X35P

DIGITAL ELECTRONIC CONTROLLER FOR REFRIGERATION UNITS WITH FREQUENCY/VOLTAGE OUTPUT TO MANAGE THE COMPRESSORS INVERTERS

OPERATING INSTRUCTIONS

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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 **X35P** model is a digital electronic microprocessor controller that can be used typically for refrigeration applications. It has **ON/OFF** or **PID** temperature control and defrost control at defined times (Real Time Clock Defrosting), at time intervals, by arrival at temperature or by length of time of continuous compressor operation through stopping the compressor, electric heating or hot gas/cycle inversion.

The instrument has **a frequency modulated digital output** (9 ÷ 12 VDC 250 Hz max.) or **analog 0 ÷ 5/10 V**, up to **4 relay outputs**, up to **4 inputs configurable** for PTC, NTC and Pt1000 temperature probes, and **2 digital inputs**. It can be also equipped with an **internal buzzer** for acoustic alarms notification, an **RS485 serial communication interface** with **MODBUS-RTU** communication protocol, a **Calendar Clock** and an **NFC interface** for parameters programming.

The calendar clock allows to program defrosting events, auxiliary output switching, control Set Point changes, instrument ON/OFF, etc. at pre-set times (max. 14 daily and 98 weekly events). A furher feature of the calendar clock instrument version is the HACCP function which can store the last 10 occurred alarms (alarm type, start, duration and temperature peaks).

2 digital inputs are always available and, as an **alternative** to **Pr3** and **Pr4** temperature probe inputs, **it is possible to configure 2 further digital inputs**.

Out5 output can be used to control the compressor speed. The output type can be:

– **0 ÷ 250 Hz Frequency modulated** [to control VFD inverters that use these signals (eg. Embraco or Secop)];
– **Analogue 0 ÷ 5/10 V** for any type of VFD inverter.

1.2 Front panel description

1. (P) **Key:** Used to set the Set Point (pressed and released) and to program the function parameters (pressed for 5 s). In programming mode is used to enter at parameters edit mode and confirm the values. In programming mode it can be used together with the (▲) key to change the programming level of the parameters. When the keyboard is locked it can be used together with the (▲) (hold pressed for 5 s) key to unlock the keyboard. When pressed alone for about 9 s, (P) unlocks the keyboard autonomously.
2. (▼)**/Aux Key:** In programming mode is used for decreasing the values to be set and for selecting the parameters. Hold pressed for 1 s while in *Normal* mode, it can also be programmed via parameter *t.Fb* to carry out other functions such as selecting the *Eco* mode, activating the **Aux** output, etc. (see: Functions of key (▼)).
3. (▲)**/☆ Key:** In *Normal* mode can be used to start/stop a manual defrost (pressed for 5 s). In programming mode is used to increase the value to be set and to select the parameters. In programming mode can be used, together with key (P) to change parameters level. Pressed together with (P) key for 5 s allows the keyboard unlock.
4. (U)**/⏻ Key:** Press and release the key to display the instrument variables (measured temperatures etc.). In programming mode press the key for 2 s to return in *Normal* mode. Hold pressed for 1 s while in *Normal* mode, it can also be programmed via parameter *t.uF* to carry out other functions such as turn ON and OFF (stand-by) the device, activate the **Aux** output, start up the continuous cycle, etc. (see: Functions of key (U)).
5. **LED SET:** During the normal operating mode, signals that a key is pressed. In programming mode indicates the programming level of the parameters.
6. **LED ☼ - COOL:** Indicates the output status (compressor or temperature control device) when the istrument is programmed for cooling operation: on (**ON**), off (**OFF**) or inhibited (**flashing**).
7. **LED ☀ - HEAT:** Indicates the output status (compressor or temperature control device) when the istrument is programmed for heating operation: on (**ON**), off (**OFF**) or inhibited (**flashing**).
8. **LED ☃:** Indicates: Defrost in progress (**ON**) or drainage time in progress (**flashing**).
9. **LED ✣:** Shows the evaporator fan output status: on (**ON**), off (**OFF**) or inhibited (**flashing**).
10. **LED ⚠:** Shows the Alarm status (**ON**), off (**OFF**) and Acknowledged or Lached (**flashing**)
11. **LED Aux:** Shows the Auxiliary output status: on (**ON**), off (**OFF**) or inhibited (**flashing**).
12. **LED ◷:** Indicates that the internal clock is running. If flashes slowly means that there is a clock error (clock chip not working). When flashes rapidly means the clock battery is drained.
13. **LED Stand-By:** When the instrument is in Stand-by mode is the only lit LED.

2. PROGRAMMING

2.1 Fast Set Point programming

The Normal mode to program the setpoint is done by momentarily pressing the (P) key, the display shows *SP* (or *SPE*) 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 1 s the value increases or decreases faster and, after two seconds, the speed increases even more in order to quickly reach the desired value.

However, through parameter *t.Ed* is possible to determine whether and which Set Points can be modified with the (P) key fast mode. *t.Ed* is programmable between 0 (OFF) and 6:

0. oF - No Set Point can be changed with this procedure (the pression of the (P) key has no effect);
1. Only **SP** (normal Set Point) can be adjusted;
2. Only **SPE** [*Eco* Set Point] can be adjusted;
3. Both **SP** and **SPE** can be adjusted;
4. Only the Active Set Point (**SP**/**SPE**) can be adjusted;
5. Can be adjusted **SP** and **SPH**;
6. Can be adjusted **SP**, **SPE** and **SPH**.

For example, if the parameter *t.Ed* = **1**, **3** or **6**, the procedure is as follows:

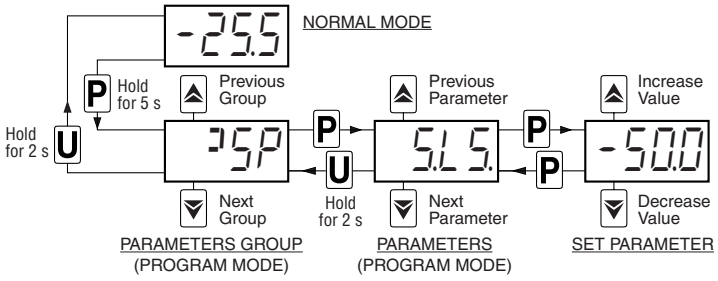
– Press and release key (P), the display shows *SP* alternated to its value;
– To modify the Set Point, press the keys (▲)/(▼) to increase/decrease its value;

– If only **SP** is changeable (t.Ed = **1**), once reached the desired value, press the (P) key to exit the Set Point programming mode;
– If also **SPE** is programmable (t.Ed = **3**), the procedure is not ended and at the (P) pressure the instrument does not exit the Set Point programming procedure, but displays SPE alternated to its value ready for changes;
– To modify the *Eco* Set Point, press the keys (▲)/(▼) to increase/decrease its value;
– When the desired value is reached press the key (P) to exit Set Point programming mode;
– If also **SPH** is programmable (t.Ed = **6**), the procedure is not ended and at the (P) pressure the instrument does not exit the Set Point programming procedure, but displays SPH alternated to its value ready for changes;
– To modify the *Turbo* Set Point, press the keys (▲)/(▼) to increase/decrease its value;
– When the desired value is reached press the key (P) to exit Set Point programming mode.

Exiting the Set Point programming mode is achieved by pressing the (P) key or automatically if no keys are pressed for about 10 seconds. After that time the display returns to the normal function mode.

2.2 Standard mode parameters programming

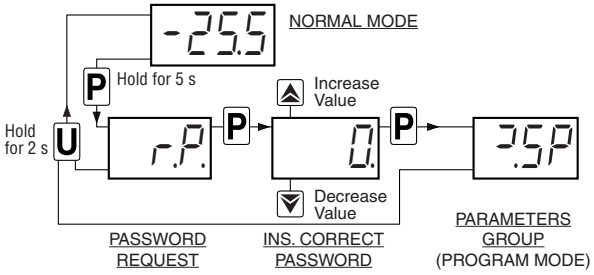
To access the instrument functional parameters when password protection is disabled:
– Press the (P) key and keep it pressed for about 5 s, after which the display shows the code that identifies the first group of programmable parameters (1st group = SP).
– Using the (▲)/(▼) keys select the desired parameters group, then enter in that group pressing the (P) key, the display starts showing the code of the first parameter of the group.
– Using the (▲)/(▼) keys select the desired parameter and, pressing the (P) key, enter the change parameter mode (the display alternately shows the parameter code and its setting) that allows to change the parameter value with the (▲) and (▼) keys.
– Once the desired value has been set, press the key (P) again: the new value will be stored and the indstrument returns to the group parameter list showing only the parameter code.
– Pressing the (▲)/(▼) keys, it is possible to select another parameter and change it as described.
– To return to the group selection mode keep the (U) key pressed for 1 s until the instrument shows the group code.
– With the (▲)/(▼) keys, it is possible to select another group of parameters and repeat the changing sequence.
– To exit the programming mode, press no keys for about 30 s or keep the (U) key pressed for 2 s until the controller exits the programming mode.



2.3 Parameter Protection Using the Password

The instrument has a parameter protection function with a password that can be customized using the t.PP parameter.
To protect the parameters, set the desired Password Number at parameter t.PP.
When the protection is active, press the (P) key to access the parameters and keep it press for about 5 s, after which the display shows r.P.
Press (P), the display shows 0, using the (▲)/(▼) keys, set the programmed password number and press again the (P) key.
If the password number inserted is correct, the display shows the code that identifies the first group of programmable parameters and it will be possible to program the instrument in the same ways described in the previous paragraphs.
All parameters are configured to be "*Password protected*" in this way, when enabled with t.PP, the protection all parameters will be protected.
The password protection can be disabled setting t.PP = **oF**.

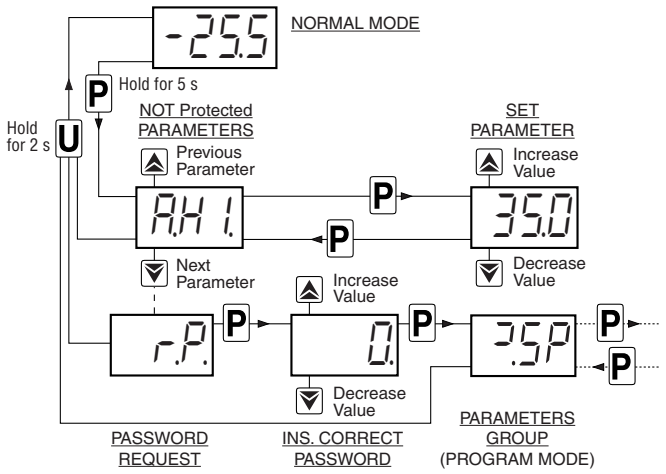
Note: If the Password gets lost, just switch OFF and ON the instrument supply, push (P) key during the initial test and keeping the key pressed for 5 s. In this way it is possible to have access to all parameters, verify and modify the parameter t.PP.



2.4 Customized mode parameters programming (parameters programming level)

The password protection hides all the configuration parameters to avoid unwanted changes being made to the programming of the controller. To make a parameter accessible without having to enter the password when t.PP password protection has been activated follow this procedure:
– Enter the programming mode using the t.PP Password, select the parameter that must be accessible with no password protection.
– Once the parameter has been selected, if the **SET** LED blinks means that the parameter is programmable by entering the password (is protected), if the **SET** LED is steady lighted means that the parameter is programmable without password (is not protected).

To change the parameter visibility, press the (P) key and keeping it pressed also press the (▲) key. The **SET** LED changes its state indicating the new access level of the parameter (**ON** = not protected; **blinking** = protected by password).



In case some parameters are "*not protected*", accessing the the programming mode the display first shows the not protected parameters, then the rP parameter (through which will be possible to access the "*protected*" parameters).

With regard to setting unprotected parameters, an exception are HACCP alarm-related parameters (H01, H02 etc. which are visible only when there are alarms stored in memory) whose display level can be set via the tHA parameter.

If tHA = **1** the parameters related to stored HACCP alarms are visible only within the SHA group (which can be displayed like all other groups without a password if tPP = **oF** or by entering the selected tPP password).

If tHA = **2** the parameters related to stored HACCP alarms are visible both within the SHA group (which can be displayed like all other groups without a password if tPP = **oF** or by entering the selected tPP password) and as unprotected parameters if the tPP parameter is given a password.

2.5 Reset parameters to default value

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

Therefore, to make the reset to the default parameters, enable the Password using the tPP parameter so that the rP insertion is requested, at this point use -48 instead of the programmed access password.

Once confirmed the password with the (P) key the display shows "---" for 2 s after which the instrument resets all the parameters to the factory default setting.

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 tLo to a value different than **oF**.

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

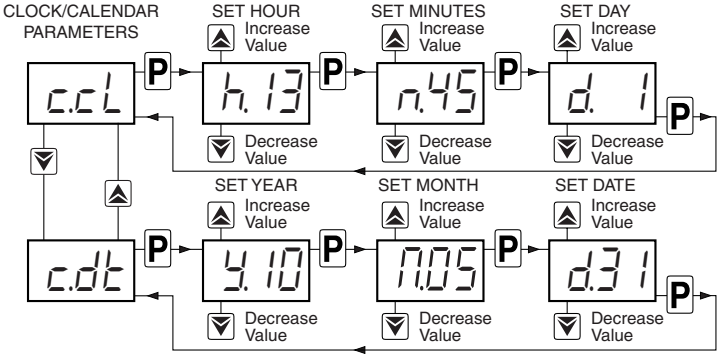
Therefore, pressing no buttons for the time set at tLo, the instrument automatically disable the normal functions of the keys.

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

To unlock the keyboard it is enough to contemporarily push (P) + (▲) keys and keep them pressed for 5 s, after which the label LF appears on the display and all the key functions will be available again (or keep the (P) key pressed for over 9 s).

2.7 Setting the current time and date

When the instrument is supplied with the internal calendar/ clock, this must be enabled and programmed to the current time and day of the week using the cCL parameter and to the current date using the cdt parameter.



After the cCL parameter has been selected, press the (P) key repeatedly to cycle through the following options:

h. + 2 digits for the hour of day in 24h format (e.g.: h. 13);

n. + 2 digits for the minutes (e.g.: n.45);

d. + 1 digit for the day of the week (e.g.: d. 1).

The days of the week 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 disabled.

Similarly, after selecting the cdt parameter, press the (P) key repeatedly to cycle through the following options:

Y. + 2 digits for the current year (e.g.: Y. 10);

n. + 2 digits for the current month (e.g.: n05);

d. + 2 digits for the current date (e.g.: d31).

When the internal clock is running, the (🕒) LED is lighted.

If (🕒) LED is ON and steady indicates that, since the time the clock was enabled, the instrument power supply has never failed and therefore the current time is probably correct.

A flashing (🕒) LED indicates that, after the clock has been enabled, a power failure certainly occurred and therefore the current time may not be correct. When in this condition, pressing any key cancels the failure indication and the (🕒) LED returns to solid (ON and not flashing).

2.8 Scheduling events at defined times (only for controllers with RTC)

The events are programmable through the 14 parameters (c01 ÷ c14) contained in the SCE group.

Exactly as for current time, because the parameters for time-related functions require multiple values to be input, these parameters are programmed in the following way:

After selecting the desired parameter, press the (P) key repeatedly to cycle through the following parameters:

h. + 2 digits for the hour of day in 24h format (e.g.: h. 13);

n. + 2 digits for the minutes of the hour (e.g.: n40);

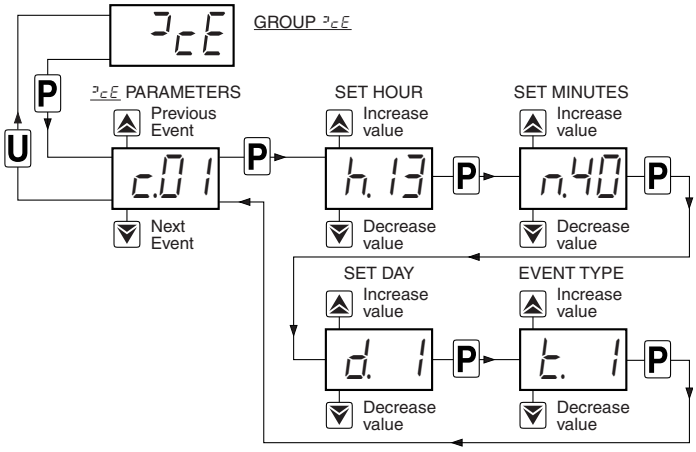
d. + 1 digit for the day of the week (e.g.: d. 1);

t. + 1 digit for the event type to be executed at the programmed time (e.g.: t. 5).

The days of the week 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;
d. 8 Every day;
d. 9 Monday, Tuesday, Wednesday, Thursday, Friday;
d.10 Monday, Tuesday, Wednesday, Thursday, Friday, Saturday;
d.11 Saturday and Sunday;
doF No day (event disabled).

The instrument offers 14 event programming parameters, allowing a maximum of 14 x 7 = 98 weekly events to be scheduled (using d. 8).



For the event types that can be programmed see the relevant paragraph.

2.9 Displaying HACCP alarms (only for controllers with RTC)

The HACCP (**H**azard **A**nalysis and **C**ritical **C**ontrol **P**oints) function causes the instrument to record the last 10 alarms that have occurred together with the information useful to determine the criticality of the alarm. The function is available only for those instruments equipped with the Real Time Clock.

The following **HACCP** alarms can be stored in memory:

HACCP alarm code	Alarm
H1	Maximum temperature alarm H1
L1	Minimum temperature alarm L1
H2	Maximum temperature alarm H2
L2	Minimum temperature alarm L2
bo	Power failure alarm (black-out)
AL	Alarm from digital input

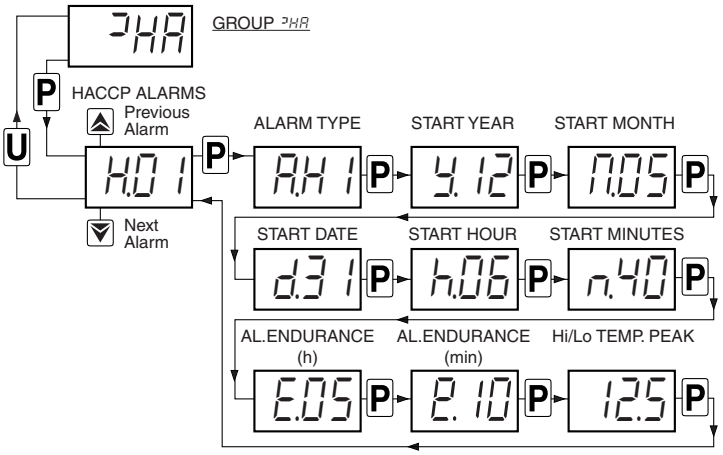
These Alarms are displayed using the same procedure used for parameters programming, but accessing to H.01 ÷ H.10 parameters contained in the PHA group.

As for the events scheduling or the time set, the time-related functions parameters require multiple values to be input, also the HACCP Alarms information are inserted in various field that are to be scrolled to be displayed.

To access the alarm list, press the P key while the instrument displays PHA group acronym, to select the desired alarm (H.01 ÷ H.10) use the ▲/▼ keys, then, press P repeatedly to display the alarm information (alarm code, time etc.).

The instrument shows in sequence:

– HACCP Alarm type (A. + 2 digits of the HACCP alarm code);
– HACCP Alarm start time;
(Y. = year, M. =month, d. = day, h. = hours, m. = minutes);
– HACCP Alarm duration (E. = hours, P. = minutes);
– Critical temperature
(max. peak if H. alarm or min. peak if Lo or other alarm).



