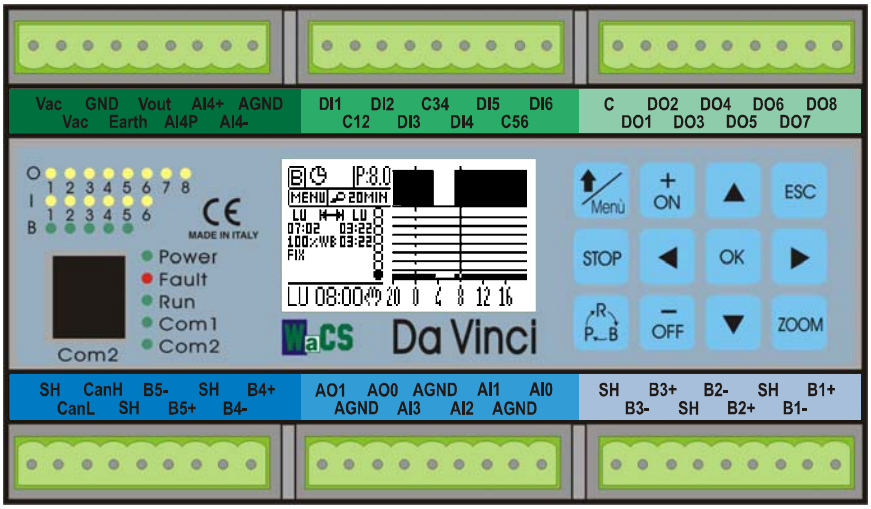
Inverter Solutions for Pumps

DaVinci

IRRIGATION ELECTRONIC BOARD



USER's HANDBOOK

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Irrigation Electronic Board "DaVinci"

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SYMBOLS:

ATTENTION! The wrong application of the instructions supplied by this handbook could cause irreparable damages to the device.

INFORMATION This information report is not strictly connected to the device, but useful for its installation.

VOCABULARY:

Station: means an "irrigation area" that can use more than one solenoid valve at the same time.

LIABILITY

The builder is not liable for the product malfunction when the item is not correctly installed: tampered with, modified, made working improperly or out of the suggested range.
The builder disclaims all responsibility for inaccuracies due to printing or transcription mistakes.
The builder shall bring the product any change he will deem necessary or useful, without jeopardizing its main features.

1 INTRODUCTION

We would thank you for choosing the "***DaVinci" electronic board***. It is the ideal solution both for the pumping groups and for the irrigation systems..

The irrigation electronic board "DaVinci" has been completely developed in Italy and it's distributed by WaCS System S.r.l.

Thanks to a widespread distribution and several agencies WaCS System operates in Italy, Europe, Eastern Europe and Middle East. The remaining geographical areas are directly managed by WaCS System (***export@wacs.it***).

Information about the distribution agencies can be found on our website ***http://www.wacs.it***

For any eventual technical trouble we kindly ask you to get in touch with the seller where you previously bought the electronic board or to directly write WaCS S.r.l an e-mail at:

support@wacs.it

In case you have suggestions for improving the "DaVinci" electronic board functionalities, we kindly ask you to directly write WaCS System S.r.l an e-mail at:

research@wacs.it

Please visit our website ***http://www.wacs.it*** to discover all the other WaCS System products in the field of the waters control and management.

2 "DAVINCI" IRRIGATION ELECTRONIC BOARD

Thanks to its versatility and user-friendliness, DaVinci electronic board can be used in a wide range of irrigation systems: drip, sprinkling and water atomization irrigation systems.

It can be used with the following functionalities:

- It can manage up to a max of 8 stations in a completely independent way (through galvanically isolated outputs); each station can be programmed with 32 different irrigation cycles on daily, weekly or personalized time periods (from 1 minute up to 31 days with a minimum time gap of 1 minute starting from a fixed date) thanks to its internal calendar (day – month – year).
- It can connect up to 6 sensors (through 6 opto-isolated inputs) and contemporarily manage the signals coming from them in order to minimize the water waste and have the maximum flexibility in connection of the sensors available on the market.
- It uses a digital output in order to control a pump/ master valve in the irrigation system;
- It can link 1 up to 4 inverters (PWM 230-400 – WaCS System S.r.l) in order to further optimize the water/power consume and to get the possibility to supply water at a pressure from 1 up to 15 Bars.

The use of the electronic board is supported by a display that provides graphic and text data in order to control both the board and the connected devices state (sensors, solenoid valves, inverters PWM).

2.1 Features

INPUT VOLTAGE (POSSIBILITY OF AC AND DC SUPPLY):
24-36 V_{DC}: connect terminal "+" to Vac input and terminal "-" to GND input
24 V_{AC} : connect the transformer 24V_{AC} outputs to the electronic board Vac inputs
Take care of connecting the earth wire to the EARTH input of the electronic board.
BUFFER BATTERY: it allows keeping the correct time in case of power outage (rechargeable lithium battery - 3V – 20 mA - item 2020).

CASE: dimensions 15,9cm x 9cm x 6,6cm; it can be fixed at standard DIN EN50022 slides, according to the DIN 43880 standard.
STATIONS: independent and simultaneous management of 8 relay outputs: 5A – 250 V_{AC} (station n°8 can be set up as the pump/ master valve)
PRESSURE:
for each single cycle the user can set a different pressure value: thanks to the inverter that manages the electrical water pump the user can link 1 to 4 PWM 230 and PWM 400 – WaCS System S.r.l. The link works through 4 serial outputs RS485 with a Transmission Control Protocol (TCP)
KEYBOARD: the user manages the electronic board thanks to 12-key frontal board.
LEDS: on the frontal board there are 4 led series which communicate the device state and the linked appliances:
8 yellow leds (marked with "***O***" on the frontal board) → the 8 digital outputs' state (irrigating stations)
6 yellow leds (marked with "***I***" on the frontal board) → the 6 digital inputs' state (sensors)
5 green leds (marked with "***B***" on the frontal board) → the 5 RS-485 communication lines' state (sensors)
1 green led (marked with "***Power***" on the frontal board) → power input
1 green led (marked with "***Run***" on the frontal board) → run state (flashing)
1 red led (marked with "***Fault***" on the frontal board) → fault state
2 green leds (marked with "***Com1***" and "***Com2***" on the frontal board) → the 2 UART state

GRAPHIC DISPLAY: the stations and electronic board cab be easily and instantly managed through the graphic display (128x64)

DAILY, WEEKLY OR PERSONALIZED IRRIGATING CYCLES: the programming can be set up for a weekly or daily period for a max of 36 irrigating cycles in each single station. The period can also be personalized for a maximum of 31 days and a resolution of 1 minute. The starting hour and date of this personal period can be set as well, and the period will be then programmed over the internal calendar.
DUTY: each irrigating cycle can be set as a duty cycle. This kind of irrigation can be useful, for example, when you need to *atomize water*: periods of high pressure irrigation alternated with irrigation halts. There are 3 different types of DUTY that can be set with 1sec resolution and a max repetition period of 99' 59" (5999s).
EX: 3h irrigation cycle with DUTY by 50% and duty period of 10 secs. This irrigating cycle will supply water (at the set pressure) for 5 secs. and halt for the following 5 secs. in cyclic phases, for all the 3h period.
DUTY RECIPROCAL DISCONNECTION: if more than one station is working at the same time in DUTY, water will be supplied in sequence, so that only one DUTY station works at the time, respecting the different setting of every DUTY. This can be useful when the user wants to turn some stations contemporarily on in a cyclic sequence (*see 6.3 page 42)*
WATER BUDGET – WB: it is possible to increase or decrease the working periods of the stations, without modifying the single cycle but only the WB value. The WB can vary by 200% (double of the active periods) till 1% (1/100 of the active periods) and can be increased by the 1%. The WB can only work with one station or with all of them altogether, according to the user needs.
MENU: it is always possible to enter the menus, containing all the options the user can set in that peculiar device state, both for setting the irrigating cycles and the electronic board.
6 DIGITAL INPUTS (SENSORS): all the 6 digital inputs (DI 1,2,3,4,5,6) are galvanically opto-isolated and independent by tows; in this way the electronic board can be linked to clean contacts, NPN and PNP outputs, that can work both in AC and in DC (whichever polarity) sending signals both at the contact closing or opening. This offers the maximum flexibility and compatibility with the sensors available on the market
The D1 input can be also set to be connected to a triac sensor (some water sensors have a triac output).
The electronic board can manage sensors sending signals both at the contact closing or opening (one of the sensors can also be triac). Each sensor can work with every station (the signals of a sensor can turn on/off a station or change its WB)
PWM 230 – 400 DEVICES: 1 to 4 PWM devices can be set to rule the water pressure and the best working of the pumps linked together with different functions, in order to obtain an automatic exchange among them.
LANGUAGE: the information supplied by the electronic board can be set in Italian, English or French.

3 "Da Vinci" electronic board working

BRIEFLY……"Da Vinci" electronic board working

DA VINCI IS AN IRRIGATION ELECTRONIC BOARD THAT CAN BE SET IN DAILY, WEEKLY OR PERSONALISED PERIODS (FROM 2 MINUTES TO 31 DAYS). IT CAN WORK IN RUN MODE (SET UP PROGRAMMES), IN BROWSE MODE (POSSIBILITY OF GRAPHICAL CHECK, WITH THE ARROW KEYS), AND IN PROGRAM MODE (PERSONALIZED SET UP OF THE ELECTRONIC BOARD). THE MODE CAN BE SELECTED PRESSING KEY  .
THE IRRIGATION CYCLES CAN BE MANUALLY TESTED, HALTING ALL THE IRRIGATING ACTIVITIES OR MANTINING THE CORRECT IRRIGATION, WHILE OPERATING ON THE ELECTRONIC BOARD.

You need to be aware of the **PROGRAMMING PERIOD,** if you want to correctly apply the desired operations and to correctly understand the information on the electronic board display (par. 3.1 – page 9).
You moreover need to be aware of the **WORKING MODE** (par.3.2 – page 9) and of the **IRRIGATION MANAGEMENT MODE** (par.3.3 – page 11).

Heredown the table of the possible electronic board states: a more detailed explanation is provided in the following paragraphs.

		IRRIGATION MANAGEMENT MODE		
		AUTOMATC IRRIGATION	MANUAL IRRIGATION	IRRIGATION HALT
WORKING MODE	RUN	•		•
	BROWSE	•	•	•
	PROGRAM	•	•	•
	STOP	**ALL THE EVENTUAL IRRIGATION ACTIVITIES ARE HALTED**		

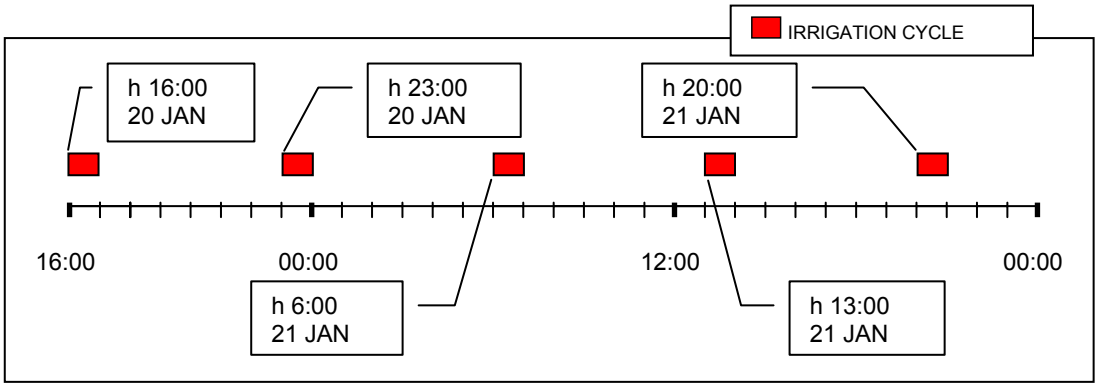
Table 1 "DaVinci" electronic board possible states

a. Daily – weekly – personalized run

Daily run The daily cycles can be programmed, repeating every day in the same way. In this mode the user only needs to set the starting and ending time of the irrigation cycle (32 irrigation cycles are available for each station)

Weekly run The weekly cycles can be differently programmed for every day of the week. In this mode you need to set the starting and ending time of the irrigation cycle as well as the day of the week.

Personalized run no doubt, this is one of the main peculiarities of this item. The personalized run can be programmed with a period that goes from 2 minutes to 31 days (1 min. resolution) with the option that the starting date and time can be set.
EX: the heredown picture shows a 7-hour period, time and date = 16:00 - 20 January 2010, with an irrigation cycle lasting 1 hour,



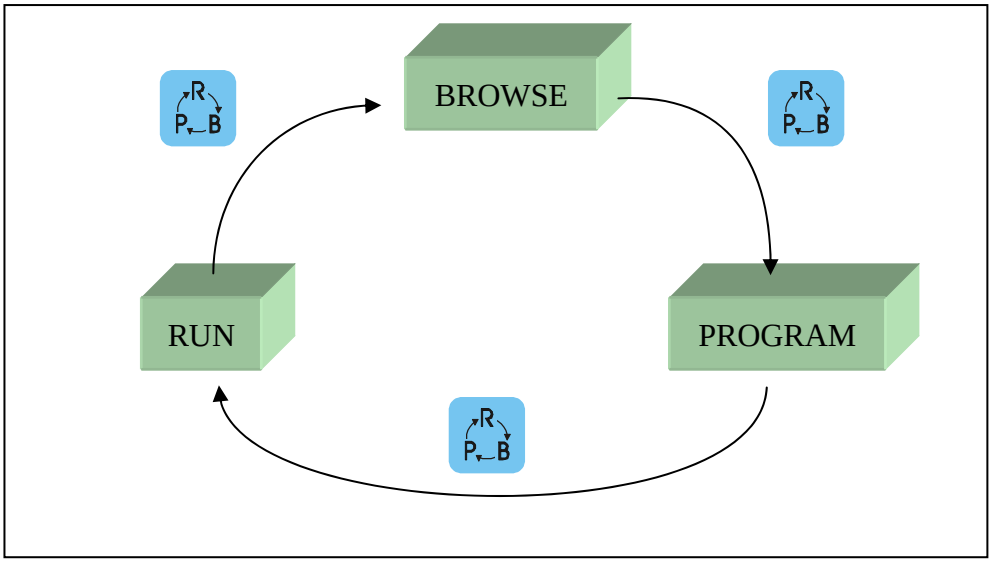
Picture 1 *7-hour irrigation cycle period*

b. Working modes

There are 3 working modes:

- RUN
- BROWSE
- PROGRAM

When turned on, the electronic board firstly displays the RUN mode. Pressing key , the mode changes into BROWSE, then PROGRAM and lastly turns again into RUN (see *Picture 2*).



Picture 2 *Irrigation electronic board working modes*

When the BROWSE or PROGRAM modes are selected, you need to choose the irrigation mode (for further information see *par. 3.3 - page 11*).

Features of the 3 electronic board working modes.

RUN MODE
Mode RUN is the mode displayed by the electronic board when you firstly turn it on; the cursor shows the current time and the graphs shows the irrigation cycles of the 8 stations. The user can enter the menu pressing key Menù and set the electronic board. (*for further information see par.5.1 page 25*).
In this mode the CAPTION (*see par.4.4.2 – page 17*) and the information in relationship with the sensors (*see chap. 8 - page 44*) are displayed.
All the details displayed in mode RUN are mentioned in *par.4.4.2 - page 17*.

BROWSE MODE
In mode BROWSE the user can move over the graphs both to select the different stations and to control the period (daily, weekly, personalized). The features of the selected irrigation cycle are displayed on the left.
The user can enter the menu pressing key Menù in order to set the electronic board. (*see par.5.1 - page 25*).
In this way all the selected irrigation cycle features are displayed: the WB value (the seasonal irrigation), the duty type, and the sensors information see *chap. 8 page 44*).
All the details displayed in mode BROWSE are mentioned in *par. 4.4.3 - page 20*.

PROGRAM MODE
In mode PROGRAM the user can move over the graphs, selecting the different stations and moving along the days of the week through the different zoom levels. In this mode the features of the eventually selected cycles are NOT displayed, but a pull-down menu with all the possible actions the user can set in that peculiar position. (*see par. 5.2 - page 36*): there the user can enter the menu pressing key Menù.
All the details displayed in mode PROGRAM are mentioned in *par.5.2 - page 36*.

c. Irrigation modes

There are 3 possible irrigation modes:
IRRIGATION MAINTENANCE: the irrigation cycles are repeated at determined times;
IRRIGATION TEST: different stations are activated when corresponding to the graph time cursor;
IRRIGATION HALT: irrigation is suspended in all the stations.

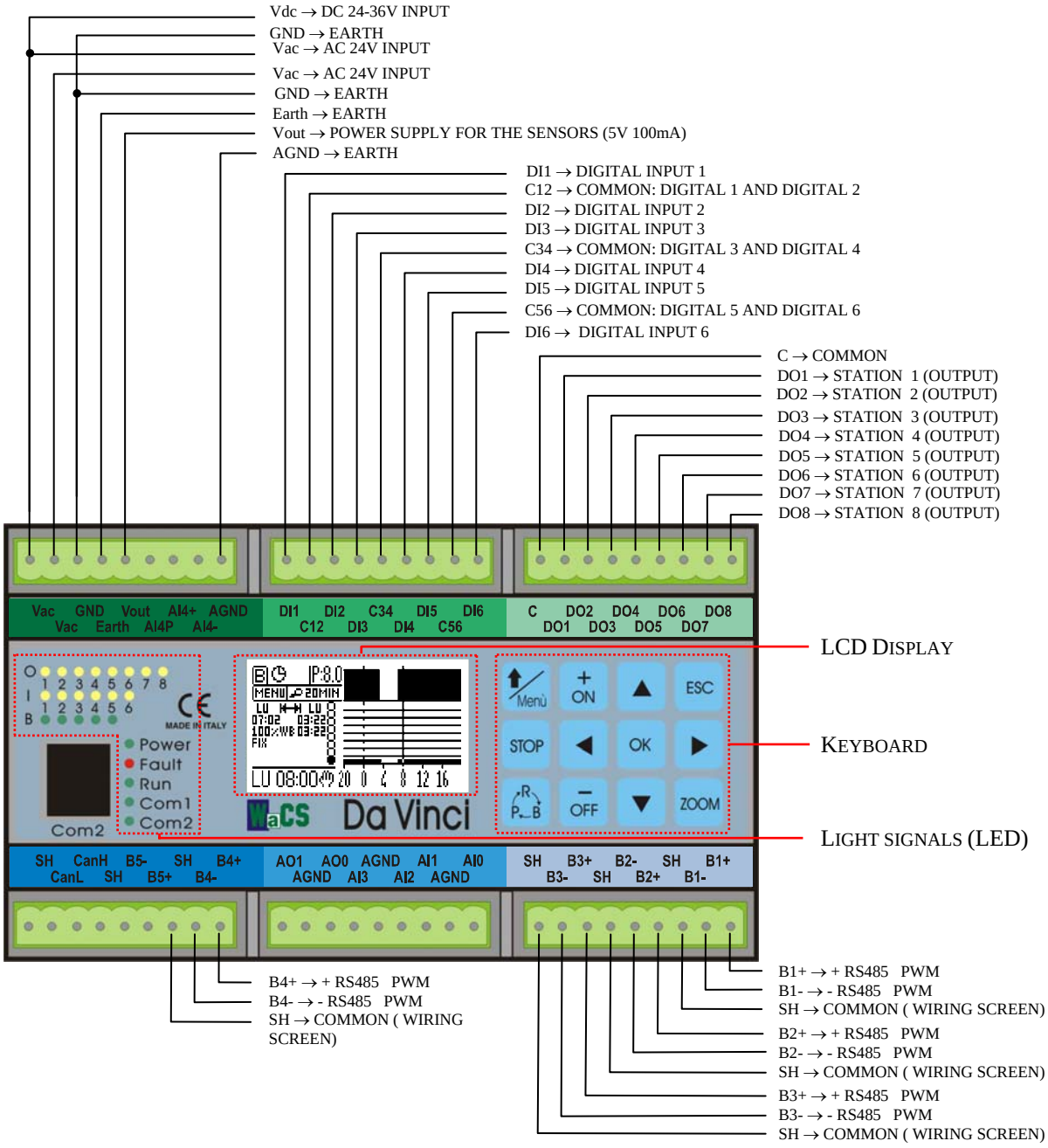
When pressing the  key to change the irrigation mode, the display shows a window with the three above mentioned options: in case the user does not change the option within 5 secs, the electronic board will automatically go back to the previous mode. The mode selected by the arrow keys, must be confirmed pressing the OK key. On the other hand, pressing the ESC key, the user will be able to go back to the previously set irrigation mode.

4 Frontal Board

BRIEFLY…Frontal Board

THE USER IS ABLE TO FULLY MANAGE THE IRRIGATION CYCLES THROUGH THE FRONTAL BOARD USING THE LEDS INFORMATION, THE DISPLAY AND THE KEYBOARD

a. Connection



4.2 Light Signals (LED)

LABEL	LED Number / COLOUR	INFO
O (Output)	1-2-3-4-5-6-7-8 / YELLOW	Every single LED (if on) shows that the water supply is going on. (In case of DUTY cycle, when the station is OFF, the corresponding LED is OFF, because of no water supply at that moment, even if part of an irrigation cycle).
I (Input)	1-2-3-4-5-6 / YELLOW	Every single LED (if on) shows the presence of a signal coming from the corresponding linked sensor (digital input).
B	1-2-3-4 / GREEN	OFF: corresponding PWM device not-enabled ON fixed: corresponding PWM230-400 device correctly linked ON flashing: there is NO communication with the corresponding PWM device.
Power	GREEN	ON fixed: electronic board correctly supplied
Fault	RED	Electronic board in fault state.
Run	GREEN	ON flashing: electronic board correctly ON.
Com1	GREEN	UART 1 traffic
Com2	GREEN	UART 2 traffic

2.2 4.3 Keyboard

12 keys form the keyboard: they could be working or not according to the electronic board state; if working, they can moreover perform different functions, according to the electronic board state. The only always-working key, and always with the same function is key:

STOP	Halt of any eventual irrigation cycle, till the same key new pressing.

Key	FUNCTION
R P B	To change the cycle mode (RUN – BROWSE – PROGRAM)
▲	To move the selected cursor up or square.
▼	To move down the selected cursor up or square.
▶	To move right the selected cursor up or square.
◀	To move left the selected cursor up or square.
OK	To save or confirm the choice. In RUN e BROWSE modes, it also shows the sensors state.
ESC	▪ Escape from the current state with the possibility to save or not the chosen state; ▪ Back to the starting state of a determined mode; ▪ From the starting state of a determined mode, back to the previous ones till the RUN mode.
Menù	To enter the different mode menus (RUN, BROWSE, PROGRAM).
+ ON	To turn on or increase the selected figure or item.
– OFF	To turn off or decrease the selected figure or item.
ZOOM	Change the zoom factor: 1 pixel 1 minute 1 pixel 5 minutes 1 pixel 20 minutes

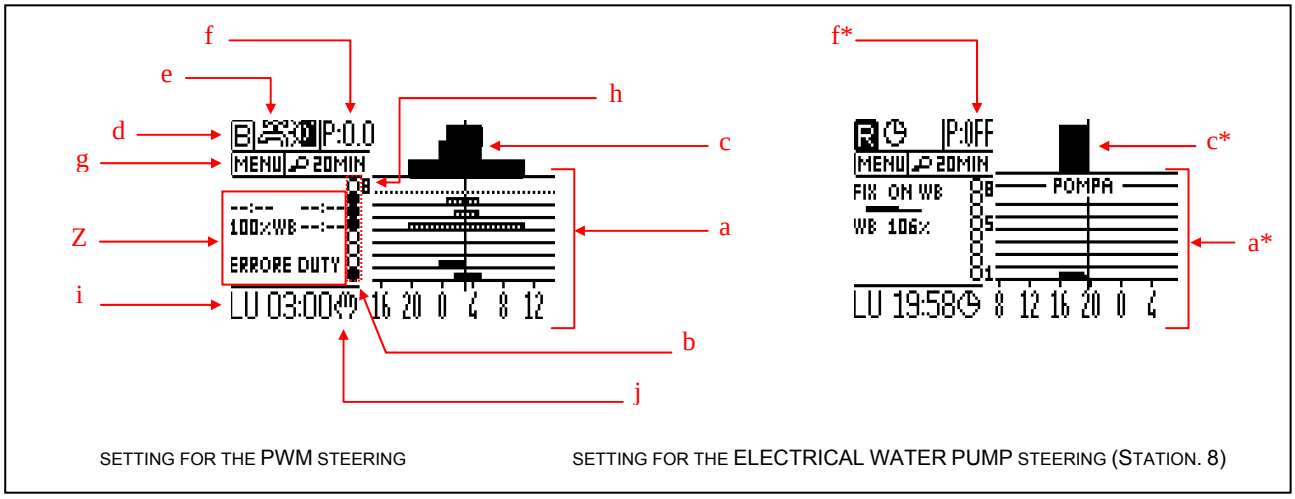
b. LCD Display

BRIEFLY… LCD Display

IN A MENU THE USER CAN READ THE DIFFERENT DISPLAY ENTRIES (SEE CHAP.5 PAGE 25), OR THE IRRIGATION CYCLES HISTOGRAM ON THE RIGHT SIDE OF THE DISPLAY AND SOME ELECTRONIC BOARD INFORMATION ON THE LEFT ONE, TOGETHER WITH THEIR RELEVANT CAPTION.

