RTN400 SM

Controllers for freezer cabinet and cold rooms with built-in compressor.

- Management of VNEK and VNEU series Embraco hermetically sealed compressors with corresponding inverter
- Energy Saving algorithms and optimised defrost control
- Defrost at single / double evaporator
- Frame heater
- Local network auto-configuration
- Easy to refit in Eliwell and/or third-party systems
- Presence of an Open Collector output

NOTE: for further information, description of the regulators and the full list of parameters, refer to the user manual available on the Eliwell website (**www.eliwell.com**).

MECHANICAL ASSEMBLY

Care must be taken to avoid damage from electrostatic sources when handling this device. In particular exposed connectors and, in some cases, exposed printed circuit boards are exceptionally vulnerable to electrostatic discharge.

⚠ WARNING

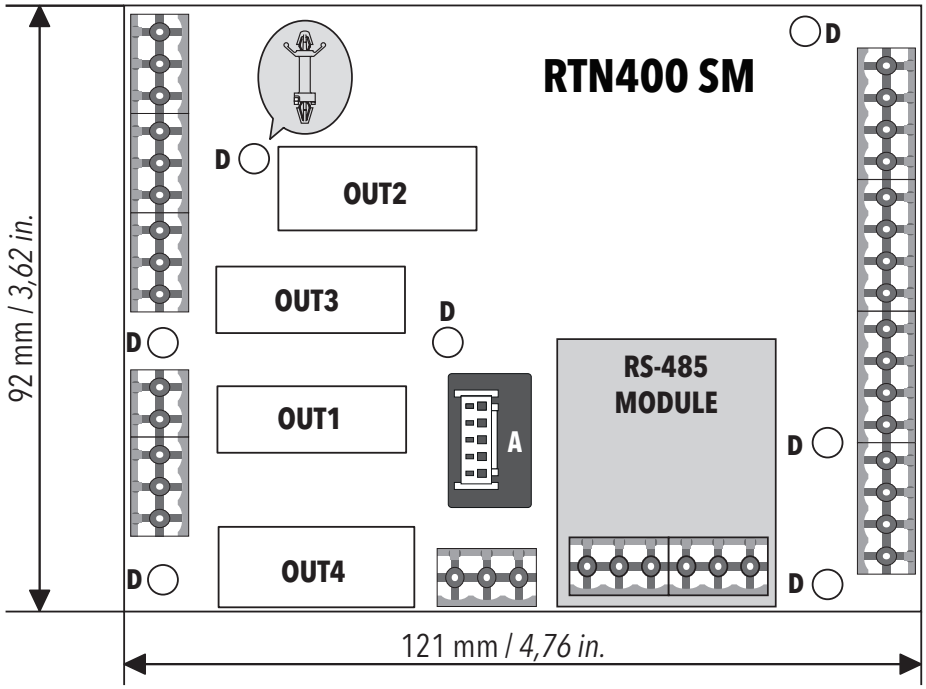
UNINTENDED EQUIPMENT OPERATION DUE TO ELECTROSTATIC DISCHARGE DAMAGE

- Keep device in the protective conductive packaging until you are ready to install the equipment.
- Only install device in approved enclosures and / or locations that prevent casual access and provide electrostatic discharge protection as defined by IEC 1000-4-2.
- Use a conductive wrist strap or equivalent field force protective device attached to an earth ground when handling sensitive device.
- Always discharge yourself by touching a grounded surface or approved antistatic mat before handling the device.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

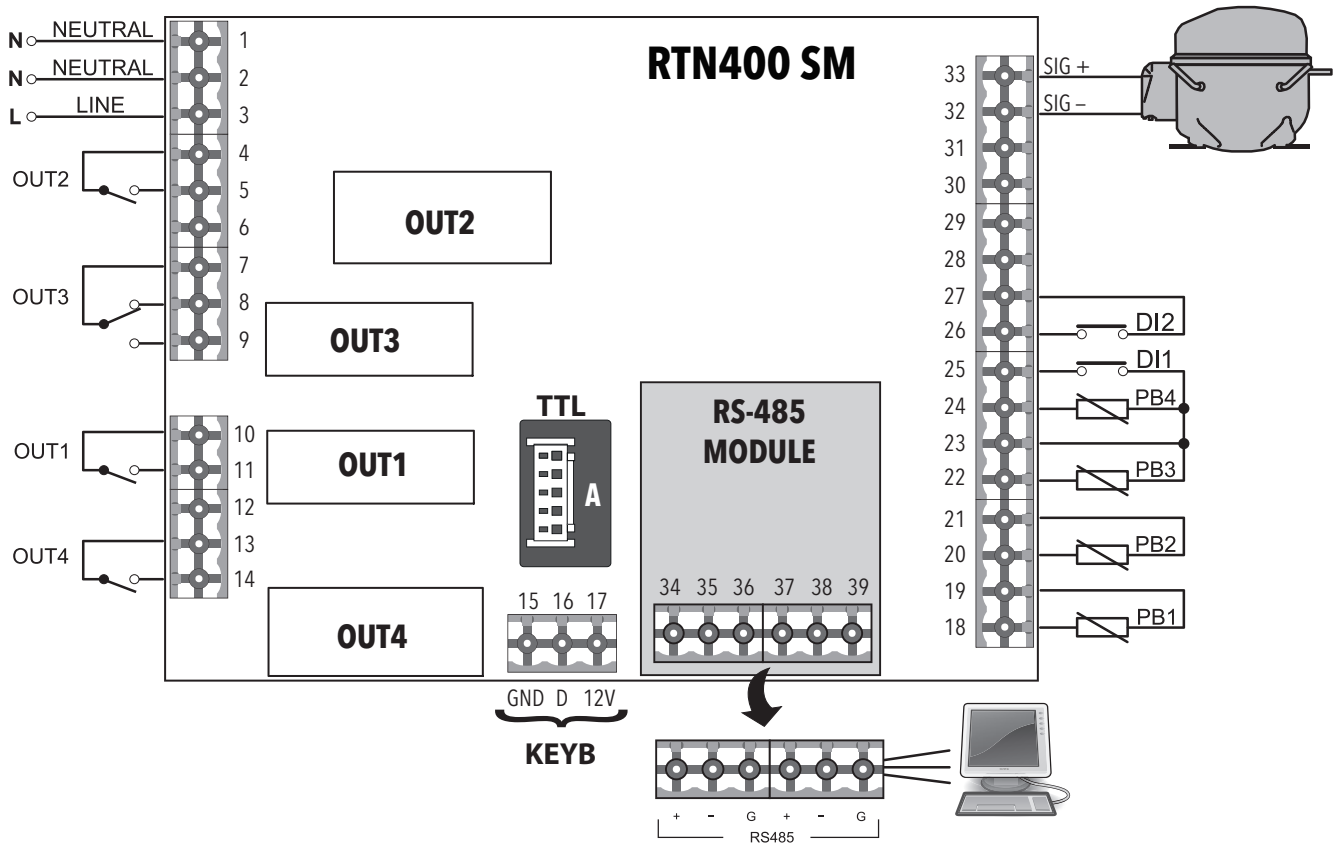
Do not install the device in places subject to high humidity and/or dirt; it is intended for use in sites with ordinary or normal levels of pollution.
Keep the area around the device cooling slots adequately ventilated.

NOTE: To install it, ONLY use plastic spacers.



D: identifies all holes to be used to assemble spacers ( ).