These parameters are automatically sorted by the instrument from the most recent (H.01) to the oldest (H.10) all the times an alarm is recorded or deleted.

If the alarms exceed the number of 10, the instrument deletes the information relating to the oldest alarm by overwriting it with the most recent one.

When this happens, the instrument increases the value of HdL parameter through which it is possible to view the number of alarms that the instrument has been forced to erase because they exceed the available memory.

Once selected the parameter related to the alarm you want to view, a flashing label means that the alarm has never been displayed (therefore acknowledged). To recognize it, simply access the parameter using the P key and view it. The next time the parameter is displayed, the label is steady lighted.

If the alarm is still in progress at the time of display, the data is displayed but the alarm is not recognized.

In the presence of unacknowledged HACCP alarms (therefore also in progress) the instrument displays the message HAC alternated to the normal display.

Within the parameter, the data will be displayed sequentially by repeated presses of the P key.

The alarm is canceled if the ▼ button is held down for more than 5 s while viewing one of the alarm data. Similarly, it is possible to reset the value of the HdL parameter by keeping the ▼ key pressed for over 5 s while displaying the HdL value).

As regards the configuration and operation of the HACCP alarms, see the relative paragraph.

3. USAGE WARNINGS

3.1 Admitted usage

The instrument has been projected and manufactured as a measuring and control device to be used according to EN60730-1 at altitudes operation below 2000 m.

The use of 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 protection.

The instrument used with NTC 103AT11 probe (identifiable by the printed code “103AT-11” visible on the sensor part) or Pt1000 is compliant with standard EN 13485 (“Thermometers for measuring the air and product temperature for the transport,storage and distribution of chilled, frozen, deep-frozen/quick-frozen food and ice cream”) with the following classification: [EN13485 air, S, A, 1,- 50°C +90°C].

Remember that the end user must periodically check and verify the thermometers in compliance with standard EN 13486.

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

4. INSTALLATION WARNINGS

4.1 Mechanical mounting

The instrument, in case 78 x 35 mm, is designed for flush-in panel mounting. Make a hole 71 x 29 mm and insert the instrument, fixing it with the provided special brackets.

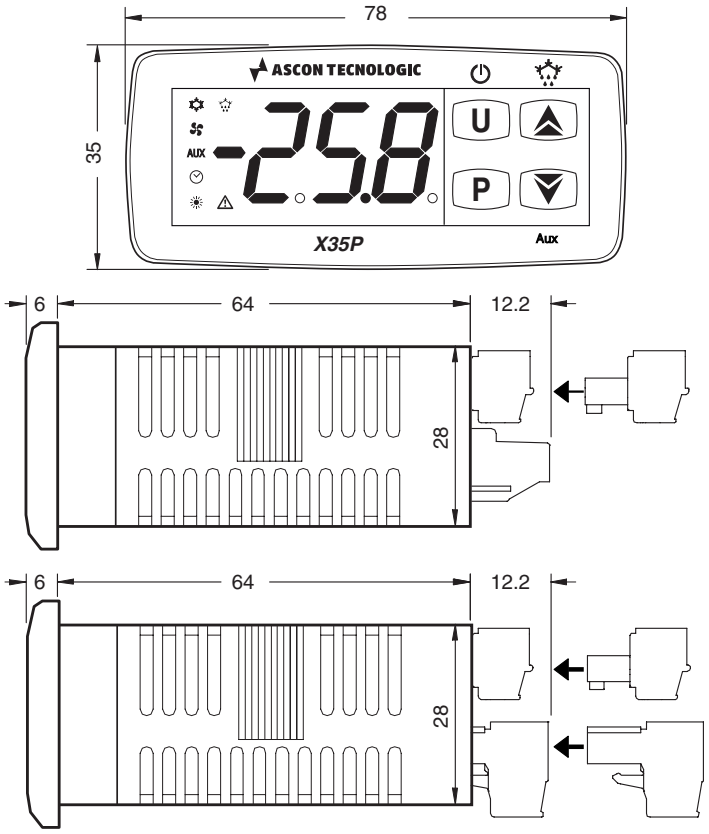
In order to obtain the declared front protection degree use the screw type bracket (optional).

Avoid placing the instrument in environments with very high humidity levels or dirt that may create condensation or introduction of conductive substances into the instrument.

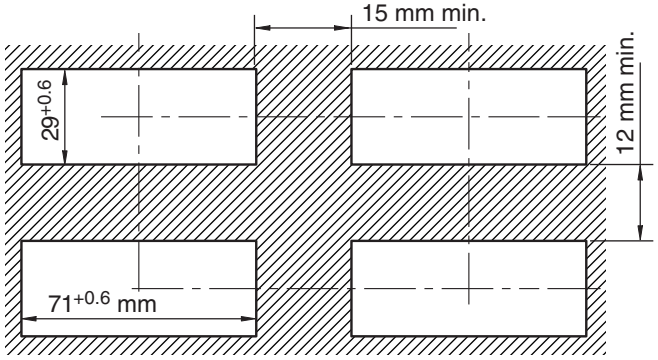
Ensure adequate ventilation to the instrument and avoid installation in containers that house devices which may overheat or which may cause the instrument to function at a higher temperature than the one permitted and declared.

Connect the instrument as far away as possible from sources of electromagnetic disturbances such as motors, power relays, relays, solenoid valves, etc.

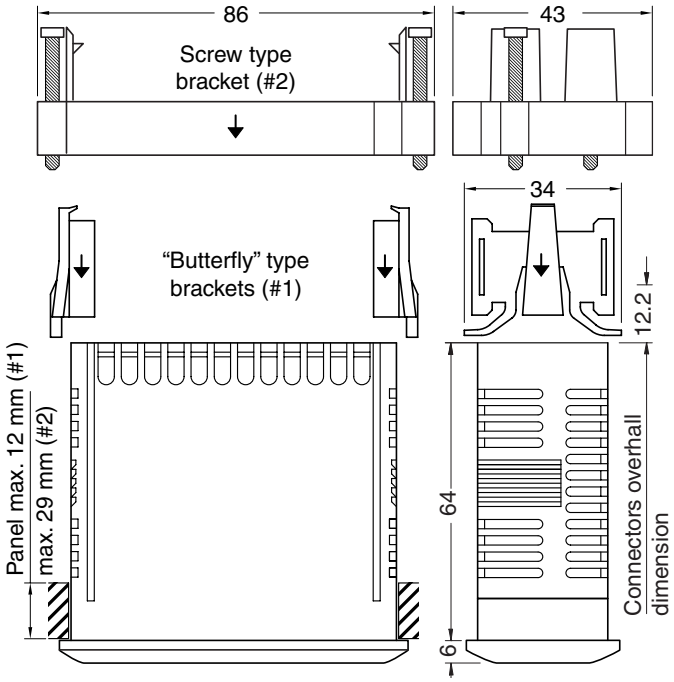
4.1.1 Mechanical dimensions [mm]



4.1.2 Panel cut-out



4.1.3 Mounting



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 overload of current: 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.

It is also recommended that the supply of all the electrical circuits connected to the instrument must be properly protected, using devices (ex. fuses) proportionate to the circulating currents.

It is strongly recommended that cables with proper insulation, according to the working voltages and temperatures are to be used.

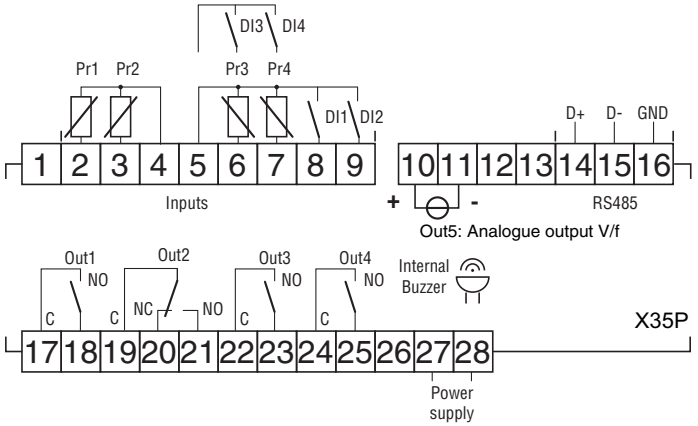
Furthermore, the probe input cable must be kept separate from line voltage wiring.

When shielded cable is used, the protection shield should be connected to ground at only one side.

For the electrical supply of the **G** (12 ÷ 24 VAC/DC) type instruments it is recommended to use an external TCTR transformer, or with equivalent features and to use a transformer for each instrument because there is no insulation between input and power supply.

⚠ We recommended that a check should be made that the parameters are those desired and that the application functions correctly **before connecting the outputs** to the actuators 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



	61810 EN	60730 EN	60730 UL	10E5 cycles, 0 T 50 °C
Out1:	16 (9) A	10 (4) A	12 A Res. 30 LRA / 5 FLA	
Out2:	8 (3) A	4 (4) A	10 A Res.	
Out3,4:	5 (1) A	2 (1) A	2 A Gen.Use	

5. FUNCTIONS

5.1 ON/Stand-by function

The instrument, once powered ON, can assume 2 different conditions:

– **ON**: The controller uses the control functions.

– **Stand-by**: The controller uses no control function and the display is turned OFF except for the Stand-by LED. The transition between Stand-by and ON status is equivalent to switching ON the instrument by giving power.

If a power failure occurs and then power returns, the system always sets itself in the condition it was in before the black-out.

The ON/Stand-by function can be selected:

– Pressing the key (U) for at least 1 s if parameter *t.UF* = **3** or **5**;

– Pressing the key (▼) for at least 1 s if parameter *t.Fb* = **3** or **5**;

– Using the digital input if parameter *i❑F* = **7** or **15** (where ❑ can be 1 ÷ 4);

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

5.2 Normal, Eco and Turbo operating modes

The instrument allows to pre-set up to 3 control Set Points:

SP *Normal* Set Point;

SPE *Eco* (economical) Set Point;

SPH *Turbo* Set Point.

Associated with each of these modes is present the correspondent differential (hysteresis):

r.d *Normal* mode differential;

r.Ed *Eco* mode differential;

r.Hd *Turbo* mode differential.

The switching between these modes can be automatic or manual.

"Normal/Eco" mode operation

Can be used where it is necessary to switch between two different operating temperatures (e.g.: day/night or working days/holidays).

Normal/*Eco* mode can be selected manually:

– Pressing the (U) key if parameter *t.UF* = **2**;

– Pressing the (▼) key if parameter *t.Fb* = **2**;

– By a digital input if parameter *i❑F* = **6** (where ❑ can be 1 ÷ 4);

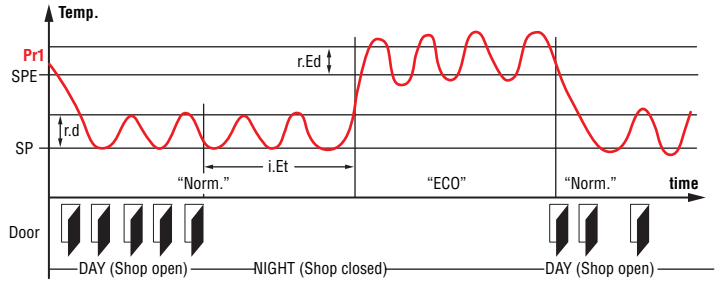
Normal/*Eco* mode can be selected automatically:

– After the door has been closed for time *iEt* (switching from *Normal* to *Eco*);

– When the door is opened if the **SPE** Set Point is active from parameter *iEt* (switching from *Normal* to *Eco*);

– After the door has been closed for time *iEt* since activation of the **SPE** Set Point from parameter *iEt* (switching from *Eco* to *Normal*);

– At times defined through the clock by programming events *t.5* (switch to *Eco* mode) and *t.7* (switch to *Normal* mode). For further information, see the paragraph: "*Programming events through the clock*".



Example of automatic switching between Eco mode and Normal mode. During working hours the door is frequently opened and the controller remains in Normal mode. When the door has not been opened for time iEt, the controller switches to Eco mode. As soon as the door is opened again, the controller reverts to Normal mode.

This function requires the usage of a digital input configured as i❑F = **1**, **2** or **3** (open door input).

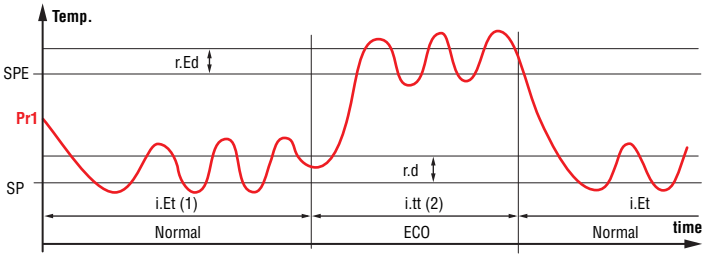
If iEt = **oF** the *Eco*/*Normal* mode selection via the digital input configured as door, is deactivated.

If itt = **oF** the *Eco*/*Normal* mode switching due to time-out is deactivated.

When in *Eco* mode, the label *Eco* is displayed.

If id5 = **Ec** the display sows the label *Eco* when the instrument is in *Eco* mode. Otherwise the label *Eco* appears approx. every 10 seconds alternated with the normal display set by the id5 parameter.

The *Eco* mode selection is always combined with the turn OFF the Auxiliary output function when used as a shop window light (oFo = **3**).



Notes: 1. iEt time is reset all the times the door is opened. In the case shown, the door is always closed.

2. itt time stops when the door is opened and the instrument immediately switches to *Normal* mode. In the case shown, the door is always closed.

Turbo/Normal/Eco mode operation

Turbo mode can be selected manually:

– Pressing the (U) key if parameter tUF = **4**;

– Pressing the (▼) key if parameter tFb = **4**;

– By a digital input if parameter i❑F = **8** (where ❑ can be 1 ÷ 4).

Turbo mode can be selected automatically:

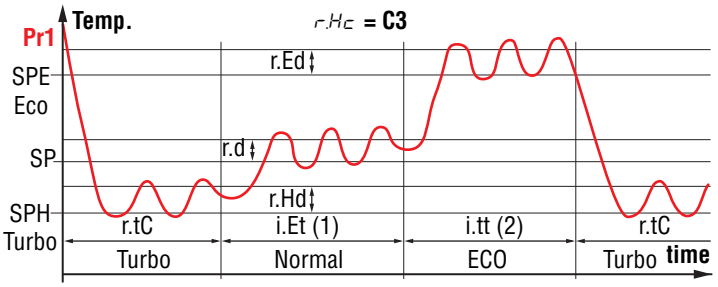
– While leaving *Eco* mode (only if rHC = **C3**);

– Every time the instrument is turned ON (only if rHC = **C3** and **Pr1** > **SPE** + **r.Ed**).

The instrument quits *Turbo* mode automatically when rtC time has elapsed or manually using the programmed command (key or digital input); the instrument always returns to *Normal* mode.

Turbo mode can be applied manually, for example when the user wishes to lower the temperature of the products quickly after loading the refrigerator. However, *Turbo* mode is applied automatically to restore product temperature at the end of *Eco* mode.

Setting rHC = **C3** gives the following operating cycle:



Notes: 1. iEt time is reset all the times the door is opened. In the case shown, the door is always closed.

2. itt time stops when the door is opened and the instrument immediately switches to *Turbo* mode. In the case shown, the door is always closed.

When switched ON, the instrument starts in the same mode it was in when it was switched OFF (*Normal* or *Eco*) unless the temperature at switch-on is higher than **SPE** + **r.Ed**. In this case (see figure) a *Turbo* cycle is automatically started.

After the rtC time has elapsed, the instrument automatically switches to *Normal* mode.

If the door is frequently opened the instrument remains in *Normal* mode. If however the door is not opened for iEt time, it automatically switches to *Eco* mode. The instrument remains in *Eco* mode until the door is opened again or, if set, until the itt time-out has elapsed.

When leaving *Eco* mode, the instrument therefore runs a *Turbo* cycle to allow the product temperature to be restored, after which it reverts to *Normal* mode and so on.

The *Turbo* in progress is indicated by the label trb alternated with the normal display.

The *Normal* Set Point (**SP**) can be set between the values stored for SLS and SHS parameters, *Eco* Set Point (**SPE**) can be set between the values of **SP** and SHS and the *Turbo* Set Point (**SPH**) can be set between the values of SLS and **SP**.

Note: In the examples that follow, the Set Point is generically indicated as **SP** and the histeresis as r.d, however, operationally, the instrument will act on the basis of the Set Point and of the histeresis selected as active.

5.3 Measure and display configuration

All parameters concerning measuring input are contained in the In group.

With SEn parameter it is possible to select the type of probe connected to the instrument. Admitted types: thermistors PTC KTY81-121 (Pt), NTC 103AT-2 (nt) or Pt1000 (P1).

With unP parameter it is possible to select the temperature measurement unit and resolution (C0 = °C/1°; C1 = °C/0.1°; F0 = °F/1°; F1 = °F/0.1°).

The instrument allows the measuring to be calibrated, that can be used for re-calibrating the instrument according to application needs, through parameters iC1 (for **Pr1** input), iC2 (for **Pr2**), iC3 (for **Pr3**) and iC4 (for **Pr4**).

The usage of **Pr2**, **Pr3** and **Pr4** probes is defined by parameters iP2, iP3 and iP4. These can be configured for the following functions:

EP **Evaporator Probe**: used to manage the defrost and the evaporator fans (see the relative paragraph);

Au **Auxiliary Probe**: can be used as a display-only probe but it is also possible to assign it temperature alarms (possible usages: product probe, antifreeze probe, etc.);

cd **Condenser Probe**: can be used as a display-only

probe but it is also possible to assign it temperature alarms in order to signal alarms related to condenser malfunctions (e.g. dirty/clogged condenser);

2E **Evaporator Probe 2**: The probe performs the functions described later for controlling defrosts in the second evaporator of twin-evaporator plants;

dG **Digital input** (see the digital inputs functions);

oF **Probe not used**, when **Pr2** and/or **Pr3** and/or **Pr4** is/are not used, set iP2, iP3, iP4 to **oF**.

It is not possible to program more probes for the same function (priority goes to lowest input).

With iFt parameter it is possible to set a software filter related to the input value measurement in order to decrease the sensibility to rapid temperature variations (increasing the time).

With ids parameter it is possible to establish what is normally shown on the display:

P1 **Pr1** probe measurement;

P2 **Pr2** probe measurement;

P3 **Pr3** probe measurement;

P4 **Pr4** probe measurement;

SP Active Set Point;

Ec The **Pr1** probe measurement in *Normal* mode and the label *Eco* when in *Eco* mode;

oF Diplay switched OFF.

With iCU parameter it is possible to program a measure offset that is applied only to the temperature shown on the display when ids= **P1**, **P2**, **P3**, **P4**, **Ec** (not to the control). The corrections to the probe measurements applied to he control procedure are those of calibration parameters.

Regardless of what has been set at ids parameter, it is possible to view all the measurement variables and the **Pr1** measurement peaks by ciclically pressing and releasing the (U) key. The display will alternately show the code that identifies the variable (see below) and its value. The variables that can be displayed are:

Pr1 **Pr1** probe measure;

Pr2 **Pr2** probe measure;

Pr3 **Pr3** probe measure (ON/OFF status if digital input);

Pr4 **Pr4** probe measure (ON/OFF status if digital input);

Lt The lowest temperature measured by **Pr1** probe;

Ht The highest temperature measured by **Pr1** probe;

P The **Out5** output power;

F The **Out5** output frequency;

and, when the real time clock is enabled:

h. + 2 digits with the actual hour;

n. + 2 digits with the actual minutes;

d. + 2 digits with the actual day;

When the instrument is switched OFF, **Pr1** peak values are always reset. However, it is possible to reset these values pressing the key (▼) for 3 s during peak visualization. The display will show "- - -" and peak memory will be reset.