On the LCD display (128 x 64 pixels - backlit) the user can read two kinds of information regarding the irrigation cycles:

1. data *not depending from the working modes (a,a*,b,c,c*,d,e,f,f*,g,h,i,j - Picture 3)*;
2. data *in relationship with the working modes* (*Z - Picture 3*);



Picture 3 *Display data. Letters with symbol * refer to the information displayed if the electronic board is set to steer the pump instead of the PWM devices: the electronic board can actually steer up to 4 pumps thanks to WaCS System-produced inverters (PWM 230-400 devices - see chap.9 page 54) with all the relevant advantages. On the other hand it can steer one pump thanks to a contactor, linking this one to* ***output 8*** *(see chap.10 page 63).*

i. data ALWAYS on the display

Data always on the display are mentioned on *Picture 3*:

a. state of the 8 stations (on/off) in relationship with time (steering PWM);

a*. state of the 7 stations (on/off) in relationship with time, at station n.8 appears the name PUMP to show that this station is active when almost one of the other stations is working, according to the chosen setting (pump/master valve steering).

b. state of the 8 stations at the very second of time shown by the cursor. If a duty cycle is ON (in this mode the irrigation is not continuous, but within a cycle, it works in alternating periods of irrigation and suspension) the indicator will be always active, even if in that very second of time the irrigation is temporarily suspended (*see par. b page 39*).

c. irrigation cycles pressure; if two stations are contemporarily active with different pressure values, only the highest will be displayed (PWM devices steering);

c*. state of the pump: the black areas mean that the pump is on (pump/master valve steering),

d. electronic board mode indicator:
   1. mode RUN → R ;
   2. mode BROWSE → B ;
   3. mode PROGRAM → P ;

e. irrigation mode (management of the stations), in mode BROWSE and PROGRAM:
   symbol can alternate with the other following symbols, according to the irrigation mode:
   1. irrigation maintenance → ;
   2. irrigation suspension → ;
   3. irrigation test → ;

f. When the electronic board is set to steer the PWM devices, this figure represents the max pressure among the different cycles covered by the cursor, in mode RUN → P:9.0; in mode BROWSE or PROGRAM it represents the selected irrigation cycle pressure; if the cursor doesn't cover any cycle → P:0.0;

> ⚠ ***If more than one irrigation cycle is contemporarily ON, working with different pressure values, the PWM steering pressure value corresponds to the highest one.***

f*. When the electronic board is set to steer the pump/master valve, this figure represents the state of the pump/master valve with reference to the cursor position in mode RUN → P: ON (OFF);
   in mode BROWSE or PROGRAM it represents the state of the pump/master valve with reference to the selected irrigation cycle; if the cursor doesn't cover any cycle → P: OFF;

g. menu with the different options that can be set according to the current electronic board mode (it can be entered through the relevant key) → MENU;

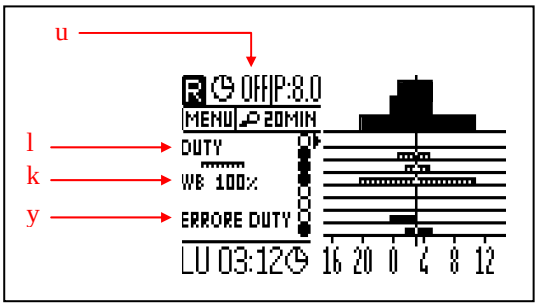
h. selected zoom factor (1min, 5min, 20min) → ZOOM

i. field ***date***: day - month – year and day of the week – hour alternate on the display

j. increase (or increase/decrease if in mode BROWSE or PROGRAM) of the field ***date*** (i) and relevant movement of the cursor over the time graph.
   1.automatic setting: time automatically increases, thanks to an internal clock, according to a pre-set hour → ;
   2. manual setting: time is manually set thanks to the right and left arrow keys (▶ ◀) → ;

ii. Data on the display in mode RUN

Over the data always appearing on the display (*see par.i page 15)*, when in mode RUN this further information will be displayed:



Picture 4 *Information displayed in mode RUN*

k. Water Budget (seasonal irrigation *par.6d page 41*):

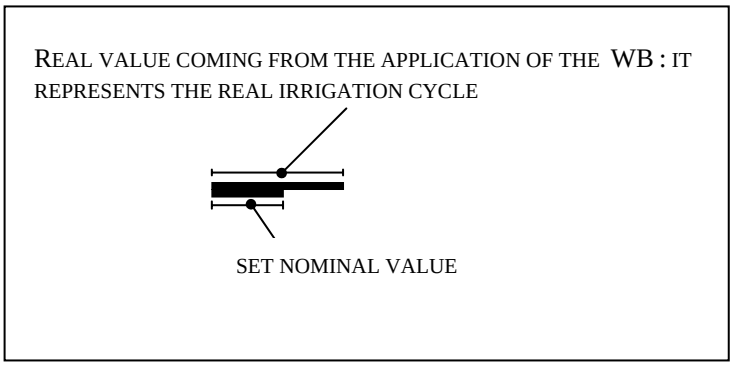
WB value is represented by "WB nn%" if all the stations have a WB = nn% , on the other hand (see *Picture 4*) the displayed WB alternatively corresponds to each single station WB value:

WBp nn%

p = number of the station
nn = WB value

l. Caption:

According to the cycle features (duty and/or WB), cycles are differently represented over the station graph.



The caption alternatively shows the different irrigation types together with their relevant written explanation :

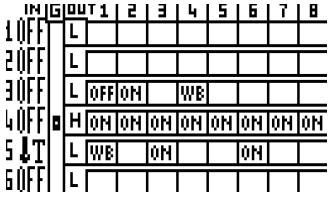
1. ( ) → set weekly irrigation
2. ( ) → set weekly irrigation with WB < 100%
3. ( ) → set weekly irrigation with WB > 100%
4. ( ) → set weekly irrigation with in duty mode
5. ( ) → set weekly irrigation with in duty mode with WB < 100%
6. ( ) → set weekly irrigation with in duty mode > 100%

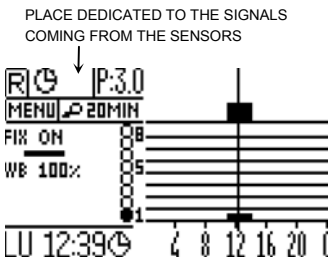
u. Sensors information.

Here are alternatively displayed all the information coming from each single sensor, at that minute sending signals to the electronic board:

- outputting sensor symbol;
- ON = irrigation beginning; OFF = irrigation halt; WB = change of the current irrigation cycle length percentage; at the same time symbol " ▸ " shows the involved stations over the graph.

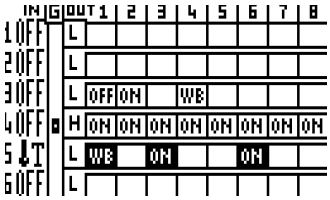
Heredown, a possible inputs setting and the relevant information displayed in mode RUN:

<table>
<tr><td rowspan="2">NO SIGNALS COMING FROM THE SENSORS</td><td>SENSORS STATE PAGE</td><td> 
</td><td>▪ None of the sensors is sending signals: boxes reporting actions to be taken (ON-OFF-WB) all have a light background with a black writing
▪ Sensors 1 – 2 – 3 – 4 - 6:
⇒ disabled sensors: writing OFF beside the sensor number (numbers "1", "2", "3", "4", "6" at the beginning of the 1°, 2°, 3°, 4°, 6° lines)

▪ sensor 3 (line n°3 – symbol "3"):
⇒ action to be taken with station n. 1: OFF
⇒ action to be taken with station n. 2: ON
⇒ action to be taken with station n. 4: WB
⇒ disabled sensor: writing OFF beside the sensor number (number "3" at the beginning of the 3° line)
▪ sensor 4 (line n°4 – symbol "4"):
⇒ GLOBAL function is selected: little black square with a white centre appearing in column G at line (4). This function allows the repeating of the same action over all the stations without setting them one by one
⇒ disabled sensor: writing OFF beside the sensor number (number "4" at the beginning of the 4° line)
▪ sensor 5 (line n°5 – symbol "⇩T"):
⇒ action to be taken with station n. 1: WB
⇒ action to be taken with station n. 3: ON
⇒ action to be taken with station n. 6: ON
⇒ enabled sensor: writing/symbol different from OFF beside the sensor number (number "5" at the beginning of 5° line); symbol ⇩T shows that the sensor is ON and according to the mode, that it is sending signals.</td></tr>
<tr><td>DISPLAY IN MODE RUN</td><td> 
</td><td>▪ There is only one irrigation cycle and it is currently working
▪ None of the sensors is sending signals: any further information is displayed and the place reserved to the signals coming from the sensors is always empty.</td></tr>
</table>

SIGNALS COMING FROM SENSOR 5

SENSORS STATE PAGE



- Sensor 5 is sending signals: boxes reporting actions to be taken over the different stations (1-3-6) are highlighted (black background with light writing

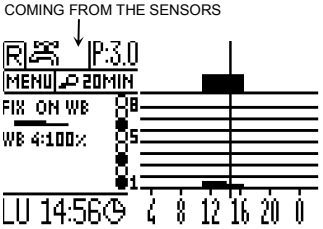
⇒ disabled sensors: writing OFF beside the sensor number (number "1"- "2"- "6" at the beginning of the 1°-2°-6° lines)

- sensor 3 (line n°3 – symbol "**3**"):
  - ⇒ action to be taken with station n. 1: OFF
  - ⇒ action to be taken with station n. 2: ON
  - ⇒ action to be taken with station n. 4: WB
  - ⇒ disabled sensor : writing OFF beside the sensor number (number "3" at the beginning of the 3° line)
- sensor 4 (line n°4 – symbol "**4**"):
  - ⇒ GLOBAL function is selected: little black square with a white centre appearing in column G at line (4). This function allows the repeating of the same action over all the stations without setting them one by one
  - ⇒disabled sensor : writing OFF beside the sensor number (number "4" at the beginning of the 4° line)
- sensor 5 (line n°5 – symbol "T"):
  - ⇒ action to be taken with station n. 1: WB
  - ⇒ action to be taken with station n. 3: ON
  - ⇒ action to be taken with station n. 6: ON
  - ⇒ enabled sensor: writing/symbol different from OFF beside the sensor number (number "5" at the beginning of 5° line); symbol T shows that the sensor is ON and according to the mode, that it is sending signals.

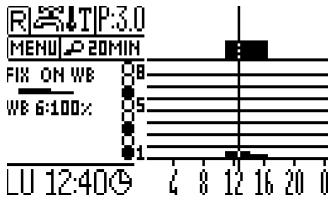
DISPLAY IN MODE RUN

In mode Run, in the space reserved to the signals coming from the sensors, the information coming from each single sensor is alternatively displayed at that very moment it is sending signals to the electronic board:

1. Empty space;
2. Symbol associated with the sensor signal;
3. ON = irrigation beginning; OFF = irrigation halt; WB = change of the current irrigation cycle length percentage; at the same time symbol " ▸ " shows the involved stations over the graph



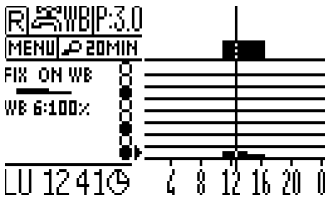
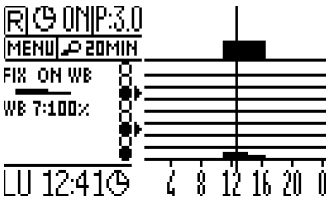
- There is only one set irrigation cycle, but 3 of the stations are currently active, therefore almost one sensor is sending signals
- Even if the sensor is sending signals, in the space reserved to this communication, the information appears only after some seconds.
- Stations 3 and 6 are ON (black spots on the graph left-hand, at lines in 3 and 6 in the graph), but none of the irrigation cycles are responsible for their activation, therefore almost one of the sensors is sending the signal to activate them.
- It is not possible to define if the WB>100% referring to station 1 is due to the sensor or it has been manually set.



- in the space reserved to the communication***, the sensor symbol appears for a few seconds, to show that the sensor is sending a signal***
- Afterwards, the actions in relationship to the relevant stations are displayed. (see below)

…..to be continued ↴

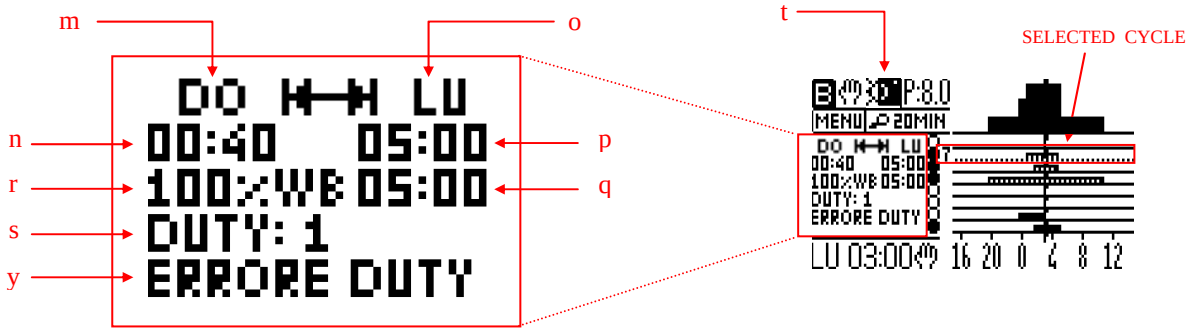
t to be continued ……

SIGNALS COMING FROM SENSOR 5	DISPLAY IN MODE RUN		
			▪ the taken action is displayed in the space reserved to the communication ▪ A right-hand arrow indicates the stations currently interested by the action ▪ In this picture action WB interests station 1; the WB applied to station 1 is higher than 100% (as shown by the drawing representing the irrigation cycle *see par.ii page 17*)
			▪ the taken action is displayed in the space reserved to the communication A right-hand arrow indicates the stations currently interested by the action ▪ In this picture action ON is taken at stations 3 and 6.
		In case there is only one signal (as above) the information is continuously repeated on the display, but if there are more than one signal at the time, they will be alternatively displayed.	

y. information about the reciprocal disconnecting of the duty
The writing DUTY ERROR appears if the reciprocal disconnecting of the duty is ON and it shows that the irrigation currently in action is losing some irrigation periods T_{ON} (see *6c page 41 for further details*).

iii. Data on the display in mode BROWSE

The information displayed in mode BROWSE refers to the selected irrigation cycle:



m. Beginning day of the irrigation cycle *set*;
n. Beginning hour of the irrigation cycle *set* ;
o. Ending day of the irrigation cycle *set*;
p. Ending hour of the irrigation cycle *set*;
q. Different information is displayed at 1-second interval according to the irrigation cycle: if the applied WB is fully executed (1) or if it must stop due to another irrigation cycle over the same station (2):
(1) → information displayed at 1-second interval:

- *Real* ending day of the irrigation cycle
- *Real* ending hour of the irrigation cycle (if the WB = 100% it will match with the above explained "p")

(2) → information displayed at 1-second interval:

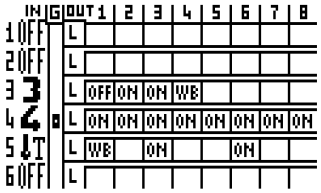
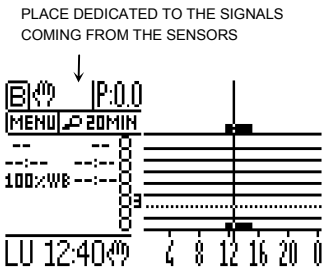
- *Real* ending day of the irrigation cycle
- *Real* ending hour of the irrigation cycle
- Symbol that shows the uncompleted execution of the irrigation cycle due to a new cycle beginning: ⋊⊣

r. Value of the WB applied to the irrigation cycle;
s. Irrigation cycle type (FIX = fixed; DUTY 1,2,3 = type of the duty);
t. Sensors information:

Here are alternatively displayed all the information coming from each single sensor sending signals to the electronic board with reference to the station selected by the cursor:

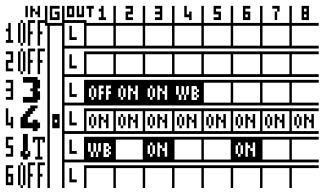
- outputting sensor symbol;
- WRITING (ON-OFF-WB) representing the taken action.

Heredown, a possible input setting and the relevant information displayed in mode BROWSE:

NO SIGNALS COMING FROM THE SENSORS	SENSORS STATE PAGE		▪ None of the sensors is sending signals : boxes reporting actions to be taken (ON-OFF-WB) all have a light background with black writing ▪ Sensors 1-2-6: ⇒ disabled sensors : writing OFF within column "IN" ▪ sensor 3 (line n°3 – symbol "**3**"): ⇒ action to be taken with station n. 1: OFF ⇒ action to be taken with station n. 2: ON ⇒ action to be taken with station n. 3: ON ⇒ action to be taken with station n. 4: WB ⇒ enabled sensor: writing **3 (bold)** beside the number of the sensor (number "3" at the beginning of the 3° line) ▪ sensor 4 (line n°4 - symbol "**4**"): ⇒ GLOBAL function is selected: little black square with a white centre appearing in column G at line (4). This function allows the repeating of the same action over all the stations without setting them one by one ⇒ disabled sensor: writing OFF beside the number of the sensor (number "4" at the beginning of the 4° line) ▪ sensor 5 (line n°5 - symbol "⇩T"): ⇒ action to be taken with station n. 1: WB ⇒ action to be taken with station n. 3: ON ⇒ action to be taken with station n. 6: ON ⇒ enabled sensor: writing/symbol different from OFF beside the sensor number (number "5" at the beginning of 5° line); symbol ⇩T shows that the sensor is ON and that it is sending signals according to the mode.
	DISPLAY IN MODE BROWSE		▪ There is only one irrigation cycle and it is currently working ▪ None of the sensors is sending signals: any further information is displayed and the place reserved to the signals coming from the sensors is always empty

SIGNALS COMING FROM SENSORS 3 AND 5

SENSORS STATE PAGE



- Sensors 1 – 2 - 6 are disabled: writing beside the sensor number (number "1"- "2"- "6" at the beginning of the 1°, 2°, 6° lines).
- Sensors 3 – 4 - 5 are enabled: writing/symbol different from OFF beside the sensor number (number "3", "4", "5" at the beginning of the 3°,4°,5° lines); symbols "**3**","**4**", "T"show that the sensors are ON and according to the mode, that they are sending signals.
- sensor 3 is sending signals:
  ⇒ action to be taken with station n. 1: OFF. The action is highlighted therefore it is operative: action OFF is operative when there is a currently active irrigation cycle over station n. 1 .
  ⇒ action to be taken with station n. 2: ON. The action is highlighted therefore it is operative: action ON is operative if there are NO currently active irrigation cycles over station n. 2.
  ⇒ action to be taken with station n. 3: ON. The action is highlighted therefore it is operative: action ON is operative if there are NO currently active irrigation cycles over station n. 3.
  ⇒ action to be taken with station n.4: WB. The action is highlighted: that means that all the irrigation cycles programmed over station n.4 are under the WB set by the sensor.
- sensor 4:
  ⇒ sensor 4 is not sending signals OR its taken actions are not operative. Thanks to the led on the frontal board (letter "I") it is possible to verify that led 4 is off and therefore, in this case, the sensor is not sending signals. The same information can also be seen on the display: in fact in correspondence of sensor 4 (line 4) and with particular regard of stations 1-2-3-6 it is not highlighted (in case the sensors was sending signals this writing should have been highlighted).
- sensor 5 is sending signals:
  ⇒ action to be taken with station n.1: WB. The action is highlighted therefore all the programmed irrigation cycles, over station n.4 are under the WB set by the sensor.
  ⇒ action to be taken with station n. 3: ON. The action is highlighted therefore it is operative: action ON is operative if there are NO currently active irrigation cycles over station n. 3.
  ⇒ action to be taken with station n. 6: ON. The action is highlighted therefore it is operative: action ON is operative if there are NO currently active irrigation cycles over station n. 2.

DISPLAY IN MODE BROWSE

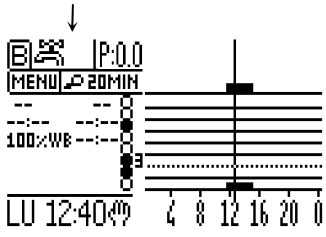
In mode Run, in the space reserved to the signals coming from the sensors, the information coming from each single sensor is alternatively displayed at that very moment it is sending signals to the electronic board:

1.Empty space;
2.Symbol associated with the sensor signal;
3.writing (ON-OFF-WB) representing the taken action

SENSOR 3

1. Empty space

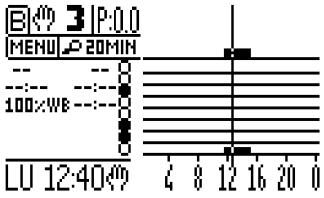
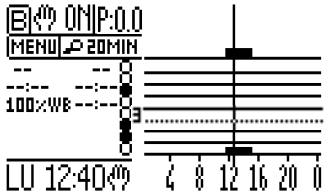
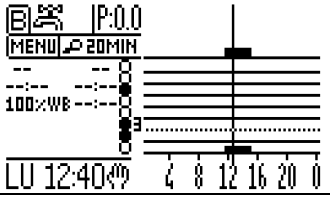
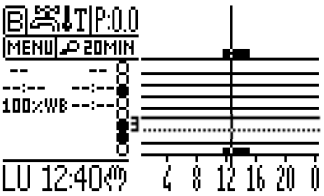
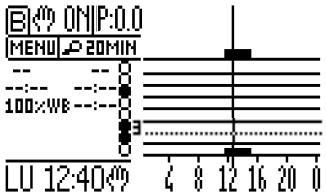
PLACE DEDICATED TO THE SIGNALS COMING FROM THE SENSORS



- There is only one programmed irrigation cycle, but the corresponding station is NOT active; moreover there are 3 active stations without irrigation cycles set to activate them, therefore almost one sensor is sending signals.
- Even if the sensor is sending signals to the reserved place, the relevant information will appear only after a few seconds.
- Stations 2, 3 and 6 are ON (black spots on the graph left-hand, at lines in 2, 3 and 6 in the graph), but none of the irrigation cycles are responsible for their activation.
- It is not possible to define if the WB>100% referring to station 1 is due to the sensor or it has been manually set.

.....to be continued ↴

↳ to be continued ……

SIGNALS COMING FROM SENSORS 3 AND 5	DISPLAY IN MODE BROWSE	SENSOR 3 2. Symbol associated with the sensor signal; 	▪ Only for a few seconds, *the symbol of the sensor currently sending signals* appears in the place reserved to the communication. *(in this case symbol "**3**")*
		SENSOR 3 3. writing ON representing the taken action 	▪ The action(in this case "ON") taken by the sensor (sensor 3) over the selected station (station 3) appears in the place reserved to the communication
		SENSOR 5 1. Empty space 	▪ There is only one programmed irrigation cycle, but the corresponding station is NOT active; moreover there are 3 active stations without irrigation cycles, therefore almost one sensor is sending signals. ▪ Even if the sensor is sending signals to the reserved place, the relevant information will appear only after a few seconds. ▪ Stations 2, 3 and 6 are ON (black spots on the graph left-hand, at lines in 2, 3 and 6 in the graph), but none of the irrigation cycles are responsible for their activation. ▪ It is not possible to define if the WB>100% referring to station 1 is due to the sensor or it has been manually set.
		SENSOR 5 2. Symbol associated with the sensor signal; 	▪ Only for a few seconds, *the symbol of the sensor currently sending signals* appears in the place reserved to the communication. *(in this case symbol "T")*
		SENSOR 5 4. writing ON representing the taken action 	▪ The action (in this case "ON") taken by the sensor (sensor 3) over the selected station (station 3) appears in the place reserved to the communication

y. information about the reciprocal disconnecting of the duty
The writing DUTY ERROR appears if the reciprocal disconnecting of the duty is ON and it shows that the irrigation currently in action is losing some irrigation periods T_{ON} (see *6c page 41 for further details*).

iv. Data on the display in mode PROGRAM

In this mode the menu (*par. 5b Menu in mode PROGRAM page 36*) OR the irrigation cycle properties are displayed (*par.6 Properties of the irrigation cycles page 38*); in this last case, the cursor (flashing) selects one of the irrigation cycle properties that can be modified pressing the keys + ON and − OFF. If the duty or the water budget (seasonal irrigation) are selected the user can enter the setting page pressing key Menu.

