W09D

DIFFERENTIAL CONTROLLER

OPERATING INSTRUCTIONS

17/07 - code: ISTR_M_W09D_E_02_--

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PREFACE

⚠ This manual contains the information necessary for the product to be installed correctly and also instructions for its maintenance and use; we therefore recommend that the utmost attention is paid to the following instructions and to save it.

Ascon Tecnologic S.r.l. reserves the right to make any formal or functional changes at any moment and without any notice.

Ascon Tecnologic S.r.l. and its legal representatives do not assume any responsibility for any damage to people, things or animals deriving from violation, wrong or improper use or in any case not in compliance with the instrument features.

⚠ Whenever a failure or a malfunction of the device may cause dangerous situations for persons, thing or animals, please remember that the plant has to be equipped with additional electromechanical devices which will guarantee safety.

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1. INSTRUMENT DESCRIPTION

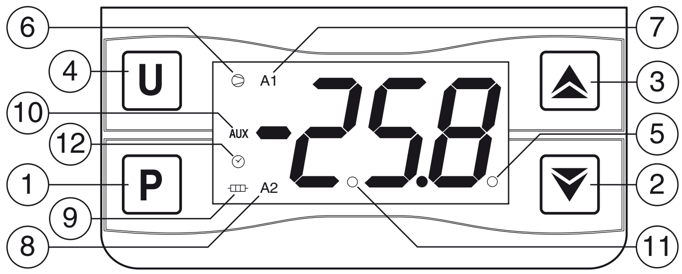
1.1 General description

The **W09D** is an microprocessor-based electronic differential temperature-controller and is typically used to control thermal solar panel plants, but can also be used in all applications that require a control function for temperature differences between two different environments as for example fluid coolers (chiller), natural climatization systems for environments by air recirculation and many other applications.
The instrument has up to 3 relay outputs, 3 inputs for PTC, NTC or Pt100 temperature probes and a digital input (as an alternative of Pr3 input), that can all be configured.

The instrument can be equipped with an internal buzzer to acoustically report the alarms and an internal clock that allows programming of various events at scheduled times.

The 3 outputs can be used to manage the temperature control device according to the differential value, to manage the temperature control device by an absolute value (auxiliary controller), to operate according to the programmable alarm thresholds and related to the probes measurements (**AL1**, **AL2**) or still to operate as auxiliary outputs in function of manual controls or automatically at programmed times.

1.2 Front panel pescription



1. [P]: Used for setting the Set point (press and release) and for programming the function parameters (hold pressed for 5 s). In programming mode is used to enter in parameters edit mode and confirm the values. In programming mode can be used together with key [▲] to change parameters level. Pressed together with the key [▲] for 5 s allows the keyboard unlock.
2. [▼]: In programming mode is used for decreasing the values to be set and for selecting the parameters. If programmed using the t.Fb parameter, pressed and hold for 1 s in normal operation mode, turns ON/OFF the Auxiliary output or other functions.
3. [▲]: In programming mode is used for increasing the values to be set and for selecting the parameters. In programming mode can be used together with key [P] to change parameters level. Pressed together with the key [P] for 5 s allows the keyboard unlock. If programmed using the t.FA parameter, pressed and hold for 1 s in normal operation mode, turns ON/OFF the differential control output or other functions.
4. [U]: Pressed and released causes the display of the instrument variables (measured temperatures etc.). In programming mode can be used to return in normal mode (pressed for 2 s). If programmed using the t.UF parameter, pressed and hold for 1 s in normal operation mode, turns ON/OFF (Stand by) the control output or other functions.
5. **LED SET**: In normal mode it flashes when a key is pressed. In programming mode is used to report the parameter programming level.
6. LED ⊖: Indicates the differential control output status: active (**ON**), not active (**OFF**) or inhibited (**flashing**).
7. LED **A1**: Indicates the AL1 alarm status: active (**ON**), not active (**OFF**).
8. LED **A2**: Indicates the AL2 alarm status: active (**ON**), not active (**OFF**).
9. LED ⊞ : Indicates the differential control output status: active (**ON**), not active (**OFF**) or inhibited (**flashing**).
10. LED AUX: Indicates the Auxiliary output status: active (**ON**), not active (**OFF**) or inhibited (**flashing**).
11. LED Stand-By: When the instrument is placed in stand-by mode remains the only LED **ON**.
12. LED ⊘: Reports the internal Clock status (**ON**).
    When lit, indicates that, after the clock has been enabled, the power supply has always been supplied to the instrument and therefore the current time is presumably correct.
    When blinks is reporting that, after the clock has been enabled, the power had an interruption and therefore the current time may also be incorrect.

2. PROGRAMMING

2.1 Fast Set point programming

The normal mode to program the Set Points (differental and auxiliary) is done by momentarily pressing the [P] key, however, through the t.Ed parameter it is possible to determine if and which Set Points can be set using the [P] key shortcut.

The t.Ed parameter can assume a value between 0... 3:

oF No Set Points can be set using the [P] key shortcut. The fast [P] key pressure has no effetct.

1 Only the SPd (Differential SP) can be set using the [P] key shortcut;

2 Only the SPA (Auxiliary SP) can be set using the [P] key shortcut;

3 Both SPd and SPA can be set using the [P] key shortcut.

For example, in the case the parameter t.Ed = **1** or **3**, the changing procedure is as follows:

Press and release the [P] key the display shows SPd alternated to the programmed value. To change it press the [▲] key to increase the value or [▼] to decrease it.

These keys increase or decrease the value one digit at a time, but if the button is pressed for more than one second the value increase or decreases rapidly and after two seconds the speed increases even more in order to quickly reach the desired value.

If only SPd is present (t.Ed = **1**), once the desired value is set, press the [P] key to exit the fast programming mode.

If also the Auxiliary Set Point (t.Ed = **3**) can be set, pressing and releasing again the [P] button the display shows SPA alternated to its programmed value. To change the value use the [▲] and [▼] keys as for the SPd Set Point value. Once the desired value is correctly set, press the [P] key to exit the fast set point change.

To exit the fast Setpoint programming mode push the [P] key after the last Set Point has been displayed or pressing no buttons for about 10 s, after which the display returns to normal operation.

The SPd Set Point can be set to a value that is between the value programmed for parameter S.Ld and the one of parameter SHd while the SPA Set Point can be set to a value that is between the value programmed for parameter S.LS and the one of parameter S.HS.

2.2 Standard mode parameters programming

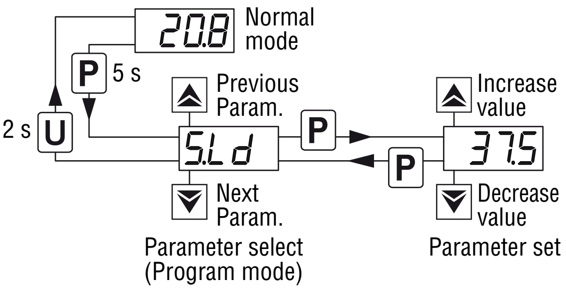
To access the instrument function parameters when password protection is disabled, press the key [P] and keep it pressed for about 5 seconds, after which the display shows the code that identifies the first programmable parameter.

Use the [▲]/[▼] keys to select the parameter to be edited, then access it by pressing the [P] key, press the [P] key, the parameter code and its setting will be displayed alternately, the parameter value can be modified with the [▲]/[▼] keys.

Once the desired value has been set, press the key [P] again: the new value is stored and the display return showing only the code of the selected parameter.

Pressing the ▲ and ▼ keys, it is possible to select another parameter and change it as described.

To exit the programming mode, press no keys for about 30 s or keep the U key pressed for 2 s.



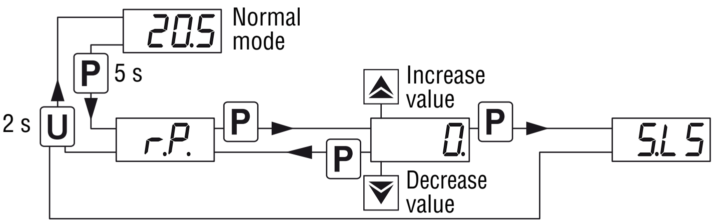
2.3 Parameter protection using the password

The instrument has a parameter protection function using a password that can be personalised, through the t.PP parameter. To protect the parameters, set the desired password number in the parameter t.PP.

When the protection is active, press the P key to access the parameters and keep it pressed for about 5 s, after which the display shows r.P, now press the P key again, the display shows 0, now using the ▲ and ▼ keys, set the programmed password number and press the key P again.

If the password is correct the instrument displays the code of the first parameter and it will be possible to program the instrument in the same way described in the previous section.

The password protection can be disabled by setting the parameter t.PP = **oF**.



Note: If the Password gets lost, just switch **OFF** and **ON** the instrument, push P key during the initial test keeping it pressed for 5 s. In this way it is possible to access the pprotected parameters, in this way the user can verify and modify the t.PP parameter.

2.4 Customized mode parameter programming (parameters programming levels)

The password hides all the configuration parameters behind a factory set password to avoid unwanted changes to the controller parameters. To make a parameter accessible without having to enter the password when t.PP password protection is active, use the procedure that follows:

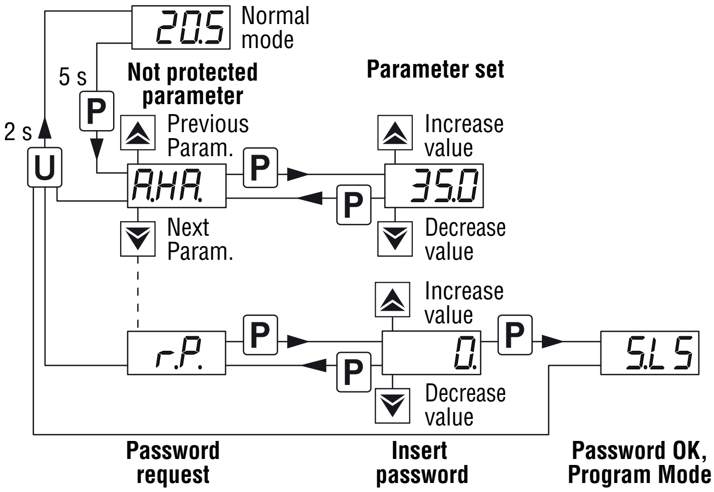
Enter the program mode using the t.PP Password and select the parameter that must be user accessible (no password protection).