CONNECTION DIAGRAM



TERMINALS				
1-2	NEUTRAL. Power supply terminals		**15-16-17**	Connection to **KDEPlus** or **KDWPlus** or **KDT Touch** external keypad or to **ECPlus** echo module.
\	LINE. Power supply terminals		**19-18**	PB1 probe connection (default: regulator 1)
4	OUT2 - Common terminal		**21-20**	PB2 probe connection (default: regulator 2)
5	OUT2 - Normally Open (NO)		**23-22**	PB3 probe connection (default: defrost)
6	NOT USED		**23-24**	PB4 probe connection (default: condenser fans)
7	OUT3 - Common terminal		**23-25**	Digital input (DI1 - default: HIGH Pressure)
8	OUT3 - Normally Closed (NC)		**27-26**	Digital input (DI2 - default: LOW Pressure)
9	OUT3 - Normally Open (NO)		**32**	Negative Frequency (SIG –) ⇨ Drop-in –
10	OUT1 - Common terminal		**33**	Positive Frequency (SIG +) ⇨ Drop-in +
11	OUT1 - Normally Open (NO)		**A**	TTL Unicard/DMI/Multi Function Key connection
12	NOT USED		**34-35-36**	RS485. Connection 1 - Supervision Gateway.
13	OUT4 - Common terminal		**37-38-39**	RS485. Connection 2 - Supervision Gateway.
14	OUT4 - Normally Open (NO)			

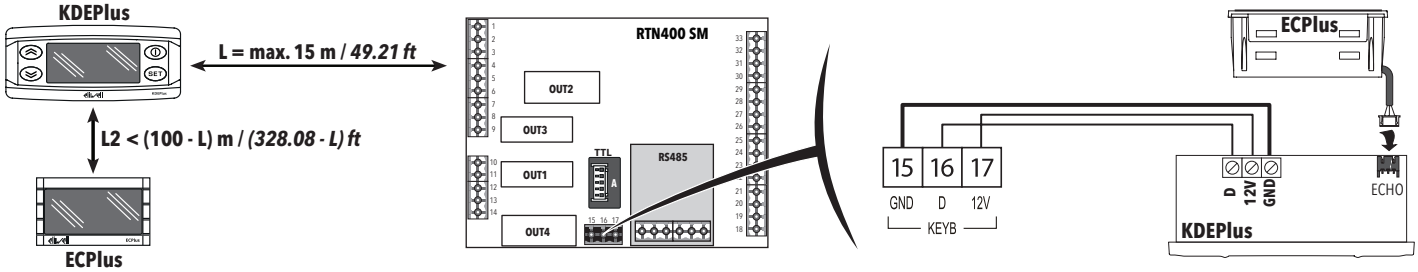
The table below displays the type and the size of cables for disconnectable terminals with pitch **5,00** or **5,08**.

mm / in. **7 / 0.28**								
mm²	0.2…2.5	0.2…2.5	0.25…2.5	0.25…2.5	2 x 0.2…1	2 x 0.2…1.5	2 x 0.25…1	2 x 0.5...1.5
AWG	*24…14*	*24…14*	*22...14*	*22...14*	*2 x 24…18*	*2 x 24…16*	*2 x 22…18*	*2 x 20...16*

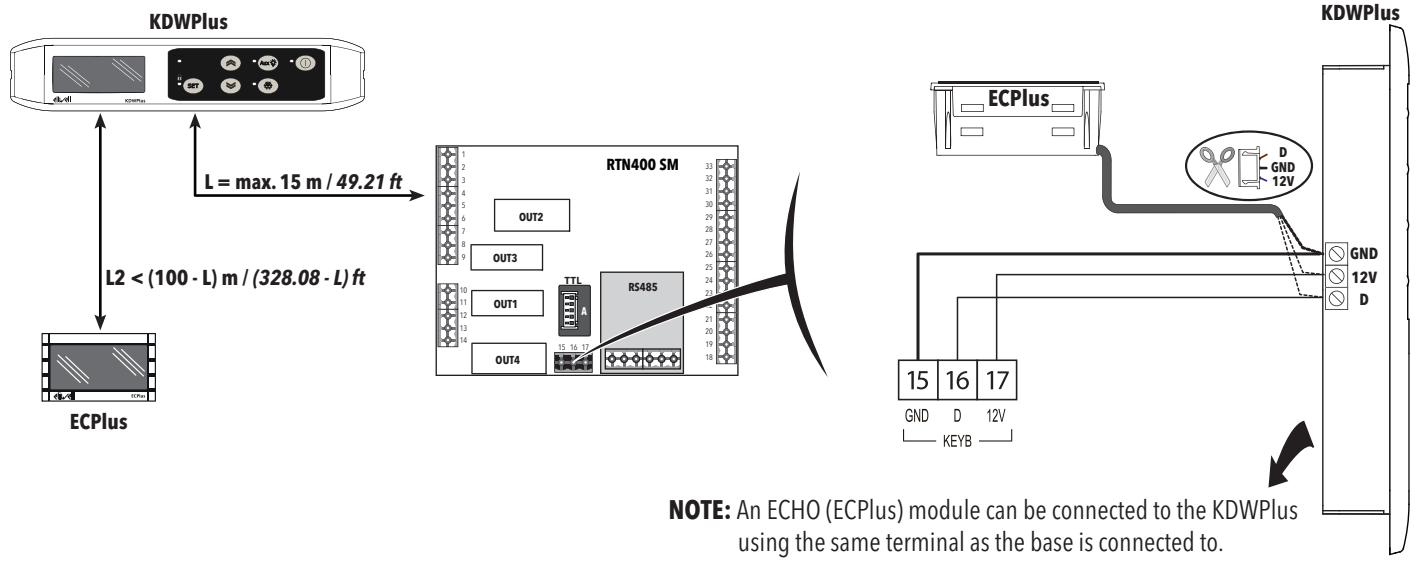
Ø 3.5 mm (*0.14 in.*)	C	N•m	0.5...0.6
		lb-in	*4.42...5.31*

CONNECTIONS WITH USER TERMINAL AND REMOTE DISPLAY

Each power board can be connected to a single **KDEPlus**, **KDWPlus** or **KDT Touch** keypad (user terminal) and if required to a module **ECPlus** (remote display) by means of the connector located on the keypad.

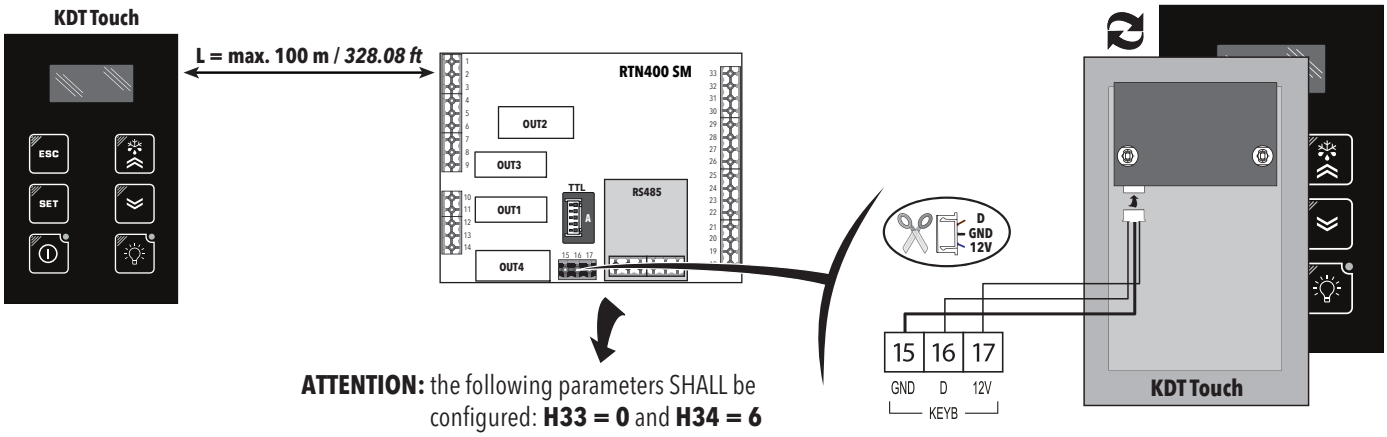


RTN400 SM + KDEPlus + ECPlus CONNECTION



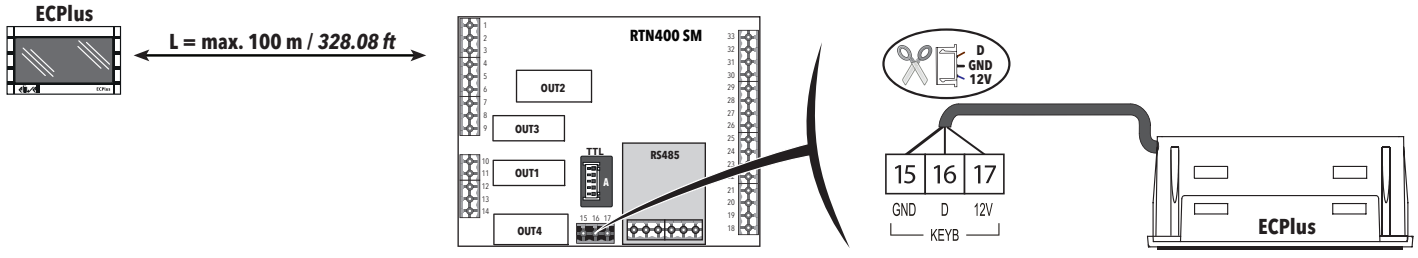
NOTE: An ECHO (ECPlus) module can be connected to the KDWPlus using the same terminal as the base is connected to.