The istrument automatically exits the display variable mode 15 seconds after the last pressure on the (U) key.

Please remember that **Pr1** probe data visualisation can be changed by the defrost display lock function (parameter ddL see the Defrost function).

5.4 Digital Inputs

All parameters concerning the Digital Inputs are contained in the in group.

The instrument has 2 voltage-free digital inputs whose function are defined by parameters i1F and i2F and whose action can be delayed by the time period set with parameters i1t and i2t.

In addition, the instrument may have 2 further voltage-free digital inputs as an alternative to the measurement inputs **Pr3** and **Pr4**. In order to use these inputs digitally, the user must set the relevant parameters iP3 and/or iP4 = **dG**.

The function performed by these digitally configured inputs is defined by parameters i3F and i4F while their action is instantaneous and cannot be delayed.

The parameters i1F, i2F, i3F, i4F can be configured for the following functions:

0 No function;

1 Cell door opening sensor with NO contact: at input closure the instrument alternately displays oP and the variable set at ids parameter. This Digital Input function starts also the timer set with parameter doA elapsed which the Open Door Alarm is activated. In addition, at door opening, the controller returns to *Normal* mode if it was in *Eco* mode and the *Eco* mode had been activated by iEt parameter;

2 Cell door opening sensor with fan stop with NO contact: Similar to function **1**, but with fans stop function. Once elapsed the doA interval the controller activates the *Door open Alarm* and restarts the fans.

3 Cell door opening sensor with compressor and fan stop with NO contact: Similar to function **2**, but with compressor stop. Once elapsed the doA interval the controller activates the *Door open Alarm* and restarts the fans and the compressor;

4 External alarm signal with NO contact: at input closure the alarm is activated and the instrument alternately shows AL and the variable set at parameter ids.

5 External alarm signal with all control outputs disabled with NO contact: at input closure the alarm is activated, all the control output (alarm and light outputs excluded) are disabled and the instrument alternately shows AL and the variable set at parameter ids;

6 *Eco*/*Normal* mode selection with NO contact: at input closure the temperature *Eco* mode is activated. When instead the DI is open returns in *Normal* mode.

7 Instrument ON/OFF (stand-by) selection with NO contact: at input closure the instrument is switched ON while it is placed in Stand-by mode when the digital input is open;

8 *Turbo* activation command with NO contact: at input closure the instrument starts a *Turbo* cycle;

9 **AUX** auxiliary output remote command of with NO contact: at input closure the instrument activates the auxiliary output as described in the oFo = **2** operating mode of the auxiliary output.

10 Disable recording of HACCP alarms with NO contact: at input closure the instrument disables the recording of HACCP alarms;

11 Reset recording of HACCP alarms with NO contact: at input closure the instrument deletes all recorded HACCP alarms.

12 External **PrA** alarm notified and **ot** output deactivated by NO contact: at input closure the instrument deactivates the output configured as **ot** and activates the alarm and the instrument display shows PrA alternated to the variable

defined at id5 parameter;

13 External **HP** alarm notified and **ot** output deactivated by NO contact: at input closure the instrument deactivates the output configured as **ot** and activates the alarm and the instrument display shows HP alternated to the variable defined at id5 parameter.

14 External **LP** alarm notified and **ot** output deactivated by NO contact: at input closure the instrument deactivates the output configured as **ot** and activates the alarm and the instrument display shows **LP** alternated to the variable defined at id5 parameter.

15 Forcing a programmed Switch-ON/Switch-OFF (Stand-by) event with NO contact: the input closure for at least 1 s switches the instrument from the ON to the Stand-by state and vice-versa, until the next event. Therefore, if switch-ON/stand-by events are programmed using the clock, this operation mode forces the state until the next event.

16 Defrost activation command with NO contact: at input closure (and elaped id1 delay) the instrument starts a defrost cycle;

17 End-Defrost command with NO contact: at input closure (and elaped id1 delay) if the defrost cycle is in progress the instrument stops it, otherwise inhibits the defrost start;

18 *Turbo* cycle control with NO contact and monostable switch mode: a *Turbo* cycle is started when the input is closed. The *Turbo* mode therefore remains active as long as the digital input remains closed and the rtC time has not elapsed. If the contact is opened during rtC time count, the *Turbo* cycle is interrupted. At the end of rtC time, to start a new cycle it is therefore necessary to open, then close digital input;

19 Inhibition of the events programmed via Real Time Clock.

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

Note: Where multiple digital inputs are configured for the same function, the instrument will treat the contacts as if they were parallel (and consequently regard the result as an OR function).

5.5 Relay Outputs and Buzzer Configuration

All parameters concerning the outputs configuration are contained in the rOu group.

The instrument outputs can be configured using parameters o01, o02, o03, o04.

The outputs can be configured for the following functions:

ot Controls the compressor or however, the temperature control device. In case of neutral zone control (rHC = nr) the output is used to command the cooling ON/OFF control device. This output is operational only if output **Out5** is not present or not used (rA5 = **0**);

dF Controls the defrost device;

Fn Controls the evaporator fans;

Au Controls the auxiliary device;

At Controls a silenceable alarm device through a contact that is NO and then closed when in alarm;

AL Controls an alarm that cannot be silenced through a contact that is NO and closed when in alarm;

An Controls an alarm with a memory function through a contact that is NO and closed when in alarm.

-t Controls a silenceable alarm device through a contact that is NC and then open when in alarm;

-L Controls an alarm that cannot be silenced through a contact that is NC and open when in alarm;

-n Controls an alarm with a memory function through a contact that is NC and open when in alarm;

on Output ON when the instrument is in ON state. This mode can be used to control the shop lights, anti-fog resistances or other utilities;

HE Controls a heating device in neutral zone control mode (rHC = **nr**);

2d Controls the second defrost device;

L1 Shop light output managed by *Normal*/*Eco* mode. This type of output is ON in *Normal* mode and OFF in *Eco* mode operation.

L2 Internal Light output managed by digital input. This output will be ON when door is open (only if i1F = **1**, **2**, **3**);

CS Output active when the variable speed compressor is running and delayed at shutdown by the time programmable in parameter rCS. This output can be used for example to control the condenser cooling fan;

oF Output disabled.

Disabling the outputs (o01 = **oF**) they can be controlled through the serial port at the following addresses:

Hex. Index	Description	Action
28E	Enable/Disable Out1 when o01 = **oF**	**0** Disable Out1 **1** Enable Out1
28F	Enable/Disable Out2 when o02 = **oF**	**0** Disable Out2 **1** Enable Out2
290	Enable/Disable Out2 when o03 = **oF**	**0** Disable Out3 **1** Enable Out3
291	Enable/Disable Out2 when o04 = **oF**	**0** Disable Out4 **1** Enable Out4

If one of the outputs is configured as Auxiliary (o01 = **Au**) its function is defined by the parameter oAo and conditioned by the time set at parameter otu. The parameter oAo can be configured for:

oF Auxiliary output not active;

1 Control output with delayed activation: the **Aux** output is activated after otu delay time from **ot** output activation; the **Aux** output is then turned OFF when **ot** is disabled. This working mode can be used as a command for a second compressor or other utilities with the same **ot** output conditions, but which must be delayed after the compressor start up to avoid excessive current absorption;

2 **Aux** Output activated by front key, digital input or Real Time Clock: the output is activated by pressing the (U) or (▼)/AUX key when suitably configured (tuF or tFb = **1**) or by a Digital Input command if configured (i1F = **9**) or by an RTC event. The commands by key or digital input have a bi-stable (toggle) function. Bi-stable means that the 1st command turns ON the output, while the 2nd turns the output OFF. In this mode, the **AUX** output can be turned OFF automatically after the time set at otu parameter. When otu = **oF** the output is activated and deactivated only manually using a key ((U) or (▼)/AUX), Digital Input or RTC ON/OFF event, otherwise, the output, once activated, is turned OFF automatically after the otu time. This function can be used to manage, for example, the cell light, anti-fog resistances or other utilities. If **AUX** output ON/OFF events are programmed by Real Time Clock, the action of the keys or digital input (in this **AUX** output mode) forces output status until the next event.

3 Intake solenoid valve output. The output is used to control

the Hot-Gas intake valve in centralized systems (ddt = **HG**) defrost mode. The output configured in this way is permanently activated during the temperature control operation, while it is deactivated during defrost and post-defrost to avoid the introduction of hot gas into the intake line.

The internal buzzer (if present) can be configured with parameter obu 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.

5.6 Temperature control

All parameters concerning the Temperature control functions can be found in the rE group and in the gorup rC5 those for the PID control of the compressor speed.

5.6.1 ON/OFF Control Using the Relay Outputs

The instrument control method for the relay outputs is of **ON/OFF** type and acts on the outputs programmed as **ot** and **HE** in response to:

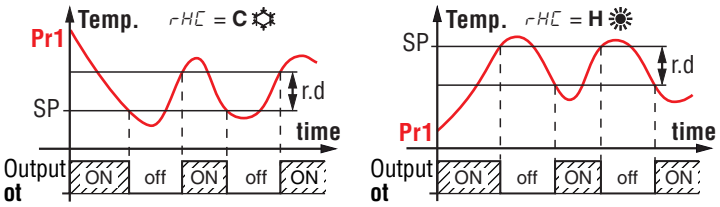
– **Pr1** probe measurement;
– Set Point(s) **SP** (or **SPE** and/or **SPH**) value(s);
– Intervention differential **r.d** (or rEd and/or rHd) value;
– The **r.HC** operating mode.

Through rHC parameter the following actions can be obtained:

- **C/H** (**C** = Cooling/**H** = Heating);
- **nr** (Neutral Zone or Cooling and Heating a single SP);
- **HC** (Cooling/Heating with 2 indepentent SP);
- **C3** (Cooling with 3 automatic modes).

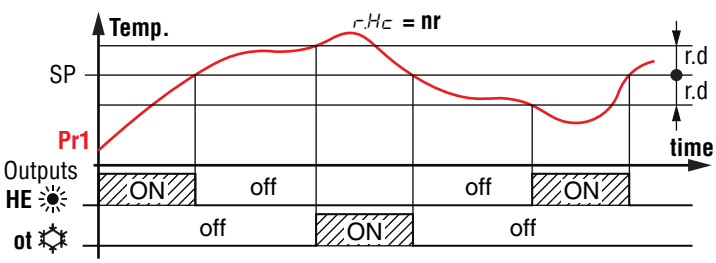
Depending on the function mode programmed with parameter rHC the differential is automatically considered by the controller with positive values for a **Refrigeration** control (rHC = **C**) or negative values for a **Heating** control (rHC = **H**).

<u>**C** = Cooling/**H** = Heating</u>



<u>**nr** Neutral Zone or Cooling and Heating with a single SP</u>

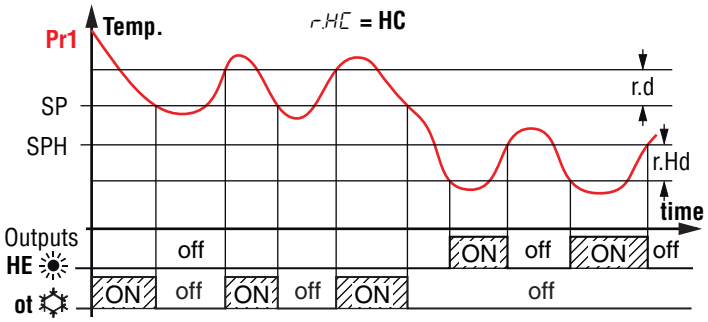
When rHC = **nr**, the output configured as **ot** operates with a Cooling action (like rHC = **C**) while the output configured as **HE** operates with a heating action; both the actions use the active Set Point (**SP**/**SPE**/**SPH**). The intervention differential (rd/rEd/rHd) is automatically assumed by the controller to have positive values for the Cooling action and negative values for the Heating action.



<u>**HC** Cooling and Heating with 2 independent SPs</u>

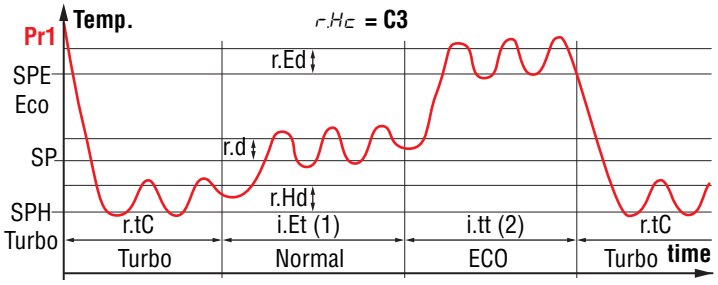
As in the previous case, when rHC = **HC** the output configured as **ot** operates with Cooling action (like rHC = **C**) while the output configured as **HE** operates with Heating action. In this case, however, the Set Point for the **ot** output is the active one (**SP**/**SPE**/**SPH**) while for **HE** output the Set Point is **SPH**. The intervention differential for the **ot** output is the active differential (rd/rEd/rHd) and is automatically assumed by the controller to have positive values for the Cooling action while for the output **HE** the differential is rHd considered with negative values as for the Heating actions.

In this mode, the activation of the *Turbo* cycle causes the instrument to operate with Neutral Zone and **SPH** set point.



<u>**C3** Cooling with three automatic modes</u>

The instrument still operates with Cooling action, but this selection activates the automatic switching between the *Normal*, *Eco* and *Turbo* modes as already described in the *Operating modes* paragraph.



The time protections described in the next paragraph (PP1/PP2/PP3) always work on the output configured as **ot**.

In the event of a probe error, it is possible to set the instrument so that the **ot** output continues working in cycles according to the times programmed with parameters rt1 (activation time) and rt2 (deactivation time). If a **Pr1** probe error occurs, the instrument continues activating **ot** output for rt1 time then disabling it for rt2 time and so on until the error persists.

By programming rt1 = **oF** the **ot** output in probe error condition remains OFF. On the other hand, programming rt1 to any value and rt2 = **oF** the **ot** output, in probe error condition, remains always ON.

Remember that the operation of the temperature controller can be conditioned by the following functions: *Compressor protection functions and Power-ON delay*, *Defrost*, *Open door* and *External alarm with output disable* from Digital Input.

5.6.2 PID Control with Frequency or Voltage Output (Out5)

All parameters concerning the configuration and operation of **Out5** output for the inverter control are contained in rC5 group.

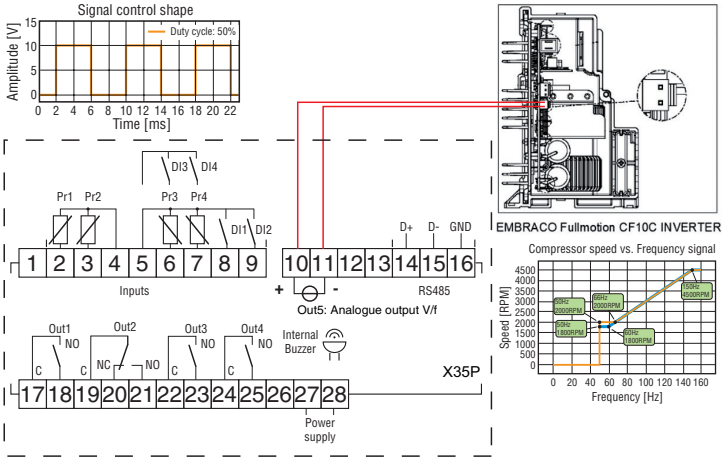
Out5 controls the inverter which manages the system compressor speed.

Out5 controls the inverter according to the PID algorithm described below and replaces the ON/OFF control output previously described as **ot**. It is available in 2 hardware configurations:

F Frequency Output (250 Hz max. with 9 ÷ 12 V amplitude).
V Voltage Output (configurable as 0 ÷ 10 V or 0 ÷ 5 V,

Frequency output with 250 Hz of max. and analogue output with 0 ÷ 10 V or 0 ÷ 5 V of amplitude).

The Frequency output model is compatible with the most popular inverters designed for driving compressors while the voltage output model is for general purpose inverters.



Embraco inverter connection example.

Out5 *Configuration for Inverter Control*

The **Out5** type V output can control the compressor inverter in Frequency (Output in frequency 250 Hz max.) or as Voltage Analog output (0 ÷ 5/10 VDC voltage output) and can be configured using the r.Ao parameter as:

0 Not used;
1 Frequency control 0...250 Hz amplitude 5 V;
2 Frequency control 0...250 Hz amplitude 10 V;
3 Voltage analogue output 0 ÷ 5 V;
4 Voltage analogue output 0 ÷ 10 V.

Note: If **Out5** is only in frequency (type **F** = 9 ÷ 12 VDC 250 Hz max.), the r.Ao parameter is not visible.

Setting parameter r.OP = **on**, the instrument operates on **Out5** output signal in manual mode to allow, for example, the system tests.

Once r.OP = **on** has been programmed, the fast Set Point setting mode (P key pressed and released) allows, instead of setting the temperature Set Point, the setting of the value that is to be implemented on the output.

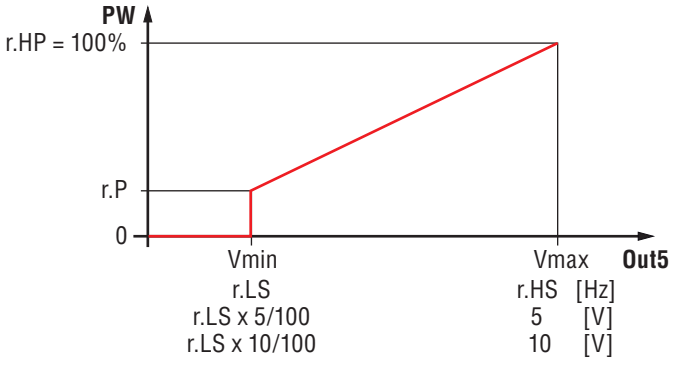
Since the compressors control normally provides for a minimum operating speed, it is necessary to establish which power value to be delivered at the output must correspond to the minimum speed that the drive must implement.

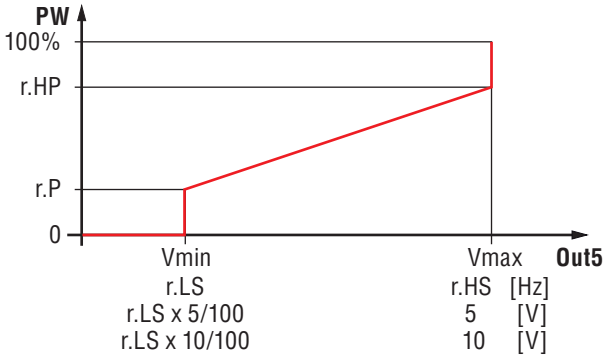
For this the parameters are provided:

r.LP Minimum control signal power threshold. Used to establish when to activate the minimum signal on the output (for example 30%). In the case of frequency output, r.LP is associated with the r.LS parameter - which is used to establish the minimum signal that is to be send to **Out5** output to start the compressor (for example 50 Hz).
In the case of analogue output, the actual signal will instead be the proportionally corresponding one and therefore the value resulting from the calculation:
r.LS x 5/100 (in the case of 0 ÷ 5 V output);
r.LS x 10/100 (in the case of 0 ÷ 10 V output).

Similarly, if it is necessary to modify the control operation dynamics also with regard to the maximum value, the following parameters are provided:

r.HP Power threshold that corresponds to the max. control signal. Used to establish the power beyond which the output signal reaches the maximum expected value (in any case it is normally 100%).
In the case of Frequency output, r.HP is combined with parameter r.HS - which is used to establish the maximum signal that is to be send to **Out5** output to obtain the maximum speed foreseen for the compressor (for example 150 Hz).
In the case of analog output, the signal implemented will instead be the maximum (5 or 10 V).