Once a parameter is selected, if the **SET LED flashes** the parameter is programmable by entering the password (is "**protected**"). If the **SET LED is steady ON** the parameter is programmable without password (is "**unprotected**").

To change the parameter visibility, press the P key and keeping it pressed also press the ▲ button.

The **SET LED** changes its state indicating the new level of parameter accessibility (**ON** = not protected; **flashing** = password protected).

When the password is enabled and some parameters are not protected, accessing the the programming mode the display first shows the not protected parameters, then the r.P parameter (through which will be possible to access the "protected" parameters).



2.5 Reset parameters to default value

The instrument allows the reset of all parameters to those values programmed in factory as default. To restore the default parameters value set value **-48** at r.P password request.

Therefore, in order to reset all parameteres to the default value, enable the Password using the t.PP parameter so that the r.P setting is requested, at this point insert **-48** instead of the programmed access password.

Once confirmed the password with the P key the display shows "- - -" for 2 s and the instrument resets all the parameters.

2.6 Keyboard lock function

On the instrument it is possible to completely lock the keyboard.

This function is useful when the controller is in an accessible area and the changes must be avoided.

To activate the keyboard lock it is enough program the parameter t.Lo to a value different from oF.

The t.Lo value is the keys inactivity time after which the keyboard will be automatically locked.

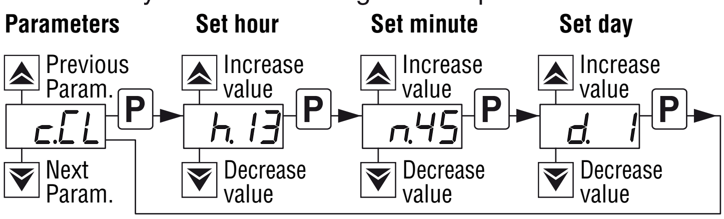
Therefore, pressing no buttons for the time set at t.Lo, the instrument automatically disable the normal functions of the keys.

When the keyboard is locked, if any of the key is pressed, the display showss Ln to indicate that the lock is active.

To unlock the keyboard it is enough to contemporarily push P and ▲ keys and keep them pushed for 5 s, after which the label LF appears on the display and all the key functions will be available again.

2.7 Setting the current time and date

If the instrument is supplied with the internal **Real Time Clock**, this must be enabled and programmed to the current time and day of the week using the C.CL parameter.



After selecting the c.CL parameter, press the P key repeatedly to cycle through the following in the order shown:
h. + 2 digits for the hour of day in 24h format (e.g. h. 14);
n. + 2 digits for the minutes (e.g. n.52);
d. + 1 digit for the day of the week (e.g. d. 1).
The days are numbered as follows:
d. 1 Monday;
d. 2 Tuesday;
d. 3 Wednesday;
d. 4 Thursday;
d. 5 Friday;
d. 6 Saturday;
d. 7 Sunday;
oF Clock to be disabled.
When the internal clock is running the ⏲ LED is lit. When ⏲ is **steady ON** means that, since the time the clock was enabled, the power supply to the instrument has never failed and therefore the **current time is presumably correct**.

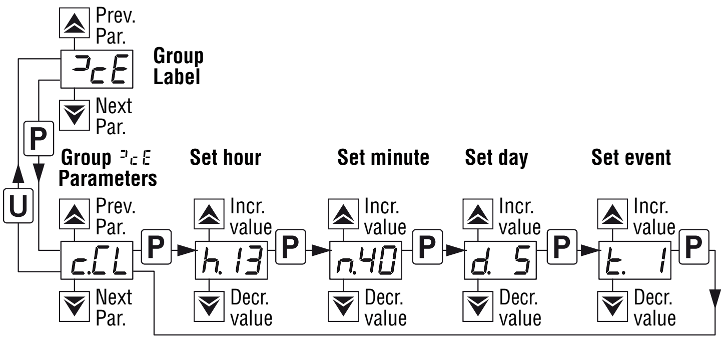
If ⏲ flashes the power supply has certainly failed and therefore the **current time may not be correct**.

In this condition, pressing any key cancels the signal and the ⏲ LED returns to solid (**ON** and **not flashing**).

2.8 Programming events at set times

The events can be programmed through the parameters contained in the group PcE (appears enabling the clock).

As for the current time setting, the parameters concerning the time-related functions require multiple values to be entered, the programming of these parameters occurs as follows.



After selecting the PcE group, press the P key to access the group parameters, then select the desired parameter and press the P key several times will appear in the order:
h. + 2 digits for the hour of day in 24h format (e.g. h. 13);
n. + 2 digits for the minutes (e.g. n.40);
d. + 1 digit for the day of the week (e.g. d.5);
t. + 2 digits for type of event you want to run at the programmed time (e.g. t. 1).
Days are considered:
d. 1 Monday;
d. 2 Tuesday;
d. 3 Wednesday;
d. 4 Thursday;
d. 5 Friday;
d. 6 Saturday;
d. 7 Sunday;
d. 8 Every day;
d. 9 Monday, Tuesday, Wednesday, Thursday, Friday;
d. 10 Monday, Tuesday, Wednesday, Thursday, Friday, Saturday;
d. 11 Saturday and Sunday;
d.oF No day (event disabled).
For the types of programmable events, see the relevant paragraph.

3. USE WARNINGS

3.1 Admitted use

⚠ The instrument has been projected and manufactured as a measuring and control device to be used according to EN61010-1 at altitudes operation below 2000 m.

Using the instrument for applications not expressly permitted by the above mentioned rule must adopt all the necessary protective measures.

The instrument **must not be used** in dangerous environments (flammable or explosive) without adequate protections.

⚠ The installer must ensure that the EMC rules are respected, also after the instrument installation, if necessary using proper filters.

4. INSTALLATION WARNINGS

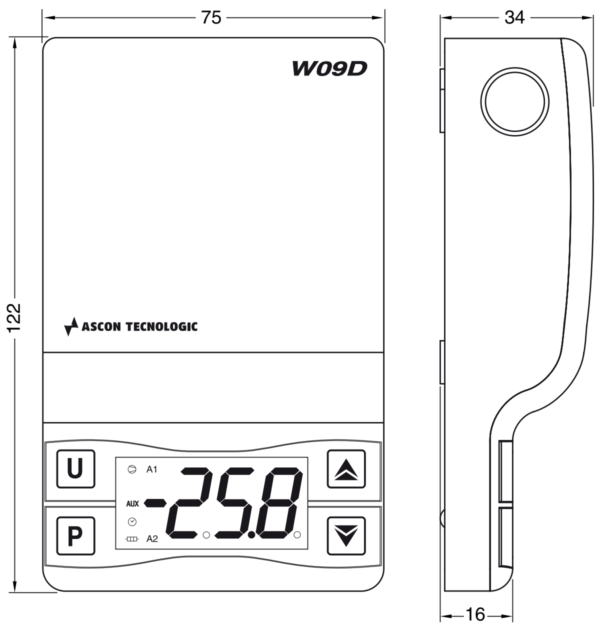
4.1 Mechanical mounting

The instrument, in case 75 x 122 mm, is designed for independently wall mounting by screws.

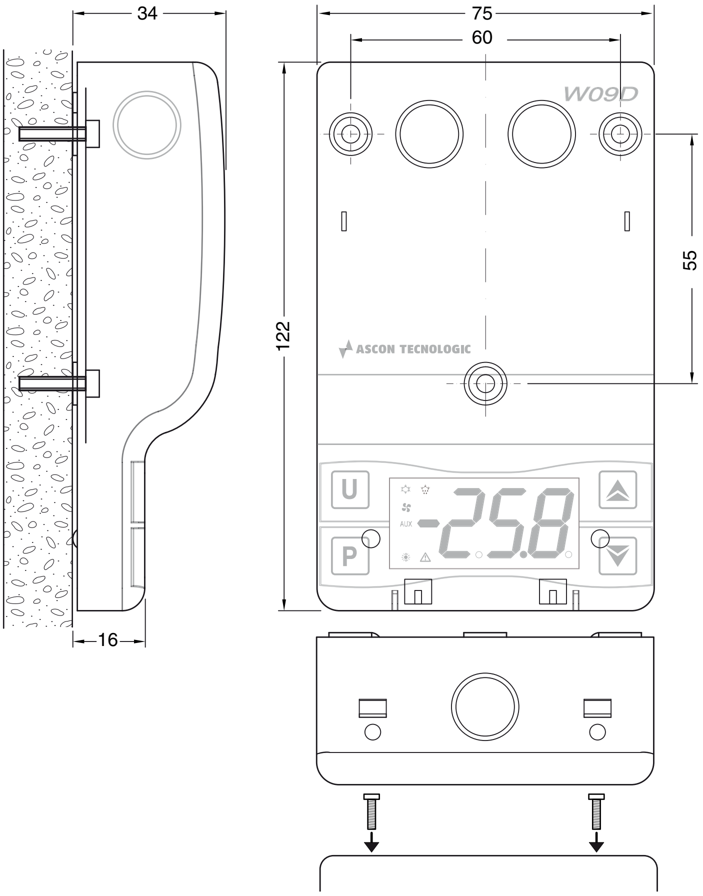
Once installed the instrument remember to close the frontal part and fixing it with the 2 provided screws so that the opening is possible only using a tool.

