TECNAIR LV
CLOSE CONTROL AIR CONDITIONING

www.tpiab.com

CLOSE CONTROL
AIR CONDITIONERS

SURVEY^{EVO}
ELECTRONIC REGULATOR

TECHNICAL USE AND MAINTENANCE MANUAL

Software Version 2.0

Techline

SYMBOLS

WARNING! DANGER!
This symbol is used to indicate situations or operations that are potentially dangerous or that require the care of the operator.

NOTE!
This symbol is used to indicate useful suggestions to the operator.

ELECTROCUTION HAZARD!
This symbol is used to indicate situations or operations that potentially expose the operator the risk of electrocution.

REVISIONS LIST				
Revision	**Date**	**Author**	**Chapters**	**Description**
A (2.0)	05/2015	AF	All	First version

TABLE OF CONTENTS

IMPORTANT WARNING

TECNAIR LV develops its products on the basis of its ten year experience in the Close Control Air Conditioning sector, on the continuous investment in product technological innovation, on strict quality procedures and processes with functional tests on 100% of its production.

However, TECNAIR LV and its branches/affiliates do not guarantee that all aspects of the product, including software, correspond with the final application requirements, despite the product being manufactured in accordance with state-of-the-art techniques. The customer (designer or installer of the final equipment) assumes every responsibility and risk concerning product configuration in order to achieve the estimated results with regard to installation and/or specific final equipment.

In this case, prior to specific agreements, TECNAIR LV can intervene as consultant for the good outcome of the application/final machine start-up, but in no case can be considered responsible for the good operation of the final system/equipment.

The TECNAIR LV units are an advanced product and their operation is detailed in the technical documentation provided with the product or it can be downloaded, even prior to purchasing, from our website www.tecnairlv.it. Every TECNAIR LV product, in relation to its advanced technological level, requires a qualification/configuration/programming/start-up phase for it to operate at its best, for the specific application. Lack in this study phase, as indicated in the manual, can cause malfunctioning in the final products of which TECNAIR LV cannot be considered responsible.

Only qualified personnel can install or carry out technical assistance interventions on the product. The final customer must only use the product as described in the documentation concerning the product itself.

Without this excluding the due compliance with the other warnings present in the manual, please note that it is, in any case, necessary for each TECNAIR LV Product:

- Stock and use the product in environments that respect temperature and humidity limits, which are specified in the manual.
- Do not install the device in particularly hot environments. Excessively high temperatures can reduce the duration of the electronic devices, damage them and deform or melt the plastic parts.
- Do not install the device in environments containing petroleum or oil vapour or any sort of aerosol, such as in kitchens (plastic parts could deteriorate) where there are flammable vapours such as petrol-based solvent.
- Do not install the device in environments containing corrosive gases, such as sulphuric gas (this could corrode the pipes and welded points). Do not use corrosive chemical products, aggressive detergents or solvents to clean the device.
- Do not install the device in environments containing equipment that generates electromagnetic waves (the system may be subject to malfunctions), or where the line voltage is subject to considerable fluctuation (such as factories, for example);
- Do not install the device in environments where the air has a high saline content, such as near sea-side cliffs.
- The appliance must not be installed on vehicles or boats.
- Do not drop, hit or shake the device, as the internal circuits and mechanisms may suffer irreparable damage.
- Do not use the product in different applications to those specified in the technical manual.

All the above recommendations are also valid for the microprocessor, the serial boards, the programming keys or, however, for any other accessory of TECNAIR LV products portfolio.

TECNAIR LV adopts a policy of continuous development, accordingly, the company reserves the right to make changes and improvements to any product described herein, without forewarning.

The technical data and dimensions are not binding.

The responsibility of TECNAIR LV in relation to its product is regulated by the TECNAIR LV general contract conditions and/or by the specific agreements with customers; in particular, as admitted by the applicable standard, in no case TECNAIR LV, its employees or its branches/affiliates will be responsible for any lost profits or sales, data and information loss, costs for substitute services or goods, damages to things or persons, activity interruptions or any direct, indirect, accidental, property, coverage, punitive, special or consequential damages in any way caused, whether contractual, extra contractual or due to negligence or other responsibility deriving from installation, use or impossibility to use the product, even if TECNAIR LV or its branches/affiliates have been warned on the possibility of damages.

WARRANTY

All TECNAIR LV products, or distinguished by the TECNAIR LV trademark, are subject to the following warranty conditions which are deemed to have been fully understood and accepted at the time of placing the order. TECNAIR LV undertakes during the period of warranty to repair or to replace with new at its own discretion, in the shortest time possible, any parts found to present recognised defects in materials, construction or workmanship that render them unfit for the intended use.

The warranty on the products sold by TECNAIR LV has a duration of TWENTY-FOUR MONTHS (2 years) from the date of shipping the material.

The following are excluded from the warranty:

- All parts typically subject to sliding or rolling friction (bearings, brushes, etc.);
- All parts typically subject to consumption (filters, humidifier cylinders, etc.);
- All parts typically subject to oxidation or corrosion if incorrectly used or maintained (headers, conductors and contacts in copper or metal alloys, internal or external parts of the unit, etc.);
- All parts not supplied by TECNAIR LV, even if integrating part of the system to which the product is enslaved.

Furthermore, TECNAIR LV reserves the right to cancel the warranty of sold products if:

- The labels or plates showing the Manufacturer mark and serial number have been deleted or removed;
- The product has been subjected to modifications or mechanical work not expressly authorised by TECNAIR LV;
- The product has been used not in conformity with the supplied instructions or for purposes different to those for which it was designed.
- The defect is the cause of negligence, inexperience, bad maintenance, carelessness and inability of the final User, damages caused by third party, accidental causes or of force majeure or, however, any other causes not attributable to manufacturing quality defects.

The above mentioned warranty conditions shall be valid provided that the Customer has fulfilled all of his contract obligations and in particular to those regarding the payment terms. The delayed or missed payment, even partial, for supply, suspends every warranty. The warranty does not give the Customer any right to suspend or delay payments that must, in any case, be granted as established at the time of placing the order and specified in our written order confirmation.

The warranty request must be made in writing detailing the found fault, the serial number or unit code where the fault has occurred and indicating the component that caused the fault, should this be easily identifiable. TECNAIR LV will not accept any warranty request made by telephone. For operational reasons, the warranty requests will only be accepted during office hours, from Monday to Friday. In the event a request is sent during a holiday, it will be considered received by TECNAIR LV during the first hour of the first successive working day to the sending of the same.

Faulty components are replaced ex works Uboldo. Transport costs are borne by the Customer, even in case of acknowledged warranty, unless otherwise specified by TECNAIR LV. The replacement costs of the defective components (labour costs, materials, refrigerant, etc.) are met by the Customer, even in case of recognised warranty, unless otherwise specified by TECNAIR LV.

TECNAIR LV does not have to pay compensation for direct or indirect damages of any nature and for any reason. Furthermore, TECNAIR LV does not answer for any delays in the supply of under warranty parts or execution of under warranty interventions.

The materials replaced under warranty remain the property of the Customer, who must dispose of it in accordance with the standard in force. Any disposal costs are met by the Customer. In the event return of the under warranty parts is requested, these must be returned within three (3) months from date of shipment of the substitute piece, under the care and at the expense of the Customer. On the contrary, all spare parts will be charged at the price on the list in force at time of their shipment.

1 INTRODUCTION

1.1 SURVEY^{EVO} ELECTRONIC REGULATION SYSTEM

SURVEY^{EVO} is an electronic regulation system developed for integrated control of Close Control conditioning units in the direct expansion (A) or chilled water (U), Free Cooling (FC) and Two Sources (TS) versions and of the relevant related accessories.

The system consists of:

- A basic I/O control board, in plastic container sized as 4 DIN modules, for installation on DIN guide inside the electrical panel:
- A user terminal with graphic LCD single-colour display (black with white LED back lighting) of 128 x 64 pixel, with 6-key pad (with pre-set functions).
- One or more electronic EC fans with integrated electronic regulation board.
- EVDrive electronic valve control boards, in plastic container sized as 4 DIN modules, for installation on DIN guide inside the electrical panel.

Additional control boards may be installed according to the type of unit and installed accessories:

- CPY humidifier control board, in plastic container sized as 6 DIN modules, for installation on DIN guide inside the electrical panel.
- DC compressor control inverter, in plastic container, for installation outside the electrical panel.

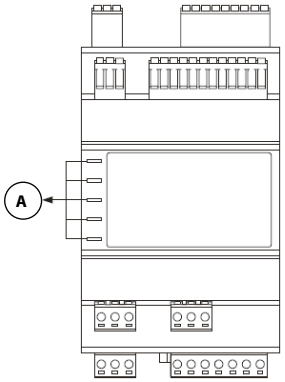
Thanks to the high degree of interfacing of the unit's main components, with the SURVEY^{EVO} electronic control system it is possible to monitor and control any operative aspect of the system, assuring the user has real time access via the display at the front of the machine or via a supervision system or BMS (Building Management System).

Constant monitoring of the system's general status affords a high degree of reliability. Integrated management of the alarms of the unit's main components allows the user to act promptly for maintenance, reducing system downtime to the minimum.

2 USER INTERFACE

2.1 SIGNAL LED OF THE SURVEY^{EVO} BASE BOARD

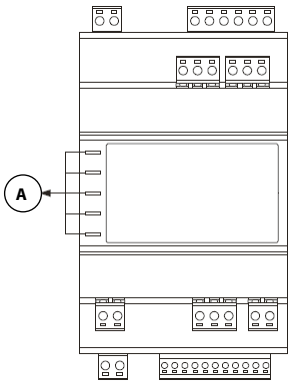
The SURVEY^{EVO} base board features LEDs with special functions as shown in the table below.



A - Signal LED		
Name	**Colour**	**Description**
ON	Green	Power supply LED: • If on, the device is powered • If off, the device is not powered
RUN	Green	Operation LED: • If on, the application software is running • If off, the application software is not running
⚠	Red	System alarm LED: • If on, a system alarm is underway with reset via the application software • If it blinks very slowly, access in external flash memory is underway • If it blinks slowly, a system alarm is underway with automatic reset • If it blinks quickly, a system alarm is underway with manual reset • If it is off, no system alarm is underway
CAN	Red	CANbus communication LEDs: • If on, CANbus communication has not been established • If it blinks slowly, CANbus communication has communication errors • If it blinks quickly, CANbus communication is correct • If it is off, no CANbus communication is underway
L1	-	Not used

2.2 EVDRIVE REGULATOR SIGNAL LED

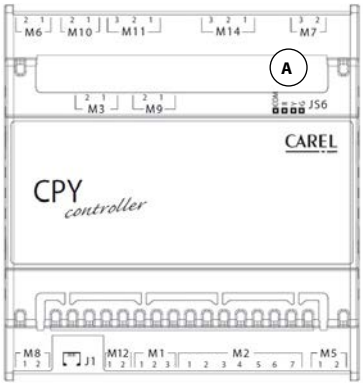
There are LEDs on the EVDrive regulator with special functions as shown in the table below.



A - Signal LED		
Name	**Colour**	**Description**
ON	Green	Power supply LED: • If on, the device is powered • If off, the device is not powered
STEP 1	Green	Stepper motor output LED: • If it is on, the valve closes completely • If it blinks slowly, the valve opens completely • If it blinks quickly, the valve is moving • If it is off, the valve is not moving
STEP 2	Green	Operation LED: • If on, superheating control is running • If off, superheating control is not running
⚠	Red	Alarm LED: • If it is on, an alarm is underway • If it blinks slowly, device operation must be disabled/enabled, for the configuration change to be effective • If it blinks quickly, device power supply must be turned off/on, for the configuration change to be effective • If it is off, no alarm is underway
COM	Green	Communication LED: • If on, communication is in alarm mode and the device is locked • If it blinks slowly, communication has errors • If it blinks quickly, communication is in alarm mode and the device is in stand-alone operation • If it is off, communication is OK

2.3 CPY HUMIDIFIER BOARD SIGNAL LED

There are LEDs on the CPY humidifier board with special functions as shown in the table below.

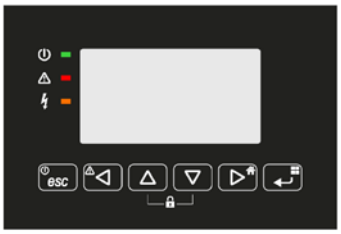


A - Signal LED		
Name	**Colour**	**Description**
	Red	Alarm LED: • If it blinks an alarm is underway • If it is off, no alarm is underway
	Yellow	Steam production LED: • If it is on, production is at 100% • If it blinks, the number of blinks indicates the production percentage • If it is off, the humidifier is off
	Green	Power supply LED: • If on, the device is powered • If off, the device is not powered

2.4 USER TERMINAL

2.4.1 USER TERMINAL KEYPAD

There are keys on the User terminal with special functions as shown in the table below.



Key	Name	Description
esc	**ESC**	If pressed, it enables exit from the menus and parameter editing.
	ON-OFF	It is pressed and held to turn the unit on and off.
	LEFT	Press it to scroll the unit's status pages to the left.
	ALARM	If pressed and held, it enables access to the active alarms menu.
	UP	It is pressed to scroll up through the pages associated with a specific group; if the cursor is in a setting field, it enables the user to increase the value.
	DOWN	It is pressed to scroll down through the pages associated with a specific group; if the cursor is in a setting field, it enables the user to decrease the value.
	RIGHT	Press it to scroll the unit's status pages to the right.
	HOME	Press and hold it to go back to the Home page.
	ENTER	Press it to edit a parameter and confirm the setting. In the active alarms menu, press it to scroll through the alarms, press it and hold it to delete active alarms.
	MENU	If pressed and held, enables access to the Main menu page.
	UP + DOWN	If pressed and held, can be used to unlock the user terminal.

2.4.2 USER TERMINALSIGNAL LED

There are LEDs on the User terminal with special functions as shown in the table below.

Key	Colour	Description
	Green	Operation LED: • If on, the unit is ON • If it blinks, the unit is turned off from remote control or due to critical alarm/Unit in standby (Local Network) • If off, the unit is OFF
	Red	Alarm LED: • If it is on, an alarm is underway and has already been viewed • If it blinks a new alarm is underway • If it is off, no alarm is underway
	Orange	Power supply LED: • If on, the device is powered • If off, the device is not powered

2.4.3 LOCAL OR REMOTE USER TERMINAL DISPLAY

The user terminal is fitted with a graphic LCD single-colour display (black with white LED back lighting) of 128 x 64 pixel, to view information on the units' control software.

The information on unit control is arranged according to the following order:

1) **MAIN BRANCH:** It makes it possible to rapidly access the units' general status. It displays the status of all components installed in the unit, or controlled by it.

2) **MAIN MENU:** It lets you access the software management **MENUS**. The **MENUS** divide the parameters into categories for easier user interaction.

3) **MENU:** The main menu contains various **MENUS** divided as follows. Every **MENU** contains **PARAMETERS GROUPS** inside of it, and allows them to be viewed or edited.

- **OPEN MENUS:** these display the alarms, device operating hours, the time and date, and enable the entry of temperature and humidity setpoints and adjustment of the internal clock.
- **PASSWORD PROTECTED MENUS**: these enable setting the unit's regulation and configuration parameters.

4) **GROUPS OF PARAMETERS:** The **PARAMETERS** are collected in specific **GROUPS**, making it easier to access and edit them.

2.4.4 SYMBOLS AND ICONS THAT CAN BE SHOWN BY THE DISPLAY

Various types of icons are used in the software pages. The meaning of the icons is laid out in the table below.

Software icons			
Probes			
			
Return temperature	Supply temperature	Return humidity	Supply humidity
Components			
			
Motorised damper	Unit fans	Condenser fans	Dry cooler fans
			
DC inverter compressor	Compressor 1	Compressor 2	Two compressors
			
Modulating electrical coil	Stage 1 electrical coil	Stage 2 electrical coil	Two-stage electrical coil
			
Water heating	Water cooling	Humidifier	Dehumidification

Statuses					
					
Average value	Alarm active	Active key lock	Active free cooling	Two sources source 1	Two sources source 2

Menu					
					
Set-Point	LAN	Parameters	Clock	Active alarms	Alarms Log
					
Working hours	Information menu	Component status	User Setup	Manufacturer setup	Language setup

3 CONTROL SOFTWARE MAIN BRANCH

3.1 CONTROL SOFTWARE MAIN BRANCH MANAGEMENT

This group of pages represents the primary control software. The pages may be accessed simply by pressing the **LEFT** () and **RIGHT** () keys. The parameters concerning the non-installed components will not be displayed, it is therefore possible that some pages cannot be displayed.

3.1.1 MAIN SCREEN

This page represents the primary software display. The following can be displayed within this page:

- The set time and date.
- The return temperature.
- The supply temperature.
- The return humidity (if present).
- The supply humidity (if present).
- The status of the unit.
- Extant active alarm.
- The icons of the main active components (see previous chapter).

3.1.2 PROGRESS BAR

This page summarises the status of the main control components, representing them through specific progress bars that indicate the percentage of control. The following can be displayed within this page:

- Status of the supply fans.
- The status of the condenser fans or dry cooler (if present).
- Status of the cooling components.
- The status of the heating components (if present).
- Dehumidification status (if present).
- Humidification status (if present).

3.1.3 VENTILATION

The ventilation status pages show different views depending on the type of set regulation.

If fixed speed regulation is active, the status of each fan in the unit will be displayed:

- The fan's speed in percentage.
- The fan's speed in RPM.
- The absorbed current in Ampere.
- Used electrical power in Watt.

If regulation proportionally to cooling or heating regulation is active, the following will be displayed in addition to the status of each fan in the unit:

- The controlled temperature and relevant set-point.
- The controlled humidity and relevant set-point (if humidity control is present).
- The cooling or heating request.
- Number of active fans.
- The fan's speed request in percentage.

If constant air flow regulation is active, the following will be displayed in addition to the status of each fan in the unit:

- The current air flow rate in m^3/h.
- The air flow rate set-point in m^3/h.
- Number of active fans.
- The fan's speed request in percentage.

If constant air pressure regulation is active, the following will be displayed in addition to the status of each fan in the unit:

- The current air pressure in m3/h.
- The air pressure set-point in Pa.
- Number of active fans.
- The fan's speed request in percentage.

3.1.4 CHILLED WATER

The chilled water regulation status pages may show different views depending on the type of accessories the unit is fitted with. It will therefore be possible to view:

- The controlled temperature and relevant set-point.
- The controlled humidity and relevant set-point (if humidity control is present).
- The cooling request.
- The dehumidification request (if humidity control is present).
- The water valve opening percentage.

If water flow rate control is present:

- The current water flow rate in l/h.
- The set water flow rate limit in l/h.
- The valve opening limitation request in percentage.

If inlet and outlet water temperature probes are present:

- The inlet water temperature reading.
- The outlet water temperature reading.

If cooling power detection system is present:

- The difference between inlet and outlet temperature.
- The current water flow rate.
- The total water side cooling capacity in Kw.
- The water side energy efficiency ratio (EER) value.

3.1.5 FREE COOLING

In free cooling units a free cooling circuit status page will be displayed and, after that, the direct expansion circuit pages (see following chapters). The free cooling page will display:

- The controlled temperature and relevant set-point.
- The controlled humidity and relevant set-point (if humidity control is present).
- The free cooling temperature.
- The cooling request.
- The dehumidification request (if humidity control is present).
- The free cooling percentage.

3.1.6 TWO SOURCES WITH PRIMARY WATER CIRCUIT

In two sources units with primary water circuit a primary circuit status page will be displayed and, after that, the secondary direct expansion or water circuit pages (see following chapters). The primary water circuit page will display:

- The controlled temperature and relevant set-point.
- The controlled humidity and relevant set-point (if humidity control is present).
- The inlet water temperature.
- The cooling request.
- The dehumidification request (if humidity control is present).
- The primary circuit water valve opening percentage.

3.1.7 DIRECT EXPANSION

The direct expansion regulation status pages may show different views depending on the type of accessories and number of cooling circuits the unit is fitted with. It will therefore be possible to view:

- The controlled temperature and relevant set-point.
- The controlled humidity and relevant set-point (if humidity control is present).
- The cooling request.
- The dehumidification request (if humidity control is present).
- Activation status of the compressors.

If compressor inverter is present:

- The compressor's speed in percentage.
- The compressor's speed in Hertz.
- The current absorbed by the compressor in Ampere.
- The compressor's electrical power in Kw.

Cooling circuit operating parameters (low pressure):

- The current evaporation pressure.
- The current evaporation temperature.
- Compressor temperature suction.
- Current superheating.

Cooling circuit operating parameters (high pressure):

- Compressor temperature discharge.
- The current condensation pressure.
- The current condensation temperature.
- Current de-superheating.
- Liquid refrigerant temperature at unit inlet.
- Current sub-cooling.

Expansion valve operating parameters:

- Current superheating.
- Current superheating set-point.
- The opening of the valve in percentage.
- Valve regulation status.

3.1.8 CONDENSERS REGULATION

In the condenser regulation pages the following information may be viewed for each condenser:

- The current condensation temperature.
- Current condensation set-point.
- The regulation request in percentage.

3.1.9 TWO SOURCES WITH SECONDARY WATER CIRCUIT

In two sources units with secondary water circuit, the following information will be displayed:

- The controlled temperature and relevant set-point.
- The controlled humidity and relevant set-point (if humidity control is present).
- The cooling request.
- The dehumidification request (if humidity control is present).
- The secondary circuit water valve opening percentage.

3.1.10 HEATING

The heating status pages may show different views depending on the type of accessories the unit is fitted with.

Unit with modulating water valve:

- The controlled temperature and relevant set-point.
- The controlled humidity and relevant set-point (if humidity control is present).
- The heating request.
- The post-heating request (if humidity control is present).
- The heating circuit water valve opening percentage.

Unit with modulating electric coil:

- The controlled temperature and relevant set-point.
- The controlled humidity and relevant set-point (if humidity control is present).
- The heating request.
- The post-heating request (if humidity control is present).
- The heating electric coil regulation percentage.
- Engaged electrical power in Kw.

Unit with electric stage coils:

- The controlled temperature and relevant set-point.
- The controlled humidity and relevant set-point (if humidity control is present).
- The heating request.
- The post-heating request (if humidity control is present).
- Number of active stages.
- Engaged electrical power in Kw.

3.1.11 HUMIDIFICATION

In units with humidification system, the following information will be displayed:

- The controlled humidity and relevant set-point.
- The humidification request.
- The humidifier operation percentage.

Unit with internal immersed electrode humidifier:

- The requested steam Production.
- The current absorbed by the humidifier in Ampere.
- The humidifier operation status.
- The humidification regulation percentage.
- Humidifier water conductivity in µS/cm.
- The humidifier power contactor status.
- The humidifier water drain valve status.
- The humidifier water filling valve status.
- The water level in the humidifier's cylinder.

3.1.12 DRY COOLER

In units with dry cooler control system, the following information will be displayed:

- The unit's inlet water temperature.
- The dry cooler regulation set-point.
- The dry cooler regulation percentage.

3.1.13 CONFIGURABLE DIGITAL INPUTS

The following information will be displayed depending on configurable digital input settings:

- Description and status of configurable digital input 1.
- Description and status of configurable digital input 2.
- Description and status of configurable digital input 3.
- Description and status of configurable digital input 4.

3.1.14 CONFIGURABLE DIGITAL OUTPUTS

The following information will be displayed depending on configurable digital output settings:

- Description and status of configurable digital output 1.
- Description and status of configurable digital output 2.
- Description and status of configurable digital output 3.
- Description and status of configurable digital output 4.

3.1.15 GRAPHS

These pages will display graphs related to:

- **Daily controlled temperature trend:** The trend represents the day's temperature average.
- **Weekly controlled temperature trend:** The trend represents the temperature average of the previous 6 days.
- **Daily controlled humidity trend:** The trend represents the day's humidity average.
- **Weekly controlled humidity trend:** The trend represents the humidity average of the previous 6 days.

4 CONTROL SOFTWARE MAIN MENU

To access the MENU, simply press and hold the **ENTER** key ().

It is possible to select the **MENUS** on the **MAIN MENU** by moving the cursor with the **UP** () and **DOWN** () keys.

Press the **ENTER** () key to access the menu selected.

4.1 SET - SET-POINT

Within the **SET (Set-point)** menu, it is possible to modify the ambient temperature and ambient humidity regulation set-points. These parameters can be modified so that the user is able to select his/her preferred environmental conditions.

4.2 NETWORK - CANBUS LOCAL NETWORK STATUS

The general status of all units of the local network may be viewed within the **NETWORK (Local network status)** menu. The unit one is accessing from will be displayed with an L (Local) while the other units bill be displayed with their network address (from 1 to 12).

The units may have the following statuses:

- --- : Unit not on the network.
- OFF: Unit off.
- ON: Unit on.
- STB: Unit in stand-by.
- ALM: Unit in alarm.
- OFL: Unit off-line.

4.3 PAR - REGULATION PARAMETERS

Within the **PAR (Parameters)** menu, after gaining access by entering the correct login password, it is possible to edit the unit regulation parameters and the unit configuration parameters. The group is divided into the following sections:

- **USER SETUP:** Modification of the unit control and operation parameters.
- **MANUFACTURER SETUP:** Configuration of unit operational parameters.
- **LANGUAGE:** Enables the software language to be changed.
- **DELETE LOGGING:** Can be used to delete the working hours count and the alarms log.

4.4 RTC - CLOCK

Within the **RTC (Clock)** menu, it is possible to change the current time and date.