RTN400 SM + KDWPlus + ECPlus CONNECTION



ATTENTION: the following parameters SHALL be configured: **H33 = 0** and **H34 = 6**

RTN400 SM + KDT Touch CONNECTION

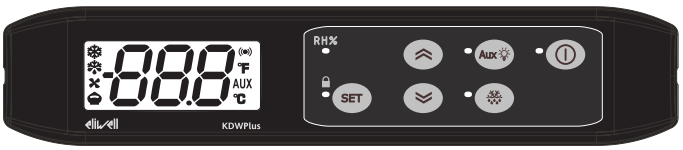


RTN400 SM + ECPlus CONNECTION

KDEPlus and KDWPlus KEYPAD INTERFACE

KDEPlus

KDWPlus



KDEPlus KEYS	KDWPlus KEYS
UP **Press and release** Scrolls through menu options Increases values **Press and hold for at least 5 secs** Defrost manual activation User-configurable function (par. H31)	**UP** **Press and release** Scrolls through menu options Increases values **Press and hold for at least 5 secs** User-configurable function (par. H31)
DOWN **Press and release** Scrolls through menu options Decreases values **Press and hold for at least 5 secs** User-configurable function (par. H32)	**DOWN** **Press and release** Scrolls through menu options Decreases values **Press and hold for at least 5 secs** User-configurable function (par. H32)
STAND-BY (ESC) **Press and release** Goes back up one level from current menu Confirms parameter value **Press and hold for at least 5 secs** User-configurable function (par. H33)	**STAND-BY (ESC)** **Press and release** Goes back up one level from current menu Confirms parameter value **Press and hold for at least 5 secs** User-configurable function (par. H33)
SET (ENTER) **Press and release** Displays alarms (if present) Opens Machine Status menu Confirms commands **Press and hold for at least 5 secs** Opens Programming menu	**SET (ENTER)** **Press and release** Displays alarms (if present) Opens Machine Status menu Confirms commands **Press and hold for at least 5 secs** Opens Programming menu
NOTE: The 2 KDEPlus and KDWPlus keypads are equivalent and guarantee the same functions.	**DEFROST (ESC)** **Press and release** Manual defrost activation Goes back up one level from current menu
	AUX/LIGHT **Press and release** Activates the AUX output / Switches on the light
+ **Press the UP and ESC keys simultaneously for at least 5 secs** Activate the Autotuning function and the °C icon will blink.	

DISPLAY ICONS

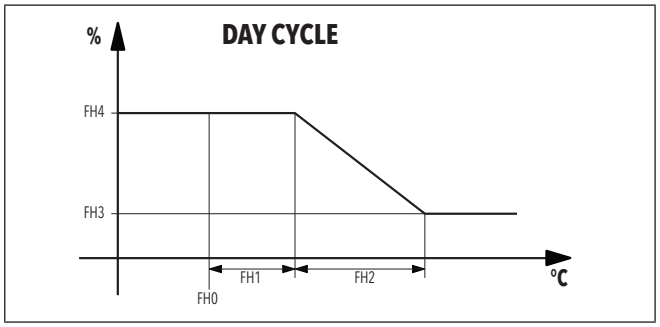
Reduced / Economy indicator icon Permanently on: Energy Saving active Blinking: reduced setpoint active Off: otherwise		**Alarms icon** Permanently on: alarm active Blinking: alarm acknowledged Off: otherwise	
Compressor icon Permanently on: compressor active Blinking: delay, protection or start inhibited Off: otherwise		**Defrost icon** Permanently on: defrost active Blinking: activated manually or from D.I. Off: otherwise	
Fans icon Permanently on: fans active Off: otherwise		**Aux icon** Permanently on: Aux output active and/or light on Blinking: Deep cooling cycle active	AUX
°C icon Permanently on: °C setting (dro=0) Blinking: autotuning active Off: otherwise	°C	**°F icon** Permanently on: °F setting (dro=1) Off: otherwise	°F

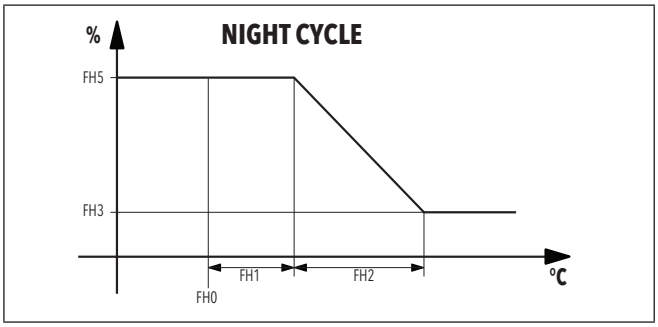
LEDS (KDWPlus ONLY)

RH%	Fans forced ON (Hxx = 15)		Keypad inhibited
Aux	Light relay on from key		Defrost active
	Device off		

FRAME HEATER (FH)

This regulator makes it possible to activate the anti-sweat heaters of a display window or refrigerated cabinet. The device manages a relay output (default: **OUT3**). Regulation will be to fixed Duty Cycle (with actuation percentage at **FH4**).





PAR.	DESCRIPTION	RANGE	M.U.	DEFAULT	LEVEL
FHt	Duration of anti-sweat heaters operation.	1...250	s*10	120	Inst
FH3	Sets minimum percentage for Duty Cycle.	0...100	%	0	Inst
FH4	Sets maximum percentage for daytime Duty Cycle.	0...100	%	50	Inst
FH5	Sets maximum percentage for night-time Duty Cycle.	0...100	%	50	Inst
FH6	Sets percentage for Duty Cycle during defrost	0...100	%	100	Inst

CONTROL WITH MODULATION OF A VARIABLE SPEED COMPRESSOR

This controller is always enabled. It is selected via parameters **rP1** (control probe) and **SP1** (setpoint 1).
This controller, on the basis of the control probe, activates a variable speed compressor controlled by an inverter and modulates its capacity, in order to cool the system (cabinet, tank...) quickly and keep the temperature value as close as possible to setpoint **SP1**. The capacity controlled by the algorithm will have a value between 0.0% and 100.0%, and will be suitably converted to an rpm value depending on the compressor.

Compressors that can be controlled are VNEK/VNEU series EMBRACO models with corresponding inverter driven by a frequency signal generated via the Open Collector output. The signal generated in square wave corresponds in a linear manner to a compressor rpm/min value between 2000 and 4500.

The main control algorithm will be based on a PID with Autotuning function (activated by pressing the ⌃ and ⏻ keys simultaneously for at least 5 seconds), equipped with several additional functions, for system pull-down or pull-up when defrosting is starting or ending.

Conversion between the capacity controlled by Controller 1 and the compressor rpm will take place in accordance with the capacity of the system which is linearly proportional to the compressor rpm. To this end, whenever the capacity controlled by Controller 1 is lower than 44.4%, the compressor will be switched off and restarted at minimum speed (2000 rpm) in accordance with PWM technology, i.e. proportional increase of compressor ON time in line with the capacity (up to a maximum value of 44.4%), within a time period specified by parameter **PUt** (default: 15 min.).