– Avoid installing the instrument in places where high humidity can generate condensation or where dirt could lead to the introduction of conductive substances into the instrument.
– Ensure the adequate ventilation to the instrument and avoid the installation within boxes where are placed devices which may overheat or have, as a consequence, the instrument functioning at temperature higher than allowed and declared.
– Connect the instrument as far as possible from source of electromagnetic disturbances so as motors, power relays, relays, electrovalves, etc..

4.1.1 Outline dimensions



4.1.2 Mounting dimensions



4.2 Electrical connections

Carry out the electrical wiring by connecting only one wire to each terminal, according to the following diagram, checking that the power supply is the same as that indicated on the instrument and that the load current absorption is no higher than the maximum electricity current permitted.

As the instrument is built-in equipment with permanent connection inside housing, it is not equipped with either switches or internal devices to protect against current overloads: the installation will include an overload protection and a two-phase circuit-breaker, placed as near as possible to the instrument and located in a position that can easily be reached by the user and marked as **instrument disconnecting device** which interrupts the power supply to the equipment.

Further recommendations:

– The supply of all the electrical circuits connected to the instrument must be properly protected using devices (ex. fuses) proportionate to the circulating currents;

– Use cables with proper insulation, according to the working voltages and temperatures;

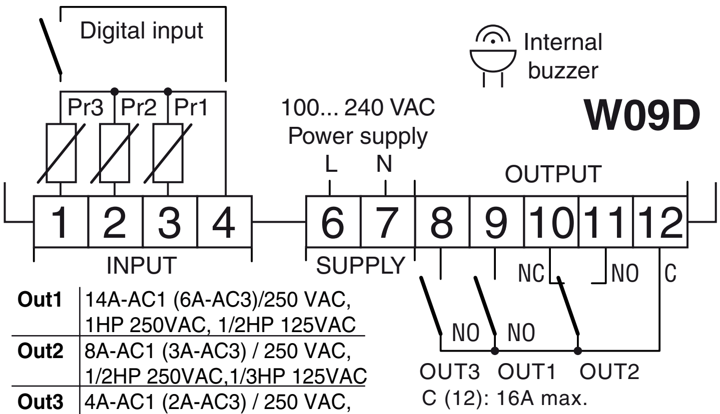
– Make sure that the input sensor cables are kept separate from line voltage wiring in order to avoid induction of electromagnetic disturbances;

– If some cables are shielded, the protection shield must be connected to ground at only one side;

– Whether the instrument is a12/12 ÷ 24 V supply version (Order Code **A** = F/G), it is recommended to use an external Power supply/transformer with a Class II Insulation and to use a power supply/transformer for each instrument because there is no insulation between supply and input.

Before connecting the outputs to the actuators we strongly recommend that a check should be made that the parameters are those desired and that the application functions correctly so as to avoid malfunctioning that may cause irregularities in the plant that could cause damage to people, things or animals.

4.2.1 Electrical wiring diagram



Out1	14A-AC1 (6A-AC3)/250 VAC, 1HP 250VAC, 1/2HP 125VAC
Out2	8A-AC1 (3A-AC3) / 250 VAC, 1/2HP 250VAC,1/3HP 125VAC
Out3	4A-AC1 (2A-AC3) / 250 VAC, 1/8HP 250/125 VAC

Common (C): 16 A max.

5. FUNCTIONS

5.1 ON/Stand-by function

Once powered up the instrument can assume 2 different conditions:

ON Means that the controller uses the control functions.

STAND-BY
Means that the controller uses no control function and the display is turned OFF except for the Stand-by LED.

The transition between Standby and ON is equivalent to power ON the instrument providing the electrical power.

In case of power failure, the system always sets itself in the condition it was in before the black-out.

– The ON/Stand-by function can be selected using the key **U** if the parameter t.UF = **1**.

– By programming a programmable event through the clock (if present).

5.2 Measure and display configuration

With the i.SE parameter is possible to select the type of probe that is to be used: PTC thermistors KTY81-121 (**Pt**), NTC 103AT-2 (**nt**) or Pt1000 (**P1**).

With the i.uP parameter is possible to select the temperature engineering unit and the desired measure resolution (**C0** = °C/1°; **C1** = °C/0.1°; **F0** = °F/1°; **F1** = °F/0.1°).

The instrument allows the measure calibration, which can be used to recalibrate the instrument according to application needs, The calibration is made by using parameters i.C1 (input Pr1), i.C2 (input Pr2) and i.C3 (Pr3 input).

Parameter i.P3 allows to select the instrument usage of Pr3 measure as:

Au Auxiliary probe;

DG Digital Input (see the Digital input functions).

If **Pr3** input is not used to set the parameter i.P3 = **oF**.

Using i.Ft parameter can be set a software filter for the measuring the input values in order to decrease the sensibility to rapid temperature changes (increasing the time). Through the i.dS parameter is possible to set the value normally displayed:

- P 1 **Pr1** probe measurement;
- P2 **Pr2** probe measurement;
- P3 **Pr3** probe measurement;
- P 1.2 The **difference** between the **temperatures of probes Pr1 - Pr2**;
- SPd The differential setting point;
- SPA The Auxiliary Adjustment Set Point;
- oF **OFF** if the numerical display must be switched OFF.

Regardless of what is set in parameter i.dS the user can view, sequentially, all the measurement variables by pressing and releasing the U key.

The display alternately shows the label that identifies the variable and its value. The variables are:

- Pr 1 Probe 1 measurement;
- Pr2 Probe 2 measurement;
- P 1.2 Difference between Pr1 - Pr2;
- Pr3 Probe 3 measurement (ON/OFF if Pr3 is a Digital Input).

If the Clock is enabled:

- h. The actual hour;
- n. The actual minutes;
- d. The actual day;

The instrument automatically exits the variables display mode about 15 seconds after the last pressure on the U key.

5.3 Digital input configuration

As an alternative to the **Pr3** measurement input the instrument can have a digital input for free of voltage contacts.

In order to use this digital input, set: i.P3 = **dG**.

The digital input function is defined using the i.F i parameter and the action is delayed for the time programmed with parameter i.t i. The i.F i parameter can be configured for the following functions:

0. Digital input not active;

1. **AL1** Alarm signalling with **NO** contact.
When AL1 is triggered (the input contact is closed and after the time indicated on the i.t i parameter) on the display are shown alternately the label **AL** and the variable set at i.dS parameter while the instrument switches the alarm output AL1 (if configured).

2. AL2 Alarm signalling with **NO** contact.
When AL2 is triggered on the display are shown alternately the label **AL** and the variable set at i.dS parameter while the instrument switches the alarm output AL2 (if configured).

3. AL1 and AL2 Alarms signalling with **NO** contact.
When the alarm is triggered on the display are shown alternately the label **AL** and the variable set at i.dS parameter while the instrument switches both AL1 and AL2 alarm outputs (if configured).

4. AL1 Alarm signalling and **rd** + **rA** control outputs disabling with NO contact.
When the alarm is triggered, the instrument disables the control outputs (**rd** and **rA**), on the display are shown alternately the label **AL** and the variable set at i.dS parameter while the instrument switches the AL1 alarm output (if configured).

5. AL2 Alarm signalling and **rd** + **rA** control outputs disabling with NO contact.
When the alarm is triggered, the instrument disables the control outputs (**rd** and **rA**), on the display are shown alternately the label **AL** and the variable set at i.dS parameter while the instrument switches the AL2 alarm output (if configured).

6. AL1 and AL2 Alarms signalling and **rd** + **rA** control outputs disabling with NO contact.
When the alarm is triggered, the instrument disables the control outputs (**rd** and **rA**), on the display are shown alternately the label **AL** and the variable set at i.dS parameter while the instrument switches both the AL1 and AL2 alarm outputs (if configured).

-1, **-2**, **-3**, etc. - Features identical to the above but obtained through a NC contact and a reversed logic operation.

When Pr3 is configured as digital input, it is possible to verify its status in variables display mode using the U key or configuring the normal display with parameter i.dS for the Pr3 input.

The display shows oF if the external contact of the digital input is open and on when closed.rd

5.4 Output and Buzzer Configuration

The instrument outputs can be configured by the relative parameters o.o 1, o.o2 and o.o3.

The outputs can be configured for the following functions:

- rd To control the Differential control device;
- rA To control the Auxiliary control device;
- A 1 To control a device activated by AL1 alarm through a Normally Open contact that is closed in alarm status;
- A2 To control a device activated by AL2 alarm through a Normally Open contact that is closed in alarm status;
- -A 1 To control a device activated by AL1 alarm through a Normally Closed contact that is open in alarm status;
- -A2 To control a device activated by AL2 alarm through a Normally Closed contact that is open in alarm status;
- Au To control an Auxiliary Output activated manually using a key or by the programmable events at set time;
- At To control a Silenceable alarm (like the internal buzzer) through an NO contact that is closed in alarm status;
- oF No function (output disabled)

The internal buzzer (if present) can be configured by parameter o.bu for the following functions:

- oF Buzzer always disable;
- 1 Buzzer signal active alarms only;
- 2 Buzzer signal key pressed only (no alarm);
- 3 Buzzer signal active alarms and key pressed.

5.5 Differential and auxiliary temperature controller

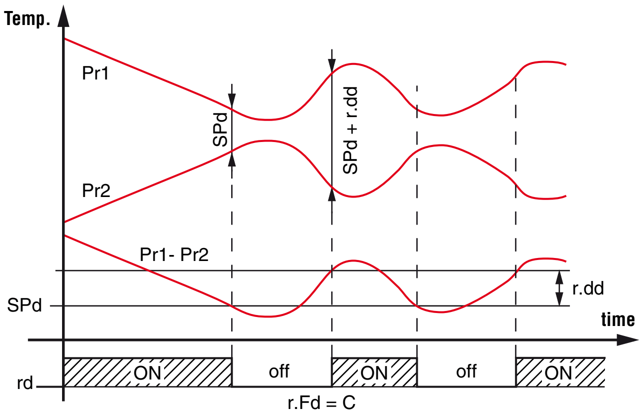
The instrument Differential Control mode is **ON/OFF** and acts on the **output** configured as **rd** depending on:

– The temperature difference between **Pr1** and **Pr2** probes,
– SPd Set Point,
– The actuator r.dd hysteresis;
– The r.Fd operating mode.