4.5 ALM - ACTIVE ALARMS

Within the **ALM (Active alarms)** menu it is possible to display the active alarms on the unit. Access to this menu is gained by pressing and holding the **ALARM** key ()

4.6 LOG - ALARMS LOG

Within the **LOG** (**Alarms log)** menu it is possible to display the log of the unit's alarms. The alarms will be stored in chronological order The page will display trigger date, trigger time and duration of the alarm.

Press the **ENTER** () to scroll alarms stored.

4.7 HOURS - OPERATION HOURS

Within the **HOURS (Operating hours)** menu it is possible to display the operating hours of the following unit components:

- **Unit hours of operation:** Indicate total unit operating hours (Unit ON).
- **Compressor 1:** Indicate total operating hours of compressor 1.
- **Compressor 2:** Indicate total operating hours of compressor 2.
- **Water Valve:** Indicate total operating hours of the chilled water valve.
- **Electric heaters:** Indicate total operating hours of the electric coil.
- **Humidifier:** Indicate total operating hours of the humidifier.
- **Free Cooling:** Indicate total operating hours of the free cooling system.
- **Dry cooler:** Indicate total dry cooler operating hours.
- **Condenser 1:** Indicate total operating hours of condenser 1.
- **Condenser 2:** Indicate total operating hours of condenser 2.

4.8 INFO - INFORMATION

Within the **INFO (Information)** menu it is possible to display the unit's serial number and software version installed on the unit.

5 UNIT USE

5.1 LANGUAGE OF THE CONTROL SOFTWARE

The regulation software lets you configure several languages. With the "**Language**" parameter (Language Menu) it is possible to select one of the following languages:

- Language pack A:

1) **Italian**
2) **English**
3) **French**
4) **German**

- Language pack B:

1) **Italian**
2) **English**
3) **Spanish**
4) **Dutch**

- Language pack C:

1) **Italian**
2) **English**
3) **Russian**
4) **Polish**

5.2 KEY LOCK

The regulation software lets you configure a key lock function, which is automatically activated if the keypad is not touched for 120 s.

With the "**Enable Key Lock**" parameter (Manufacturer Setup - Key lock configuration) it is possible to select one of the following types of key lock:

1) **No:** Key lock is not active.
2) **Yes:** The keys will lock after inactivity.
3) **User Password:** The keys will lock after inactivity and the user password will be required to unlock the keypad.

When the keys are locked the display shows the relevant icon ( ) and it will be possible to:

- Display components status by pressing the **LEFT** ( ) and **RIGHT** ( ) keys.
- Display active alarms by pressing and holding the **ALARM** key ( ).

When the keys are locked it will **NOT** be possible to:

- Turn the unit on and off via the keypad.
- Access the main menu.
- Delete active alarms.

To remove the key lock just press the **UP** and **DOWN** keys ( ) at the same time for a few seconds. An unlock password might be required, this is the **USER** password.

5.3 UNIT SWITCH-ON

The unit may be switched on and off by pressing the **ON/OFF** button (

) for a few seconds. The unit's status may be viewed on the display's main page.

If the units are installed in local network, depending on the configuration of the "**Dynamic ON-OFF**" parameter (Manufacturer's set-up- Local network configuration), it will be possible to switch on or off simultaneously all the units in a local network.

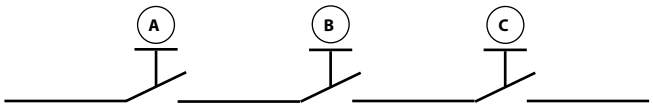
When it is on (**Unit ON**), the unit may be controlled via the digital OFF input remotely and via the supervision system/BMS Modbus.

5.3.1 OFF VIA REMOTE AND VIA SUPERVISORY/BMS MODBUS SYSTEM

After being started from the terminal, the unit may be turned off and on via a digital OFF input remotely and via the supervision system/BMS Modbus.

For reasons of operator safety, should the unit be set to OFF from the display, the unit may not be started in any way via the digital OFF input remotely and via the supervision system/BMS Modbus.

The unit's switch on priority is therefore as follows:



A On/Off from display
B OFF via remote
C Off via supervisory/BMS Modbus system

5.3.2 AUTOMATIC RE-START DUE TO POWER FAILURE

The control software features an automatic re-start function in case of power supply failure. Should there be a power supply line outage, when it is restored SURVEY^{EVO} will resume the operation mode prior to the problem.

Resuming previous operation will only be possible if, upon restarting, the unit has no shut-down alarms that prevent switching back on.

5.3.3 POWER SUPPLY FAILURE ALARM

With parameter "**Power supply failure alarm**" (Manufacturer's set-up - Alarms management configuration) it is possible to enable an alarm to alert the user that SURVEY^{EVO} has undergone a restart due to a power outage.

The parameter makes it possible to choose the alarm triggering type:

1) **Disabled:** No alarm is generated in the event of restart due to power failure.
2) **Enabled:** The alarm will **ALWAYS** be generated at the next control SURVEY^{EVO} restart.
3) **Unit ON**: The alarm will be generated at the next control SURVEY^{EVO} restart only if the unit was operating (**Unit ON**). If the unit was off (**Unit OFF**), no alarm will be generated.

When it is configured, SURVEY^{EVO} restart following a power failure will generate the "**Power supply failure alarm**" to alert the user to the problem.

5.4 MOTORISED SHUTTERS CONTROL

The regulation software is able to control motorised shutters, whose function is to isolate the unit from the environment when it is off.

Upon switching on (Unit ON) SURVEY[EVO] will start opening the shutters. When the digital shutter status input (ID2) is **OPEN (Shutter open)** the fans will be started.

With parameter "**Shutter status alarm delay**" (Manufacturer's set-up - Alarms management configuration) it is possible to set an alarm trigger delay at switch on, to allow the motor to open the shutter.

If the digital shutter status input is **CLOSED (Shutter closed),** at the end of the opening periods or during normal unit operation, the "**Shutter status alarm**" will be triggered. which will stop unit operation.

5.5 AIR SUPPLY FANS REGULATION

SURVEY[EVO] has the possibility to control one or more air supply fans with various types of control. The type of control is connected to the fan's features.

With the "**Number of fans**" parameter (Manufacturer Setup - Ventilation configuration) it is possible to configure the number of fans installed in the unit.

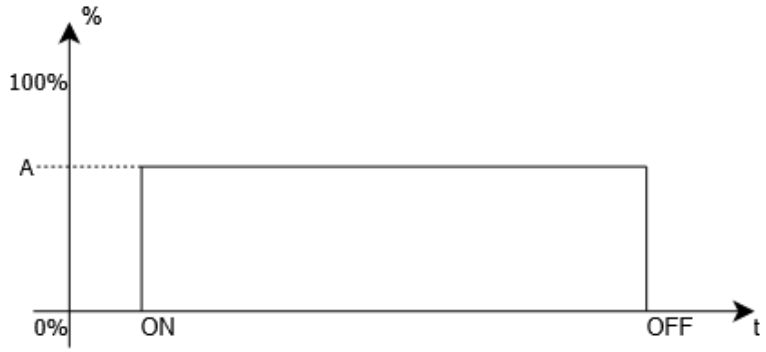
With the "**Type of fans**" parameter (Manufacturer Setup - Ventilation configuration) it is possible to configure the fan control choosing from the following types.

1) **On-off:** The fans will be controlled via a digital output.
2) **Analogue:** The fans will be controlled via a digital output and a 0-10 V analogue output.
3) **Modbus:** The fans will be controlled via Modbus Master communication protocol.

5.5.1 FIXED SPEED VARIABLE FANS CONTROL

With the "**Type of regulation**" parameter (Manufacturer Setup - Ventilation configuration) it is possible to configure the fan regulation setting a fixed operating speed.

With the "**Maximum fan speed**" parameter (Manufacturer Setup - Ventilation configuration) it is possible to configure the operation speed you wish to maintain.



A Maximum fan speed" (Manufacturer Setup - Ventilation configuration)

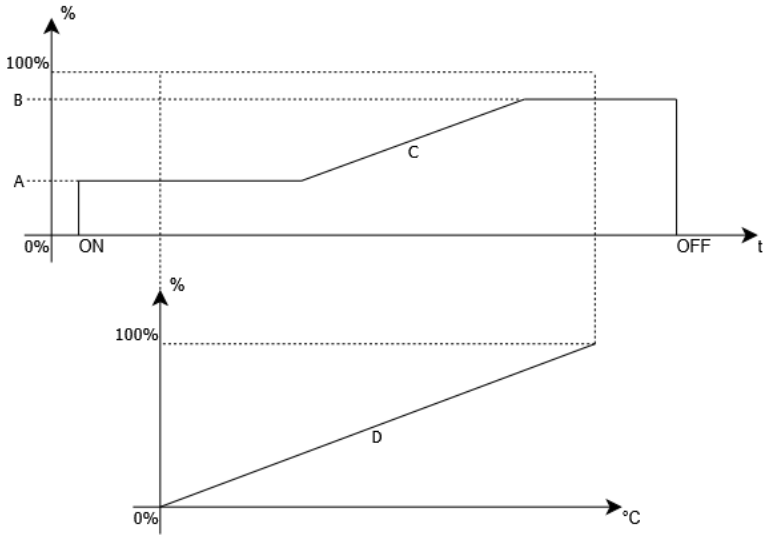
5.5.2 REGULATION OF MODULATING FANS PROPORTIONALLY TO THE COOLING OR HEATING REQUEST

With the "**Type of regulation**" parameter (Manufacturer Setup - Ventilation configuration) it is possible to configure the fan regulation so as to modulate the speed accoridng to the cooling or heating request. This can result in significant energy savings and a reduction in noise levels, particularly with partial loads.

With the "**Minimum fan speed**" parameter (Manufacturer Setup - Ventilation configuration) it is possible to configure the minimum operation speed at which the fan may regulate.

With the "**Maximum fan speed**" parameter (Manufacturer Setup - Ventilation configuration) it is possible to configure the maximum operation speed at which the fan may regulate.

Setting minimum speed at a value below 30% is not recommended because this might prevent correct detection of ambient temperature and humidity. In the event of direct expansion unit with electric coils the fan will be maintained at maximum speed until the component switches off, in order to prevent regulation problems.

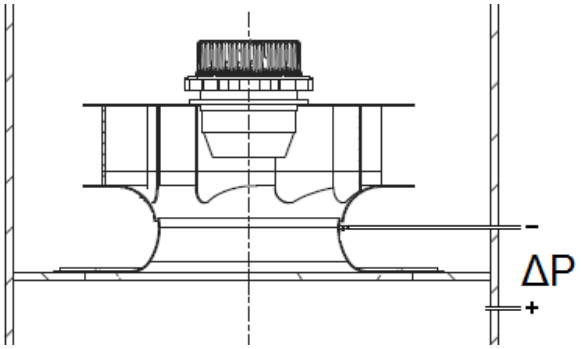


A Minimum fan speed" (Manufacturer Setup - Ventilation configuration)
B Maximum fan speed" (Manufacturer Setup - Ventilation configuration)
C Fan modulation area
D Cooling or heating request

5.5.3 ADJUSTMENT OF CONSTANT AIR FLOW VARIABLE SPEED FANS

With the "**Type of regulation**" parameter (Manufacturer Setup - Ventilation configuration) it is possible to configure fan regulation so as to modulate the speed according to the air flow, in order to keep it constant with respect to parameter "**Air flow set-point**" (User setup - Ventilation set-point).

In order to calculate air flow rate, the unit requires a pressure sensor installed inside the machine and connected with the fan nozzle.



With the "**Differential air pressure**" parameter (Manufacturer Setup - Probe configuration) it is possible to configure the air differential pressure sensor presence.

Flow rate will be calculated based on the following mathematical function:

$$V = \sqrt{\Delta P} * k$$

Where:

- **V** is the flow rate in m³/h
- **ΔP** is the measured pressure difference
- **K** is the fan's characteristic coefficient, parameter "**Air flow coefficient**" (Manufacturer set-up - Ventilation configuration)

Fan speed will be increased or decreased, in order to reach the set-point. A 100 m³/h dead zone makes it possible to stabilise fan speed.

With the "**Minimum fan speed**" parameter (Manufacturer Setup - Ventilation configuration) it is possible to configure the minimum operation speed at which the fan may regulate.

With the "**Maximum fan speed**" parameter (Manufacturer Setup - Ventilation configuration) it is possible to configure the maximum operation speed at which the fan may regulate.

This type of regulation is optimal to assure constant flow rate even in the event of variable system load losses (e.g. dirty filters) which might reduce it considerably.

5.5.4 CONSTANT PRESSURE VARIABLE FANS CONTROL

With the "**Type of regulation**" parameter (Manufacturer Set-up - Ventilation configuration) it is possible to configure fan regulation so as to modulate the speed according to ambient pressure, in order to keep it constant with respect to parameter "**Air pressure set-point**" (User set-up - Ventilation set-point).

In order to calculate air pressure, the unit requires a pressure sensor installed inside the machine.

With the "**Differential air pressure**" parameter (Manufacturer Setup - Probe configuration) it is possible to configure the air differential pressure sensor presence.

Fan speed will be increased or decreased, in order to reach the set-point. A 2 Pa dead zone makes it possible to stabilise fan speed.

With the "**Minimum fan speed**" parameter (Manufacturer Setup - Ventilation configuration) it is possible to configure the minimum operation speed at which the fan may regulate.

With the "**Maximum fan speed**" parameter (Manufacturer Setup - Ventilation configuration) it is possible to configure the maximum operation speed at which the fan may regulate.

This regulation is ideal for rooms with air distribution from the raised floor, especially in the following cases:

- Premises intended for future expansion: In these cases the floor is "opened" during expansion steps and pressure will tend to drop as a consequence. The unit will therefore be able to offset by increasing fan speed assuring optimal air distribution.
- Premises subject to constant maintenance. In these cases the floor is opened during maintenance operations and pressure will tend to drop as a consequence. The unit will therefore be able to offset by increasing fan speed assuring optimal air distribution.

5.5.5 STARTING SPEED CONTROL

If modulating fan regulation is set, it will be possible to configure a start-up period. During the set start-up period the fans will be overridden at start-up speed. At the end of the start-up time the fans will start regulating normally.

With the "**Start-up fan speed**" parameter (Manufacturer Set-up - Ventilation configuration) it is possible to configure the operation speed at which the fan is regulated during the start-up period.

With the "**Fan start-up time**" parameter (Manufacturer Set-up - Fan configuration) it is possible to configure the fans' start-up period duration.

This function is optimal to reach more quickly the work condition at the unit's start, with no need to wait for the modulation period required for reaching the set-point.

5.5.6 FAN ALARM MANAGEMENT

If the fans are controlled via 0-10 V signal or digital On-Off, the alarm will be managed via the relevant digital input. In case one or more fans should be in alarm, SURVEY^{EVO} will trigger the "**General supply fans alarm**", which will stop unit operation

If the fans are controlled via Modbus connection, SURVEY^{EVO} is able to detect the following alarm conditions of each fan installed in the unit, triggering the "**Fan inverter alarm (1-2-3-4-5)**" in which the nature of the problem is specified. The following alarm causes are possible:

- **Communication failure:** SURVEY^{EVO} constantly monitors correct communication with the fans' control module in order to assure their correct operation.
- **Phase/power supply failure alarm:** The fans' control electronic constantly checks for motor power supply. The check is carried out on every individual motor phase.
- **High regulation module temperature:** The fans' control electronics constantly check the control module's temperature in order to prevent damage due to excessively high temperatures.
- **High motor temperature:** The fans' control electronics constantly check the motor temperature in order to prevent damage due to excessively high temperatures.
- **Regulation module malfunction:** The fans' control electronics constantly check the control module's status and alerts to any damage.
- **Motor overload:** The fans' control electronics constantly check the motor status and alerts to any overload.
- **Low DC power supply:** The fans' control electronics constantly check the control module's status and alerts to any DC power supply reduction.
- **Master-slave communication failure:** The fans' control electronics constantly check the communication status with the slave fans and alerts to any communication failure.
- **Hall sensor error:** The fans' control electronics constantly check the Hall sensor status and alerts to any damage.

5.5.7 AIR DIFFERENTIAL PRESSURE SENSOR ALARM

If the unit is fitted with differential pressure sensor for controlling the fans, it will be constantly monitored.

In the event the differential air pressure sensor should be broken or disconnected SURVEY^{EVO} will trigger the "**Broken air differential pressure sensor alarm**".

In the event of broken or disconnected pressure sensor SURVEY^{EVO} will stop speed regulation at the last value at which the set-point was reached. If the set-point has never been reached the speed is blocked at 50% or at start-up speed, if set.

5.6 TEMPERATURE REGULATION

5.6.1 TEMPERATURE CONTROL TYPE

All units are fitted with two operating temperature detection probes. One probe is located in the ambient air intake section and is defined as "**Return temperature probe"**, while another probe is placed in the ambient air supply compartment and is defined as "**Supply temperature probe".**

With the "**Regulation sensor**" parameter (User Set-up - Temperature regulation) it is possible to configure which probe is designated to temperature control. The type of control is normally connected to the type of system one wishes to implement. The following controls may be selected:

- **Return temperature regulation:** SURVEY^{EVO} uses the return temperature value to regulate the temperature. This setting is ideal for rooms where the thermal loads are consistently distributed.

- **Supply temperature regulation:** SURVEY^{EVO} uses the supply temperature value to regulate the temperature. This setting is ideal for rooms where the thermal loads are not consistent, and the return temperature might not be correct.

5.6.2 SETTING THE TEMPERATURE SET-POINT LIMITS

Should it be required to limit the setting field of the temperature regulation set-point, it is possible to configure its minimum and maximum limit:

With the "**Minimum temperature set-point limit**" parameter (Manufacturer Set-up - Set-point limit configuration) it is possible to configure the minimum setting limit of the temperature set-point.

With the "**Maximum temperature set-point limit**" parameter (Manufacturer Set-up - Set-point limit configuration) it is possible to configure the maximum setting limit of the temperature set-point.

This function is ideal to prevent excessively high or low regulation values to be set, which might create problems in the system.

5.6.3 TEMPERATURE REGULATION DEAD ZONE SETTING

In order to prevent continuous swings of the cooling or heating request near the regulation set-point, it is possible to configure a regulation dead zone which will deviate the regulation start point from the set-point. See the following chapters for further information.

With the "**Temperature dead zone**" parameter (Manufacturer Set-up - Dead zone configuration) it is possible to configure the temperature regulation dead zone.

This function is ideal for systems where the thermal loads are highly variable and there might be over-regulation near the set-points.

5.6.4 PROPORTIONAL TEMPERATURE REGULATION

With the "**Regulation type**" parameter (User Set-up - Temperature regulation) it is possible to configure the "**P**" (Proportional) regulation type for temperature control.

This type of regulation is ideal in cases where the "force" of actuators should be directly proportional to the "distance" of the regulation magnitude from the ideal setting (Set-point), with respect to the maximum setting that should be obtained (Proportional band).

This type of regulation will always tend to have a **fully operational regulation error**, i.e. a deviation of the temperature from the set-point. The width of the deviation will vary according to the correctness of the unit's sizing with respect to the system thermal load: the more over-sized the unit, the greater the deviation when fully operational.

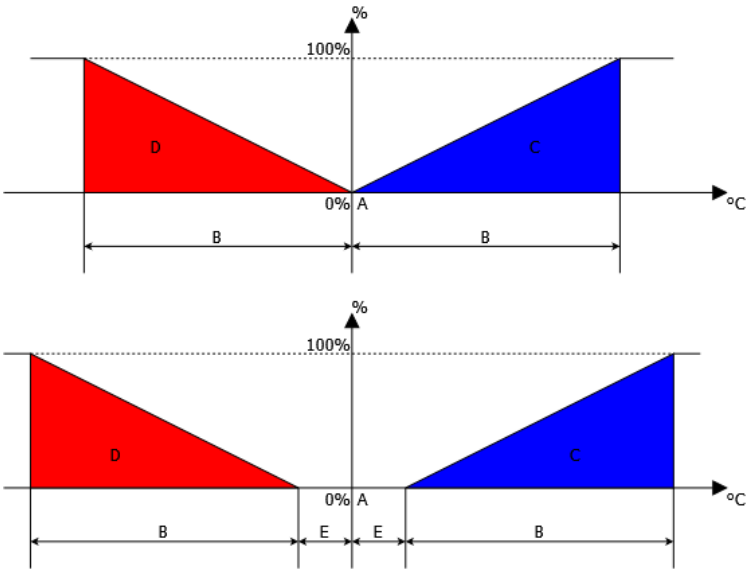
The control output of the components is therefore regulated according to the following function:

$$Out_p = \frac{100}{Bp} * (In - Set)$$

Where:

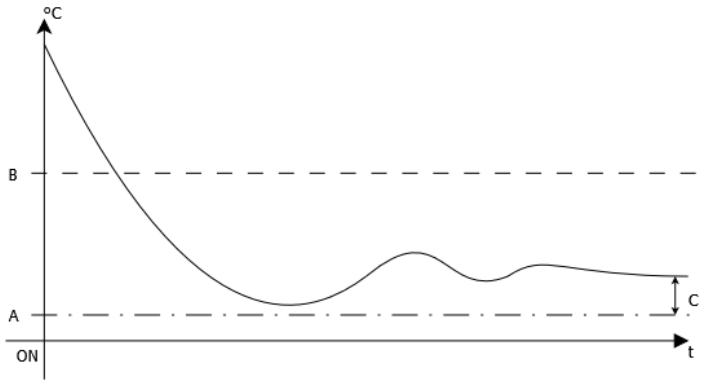
- **Bp** is the "**Proportional band**" parameter (User set-up - Temperature regulation)
- **In** is the controlled temperature value
- **Set** is the "**Temperature set-point**" parameter (Main menu - Set-point)

The following graph shows proportional regulation, with and without dead zone:



A **Temperatureset-point(Mainmenu-Set-point)**
B **Proportionalband(Userset-up-Temperature regulation)**
C **Cooling regulation**
D **Heating regulation**
E **Temperaturedeadzone(ManufacturerSet-up - Dead zone configuration)**

The following graph shows the system's response to Proportional regulation in cooling. The heating response will be the mirror opposite.



A **Temperatureset-point(Mainmenu-Set-point)**
B **Proportionalband(Userset-up-Temperature regulation)**
C **Fully operational regulation error**

5.6.5 PROPORTIONAL + INTEGRAL TEMPERATURE REGULATION

With the "**Regulation type**" parameter (User Set-up - Temperature regulation) it is possible to configure the "**PI**" (Proportional + Integral) regulation type for temperature control.

This type of regulation is ideal in cases where one wishes to reduce to the minimum the **Fully operational regulation error**, thus increasing regulation precision over time.

Proportional + Integral regulation adds to the "**Proportional error**" (previous chapter) the so-called "**Integral Error**", which allows the controller to retain the memory of past "**Proportional error**" values. This property gives "**PI**" regulation the ability to make the process as close as possible to the required point of reference.

The control output of the components is therefore regulated according to the following function:

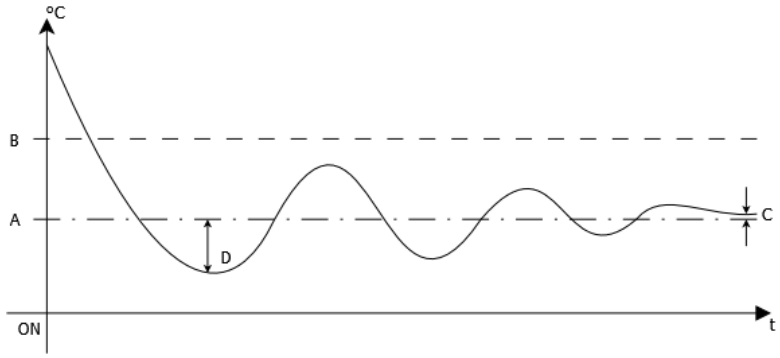
$$Out_{pi} = Out_p + \frac{100}{Bp * Ti} \int (In - Set)\, dt$$

Where:

- **Out_p** is the proportional error (previous chapter)
- **Bp** is the "**Proportional band**" parameter (User set-up - Temperature regulation)
- **Ti** is the "**Integration Time**" parameter (User set-up - Temperature regulation)
- **In** is the controlled temperature value
- **Set** is the "**Temperature set-point**" parameter (Main menu - Set-point)

Unlike Proportional regulation, whose control output will be at 0% upon reaching the Set-point, in Proportional + Integral regulation the control output will tend to be subject to **Over-regulation** due to integral action. Hence there may be **Out_{pi}** values higher than 0% even when the controlled value is lower than the Set-point. **Over-regulation** will tend to decrease over time until close to 0%.

The following graph shows the system's response to Proportional + Integral regulation in cooling. The heating response will be the mirror opposite.



A **Temperatureset-point(Mainmenu-Set-point)**
B **Proportionalband(Userset-up-Temperature regulation)**
C **Fully operational regulation error**
D **Over-regulation**

Regulation optimisation may require a certain amount of time since the system has to operate for at least 30 minutes to assure mathematical calculation is optimised. If, after 30 minutes have elapsed, the system still appears to be very unstable, the parameters will need to be changed again and tests be started again.

In order to reduce test times we suggest entering the following values:

- "**Proportional band**" parameter (User set-up - Temperature regulation): **10.0 °C**
- "**Integration Time**" parameter (User set-up - Temperature regulation): **180 s**

5.6.6 PROPORTIONAL + INTEGRAL + DERIVATIVE TEMPERATURE REGULATION

With the "**Regulation type**" parameter (User Set-up - Temperature regulation) it is possible to configure the "**PI**D" (Proportional + Integral + Derivative) regulation type for temperature control.