Controlled capacity	Compressor speed - PWM period = 15 min
0%	Compressor OFF
22.2%	PWM: Compressor ON for 7.5 min (at 2000 rpm) + Compressor OFF for 7.5 min
44.4%	Compressor ON - 2000 rpm
72.2%	Compressor ON - 3250 rpm
100%	Compressor ON - 4500 rpm

CLOCK (RTC)

The clock can be used to set defrost times (6 time bands for weekdays and 6 time bands for weekends/public holidays), periodic defrost (every **n** days) and daily events (1 event for weekdays and 1 event for weekends/public holidays)

Descriptione	Range	M.U.
Current time: minutes	0...59	min
Current time: hours	0...23	hours
Current time: day (**0** = Sunday; **1** = Monday; ... ; **6** = Saturday)	0...6	days

Time band defrosts and periodic defrost are mutually exclusive functions (they cannot be activated simultaneously).
If defrost by RTC has been enabled and the clock has failed, the defrost will run according to the mode set in **dit** (provided **dit≠0**).

UNICARD / MULTI FUNCTION KEY

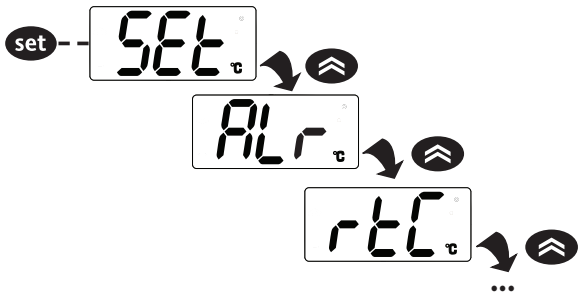
The Unicard/Multi Function Key is connected to the serial port (**TTL**) and allows fast programming of device parameters.
Access the 'Installer' parameters by entering PA2, then scroll through the folders with the ⌃ and ⌄ keys until the **FPr** folder is displayed.
Press SET key to select the folder, scroll the parameters with ⌃ and ⌄ keys, then press SET key to select the function (e.g. **UL**).

- **Upload** (UL): select UL and press SET key. This function uploads the programming parameters from the device to the card or key. If the operation is successful, the display will show '**yES**', otherwise it will show '**no**'.
- **Download**: Connect the Unicard/Multi Function Key with the instrument switched off. At power-on, data will automatically start downloading from the Unicard/Multi Function Key to the device. At the end of the lamp test, the display will show '**dLy**' if the operation was successful and '**dLn**' if it failed.

NOTE: After the download, the device will use the newly uploaded map settings.

'MACHINE STATUS' MENU

Press and release the SET key to access the 'Machine Status' menu. If no alarms are active, the 'SEt' label appears.
The various folders of the menu can be scrolled using the ∧ and ∨ keys:



- SEt: setpoint programming
- ALr: alarms folder
- rtC: clock parameters folder - contains:
  - dAy: day of week
  - h: hours
  - ': minutes
- Pb1...Pb4: value of probes Pb1...Pb4
- idF: firmware mask number
- reL: FW release number
- tAb: E2 map code

Programming the setpoint: To view the Setpoint value, press the SET key when the 'SEt' label is displayed. The Setpoint value appears in the display. To change the Setpoint value, press the ∧ e ∨ keys within 15 seconds. Press SET key to confirm the selection.

Displaying the probes: When labels Pb1 ... Pb4 appear, the value measured by the single probe can be displayed by pressing the relative key. (**NOTE**: the value cannot be changed).

'PROGRAMMING' MENU

To access the 'Programming' menu, press and hold the SET key for at least 5 seconds. If PASSWORD protection is activated, a prompt will appear: enter **PA1** for 'User' parameters or **PA2** for 'Installer' parameters (see 'PASSWORD' section).

'**User**' parameters: When the menu is accessed, the display will show the first parameter (e.g. '**rE**').
Press ∧ and ∨ keys to scroll through all parameters of the current level. Select the desired parameter by pressing SET key.
Press ∧ and ∨ keys to change the value, and SET key to save the change.

'**Installer**' parameters: When the menu is accessed, the display will show the first folder (e.g. "**CP**").
Press ∧ and ∨ keys to scroll through all the folders in the current level. Select the desired folder by pressing SET key.
Press ∧ and ∨ keys to scroll through all parameters of the current folder. Select the desired parameter by pressing SET key.
Press ∧ and ∨ keys to change the value, and SET key to save the change.

NOTE: It is advisable to switch the device off and on again each time the configuration of the parameters is changed.

PASSWORD

Password **PA1**: gives access to '**User**' (**User**) parameters. The default setting is password protection disabled (**PS1=0**).
Password **PA2**: gives access to '**Installer**' (**Inst**) parameters. The default setting is password protection enabled (**PS2=15**).

The visibility of PA2 is:

1) **PA1** and **PA2≠0**: Press and hold SET key for at least 5 seconds to display **PA1** and **PA2**.
Next, decide whether to access the 'User' parameters (**PA1**) or the 'Installer' parameters (**PA2**).

2) **Otherwise**: Password **PA2** is among the level1 parameters, at the end.
If protection is enabled, the password will be required in order to access the 'Installer' parameters.

Press SET key to type in the password, change the value with the ∧ and ∨ keys and confirm with SET key.

NOTE: If the value entered is incorrect, label **PA1**/**PA2** will be shown again and the procedure must be repeated.

FIRMWARE BOOT LOADER

The device is equipped with a Boot Loader, so it is possible to update the Firmware directly on the field.
Updating may be carried out using UNICARD or MULTI FUNCTION KEY (MFK).

Updating procedure:

- Connect the UNICARD/MFK equipped with the application;
- Power the device if it is off, otherwise switch it off and on again

  NOTE: the UNICARD/MFK can be connected even with the instrument powered.
- Wait until the led of the UNICARD/MFK is blinking (operation in progress);
- The operation will be concluded when the Led of the UNICARD/MFK is:
  - **ON**: operation concluded correctly;
  - **OFF**: operation not performed (application not compatible ...)

  WARNING: the led display is guaranteed only for UNICARDS produced from week 18-12 onward.

In order to download the Firmware application on the UNICARD (in CLONE mode as used for parameters maps) you must use the Device Manager (version 05.00.06 or later), which you can download from the Eliwell site after having registered at level 2.

NOTE: with this version of the Device Manager the UNICARD can be connected DIRECTLY without using the DMI.