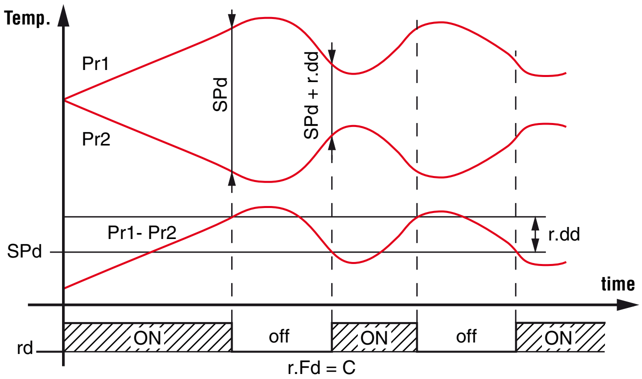
Regarding the operating mode programmed at parameter r.Fd, the hysteresis is automatically considered by the controller with positive values for a r.Fd = **C** control or with negative values for the control r.Fd = **H**.

The controller will modify the power of the **rd** output in order to maintain the SPd value equal to the Pr1 - Pr2 difference.

The r.Fd = **C** operating mode is used for those applications where the actuator action decreases the Pr1 - Pr2 difference (thus contrasting the Pr1 - Pr2 difference that naturally tends to increase).



The r.Fd = **H** mode, however, is used for applications where the actuator action increases the Pr1 - Pr2 difference (thus contrasting the Pr1 - Pr2 difference that naturally tends to decrease).



The Auxiliary control mode is also **ON/OFF** and acts on the **output** configured as **rA** depending on:

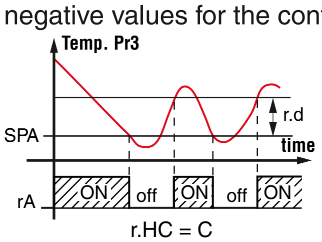
– The temperature of **Pr3** probe;

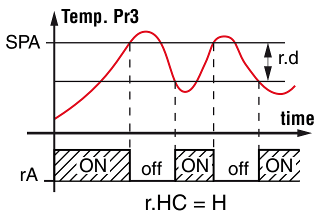
– SPA Set Point;

– The r.d hysteresis;

– The r.HC operating mode.

Regarding the operating mode programmed at parameter r.HC, the hysteresis is automatically considered by the controller with positive values for a r.HC = **C** control or with negative values for the control r.HC = **H.**





If appropriately programmed, the controller functions can be manually enabled/disabled using the ▲ or ▼ keys or automatically through the programmable events at set times.

While the controller is enabled/disabled, the display shows for a few seconds r.on or r.oF.

During normal operation, if the controller is disabled and the output should turn ON, the LED related to the disabled controller function will blink to indicate its inhibition.

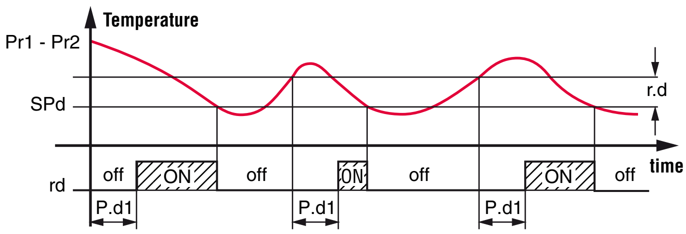
5.6 Control outputs delay function and Power ON delay

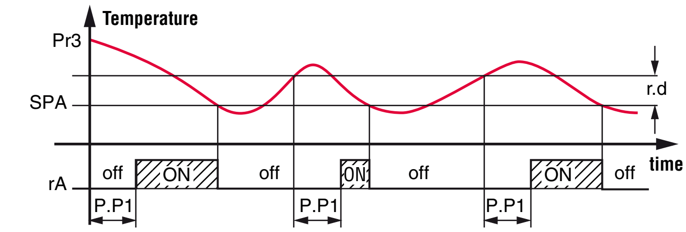
As the normally-used actuators are pumps or compressors, the instrument is equipped with time control functions to drive the control outputs in order to avoid frequent and repeated starts that can cause overheating of the actuators. These functions provide 2 time-controlled checks on the power ON of the **rd** output and 2 similar time controls on the **rA** output associated with the request for differential and auxiliary temperature controllers.

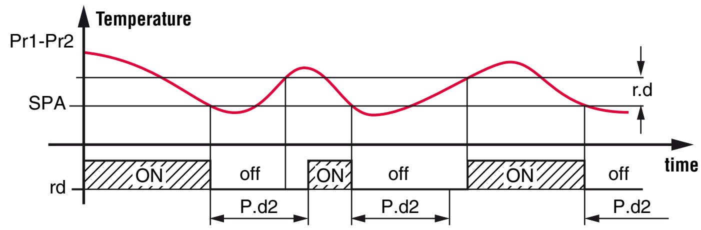
The protection features consist of preventing an output activation during the count of the protection times set and that any activation occurs only at the expiration of all protection times.

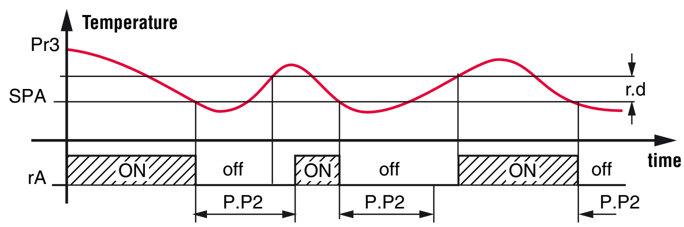
The first type of control consists of a delay in output **rd** activation as set at parameter P.d1 and a similar delay in the activation of output **rA** according to the parameter P.P1 setting (power ON delay).

The second control inhibits the activation of **rd** output if, since the output has been switched OFF, the time set at parameter P.d2 has not elapsed and a similar delay to activate **rA** output according to the parameter P.P2 setting (delay after power-OFF or minimum power-OFF time).









Example with cooling function

During all the inhibitory steps caused by the protections, the LED that reports the control outputs activation (**rd** or **rA**) flashes.

It is also possible to prevent the outputs activation at power ON for the time set at parameter P.od. During the power ON delay phase, the display shows the label od or alternated to the normal display.

The described timer functions are deactivated by programming their parameters to **oF**.

5.7 Temperature Alarm functions

Some temperature conditions on probes Pr1, Pr2 and Pr3 (if used) can occur during the operation in plants with differential control, these cause the instrument tio operate in a particular way.

For these reasons, the instrument has 2 absolute (max. and min.) alarm thresholds related to each of the probes and some parameters through which it is possible to determine the behavior of the outputs when these alarms are activated.

When the temperature alarms are triggered, the instrument shows the normal display alternated to the variable set at paragraph i.dS:

Hi1 AL1 max. alarm;
Lo1 AL1 min. alarm;
Hi2 AL2 max. alarm;
Lo2 AL2 min. alarm;
Hi3 AL3 max. alarm;
Lo3 AL3 min. alarm.

As multiple alarms can be concomitant, if this occurs, the display will alternately report the alarm conditions present and the normal display.

The alarm thresholds can be set to parameters:

1.HA Pr1 max. alarm;
1.LA Pr1 min. alarm;
2.HA Pr2 max. alarm;
2.LA Pr2 min. alarm;
3.HA Pr3 max. alarm;
3.LA Pr3 min. alarm.

And the relative intervention hysteresis at paragraphs:

1.Ad For the alarms referred to Pr1;
2.Ad For the alarms referred to Pr2;
3.Ad For the alarms referred to Pr3.

In order to obtain a greater operational versatility, the temperature alarms intervention can delayed by the time set at parameters:

1.At For the alarms referred to Pr1;
2.At For the alarms referred to Pr2;
3.At For the alarms referred to Pr3.

And are only active after the A.PA time has elapsed after the instrument has been powered ON when there are alarm conditions at power ON.

In addition, temperature alarms have a timed activation function programmable through parameters:

1.Ao For the alarms referred to Pr1;
2.Ao For the alarms referred to Pr2;
3.Ao For the alarms referred to Pr3.

This function allows to establish the minimum and maximum time for switching the alarm output.

In practice, when the alarm is triggered, the configured outputs are switched ON and remain ON for the programmed time regardless of the alarm status while counting.

Therefore, if the alarm remains active while counting, the programmed time will be the maximum switching time, but if the alarm disappears during counting, the configured alarm outputs will not be activated and the programmed time will therefore be the minimum switching time.

The activation timer is triggered by the alarm, the timer remains active regardless of the alarm status, but the timer reset happens when the time expires and the alarm is no longer present or when the alarm ceases and the activation timer has finished counting.

The function is disabled by setting oF the parameters.

The instrument allows to configure 2 alarm outputs operating with closing logic (**A1**, **A2**) or opening logic (**-A1**, **-A**2).

In practice, the output must be triggered when the alarm is triggered or the instrument is turned ON or turned OFF when the alarm is triggered so that it can also be used to detect the the instrument power failures.

Through parameters 1.Ar, 2.Ar and 3.Ar it is possible to establish the operating mode of the **rd** differential control output when an alarm occurs, while through parameters 1.AH, 1.AL, 2.AH, 2.AL, 3.AH, 3.AL it is possible to establish the behavior of the other two alarm outputs **AL1** and **AL2** (if Present and configured).

Since simultaneous alarms for different probes are possible, it may be verified that the instrument is programmed to operate discordant actions on differential **rd** control output (e.g. An alarm on **Pr1** probe disengages the output and an alarm on Probe **Pr2** activates it).