This type of regulation is ideal in cases where one wishes to reduce to the minimum the **Fully operational regulation error** and **Over-regulation,** thus making temperature control more stable and precise.

"PID" regulation adds to Proportional + Integral regulation the so-called "**Derivative error**", which makes it possible to take into account the "speed" with which the magnitude changes, and therefore to correct the control output more quickly.

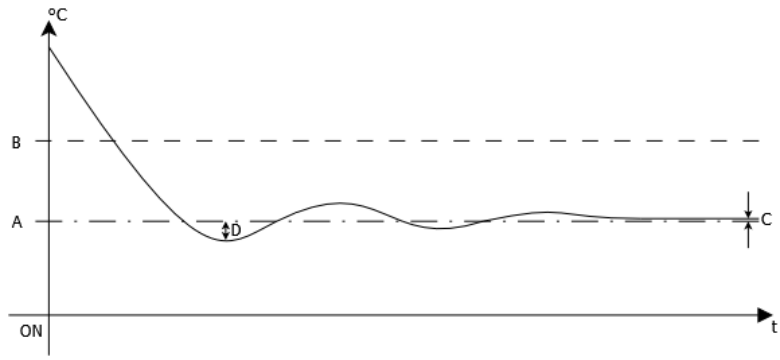
The control output of the components is therefore regulated according to the following function:

$$Out_{pid} = Out_p + Out_{pi} + \frac{100}{Bp} * Td \frac{d(In - Set)}{dt}$$

Where:

- **Out$_p$** is the proportional error (previous chapter)
- **Out$_{pi}$** is the proportional error (previous chapter)
- **Bp** is the "**Proportional band**" parameter (User set-up - Temperature regulation)
- **Td** is the "**Derivation Time**" parameter (User set-up - Temperature regulation)
- **In** is the controlled temperature value
- **Set** is the "**Temperature set-point**" parameter (Main menu - Set-point)

The following graph shows the system's response to Proportional + Integral + Derivative regulation in cooling. The heating response will be the mirror opposite.



A **Temperatureset-point(Mainmenu-Set-point)**
B **Proportionalband(Userset-up-Temperature regulation)**
C **Fully operational regulation error**
D **Over-regulation**

Regulation optimisation may require a certain amount of time since the system has to operate for at least 30 minutes to assure mathematical calculation is optimised. If, after 30 minutes have elapsed, the system still appears to be very unstable, the parameters will need to be changed again and tests be started again.

In order to reduce test times we suggest entering the following values:

- "**Proportional band**" parameter (User set-up - Temperature regulation): **40.0 °C**
- "**Integration Time**" parameter (User set-up - Temperature regulation): **60 s**
- "**Derivation Time**" parameter (User set-up - Temperature regulation): **1 s**

5.6.7 HIGH OR LOW TEMPERATURE ALARM

With parameters "**High temperature alarm offset**" (User set-up - Temperature regulation) and "**Low temperature alarm offset**" (User set-up - Temperature regulation) it is possible to configure two alarm thresholds for temperature control.

Exceeding these thresholds will trigger the "**High regulation temperature alarm** or the "**Low regulation temperature alarm"** to alert the operator to any problems.

High and low temperature alarm triggering is not a shutdown problem for the unit that will continue operating regularly. With the "**Temperature and humidity alarms delay**" parameter (Manufacturer Set-up - Alarms management configuration) it is possible to delay alarm triggering.

Alarm triggering is defined by the following formulas:

$$Al_{Ht} = In > Set + Offset_{Ht}$$

$$Al_{Lt} = In < Set - Offset_{Lt}$$

Where:

- **Al_{Ht}** is the high temperature alarm
- **Al_{Lt}** is the low temperature alarm
- **In** is the controlled temperature value
- **Set** is the "**Temperature set-point**" parameter (Main menu - Set-point)
- **$Offset_{Ht}$** is the "**High temperature alarm offset**" parameter (User set-up - Temperature regulation)
- **$Offset_{Lt}$** is the "**Low temperature alarm offset**" parameter (User set-up - Temperature regulation)

5.6.8 AIR TEMPERATURE PROBES ALARM MANAGEMENT

In the event the return temperature probe should be broken or disconnected SURVEY^{EVO} will trigger the "**Broken return temperature probe alarm**".

In the same way, in the event the supply temperature probe should be broken or disconnected SURVEY^{EVO} will trigger the "**Broken supply temperature probe alarm**".

In order not to interrupt temperature regulation, SURVEY^{EVO} will use the working sensor as valid value. In the event both probes should be broken, temperature regulation will be stopped.

5.7 LIMIT TEMPERATURE REGULATION

5.7.1 LIMIT TEMPERATURE

With the "**Regulation sensor**" parameter (User Set-up - Temperature regulation) it is possible to configure which probe is designated to temperature control. The probe not designated for regulation may be used in order to set a limit to regulation (limit temperature) to prevent system issues. Therefore:

- **Supply limit temperature:** In the event the return temperature should be controlled, limits for the supply temperature may be set in order to ensure the air let into the room is neither too hot or too cold.
- **Return limit temperature:** In the event the supply temperature should be controlled, limits for the return temperature may be set in order to ensure the air in the room is neither too hot or too cold.

5.7.2 HIGH AND LOW LIMIT TEMPERATURE MANAGEMENT

With parameters "**Limit temperature upper limit**" (User set-up - Limit temperature regulation) and "**Limit temperature lower limit**" (User set-up - Temperature regulation) it is possible to configure two alarm thresholds for the limit temperature.

Exceeding these thresholds will trigger the "**High limit temperature alarm**" or the "**Low limit temperature alarm"** to alert the operator to any problems.

High and low limit temperature alarm triggering is not a shutdown problem for the unit that will continue operating regularly. With the "**Temperature and humidity alarms delay**" parameter (Manufacturer Set-up - Alarms management configuration) it is possible to delay alarm triggering.

Alarm triggering is defined by the following formulas:

$$Al_{Hlt} = In > Limit_{Hlt}$$

$$Al_{Llt} = In < Limit_{Llt}$$

Where:

- **Al_{Hlt}** is the high limit temperature alarm
- **Al_{Llt}** is the low limit temperature alarm
- **In** is the limit temperature value
- **$Limit_{Hlt}$** is the "**Limit temperature upper limit**" parameter (User set-up - Limit temperature regulation)
- **$Limit_{Llt}$** is the "**Lower limit temperature limit**" parameter (User set-up - Limit temperature regulation)

In order to improve limit temperature management it is possible to actively intervene on regulation parts in various ways. With parameters "**High limit temperature management**" (User set-up - Limit temperature regulation) and "**Low limit temperature management**" (User set-up - Limit temperature regulation) it is possible to configure the following actions:

- **Alarm only:** Upon exceeding the thresholds a warning alarm is triggered.
- **Stop component**: Upon exceeding the thresholds the cold or hot component is disabled for the limit temperature to return within the alarm threshold. If the limit temperature remains over the thresholds a warning alarm is triggered.
- **Regulation reduction**: Upon exceeding the thresholds, the regulation signal of the regulation components is reduced proportionally to maintain the limit temperature below the alarm threshold. If the limit temperature remains over the thresholds a warning alarm is triggered.
- **Cold/hot activation**: When the alarm threshold is exceeded, the cold or hot component is activated proportionally to maintain the temperature below the alarm threshold. If the limit temperature remains over the thresholds a warning alarm is triggered.

5.8 HUMIDITY REGULATION

5.8.1 SUPPLY AND RETURN HUMIDITY PROBE CONFIGURATION

The units may be fitted with a return humidity probe, parameter "**Return humidity**" (Manufacturer set-up - Probe configuration), that lets you view the return air humidity reading.

The units may also be fitted with a supply humidity probe, parameter "**Supply humidity**" (Manufacturer set-up - Probe configuration), that lets you view the supply air humidity reading.

Humidity regulation will also take place on the return humidity value, which usually corresponds to that of the room to be controlled. The supply humidity value is only used as means to control the unit's operation status and cannot be used to control the components designated for humidification and dehumidification operations.

5.8.2 SETTING THE RETURN HUMIDITY SET-POINT LIMITS

Should it be required to limit the setting field of the humidity regulation set-point, it is possible to configure its minimum and maximum limit:

With the "**Minimum humidity set-point limit**" parameter (Manufacturer Set-up - Set-point limit configuration) it is possible to configure the minimum setting limit of the humidity set-point.

With the "**Maximum humidity set-point limit**" parameter (Manufacturer Set-up - Set-point limit configuration) it is possible to configure the maximum setting limit of the humidity set-point.

This function is ideal to prevent excessively high or low regulation values to be set, which might create problems in the system.

5.8.3 RETURN HUMIDITY REGULATION DEAD ZONE SETTING

In order to prevent continuous swings of the dehumidification and humidification request near the regulation set-point, it is possible to configure a regulation dead zone which will deviate the regulation start point from the set-point. See the following chapters for further information.

With the "**Humidity dead zone**" parameter (Manufacturer Set-up - Dead zone configuration) it is possible to configure the humidity regulation dead zone.

This function is ideal for systems where the thermal loads are highly variable and there might be over-regulation near the set-points.

5.8.4 RETURN HUMIDITY PROPORTIONAL REGULATION

With the "**Dehumidification**" parameter (Manufacturer Set-up - Humidity regulation configuration) it is possible to enable dehumidification operation. Dehumidification is regulated with the Proportional system.

The control output of the components is therefore regulated according to the following function:

$$Out_p = \frac{100}{Bp} * (In - Set)$$

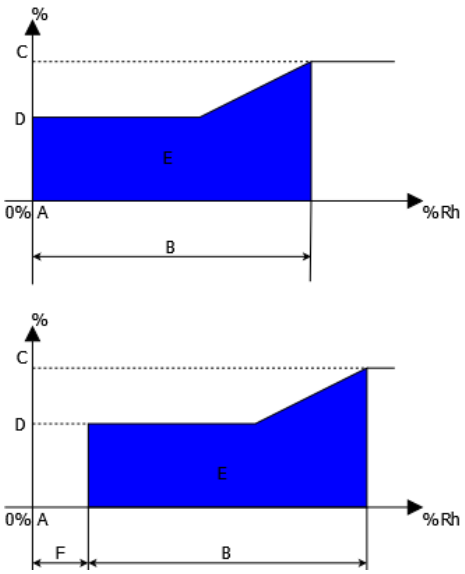
Where:

- **Bp** is the "**Proportional dehumidification band**" parameter (User set-up - Humidity regulation)
- **In** is the controlled humidity value
- **Set** is the "**Humidity set-point**" parameter (Main menu - Set-point)

Dehumidification is only activated when the control output reaches parameter "**Dehumidification trigger threshold**" (Manufacturer set-up - Humidity regulation configuration).

With parameter "**Minimum dehumidification limit**" (Manufacturer set-up - Humidity regulation configuration) it will be possible to limit regulation to prevent the request from being too low, and therefore dehumidification effect not being sufficient. This is because the dehumidification effect is only possible with a very low air temperature, therefore with very high cooling request.

The following graph shows proportional regulation, with and without dead zone:



A **Humidity set-point (Main menu - Set-point)**
B **Dehumidification proportional band (User set-up - Humidity regulation)**
C **Dehumidification trigger threshold (Manufacturer set-up - Humidity regulation configuration)**
D **Minimum dehumidification limit (Manufacturer set-up - Humidity regulation configuration)**
E **Cooling regulation**
F **Humidity dead zone (Manufacturer Set-up - Dead zone configuration)**

5.8.5 PARTIAL DEHUMIDIFICATION

With the "**Partial dehumidification**" parameter (Manufacturer Set-up - Humidity regulation configuration) it is possible to inhibit activation of both compressors in dehumidification operation.

This function is ideal in systems whose ambient thermal load and any unit heating triggering, is not enough to offset activation of both compressors, excessively cooling the room.

When this function is enabled the set-point might be reached in a longer time than with conventional regulation.

5.8.6 DEHUMIDIFICATION LOCK

With parameter "**Dehumidification lock offset**" (Manufacturer set-up - Humidity regulation configuration) it is possible to enter a temperature offset which, when exceeded, interrupts the dehumidification request to prevent ambient temperature from dropping too low.

This function is ideal in systems whose ambient thermal load and any unit heating triggering, is not enough to offset dehumidification activation, escessively cooling the room.

When this function is enabled the set-point might be reached in a longer time than with conventional regulation.

Dehumidification lock triggering is defined by the following formula:

$$Dh_{stop} = In < Set - Offset_{dh}$$

Where:

- **In** is the controlled temperature value
- **Set** is the "**Temperature set-point**" parameter (Main menu - Set-point)
- **Offset$_{dh}$** is the "**Dehumidification lock offset**" parameter (Manufacturer set-up - Humidity regulation set-up)

5.8.7 HUMIDIFIER PRESENCE SETTING

With the "**Humidifier**" parameter (Manufacturer Set-up - Humidity regulation configuration) it is possible to configure the presence of a humidification system for room humidification regulation.

The parameter makes it possible to select the following humidification regulation types:

1) **No:** There is no type of humidification regulation in the unit, hence it will be disabled.
2) **Internal (Modbus):** The unit features internal humidifier driven by CPY board. CPY board interfacing will take place with Modbus Master protocol.
3) **External (Analogue):** The unit or system features an external humidifier (not integrated with the controller). Humidifier interfacing will take place with 0-10 V analogue signal.

5.8.8 HUMIDIFICATION PRODUCTION PERCENTAGE

With the "**Humidification production percentage**" parameter (Manufacturer Set-up - Humidity regulation configuration) it is possible to configure the maximum limit of the humidifier control output, in order to reduce steam production.

This function is ideal in systems where maximum humidifier production is too high and there may be steam over-production issues and possible formation of condensate inside the unit.

5.8.9 STEAM PRODUCTION DURING COOLING

With the "**Joint humidification and cooling**" parameter (Manufacturer Set-up - Humidity regulation configuration) it is possible to enable steam production at the same time as cooling.

During cooling, steam production should normally be stopped in order to prevent formation of condensate inside the unit, owing to low air temperature.

This function makes it possible, in systems where steam production is required even during cooling (areas with very cold climate), to prevent issues due to a drastic drop in ambient humidity.

This function is not recommended in direct expansion units, as the supply air temperature may be very low and lead to condensate formation.

5.8.10 RETURN HUMIDIFICATION PROPORTIONAL REGULATION

With the "**Enable humidification**" parameter (User Set-up - Humidifier regulation) it is possible to enable humidification operation. Humidification is regulated with the Proportional system.

Proportional humidification regulation offers a modulation effect of the amount of steam produced by the humidification system.

In the case of the integrated humidifier regulation may vary from 8% to 100% of total production. Below 8% of the control output steam production might not be linear.

For humidification systems other than integrated humidifier, please refer to their features with regards to steam production linearity.

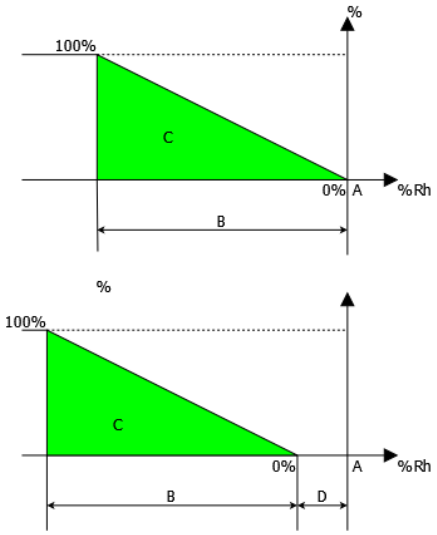
The control output of the components is therefore regulated according to the following function:

$$Out_p = \frac{100}{Bp} * (In - Set)$$

Where:

- **Bp** is the "**Proportional humidification band**" parameter (User set-up - Humidity regulation)
- **In** is the controlled humidity value
- **Set** is the "**Humidity set-point**" parameter (Main menu - Set-point)

The following graph shows proportional regulation, with and without dead zone:



A **Humidity set-point (Main menu - Set-point)**
B **Humidification proportional band (User set-up - Humidity regulation)**
C **Humidification regulation**
D **Humidity dead zone (Manufacturer Set-up - Dead zone configuration)**

5.8.11 MANUAL HUMIDIFIER WATER DRAIN

In order to carry out routine humidifier maintenance, it might be required to force emptying water from the cylinder.

With the "**Manual drain**" parameter (User Set-up - Humidifier regulation) it is possible to manually drain water from the steam cylinder to remove it for maintenance.

5.8.12 LINES AND HUMIDIFIER CYLINDER PRE-WASHING MANAGEMENT

The pre-washing function allows cleaning the cylinder and water lines, in particular after having carried out the hydraulic connections and/or replaced the cylinder. During washing, the cylinder is filled (with closed contactor) and emptied 3 times to remove any impurities present inside the cylinder and the pipes.

With the "**Cylinder pre-washing**" parameter (User Set-up - Humidifier regulation) it is possible to enable the pre-washing function.

The humidifier will automatically go back to normal operation at the end of the pre-washing function.

5.8.13 HIGH AND LOW RETURN AND SUPPLY HUMIDITY ALARMS

With parameters "**High return humidity alarm offset**" (User set-up - Humidity regulation) and "**Low return humidity alarm offset**" (User set-up - Humidity regulation) it is possible to configure two alarm thresholds for humidity control.

Exceeding these thresholds will trigger the "**High return humidity alarm**" or the "**Low return humidity alarm"** to alert the operator to any problems.

In units with supply humidity probe, with parameters "**Upper supply humidity limit**" (User set-up - Humidity regulation) and "**Lower supply humidity limit**" (User set-up - Humidity regulation) it is possible to configure two alarm thresholds for supply humidity.

Exceeding these thresholds will trigger the "**High supply humidity alarm**" or the "**Low supply humidity alarm"** to alert the operator to any problems.

High and low humidity alarm triggering is not a shutdown problem for the unit that will continue operating regularly. With the "**Temperature and humidity alarms delay**" parameter (Manufacturer Set-up - Alarms management configuration) it is possible to delay alarm triggering.

Alarm triggering is defined by the following formulas:

$$Al_{Hh} = In > Set + Offset_{Hh}$$

$$Al_{Lh} = In < Set - Offset_{Lh}$$

$$Al_{Hsh} = In > Limit_{Hsh}$$

$$Al_{Lsh} = In < Limit_{Lsh}$$

Where:

- **Al_{Hh}** is the high return humidity alarm
- **Al_{Lh}** is the low return humidity alarm
- **Al_{Hsh}** is the high supply humidity alarm
- **Al_{Lsh}** is the low supply humidity alarm
- **In** is the return humidity value
- **Set** is the "**Humidity set-point**" parameter (Main menu - Set-point)
- **$Offset_{Hh}$** is the "**High return humidity alarm offset**" parameter (User set-up - Humidity regulation)
- **$Offset_{Lh}$** is the "**Low return humidity alarm offset**" parameter (User set-up - Humidity regulation)
- **$Limit_{Hsh}$** is the "**Upper supply humidity limit**" parameter (User set-up - Humidity regulation)
- **$Limit_{Lsh}$** is the "**Lower supply humidity limit**" parameter (User set-up - Humidity regulation)

5.8.14 AIR HUMIDITY PROBES ALARM MANAGEMENT

In the event the return humidity probe should be broken or disconnected SURVEY^{EVO} will trigger the "**Broken return humidity probe alarm**". In the same way, in the event the supply humidity probe should be broken or disconnected SURVEY^{EVO} will trigger the "**Broken supply humidity probe alarm**".

The return humidity probe alarm stops humidity regulation, whereas the supply probe has no effects on regulation.

5.8.15 HUMIDIFIER ALARM MANAGEMENT

The CPY humidifier board controls the internal humidifier's alarm detection. With the Modbus Master protocol SURVEY^{EVO} receives the humidifier's alarm statuses, triggering the "**Internal humidifier alarm**" and providing the type of extant alarm. See the chapter on alarm management for further information.

With the "**Configurable output (1-2-3-4)**" parameter (Manufacturer Set-up - digital output configuration) it is possible to configure one of the four digital outputs in order to provide the "**General external humidifier alarm**".

Both alarms stop humidifier regulation.

5.9 DIRECT EXPANSION UNIT REGULATION

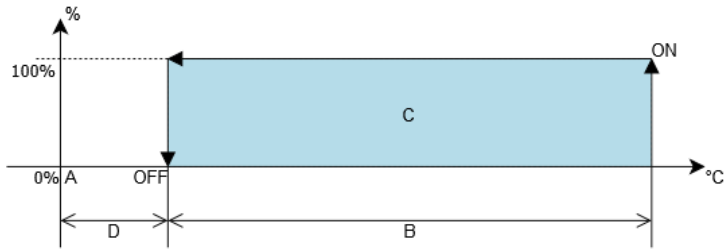
With the "**Machine type configuration**" parameter (Manufacturer Set-up - Machine type configuration) it is possible to configure the type of temperature regulation with direct expansion system (**Direct Expansion**).

Direct expansion units exploit the properties of refrigerant gas R410a to cool air. The main regulation components of direct expansion units is the compressor (or compressors in the event of multi-circuit units).

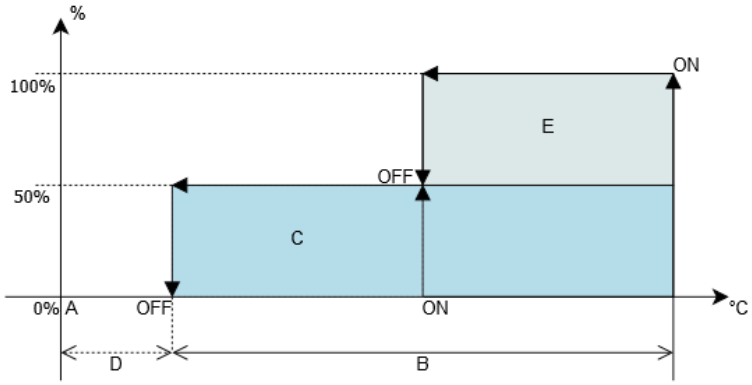
5.9.1 MANAGEMENT OF NON REGULATED COMPRESSORS

SURVEY^{EVO} is able to control up to 2 compressors on 2 separate cooling circuits. The following pictures show the start-up diagram of the compressors with Proportional temperature regulation:

With the "**Number of compressors**" parameter (Manufacturer Set-up - Direct expansion configuration) it is possible to configure the number of compressors installed in the unit.



Regulation with 1 compressor



Regulation with 2 compressors

A Temperatureset-point(Mainmenu-Set-point)
B Proportionalband(Userset-up-Temperature regulation)
C Compressor 1
D Temperaturedeadzone(ManufacturerSet-up - Dead zone configuration)
E Compressor 2

5.9.2 AUTOMATIC NON REGULATED COMPRESSOR ROTATION

With the "**Type of compressor rotation**" parameter (Manufacturer Set-up - Direct expansion configuration) it is possible to configure the rotation type of non-regulated compressors.

Rotation of non-regulated compressors makes it possible to choose the compressor actuation logic in order to balance the hours of compressor operation as much as possible. Two different types of rotation can be set:

- **FIFO + HS: FIFO** (First In - First Out) rotation ensures the first compressor to switch on is always the first to switch off. The first compressor to be switched on is defined with **HS** logic (Hours and Start-up). **HS** logic takes into account both operating hours and the number of start-ups of the compressors The compressor with the lowest number of operating hours + start-ups will be started first.

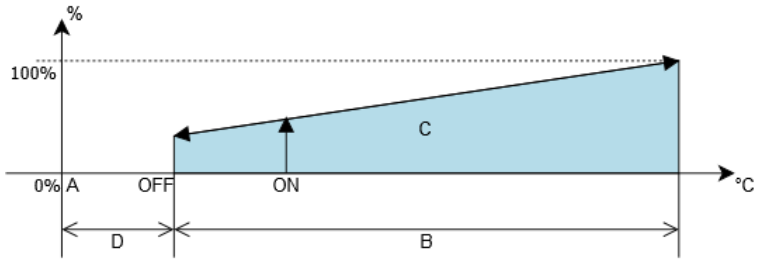
- **LIFO + HS: LIFO** (Last In - First Out) rotation ensures the last compressor to switch on is always the first to switch off. The first compressor to be switched on is defined with **HS** logic (Hours and Start-up). **HS** logic takes into account both operating hours and the number of start-ups of the compressors The compressor with the lowest number of operating hours + start-ups will be started first.

5.9.3 COMPRESSOR MANAGAMENT WITH INVERTER REGULATION

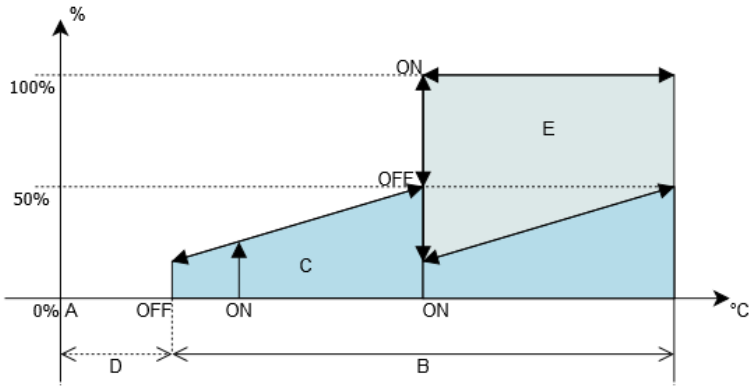
With the "**Enable compressor inverter**" parameter (Manufacturer Set-up - Direct expansion configuration) it is possible to configure the regulation type of inverter compressors. Two different types of regulation can be set:

1) **No:** There is no type of compressor regulation in the unit, hence it will be disabled.
2) **Internal (Modbus):** The unit features internal inverter interfaced by Modbus Master protocol.
3) **External (Analogue):** The unit or system features an external inverter (not integrated with the controller). Inverter interfacing will take place with 0-10 V analogue signal.