PARAMETERS TABLE

PAR.	DESCRIPTION	M.U.	RANGE	DEFAULT	LEVEL
	COMPRESSOR (CP)				
SP1	Temperature control SEtpoint.	°C/°F	LS1...HS1	-25.0	User/Inst
SP2	Temperature control SEtpoint regulated by thermostat.	°C/°F	LS2...HS2	20.0	Inst
dF2	2° thermostat activation differential (absolute or relative). **NOTE: dF2≠0.**	°C/°F	-58.0...302	2.0	Inst
Stt	Differential control mode **dF2**. **AbS** (0) = absolute value **rEL** (1) = relative value	flag	AbS/rEL	rEL	Inst
HS1	Maximum value assignable to setpoint SP1. **NOTE: The two setpoints are interdependent: HS1 cannot be less than LS1 and vice versa.**	°C/°F	LS1...302	10.0	User/Inst
LS1	Minimum value assignable to setpoint SP1. **NOTE: The two setpoints are interdependent: LS1 cannot be greater than HS1 and vice versa.**	°C/°F	-58.0...HS1	-30.0	User/Inst
HS2	Maximum value assignable to setpoint SP2. **NOTE: The two setpoints are interdependent: HS2 cannot be less than LS2 and vice versa.**	°C/°F	LS2...302	50.0	Inst
LS2	Minimum value assignable to setpoint SP2. **NOTE: The two setpoints are interdependent: LS2 cannot be greater than HS2 and vice versa.**	°C/°F	-58.0...HS2	10.0	Inst
Cit	Compressor minimum running time before switching off. If **Cit** = 0 it is not active.	min	0...250	0	Inst
CAt	Compressor maximum running time before switching off. If **CAt** = 0 it is not active.	min	0...250	0	Inst
dOn	Delay time between power-ons; the delay time indicated must elapse between two consecutive compressor power-ons.	s	0...250	0	Inst
dOF	Delay after switching off; the delay time indicated must elapse between deactivation of the compressor relay and the next switch-on.	min	0...250	0	Inst
dbi	Delay time between power-ons; the delay time indicated must elapse between two consecutive compressor power-ons.	min	0...250	0	Inst
OdO	Delay before outputs are activated after instrument is powered up or following a power failure. **0 = not active**.	min	0...250	0	Inst
Put	Compressor activation PWM period.	min	0...200	12	Inst
CEr	Controlled capacity value in the event of control probe error.	%	0.0...100.0	50.0	Inst
PdS	Pull Down forced restart differential.	°C/°F	-50.0...50.0	3.0	Inst
PuS	Pull Up forced restart differential.	°C/°F	-50.0...50.0	-3.0	Inst
Pud	Temperature timeout out of range. The timer is activated when the control probe reaches a value higher than **SP1+Pds** (in the case of Pull Down) or lower than **SP1+PuS** (in the case of Pull Up). When the timer stops, a Pull Down or Pull Up procedure will begin, depending on the zone in which the probe is located. If the temperature returns to an appropriate value before the time has elapsed, the timer will be reloaded.	min	0...1000	4	Inst
PdE	Pull Down end differential.	°C/°F	-50.0...50.0	0.0	Inst
PuE	Pull Up end differential. If a Pull Up is activated before the **Pud** timer stops, the compressor is stopped until **SP1+PuE** is reached.	°C/°F	-50.0...50.0	0.0	Inst
Pdt	Optimised Pull Down timer.	min	0...1000	10	Inst
Pdd	Controlled capacity value, if a Pull Down is activated when the **Pud** time has elapsed, and which is maintained: • for a length of time **Pdt**, at the end of which the capacity will be forced to 100% until **SP1+PdE** is reached • until the temperature **SP1+PdE** is reached (if the time **< Pdt**).	%	0.0...100.0	60.0	Inst
CPd	Controlled capacity after a Pull Down in day operating mode.	%	0.0...100.0	60.0	Inst
CPn	Controlled capacity after a Pull Down in night operating mode.	%	0.0...100.0	50.0	Inst
	DEFROST (dEF)				
dty	Type of defrost. **0** = electrical defrost (using heaters) or air defrost **1** = inverse cycle defrost **2** = hot gas defrost for plug-in applications (with integrated compressor) **3** = hot gas defrost for applications with remote control (e.g. ducted counters) **4** = electrical defrost (using heaters) or air defrost with energy saving algorithms	num	0...4	0	Inst
dit	Interval between the start of two consecutive defrost cycles. **0** = function disabled (**defrost is NEVER activated**).	hours	0...250	24	User/Inst

PAR.	DESCRIPTION	M.U.	RANGE	DEFAULT	LEVEL
dCt	Selects the count mode for the defrost interval: **0** = defrost disabled **1** = compressor running hours (DIGIFROST® method); defrost active ONLY when compressor is on **NOTE**: compressor running time is counted separately from the evaporator probe (count active even if the evaporator probe is absent or faulty) **2** = appliance running hours; defrost count always active when machine is on and starts at each power-up **3** = compressor stop. Every time the compressor stops, a defrost cycle is run depending on parameter **dtY** **4** = RTC **5** = temperature	num	0...5	2	Inst
dOH	Delay for start of first defrost after request.	min	0...250	0	Inst
dE1	Evaporator 1 defrost time-out; determines maximum duration of the defrost cycle.	min	1...250	60	User/Inst
dS1	Defrost 1 end temperature (determined by evaporator probe 1)	°C/°F	-58.0...302	5.0	User/Inst
dSS	Start defrost temperature threshold (only if **dCt = 5**).	°C/°F	-58.0...302	-30.0	Inst
dPO	Determines whether or not the instrument must defrost at power-up (provided that the temperature measured at the evaporator will allow defrost). **no** (0) = no, no defrost at power-up **yES** (1) = yes, defrost at power-up.	flag	no/yES	no	Inst
tcd	Minimum time that must elapse with the compressor ON or OFF before defrost is activated.	min	-60...60	0	Inst
ndE	Defrost duration in minutes (only if set 'for hot gas' - **dty = 2** o **dty = 3**).	min	0...250	0	Inst
PdC	Hot gas extraction time at defrost end.	min	0...250	0	Inst
tPd	Minimum pump down time that must elapse before defrost starts.	min	0...255	0	Inst
dPH	Periodic defrost start time (only if **dCt = 4**). **0...23** = start hour; **24** = disabled.	hours	0...24	24	User/Inst
dPn	Periodic defrost start minutes (only if **dCt = 4**).	min	0...59	0	User/Inst
dPd	Interval between one defrost and next (periodic function) (only if **dCt = 4**).	days	1...7	1	User/Inst
Fd1	Weekend/public holiday 1 (only if **dCt = 4**). **0 ... 6** = start day; **7** = disabled.	days	0...7	7	Inst
Fd2	Weekend/public holiday 2 (only if **dCt = 4**). **0 ... 6** = start day; **7** = disabled.	days	0...7	7	Inst
d1H	Start time weekday defrost 1 (only if **dCt = 4**). **0 ... 23** = start hour; **24** = disabled.	hours	0...24	24	Inst
d1n	Start time minutes weekday defrost 1 (only if **dCt = 4**).	min	0...59	0	Inst
d2H	Start time weekday defrost 2 (only if **dCt = 4**). **d1H ... 23** = start hour; **24** = disabled.	hours	d1H...24	24	Inst
d2n	Start time minutes weekday defrost 2 (only if **dCt = 4**).	min	0...59	0	Inst
d3H	Start time weekday defrost 3 (only if **dCt = 4**). **d2H ... 23** = start hour; **24** = disabled.	hours	d2H...24	24	Inst
d3n	Start time minutes weekday defrost 3 (only if **dCt = 4**).	min	0...59	0	Inst
d4H	Start time weekday defrost 4 (only if **dCt = 4**). **d3H ... 23** = start hour; **24** = disabled.	hours	d3H...24	24	Inst
d4n	Start time minutes weekday defrost 4 (only if **dCt = 4**).	min	0...59	0	Inst
d5H	Start time weekday defrost 5 (only if **dCt = 4**). **d4H ... 23** = start hour; **24** = disabled.	hours	d4H...24	24	Inst
d5n	Start time minutes weekday defrost 5 (only if **dCt = 4**).	min	0...59	0	Inst
d6H	Start time weekday defrost 6 (only if **dCt = 4**). **d5H ... 23** = start hour; **24** = disabled.	hours	d5H...24	24	Inst
d6n	Start time minutes weekday defrost 6 (only if **dCt = 4**).	min	0...59	0	Inst
F1H	Start time weekend/public holiday defrost 1 (only if **dCt = 4**). **0 ... 23** = start hour; **24** = disabled.	hours	0...24	24	Inst
F1n	Start time minutes weekend/public holiday defrost 1 (only if **dCt = 4**).	min	0...59	0	Inst
F2H	Start time weekend/public holiday defrost 2 (only if **dCt = 4**). **F1H ... 23** = start hour; **24** = disabled.	hours	F1H...24	24	Inst
F2n	Start time minutes weekend/public holiday defrost 2 (only if **dCt = 4**).	min	0...59	0	Inst
F3H	Start time weekend/public holiday defrost 3 (only if **dCt = 4**). **F2H ... 23** = start hour; **24** = disabled.	hours	F2H...24	24	Inst
F3n	Start time minutes weekend/public holiday defrost 3 (only if **dCt = 4**).	min	0...59	0	Inst
F4H	Start time weekend/public holiday defrost 4 (only if **dCt = 4**). **F3H ... 23** = start hour; **24** = disabled.	hours	F3H...24	24	Inst
F4n	Start time minutes weekend/public holiday defrost 4 (only if **dCt = 4**).	min	0...59	0	Inst
F5H	Start time weekend/public holiday defrost 5 (only if **dCt = 4**). **F4H ... 23** = start hour; **24** = disabled.	hours	F4H...24	24	Inst
F5n	Start time minutes weekend/public holiday defrost 5 (only if **dCt = 4**).	min	0...59	0	Inst
F6H	Start time weekend/public holiday defrost 6 (only if **dCt = 4**). **F5H ... 23** = start hour; **24** = disabled.	hours	F5H...24	24	Inst
F6n	Start time minutes weekend/public holiday defrost 6 (only if **dCt = 4**).	min	0...59	0	Inst
	FANS (FAn)				
dt	Dripping time.	min	0...250	0	Inst

PAR.	DESCRIPTION	M.U.	RANGE	DEFAULT	LEVEL
	ALARMS (AL)				
rA1	Selects probe 1 to be used for temperature alarms. **diS** (0) = disabled; **Pb1** (1) = will use probe Pb1; **Pb2** (2) = will use probe Pb2; **Pb3** (3) = will use probe Pb3; **Pb4** (4) = will use probe Pb4; **Pb5** (5) = not used; **Pbi** (6) = will use virtual probe	num	diS, Pb1...Pb5, Pbi	Pb1	Inst
rA2	Selects probe 2 to be used for temperature alarms. Same as **rA1**.	num	diS, Pb1...Pb5, Pbi	diS	Inst
Att	Parameters **HAL** and **LAL** mode intended as the absolute temperature value or differential in relation to the Setpoint. **AbS** (0) = absolute value; **rEL** (1) = relative value. **NOTE: In the case of relative values (par Att=1), the HAL parameter should be set to positive values, whereas the LAL parameter should be set to negative values (-LAL).**	flag	AbS/rEL	AbS	Inst
AFd	Alarms cut-in differential.	°C/°F	0.1...25.0	2.0	Inst
HA1	Probe 1 maximum alarm. Temperature value (intended either as distance from setpoint or as an absolute value based on Att) above which the probe will trigger activation of the alarm signal (only if **rA1 ≠ dis**). See **'Max/Min temperature alarms'**.	°C/°F	LA1...302	-12.0	User/Inst
LA1	Probe 1 minimum alarm Temperature value (intended as distance from setpoint or as an absolute value based on Att) beneath which the probe will trigger activation of the alarm signal (only if **rA1 ≠ dis**). See **'Max/Min temperature alarms'**.	°C/°F	-58.0...HA1	-30.0	User/Inst
HA2	Probe 2 maximum alarm. Temperature value (intended either as distance from setpoint or as an absolute value based on Att) above which the probe will trigger activation of the alarm signal (only if **rA2≠diS**). See **'Max/Min temperature alarms'**.	°C/°F	LA2...302	-12.0	Inst
LA2	Probe 2 minimum alarm Temperature value (intended either as distance from setpoint or as an absolute value based on Att) beneath which the probe will trigger activation of the alarm signal (only if **rA2≠diS**). See **'Max/Min temperature alarms'**.	°C/°F	-58.0...HA2	-30.0	Inst
PAO	Alarm override time after device is switched on following a power failure. **This parameter refers to high/low temperature alarms only.**	hours	0...10	1	Inst
dAO	Temperature alarm override time after defrost.	min	0...250	60	Inst
tA1	Delay preceding indication of temperature alarm. **This parameter refers to high/low temperature alarms LA1 and HA1 only.**	min	0...250	60	Inst
tA2	Delay preceding indication of temperature alarm (only if **rA2≠diS**). **This parameter refers to high/low temperature alarms LA2 and HA2 only.**	min	0...250	60	Inst
dAt	Alarm indicating end of defrost as a result of timeout. **no** (0) = does not activate alarm; **yES** (1) = activates alarm.	flag	no/yES	no	Inst
	LIGHTS & DIGITAL INPUTS (Lit)				
ASb	Activation of AUX or LIGHT input using key when controller is in stand-by. **no** (0) = disables relay until controller comes out of stand-by **yES** (1) = status of relay remains unchanged and relay can be activated/deactivated by key	flag	no/yES	no	Inst
	PRESSURE SWITCH (PrE)				
PEn	Number of errors allowed per pressure switch input. **0** = disabled.	num	0...15	0	Inst
PEi	Pressure switch error count interval.	num	1...250	1	Inst
	ENERGY SAVING (EnS)				
ESt	Type of event activated by RTC: **0**= disabled; **1**= Energy Saving; **2**= Energy Saving + Light off; **3**= Energy Saving + Light off + AUX output on; **4**= instrument off.	num	0...4	0	Inst
ESF	Activation of fans in night mode (energy saving). **no** (0) = disabled; **yES** (1) = enabled if energy saving mode is active (**ESt≠0** and **ESt≠4**)	flag	no/yES	no	Inst
OS1	Setpoint 1 offset (SP1).	°C/°F	-50.0...50.0	3.0	Inst
OS2	Setpoint 2 offset (SP2).	°C/°F	-50.0...50.0	0.0	Inst
dn2	Cut-in differential 2 in energy saving mode.	°C/°F	-58.0...302	4.0	Inst
EdH	Start time hours weekday Energy Saving (only if **H68=yES**). **0 ... 23** = start hour; **24** = disabled.	hours	0...24	24	Inst
Edn	Start time minutes weekday Energy Saving (only if **H68=yES**).	min	0...59	0	Inst
Edd	Duration of weekday Energy Saving (only if **H68=yES**).	hours	1...72	10	Inst
EFH	Start time hours weekend/public holiday Energy Saving (only if **H68=yES**). **0 ... 23** = start hour; **24** = disabled.	hours	0...24	24	Inst
EFn	Start time minutes weekend/public holiday Energy Saving (only if **H68=yES**).	min	0...59	0	Inst
EFd	Duration of weekend/public holiday Energy Saving (only if **H68=yES**).	hours	1...72	24	Inst

PAR.	DESCRIPTION	M.U.	RANGE	DEFAULT	LEVEL
	FRAME HEATER (FrH)				
FHt	Duration of anti-sweat heaters operation. **NOTE** = only used when OC output is used with SSR relay.	s*10	1...250	120	Inst
FH3	Sets minimum percentage for Duty Cycle.	%	0...100	0	Inst
FH4	Sets maximum percentage for day Duty Cycle.	%	0...100	50	Inst
FH5	Sets maximum percentage for night-time Duty Cycle.	%	0...100	50	Inst
FH6	Setting of percentage for Duty Cycle during defrost.	%	0...100	100	Inst
	COMMUNICATION (Add)				
Adr	Modbus protocol controller address.	num	1...250	1	Inst
bAU	Baudrate selection. **96** (0) = 9600; **192** (1) = 19200; **384** (2) = 38400.	num	96/192/384	96	Inst
Pty	Sets the Modbus parity bit. **n** (0) = none; **E** (1) = even; **o** (2) = odd.	num	n/E/o	E	Inst
	DISPLAY (diS)				
LOC	LOCk. Setpoint edit lock. The parameter programming menu can still be accessed, and the settings changed, which means also that the status of this parameter can be changed so as to unlock the keypad. **no** (0) = no; **yES** (1) = yes.	flag	no/yES	no	Inst
PS1	PAssword 1. When enabled (**PS1 ≠ 0**), this password provides access to User parameters (**User**).	num	0...250	0	User/Inst
PS2	PAssword 2. When enabled (**PS2 ≠ 0**), this password provides access to Installer parameters (**Inst**).	num	0...250	15	Inst
ndt	Display values with decimal point. **no** (0) = no (integers only); **yES** (1) = yes (with decimal point).	flag	no/yES	yES	Inst
CA1	Calibration of probe **Pb1**. Positive or negative temperature value added to the value read by **Pb1**. This sum is used for both temperature display and temperature regulation purposes.	°C/°F	-30.0...30,0	0.0	User/Inst
CA2	Calibration of probe **Pb2**. Positive or negative temperature value added to the value read by **Pb2**. This sum is used for both temperature display and temperature regulation purposes.	°C/°F	-30.0...30,0	0.0	User/Inst
CA3	Calibration of probe **Pb3**. Positive or negative temperature value added to the value read by **Pb3**. This sum is used for both temperature display and temperature regulation purposes.	°C/°F	-30.0...30,0	0.0	User/Inst
CA4	Calibration of probe **Pb4**. Positive or negative temperature value added to the value read by **Pb4**. This sum is used for both temperature display and temperature regulation purposes.	°C/°F	-30.0...30,0	0.0	User/Inst
LdL	Minimum value that can be displayed by the device.	°C/°F	-58.0...HdL	-50.0	Inst
HdL	Maximum value that can be displayed by the device.	°C/°F	LdL...302	50.0	Inst
ddL	Display mode during defrost. **0** = displays the temperature read by probe **1** = locks the reading at the temperature value registering via the probe when the defrost cycle starts and until the next time the SEt is reached **2** = displays label **dEF** during defrost and until the SEt is reached (or until **Ldd** elapses)	num	0/1/2	1	User/Inst
Ldd	Timeout value for display unlock - label **dEF**.	min	0...250	40	User/Inst
dro	Selection of °C or °F to display the probe value. **C** (0) = °C, **F** (1) = °F. **NOTE: switching from °C to °F or vice versa DOES NOT modify the setpoint, differential, etc. (e.g. set=10°C becomes 10°F).**	flag	C/F	C	Inst
ddd	Select the type of value to show in the display. **SP1** (0) = Setpoint SP1; **Pb1** (1) = will use probe Pb1; **Pb2** (2) = will use probe Pb2; **Pb3** (3) = will use probe Pb3; **Pb4** (4) = will use probe Pb4; **Pb5** (5) = not used; **Pbi** (6) = will use virtual probe; **LP** (7) = not used.	num	SP1, Pb1...Pb5, Pbi, LP	Pb1	Inst
	CONFIGURATION (CnF) ➡ If one or more parameters present in the folder are changed, the controller **MUST** be switched off and switched on again.				
H08	Stand-by operating mode. **0** = display off; the regulators are active and the device will indicate any alarms, refreshing the display **1** = display off; regulators and alarms inhibited **2** = display shows 'OFF' label; regulators and alarms inhibited	num	0/1/2	2	Inst
dti	Unit of measurement for digital inputs DI1 and DI2. **0** = minutes; **1** = seconds.	num	0/1	0	Inst
d15	Delay preceding activation of digital input DI1.	min	0...255	0	Inst
d18	Delay preceding activation of digital input DI2.	min	0...255	0	Inst
H31	Configuration of **UP** key. **0** = disabled; **1** = defrost; **2** = reduced Set; **3** = light; **4** = energy saving; **5** = AUX; **6** = stand-by; **7** = not used; **8** = defrost start/stop	num	0...8	1	Inst
H32	Configuration of **DOWN** key. Same as **H31**.	num	0...8	3	Inst
H33	Configuration of **ESC** key. Same as **H31**.	num	0...8	0	Inst
H68	Clock presence. **no** (0) = clock absent; **yES** (1) = clock present.	flag	no/yES	yES	Inst

PAR.	DESCRIPTION	M.U.	RANGE	DEFAULT	LEVEL
H70	Selection of 1° probe to use as virtual probe. **diS** (0) = disabled; **Pb1** (1) = will use probe Pb1; **Pb2** (2) = will use probe Pb2; **Pb3** (3) = will use probe Pb3; **Pb4** (4) = will use probe Pb4; **Pb5** (5) = not used.	num	diS, Pb1...Pb5	Pb1	Inst
H71	Selection of 2° probe to use as virtual probe. Same as **H70**.	num	0...5	Pb2	Inst
H72	% calculation used by virtual probe - daytime.	%	0...100	50	Inst
H73	% calculation used by virtual probe - night-time (Energy Saving mode).	%	0...100	50	Inst
	COPY CARD (FPr)				
UL	Upload. To transfer programming parameters from instrument to CopyCard.	/	/	/	
dL	Download. To transfer programming parameters from Copy Card to instrument.	/	/	/	
	FUNCTION (FnC)				

The following functions are available:

Function	Function label ACTIVE	Function label NOT ACTIVE	Alarm signalling
Reset pressure switch alarms	rAP	rAP	Alarm ON icon
Reset tuning (new plant)	nPL	nPL	---
Autotuning deactivation	ton	toF	---

NOTES: • To change the status of a given function, press the 'set' key.
• If the instrument is switched off, the function labels will return to the default status.

DEVICE MANAGER

RTN400 SM can interface with 'Device Manager' software through the DMI interface.
This connection allows the value/visibility of fixed parameters and parameters present in vectors to be controlled from a PC.
The connection takes place directly on the device; in the case of the Unicard.

DIAGNOSTICS

Alarms are always indicated by the buzzer (if present) and the alarm icon ((•)).
To acknowledged the buzzer, press and release any key, the relative icon will continue to flash.

NOTE: If alarm exclusion times have been set (see 'AL' folder in the parameters table) the alarm will not be indicated.

'ALARMS' TABLE

Label	Description	Cause	Effects	Remedy
E1	Pb1 probe error	• Measured values are outside operating range • Probe inoperable / short-circuited / open	• label **E1** displayed • alarm icon permanently on	• check probe type (**H00**) • check probe wiring • replace probe
E2	Pb2 probe error	• Measured values are outside operating range • Probe inoperable / short-circuited / open	• label **E2** displayed • alarm icon permanently on	• check probe type (**H00**) • check probe wiring • replace probe
E3	Pb3 probe error	• Measured values are outside operating range • Probe inoperable / short-circuited / open	• label **E3** displayed • alarm icon permanently on	• check probe type (**H00**) • check probe wiring • replace probe
E4	Pb4 probe error	• Measured values are outside operating range • Probe inoperable / short-circuited / open	• label **E4** displayed • alarm icon permanently on	• check probe type (**H00**) • check probe wiring • replace probe
Ei	VIRTUAL probe error	• Measured values are outside operating range • Probe inoperable / short-circuited / open	• label **Ei** displayed • alarm icon permanently on	• check probe type • check probe wiring • replace probe
AH1	HIGH temperature 1 alarm	Value read by probe 1 > HA1 after time set in **tA1**. (see 'MAX/MIN TEMP. ALARMS')	• label **AH1** recorded in folder ALr • no effect on regulation	Await return to normal of value read by the selected probe with **rA1** lower than **HA1-AFd**
AL1	LOW temperature 1 alarm	Value read by probe 1 < LA1 after time set in **tA1**. (see 'MAX/MIN TEMP. ALARMS')	• label **AL1** recorded in folder ALr • no effect on regulation	Await return to normal of value read by the selected probe with **rA1** higher than **LA1+AFd**
AH2	HIGH temperature 2 alarm	Value read by probe 2 > HA2 after time set in **tA2**. (see 'MAX/MIN TEMP. ALARMS')	• label **AH2** recorded in folder ALr • no effect on regulation	Await return to normal of value read by the selected probe with **rA2** lower than **HA2-AFd**
AL2	LOW temperature 2 alarm	Value read by probe 2 < LA2 after time set in **tA2**. (see 'MAX/MIN TEMP. ALARMS')	• label **AL2** recorded in folder ALr • no effect on regulation	Await return to normal of value read by the selected probe with **rA2** higher than **LA2+AFd**
EA	External alarm	Digital input activated	• label **EA** recorded in folder ALr • alarm icon permanently on • lockout of regulation as requested by **EAL**	Check and remove external cause of alarm on D.I.
OPd	Door open alarm	Digital input activated (for a time greater than **tdO**)	• label **Opd** recorded in folder ALr • alarm icon permanently on • lockout of regulation as requested by **dOd**	• close the door • delay preceding indication of alarm defined by **OAO**