In this cases is possible to establish, through parameter A.Pr, which is the alarm (**1**, **2** or **3**) that has the action priority ans also establish which action must be done before the others.

The alarm outputs can operate according to the temperature alarms (can be used to automatically operate on the plant performing the function established by the designer) but can also intervene to report the probes errors.

Through the parameter AEA it is possible to establish the behavior of the two alarm outputs (**AL1** and **AL2**) in case of probe error (so that a system malfunction can be reported).

5.8 General description of some typical applications of differential thermal control

5.8.1 Solar collectors (solar thermal panels)

The most common application for differential controllers is the managing of solar collector systems with a forced circulation heat exchanger. These systems consist of a hydraulic circuit composed by solar panels and a heat exchanger placed in a water storage tank.

The control can be carried out with cooling action (r.Fd = **C**), in fact, provides for the activation of the output when the temperature difference is higher than a certain value (in practice the action involves cooling the collector fluid).

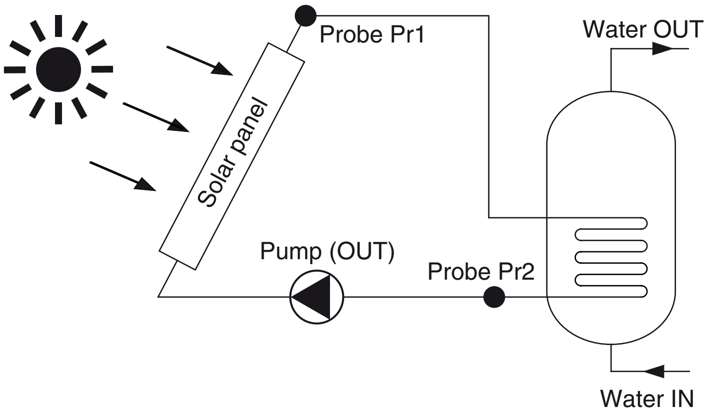
The instrument measures the temperature reached by the liquid coming out of the solar panels (probe **Pr1**) and that of the liquid at the end of the exchanger (probe **Pr2**).

If the liquid in the panels (**Pr1**) is warmer than the one in the tank (**Pr2**), there is a temperature difference (**Pr1** - **Pr2**) greater than the value [SPd + r.dd], the instrument activates the output configured as **rd** which, by controlling a pump, circulates the liquid in the exchanger circuit.

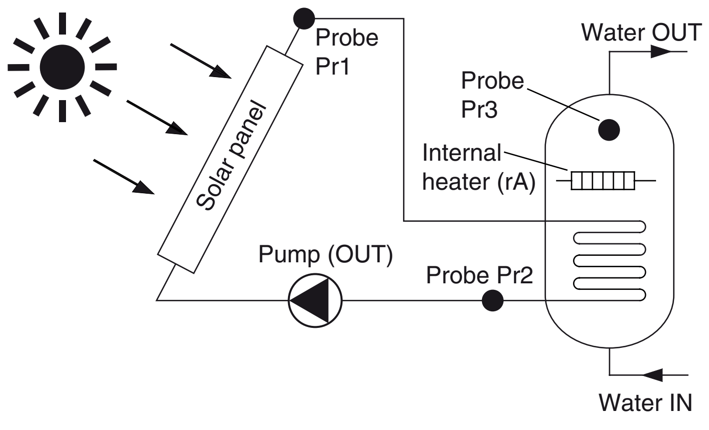
During the operation of the pump, when the heat exchange occurs, obviously the temperature difference will decrease with a tendency of 0.

When the temperature difference set with parameter SPd is reached, the output **rd** is then switched off.

Such Set Point will therefore be a user estimated temperature difference that allows the heat to be transferred from the exchanger fluid to the storage water tank and thus to exploit the available thermal energy produced by the solar panel.

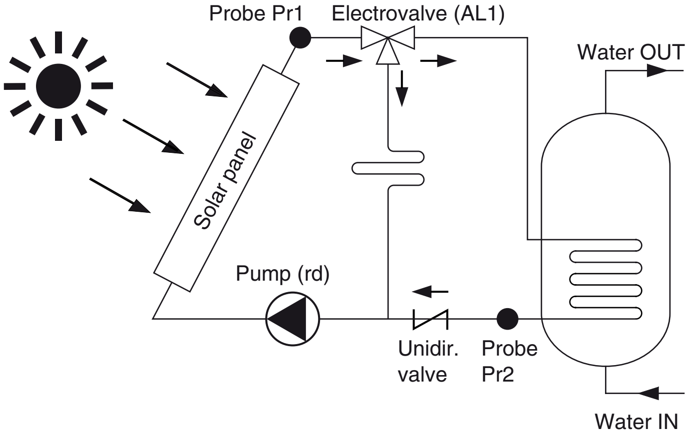


Using the Auxiliary Control, it is possible to command, through the output **dA**, an **Additional Heater** if the energy coming from the solar collector is not enough.



In this case, the Probe **Pr3** is used as the process value for the Auxiliary Control which operates with **heating** action. **SPA** Set Point will be the desired temperature of the water inside the storage tank.

As regards the use of alarms, the diagram below illustrates a typical application for which, for example, can be used the **AL1** alarm output (the diagram can be used, for example, in cases A3, B2, C2).



Thanks to the possibility of having **AL2** alarm output, the system designer can still achieve more complex and complete applications.

Through the above mentioned parameters, it is possible to configure the operation of the alarm outputs as desired, with virtually all possible combinations.

Without any claim of completeness, some of the particular cases that may occur (although the most frequent are only some of the cases mentioned below) are listed below and for which the alarm functions (also combined) can be used followed by the perameters programming necessary to obtain the desired the Behavior of the outputs.

Case A - Minimum Alarm on Probe Pr1 (Solar Collector Antifreeze)

Since on the solar collector it is possible that during the winter period the temperature of the liquid may drop too low, it is possible to use the minimum alarm as a function of the temperature measured by Probe **Pr1** whose threshold is adjustable in parameter 1.LA.

At the intervention of this alarm the instrument can:

1. Activate circulation pump output independently of the differential controller until the **Pr1** temperature rises above the [1.LA + 1.Ad] value. In this case the heat transfer will come from the tank heat exchanger to the solar panel. (1.Ar = **3**);
2. Disconnect the circulation pump independently of the differential controller (because it is believed that the liquid is too cold to be injected into the exchanger) until the **Pr1** temperature rises above [LAL1 + ALd1]. (1.Ar = **4**);
3. Activate the circulation pump output independently of the differential controller and the alarm output (e.g. **AL1**) that will be used to switch a 3-way valve that will divert the fluid flow to an external heat exchanger instead of Towards the tank exchanger until the **Pr1** temperature rises above the [1.LA + 1.Ad] value.
   In this case, the alarm output can also be used to control any heating actuator (electric resistors or other).
   (1.Ar = **3**; 1.AL = **1**).

Case B - High alarm on probe Pr2 (Overheating water exchanger)

Since during the summer it may happen that the liquid temperature in the heat exchanger rises too high and consequently the water temperature in the tank is too high, it is possible to use the high alarm as a function of the temperature measured by the **Pr2** probe whose threshold can be set parameter 2.HA.

At the intervention of this alarm the instrument can:

1. Stop the circulation pump independently of the differential controller (interrupting the heat exchange) until the **Pr2** temperature drops below the [2.HA - 2.Ad] value.
   (1.Ar = **2**).
2. Activate the circulation pump output independently of the differential controller and the alarm output (e.g. **AL1**) that can be used to switch a **3-way valve** that will divert the fluid flow to an external cooling exchanger towards the tank exchanger until the **Pr2** temperature drops below the [2.HA - 2.Ad] value. In this case, the alarm output can also be used to control any cooling actuator (fan or other).
   (2.Ar = **1**; 2.AH = **1**).

Case C - High alarm on probe Pr1 (Overheating solar collector)

Since in the solar collector it is possible that, during the summer period, the temperature of the liquid can rise excessively, the high alarm can be used depending on the temperature measured by Probe **Pr1** whose threshold is adjustable with parameter 1.HA.

At the intervention of this alarm the instrument can:

1. Stop the circulation pump independently of the differential controller (because it is considered that the liquid is too hot to be injected into the exchanger) until the **Pr1** temperature drops below the [1.HA - 1.Ad] value.
   (1.Ar = **2**).
2. Activate the circulation pump output independently of the differential controller and the alarm output (e.g. **AL1**) that can be used to switch a 3-way valve that will divert the fluid flow to an external cooling exchanger towards the tank exchanger until the temperature drops below the [1.HA - 1.Ad] value (similar to case **B2** for the exchanger overheating).
   (1.Ar = **1**; 1.AH = **1**).

Case D - Low Alarm on Probe Pr2 (Water Exchanger Antifreeze)

This is a rather rare case as usually the water tank in forced circulation systems is placed inside the building and is, in most cases, equipped with an actuator for post-heating water (in practice the supplementary heater to the solar energy that can be achieved by the same instrument with the auxiliary regulator).

For these reasons the temperature measured by **Pr2** Probe in the water heater exchanger should never drop at temperatures close to 0°C.

However, if the system involves post-heating in another reservoir or in special cases (such as failure of parts of the plant during the winter), the low alarm threshold can be used depending on the temperature measured by **Pr2** probe. The **AL2** theshold can be set at parameter 2.LA.