5 MENU

BRIEFLY…MENU

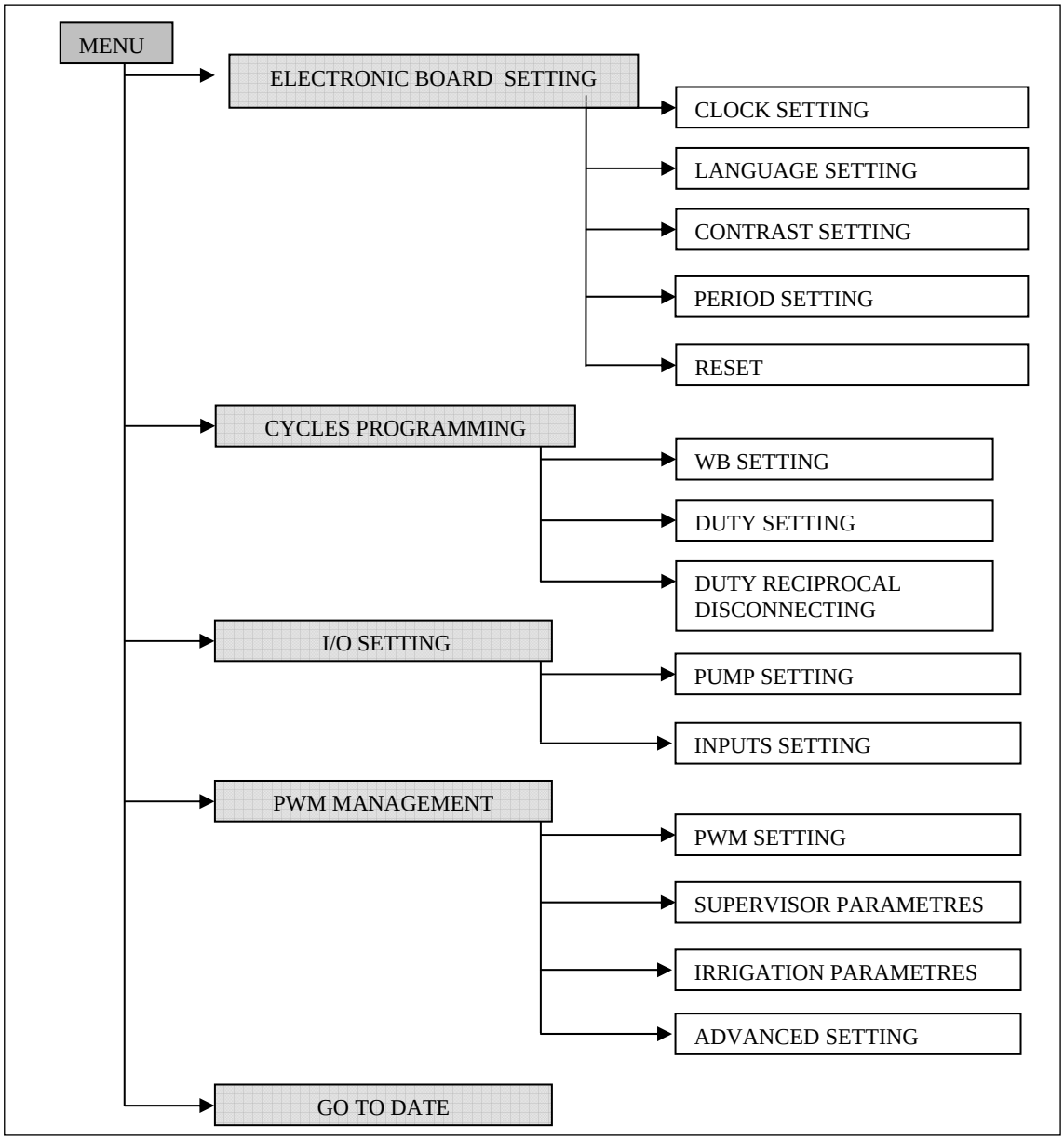
PRESSING THE RELEVANT KEYS, THE USER CAN ENTER THE TWO AVAILABLE MENUS: ***RUN-BROWSE*** *AND* ***PROGRAM.*** *WITH THESE MENUS THE ELECTRONIC BOARD CAN BE SET AND PROGRAMMED.*

There are several menus, different in contents and look, that the user can enter pressing the relevant key :

- MENU RUN - BROWSE that can be entered through modes RUN and BROWSE;
- MENU PROGRAM that can be entered through modes PROGRAM.

a. Menu in mode RUN and BROWSE

The menu structure is explained in the heredown picture:



Picture 4 Menu structure in modes RUN and BROWSE

i. MENU

- ▲ TO MOVE UPWARDS, IN THE SELECTION
- ▼ TO MOVE DOWNWARDS, IN THE SELECTION
- OK SELECTION CONFIRMATION
- ESC BACK TO THE MENU

ii. MENU → *ELECTRONIC BOARD SETTING*

- ▲ TO MOVE UPWARDS, IN THE SELECTION
- ▼ TO MOVE DOWNWARDS, IN THE SELECTION
- OK SELECTION CONFIRMATION
- ESC BACK TO THE MENU

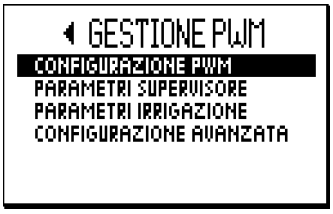
iii. MENU → *CYCLES PROGRAMMING*

- ▲ TO MOVE UPWARDS, IN THE SELECTION
- ▼ TO MOVE DOWNWARDS, IN THE SELECTION
- OK SELECTION CONFIRMATION
- ESC BACK TO THE MENU

iv. MENU → *I/0 SETTING*

- ▲ TO MOVE UPWARDS, IN THE SELECTION
- ▼ TO MOVE DOWNWARDS, IN THE SELECTION
- OK SELECTION CONFIRMATION
- ESC BACK TO THE MENU

v. MENU → *PWM MANAGEMENT*



- ▲ TO MOVE UPWARDS, IN THE SELECTION
- ▼ TO MOVE DOWNWARDS, IN THE SELECTION
- OK SELECTION CONFIRMATION
- ESC BACK TO THE MENU

vi. MENU → *GO TO DATE*

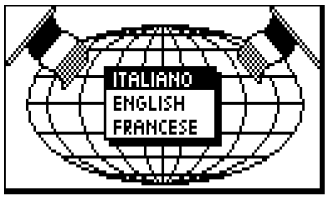
- ▲ TO MOVE UPWARDS THE FLASHING CURSOR
- ▼ TO MOVE DOWNWARDS THE FLASHING CURSOR
- ◄ TO MOVE LEFTWARDS THE FLASHING CURSOR
- ► TO MOVE RIGHTWARDS THE FLASHING CURSOR
- + ON INCREASE OF THE SELECTED VALUE
- – OFF DECREASE OF THE SELECTED VALUE
- OK EXIT / SAVE CHANGE
- ESC EXIT – SAVE/DON'T SAVE CHANGE OPTION

Use this function to set the date and hour of the cursor over the time axe can be set using this function, without pressing the arrow keys.

vii. MENU → ELECTRONIC BOARD SETTING → *TIME*

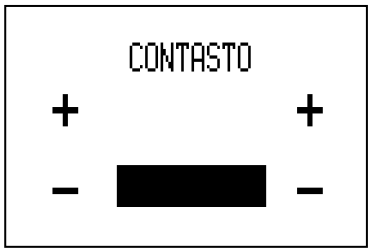
- ▼ TO MOVE DOWNWARDS THE FLASHING CURSOR
- ▲ TO MOVE UPWARDS THE FLASHING CURSOR
- ◄ TO MOVE LEFTWARDS THE FLASHING CURSOR
- ► TO MOVE RIGHTWARDS THE FLASHING CURSOR
- + ON INCREASE OF THE SELECTED VALUE
- – OFF DECREASE OF THE SELECTED VALUE
- OK EXIT / SAVE CHANGE
- ESC EXIT – SAVE/DON'T SAVE CHANGE OPTION

viii. MENU → ELECTRONIC BOARD SETTING → ***LANGUAGE***



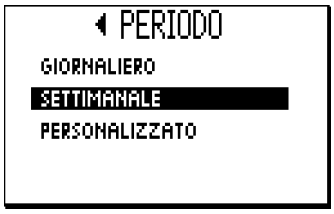
- ▲ TO MOVE UPWARDS THE FLASHING CURSOR
- ▼ TO MOVE DOWNWARDS THE FLASHING CURSOR
- OK SELECT THE LANGUAGE / SAVE CHANGE
- ESC EXIT – SAVE/DON'T SAVE CHANGE OPTION

ix. MENU → ELECTRONIC BOARD SETTING → ***CONTRAST SETTING***



- + ON INCREASE CONTRAST
- – OFF DECREASE CONTRAST
- OK EXIT / SAVE CHANGE
- ESC EXIT – SAVE/DON'T SAVE CHANGE OPTION

x. MENU → ELECTRONIC BOARD SETTING → ***PERIOD SETTING***



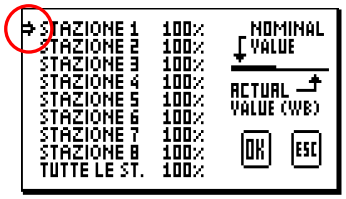
- ▲ TO MOVE UPWARDS THE FLASHING CURSOR
- ▼ TO MOVE DOWNWARDS THE FLASHING CURSOR
- OK EXIT / SAVE CHANGE
- ESC UNDO / BACK TO MAIN MANU

xi. MENU → ELECTRONIC BOARD SETTING → ***RESET***

- ▲ TO MOVE UPWARDS THE FLASHING CURSOR
- ▼ TO MOVE DOWNWARDS THE FLASHING CURSOR
- OK EXIT / SAVE CHANGE
- ESC UNDO / BACK TO MAIN MANU

Resetting the default, the electronic board is automatically set with its original features (all the programmed irrigation cycles and the set parameters will be lost, if not previously saved). The programmed irrigation cycles and set parameters can be saved and redo at any times.

xii. MENU → CYCLES PROGRAMMING → *WB SETTING*



▲ TO MOVE UPWARDS THE FLASHING CURSOR

▼ TO MOVE DOWNWARDS THE FLASHING CURSOR

+ ON INCREASE OF THE SELECTED WATER BUDGET

– OFF DECREASE OF THE SELECTED WATER BUDGET

OK EXIT / SAVE CHANGE

ESC EXIT – SAVE/DON'T SAVE CHANGE OPTION

In many cases, the length of the programmed irrigation cycles needs to be changed, without interfering with every single cycle. The function to obtain this option is the ***seasonal irrigation (Water Budget - WB)***.
The seasonal irrigation works on the irrigation cycle length (in minutes), defined during the programming, and thanks to the WB value (in %) it allows to obtain the ***real*** length of the irrigation cycle.

$$\text{irrigation cycle real length} = \frac{\text{length defined during the programming of the irrigation cycle} * \text{WB}}{100}$$

The WB value can vary by 1% till 200% with a 1% resolution, modifying the programmed irrigation cycles length, by the 1% (1/100 of the programmed length) till the 200% (double length of the programmed one).

Every single station is featured by its own WB, but it is possible to contemporarily modify all the stations thanks to the WB_{TOTAL} (all the stations).

> ⚠ ***If more than one cycle is active at the same time, but with different pressure values, the PWM steering pressure will be the highest value.***

The WB can be set from the page ***"SETTING WB"***. The options that can be chosen from this page depend on the current electronic board working mode:

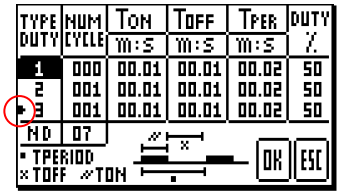
ELECTRONIC BOARD IN MODE RUN
Enter the WB setting page from the Menu.
Here, it is possible to change the WB of every single station, if the WB is the same in all the stations, the same figure appears in the field (*all the stations*), but if the WB is different three horizontal stripes will appear (---).
Modifying the WB value in the relevant field (*all the stations*) all the stations WBs will turn into the same WB value, if before it was different.

ELECTRONIC BOARD IN MODE BROWSE
Enter the WB setting page from the Menu.
Here, it is possible to change the WB of every single station, if the WB is the same in all the stations, the same figure appears in the field (*all the stations*), but if the WB is different three horizontal stripes will appear (---).

Modifying the WB value in the relevant field (*all the stations*) all the stations WBs will turn into the same WB value, if before it was different.
There is a small arrow (circled in red in the Picture) to highlight the selected station (in mode BROWSE, one station is surely selected).

ELECTRONIC BOARD IN MODE PROGRAM
Enter the WB setting page from the irrigation cycle properties, moving over the WB field and pressing key Menù.
Here, it is possible to change the WB of every single station, if the WB is the same in all the stations, the same figure appears in the field (*all the stations*), but if the WB is different three horizontal stripes will appear (---).
Modifying the WB value in the relevant field (*all the stations*) all the stations WBs will turn into the same WB value, if before it was different.
There is a small arrow (circled in red in the Picture) to highlight the selected station (in mode RUN, one station is surely selected).

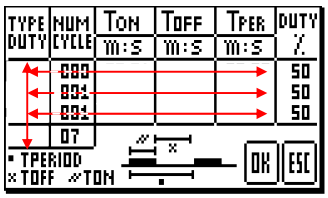
xiii. MENU → CYCLES PROGRAMMING → ***DUTY SETTING***



a)

- ▲ TO MOVE UPWARDS THE TYPE DUTY SELECTION (TYPE DUTY)
- ▼ TO MOVE DOWNWARDS THE TYPE DUTY SELECTION (TYPE DUTY)
- ▶ TO MOVE RIGHTWARDS THE FLASHING CURSOR
- ◀ TO MOVE LEFTWARDS THE FLASHING CURSOR
- + ON INCREASE OF THE SELECTED VALUE
- − OFF DECREASE OF THE SELECTED VALUE
- OK EXIT / SAVE CHANGE
- ESC EXIT – SAVE/DON'T SAVE CHANGE OPTION

MOVEMENTS



b)

DUTY is an irrigation cycle property represented by irrigation periods (T_{ON}) alternating to no-irrigation periods (T_{OFF}), lasting all the irrigation cycle. ($T_{PERIOD} = T_{ON} + T_{OFF}$)
In the schedule there are all the information regarding the duty/no duty.

TYPE DUTY

It represents the type of DUTY that can be selected:

DUTY 1	⇒	DUTY type 1
DUTY 2	⇒	DUTY type 2
DUTY 3	⇒	DUTY type 3
ND (No Duty)	⇒	no associated DUTY (continuous supply)

NUM CYCLE (no selection)

It represents the number of irrigation cycles of that special type: in the picture for example there are 7 cycles type NO DUTY, 1 cycle type DUTY 2 and 1 cycle type DUTY 3.

T_{ON}

It represents the irrigation period length, expressed in minutes and seconds; changing the T_{ON} automatically T_{PERIOD} changes, too, in order to respect the equation ($T_{PERIOD} = T_{ON} + T_{OFF}$). If changing T_{PERIOD} the equation cannot be respected, T_{OFF} changes, too.

T_{OFF}

It represents the no-irrigation period length, expressed in minutes and seconds; changing the T_{OFF} automatically T_{PERIOD} changes, too, in order to respect the equation ($T_{PERIOD} = T_{ON} + T_{OFF}$). If changing T_{PERIOD} the equation cannot be respected, T_{ON} changes, too.

T_{PERIOD}

It represents the T_{ON} and T_{OFF} periods length, expressed in minutes and seconds; changing the T_{PERIOD} automatically T_{OFF} changes, too, in order to respect the equation ($T_{PERIOD} = T_{ON} + T_{OFF}$). If changing T_{OFF} the equation cannot be respected, T_{ON} changes, too.

DUTY (no selection)

It represents the DUTY value, as heredown defined:

$$DUTY = \frac{T_{ON}}{T_{PERIOD}} \cdot 100$$

The duty setting page depends on the electronic board working mode.

ELECTRONIC BOARD IN MODE RUN

Enter the DUTY setting page from the Menu.

The possible movements over the setting page are represented by the arrows shown in Picture b (red coloured)

- to select the DUTY type or NO DUTY (ND) press keys ▼, ▲;
- to enter the DUTY relevant fields press key ▶ .

The DUTY parameters can be modified pressing + ON and − OFF.

ELECTRONIC BOARD IN MODE BROWSE

Enter the DUTY setting page from the Menu.

When selecting an irrigation cycle in mode BROWSE, the type of duty/no duty of this cycle is shown on the setting page of the duty, thanks to a small rightwards arrow (type 3 in the example - red circle)
The possible movements over the setting page are represented by the arrows shown in Picture b (red coloured):

- to select the DUTY type or NO DUTY (ND) press keys ▼, ▲;
- to enter the DUTY relevant fields press key ▶ .

The DUTY parameters can be modified pressing + ON and − OFF.

The change or the selection of a parameter relevant to a special type of duty, automatically matches the selected cycle to that special type of duty, highlighting it with a small rightwards arrow (red circle). This happens only if an irrigation cycle is previously selected, otherwise the changes only refers to the type of duty, without interfering with the type of duty associated with a special irrigation cycle.

ELECTRONIC BOARD IN MODE PROGRAM

To enter the duty setting page, the irrigation cycle properties must be displayed and the cursor must meet with the type of duty indication; from here, the type of duty can be modified pressing keys + ON and − OFF. To modify the duty properties enter the duty setting page pressing key Menu.

The type of duty/no duty of the irrigation cycle is highlighted on the duty setting page with a small rightwards arrows (type 3 in the example - red circle)

The possible movements over the setting page are represented by the arrows shown in Picture b (red coloured):

- to select the DUTY type or NO DUTY (ND) press keys ▼, ▲;
- to enter the DUTY relevant fields press key ▶ .

The DUTY parameters can be modified pressing + ON and − OFF.

The change or the selection of a parameter relevant to a special type of duty, automatically matches the selected cycle to that special type of duty, highlighting it with a small rightwards arrow (red circle).

For further details about the DUTY features see *par.6b page 39.*

xiv. MENU → CYCLES PROGRAMMING → *DUTY RECIPROCAL DISCONNECTING*

▲ TO MOVE UPWARDS, IN THE SELECTION

▼ TO MOVE DOWNWARDS, IN THE SELECTION

OK SELECTION CONFIRMATION

ESC CANCEL / BACK TO THE MAIN MENU

The duty reciprocal disconnection is a functions interfering only when two duty type irrigation cycles are working at the same time. In this case, the water supplying and suspension periods (*for further details about the DUTY features see par.6b page 39*) of the two irrigation cycles are completely independent, if this function is NOT active, it may happen, therefore, that the water supply is contemporary asked by the two irrigation cycles.
The duty reciprocal disconnection allows activating the stations in a sequential way, respecting the water supplying and suspension periods, but activating only one station at the time (*for further details about the DUTY RECIPROCAL DISCONNECTION see par. 6c page 41).*

xv. MENU → I/O SETTING → *PUMP SETTING*

▲ TO MOVE UPWARDS, IN THE SELECTION

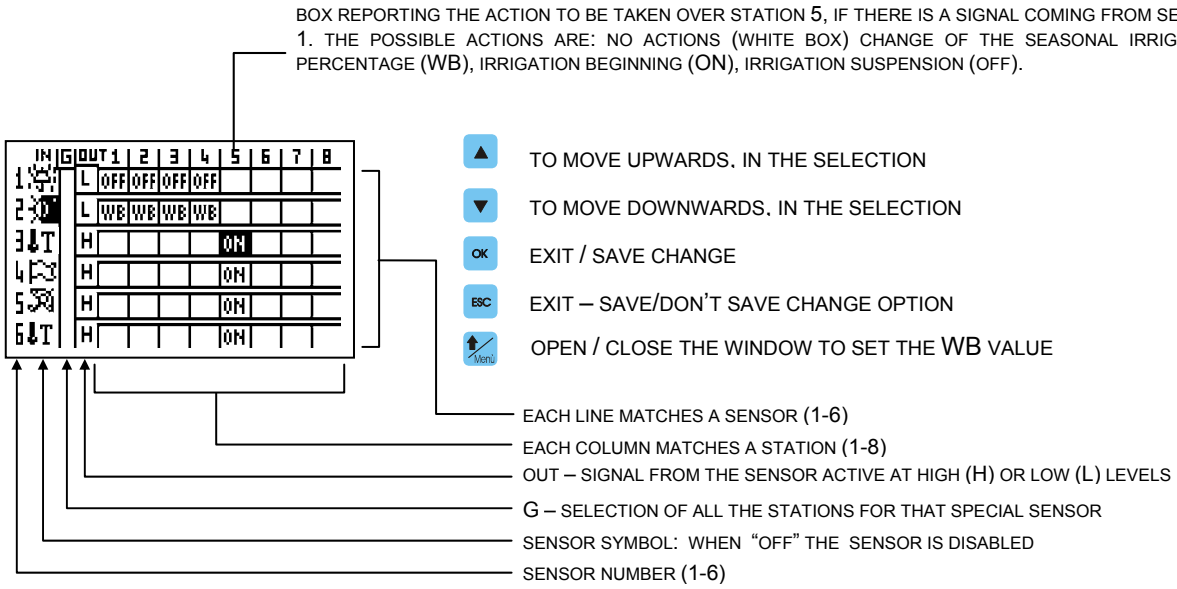
▼ TO MOVE DOWNWARDS, IN THE SELECTION

OK EXIT / SAVE CHANGE

ESC EXIT – SAVE/DON'T SAVE CHANGE OPTION

The electronic board can steer a pump/master valve (for instance thanks to a contactor linked to digital output 8). The pump will be activated only in case of active irrigation cycles. To set this function at station 8 "*ENABLE PUMP"* must be selected in the pump setting page. In this way, station 8 cannot be selected and the PWM relevant graph will automatically issue the pump relevant information (possible states: ON – OFF). For further details about the pump/master valve see *chap.10 page 63.*

xvi. MENU → I/O SETTING→ ***INPUTS SETTING***



In the inputs setting page, each line matches with a sensor (max. 6 sensors), while each column matches with a station (8 stations).
Vertical movements are possible only along column "***IN"***, while horizontal movements are always allowed. Along column ***IN*** the symbol to associate with the signal coming from the relevant sensor can be chosen pressing keys + ON − OFF :

- symbol ***OFF*** means that the sensor is disabled, even if there are some set actions (writing: ON – OFF-WB) in the boxes matching the stations to that special line;
- all the other symbols have no peculiar functions, but they are only reminders to know which of the sensor is responsible for that special signal.

The symbol is displayed in mode ***RUN and BROWSE according to the modes explained in chap.8 page*** 44.

Along column ***OUT*** select H or L, pressing keys + ON − OFF, to choose to receive the signal at the opening or closing of the contact, in order to have the maximum compatibility with the sensors on the market.
The action to be associated with the station, according to the signals coming from its special sensor, can be selected into the different column, numbered from 1 to 8. The possible actions in priority order (OFF highest priority)

OFF : irrigation suspension;
ON : irrigation beginning (fixed irrigation, no duty);
WB : set WB application;
___: respect of the irrigation periods set in memory;

selecting ON, when the electronic board is set to work with PWM devices *(see chap.9 page 54)*, the user can decide the associated pressure value pressing key Menù: in the opening window the default pressure value can be modified pressing keys + ON and − OFF.

Selecting Wb, it is possible to modify its value pressing key Menù: in the opening window the current WB value can be modified pressing keys + ON and − OFF.
When more than one signal, coming from the sensors at the same time, set a WB over a special station, ***the currently programmed WB is not considered anymore,*** but this value will be the result of the other WBs combination, in relationship to the sensors interfering with that special station.

For instance, let's examine station n.5 which is associated with WB_{PROG} = 120%, set when programming, that station.
Let's pretend that now that sensors 1,2,3,6 are sending signals type WB, interfering with station n.5 with the following values: WB_1=110%; WB_2=10%; WB_3=60%; WB_6=80%.

the final result will be:

- WB_{PROG} is not considered in the real WB of the station
  the real WB is determined by the product of the WBs in relationship with the sensors, currently sending signals:
- $WB_{REAL} = \left(\frac{WB_1}{100}\right)\cdot\left(\frac{WB_2}{100}\right)\cdot\left(\frac{WB_3}{100}\right)\cdot\left(\frac{WB_4}{100}\right)\cdot 100 \cong 5\%$

The real actions, currently happening over the relevant stations, are highlighted (light writing, black box) on the input setting page (key OK in modes RUN and BROWSE). In the picture, action ON is currently active due to a signal coming from sensor 3.
Column ***G*** (Global) allows the same sensor to be contemporarily active over all the stations without selecting them one by one (press keys + ON − OFF to select/cancel Global), afterwards move the cursor in one of the stations (obviously same line) and change the action as previously explained; all the actions in that line, will automatically change, too.

xvii. MENU → PWM MANAGEMENT → *PWM SETTING*

P:5.0	RD	OFF	OFF	OFF
FREQ	50			
IEFF	23			
FL.	30			
ST.	GO			

- ▶ TO MOVE THE CURSOR RIGHTWARDS
- ◀ TO MOVE THE CURSOR LEFTWARDS
- + ON INCREASE OF THE SELECTED VALUE
- − OFF DECREASE OF THE SELECTED VALUE
- OK EXIT / SAVE CHANGE
- ESC EXIT / DON'T SAVE CHANGE

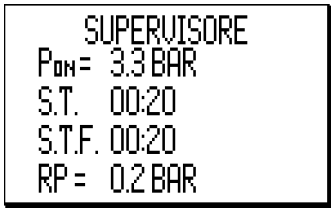
The pressure value is displayed up on the left.
Each column shows the real-time updated information coming from the 4 PWMs that can be set: frequency, IEFF, flow, state.

