) by means of the "▲▼" keys to enable the latch or OFF (4a) to disable it, then confirm with "S".
**DISABLE:** set the DISABLE function. When the instrument is switched on, the first alarm condition will be ignored (useful also in case of DOWN alarm). Choose the DISABLE function by means of the "▲▼" keys and confirm with "S". Then select ON (4b) to enable it or OFF (4b) to disable it by means of the "▲▼" keys and confirm with "S".
**SET 1** (Set point 1) (4): set the first alarm set point of the variable. Choose SET 1 (4c) by means of the "▲▼" keys and confirm with "S". Then set the value by means of the "▲▼" keys and confirm with "S".
**SET 2** (5): set the second alarm set point of the variable. Choose SET 2 (5a) by means of the "▲▼" keys and confirm with "S". Then set the value by means of the "▲▼" keys, then confirm with "S".
**OUT** (5): select the output to be enabled in case of alarm. The list will display all the outputs that in the menu "Digital outputs" have been set as "alarm". Choose the OUT function by means of the "▲▼" keys and confirm with "S". NONE-FFT, virtual alarm with trigger function for signal FFT analysis. The analysis relevant to the 10s that precede the alarm event will be stored (FIFO) and available for the remote downloading by means of a specific software PowerSoft.Then select by means of the "▲▼" keys the desired output (5b) then confirm with "S".
**DELAY ON** (5): set a delay on activation of the alarm. Choose the function DELAY ON by means of the "▲▼" keys and confirm with "S". Then set the value in seconds (5c) by means of the "▲▼" keys quindi confermare con "S".
**DELAY OFF** (6): set a delay on deactivation of the alarm. Choose the DELAY OFF function by means of the "▲▼" keys and confirm with "S". Afterwards set its value in seconds (6a) by means of the "▲▼" keys then confirm it with "S".




**FUNCTION** (6): set its OR or AND logic. Choose FUNCTION by means of the "▲▼" keys and confirm with "S". Afterwards select by the "▲▼" keys the logic function to be coupled to the OR (6b) or AND (6b) alarm, then confirm with "S". See details in "Logic and alarm parameters". Proceed, if necessary, with the configuration of the other alarms (up to a maximum of 16 alarms).

To exit the menu "digital outputs" keep the "S" key pressed for at least 2 seconds.

## Logic and alarm parameters

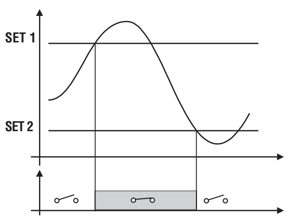


Each symbol includes all the settings described in the "alarm" paragraph and listed on the right:

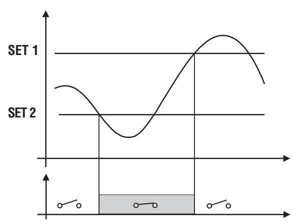
- Enable.
- Variable
- Type
- Latch
- Disable

- Set 1
- Set 2
- OUT
- Delay on. Delay off.
- Function (and/or)

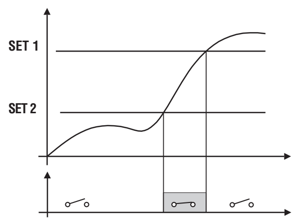
**A, B, C... up to 16** locks to control parameters.



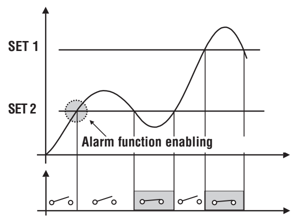

**UP alarm**




**DOWN alarm**

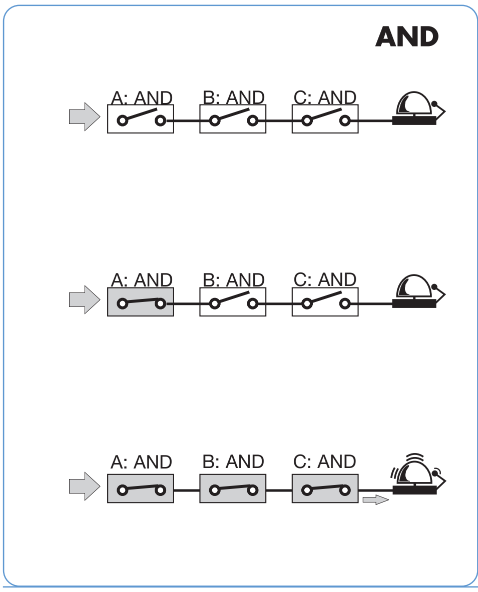


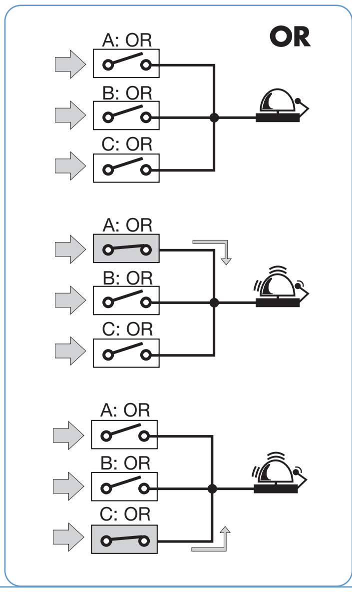

**In-window alarm**
**Alarm is on when the value is between SET 1 and SET 2**

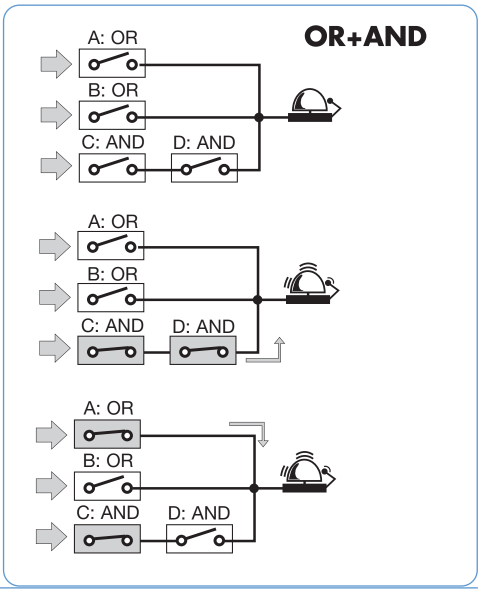



**Ext. window alarm with disabling at power on**
Alarm is on when value exceeds SET 1 or goes below SET 2

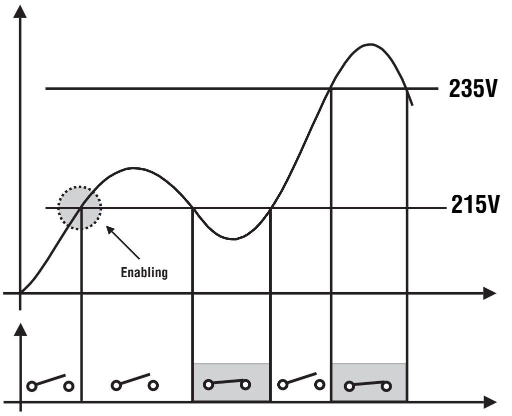
### Example of AND/OR logic alarm:



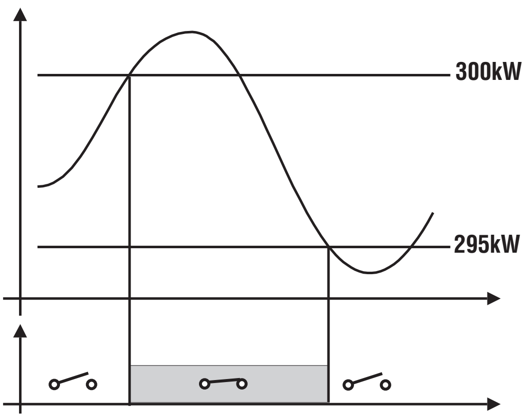



## Example of alarm parameters programming




The enabling of an alarm is required when the system voltage VL1-N exceeds or is below the range 215V - 235VAC. The external window alarm is selected so that the output is enabled when the measured value exceeds 235V or is below 215V.

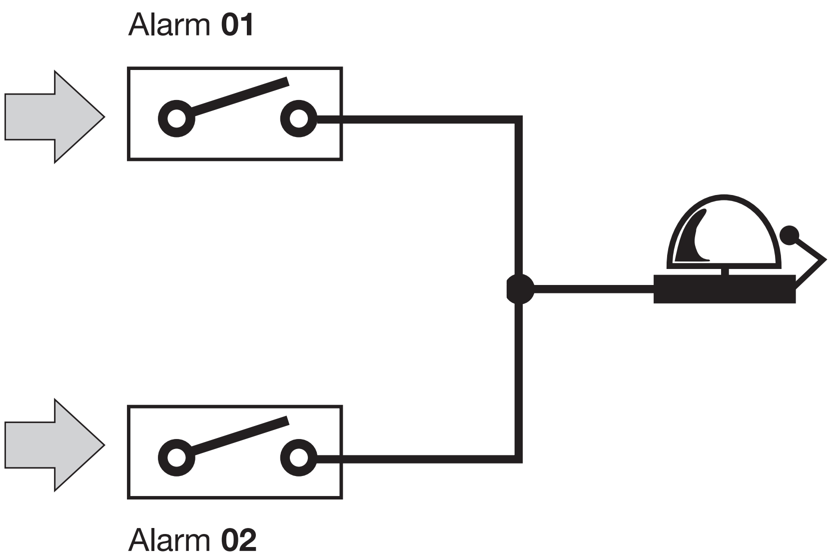
Here below you will find the recommended programming:
- Enabling of one of the 16 alarms (alarm example 01 ON)
- Choose the variable to be monitored: VL1-N= V1
- Choose the type of desired alarm: OUT
- Choose if the latch is to be enabled or not: OFF
- Choose if enabling or not the disabling of the first alarm status from the switching on of the instrument: ON.
- Set set-point 1: Set 1 = 235V
- Set set-point 2: Set 2 = 215V
- Choose to which digital output the alarm you are programming is to be addressed (the “C0” digital output is to be previously enabled to the “alarm” function; in the same menu it’s possible to select the desired type of output: “ND or NE”).
- Should a DELAY ON (delay on activation) be required, set the desired number of seconds: “5 seconds”.
- Should a DELAY OFF (delay on deactivation) be required, set the desired number of seconds: “5 seconds”
- Choose the kind of logic with which the alarm is to be treated: “OR” (see examples of logic alarm: AND/OR).




The disconnection of a load when a set value of absorbed power is required. For example when 300kW are exceeded, the alarm occurs and a set load is disconnected. An UP alarm is selected. Below you’ll find the recommended programming:
- Enabling of one of the 16 alarms (example: alarm 02 ON).
- Choose the variable to be monitored: W system (W∑)
- Choose the type of required alarm: “UP”
- Choose if the latch is to be enabled or not:“OFF”
- Choose if the disabling of the first alarm status from the switching of the instrument is to be enabled or not: “OFF”
- Set set-point 1: Set 1 = 300kW
- Set set-point 2: Set 2 = 295kW
- Choose to which digital output the alarm you are programming is to be addressed: “D0” (the “D0” digital output is to be previously enabled to the “alarm” function; in the same menu it’s possible to select the desired type of output: “ND or NE”).
- Should a DELAY ON (delay on activation) be required, set the desired number of seconds: “5 seconds”.
- Should a DELAY OFF (delay on deactivation) be required, set the desired number of seconds: “5 seconds”
- Choose the kind of logic with which the alarm is to be treated: “OR” (see examples of logic alarm: AND/OR).

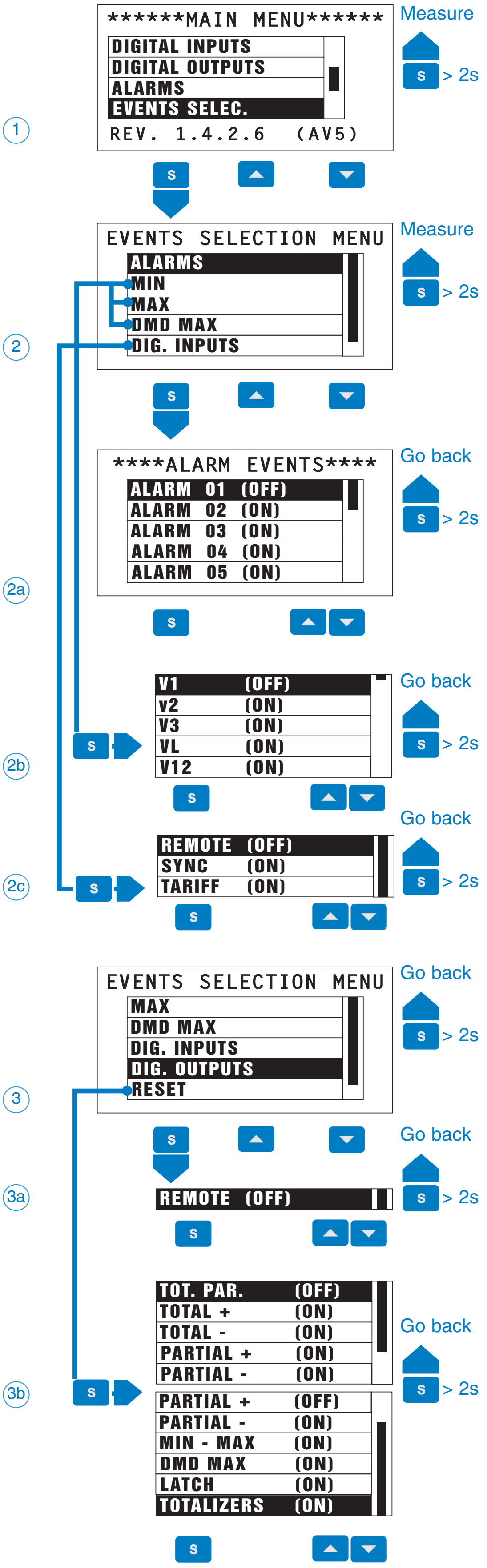
We suggest you to use a delay of a few seconds when disabling the alarms in order to avoid the consequence of a switching on and off of the output and the subsequent damaging of the contacts due to fluctuations of the measured signal with a value close to the selected alarm set-points.