At the intervention of this alarm the instrument can:

1. Stop the circulation pump independently of the differential controller (because the fluid coming from the solar panel is too cold) until the **Pr2** temperature rises above the value [2.LA + 2.Ad].
   (2.Ar = **4**).
2. Stop circulation pump independently of the differential controller and activate the alarm output (e.g. **AL1**) to activate a heating actuator (electrical resistance or other) until the **Pr2** temperature rises above the value [2.LA + 2.Ad].
   (2.Ar = **4**; 2.AL = **1**)
3. Activate circulation pump and the alarm output (e.g. **AL1**) which can be used to switch a 3-way valve that will divert the fluid flow to an external heat exchanger instead of the solar collector until the **Pr2** temperature rises above the [2.LA + 2.Ad] value.
   In this case, the alarm output can also be used to control any heating actuator (electric resistors or other).
   (2.Ar = **3**; 2.AL = **1**).

Note: In this latter case, the application scheme will look similar to the one illustrated but with the three-way valve placed on the tube that exits the pump and the non-return valve on the tube that exits the solar collector.

Case E - High alarm on probe Pr3 (Overheating output water)

During summer happens that the heat input from the solar collector is excessive and therefore the temperature of the liquid in the storage tank or any other part of the plant (e.g. if the plant serves a swimming pool inside the pool buiding) rises up too.

In this case the high alarm can be used according to the temperature measured by Probe **Pr3** whose threshold is adjustable in parameter 3.HA.

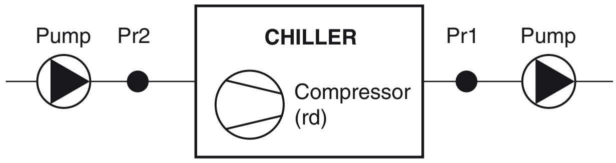
At the intervention of this alarm the instrument can:

1. Stop the circulation pump independently of the differential controller (interrupting the heat exchange) until the **Pr3** temperature drops below the [3.HA - 3.Ad] value.
   (3.Ar = **2**).
2. Activate the circulation pump and the alarm output (e.g. **AL1**) that can be used to switch a 3-way valve to divert the fluid flow to a second excess heat accumulator up to the **Pr3** temperature will not be lowered below the [3.HA - 3.Ad] value.
   (3.Ar = **1**; 3.AL = 1).

5.8.2 Chillers (fluid coolers)

The action r.Fd = **C**, can also be used to control a cooling circuit with a cooling actuator such as a Chiller through which the water exiting the chiller colder than the one that enters the chiller while maintaining a negative temperature difference (**SPd** will be set to negative values).

In this application, the **Pr1** probe must be placed in such a way that it measures temperature of the water that exits the chiller and the Pr2 positioned to measure the water that enters the chiller.



If the output water temperature (**Pr1**) is equal to or greater than the input water (**Pr2**), there is a temperature difference (**Pr1** - **Pr2**) greater than the value [SPd + r.dd] the instrument activates the **rd** output which, by controlling a refrigeration system, will cool the water that exits the chiller.

During the refrigerator operation, the temperature measured by the **Pr1** probe will therefore decrease.

When the difference set by the **SPd** Set Point is reached, the output **rd** is then switched **OFF**.

The alarm thresholds must be set in order to perform any action on the plant such as interrupting the **rd** output if the inlet water is too cold or enable differential control only within a set temperature range or other any combinations.

5.8.3 Climatizzazione naturale degli ambienti

Using the r.Fd = **C** action, the controller can also be used to manage the rooms air conditioning through air recirculation.

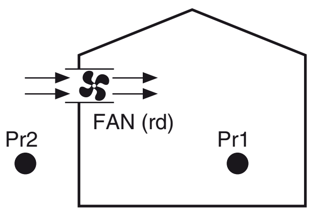
In the example, the controller is used to cool an indoor environment using the outside air.

In this application you will need to place **Pr1** probe to measure the internal temperature and **Pr2** probe to measure the external temperature.

If the external temperature (**Pr2**) is lower than the internal (**Pr1**), there is a temperature difference (**Pr1** - **Pr2**) greater than the value [SPd + r.dd], the instrument activates the output **rd** which controls a **fan** (or a **damper** or **fan** + **damper**) to cool down the interior.

During operation of the system fan, the temperature measured by the Probe **Pr1** should decrease.

When the difference set in **SPd** Set Point (e.g. 0 when the internal temperature is equal to the external one), the output **rd** is then switched **OFF**.



By means of the alarm thresholds it will then be possible to perform any action on the system such as to interrupt the control output **rd** if the outside temperature is too cold or enable the differential adjustment only within a temperature band established or still other possible combinations.

5.9 Alarm conditions

The alarm conditions of the instrument are:

- Probe Errors: E1, -E1, E2, -E2, E3, -E3;
- Temperature alarms: Hi1, Lo1, Hi2, Lo2, Hi3, Lo3;
- External alarm: AL.

If one of the probes **Pr1** or **Pr2** fails, the instrument deactivates the output configured as **rd**.

In the event of a fault of **Pr3** probe, the instrument deactivates the output configured as **rA**.

In case of **sensor error**, the instrument switches the indicated output(s) as programmed at parameter A.E.A (0 = **no action**; 1 = **Switch output AL1**; 2 = **Switch output AL2**; 3 = **Switches both outputs AL1 and AL2**).

Alarm functions act on the internal buzzer, if present and configured with parameter O.bu and the desired outputs, if configured with parameters o.o1, o.o2 and o.o3 as set to the above mentioned parameters.

The buzzer (if present) can be configured to report the alarms by programming parameter O.bu = **1** or **3** and always acts as a silent alarm signal.

This means that, when activated, it can be switched OFF by briefly pressing any key.

Outputs can, however, operate to signal alarms such as the following programming of the output configuration parameters:

- A1 For the control of a device that can be activated in function of alarm **AL1** through a Normally Open and closed alarm contact.
- A2 For the control of a device that can be activated in function of alarm **AL2** through a Normally Open and closed alarm contact.
- -A1 For the control of a device that can be activated in response to alarm **AL1** through a Normally Closed and open alarm contact.
- -A2 For the control of a device that can be activated in function of alarm **AL2** through a Normally Closed and open alarm contact.
- At To command a silent alarm device through a Normally Open and closed alarm contact.

5.10 Operation of keys U, ▲ and ▼

Three of the instrument buttons, in addition to their normal functions, can be configured to operate other commands.

The function of the U key can be defined by the parameter t.UF while that of the ▲ and ▼ keys through parameter t.FA and t.Fb.

The t.UF parameter can be programmed for the following operations:

OF The key performs no function.

1 **Standby** - Pressing the key for at least 1 s the user can switch the instrument from **ON** to **Stand-by** state and vice-versa. If ON/Standby events were programmed with the clock, the key action has the priority on the clock programmed action.

2 **Programmed Event Forcing Standby** - Pressing the button for at least 1 s the user can switch the instrument from **ON** to **stand-by** state and vice-versa. If ON/Standby events were programmed with the clock, the key action forces the output to the next switching event otherwise the mode is identical to 1.

The t.FA and t.Fb parameters can be programmed for the following operations:

OF The key performs no function.

1 **Activating/deactivating the differential rd output** - Pressing the key for at least 1 s the user can manually force the status of the differential **rd** output. At the first key pression, the output passes in **ON**, at the second key pression in **OFF** state and at the third key pression the output returns to be **managed by the controller**. The current status is reported on the display with the messages on (forced **ON**) and oF (forced **OFF**) alternated to the normal display. If activation/deactivation events were programmed with the clock, the key action has the priority on the clock programmed action.

2 **Activating/deactivating rA Auxiliary output** - Pressing the key for at least 1 s user can manually activate/deactivate the Auxiliary output (if configured). If activation/deactivation events were programmed with the clock, the key action forces the output to the next switching event

3 **Activating/deactivating "rA" auxiliary controller** - Pressing the key for at least 1 s the user can manually force the Auxiliary controller to be switched **on**/**off**. The command is reported on the display with the mes-

sages r.on (switch-on) and r.oF (switch-off) alternated with the normal display. If a scheduled activation/deactivation timer events are programmed, the action with this mode forces the output to the next switch event.

4 **Activating/deactivating “rd” differential controller** - Pressing the key for at least 1 s the user can force the differential controller to ON/OFF status. The command is reported by the display with the messages r.on (switch-on) and r.oF (switch-off) alternated with the normal display. If a scheduled activation/deactivation timer events are programmed, the action with this mode forces the output to the next switch event.

5 **Activating/deactivating both the controllers (“rd” and “rA”)** - Pressing the key for at least 1 s it is possible to force the ON/OFF status the differential and auxiliary controllers. The command is reported by the display with the messages r.on (switch-on) and r.oF (switch-off) alternated with the normal display. If a scheduled activation/deactivation timer events are programmed, the action with this mode forces the output to the next switch event.

Note: In all cases also if the controllers are deactivated, the alarms are always operating. Alarms are disabled only when the instrument is in stand-by. During the normal operation, if a controller is disabled and the output switches to ON, the LED related to the disabled controller blinks to indicate its inhibition.

5.11 Clock programmable events

The instrument provides **14** event scheduling parameters that allows the user to schedule up to **14 x 7 = 98** weekly events (using d. 8). In any case, events can also be programmed daily according to the following settings:

d. 1 = Monday... d. 7 = Sunday;
d. 8 = Every day
d. 9 = Monday, Tuesday, Wednesday, Thursday, Friday;
d.10 = Monday, Tuesday, Wednesday, Thursday, Friday, Saturday;
d.11 = Saturday and Sunday;
d.oF = No one.

The programmable events are:

t. 1 = Power on instrument;
t.2 = Stand-by instrument;
t.3 = Auxiliary output power on;
t.4 = Switch off auxiliary output;
t.5 = Auxiliary controller activation (**rA**);
t.6 = Auxiliary controller deactivation (**rA**);
t.7 = Differential controller activation (**rd**);
t.8 = Differential controller deactivation (**rd**);
t.9 = Controller activation (**rd** and **rA**);
t.10 = Controller deactivation (**rd** and **rA**).

Example of event scheduling:

The auxiliary controller must be activated every working day (Monday... Friday) from 11 am to 7 pm and on public holidays (Saturday) from 9 am to 9 pm.