The 4 PWM devices can be selected and set pressing the arrow keys and keys + ON and − OFF, as follows:

OFF the device is NOT steered by the electronic board: there is no communication between the PWM and the Da Vinci Electronic board.
RS the PWM device is set as ***RESERVE***: it will be activated only when another PWM is in security or loses the communication.
RD the PWM device is set as ***READY***: it is part of the regulation group (for further details *par.9c page 55*)
DS the PWM device is set as ***DISABLE***: it will never take part of the management (this mode is necessary when the pump needs to be in halt state, but supplied with power.

The loss of communication with a PWM device is alerted with the "***?***" symbol (question mark).
When the communication works again, all the displayed values are automatically adjusted with the PWM ones and symbol "?" disappears.
From this setting page it is possible to try to reset eventual PWM devices in security (*see par9.c.iii - page 57*). When almost one of the PWM devices is in security and the user enters this page, or to device gets in security while already in this page, the display will show the request to reset the PWM or the ignore the protection signal. If ignored, to try to reset the device first exit and then enter the page again: the reset request will be displayed again. (for further details about the PWM protection, see the device user's handbook)

xviii. MENU → PWM MANAGEMENT → ***SUPERVISOR PARAMETERS***

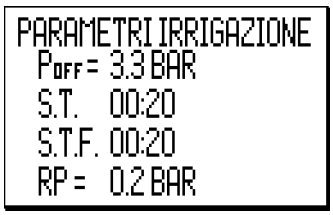


▶ TO MOVE THE CURSOR RIGHTWARDS
◀ TO MOVE THE CURSOR LEFTWARDS
+ ON INCREASE OF THE SELECTED VALUE
− OFF DECREASE OF THE SELECTED VALUE
OK EXIT / SAVE CHANGE
ESC EXIT / DON'T SAVE CHANGE

These parameters will be used by the electronic board in mode *supervisor of PWM devices* (*see par. 9d page 62*):

P_{ON} the pressure maintained in the water system
STA Period referring to the *Absolute Time* exchange: it is expressed in hours and minutes and it represents the period of time at the end of which the priority among the PWM devices, set as RD, is changed (for further details see *par.9.c.vi - page 60*).
STF Period referring to the *Working Time* exchange: it is expressed in hours and minutes and it represents the PWM working period (the time in which the devices are in state "Go") at the end of which the priority among the PWM devices, set as RD, is changed (for further details see par.9.c.vi - page 60).
rP Drop in pressure for restart: used for the PWM devices management politics.

xix. MENU → PWM MANAGEMENT→ ***IRRIGATION PARAMETERS***



▶ TO MOVE THE CURSOR RIGHTWARDS
◀ TO MOVE THE CURSOR LEFTWARDS
+ ON INCREASE OF THE SELECTED VALUE
− OFF DECREASE OF THE SELECTED VALUE
OK EXIT / SAVE CHANGE
ESC EXIT / DON'T SAVE CHANGE

These parameters will be used by the electronic board in mode *supervisor of PWM devices* (*see par. 9d page 62*):

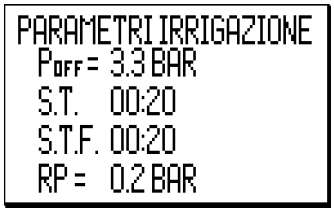
P_{OFF} Pressure of the water system when none of the cycles are active.

STA Period referring to the *Absolute Time* exchange: it is expressed in hours and minutes and it represents the period of time at the end of which the priority among the PWM devices, set as RD, is changed (for further details see *par.9.c.vi - page 60*).

STF Period referring to the *Working Time* exchange: it is expressed in hours and minutes and it represents the PWM working period (the time in which the devices are in state "Go") at the end of which the priority among the PWM devices, set as RD, is changed (for further details see par.9.c.vi page 60).

rP Drop in pressure for restart: used for the PWM devices management politics.

xx. MENÙ → PWM MANAGEMENT → ***ADVANCED SETTING***



▲ TO MOVE UPWARDS, IN THE SELECTION

▼ TO MOVEDOWNWARDS, IN THE SELECTION

OK EXIT / SAVE CHANGE

ESC EXIT – SAVE/DON'T SAVE CHANGE OPTION

Selecting the boxes on the right, the user can personally manage the PWM devices, belonging to the PWM regulating group, linked to the Da Vinci electronic board:

T.A. EXCHANGE: if selected, the priority change, among the PWM devices, will happen at the end of a determined period, expressed in hours and minutes, by STA

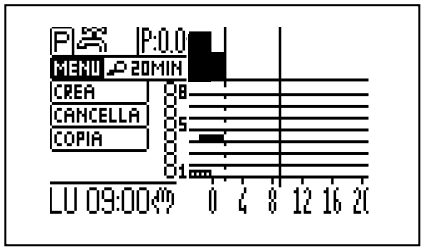
T.F. EXCHANGE: if selected, the priority of the PWM device that was in state "Go" for a period "STF" (expressed in hours and minutes) is taken to a minimum value (see *par.9c.vi.2 page 61* for further details)

EXCHANGE AT STANDBY: if selected, the change of priority happens when the PWMs are in standby

ECONOMY/ FAST: if selected the management of the regulating group will prefer the quickness of intervention of the same regulating group, but if NOT selected the energy conservation will be preferred.

B. Menu in mode PROGRAM

This menu is automatically displayed when the mode PROGRAM is selected:



Picture 5 *Display in mode PROGRAM*

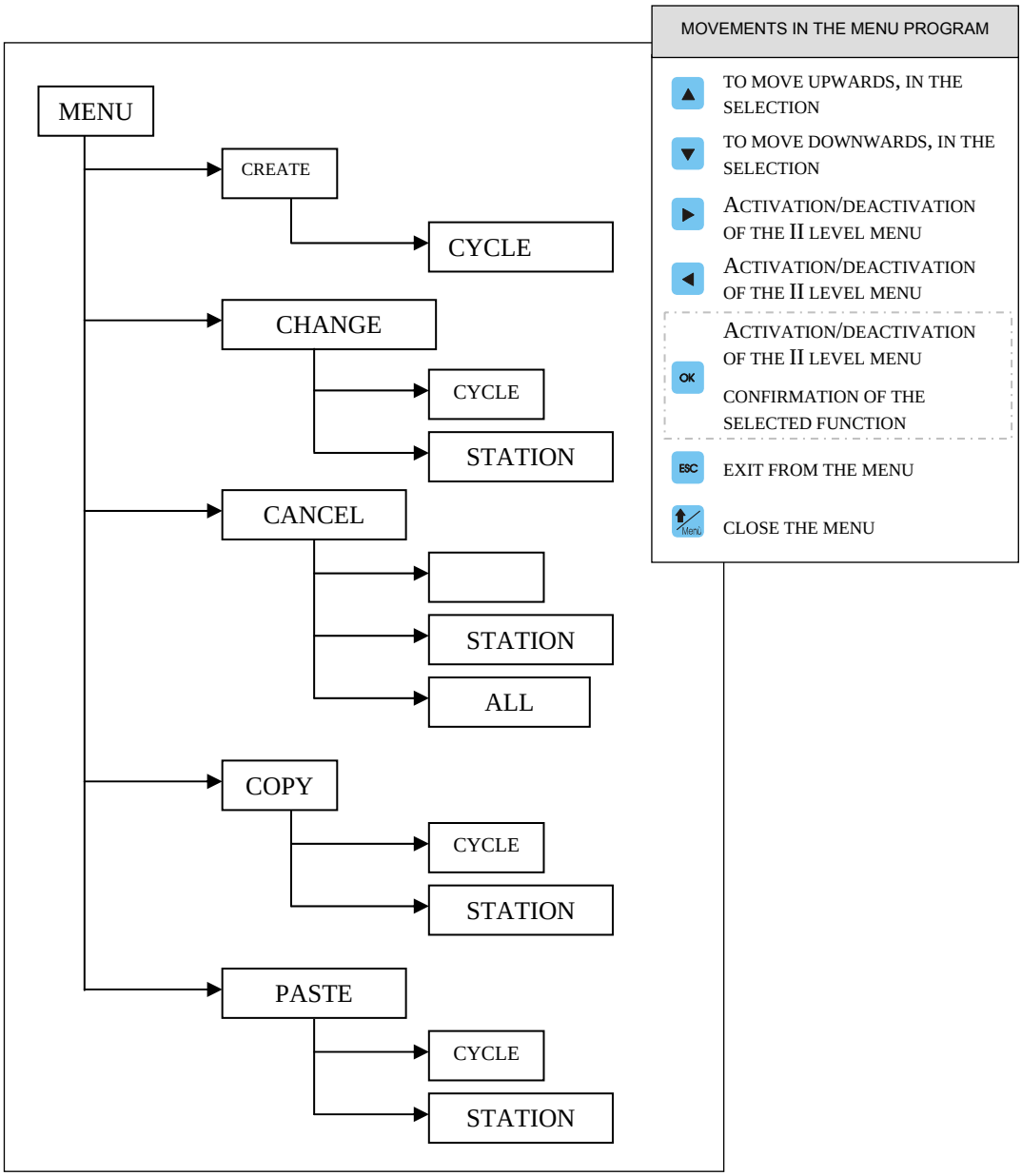
The menu entries belong to two levels:

- the first level (see entries in *Picture 6*) represents the *ACTION* that can be ordered: create – cancel – copy….
- the second level represents the *OBJECT* which the first level action is directed to, the following actions will be therefore possible:

-

FIRST LEVEL	SECOND LEVEL
CREATE	CYCLE
CANCEL	CYCLE
CANCEL	STATION
CANCEL	ALL
COPY	CYCLE
COPY	STATION

In order to make the menu more user friendly, ***the menu entries change according to the state the user is currently using, displaying all the possible actions that can be taken from that particular state***; for instance: the writing "cancel cycle" will only appear if a cycle is selected; this type of menu is a good help to guide the user, time by time, choosing among the actions that can currently be taken.
Therefore the complete menu structure, *Picture 6,* will be never completely displayed, thus the possible actions depend on the state of the electronic board at that special time.



Picture 6 *Structure of the menu in mode PROGRAM*

6 Irrigation cycles properties

BRIEFLY… Irrigation cycles properties

ONCE THE IRRIGATION CYCLE IS PROGRAMMED, IT CAN BE MODIFIED THANKS TO THE WB (SEASONAL IRRIGATION PARAMETER) OR THANKS TO THE SENSORS INTERFERENCE. THE DUTY IRRIGATION (REGULAR WATER SUPPLIES ALTERNATE TO WATER SUSPENTION PERIODS) IS ALSO POSSIBLE, WHEN THERE IS MORE THAN ONE CYCLE IN MODE DUTY. THESE ONES WILL BE MANAGED IN SUCCESSION, IN ORDER TO HAVE ONLY ONE WATER SUPPLY AT THE TIME.

The Da Vinci irrigation electronic board can program the irrigation cycles with 1 minute resolution; minimum length 2 minutes and maximum length corresponding to the programming period (see par a page 9). 36 cycles can be programmed for each station; every irrigation cycle is featured by:

1. *REAL IRRIGATION PERIOD*;
2. *DUTY TYPE (DUTI1-DUTY2-DUTY3-NO DUTY);*
3. *WATER BUDGET VALUE (WB - SEASONAL IRRIGATION).*

a. REAL IRRIGATION PERIOD

The real irrigation period of a cycle, is determined by the length of the irrigation period, set when programming, applied to the relevant WB (if WB = 100% the length of the real irrigation period and the one set when programming is exactly the same). For instance: one cycle lasts 1h according to the programming (60 minutes), with a 110% WB the real irrigation period will correspond to:

$$real\_length = \frac{60 \cdot 110}{100} = 66\,\text{min}$$

i. IRRIGATION PERIOD SET WHEN PROGRAMMING

THE IRRIGATION PERIOD OF A CYCLE, SET WHEN PROGRAMMING, IS DETERMINED BY:

- Day (programming period different from the daily one) and beginning hour (nominal value);
- Day (programming period different from the daily one) and ending hour (nominal value);

IMPORTANT: the beginning minute always belongs to the irrigation period, while the ending minute does NOT belong to the irrigation period, therefore it is possible that a cycle (cycle 1) ends on Sunday at 13:56 and over the same station another cycle (cycle 2) begins at 13:56. Therefore, cycle 1 will last till 13:55 and 59 seconds and cycle 2 will exactly begin at 13:56.

In some situations the real length of the irrigation cycle is different from the previously calculated one and in particular it could be shorter than the forecasted one:

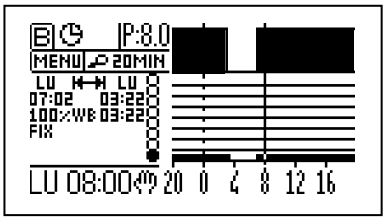
ii. ADVANCED HALT OF THE IRRIGATION CYCLE (WITH WB>100%)

The real irrigation period surely begins with the set beginning day and hour, but it may NOT end at the set ending day and hour (nominal value):

- A WB ≠ 100% defines an irrigation cycle end different from the one set when programming
- A WB > 100% may define an overlapping of cycle 1 on the previously set cycle 2: in this case cycle one will exactly end at the very beginning of cycle 2, which remains unchanged;

iii. IRRIGATION CYCLES WITH ENDING DAY AND/OR HOUR PRECEEDING THE BEGINNING DAY AND/OR HOUR

An irrigation cycle with ending day and/or hour preceding the beginning day and/or hour will correctly begin and end at the set day and/or hour. In the picture the example of a cycle beginning on Monday at 7:02 and cycle end on Monday at 03:22



Picture 7 *Display in mode BROWSE*

b. DUTY

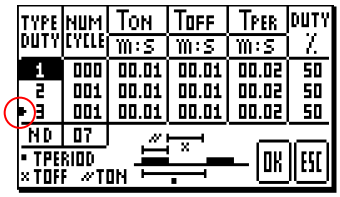
DUTY is one of the properties of an irrigation cycle, represented by water supply periods (T_{ON}) alternating to water suspension periods (T_{OFF}) for all the irrigation cycle ($T_{PERIOD} = T_{ON} + T_{OFF}$).
There can be irrigation cycles steered by solenoid valves, linked to the electronic board, opening and closing at regular times, with 1 second resolution, respecting the below specifics:

	Min	Max
period (T_{PERIOD})	2 secs	99min 60 secs
Opening Time (T_{ON})	1 sec	99min 59 secs
Closing Time (T_{OFF})	1 sec	99min 59 secs
duty (%)	1 %	99%
$T_{PERIOD} = T_{ON} + T_{OFF}$		
$duty(\%) = \frac{T_{ON}}{T_{PERIOD}} \cdot 100$		

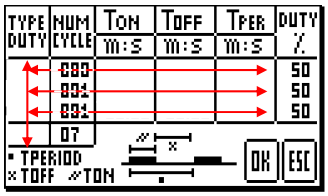
The duty can be programmed setting two of the following parameters:

T_{PERIOD}, T_{ON},T_{OFF}

in the DUTY setting page.



SPOSTAMENTI



Picture 9 *DUTY setting page and possible movements in this page (for further details see chap.5 page 25)*

In the schedule setting of the page there is all the information in relationship with the chosen type of duty (obviously there is the possibility of no duty: NO DUTY).

TYPE DUTY

It represents the type of DUTY that can be selected:

DUTY 1	⇒	DUTY type 1
DUTY 2	⇒	DUTY type 2
DUTY 3	⇒	DUTY type 3
ND (No Duty)	⇒	no associated DUTY (continuous supply)

NUM CYCLE (no selections)

It represents the number of irrigation cycles of that special type: in the picture for example there are 7 cycles type NO DUTY, 1 cycle type DUTY 2 and 1 cycle type DUTY 3.

T_{ON}

It represents the irrigation period length, expressed in minutes and seconds; changing the T_{ON} automatically T_{PERIOD} changes, too, in order to respect the equation ($T_{PERIOD} = T_{ON} + T_{OFF}$). If changing T_{PERIOD} the equation cannot be respected, T_{OFF} changes, too.

T_{OFF}

It represents the no-irrigation period length, expressed in minutes and seconds; changing the T_{OFF} automatically T_{PERIOD} changes, too, in order to respect the equation ($T_{PERIOD} = T_{ON} + T_{OFF}$). If changing T_{PERIOD} the equation cannot be respected, T_{ON} changes, too.

T_{PERIOD}

It represents the T_{ON} and T_{OFF} periods length, expressed in minutes and seconds; changing the T_{PERIOD} automatically T_{OFF} changes, too, in order to respect the equation ($T_{PERIOD} = T_{ON} + T_{OFF}$). If changing T_{OFF} the equation cannot be respected, T_{ON} changes, too.

DUTY (no selection)

It represents the DUTY value, as heredown defined:

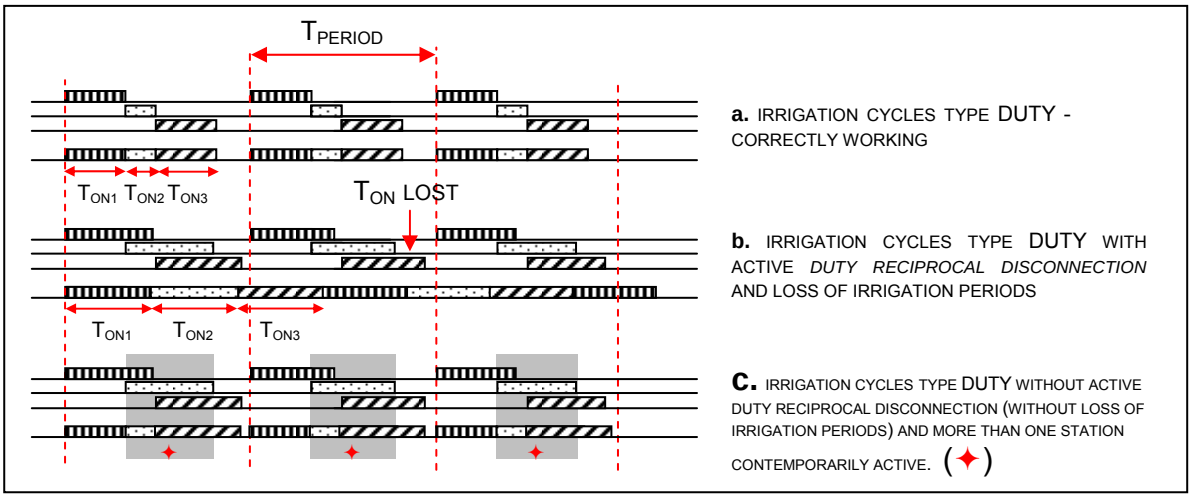
$$DUTY = \frac{T_{ON}}{T_{PERIOD}} \cdot 100$$

Setting two of the parameters among Tperiod, Ton, Toff, the third one is automatically updated at the correct value, as for DUTY. For instance: Tperiod = 60 secs and Ton = 20 secs, there will be a water supply for 20 seconds and a water suspension for 40 seconds, in a repetitive way for all the irrigation cycle length, set to obtain in this way a 33% DUTY. For each irrigation cycle it is possible to select one of the three available DUTY types.

To set DUTY see *chap.5 page 25.*

c. DUTY RECIPROCAL DISCONNECTION

The DUTY reciprocal disconnection allows the optimization of the water supply when there is more than one irrigation cycle, type DUTY, contemporarily ON, activating for the determined period one station at the time, in sequence. This is obviously possible when the sum of the entire T_{ON}, in relationship with the active cycles, is minor then the minimum T_{PERIOD}. (Picture 10-a); if this possibility does not occur (Picture 10-b) the activation of this function could take to a loss of some irrigation periods (T_{ON}) - see in the picture how in the time period covering the two periods, only the third one ($T_{ON}3$) is working. This situation is communicated with the writing "DUTY ERROR (in modes RUN and BROWSE- *see 4b.ii and 4b.iii pages 17-20*).



Picture 10 *Irrigation cycles type DUTY with and without reciprocal disconnection*

In order not to lose any irrigation period, the duty reciprocal disconnection must NOT be active (Picture 10-c). In this way the various TON are all working for every T_{PERIOD}: the disadvantage is that for a certain period more than one station will be active at the same time (grey highlighted, with symbol ✦).
When the *DUTY RECIPROCAL DISCONNECTION* is NOT active, the the entire T_{ON} and the T_{PERIOD} will be fully respected. On the other hand there could be a lack of sync (sequentiality and/or synchronicity) among the irrigation cycles belonging to different stations.

d. WATER BUDGET (seasonal irrigation WB)

In many cases it is necessary to change the previously set irrigation cycles periods, without necessarily interfering with each single cycle. The option to obtain this function is the ***seasonal irrigation (Water Budget - WB).***

The seasonal irrigation interferes on the irrigation cycle time length, expressed in minutes, set when programming, and thanks to the WB (expressed in %) it allows to obtain the ***effective length*** of the irrigation

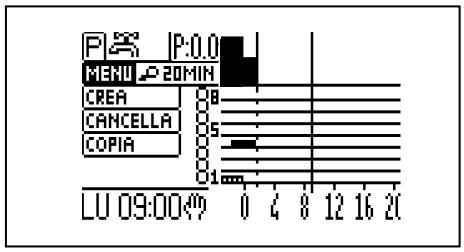
cycle

irrigation cycle effective time length = time length set when programming the irrigation cycle * WB / 100

The WB value can vary by 1% till the 200% with a 1% resolution, modifying the programmed irrigation cycles length, by the 1% (1/100 of the programmed length) till the 200% (double length of the programmed one).
Every single station is featured by its own WB, but it is possible to contemporarily modify all the stations thanks to the WB_{TOTAL} (all the stations). *(For further details see chap.5 page 25)*

7 Programming

In order to program the Da Vinci electronic board it is necessary to enter the mode *PROGRAM* pressing key (for further details about how to enter mode *PROGRAM see par.3b page 9*).
In mode *PROGRAM* the user can move all over the graph, selecting the various stations, and during all the week long, using the different zoom levels. In this mode it is not possible to see the selected cycle properties but in the pull down menu, there are all the entries of the actions that can be taken.