Label	Description	Cause	Effects	Remedy
Ad2	End defrost by time-out	End of defrost cycle due to timeout rather than due to defrost end temperature being read by Pb2	• label **Ad2** recorded in folder ALr • alarm icon permanently on	Await next defrost cycle for automatic return to normal
Prr	Preheat alarm	Alarm for preheat input regulator ON	• label **Prr** displayed • compressor icon blinking • regulation inhibited (Compressor and Fans) **NOTE**: defrost will also be inhibited if hot gas	Preheat input regulator off
E10	Clock alarm	• clock (RTC) battery spent • RTC failure	• label **E10** recorded in folder ALr • functions associated with clock not available	Connect the instrument to the power supply
nPA	General pressure switch alarm	Activation of pressure switch alarm by general pressure switch.	If the number of pressure switch activations is **n < PEn**: • Folder **nPA** recorded in folder ALr with the number of pressure switch activations • Regulation blocked	Check and remove the cause that triggered the alarm on the digital input (Auto Reset).
PA	General pressure switch alarm	Activation of pressure switch alarm by general pressure switch.	If the number of pressure switch activations is **n = PEn**: • Label **PA** displayed • Label **PA** recorded in folder ALr • Alarm LED on • Relay activated (if configured) • Regulation blocked	• Switch the device off and back on again. • Reset alarms from functions folder, pressing the rAP function (Manual Reset).
LPA	Minimum pressure switch alarm	Activation of pressure switch alarm by low pressure switch regulator.	If the number of pressure switch activations is **n < PEn**: • Folder **LPA** recorded in folder ALr with the number of pressure switch activations • Regulation blocked	Check and remove the cause that triggered the alarm on the digital input (Auto Reset).
PA	Minimum pressure switch alarm	Activation of pressure switch alarm by low pressure switch regulator.	If the number of pressure switch activations is **n = PEn**: • Label **PA** displayed • Label **PA** recorded in folder ALr • Alarm LED on • Relay activated (if configured) • Regulation blocked	• Switch the device off and back on again • Reset alarms from functions folder, pressing the rAP function (Manual Reset).
HPA	Maximum pressure switch alarm	Activation of pressure switch alarm by high pressure switch regulator.	If the number of pressure switch activations is **n < PEn**: • Folder **HPA** recorded in folder ALr with the number of pressure switch activations • Regulation blocked	Check and remove the cause that triggered the alarm on the digital input (Auto Reset).
PA	Maximum pressure switch alarm	Activation of pressure switch alarm by high pressure switch regulator.	If the number of pressure switch activations is **n = PEn**: • Label **PA** displayed • Label **PA** recorded in folder ALr • Alarm LED on • Relay activated (if configured) • Regulation blocked	• Switch the device off and back on again • Reset alarms from functions folder, pressing the rAP function (Manual Reset).

ELECTRICAL CONNECTIONS

⚠⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Disconnect all power from all equipment including connected devices, prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires.
- Always use a properly rated voltage sensing device to confirm the power is off where and when indicated.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the device.
- Use only the specified voltage when operating this equipment and any associated products.

Failure to follow these instructions will result in death or serious injury.

This device has been designed to operate outside of any hazardous location. Only install this device in zones known to be free of hazardous atmosphere.

The device is equipped with screw connectors accepting cables of maximum cross-section 2,5mm^2 (13 AWG) (one wire per terminal).
Temperature probes (NTC) have no connection polarity and can be extended using normal two core cable (note that the extension of the probes influences the device's EMC electromagnetic compatibility: take great care with the wiring).
Probe cables, auxiliary power cables and the RS485 serial cable should be routed separately from main power cables.

TECHNICAL DATA (EN 60730-2-9)

Classification:	electronic automatic control (not safety) device for incorporation
Mounting:	open board
Type of action:	1.B
Pollution class:	2
Material class:	IIIa
Over-voltage category:	II
Nominal pulse voltage:	2500 Vac
Temperature:	Operation: –5...55 °C (23...131 °F) - Storage: –30...85 °C (-22...185 °F)
Power supply:	SMPS 100...240 Vac (±10%) 50/60 Hz
Consumption:	5.5 W max
Fire resistance category:	D
Software class:	A
RTC life:	In absence of external power, the clock battery will last 3 years

FURTHER INFORMATION

Input Characteristics

Measurement range:	**NTC**: –50...110 °C (-58...230 °F) - on 3-digit display with +/- sign
Accuracy:	±1.0° for temperatures below -30 °C (-22 °F) ±0.5° for temperatures between -30 °C (-22 °F) and 25 °C (77 °F) ±1.0° for temperatures above 25 °C (77 °F)
Resolution:	1 or 0,1 °C (1 or 0,1 °F)
Buzzer:	NO
Analogue/Digital Inputs:	4 NTC inputs 2 multifunctional, voltage-free digital inputs (DI1 and DI2)

Output Characteristics

Digital Outputs:

DESCRIPTION	DEFAULT	EN60730 (max 240 Vac)	UL (max 240 Vac)	(max 250 Vac)
OUT1: SPST sealed relay	Fans condenser	NO 8(4) A - NC 6(3) A	NO 8 A - NC 6 A resistive NO 2,9 FLA - NC 17,4 LRA	
OUT2: SPST sealed relay	Defrost	12(9) A	10 FLA - 60 LRA	
OUT3: SPDT sealed relay	Frame Heater	NO 8(4) A - NC 6(3) A	NO 8 A - NC 6 A resistive NO 2,9 FLA - NC 17,4 LRA	
OUT4: SPST sealed relay	Light	12 A resistive		0,5 A STD ballast

OC (Open Collector) Output: **OC:** 1 multifunctional output: 12Vdc 20mA

Mechanical Characteristics

Dimensions:	121x92 mm (4,76x3,62 in.)
Terminals:	removable screw terminals for 2.5 mm^2 (13 AWG) cross-section wires
Connectors:	TTL for Unicard / Device Manager connection (via DMI)
Humidity:	Operation / Storage: 10...90% RH (non-condensing)

Regulation

Food Safety: The device complies with standard EN13485 as follows:

- suitable for storage
- application: air
- climate range: A
- measurement class 1 in the -25...15 °C (-13...59 °F) range (*****)

(*** using Eliwell probes only**)

NOTE: The technical specifications stated in this document regarding measurement (range, accuracy, resolution, etc.) refer to the device alone and not to any accessories provided, such as the probes. This means, for example, that the error introduced by the probe must be added to the characteristic error of the device.

DISCLAIMER

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RESPONSIBILITY AND RESIDUAL RISKS

ELIWELL CONTROLS SRL declines any liability for damage due to:

- installation/use other than expressly specified and, in particular, in conflict with the safety prescriptions set down in regulations and/or specified in this document
- use on panels that do not provide adequate protection against electric shocks, water or dust in the adopted mounting conditions
- use on panels allowing access to dangerous parts without having to use tools
- tampering with and/or modification of the product
- installation/use on panels that do not comply with statutory regulations and requirements.

CONDITIONS OF USE

Permitted use

For safety reasons, the device must be installed and used in accordance with the instructions provided. In particular, parts carrying dangerous voltages must not be accessible under normal conditions. The device must be adequately protected from water and dust with regard to the application, and must only be accessible using tools (with the exception of the front panel). The device is suitable for use in household refrigeration appliances and/or similar equipment and has been tested for safety aspects in accordance with the harmonized European reference standards.

Prohibited use

Any use other than that expressly permitted is prohibited. The relay contacts provided are mechanical and subject to failure: any protection devices required by product standards, or suggested by good practice in view of obvious safety requirements, must be installed externally of the device.

DISPOSAL

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

MANUFACTURING DATE

The manufacturing date appears on the device label to indicate production week and year (WW-YY).

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