It is also necessary to program the auxiliary output activation every day from 8.00 to 12.00, from 14.00 to 18.00, from 20.00 to 0.00, from 2.00 to 6.00.

Event	Par.	hour	minute	day	Event type
Weekday auxiliary controller activation	c.01	h.11	n.00	d.09	t.05
Weekday auxiliary controller deactivation	c.02	h.09	n.00	d.09	t.06
Holidays auxiliary controller activation	c.03	h.09	n.00	d.11	t.05
Holidays auxiliary controller deactivation	c.04	h.21	n.00	d.11	t.06
Auxiliary output activation (1)	c.05	h.08	n.00	d.08	t.03
Auxiliary output deactivation (1)	c.06	h.12	n.00	d.08	t.04
Auxiliary output activation (2)	c.07	h.14	n.00	d.08	t.03
Auxiliary output deactivation (2)	c.08	h.18	n.00	d.08	t.04
Auxiliary output activation (3)	c.09	h.20	n.00	d.08	t.03
Auxiliary output deactivation (4)	c.10	h.00	n.00	d.08	t.04
Auxiliary output activation (4)	c.11	h.02	n.00	d.08	t.03
Auxiliary output deactivation (4)	c.12	h.06	n.00	d.08	t.04
	c.13	h.00	n.00	d.oF	t.oF
	c.14	h.00	n.00	d.oF	t.oF

6. PROGRAMMABLE PARAMETERS TABLE

Here below is a description of all the parameters available on the instrument. Some of them may not be present due to the fact that they depend on the type of instrument.

S. - Set Point parameters

Par.		Description	Range	Def.	Note
1	SLd	Min. Differential Control Setpoint	-99.9 ÷ S.Hd	-50.0	
2	SHd	Max. Differential Control Setpoint	S.Ld ÷ 999	99.9	
3	SLS	Min. Auxiliary Control Setpoint	-99.9 ÷ S.HS	0.0	
4	SHS	Max. Auxiliary Control Setpoint	S.LS ÷ 999		
5	SPd	Differential Control Setpoint	S.Ld ÷ S.Hd		
6	SPA	Auxiliary Control Setpoint	S.LS ÷ S.HS	0.0	

i. - Measuring inputs parameters

Par.		Description	Range	Def.	Note
7	iSE	Probe type	**Pt** PTC; **nt** NTC; **P1** Pt1000.	nt	
8	iuP	Unit of measurement and resolution (decimal point)	**C0** °C, resolution 1°; **F0** °F, resolution 1°; **C1** °C, resolution 0.1°; **F1** °F, resolution 0.1°.	C1	
9	iFt	Measurement filter	oF ÷ 20.0 s	2.0	
10	iC1	Pr1 Probe Calibration	-30.0 ÷ 30.0°C/°F	0.0	
11	iC2	Pr2 Probe Calibration	-30.0 ÷ 30.0°C/°F	0.0	
12	iC3	Pr3 Probe Calibration	-30.0 ÷ 30.0°C/°F	0.0	
13	iP3	Pr3 Input usage	**oF** Not used; **Au** Auxliary probe; **dG** Digital Input.	oF	
14	iFi	Function and logic functioning of the Digital Input	**0** No function; **1** AL alarm signal with AL1 output switching; **2** AL alarm signal with AL2 output switching; **3** AL alarm signal with output switching AL1 and AL2; **4** AL alarm signaling with AL1 output switching and **rd** output; **5** AL alarm signaling with AL2 output switching and **rd** output off; **6** AL alarm signaling with output switching AL1, AL2 and **rd** output.	0	
15	iti	Digital Input Delay	**oF** Function disabled; 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
16	idS	Variable normally displayed	**OF** Display Off; **Pr1** Probe measurement Pr1; **Pr2** Probe measurement Pr2; **Pr3** Probe measurement Pr3; **P1.2** Pr1-Pr2 difference; **SPd** Differential Set Point; **SPA** Set Point Auxiliary Controller.	P1.2	

r. - Temperature control parameters

Par.		Description	Range	Def.	Note
17	r.dd	Differential Controller Hysteresis	0.1 ÷ 30.0°C/°F	2.0	
18	r.d	Auxiliary Controller Hysteresis	0.1 ÷ 30.0°C/°F	oF	
19	r.Fd	Differential Control operating mode	**H** Heating (reverse action); **C** Cooling (direct action).	C	
20	r.HC	Auxiliary Control operating mode	**H** Heating (reverse action); **C** Cooling (direct action).	H	

P. - Control Output delay and Power ON delay parameters

Par.		Description	Range	Def.	Note
21	P.d1	Differential controller output activation delay (**rd**)	**oF** Disabled; 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10).	oF	
22	P.d2	Activation delay after switch OFF differential controller output (**rd**)	**oF** Disabled; 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10).	oF	
23	P.P1	Auxiliary controller output delay (**rA**)	**oF** Disabled; 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10).	oF	
24	P.P2	Activation delay after switch OFF Auxiliary controller output (**rA**)	**oF** Disabled; 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10).	oF	
25	P.od	Outputs delay at power ON	**oF** Disabled; 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10).	oF	

1. - Probe Pr1 Alarm parameters

Par.		Description	Range	Def.	Note
26	1HA	**Pr1** High temperature Alarm threshold	**oF** Disabled; -99.9 ÷ +999°C/°F.	oF	
27	1LA	**Pr1** Low temperature Alarm threshold	**oF** Disabled; -99.9 ÷ +999°C/°F	oF	
28	1Ad	1.HA and 1.LA Temperature Alarms Histeresys	0.0 ÷ 30.0°C/°F	1.0	
29	1At	1.HA and 1.LA Temperature Alarms Delay	**oF** Disabled; 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10).	oF	
30	1Ao	1.HA and 1.LA Temperature Alarms Activation time	**oF** Disabled; 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10).	2.00	
31	1Ar	1.HA and 1.LA alarms action on the **rd** differential control output	**0** No action; **1** 1.HA enables output (1.LA no action); **2** 1.HA disables output (1.LA no action); **3** 1.LA enables output (1.HA no action); **4** 1.LA disables output (1.HA no action); **5** 1.HA and 1.LA enables output; **6** 1.HA and 1.LA disables output; **7** 1.HA enables output and 1.LA disables output; **8** 1.HA disables output and 1.LA enables output.	1.00	
32	1AH	1.HA alarm action on the alarm outputs	**0** No action; **1** Switches only AL1 output; **2** Switches only AL2 output; **3** Switches both AL1 and AL2 outputs	0	
33	1AL	1.LA alarm action on the alarm outputs	**0** No action; **1** Switches only AL1 output; **2** Switches only AL2 output; **3** Switches both AL1 and AL2 outputs.	0	

2. - Probe Pr2 Alarm parameters

Par.		Description	Range	Def.	Note
34	2HA	**Pr1** High temperature Alarm threshold	**oF** Disabled; -99.9 ÷ +999°C/°F.	oF	
35	2LA	**Pr1** Low temperature Alarm threshold	**oF** Disabled; -99.9 ÷ +999°C/°F	oF	
36	2Ad	2.HA and 2.LA Temperature Alarms Histeresys	0.0 ÷ 30.0°C/°F	2.0	
37	2At	2.HA and 2.LA Temperature Alarms Delay	**oF** Disabled; 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10).	oF	
38	2Ao	2.HA and 2.LA Temperature Alarms Activation time	**oF** Disabled; 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10).	2.00	
39	2Ar	2.HA and 2.LA alarms action on the **rd** differential control output	**0** No action; **1** 2.HA enables output (2.LA no action); **2** 2.HA disables output (2.LA no action); **3** 2.LA enables output (2.HA no action); **4** 2.LA disables output (2.HA no action); **5** 2.HA and 2.LA enables output; **6** 2.HA and 2.LA disables output; **7** 2.HA enables output and 2.LA disables output; **8** 2.HA disables output and 2.LA enables output.	2.00	
40	2AH	2.HA alarm action on the alarm outputs	**0** No action; **1** Switches only AL1 output; **2** Switches only AL2 output; **3** Switches both AL1 and AL2 outputs	0	
41	2AL	2.LA alarm action on the alarm outputs	**0** No action; **1** Switches only AL1 output; **2** Switches only AL2 output; **3** Switches both AL1 and AL2 outputs.	0	

3. - Probe Pr3 Alarm parameters

Par.		Description	Range	Def.	Note
42	3HA	**Pr1** High temperature Alarm threshold	**oF** Disabled; -99.9 ÷ +999°C/°F.	oF	
43	3LA	**Pr1** Low temperature Alarm threshold	**oF** Disabled; -99.9 ÷ +999°C/°F	oF	
44	3Ad	3.HA and 3.LA Temperature Alarms Histeresys	0.0 ÷ 30.0°C/°F	3.0	
45	3At	3.HA and 3.LA Temperature Alarms Delay	**oF** Disabled; 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10).	oF	
46	3Ao	3.HA and 3.LA Temperature Alarms Activation time	**oF** Disabled; 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10).	2.00	

Par.		Description	Range	Def.	Note
47	3Ar	3.HA and 3.LA alarms action on the **rd** differential control output	**0** No action; **1** 3.HA enables output (3.LA no action); **2** 3.HA disables output (3.LA no action); **3** 3.LA enables output (3.HA no action); **4** 3.LA disables output (3.HA no action); **5** 3.HA and 3.LA enables output; **6** 3.HA and 3.LA disables output; **7** 3.HA enables output and 3.LA disables output; **8** 3.HA disables output and 3.LA enables output.	3.00	
48	3AH	3.HA alarm action on the alarm outputs	**0** No action; **1** Switches only AL1 output; **2** Switches only AL2 output; **3** Switches both AL1 and AL2 outputs	0	
49	3AL	3.LA alarm action on the alarm outputs	**0** No action; **1** Switches only AL1 output; **2** Switches only AL2 output; **3** Switches both AL1 and AL2 outputs.	0	