Picture 11 *Display in mode PROGRAM*

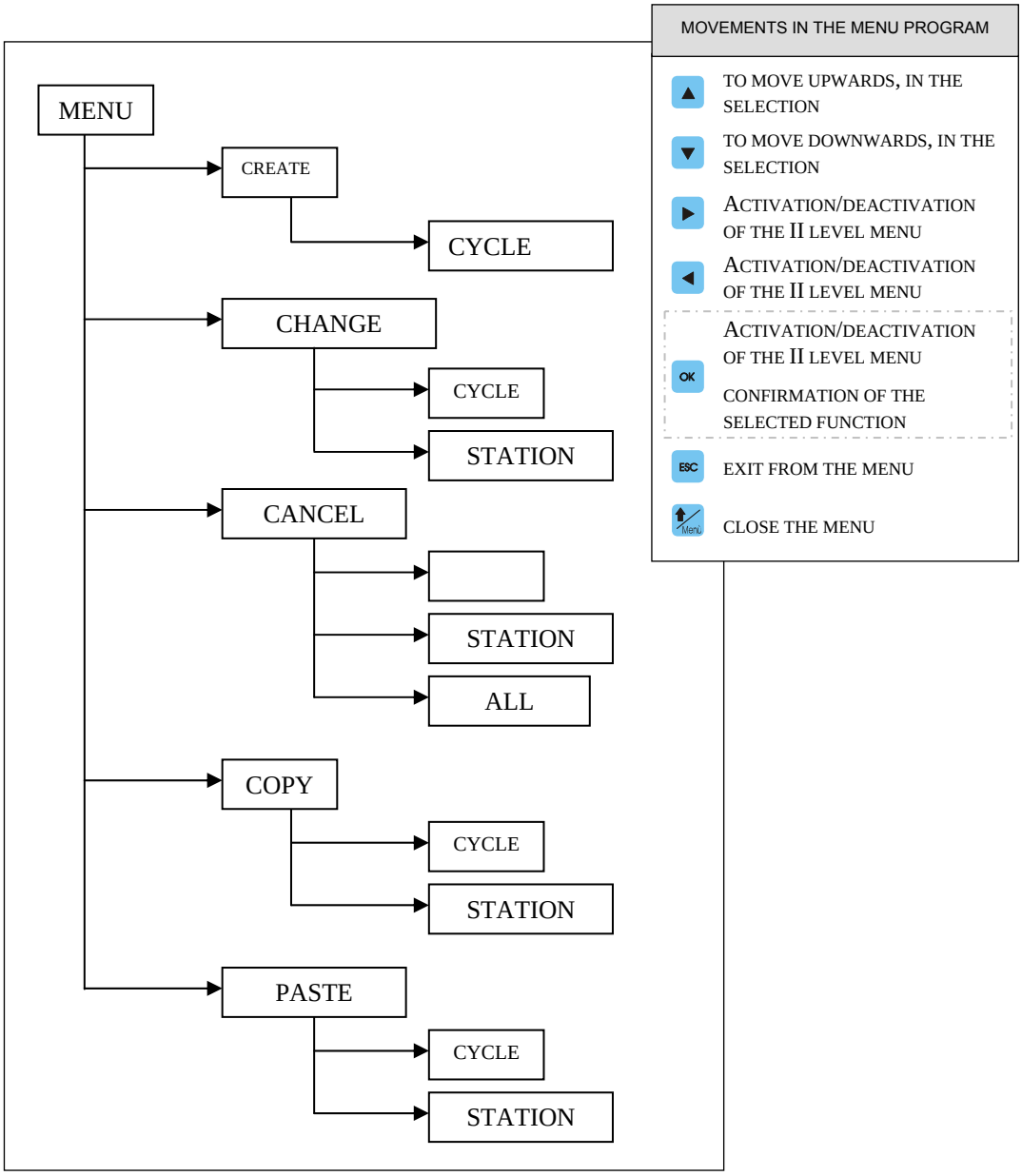
The menu entries belong to two levels:

- the first level (the menu entries "**Error. The reference origin is not found**" belongs to this level) represents the *ACTION* that can be ordered: create – cancel – copy….
- the second level represents the *OBJECT* which the first level action is directed to, the following actions will be therefore possible:

FIRST LEVEL	SECOND LEVEL	ACTION
CREATE	CYCLE	CREATION OF AN IRRIGATION CYCLE; THE DEFAULT CREATES A CYCLE BEGINNING WHERE THE CURSOR IS POSITIONED, WITH A 10 PIXEL LENGTH, CORRESPONDING TO *2hours and 20minutes, 50 minutes or 10 minutes* ACCORDING TO THE ZOOM LEVEL. IT IS POSSIBLE TO SELECT THE PROPERTIES OF THE CYCLE USING THE ARROW KEYS AND TO CHANGE THEIR VALUE PRESSING KEYS + ON AND − OFF, THANKS TO THE FLASHING CURSOR ON THE DISPLAY LEFT, AT THE DEFAULT CYCLE PROPERTIES LEVEL. IF A DUTY IS SELECTED, IT IS POSSIBLE TO CHANGE ITS TYPE PRESSING KEYS + ON AND − OFF OR IT IS POSSIBLE TO ENTER THE DUTY SETTING PAGE PRESSING KEY Menù (WHEN THE FIELD IS SELECTED) PRESSING KEY OK IT IS POSSIBLE TO SAVE THE CHANGES, WHILE PRESSING KEY ESC IT IS POSSIBLE TO GO BACK TO THE MENU, WITHOUT SAVING THE CHANGES. FOR FURTHER DETAILS ABOUT THE IRRIGATION CYCLE DISPLAYED INFORMATION SEE *PAR. 4B.III PAGE 20 AND PAR.4B.IV PAGE 24* – FOR AN EXAMPLE OF AN IRRIGATION CYCLE CREATION *SEE PAR. 12B PAGE 67.*
CHANGE	CYCLE	CHANGE THE SELECTED CYCLE; ACT LIKE IN "CREATE CYCLE". FOR AN EXAMPLE OF IRRIGATION CYCLE CHANGE SEE *PAR.12C PAGE 69.*
CANCEL	CYCLE	CANCEL THE SELECTED CYCLE
CANCEL	STATION	CANCEL THE SELECTED STATION

CANCEL	ALL	CANCEL ALL THE SAVED CYCLES
COPY	CYCLE	COPY OF A CYCLE FOR THE FURTHER PASTE FUNCTION. PER UN ESEMPIO FOR AN EXAMPLE OF IRRIGATION CYCLE COPY SEE *PAR.11D PAGE 71.*
COPY	STATION	COPY OF A STATION FOR THE FURTHER PASTE FUNCTION.
PASTE	CYCLE	PASTE A PREVIOUSLY COPIED CYCLE, IN ANY POSITION.
PASTE	STATION	PASTE A PREVIOUSLY COPIED STATION, ON ANY STATION.

In order to make the menu more user friendly, ***the menu entries change according to the state the user is currently using, displaying all the possible actions that can be taken from that particular state***; for instance: the writing "cancel cycle" will only appear if a cycle is selected; this type of menu is a good help to guide the user, time by time, choosing among the actions that can currently be taken.
Therefore the complete menu structure, *Picture 12,* will be never completely displayed, thus the possible actions depend on the state of the electronic board at that special time.



Picture 82 *Structure of the menu in mode PROGRAM*

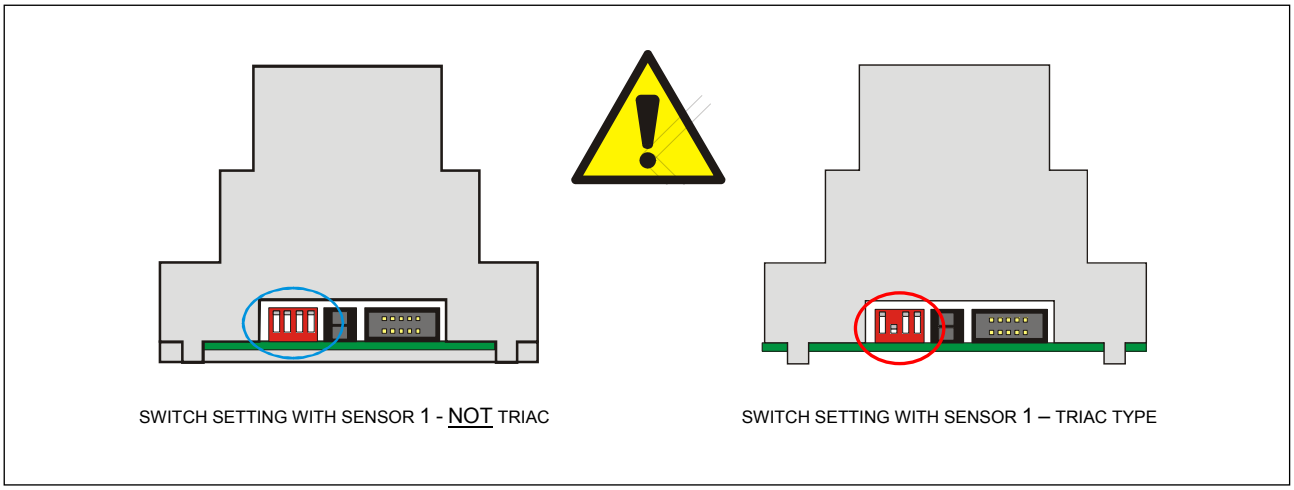
8 Sensors

BRIEFLY…Sensors

THERE ARE 6 OPTO-ISOLATED INPUTS THAT CAN BE LINKED TO 6 SENSORS (OF VARIED TYPES – ONE CAN BE TRIAC TYPE, TOO) AND ACCORDING TO THE SIGNALS COMING FROM THESE SENSORS SOME STATIONS CAN BE ACTIVATED OR DEACTIVATED, WITH THE POSSIBILITY OF SETTING DIFFERENT PRESSURE VALUES ON THE PWM DEVICES, IF CONNECTED, OR CHANGING THE IRRIGATION CYCLES WB.

All the 6 digital inputs (DI 1,2,3,4,5,6) are galvanically opto-isolated and independent by tows; in this way the electronic board can be linked to clean contacts, NPN and PNP outputs, that can work both in AC and in DC (whichever polarity) sending signals both at the contact closing or opening. This offers the maximum flexibility and compatibility with the sensors on the market
The D1 input can also be set to be connected to a triac sensor (some rain sensors have a triac output, as for instance, the rain sensor RAIN CHECK, produced by RAIN BIRD).

To set the triac output sensor, the user needs to set the red coloured switch, on the left side of the electronic board as shown on *Picture 13*:



Picture 93 *left side of the electronic board (switch setting).*

Each electronic board input couple (to be connected to the sensors) has a common terminal:

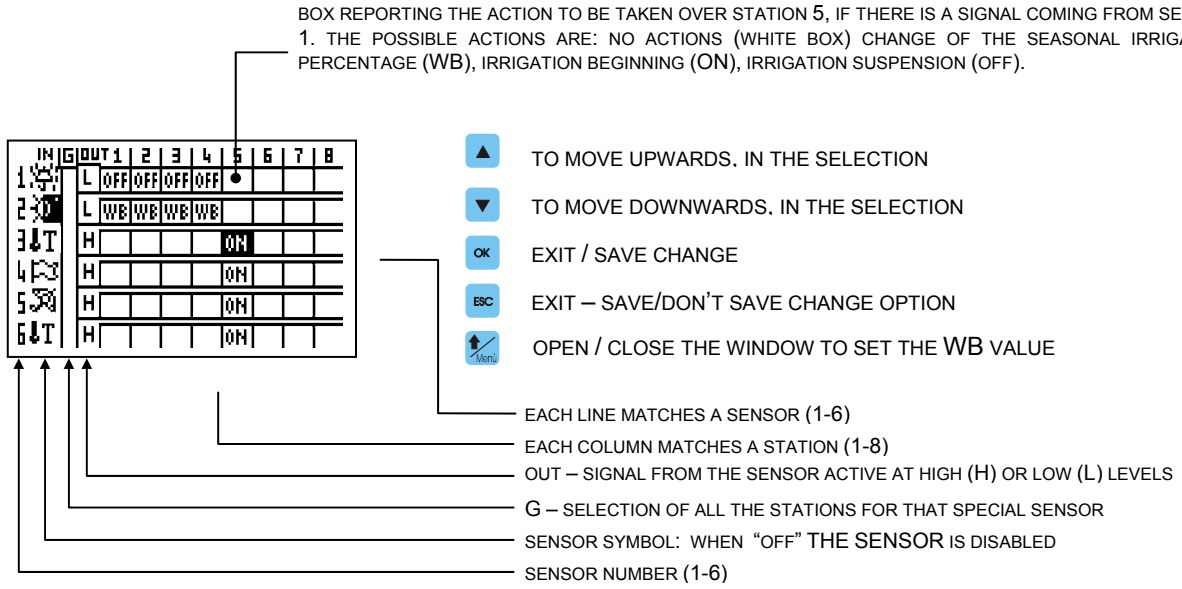
DI1 and DI2 have the common terminal C12;

DI3 and DI4 have the common terminal C34;

DI5 and DI6 have the common terminal C56.

All the properties that can be associated with a sensor can be found in the input setting page (*Picture* 14). Vertical movements are possible only along column "***IN"***, while horizontal movements are always allowed. In modes RUN and BROWSE this page can be entered in two different ways:

- To simply display the setting and the signals state press key OK;
- To display and modify the sensors settings enter through the menu entries.



Picture 14 *Sensors setting page*

Along column ***IN*** the symbol to associate with the signal coming from the relevant sensor can be chosen pressing keys + ON − OFF :

- symbol ***OFF*** means that the sensor is disabled, even if there are some set actions (writing: ON – OFF-WB) in the boxes matching the stations to that special line;
- all the other symbols have no peculiar functions, but they are only reminders to know which of the sensors is responsible for that special signal.

The symbol is displayed in mode ***RUN and BROWSE according to the modes explained in chap.8 page*** 44.

Along column ***OUT*** select H or L, pressing keys + ON − OFF, to choose to receive the signal at the opening or closing of the contact, in order to have the maximum compatibility with the sensors on the market.
The action to be associated with the station, according to the signals coming from its special sensor, can be selected into the different columns, numbered from 1 to 8. The possible actions in priority order (OFF highest priority)

OFF : irrigation suspension;
ON : irrigation beginning (fixed irrigation, no duty);
WB: set WB application;
___: respect of the irrigation periods set in memory;

Selecting Wb, it is possible to modify its value pressing key Menù: in the opening window the current WB value can be modified pressing keys + ON and − OFF.

When more than one signal, coming from the sensors at the same time, set a WB over a special station***, the currently programmed WB is not considered anymore,*** but this value will be the result of the other WBs combination, in relationship to the sensors interfering with that special station.

For instance, let's examine station n.5 which is associated with WB_{PROG} = 120%, set when programming, that station.
Let's pretend that now that sensors 1,2,3,6 are sending signals type WB, interfering with station n.5 with the following values: WB_1=110%; WB_2=10%; WB_3=60%; WB_6=80%.

the final result will be:

- WB_{PROG} is not considered in the real WB of the station
  the real WB is determined by the product of the WBs in relationship with the sensors, currently sending signals:
- $$WB_{REAL} = \left(\frac{WB_1}{100}\right)\cdot\left(\frac{WB_2}{100}\right)\cdot\left(\frac{WB_3}{100}\right)\cdot\left(\frac{WB_4}{100}\right)\cdot 100 \cong 5\%$$

The real actions, currently happening over the relevant stations, are highlighted (light writing, black box) on the input setting page (key OK in modes RUN and BROWSE). In the picture, action ON is currently active due to a signal coming from sensor 3.
Column ***G*** (Global) allows the same sensor to be contemporarily active over all the stations without selecting them one by one (press keys + ON − OFF to select/cancel Global), afterwards move the cursor in one of the stations (obviously same line) and change the action as previously explained; all the actions in that line, will automatically change, too.

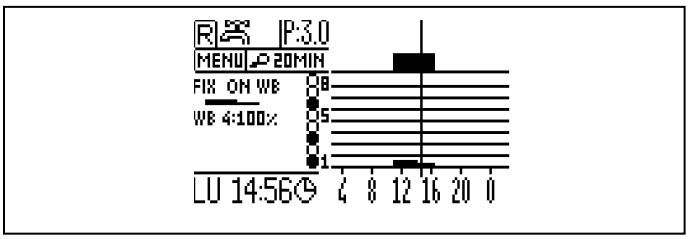
i. Signals coming from the sensors

Signals coming from the sensors are differently managed according to the set mode: RUN, BROWSE or PROGRAM.

The frontal panel leds, with reference to the signals coming from the sensors (indicated by letter "I") ***always*** shows the input state.

In modes RUN and BROWSE the signals coming from the sensors DO steer the stations, in this way the symbols indicating the irrigation cycles and their state are automatically updated.

Picture 14 shows the automatic activation of stations 3 and 6, otherwise not working, thanks to a signal coming from a sensor (for further details see par.ii page 47 and par.iii page 50). See the station state indicators (black spots at stations n.3 and n.6).



Picture 15 *Signals coming from the sensors (mode RUN)*

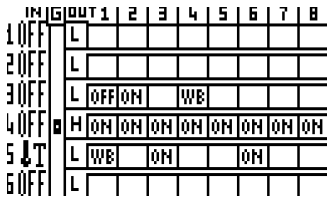
In mode PROGRAM the signals coming from the sensors are differently managed according to the electronic board is:

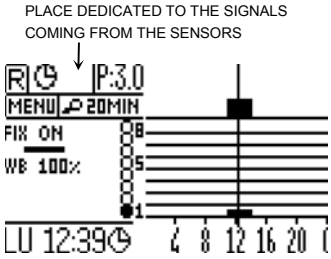
- IRRIGATION SUSPENSION;
- IRRIGATION MAINTENANCE;
- IRRIGATION TEST.

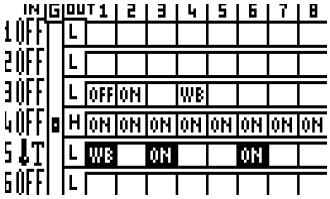
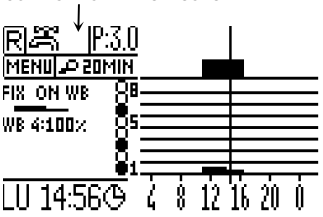
In mode PROGRAM, in the ***IRRIGATION SUSPENSION*** state, no information about the sensors is displayed (is some of the sensors steer on the WB of a special station, the displayed cycles show the WB set when programming and not the one set by the sensors).
In mode PROGRAM, in the ***IRRIGATION MAINTENANCE*** state, the display is the same of the suspension, but the currently working irrigations are maintained, considering the sensors effects, too. It may happen then, that for a signal activating a station, the same station is already active, even if not displayed in this state, because there are no irrigation cycles and the station state indicators don't signal any active station.
In this case the frontal panel leds are really useful, both at the digital inputs (DI – sensors) and at the digital outputs (DO – stations); in this situation the input led, sending signals, is active, as well as the station led, currently supplying water thanks to the sensors signals.
In mode PROGRAM, in the ***IRRIGATION TEST*** state, signals coming from the sensors are completely ignored (the input leds are anyway sending signals) and there are no displayed signals in relationship with an eventual sensors action over the irrigation cycles.
Cycles with a WB steered by eventual signals coming from the sensors are not displayed nor the WB set when programming is took into account.

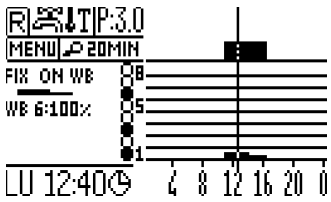
ii. Signals coming from sensors in mode RUN

Heredown a possible setting of the inputs and the information displayed in mode RUN:

NO SIGNALS COMING FROM THE SENSORS	SENSORS STATE PAGE		▪ None of the sensors is sending signals: boxes reporting actions to be taken (ON-OFF-WB) all have a light background with a black writing ▪ Sensors 1 – 2 – 3 – 4 - 6: ⇒ disabled sensors: writing OFF beside the sensor number (numbers "1", "2", "3", "4", "6" at the beginning of the 1°, 2°, 3°, 4°, 6° lines) ▪ sensor 3 (line n°3 – symbol "**3**"): ⇒ action to be taken with station n. 1: OFF ⇒ action to be taken with station n. 2: ON ⇒ action to be taken with station n. 4: WB ⇒ disabled sensor: writing OFF beside the sensor number (number "3" at the beginning of the 3° line) ▪ sensor 4 (line n°4 – symbol "**4**"): ⇒ GLOBAL function is selected: little black square with a white centre appearing in column G at line (4). This function allows the repeating of the same action over all the stations without setting them one by one ⇒ disabled sensor: writing OFF beside the sensor number (number "4" at the beginning of the 4° line) ▪ sensor 5 (line n°5 – symbol "**T**"): ⇒ action to be taken with station n. 1: WB ⇒ action to be taken with station n. 3: ON ⇒ action to be taken with station n. 6: ON ⇒ enabled sensor: writing/symbol different from OFF beside the sensor number (number "5" at the beginning of 5° line); symbol **T** shows that the sensor is ON and according to the mode, that it is sending signals.

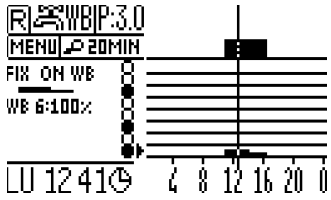
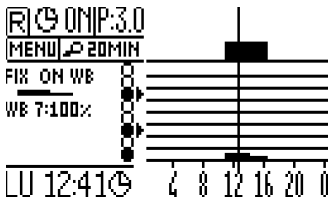
	DISPLAY IN MODE RUN		▪ There is only one irrigation cycle and it is currently working. ▪ None of the sensors is sending signals: any further information is displayed and the place reserved to the signals coming from the sensors is always empty.

SIGNALS COMING FROM SENSOR 5	SENSORS STATE PAGE		▪ Sensor 5 is sending signals: boxes reporting actions to be taken over the different stations (1-3-6) are highlighted (black background with light writing ⇒ disabled sensors: writing OFF beside the sensor number (number "1"-"2"- "6" at the beginning of the 1°-2°-6° lines) ▪ sensor 3 (line n°3 – symbol "**3**"): ⇒ action to be taken with station n. 1: OFF ⇒ action to be taken with station n. 2: ON ⇒ action to be taken with station n. 4: WB ⇒ disabled sensor : writing OFF beside the sensor number (number "3" at the beginning of the 3° line) ▪ sensor 4 (line n°4 – symbol "**4**"): ⇒ GLOBAL function is selected: little black square with a white centre appearing in column G at line (4). This function allows the repeating of the same action over all the stations without setting them one by one ⇒s disabled sensor : writing OFF beside the sensor number (number "4" at the beginning of the 4° line) ▪ sensor 5 (line n°5 – symbol "⇩T"): ⇒ action to be taken with station n. 1: WB ⇒ action to be taken with station n. 3: ON ⇒ action to be taken with station n. 6: ON ⇒ enabled sensor: writing/symbol different from OFF beside the sensor number (number "5" at the beginning of 5° line); symbol ⇩T shows that the sensor is ON and according to the mode, that it is sending signals.
	DISPLAY IN MODE RUN	In mode Run, in the space reserved to the signals coming from the sensors, the information coming from each single sensor is alternatively displayed at that very moment it is sending signals to the electronic board: 4. Empty space; 5. Symbol associated with the sensor signal; 3. ON = irrigation beginning; OFF = irrigation halt; WB = change of the current irrigation cycle length percentage; at the same time symbol " ▸ " shows the involved stations over the graph	
			▪ There is only one set irrigation cycle, but 3 of the stations are currently active, therefore almost one sensor is sending signals ▪ Even if the sensor is sending signals, in the space reserved to this communication, the information appears only after some seconds. ▪ Stations 3 and 6 are ON (black spots on the graph left-hand, at lines in 3 and 6 in the graph), but none of the irrigation cycles are responsible for their activation, therefore almost one of the sensors is sending the signal to activate them. ▪ It is not possible to define if the WB>100% referring to station 1 is due to the sensor or it has been manually set.

			▪ in the space reserved to the communication, ***the sensor symbol appears for a few seconds, to show that the sensor is sending a signal*** ▪ Afterwards, the actions in relationship to the relevant stations are displayed. (see below) ▪

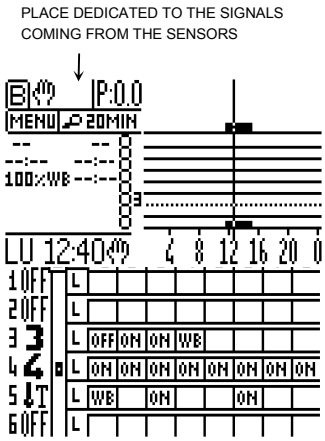
.....to be continued ↴

↳ to be continued ……

SIGNALS COMING FROM SENSOR 5	DISPLAY IN MODE RUN		▪ the taken action is displayed in the space reserved to the communication ▪ A right-hand arrow indicates the stations currently interested by the action ▪ In this picture action WB interests station 1; the WB applied to station 1 is higher than 100% (as shown by the drawing representing the irrigation cycle *see par.4b.ii page 17*)
			▪ the taken action is displayed in the space reserved to the communication A right-hand arrow indicates the stations currently interested by the action ▪ In this picture action ON is taken at stations 3 and 6.
		In case there is only one signal (as above) the information is continuously repeated on the display, but if there are more than one signal at the time, they will be alternatively displayed.	

iii. Signals coming from sensors in mode BROWSE

Heredown a possible setting of the inputs and the information displayed in mode BROWSE:

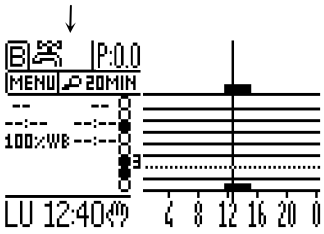
<table>
<tr>
<td rowspan="2">NO SIGNALS COMING FROM THE SENSORS</td>
<td>SENSORS STATE PAGE</td>
<td> 
</td>
<td>▪ None of the sensors is sending signals : boxes reporting actions to be taken (ON-OFF-WB) all have a light background with black writing
▪ Sensors 1-2-6:
⇒ disabled sensors : writing OFF within column "IN"

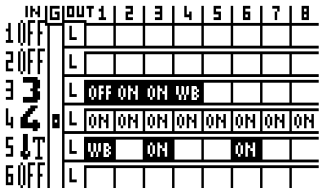
▪ sensor 3 (line n°3 – symbol "3"):
⇒ action to be taken with station n. 1: OFF
⇒ action to be taken with station n. 2: ON
⇒ action to be taken with station n. 3: ON
⇒ action to be taken with station n. 4: WB
⇒ enabled sensor: writing 3 (bold) beside the number of the sensor (number "3" at the beginning of the 3° line)
▪ sensor 4 (line n°4 - symbol "4"):
⇒ GLOBAL function is selected: little black square with a white centre appearing in column G at line (4). This function allows the repeating of the same action over all the stations without setting them one by one
⇒ disabled sensor: writing OFF beside the number of the sensor (number "4" at the beginning of the 4° line)
▪ sensor 5 (line n°5 - symbol "T"):
⇒ action to be taken with station n. 1: WB
⇒ action to be taken with station n. 3: ON
⇒ action to be taken with station n. 6: ON
⇒ enabled sensor: writing/symbol different from OFF beside the sensor number (number "5" at the beginning of 5° line); symbol T shows that the sensor is ON and that it is sending signals according to the mode.</td>
</tr>
<tr>
<td>DISPLAY IN MODE BROWSE</td>
<td></td>
<td>▪ There is only one irrigation cycle and it is currently working
▪ None of the sensors is sending signals: any further information is displayed and the place reserved to the signals coming from the sensors is always empty</td>
</tr>
</table>

SIGNALS COMING FROM SENSORS 3 AND 5

SENSORS STATE PAGE

PLACE DEDICATED TO THE SIGNALS COMING FROM THE SENSORS





- Sensors 1 – 2 - 6 are disabled: writing beside the sensor number (number "1"- "2"- "6" at the beginning of the 1°, 2°, 6° lines).
- Sensors 3 – 4 - 5 are enabled: writing/symbol different from OFF beside the sensor number (number "3", "4", "5" at the beginning of the 3°,4°,5° lines); symbols "**3**","**4**", "T"show that the sensors are ON and according to the mode, that they are sending signals.
- sensor 3 is sending signals:
  ⇒ action to be taken with station n. 1: OFF. The action is highlighted therefore it is operative: action OFF is operative when there is a currently active irrigation cycle over station n. 1.
  ⇒ action to be taken with station n. 2: ON. The action is highlighted therefore it is operative: action ON is operative if there are NO currently active irrigation cycles over station n. 2.
  ⇒ action to be taken with station n. 3: ON. The action is highlighted therefore it is operative: action ON is operative if there are NO currently active irrigation cycles over station n. 3.
  ⇒ action to be taken with station n.4: WB. The action is highlighted: that means that all the irrigation cycles programmed over station n.4 are under the WB set by the sensor.
- sensor 4:
  ⇒ sensor 4 is not sending signals OR its taken actions are not operative. Thanks to the led on the frontal board (letter "l") it is possible to verify that led 4 is off and therefore, in this case, the sensor is not sending signals. The same information can also be seen on the display: in fact in correspondence of sensor 4 (line 4) and with particular regard of stations 1-2-3-6 it is not highlighted (in case the sensors was sending signals this writing should have been highlighted).
- sensor 5 is sending signals:
  ⇒ action to be taken with station n.1: WB. The action is highlighted therefore all the programmed irrigation cycles, over station n.4 are under the WB set by the sensor.
  ⇒ action to be taken with station n. 3: ON. The action is highlighted therefore it is operative: action ON is operative if there are NO currently active irrigation cycles over station n. 3.
  ⇒ action to be taken with station n. 6: ON. The action is highlighted therefore it is operative: action ON is operative if there are NO currently active irrigation cycles over station n. 2.