PID Temperature Control

As mentioned, the control method used by the instrument on **Out5** output is of the **PID** type.

The controller operates on output **Out5** with the action (Cooling or Heating) configured at parameter r.HC (if r.HC = **nr**/**HC** is configured, **Out5** operates with a Cooling action).

The PID control determines the power to be implemented on **Out5** output as a function of **Pr1** temperature, the active Set Point and the parameters:

r.Pb Proportional band;
r.td Derivative time;
r.ti Integral time.

These parameters can be manually set or calculated by the instrument using the *Autotuning* function which allows the automatic tune of the above mentioned parameters.

After having set the action and the desired Set Point, to activate the *Autotuning* function program the r.At parameter as:

1 Autotune is to be started automatically all the times the instrument is turned on;
2 Autotune is to be started automatically at the next instrument power ON and, as the tuning process is ended, the r.At parameter is changed to **oF**;
3 Autotune is to be started manually pressing contemporaneously for at least 10 s the keys U + ▼;

oF When r.At = **oF** the Autotuning is disabled.

The instrument performs a series of operating cycles with the compressor operating at 100% of the power and without taking into account delays and the power set speed changes; at the end of the tuning cycles it will automatically calculate and store the values of the control parameters r.Pb, r.td, r.ti.

If the Autotune process is not completed within 12 hours, the instrument will display the *EAt* error message.

Should a probe error occur during Autotuning, the instrument will naturally interrupt the running cycle.

Autotuning in progress is indicated by the *At* label alternated, every 10 s, to normal display.

Note: Frequent and close compressor starts are not recommended in a compressor controlled cooling process.

Therefore it is recommended to experiment with manual autotuning by monitoring the system behavior.

Furthermore, since the refrigeration processes are normally quite slow, to optimize the control it is not necessary to carry out the Autotune function but, probably, the proportional band only contribution is sufficient.

The power value calculated by the PID control will then be implemented on **Out5** output according to the rules established by the *r.LP*, *r.LS*, *r.HP*, *r.HS* output configuration parameters previously described.

In addition to these implementation rules, the tool provides additional parameters to optimize the control operation which are:

r.Su Output signal variation speed for power increase [%/s];

r.Sd Output signal variation speed for power decrease [%/s];

r.1t Holding time Minimum output power of the control band after reaching the Set Point;

r.2t Holding time Minimum input power of the control band after reaching the Set Point;

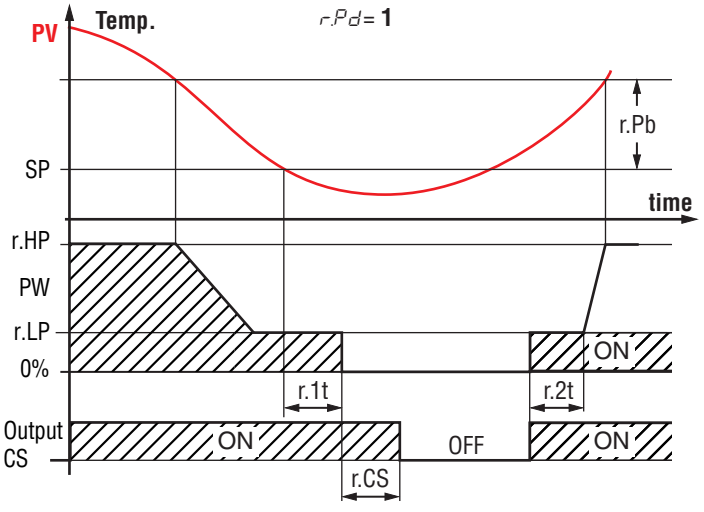
r.Pd Pull-down behavior (First reaching of the Set Point):

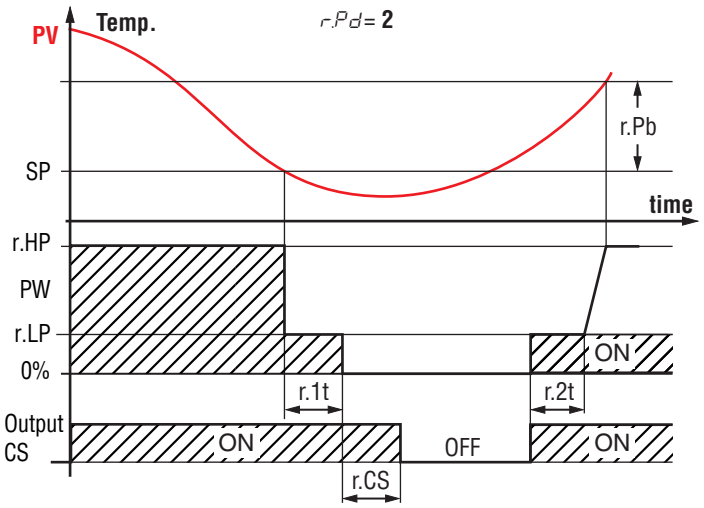
1 Outputs the power calculated within the proportional band;

2 100% of the power until the Set Point is reached.

Even in the case of PID control, all the *Pod* delay protections (*PP1*, *PP2*, *PP3*) are in any case operative on the implementation of the output control signal (for example if the *Pod* parameter **is different from oF** at start-up, the output signal is delayed by the set time or if the compressor stops, it cannot restart unless the time *PP2* has elapsed first).

The instrument that uses the compressor speed control may need to have a digital output that is activated when the compressor is running (output configured as **CS**), for example to drive the condenser fans and perform so that they switch OFF with a certain delay compared to the compressor switching OFF, this delay can be set at parameter *r.CS*.





Operation examples with the Proportional band contribution only

In particular cases, the control output **Out5** must be able to set itself in predetermined conditions regardless of the power calculated by the PID regulator. These conditions appear to be:

– Probe **Pr1** in error;

– Defrost with hot gas/cycle inversion (*ddt* = **in**);

– Compressor lock with door open (*dF* = **3**).

For these conditions it is possible to establish the power to be applied when they occur through the parameters:

r.F1 Output power in case of probe error;

r.in Output power in case of defrost with hot gas/cycle inversion (*ddt* = **in**);

r.dc Output power in case of compressor block with door open (*dF* = **3**).

As previously mentioned, the power implemented on **Out5** output can be viewed with the indication P among the measurement variables by pressing and releasing the U key.

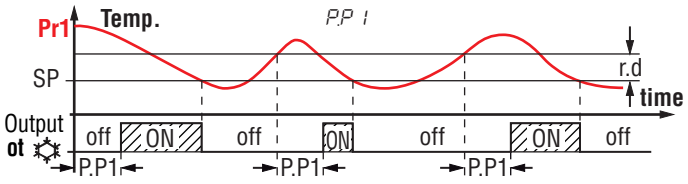
5.7 Compressor protection functions and power-ON delay

All parameters concerning the compressor protection functions can be found in the *PPr* group.

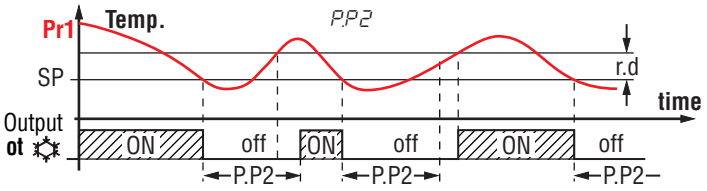
The "*Compressor Protection*" function aims to avoid repeated compressor start-ups controlled by the instrument in Cooling applications or otherwise can be used to add a timed control on the actuator control output.

This function foresees 3 time controls on the switching ON of the output configured as **ot** or, if used **Out5**, associated to the temperature control request. The protection consists in preventing the **ot/Out5** output being switched ON during the times set with parameters *PP1*, *PP2* and *PP3* and therefore that any activation occurs only upon expiry of all protection times.

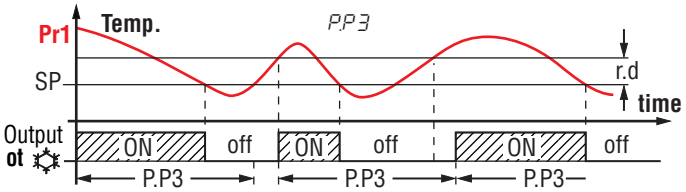
1. First control (parameter *PP1*) foresees a delay to **ot/Out5** output activation (switching-ON delay).



2. Second control (parameter *PP2*) foresees an inhibition to the activation of **ot/Out5** output by a time delay that starts when the output is turned OFF (delay after switching-OFF).



3. Third control (parameter *PP3*) foresees an inhibition to the activation of **ot/Out5** output by a time delay that starts when the output was turned ON last time (delay between two switching-ON).



During the output inhibition the LED **OUT** (☼ or ☀) blinks.

It is also possible to prevent the activation of all the outputs after the instrument is turned ON for the time set at parameter *Pod* (Power ON delay).

During the power ON delay phase, the display shows the indication *od*, alternated with the normal display.

These functions are disabled when all the relative parameters are set to **oF** (*PP1*, *PP2*, *PP3* and *Pod* = **oF)**.

In case **HOT-GAS** defrost mode for centralized systems (*ddt* = **HG**), parameters *PP1* and *PP2* are used to set the activation delay of the *Liquid* solenoid valve and the deactivation delay of the *Aspiration* solenoid valve (see "*HOT-GAS defrost operation for centralized systems*").

5.8 Defrost control

All parameters concerning the defrost control are contained in the *dEF* group.

The defrost control acts on the outputs configured as **ot/Out5** and **dF**.

The defrost type that the instrument must perform is established by parameter *ddt* which can be programmed as:

EL **With electrical heating** (or by **compressor stop**): during defrost, the **ot/Out5** output is deactivated while the output **dF** is enabled. If the **dF** output is not used, the defrost will take place by compressor stop;

in **With hot gas** or **Inversion of cycle**: during defrosting both the outputs (**ot/Out5** and **dF**) are enabled. If the compressor is controlled by **Out5**, the power can be programmed with parameter *r.in* contained in the *rEG* group;

no **Without compressor output conditioning**: while defrosting, the **ot/Out5** output continues to operate in order to control the temperature, also **dF** output is enabled.

Et **With electrical heating and defrosting temperature control**: while defrosting, the **ot/Out5** output is deactivated while the output **dF** operates as evaporator temperature control. In this mode the defrost duration is by *ddE* time-out. During defrost the **dF** output behaves as an heating action temperature control with **SP** = *dtE*, the differential fixed to 1°C and refers to the temperature measured by the evaporator probe (**EP**). In this mode, if the evaporator probe is not enabled or in error, the defrost action behaves as with **EL** selection (therefore the **dF** output during defrost must always remain active).

HG **With hot gas in centralized systems**: with this mode it is necessary to **configure 3 outputs** to control *Liquid* solenoid valve (**ot/Out5** output), *Hot gas* solenoid valve (**dF** output) and *suction* solenoid valve (**Au** outputwith configuration *Fo* = **3**). During defrost, only the output **dF** is activated, while before and after defrost the valves perform a sequence of timed operations described below.

5.8.1 Starting automatic defrosts

The automatic control of defrost occours:

– Defrost at defined times – "Real Time Clock Defrost" (when peresent and enabled the RTC);
– By interval times (regular or dynamic);
– By Evaporator temperature;
– By continuous compressor running time.

In order to avoid unnecessary defrosts when the evaporator temperature is high, the *dtS* parameter allows to set the temperature related to the evaporator probe (probe configured as **EP**) under which defrosts are possible.

If the temperature measured by the **EP** probe is higher than that at parameter *dtS* the defrosts are inhibited.

Defrosting at defined times – "Real Time Clock Defrosts"

The choice *ddC* = **cL** disables the defrost at specified intervals (parameters *dd1* and *dSd*) and enables the Real Time Clock Defrosts programmed through parameters *c.01*, *c.02*, *c.03*, *c.04*, *c.05*, *c.06*, *c.07*, *c.08*, *c.09*, *c.10*, *c.11*, *c.12*, *c.13* and, *c.14*. In this mode the instrument can therefore manage up to a maximum of 14 daily defrost events (14 x 7 = 98 weekly defrosts with *d8*).

In any case, the events can be programmed as desired even daily according to the following settings:

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;
doF No day (event disabled).

These options allow to manage the start of defrosts at different hours for weekdays and holidays according to user needs.

For further detailed information and programming examples, see the "*Programmable events*" paragraph.

Note: Remember that for "*Real Time Clock Defrosts*" the user must set *ddC* = **cL** and the internal clock must be present and enabled.

Defrost by regular interval time

Counting mode interval and automatic defrost starts are set through the *ddC* parameter. *ddC* possibe settings:

rt Intervals with counting of the total functioning time (instrument ON). This mode the one currently used in the refrigerators systems;

ct Intervals with counting of the compressor functioning time (**ot** output switched ON). The *dd1* interval is counted as the sum of the operating times of the control output (**ot** output activated). This mode is typically used in the positive temperature refrigerator systems with defrost by compressor stop.

cS Defrost at all compressor stop. The instrument carries out a defrost cycle at each compressor stop (i.e. at each deactivation of the **ot** output) or however at *dd i* defrost interval end with counts the total function time (instrument ON). If *dd i* = **oF** the defrost happens only when the compressor stops. This mode is used only on particular refrigerator systems in which the maximum evaporator efficiency conditions at each compressor cycle are requested.

To enable the automatic defrost at intervals, after setting *ddC* parameter as desired (**rt**, **ct** or **cS**), with parameter *dd i* select the time interval between the end of a defrost and the beginning of the next.

The time that the instrument must wait to perform the first defrost after power ON can be set with parameter *d5d*. *d5d* allows to perform the first defrost to a different interval from *dd i* time.

To force the instrument to perform a defrost cycle at each power ON (as long as the conditions set with parameters *dt5* and *dtE* are satisfied) set parameter *d5d* = **oF**.

This allows the evaporator to be permanently defrost, even when frequent interruptions to power supply occur that may cause the cancellation of the various defrosting cycles.

If instead it is desired that all the defrosts are performed at the same interval time, set *d5d* = *dd i*.

Setting *dd i* = **oF** the Automatic defrost function by interval is totally disabled (including the first, regardless to the time set at the *d5d* parameter).

Dynamic Defrost Intervals System

Note: For this function is mandatory to use the evaporator probe.

Program *ddC* = **rt**, **ct** or **cS** and set *ddd* = **any value** (except 0) to enable the Dynamic Defrost Intervals System mode.
If *ddd* = *0* the Dynamic defrost is disabled.

This mode allows to dynamically reduce the defrost interval counting (*dd i* or *d5d* if is the first defrost), anticipating, when necessary, the defrost execution, all based on an algorithm that detects a drop in the refrigerator thermal exchange performance. In order to evaluate the thermal exchange efficiency, near the first passage from the operating Set Point, the instrument stores the temperature difference (ΔT0) between the **Pr1** probe (cell temperature) and the **EP** probe (evaporator).

Subsequently, the dynamic defrost algorithm allows to highlight the heat exchange reductions by evaluating the current temperature difference between the 2 probes (**Pr1** and **EP**) and the stored one.

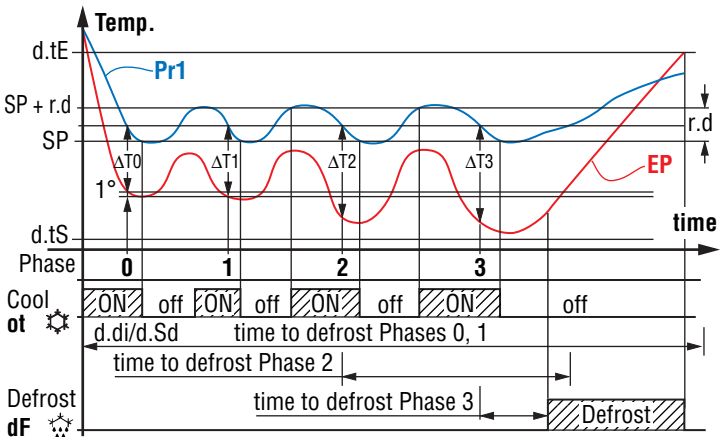
The advantage of the *Dynamic Defrost Interval* is the possibility to program a defrost interval time longer than normal. In this way, when necessary, the instrument has the possibility to anticipate/posticipate the defrost cycle from the programmed time.

If the system results correctly set, it is possible to avoid many unnecessary defrost cycles (and therefore obtain a consistent energy saving) that may occur with normal operation when, to ensure more system efficiency, the defrosts interval is programmed with a time that is often too short.

With parameter *ddd* - *Defrost interval percentage reduction* - is possible to establish the percentage of reduction of the remaining time to start next defrost when the conditions for the reduction happen.

If parameter *ddd* = **100%**, at first increasing (> 1°) of the ΔT between cell (**Pr1**) and evaporator (**EP**) probes from the ΔT stored value, the instrument starts immediately a defrost.

To function correctly the instrument needs a ΔT reference value, but, as all variations (Active Set Point, *r.d* differential or the execution of a defrost cycle) delete the ΔT reference value, often no reduction can be made until a new reference value has been acquired (at the end of the next defrost).



E.g. "*Dynamic defrost intervals system*" with a reduction *ddd* = **40%** and temperature defrost end.

Defrost by evaporator temperature

The instrument starts a defrost cycle when the evaporator temperature (**EP** probe) falls below the *dtF* programmed temperature for *d5t* programmed time to ensure a defrost if the evaporator reaches very low temperatures which, as a rule, are symptomatic of a bad heat exchange compared to normal operating conditions.

If *dtF* = **-99.9** the function is disabled.

The function is active in all modes of defrost operation (*ddC* = **cL**, **rt**, **ct**, **cS**).

Defrost by continuous compressor running time

The instrument start a defrost cycle when the compressor is turned continuously ON for the time *dcd*.

This function is used because the continuous compressor operation for an extended period is usually symptomatic of a bad thermal exchange in comparison to the normal working conditions.

If *dcd* = **oF** the function is disabled.

The function is active in all modes of defrost operation (*ddC* = **cL**, **rt**, **ct**, **cS**).

5.8.2 Manual defrost

To manual start a defrost cycle, press the key ▲/☼ and keep it pressed for about 5 s while the instrument functoining in *Normal* mode. After the key pressure, if the conditions are correct, the ☼ **LED** lights up and the instrument performs a defrost cycle.

To stop a defrost cycle, press the key ▲/☼ and keep it pressed for about 5 s during the defrost cycle execution.

5.8.3 Defrost ends

With 1 evaporator

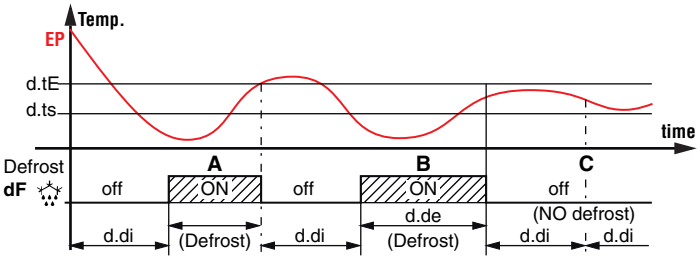
The automatic defrost cycle can be ended by time or, if an evaporator probe is used (**Pr2** probe configured as **EP**), when the evaporator reaches a particular temperature.

If the evaporator probe is not used the duration cycle is set by the parameter *ddE* (setting *ddE* = **oF** the interval/manual defrosts are disabled).

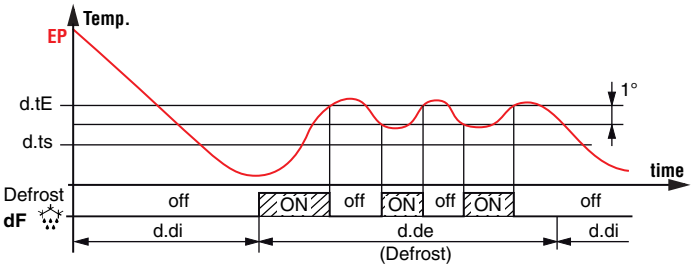
If instead the evaporator probe is used, the defrost cycle ends when the temperature measured by the evaporator probe exceeds the temperature set at parameter *dtE*.

If *dtE* temperature is not reached, the defrost cycle is interrupted when the time set at the parameter *ddE* has elapsed.

If the temperature measured by the **EP** probe is higher than the temperature set at parameters *dtS* and *dtE*, defrosts are inhibited.



E.g.: Defrost **A** ends due to reaching of temperature *dtE*, defrosting **B** ends at the end of the *ddE* time as the temperature *dtE* is not reached, defrosting **C** does not take place as the temperature is higher than *dtS*.

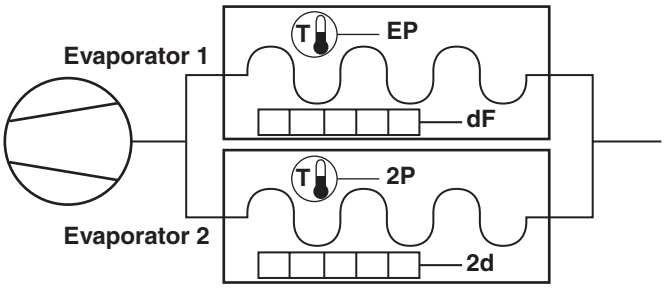


E.g.: Electric defrost with evaporator temperature control (*ddt* = **Et**): the defrost ends after the *ddE* programmed time. During defrost the **dF** output switches ON/OFF to control evaporator temperature in heating mode with *dtE* Set Point and 1° differential (Hysteresis).

With 2 evaporators

The instrument can also be used to control defrosts in twin evaporators systems (or with a single evaporator, but large enough to require two defrost control areas) by means of two defrost outputs and two probe inputs for the two evaporators.

Defrosts are always launched simultaneously for both evaporators and therefore the output configured as **2d** is always activated simultaneously with the output configured as **dF**.



E.g.: Schematic example of plant with two evaporators, 2 probes and electric defrosters.

If the two evaporator probes are not used, the defrost end, intended as deactivation of the defrost outputs, happens separately at the end of the times defined at parameters *ddE* (for output **dF** which controls evaporator 1 defroster) and *dd2* (for output **2d** which controls evaporator 2 defroster). However, the end of a defrost as a controller phase always occurs when both times have elapsed.

If each evaporator is equipped with its own probe, an input as evaporator probe 1 (*iP❑* = **EP**) and an input as evaporator probe 2 (*iP❑* = **2E**) must be configured.

In this case the instrument controls the defrosts using the following criteria:

– Defrost is enabled when at least one of the two temperature readings is below the temperature set at parameter *dtS*;
– Defrost by temperature starts when at least one of the two Temperature readings remains below the temperature set at parameter *dtF* for time *dSt*;
– The defrost end, in the sense of deactivation of the defroster command outputs **dF** and **2d** in modes *ddt* = **EL**, **in** and **no** occurs separately for the two evaporators when their respective temperatures sensed by the probes rise above the values set at parameter *dtE* (evaporator 1 with probe **EP**) and *dt2* (evaporator 2 with probe **2E**). If these temperatures are not reached within the times set at parameters *ddE* and *dd2* their respective defrosting actions are interrupted. However, the end of defrost, as a controller phase, occurs when both readings exceed the intended values (or, if the temperatures are not reached, when their maximum durations have reached).

If the selected defrost mode is of the type employing electric heating and thermostating (*ddt* = **Et**), the two defrost outputs **dF** e **2d** behave as temperature controllers with heating function with the their own Set Point: *dtE* (evaporator 1) and *dt2* (evaporator 2), both with hysteresis fixed at 1°C and with reference to the respective temperatures measured on the two evaporators.

If one of the two evaporator probes is not enabled or is in error, its defrost behaves as with selection **EL** (during defrost the defrost output remains always active).

Note: The "*Dynamic Defrost*" function and the thermostatting function of the fans, always and only operate as a function of the probe configured as **EP** (evaporator 1). If the control with the twin evaporator is not used, it is recommended to set *dd2* = **oF** in order to avoid unwanted influences on total defrost duration.

The defrost cycle in progress is shown on the instrument with the lighting up of the ☼ LED.

In order to allow evaporator dripping, at the end of the defrost is possible to delay the compressor (**ot** output) restart of the time set with parameter *dtd*. During this delay the ☼ LED flashes to indicate the dripping in progress.

5.8.4 Defrosts in event of evaporator probe error

In event of evaporator probe error the defrosts occur at intervals *dE* , with duration *dEE*.

In the event that a probe error occurs, when the time left to start or end of the defrost normally counted is less than that set for the parameters related to the probe error conditions, the defrost start or end occurs with the shortest time.

These functions are provided because, when the evaporator probe is used, the defrost duration is usually set longer than necessary (the time *ddE* is a security time-out) and, in the case the "*Dynamic Intervals Defrost System*" is used, the interval is usually set longer than what is normally programmed into instruments that do not have these functions.

Note: In case of plants with double evaporator, the defrost duration switching function acts only on parameter *ddE* relative to evaporator **1** (*dd2* remains at the same value even if the probe configured as **2P** is in error).

5.8.5 Defrost display lock

Through parameters *ddL* and *RdA* it is possible to define the display behaviour during defrost.

The *ddL* parameter can assume the following values:

on Locks the display on the last **Pr1** probe temperature readedfor all the defrost cycle and until, after defrost end, the **Pr1** temperature has not reached the lock

value or the value [SP + r.d] or is elapsed the time setted on parameter AdA.

Lb Shows the label dEF during the defrost cycle and of PdF after the defrost, until, at defrost end, the **Pr1** temperature has not reached the lock value or the value [SP + r.d] or is elapsed the time setted on parameter AdA.

oF The display continues showing the temperature measured by **Pr1** probe during the defrost cycle.

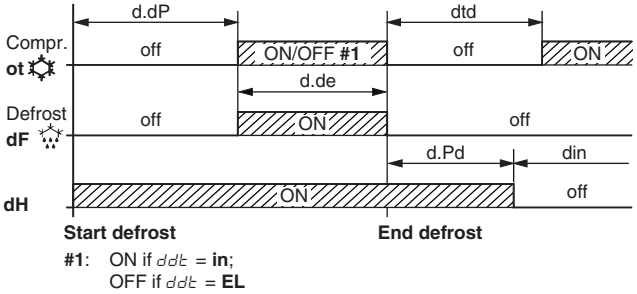
5.8.6 Pre- and Post-Defrost Output

Configuring an output as **dH** and setting the ddP/dPd times allow to have an output signal before defrost and after the end of defrost. The **dH** output can be used to control a drainage resistance that can be enabled before, during and after defrost.

The pre- and post-defrost activation times of **dH** Output can be programmed by parameters ddP and dPd.

The operation consists in deactivating the **ot**/**Out5** control output and activating the **dH** output at defrost beginning. Elapsed the ddP time the **dF** defrost output is activated, while the **ot**/**Out5** control output remains not active if the defrost is electric or must be reactivated if the defrost is with hot gas/cycle inversion. At this point, after the ddE time has elapsed, the **dF** defrost output and the **ot**/**Out5** control output (if active) are deactivated.

ot/Out5 control output will be reactivated at the end of the counting of dtd dripping time while the output **dH** will be deactivated once the time dPd has elapsed.



#1: ON if ddt = **in**;
OFF if ddt = **EL**

5.8.7 Hot-gas defrost in centralized systems

The described operation is enabled setting ddt = **HG**.

When using this defrost mode it is necessary to configure **3 outputs** to control:

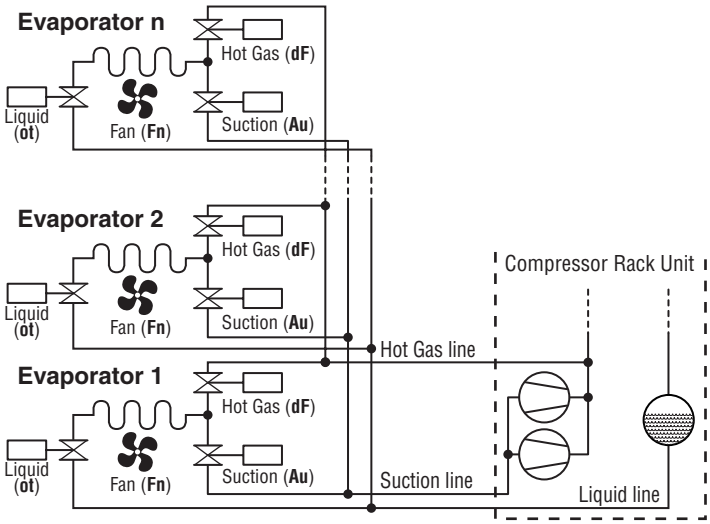
– The *Liquid Solenoid Valve* (output **ot**);
– The *Hot Gas Solenoid Valve* (**dF** output);
– The *Suction Solenoid Valve* (**Au** output with oFo = **3** configuration).

In this configuration, during defrost only the **dF** output is active, while before and after defrosting, the valves **ot** and **Au** perform a sequence of timed operations described below.

As in all Hot Gas defrosts, also these systems use the heat of the compressor exhaust gas to perform the defrost.

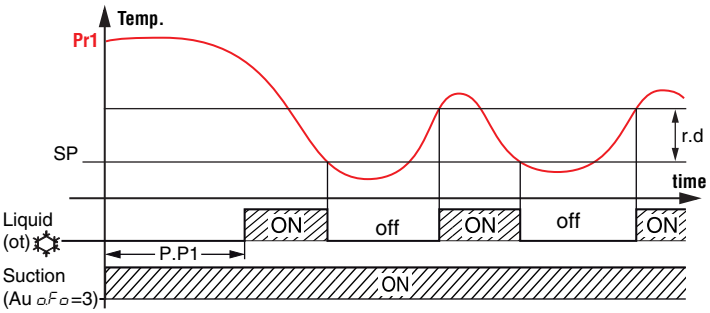
However, given the construction of these systems in which all the evaporators are mounted in parallel and the compressors, being centralized, are not controlled by the instrument (to adjust the temperature the instrument controls the *Liquid solenoid valve*) it is necessary to use an output that controls an *Aspiration solenoid valve* so that the evaporator that performs the defrost is isolated from the system.

Similarly while defrosting, the *Liquid solenoid valve* (the same used to control the temperature) **must** also **be closed to isolate** the **evaporator**.



Note: For greater clarity in the diagram, some details concerning the hydraulic circuit have been deliberately omitted (non-return valves etc.) because they are not controlled by the instrument but are still necessary for the correct system operation.

To avoid sudden pressure changes in the plant, the defrost phases are performed respecting a precise sequence described below.



The system configured for the **Hot Gas defrost in centralized plants** behaves as follows:

– At start-up, the *Suction solenoid valve* is activated immediately (respecting, if set, the Pod delay), after which, if there is a cooling request, also the *Liquid solenoid valve* is activated (respecting the PP1 delay).
– During the control phase, the *Suction solenoid valve* is therefore always activated while the *Liquid valve* is activated as a function of the temperature control.

A) When defrost occurs, first of all *Liquid valve* (**ot** output)is immediately deactivated (if active);

B) Then, after the delay set at parameter PP2 the instrument also deactivates:
- the *Suction valve* (output **Au** configured with oFo = **3**) and, if parameter FFE = **oF**,
- the *Fans output* (**Fn** output).

Note: During this period of time, the fans operation and maintaining the suction valve open are necessary to facilitate the complete evaporation of the fluid contained in the evaporator.

If the defrost request occurs when the *Liquid valve* outlet is already closed and the time PP2 has elapsed (which counting always starts when the **ot** output is turned OFF) the deactivation of the *Suction valve* and eventually of the fans is immediate.

Otherwise, the defrost request happens during the PP2 time count, the *Suction valve* and the fans deactivation occurs at the when PP2 counting expires. At this point the *Hot Gas*

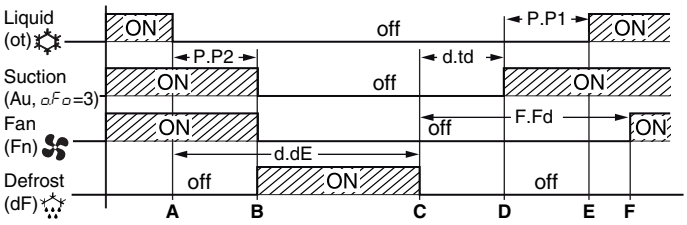
valve is activated (**dF** output) and the defrost begins;

C At defrost end (always handled by the *ddE* time or by the evaporator temperature *dtE* or by the manual control), the output **dF** is deactivated and the delay times *dtd* (dripping time) and *FFd* are activated (fans delay after defrost);

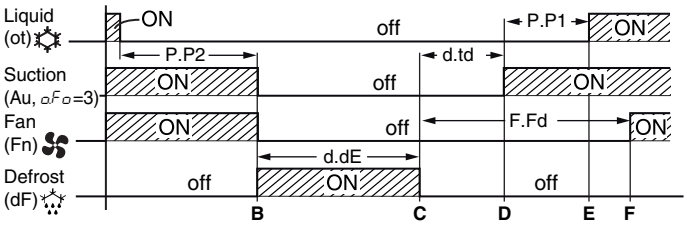
D When *dtd* time counting has elapsed, the output of the *Suction solenoid valve* is reactivated, as when the instrument is switched ON;

E In the event that, as often happens, the temperature controller should request it, after the *PP1* time the *Liquid valve* will be activated and the instrument returns to the normal temperature control mode;

F When *FFd* time counting has elapsed, fans are re-activated if the evaporator temperature is lower than the one set at parameter *FFL*;



Example of **Hot Gas defrost for centralized systems** with defrost start when the *Liquid valve* is open.



Example of **Hot Gas defrost for centralized systems** with defrost start when the *Liquid valve* is closed after the *PP2* time counting has expired.

5.9 Evaporator fans control

All parameters concerning evaporator fans control are contained in the group *FAn*.

The fans control operates on the output configured as **Fn** depending on certain instrument control statuses and the temperature measured by the **EP** evaporator probe.

In the case that **EP** evaporator probe is not used or in error , the output **Fn** is activated only depending on the parameters *Fon*, *FoF* and *FFE*.

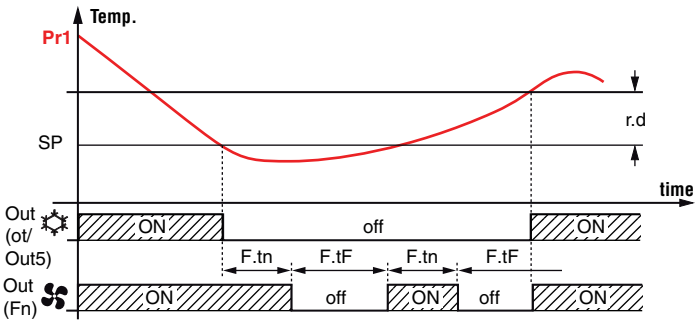
Parameters *Fon* and *FoF* decides the fans functioning when the output configured as **ot/Out5** (compressor) is OFF.

When output **ot/Out5** is OFF , it is possible to set the instrument so that that the **Fn** output continues working in cycles according to the times programmed at the parameters *Fon* (fan activation time at compressor OFF) and *FoF* (fan deactivation time at compressor OFF).

When **ot/Out5** output is switched OFF, the instrument activates the **Fn** output for the time *Fon*, then deactivates it for the time *FoF* and so on whilst **ot/Out5** output remains OFF.

Setting *Fon* = **oF** the **Fn** output will be deactivated when the **ot/Out5** output is switched OFF (evaporator fans OFF when the compressor is OFF or fans run on compressor).

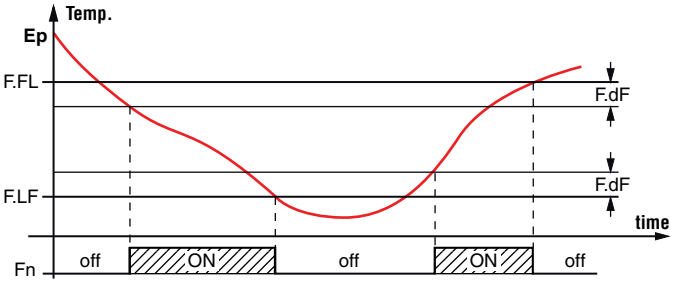
Programming instead *Fon* to any value and *FoF* = **oF** the output **Fn**, with **ot/Out5** OFF condition, will remain switched ON (evaporator fans ON with compressor OFF).



The parameter *FFE* instead decides whether the fans must always be switched ON independently of the defrost status (*FFE* = **on**) or switched OFF during defrost (*FFE* = **oF**); in this later case, it is possible to delay the fans re-start even after the end of the defrost by the time set at parameter *FFd*.

When this delay is active the **LED** flashes to signal the delay in progress.

When the evaporator probe is used the fans, as well as being conditioned by the parameters *Fon*, *Fon* and *FFE*, are also conditioned by a temperature control.



In fact it is possible disable the fans when the temperature measured by **EP** evaporator probe is higher than the one set at parameter *FFL* (temperature too hot) or lower than the one set at parameter *FLF* (temperature too cold).

The relative differential that can be set at parameter *FdF* is also associated with these parameters.

Note: Particular attention should be paid to the proper use of temperature-based fans control functions, as in a typical refrigeration application, the evaporator fan stop blocks the heat exchange.

Remember that the fans functioning can be conditioned by the "*Door open*" function controlled by digital input.

5.10 Alarm functions

All parameters concerning the Alarm functions are contained in the group *AL*.

The alarm conditions of the instrument are:

– Probe errors: *E1*, *-E1*, *E2*, *-E2*, *E3*, *-E3*, *E4*, *-E4*;

– Temperature alarms: *H1*, *L1*, *H2*, *L2*;

– External alarm: *AL*, *Pr*, *HP*, *LP*;

– Open door alarm: *oP*;

The alarm functions act on LED ⚠, on the internal buzzer (when present and configured with parameter *obu*) and on the output selected with parameters *o1*, *o2*, *o3* and *o4* according to the parameters set.

All alarm conditions are pointed out lighting up the ⚠ LED, while the acknowledged alarm is indicated by the flashing of ⚠ LED.

The buzzer (when present) can be programmed to be activated when an alarm occurs (*obu* = **1** or **3**) and can be disabled (alarm silencing) manually by pressing any of the instrument keys.

The possible selections of output parameters for the alarm signalling function are:

At When the output is to be activated in alarm condition and can be deactivated manually by pressing any key of the instrument (typical application for an acoustic signal);

AL When the output is to be activated in alarm condition but cannot be deactivated manually; it is then deactivated only when the alarm status ceases (typical application for a light signal);

An When the output is to be activated in alarm condition and must remain active even when the alarm status has ceased(Alarm memory). The disabling action (recognition of a stored alarm) can only be carried out manually by pressing any key when the alarm status has removed.

-t Function similar to *At* but with inverse logic function (output active in normal conditions, disabled in alarm).

-L Function similar to *AL* but with inverse logic function (output active in normal conditions, disabled in alarm).