The instrument is able to manage 2 types of alarms:
1. Real alarm = when the alarm is connected to a digital output (relay output or open collector output). The activation of a real alarm causes the switching at fixed light of the “AL” LED on the front of the instrument.
2. Virtual alarm = when the alarm is not connected to any output. The activation of a virtual alarm causes the switching at blinking light of the “AL” LED. In case a virtual alarm and a real alarm occur at the same time, the latter has the prevalence over the control of the above mentioned LED (therefore it will be ON with a fixed light). By exploiting the OR and AND functions, it’s possible to connect together more than one virtual alarm and direct them together to one digital output (relay output or open collector output). In any case the limit of 16 programmable alarms will still be valid.



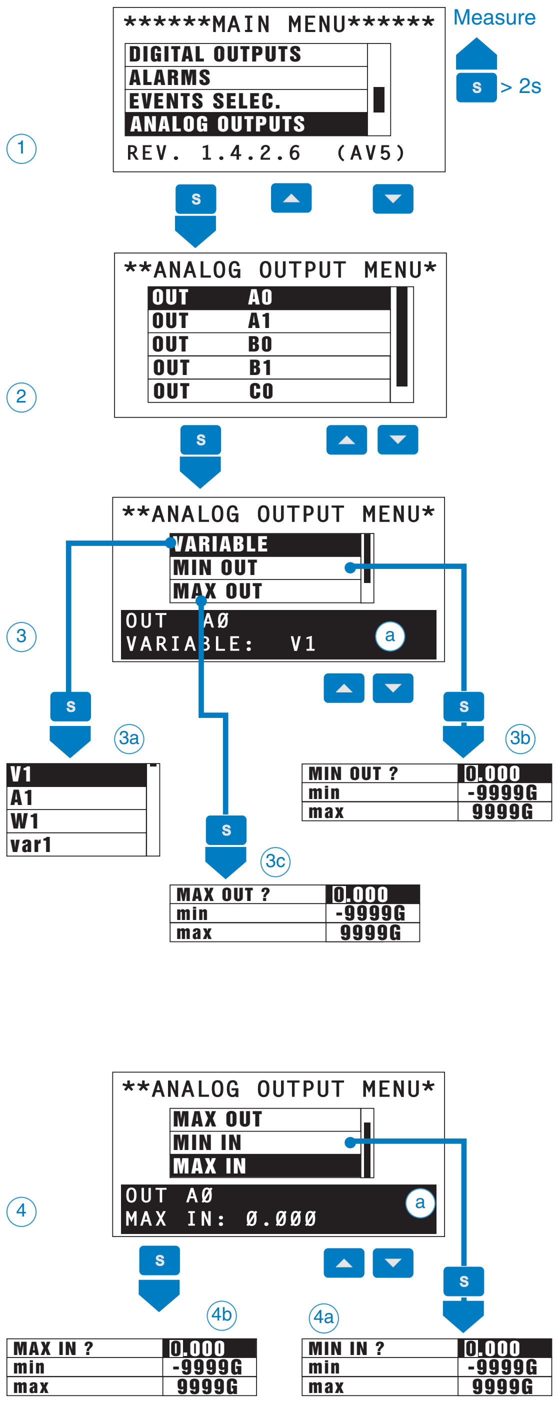

The above drawing explains the operation of the alarms described in the example. Having the “OR function been chosen for both the alarms, the operation of the digital output can be represented by two contacts in parallel. The enabling of only one of the two alarms will enable also the digital output.

## Events selection




This sub-menu allows the user to select which events are to be stamped. Choose the function EVENTS SELEC. (1) by means of the “▲▼” keys and confirm with “S”. Afterwards proceed as follows:
**ALARMS** (2): select if the alarm events are to be stamped. Choose alarms by means of the “▲▼” keys and confirm with “S”, then , alarm by alarm by means of the “▲▼” keys, decide whether the stamping is to be enabled “ON” or disabled “OFF”, by pressing the “S” key.
**MIN, MAX, DMD MAX** (2): select whether to store the minimum, maximum and dmd values for each variable measured by the instrument. Select the minimum, maximum or dmd maximum by means of the “▲▼” keys and confirm with “S”, then select, variable by variable if the storing is to be carried out (2b), choose by means of the “▲▼” keys the desired variable and decide whether to enable the storing “ON” or disable the storing “OFF” by pressing the “S” key.
**DIG. INPUTS** (2): select whether to store the status variables of the digital inputs. Choose DIG. INPUTS by means of the “▲▼” keys and confirm with “S”, then select one by one the digital inputs of which the storing is required (2c), choose by means of the “▲▼” keys the type of digital inputs (remote, synchronism, tariff), then confirm whether to enable the storing “ON” or disable it “OFF” by pressing the “S” key.
**DIG. OUTPUTS** (3): select whether to store the status variations of the digital outputs or not. Select the digital outputs by means of the “▲▼” keys and confirm with “S”, then confirm whether to enable the storing “ON” or disable it “OFF” by pressing the “S” key.
**RESET** (3): select whether the resets which have been carried out are to be stored or not. Choose RESET by means of the “▲▼” keys, then select which resets are to be stored (3b), by means of the “▲▼” keys and select whether to enable the storing “ON” or disable it “OFF” by pressing the “S” key.

## Analog outputs




This submenu allows the programming of the analog outputs (0-20mA, 0-10V, -5/+5mA). Select the function ANALOG OUTPUTS (1) by means of the "▲▼" and confirm with "S". Then select the output to be programmed by means of the "▲▼" keys (2) and confirm with "S"; afterwards set the following parameters:

**VARIABLE** (3): select the variable to be retransmitted by means of the analog output. Choose the function "VARIABLE" (3) by means of the "▲▼" keys and confirm pressing the "S" key. Then select by the "▲▼" keys the variable to be retransmitted (the list of the variables depends on the selected system) (3a) then confirm with "S".

**MIN OUT** (3): set the value expressed as % of the output range (0-20mA, 0-10V, -5/+5mA) to be coupled to the minimum measured value. The instrument displays also the maximum and minimum value which can be set (min, max). Select the function "MIN OUT" by means of the "▲▼" keys and confirm with "S". Then set the value (3b) by means of the "▲▼" keys and confirm with "S". **MAX OUT** (3): select the value expressed as % of the output range (0-20mA, 0-10V, -5/+5mA) to be coupled to the maximum measured value. The also instrument displays the maximum and minimum value which can be set (min, max). Select the MAX OUT function by means of the "▲▼" keys and confirm with "S". Afterwards set the value (3c) by means of the "▲▼" keys and confirm with "S".

**MIN IN** (4): minimum value of the variable input range to which the "MIN OUT" value, retransmitted by the analog output, will be coupled. The instrument also displays the maximum and minimum value which can be set (min, max) . Choose the function "MIN IN" by means of the "▲▼" keys and confirm with "S". Then set the value (4a) by means of the "▲▼" keys, then confirm with "S".

**MAX IN** (4): maximum value of the variable input range to which the "MAX OUT" value, retransmitted by the analog output, will be coupled. The instrument also displays the maximum and minimum value which can be set (min, max). Choose the MIN IN function by means of the "▲▼" and confirm with "S". Then set the value (4b) by means of the "▲▼" keys and confirm with "S".

Proceed, if possible, with the configuration of the other analog outputs (up to a maximum of 8 outputs). To exit the menu "analog outputs", keep the "S" key pressed for at least 2 seconds.

⚠ The instrument can manage the following analog outputs combinations: Max n. 8 0-10VDC outputs; Max n.8 5/+5mADC outputs. Any combination of the two above mentioned types considering that each module manages up to 2 outputs. Max n.4 0/20mADC outputs. Max n.4 0/20mADC outputs + max n.4 0-10VDC outputs.

## Programming examples of the analog outputs

**Power retransmission by means of a 0-20mA analog output.**

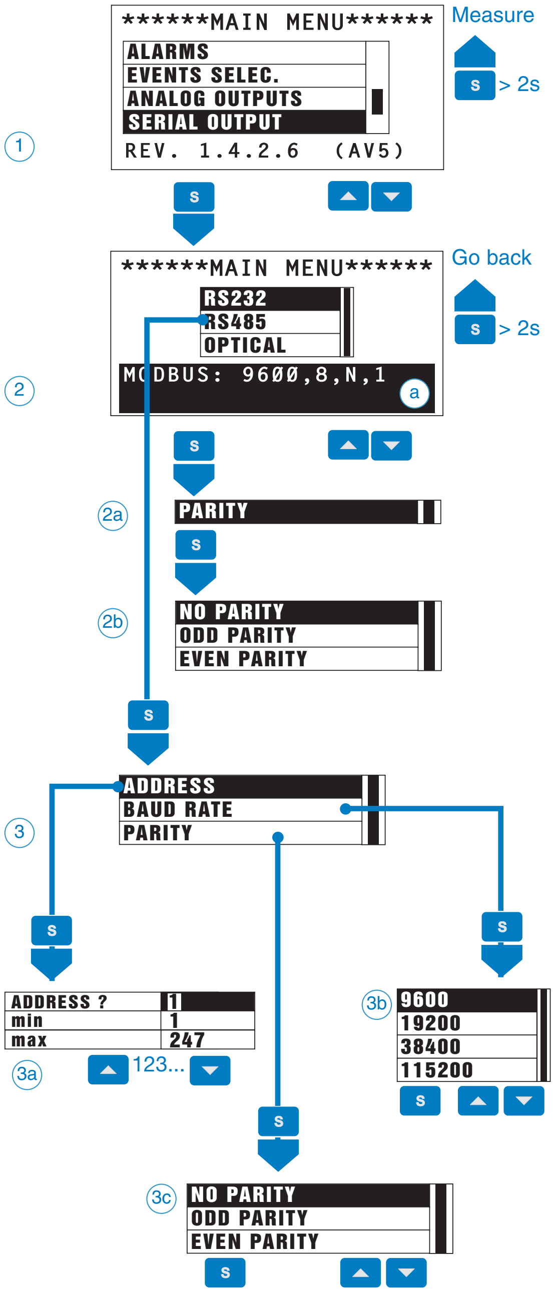
It's necessary to measure a consumed power up to 100kW and retransmit this value by means of a signal from 4 to 20 mA: the module to be used is AO2050 (2x from 0 to 20mA), the instrument is to be programmed as follows:
**VARIABLE:** W∑ (system active power).
**MIN OUT:** 20.0% means 4 mA the calculation to be carried out is the following: (100*minimum output) / fullscale output =100*4mA/ 20mA=20%.
**MAX OUT:** 100.0% means 20mA, the calculation to be carried out is: (100*maximum output) / fullscale output = 100*20mA/20mA= 100.
**MIN IN:** 0,0k; the multiple k,M,G can be selected on the instrument according to the chosen VT and CT values.
**MAX IN:** 100.0k; the k, M, G multiples can be selected on the instrument according to the selected VT and CT values.

**Transmission of active consumed and generated power by means of -5/+5mA analog output.**
It's necessary to measure both the consumed active power up to 100kW and the generated active power up to -100kW and retransmit this value by means of a signal from -5 to +5mA: the module to be used is AO2052 (2x from -5/+5mA), the instrument is to be programmed as follows:
**VARIABLE:** W∑ (system active power).
**MIN OUT:** -100% means -5mA, the calculation to be carried out is: (100*minimum output)/ fullscale output= 100*5mA/-5mA=-100%.
**MAX OUT:** 100,0% means 20mA, the calculation to be carried out is: (100*max output)/ fullscale output= 100*5mA/5mA= +100%.
**MIN IN:** -100,0k; the multiples k,M and G can be selected on the instrument on the basis of the VT and CT values.
**MAX IN:** 100,0k; the multiples K, M and G can be selected on the instrument depending on the VT and CT values being selected.