DISPLAY IN MODE BROWSE

In mode Run, in the space reserved to the signals coming from the sensors, the information coming from each single sensor is alternatively displayed at that very moment it is sending signals to the electronic board:

1.Empty space;
5.Symbol associated with the sensor signal;
6.writing (ON-OFF-WB) representing the taken action

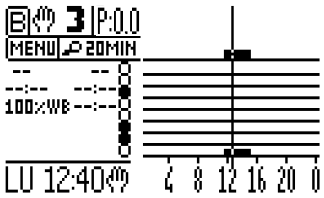
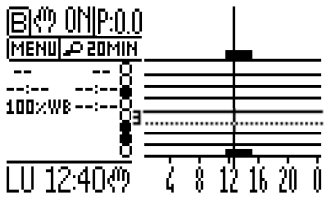
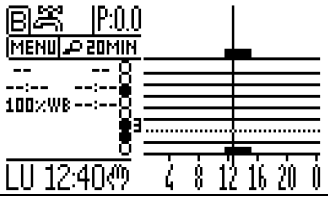
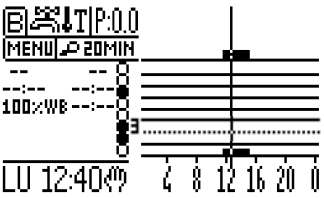
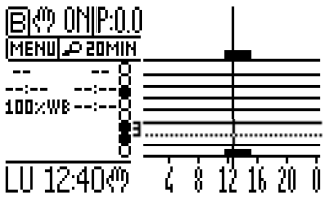
SENSOR 3

1. Empty space

- There is only one programmed irrigation cycle, but the corresponding station is NOT active; moreover there are 3 active stations without irrigation cycles set to activate them, therefore almost one sensor is sending signals.
- Even if the sensor is sending signals to the reserved place, the relevant information will appear only after a few seconds.
- Stations 2, 3 and 6 are ON (black spots on the graph left-hand, at lines in 2, 3 and 6 in the graph), but none of the irrigation cycles are responsible for their activation.
- It is not possible to define if the WB>100% referring to station 1 is due to the sensor or it has been manually set.

.....to be continued ↴

to be continued ……

SIGNALS COMING FROM SENSORS 3 AND 5	DISPLAY IN MODE BROWSE	SENSOR 3 2. Symbol associated with the sensor signal; 	▪ Only for a few seconds, *the symbol of the sensor currently sending signals* appears in the place reserved to the communication. *(in this case symbol "**3**")*
		SENSOR 3 3. writing ON representing the taken action 	▪ The action(in this case "ON") taken by the sensor (sensor 3) over the selected station (station 3) appears in the place reserved to the communication
		SENSOR 5 1. Empty space 	▪ There is only one programmed irrigation cycle, but the corresponding station is NOT active, moreover there are 3 active stations without irrigation cycles, therefore almost one sensor is sending signals. ▪ Even if the sensor is sending signals to the reserved place, the relevant information will appear only after a few seconds. ▪ Stations 2, 3 and 6 are ON (black spots on the graph left-hand, at lines in 2, 3 and 6 in the graph), but none of the irrigation cycles are responsible for their activation. ▪ It is not possible to define if the WB>100% referring to station 1 is due to the sensor or it has been manually set.
		SENSOR 5 2. Symbol associated with the sensor signal; 	▪ Only for a few seconds, *the symbol of the sensor currently sending signals* appears in the place reserved to the communication. *(in this case symbol "T")*
		SENSOR 5 7. writing ON representing the taken action 	▪ The action (in this case "ON") taken by the sensor (sensor 3) over the selected station (station 3) appears in the place reserved to the communication

to be continued……

9 Management of the inverter to steer the electrical pump (PWM 230 – 400 WaCS)

BRIEFLY…

THE WATER SYSTEM PRESSURE CAN BE SET THANKS TO THE INVERTERS MANAGEMENT THAT STEER THE ELECTRICAL PUMPS (PWM 230 – 400 DEVICES) IN A RANGE BETWEEN 1 AND 15 BARS. THE ELECTRONIC BOARD CAN MANAGE AND SUPERVISE TILL A MAX. OF 4 PWM DEVICES.

The Da Vinci electronic board can be connected to PWM 230 and/or PWM 400 devices (inverters that can steer the electrical pumps - WaCS System products) in order to obtain a pumping group made of max. 4 PWM devices that can maintain the water system at a steady pressure (Da Vinci electronic board used as a "simple" *PWM DEVICES SUPERVISOR).* It is also possible to set irrigation cycles for each single solenoid valve, and for each cycle it is possible to program the set-point pressure for the PWM devices group (Da Vinci electronic board used as an *IRRIGATION ELECTRONIC BOARD*).

a. PWM devices fitting up

The PWM devices must be connected at three contacts of the terminal board of the Da Vinci: SH (common); Bn- ; Bn+ (with n=1,2,3,4; for an example of connection between the PWM devices and the electronic board see *par.11b page 65 and refer to* "*DaVinci electronic board fitting up handbook"*).
It is possible to enable or disable the connection with the PWM thanks to the relevant setting page (*par.5a.xvii page 34*). The connection state is communicated by the B1.B4 leds:

Fixed led ON: communication OK;
Flashing led ON: communication error;
Led OFF: PWM with the DaVinci electronic board (PWM OFF).

b. PWM devices setting

Enter the *PWM SETTING* page through the run-browse menu in order to set the working modes of the PWM devices (see *par. b – page. 54*); the PWM devices can be set in the following modes: OFF; Rd; Rs; dS.

MODE OFF
The DaVinci electronic board does not communicate with the PWM device, which works independently from eventual other devices. This is the only possibility for the PWM device not to work under the DaVinci electronic board control.

MODE RD (READY)
The DaVinci electronic board supervise the PWM device through the communication. In this case the PWM device is part of the *REGULATION GROUP* (for further details about the *REGULATION GROUP* see *par.c page 55*).

MODE RS
During a correct work of all the PWM devices, the RS-set PWM device is not part of the regulation group. When one of the PWM devices turns into pump security, the electronic board puts the RS-set PWM device into to regulation group. When the PWM device in security goes back to the correct working, the RS device automatically exits from the regulation group and turns back to the standby state.

MODE DS
The PWM device that will never be part of the regulation group, but supervised by the DaVinci electronic board.

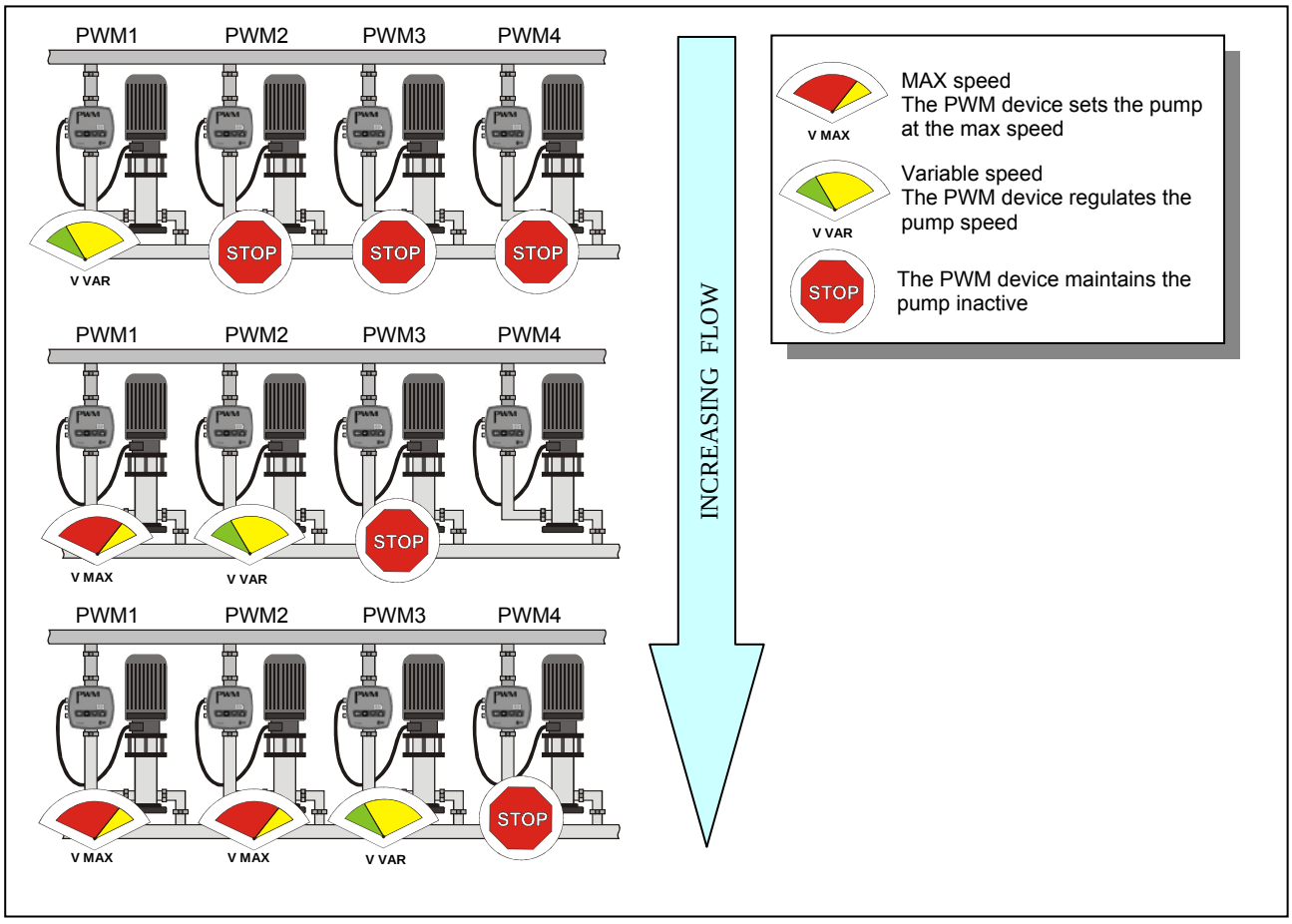
c. PWM devices regulation group

The regulation group is made of PWM devices that work to assure a water system steady pressure, managing the water pumps start/halt and their speed, reducing the management costs of the system. In order the reduce the pumps wear, the PWM devices intervention order is exchanged according to the different needs of the pumping groups. The main features characterizing the system (Da Vinci electronic board + PWM devices) are:

Pumps starting mode
Pumps halting mode
Management of the *SECURITY* interfering with the PWM devices
ECONOMY mode
FAST mode
Wear reduction of the used pumps

i. Pumps starting mode

When a pump needs to be started, a PWM device (for example PWM1) starts its own pump and regulates its speed in order to fulfil the water request.
Once reached the max. speed (that can be set on the PWM), another PWM device (for example PWM2) starts its own pump. In order to optimize the pressure regulation in the water system, PWM1 maintains its pump at the max. speed, while PWM2 manages its own pump speed so that the water request is fulfilled, always maintaining the pump at the set pressure.
If the water request increases, when PWM2 pump reaches its max. speed, PWM3 starts its own pump and regulates its speed, while PWM1 and PWM2, maintain their pumps at the max. speed.
See Picture 16

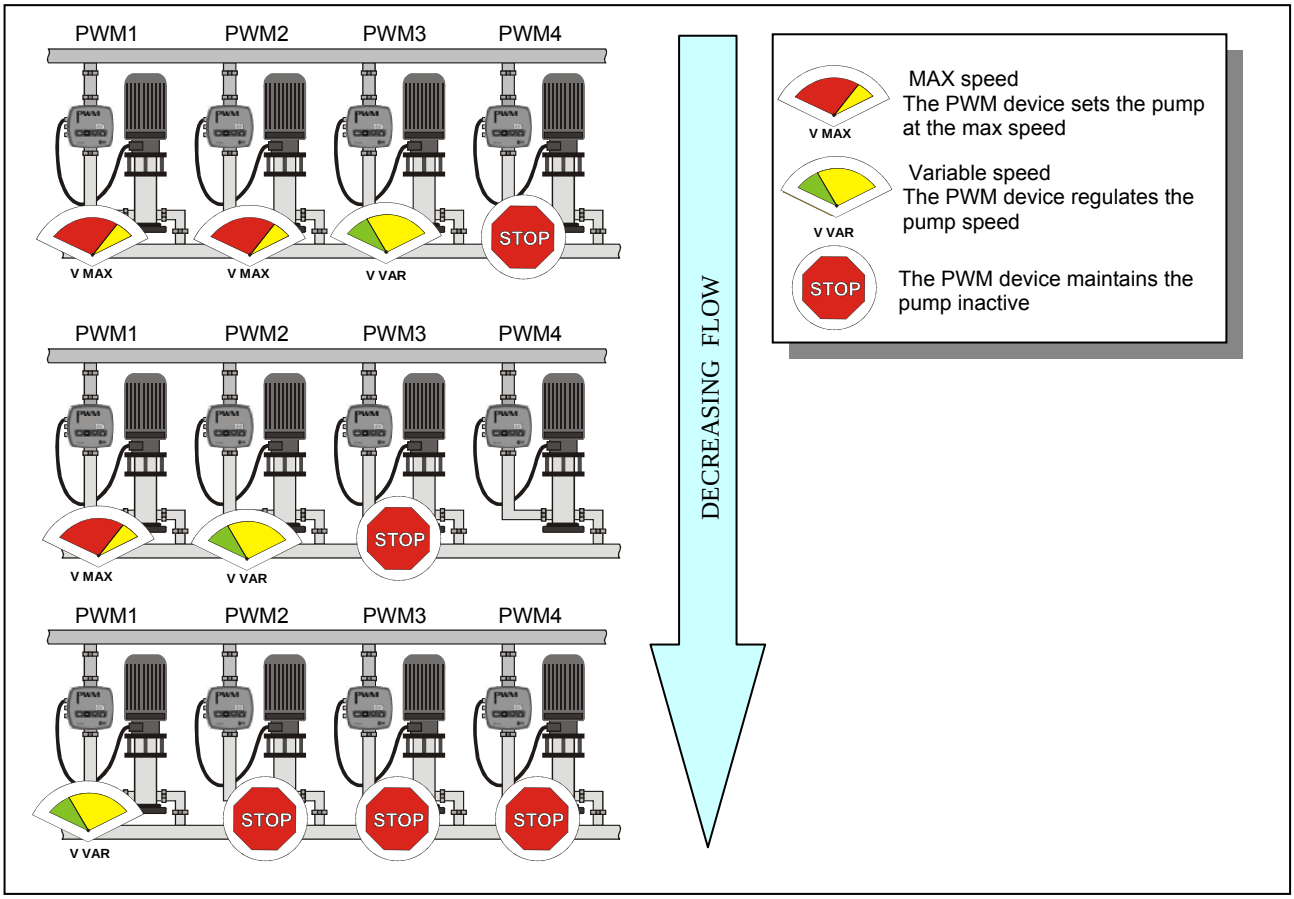


Picture 16 *4 PWM devices system*

ii. Pumps halting mode

Let's pretend that 3 PWM devices are currently working, if the water request decreases, the pumps will be stopped in the opposite sequence of the previously described situation see *par. i page 55*. In few cases the halt is not respected, because of pump wear reduction policies (see *par.1a.i page 60*).

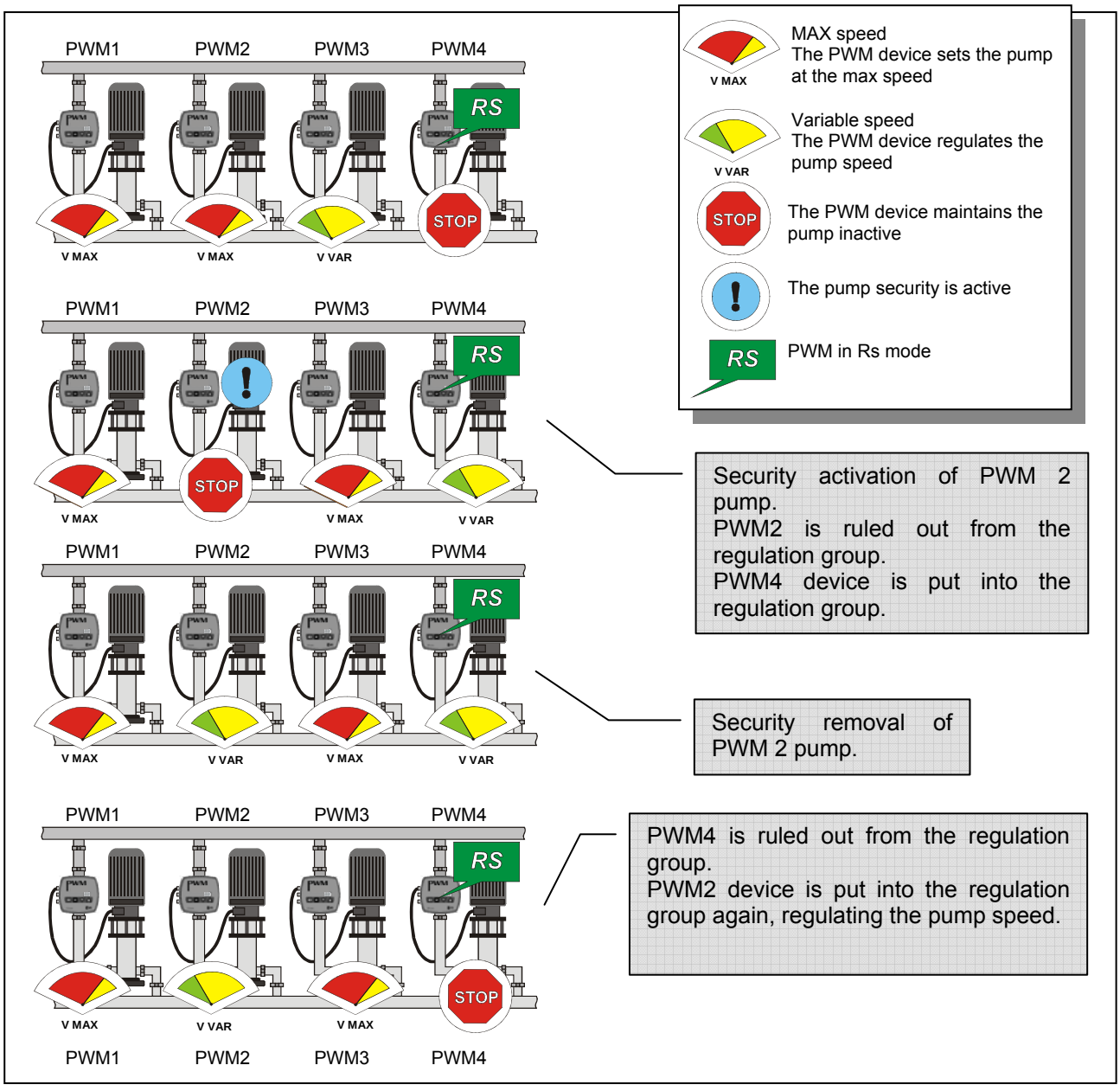
See Picture 17



Picture 17 *Devices halting sequence according to a decreasing flow request*

iii. Management of the SECURITY interfering with the PWM devices

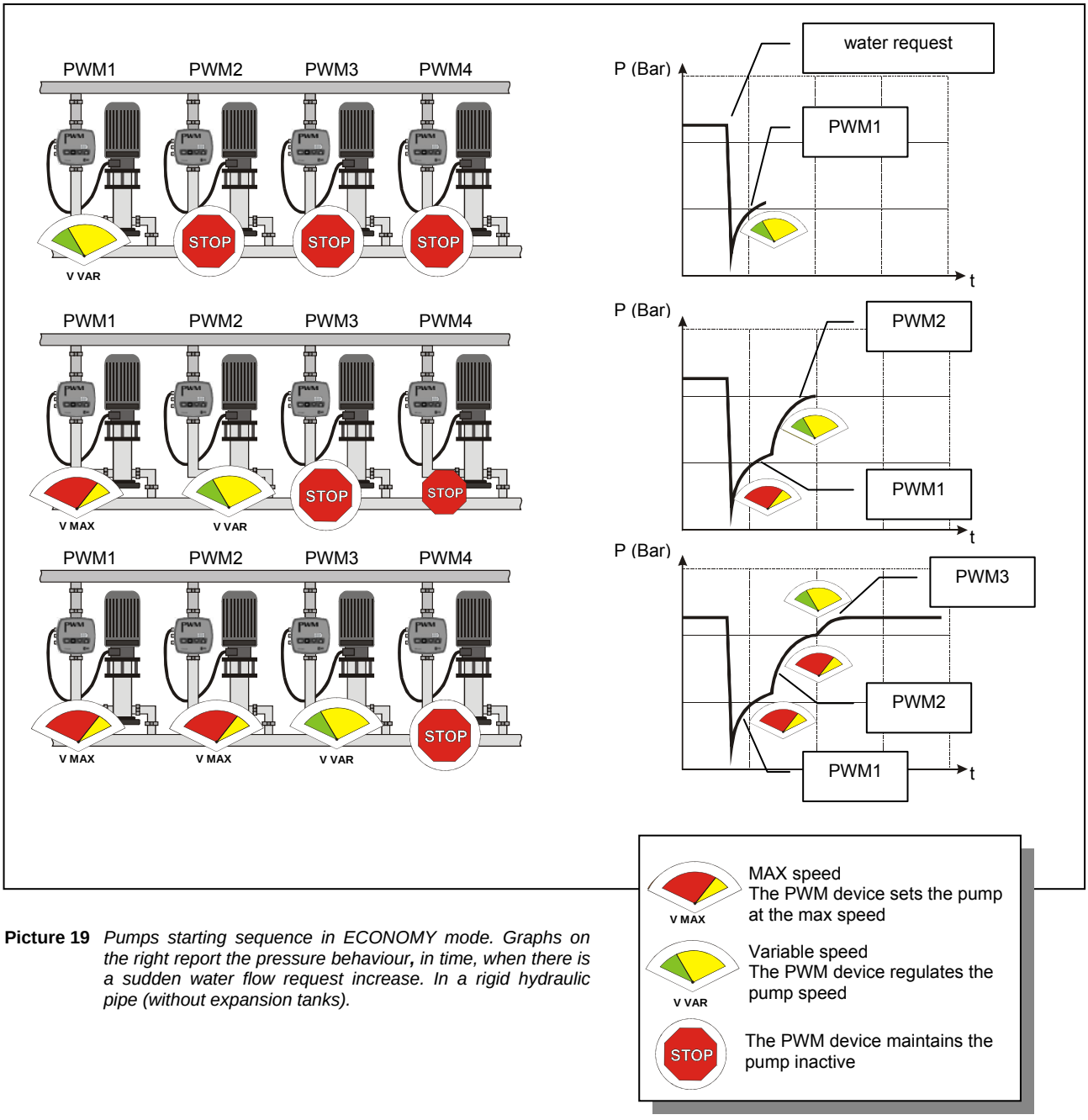
All the PWM devices have a security system, in order to protect the pump, the engine, the power supply and the PWM device, as well. If a working PWM device gets in security, the Da Vinci electronic board activates another PWM device to fulfil the water request. If there is a PWM device set in RS mode, this will be put into the regulation group. The security will be automatically removed, when the reason that caused the protection is automatically or manually removed, both through the electronic board or the PWM device (for further details see *par. 5a.xvii page 34*). In the manual removal there is an attempt of making the device correctly working again, but if the reason that caused the protection still remains, the security activates again. When the security is removed (either automatically or manually) the PWM device gets back into the regulation group and the previously activated RS device will be automatically ruled out and stops its pump. See in *picture 18* the example of a regulation group made of 3 PWM devices, with the PWM2 security activation and removal; PWM4 is set in a RS mode.