The inverter compressor will always be installed on **Circuit 1**, therefore in case of regulation with 2 compressors rotation will be disabled. The following pictures show the start-up diagram of the compressors with Proportional temperature regulation:



Regulation with 1 compressor



Regulation with 2 compressors

A **Temperatureset-point(Mainmenu-Set-point)**
B **Proportionalband(Userset-up-Temperature regulation)**
C **Compressor 1**
D **Temperaturedeadzone(ManufacturerSet-up - Dead zone configuration)**
E **Compressor 2**

5.9.4 SUPERHEATING REGULATION WITH ELECTRONIC EXPANSION VALVE

Optimal operation of cooling circuits is mainly connected to refrigerant **Superheating** value regulation on evaporator outlet. **Superheating - SH** refers to the **difference between evaporation temperature and suction temperature of the compressor**.

Correct **Superheat - SH** value not only assures the compressor is protected from damage due to sudden liquid refrigerant backflow, but also ensures the compressor always operates at the best possible condition, reducing the electrical current absorbed by the compressor motor.

In order to achieve optimal of **Superheat - SH** regulation all direct expansion units are fitted with **Electronic expansion valve EEV**, whose positioning precision assures constant modulation of the refrigerant flow into the evaporation coil.

Valve modulation is controlled by the EVDrive control module through a specific algorithm. **Superheating - SH** value is calculated through the readings transmitted by the probes installed on the suction section of the compressor. Two probes are used for calculation:

- **Suction pressure probe:** This probe detects pressure of the evaporation coil, through which it is possible to calculate the **evaporation temperature**.
- **Suction temperature probe:** This probe detects compressor suction temperature.

The **Superheating** (**SH**) value is compared with the **superheating set-point** (6.0 K) and the valve opening percentage is calculated, with a PID algorithm, to maintain **Superheating** (**SH**) constant near the set-point.

The EVDrive control module**,** in addition to superheating regulation, is also able to control some safety algorithms required to protect the compressor. These algorithms will be explained in the following chapters.

5.9.5 CONDENSATION PRESSURE AND TEMPERATURE DETECTION

The condensation pressure and temperature reading is indispensable for cooling circuit operation. Using a pressure sensor, the SURVEY^{EVO} microprocessor constantly detects the condensation pressure value and calculates the equivalent temperature.

5.9.6 LIQUID TEMPERATURE DETECTION AND SUB-COOLING

For optimal operation of cooling circuits the liquid refrigerant flowing into the EEV valve must have optimal **Subcooling - SC. Subcooling** refers to the **difference between the condensation temperature and the liquid refrigerant temperature**. The SURVEY^{EVO} microprocessor constantly detects the liquid refrigerant value and calculates the subcooling value.

5.9.7 DE-SUPERHEATING MANAGEMENT

De-superheat - DSH refers to the **difference between compressor drain temperature and compressor condensation temperature**.

In a correctly operating unit the de-superheat value should be between 20.0 K and 30.0 K. SURVEY^{EVO} constantly monitors the de-superheat value and implements the following regulations:

- **In the event de-superheat should be lower than 20 K liquid may flow back to the compressor.** To counter this phenomenon the superheating set-point will be raised up to 12.0 K.
- **In the event de-superheat should be higher than 30 K there is no liquid backflow risk.** Therefore, in view of the "favourable" condition in relation to compressor safety, it is possible to reduce the superheat set-point to increase system efficiency (condensation pressure decrease and evaporation pressure increase) up to minimum 5.0 K.

5.9.8 CONTROL OF EARLY VALVE OPENING UPON COMPRESSOR START-UP

In order to reduce compressor load upon start-up (ΔP between suction and supply), and consequently electrical motor breakaway, the expansion valve control driver manages an early valve opening algorithm.

In the event of compressor start-up request, the expansion valve will open at 100% for 5 seconds in order to balance circuit pressures, after which the compressor will be started.

5.9.9 LOW SUPERHEAT (LoSH) MANAGEMENT

A **Low Superheat - LoSH** figure may indicate a less than optimal operating condition, which might lead to liquid flowing back to the compressor.

The expansion valve control driver manages an algorithm to monitor low superheat. In the event the superheat pressure figure should exceed the limit figure of **3.0 K**, low superheat status will be displayed on the controller.

5.9.10 HIGH SUPERHEAT (HiSH) MANAGEMENT

A **High Superheat - HiSH** figure may indicate poor refrigerant charge, which does not allow optimal regulation of the **Superheat value** (**SH**).

The expansion valve control driver manages an algorithm to monitor high superheat. In the event the superheat pressure figure should exceed the limit figure of **15.0 K**, high superheat status will be displayed on the controller.

5.9.11 HIGH COMPRESSOR EVAPORATION PRESSURE MANAGEMENT (MOP)

Scroll compressors installed in the units entail the need to work at evaporation pressures that do not exceed the figures set by the manufacturer. Exceeding the constructive limit may involve mechanical damage to the compressor.

In order to protect the compressor, the expansion valve control driver manages an algorithm for high evaporation pressure regulation (**Maximum Operating Pressure - MOP**).

Should the evaporation pressure reading exceed the limit of **10.5 Barg (12.0 °C)**, the Superheat set-point (see previous chapters) will be raised in order to reduce valve opening and consequently evaporation pressure. After restoring an acceptable evaporation pressure figure, the control algorithm will go back to regulating the valve normally.

5.9.12 LOW COMPRESSOR EVAPORATION PRESSURE MANAGEMENT (LOP)

Scroll compressors installed in the units entail the need to work at evaporation pressures that do not exceed the figures set by the manufacturer. Exceeding the constructive limit may involve mechanical damage to the compressor.

In order to protect the compressor, the expansion valve control driver manages an algorithm for low evaporation pressure regulation (**Low Operating Pressure - LOP**).

Should the evaporation pressure reading exceed the limit of **6.2 Barg (-3 °C)**, valve opening will be forced to the current figure to stop the pressure from continuing to go down, triggering a low pressure alarm. After restoring an acceptable evaporation pressure figure, the control algorithm will go back to regulating the valve normally.

5.9.13 LOW EVAPORATION PRESSURE ALARM

Suction pressure below the standard readings involves a work overload for the compressor. The refrigerant will be highly superheated on evaporator outflow and will reach the compressor at a temperature above its standard figure. This causes abnormal overheating of the motor coils in particular, and of the compressor's mechanical parts in general.

In order to improve compressor protection, SURVEY^{EVO} constantly monitors evaporation pressure. Should the evaporation pressure reading go below **4 Barg (- 14.0 °C)**, the compressor will be stopped to prevent damaging it and the "**Low compressor pressure alarm (1-2)**" will be triggered.

Low outside air temperature might lead to the refrigerant migrating into the condenser. This phenomenon would result in a low pressure condition during the first few minutes of compressor operation.

In order to prevent false alarms, in conditions of low outside temperature, the low pressure alarm is delayed upon compressor start-up. With the "**Low compressor pressure alarm delay**" parameter (Manufacturer Set-up - Alarms management configuration) it is possible to delay alarm triggering.

5.9.14 HIGH COMPRESSOR

High discharge temperature of the compressor might give rise to several problems with the compressor and cooling circuit. In order to improve compressor protection, all units are fitted with a compressor discharge temperature probe installed on every circuit. This probe has the purpose of ensuring the discharge temperature does not exceed the compressor's damage threshold.

Discharge temperature is managed through two different trigger thresholds:

1) **Discharge temperature protection threshold (110.0 °C):** Should the discharge temperature exceed this threshold, the compressor request would be reduced in order to maintain the temperature below this threshold. No alarm is triggered by the controller and the unit continues operating regularly. This option is only valid for compressors controlled by inverter.

2) **Discharge temperature alarm threshold (115.0°C):** Should the discharge temperature exceed this threshold, the compressor would be immediately stopped with the "**High compressor discharge temperature alarm (1-2)**".

In order to prevent false alarms in transient situations, the high discharge temperature alarm is delayed. With the "**High compressor discharge temperature alarm delay**" parameter (Manufacturer Set-up - Alarms management configuration) it is possible to delay alarm triggering.

5.9.15 FAILED COMPRESSION COMPRESSOR ALARM

Excessively small compression ratio, i.e. the ratio between circuit pressures (Condensation pressure/Evaporation pressure) indicates that the compressor is not correctly compressing the refrigerant. Possible causes are mechanical rupture of the compressor, incorrect compressor direction of rotation or incorrect operating condition.

In order to improve compressor protection, SURVEY^{EVO} constantly monitors pressure ratio (Condensation pressure/Evaporation pressure). Should the pressure difference be less than **2.0 Barg**, the compressor will be stopped and the "**Low compression compressor alarm (1-2)**".

5.9.16 HIGH CONDENSATION PRESSURE ALARM

Condensation pressure above the standard readings involves a work overload for the compressor. Its absorption will tend to rise, with the risk to damage the motor. Furthermore, as the pressure rises so does the risk of damaging the cooling circuit components, due to the high pressure.

In order to improve compressor protection, SURVEY^{EVO} constantly monitors condensation pressure. A manual reset pressure sensor is installed on the circuit and will open the digital input to lock the compressor in the event of high pressure, triggering the "**High compressor pressure alarm (1-2)**".

5.9.17 COMPRESSOR THERMAL MAGNETIC PROTECTION ALARM

All compressors are electrical fixtures and are therefore protected by thermal magnetic switches in order to preserve the motor and the power line in the event of electrical motor short circuit and overload.

In the event of failure, the thermal magnetic switch will break the power line and open the digital alarm input, triggering the "**Compressor thermal magnetic protection alarm (1-2)**".

5.9.18 ELECTRONIC VALVE ALARM MANAGEMENT

The EVDrive valves regulation driver manages all alarms concerning electronic valves triggering the "**Compressor electronic expansion valve alarm (1-2)**". Driver alarms stop cooling circuit operation. Below is the list of valve alarms:

- **Communication failure:** the alarm indicates failed communication with the SURVEY^{EVO} regulator.
- **Evaporation pressure probe alarm:** In the event the evaporation pressure probe should be broken or disconnected, the driver will signal the fault to the SURVEY^{EVO}.
- **Condensation pressure probe alarm:** In the event the condensation pressure probe should be broken or disconnected, the driver will signal the fault to the SURVEY^{EVO}.
- **Suction temperature probe alarm:** In the event the suction temperature probe should be broken or disconnected, the driver will signal the fault to the SURVEY^{EVO}.
- **Discharge temperature probe alarm:** In the event the discharge temperature probe should be broken or disconnected, the driver will signal the fault to the SURVEY^{EVO}.

5.9.19 LIQUID TEMPERATURE PROBE ALARM MANAGEMENT

The SURVEY^{EVO} microprocessor constantly monitors the liquid temperature probe status, triggering the "**Liquid temperature probe alarm (1-2)**".

The broken liquid temperature probe alarm does not stop compressor operation.

5.9.20 COMPRESSOR INVERTER ALARM MANAGEMENT

With the Modbus Master protocol SURVEY^{EVO} receives the compressor inverter's alarm statuses, triggering the "**Compressor inverter alarm**" and providing the type of extant alarm. See the chapter on alarm management for further information.

In the event of external inverter, the alarm must be connected to the digital input dedicated to compressor thermal protection (See previous chapter).

5.9.21 COMPRESSOR ALARM SEVERITY MANAGEMENT

With parameter "**Compressor alarm severity**" (Manufacturer set-up - Alarm management configuration) it is possible to define whether the compressor alarms should stop the unit or not.

If configured as **CRITICAL**, one or more triggered alarms of the compressor, or a cooling circuit component, will stop the unit for critical alarm. In case of unit with 2 circuits, both must be in alarm status for the unit to stop.

If configured as **NON CRITICAL**, one or more triggered alarms of the compressor, or a cooling circuit component, will not stop the unit but only the compressor.

5.10 CONDENSER REGULATION

With parameter "**Condenser regulation**" (Manufacturer set-up - Condenser regulation configuration) it is possible to configure the type of condenser regulation of direct expansion units. The following types of regulation can be selected:

1) **No:** There is no type of condenser regulation in the unit, hence it will be disabled.
2) **Proportional:** The condensers will be regulated with a proportional system through a 0-10 V signal.
3) **AutoSet-point:** The condensers will be regulated with a proportional system through a 0-10 V signal. The regulation set-point will be calculated automatically based on operating conditions (see following chapters).

5.10.1 CONDENSERS PROPORTIONAL REGULATION

To avoid condensation temperature over-regulation issues, the condenser is only regulated with compressor on.

The control output of the condensers is therefore regulated according to the following function:

$$Out_p = \frac{100}{Bp} * (In - Set)$$

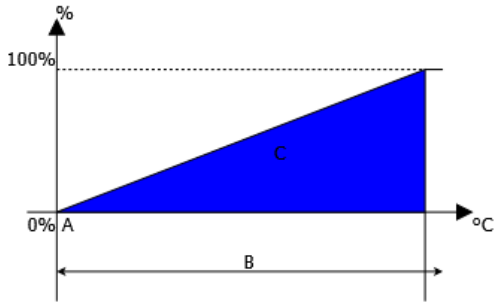
Where:

- **Bp** the "**Proportional condensation band**" parameter (User set-up - Condenser regulation)
- **In** is the condensation temperature value
- **Set** is the "**Condensation set-point** " parameter (User set-up - Condenser regulation)

With parameter "**Minimum condensation request**" (Manufacturer set-up - Condensation regulation configuration) it is possible to configure the minimum operating request at which the condenser may be regulated.

With parameter "**Maximum condensation request**" (Manufacturer set-up - Condensation regulation configuration) it is possible to configure the maximum operating request at which the condenser may be regulated.

The following graph shows proportional regulation:



A **Condensation set-point (User set-up - Condenser regulation)**
B **Condensationproportionalband(Userset-up - Condenser regulation)**
C **Condenser regulation**

5.10.2 CONDENSER REGULATION WITH AUTOSET-POINT

Low condensation temperature makes it possible to achieve compressor energy savings. If condensation temperature regulation is tied to outdoor temperature (e.g. Air or water condensers with dry cooler), during the cold season it is possible to reduce the regulation set-point in order to increase energy savings.

Through condenser regulation with **AutoSet-point** it is possible, with a suitable algorithm, to achieve the best possible regulation set-point for the condensers' operating conditions.

For optimal AutoSet-point system regulation it is recommended to set parameter "**Condensation set-point**" (User set-up - Condenser regulation) at the minimum value at which one wishes the condensers to work (e.g. 35°C).

The set-point is regulated in the following manner:

- **LOW OUTDOORS TEMPERATURE CONDITIONS:** As long as outdoor air (or water) temperature is such that condensation temperature remains within the zone defined by parameter "**Condensation set-point**" (User set-up - Condenser regulation) + parameter "**Condensation proportional band**" (User set-up - Condenser regulation), regulation type is proportional (see previous chapter).

- **INCREASE IN THE OUTDOOR TEMPERATURE:** Upon increase in outdoor air (or water) temperature, condensation temperature also starts increasing. Upon achieving 100% of the demand, a timer will be started. As soon as the timer exceeds parameter "**AutoSet-point time**" (Manufacturer set-up - Condenser regulation configuration), parameter "**Condensation set-point**" (User set-up - Condenser regulation) will be added to parameter "**Condensation set-point increase**" (User set-up - Condenser regulation). The set-point will be increased until the temperature falls within the new regulation range, up to the maximum equalling parameter "**Maximum condensation set-point**" (User set-up – Condensers regulation).

- **REGULATION WITH RAISED SET-POINT:** For as long as the set-point is increased, the condensation request will be forced to a minimum value equalling parameter "**Minimum AutoSet-point request**" (Manufacturer set-up - Condensers regulation configuration). This stops the condensation temperature value from being affected if the set-point is reached.

- **DROP IN OUTDOOR TEMPERATURE:** With a drop in the outdoor air temperature, the condensation temperature tends to fall below the changed set-point. In this case, a timer will start as soon as the condensation temperature is outside of the regulation range. As soon as parameter "**AutoSet-point time**" is exceeded (Manufacturer set-up - Condensers regulation configuration), parameter "**Condensation Set-point increase**" (User set-up – Condensers regulation) will be subtracted from the modified set-point. The set-point will decrease until the temperature falls within the regulation range, or until it reaches the parameter "**Condensation set-point**" (User setup – Condensers regulation).

5.10.3 START-UP REQUEST MANAGEMENT

In order to improve condenser regulation it is possible to configure a start-up period. During the set start-up period regulation will be overridden at start-up request. At the end of the start-up time regulation will go back to normal proportional operation.

With parameter "**Condensation start-up request**" (Manufacturer set-up - Condensation regulation configuration) it is possible to configure the request at which the condenser will be regulated during the start-up period.

With the "**Condensation start-up time**" parameter (Manufacturer Set-up - Condensation regulation configuration) it is possible to configure the duration of the condensation regulation start-up period.

This function is optimal to reach more quickly the work condition at the unit's start, with no need to wait for the modulation period required for reaching the set-point.

5.10.4 CONDENSER REGULATION MANAGEMENT WITH BROKEN PROBE

In order not to interrupt condenser regulation, in the event of breakdown of the condensation pressure sensor it is possible to override the request at a pre-set value.

With parameter "**Override with probe error**" (Manufacturer Set-up - Condensation regulation configuration) it is possible to configure the percentage at which the request will be overridden with "**Condensation pressure sensor alarm**".

5.10.5 CONDENSER ALARM MANAGEMENT

In order to detect any issues to do with the condensers, it is possible to configure a digital input as condenser alarm.

With the "**Configurable input (1-2-3-4)**" parameter (Manufacturer Set-up - Digital input configuration) it is possible to configure one of the four digital inputs in order to detect the condenser 1 or 2 alarm.

When configured, the digital input opening will trigger the "**General condenser alarm (1-2)**" which will stop regulation of the condensers and compressors connected to them.

Depending on the setting of parameter "**Compressor alarms severity**" (Manufacturer Set-up - Alarm management configuration), triggering may also stop the unit.

5.11 EVAPORATING UNIT REGULATION FOR CONNECTION TO REMOTE CONDENSING UNIT

With the "**Machine type configuration**" parameter (Manufacturer Set-up - Machine type configuration) it is possible to configure the type of temperature regulation with direct expansion system for connection to remote condensing unit (**Evaporator**).

The units for connection to remote condensing units are supplied without compressors and without expansion valve, as these components are installed in the condensing unit.

5.11.1 CONFIGURATION FOR OPERATION WITH REMOTE CONDENSING UNIT

In order to assure system operation with remote condensing unit the unit's control outputs must be configured.

With the "**Configurable output (1-2-3-4)**" parameter (Manufacturer Set-up - Digital output configuration) it is possible to configure one of the four digital outputs in order to provide the condensing unit start up contact.

The 0-10 V modulating cooling request regulation output (AO 2 - External inverter) will make it possible to drive a condensing unit with inverter compressor.

The cooling request will take place in the manner detailed in the previous chapters (Direct expansion).

5.11.2 CONDENSING UNIT ALARM MANAGEMENT

In order to supply the unit with information on the condensing unit's status, it is possible to configure a digital input as general condensing unit alarm.

With the "**Configurable input (1-2-3-4)**" parameter (Manufacturer Set-up - Digital input configuration) it is possible to configure one of the four digital inputs in order to detect the condensing unit alarm.

When configured, digital input opening will trigger the "**General condensing unit alarm**" which will stop condensing unit regulation.

Depending on the setting of parameter "**Compressor alarms severity**" (Manufacturer Set-up - Alarm management configuration), triggering the alarm may also stop the unit.

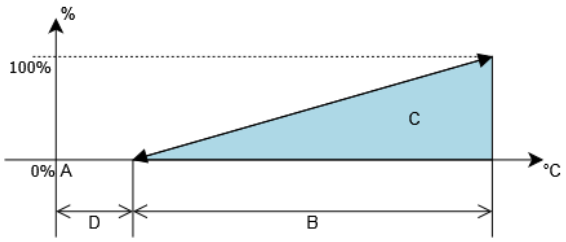
5.12 CHILLED WATER UNITS REGULATION

With the "**Machine type configuration**" parameter (Manufacturer Set-up - Machine type configuration) it is possible to configure the type of temperature regulation with chilled water system (**Chilled water**).

Chilled water units use a water system for temperature regulation. The unit's cooling power is modulated by regulating a valve with 0-10 V control signal.

5.12.1 CHILLED WATER CIRCUIT MANAGEMENT

SURVEY^{EVO} is able to manage a maximum of one water circuit with regulation via 0-10 V control signal. The following pictures show the valve control diagram with Proportional temperature regulation:



A **Temperatureset-point(Mainmenu-Set-point)**
B **Proportionalband(Userset-up-Temperature regulation)**
C **Valve Regulation**
D **Temperaturedeadzone(ManufacturerSet-up - Dead zone configuration)**

5.12.2 WATER CIRCUIT TEMPERATURE DETECTION

Through installation of two temperature probes, SURVEY^{EVO} is able to detect the water circuit inlet and outlet water temperatures.

With parameter "**IN / Free cooling water temperature**" (Manufacturer set-up - Probe configuration) it is possible to configure the water detection probe on water circuit inlet.

With parameter "**OUT water temperature**" (Manufacturer set-up - Probe configuration) it is possible to configure the water detection probe on water circuit outlet.

5.12.3 WATER CIRCUIT FLOW RATE DETECTION

By installing a water flow rate measurement device, SURVEY^{EVO} is able to detect instantaneous water flow rate on water circuit outlet.

With parameter "**Water flow rate sensor 1**" (Manufacturer set-up - Probe configuration) it is possible to configure the water flow rate detection sensor on water circuit outlet.

In case of very large water circuits, water flow rate is measured with the installation of two water flow rate measuring devices, in this case parameter "**Water flow rate sensor 2**" (Manufacturer set-up - Probe configuration) also needs to be enabled. Water flow rate will be the result of the sum of both sensors' flow rates.

With parameter "**Water flow rate sensor diameter**" (Manufacturer set-up - Chilled water configuration) it is possible to configure the type of water flow rate detection sensor installed in the water circuit.

5.12.4 CALCULATION OF TOTAL COOLING CAPACITY OF THE WATER CIRCUIT AND UNIT EER

In the event both the water temperature probes and the water flow sensor should be installed in the unit, SURVEY^{EVO} will be able to calculate the **ΔT water** value and the total cooling capacity value of the water circuit in kW.

By reading the electrical power absorbed by the fans, SURVEY^{EVO} is also able to provide the **EER** (**Energy Efficiency Ratio**) reading

5.12.5 INDEPENDENT PRESSURE WATER CIRCUIT FLOW RATE MANAGEMENT

Via the water flow rate meter, SURVEY^{EVO} is able to ensure the water circuit flow rate does not exceed the unit's nominal one. This type of control makes it possible to avoid excessive water flow rate which might cause issues with valves operation.

With parameter "**Enable water flow rate regulation**" (Manufacturer set-up - Chilled water configuration) it is possible to enable the unit's water flow rate regulation.

With enabled flow rate regulation, SURVEY^{EVO} will compare the current flow rate value with parameter "**Water flow rate set-point**" (Manufacturer set-up - Chilled water configuration). Should the water flow rate exceed the set-point, regulation will reduce valve opening to bring water flow rate back within normal operation figures.

With parameters "**Water proportional band**" (Manufacturer set-up - Chilled water configuration), "**Water Integration time**" (Manufacturer set-up - Chilled water configuration) and "**Water derivation time**" (Manufacturer set-up - Chilled water configuration) it is possible to regulate the water flow rate regulation response speed.

5.12.6 WATER TEMPERATURE AND FLOW RATE PROBES ALARMS MANAGEMENT

In the event the inlet water temperature probe should be broken or disconnected SURVEY^{EVO} will trigger the "**Broken IN / Free cooling water temperature probe alarm**".

In the event the outlet water temperature probe should be broken or disconnected SURVEY^{EVO} will trigger the "**Broken OUT water temperature probe alarm**".

In the event the water flow rate sensor 1 should be broken or disconnected SURVEY^{EVO} will trigger the "**Broken water flow rate sensor 1 alarm**".

In the event the water flow rate sensor 2 should be broken or disconnected SURVEY^{EVO} will trigger the "**Broken water flow rate sensor 2 alarm**".

These alarms stop cooling capacity and EER calculation and water flow rate regulation, if enabled.

5.13 FREE COOLING UNIT CONTROL

With the "**Machine type configuration**" parameter (Manufacturer Set-up - Machine type configuration) it is possible to configure the type of temperature regulation with water or air free cooling system (**Free Cooling**).

The units with free cooling system use outdoor air to cool the room free of charge, when possible. Free cooling may be direct (outdoor air inflow) or indirect (through water circuit), in both cases the secondary circuit is always direct expansion with built-in air or water condenser.

5.13.1 FREE COOLING SYSTEM CONTROL

The free cooling system is managed through temperature detection of outdoor or water flowing into the unit.

With parameter "**IN / Free cooling water temperature**" (Manufacturer set-up - Probe configuration) it is possible to configure the free cooling temperature detection probe.

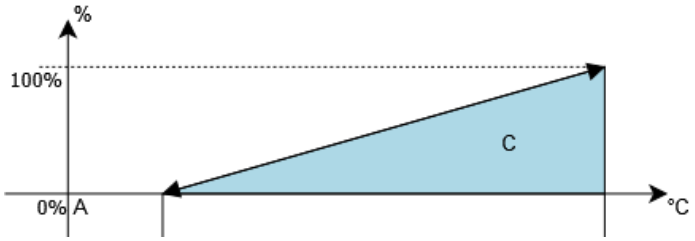
regulation will activate free cooling operation when the following function is valid:

$$T_{Reg} - T_{Fc} \geq \Delta_{Fc}$$

Where:

- T_{Reg} is the regulated temperature
- T_{Fc} is the free cooling temperature
- Δ_{Fc} is parameter "**Delta free cooling**" (User set-up - Free cooling & two sources regulation)

When the free cooling system is active, temperature is regulated by regulating the damper or free cooling valve with0-10 V control signal. The following pictures show the control diagram of the free cooling component with Proportional temperature regulation:



A **Temperatureset-point(Mainmenu-Set-point)**
B **Proportionalband(Userset-up-Temperature regulation)**
C **Free cooling regulation**
D **Temperaturedeadzone(ManufacturerSet-up - Dead zone configuration)**

Should the free cooling system not be sufficient for temperature regulation, and the cooling request should reach 100%, SURVEY[EVO] will activate the secondary circuit compressors. Compressor activation will be delayed in order to prevent unnecessary triggering.

After activating, the compressors will regulate the temperature as detailed in the previous chapters (direct expansion), while the free cooling signal will remain at 100%. After reaching the set-point the compressors will be stopped, while the free cooling valve will be overridden at 100% for a few seconds.

Should the outdoor temperature no longer be able to provide free cooling operation, and therefore the function should no longer be valid, the unit will only operate in direct expansion. See the previous chapters for further information.

5.13.2 FREE COOLING SYSTEM OVERRIDING

In order for the free cooling system to always be active, it is possible to set a digital input as free cooling system overriding input.

With the "**Configurable input (1-2-3-4)**" parameter (Manufacturer Set-up - Digital input configuration) it is possible to configure one of the four digital inputs in order to override free cooling operation, both always on and always off.

5.13.3 FREE COOLING TEMPERATURE PROBE ALARM MANAGEMENT

In the event the free cooling temperature probe should be broken or disconnected SURVEY^{EVO} will trigger the "**Broken IN / Free cooling temperature probe alarm**".

This alarm stops free cooling operation and activates the cooling circuit components.

5.14 DRY COOLER REGULATION

In units with water circuit, and especially in units with free cooling system, it is possible to have speed regulation for a dry cooler fans (liquid cooler) to supply water to the unit.

With parameter "**IN / Free cooling water temperature**" (Manufacturer set-up - Probe configuration) it is possible to configure the water detection probe on water circuit inlet.

With parameter "**Dry cooler regulation**" (Manufacturer set-up - Dry cooler regulation configuration) it is possible to configure the type of regulation of the dry coolers connected to the unit. The following types of regulation can be selected:

1) **No:** There is no type of dry cooler regulation in the unit, hence it will be disabled.
2) **Proportional:** The dry coolers will be regulated with a proportional system through a 0-10 V signal.
3) **AutoSet-point:** The dry coolers will be regulated with a proportional system through a 0-10 V signal. The regulation set-point will be calculated automatically based on operating conditions (see following chapters).

5.14.1 DRY COOLER PROPORTIONAL REGULATION

The control output of the dry coolers is regulated according to the following function:

$$Out_p = \frac{100}{Bp} * (In - Set)$$

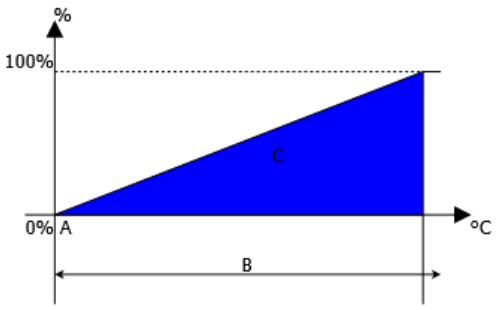
Where:

- **Bp** the "**Proportional dry cooler band**" parameter (User set-up - Dry cooler regulation)
- **In** is the condensation temperature value
- **Set** is the "**Dry cooler set-point** " parameter (User set-up - Dry cooler regulation)

With the "**Minimum fan speed**" parameter (Manufacturer Set-up - Dry cooler regulation configuration) it is possible to configure the minimum operation speed of the dry cooler fans.

With the "**Maximum fan speed**" parameter (Manufacturer Set-up - Dry cooler regulation configuration) it is possible to configure the maximum operation speed of the dry cooler fans.

The following graph shows proportional regulation:



A **Drycoolerset-point(Userset-up-Drycooler regulation)**
B **Proportional dry cooler band (User set-up - Dry cooler regulation)**
C **Dry cooler regulation**

5.14.2 DRY COOLER REGULATION WITH AUTOSET-POINT

Through dry cooler regulation with **AutoSet-point** it is possible, with a suitable algorithm, to achieve the best possible regulation set-point for the water temperature.

For optimal AutoSet-point system regulation it is recommended to set parameter "**Dry cooler set-point**" (User set-up - Dry cooler regulation) at the minimum value at which one wishes the dry coolers to work (e.g. 7 °C).

The set-point is regulated in the following manner:

- **LOW OUTDOORS TEMPERATURE CONDITIONS:** As long as outdoor air temperature is such that water temperature remains within the zone defined by parameter "**Dry cooler set-point**" (User set-up - Dry cooler regulation) + parameter "**Dry cooler proportional band**" (User set-up - Dry cooler regulation), regulation type is proportional (see previous chapter).

- **INCREASE IN THE OUTDOOR TEMPERATURE:** Upon increase in outdoor air temperature, water temperature also starts increasing. Upon achieving 100% of the demand, a timer will be started. As soon as the timer exceeds parameter "**AutoSet-point time**" (Manufacturer set-up - Dry cooler regulation configuration), parameter "**Dry cooler set-point**" (User set-up - Dry cooler regulation) will be added to parameter "**Dry cooler set-point increase**" (User set-up - Dry cooler regulation). The set-point will be increased until the temperature falls within the new regulation range, up to the maximum equalling parameter "**Maximum dry cooler set-point**" (User set-up – Dry cooler regulation).

- **REGULATION WITH RAISED SET-POINT:** For as long as the set-point is increased, the fans speed will be forced to a minimum value equalling parameter "**Minimum AutoSet-point speed**" (Manufacturer set-up - Dry cooler regulation configuration). This stops the water temperature value from being affected if the set-point is reached.

- **DROP IN OUTDOOR TEMPERATURE:** With a drop in the outdoor air temperature, the water temperature tends to fall below the changed set-point. In this case, a timer will start as soon as the water temperature is outside of the regulation range. As soon as parameter "**AutoSet-point time**" is exceeded (Manufacturer set-up - Dry cooler regulation configuration), parameter "**Dry cooler Set-point increase**" (User set-up – Dry cooler regulation) will be subtracted from the modified set-point. The set-point will decrease until the water temperature falls within the regulation range, or until it reaches the parameter "**Set-point dry cooler**" (User setup - Dry cooler regulation).

5.14.3 START-UP REQUEST MANAGEMENT

In order to improve dry cooler regulation it is possible to configure a start-up period. During the set start-up period regulation will be overridden at start-up speed. At the end of the start-up time regulation will go back to normal proportional operation.

With parameter "**Fans start-up speed**" (Manufacturer set-up - Dry cooler regulation configuration) it is possible to configure the speed at which the dry cooler fans will be regulated during the start-up period.

With the "**Fans start-up time**" parameter (Manufacturer Set-up - Dry cooler regulation configuration) it is possible to configure the duration of the dry cooler fans regulation start-up period.

This function is optimal to reach more quickly the work condition at the unit's start, with no need to wait for the modulation period required for reaching the set-point.

5.14.4 DRY COOLER FANS CUT-OFF REGULATION

To avoid issues with water temperature over-regulation, it is possible to set a cut off value for dry cooler fans regulation.

With the "**Fans cut off**" parameter (Manufacturer Set-up - Dry cooler regulation configuration) it is possible to configure a cut-off temperature of the condensation fans. When water temperature reaches the set-point - cut-off, fans regulation will be stopped.

5.14.5 DRY COOLER REGULATION MANAGEMENT WITH BROKEN WATER TEMPERATURE PROBE

In order not to interrupt dry cooler regulation, in the event of breakdown of the IN water temperature probe it is possible to override the fans speed at a pre-set value.

With parameter "**Override with probe error**" (Manufacturer Set-up - Dry cooler regulation configuration) it is possible to configure the percentage at which the fans speed will be overridden with "**Broken IN /Free cooling water temperature probe alarm**".

5.14.6 DRY COOLER ALARMS MANAGEMENT

In order to detect any issues to do with the dry coolers, it is possible to configure a digital input as general dry cooler alarm.

With the "**Configurable input (1-2-3-4)**" parameter (Manufacturer Set-up - Digital input configuration) it is possible to configure one of the four digital inputs in order to detect the general dry cooler alarm.

When configured, digital input opening will trigger the "**General dry cooler alarm**" which will stop dry cooler regulation.

5.15 WATER PUMP MANAGEMENT

SURVEY^{EVO} is able to control activation of a water circulation pump feeding the unit's circuits.

5.15.1 WATER PUMP MANAGEMENT CONFIGURATION

With parameter "**Pump regulation type**" (Manufacturer set-up - Water pump configuration) it is possible to configure the type of pump activation. The following types of regulation can be selected:

1) **No:** There is no type of water pump regulation in the unit, hence it will be disabled.
2) **Unit ON:** The pump will be activated at the same time as the unit's ON.
3) **Cooling request:** The pump will be activated only in case of cooling request.

With the "**Configurable output (1-2-3-4)**" parameter (Manufacturer Set-up - Digital output configuration) it is possible to configure one of the four digital outputs in order to control the water pump.

5.15.2 WATER PUMP SWITCH OFF DELAY MANAGEMENT

In some cases the water pump might need to operate for a few seconds after the switch off request.

With parameter "**Pump switch off delay**" (Manufacturer Set-up - Water pump configuration) it is possible to configure a pump switch-off delay.

5.15.3 WATER PUMP ALARM MANAGEMENT

In order to supply the unit with information on the water pump's status, it is possible to configure a digital input as general water pump alarm.

With the "**Configurable input (1-2-3-4)**" parameter (Manufacturer Set-up - Digital input configuration) it is possible to configure one of the four digital inputs in order to detect the water pump alarm.

When configured, digital input opening will trigger the "**General water pump alarm**" which will stop water pump regulation.

Depending on the setting of parameter "**Water pump alarms severity**" (Manufacturer Set-up - Alarm management configuration), triggering the alarm may also stop the unit.

5.16 TWO SOURCES UNIT REGULATION

With the "**Machine type configuration**" parameter (Manufacturer Set-up - Machine type configuration) it is possible to configure the type of temperature regulation with water or direct expansion two sources system (**Two sources**).

Units with two sources system have two separate cooling sources inside, a primary one for normal regulation and a secondary emergency one in case of any problems with the primary source.

With parameter "**Primary source selection**" (Manufacturer Set-up - Machine type configuration) it is possible to configure the type of primary cooling choosing between Chilled water and Direct expansion.

With parameter "**Secondary source selection**" (Manufacturer Set-up - Machine type configuration) it is possible to configure the type of secondary cooling choosing between Chilled water and Direct expansion.

5.16.1 TWO SOURCES WATER SYSTEM REGULATION

The two sources with chilled water primary cooling source is controlled by detecting water temperature on primary circuit inlet.

With parameter "**IN / Free cooling water temperature**" (Manufacturer set-up - Probe configuration) it is possible to configure the water temperature detection probe on primary circuit inlet.

SURVEY^{EVO} will use the primary source for temperature regulation, for as long as the inlet water temperature remains below parameter "**Water set-point two sources**" (User set-up - Free cooling & two sources regulation) + parameter "**Water band two sources**" (User set-up - Free cooling & two sources regulation).

Should inlet water temperature be higher than parameter "**Water set-point two sources**" (User set-up - Free cooling & two sources regulation) + parameter "**Water band two sources**" (User set-up - Free cooling & two sources regulation), SURVEY^{EVO} will stop the primary source and switch to the secondary one.

Switching back to the primary source will take place when water temperature is again the same as parameter "**Water set-point two sources**" (User set-up - Free cooling & two sources regulation).

5.16.2 TWO SOURCES DIRECT EXPANSION SYSTEM REGULATION

The two sources system with direct expansion primary cooling source is managed by detecting the alarms of the primary direct expansion circuit.

SURVEY^{EVO} will use the primary source for temperature regulation, for as long as there are no alarms that affect cooling circuit operation.

Should the cooling circuit no longer be operative, SURVEY^{EVO} will stop the primary source to switch to the secondary one. The secondary source will remain active until the cooling circuit conditions have been restored.

5.16.3 SECONDARY COOLING SOURCE OVERRIDING

With parameter "**Source exchange two sources**" (User set-up - Free cooling & two sources regulation) it is possible to override secondary source operation.

In order to speed up the switch to the secondary cooling source, or in the event of maintenance, it is also possible to set a digital input as forced source exchange input.

With the "**Configurable input (1-2-3-4)**" parameter (Manufacturer Set-up - Digital input configuration) it is possible to configure one of the four digital inputs in order to override operation with secondary source.

5.17 HEATING COMPONENTS REGULAITON

With parameter "**heating**" (Manufacturer set-up - Heating configuration) it is possible to configure the type of temperature regulation during winter heating and summer post-heating (dehumidification). The following types of regulation can be selected:

1) **No:** There is no type of heating regulation in the unit, hence it will be disabled.
2) **Stage resistors:** The unit is fitted with a stage heating electrical coil, which is controlled by the relevant digital outputs.
3) **Modulating coil:** The unit is fitted with a modulating heating electrical coil, which is controlled by a 0-10 V signal.
4) **Water valve:** The unit is fitted with a water heating coil, which is controlled by a 0-10 V signal.

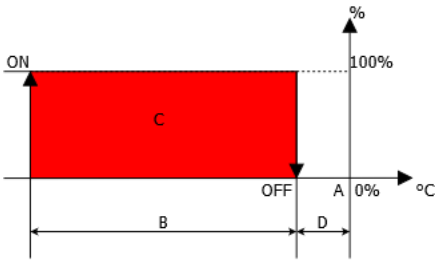
5.17.1 HEATING WITH STAGE ELECTRICAL COILS

SURVEY[EVO] is able to control electrical stage coils with up to 2 stages. The following pictures show the start-up diagram of the stages with Proportional temperature regulation:

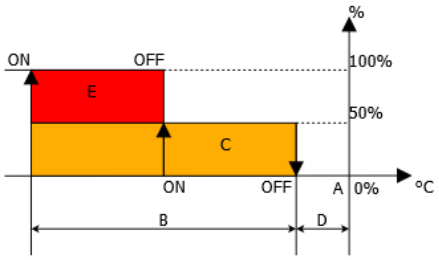
With parameter "**Number of electrical coil stages**" (Manufacturer set-up - Heating configuration) it is possible to configure the number of stages the unit's electrical coil consists of (Maximum 2).

With parameter "**Type of stage activation**" (Manufacturer set-up - Heating configuration) it is possible to configure the type of stage switching on choosing between **Linear** and **Stepped**. See the following graphs for further information.

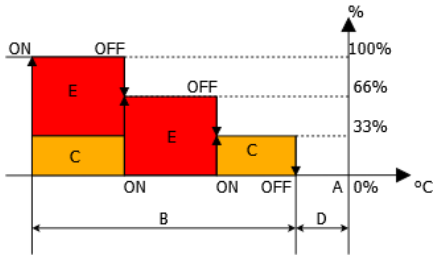
With parameter "**Electrical coil power**" (Manufacturer set-up - Heating configuration) it is possible to configure the electrical power of the installed coils.



Regulation with 1 stage



Regulation with 2 stages (Linear)



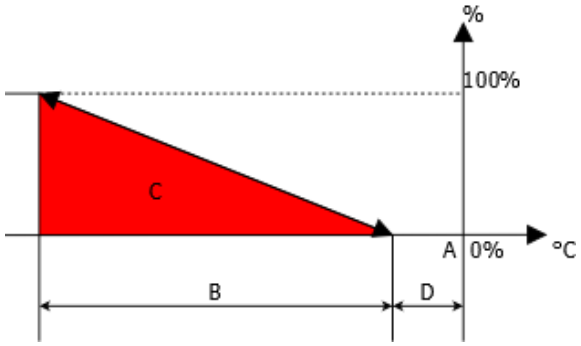
Regulation with 2 stages (Stepped)

A Temperatureset-point(Mainmenu-Set-point)
B Proportionalband(Userset-up-Temperature regulation)
C Stage 1
D Temperaturedeadzone(ManufacturerSet-up - Dead zone configuration)
E Stage 2

5.17.2 HEATING WITH ELECTRICAL OR WATER MODULATING COILS

SURVEY^{EVO} is able to manage electrical or water modulating coils via 0-10 V signal. The following pictures show the modulation diagram with Proportional temperature regulation:

With parameter "**Electrical coil power**" (Manufacturer set-up - Heating configuration) it is possible to configure the electrical power of the installed coil.



A Temperatureset-point(Mainmenu-Set-point)
B Proportionalband(Userset-up-Temperature regulation)
C Heating
D Temperaturedeadzone(ManufacturerSet-up - Dead zone configuration)

5.17.3 ELECTRICAL COIL ALARMS MANAGEMENT

The electrical coils provide active protection against overheating, through the installation of a safety thermostat placed inside the electrical coil.

Should the safety thermostat detect a temperature exceeding 135 °C, it will stop its operation.

Opening the alarm digital input will trigger the "**Electrical coil safety thermostat alarm**" which will stop heating regulation. The thermostat is manually reset. therefore it will need to be reset to clear the alarm.

5.18 CONFIGURABLE DIGITAL INPUTS

SURVEY^{EVO} is able to control up to four digital inputs freely configurable by the user.

With the "**Configurable input (1-2-3-4)**" parameter (Manufacturer Set-up - Digital input configuration) it is possible to configure one of the four digital inputs according to system requirements.

With parameter "**Configurable input logic (1-2-3-4)**" (Manufacturer Set-up - Digital input configuration) it is possible to configure the input wiring logic choosing between **N.C. - Normally closed and N.O. - Normally open**.

5.18.1 CONFIGURABLE DIGITAL INPUTS MANAGEMENT

With parameter "**Configurable input (1-2-3-4)**" (Manufacturer Set-up - Digital input configuration) it is possible to configure one of the following types of control:

TYPES OF CONFIGURABLE DIGITAL INPUTS	
Control	**Software reaction**
Fire/Smoke Alarm	Unit OFF
General water pump alarm	Pump and cooling OFF
External humidifier general alarm	Humidification OFF
General supply fans alarm	Unit OFF
Condenser 1 general alarm	Condenser 1 OFF and compressor 1 OFF
Condenser 2 general alarm	Condenser 2 OFF and compressor 2 OFF
Dry cooler general alarm	Dry cooler OFF and cooling OFF
Gas leak detector alarm	Alarm only
Condensing unit generic alarm	Cooling OFF
Non-critical generic alarm	Alarm only
Critical generic alarm	Unit OFF
STOP Cooling	Cooling OFF
STOP Heating	Heating OFF
STOP Humidification	Humidification OFF
STOP Dehumidification	Dehumidification OFF
STOP Heating and humidification	Heating OFF and humidification OFF
STOP Cooling, heating and humidification	Cooling, heating and humidification OFF
STOP Free cooling	OFF free cooling
Free cooling override	ON free cooling
2nd Source two sources override	2nd Source two sources ON

5.19 CONFIGURABLE DIGITAL OUTPUTS

SURVEY^{EVO} is able to control up to four digital outputs freely configurable by the user.

With the "**Configurable output (1-2-3-4)**" parameter (Manufacturer Set-up - Digital output configuration) it is possible to configure one of the four digital outputs according to system requirements.

With parameter "**Configurable output logic (1-2-3-4)**" (Manufacturer Set-up - Digital output configuration) it is possible to configure the output operation logic choosing between **N.C. - Normally closed and N.O. - Normally open**.

5.19.1 CONFIGURABLE DIGITAL OUTPUTS MANAGEMENT

With parameter "**Configurable output (1-2-3-4)**" (Manufacturer Set-up - Digital input configuration) it is possible to configure one of the following types of control:

TYPES OF CONFIGURABLE DIGITAL OUTPUTS
Water pump control
Condensing unit control
Unit status signal
Cooling status signal
Heating status signal
Humidification status signal
Dehumidification status signal
Free cooling status signal
General alarm signal
Non-critical alarm signal
Critical alarm signal
Dirty filters alarm signal
Cooling alarm signal
Heating alarm signal
Fans alarm signal
Temperature alarm signal
Humidity alarm signal
Flooding / Condensate drain alarm signal

5.20 INTERNAL COMPONENTS ALARMS MANAGEMENT

5.20.1 AIR FILTER ALARM MANAGEMENT

SURVEY^{EVO} is able to control an air filter alarm, to signal the presence of dirty filters.

Should a filter be dirty, the suitable pressure sensor will act on the digital dirty filters alarm input. SURVEY^{EVO} will trigger the "**Clogged air filters alarm**". The air filters alarm does not stop normal unit operation.

5.20.2 WATER PRESENCE/ CONDENSATE DRAIN PUMP ALARM MANAGEMENT

SURVEY^{EVO} is able to control a water presence alarm, to signal the presence of water in the unit. The water alarm is controlled by a detector fitted with water presence probe, to be installed by the user. If the condensate drain pump is present, the pump alarm will be inserted in series to the water detector alarm.

Should water presence or a pump alarm be detected, SURVEY^{EVO} will trigger the "**Water presence/Condensate drain pump alarm**".

Depending on the setting of parameter "**Water presence alarms severity**" (Manufacturer Set-up - Alarm management configuration), triggering the alarm may also stop the unit.

5.20.3 REFRIGERANT GAS LEAKS DETECTION ALARM MANAGEMENT

SURVEY^{EVO} is able to manage a refrigerant gas leak detection alarm. The gas leak alarm is managed by a detector fitted with probe installed in the unit.

With the "**Configurable input (1-2-3-4)**" parameter (Manufacturer Set-up - Digital input configuration) it is possible to configure one of the four digital inputs in order to control the refrigerant gas leak alarm.

Should a refrigerant gas leak occur, the suitable sensor will act on the digital alarm input. SURVEY^{EVO} will trigger the "**Refrigerant gas leak detector alarm"**. The air filters alarm does not stop normal unit operation.

5.20.4 SMOKE/FIRE ALARM MANAGEMENT

SURVEY^{EVO} is able to control a smoke or fire presence alarm, to switch off the unit.

With the "**Configurable input (1-2-3-4)**" parameter (Manufacturer Set-up - Digital input configuration) it is possible to configure one of the four digital inputs to control the smoke/fire alarm.

By acting on the alarm digital input, SURVEY^{EVO} will trigger the "**Smoke/fire presence alarm"** which stops normal unit operation.

According to the setting of parameter "**Smoke/fire alarm reset type**" (Manufacturer set-up - Alarms management configuration), it is possible to select the type of alarm reset choosing between **Manual** or **Automatic**.

5.20.5 NON CRITICAL AND CRITICAL GENERIC ALARM MANAGEMENT

SURVEY^{EVO} is able to control a generic non-critical or critical alarm, which may be intended for the user for different purposes.

With the "**Configurable input (1-2-3-4)**" parameter (Manufacturer Set-up - Digital input configuration) it is possible to configure one of the four digital inputs to control the generic non-critical or critical alarm.

By acting on the digital alarm input, SURVEY^{EVO} will trigger the "**Non-critical generic alarm"** or the "**Critical generic alarm"**. The non-critical generic alarm does not stop normal unit operation. The critical generic alarm stops normal unit operation.

5.21 PROBE CALIBRATION MANAGEMENT

The value of the probes installed inside the unit might need to be changed depending on system requirements. To this end SURVEY^{EVO} is able to manage a probe calibration value to be added to the actual reading.

With parameter "**Return temperature**" (User set-up - Probe calibration) it is possible to calibrate the return temperature probe.

With parameter "**Supply temperature**" (User set-up - Probe calibration) it is possible to calibrate the supply temperature probe.

With parameter "**Return humidity**" (User set-up - Probe calibration) it is possible to calibrate the return humidity probe.

With parameter "**Supply humidity**" (User set-up - Probe calibration) it is possible to calibrate the supply humidity probe.

With the "**Differential air pressure**" parameter (User Set-up - Probe calibration) it is possible to calibrate the air differential pressure sensor.

With parameter "**IN / Free cooling water temperature**" (User set-up - Probe calibration) it is possible to calibrate the water inlet / free cooling temperature probe.

With parameter "**OUT water temperature**" (User set-up - Probe calibration) it is possible to calibrate the water outlet temperature probe.

With parameter "**Water flow rate sensor 1**" (User set-up - Probe calibration) it is possible to calibrate the water flow rate sensor 1.

With parameter "**Water flow rate sensor 2**" (User set-up - Probe calibration) it is possible to calibrate the water flow rate sensor 2.

5.22 MODBUS RTU SLAVE SERIAL COMMUNICATION MANAGEMENT

The SURVEY^{EVO} regulator is fitted with a serial RS485 output for connection to supervision/BMS systems, via Modbus RTU slave protocol. See the following chapters for further information.

With parameter "**Modbus address**" (User set-up - Supervision) it is possible to set the unit's serial address for interfacing with the Modbus network.

With parameter "**Modbus Baudrate**" (User set-up - Supervision) it is possible to set the unit's communication speed for interfacing with the Modbus network.

5.23 CHANGING ACCESS PASSWORDS

The parameter management menus are password protected. These passwords may be changed according to the user's requirements. If modified, the original passwords will no longer be valid.

With parameter "**User password**" (User set-up - Password) it is possible to change the password to access the **User** menu.

With parameter "**Manufacturer password**" (Manufacturer set-up - Password) it is possible to change the password to access the **Manufacturer** menu.

5.24 CLEARING THE ALARM LOG AND OPERATING HOURS

5.24.1 CLEARING THE ALARM LOG

During unit maintenance operations it might be required to clear the alarm log stored in the SURVEY^{EVO}.

With parameter "**Clear alarm log**" (Log clearing - Alarm log) it is possible to deleted the stored alarms log.

Access to alarms log clearing is only possible with a **Manufacturer** log in.

5.24.2 CLEARIGN OPERATING HOURS

During unit maintenance operations it might be required to clear the operating hours of the main components, stored in the SURVEY^{EVO}.

With parameter "**Unit hours**" (Log clearing - Operating hours) it is possible to delete the unit's operating hours.

With parameter "**Compressor 1**" (Log clearing - Operating hours) it is possible to delete compressor 1 operating hours.

With parameter "**Compressor 2**" (Log clearing - Operating hours) it is possible to delete compressor 2 operating hours.

With parameter "**Electric resistors**" (Log clearing - Operating hours) it is possible to delete electric resistors operating hours.

With parameter "**Electric resistors**" (Log clearing - Operating hours) it is possible to delete electric resistors operating hours.

With parameter "**Humidifier**" (Log clearing - Operating hours) it is possible to delete the humidifier's operating hours. In case of internal humidifier operating hours on the CPY board will also be cleared.

With parameter "**Free cooling**" (Log clearing - Operating hours) it is possible to delete free cooling operating hours.

With parameter "**Dry cooler**" (Log clearing - Operating hours) it is possible to delete dry cooler operating hours.

With parameter "**Condenser 1**" (Log clearing - Operating hours) it is possible to delete condenser 1 operating hours.

With parameter "**Condenser 2**" (Log clearing - Operating hours) it is possible to delete condenser 2 operating hours.

Access to alarms log clearing is only possible with a **Manufacturer** log in.

6 COMPONENT CONTROL MODBUS MASTER NETWORK

SURVEY^{EVO} microprocessors use a Modbus MASTER network to control the devices installed in the unit. The following devices are interfaced with the Modbus MASTER network:

- EC air supply fans.
- EVDrive electronic expansion valve control boards.
- CPY immersed electrode humidifier control board.
- DC compressor regulation inverter.

The Modbus Master control network is implemented during unit assembly in the production line (see wiring diagram for additional details):

6.1 MODBUS MASTER NETWORK DEVICE ROUTING

The components connected to the Modbus master network are routed in the testing stage in the factory.

In the event of replacement the components will be sent already configured for connection to the Modbus Master network. Only fans will be sent not pre-configured. Fans routing configuration will take place through a self-routing function.

The following table sets out the addresses of individual components that might be included in the Modbus Master network:

Modbus Master network routing	
Device	**Address**
EVDrive compressor 1	2
EVDrive compressor 2	3
CPY	4
BLDC inverter AGILE	5
Fan 1	6
Fan 2	7
Fan 3	8
Fan 4	9
Fan 5	10

6.1.1 FANS SELF-ROUTING IN CASE OF REPLACEMENT

In the event of fans replacement, the SURVEY^{EVO} microprocessor features a check and self-routing function of the Modbus master network.

In the event of a communication alarm of one or more fans the SURVEY^{EVO} microprocessor will start checking whether there are new fans in the network.

If the SURVEY^{EVO} microprocessor finds a non configured fan (new) in the network, it will change the address to that of the faulty one. Should there be several fans in alarm the fan will be given the first free address.

During the self-routing process the NEW FANS will have to be connected ONE AT A TIME.

7 UNIT CONTROL CANBUS NETWORK

SURVEY^{EVO} is able to control up to twelve connected units that form a local network. The local network allows information to be exchanged between the units that will be able to work in synchrony to control the conditioned premises, also assuring a higher safety level by sharing the thermal load.

Network management is **Multi-Master** type, i.e. there is no unit that sets the others' actions. All the units in the network have the task to monitor the general condition, acting in synchrony in the required regulation.

7.1 ADDRESSING UNIT IN THE LOCAL NETWORK

All the units connected in local network must have a unique address that identifies them within the network. With parameter "**Network address**" (Manufacturer set-up - Local network configuration) it is possible to select the unit's network address, according to the following logic:

SURVEY^{EVO} network routing				
Unit Address	**Type**	**SURVEY ID**	**Display ID**	**Remote Display ID**
13	Stand alone	13	99	126
1	Unit 1	1	101	
2	Unit 2	2	102	
3	Unit 3	3	103	
4	Unit 4	4	104	
5	Unit 5	5	105	
6	Unit 6	6	106	
7	Unit 7	7	107	
8	Unit 8	8	108	
9	Unit 9	9	109	
10	Unit 10	10	110	
11	Unit 11	11	111	
12	Unit 12	12	112	

The network address may only be modified with the SURVEY^{EVO} not connected to other units.

Should the units be connected the network cables must first be disconnected.

For more details on network connection refer to the wiring diagram and the units' installation manual

7.2 LOCAL NETWORK TYPES

With parameter "**Network operation**" (Manufacturer set-up - Local network configuration) it is possible to select the type of local network one wishes to control. The following types of local network can be selected:

1) **No:** No local network is present.
2) **Duty/Stand-by:** The network will be managed with the Duty/Stand-by regulation type.
3) **SmartNet:** The network will be managed with the SmartNet system regulation type.

7.3 LOCAL NETWORK REGULATION WITH DUTY/STAND-BY SYSTEM

Duty/Stand-by regulation is the conventional method for regulation of units in a local network. The main feature of this type of local network is that a part of the units are operating (Duty) and a part of the units are in stand-by awaiting to start up in case of need (Stand-by).

With parameter "**Number of networked units**" (Manufacturer set-up - Local network configuration) it is possible to select the total number of units in the local network.

With parameter "**Number of stand-by units**" (Manufacturer set-up - Local network configuration) it is possible to select the number of units that will remain off in stand-by. It is not possible to set all units in stand-by, at least one unit will always be operating.

7.3.1 AUTOMATIC UNIT ROTATION WITH DUTY/STAND-BY SYSTEM

In order to balance the units' operating hours, in Duty/Stand-by operation it is possible to set an automatic rotation function to switch the units' role.

With parameter "**Enable unit rotation**" (Manufacturer set-up - Local network configuration) it is possible to enable the unit's role rotation.

With parameter "**Rotation interval**" (Manufacturer set-up - Local network configuration) it is possible to set the time interval between role rotations.

7.3.2 STAND-BY UNIT ACTIVATION IN CASE OF ALARM

The purpose of Stand-by units is that of being switched on to replace Duty units in the event of a critical problem.

To this end, in the event one of the two Duty units should be stopped due to a critical alarm, one of the Stand-by units will be switched on to make up for the lack.

Should there be several Stand-by units, the unit with the least number of operating hours will be switched on. Should the units have the same number of operating hours, the unit with the lowest network address will be switched on.

7.3.3 MANAGEMENT OF THE TEMPERATURE REGULATION SUPPORT SYSTEM

In Duty/Stand-by operation it is possible to set a temperature regulation support control function.

With parameter "**Enable support**" (Manufacturer set-up - Local network configuration) it is possible to enable support switch-on of stand-by units.

With parameter "**Support switch on time**" (Manufacturer set-up - Local network configuration) it is possible to set the time interval for supporting units switch-on.

Should the regulated temperature in one or more Duty units exceed the proportional band limit, the Stand-by units will be switched on in sequence so the temperature goes back to the set-point. Switching on will occur after the set switch-on time.

Should there be several Stand-by units, the unit with the least number of operating hours will be switched on. Should the units have the same number of operating hours, the unit with the lowest network address will be switched on.

The switched on units will regulate the temperature according to their settings, regardless of the Duty units that have required switching on. In order to improve regulation it is possible to use the operation described in the following chapters.

Upon reaching the set-point the units will be stopped and go back to Stand-by.

7.4 LOCAL NETWORK REGULATION WITH SMARTNET SYSTEM

A new type of network has been developed in order to improve local networked units management to keep on, where possible, all networked units evenly sharing the work load.

Case studies in important data centres have highlighted that this type of network offers three main advantages, compared the Duty/Stand-by system:

- **High energy savings:** Splitting the load allows the units to work at reduced conditions, which significantly reduce the system's energy consumption.
- **Consistent and precise regulation:** Thanks to the absence of stand-by units, temperature regulation will be consistent and precise, reducing the formation of Hot Spots due to units down.
- **Maximum operational safety:** Units in stand-by may feature problems on start-up that might prevent them from actively work in regulation. Being always on, smartnet networked units cannot be subject to switching on issues.

With parameter "**Number of networked units**" (Manufacturer set-up - Local network configuration) it is possible to select the total number of units in the local network.

Unit regulation will be independent, according to their settings. In order to improve regulation it is possible to use the operation described in the following chapters.

7.5 SWITCHING ON SYSTEM WITH DYNAMIC ON/OFF

All units in local network may be switched on or off individually as is the case with stand-alone units. In order to reduce switching on times of the entire local network it is possible to choose whether to switch on or off all the units simultaneously.

With parameter "**Dynamic On/Off**" (Manufacturer set-up - Local network configuration) it is possible to enable simultaneous switching on and off of all networked units.

The Dynamic On/Off function is especially suited for local Duty/Stand-by networks to prevent any errors in switching on stand-by units.

7.5.1 UNIT NETWORK ENTRY

If the Dynamic On/Off system is not present, when one or more units enter the network components regulation will be subject to a reset to prevent misalignment issues.

Therefore the fans will go back to minimum or start speed (only for constant pressure regulation), while the temperature regulation will be recalculated if a proportional + integral + derivative system is set.

7.6 DYNAMIC SET-POINT SYSTEM

In all local network units, the temperature set-point may be individually changed as is the case for stand-alone units. In the event all units need to regulate with the same set-point, it is possible to activate the dynamic set-point function which allows set-points to be changed simultaneously in all networked units.

With parameter "**Dynamic Set-point**" (Manufacturer set-up - Local network configuration) it is possible to enable simultaneous set-point change in all networked units.

The dynamic set-point function is especially suitable to prevent incorrect network set-point settings which might create regulation conflicts.

7.7 AIR TEMPERATURE, HUMIDITY AND PRESSURE AVERAGE CONTROL SYSTEM

Local network units are usually used to manage a single room. In these cases it is possible to set a regulation control system by using average values detected by the networked units.

Using the average function makes it possible to obtain consistent components regulation of individual units, which will be activated simultaneously on all networked units.

This function also makes it possible to prevent regulation conflict issues, where two or more units regulate in the opposite way, for instance one heats and the other cools at the same time.

With parameter "**Temperature average**" (Manufacturer set-up - Local network configuration) it is possible to enable the average calculation of temperatures detected by the unit, in relation to temperature regulation.

With parameter "**Humidity average**" (Manufacturer set-up - Local network configuration) it is possible to enable the average calculation of humidity detected by the unit, in relation to humidity regulation.

With parameter "**Ambient pressure average**" (Manufacturer set-up - Local network configuration) it is possible to enable the average calculation of ambient pressures detected by the unit, in relation to constant air pressure regulation.

7.7.1 EXCLUSION FROM AVERAGE CALCULATION

In order to prevent issues in average calculation, it will exclude automatically the units that are:

- **OFF:** Units set to OFF will be automatically excluded from average calculation.
- **In Stand-by**: Units in stand-by will actively participate in average calculation only when they are active in replacement or support
- **In critical alarm**: Units in OFF FROM ALARM will be automatically excluded from average calculation.
- **With probes in alarm**: Units that have broken probes will be automatically excluded from average calculation in relation to the probe in alarm.

Upon restoring the unit's normal operative conditions, it will automatically be included again in average calculation.

7.8 FAILED LOCAL NETWORK COMMUNICATION ALARM MANAGEMENT

The units constantly monitor the local network communication status. Should there be a problem and communication should remain down for longer than 30 s, SURVEY^{EVO} will trigger the "**Local network communication alarm"**.

In the event of alarm the unit will continue operating regularly as if it were in stand-alone, without interrupting component regulation at all.

When connection is restored the alarm is automatically reset and the unit starts regulating again according to the type of local network.

8 CONTROL SOFTWARE PARAMETERS AND THEIR MODIFICATION

8.1 ACCESS TO PASSWORD PROTECTED MENUS

To access the parameters for the **PROTECTED MENUS** it is necessary to enter in the **PARAMETERS MENU,** the correct **LOGIN** password:

- **USER PARAMETERS**: Default password **0123** (Modifiable)
- **MANUFACTURER PARAMETERS**: Default password **0694** (Modifiable)

8.1.1 LOGIN PASSWORD ENTRY

- Select the **LOGIN MENU** with the **UP** ( ) and **DOWN** ( ) keys and press **ENTER** ( ) to access the menu.
- It is possible to select individual digits of the password with the **UP** ( ) and **DOWN** ( ) keys.
- To change the digit press **ENTER** ( ); when it is selected, the digit starts blinking.
- Use the **UP** ( ) and **DOWN** ( ) key to change the password digit.
- To memorise the entered value, simply press ENTER ( ).
- However, should you not wish to save the parameter, just press **ESC** ( ).

8.2 ACCESS TO REGULATION PARAMETER MENUS

- Select the **MENU** you wish to access with the **UP** ( ) and **DOWN** ( ) keys and press **ENTER** ( ) to access the **MENU**.

The **PARAMETERS MENUS** are divided into several **GROUPS,** whose name describes the function of the parameters it contains.

To access change of the **PARAMETERS** of each group, just select the **GROUP** you wish to access with the **UP** ( ) and **DOWN** ( ) keys and press **ENTER** ( ) to access the **GROUP**.

8.3 MODIFYING THE CONTROL PARAMETERS

- Select the **PARAMETER** you wish to change with the **UP** ( ) and **DOWN** ( ) keys
- To change the parameter press **ENTER** ( ); when it is selected, the parameter starts blinking.
- Use the **UP** ( ) and **DOWN** ( ) key to change the parameter.
- To memorise the entered value, simply press ENTER ( ).
- However, should you not wish to save the parameter, just press **ESC** ( ).

8.4 EXITING THE GROUPS, MENUS AND MAIN MENU

It is possible to exit the **GROUPS**, the **MENUS** and the **MAIN MENU** by pressing the **ESC** ( ) key.

8.5 SET-POINT MENU: SET-POINTS MODIFICATION

8.5.1 SET-POINT

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Temperature set-point	22.0	°C	
Humidity set-point	50	%Rh	

8.6 USER SETUP: SETTINGS THE OPERATING PROGRAM

8.6.1 LANGUAGE

DESCRIPTION	DEFAULT	NEW
Language	Italian	

8.6.2 VENTILATION SET-POINT

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Air flow rate set-point	2,200	m^3/h	
Air pressure set-point	20	Pa	

8.6.3 TEMPERATURE REGULATION

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Regulation sensor	Return	-	
Regulation type	P	-	
Proportional band	2.0	°C	
Integration time	0	s	
Derivation time	0	s	
High temperature alarm offset	10.0	°C	
Low temperature alarm offset	10.0	°C	

8.6.4 LIMIT TEMPERATURE REGULATION

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Temperature upper limit	30.0	°C	
High limit temperature management	Alarm Only	-	
Temperature lower limit	8.0	°C	
Low limit temperature management	Alarm Only	-	

8.6.5 HUMIDITY REGULATION

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Dehumidification proportional band	10	%Rh	
Humidification proportional band	10	%Rh	
High return humidity alarm offset	20	%Rh	
Low return humidity alarm offset	20	%Rh	
Higher supply humidity limit	95	%Rh	
Lower supply humidity limit	20	%Rh	

8.6.6 HUMIDIFIER REGULATION

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Humidification enabling	Yes	-	
Manual discharge	No	-	
Cylinder pre-wash	No	-	

8.6.7 FREE COOLING AND TWO SOURCES REGULATION

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Free cooling delta	4.0	°C	
Two sources water set-point	7.0	°C	
Two sources water band	0.5	°C	
Two sources source exchange	No	-	

8.6.8 CONDENSER REGULATION

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Condensation set-point	45.0	°C	
Condensation proportional band	5.0	°C	
Condensation set-point alarm	1.0	°C	
Maximum condensation set-point	55.0	°C	

8.6.9 DRY COOLER REGULATION

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Dry cooler set-point	10.0	°C	
Dry cooler proportional band	5.0	°C	
Dry Cooler set-point increase	1.0	°C	
Maximum dry Cooler set-point	50.0	°C	

8.6.10 PROBE CALIBRATION

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Return temperature	0.0	°C	
Supply temperature	0.0	°C	
Return humidity	0	%Rh	
Supply humidity	0	%Rh	
Air differential pressure	0	Pa	
IN / Free cooling water temperature	0.0	°C	
OUT water temperature	0.0	°C	
Water flow rate 1	0	l/h	
Water flow rate 2	0	l/h	

8.6.11 EXTERNAL SUPERVISOR

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Modbus address	1	-	
Modbus Baudrate	19200	Baud	

8.6.12 PASSWORD

DESCRIPTION	DEFAULT	NEW
User Password	0123	

8.7 MANUFACTURER SETUP LOOP: CONFIGURATION OF THE COMPONENTS

8.7.1 PROBE CONFIGURATION

DESCRIPTION	DEFAULT	NEW
Return humidity	No	
Supply humidity	No	
Air differential pressure	No	
IN / Free cooling water temperature	No	
OUT water temperature	No	
Water flow rate sensor 1	No	
Water flow rate sensor 2	No	

8.7.2 DIGITAL INPUT CONFIGURATION

DESCRIPTION	DEFAULT	NEW
Configurable input 1	No	
Configurable input 1 logic	N.O.	
Configurable input 2	No	
Configurable input 2 logic	N.O.	
Configurable input 3	No	
Configurable input 3 logic	N.O.	
Configurable input 4	No	
Configurable input 4 logic	N.O.	

8.7.3 CONFIGURABLE DIGITAL OUTPUTS

DESCRIPTION	DEFAULT	NEW
Configurable output 1	No	
Configurable output 1 logic	N.O.	
Configurable output 2	No	
Configurable output 2 logic	N.O.	
Configurable output 3	No	
Configurable output 3 logic	N.O.	
Configurable output 4	No	
Configurable output 4 logic	N.O.	

8.7.4 VENTILATION CONFIGURATION

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Number of fans	1	-	
Type of fans	Modbus	-	
Regulation type	Cooling/heating reg.	-	
Maximum fan speed	100	%	
Minimum fan speed	40	%	
Start-up fan speed	60	%	
Start-up fan time	20	s	
Air flow rate coefficient	72	-	

8.7.5 MACHINE TYPE CONFIGURATION

DESCRIPTION	DEFAULT	NEW
Unit Type	Direct Expansion	
Primary Source Selection	CW	
Secondary Source Selection	DX	

8.7.6 DIRECT EXPANSION CONFIGURATION

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Number of compressors	1	-	
Enable compressor inverter	No	-	
Type of compressor rotation	FIFO+HS	-	

8.7.7 CHILLED WATER CONFIGURATION

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Water flow rate sensor diameter	DN6	-	
Enable water flow rate regulation	No	-	
Water flow rate set-point	2400	l/h	
Proportional water band	300	l/h	
Integration water time	0	s	
Derivation water time	0	s	

8.7.8 HEATING CONFIGURATION

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Heating	No	-	
Electric coil power	6.0	kW	
Electric coil stages number	1	-	
Type of stage switch on	Steps	-	

8.7.9 HUMIDITY REGULATION

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Humidifier	No	-	
Humidification production percentage	100	%	
Cooling and humidifying together	Yes	-	
Dehumidification	Yes	-	
Select dehumidification trigger	100	%	
Minimum dehumidification limit	60	%	
Partial dehumidification	No	-	
Dehumidification lock offset	4.0	°C	

8.7.10 CONDENSATION REGULATION CONFIGURATION

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Condenser regulation	No	-	
Minimum condensation request	10	%	
Maximum condensation request	100	%	
Condensation start-up request	50	%	
Condensation start-up time	10	s	
Override with probe error	100	%	
AutoSet-point time	5	Min	
Minimum AutoSet-point request	20	%	

8.7.11 DRY COOLER REGULATION CONFIGURATION

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Dry cooler regulation	No	-	
Minimum fan speed	10	%	
Maximum fan speed	100	%	
start-up fan speed	50	%	
Fans start-up time	10	s	
Fans Cut-off	2.0	°C	
Override with probe error	100	%	
AutoSet-point time	5	Min	
Minimum AutoSetpoint speed	20	%	

8.7.12 WATER PUMP CONFIGURATION

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Pump Regulation type	No	-	
Pump switch off delay	60	s	

8.7.13 SET-POINT LIMITS CONFIGURATION

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Minimum temperature set-point limit	15.0	°C	
Maximum temperature set-point limit	40.0	°C	
Minimum humidity set-point limit	20	%Rh	
Maximum humidity set-point limit	75	%Rh	

8.7.14 DEAD ZONE CONFIGURATION

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Temperature dead zone	0.2	°C	
Humidity dead zone	2	%	

8.7.15 LOCAL NETWORK CONFIGURATION

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Network address	13	-	
Network operation	No	-	
Number of networked units	2	-	
Number of Units in standby	0	-	
Enable unit rotation	No	-	
Time period for rotation	12	h	
Enable support	No	-	
Support switch on time	120	s	
Dynamic On/Off	Yes	-	
Dynamic set-point	Yes	-	
Temperature average	No	-	
Humidity average	No	-	
Ambient pressure average	No	-	

8.7.16 ALARM MANAGEMENT CONFIGURATION

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Temperature and humidity alarm delay	300	s	
Damper status alarm delay	150	s	
Compressor low pressure alarm delay	180	s	
Drain High Temperature Alarm Delay	60	s	
Compressor low compression alarm delay	60	s	
Fire/smoke alarm reset type	Manual	-	
Compressor alarms severity	Critical	-	
Water presence alarm severity	Non-critical	-	
Water pump alarm severity	Non-critical	-	
Power supply failure alarm	Unit ON	-	

8.7.17 SUNDRY CONFIGURATIONS

DESCRIPTION	DEFAULT	UNIT OF MEASURE	NEW
Enable key lock	No	-	

8.7.18 PASSWORD

DESCRIPTION	DEFAULT	NEW
Manufacturer Password	0694	

9 UNIT ALARMS MANAGEMENT

9.1 SIGNALLING, CHECK AND CLEARANCE OF ALARM CONDITIONS

9.1.1 ALARM PRESENCE SIGNALLING

The presence of one or more active alarms is signalled by:

- Activation of the **Buzzer** incorporated in the user terminal.
- Illumination of the RED LED on the front panel of the user terminal (⚠).
- Alarm presence icon (⚠) is displayed in the program's main page.
- If the alarm is **CRITICAL**, and therefore blocks unit operation, the **GREEN LED** (⏻) starts flashing.

9.1.2 ALARM CONDITION CHECK

Press and hold the **ALARM** key () to display on the user terminal the message corresponding to the active alarm. The **Buzzer** is shut off.

Use the **ENTER** () key to scroll through all active alarm signals.

Press **EXIT** () to return to the main program page.

9.1.3 RESETTING AN ALARM

While an alarm is displayed, press **ENTER** () for a few seconds, to clear the displayed alarm.

Alarms whose causes have not been restored yet cannot be removed.