**Retransmission of the POWER FACTOR (PF) by means of the 0-20mA analog output.**
It's necessary to retransmit the whole range of the admitted values for the PF with a signal from 0 to 20mA. Particular attention must be paid to the value of the PF variable which may vary from C0,001 and L0,000 (for each phase): these values will be retransmitted and will then correspond to 0 and 20 mA. When the PF will have a value equal to 1, being in the middle between C0,001 and L0,000, the value of the output will correspond to the middle of the scale, that is 10mA. As a consequence, the instrument will have to be programmed as follows:

**VARIABLE:** PF L1 (or L2 or L3 or PF∑).
**MIN OUT:** 0,0%.
**MAX OUT:** 100,0%.
**MIN IN:** C0,001 (the C symbol shows a CAPACITIVE value).
**MAX IN:** L0,001 (the L symbol shows an INDUCTIVE value). L0,001 has been chosen as minimum value to be set in order to avoid any undesirable swifting of the repeated outputs.

## Serial outputs




This function allows the user to set the RS232 and RS485 serial ports as well as the optical port. Choose the SERIAL OUTPUT function (1) by means of the "▲ ▼" keys and confirm with "S". Then choose the serial port to be set and the instrument will synthetically display the previously set parameters (a).

**RS232** (2): set the parameters of the RS232 serial port (AR1039 module), if present, then select RS232 by means of the "▲ ▼" keys and confirm with "S", select the type of parity to be used (2a, 2b) with the "▲ ▼" keys and confirm the selection with the "S" key.

**RS485** (2): set the communication parameters of the RS485 serial port (AR1034 module, max 9600 bps, AR2040 max, 115,2kbps), if present; select it by means of the "▲ ▼" keys and confirm with the "S" key. Then select the following:

**ADDRESS** (3): select the serial address to be given to the instrument (from 1 to 247). Enter the desired address (3a) by means of the "▲ ▼" keys and confirm with the "S" key.

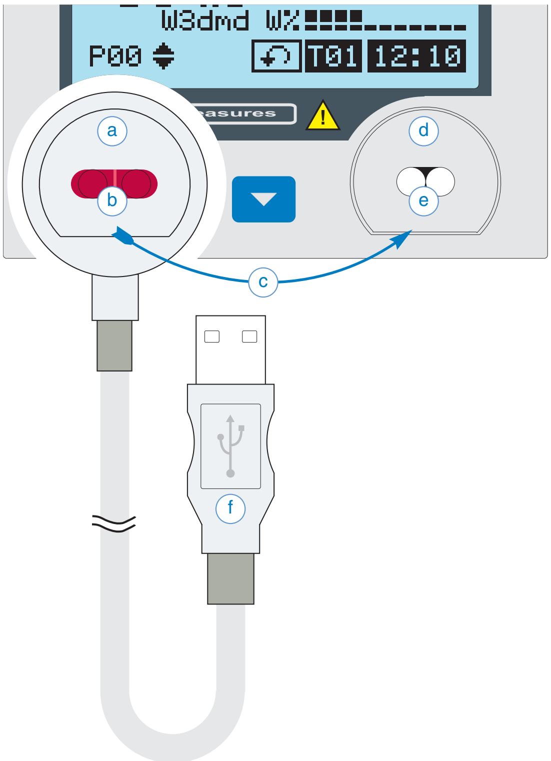
**BAUD RATE** (3): select the baud rate of the serial port. Select the desired baud rate value (3b) by means of the "▲ ▼" keys and confirm with the "S" key.

**PARITY** (3): select the type of parity of the serial port (3c) by means of the "▲ ▼" keys and confirm with the "S" key.

**OPTICAL** (2): set the parameters of the front optical port (see next paragraph "Optical port").

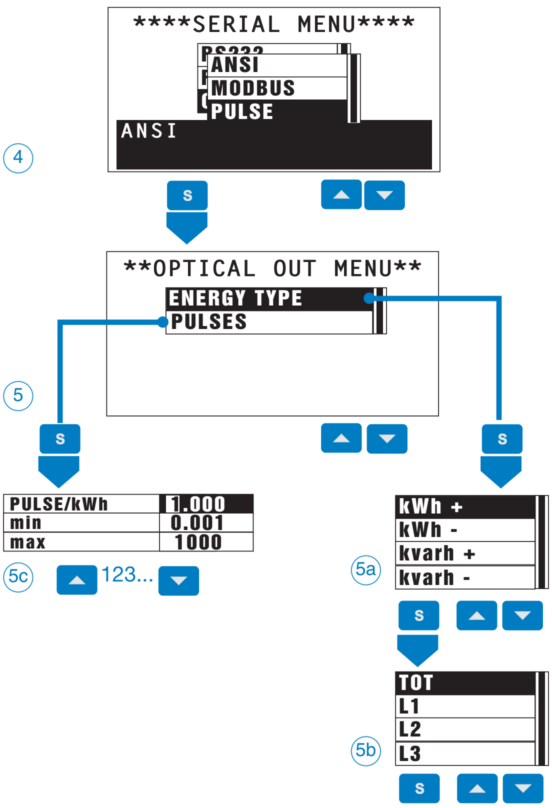
To exit the various menus and submenus, keep the "S" key pressed for at least 2 seconds.

## Optical port




The serial optical port (d) transmits the data by means of an infrared device (e-b). The connection (c) to the PC through the relevant magnetic connector (a) is made by means of a USB port (f) or 232 serial port (depending on the model being used): the user will then be able to read, transmit or receive information on the WM5 programming (the WM5Soft software can be purchased on request).
The optical port makes it also possible to retransmit the energy metering by means of pulses . In this case the light generated by the optical port is not visible because it's within the infrared spectrum. Set the desired type of use of the optical port (energy transmission by means of pulses or MODBUS or ANSI serial communication) before using it.

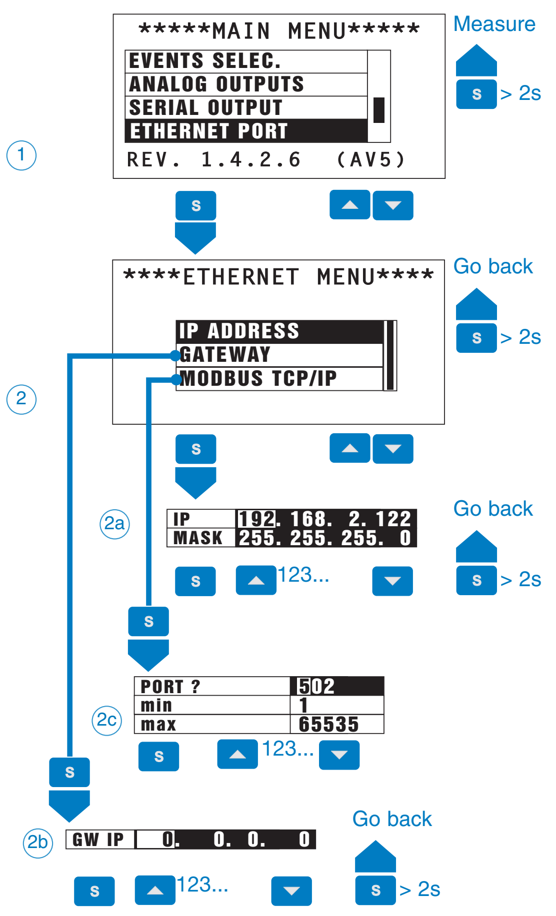
Follow steps (1) and (2) on the previous page, then select "OPTICAL" (2) by means of the "▲▼" keys and confirm with "S". Afterwards, select the type of protocol/communication mode (4) to be used:




**ANSI** (4): standard ANSI serial communication protocol. Choose the ANSI function by means of the "▲▼" keys and confirm with "S".
**MODBUS** (4): MODBUS serial communication protocol. Choose the MODBUS function by means of the "▲▼" keys and confirm with "S". Then set the relevant parameters such as baud rate and parity, see steps (3b) and (3c) on the previous page.
**PULSE** (4): the port will be enabled for the energy retransmission. Select the PULSE function by means of the "▲▼" keys and confirm with "S". Then select the energy type to be retransmitted (5), select ENERGY TYPE by means of the "▲▼" keys and confirm with "S". The instrument will display the list of available energies (5a) (kWh+, kWh-, kvarh+, kvarh-) (5a); select the desired energy by means of the "▲▼" keys and confirm with the "S" key: for each energy it's possible to choose if retransmitting the total energy metering (TOT) or by tariff from T1 to T12 (5b), choose the desired energy detail by means of the "▲▼" keys and confirm with "S". Finally, set the value of the pulse related to the measured energy, that is the number of pulses generated for each measured kWh+ (or kWh- or kvarh+ or kvarh-). Choose PULSE (5) by means of the "▲▼" keys and confirm with "S", then (5c) set the desired pulse value and confirm it by means of the "S" key.

**Note:** set the optical port in the MODBUS mode before using it related to the serial communication software "Wm5Soft".

## Ethernet Port




This function allows the user to set the Ethernet port. Choose the ETHERNET PORT function (1) by means of the "▲▼" keys and confirm with "S".

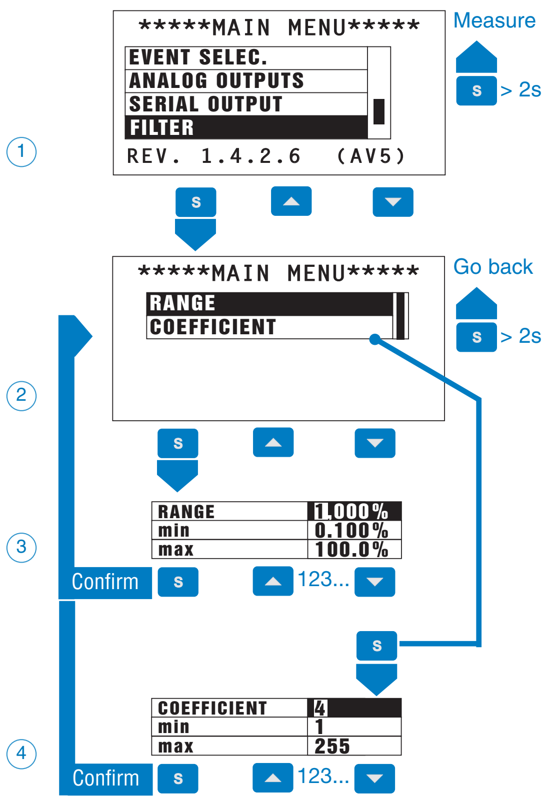
**IP ADDRESS** (2): set the IP parameters. Select IP ADDRESS by means of the "▲▼" keys and confirm with "S". Then select IP (IP address) or MASK (netmask) by means of the "▲▼" keys and confirm with "S". Set the value (2a) by means of the "▲▼" keys, where the "▲" key increases the value and the "▼" key switches to the following number. Confirm with "S".

**GATEWAY** (2): set the IP gateway parameters. Select GATEWAY by means of the "▲▼" keys and confirm with "S". Set the value (2b) by means of the "▲▼" keys, where the "▲" key increases the value and the "▼" key switches to the following number. Confirm with "S".

**MODBUS TCP/IP** (2): to modify the default port of the Ethernet port (502), select MODBUS TCP/IP by means of the "▲▼" keys and confirm with "S". Set the value (2b), from 1 to 65535, by means of the "▲▼" keys and confirm with "S".

To exit the various menus and submenus, keep the "S" key pressed for at least 2 seconds.

## Digital filter




Thanks to the digital filter, it's possible to stabilize the measurements which are too instable when displaying the relevant values.

By means of the "▲▼" keys, select FILTER and confirm with "S". Select the function to be set from the various submenus with the "▲▼" keys and confirm with "S":

**RANGE** (3): set the operating range of the digital filter. The value is expressed as a %. By means of the "▲▼" keys select RANGE and confirm with "S", then set the value as a percentage by means of the "▲▼" keys and confirm the value with the "S" key.

**COEFFICIENT** (4): set the filtering coefficient of the instantaneous measures. By increasing the value, also the stability and the settling time of the measures are increased. Select COEFFICIENT by means of the "▲▼" keys and confirm with the "S" key, then set the value by means of the "▲▼" keys and confirm the new value with the "S" key.

## Digital filter programming Examples

**Example 1**

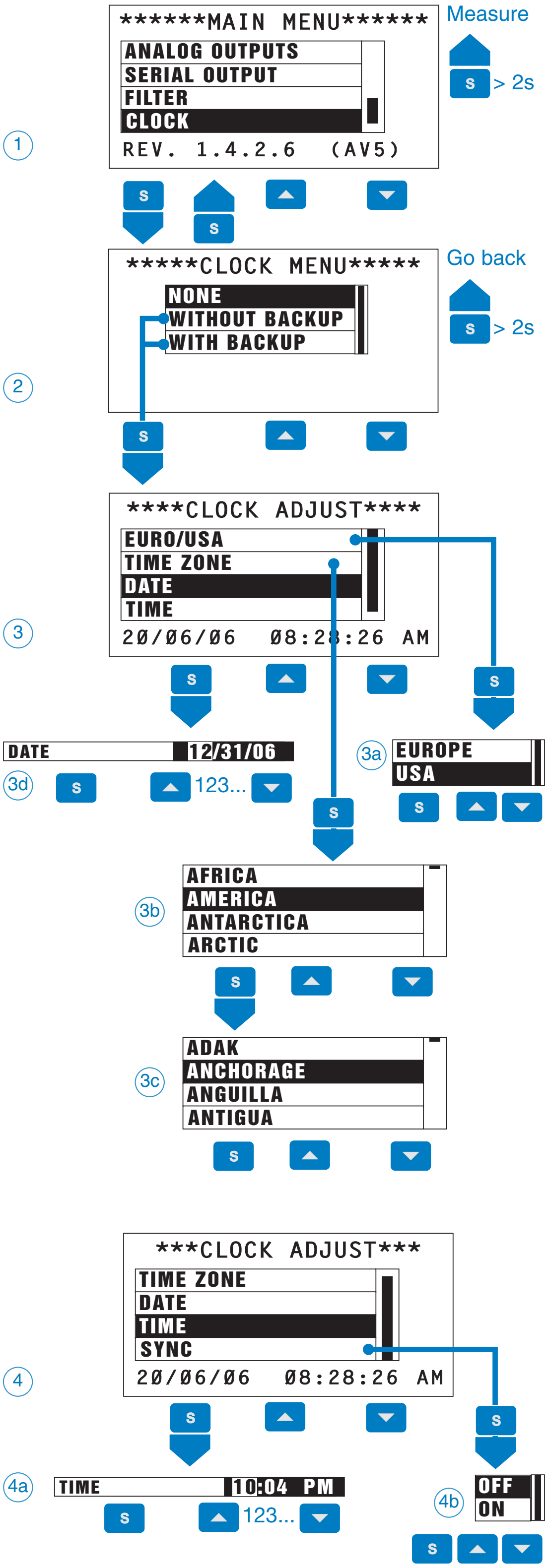
**How to stabilize the value of the VL-N variable displayed on the display, fluctuating from 222V and 228V.**
The parameters of the digital filter have to be programmed as follows:
**RANGE:** the variable has fluctuations within the mean value whose amplitude is equal to ±0,75% of the full scale rated value of the variable itself (obtained by the following calculation: (228-222)/ 2= ±3V, then ±3*100/400V= ±0,75% where 400V is the phase-neutral rated value of an AV5 input). The “range” parameter, representing the action range of the digital filter, is to be programmed to a value which must be slightly higher than the percentage amplitude of the fluctuation: ex. 1.0%.
**COEFFICIENT:** if the new value measured by the instrument is within the action range of the filter, the new displayed value is obtained by adding algebrically the previous value to the variation divided by the filtering coefficient. As a consequence, a value higher than this coefficient implies a longer settling time and therefore a better stability. You generally obtain the best result by setting the filtering coefficient to a value equal to at least 10 times the range parameter value.
In the following example: 1,0*10=10, the stability of the filtering coefficient can be improved by increasing the filtering coefficient, the admitted values are included within 1 and 255.

**Example 2**
**How to stabilize the value of the displayed System Active Power (W∑), fluctuating between 300kW and 320kW (the load is connected to the instrument by means of a 300/5A CT and a direct measure of the voltage).**

The parameters of the digital filter must be programmed as follows:
**RANGE:** the variable has fluctuations within the mean value whose amplitude is equal to ±2,78% of the full scale rated value of this variable. This value is obtained by the following calculation: (320-300)/ 2= ±10kW, then ±10*100/360kW= ±2,78%, where 360kW is the rated value of the System Active Power of an AV5 input, at the above mentioned CT and VT ratios and obtained by means of the following formula: (320-300)/ 2= ±10kW, then ±10*100/360kW= ±2,78%, where 360kW is the rated value of the System Active Power of an AV5 input at the above mentioned CT and VT ratios and obtained by means of the following formula: “VLN * VT * IN * CT * 3” where VLN = rated input voltage (400V for the AV5 input), VT= primary/secondary ratio of the voltage transformer being used, IN = rated current (5A for the AV5 type input), CT = primary/secondary ratio of the voltage transformer being used (in this example “400*1*5*60*3=360kW).
The RANGE parameter, representing the digital filtering coefficient action range, is to be programmed to a value which must be slightly higher than the percentage of the fluctuation: ex. 3.0%.
**COEFFICIENT:** if the new value acquired by the instrument is within the filtering action range, the new displayed value is obtained by adding algebrically the previous value to the variation divided by the filtering coefficient. As a consequence, a value higher than this coefficient implies an higher settling time and therefore a better stability. Generally speaking the best result is obtained setting the filtering coefficient to a value equal to at least 10 times the value of the range parameters. In the example: 3.0*10=30. In order to improve the stability you can increase the filtering coefficient, the admitted values are included within 1 and 255.

**Example 3.**
**It’s necessary to stabilize the value of the displayed variable AL 1 (phase current 1), fluctuating within 470V and 486V.**
To be able to manage the alarm function and following activation and deactivation of the relay, this value is not to be subject to continuous fluctuations. In this example we have considered using a 500/5A CT. The paramters of the digital filter is to be programmed as follows:
**RANGE:** the variable has fluctuations within the mean value whose amplitude is equal to ±1,60% of the full scale rated value of this variable (obtained by means of the calculation: (486-470)/ 2= ±8A, then ±8*100/500V= ±1,60% where 500A is the value referred to the primary of the transformer being used). The “range” parameter, which represents the action range of the digital filter, is to be programmed to a value slightly higher than the pourcentage amplitude of the fluctuation: for example 2.0%.
**COEFFICIENT:** if the new value acquired by the instrument is within the filtering action range, the new displayed value is calculated algebrically adding to the previous value the variation divided by the filtering coefficient. As a consequence, a higher value of this coefficient implies a higher settling time and therefore a better stability. Generally speaking, the best result is obtained setting the filtering coefficient at a value equal to at least 10 times the value of the range parameter. In the example: 2.0*10=20. To improve the stability you can increase the filtering coefficient, the admitted values are within 1 and 255.

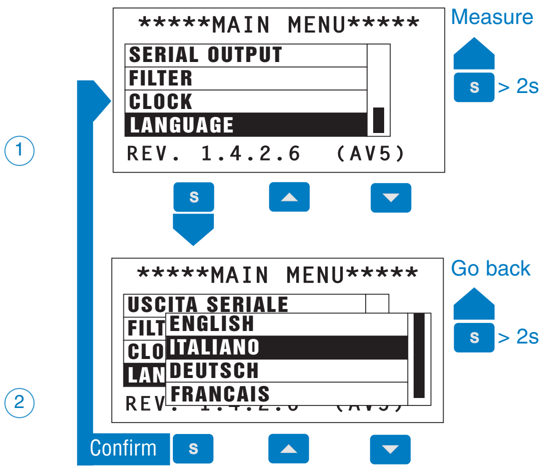
## Clock




The backup of the time is only possible with the AR1039 module being installed.

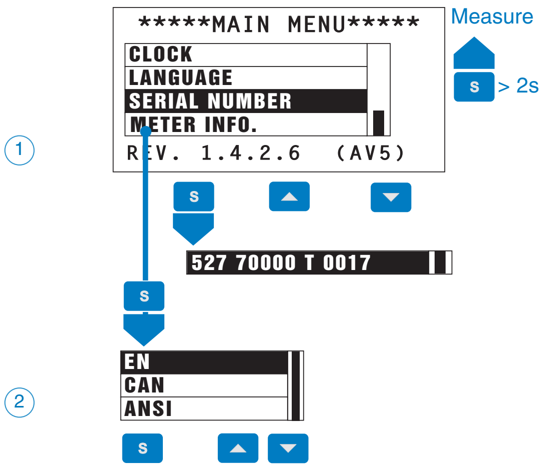
In the clock menu the clock functions can be set. Choose the CLOCK (1) function by means of the "▲▼" keys and confirm with "S". The instrument displays three functioning modes.
**NONE** (2): WM5 is not supplied with a clock, therefore it will not be possible to manage the tariffs by means of TIME/CALENDAR (all functions which are linked to the presence of the clock will be deactivated). Choose the function NONE by means of the "▲▼" keys and press the "S" key to confirm.
**WITHOUT BACKUP** (2): WM5 will be able to manage date and time but, in case of power supply failure, it will not store neither time nor date. When the instrument will be switched on again, the correct date and time will have to be set again. Select the WITHOUT BACKUP function by means of the "▲▼" keys and confirm with "S".
**WITH BACKUP** (2): WM5 is supplied with a clock and the correct date and time will be stored also in case of power failure. Select the function "WITH BACKUP" by means of the "▲▼" keys and confirm with "S". The function "WITH BACKUP" can be selected only if the AR1039 module is used. Then all the information necessary to the clock are to be set.
**EURO/USA** (3): set the time format as 24h european (00:00) or 12h american (12:00 AM). Select the EURO/USA function by means of the "▲▼" keys and confirm with "S". Select EUROPE (3a), to set the time format as 24h, or choose USA (3a), to set the time format as 12h.
**TIME ZONE** (3): set the time zone related to the place where WM5 is installed, choose the correct time zone (3b) by means of the "▲▼" zone and confirm with "S". Then select by means of the "▲▼" keys the correct country (3c) and confirm with "S".
**DATE** (3): set the current date, choose the DATE function by means of the "▲▼" keys and confirm with "S". Then select the date by means of the "▲▼" keys, set the date (3d) and confirm with "S".
**TIME** (4): set the current time, select the TIME function by means of the "▲▼" keys and confirm with "S". Then set the time (4a) by means of the "▲▼" keys and confirm with the "S" key.
**SYNC** (4): enables or disables the synchronism of the clock with the digital inputs enabled as SYNC, the clock at each synchronization pulse will set to the multiple of the integration time nearer to the current time. Choose the SYNC function by means of the "▲▼" keys and confirm with "S". Then, by means of the "▲▼" keys, choose OFF (4b) to disable the synchronism or ON (4b) to enable it and confirm with "S".

## Language




This function allows to set the language to be displayed by WM5. Choose the LANGUAGE function (1) by means of the "▲▼" keys and confirm with "S". Then select the desired language by means of the "▲▼" keys and confirm with "S".

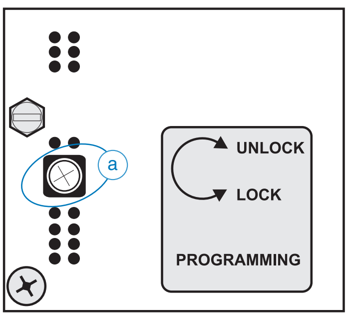
## Serial number and Meter Info.




Selecting the SERIAL NUMBER function, the instrument displays the serial number of the instrument. Select the function SERIAL NUMBER (1) by means of the "▲▼" keys and confirm with "S".

Selecting the METER INFORMATION function, the instrument displays the information relevant to the reference standard used by the instrument. Select the function METER INFORMATION (1) by means of the "▲▼" keys and confirm with "S". Choose the desired standard by means of the "▲▼" keys and confirm with "S".
Note: the selected standard is displayed in the Info pages too.

## Keypad lock, lock of access to programming and reset menu



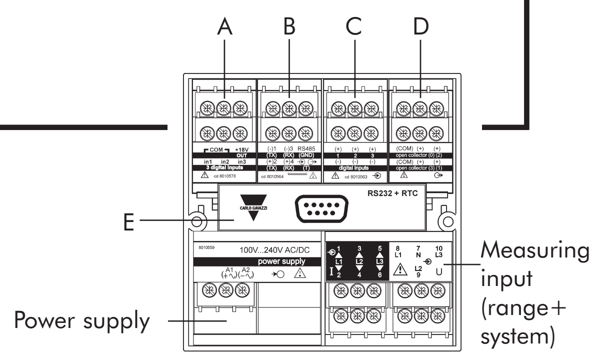

By turning the screwdriver anticlockwise to the end-of-stroke of the relevant trimmer, as shown in the figure on the left (a), it's possible to lock the access to the programming of the instrument both from keypad and from serial communication. Moreover, after locking the keypad it will not be possible to carry out the reset commands any more. However, it will be still possible to scroll all the display pages and the relevant details.

**WM5 96 AV53 H XX XX XX XX XX**

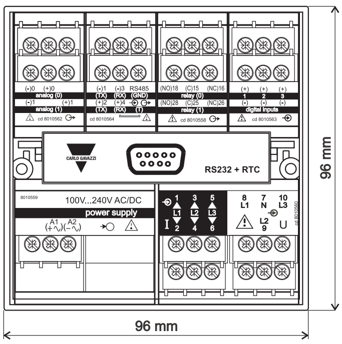
| Description | Ch | Part No. | Legend |
|---|---|---|---|
| **Model** | | | |
| WM5-96 with optical port ANSI C12.18 type | | AD2001 | WM5 96 |
| WM5-96 without optical port | | AD2000 | WM5 96 |
| **(Range code + system) measuring inputs** | | | |
| 400/690VL-L 1/5A (10A) | | AQ2030 | AV5.3 |
| 120/208VL-L 1/5A (10A) | | AQ2031 | AV6.3 |
| **Power supply** | | | |
| 18-60VAC/DC Power supply | | AP1021 | L |
| 90-260VAC/DC Power supply | | AP1020 | H |
| **SLOT A** | | | |
| None | | | XX |
| Ethernet/Internet port | 1 | AR1061 | E2 |
| Digital inputs | 3 | AQ1038 | D1 |
| Digital inputs + aux | 3 | AQ1042 | D2 |
| Open collector output | 4 | AO1037 | O4 |
| Open collector output | 2 | AO1036 | O2 |
| Open collector output | 1 | AO1059 | O1 |
| Relay output | 1 | AO1058 | R1 |
| Analogue output 20mADC | 2 | AO2050 | B1 |
| Analogue output 10VDC | 2 | AO2051 | W1 |
| Analogue output +/-5mA | 2 | AO2052 | B2 |
| **SLOT B** | | | |
| None | | | XX |
| Digital inputs | 3 | AQ1038 | D1 |
| Digital inputs + aux | 3 | AQ1042 | D2 |
| Open collector output | 4 | AO1037 | O4 |
| Open collector output | 2 | AO1036 | O2 |
| Open collector output | 1 | AO1059 | O1 |
| Relay output | 1 | AO1058 | R1 |
| Analogue output 20mADC | 2 | AO2050 | B1 |
| Analogue output 10VDC | 2 | AO2051 | W1 |
| Analogue output +/-5mA | 2 | AO2052 | B2 |
| RS485 9600bps | 1 | AR1034 | S1 |
| RS485 115200bps | 1 | AR2040 | S2 |
| **SLOT C** | | | |
| None | | | XX |
| Digital inputs | 3 | AQ1038 | D1 |
| Digital inputs + aux | 3 | AQ1042 | D2 |
| Open collector output | 4 | AO1037 | O4 |
| Open collector output | 2 | AO1036 | O2 |
| Open collector output | 1 | AO1059 | O1 |
| Relay output | 1 | AO1058 | R1 |
| Relay output | 2 | AO1035 | R2 |
| Analogue output 10VDC | 2 | AO2051 | W1 |
| Analogue output +/-5mA | 2 | AO2052 | B2 |
| **SLOT D** | | | |
| None | | | XX |
| Digital inputs | 3 | AQ1038 | D1 |
| Digital inputs + aux | 3 | AQ1042 | D2 |
| Open collector output | 4 | AO1037 | O4 |
| Open collector output | 2 | AO1036 | O2 |
| Open collector output | 1 | AO1059 | O1 |
| Relay output | 1 | AO1058 | R1 |
| Relay output | 2 | AO1035 | R2 |
| Analogue output 10VDC | 2 | AO2051 | W1 |
| Analogue output +/-5mA | 2 | AO2052 | B2 |
| **OPTIONS SLOT E** | | | |
| Utility grade with optical port | | | XX |
| RS232 + RTC (utility grade) | 1 | AR1039 | SX |
| Revenue approval. An "instrument setting" form must be properly filled in by the user. | | | XU |
| RS232+RTC + "XU" option | 1 | AR1039 | SU |
| | | | YY |
| RS232 + RTC (utility grade) without optical port. | 1 | AR1039 | SY |

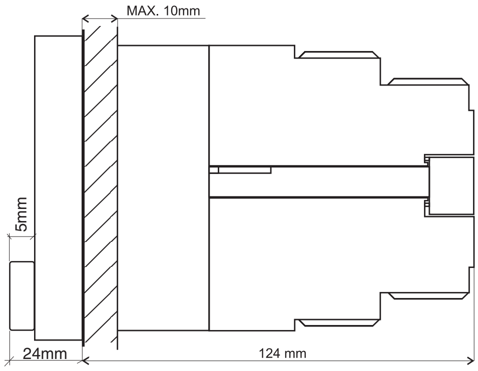
**Examples of which modules to order for:**
**WM5-96 AV53 H B1 S1 R2 O2 SX**

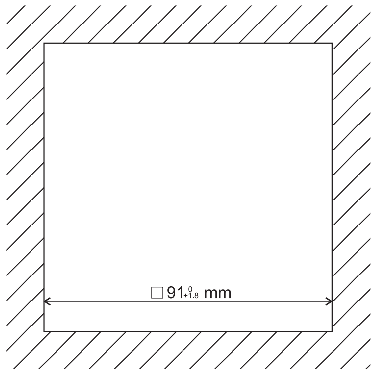
| Material | Code |
|---|---|
| WM5 96 | AD2001 |
| AV53 measuring inputs (400/690VL-L) | AQ2030 |
| 90-260VAC/DC power supply | AP1020 |
| 20mA analogue output (2 channels) | AO2050 |
| RS485 serial port at 9600 bps | AR1034 |
| Relay output (2 channels) | AO1035 |
| Open collector output (2 channels) | AO1036 |
| RS232 serial port +RTC | AR1039 |



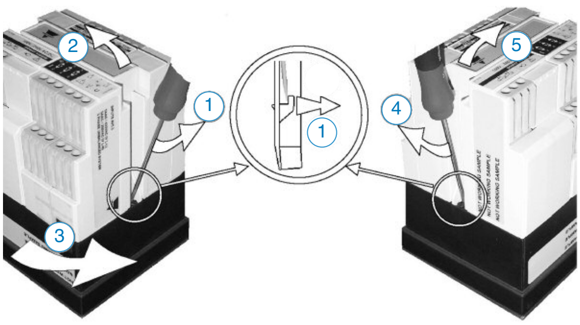
## Panel cut-out and dimensions

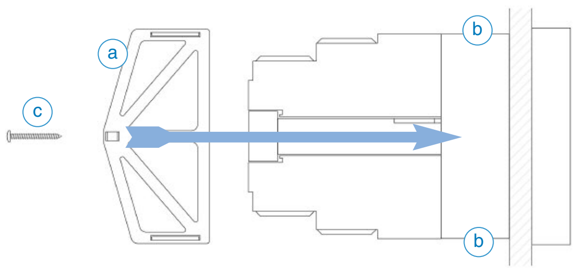


## Fixing, removing the modules and mounting the instrument to the panel

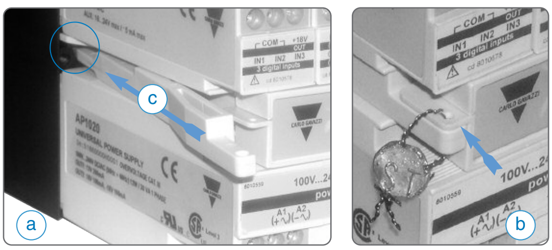



**Mounting and removing the modules:** the different modules (input, output and power supply) have been designed to be plugged in the available slots. To know in which slots they are to be mounted, refer to the table on the left. For a correct assembling of the instrument, first plug the modules into the relevant slots, then as last operation plug in the central module which can also be a blind module or an RS232 serial communication module. This module also locks the other modules in the relevant slots. To remove the modules use a screwdriver with a flattened tip and move the two fixing tabs to the side (1); then remove the central module from its slot by pressing your thumb towards points (2) and (5). Finally extract the central module.

**Panel mounting:** insert the instrument (holding its front side) into the panel and fasten it (from the back) by fixing the two lateral brackets being supplied (a) to the appropriate location (b), and then locking them by means of the two screws supplied with the instrument (c).

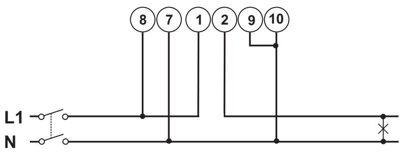
## Sealing the instrument




The special sealing kit, made by two plastic “cuneiform” devices (c) is supplied with the instrument; these two devices will have to be inserted as shown in the figure on the left (a), then the seal is to be placed as indicated by the pointer (b).

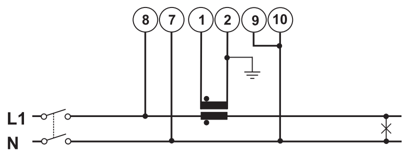
## 1-phase, 2-wire input connections, (1P)

Fig. 1



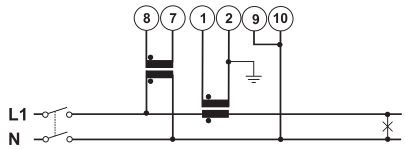

Direct connection

Fig. 2




CT connection

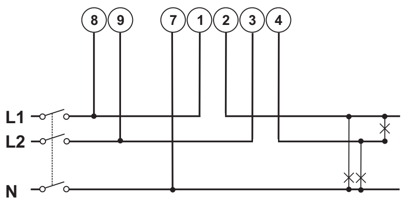
Fig. 3




CT and VT connection

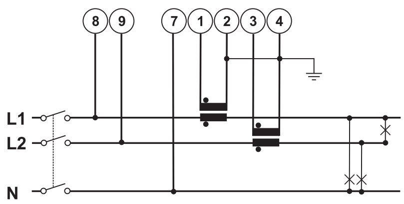
## 2-phase, 3-wire input connections (2P)

Fig. 4

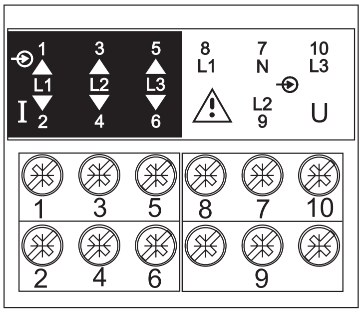



Direct connection

Fig. 5

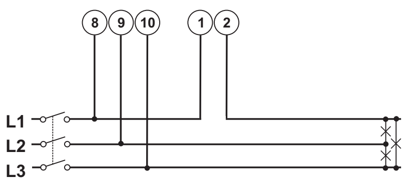



CT connection



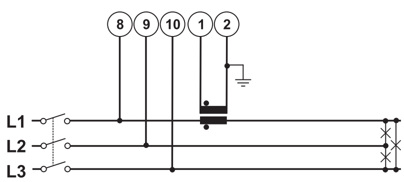

## 3-phase, 3 and 4-wire input connections - Balanced load (3P)

Fig. 6



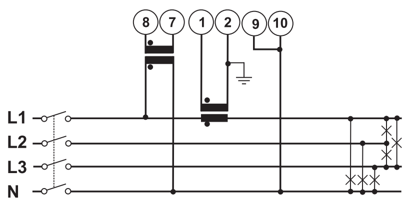

Direct connection (3-wire system)

Fig. 7




CT and VT connection (3-wire system)

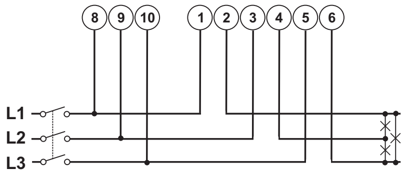
Fig. 8




CT and VT connection (4-wire system)

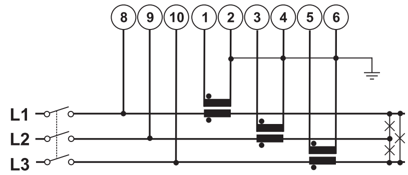
## 3-phase, 3-wire input connections - unbalanced load (3P)

Fig. 9



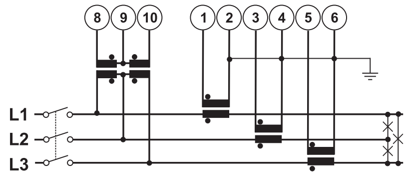

Direct connection (3-wire system)

Fig. 10




CT connection (3-wire system)

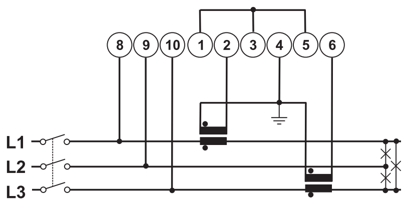
Fig. 11




CT and VT connection (3-wire system)

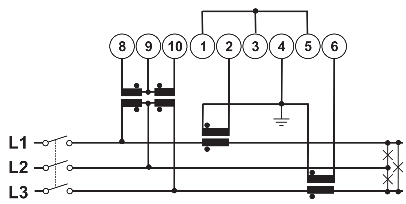
## 3-phase, 3-wire ARON input connections (3P)

Fig. 12

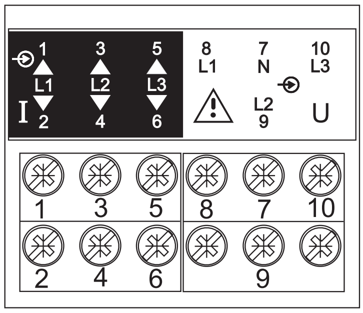



ARON connection (3-wire system)