Picture 18 *Management of the pump security through a PWM device*

iv. ECONOMY mode

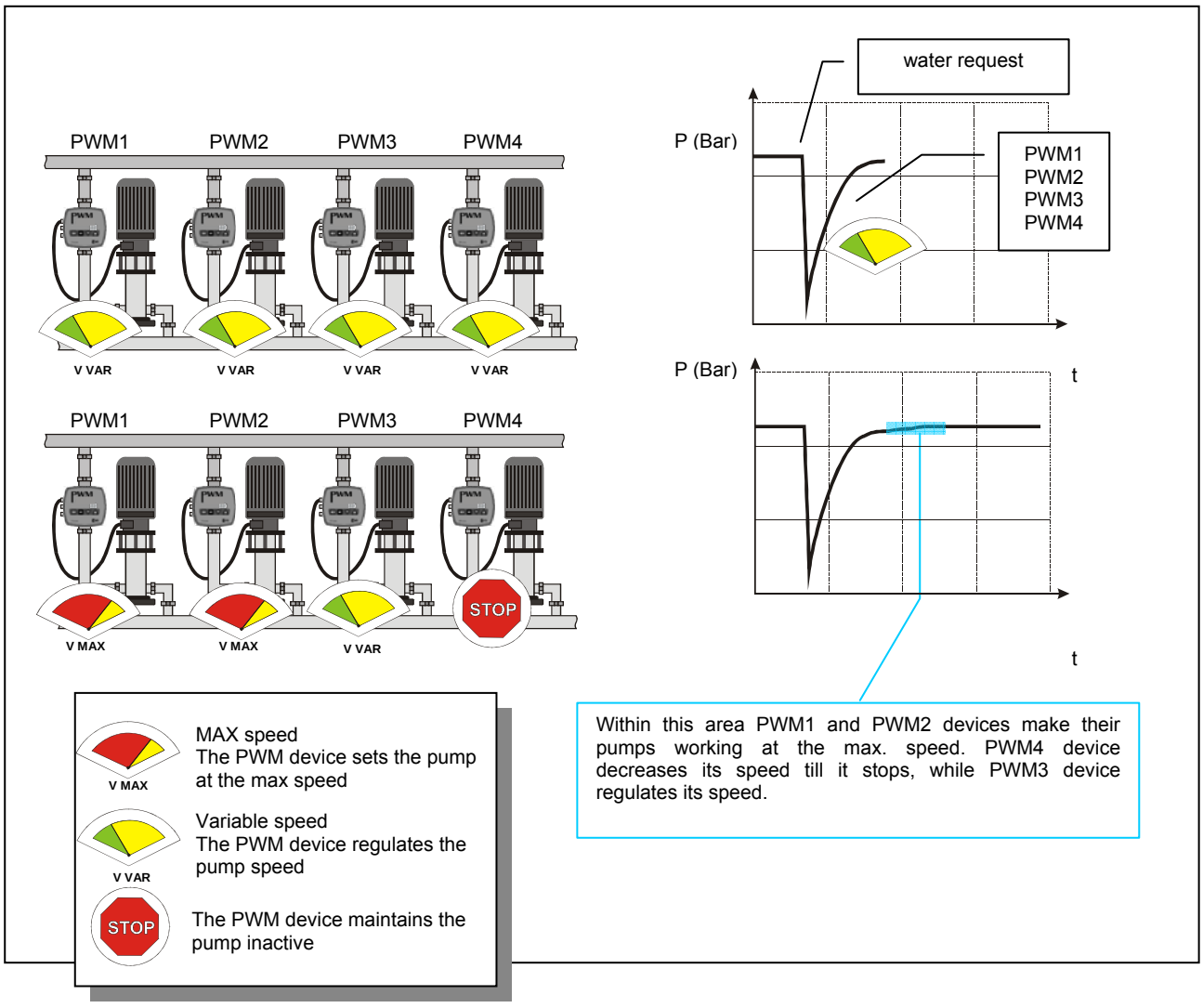
In an aim of energy conservation, the Da Vinci electronic board can be set in ECONOMY mode. (par. MENÙ → PWM MANAGEMENT → *page 36*): a PWM device starts its pump only when the other eventually working PWM devices reach their max. speed. The ECONOMY mode grants the minimum number of necessary pumps working at the same time, in order to fulfil the water request.
See in *Picture 19* the example of 3 pumps activation sequence necessary to fulfil the water request from no flow to a determined flow, in a few seconds, at a set steady pressure. The time could become important in those plants where there are sudden requests of water supply. For these situations see FAST mode (next paragraph).



Picture 19 *Pumps starting sequence in ECONOMY mode. Graphs on the right report the pressure behaviour, in time, when there is a sudden water flow request increase. In a rigid hydraulic pipe (without expansion tanks).*

v. FAST mode (pre-set)

This mode is suitable for those systems that need to quickly answer important increases in the water supply request. To face a sudden pressure decrease in the hydraulic system, all the PWM devices start their pumps to take the pressure back to the set value. In a few seconds, once reached the needed pressure value, the pumps that are no more necessary to maintain a steady pressure in the system, according to the water flow request, will be halted. In this way, the minimum number of necessary pumps will be working at the same time, in order to fulfil the water request.
See in *Picture 20* an example of the same water flow request already described in *Picture 19* (ECONOMY mode)



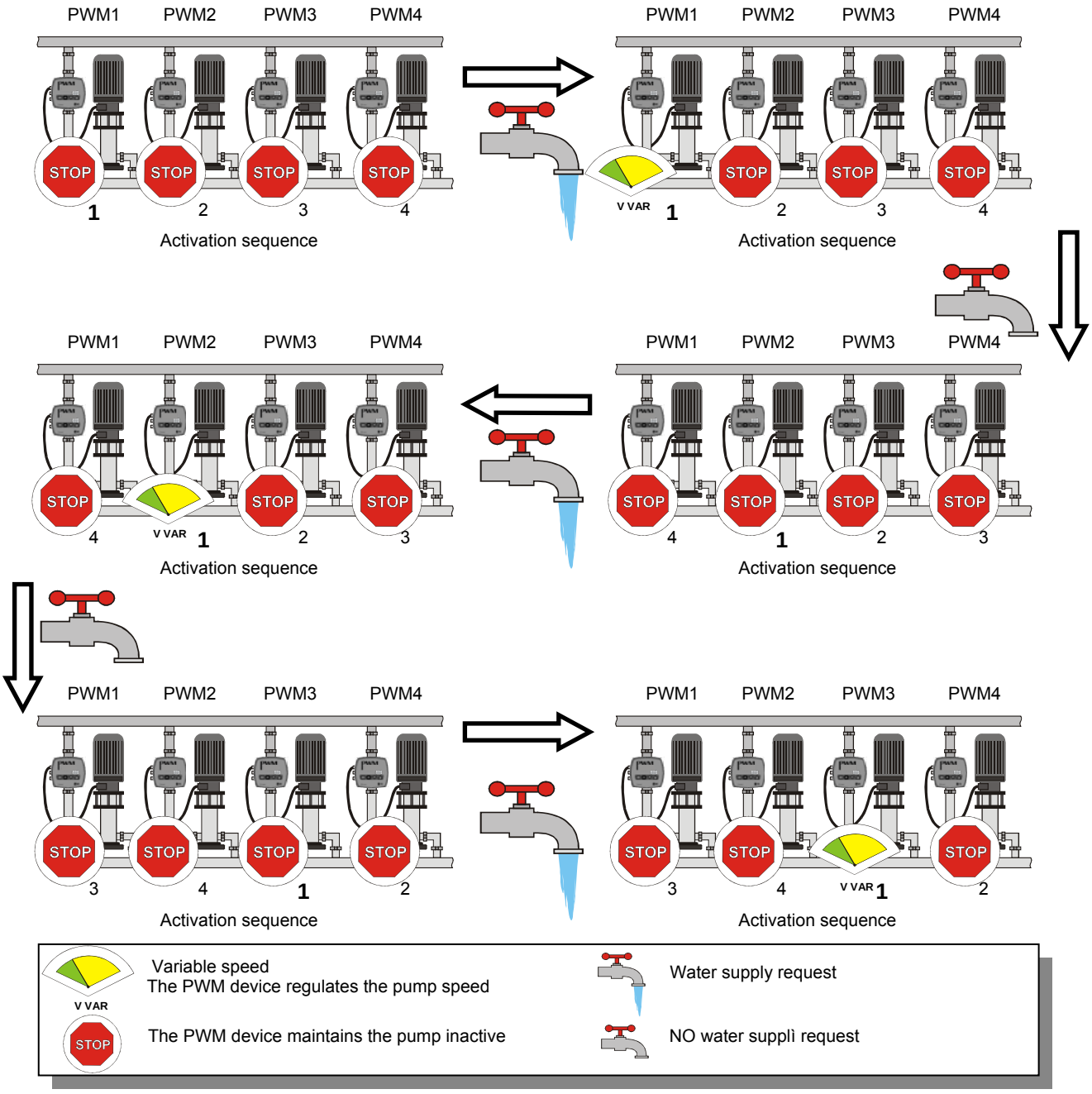
Picture 20 *Pumps starting sequence in FAST mode. Graphs on the right report the pressure behaviour, in time, when there is a sudden water flow request increase. In a rigid hydraulic pipe (without expansion tanks).*

vi. Wear reduction of the used pumps

Some PWM devices management policies can be applied in order to keep all the pumps of the regulation group in working order and to optimize their work. These policies modify the pumps intervention order in case of water supply request. This order can be programmed according to 3 functions that can be set from the MENU (*par.*5a.xx **MENÙ → PWM MANAGEMENT →** pag.36): EXCHANGE AT STANDBY, T.A. (ABSOLUTE TIME) EXCHANGE AND T.F. (FUNCTIONING TIME)

1. Exchange at standby.

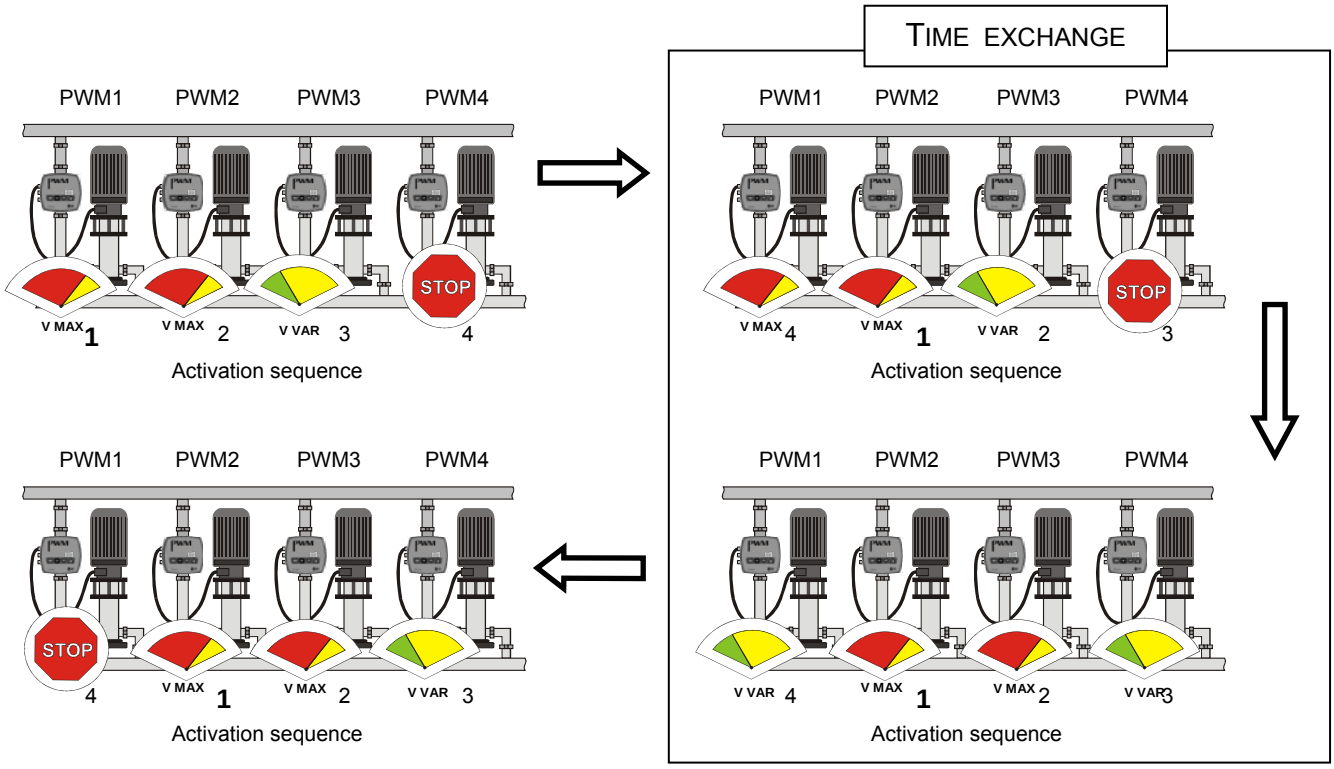
Each time all the PWM devices have their pumps inactive, their activation order is changed; see an example in the heredown picture:



Picture 21 *Exchange of the intervention sequence in mode* EXCHANGE AT STANDBY

2. T.A. (absolute time) and T.F. (functioning time) exchange

In the T.A. and T.F. modes the pumps activation order is changed each time a set time period ends. It can be set trough the advances menu (an example in Picture 22).
In the T.A. mode the set time period represents the time interval between two priority exchanges. In the T.F. mode the time period represents the real working time of the devices.
See in *Picture 22* an example in which the activation order exchange makes the PWM1 pump, currently at max. speed, halt.



Picture 22 *Exchange of the intervention sequence in mode T.A. and T.F.* EXCHANGE

d. DaVinci as PWM devices supervisor.

The Da Vinci electronic board can be used as a PWM devices supervisor, without creating the irrigation cycles and therefore activating the digital outputs.
In this mode the parameters can be set through the SUPERVISOR PARAMETERS in the menu (*par.5a.xviii page 35):*

P_{ON} → set-point pressure of the PWM devices group
S.T. → period of time used for the Time Exchange (see *par.c.vi.2 page 61*)
S.T.F. → period of time used for the T.F. Exchange (see *par.c.vi.2 page 61*)
RP → drop in pressure setting, for the restart (for further details see the *PWM device user's handbook*)

The PWM devices will work accordingly to the different management policies, in order to regulate the pressure at the set-point value; in case there is no communication with the electronic board (for instance a broken cable) the PWM devices will independently continue their work, regulating the pressure value as for the last received input by the electronic board, granting the water supply.

e. DaVinci as irrigation board

The Da Vinci electronic board can be used as an irrigation board with the possibility to regulate the pressure values, thanks to the PWM devices.
In this mode the parameters can be set through the MENU → PWM MANAGEMENT→ *IRRIGATION* page 35 *:*

P_{OFF} → set-point pressure of the PWM devices group, with no cycles
S.T. → period of time used for the Time Exchange (see *par.c.vi.2 page 61*)
S.T.F. → period of time used for the T.F. Exchange (see *par.c.vi.2 page 61*)
RP → drop in pressure setting, for the restart (for further details see the *PWM device user's handbook*)

The PWM devices will work accordingly to the different management policies, in order to regulate the pressure at the set-point value, set by the different irrigation cycles;
If there are no active irrigation cycles, the pressure of the PWM devices will be P_{OFF}.

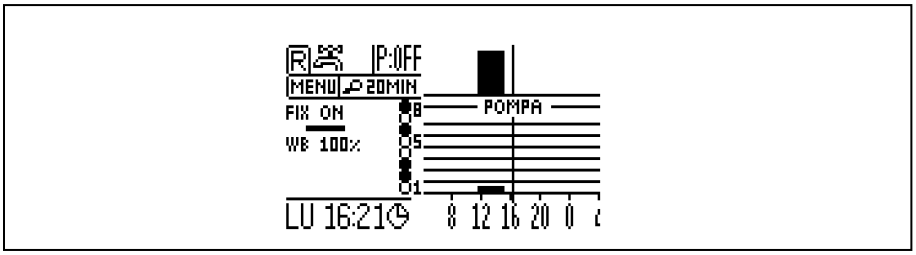
10 Pump management or master valve.

BRIEFLY…

A PUMP OR A MASTER VALVE CAN BE CONNECTED TO THE ELECTRONIC BOARD DIGITAL OUTPUT N.8, THROUGH (FOR EXAMPLE) A CONTACTOR

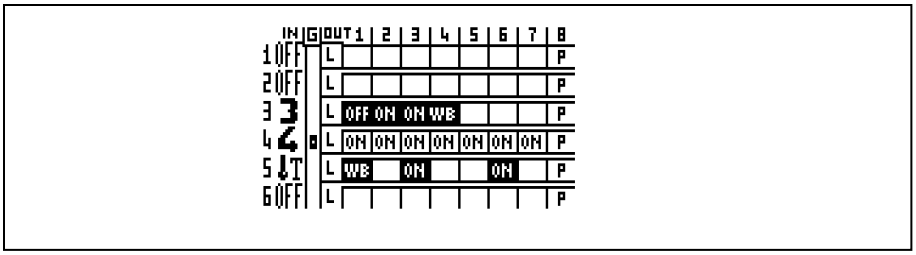
The electronic board digital output (DO8) can be used to steer a master valve of the hydraulic system, or to steer a pump thanks to a contactor.
Enter the setting page and select "ENABLE PUMP" to set the electronic board in mode pump/master valve
When the digital output is set in mode pump/master valve, it becomes active when almost one station is active.
These are the effects on the electronic board when set in mode pump/master valve:

1. in mode BROWSE, the graph area in relationship with the PWM devices set pressure, refers to the pump state ON/OFF (see *Picture 23*) and the figure reporting the pressure value displays the pump/master valve state (ON/OFF).
2. The horizontal line reporting the station numbers cannot no more be selected, while the writing PUMP appears (see *Picture 23*)



Picture 23 Mode RUN with output 8 set as pump/master valve

3. In the sensors setting page, column 8, corresponding to digital output 8, cannot be selected and letter "P" appears, to show that it is in pump/master valve mode and that the sensors cannot work with this output (see *Picture 24*)



Picture 24 se *Sensors setting page with output 8 set in pump/master valve mode*

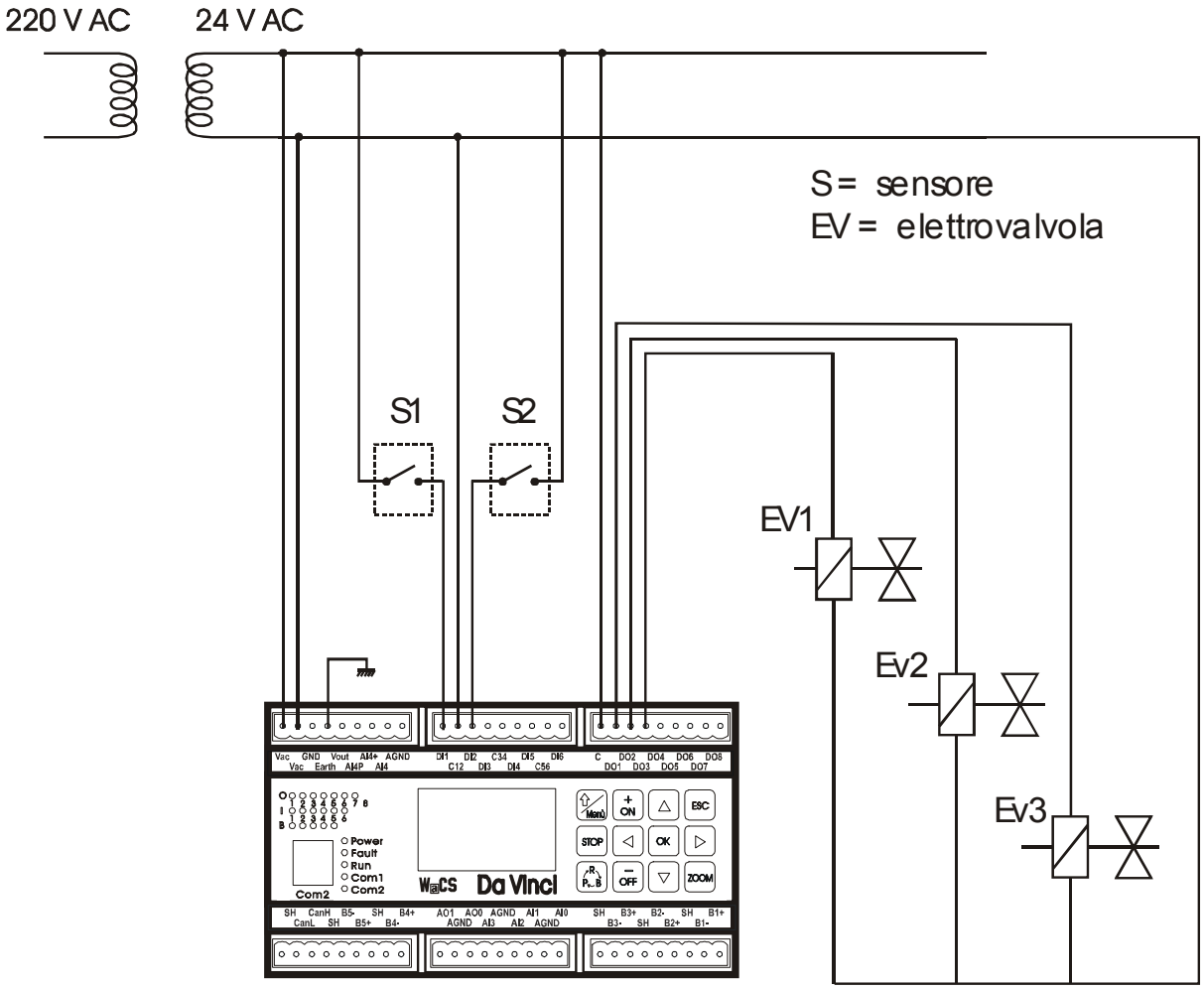
3 Da Vinci electronic board typical fitting up

BRIEFLY… Da Vinci electronic board tyical fitting up

THE DA VINCI ELECTRONIC BOARD, THANKS TO ITS WIDE VERSATILITY, CAN BE FIT UP IN DIFFERENT MODES ACCORDING TO THE NEEDS: IT CAN BE SUPPLIED BY AC OR DC POWERS, IT HAS 8 DIFFERENT OUTPUTS (7 FOR THE STATIONS AND 1 THAT CAN BE SET IN PUMP/MASTER VALVE MODE), IT CAN MANAGE UP TO 6 SENSORS AND IT CAN STEER AN INVERTER TO MANAGE THE ELECTRICAL WATER PUMP .