-n Function is similar to *An* but with inverse logic function (output active in normal conditions, disabled in alarm).

5.10.1 Temperature alarms

The instrument has 2 temperature alarms, fully configurable with a maximum and a minimum threshold.

The temperature alarms work according to the probe measurements set at parameters *AY 1* and *AY2*, the alarm thresholds set with parameters *AH 1* and *AH2*(max. alarms) and *AL 1* and *AL2* (min. alarms) and the relative differentials *Ad2* and *Ad2*.

Using parameters *AY 1* and *AY2* it is also possible to define whether the alarm thresholds *AH 1*, *AH2*, *AL 1*, *AL2* are absolute or relative to the set point.

Depending on the desired alarm operating mode, parameter *AY 1* and *AY2* can be set as:

1 Absolute alarms referred to **Pr1** and display of label (*H - L*);
2 Relative alarms referred to **Pr1** and display of label (*H - L*);
3 Absolute alarms referred to **Au** and display of label (*H - L*);
4 Relative alarms referred to **Au** and display of label (*H - L*);
5 Absolute alarms referred to **CD** and display of label (*H - L*);
6 Absolute alarms referred to **Pr1**, no label displayed;
7 Relative alarms referred to **Pr1**, no label displayed;
8 Absolute alarms referred to **Au**, no label displayed;
9 Relative alarms referred to **Au**, no label displayed;
10 Absolute alarms referred to **CD**, no label displayed;
11 Absolute alarms referred to **EP** and display of label (*H - L*);
12 Absolute alarms referred to **EP**, no label displayed.

Using some parameters it is also possible to delay the enabling and the intervention of these alarms. These parameters are:

AP 1, *AP2* Temperature alarm intervention delay **at instrument power ON** when the instrument is in alarm status at power ON. If the instrument is not in alarm status at power ON, *AP 1* and *AP2* are not considered.

AdA This is the time period during which temperature alarms 1 are disabled at the end of a defrost cycle.
Note: During defrosts and after defrosts for the time set with *AdA*, alarm 1 is disabled, whereas during defrosts alarm 2 is always enabled.

At 1, *At2* Activation delay times for temperature alarms 1 and 2.

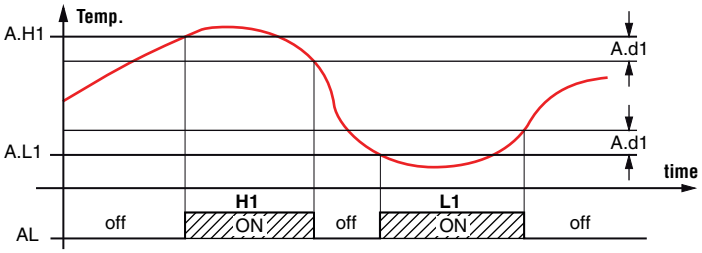
Temperature alarms 1 and 2 are enabled at the end of the alarm-disabling time periods and activated after time periods *At 1* and *At2* when the temperature measured by the probe configured for the alarm rises above or drops below the respective maximum and minimum alarm thresholds.

With parameters *AA 1* and *AA2* it is also possible to set the action of the alarms on the control output and on the alarm outputs (buzzer included).

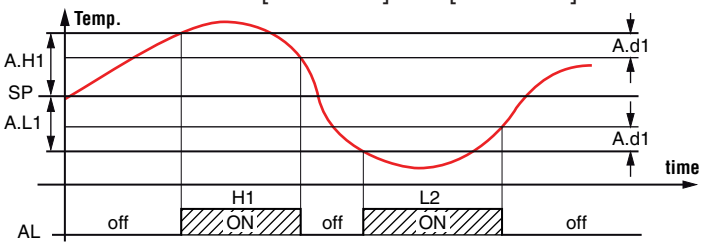
This means that, for example, is possible to act on the control output directly, by deactivating it in the case there are temperature alarms also on the probes configured as **Au** (e.g. *antifreeze* function) or as **CD** (e.g. *dirty condenser* function).

Configuring both alarms with reference to the same probe, the instrument also allows to manage pre-alarm signals (for example that do not activate the alarm output and/or the buzzer) and alarm (which instead activate the alarm output and/or the buzzer).

If the alarms are *Absolute alarms* (*A❑❑* = **1**, **3**, **5**, **7**, **9**, **10**), the alarm thresholds are the same as those set at parameters *AH❑* and *AL❑*.



If the alarms are *Relative alarms* (*A❑❑* = **2**, **4**, **6**, **8**), the alarm thresholds are: [*SP* + *AH❑*] and [*SP* + *AL❑*].



The maximum and minimum temperature alarms can be disabled by setting the related parameters *AH❑* and *AL❑* = **oF**.

Triggering of the temperature alarms causes the ⚠ LED to light up, activates outputs configured with the set alarm function, and activates the internal buzzer if present and configured.

5.10.2 External alarms (digital inputs)

The instrument can notify alarms external to the instrument when one or more digital inputs configured *i❑F* = **4**, **5**, **12**, **13**, **14** are activated.

Simultaneously to the configured alarm signal (buzzer and/or output), the instrument point out the alarm by lighting up the ⚠ LED and displaying the label of the alarm detected (*AL*, *PrA*, *HP*, *LP*) alternated to the variable set at parameter *id5*.

The *i❑F* = **4** mode produces no action on the control outputs whereas the other modes deactivate the **ot/Out5** output or deactivate all control outputs at digital input intervention.

Alarm	ot/Out5 output (compressor)	Other control outputs (Fn, dF, Au, HE)
AL (4)	Unchanged	
AL (5)	OFF	
PrA, HP, LP	OFF	Unchanged

5.10.3 Open door alarm

The instrument can point out an **Open door alarm** activated by the digital input with the function programmed as: *i❑F* = **1**, **2** or **3**.

When the digital input is activated the instrument shows *oP* akternated to the variable set at parameter *id5*. After the delay

programmed at parameter AoA, the instrument signals the alarm via the activation of the configured alarm output (buzzer/ouput), powering up the ⚠ LED while continues displaying the label oP.

At the intervention of the open door alarm the inhibited outputs are immediately reactivated (fans or fans + compressor).

5.11 HACCP function (alarm recording)

The parameters associated with displaying **HACCP** alarms are contained in the HA group, while those associated with the configuration are contained in the AL group.

The HACCP (*Hazard Analysis and Critical Control Points*) function causes the instrument to record the last 10 alarms that have occurred together with those information useful for determining the criticality of the alarm. The function is available only for those instruments equipped with the calendar clock.

The following HACCP alarms can be stored in memory:

Alarm code HACCP	Alarm
H1	Maximum temperature alarm H1
L1	Minimum temperature alarm L1
H2	Maximum temperature alarm H2
L2	Minimum temperature alarm L2
bo	Power failure (black-out) alarm
AL	Alarm from digital input

HACCP alarms are stored if the correspondent enabling parameters are configured and the preset time configured in the same parameter has elapsed.

Furthermore, alarm recording can also be disabled through a configured digital input (i❑F = **13**) or through the U or ▼/ **AUX** keys, if appropriatrely configured (t.UF o t.Fb = **7**).

To view these alarms, use the procedure for viewing the programming parameters and access the H01 ÷ H10 parameters contained in the HA group.

Note: See paragraph *"2.9 Displaying haccp alarms (only for controllers with RTC)" a pagina 5* for details.

The instrument automatically sorts these parameters from most recent (H01) to oldest (H10) whenever an alarm is recorded or deleted.

If more than 10 alarms occur, the instrument deletes the information about the oldest alarm by overwriting it with the most recent alarm.

When this occurs the instrument increments by one the value of the HdL parameter through which is possible to display the number of alarms the instrument has been forced to delete when these exceeded the permitted memory.

After selecting the parameter for the alarm which the user wishes to display, if the label flashes this indicates that the alarm has never been displayed (therefore not recognized/acknowledged).

To recognise it, simply access the parameter pressing the P key and display it.

The next time it is displayed, the parameter label will be shown solid (not flashing).

If the alarm is still active at the time it is displayed, the data are shown but the alarm is not recognized and cannot be cancelled.

In the event of unrecognized (and therefore still ongoing) HACCP alarms, the instrument shows the message HAC alternated with the *Normal display*.

Within the parameter the data will be displayed sequentially as the P key is repeatedly pressed.

The alarm can be deleted by holding down the ▼ key for more than 5 s while one of the data of the alarm is displayed. Its deletion is confirmed by the display indicating "- - -" for approx. 1 s.

Similarly the value of the HdL parameter can be reset by holding down the ▼ key for more than 5 seconds while the value is displayed.

However, if desired, all alarms can be deleted immediately by:

– Holding down the U key for 5 s if parameter t.UF = **6**;
– Holding down the ▼ key for 5 s if parameter t.Fb = **6**;
– By a digital input if the relevant parameter i❑F = **11**.
– By the parameter reset function (at the password prompt rP enter **-48**).

5.11.1 HACCP temperature alarms

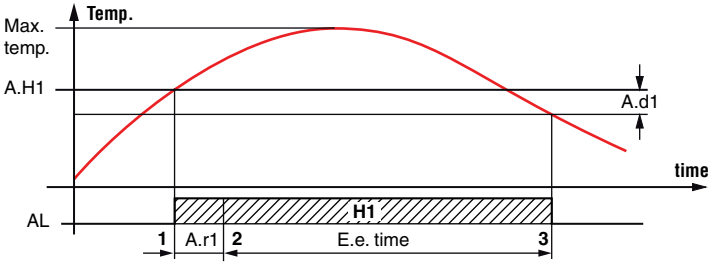
Setting parameters Ar1 (for alarms **H1** and **L1**) and Ar2 (for alarms **H2** and **L2**) it is possible to enable recording of temperature alarms as HACCP alarms.

The same parameters can also be used to define the minimum alarm duration that will cause the alarm to be recorded as an HACCP alarm. If the alarm duration is shorter than the programmed time, the alarm is not recorded.

Setting Ar❑ = **oF**, recording is disabled.

For each recorded temperature alarm, the following data are stored:

– Alarm type (**A.** = **H1** or **L1** or **H2** or **L2**);
– HACCP alarm start time
(**y.** = year, **M.** = month, **d.** =day, **h** = hours, **n.** = minutes);
– HACCP alarm duration (**E.** = hours, **e.** = minutes);
– Critical temperature reached (max. peak if **Hi** alarm or min. peak if **Lo** alarm).



Example of HACCP maximum temperature alarm H1

1. Configured alarm start (in this case with At1 = **oF**);
2. HACCP alarm recording start;
3. Alarm end.

Note: If there is a power failure during a temperature alarm, the instrument records the duration of the alarm up until the moment the power failure began.
In order to capture correct information on the temperature conditions which the user wishes to monitor, it is recommended to set a black-out alarm and if necessary disable the on-startup alarm delays (AP❑) so that if the alarm is still active when the power returns it is recorded as a new alarm at the end of the power failure.

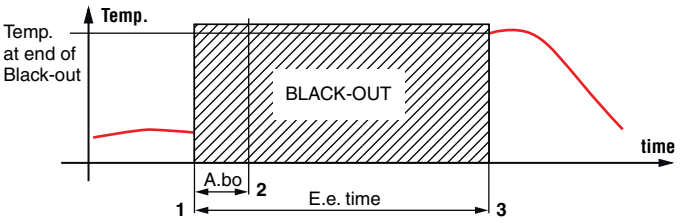
5.11.2 HACCP power failure alarms

This type of alarm is recorded only if the power failure exceeds the value set at parameter Abo.

If Abo = **oF** the black-out alarm is never recorded. For each recorded black-out alarm, the following data are recorded:

– Alarm type (A. = **bo**);
– Start time
(**y.** = year, **M.** = month, **d.** =day, **h** = hours, **n.** = minutes);
– Black-out duration (**E.** = hours, **e.** = minutes);
– The temperature of alarm 1 probe (see parameter Ay1)

measured at black-out end (if available; if not available the display shows "- - -").



Example of HACCP black-out alarm

1. Power failure;
2. Min. power failure duration that will enable HACCP black-out alarm recording;
3. Return of power supply (alarm end).

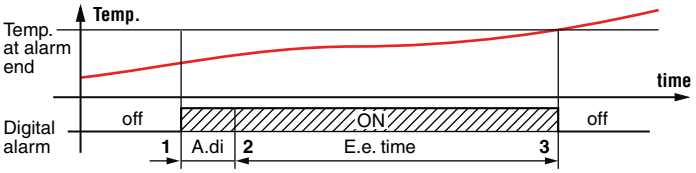
5.11.3 HACCP alarms from digital input

HACCP alarms from digital input are recorded only if the generic alarm (**AL**) from a digital input is configured in modes **4** or **5** and remains for a time longer than the time set in parameter Ad i.

If Ad i = **oF**, an alarm from a digital input is never recorded.

For each alarm from a digital input recorded, the following data are stored:

– Alarm type (**A.** = **AL**);
– Start time
(**y.** = year, **M.** = month, **d.** = day, **h** = hours, **n.** = minutes);
– Alarm duration (**E.** = hours, **e.** = minutes);
– The temperature of alarm 1 probe (see parameter AY i) measured at alarm end (if available, if not available the display shows "- - -").



Note: If the power fails during an alarm from a digital input, the instrument records the alarm duration until the moment the power failure began.

5.12 Functioning of keys U and ▼/Aux

All the parameters concerning keyboard functions are contained in the group tS.

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

The U key function can be defined by the parameter t.UF while the ▼/AUX key function can be defined by the parameter t.Fb.

Both the parameters have the same possibilities and can be configured for the following functions:

oF The key carries out no function;

1 Pressing the key for at least 1 s, it is possible to enable/disable the auxiliary output if configured (oFo = **2**).
If are programmed activation/deactivation events of the auxiliary output by Real Time Clock the action of the keys force output status until the next event;

2 Pressing the key for at least 1 s, it is possible to toggle between *Eco* and *Normal* mode (**SP**, **SPE**). Once the selection has been made, the display shows the active Set Point code (**SP**, *Eco*) for about 1 s. If are programmed mode changes events by Real Time Clock the action of the keys force status until the next event.

3 Pressing the key for at least 1 s, it is possible to switch the instrument from ON to Stand-by status and vice-versa. If switch-ON/Stand-by events are programmed using the RTC, the key action has priority on the event.

4 Pressing the key for at least 1 s activates/deactivates a **Turbo** cycle.

5 Forces a programmed Switch-ON/Switch-OFF (Stand-by) event - Pressing the key for at least 1 s switches the instrument from the ON state to the Stand-by state and vice-versa, until the next event. Therefore, if switch-ON/Stand-by events are programmed using the RTC, the key action has priority on the event.

6 HACCP Alarm Reset - Pressing the key for at least 1 s resets stored HACCP alarms. The display confirms the reset showing "- - -" for about 1 s.

7 HACCP Alarm Recording Disabled - Pressing the key for at least 1 s disables/enables recording of the HACCP alarms. After the selection is made the display shows for about 1 s:
Hon (HACCP alarms enabled) or
HoF (HACCP alarms disabled).

5.13 Clock programmable events

Programmable events are set using the **14 parameters** (c.01 ÷ c. 14) contained in the PrE group.

After selecting the desired parameter, press the P key repeatedly to cycle through the following:

h.❑❑ Hours (e.g. h. 13);
n.❑❑ Minutes (e.g. n.45);
d.❑ Day of the week (e.g. d. 1);
t.❑ Event to be performed at programmed time (e.g. t. 1).

Note: See *"2.8 Scheduling events at defined times (only for controllers with RTC)" a pagina 4* for details.

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;
d. 8 every day;
d. 9 Monday, Tuesday, Wednesday, Thursday, Friday;
d. 10 Monday, Tuesday, Wednesday, Thursday, Friday, Saturday;
d. 11 Saturday and Sunday;
doF No day (event disabled).

The 14 event-programming parameters allow a maximum of 14 x 7 = **98** weekly events to be scheduled (using d. 8).

The following events can be programmed:

t. 1 Switch instrument ON;
t.2 Put instrument in Stand-by;
t.3 Switch auxiliary output ON;
t.4 Switch auxiliary output OFF;
t.5 Start defrost (to enable the scheduled defrosts, also program ddC = **cL**);
t.6 Switch to *Eco* mode (**SPE**);
t.7 Switch to *Normal* mode (**SP**).

A manual intervention, e.g. to change the mode (*Eco* or *Normal*) or activate/deactivate the auxiliary output, is effective only until the next scheduled event.

For example, if the instrument is in *Eco* mode and is forced manually to *Normal* mode it will stay in *Normal* mode until

the next event that switches it to *Eco* mode.

Programming example

The user wishes to set the following events:

– 4 daily defrosts weekdays at 7:00, 12:00, 17:00 and 22:00;
– 2 defrosts every Sunday at 7.00 and 19.00 (also set ddC = **cL**);
– 1 daily weekday switching from *Normal* to *Eco* mode at 20.00 and 1 switching from *Eco* to *Normal* mode at 6.00;
– No switches on Sundays;
– 1 daily weekday switching **Aux** output ON at 8.00 and 1 daily switching the **Aux** output to OFF at 21.00;
– No switches on Sundays.

Event	Parameter	Hour	Minutes	Days	Event
Work day defrost 1	c.01	h.07	n.00	d.10	t.5
Work day defrost 2	c.02	h.12	n.00	d.10	t.5
Work day defrost 3	c.03	h.17	n.00	d.10	t.5
Work day defrost 4	c.04	h.22	n.00	d.10	t.5
Sunday defrost 1	c.05	h.07	n.00	d.7	t.5
Sunday defrost 2	c.06	h.19	n.00	d.7	t.5
ECO mode	c.07	h.20	n.00	d.10	t.6
Nomal mode	c.08	h.06	n.00	d.10	t.7
Aux ON	c.09	h.08	n.00	d.10	t.3
Aux OFF	c.10	h.21	n.00	d.10	t.4
	c.11 ÷ c.14	h.00	n.00	doF	t.oF

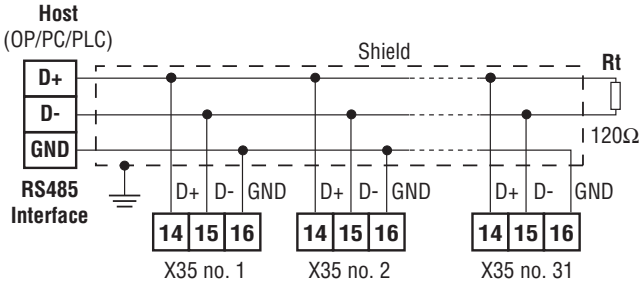
5.14 RS485 Serial Interface

The instrument can be equipped with a non insulated **RS485** serial communications interface, by means of which it is possible to connect the controller to a network to which other instruments (PLC controllers) are connected, all depending typically on a personal computer used as plant supervisor.

Using a Personal Computer it is possible to acquire all the function information and to program all the instrument configuration parameters. The software protocol adopted fa **MODBUS RTU** type, widely used in several PLC and supervision programs available on the market (the series *Protocol manual* is available on request).

The instrument has two terminals called **D+** and **D-** that must be connected to all network terminals with the same label.

For wiring the line, it is advisable to adopt a 3-pole wired and shielded cable connected as shown.



The interface circuit allows the connection of up to **32** instruments on the same line.

To maintain the line in rest conditions a 120Ω resistance (**Rt**) must be connected to the end of the line.

If the instrument is equipped with the serial interface, the parameters to be programmed are those present at parameters group PtS:

tAd Address of the station. Set a different number (1 ÷ 255) for each station.

tbr Serial interface baud rate. Settings available:
1 = 9600 baud, 2 - 19200 baud, 3 - 38400 baud.

6. ACCESSORIES

The instrument is equipped with a connector that allows the connection to some accessories.

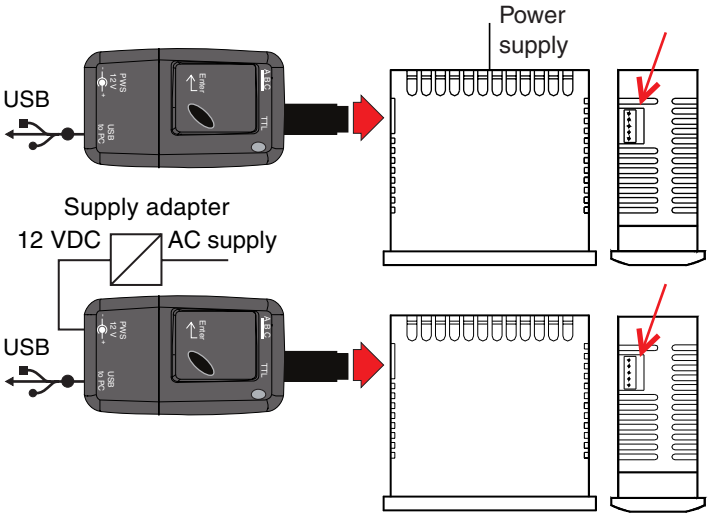
6.1 Parameters configuration by "A01"

The instrument is equipped with a 5 poles connector that allows the transfer from and toward the instrument of the functioning parameters through the device **A01**.

This device it is mainly usable for serial programming those instruments that need the same parameters configuration or to keep a copy of the parameters setting of an instrument and allow its fast duplication.

The same device allows to connect a PC via USB with which, through the appropriate configuration software for "*AT UniversalConf tools*", the operating parameters can be configured.

To use the **A01** device it is necessary that the device or instrument are being correctly supplied.



For additional info, please look at the **A01** instruction manual.

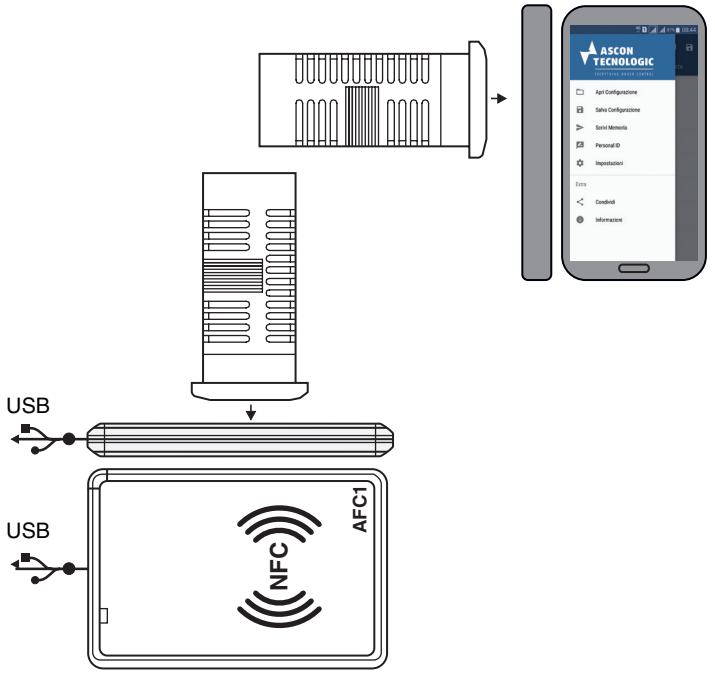
6.2 Parameters configuration using an NFC Device

The **AFC1** is a contactless **NFC** (**N**ear **F**ield **C**ommunications) connection device that allows to **Upload/Daownload** the operating parameters **From/To** the instruments. The **AFC1** is powered directly by the **USB** port through which is connected to a **PC**.

When an instrument is equipped with the **NFC** communication option, its operating parameters can be set through a common Personal Computer, the "*AT UniversalConfig*" program and the **AFC1** device or directly from a smartphone equipped with the **NFC** interface and the appropriate "*AT Conf*" App.

Once the changes have been made, the parameters can be sent to the instrument using the **NFC** communications.

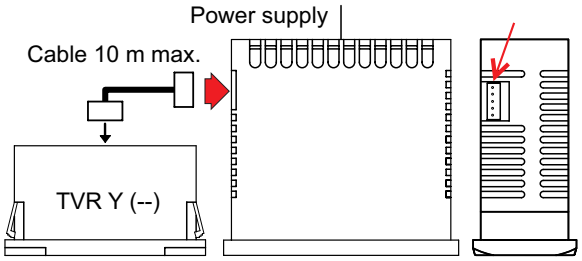
To load the operating parameters in the instrument using the **AFC1** device, place the instrument on the **AFC1** with the display of the controller facing the **NFC** symbol ((( ))) on the **NFC1** device, then send the parameters to the instrument memory.



To load the program in the instrument using a Smartphone, place the NFC antenna of the Smartphone facing the display of the controller, then, using the commands of the "*AT Conf*" App download the parameter data (consult the Smartphone manual for details about the NFC antenna position).

6.3 TVR Y remote display

To the instrument it is possible to connect the remote display **TVR Y** through a special cable that can have a maximum length of 10 m. The device **TVR Y**, directly supplied by the instrument, allows to show the temperature measured by the probe **Pr1** through a 2½ digit display.



For additional info, please look at the TVR Y instruction manual.

7. PROGRAMMABLE PARAMETERS TABLE

Here below is a description of all the parameters available on the instrument. Some of them may not be present, either due to the fact they depend on the type of instrument or because they are automatically disabled as unnecessary.

Note: Those parameters marked with (**#**) character can be applied to models with Real Time Clock only.

SP Group - Set Point parameters

Parameter		Hex. address	Description	Modbus range	Display Range	Default	Note
1	SLS	2800	Minimum Set Point	-99.9 ÷ S.HS		-50.0	
2	SHS	2801	Maximum Set Point	S.LS ÷ 999		99.9	
3	SP	2802	Set Point	S.LS ÷ S.HS		0.0	
4	SPE	2803	Eco Set Point	SP ÷ S.HS		2.0	
5	SPH	2804	"Turbo" Set Point (or independent Heating Set Point in mode HC)	S.LS ÷ SP		-2.0	

in Group - Inputs parameters

Parameter		Hex. address	Description	Modbus range	Display Range	Default	Note
6	SE	2805	Probes Type	0 = Pt 1 = nt 2 = P1	Pt PTC nt NTC P1 Pt1000	nt	
7	uP	2806	Unit of measurement and resolution (decimal point)	0 = C0 1 = F0 2 = C1 3 = F1	C0 °C with 1° res. F0 °F with 1° res. C1 °C with 0.1° res. F1 °F with 0.1° res.	C1	
8	FE	2807	Measurement filter	0 = oF 0.1 ÷ 20.0 s	oF Filter disabled 0.1 ÷ 20.0 s	2.0	
9	C1	2808	Pr1 Probe Calibration	-30.0 ÷ 30.0°C/°F		0.0	
10	C2	2809	Pr2 Probe Calibration	-30.0 ÷ 30.0°C/°F		0.0	
11	C3	280A	Pr3 Probe Calibration	-30.0 ÷ 30.0°C/°F		0.0	
12	C4	280B	Pr4 Probe Calibration	-30.0 ÷ 30.0°C/°F		0.0	
13	CU	280C	Measure offset on the display	-30.0 ÷ 30.0°C/°F		0.0	
14	P2	280D	Pr2 input function	0 = oF 1 = EP 2 = Au 3 = cd 4 = 2E	oF No function EP Evaporator 1 Au Aux cd Condenser 2E Evaporator 2	EP	
15	P3	280E	Pr3 input function	0 = oF 1 = EP 2 = Au	oF No function EP Evaporator 1 Au Aux	oF	
16	P4	280F	Pr4 input function	3 = cd 4 = 2E 5 = dG	cd Condenser 2E Evaporator 2 dG Digital input	oF	
17	1F	2810	Function and function logic of digital input **DI1**	0 No function 1 Door open 2 Door open with fan stop 3 Door open with fan and compressor stop 4 External "AL" alarm 5 External "AL" alarm with deactivation of control outputs 6 Selection of active Set Point (SP-SPE) 7 Switch on/ off (Stand - by) 8 "*Turbo*" cycle activation 9 Remote command of AUX output 10 Disable recording of HACCP alarms 11 Reset of HACCP alarms 12 External "PrA" alarm 13 External "HP" alarm 14 External "LP" alarm 15 Forcing events Switch ON/OFF (Stand - by) 16 Start Defrost 17 Stop Defrost 18 Start a "*Turbo*" cycle with monostable control 19 Inhibition of the events programmed via Real Time Clock			
18	1E	2811	Delay in acquiring digital input **DI1**	0 = oF 0.01 ÷ 99.59 (min. s)	oF Delay disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
19	2F	2812	Function and function logic of digital input **DI2**	See (17) **i.1F**		0	
20	2E	2813	Delay in acquiring digital input **DI2**	0 = oF 0.01 ÷ 99.59 (min. s)	oF Delay disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	

Parameter		Hex. address	Description	Modbus range	Display Range	Default	Note
21	i3F	2814	Function and function logic of digital input **Pr3**	See (17) **i.1F**		0	
22	i4F	2815	Function and function logic of digital input **Pr4**			0	
23	iEt	2816	Delay to Eco mode with door closed	0 = oF 0.01 ÷ 99.59 (h.min.)	oF No function 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10)	oF	
24	itt	2817	Time-out ECO mode.	0 = oF 0.01 ÷ 99.59 (h.min.)	oF No function 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10)	oF	
25	idS	2818	Variable visualized normally on display:	0 = P1 1 = P2 2 = P3 3 = P4 4 = Ec 5 = rE 6 = SP 7 = oF	P1 Probe **Pr1** measure P2 Probe **Pr2** measure P3 Probe **Pr3** measure P4 Probe **Pr4** measure Ec **Pr1** in normal mode, Eco in Eco mode rE Remote viewing from serial port SP Active Set Point oF Display off	P1	

PdF Group - Defrost control parameters

Parameter		Hex. address	Description	Modbus range	Display Range	Default	Note
26	ddt	2819	Defrost Type	0 = EL 1 = in 2 = no 3 = Et 4 = HG	EL Electrical heating/stop. compr. in Hot gas/reverse cycle no Without compressor output condictioning Et Electrical heating with evaporator temperature control HG HOT-GAS defrost for centralized plants	EL	
27	ddC	281A	Defrost starting mode	1 = rt 2 = ct 3 = cS 0 = cL	rt Real time intervals ct **ot** output ON time intervals cS Defrost when **ot** switches OFF (+ rt intervals) cL By real time clock	rt	
28	dd i	281B	Defrost interval	0 = oF 0.01 ÷ 99.59 (h.min.)	oF Defrost interval disabled 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10)	6.00	
29	dSd	281C	Delay first defrost after power-ON	0 = oF 0.01 ÷ 99.59 (h.min.)	oF Defrost at power-ON 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10)	6.00	
30	ddd	281D	Dynamic Defrost Percentage reduction	0 ÷ 100%		0	
31	ddE	281E	Lenght (max.) of defrost cycle (evaporator 1)	0 = oF 0.01 ÷ 99.59 (min.s)	oF Interval and the manual defrosts disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	20.0	
32	ddL	281F	Defrost display Lock	0 = oF 1 = on 2 = Lb	oF Display free on Lock on temperature **Pr1** before defrost Lb Lock on label dEF (in defrost) and PdF (post-defrost)	oF	
33	dtE	2820	Defrost stop temperature (evaporator 1)	- 99.9 ÷ 999°C/°F		8.0	
34	dE i	2821	Defrostinterval for evaporator probe error	0 = oF 0.01 ÷ 99.59 (h.min)	oF Interval disabled 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10)	6.00	
35	dEE	2822	Lengh of defrost cycle for evaporator probe error	0 = oF 0.01 ÷ 99.59 (min.s)	oF Parameter disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	10.0	
36	dtS	2823	Defrost enable temperature	- 99.9 ÷ 999 °C/°F	- 99.9 ÷ 999°C/°F	2.0	
37	dtF	2824	Defrost start temperature	- 99.9 ÷ 999 °C/°F	- 99.9 ÷ 999°C/°F	-99.9	
38	dSt	2825	Defrost start delay by evaporator temperature	0 = oF 0.01 ÷ 99.59 (min.s)	oF Delay disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	1.00	
39	dcd	2826	Delay start Defrost by continuous compressor running time	0 = oF 0.01 ÷ 99.59 (h.min)	oF Delay disabled 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10)	oF	
40	dtd	2827	Compressor delay after defrost (drainage time)	0 = oF 0.01 ÷ 99.59 (min.s)	oF Delay disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
41	dd2	2828	Lenght (max.) of defrost cycle evaporator 2	0 = oF 0.01 ÷ 99.59 (min.s)	oF Parameter disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
42	dt2	2829	Defrost stop temperature evaporator 2	- 99.9 ÷ 999°C/°F		8.0	

rE Group - Temperature control parameters

Parameter		Hex. address	Description	Modbus range	Display Range	Default	Note
43	r.d	282A	Differential (Hysteresis)	0.0 ÷ 30.0°C/°F		2.0	
44	r.Ed	282B	Differential (Hysteresis) in Eco mode	0.0 ÷ 30.0°C/°F		4.0	
45	r.Hd	282C	Differential (Hysteresis) Turbo mode or Heating HC mode	0.0 ÷ 30.0°C/°F		1.0	
46	rt1	282D	**OT** Output activation time for **Pr1** probe error	0 = oF 0.01 ÷ 99.59 (min.s)	oF Activation time disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
47	rt2	282E	**OT** Output deactivation time for **Pr1** probe error	0 = oF 0.01 ÷ 99.59 (min.s)	oF Deactivation time disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
48	r.HC	282F	Output operating mode	0 = H 1 = C 2 = nr 3 = HC 4 = C3	H Heating C Cooling nr Neutral Zone HC Neutral Zone with independent Set point C3 Cooling with 3 automatic switch modes	C	
49	rtC	2830	Lengh of Turbo cycle	0 = oF 0.01 ÷ 99.59 (h.min)	oF Turbo cycle disabled 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10)	oF	

Fn Group - Evaporator fans control parameters

Parameter		Hex. address	Description	Modbus range	Display Range	Default	Note
50	Ftn	2831	Fan time activation with **ot** output (compressor) **OFF**	0 = oF 0.01 ÷ 99.59 (min.s)	oF **FN** = OFF when **ot** = OFF 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	5.00	
51	FtF	2832	Fan time deactivation with **ot** output (compressor) **OFF**	0 = oF 0.01 ÷ 99.59 (min.s)	oF If Ftn = any value, **FN** = ON when **ot** = OFF 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
52	FFL	2833	High temperature fan deactivation	- 99.9 ÷ 999 °C/°F	- 99.9 ÷ 999°C/°F	10.0	
53	FLF	2834	Low temperature fan deactivation	- 99.9 ÷ 999 °C/°F	- 99.9 ÷ 999°C/°F	-99.9	
54	FdF	2835	Differential fan control	0.0 ÷ 30.0°C/°F	0.0 ÷ 30.0°C/°F	1.0	
55	FFE	2836	Fan status during defrost	0 = oF 1 = on	oF - on	oF	
56	FFd	2837	Fan delay after defrost	0 = oF 0.01 ÷ 99.59 (min.s)	oF Delay disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	

Pr Group - Compressor protection and power on delay parameters

Parameter		Hex. address	Description	Modbus range	Display Range	Default	Note
57	PP1	2838	Output **ot** delay at switch ON	0 = oF 0.01 ÷ 99.59 (min.s)	oF Delay disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
58	PP2	2839	Output **ot** delay after switch OFF	0 = oF 0.01 ÷ 99.59 (min.s)	oF Delay disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
59	PP3	283A	Output **ot** delay between 2 switching-ON	0 = oF 0.01 ÷ 99.59 (min.s)	oF Delay disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
60	Pod	283B	Delay outputs at power ON	0 = oF 0.01 ÷ 99.59 (min.s)	oF Delay disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	

PAL Group - Alarms parameters

Parameter		Hex. address	Description	Modbus range	Display Range	Default	Note
61	AY 1	283C	Temperature Alarm 1 Type	1 Absolute to **Pr1** probe with label (H - L); 2 Relative to **Pr1** probe with label (H - L); 3 Absolute to **Au** probe with label (H - L); 4 Relative to **Au** probe with label (H - L); 5 Absolute to **cd** probe with label (H - L); 6 Absolute to **Pr1** probe with no label; 7 Relative to **Pr1** probe with no label; 8 Absolute to **Au** probe with no label; 9 Relative to **Au** probe with no label; 10 Absolute to **cd** probe with no label; 11 Absolute to **EP** probe with no label; 12 Absolute to **EP** probe with label (H - L).		1	
62	AH 1	283D	High temperature Alarm 1 threshold	-100.0 = oF -99.9 ÷ 999 °C/°F	oF Max. alarm disabled -99.9 ÷ 999°C/°F	oF	
63	AL 1	283E	Low temperature Alarm 1 threshold	-100.0 = oF -99.9 ÷ 999°C/°F	oF Min. alarm disabled -99.9 ÷ 999°C/°F	oF	
64	Ad 1	283F	Alarms AH 1 and AL 1 Hysteresis	0.0 ÷ 30.0°C/°F	0.0 ÷ 30.0°C/°F	1.0	
65	At 1	2840	Alarms AH 1 and AL 1 delay	0 = oF 0.01 ÷ 99.59 (h.min)	oF Dealy disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
66	AP 1	2841	Temperature Alarms 1 delay at power on	0 = oF 0.01 ÷ 99.59 (h.min)	oF Power ON dealy disabled 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10)	2.00	
67	AA 1	2842	Alarms **H1** e **L1** actions	0 No actions 1 Activate alarm outputs 2 Disable (**ot** e **HE**) but not activate alarm outputs 3 Disable (**ot** e **HE**) and activate alarm outputs		1	
68	AY2	2843	Temperature alarm 2 Type	See parameter (61) AY 1		3	
69	AH2	2844	High temperature Alarm 2 threshold	-100.0 = oF -99.9 ÷ 999°C/°F	oF Max. alarm disabled -99.9 ÷ 999°C/°F	oF	
70	AL 2	2845	Low temperature Alarm 2 threshold	-100.0 = oF -99.9 ÷ 999°C/°F	oF Min. alarm disabled -99.9 ÷ 999°C/°F	oF	
71	Ad2	2846	Alarms AH2 and AL 2 Hysteresis	0.0 ÷ 30.0°C/°F	0.0 ÷ 30.0°C/°F	1.0	
72	At 2	2847	Alarms AH2 and AL 2 delay	0 = oF 0.01 ÷ 99.59 (min.s)	oF Dealy disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
73	AP2	2848	Temperature Alarm 2 delay at power on	0 = oF 0.01 ÷ 99.59 (min.s)	oF Power ON dealy disabled 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10)	2.00	
74	AA2	2849	Alarms **H2** e **L2** actions	0 No actions 1 Activate alarm outputs 2 Disable (**ot** and **HE**) but not activate alarm outputs 3 Disable (**ot** and **HE**) and activate alarm outputs		1	
75	AdA	284A	Temperature Alarm 1 delay after defrost and unlock display delay after defrost	0 = oF 0.01 ÷ 99.59 (h.min)	oF Dealy disabled 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10)	1.00	
76	AoA	284B	Alarm delay with door open	0 = oF 0.01 ÷ 99.59 (min.s)	oF Dealy disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	3.00	
77	Ar 1 (#)	284C	AH 1/AL 1 delay to be recorded as an HACCP alarm	0 = oF 0.01 ÷ 99.59 (min.s)	oF Alarms never registered as HACCP 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
78	Ar2 (#)	284D	AH2/AL 2 delay to be recorded as an HACCP alarm	0 = oF 0.01 ÷ 99.59 (min.s)		oF	
79	Abo (#)	284E	Black out alarm delay to be recorded as an HACCP alarm	0 = oF 0.01 ÷ 99.59 (min.s)	oF HACCP recording disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
80	Ad i (#)	284F	HACCP alarm delay from digital input (AL)	0 = oF 0.01 ÷ 99.59 (min.s)		oF	