Fig. 13

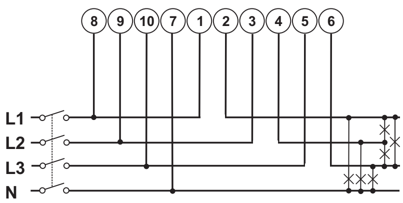



ARON and VT connection (3-wire system)



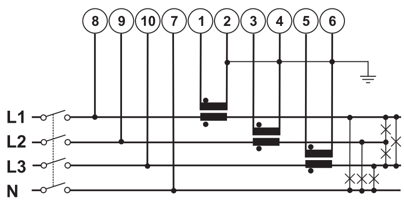

## 3-phase, 4-wire input connections - unbalanced load (3P+N)

Fig. 14



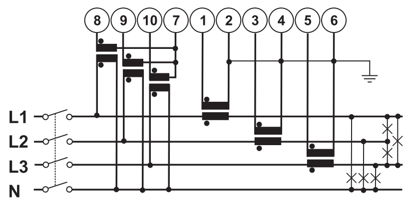

Direct connection (4-wire system)

Fig. 15



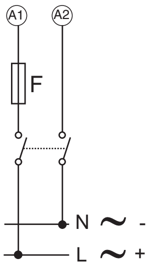

CT connection (4-wire system)

Fig. 16



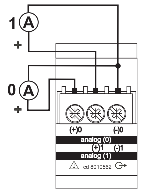

CT and VT connection (4-wire system)

## Power supply, analogue and digital output modules

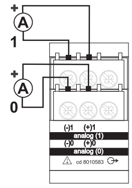



**AP1020.**
**AP1021.**
Power supply.

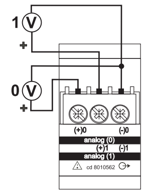
F= 1.25 A T



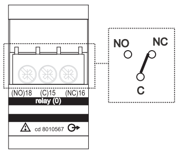
**AO2050.**
2 analogue outputs
0-20mA DC.



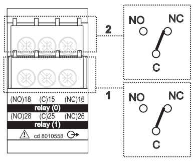
**AO2052.**
2 analogue outputs
-5/+5mA DC.



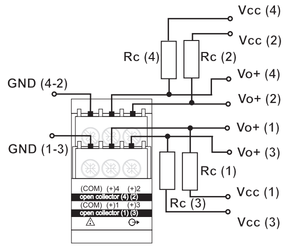
**AO2051.**
2 analogue outputs
10V DC.




**AO1058.**
1 relay output

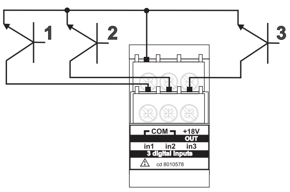



**AO1035.**
2 relay outputs

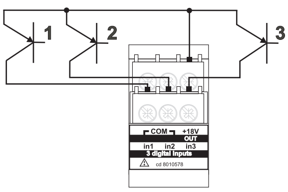



**AO1037.** 4 open collector outputs. This wiring diagram is also valid for the open collector modules with 1 or 2 outputs. The load resistances (Rc) must be designed so that the close contact current is lower than 100mA; the VDC voltage must be lower than or equal to 30VDC.

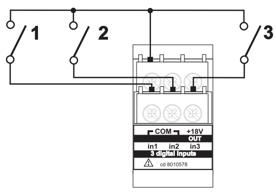
## Digital inputs



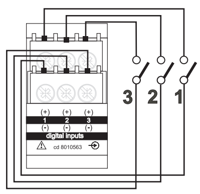
**AQ1042.**
Connection by means of
NPN transistors.



**AQ1042.**
Connection by means of
PNP transistors.

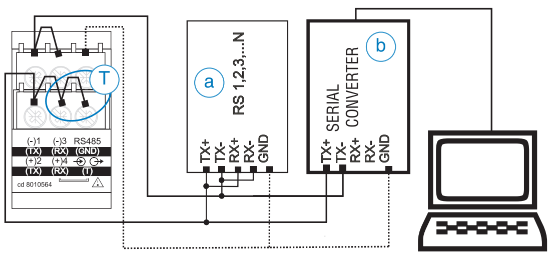


**AQ1042.**
Connection by means of
contacts.



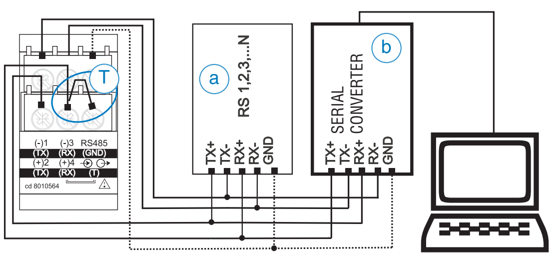
**AQ1038.**
Connection by
means of contacts.

## RS485 serial port (AR1034 9600bps, AR2040 115200bps)




**2-wire connection.** Other WM5-96 (a) provided with RS485 are connected in parallel (b). Serial RS485-RS232 converter.

**Termination of the serial port** (T)**:** it's carried out <u>only</u> on the last instrument of the network, by means of a jumper between (Rx+) and (T).




**4-wire connection.** Other WM5-96 (a) provided with RS485 are collected in parallel (b). Serial RS485-RS232 converter.

**Terminatio of the serial port** (T)**:** it is carried out <u>only</u> on the last instrument of the network, by means of a jumper between (Rx+) and (T).

## Input Specifications

| | |
|---|---|
| **Number of analogue inputs** | |
| Current | 1 (1-phase; system code: 3)<br>3 (3-phase; system code: 3) |
| Voltage | 1 (1-phase; system code: 3)<br>4 (3-phase; system code: 3) |
| **Digital inputs (on request)** | Up to 12 |
| AQ1038 | No. of inputs: 3 (voltage-free) |
| Purpose | "dmd" measurements synchronisation.<br>Tariff selection: energy.<br>Contact status reading.<br>Clock synchronisation. |
| Contact measuring current | <8mA/ 17.5 to 25VDC |
| AQ1042 | Number of inputs: 3 + excitation output |
| Purpose | "dmd" measurements synchronisation.<br>Tariff selection: energy.<br>Contact status reading.<br>Clock synchronisation. |
| Excitation output | 16V<+Aux<24VDC Max15mA |
| Contact measuring current | 15mA |
| Common characteristics | |
| Close contact resistance | Max 1kΩ |
| Open contact resistance | Min 100kΩ |
| Insulation | see "Insulation between inputs and outputs" table |
| **Accuracy** | (display, RS232, RS485)<br>In: 5A, If.s.: 10A<br>Un: see voltage ranges below |
| Current ($A_{L1}$, $A_{L2}$, $A_{L3}$) | from 0.05In to Imax: (@20°C ±5°C, R.H. ≤75%) ±(0.2%RDG+2DGT)<br>from 0.01In to 0.05In: ±(0.5%RDG+2DGT) |
| Current ($A_n$) | ±0.5% RDG (0.2 to 2 In) |
| Voltage | from 40 to 100 Hz (@20°C±5°C, R.H.≤75%) |
| range AV5: | 400/690$V_{L-L}$ AC<br>$V_{L-N}$: from 185 V to 460 V<br>$V_{L-L}$: from 320 V to 800 V<br>±(0.2%RDG+1DGT) |
| range AV6: | 120/208$V_{L-L}$ AC<br>$V_{L-N}$: from 45 V to 145 V<br>$V_{L-L}$: from 78 V to 250 V<br>±(0.2%RDG+1DGT)<br>Includes also: frequency, power supply and output load influences. |
| Frequency | ±0.1% RDG (40 to 440 Hz) |
| Active power and apparent power (@ 20°C ± 5°C, R.H. ≤ 75%) | 0.05In to Imax, PF 1: ±(0.5%RDG+1DGT)<br>0.01In to 0.05In, PF 1: ±(1%RDG+1DGT)<br>0.1In to Imax, PF 0.5L, PF 0.8C: ±(0.6%RDG+1DGT)<br>0.02In to 0.1In, PF 0.5L, PF 0.8C: ±(1%RDG+1DGT) |
| Reactive power (@ 20°C ± 5°C, R.H. ≤ 75%) | 0.1In to Imax, senφ 0.5L/C: ±(2%RDG+1DGT)<br>0.05In ÷ 0.1In, senφ 0.5L/C: ±(2.5%RDG+1DGT)<br>0.05In ÷ Imax, senφ 1: ±(2%RDG+1DGT) 0.02In to 0.05In, senφ 1: ±(2.5%RDG+1DGT) |
| Energies (@ 20°C ± 5°C, R.H. ≤ 75%) | Active: class 0.5 according to EN62053-22, ANSI C12.20<br>Reactive: class 2 according to EN62053-23, ANSI C12.1<br>In: 5A, Imax: 10A<br>0.1In: 500mA,<br>Start-up current: 5mA Un: 400/690$V_{L-L}$ (AV5)<br>Un: 120/208$V_{L-L}$ (AV6) |
| Harmonic distortion (@ 20°C ± 5°C, R.H. ≤ 75%) | 1% FS (FS: 100%)<br>fase: ±2°; Imin: 5mA $_{RMS}$;<br>Imax: 15Ap; Umin: 30$V_{RMS}$;<br>Umax: 500Vp |
| **Temperature drift** | ≤200ppm/°C (A/V), ≤300ppm/°C (all other measurements) |
| **Sampling rate** | 6400 samples/s @ 50Hz<br>7680 samples/s @ 60Hz |
| **Display** | Graph LCD, backlighted (128x64 dots). Read-out for instantaneous variables: 4x4 digit<br>Total energies: 4x9 digit;<br>Partial energies: 4x9 digit |
| **Display refresh time** | 100ms |
| **Max. and min. indication** | Max. 9999 (999,999,999),<br>Min. -9999 (–999,999,999) |
| **Front LED** | Red<br>Blinking light in case of virtual alarm. Fixed light in case of digital output activation (alarm) |
| **Measurements** | Current, voltage, power, energy, power factor, frequency, harmonic distortion (see "Display pages"). TRMS measurement of a distorted wave (voltage/current). |
| Coupling type | Direct |
| Crest factor | < 3, max 10A peak |
| **Input impedance** | |
| 400/690$V_{L-L}$ (AV5) | 1.77 MΩ ±5% |
| 120/208$V_{L-L}$ (AV6) | 885 kΩ ±5% |
| Current | ≤ 0.01Ω |
| **Frequency** | 40 to 440 Hz |
| **Overload** (maximum values) | |
| Permanent: voltage/current | AV5: 460$V_{LN}$, 800$V_{LL}$/10A<br>AV6: 145$V_{LN}$, 250$V_{LL}$/10A |
| For 500ms: voltage/current | AV5: 800$V_{LN}$, 1380$V_{LL}$/36A<br>AV6: 240$V_{LN}$, 416$V_{LL}$/36A |

## Output specifications

| | |
|---|---|
| **Analogue outputs (on request)** | |
| Number of outputs | Fino a 8 (max 4 x 20mA + 4 x 10VDC o 4 x 20mA o 8 x 10VDC o 8 x ±5mA) |
| Accuracy (@25°C ±5°C, R.H. ≤60%) | ±0.1%FS (20mA o 10VCC) ±0.3%FS (±5mA), FS=10mA |
| Range | 0 ÷ 20mA o 0 ÷ 10 VCC o ±5mA |
| Scaling factor: | Programmable within the whole range of retransmission; it allows the retransmission management of all values from: 0 and 20 mA, 0 and 10VDC, or -5mA and +5mA |
| Response time | 400 ms typical (filter excluded) |
| Ripple | ≤1% (according to IEC 60688-1, EN 60688-1) |
| Total temperature drift | ≤ 500 ppm/°C |
| Load : 20 mADC | ≤ 350 Ω |
| 10 VDC | ≥ 10kΩ |
| ±5 mA | ≤ 1400Ω |
| Insulation | see "insulation between inputs and outputs" table |
| **Optical communication port** | According to ANSI C12.18 |
| **RS422/RS485 port (on request)** | Multidrop bidirectional (static and dynamic variables) |
| Connections | 2 or 4 wires, max. distance 1000m, termination directly on the module . Addresses: from 1 to 247, selectable by key-pad. |
| Protocol | MODBUS RTU /JBUS, |
| Data (bidirectional) | |
| Dynamic (reading only) | All display variables (see also the table "List of the variables that can be connected to"...) |
| Static (writing only) | All configuration parameters, reset of energy, activation of digital 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 | 9.6k, 19.2k, 38.4k, 115.2k bit/s selectable bauds |
| Insulation | see "Insulation between inputs and outputs" table |
| **RS232 port (on request)** | Bidirectional (static and dynamic variables) |
| Connections | 3 wires, max. distance 15m, |
| Data format | 1-start bit, 8-data bit, no parity, even parity, odd parity, 1 stop bit |
| Baud-rate | 9.6k bit/s |
| Protocol | MODBUS RTU /JBUS |
| Other data | as for RS422/485 |

| | |
|---|---|
| **Ethernet/Internet port** | |
| Protocols | Modbus TCP |
| IP configuration | Static IP |
| TCP port | Selectable (default 502) |
| Client connections | Max 5 simultaneously |
| Connections | RJ45 10/100 BaseTX |
| **Digital outputs (on request)** | |
| Pulse type | |
| Number of outputs | Up to 16 |
| Type | Programmable from 0.001 to 1000 pulses per kWh/kvarh (total and partial) Outputs connectable to the total and/or partial energy meters (Wh/varh) |
| Pulse duration ≥ | 100ms, < 120msec (ON), 100ms (OFF) according to EN62053-31 |
| Alarm type | |
| Number of outputs | up to 16, independent |
| Alarm modes | Up alarm, down alarm, in window alarm, out window alarm. All of them can be used with start up deactivation function and/or latch. All the alarms can be connected to all variables (see the table "List of the variables that can be connected to"). |
| Set-point adjustment | from 0 to 100% of the electrical scale |
| Hysteresis | from 0 to full scale |
| On-time delay | 0 to 255s |
| Output status | Selectable; normally de-energised and normally energised |
| Min. response time | ≤200ms, filters excluded, Set-point on-time delay: "0 s" |
| **Note** | The 16 digital outputs can also work as combination of pulse outputs and alarm outputs. |
| **Static (digital) outputs** | **(on request)** |
| Purpose | For pulse outputs or for alarm outputs |
| Signal | $V_{ON}$ 1.2 VDC/ max. 100 mA $V_{OFF}$ 30 VDC max. Insulation see "Insulation between inputs and outputs" table |
| **Relay (digital) outputs** | **(on request)** |
| Purpose | For alarm outputs or for pulse outputs |
| Output type | Relay SPDT AC 1-8A, 250VAC DC 12-5A, 24VDC AC 15-2.5A, 250VAC DC 13-2.5A, 24VDC |
| Insulation | see "Insulation between inputs and outputs" table |
| Electrical life | $\geq 10^5$ operations (@ 8A, 250V, PF1) |
| Mechanical life | $\geq 30x10^6$ operations |

## Software functions

| | |
|---|---|
| **Password** | Numeric code of max 4 digits from 0 to 1000; 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** | |
| System 1 | 1-phase (2 wires) |
| System 2, unbalanced | 2-phase (3 wires) |
| System 3, balanced | 3-phase (3 wires+1CT) |
| System 3, unbalanced | 3-phase (3 wires) 3-phase (4 wires) |
| **Transformer ratio** | CT up to 60 kA (6000 max) VT (PT) up to 600 kV (6000 max) |
| **Filters** | |
| Filter operating range | 0.1 to 100% of the input electrical scale. |
| Filtering coefficient | 1 to 255 |
| Filter action | Display, alarms, serial outputs (fundamental variables: V, A, W and their derived ones). |
| **Alarms** | |
| Working mode | "OR" or "AND" or "OR+AND" functions (see "Alarm parameter and logic" page). Freely programmable on up to 16 alarms. The alarms can be connected to any variables available in the table "List of the variables that can be connected to" |

| | |
|---|---|
| **Reset** | By means of the key-pad or of the configuration software, it is possible to reset the following data:<br>- all the min, max, dmd, dmd-max values.<br>- total and partial counters.<br>- latch alarms.<br>- all the events. |
| **Data stamping** | |
| Type of data | Alarm, min, max, digital input status, digital output status as remote control, resets. All events are stored with date (dd:MM:yy) and hour (hh:mm:ss) reference |
| Number of events | Up to 10.000 |
| Data management type | FIFO |
| Data storage type | Data flash |
| **Displaying** | 4 variables per page<br>1 page that can be laid out by the user<br>Up to 36 pages |
| Energy meters | Up to 28 pages depending on the selected tariff mode. Displaying of the consumed energy of the previous 12 months. |
| Stored events | 10,000 events. |
| **Display language** | Selectable: English, Italian, French, German, Spanish |

## Wm5Soft parameter programming and variable reading software

| | |
|---|---|
| **Wm5Soft** | Multi-language software (Italian, English, French, German, Spanish) for variable reading, instrument calibration and parameters programming. The program runs under Windows XP/Vista |
| Working mode | Three different working modes can be selected:<br>- management of local RS232 (MODBUS);<br>- management of local optical port (MODBUS);<br>- management of a local RS485 network (MODBUS); |
| Data Storing | In pre-formatted XLS files (Excel data base). |
| Data Transfer | Manual or automatic at programmable timings. |

## Time period management

| | |
|---|---|
| **Meters** | |
| Total | 4 (9-digit) |
| Partial and multitariff | 48 (9-digit) |
| **Tariffs** | Up to 12 |
| **Time periods** | |
| Number of periods | Up to 24 per day<br>Up to 100 different days per year |
| **Pulse output** | Connectable to total and/or partial meters (multitariff) |
| **Energy meter recording** | Consumption history by recording of the monthly energy meters (12 previous months). Recording of total and partial energy meters.<br>Energy meter recording (EEPROM)<br>Max.999.999.999kWh/kvarh. |

| | |
|---|---|
| **Energy Meters** | |
| Total energy meters | 4 (+kWh, +kvarh, -kWh, -kvarh)<br>It is possible to divide each energy meter here above listed in 3 additional energy meters (1 for each phase “L1-L2-L3”) |
| Monthly energy meters | 48 (energy meters for each month: “+kWh, +kvarh, -kWh, -kvarh”) |
| Partial energy meters | 16 (using digital inputs: max 4 tariffs).<br>48 (using the internal clock: max 12 tariffs) |

## Harmonic distortion analysis

| | |
|---|---|
| **Analysis principle** | FFT |
| **Harmonic measurement** | |
| Current | Up to the 63rd harmonic |
| Voltage | Up to the 63rd harmonic |
| **Type of harmonics** | THD (VL1 and VL1-N)<br>THD odd (VL1 and VL1-N)<br>THD even (VL1 and VL1-N)<br>The same for the other phases: L2, L3.<br>THD (AL1)<br>THD odd (AL1)<br>THD even (AL1)<br>The same for the other phases: L2, L3. |
| **Harmonic phase angle** | The instrument measures the angle between the single harmonic of “V” and the single harmonic of “I” of the same order. According to the value of the electrical angle, it is possible to know if the distortion is absorbed or generated.<br>Note: if the system has 3 wires the angle cannot be measured. |
| **Harmonic details** | The harmonic contents is displayed as a graph showing the whole harmonic spectrum. This value is also given as a numerical information:<br>THD % / RMS value<br>THD even % / RMS value<br>THD odd% / RMS value<br>single harmonics in % / RMS value |
| **System** | The harmonic distortion can be measured in single-phase, 3-wire or 4-wire systems.<br>Tw: 0.02 sec@50Hz without filter |

## General Specifications

| | |
|---|---|
| **Operating temperature** | -10° to +45°C (14° to 113°F) (R.H. < 90% non-condensing) |
| **Limit range of operating temp.** | -20° to +55°C (-4° to 131°F) (R.H. <90% non-condensing) |
| **Storage temperature** | -30° to +60°C (-22° to 140°F) (R.H. < 90% non-condensing) |
| **Installation category** | III |
| **Pollution degree** | 2 |
| **Altitude** | up to 2000m (6560 feet) above sea-level |
| **Insulation reference voltage** | 300 VRMS to ground (AV5 input) |
| **Dielectric strength** | 4kVAC$_{RMS}$ (for 1 min) |
| **Noise Rejection** CMRR | 100 dB, 48 to 62 Hz |
| **EMC** Emissions | EN61000-6-3, EN60688 residential environment, commerce and light industry ANSI/IEEE C37.90-1989 (surge, withstand and fast transient test) |

| | |
|---|---|
| **Pulse voltage (1.2/50µs)** | EN61000-4-5 |
| **Safety standards** | IEC60664, IEC61010-1 EN60664, EN61010-1 |
| **Measurement standards** ANSI C12.20, ANSI C12.1 | IEC60688, EN60688, EN62053-22, EN62053-23, |
| **Approvals** | CE, cURus and CSA |
| **Connections 5(6) A** | Screw-type max. 2.5 mm$^2$ wires (2x 1.5mm$^2$); max screw tightening torque: 0.5Nm |
| **Housing** Dimensions Material | 96x96x140 mm ABS, self-extinguishing: UL 94 V-0 |
| **Protection degree** | Front: IP65 / NEMA 4x |
| **Weight** | Approx. 600 g (packing included) |

## Supply Specifications

| | |
|---|---|
| **AC/DC voltage** | 90 to 260V (standard) 18 to 60V (on request) |
| **Power consumption** | ≤ 30VA/12W (90 to 260V) ≤ 20VA/12W (18 to 60V) |

## Revenue Approval Settings

- The access to the programming parameters via front key pad and/or serial communication ports is locked.
- The front key pad (up and down keys) allows the displaying of the variables only, while the communication ports allows the transmission of the variables only.
- A proper “instrument settings” form must be filled up by the user before equipment supplying.
- WM5-96 is supplied with the desired modules plugged and sealed in the proper slots.
- WM5-96 fulfils: the ANSI/IEEE C12.20-1998 requirements;
  the CAN3-C17-M84 requirements;
  and can be certified according to:
  C12.20-1998, class 0.5 (independent labs);
  AE-0924 Industry Canada Approval.

## Function Description

**Input and output scaling capability.**
Working of the analogue outputs (y) versus input variables (x)

**Figure A**
The sign of measured quantity and output quantity remains the same. The output quantity is proportional to the measured quantity.

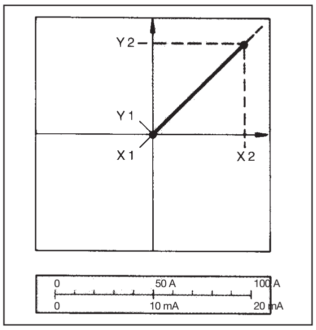



**Figure D**
The sign of measured quantity and output quantity remains the same. With the measured quantity being zero, the output quantity already has the value $Y1 = 0.2\ Y2$.
Live zero output.

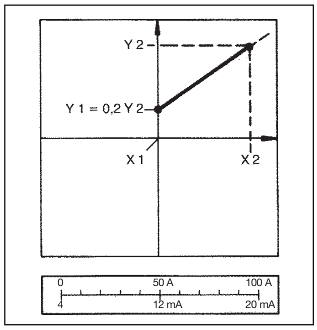



**Figure B**
The sign of measured quantity and output quantity changes simultaneously. The output quantity is proportional to the measured quantity.

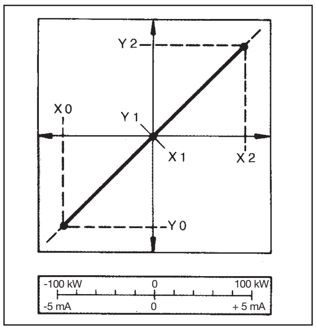



**Figure E**
The sign of the measured quantity changes but the one of the output quantity remains the same. The output quantity steadily increases from value X1 to value X2 of the measured quantity.

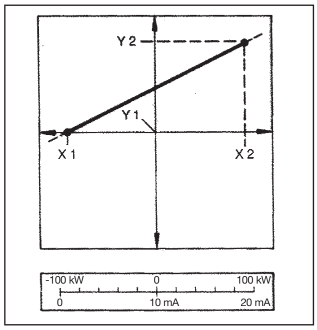



**Figure C**
The sign of measured quantity and output quantity remains the same. On the range X0...X1, the output quantity is zero. The range X1...X2 is delineated on the entire output range Y0 = Y1...Y2 and thus presented in strongly expanded form.

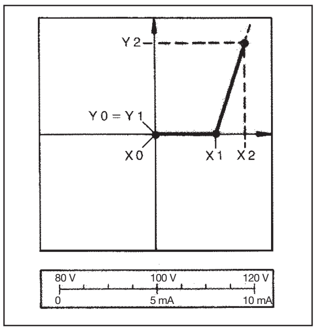
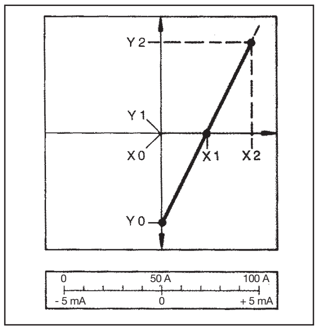



**Figure F**
The sign of the measured quantity remains the same, the one of the output quantity changes as the measured quantity leaves range X0...X1 and passes to range X1...X2 and vice versa.

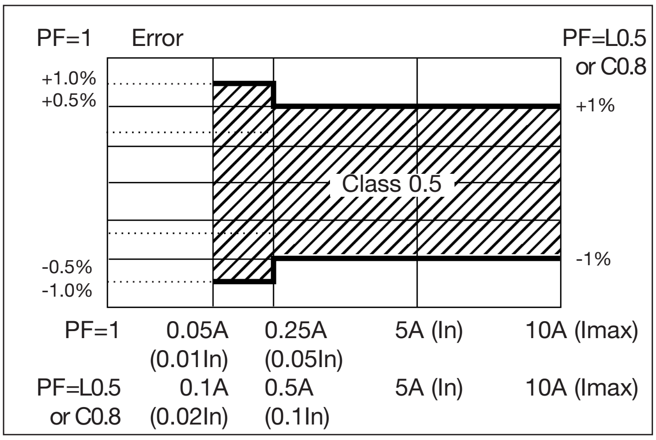



## Insulation between inputs and outputs

| | Meas. /digital inputs | Relay output | Open collector | Analogue out. 10V, 20mA | Analogue out. ±5mA | AR1034 | AR2040 | AR1039 | 90-260VAC/DC | 18-60VAC/DC |
|---|---|---|---|---|---|---|---|---|---|---|
| Meas. /digital inputs | - | 4kV | 4kV | 2kV | 2kV | 4kV | 2kV | 4kV | 4kV | 4kV |
| Relay output | 4kV | 4kV (*) | 4kV | 4kV | 4kV | 4kV | 4kV | 4kV | 4kV | 4kV |
| Open collector | 4kV | 4kV | 4kV (*) | 4kV | 4kV | 4kV | 4kV | 4kV | 4kV | 4kV |
| Analogue out. 10V, 20mA | 2kV | 4kV | 4kV | 4kV (*) | 4kV | 4kV | 4kV | 4kV | 4kV | 4kV |
| Analogue out. ±5mA | 2kV | 4kV | 4kV | 4kV | 200V (**) | 4kV | 4kV | 4kV | 4kV | 4kV |
| AR1034 | 4kV | 4kV | 4kV | 4kV | 4kV | - | - | 4kV | 4kV | 4kV |
| AR2040 | 2kV | 4kV | 4kV | 4kV | 4kV | - | - | 4kV | 4kV | 4kV |
| AR1039 | 4kV | 4kV | 4kV | 4kV | 4kV | 4kV | 4kV | - | 4kV | 4kV |
| 90-260VAC/DC | 4kV | 4kV | 4kV | 4kV | 4kV | 4kV | 4kV | 4kV | - | - |
| 18-60VAC/DC | 4kV | 4kV | 4kV | 4kV | 4kV | 4kV | 4kV | 4kV | - | - |

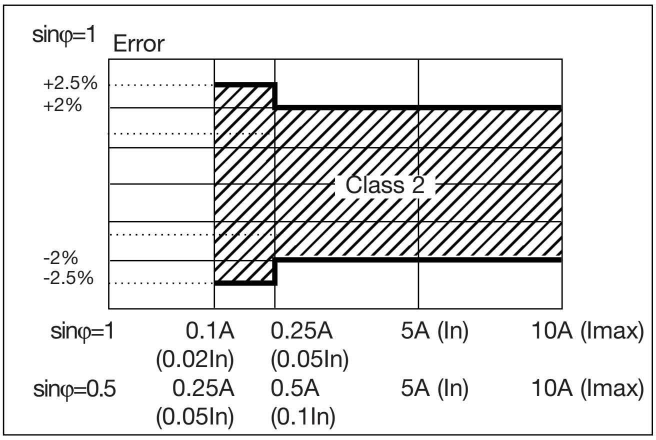
**NOTE:** In case of fault of first insulation the current from the measuring inputs to the ground is lower than 2 mA.
**(*)** The given insulation is granted among outputs plugged in different slots. The modules equipped with two or four outputs have therefore non insulation among the outputs. **(**)** Insulation between the 2 outputs of the same module is 200V for 1 min.

## Accuracy




**kWh**, accuracy (RDG) depending on the current

**Class 0.5 accuracy limits (active energy) EN62053-21**
5(10A) start-up current: 5mA.




**kvarh**, accuracy (RDG) depending on the current

**Class 2 accuracy limits (reactive energy) EN62053-23**
5(10A) start-up current: 5mA.

## Used calculation formulas

**Phase variables**

Instantaneous effective voltage

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

Instantaneous active power

$$W_1 = \frac{1}{n}\cdot\sum_{1}^{n}(V_{1N})_i\cdot(A_1)_i$$

Instantaneous power factor

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

Instantaneous effective current

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

Instantaneous apparent power

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

Instantaneous reactive power

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

**System variables**
Equivalent three-phase voltage

$$V_\Sigma = \frac{V_{12}+V_{23}+V_{31}}{3}$$

Voltage asymmetry

$$ASY_{LL} = \frac{(V_{LL\,max}-V_{LL\,min})}{V_{LL\,\Sigma}}$$

$$ASY_{LN} = \frac{(V_{LN\,max}-V_{LN\,min})}{V_{LN\,\Sigma}}$$

Three-phase reactive power

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

Neutral current

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

Three-phase active power

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

Three-phase apparent power

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

Three-phase power factor

$$\cos\phi_\Sigma = \frac{W_\Sigma}{VA_\Sigma} \quad \text{(TPF)}$$

**Energy metering**

$$kWh_i = \int_{t_1}^{t_2} P_i(t)\,dt \cong \Delta t\sum_{n_1}^{n_2} P_{nj}$$

$$kVarh_i = \int_{t_1}^{t_2} Q_i(t)\,dt \cong \Delta t\sum_{n_1}^{n_2} Q_{nj}$$

Where:

**i**= considered phase (L1, L2 or L3)
**P**= active power; **Q**= reactive power;
**$t_1$, $t_2$** =starting and ending time points of consumption recording; **n**= time unit;$\Delta$**t**= time interval between two successive power measurements;
**$n_1$, $n_2$** = starting and ending discrete time points of power recording

## List of the variables that can be connected to:

**Analogue outputs (all listed variables with the only exception of energies), alarm outputs (all listed variables with the only exception of energies), pulse outputs (only energies), communication (all listed variables).**

| No. | 1-phase | 2-ph. 3-wire system | 3-ph. 4-wire system | 3-ph. 3-wire bal. (1 CT) | 3-ph. 4-wire unbal. sys. | Notes unbal. sys. | |
|---|---|---|---|---|---|---|---|
| 1 | V L1 | x | x | x | o | x | |
| 2 | V L2 | o | x | x | o | x | |
| 3 | V L3 | o | o | x | o | x | |
| 4 | V L-N sys | o | x | x | o | x | Sys = system = Σ |
| 5 | V L1-2 | o | x | x | x | x | |
| 6 | V L2-3 | o | o | x | x | x | |
| 7 | V L3-1 | o | o | x | x | x | |
| 8 | V L-L sys | o | o | x | x | x | Sys = system = Σ |
| 9 | A L1 | x | x | x | x | x | |
| 10 | A L2 | o | x | x | x | x | |
| 11 | A L3 | o | o | x | x | x | |
| 12 | An | o | x | x | o | x | An=neutral current |
| 13 | W L1 | x | x | x | x | x | |
| 14 | W L2 | o | x | x | x | x | |
| 15 | W L3 | o | o | x | x | x | |
| 16 | W sys | o | x | x | x | x | |
| 17 | var L1 | x | x | x | x | x | |
| 18 | var L2 | o | x | x | x | x | |
| 19 | var L3 | o | o | x | x | x | |
| 20 | var sys | o | x | x | x | x | Sys = system = Σ |
| 21 | VA L1 | x | x | x | x | x | |
| 22 | VA L2 | o | x | x | x | x | |
| 23 | VA L3 | o | o | x | x | x | |
| 24 | VA sys | o | x | x | x | x | Sys = system = Σ |
| 25 | PF L1 | x | x | x | x | x | |
| 26 | PF L2 | o | x | x | x | x | |
| 27 | PF L3 | o | o | x | x | x | |
| 28 | PF sys | o | x | x | x | x | Sys = system= Σ |
| 29 | Hz | x | x | x | x | x | |
| 30 | ASY VL-N | o | x | x | o | x | Asymmetry of phase-neutral |
| 31 | ASY VL-L | o | o | x | x | x | Asymmetry of phase-phase |
| 32 | THD V1 | x | x | x | o | x | |
| 33 | THD V2 | o | x | x | o | x | |
| 34 | THD V3 | o | o | x | o | x | |
| 35 | THD V1-2 | o | x | x | x | x | |
| 36 | THD V2-3 | o | o | x | x | x | |
| 37 | THD V3-1 | o | o | x | x | x | |
| 38 | THD A1 | x | x | x | x | x | |
| 39 | THD A2 | o | x | x | x | x | |
| 40 | THD A3 | o | o | x | x | x | |
| 41 | THDo V1 | x | x | x | o | x | |
| 42 | THDo V2 | o | x | x | o | x | |
| 43 | THDo V3 | o | o | x | o | x | |
| 44 | THDo V1-2 | o | x | x | x | x | |
| 45 | THDo V2-3 | o | o | x | x | x | |
| 46 | THDo V3-1 | o | o | x | x | x | |
| 47 | THDo A1 | x | x | x | x | x | |
| 48 | THDo A2 | o | x | x | x | x | |
| 49 | THDo A3 | o | o | x | x | x | |
| 50 | THDe V1 | x | x | x | o | x | |
| 51 | THDe V2 | o | x | x | o | x | |
| 52 | THDe V3 | o | o | x | o | x | |
| 53 | THDe V1-2 | o | x | x | x | x | |
| 54 | THDe V2-3 | o | o | x | x | x | |
| 55 | THDe V3-1 | o | o | x | x | x | |
| 56 | THDe A1 | x | x | x | x | x | |
| 57 | THDe A2 | o | x | x | x | x | |
| 58 | THDe A3 | o | o | x | x | x | |
| 59 | Phase seq. | o | o | x | x | x | Phase sequence |

(x) = available (o) = not available

# WM5-96 User's Page

**Customer's data:** ..................................................................

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**Serial number WM5 96:** ..................................................................

**Note:** ..................................................................

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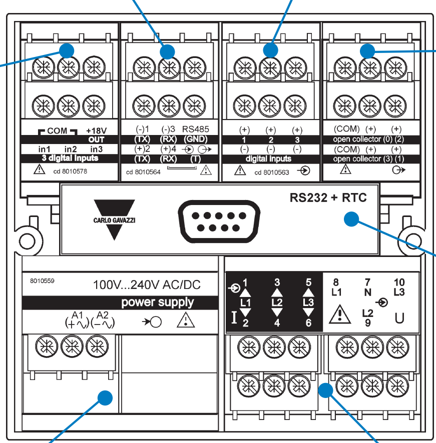
**Slot A**
- ☐ Empty
- ☐ AQ1038
- ☐ AQ1042
- ☐ AO1037
- ☐ AO1036
- ☐ AO1059
- ☐ AO1058
- ☐ AO2050
- ☐ AO2051
- ☐ AO2052

**Slot B**
- ☐ Empty
- ☐ AQ1038
- ☐ AQ1042
- ☐ AO1037
- ☐ AO1036
- ☐ AO1059
- ☐ AO1058
- ☐ AO2050
- ☐ AO2051
- ☐ AO2052
- ☐ AR1034
- ☐ AR2040

**Slot C**
- ☐ Empty
- ☐ AQ1038
- ☐ AQ1042
- ☐ AO1037
- ☐ AO1036
- ☐ AO1059
- ☐ AO1058
- ☐ AO1035
- ☐ AO2051
- ☐ AO2052

**Slot D**
- ☐ Empty
- ☐ AQ1038
- ☐ AQ1042
- ☐ AO1037
- ☐ AO1036
- ☐ AO1059
- ☐ AO1058
- ☐ AO1035
- ☐ AO2051
- ☐ AO2052




**Slot E**
- ☐ Empty
- ☐ AR1039

**Power supply**
- ☐ AP1021
- ☐ AP1020

**Measuring inputs**
- ☐ AQ2030
- ☐ AQ2031

## OUR SALES NETWORK IN EUROPE

**AUSTRIA** - Carlo Gavazzi GmbH
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## OUR SALES NETWORK IN ASIA AND PACIFIC

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**MALAYSIA** - Gavazzi Automation
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**CHINA** - Carlo Gavazzi Automation
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**HONG KONG** - Carlo Gavazzi Automation
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## OUR PRODUCTION SITES

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Carlo Gavazzi Industri
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Carlo Gavazzi Ltd
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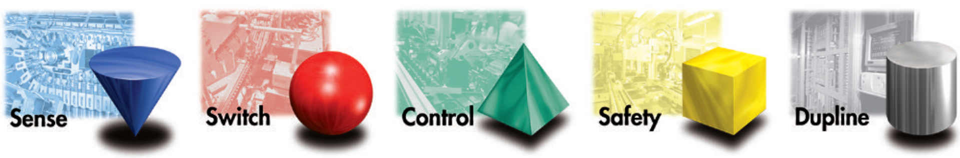


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Further information on **www.carlogavazzi.com/ac**

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