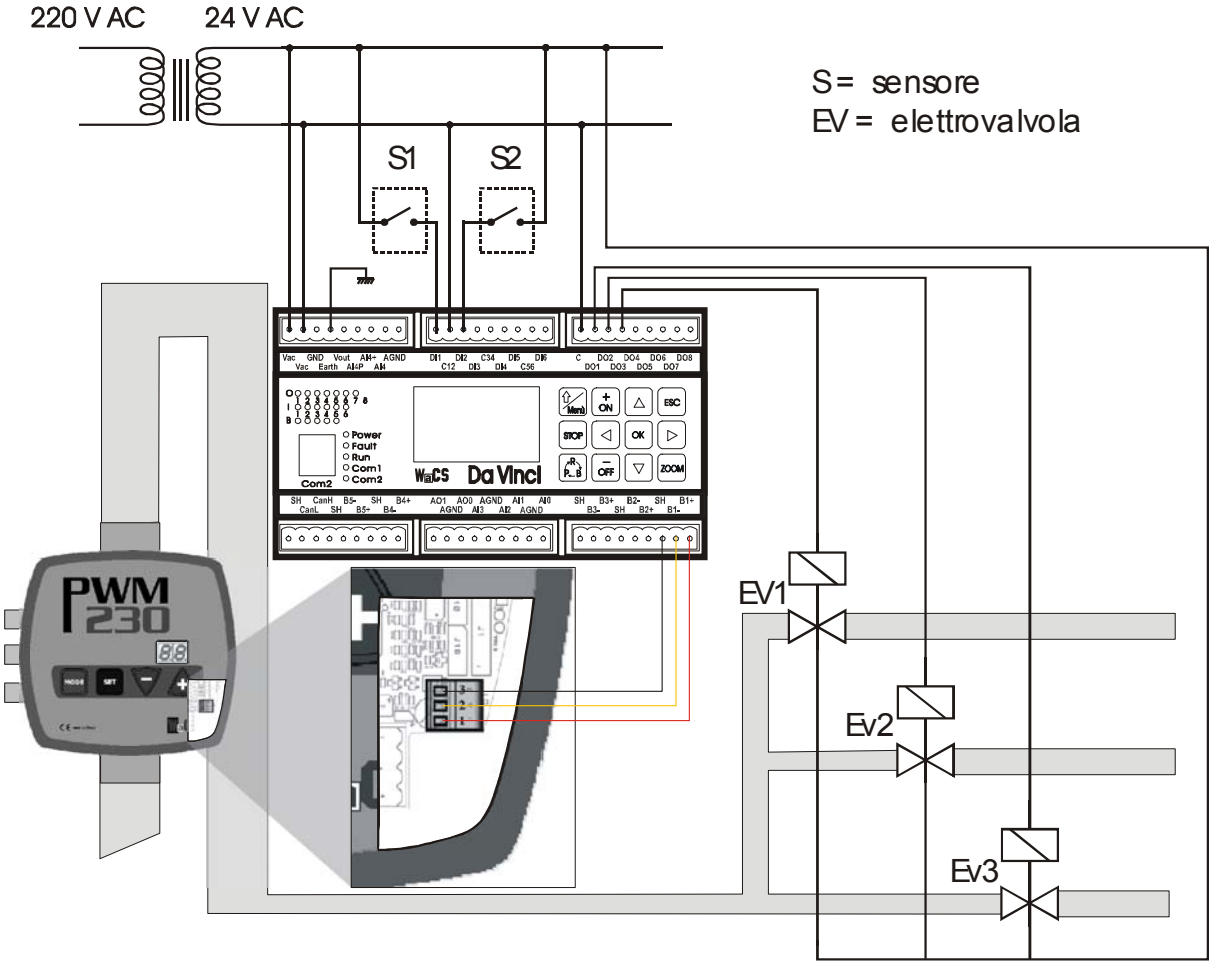
a. Example of connection with 24V AC power supply - sensors

Use of two sensors (S1 can also be a TRIAC) and management of three irrigation stations.



All the 6 digital inputs (DI 1,2,3,4,5,6) are galvanically opto-isolated and independent by tows; in this way the electronic board can be linked to clean contacts, NPN and PNP outputs, that can work both in AC and in DC (whichever polarity) sending signals both at the contact closing or opening. This offers the maximum flexibility and compatibility with the sensors on the market
The D1 input can be also set to be connected to a triac sensor paying attention to the ON position of the dip-switch 1 (see chap. 8 page 44). For further details see the *"Fitting up handbook"*

b. Example of connection with 24V AC power supply – sensors – PWM 230/400



The communication between the electronic board and the PWM is possible thanks to the serial communication standard RS485 and the Transmission Control Protocol (TCP), using a screened cable.
The communication with the PWM must be activated through the electronic board (chap.9 page 54), while the PWM device must be set as electronic board slave (see the PWM device *"User's Handbook")*

All the 6 digital inputs (DI 1,2,3,4,5,6) are galvanically opto-isolated and independent by tows; in this way the electronic board can be linked to clean contacts, NPN and PNP outputs, that can work both in AC and in DC (whichever polarity) sending signals both at the contact closing or opening. This offers the maximum flexibility and compatibility with the sensors on the market
The D1 input can be also set to be connected to a triac sensor paying attention to the ON position of the dip-switch 1 (see chap. 8 page 44). In this case only two sensors have been connected to inputs 1 and 2.

For further details see the *"Fitting up handbook"*

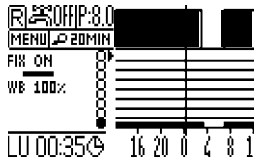
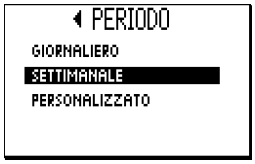
11 What to do to…….

BRIEFLY … WHAT TO DO TO…

A SHORT LIST OF ACTIONS TO TAKE TO SET THE MOST COMMON FUNCTIONS

a. Set the electronic board in weekly or daily modes

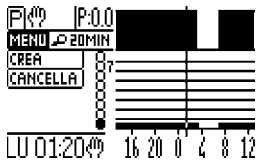
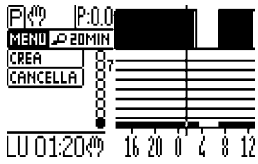
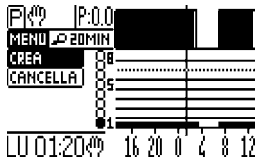
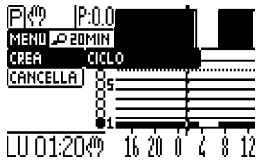
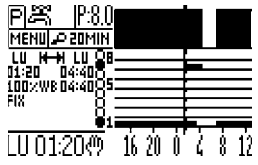
Enter mode RUN eventually pressing key ESC more than once.
Follow these steps:

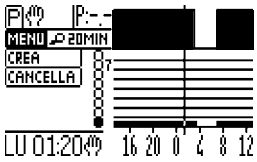
DISPALYED PAGE	ACTION TO TAKE	KEY TO PRESS
	ENTER THE RUN-BROWSE MODES MENU	Menu
	SELECT ENTRY ***ELECTRONIC BOARD SETTING***	▲ ▼
	OPEN THE ***ELECTRONIC BOARD SETTING*** MENU	OK
	SELECT ENTRY ***SETTING PERIOD***	▲ ▼
	OPEN THE ***SETTING PERIOD*** MENU	OK
	SELECT THE DESIRED WORKING MODE: WEEKLY OR DAILY	▼ ▲
	CONFIRM YOUR CHOICE	OK

b. Create an irrigation cycle (PWM steering)

Follow the steps to create an irrigation cycle.
The electronic board must be in PROGRAM mode. To take the electronic board in PROGRAM mode select RUN mode and then PROGRAM mode.

- To take the electronic board in RUN mode press key ESC more than once.
- To take the electronic board in mode PROGRAM, from the RUN mode:
  1) press key and choose, in the displayed page, among the 3 possible options: irrigation maintenance, irrigation test, irrigation suspension.
  2) press key again and choose, in the displayed page, among the 3 possible options: irrigation maintenance, irrigation test, irrigation suspension.

DISPALYED PAGE	ACTION TO TAKE	KEY TO PRESS
	PUT THE CURSOR AT THE STATION WHERE THE IRRIGATION CYCLE IS TO BE CREATED. IN THIS PICTURE THE CURSOR IS THE FLASHING 7, TO SHOW THAT THE SELECTED STATION IS THE N.7 (THE STATION CORRESPONDING HORIZONTAL LINE IS FLASHING, TOO) THE MENU SHOWS THE POSSIBLE ACTIONS THAT CAN BE TAKEN. IF A CYCLE IS ALREADY SET, ENTRY ***CREATE*** WILL NOT BE DISPLAYED, BUT ***MODIFY***; IN THIS CASE THE CYCLE CAN BE MODIFIED OR CHANGED (SEE PAGE 69)	▲ ▼
	*ENTER THE **SETTING MENU***	Menù
	SELECT ENTRY ***CREATE*** FROM THE PULL DOWN MENU	▲ ▼
	OPEN THE CREATE MENU	OK
	SELECT ENTRY ***CYCLE*** FROM THE PULL DOWN MENU	▲ ▼
	SELECT ***CREATE CYCLE***	OK
	SELECT THE PARAMETER TO BE MODIFIED ON THE DISPLAY LEFT: BEGINNING DAY [M] → LU LU ← ENDING DAY [M] (NOMINAL) BEGINNING HOUR [M] → 01:20 04:40 ← ENDING HOUR [M] (NOMINAL) STATION WB [M] → 100%WB 04:40 ← ENDING HOUR [NM] (REAL) IRRIGATION TYPE [M] → FIX [M] MODIFIABLE: IT IS A PARAMETER THAT CAN BE SELECTED THROUGH THE CURSOR AND THAT CAN BE MODIFIED BY THE USER. [NM] NOT MODIFIABLE : IT IS A PARAMETER THAT IS AUTOMATICALLY SET BY THE ELECTRONIC BOARD, THEN IT CANNOT BE SELECTED NOR MODIFIED NOMINAL ENDING DAY AND HOUR = VALUES SET BY THE USER WHEN PROGRAMMING IN ORDER TO DEFINE THE IRRIGATION CYCLE REAL ENDING HOUR = THE REAL IRRIGATION CYCLE ENDING HOUR OBTAINED AFTER THE WB APPLICATION (IN MODE RUN THE REAL ENDING DAY IS NOT DISPLAYED, BUT THIS IS DISPLAYED IN MODE BROWSE – SEE PAR. 4B.III PAG.20)	◄ ► ▼ ▲
	CHANGE THE SELECTED PARAMETER (INCREASE/DECREASE THE SELECTED VALUE)	+ ON − OFF
	WHEN THE FIELD *STATION WB* OR *TYPE OF IRRIGATION* IS SELECTED, THE CHANGES CAN BE MADE ENTERING THE PARAMETER SETTING PAGE (WB OR TYPE OF IRRIGATION)	Menù

	SAVE THE CYCLE (IF KEY ESC IS PRESSED INSTEAD OF KEY OK THE INITIAL DISPLAY COMES BACK WITHOUT SAVING THE CREATED CYCLE)	OK

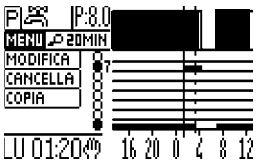
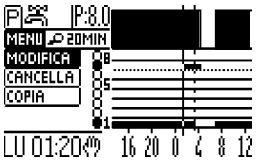
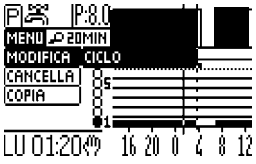
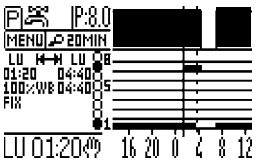
c. Change the irrigation cycle properties (PWM steering)

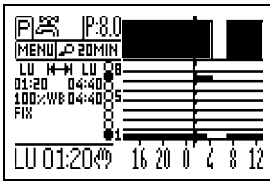
Follow the steps to change an irrigation cycle.
The electronic board must be in PROGRAM mode. To take the electronic board in PROGRAM mode select RUN mode and then PROGRAM mode.

- To take the electronic board in RUN mode press key ESC more than once.
- To take the electronic board in mode PROGRAM, from the RUN mode:
  1) press key R P_B and choose, in the displayed page, among the 3 possible options: irrigation maintenance, irrigation test, irrigation suspension.
  2) press key R P_B again and choose, in the displayed page, among the 3 possible options: irrigation maintenance, irrigation test, irrigation suspension.

Select the irrigation cycle to be changed as follows:

1. Use keys ▼ ▲ to select the desired station, highlighted by the flashing horizontal line and by the station number on the graph left (in the below pictures it is n. "7");
2. Use keys ◄ ► to move along the time axe till the cycle to modify is reached.

DISPALYED PAGE	ACTION TO TAKE	KEY TO PRESS
	PUT THE CURSOR AT THE CYCLE TO BE MODIFIED	◄ ► ▼ ▲
	OPEN THE ***SETTING MENU***	Menù
	SELECT ENTRY ***MODIFY*** FROM THE PULL DOWN MENU	▲ ▼
	OPEN ***MODIFY*** MENU	OK
	SELECT ENTRY ***CYCLE*** FROM THE PULL DOWN MENU	▲ ▼
	SELECT ***MODIFY CYCLE***	OK
	SELECT THE PARAMETER TO BE MODIFIED ON THE DISPLAY LEFT: BEGINNING DAY M → LU ⊢⊣ LU ← ENDING DAY M (NOMINAL) BEGINNING HOUR M → 01:20 04:40 ← ENDING HOUR M (NOMINAL) STATION WB M → 100%WB 04:40 ← ENDING HOUR NM (REAL) IRRIGATION TYPE M → FIX M MODIFIABLE: IT IS A PARAMETER THAT CAN BE SELECTED THROUGH THE CURSOR AND THAT CAN BE MODIFIED BY THE USER. NM NOT MODIFIABLE : IT IS A PARAMETER THAT IS AUTOMATICALLY SET BY THE ELECTRONIC BOARD, THEN IT CANNOT BE SELECTED NOR MODIFIED NOMINAL ENDING DAY AND HOUR = VALUES SET BY THE USER WHEN PROGRAMMING IN ORDER TO DEFINE THE IRRIGATION CYCLE REAL ENDING HOUR = THE REAL IRRIGATION CYCLE ENDING HOUR OBTAINED AFTER THE WB APPLICATION (IN MODE RUN THE REAL ENDING DAY IS NOT DISPLAYED, BUT THIS IS DISPLAYED IN MODE BROWSE – SEE PAR. 4B.III PAG.20)	◄ ► ▼ ▲
	CHANGE THE SELECTED PARAMETER (INCREASE/DECREASE THE SELECTED VALUE)	+ ON − OFF
	WHEN THE FIELD *STATION WB* OR *TYPE OF IRRIGATION* IS SELECTED, THE CHANGES CAN BE DONE ENTERING THE PARAMETER SETTING PAGE (WB OR TYPE OF IRRIGATION)	Menù

	SAVE THE CYCLE (IF KEY ESC IS PRESSED INSTEAD OF KEY OK THE INITIAL DISPLAY COMES BACK WITHOUT SAVING THE CREATED CYCLE)	OK

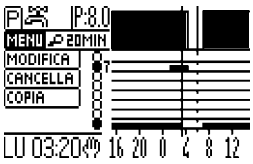
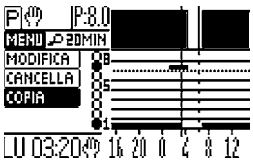
d. Copy of an irrigation cycle starting from a determined beginning hour

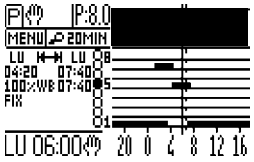
Follow the steps to copy an irrigation cycle.
The electronic board must be in PROGRAM mode. To take the electronic board in PROGRAM mode select RUN mode and then PROGRAM mode.

- To take the electronic board in RUN mode press key ESC more than once.
- To take the electronic board in mode PROGRAM, from the RUN mode:
  1) press key and choose, in the displayed page, among the 3 possible options: irrigation maintenance, irrigation test, irrigation suspension.
  2) press key again and choose, in the displayed page, among the 3 possible options: irrigation maintenance, irrigation test, irrigation suspension.

Select the irrigation cycle to be changed as follows:

3. Use keys ▼ ▲ to select the desired station, highlighted by the flashing horizontal line and by the station number on the graph left (in the below pictures it is n. "7");
4. Use keys ◄ ► to move along the time axe till the cycle to modify is reached.

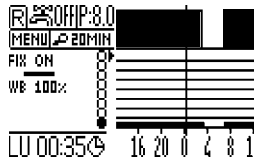
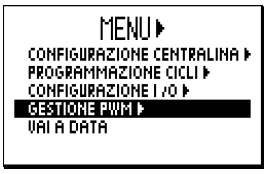
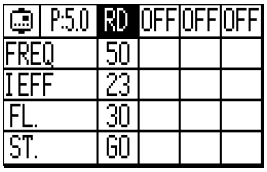
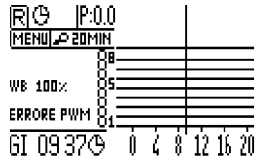
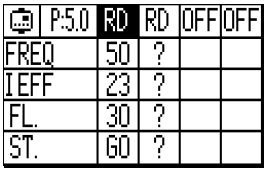
DISPALYED PAGE	ACTION TO TAKE	KEY TO PRESS
	PUT THE CURSOR AT THE CYCLE TO BE MODIFIED	◄ ► ▼ ▲
	OPEN THE ***SETTING MENU***	Menù
	SELECT ***COPY*** FROM THE PULL DOWN MENU	▲ ▼
	OPEN THE ***COPY*** MENU	OK
	SELECT ***CYCLE*** FROM THE PULL DOWN MENU	▲ ▼
	MAKE THE ***COPY*** OF THE SELECTED CYCLE	OK
	PUT THE CURSOR AT THE STATION AND BEGINNING HOUR THAT THE CYCLE NEED TO BE COPIED (STATION 5 – BEGINNING HOUR MONDAY 06:00)	◄ ► ▼ ▲
	ENTER THE ***SETTING MENU***	Menù
	SELECT ENTRY ***PASTE***	▲ ▼
	ENTER THE ***PASTE MENU***	OK
	SELECT ENTRY ***CYCLE***	▲ ▼

	SELECT ***PASTE CYCLE***	OK
	THE PASTED CYCLE PROPERTIES CAN BE NOW MODIFIED (SEE PAR.C PAGE 69)	◄ ► ▼ ▲ + ON − OFF
	SAVE THE CYCLE (IF KEY ESC IS PRESSED INSTEAD OF KEY OK THE INITIAL DISPLAY COMES BACK WITHOUT SAVING THE CREATED CYCLE)	OK

e. Set the electronic board to work with a PWM

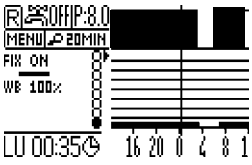
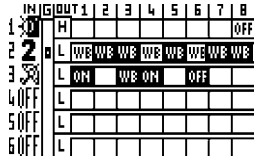
Set the PWM device in mode ***electronic board slave*** (see the PWM user's handbook) and connect it to the electronic board (see the electronic board "*Fitting up handbook*")
The communication must now be activated through the electronic board. Follow the steps to activate the communication, starting from mode RUN.

To take the electronic board in RUN mode press key ESC more than once.

DISPALYED PAGE	ACTION TO TAKE	KEY TO PRESS
	ENTER THE RUN-BROWSE MODES MENU	
	SELECT ENTRY ***PWM MANAGEMENT***	
	OPEN THE ***PWM MANAGEMENT*** MENU	
	SELECT ENTRY *PWM IRRIGATION SETTING*	
	OPEN THE *PWM IRRIGATION SETTING* MENU	
	SELECT THE COLUMN OF THE PWM DEVICE TO BE ACTIVATED	
	SET THE PWM DEVICE AS RD (READY)	
 	IF THERE IS A COMMUNICATION LACK BETWEEN THE ELCTRONIC BOARD AND THE PWM DEVICE, IT IS SIGNALED BY BOTH THE DEVICES: ▪ THE DEVICE MAINTAINS THE LAST SET PRESSURE VALUE AND SIGNALS THE LACK OF COMMUNICATION BY THE FLASHING WRITING *STANDBY* OR *GO* ON THE DISPLAY ▪ THE IRRIGATION BOARD SIGNALS THE LACK OF COMMUNICATION BY THE WRITING *PWM ERROR* ON THE DISPLAY OR WITH A "?" IN THE SETTING PAGE.	

f. Managing and setting the sensors

To set the sensors go to the sensors setting page. Follow the steps starting from mode RUN.
To take the electronic board in RUN mode press key ESC more than once.

DISPALYED PAGE	ACTION TO TAKE	KEY TO PRESS
	ENTER THE RUN-BROWSE MODES MENU	Menu
	SELECT ENTRY ***SETTING***	▲ ▼
	OPEN THE THE ***SETTING*** MENU	OK
	SELECT ENTRY ***INPUT SETTING***	▲ ▼
	OPEN THE ***INPUT SETTING*** MENU	OK
	MOVE OVER THE CHART REMEMBERING THAT VERTICAL MOVEMENTS ARE POSSIBLE ONLY ALONG COLUMN "IN", WHILE HORIZONTAL MOVEMENTS ARE ALWAYS ALLOWED.	◄ ► ▼ ▲
	MAKE YOUR CHOICES IN THE SELECTED BOXES (FOR FURTHER DETAILS SEE *CHAP.8 PAGE 44*)	+ ON – OFF

INFORMATION ON THE SENSORS SETTING CHART:
3 SENSORS ARE ACTIVE (1-2-3); THE SIGNAL COMING FROM SENSOR 1 SHOWS THE SYMBOL; THE SIGNAL COMING FROM SENSOR 2 SHOWS 2 WHILE SENSOR 3 SHOWS . MOREOVER SENSOR 1 SENDS ITS SIGNAL AT THE CONTACT CLOSING, WHILE SENSORS 2 AND 3 AT THE OPENING CONTACT (LETTERS H AND L IN COLUMN OUT).
SENSOR 1 INTERFERE DISCONECTING STATION 8; SENSOR 2 (BLACK RIGHT-ANGLED IN COLUMN G – GLOBAL = WORKS OVER ALL THE STATIONS) MODIFIES THE WB VALUE OF ALL THE STATIONS, WHILE SENSOR 3 ACTIVATES STATIONS 1 AND 4, CHANGES THE WB OVER STATION 3 AND SICONNETS STATION 6.
SOME OF THE ACTIONS ARE HLIGHLIGHTED WITH A LIGHT WRITING ON A BLACK BACKGROUND: THIS MEANS THAT SOME SIGNALS ARE ARRIVING FROM THE RELEVANT SENSORS AND THAT SOME ACTIONS HAVE BEEN TAKEN:
SENSOR 1:
WOULD SUSPEND THE STATION 8 IRRIGATION, BUT THERE ISN'T ANY CYCLE .
SENSOR 2:
WOULD APPLY THE WB OVER ALL THE STATIONS, BUT IT CAN DO IT ONLY OVER STATIONS 2, 3, 5, 7 AND 8 BECAUSE STATIONS 1-4-6 ARE UNDER "MAJOR PRIORITY ACTIONS"
SENSOR 3:
ACTIVATES STATIONS 1 AND 4 INDEPENDENTLY FROM THE PRESENCE OF A WORKING IRRIGATION CYCLE OR NOT; IT SUSPENDS THE STATION 6 IRRIGATION (THERE WAS A WORKING IRRIGATION CYCLE – PRESENCE OF A CYCLE); IT APPLIES THE WB TO STATION 3 (THERE IS A WORKING IRRIGATION CYCLE – PRESENCE OF A CYCLE);

FOR FURTHER DETAILS ABOUT THE SENSORS MANAGEMENT SEE CHAP.8 PAGE 44.

12 Problems and solutions

Cause: FLAT BATTERIES

THE ELECTRONIC BOARD IS NOT CONNECTED TO THE POWER SUPPLY AND THE BUFFER BATTERY HAS NO LONGER KEPT IN MEMORY THE SET TIME.

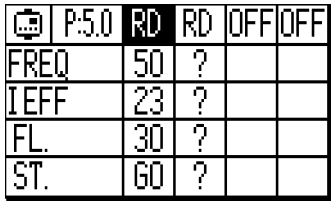
Actions to be taken:

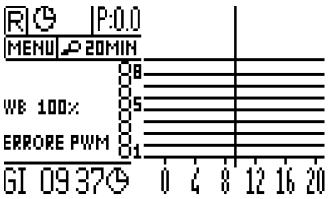
- RESET THE TIME. THE ELECTRONIC BOARD MAY SWITCH ON AGAIN, BUT IF THIS IS NOT THE FIRST SWITHCHING ON, THE BATTERY NEEDS TO BE CHANGED AS SOON AS POSSIBLE TO GRANT THE TIME MEMORY IN CASE THE POWER SUPPLY IS OFF.

Cause: INTERNAL ERROR

Actions to be taken:

- RESET THE TIME, EVENTUALLY REPEAT THE ACTION MORE THAN ONCE.
- IF THE PROBLEM IS NOT SOLVED, SUSPEND THE POWER SUPPLY FOR ALMOST 1 MINUTE AND THEN CONNECT THE ELECTRONIC BOARD TO THE POWER SUPPLY AGAIN
- IF THE PROBLEM IS NOT SOLVED, GET IN TOUCH WITH THE RESELLER





Cause: NO COMMUNICATION WITH THE PWM

THE ELECTRONIC BOARD HAS LOST THE COMMUNICATION WITH THE PWM. ACCORDING TO THE ELECTRONIC BOARD SETTING, THE PWM PRESSURE SET-POINT CORRESPONDS TO THE P_{ON} OR P_{OFF} VALUES (IF IT HAS NEVER BEEN SET THE PWM SET-POINT VALUE IS THE DEFAULT ONE).

Actions to be taken:

- DICONNECT THE COMMUNICATION IF:
  1. NO PWM DEVICES HAVE BEEN FITTED UP;
  2. THE FITTED UP DEVICES ARE NOT ITEMS PWM 230 AND PWM 400 (WACS SYSTEM PRODUCTS)

- IF ITEMS PWM 230 AND PWM 400 HAVE BEEN FITTED UP, BE SURE THAT:
  1. THE PWM IS CORRECTLY CONNECTED TO THE POWER SUPPLY;
  2. THE CABLE BETWEEN THE PWM AND THE ELECTRONIC BOARD IS CORRECTLY CONNECTED (SEE THE "*FITTING UP HANDBOOK*")
  3. THE CONNECTING CABLE IS NOT CLOSE TO STRONG ELECTROMAGNETIC SOURCES

Notes:

Notes: