TLW 24

MICROPROCESSOR-BASED DIGITAL ELECTRONIC FREEZER CONTROLLER

OPERATING INSTRUCTIONS

Vr. 04 (ENG) - 17/05 - cod.: ISTR-MTLW24-ENG04

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.

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

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1. INSTRUMENT DESCRIPTION

1.1 General description

TLW 24 is a digital controller with microprocessor that is typically used in cooling applications that have temperature control with ON/OFF regulation and defrosting control with set time by means of electrical heating or hot gas/reverse cycle. The instrument has up to 4 relay outputs, 2 inputs for PTC or NTC temperature probes and a digital input, that can all be configured.

The 4 outputs can be used for controlling the compressor or the temperature control device (OUT), the defrosting device (DEF), the evaporation fan (FAN), the room light (LIGH) or, alternatively any of the previous functions, using an auxiliary device (AUX) or an alarm (AL). The two inputs for the PTC and NTC temperature probes (which can be selected

by parameter) can be used to measure the cell temperature (Pr1) and the evaporator temperature (Pr2) while the digital input (DIG) can be programmed to carry out various functions such as defrosting commands, selecting a different set of temperature regulations, external alarm signals, activating a continuous cycle, and activating an auxiliary output etc.

The instrument is equipped with 7 programme keys, a 4-digit display and 9 LED signals, in addition to an internal buzzer that is the sound system for alarms. Other important characteristics of the instrument are: programme parameters protection using personalised password, Keyboard lock function, switching on and off (stand-by) of the instrument using the front keys or the digital input, configuration of parameters via the A01 device, storing two sets of switchable temperature controls and the power supply range of 100... 240 VAC.

1.2   Front Panel description
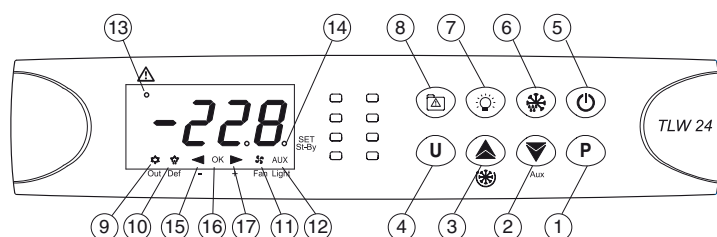
1. **P Key:** Used for setting the Set point and for programming the function parameters.
2. **DOWN/AUX Key:** Used for decreasing the values to be set and for selecting the parameters.

   Outside the programming mode it permits visualisation of the minimum room probe (Pr1) peak measure. It can also be programmed via the parameter "**Fbd**" to carry out other functions such as activating the Aux output or selecting the active set point (see par. 4.14).
3. **UP/CONT. CYCLE Key:** Used for increasing the value to be set, for selecting the parameters and for starting up the continuous cycle. Outside the programming mode it permits visualisation of the maximum room probe (Pr1) peak measure.
4. **U Key:** Used to display the temperatures taken by the cell probes and evaporator (Pr1 and Pr2). It can also be programmed via the parameter "**USrb**" to carry out other functions, just like the key DOWN/AUX (see par. 4.14).
5. **ON/OFF(Stand-by) Key:** Used for turning on and off (stand-by) the controller.
6. **DEFROST Key:** Used for activating manual defrosting.
7. **LIGHT Key:** Used for activating LIGH output.
8. Key Not used
9. **LED OUT:** Indicates the compressor output status (or the temperature control device) on (on), off (off) or inhibited (flashing).
10. **LED DEF:** Indicates defrosting in progress (on) or dripping (flashing).
11. **LED FAN:** Indicates fan output status on (on), off (off) or delayed after defrosting (flashing).
12. **AUX/LIGHT LED:** Indicates LIGH and AUX outputs status:
    OFF: Both outputs are OFF;
    Alternately flashing and OFF: LIGH output ON and AUX output OFF;
    Alternately flashing and ON: both outputs are ON;
    Alternately OFF and ON: LIGH output OFF and AUX

output ON.
13. **AL LED:** Indicates the alarm status on (on), off (off) and silenced or stored (flashing);
14. **SET/STAND-BY LED:** Indicates the input in programming mode and the programming level of the parameters. It also indicates the Stand-by status.
15. **- LED:** Indicates that a low temperature alarm is in progress (lit) or that a low temperature alarm has been memorised (flashing). In Room Peak values mode it indicate the minimum value.
16. **OK LED:** Indicates that there is no alarm active.
17. **+ LED:** Indicates that a high temperature alarm is in progress (lit) or that a high temperature alarm has been stored (flashing). In Room Peak values mode it indicate the maximum value.

2.1   Set Point Programming

Press the key **P** then release it and the display will show **SP 1** (or **SP 2** if the second set is active at that time) alternating with the set value (see selection of the active set point).

To change it press the **UP** key to increase the value or **DOWN** to decrease it.

These keys change the value one digit at a time but if they are pressed for more than one second, the value increases or decreases rapidly and, after two seconds in the same condition, the changing speed increases in order to allow the desired value to be reached rapidly.

Exiting the Set mode is achieved by pressing the P key or automatically if no key is pressed for 15 seconds. After that time the display returns to the normal function mode.

2.2   Parameters programming

To access the instrument function parameters, press the key **P** and keep it pressed for about 5 s, after which the SET LED lights up, the display displays the code that identifies the first group of parameters ("**¹SP**") and the group of parameters that are to be edited are selected by pressing the **UP** and **DOWN** keys.

Once the group of parameters has been selected, press the **P** and the code that identifies the first parameter in the selected group is displayed.

Again using the **UP** and **DOWN** keys, the desired parameter can be selected and pressing the **P** key, the display alternately shows the parameter code and its setting that can be changed with the **UP** and **DOWN** keys.

Once the desired value has been set, press the key **P** again: the new value will be stored and the display shows only the abbreviation of the selected parameter.

Pressing the **UP** and **DOWN** keys, it is possible to select another parameter (if present) and change it as described.

To return to select another group of parameters, keep the **UP** or the **DOWN** key pressed for about 1 second, after which the display returns to the code of the parameter group.

Release the pressed key and using the **UP** and **DOWN** keys select another group (if present).

To exit the programming mode, press no keys for about 20 seconds, or keep the **UP** or **DOWN** key pressed until the controller exits the programming mode.

Hold for 5 s — P → | Previous Group | Previous Parameter | Increase Value

Hold for 2 s | *SP* . Hold for 2 s | *SPAt*. | *1*

Next Group | Hold longer | Next Parameter | Decrease Value

EXIT
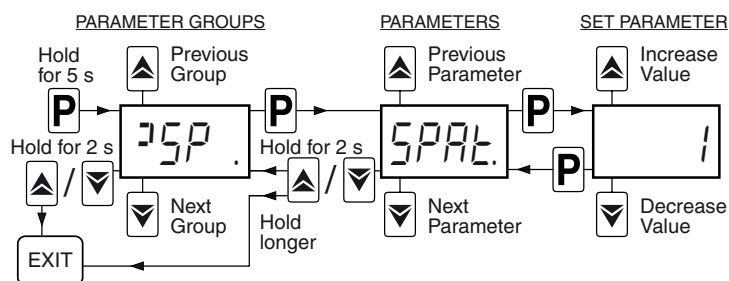
2.3 Parameters protection with password and keyboard lock function

The instrument has a parameter protection function obtained through a password customizable with "**PASS**" parameter contained in the group "┘**PAn**".

If the protection is needed, set a proprietary password number in parameter "**PASS**".

When the protection is working, press the **P** key to access the parameters and keep it press for about 5 s, after which the LED SET flashes and the display shows "*0*" .

At this point, using the **UP** and **DOWN** keys, set the programmed password number and press the key "**P**".

If the password is correct, the display shows the code that identifies the first group of parameters("┘**SP**"). At this time is possible to program the controller in the same way described in the previous section.

Protection using a password can be disabled by setting "**PASS**" = **OFF**.

In addition to Password protection it is possible to completely lock the keyboard. This function is particularly useful when the controller is in an open area and must be protected from undesired changes.

To activate the keyboard lock it is enough to press the **UP** and **DOWN** keys at the same time and keep them pressed for 3 s while the controller is ON.

After 3 s, the label *LOn* appears on the display and all the key functions will be locked except the Set Point display.

When the keyboard is locked, if a key is pressed, on the display appears again *LOn* to indicate the lock.

To unlock the keyboard it is enough to press **UP** and **DOWN** keys together and keep them pressed for 3 s, afterwhich the label *LOF* appears on the display and all the functions are again available to be modified.

2.4 Parameters programming levels

The instrument has two parameter programming levels.

The first level ("**visible**" parameters) is accessed according to the procedure described above (with or without password request) while the second level ("**hidden**" password) can be accessed according to the following procedure.

Remove the power supply to the instrument, press the key **P** and return power to the instrument, keeping the key pressed.

After about 5 s the SET led lights up, the display shows the code that identifies the first group of parameters("┘**SP**"), now it is possible to set the controller parameters using the programming procedure previously described.

Once a parameter has been selected, the SET LED on means that the parameter can be programmed even on the first level ("visible"). The SET LED off it means that the parameter can only be programmed on this level (i.e. "hidden").

To change the visibility of the parameter, press the key **U**: the

SET LED changes its status, indicating the accessibility level of the parameter (on = "visible"; off = "hidden").

The access procedure for "hidden" parameters allows the "PASS" parameter to be checked and changed and is useful therefore if the password set has been forgotten.

2.5 Active set point selection

The instrument allows up to set up 2 different control Set points ("**SP 1**" and "**SP 2**") and choose which one is to be make active during control. This function can be used when is necessary to switch between two different functioning temperatures (e.g. day and night or positive and negative etc.).

The active Set point can be selected (see parameters 4.12 and 4.14):

– Through parameter "**SPAt**";
– Using the key **U** if "**USrb**" = **2**;
– Using the key DOWN/AUX if "**Fbd**" = **2**;
– Using the digital input if "**diF**" = **9**.

"**SP1**" and "**SP2**" can be set within the values of parameters "**SPLL**" and "**SPHL**".

Note: In the examples that follow, the Set point is indicated as "**SP**", in any case during normal operations the controller works according to the Set point selected as active.

2.6 On/Stand-by Function

Once powered, the controller can assume 2 distinct conditions:

ON The controller applies the control functions to the process.

STAND-BY

The controller applies NO control functions to the process except for the Light control; the display is turned off except for the green SET LED.

If a power failure occurs, when power returns, the system always sets itself in the same condition it was in before the black-out. The ON/Stand-by function can be selected:

– Using the ON/OFF key hold pressed for 1 s;
– Using the digital input when parameter "**diF**" = **11** (see 4.12).

3. INSTALLATION AND USE WARNINGS

3.1 Permitted use

⚠ The instrument has been projected and manufactured as a measuring and control device to be used according to EN 60730-1 at altitudes operation below 2000 m.

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

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

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

3.2   Mechanical mounting

The instrument, in case 185 x 37 mm, is designed for flush-in panel mounting.

Make a hole 150 x 31 mm, insert the instrument, fix it with 2 screws and to apply the provided special covers.

We recommend to mount the gasket in order to obtain the declared front protection degree. 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..

3.3   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 to protect all the electrical circuits connected to the instrument 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, be used. Furthermore, the probe input cable must to be kept separate from line voltage wiring. If the input cable of the probe is shielded, the shield must be connected to ground at only one side.

For those instruments with **F** or **G** power supply version (12/24 V) it is necessary to use a TCTR transformer or a transformer with equivalent features (insulation class II); it is also recommended to use a transformer for each instrument because there is no insulation between supply and input.

We recommend 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.

3.4   Electrical wiring diagram
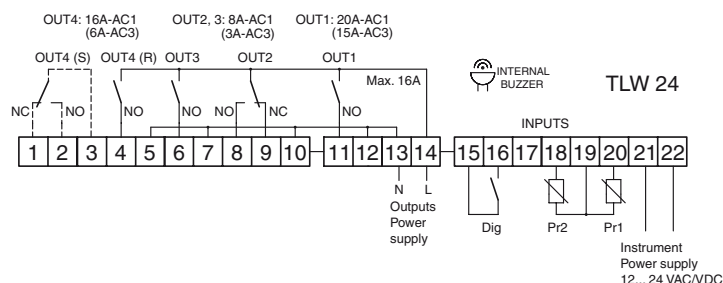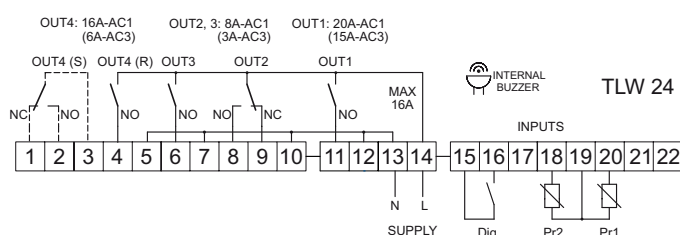
4.   FUNCTIONS

4.1   Measuring and display

All the parameters referring to the measure are inserted in the group "InP".

With the parameter "**SEnS**" it is possible to select the probe type installed that can be: thermistor PTC KTY81-121 (Ptc) or NTC 103AT-2 (ntc).

Once the type of probe used has been selected, through the parameter "**Unit**", it is possible to select the temperature measurement unit (°C/°F) and with parameter "**dP**", the desired measurement resolution (OFF = 1°; On = 0.1°).

The instrument allows to calibrate the measure. This operation re-calibrates the instrument according to application needs, through the parameters "**OFS1**" (for probe **Pr1**) and "**OFS2**" (for probe **Pr2**).

If probe Pr2 (evaporator) is not used, set "**Pr 2**" = **OFF**.

Using the "**FiL**" parameter is possible to set the time constant of the software filter for the input in order to decrease (increasing the time) the sensitivity to measurement disturbances.

Through the paragraph "**diSP**", it is possible to set normal visualization of the display. The displayed variable can be: probe (Pr 1) measurement, probe (Pr 2) evaporator measurement, active Set point (SP) or the numerical display switched off (OFF).

Regardless of what has been set with "**diSP**", it is possible to cyclically display all the variables by pressing the **U** key, the display alternately shows the code that identifies the variable **(Pr 1**, **Pr 2**) and its value. The controller automatically exits this display mode 10 s after the last pressure on the key **U**.

Also remember that the display of probe Pr1 values can also be changed by the display block during defrost using the parameter "**DLo**" (see 4.7).

4.2   Cell probe peak values memory

The instrument stores the minimum and maximum peak values measured by the cell probe (Pr1).

During instrument normal operation the peak values can be displayed as follows:

– Press and release the UP button, the controller lights up the **+** LED while the display sows, flashing, the max. cell stored temperature.

– Press and release the DOWN button, the controller lights up the **-** LED while the display sows, flashing, the min. cell stored temperature.

After 5 s, or pressing the same button, the display returns to normal mode.

In order to reset the stored values, power the instrument OFF then On again or maintain pressed the **P** button for about 2 s while displaying the peak values, the controller shows the message "**r.Pic**" and resets the peak values.

4.3 Outputs configuration

The instrument outputs can be configured using parameters "**Out1**", "**Out2**", "**Out3**" and "**Out4**" loaded in "$^]$**Out**" group.

The outputs can be configured for the following functions:

Out Compressor control or temperature control device.

dEF To control the defrosting device.

FAn To control the fans.

LIGH To control the light.

AuS To control the auxiliary device (see par. 4.13).

ALt To control an acknowledgeable alarm device through an NO contact that closes when the alarm is active.

AL To control a not acknowledgeable alarm device through an NO contact that closes when the alarm is active.

ALL To control a latched alarm through an NO contact that closes when the alarm is active.

-ALt To control an acknowledgeable alarm device through an NC contact that opens when the alarm is active.

-AL To control a not acknowledgeable alarm device through an NC contact that opens when the alarm is active.

-ALL To control a latched alarm through an NC contact that opens when the alarm is active (see 4.11.4).

On Output ON when the instrument is in ON state. This mode can be used to control the fog resistance on room door or other utilities like the door open light.

OFF Output disabled.

4.4 Temperature control

All parameters concerning temperature control are stored in group "$^]$**rEG**".

The instrument performs an ON/OFF control on the output configured as "**Out**" depending on the probe Pr1 measure, the active Set Point "**SP**" (1 or 2), the "**HSEt**" intervention and the "**Func**" function mode.

Depending on the function mode programmed for parameter "**Func**" the differential is automatically considered by the controller with **positive** values for Cooling control ("**Func**" = **CooL**) or negative values for a **Heating** control ("**Func**" = **HEAt**).

In the event of cell probe error (**Pr1**), it is possible to set the instrument so that the output "**Out**" continues working in cycles according to the times programmed parameter "**tonE**" (activation time) and "**toFE**" (deactivation time).

If a probe Pr1 error occurs the instrument activates the output for the time "**tonE**", then deactivates it for the time "**toFE**" and so on whilst the error remains.

Programming "**tonE**" = **OFF** the output, in probe error condition, remains switched **OFF**.

Programming "**tonE**" to **any value** and "**toFE**" = **OFF** the output in probe error condition remains switched **ON**.

CooL

HEAt
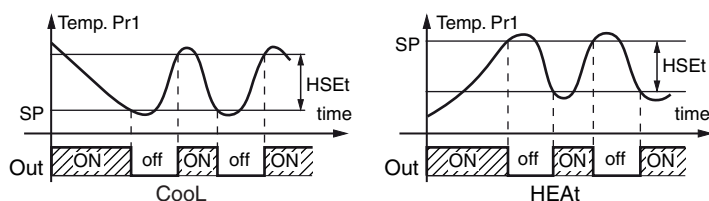
Remember that the temperature control function can be conditioned by the "*Continuous Cycle*", "*Compressor Protection*", "*Minimum compressor function time*", "*Delay compressor start up after defrosting*" and "*Inhibition of compressor close to defrosting*" functions described below.

4.5 Continuous cycle function

The instrument has a "*Continuous cycle function*" by which it is possible to maintain the output configured as "**out**" **always active** for the time set in parameter "**tCC**" (group "$^]$**rEG**") regardless the temperature control command.

The function can be used when is required a quick temperature lowering of the products after a refrigerator load phase.

Pay attention to the fact that during the Continuous cycle, defrost is inhibited and temperature alarms are disabled for the entire cycle plus the time set in parameter "**dALc**" (4.11.1).

Continuous cycle can only be start pressing the **UP/CONT.CYCLES** key for at least 5 s or through the Digital input command if suitably programmed ("**diF**" = **3**)(4.12).

The continuous cycle in progress is shown on the display with the indication CC and can be stopped by a further action on the key or digital input (as for activation).

The continuous cycle function cannot be activated during defrosting and with "**tCC**" = **OFF**.

4.6 Compressor protection function and power-on delay

All parameters concerning the Compressor protection function and power-on delay at are contained in the group "$^]$**PrC**".

The "**Compressor Protection**" function carried out by the machine aims to avoid close start-ups of the compressor controlled by the instrument in cooling applications.

This function foresees a time control on the switching on of the output (**Out**) associated with the temperature control.

The protection consists of preventing the output being switched ON during the time set in parameter "**PtC**" and counted depending on what has been programmed in parameter "**PSC**", and therefore that any activation occurs only after the "**PtC**" time has finished.

If during the power on delay phase, the controller request should disappear, due to an inhibition caused by the compressor protection function, the foreseen output start-up is naturally cancelled.

Using the parameter "**PSC**", it is possible to set the type of compressor protection and therefore from when the inhibition time "**PtC**" must start.

The parameter "**PSC**" can be set as:

1. Power on delay:
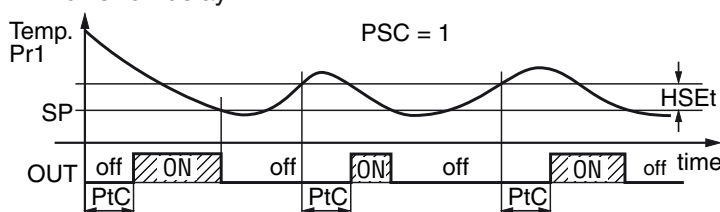
2. Delay after Power OFF:
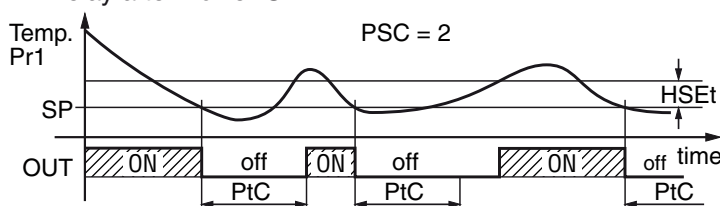
3. Delay between Power ON phases:
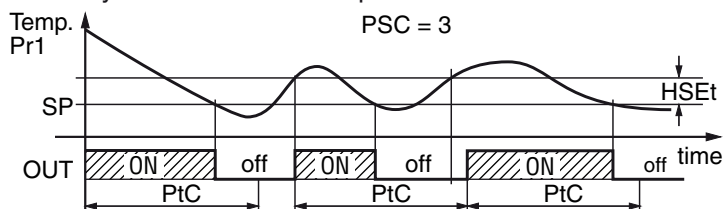
Through the parameter "**LCt**" it is also possible to set the minimum output activation time to avoid the compressor switching on for too short times.

The OUT LED flashes during the output power on delay phases caused by the "Compressor Protection" or delay of power off caused by the minimum function time "**LCt**".

It is also possible to prevent activation of all the outputs after the instrument has been turned ON for the period of time set with parameter "**od**".

During the power on delay phase, the display shows the indication _od_ alternated with the normal programmed display.

All timer functions are disabled setting the relative parameters to **OFF**.

## 4.7 Defrost control

All the parameters concerning the defrost control that act on the "**Out**" and "**dEF**" outputs are contained in group "]**dEF**".

The type of defrosting that the instrument must carry out is set by the parameter "**dtyP**". It can be programmed as:

EL WITH ELECTRICAL HEATING or BY STOPPING COMPRESSOR (during defrost, output "**Out**" is deactivated while "**dEF**" is enabled);

in WITH HOT GAS or INVERSION OF CYCLE (during defrost both "**Out**" and "**dEF**" are enabled).

The automatic defrost can take place at intervals.

Defrosting at intervals is possible by setting the time that runs between the two next automatic defrost cycles with parameter "**dint**".

Counting this interval is set through the parameter "**dCt**" that can be programmed:

rt Counts the total function time (instrument on).

ct Counts only the compressor function time (output OUT switched on).

cS The instrument carries out a defrosting cycle at each compressor stop (i.e. at each deactivation of the output OUT). If this option is used, set "**dint**" = **OFF**.

The automatic defrosting cycle can be ended by time or, if an evaporator probe is used (Pr2), when a temperature is reached.

If the evaporator probe is not used ("**Pr 2**" = **OFF**) the duration cycle is set by the parameter "**dEFE**".

If instead the evaporator probe is used ("**Pr 2**" = **on**) the defrost ends when the temperature measured by the probe exceeds the temperature set in the parameter "**tEdF**".

If this temperature is not reached in the time set in the parameter "**dEFE**", defrosting is interrupted.

In order to avoid unnecessary defrosts, it is provided the "**tSdF**" parameter to set the defrost enabling temperature.

If the temperature measured by the probe is higher than the one set in the parameter "**tSdF**" and in the parameter "**tEdF**" the defrosting is inhibited.

At the end of defrosting, it is possible to delay the new start-up of the compressor (output "Out") at the time set in pa-

rameter "**tdCO**" to allow the evaporator to drain. During this delay, the LED **Def** flashes to indicate the draining state.

To set a defrost cycle every time the instrument is switched on (as long as the conditions set in parameters "**tSdF**" and "**tEdF**" apply) set "**SdEF**" = **yES**.

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

During the defrost procedure, it may occur that the temperature measured by the cell probe (Pr1) increases excessively (this obviously depends on Pr1 probe position compared to the evaporator).

In order to hide this temperature increasing, it is possible to use the parameter "**dLo**" (Block display during defrosting) and "**Etdu**" (Differential unblocking of display after defrosting).

"**dLo**" = **On** allows to display the last Pr1 reading during the whole defrost cycle since the temperature does not return under the value ["**SP**" + "**Etdu**"] when the defrost procedure is ended (or the time set in the parameter "**dALd**" contained in the block "]**AL**").

"**dLo**" = **Lb** writes _dEF_ on the display during defrost and, at the end of defrost, writes _PdEF_ until Pr1 temperature does not return under the ["**SP**" + "**Etdu**"] value (or the time set in the parameter "**dALd**" contained in the block "]**AL**").

By setting "**dLo**" = **OFF** the instrument displays the temperature measured by Pr1 probe during the whole defrost procedure.

Note that the temperature alarms are disabled during the whole defrost cycle and afterwards for the time set with parameter "**dALd**" (4.11.1).
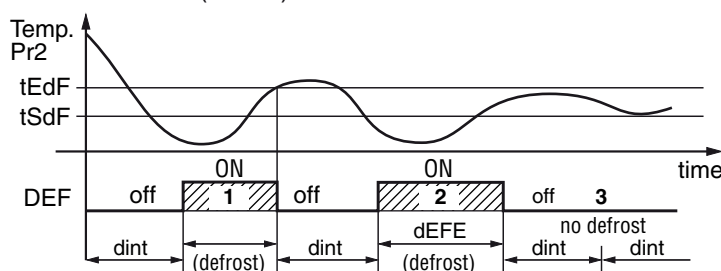
E.g. Defrost cycle 1 ends as temperature "**tEdF**" is reached, defrost 2 ends as "**dEFE**" time has elapsed also if "**tEdF**" is not reached, defrost cycle 3 does not take place as the temperature is higher than "**tSdF**".

4.8 Manual defrost

To start a manual defrost cycle, press the DEFROST key and keep it pressed for about 5 s after which, if the conditions are correct, the led DEF lights up and the instrument performs a defrost cycle.

The command to launch/stop a defrost cycle can also be given by a appropriately programmed digital input (4.12).

4.9 Evaporator fan control

All the parameters concerning fan control are contained in the "]**FAn**" group.

Fan control operates on the output configured as "**FAn**" depending on some instrument parameter settings and the temperature measured by the probe Pr2.

If probe Pr2 is not used ("**Pr 2**" = **OFF**) or a Pr 2 error occurred (**E2** or **-E2**), the **FAN** output activation depends on parameters "**FCOF**" and "**FEdF**".

"**FCOF**" parameter allows to force **ON** the **FAN** output during the control action independently to compressor status

("**FCOF**" = **On**) or switch to OFF together with the compressor ("**FCOF** "= **OFF**).

"**FEdF**" parameter allows to set if FAN output must be active ("**FEdF**" = **On**) or OFF ("**FEdF**" = **OFF**) during the defrost cycle.

In this latter case, setting a time in parameter "**Fd**", is possible to delay the fan start-up even after the end of the defrost cycle.

When probe Pr2 is used ("**Pr 2**" = **on**), the fan output is conditioned by parameters "**FCOF**" and "**FEdF**" as well as by the temperature control.

Fan output can be disabled when probe Pr2 temperature is higher than the one set in "**FLt**" (temperature too hot) or lower than the one set in "**Fct**" (temperature too cold). The relative differential that can be set in parameter "**dF**" is also associated with these parameters.
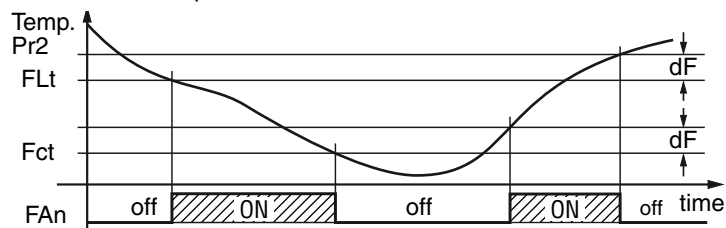
4.10   Room light control

The room light control acts on the output configured as "**LIGH**" through the LIGHT button or, if correctly programmed with parameter "**diF**" (4.12), through the digital input.

The **LIGH** output can always be activated also when the controller is in **OFF** mode (standby).

When the LIGH output is activated through the **LIGHT** button the digital input has no effect on the output (must be switched off using the **LIGHT** button).

4.11   Alarm functions

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

The instrument alarm functions act on the internal buzzer and on the output configured using parameters "**Out1**", "**Out2**", "**Out3**" or "**Out4**", depending on what is set on the said parameters.

Possible selections are:

ALt   The output becomes ON when the alarm turns to active and can be acknowledged (silenced) by pressing one of the instrument buttons (typical application for acoustic alarms).

AL   The output becomes ON when the alarm turns to active, but cannot be manually acknowledged, it returns OFF when the alarm condition has ceased (typical application for luminous alarms).

ALL   The output becomes ON when the alarm turns to active and remains active also when the alarm condition has ceased (latched alarm). The acknowledgement (latched alarm acknowledge) can be done manually pressing one of the instrument buttons (typical application for luminous alarms).

-ALt   The alarm output acts as ALt, but with an inverted functioning logic (output activated in normal conditions and disabled in alarm status).

-AL   The alarm output acts as AL, but with an inverted functioning logic (output activated in normal conditions and disabled in alarm status).

-ALL   The alarm output acts as ALL, but with an inverted functioning logic (output activated in normal conditions and disabled in alarm status).

When there is no alarm active, the OK LED (green) is lit.

Any active alarm is shown on the instrument display with the lighting up of the AL LED and the switching off of the led OK.

Any acknowledged (silenced) or latched (memorised) alarm is pointed out by the AL LED flashing. To stop the Buzzer, press and release one of the instrument buttons.

The alarm conditions of the instrument are:

– Probe(s) error "**E1**", "**-E1**", "**E2**, "**-E2**";

– Temperature alarm "**HI**" e "**LO**";

– External alarm "**AL**";

– Open door alarm "**AP**".

4.11.1   Temperature alarms

Temperature alarms operate according to:

– The probe Pr1 measurements;

– The type of alarm set in the parameter "**Aty**";

– The alarm thresholds set in parameters "**HAL**" (maximum alarm) and "**LAL**" (minimum alarm);

– The relative differential "**dAL**".

Through parameter "**Aty**" it is possible to set if the alarm thresholds "**HAL**" and "**LAL**" must be considered as absolute ("**Aty**" = **Ab**) or relative to the active Set Point ("**Aty**" = **dE**).

Using some parameters it is also possible to delay the enablement and the intervention of these alarms.

PAL   Temperature alarm exclusion time at power ON if the instrument is in alarm status at power ON.

dALd Temperature alarm exclusion time at defrost cycle end (and, if programmed, at the end of draining cycle) or from the cell door opening moment (if the digital input functioning mode is set as "**diF**" = **5**, **6**, **7**).

dALc Temperature alarm exclusion time at the end of a continuous cycle.

ALd   Temperature alarm delay activation time.

  The temperature alarm is enabled at the end of exclusion time and is activated after the time set in "**ALd**" when the temperature measured by the probe Pr1 exceeds or goes below the maximum and/or minimum alarm thresholds.

  The alarm thresholds are the same set with parameters "**HAL**" and **LAL**" if the alarms are absolute ("**Aty**" = **Ab**)
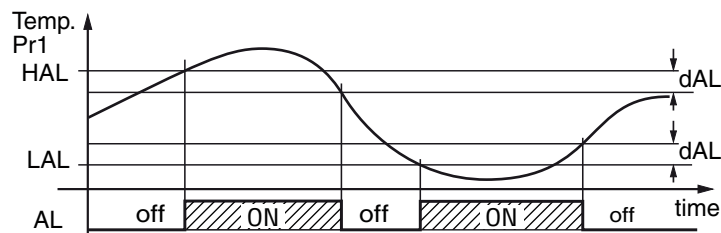
or those of ["**SP**" + "**HAL**"] and ["**SP**" - "**LAL**"] in presence of relative alarms ("**Aty**" = **dE**).
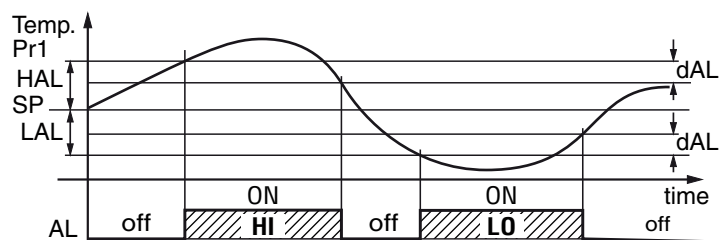
The maximum and minimum temperature alarms can be disabled by setting the relative parameters "**HAL**" and "**LAL**" = **OFF**.

At the same time as the signalling of the configured alarm (buzzer and output), the instrument signals the alarm by

turning on the **AL** LED, switching off the **OK** LED, turning on the LED "**-**" in case of minimum alarm or the LED "**+**" for maximum alarm, and shows on the display:

– H I alternated to the variable set for parameter "**diSP**" in case of max. alarm;
– L O alternated to the variable set for parameter "**diSP**" in case of min. alarm.

4.11.2 External alarm

The instrument can signal an external alarm by activating the digital input with the function programmed as "**diF**" = **4** or **10** (4.12).

At the same time as the signalling of the configured alarm (buzzer and output), the instrument signals the alarm by turning on the **AL** LED, turning off the **OK** LED and displaying AL alternated to the variable set with parameter "**diSP**".

4.11.3 Open door alarm

The instrument can signal an open door alarm by activating the digital input with the function programmed as "**diF**" = **5**, **6**, **7** (4.12). When the digital input is activated and after the delay programmed in parameter "**oAd**", the instrument signals the alarm activating the configured devices (buzzer and output), turning on **AL** LED, turning off **OK** LED and showing on the display AP alternately to the variable set in parameter "**diSP**".

If the function of the digital input foresees the fan or the fan and compressor switch off at the alarm activation the load will be reactivated even if the digital input is active.

4.11.4 Alarm memory

The instrument offers the possibility of arranging the alarm memory function via the parameter "**tAL**".

If "**tAL**" = **no**, the instrument cancels the alarm signal when the alarm status ends, if instead it is programmed as "**yES**", the **AL** LED flashes even when the alarm status has ended to indicate that there has been an alarm.

If the stored alarm is for temperature, it also keeps flashing the "**-**" LED to show a minimum alarm and "**+**" to show a maximum alarm. Press any key to cancel the alarm memory signal.

It must be remembered that if an output function is desired (or the buzzer) with an alarm memory (= **ALL** or = **-ALL**) it is necessary to set the parameter "**tAL**" = **yES**.

4.12 Digital input

All the parameters concerning the digital input functions are contained in the group "⌐**din**".

The digital input present on the instrument accepts contacts free of voltage, the function carried out is defined by the parameter "**diF**" and the action can be delayed for the time set in parameter "**did**".

"**diF**" can be configured for the following functions:

0. Digital input not active;
1 Start a defrost cycle with NO contact: closing the input (and after the "**did**" time) a defrosting cycle is activated.
2 Stop the defrost cycle with NO contact: closing the input (and after the "**did**" time) a defrosting cycle is ended if in progress or defrosting is inhibited.
3 Continuous cycle activation command with NO contact: closing the input (and after the "did" time) a continuous cycle is started up as described in the paragraph on the continuous cycle function.
4 External alarm signal with NO contact: closing the input

(and after the "**did**" time) the alarm is activated and the instrument alternately shows AL and the variable set in parameter "**diSP**" on the display.

5 Cell door opening with light on with NO contact: closing the input (and after the "**did**" time) the light is switched on and the instrument alternately shows AP and the variable set in parameter "**diSP**" on the display. With this function, the action of the digital input also activates the time set in parameter "**oAd**" after which the alarm is activated to signal that the door has been left open. At the deactivation of digital input the light is switched off.

6 Cell door opening with light on and fan block with NO contact: closing the input (and after the "**did**" time) the light is switched on, the fans are stopped and the instrument alternately shows AP and the variable set in parameter "**diSP**" on the display. With this function mode, the action of the digital input also activates the time set in parameter "**oAd**" after which the alarm is activated to signal that the door has been left open. At the deactivation of digital input the light is switched off. At the alarm activation the fan will be reactivated even if the digital input is active.

7 Cell door opening with light on, compressor block and fan block with NO contact: similar to "**diF**" = **6** but with fan and compressor block. At the alarm activation the fan will be reactivated even if the digital input is active.

8 Remote control of auxiliary output AUX with NO contact: closing the input (and after the "**did**" time) the auxiliary output is activated as described in the "**FOA**" = **2** function mode of the auxiliary output.

9 Selecting the active set point with NO contact: closing the input (and after the "**did**" time) the temperature control set point "**SP 2**" is activated. When the input is open the set point "**SP 1**" is active (see selecting the active set point).

10 Signalling an external alarm with disablement of all the control outputs with NO contact: closing the input (and after the "**did**" time) all the control outputs are disabled, the alarm is activated and the instrument alternately shows AP and the variable set in parameter "**diSP**" on the display.

11 Switching on/off (Stand-by) the instrument with a NO contact: closing the input (and after the "**did**" time) the instrument is switched ON while it is placed in Stand-by when opened.

-1, -2, -3... -11 Similar to the previous but with function logic reversed (contact normally closed).

4.13 Auxiliary output

All the parameters concerning the auxiliary output functions are contained in the group "⌐**AuS**".

The auxiliary output can be configured to operate on any of the outputs by programming the parameter of the desired output = **AuS**.

The function carried out is defined by the parameter "**FOA**" and the function is conditioned by the time set in parameter "**tuA**".

The parameter "**FOA**" can be configured for the following functions:

0 Auxiliary output not active;
1 Control output delayed with contact normally open: the auxiliary output is activated with delay that can be set on the parameter "**tuA**" compared to the output configured as **Out**. The output is then turned off at the same time as the **OUT** output is disabled. This function mode can be used as a command for a second compressor or for all other working utilities according to the same **OUT** output

conditions, but which must be delayed after the start up of the compressor to avoid excess electricity absorption.

2 Activation by front key (**U** or **DOWN/AUX**) or by digital input with contact normally open: the output is activated by pressing the keys **U** or **DOWN/AUX** suitably configured ("**USrb**" or "**Fbd**" = **1**) or via activation of the digital input if suitably configured ("**diF**" = **8**). These commands have a toggle function, it means that at the first pressure on the button the output is activated while at the second is the output is disabled. In this mode, the **AUX** output can be turned off automatically after a certain time that can be set with parameter "**tuA**". When "**tuA**" = **OFF** the output is activated and deactivated only manually, using the front key (**U** or **DOWN/AUX**) or via the digital input. Differently, the output, once activated, is turned off automatically after the set time. This function can be used, for example, as a cell light command, for fog resistance or other utilities.

4.14 Functioning of keys "U" and "DOWN/AUX"

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 "**USrb**" while the **DOWN/AUX** key function can be defined by the parameter "**Fbd**" both contained in the group "⌐**PAn**".

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

0. The key carries out no function.

1. Pressing the key for at least 1 second, it is possible to enable/disable the auxiliary output if configured ("**FOA**"=2).

2. Pressing the key for at least 1 second, it is possible to select one of the 2 stored set point in rotation. Once selection has been made, the display flashes the active set point code for about 1 s (5P 1 or 5P 2).

4.15 Parameters configuration by "A01"

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

This device it is mainly usable for the serial programming of the instruments which need to have the same parameters configuration or to keep a copy of the programming of an instrument and allow its rapid retransmission.

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

To use the device A01 it is necessary that the device or instrument are being supplied directly or through the key.
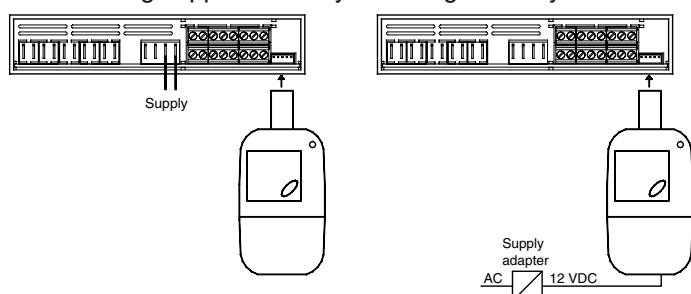
For additional info, please have a look at the A01 instruction manual.

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.

⌐SP Group - Set Point parameters

Parameter		Description	Range	Def.
1	SPAt	Active Set point	1 ÷ 2	1
2	SP1	Set Point 1	SPLL ÷ SPHL	0.0
3	SP2	Set Point 2	SPLL ÷ SPHL	0.0
4	SPLL	Minimum Set Point	-58 ÷ SPHL	-50.0
5	SPHL	Maximum Set Point	SPLL ÷ 302	100.0

⌐InP Group - Measuring inputs parameters

Parameter		Description	Range	Def.
6	SEnS	Probes Type	Ptc - ntc	Ptc
7	OFS1	Pr1 Probe (cell) Calibration	-30 ÷ +30°C/°F	0.0
8	OFS2	Pr2 Probe (evaporator) Calibration	-30 ÷ +30°C/°F	0.0
9	Pr 2	Pr2 Probe Presence (evaporator)	On - OFF	On
10	Unit	Temperature Unit	°C - °F	°C
11	dP	Decimal point	On - OFF	On
12	FiL	Measure Filter	OFF ÷ 20.0 s	2.0
13	diSP	Variable normally shown on display	OFF Display off Pr1 Pr1 measure Pr2 Pr2 measure SP Active SP	Pr1

⌐rEG Group - Temperature control parameters

Parameter		Description	Range	Def.
14	HSEt	Differential	0 ÷ 30°C/°F	2.0
15	tonE	OUT activation time if probe Pr1 broken	OFF ÷ 99.59 min.s	OFF
16	toFE	OUT deactivation time if probe Pr1 broken	OFF ÷ 99.59 min.s	OFF
17	Func	Function mode output OUT	HEAt - CooL	CooL
18	tCC	Continuous cycle Time	OFF ÷ 99.59 h.min	OFF

⌐dEF Group - Defrost parameters

Parameter		Description	Range	Def.
19	dtyP	Defrost Type	EL Electrical in Hot gas/Reverse cycle	EL
20	dint	Defrosting interval	OFF ÷ 99.59 h.min	6.00
21	dEFE	Max. length of defrost cycle	0.01 ÷ 99.59 min.s	30.00
22	tEdF	Defrost stop temperature	-58 ÷ +302°C/°F	8.0
23	tSdF	Defrost enable temperature	-58 ÷ +302°C/°F	2.0
24	dCt	Defrosting intervals Counting mode	rt Real time ct On OUT time cS At every OUT OFF	rt
25	tdCO	Compressor delay after defrost (drainage time)	OFF ÷ 99.59 min.s	OFF
26	SdEF	Defrost at power on	no - yES	no
27	dLo	Defrost display Lock	OFF Display free On Lock on temperature Pr1 before defrost Lb Lock on label "dEF" (during defrosting), "PdEF" (during post-defrosting)	OFF
28	Etdu	Differential display unlock after defrost	0 ÷ 30°C/°F	2.0

FAn Group - Evaporator fan parameters

Parameter		Description	Range	Def.
29	FCOF	Fan status with compressor OFF	On - OFF	On
30	FEdF	Fan status during defrost	On - OFF	OFF
31	FLt	High temperature fan off	-58 ÷ +302°C/°F	2.0
32	Fct	Low temperature fan off	-58 ÷ +302°C/°F	-50.0
33	dF	Differential fan control	0 ÷ 30°C/°F	2.0
34	Fd	Fan delay after defrost	OFF ÷ 99.59 min.s	OFF

PrC Group - Compressor protection and Power on delay parameters

Parameter		Description	Range		Def.
35	PSC	Type of compressor protection	1 Delay at switch ON 2 Delay after switch OFF 3 Delay between starts		1
36	PtC	Compressor protection time	OFF ÷ 99.59 min.s		OFF
37	LtC	Minimum compressor function time	OFF ÷ 99.59 min.s		OFF
38	od	Delay at power on	OFF ÷ 99.59 min.s		OFF

AL Group - Alarm parameters

Parameter		Description	Range		Def.
39	Aty	Temperature alarms Type	Ab Absolute dE Relative to Set		Ab
40	HAL	High temp. Alarm threshold	OFF/-58 ÷ +302°C/°F		OFF
41	LAL	Low temp. Alarm threshold	OFF/-58 ÷ +302°C/°F		OFF
42	dAL	Temp. alarms Differential	0 ÷ 30°C/°F		2.0
43	ALd	Temp. alarms delay	OFF ÷ 99.59 min.s		OFF
44	tAL	Alarm memory	no - yES		no
45	PAL	Temp. alarms delay at power ON	OFF ÷ 99.59 h.min		2.00
46	dALd	Temp. alarms delay and unlock display delay after defrost	OFF ÷ 99.59 h.min		1.00
47	dALc	Temp. alarms delay after continuous cycle	OFF ÷ 99.59 h.min		OFF
48	oAd	Alarm delay with open door	OFF ÷ 99.59 min.s		OFF

din Group - Digital Input parameters

Par.		Description	Range	Def.
49	diF	Function and function logic of digital input	0 No function 1 Start defrost 2 End defrost 3 Continuous cycle 4 External alarm 5 Door open with light on 6 Door open with light on and fan block 7 Door open with light on, fan+compressor block 8 Auxiliary output command 9 Selection of active SP 10 External alarm with deactivation of control outputs 11 Switch on/Switch off (Stand-by)	0
50	did	Digital input delay	OFF ÷ 99.59 min.s	OFF

AuS Group - Auxiliary Output Parameters

Par.		Description	Range	Def.
51	FOA	Function mode auxiliary output	0 No Function 1 Control output delayed 2 Manual activation by key or digital input	0
52	tuA	Time relative to auxiliary output	OFF ÷ 99.59 min.s	OFF

Out Group - Outputs parameters

Par.		Description	Range		Def.
53	Out1	Configuration of OUT1 output	OFF No function Out Temperature control (compressor)		Out
54	Out2	Configuration of OUT2 output	dEF Defrost FAn Fans		dEF
55	Out3	Configuration of OUT3 output	AuS Auxiliary ALt Ack. alarm AL Alarm not Acknowledgeable		FAn
56	Out4	Configuration of OUT4 output	ALL Latched alarm On On state		LIGH

PAn Group - Keyboard parameters

Par.		Description	Range		Def.
57	Fbd	DOWN/AUX Key Function mode	OFF No function 1 Auxiliary output command 2 Active Set Point Selection		OFF
58	USrb	U Key Function mode			OFF
59	PASS	Access Password to parameter functions	OFF ÷ 9999		OFF

6.1 Notifications

Error messages

Error	Reason	Action
E 1, -E 1	The probe Pr1 may be interrupted or in short circuit, or may measure a value outside the range allowed	Check the correct connection of the probe with the instrument and check the probe works correctly
E2, -E2	The probe Pr2 may be interrupted or in short circuit, or may measure a value outside the range allowed	
EEP-	Internal memory error	Check and if necessary reprogramme the parameters function

In Cell probe error status, the output OUT behaves as set by the parameters "**tonE**" and "**toFE**".

Other messages:

Message	Reason
od	Delay in switching on in progress
dEF	Defrosting in progress with dLo = **Lb**
PdEF	Post-defrosting in progress with dLo = **Lb**
CC	Continuous cycle in progress
HI	Maximum temperature alarm in progress
LO	Minimum temperature alarm in progress
AL	Digital input alarm in progress
AP	Door open
LOn	Keyboard locked

6.2 Cleaning

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

6.3 Warranty and Repairs

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

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

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

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

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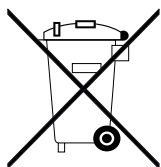
The appliance (or the product) must be disposed of separately in compliance with the local standards in force on waste disposal

7.1 Electrical characteristics

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

AC frequency: 50/60 Hz;

Power consumption: about 5 VA;

Inputs: 2 inputs for temperature probes:
PTC (KTY 81-121, 990Ω @ 25°C) or
NTC (103AT-2, 10 kΩ @ 25°C);
1 digital input for free voltage contacts;

Outputs: Up to 4 relay Outputs;

OUT1 SPST-NO (16A-AC1, 12A-AC3 /250VAC, 2HP 250VAC, 1 HP 125VAC;

OUT2 SPDT (8A-AC1, 3A-AC3 250 VAC, 1/2HP 250 VAC, 1/3 HP 125 VAC);

OUT3 SPST-NO (8A-AC1, 3A-AC3 250 VAC, 1/2HP 250 VAC, 1/3 HP 125 VAC);

OUT4 SPST-NO (R) o SPDT (S) (16A-AC1, 6A-AC3 250 VAC,1HP 250VAC, 1/2HP 125 VAC);

Common power supply (pin 13, 14): 16 A max. (11.5 A max. for UL873 with Faston terminals);

Relay outputs Electrical life: OUT1, 2, 3 = 30000 operations; OUT4 = 50000 operations (VDE homologation);

Installation category: II;

Measurement category: I;

Protection class against electrical shock: Class II for Front panel;

Isolation: Reinforced insulation between the low voltage part (supply and relay outputs) and front panel; Reinforced insulation between the low voltage section (supply and relay outputs) and the extra low voltage section (inputs); Reinforced between supply and OUT 4 relay output (S); No insulation between supply F or G type and inputs.

7.2 Mechanical characteristics

Housing: Self-extinguishing plastic, UL 94 V0;

Dimensions: 38 x 185 mm, depth 78 mm;

Weight: about 240 g;

Mounting: Flush in panel in 31 x 150 mm hole;

Connections: Faston 6.3 mm (Power supply and outputs) and 2.5 mm² screw terminals block (inputs);

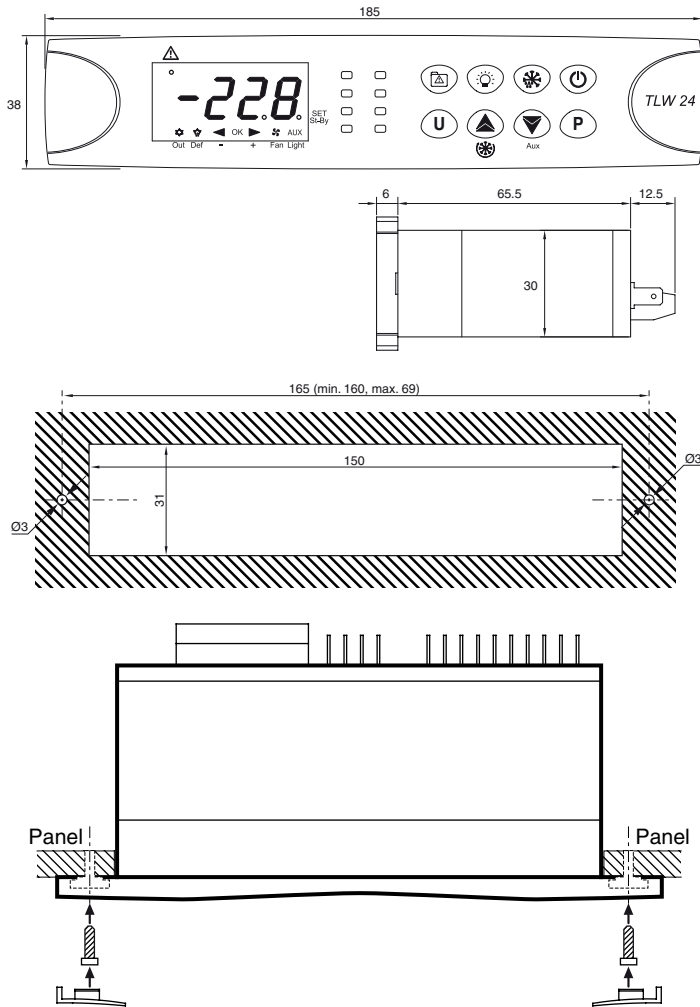**Protection degree:** IP 65 mounted in panel with gasket;

Pollution situation: 2;

Operating temperature: 0... 50°C;

Operating humidity: 30... 95 RH% without condensation;

Storage temperature: -10... +60°C.

7.3 Mechanical dimensions, panel cut-out and mounting [mm]

7.4 Functional features

Temperature Control: ON/OFF mode;

Defrost control: Interval cycles by Electric Heating or hot-gas/reverse cycle

Measurement range: PTC: -50... +150°C/ -58... +302°F;
NTC: -50... +109°C/ -58... +228°F;

Display resolution: 1° or 0.1°;

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

Sampling rate: 130 ms;

Display: 4 Digit Red h 12 mm;

Compliance: ECC directive EMC 2004/108/CE (EN 61326), ECC directive LV 2006/95/CE (EN 60730-1:2016, EN 60730-2-9:2012);

Approvals: C-UL (file n. E212227).

8. INSTRUMENT ORDERING CODE

TLW 24 a b c d ee ff g h

⊐a: OUT2

R = Yes (SPDT 8A-AC1);
- = Not present;

⊐b: OUT3

R = Yes (SPDT 8A-AC1);
- = Not present;

⊐c: OUT4

R = Yes, voltage output (SPST-NO 16A-AC1);
S = Yes free voltage output (SPDT 16A-AC1);
- = Not present;

⊐d: INTERNAL BUZZER

B = YES;
- = Not present;

⊐ee: TERMINALS BLOCK

-- = Standard (PWS Faston, Input screw terminals);
MV = Screw termials;

⊐ff: SPECIAL CODES

⊐g: SPECIAL VERSIONS

⊐h: FRONT COVER/SPECIAL POWER SUPPLY

- = Standard (Pws 100... 240 VAC with NO front cover);
C = Power supply 100... 240 VAC with Front Cover;
G = Power supply 12... 24 VAC/VDC;
F = Power supply 12 VAC/VDC;
I = Power supply 12... 24 VAC/VDC with Front Cover;
J = Power supply 12 VAC/VDC with Front Cover.