A. - Parameters common to all the alarms

Par.		Description	Range	Def.	Note
50	APr	Alarm priority	1/2/3	1	
51	AEA	Probe error action on alarm outputs	**oF** Function disabled; **1** Switches only AL1 output; **2** Switches only AL2 output; **3** Switches both AL1 and AL2 outputs.	0	
52	APA	Alarms disable at power ON	**oF** Function disabled; 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10)	oF	

O. - Outputs configuration and Buzzer Parameters

Par.		Description	Range	Def.	Note
53	o.o1	Output 1 Function	**OF** Not Used; **Rd** Differential Controller; **RA** Auxiliary Controller; **A1** Alarm AL1; **A2** Alarm AL2; **-A1** Alarm AL1 NC; **-A2** Alarm AL2 NC; **Au** Auxiliary alarm; **At** Acknowledgeable Alarm;	rd	
54	o.o2	Output 1 Function		A1	
55	o.o3	Output 1 Function		A2	
56	o.bu	Buzzer Function	**oF** Disable; **1** Active alarms only; **2** Key pressed only; **3** Active for alarms and key pressed.	2	

t. - Keyboard configuration parameter (and serial communications)

Par.		Description	Range	Def.	Note
57	t.UF	[U] Key Function	**oF** No function; **1** Switch ON/Switch OFF (Stand-by); **2** Event Forcing ON/OFF (Stand-by).	oF	
58	t.FA	[▲] Key Function	OF No Functions; 1 Activating/deactivating the differential output; 2 Activating/deactivating the Auxiliary output; 3 Activating/deactivating of auxiliary controller (**rA**); 4 Differential controller activating/deactivating (**rd**); 5 Controllers activating/deactivating (both **rd** and **rA**)	oF	
59	t.Fb	[▼] Key Function		oF	
60	t.Lo	Keyboard lock function delay	**oF** Disabled; 0.01 ÷ 9.59 (min.s) ÷ 30.0 (min.s x 10).	oF	
61	t.Ed	Set Point visibility with [P] key fast procedure	**0** None; **1** SPd; **2** SPA; **3** SPd and SPA.	1	
62	t.PP	Password to Access Parameter functions	**oF** Disabled; 001 ÷ 999.	oF	
63	t.Ad	Device address for serial communications	**0** Disabled; 1 ÷ 255.	1	

cE Group - Parameter for events programmable through the clock

Par.		Description	Range	Def.	Note
64	c.01	1st programmable event	H Hour (0 ÷ 23); N Minutes (0 ÷ 50); D Day of the week (d.1 = Monday... d.7 = Sunday); d. 8 Every day; d. 9 Monday, Tuesday, Wednesday, Thursday, Friday; D.10 Monday, Tuesday, Wednesday, Thursday, Friday, Saturday; D.11 Saturday and Sunday; D.oF No one; T Scheduled event; T.1 Power on instrument; T.2 Stand-by instrument; T.3 Auxiliary output power on; T.4 Switch off auxiliary output; T.5 Auxiliary Control activation (“rA”); T.6 Auxiliary Control deactivation (“rA”); T.7 Differential Control activation (“rd”); T.8 Differential Control deactivation (“rd”); T.9 Controls activation (“rd” and “rA”); T.10 Controls deactivation (“rd” and “rA”)	h.0 n.0 d.oF t.oF	
65	c.02	2nd programmable event			
66	c.03	3rd programmable event			
67	c.04	4rd programmable event			
68	c.05	5rd programmable event			
69	c.06	6rd programmable event			
70	c.07	7rd programmable event			
71	c.08	8rd programmable event			
72	c.09	9rd programmable event			
73	c.10	10rd programmable event			
74	c.11	11rd programmable event			
75	c.12	12rd programmable event			
76	c.13	13rd programmable event			
77	c.14	14rd programmable event			

C. - Clock Parameters

Par.		Description	Range	Def.	Note
78	C.CL	Time and current day of the week	H Hour (0 ÷ 23); N Minutes (0 ÷ 50); D Day of the week (d.1 = Monday... d.7 = Sunday); D.oF Clock disabled;		

7. PROBLEMS, MAINTENANCE AND WARRANTY

7.1 Notifications

7.1.1 Error messages

Error	Reason	Action
E1 -E1 E2 -E2 E3 -E3	The probe may be interrupted (**E**) or in short circuit (**-E**) or may measure a value outside the range allowed	Check the probe connection with the instrument and check that the probe works correctly
EPr	Internal EEPROM memory error	Press P key

7.1.2 Other messages

Message	Reason
od	Delay at power-on in progress
Ln	Keyboard locked
Hi1	Pr1 Maximum temperature alarm in progress
Lo1	Pr1 Minimum temperature alarm in progress
Hi2	Pr2 Maximum temperature alarm in progress
Lo2	Pr2 Minimum temperature alarm in progress
Hi3	Pr3 Maximum temperature alarm in progress
Lo3	Pr3 Minimum temperature alarm in progress
AL	Digital Input (external) alarm in progress
on	**rd** controller output forced to ON
oF	**rd** controller output forced to OFF
r.on	Controller Automatic/Manual activation
r.oF	Controller Automatic/Manual deactivation

7.2 Cleaning

We recommend cleaning of the instrument only with a slightly wet cloth using water and not abrasive cleaners or solvents.

7.3 Warranty and Repairs

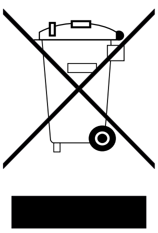
The instrument is under warranty against manufacturing flaws or faulty material, that are found within 12 months from delivery date. The warranty is limited to repairs or to the replacement of the instrument.

The eventual opening of the housing, the violation of the instrument or the improper use and installation of the product will bring about the immediate withdrawal of the warranty effects.

In the event of a faulty instrument, either within the period of warranty, or further to its expiry, please contact our sales department to obtain authorisation for sending the instrument to our company.

The faulty product must be shipped to Ascon Tecnologic with a detailed description of the faults found, without any fees or charge for Ascon Tecnologic, except in the event of alternative agreements.

7.4 Disposal



The appliance (or the product) must be disposed of separately in compliance with the local standards in force on waste disposal.

8. TECHNICAL DATA

8.1 Electrical characteristics

Power supply: 100/240 VAC ±10%;
AC frequency: 50/60 Hz;
Power consumption: about 4 VA;
Inputs: 3 inputs for **temperature probes**:
NTC (103AT-2, 10 kΩ @ 25°C);
PTC (KTY 81-121, 990Ω @ 25°C);
Pt1000 (1000Ω @ 0°C);
1 free of voltage digital input alternatively to input Pr3;
Output: Up to 3 relay output SPST-NO;

Output	UL 60730
Output 1: SPST- NO	14A-AC1, 6A-AC3 250 VAC, 1 HP 250 VAC, 1/2 HP 125 VAC
Output 2: SPDT	8A-AC1, 3A-AC3 250 VAC, 1/2 HP 250 VAC, 1/3 HP 125 VAC
Output 3: SPST- NO	4A-AC1, 2A-AC3 250 VAC, 1/8 HP 250-125 VA

Max. curent for the output common terminal (12): 16 (A);
Relay output Electrical life: 100000 operations (EN60730);
Action type: Type 1.B (EN 60730-1);
Overvoltage category: II;
Protection class: Class II;
Isolation: Reinforced insulation between the low voltage parts (115/240 V and relays output) and front panel; Reinforced insulation between the low voltage parts (115/240 V and relays output) and the extra low voltage section (inputs), Reinforced between Power sully and relays..

8.2 Mechanical characteristics

Housing: Self-extinguishing plastic, UL 94 V0;
Heat and fire resistance category: D;
Dimensions: 75 x 122 mm, depth 34 mm;
Weight: about 135 g;
Mounting: Wall mounting;
Connections: Screw terminals for 2.5 mm^2 (AWG 14) cables;
Protection degree: IP40;
Pollution degree: 2;
Operating temperature: 0... 50°C;
Operating humidity: < 95 RH% with no condensation;
Storage temperature: -25... +60°C.

8.3 Functional features

Temperature Control: ON/OFF mode;
Defrost control: Interval cycles by stopping compressor;
Measurement range: **NTC**: -50... +109°C/-58... +228°F;
PTC: -50... 150°C/-58... 302°F;
Pt1000: -99.9... 500°C/-148... 932°F;
Display resolution: 1° or 0.1° (range -99.9... +99.9°);
Overall accuracy: ±(0.5% fs + 1 digit);
Sampling rate: 130 ms;
Display: 3 Digit Red or Blue (optional), height 15.5 mm;
Software class and structure: Class A;
Internal clock time retention: about 4 ours;
Compliance: Directive 2004/108/EU (EN55022: class B; EN61000-4-2: 8kV air, 4kV cont.; EN61000-4-3: 10V/m; EN61000-4-4: 2kV supply, inputs, outputs; EN61000-4-5: supply 2kV com. mode, 1 kV\diff. mode; EN61000-4-6: 3V), Directive 2006/95/EU (EN 60730-1, EN 60730-2-7, EN 60730-2-9).

9. INSTRUMENT ORDERING CODE

Model
W09D - = Wall Mount Differential Controller

A: Power supply
H = 100... 240 VAC

b: Output 1
R = Relay SPST-NO 16A-AC1 (resistive load)

c: Output 2
R = Relay SPDT 8A-AC1 (resistive load)
- = Not present

d: Output 3
R = Relay SPST-NA 5A-AC1 (resistive load)
- = Not present

e: Buzzer
B = Buzzer
- = Not present

f: Connection type
- = Standard (screw terminals)

g: Display
- = Red (standard)
B = Blue

h: Clock
C = Clock
- = Not present

W09D a b c d e f g h **i, j, k: Reserved codes**
ll, mm: Special codes