9.2 DESCRIPTION OF SURVEY^{EVO} MICROPROCESSOR ALARMS

9.2.1 SERIOUS ALARMS

Name:	**Damper status alarm**
Cause:	The motorised shutters of the unit are closed
Delay:	On start: Second parameter - In operation: 5 s
Effect:	The intervention causes the unit to shut off. All devices will be stopped without complying with operating times.
Solutions:	Check damper motor Check damper motor electrical connection Check damper status
Restore:	The alarm is manually restore

Name:	**General supply fan alarm**
Cause:	The unit fans are blocked because of the intervention of the air flow or electric fan protection sensor.
Delay:	On start: 40 s - In operation: 5 s
Effect:	The intervention causes the unit to shut off All devices will be stopped without complying with operating times
Solutions:	Check for any air system problems that may reduce the unit's air flow Check electrical connection of the air flow sensor and fan electrical protection Check fan speed Check the condition of the fan
Restore:	The alarm is manually restore

Name:	**Fan 1 inverter alarm**
Cause:	The fan has one of the following problems: **Communication failure** **Phase/power supply failure alarm** **High regulation module temperature** **Regulation module malfunction** **Motor overload** **Low DC power supply** **Master-slave communication failure** **Hall sensor error** **High motor temperature**
Delay:	On start: 30 s - In operation: 30 s
Effect:	The intervention causes the unit to shut off All devices will be stopped without complying with operating times
Solutions:	Check Modbus communication cable wiring Check fan electrical connection Check power line supply voltage Check fan regulation module Check the condition of the fan
Restore:	The alarm is manually restore

Name:	**Fan 2 inverter alarm**
Cause:	The fan has one of the following problems: **Communication failure** **Phase/power supply failure alarm** **High regulation module temperature** **Regulation module malfunction** **Motor overload** **Low DC power supply** **Master-slave communication failure** **Hall sensor error** **High motor temperature**
Delay:	On start: 30 s - In operation: 30 s
Effect:	The intervention causes the unit to shut off All devices will be stopped without complying with operating times
Solutions:	Check Modbus communication cable wiring Check fan electrical connection Check power line supply voltage Check fan regulation module Check the condition of the fan
Restore:	The alarm is manually restore

Name:	**Fan 3 inverter alarm**
Cause:	The fan has one of the following problems: **Communication failure** **Phase/power supply failure alarm** **High regulation module temperature** **Regulation module malfunction** **Motor overload** **Low DC power supply** **Master-slave communication failure** **Hall sensor error** **High motor temperature**
Delay:	On start: 30 s - In operation: 30 s
Effect:	The intervention causes the unit to shut off All devices will be stopped without complying with operating times
Solutions:	Check Modbus communication cable wiring Check fan electrical connection Check power line supply voltage Check fan regulation module Check the condition of the fan
Restore:	The alarm is manually restore

Name:	**Fan 4 inverter alarm**
Cause:	The fan has one of the following problems: **Communication failure** **Phase/power supply failure alarm** **High regulation module temperature** **Regulation module malfunction** **Motor overload** **Low DC power supply** **Master-slave communication failure** **Hall sensor error** **High motor temperature**
Delay:	On start: 30 s - In operation: 30 s
Effect:	The intervention causes the unit to shut off All devices will be stopped without complying with operating times
Solutions:	Check Modbus communication cable wiring Check fan electrical connection Check power line supply voltage Check fan regulation module Check the condition of the fan
Restore:	The alarm is manually restore

Name:	**Fan 5 inverter alarm**
Cause:	The fan has one of the following problems: **Communication failure** **Phase/power supply failure alarm** **High regulation module temperature** **Regulation module malfunction** **Motor overload** **Low DC power supply** **Master-slave communication failure** **Hall sensor error** **High motor temperature**
Delay:	On start: 30 s - In operation: 30 s
Effect:	The intervention causes the unit to shut off All devices will be stopped without complying with operating times
Solutions:	Check Modbus communication cable wiring Check fan electrical connection Check power line supply voltage Check fan regulation module Check the condition of the fan
Restore:	The alarm is manually restore

Name:	**Fire/smoke presence alarm**
Cause:	The digital smoke/fire alarm input is open
Delay:	On start: 10 - In operation: 5 s
Effect:	The intervention causes the unit to shut off All devices will be stopped without complying with operating times
Solutions:	Check for any smoke or fire inside the room Check electrical connection of the digital input
Restore:	Second parameter

Name:	**Critical generic alarm**
Cause:	The digital critical generic alarm input is open
Delay:	On start: 10 s - In operation: 5 s
Effect:	The intervention causes the unit to shut off All devices will be stopped without complying with operating times
Solutions:	Check electrical connection of the digital input
Restore:	The alarm is manually restore

9.2.2 PROBE ALARMS

Name:	**Broken return temperature probe alarm**
Cause:	The return temperature probe is broken or disconnected
Delay:	On start: 10 s - In operation: 10 s
Effect:	See previous chapters
Solutions:	Check probe electrical connection Check probe signal
Restore:	The alarm will be automatically reset

Name:	**Supply temperature probe error**
Cause:	The supply temperature probe is broken or disconnected
Delay:	On start: 10 s - In operation: 10 s
Effect:	See previous chapters
Solutions:	Check probe electrical connection Check probe signal
Restore:	The alarm will be automatically reset

Name:	**Broken return humidity probe alarm**
Cause:	The return humidity probe is broken or disconnected
Delay:	On start: 10 s - In operation: 10 s
Effect:	Humidity regulation will be stopped
Solutions:	Check probe electrical connection Check probe signal
Restore:	The alarm will be automatically reset

Name:	**Broken supply humidity probe alarm**
Cause:	The supply humidity probe is broken or disconnected
Delay:	On start: 10 s - In operation: 10 s
Effect:	Alarm limit regulation will be stopped
Solutions:	Check probe electrical connection Check probe signal
Restore:	The alarm will be automatically reset

Name:	**Broken IN/Free cooling water temperature probe alarm**
Cause:	The IN/Free cooling water temperature probe is broken or disconnected
Delay:	On start: 10 s - In operation: 10 s
Effect:	See previous chapters
Solutions:	Check probe electrical connection Check probe signal
Restore:	The alarm will be automatically reset

Name:	**Broken OUT water temperature probe alarm**
Cause:	The OUT temperature probe is broken or disconnected
Delay:	On start: 10 s - In operation: 10 s
Effect:	See previous chapters
Solutions:	Check probe electrical connection Check probe signal
Restore:	The alarm will be automatically reset

Name:	**Broken differential air pressure sensor alarm**
Cause:	The differential air pressure sensor is broken or disconnected
Delay:	On start: 10 s - In operation: 10 s
Effect:	See previous chapters
Solutions:	Check sensor electrical connection Check sensor signal
Restore:	The alarm will be automatically reset

Name:	**Broken water flow rate sensor 1 alarm**
Cause:	The water flow rate sensor is broken or disconnected
Delay:	On start: 10 s - In operation: 10 s
Effect:	See previous chapters
Solutions:	Check sensor electrical connection Check sensor signal
Restore:	The alarm will be automatically reset

Name:	**Broken water flow rate sensor 2 alarm**
Cause:	The water flow rate sensor is broken or disconnected
Delay:	On start: 10 s - In operation: 10 s
Effect:	See previous chapters
Solutions:	Check sensor electrical connection Check sensor signal
Restore:	The alarm will be automatically reset

Name:	**Broken liquid temperature probe 1 alarm**
Cause:	The compressor 1 liquid temperature probe is broken or disconnected
Delay:	On start: 10 s - In operation: 10 s
Effect:	Warning only. Sub-cooling calculation will be stopped.
Solutions:	Check sensor electrical connection Check sensor signal
Restore:	The alarm will be automatically reset

Name:	**Broken liquid temperature probe 1 alarm**
Cause:	The compressor 1 liquid temperature probe is broken or disconnected
Delay:	On start: 10 s - In operation: 10 s
Effect:	Warning only. Sub-cooling calculation will be stopped.
Solutions:	Check sensor electrical connection Check sensor signal
Restore:	The alarm will be automatically reset

9.2.3 COMPRESSOR ALARMS

Name:	**Compressor 1 magnetic thermal protection alarm**
Cause:	The compressor's magnetic thermal protection has triggered an alarm
Delay:	On start: 10 s - In operation: 5 s
Effect:	See previous chapters
Solutions:	Check compressor electrical connection Check compressor absorbed current
Restore:	The alarm is manually restore

Name:	**Compressor 2 magnetic thermal protection alarm**
Cause:	The compressor's magnetic thermal protection has triggered an alarm
Delay:	On start: 10 s - In operation: 5 s
Effect:	See previous chapters
Solutions:	Check compressor electrical connection Check compressor absorbed current
Restore:	The alarm is manually restore

Name:	**Compressor 1 high pressure alarm**
Cause:	The compressor's high pressure protection has triggered an alarm
Delay:	On start: 10 s - In operation: 5 s
Effect:	See previous chapters
Solutions:	Check the condensation pressure Check condenser status Check condenser regulator Check the condenser power supply line
Restore:	The alarm is manually restore

Name:	**Compressor 2 high pressure alarm**
Cause:	The compressor's high pressure protection has triggered an alarm
Delay:	On start: 10 s - In operation: 5 s
Effect:	See previous chapters
Solutions:	Check the condensation pressure Check condenser status Check condenser regulator Check the condenser power supply line
Restore:	The alarm is manually restore

Name:	**Compressor 1 low pressure alarm**
Cause:	The compressor's low pressure protection has triggered an alarm
Delay:	On start: Second parameter - In operation: 5 s
Effect:	See previous chapters
Solutions:	Check evaporation pressure Check electronic expansion valve status Check the cooling circuit
Restore:	The alarm is manually restore

Name:	**Compressor 2 low pressure alarm**
Cause:	The compressor's low pressure protection has triggered an alarm
Delay:	On start: Second parameter - In operation: 5 s
Effect:	See previous chapters
Solutions:	Check evaporation pressure Check electronic expansion valve status Check the cooling circuit
Restore:	The alarm is manually restore

Name:	**Compressor 1 high discharge temperature alarm**
Cause:	The compressor's drain high temperature protection has triggered an alarm
Delay:	On start: Second parameter - In operation: Second parameter
Effect:	See previous chapters
Solutions:	Check the compressor temperature discharge Check evaporation pressure Check the cooling circuit
Restore:	The alarm is manually restore

Name:	**Compressor 2 high discharge temperature alarm**
Cause:	The compressor's drain high temperature protection has triggered an alarm
Delay:	On start: Second parameter - In operation: Second parameter
Effect:	See previous chapters
Solutions:	Check the compressor temperature discharge Check evaporation pressure Check the cooling circuit
Restore:	The alarm is manually restore

Name:	**Compressor 1 low compression alarm**
Cause:	The compressor compression ratio is too low
Delay:	On start: Second parameter - In operation: 5 s
Effect:	See previous chapters
Solutions:	Check compressor rotation direction Check evaporation pressure Check the cooling circuit
Restore:	The alarm is manually restore

Name:	**Compressor 2 low compression alarm**
Cause:	The compressor compression ratio is too low
Delay:	On start: Second parameter - In operation: 5 s
Effect:	See previous chapters
Solutions:	Check compressor rotation direction Check evaporation pressure Check the cooling circuit
Restore:	The alarm is manually restore

Name:	**Compressor 1 inverter alarm**
Cause:	The inverter is in alarm due to a fault Alarms are indicated through an alphanumerical code (e.g. F0102) See following chapters for the description of the alarms
Delay:	On start: 30 s - In operation: 30 s
Effect:	See previous chapters
Solutions:	See following chapters
Restore:	The alarm is manually restore

Name:	**Compressor 1 electronic expansion valve alarm**
Cause:	The valve driver has one of the following problems: **Communication failure** **Evaporation pressure probe alarm** **Condensation pressure probe alarm** **Suction temperature probe alarm** **Discharge temperature probe alarm**
Delay:	On start: 30 s - In operation: 30 s
Effect:	See previous chapters
Solutions:	Check valve driver connection Check probe connection Check probe signal
Restore:	The alarm is manually restore

Name:	**Compressor 2 electronic expansion valve alarm**
Cause:	The valve driver has one of the following problems: **Communication failure** **Evaporation pressure probe alarm** **Condensation pressure probe alarm** **Suction temperature probe alarm** **Discharge temperature probe alarm**
Delay:	On start: 30 s - In operation: 30 s
Effect:	See previous chapters
Solutions:	Check valve driver connection Check probe connection Check probe signal
Restore:	The alarm is manually restore

9.2.4 INTERNAL HUMIDIFIER ALARMS

Name:	**Internal humidifier alarm**
Cause:	The internal humidifier has one of the following problems: **Communication failure** **Electrode high current** **Internal memory error** **Parameter error** **High water conductivity** **Maintenance time expired** **Life timer expired** **No water** **Low steam flow rate** **No discharge** **Cylinder maintenance** **Connection error** **High water level** **Foam presence** **Cylinder burnt out** See following chapters for the description of the alarms
Delay:	On start: 10 s - In operation: 5 s
Effect:	Humidification will be stopped
Solutions:	See following chapters
Restore:	The alarm is manually restore

9.2.5 COMPONENT ALARMS

Name:	**Water presence/ Condensate drain pump sensor alarm**
Cause:	The water detecting system is in alarm The condensation drain pump is in alarm
Delay:	On start: 10 s - In operation: 5 s
Effect:	Second parameter
Solutions:	Check water detection probe connection Check for water on the water detection probe Check condensate drain pump connection Check condensate drain pump status
Restore:	The alarm is manually restore

Name:	**Electric coil safety thermostat alarm**
Cause:	The electrical coil has overheated
Delay:	On start: 10 s - In operation: 5 s
Effect:	The electrical coil will be stopped
Solutions:	Check fan speed Check fan air flow rate Check the aeraulic circuit
Restore:	The alarm is manually restore

Name:	**Clogged air filter alarm**
Cause:	The dirty filter differential pressure sensor has detected excessive pressure
Delay:	On start: 10 s - In operation: 5 s
Effect:	Warning only
Solutions:	Check the condition of the air filters Check pressure sensor calibration Check pressure sensor connection Check the aeraulic circuit
Restore:	The alarm is manually restore

Name:	**Dry cooler general alarm**
Cause:	The dry cooler has an alarm
Delay:	On start: 10 s - In operation: 5 s
Effect:	See previous chapters
Solutions:	Check the dry cooler condition
Restore:	The alarm is manually restore

Name:	**External humidifier general alarm**
Cause:	The external humidifier has an alarm
Delay:	On start: 10 s - In operation: 5 s
Effect:	Humidification will be stopped
Solutions:	Check status of the external humidifier
Restore:	The alarm is manually restore

Name:	**General water pump alarm**
Cause:	The water pump has an alarm
Delay:	On start: 10 s - In operation: 5 s
Effect:	See previous chapters
Solutions:	Check the condition of the water pump
Restore:	The alarm is manually restore

Name: **Condenser 1 general alarm**
Cause: The external condenser has an alarm
Delay: On start: 10 s - In operation: 5 s
Effect: See previous chapters
Solutions: Check the condition of the external condenser
Restore: The alarm is manually restore

Name: **Condenser 2 general alarm**
Cause: The external condenser has an alarm
Delay: On start: 10 s - In operation: 5 s
Effect: See previous chapters
Solutions: Check the condition of the external condenser
Restore: The alarm is manually restore

Name: **Condensing unit generic alarm**
Cause: The external condensing unit has an alarm
Delay: On start: 10 s - In operation: 5 s
Effect: See previous chapters
Solutions: Check status of the external condensing unit
Restore: The alarm is manually restore

Name: **Refrigerant gas leak detector alarm**
Cause: The refrigerant gas leak detector has an alarm
Delay: On start: 10 s - In operation: 5 s
Effect: See previous chapters
Solutions: Check status of the refrigerant gas leak detector
Restore: The alarm is manually restore

Name: **Power supply failure alarm**
Cause: The unit's power supply has failed
Delay: On start: 5 s - In operation: 5 s
Effect: See previous chapters
Solutions: Check the unit's power supply line status
Restore: The alarm is manually restore

Name: **Non-critical generic alarm**
Cause: The digital non-critical generic alarm input is open
Delay: On start: 10 s - In operation: 5 s
Effect: Warning only
Solutions: Check status of the digital input
Restore: The alarm is manually restore

9.2.6 LAN ALARMS

Name:	**Local network communication alarm**
Cause:	The unit does not detect other units in local network
Delay:	On start: 30 s - In operation: 30 s
Effect:	See previous chapters
Solutions:	Check local network connection Check local network parameter configuration
Restore:	The alarm will be automatically reset

9.2.7 TEMPERATURE AND HUMIDITY ALARMS

Name:	**High temperature regulation alarm**
Cause:	The regulated temperature has exceeded the alarm threshold
Delay:	On start: Second parameter - In operation: Second parameter
Effect:	Warning only
Solutions:	Check the unit's operation status
Restore:	The alarm will be automatically reset

Name:	**Low temperature regulation alarm**
Cause:	The regulated temperature has exceeded the alarm threshold
Delay:	On start: Second parameter - In operation: Second parameter
Effect:	Warning only
Solutions:	Check the unit's operation status
Restore:	The alarm will be automatically reset

Name:	**High limit temperature alarm**
Cause:	The limit temperature has exceeded the alarm threshold
Delay:	On start: Second parameter - In operation: Second parameter
Effect:	Second parameter (See previous chapters)
Solutions:	Check the unit's operation status
Restore:	The alarm will be automatically reset

Name:	**Low limit temperature alarm**
Cause:	The limit temperature has exceeded the alarm threshold
Delay:	On start: Second parameter - In operation: Second parameter
Effect:	Second parameter (See previous chapters)
Solutions:	Check the unit's operation status
Restore:	The alarm will be automatically reset

Name:	**High return humidity alarm**
Cause:	The return humidity has exceeded the alarm limit
Delay:	On start: Second parameter - In operation: Second parameter
Effect:	Warning only
Solutions:	Check the unit's operation status
Restore:	The alarm will be automatically reset

Name: **Low return humidity alarm**
Cause: The return humidity has exceeded the alarm limit
Delay: On start: Second parameter - In operation: Second parameter
Effect: Warning only
Solutions: Check the unit's operation status
Restore: The alarm will be automatically reset

Name: **High supply humidity alarm**
Cause: The supply humidity has exceeded the alarm limit
Delay: On start: Second parameter - In operation: Second parameter
Effect: Warning only
Solutions: Check the unit's operation status
Restore: The alarm will be automatically reset

Name: **Low supply humidity alarm**
Cause: The supply humidity has exceeded the alarm limit
Delay: On start: Second parameter - In operation: Second parameter
Effect: Warning only
Solutions: Check the unit's operation status
Restore: The alarm will be automatically reset

9.3 DESCRIPTION OF INTERNAL HUMIDIFIER CPY BOARD ALARMS

DESCRIPTION	CAUSE	SOLUTION
Electrode high current	Electrode overcurrent. The current is greater than the maximum limits due to: • Water conductivity too high. • Water level high due to leakage in filling valve. • Water level high due to malfunctioning of drain valve/header. • Electrode malfunction (for example, a bridge of hard water build up between the electrodes or touching electrodes). • TAM electrical circuit not configured properly. • Malfunctioning of TAM electrical circuit.	• The conductivity level of the water must be between 125-1250 µS/cm. • Check for leakage in the filling valve and clean it or have it replaced. • Check that the drain valve is working properly. • Replace the cylinder. • Refer to the wiring diagram. • Replace the TAM.
Internal memory error	The software or configuration parameters are faulty.	Contact TECNAIR
Parameter error	The configuration parameters are faulty.	Contact TECNAIR
High water conductivity	High supply water conductivity. The possible cause could depend on: • Conductivity probes short-circuited. • Water conductivity greater than maximum limit.	• Clean the conductivity reading electrodes. • The conductivity level of the water must be between 125-1250 µS/cm.
Maintenance time expired	Maintenance time expired	Replace/clean the cylinder, then reset operating hours to zero
Life timer expired	Life timer expired	Replace/clean the cylinder, then reset operating hours to zero
No water	No feed water; the humidifier is trying to introduce water but the level inside the cylinder does not increase at the intended speed. The problem could depend on low mains water pressure or lack of mains water.	The mains water pressure must be between 0.1 and 0.8 MPa (1-8 bar).
Low steam flow rate	Low steam flow rate during reduced production. The steam flow rate is estimated by the TAM wiring diagram. The problem could depend on: • Network water conductivity too low. • Too much foam inside the cylinder. • High amount of limestone inside the cylinder. • TAM electrical circuit not configured properly. • Malfunctioning of TAM electrical circuit.	• The conductivity level of the water must be between 125-1250 µS/cm. • Clean the cylinder and restart. • Clean/replace the cylinder. • Refer to the wiring diagram. • Replace the TAM.
No discharge	The water inside the cylinder is unable to flow correctly. The problem could depend on: • Drain valve clogged/malfunctioning. • Header clogged. • Cylinder filter clogged.	• Check that the drain valve is working properly. • Remove the cylinder and the drain valve and clean the header. • Replace the cylinder.
Cylinder maintenance	The cylinder requires maintenance due to limestone build-up.	Unscheduled maintenance: make sure the cylinder works properly, and, if needed, replace it.
Connection error	Control signal not connected correctly.	Check the wiring of the control signal.

DESCRIPTION	CAUSE	SOLUTION
High water level	High water level without humidification request. The alarm occurs if water reaches the high level electrodes when the humidifier is blocked or disabled.	Check for leakage in the filling valve and clean/ replace it.
Foam presence	Presence of foam inside the cylinder due to lubricants, solvents, detergents in the feed water (sometimes present in the water pipes after installation because they are dirty).	• Wash the feed water pipes abundantly. • Check the quality of the water.
Cylinder burnt out	Cylinder burnt out. The alarm is displayed when production does not meet the request within 3 hours of the "Cylinder Maintenance" display.	Scheduled maintenance: change the cylinder.

9.4 DESCRIPTION OF COMPRESSOR BLDC INVERTER ALARMS

Code		Description	Solution
F00	00	No alarm	-
F01	02	Inverter overload (60 s)	Check how charged the motor is
	03	Short inverter overload (60 s)	Check the motor parameters
F02	00	Inverter heat sink over-temperature	Check inverter ventilation
F03	00	Internal inverter over-temperature	Check inverter ventilation
	03	Inverter condenser over-temperature	Check inverter ventilation
F04	00	Motor over-temperature	Check motor cooling
	01	Magneto-thermal motor protection tripped	Check the motor
	02	No charge to the inverter	Check the motor
	03	No phases	Check the motor and the electrical connection
F05	00	Overloaded	Check the motor and the ramps
	06	Over-current	Check the motor and the electrical connection
	07	No phase 1	Check the motor and the electrical connection
	08	No phase 2	Check the motor and the electrical connection
	09	No phase 3	Check the motor and the electrical connection
	11	The motor is still running	Check the motor and the electrical connection
F07	00	DC circuit surge	Check the deceleration ramps
	01	DC circuit undervoltage	Check the power supply line
	02	No power supply	Check the power supply line
	03	No power supply phases	Check the power supply line
	04	DC circuit reference too low	Check the power supply line
	05	Chopper brake surge	Check the power supply line
	06	Chopper motor surge	Check the power supply line
F08	01	24 V power supply line undervoltage	Check the power supply line
	04	24 V power supply line surge	Check the power supply line
	06	Optional module undervoltage	Contact TECNAIR LV
F10	10	Chopper brake surge	Check the power supply line
F11	00	Output frequency too high	Check parameters
	01	Maximum frequency reached	Check parameters

10 SUPERVISION THROUGH MODBUS RTU SLAVE PROTOCOL

SURVEY^{EVO} microprocessors may be fitted as part of a supervisory and/or BMS (Building Management System) that adopts the standard Modbus® RTU through a RS485 serial circuit board.