Group - Outputs and buzzer configuration parameters

Parameter		Hex. address	Description	Modbus range	Display Range	Default	Note
81	o.o 1	2850	OUT1 function	0 = oF 1 = ot 2 = dF 3 = Fn 4 = Au 5 = At 6 = AL 7 = An 8 = -t 9 = -L 10 = -n 11 = on 12 = HE 13 = 2d 14 = L1 15 = L2 16 = CS 17 = dH	oF No function ot Temperature control (compressor) dF Defroster 1 Fn Fans Au Auxiliary At/-t Silenceable alarm AL/-L Not silenceable Alarm An/-n Stored alarm on ON when instrument switch ON HE Heating (Neutral zone control) 2d Defroster 2 L1 Light in Eco mode (ON with **SP**/OFF with **SPE**) L2 Internal light (Door close: OFF/Door open: ON) CS Output active when the variable speed compressor is running dH Pre- and Post-defrost output	CS	
82	o.o2	2851	OUT2 function			dF	
83	o.o3	2852	OUT3 function			Fn	
84	o.o4	2853	OUT4 function			Au	
85	o.bu	2854	Buzzer function mode	oF Buzzer disabled 1 Active alarms only 2 Key pressed only 3 Active alarms and key pressed		3	
86	o.Fo	2855	Function mode auxiliary output	oF No Function 1 Aux. output delayed than **ot** control output 2 Manual activation by key or digital input 3 Output Suction solenoid (HOT GAS defrost in centralized plants)		oF	
87	o.tu	2856	Time relative to auxiliary output	0 = oF 0.01 ÷ 99.59 (min.s)	oF Time relative to auxiliary output disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	

Group - Keyboard and serial communications parameters

Parameter		Hex. address	Description	Modbus range	Display Range	Default	Note
88	t.UF	2857	Function mode key (U)	oF No function 1 Auxiliary output command 2 Normal/Eco mode Selection 3 Switch ON/OFF (Stand-by) 4 Turbo cycle command 5 Manual Switch ON/OFF (Stand-by) when set by clock 6 HACCP Alarms Reset 7 HACCP Alarms recording disable/enable		oF	
89	t.Fb	2858	Function mode key (▼)/Aux			oF	
90	t.Lo	2859	Keyboard lock function delay	0 = Disabled (oF) 0.01 ÷ 30.00 (min.s)	oF Delay disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
91	t.Ed	285A	Set Point Visibility with fast procedure by key (P)	0 = No Set Point (oF) 1 = SP 2 = SPE 3 = SP and SPE 4 = Active Set Point 5 = SP and SPH 6 = SP, SPE and SPH		4	
92	t.PP	285B	Access Password to parameter functions	0 = oF 1 ÷ 999	oF Password disabled 1 ÷ 999	oF	
93	t.HA (#)	285C	HACCP Alarms Parameters level	1 Visible as protected parameters 2 Visible as unprotected parameters		1	
94	t.AS	285D	MODBUS Station address (serial communication)	0 = oF 1 ÷ 255	1 ÷ 255	1	
95	t.br	285E	Serial communication baud rate	1 = 9600 2 = 19200 3 = 38400	1 9600 2 19200 3 38400	1	

PcL Group - Real Time Clock (RTC) setting parameters

Parameter		Hex. address	Description	Modbus range	Display Range	Default	Note
96	c.CL (#)	2862	Current time and current day of the week	b0 ÷ b4 = h b5 ÷ b10 = min b11 ÷ 14 = gg (0 = oF) b15 = Not used	h Hour (0 ÷ 23) n Minute (0 ÷ 59) d Day of the week (d.1 = Monday ÷ d.7 = Sunday) d.oFClock disabled		
97	c.dt (#)	2863	Current date	b0 ÷ b6 = Year b7 ÷ b10 = Month b11 ÷ 15 = Day date	y Year (10 ÷ 99) M Month (1 ÷ 12) d Day date (1 ÷ 31)		

PcE Group - Clock programmable events parameters

Parameter		Hex. address	Description	Modbus range	Display Range	Default	Note
98	c.01 (#)	2864	Event 1	b0 ÷ b4 = h b5 ÷ b10 = min b11 ÷ 14 = dd (0 = oF) b15 = Not used	h Hour n Minute d. ❑ Day of the week (d.1 = Monday ÷ d.7 = Sunday) d. 8 Every day d. 9 From Monday to Friday d.10 From Monday to Saturday d.11 Saturday and Sunday d.oF No day (event disabled) t. ❑ Event type t.1 Switch ON t.2 Stand-by t.3 Switch ON Aux output t.4 Switch OFF Aux output t.5 Start defrost t.6 Switch to Eco mode (**SPE**) t.7 Switch to normal mode (**SP**)	h.0 n.0 d.oF t.1	
		287D		t = 1 ÷ 7			
99	c.02 (#)	2865	Event 2	See event 1 (C.01)			
		287E		See event 1 (C.01)			
100	c.03 (#)	2866	Event 3	See event 1 (C.01)			
		287F		See event 1 (C.01)			
101	c.04 (#)	2867	Event 4	See event 1 (C.01)			
		2880		See event 1 (C.01)			
102	c.05 (#)	2868	Event 5	See event 1 (C.01)			
		2881		See event 1 (C.01)			
103	c.06 (#)	2869	Event 6	See event 1 (C.01)			
		2882		See event 1 (C.01)			
104	c.07 (#)	286A	Event 7	See event 1 (C.01)			
		2883		See event 1 (C.01)			
105	c.08 (#)	286B	Event 8	See event 1 (C.01)			
		2884		See event 1 (C.01)			
106	c.09 (#)	286C	Event 9	See event 1 (C.01)			
		2885		See event 1 (C.01)			
107	c.10 (#)	286D	Event 10	See event 1 (C.01)			
		2886		See event 1 (C.01)			
108	c.11 (#)	286E	Event 11	See event 1 (C.01)			
		2887		See event 1 (C.01)			
109	c.12 (#)	286F	Event 12	See event 1 (C.01)			
		2888		See event 1 (C.01)			
110	c.13 (#)	2870	Event 13	See event 1 (C.01)			
		2889		See event 1 (C.01)			
111	c.14 (#)	2871	Event 14	See event 1 (C.01)			
		288A		See event 1 (C.01)			

Note: These events are in R/W mode and can be found also at hex address 2C00 and later.

HA Group - HACCP stored alarms (read only parameters)

Parameter		Hex. address	Description	Modbus range	Display Range	Default	Note
112	H.01 (#)	2872	Stored Alarm no. 1	Note	A. Alarm type (H1/L1/H2/L2/bo/AL) y. Start year (10 ÷ 99) M. Start month (1 ÷ 12) d. Start date (1 ÷ 31) h. Start hour (0 ÷ 23) n. Start min. (0 ÷ 59) E. Duration (0 ÷ 99 h) e. Duration (0 ÷ 59 min) _ Peak max./min. (critical temperature) (-9.9 ÷ 999°C/°F)		
113	H.02 (#)	2873	Stored Alarm no. 2	See alarm 1 (H.01)			
114	H.03 (#)	2874	Stored Alarm no. 3	See alarm 1 (H.01)			
115	H.04 (#)	28	Stored Alarm no. 4	See alarm 1 (H.01)			
116	H.05 (#)	2876	Stored Alarm no. 5	See alarm 1 (H.01)			
117	H.06 (#)	2877	Stored Alarm no. 6	See alarm 1 (H.01)			
118	H.07 (#)	2878	Stored Alarm no. 7	See alarm 1 (H.01)			
119	H.08 (#)	2879	Stored Alarm no. 8	See alarm 1 (H.01)			
120	H.09 (#)	287A	Stored Alarm no. 9	See alarm 1 (H.01)			
121	H.10 (#)	287B	Stored Alarm no. 10	See alarm 1 (H.01)			
122	HdL (#)	287C	Number of HACCP alarms deleted (out of space)	0 ÷ 100		0	

Note: The HACCP alarms can be read from the hex address 2E00 and later.

CS Group - Out5/PID setting parameters

Parameter		Hex. address	Description	Modbus range	Display Range	Default	Note
123	r.Ao	287D	Out5 Control output configuration (Analogue/Frequency)	0 Not used 1 Frequency 0...250 Hz amplitude 5 V 2 Frequency 0...250 Hz amplitude 10 V 3 Analogue 0 ÷ 5 V 4 Analogue 0 ÷ 10 V		2	
124	r.LP	287E	Power threshold - minimum control signal	0 ÷ r.HP	0 ÷ r.HP	20	
125	r.LS	287F	Frequency signal (or % of the analogue signal) to be implemented on **Out5** in correspondence with the min. power set at parameter r.LP	0 … r.HS Hz/%	r.LS ÷ 250 Hz/%	50	
126	r.HP	2880	Power threshold - maximum control signal	r.LP ÷ 100 %	r.LP ÷ 100	100	
127	r.HS	2881	Frequency signal to be implemented on **Out5** in correspondence with the max. power set at parameter r.LP	r.LS … 250 Hz	r.LS ÷ 250 Hz	150	
128	r.At	2882	Autotuning	oF No 1 All times the controlled is powered ON 2 At first Power ON only 3 Manual tuning start (U/▼ keys combination)		oF	
129	r.Su	2883	Change rate of the output signal when power increase	1 ÷ 100%/s	1 ÷ 100%/s	100	
130	r.Sd	2884	Change rate of the output signal when power decrease	1 ÷ 100%/s	1 ÷ 100%/s	100	
131	r.1t	2885	Hold time of the minimum output power of the control band after Set Point reaching	0 = oF 0.01 ÷ 99.59 (min. s)	0 oF 0.01 ÷ 99.59 (min.s)	oF	
132	r.2t	2886	Hold time of the minimum input power of the control band after Set Point reaching	0 = oF 0.01 ÷ 99.59 (min. s)	0 oF 0.01 ÷ 99.59 (min.s)	oF	
133	r.OP	2887	Enable manual mode for **Out5** control output (Frequency/Analogue)	0 = oF 1 = on	oF 0 on 1	oF	
134	r.Pd	2888	Pull-down behavior	1 Output Power calculated within the proportional band 2 100% of the power until the Set Point is reached		2	
135	r.Pb	2889	Proportional band	0.1 ÷ 99.9 °C/°F	0.1 ÷ 99.9°C/°F	5.0	
136	r.td	288A	Derivative time	0 oF 1 ÷ 500 s	0 oF 1 ÷ 500 s	oF	
137	r.t i	288B	Integral time	0 oF 1 ÷ 500 s	0 oF 1 ÷ 500 s	oF	
138	r.F1	288C	Output power when a pobe error occur	0 ÷ 100%	0 ÷ 100%	0	
139	r.in	288D	Output power in case of Hot gas/Reverse cycle defrost (ddt = **in**)	r.LP ÷ 100%	r.LP ÷ 100%	100	
140	r.dc	288E	Output power in case of compressor lock for open door (i❑F = **3**)	0 ÷ 100%	0 ÷ 100%	20	
141	r.CS	288F	Variable speed compressor output shutdown delay when running (**CS** output)	0 = oF 0.01 ÷ 99.59 (min. s)	0 oF 0.01 ÷ 99.59 (min. s)	oF	
142	ddP	2891	Pre-defrost duration	0 = oF 0.01 ÷ 99.59 (min. s)	oF Function disabled 0.01 ÷ 9.59 (min. s) ÷ 99.5 (min.sx10)	oF	
143	dPd	2892	Post-defrost duration	0 = oF 0.01 ÷ 99.59 (min. s)	oF Function disabled 0.01 ÷ 9.59 (min. s) ÷ 99.5 (min.sx10)	oF	

8. PROBLEMS AND MAINTENANCE

8.1 Notifications

8.1.1 Error messages

Error	Reason	Action
E1 -E1 E2 -E2 E3 -E3 E4 -E4	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
Err	Fatal memory error	Replace the instrument or ship to factory for repair

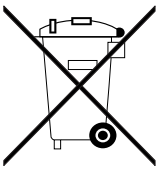
8.1.2 Other messages

Message	Reason
od	Delay at power-on in progress
Ln	Keyboard locked
H1	Maximum temperature alarm 1 in progress
L1	Minimum temperature alarm 1 in progress
H2	Maximum temperature alarm 2 in progress
L2	Minimum temperature alarm 2 in progress
AL	Digital Input alarm in progress
PrA	Digital input alarm PrA in progress
HP	Digital input alarm HP in progress
LP	Digital input alarm LP in progress
oP	Door Open
dEF	Defrost in progress with ddL = Lb
PdF	Post-defrosting in progress with ddL = Lb
Eco	Eco Mode in progress
trb	Turbo mode active
HAC	Not acknowledged HACCP alarms present
---	Reset/delete peak values and HACCP alarms
Hon	HACCP Alarms record enable
HoF	HACCP Alarms record disable

8.2 Cleaning

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

8.3 Disposal



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

9. WARRANTY AND REPAIRS

The instrument is under warranty against manufacturing flaws or faulty material, that are found within 18 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.

10. TECHNICAL DATA

10.1 Electrical characteristics

Power supply: 12 VDC, 12 ÷ 24 VAC/VDC, 100 ÷ 240 VAC ±10%;

AC frequency: 50/60 Hz;

Power consumption: about 6 VA;

Inputs: Up to **4 inputs** for **temperature probes** (**Pr1**... **Pr4**):
NTC (103AT-2, 10 kΩ @ 25°C);
PTC (KTY 81-121, 990 Ω @ 25°C);
Pt1000 (1000 Ω @ 0°C);
up to 4 free of voltage digital inputs ((**DI1**... **DI4**) (**DI3** and **DI4** an alternative to **Pr3** and **Pr4**);

Output: Up to **4 relay outputs** + **Out5** output [frequency (9 ÷ 12 VDC 250 Hz max.) or analogue (0 ÷ 5/10 V) output];

	EN 61810	EN 60730	UL 60730
Out1 - SPST-NO - 16A - 1HP 250V	16 (9) A	10 (4) A	12 A Res., 30 LRA, 5 FLA
Out2 - SPDT - 8A - 1/2HP 250 V	8 (3) A	4 (4) A	10 A Res.
Out3/Out 4 - SPST-NO - 5A - 1/10HP 125/250 V	5 (1) A	2 (1) A	2 A Gen. Use

12 A per contact for the model with removable terminals;

Relay output Electrical life (EN60730)**:** Out1, Out2: 30000 operations, Out3, Out4: 60000 operations;

Action type: Type 1.B (EN 60730-1);

Overvoltage category: II;

Protection class: Class II;

Isolation: Reinforced insulation between the low voltage parts (type H supply type and relays output) and front panel; Reinforced insulation between the low voltage section (type H supply type and relay outputs) and the extra low voltage section (inputs), Reinforoced between power supply and relay outputs.

10.2 Mechanical characteristics

Housing: Self-extinguishing plastic, UL 94 V0;

Heat and fire resistance category: D;

Ball Pressure Test as described in EN60730: accessible parts 75°C; support live parts 125°C;

Dimensions: 78 x 35 mm, depth 64 mm (+12.5 or +14.5 mm depending on the terminal block type);

Weight: About 150 g;

Mounting: Incorporated flush in panel in a 71 x 29 mm hole (max. panel thickness 12 mm);

Connections:

Inputs: fixed or removable terminal block for 0.14 ÷ 1.5 mm²/AWG 28 ÷ 16 cables;

Power supply and Outputs: fixed or removable terminal block for 0.2 ÷ 2.5 mm²/AWG 24 ÷ 14 cables;

Protection degree: IP65 (NEMA 3S) mounted with the optional screw baracket installed;

Pollution degree: 2;

Operating temperature: 0 ÷ 50°C;

Operating humidity: < 95 RH% with no condensation;

Storage temperature: -25 ÷ +60°C.

10.3 Functional features

Temperature Control: ON/OFF or PID mode;

Defrost control method: Interval cycles, at set times, or evaporator temperature by Electric Heating, by hot-gas/reverse cycle or stopping compressor;

Measurement range: **NTC:** -50 ÷ +109°C/-58 ÷ +228°F;
PTC: -50 ÷ +150°C/-58 ÷ 302°F;
Pt1000: -99.9 ÷ 300°C/-99.9 ÷ 572°F;

Display resolution: 1° or 0.1° (range -99.9 ÷ +99.9°);

Overall accuracy: ±(0.5% fs + 1 digit);

Sampling rate: 800 ms;

Clock accuracy at 25°C: ±15.8 minutes/year;

Maintaining the internal clock without power supply: About 5 years (with internal lithium battery);

Type of Communications Interface: Not isolated RS485;

Interface Communications protocol: MODBUS RTU (JBUS);

Serial communications speed: Selectable: 9600, 19200, 38400 baud;

Display: 3 Digit Red (Blue and White optional), height 15.5 mm;

Software class and structure: Class A;

Compliance:

LV Directive 2014/35/EU

(EN 60730-1, EN 60730-2-9); UL60730-1, UL 60730-2-9.

EMC Directive 2014/30/EU

(EN55011: class B;
EN61000-4-2: 8 kV air, 4 kV cont.;
EN61000-4-3: 10 V/m;
EN61000-4-4: 2 kV supply and relay outputs, 1 kV inputs;
EN61000-4-5: supply 2 kV com. mode, 1 kV/diff. Mode;
EN61000-4-6: 3V).

Regulation 37/2005/CE

(EN13485 air, S, A, 2, -50°C +90°C with probe NTC 103AT11 or Pt1000 clas B or better).

11. HOW TO ORDER

MODEL
X35P- Instrument with mechanical keyboard

a: POWER SUPPLY
H = 100 ÷ 240 VAC
G = 12 ÷ 24 VAC/VDC
X = 12 VDC

b: OUT3 AND OUT4 OUTPUT
R = Out3 & Out4 Relays SPST-NO 5A (for resistive loads)
A = Out3 Relay SPST-NO 5A (for resistive loads)
- = Not present

c: OUT5 OUTPUT
F = Frequency output 9 ÷ 12 VDC 250 Hz max.
V = Voltage output 0 ÷ 5 VDC or 0 ÷ 10 VDC (only when power supply a = H)

d: TERMINALS
V = Fixed Screw terminals (standard);
E = Removable screw terminals;
N = Removable screw terminals (fixed part only);
F = Faston.

c: DISPLAY
B = Blue
I = Red
T = White

f: SERIAL PORT
X = Not insulated RS485
- = Not present

g: BUZZER and CLOCK
A = Buzzer and Clock
B = Buzzer only
C = Clock only
- = Buzzer and Clock not present

h: NFC PROGRAMMING NTERFACE
N = NFC programming interface
- = Not present

i: Bezel colour
A = Black
W = White

J: PACKAGING + BRACKET TYPE
L = AT package + "Butterfly" type brackets (standard);
V = AT package + Screw type bracket

X35P	-	a	b	c	-	e	-	-	h	i	j	k	ll	mm

k: RESERVED CODES;
ll, mm: SPECIAL CODES.