The serial communication protocol used has the following characteristics:

SERIAL COMMUNICATION PROTOCOL CHARACTERISTICS	
Protocol	Modbus® Slave, RTU mode
Communication Std.	RS485 Opto-isolated in terms of the network
Baud Rate	Varies between 1200 and 38400 Baud
Word Length	8
Parity	Even
Stop Bits	1

10.1 CLOSE CONTROL SURVEY^{EVO} MICROPROCESSOR SUPERVISOR VARIABLES (SOFTWARE VERSION 2.0)

HOLDING REGISTER							
ID Base 0	**ID Base 1**	**Bit**	**Description**	**Unit measures**	**Minimum**	**Maximum**	**Mode**
Digital inputs status							
0x0100	257	0	Motorised Shutters Status	-	0	65535	R
		1	Dirty Filter Alarm				
		2	Remote OFF				
		3	General Electric Coil Alarm				
		4	Flooding / Condensate drain alarm				
		5	Configurable input 1				
		6	Configurable input 2				
		7	Configurable input 3				
		8	Configurable input 4				
		9	Compressor 1 Thermal Alarm				
		10	Compressor 1 high pressure alarm				
		11	Compressor 1 low pressure alarm				
		12	Compressor 2 Thermal Alarm				
		13	Compressor 2 high pressure alarm				
		14	Compressor 2 low pressure alarm				
Digital outputs status							
0x0180	385	0	Fans Control	-	0	65535	R
		1	Shutters control				
		2	Electrical Heating Coil 1 Status				
		3	Electrical Heating Coil 2 Status				
		4	Not used				
		5	Configurable digital output 1				
		6	Configurable digital output 2				
		7	Configurable digital output 3				
		8	Configurable digital output 4				
		9	Compressor 1 Control				
		10	Compressor 2 Control				

HOLDING REGISTER							
ID Base 0	**ID Base 1**	**Bit**	**Description**	**Unit measures**	**Minimum**	**Maximum**	**Mode**
Analogue inputs							
0x0200	513	-	Return humidity	%Rh	-32768	32767	R
0x0201	514	-	Return temperature	°C	-3276.8	3276.7	R
0x0202	515	-	Supply humidity	%Rh	-32768	32767	R
0x0203	516	-	Supply temperature	°C	-3276.8	3276.7	R
0x0204	517	-	Air pressure	Pa	-32768	32767	R
0x0205	518	-	Water inlet temperature	°C	-3276.8	3276.7	R
0x0206	519	-	Water outlet temperature	°C	-3276.8	3276.7	R
0x0207	520	-	Compressor 1 condensation pressure	Barg	-3276.8	3276.7	R
0x0208	521	-	Compressor 2 condensation pressure	Barg	-3276.8	3276.7	R
0x0209	522	-	Compressor 1 condensation temperature	°C	-3276.8	3276.7	R
0x020A	523	-	Compressor 2 condensation temperature	°C	-3276.8	3276.7	R
0x020B	524	-	Compressor 1 drain temperature	°C	-3276.8	3276.7	R
0x020C	525	-	Compressor 2 drain temperature	°C	-3276.8	3276.7	R
0x020D	526	-	Compressor 1 suction temperature	°C	-3276.8	3276.7	R
0x020E	527	-	Compressor 2 suction temperature	°C	-3276.8	3276.7	R
0x020F	528	-	Compressor 1 evaporation pressure	Barg	-327.68	327.67	R
0x0210	529	-	Compressor 2 evaporation pressure	Barg	-327.68	327.67	R
0x0211	530	-	Compressor 1 evaporation temperature	°C	-3276.8	3276.7	R
0x0212	531	-	Compressor 2 evaporation temperature	°C	-3276.8	3276.7	R
0x0213	532	-	Compressor 1 liquid temperature	°C	-3276.8	3276.7	R
0x0214	533	-	Compressor 2 liquid temperature	°C	-3276.8	3276.7	R
0x0215	534	-	Water flow rate 1 (Low)	l/h	0	4294967295	R
0x0216	535	-	Water flow rate 1 (High)				
0x0217	536	-	Water flow rate 2 (Low)	l/h	0	4294967295	R
0x0218	537	-	Water flow rate 2 (High)				
0x0219	538	-	Total water flow rate (Low)	l/h	0	4294967295	R
0x021A	539	-	Total water flow rate (High)				
0x021B	540	-	Return humidity (average local network)	%Rh	-32768	32767	R
0x021C	541	-	Return temperature (average local network)	°C	-3276.8	3276.7	R
0x021D	542	-	Supply humidity (average local network)	%Rh	-32768	32767	R
0x021E	543	-	Supply temperature (average local network)	°C	-3276.8	3276.7	R
0x021F	544	-	Air pressure (local network average)	°C	-3276.8	3276.7	R
Analogue outputs							
0x0280	641	-	Supply Fans Speed Control	%	0.00	100.00	R
0x0281	642	-	Cooling Valve / Free Cooling / External Inverter	%	0.00	100.00	R
0x0282	643	-	Heating Valve / Modulating electrical coil	%	0.00	100.00	R
0x0283	644	-	Two Sources Water Valve	%	0.00	100.00	R
0x0284	645	-	Dry cooler / Condenser 1	%	0.00	100.00	R
0x0285	646	-	Humidifier / Condenser 2	%	0.00	100.00	R
Unit Status							
0x0500	1281	-	Status of unit *	-	0	5	R
0 = Unit OFF - 1 = OFF Remote - 2 = OFF from supervisor - 3 = Off from alarm - 4 = Stand-by - 5 = Unit ON							
Supply air flow rate							
0x0516	1303	-	Air flow rate (Low)	m^3/h	0	4294967295	R
0x0517	1304	-	Air flow rate (High)				

HOLDING REGISTER							
ID Base 0	**ID Base 1**	**Bit**	**Description**	**Unit measures**	**Minimum**	**Maximum**	**Mode**
Hours of operation							
0x057A	1403	-	Unit (Low)	h	0	100000	R
0x057B	1404	-	Unit (High)				
0x051F	1312	-	Compressor 1 (Low)	h	0	100000	R
0x0520	1313	-	Compressor 1 (High)				
0x0521	1314	-	Compressor 2 (Low)	h	0	100000	R
0x0522	1315	-	Compressor 2 (High)				
0x052B	1324	-	Electrical coil (Low)	h	0	100000	R
0x052C	1325	-	Electrical coil (High)				
0x052D	1326	-	Dry cooler (Low)	h	0	100000	R
0x052E	1327	-	Dry cooler (High)				
0x052F	1328	-	Humidifier (Low)	h	0	100000	R
0x0530	1329	-	Humidifier (High)				
0x0531	1330	-	Cooling valve (Low)	h	0	100000	R
0x0532	1331	-	Cooling valve (High)				
0x0533	1332	-	Condenser 1 (Low)	h	0	100000	R
0x0534	1333	-	Condenser 1 (High)				
0x0535	1334	-	Condenser 2 (Low)	h	0	100000	R
0x0536	1335	-	Condenser 1 (High)				
0x0547	1352		Free Cooling (Low)	h	0	100000	R
0x0548	1353		Free Cooling (High)				
Electronic expansion valves state							
0x053B	1340	-	Current EEV1 superheating set-point	°C	-3276.8	3276.7	R
0x053C	1341	-	Current EEV2 superheating set-point	°C	-3276.8	3276.7	R
0x053D	1342	-	Current EEV1 superheating	°C	-3276.8	3276.7	R
0x053E	1343	-	Current EEV2 superheating	°C	-3276.8	3276.7	R
0x053F	1344	-	Current EEV1 position	%	0.00	655.35	R
0x0540	1345	-	Current EEV2 position	%	0.00	655.35	R
0x057C	1405	-	Current EEV1 de-superheating	°C	-3276.8	3276.7	R
0x057D	1406	-	Current EEV2 de-superheating	°C	-3276.8	3276.7	R
0x057E	1407	-	Current EEV1 sub-cooling	°C	-3276.8	3276.7	R
0x057F	1408	-	Current EEV2 sub-cooling	°C	-3276.8	3276.7	R
Internal humidifier status							
0x0541	1346	-	Current humidifier production	kg/h	0.0	6553.5	R
0x0542	1347	-	Supply water conductivity	µS/cm	0	65535	R
0x0543	1348	-	Absorbed humidifier current	A	0.0	6553.5	R
0x0545	1350	-	Humidifier manner of operation	-	0	65535	R
0 = Non active; 1 = Soft-start; 2 = Start full production after reduced production; 3 = Full production; 4 = Reduced production; 5, 6, 7 = Soft-start							
0x0546	1351	-	Humidifier status of operation	-	0	65535	R
0 = Non active (no request or locked or disabled); 1 = Start evaporation cycle; 2 = Water filing in progress; 3 = Evaporation in progress; 4 = AFS Drain; 5 = Water drain (for dilution or manual); 6 = End water drain; 7 = Complete drain for prolonged inactivity period; 8 = Complete drain from manual or network request; 9 = Water lack management; 10 = Pre-wash; 11 = Periodic drain							
0x0549	1354	-	Humidifier control	-	0	1	R
0x054A	1355	-	Drain valve	-	0	1	R
0x054B	1356	-	Filling valve	-	0	1	R
0x054C	1357	-	High water level	-	0	1	R

HOLDING REGISTER							
ID Base 0	ID Base 1	Bit	Description	Unit measures	Minimum	Maximum	Mode
Fans status							
0x054D	1358	-	Fan Speed 1	RPM	0	65535	R
0x054E	1359	-	Fan Speed 2	RPM	0	65535	R
0x054F	1360	-	Fan Speed 3	RPM	0	65535	R
0x0550	1361	-	Fan Speed 4	RPM	0	65535	R
0x0551	1362	-	Fan Speed 5	RPM	0	65535	R
0x0552	1363	-	Fan Speed 1	%	0.00	655.35	R
0x0553	1364	-	Fan Speed 2	%	0.00	655.35	R
0x0554	1365	-	Fan Speed 3	%	0.00	655.35	R
0x0555	1366	-	Fan Speed 4	%	0.00	655.35	R
0x0556	1367	-	Fan Speed 5	%	0.00	655.35	R
0x0557	1368	-	Fan 1 absorbed current	A	0.0	6553.5	R
0x0558	1369	-	Fan 1 absorbed electrical power	W	0	65535	R
0x0559	1370	-	Fan 2 absorbed current	A	0.0	6553.5	R
0x055A	1371	-	Fan 2 absorbed electrical power	W	0	65535	R
0x055B	1372	-	Fan 3 absorbed current	A	0.0	6553.5	R
0x055C	1373	-	Fan 3 absorbed electrical power	W	0	65535	R
0x055D	1374	-	Fan 4 absorbed current	A	0.0	6553.5	R
0x055E	1375	-	Fan 4 absorbed electrical power	W	0	65535	R
0x055F	1376	-	Fan 5 absorbed current	A	0.0	6553.5	R
0x0560	1377	-	Fan 5 absorbed electrical power	W	0	65535	R
DC compressor inverter status							
0x056E	1391	-	Current compressor speed (Low)	Hz	-21474836.48	21474836.47	R
0x056F	1392	-	Current compressor speed (Hz) (High)				
0x0571	1394	-	Current compressor electrical power (Low)	kW	-21474836.48	21474836.47	R
0x0572	1395	-	Current compressor electrical power (High)				
0x0573	1396	-	Current compressor absorbed current (Low)	A	-21474836.48	21474836.47	R
0x0574	1397	-	Current compressor absorbed current (High)				
Water cooling power							
0x0567	1384		Chilled water cooling power (Low)	kW	0.00	42949672.95	R
0x0568	1385		Chilled water cooling power (High)				
0x056B	1388		EER	-	0.00	655.35	R
Electric coil status							
0x050D	1294		Number of active stages	-	0	255	R
0x0580	1409		Electrical power requirement	kW	0.0	6553.5	R
Set-Point							
0x0600	1537	-	Temperature set-point	°C	-40.0	302.0	R/W
0x0601	1538	-	Humidity set-point	%Rh	0	100	R/W
Ventilation set-point							
0x0602	1539		Supply air flow rate set-point (Low)	m^3/h	500	99000	R/W
0x0603	1540		Air flow rate set-point (High)				
0x0604	1541		Air pressure set-point	Pa	-900	900	R/W

HOLDING REGISTER							
ID Base 0	**ID Base 1**	**Bit**	**Description**	**Unit measures**	**Minimum**	**Maximum**	**Mode**
Temperature Regulation							
0x0606	1543		Regulation sensor		0	1	R/W
0 = Return; 1 = Supply							
0x0605	1542		Regulation type		0	2	R/W
0 = Proportional (P); 1 = Proportional + Integral (PI); 2 = Proportional + Integral + Derivative (PID)							
0x0607	1544		Proportional Band	°C	0.1	108.0	R/W
0x0608	1545		Integration time	s	0	9999	R/W
0x0609	1546		Derivation time	s	0	9999	R/W
0x060A	1547		High temperature alarm offset	°C	0.0	36.0	R/W
0x060B	1548		Low temperature alarm offset	°C	0.0	36.0	R/W
Limit temperature regulation							
0x0613	1556	-	Temperature upper limit	°C	-15.0	194.0	R/W
0x0614	1557	-	High limit temperature management	-	0	3	R/W
0 = Alarm only; 1 = Stop component; 2 = Reduction; 3 = Cold activation							
0x0615	1558	-	Temperature lower limit	°C	-15.0	194.0	R/W
0x0616	1559	-	Low limit temperature management	-	0	3	R/W
0 = Alarm only; 1 = Stop component; 2 = Reduction; 3 = Cold activation							
Humidity regulation							
0x060F	1552	-	Dehumidification proportional band	%RH	1	50	R/W
0x060C	1549	-	Humidification proportional band	%RH	1	50	R/W
0x0611	1554	-	High return humidity alarm offset	%RH	0	100	R/W
0x0612	1555	-	Low return humidity alarm offset	%RH	0	100	R/W
0x0729	1834	-	Higher supply humidity limit	%RH	0	100	R/W
0x072A	1835	-	Lower supply humidity limit	%RH	0	100	R/W
Humidifier regulation							
0x060E	1551	-	Humidification enabling	-	0	1	R/W
0x074F	1872	-	Manual discharge	-	0	1	R/W
0x0750	1873	-	Cylinder pre-wash	-	0	1	R/W
Free cooling and two sources regulation							
0x0618	1561	-	Free cooling delta	°C	1.0	54.0	R/W
0x0619	1562	-	Two sources water set-point	°C	1.0	86.0	R/W
0x06D2	1747	-	Two sources water band	°C	0.1	36.0	R/W
0x061A	1563	-	Two sources source exchange	-	0	1	R/W
Condenser regulation							
0x056C	1389	-	Current condenser 1 set-point	°C	-3276.8	3276.7	R
0x056D	1390	-	Current condenser 2 set-point	°C	-3276.8	3276.7	R
0x0645	1606	-	Condensation set-point	°C	30.0	149.0	R/W
0x0646	1607	-	Condensation proportional band	°C	1.0	72.0	R/W
0x06D7	1752	-	Condensation set-point increase	°C	0.1	90.0	R/W
0x06D8	1753	-	Maximum condensation set-point	°C	0.1	149.0	R/W
Dry cooler regulation							
0x0537	1336	-	Current dry cooler set-point	°C	-3276.8	3276.7	R
0x061B	1564	-	Dry cooler set-point	°C	1.0	149.0	R/W
0x061C	1565	-	Dry cooler proportional band	°C	0.5	36.0	R/W
0x061D	1566	-	Dry Cooler set-point increase	°C	0.1	90.0	R/W
0x061E	1567	-	Maximum dry Cooler set-point	°C	0.1	149.0	R/W

HOLDING REGISTER							
ID Base 0	**ID Base 1**	**Bit**	**Description**	**Unit measures**	**Minimum**	**Maximum**	**Mode**
Alarms							
0x0300	769	0	Broken return humidity probe alarm	-	0	65535	R
		1	Broken return temperature probe alarm				
		2	Broken differential air pressure sensor alarm				
		3	Broken supply temperature probe alarm				
		4	Broken IN water temperature probe alarm Broken free cooling temperature probe alarm				
		5	Broken OUT water temperature probe alarm				
		6	Broken water flow rate sensor 1 alarm Broken liquid temperature probe 1 alarm				
		7	Broken supply humidity probe alarm				
		8	Broken water flow rate sensor 2 alarm Broken liquid temperature probe 2 alarm				
		9	Water presence sensor alarm Condensate drain pump alarm				
		10	Electric coil safety switch				
		11	Damper status alarm				
		12	Clogged air filter alarm				
		13	Compressor 1 magnetic thermal protection alarm				
		14	Compressor 2 magnetic thermal protection alarm				
		15	Compressor 1 high pressure alarm				
0x0301	770	0	Compressor 2 high pressure alarm	-	0	65535	R
		1	Compressor 1 low pressure alarm				
		2	Compressor 2 low pressure alarm				
		3	Compressor 1 high high drain temperature alarm				
		4	Compressor 2 high high drain temperature alarm				
		5	EEV 1 alarm				
		6	EEV 2 alarm				
		7	DC compressor inverter alarm				
		8	Fan 1 inverter alarm				
		9	Fan 2 inverter alarm				
		10	Fan 3 inverter alarm				
		11	Fan 4 inverter alarm				
		12	Fan 5 inverter alarm				
		13	Internal humidifier alarm				
		14	Local network communication alarm				
		15	High temperature regulation alarm				

HOLDING REGISTER							
ID Base 0	**ID Base 1**	**Bit**	**Description**	**Unit measures**	**Minimum**	**Maximum**	**Mode**
0x0302	771	0	Low temperature regulation alarm	-	0	65535	R
		1	High return humidity alarm				
		2	Low return humidity alarm				
		3	High suppy humidity alarm				
		4	Low supply humidity alarm				
		5	High limit temperature alarm				
		6	Low limit temperature alarm				
		7	Dry cooler general alarm				
		8	External humidifier general alarm				
		9	General water pump alarm				
		10	Condenser 1 general alarm				
		11	Condenser 2 general alarm				
		12	Refrigerant gas leak detector alarm				
		13	General supply fans alarm				
		14	Fire/Smoke presence alarm				
		15	Non-critical generic alarm				
0x0303	772	0	Critical generic alarm	-	0	65535	R
		1	Condensing unit generic alarm				
		2	Power supply failure alarm				
		3	Compressor 1 low compression alarm				
		4	Compressor 2 low compression alarm				
0x0304	773	0	EEV1 communication down alarm	--	0	65535	R
		1	EEV1 Suction temperature probe alarm				
		2	EEV1 Evaporation pressure probe alarm				
		3	EEV1 Condensation pressure probe alarm				
		4	EEV1 Discharge temperature probe alarm				
0x0305	774	0	EEV2 communication down alarm	-	0	65535	R
		1	EEV2 Suction temperature probe alarm				
		2	EEV2 Evaporation pressure probe alarm				
		3	EEV2 Condensation pressure probe alarm				
		4	EEV2 Discharge temperature probe alarm				
0x0306	775	0	CPY communication down alarm	-	0	65535	R
		1	Internal memory error				
		2	Parameter error				
		3	Electrode high current				
		4	Low steam flow rate				
		5	No discharge				
		6	Maintenance time expired				
		7	No water				
		8	Cylinder maintenance				
		9	Cylinder burnt out				
		10	Foam presence				
		11	Life timer expired				
		12	High water level				
		13	High water conductivity				
		14	Connection error				

HOLDING REGISTER							
ID Base 0	ID Base 1	Bit	Description	Unit measures	Minimum	Maximum	Mode
0x0307	776	0	Fan 1 phase/power supply down alarm	-	0	65535	R
		1	Fan 1 communication down				
		2	High vent. regulation module temperature 1				
		3	Vent. master-slave communication failure 1				
		4	Vent. regulation module malfunction 1				
		5	High fan 1 motor temperature				
		6	Fan 1 Hall sensor error				
		7	Fan 1 overload motor				
		8	Not used				
		9	Not used				
		10	Not used				
		11	Not used				
		12	Fan 1 low DC power supply				
0x0308	777	0	Fan 2 phase/power supply down alarm	-	0	65535	R
		1	Fan 2 communication down				
		2	High vent. regulation module temperature 2				
		3	Vent. master-slave communication failure 2				
		4	Vent. regulation module malfunction 2				
		5	High fan 2 motor temperature				
		6	Fan 2 Hall sensor error				
		7	Fan 2 overload motor				
		8	Not used				
		9	Not used				
		10	Not used				
		11	Not used				
		12	Fan 2 low DC power supply				
0x0309	778	0	Fan 3 phase/power supply down alarm	-	0	65535	R
		1	Fan 3 communication down				
		2	High vent. regulation module temperature 3				
		3	Vent. master-slave communication failure 3				
		4	Vent. regulation module malfunction 3				
		5	High fan 3 motor temperature				
		6	Fan 3 Hall sensor error				
		7	Fan 3 overload motor				
		8	Not used				
		9	Not used				
		10	Not used				
		11	Not used				
		12	Fan 3 low DC power supply				

HOLDING REGISTER							
ID Base 0	**ID Base 1**	**Bit**	**Description**	**Unit measures**	**Minimum**	**Maximum**	**Mode**
0x030A	779	0	Fan 4 phase/power supply down alarm	-	0	65535	R
		1	Fan 4 communication down				
		2	High vent. regulation module temperature 4				
		3	Vent. master-slave communication failure 4				
		4	Vent. regulation module malfunction 4				
		5	High fan 4 motor temperature				
		6	Fan 4 Hall sensor error				
		7	Fan 4 overload motor				
		8	Not used				
		9	Not used				
		10	Not used				
		11	Not used				
		12	Fan 4 low DC power supply				
0x030B	780	0	Fan 5 phase/power supply down alarm	-	0	65535	R
		1	Fan 5 communication down				
		2	High vent. regulation module temperature 15				
		3	Vent. master-slave communication failure 15				
		4	Vent. regulation module malfunction 5				
		5	High fan 5 motor temperature				
		6	Fan 5 Hall sensor error				
		7	Fan 5 overload motor				
		8	Not used				
		9	Not used				
		10	Not used				
		11	Not used				
		12	Fan 5 low DC power supply				
0x030C	781	-	DC compressor inverter communication alarm		0	1	R
0x030D	782	-	DC compressor inverter alarm code [0]		0	255	R
0x030E	783	-	DC compressor inverter alarm code [1]		0	255	R
0x030F	784	-	DC compressor inverter alarm code [2]		0	255	R
0x0310	785	-	DC compressor inverter alarm code [3]		0	255	R
0x0311	786	-	DC compressor inverter alarm code [4]		0	255	R
48 = 0; 49 = 1; 50 = 2; 51 = 3; 52 = 4; 53 = 5; 54 = 6; 55 = 7; 56 = 8; 57 = 9; 70 = F							

HOLDING REGISTER							
ID Base 0	ID Base 1	Bit	Description	Unit measures	Minimum	Maximum	Mode
Reset alarms							
0x0312	787		Water presence sensor alarm reset Condensate drain pump alarm reset		0	1	R/W
0x0313	788		Electr. coil safety thermostat alarm reset		0	1	R/W
0x0314	789		Damper status alarm reset		0	1	R/W
0x0315	790		Clogged air filter alarm reset		0	1	R/W
0x0316	791		Comp. magnetic thermal protection alarm reset 1		0	1	R/W
0x0317	792		Comp. magnetic thermal protection alarm reset 2		0	1	R/W
0x0318	793		Compressor 1 high pressure alarm reset		0	1	R/W
0x0319	794		Compressor 2 high pressure alarm reset		0	1	R/W
0x031A	795		Compressor 1 low pressure alarm reset		0	1	R/W
0x031B	796		Compressor 2 low pressure alarm reset		0	1	R/W
0x031C	797		Comp. high drain temperature alarm reset 1		0	1	R/W
0x031D	798		Comp. high drain temperature alarm reset 2		0	1	R/W
0x031E	799		Compressor 1 EEV alarm reset		0	1	R/W
0x031F	800		Compressor 2 EEV alarm reset		0	1	R/W
0x0320	801		Compressor 1 inverter alarm reset		0	1	R/W
0x0321	802		Fan 1 inverter alarm reset		0	1	R/W
0x0322	803		Fan 2 inverter alarm reset		0	1	R/W
0x0323	804		Fan 3 inverter alarm reset		0	1	R/W
0x0324	805		Fan 4 inverter alarm reset		0	1	R/W
0x0325	806		Fan 5 inverter alarm reset		0	1	R/W
0x0326	807		Internal humidifier alarm reset		0	1	R/W
0x0327	808		Dry cooler general alarm reset		0	1	R/W
0x0328	809		External humidifier general alarm reset		0	1	R/W
0x0329	810		General water pump alarm reset		0	1	R/W
0x032A	811		Condenser 1 general alarm reset		0	1	R/W
0x032B	812		Condenser 2 general alarm reset		0	1	R/W
0x032C	813		Refrigerant gas leak detector alarm reset		0	1	R/W
0x032D	814		General supply fans alarm reset		0	1	R/W
0x032E	815		Fire/Smoke presence alarm reset		0	1	R/W
0x032F	816		Non-critical generic alarm reset		0	1	R/W
0x0330	817		Critical generic alarm reset		0	1	R/W
0x0331	818		Condensing unit generic alarm reset		0	1	R/W
0x0332	819		Power supply failure alarm reset		0	1	R/W
0x0333	820		Comp. low compression alarm reset 1		0	1	R/W
0x0334	821		Comp. low compression alarm reset 2		0	1	R/W

11 SURVEY DEVICE TROUBLESHOOTING

11.1 THE UNIT DOES NOT START

Check the following:

- The mains power supply is on.
- 24 Vac is on downstream of the supply voltage transformer.
- Proper plugging in of 24 Vac supply connector.
- The protection fuse is intact.
- The cable connecting the terminal and the main board has been connected properly.

11.2 INCORRECT READING OF INPUT SIGNALS

Check the following:

- The inputs have been calibrated correctly (from program).
- Proper probe power supply.
- Proper probe connection as per wiring diagram.
- Proper probe output signal.
- The probe wires are positioned at a suitable distance from potential sources of electromagnetic interference (power cables, contactors, high-voltage cables and cables connected to devices with high voltage consumption at start-up).
- The thermal resistance level between the probe and any probe pocket is not too high. Place a little paste or conductive oil inside the pockets if necessary, in order to guarantee effective temperature transmission.

11.3 QUESTIONABLE ALARM SIGNALLING FROM DIGITAL INPUT

Check the following:

- 24 Vac power supply presence on the alarm contact.
- The terminal is regularly inserted in its seat.
- There are no breaks upstream of the terminal.

11.4 FAILED CLOSURE OF A DIGITAL OUTPUT

Check the following:

- 24 Vac power supply presence on the digital contact.
- The terminal is regularly inserted in its seat.
- There are no breaks downstream of the terminal.

11.5 ABSENCE OF ANALOGUE OUTPUTS

Check the following:

- 0-10 V cc analogue output signal presence.
- The terminal is regularly inserted in its seat.
- There are no breaks downstream of the terminal.

11.6 THE SURVEY ACTIVATES THE WATCH-DOG FUNCTION

Check the following:

- The power cables do not run near the main board microprocessors.
- There are no sources of electromagnetic interference near the microprocessor or the data transmission cables.

11.7 SERIAL CONNECTION WITH THE SUPERVISOR/BMS DOES NOT WORK

Check the following:

- Proper setting of the unit's serial address.
- Proper setting of the unit's baud rate (communication speed).
- The type of serial cables used.
- Correct serial cable connection based on the wiring diagram.
- The power cables do not run near the main board microprocessors.
- There are no sources of electromagnetic interference near the microprocessor or the data transmission cables.

11.8 LOCAL NETWORK CONNECTION DOES NOT WORK

Check the following:

- Proper setting of the unit's serial address.
- Proper setting of the unit's baud rate (communication speed).
- The type of serial cables used.
- The power cables do not run near the main board microprocessors.
- There are no sources of electromagnetic interference near the microprocessor or the data transmission cables.

11.9 MODBUS MASTER CONNECTION DOES NOT WORK

Check the following:

- Correct serial cable connection based on the wiring diagram.
- The power cables do not run near the main board microprocessors.
- There are no sources of electromagnetic interference near the microprocessor or the data transmission cables.

12 NOTES

TECNAIR LV

CLOSE CONTROL AIR CONDITIONING

TPi Klimatimport AB www.tpiab.com info@tpiab.com

TECNAIR LV

CLOSE CONTROL AIR CONDITIONING

LU-VE GROUP
leadership with passion

ICIM CISQ IQNet
ISO 9001
Cert. n. 0279/6

EAC

R-410A REFRIGERANT

www.tpiab.com

TPi Klimatimport AB www.tpiab.com info@tpiab.com